may be encountered during construction. Only the Sea Land site, which is located within approximately 500 feet of portions of the Yellow Alternative, contains significant contamination levels. The documented contamination is unlikely to impact the proposed construction unless the proposed alignment is moved to cross over or very near the contaminated site.

Additional site investigation efforts are warranted at five sites before property acquisition. The level of investigation may range from review of regulatory documents to formal Phase I Environmental Site Assessments or Phase II Site Investigations, depending on site conditions and the likelihood of property purchase. Changes to the alternative alignments will change the need for site specific investigations.

The types of contaminants that may be encountered include petroleum contamination in soil and groundwater, toxic metals, PAHs, and volatile organic compounds (VOCs, typically solvents). These contaminants may occur both as soil contaminants and as dissolved groundwater contaminants. If the proposed construction encounters any of these contaminants of concern, appropriate excavation and disposal of contaminated materials in accordance with all applicable state and local regulations would be required.

F. Natural Environment

This section discusses natural resources in the project area, including topography; geology; soils; groundwater; surface water and water quality; waters of the United States, including wetlands; floodplains; vegetation and wildlife; rare, threatened and endangered species; wild and scenic rivers; coastal zone management areas; and unique, sensitive and other natural areas. Impacts to these resources were previously detailed in the DEIS for the four retained alternatives (Yellow, Purple, Brown and Green) and are summarized herein.

Since the recommendation of the Green North Alternative as the Preferred Alternative was published in the DEIS, four refinements have been undertaken that have contributed to an increase in some resource impacts for the Preferred Alternative shown on the plan sheets in ***Appendix B***. It is estimated that these refinements would have brought about a similar increase in the levels of impacts for all of the build alternatives if they had all been subjected to a similar level of design refinement.

- Alignment Changes: The design of the Preferred Alternative was refined as a result of comments received on the DEIS and during the Public Hearings (refer to ***Chapter IV Sections A.1.g*** and ***D***) to include Ratledge Road Area Option 4B Modified and a local connection between Strawberry Lane and existing US 301.

- Refinements in planning-level engineering included additional alignment modifications, refined sections based on topography, and refined stormwater management design based on the identification of existing drainage patterns. This combination of refinements resulted in the elevation of the roadway being raised in some areas to provide adequate drainage, resulting in an expanded Limit of Disturbance (LOD). Prior to refined engineering, the LOD for the Green North Alternative was 897 acres; the Preferred Alternative LOD encompasses

941 acres, a five percent increase. This increase would have been seen in all of the build alternatives, were they subjected to a similar level of engineering design.

- The identification and definition of forest areas was refined to reflect current coverage, based on more recent and improved aerial photography (2006) along the Preferred Alternative alignment. This resulted in several previously classified forested wetlands being reclassified and the inclusion of hedgerows not previously identified. The resulting increases in forest coverage, along with the expanded LOD, led to an increase in the acreage of impacted forestland for the Preferred Alternative that would, in some areas, apply proportionally to the other build alternatives. Refer to ***Section 8*** of this chapter for details.

- Finally, improved wetland delineation for the Preferred Alternative included the separate delineation of streams that had previously been included within wetland systems (i.e., streams within a wetland corridor); ephemeral, intermittent and perennial waters of the US not surrounded by wetlands were surveyed; and traditional field survey methods were used to precisely locate wetland boundaries previously based on GPS surveys. This level of delineation resulted in the identification of additional wetlands within the LOD of the Preferred Alternative as well as some changes in impacted acreages of impacted wetlands. In addition, alignment changes in the Ratledge Road area (refer to ***Chapter II Section C.4***) resulted in an increase in impacted wetlands in this area.

1. <u>Topography</u>

a. Existing Conditions

Topography data were obtained through TopoZone.com, which provides interactive maps based upon the United States Geological Survey (USGS) topographic mapping for the country. TopoZone.com provides elevations above mean sea level (MSL) throughout the project area that may be altered by the proposed alternatives.

The project area is located in New Castle County in northern Delaware entirely within the Atlantic Coastal Plain. Topography in the project area ranges from sea level to approximately 80 feet above mean sea level (MSL). The landscape throughout the project area is generally flat, with a few low, wide ridges and narrow, steep-sided stream valleys. A total of five different drainage areas are located within the project area. These watersheds include the C&D Canal East, C&D Canal West, Bohemia Creek Watershed, Sassafras River Watershed, and Appoquinimink River Watershed. Elevations along these low-lying drainages range from sea level to approximately 40 feet above MSL.

The Brown, Purple and Green Alternatives south of the C&D Canal are oriented predominately north-south and are on the drainage divide between the Chesapeake Bay and Delaware Bay drainages. These alternatives follow the same alignment west of existing US 301 and Middletown along what is commonly referred to as the ridge route. The topography in this area is very flat because it lies at the drainage divide where there is very little erosion or stream valley development. The southern portion of the Yellow Alternative is located east of the ridge alignment and crosses several streams that flow into the Delaware Bay. It is also located in flat topography, except where the alignment crosses steep-sided stream valleys and wetlands. The east-west portions of all of the build alternatives generally follow the shallow grade of the watersheds.

b. Environmental Consequences

The No-Build Alternative would have no effect on the topography of the project area. The Preferred Alternative (Green North) and the other build alternatives (Yellow, Brown North, Brown South, Purple, and Green South) would result in no appreciable gross changes to project area topography. For the most part, the grades of the alternatives would follow the existing grades of the landscape. Minor elevation changes would be made to the terrain to facilitate road drainage as well as interchange/overpass construction and wetland mitigation site creation.

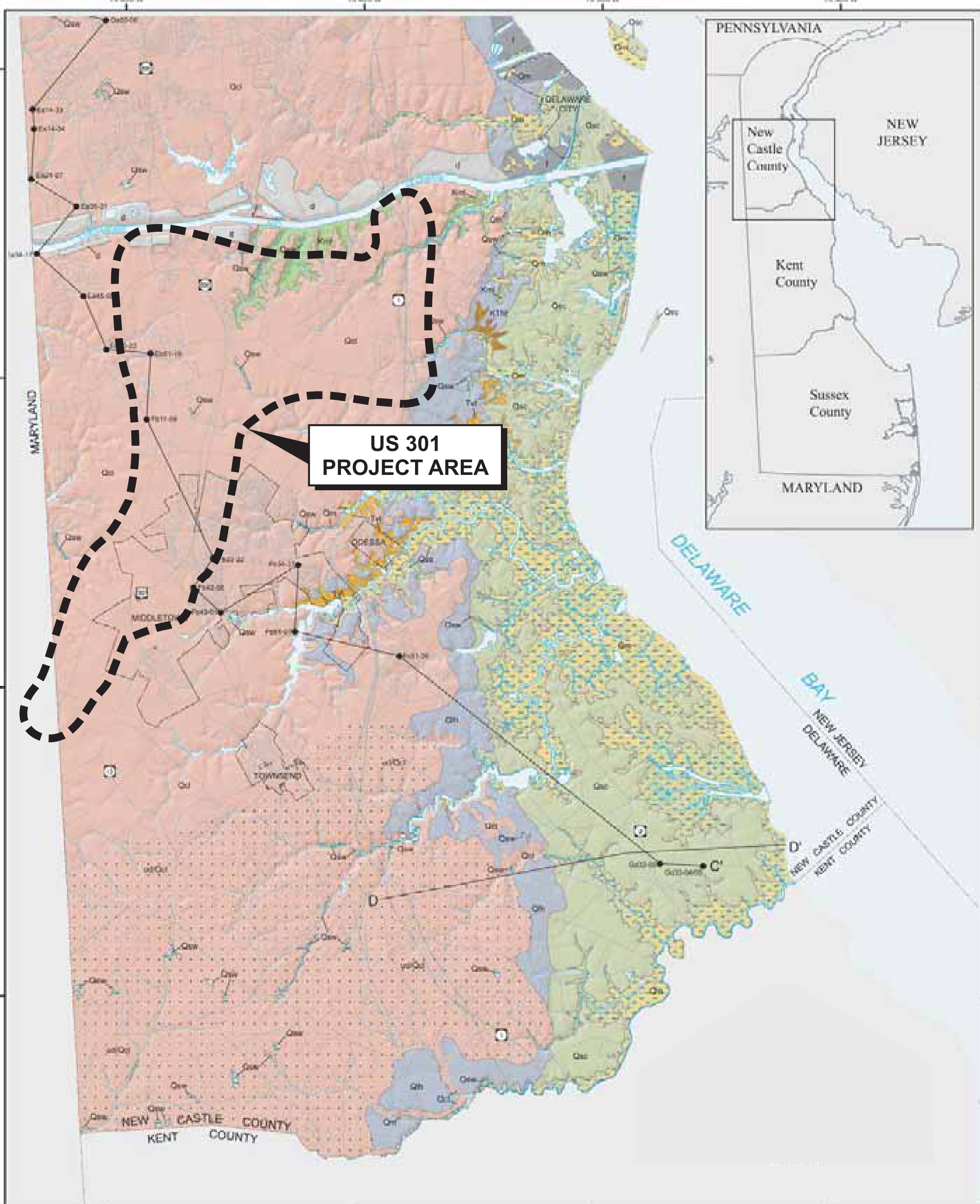
2. Geology

a. Existing Conditions

Geological data were obtained through maps from the Delaware Geological Survey and the University of Delaware. Information obtained includes geologic formations exposed at ground surface and encountered in representative well logs throughout New Castle County. The geology of the project area is shown on ***Figure III-12***.

The project area occurs entirely within the Delmarva Coastal Plain physiographic province. The Coastal Plain is typified by sedimentary deposits that dip gently and increase in thickness toward the southeast. The geologic formation that occurs at ground surface across most of the project area is the Pleistocene-age Columbia formation. This formation consists primarily of sands and gravels originating from glacial outwash and extends to depths of 10 to over 100 feet below ground surface. This relatively recent formation covers the eroded surfaces of the older, dipping, Coastal Plain strata.

Limited exposures of the older strata within and near the project area, such as the upper Cretaceous-age Mt. Laurel formation, occur in the C&D Canal and some stream valleys draining into the C&D Canal (see ***Figure III-13***). However, the older, dipping strata beneath the Columbia formation underlie extensive areas and form an important series of groundwater aquifers. Even though the Cretaceous and Tertiary-age strata covered by the Columbia formation do not daylight within the project area, groundwater percolating downward through the Columbia likely recharges the deeper aquifers through the truncated surfaces of the dipping strata.



Source:
Modified from *Geologic Map of New Castle County, Delaware, 2005,* Delaware Geologic Survey

0 1 2 3 3 5

SCALE IN MILES

Not to Scale

US 301 Project Development

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GEOLOGIC MAP OF PROJECT AREA

Delaware Department of Transportation

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Figure III-12A

DESCRIPTIONS OF GEOLOGIC MAP UNITS

COASTAL PLAIN

f — **Fill**
Man-made deposits of natural earth material, including dredge spoil, used to extend shore land and/or to fill a low-lying area such as where a road crosses a valley or marsh. Fill areas include Cherry Island Landfill and Pigeon Point Landfill near Wilmington that were marsh prior to landfill construction. Some construction debris (concrete, bricks, etc.) may be incorporated in the unit.

d — **Dredge Disposal Deposits**
Located on uplands and consist of dredged material from the Chesapeake and Delaware Canal. Primarily a mixture of sand, silt, and clay from Cretaceous geologic units through which the Canal was cut.

Qsw — **Swamp Deposits (Holocene)**
Structureless, black to brown, organic-rich, silty and clayey, fine to coarse quartz sand with thin interbeds of medium to coarse quartz sand. Organic particles consist of leaves, twigs, and larger fragments of deciduous plants in stream valleys. In stream valleys, swamp deposits fine upward and grade laterally with salt marsh deposits toward the Delaware River. Defined primarily on the presence of deciduous vegetation in stream valleys (Ramsey, 1997). On uplands, consist of dark- to light-gray clayey silt and very fine to coarse sand. Characterized by areas of seasonally standing water, internal drainage, and hydrophyllic trees. From 1 to 20 ft thick.

Qm — **Marsh Deposits (Holocene)**
Structureless to finely laminated, black to dark-gray, organic-rich silty clay to clayey silt with discontinuous beds of peat and rare shells (Ramsey, 1997). In-place or transported fragments of marsh grasses such as Spartina are common. Includes some clayey silts of estuarine channel origin. Map area delineated on the distribution of salt-tolerant marsh grasses. Thickness ranges between 1 and 40 ft.

ud/Qcl — **Undrained Depression Deposits (upper Pleistocene to lower Holocene)**
A belt of upland depressions that stretches across southern New Castle County. Sometimes referred to as Delmarva Bays, are irregular in shape and have internal drainage not integrated with any stream network. Filled with organic-rich woody silts to gray medium to coarse quartz sand (Webb, 1990). Some have a sandy rim at their margins. During wet periods, many are filled with water. Because of the abundance and relative small size (< 500 ft. diameter), individual basins are not mapped; rather, a pattern indicates the extent of these units where they overlie the Columbia Formation. Largest depressions appear as areas of swamp. Radiocarbon dates (Webb, 1990) indicate ages from 11,000 B.P to Recent. Origin is considered by the author to be related to cold-climate periglacial conditions.

Qsc — **Scotts Corners Formation (upper Pleistocene)**
Heterogeneous unit of light-gray to brown to light-yellowish-brown, coarse to fine sand, gravelly sand and pebble gravel with rare discontinuous beds of organic-rich clayey silt, clayey silt, and pebble gravel. Sands are quartzose with some feldspar and muscovite. Commonly capped by one to two ft of silt to fine sandy silt. Laminae of opaque heavy minerals common. Unit underlies a terrace parallel to the present Delaware River that has elevations less than 25 ft. Interpreted to be a transgressive unit consisting of swamp, marsh, estuarine channel, beach, and bay deposits. Climate during deposition was temperate to warm temperate as interpreted from fossil pollen (Ramsey, 1997). Overall thickness rarely exceeds 15 ft.

Qlh — **Lynch Heights Formation (upper Pleistocene)**
Heterogeneous unit of light-gray to brown to light yellowish brown, medium to fine sand with discontinuous beds of coarse sand, gravel, silt, fine to very fine sand, and organic-rich clayey silt to silty sand. Upper part of unit commonly consists of fine, well-sorted sand. Small-scale cross-bedding within sands is common. Some interbedded clayey silts and silty sands are burrowed. Beds of shell rarely encountered. Sands are quartzose, slightly feldspathic, and typically micaceous where very fine to fine grained. Unit underlies a terrace parallel to present Delaware River that has elevations between 50 and 30 ft. Interpreted to be a fluvial to estuarine unit of fluvial channel, tidal flat, tidal channel, beach, and bay deposits (Ramsey, 1997). Overall thickness rarely exceeds 20 ft.

Qcl — **Columbia Formation (middle Pleistocene)**
Yellowish- to reddish-brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel. Typically cross-bedded with cross-sets ranging from a few inches to over three ft in thickness. Scattered beds of tan to reddish gray clayey silt common. In places, the upper 5 to 25 ft a grayish- to reddish-brown silt to very fine sand overlying medium to coarse sand. Near base of unit, clasts of cobble to small boulder size found in gravel bed ranging from a few inches to three ft thick. Gravel fraction consists primarily of quartz with lesser amounts of chert. Clasts of sandstone, siltstone, and shale from the Valley and Ridge Province, and pegmatite, micaceous schist, and amphibolite from the Piedmont are present. The Columbia fills an eroded surface and ranges from less than 10 ft thick to over 100 ft. Primarily a body of glacial outwash sediment (Jordan, 1964, Ramsey, 1997). Pollen indicate deposition in a cold climate during middle Pleistocene (Groot and Jordan, 1999).

Tvt — **Vincentown Formation (Paleocene)**
Glauconitic sand that ranges from slightly silty to moderately silty and slightly to moderately clayey. Dominant constituent is subrounded to subangular clear quartz sand that ranges from medium to fine grained. Fine-grained glauconite is a secondary constituent, which ranges from 5 percent in the clayey zones to 15 percent where cleaner. Towards bottom of unit, glauconite percentages increase to about 50 percent of the sand fraction. Silty and clayey zones are thin to thick laminae ranging from 0.01 to 0.5 ft thick. Olive gray to dark-yellowish-brown in zones where iron cement is present. Interpreted to be marine in origin. Rarely occurs in outcrop and is covered by colluvium along the stream valley bluffs where shown on the map. Ranges from 50 to 100 ft in thickness in the subsurface and less than 30 ft thick where it is cut by younger deposits updip.

COASTAL PLAIN (cont.)

KTht — **Hornerstown Formation (Upper Cretaceous and Paleocene)**
Glauconite sand that is silty and slightly to moderately clayey and contains scattered shell beds. Glauconite approximately 90 percent to 95 percent of the sand fraction and quartz 5 percent to 10 percent. Near the top of unit, silt-filled burrows are present. Lower, the unit is commonly laminated with silty sand and moderately clayey sand. Silt and clay matrix is calcareous. Uniformly a dark-greenish-gray. Interpreted to be marine in origin. The Cretaceous-Tertiary boundary is considered to lie within the formation. Rarely occurs in outcrop and where shown on the map is covered by colluvium along the stream valley bluffs. Ranges between 10 and 50 feet in thickness.

Kml — **Mt. Laurel Formation (Upper Cretaceous)**
Slightly calcareous, glauconitic, quartz sand that is medium to fine grained. Contains about 3 to 5 percent glauconite. Sand is subrounded to subangular and slightly silty with a few moderately silty zones. Scattered belemnites are present as well as a few scattered shell fragments or thin shell beds. Uniform dark olive gray or yellowish-brown where weathered. In outcrop, reported to be extensively burrowed (Owens, et al., 1970). Where it is the surficial deposit south of the Chesapeake and Delaware Canal, the Mt. Laurel can be confused with the Columbia Formation, especially where the color is similar. Can be differentiated by ubiquitous presence of glauconite and generally better sorted sands of the Mt. Laurel. Marine in origin. Ranges from 20 to 100 ft in thickness.

Kpt — **Potomac Formation (Cretaceous)**
Dark-red, gray, pink, and white silty clay to clayey silt and very fine to medium sand beds. Beds of gray clayey silt to very fine sand that contain pieces of charcoal and lignite are common. Deposited in a fluvial setting in a tropical to subtropical environment as indicated by abundant paleosol horizons. Ranges from 20 ft updip to over 1600 ft thick in southern New Castle County.

CROSS-SECTION UNITS (not shown on map)

Qus — **Quaternary (undifferentiated)** *shown on cross section C-C' only*
Includes the Quaternary surficial units of the Columbia Formation, Lynch Heights Formation, and Scotts Corners Formation. Primarily Sand.

Tc — **Calvert Formation (Miocene)** *subsurface only*
Gray to grayish-brown clayey silt to silty clay interbedded with gray to light-gray silty to fine to coarse quartz sands. Discontinuous beds of shell are common in the sands and in the clayey silts. The unit ranges up to 100 ft in thickness.

Tsr — **Shark River Formation (Eocene)** *subsurface only*
Glauconitic clayey silt and clay, with some glauconite sand and fine glauconitic quartz sand. Deposited in the middle Eocene (Benson and Spoljaric, 1996), and is generally 60 to 70 ft thick. Based on the microfossils (unpublished DGS file data), it can be characterized as an open shelf deposit.

Tmq — **Manasquan Formation (Paleocene to Eocene)** *subsurface only*
Consists of 30 ft of silty, shelly, fine sands that are commonly glauconitic (Benson and Spoljaric, 1996). Deposited during the latest Paleocene to early Eocene (Benson and Spoljaric, 1996). Based on microfossils (unpublished DGS file data), it can be characterized as an open shelf deposit.

Knv — **Navesink Formation (Upper Cretaceous)** *subsurface only*
Generally a calcareous silt that is slightly to moderately sandy and slightly to moderately clayey. Sand is fine to very fine grained composed of about 50 percent glauconite, 40 percent peloids, and 10 percent quartz. Sediment is laminated, marked by varying amounts of clay and sand. Peloids are yellow to yellowish-brown flat to ovoid pellets that are calcareous and may contain flakes of chitin and grains of glauconite or quartz. Scattered shell fragments are present but form a minor constituent of the sediment. Uniformly dark-greenish-gray, slightly lighter in color than the overlying Hornerstown Formation. 10 to 20 ft thick.

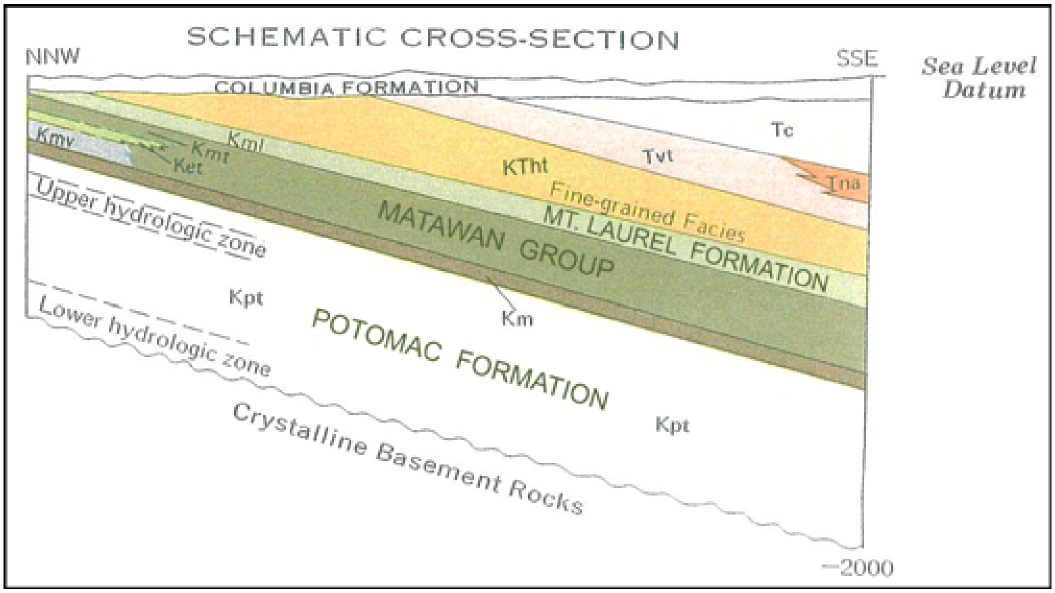
Kmt — **Marshalltown Formation (Upper Cretaceous)** *mainly in subsurface; in outcrop only at the Chesapeake and Delaware Canal*
Greenish-gray, slightly silty, fine-grained glauconitic quartz sand. Glauconite comprises 30 to 40 percent of the sand fraction. Ranges from 10 to 50 ft in thickness. Extensively burrowed. Interpreted to be marine in origin.

Ket — **Englishtown Formation (Upper Cretaceous)** *mainly in subsurface; in outcrop only at the Chesapeake and Delaware Canal*
Light-gray to white, micaceous, slightly silty to silty, fine-grained, slightly glauconitic quartz sand. In outcrop, it is extensively burrowed with Ophiomorpha burrows. Ranges from 20 to 50 ft in thickness. On the cross-section, the Englishtown is shown only where the sands are well developed. Interpreted to be nearshore marine to tidal flat in origin.

Kmv — **Merchantville Formation (Upper Cretaceous)** *mainly in subsurface; in outcrop only in areas too small to be represented on the map and at the Chesapeake and Delaware Canal*
Light- to dark-gray, very micaceous, glauconitic, very silty fine- to very fine-grained sand to fine sandy silt. Ranges from 20 to 120 ft in thickness. Marine in origin.

Km — **Magothy Formation (Upper Cretaceous)** *mainly in subsurface; in outcrop only in areas too small to be represented on the map and at the Chesapeake and Delaware Canal*
Dark-gray to gray silty clay to clayey silt that contains abundant fragments of lignite; grades downward into a very fine to fine sand with scattered and discontinuous thin beds of clayey silt with lignite fragments. Thickness ranges from 20 to 30 ft. Updip in the vicinity of the Chesapeake and Delaware Canal, the Magothy fills channels incised into the Potomac Formation and is discontinuous in its extent. Interpreted to have been deposited in coastal to nearshore environments.

Figure III-13: Generalized Geologic Cross-Section



Source: Geologic Map of New Castle County, Delaware, Delaware Geologic Survey. 2005

Based on the Geologic Map of New Castle County, obtained from the Delaware Geologic Survey, the sedimentary deposits that underlie the near-surface Columbia formation consist of the following significant strata beneath the project area. They are listed from youngest and nearest the surface to oldest and deepest.

- Rancocas Aquifer – Formed by the glauconitic, fine sands of the Eocene-age Manasquan and Paleocene-age Vincentown Formations.
- Hornerstown Formation, Paleocene and upper Cretaceous – dark, greenish-gray glauconite sand with a calcareous silt and clay matrix. This formation forms part of the confining bed below the Rancocas aquifer.
- Navesink Formation, upper Cretaceous – Glauconite silt with clay and very fine sand. Also forms part of the confining bed below the Rancocas aquifer.
- Mount Laurel Formation, upper Cretaceous – Includes the Mount Laurel aquifer, which is typified by gray to greenish red-brown, glauconitic, fine to medium quartz sand with some silt.
- Marshalltown Formation, upper Cretaceous – dark greenish gray, massive, highly glauconitic, very silty fine sand. Confining bed above the Englishtown Formation.
- Englishtown Formation, upper Cretaceous – light gray and rust brown, well sorted micaceous, sparingly glauconitic, often “fluffy”, fine sand with thin interbedded layers of dark gray silty sand. Forms a minor aquifer.
- Merchantville Formation, upper Cretaceous – dark gray to dark blue, micaceous, glauconitic sandy silt and silty fine sand; very sticky when wet. Forms a confining bed above the Magothy aquifer.

- Magothy Formation, upper Cretaceous – Dark gray to gray silty clay to clayey silt grading downward into sand. The Magothy aquifer occurs within the lower part of the formation, characterized by discontinuous fine sands thought to represent deposits in channels incised into the underlying Potomac formation.
- Potomac Formation, lower Cretaceous-age – Dark red, white, pink and gray clay interlayered with sand and gravel beds ranging in thickness from 20 feet updip to over 1,600 feet in southeast New Castle County. The Potomac aquifers occur within the sand and gravel strata of the Potomac formation.

The aquifers described above form important ground water supplies for individual, public, and industrial water users. High quality ground water is an important natural resource in Delaware and much of the Atlantic Coastal Plain. The coarse material deposits of the Columbia formation that are good shallow aquifers are also a useful source of exploitable sand and gravel, which are important natural resources in northern Delaware. Greensand (glauconite) from various upper Cretaceous and Tertiary-age formations has been used in the past as fertilizer because it is a source of potash. In New Jersey, glauconite is used in water softening.

The C&D Canal is one of the most prolific fossil locations in the Atlantic Coastal Plain because it cuts through and exposes many of these prehistoric sedimentary layers. Most of the outcrops on the beaches below the riprap are fossiliferous but exposed only at low tide.

b. Environmental Consequences

The No-Build Alternative would have no effect on project area geology. Furthermore, due to the relative flatness of the project area, all build alternatives (including the Preferred Alternative) would require only minor excavation with minimal impacts to the local near-surface geologic deposits. The major aquifers are located in the Columbia Formation. The potential impacts to aquifers are discussed further in ***Section F.4*** of this Chapter. Because the exploitable sand and gravel deposits are at or near the surface, any roadway construction on these resources would make them unavailable for exploitation.

3. <u>Soils</u>

a. Existing Conditions

Information on soils in the project area was obtained from the US Natural Resources Conservation Service (NRCS), the Soil Survey for New Castle County and GIS soil layers. The soil survey supplied information on soil series and units in the project area. Data pertaining to soil texture, drainage characteristics, erodability, prime farmland and significant soils, and hydric soils are discussed below.

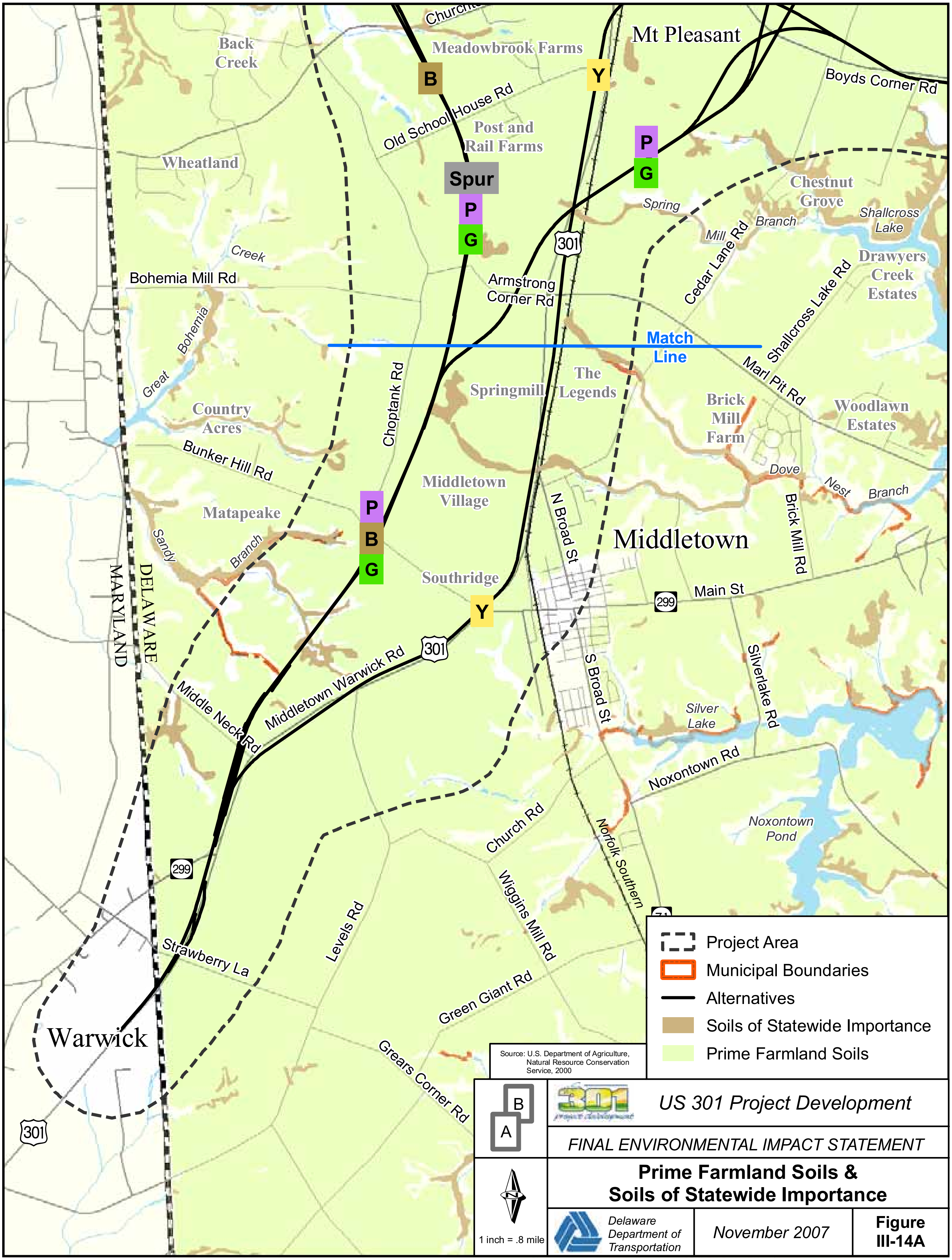
A soil association is a landscape that has a distinctive proportional pattern of soils and normally consists of one or more major soils and at least one minor soil. All project alternatives fall within the Matapeake-Sassafras Association. This association is characterized by nearly level to steep, well-drained soils on uplands. The Matapeake soils have a silt loam surface layer and silty clay loam subsoil. Sassafras soils have a sandy loam surface layer and sandy loam and sandy clay loam subsoil.

The United States Department of Agriculture (USDA) NRCS has mapped the soil types that occur within these associations for New Castle County. Thirty-four (34) soil map units occur within the project area representing twelve soil series (***Table III-51***).

Table III-51: Soil Series in Project Area

Soil Series - Map Units	USDA Soil Textures	Drainage Characteristics
Butlertown – BuA,BuB2,BuC2	Silt loam	Moderately well drained
Collington – CsC3,CsD3	Fine sandy loam	Well drained
Elkton – EIA,EmA	Sandy loam, silt loam	Poorly drained
Fallsington – Fa,Fs	Sandy loam, loam	Poorly drained
Johnston – Jo	Loam	Very poorly drained
Keyport – KeA,KeB2	Silt loam	Moderately well drained
Made Land - Ma	Varies	Varies
Matapeake -MeA,MeB2,MeC2,MeC3,MeD2, MeD3,MkA,MkB2,MkC2	Silt loam	Well drained
Mattapex – MtA	Silt loam	Moderately well drained
Mixed alluvial Land - Mv	Sand to loam	Poorly drained
Othello – Ot	Silt loam	Poorly drained
Pocomoke – Po	Loam	Very poorly drained
Sassafras SaA,SaB2,SaC2,SaC3,SaD2,SaD3	Sandy loam	Well drained
Sassafras and Matapeake - SmE	Sandy loam, silt loam	Well drained
Tidal Marsh - Tm	Sand to clay	Very poorly drained
Woodstown – WoA,WoB2,WsA,WsB2	Sandy loam, loam	Moderately well drained

The Delaware NRCS local office was contacted to obtain information regarding prime farmland soils and farmland soils of statewide importance in New Castle County. Seventeen (17) of the soil map units are classified as prime farmland soils, nine are considered soils of statewide importance, and nine are hydric soil units. The NRCS maintains a list of soil survey map units that contain hydric soils for New Castle County. Prime farmland soils and soils of statewide importance are shown on ***Figure III-14***.



US 301 Project Development

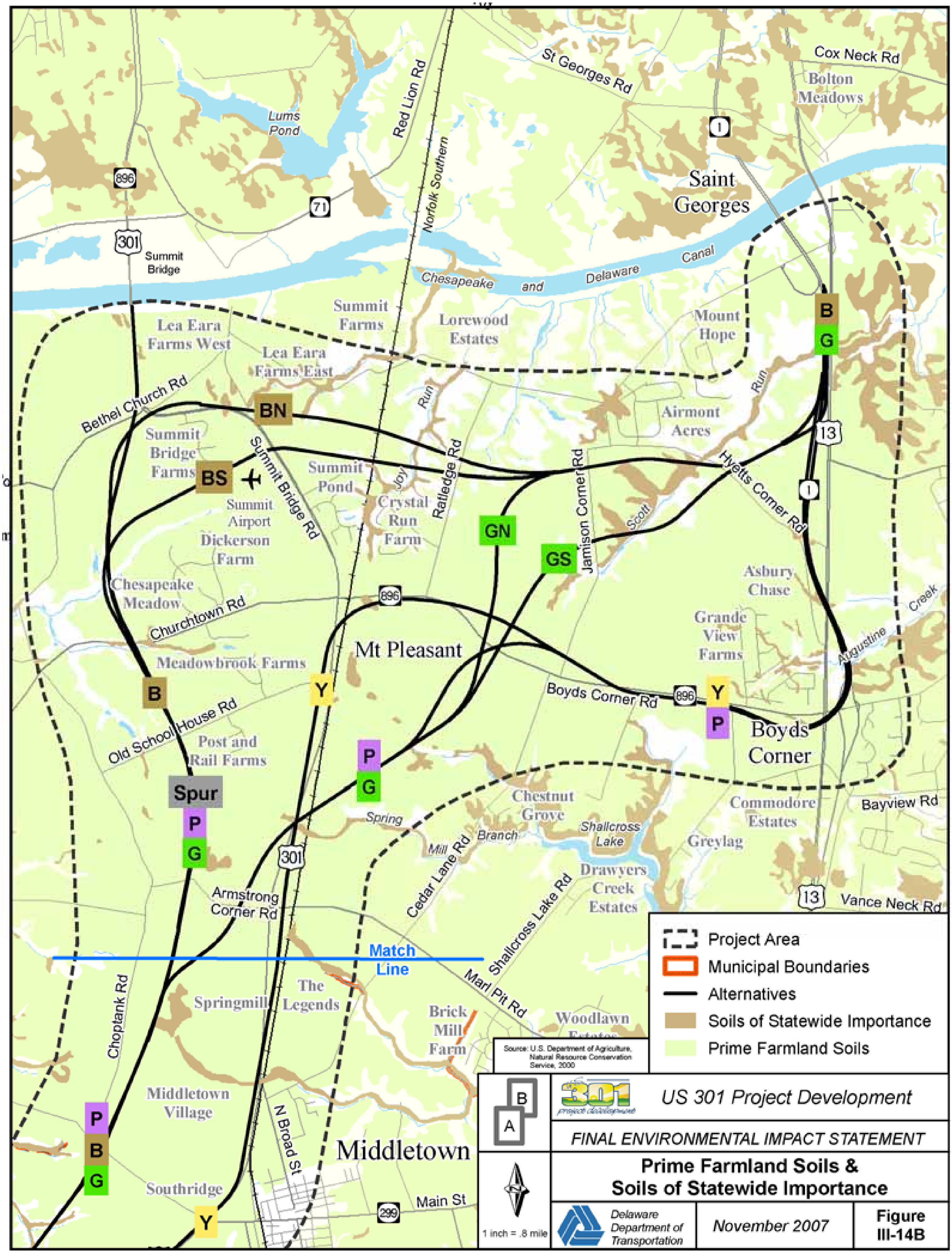
FINAL ENVIRONMENTAL IMPACT STATEMENT

Prime Farmland Soils & Soils of Statewide Importance

Delaware Department of Transportation

November 2007

Figure III-14A



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FINAL ENVIRONMENTAL IMPACT STATEMENT

Prime Farmland Soils & Soils of Statewide Importance

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Figure III-14B

Prime farmland soils, listed in ***Table III-52***, are soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and are also available for these uses. Prime farmland soils typically have an adequate and dependable water supply, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt content, and few or no rocks. They are permeable to water and air, not excessively erodable or saturated with water for a long period of time, and do not flood frequently or are protected from flooding. Soils of statewide importance, listed in ***Table III-53***, are those soils that fail to meet one or more of the requirements of prime farmland, but are important for the production of food, feed, fiber or forage crops. They include those soils that are nearly prime farmland and that economically produce high yields of crops when treated or managed according to acceptable farming methods. Some may produce as high a yield as prime farmland soils if conditions are favorable.

Table III-52: Prime Farmland Soils Located Along Project Alternatives

Map Unit	Yellow	Purple	Brown South	Brown North	Green North	Green South
BuA		√	√	√	√	√
BuB2	√	√	√	√	√	√
Fa	√	√	√	√	√	√
Fs	√	√	√	√	√	√
MeA	√	√	√	√	√	√
MeB2	√	√	√	√	√	√
MkA	√	√	√	√	√	√
MkB2	√	√	√	√	√	√
MtA	√	√	√	√	√	√
Ot	√	√	√	√	√	√
Po	√	√			√	√
SaA	√	√	√	√	√	√
SaB2	√	√	√	√	√	√
WoA	√	√	√	√	√	√
WoB2	√	√	√	√	√	√
WsA	√	√	√	√	√	√
WsB2	√	√	√	√	√	√

Table III-53: Soils of Statewide Importance Located Along Project Alternatives

Map Unit	Yellow	Purple	Brown South	Brown North	Green North	Green South
BuC2			√	√	√	√
EIA	√	√	√	√	√	√
EmA	√	√	√	√	√	√
Jo	√	√	√	√	√	√
KeA	√	√	√	√		
KeB2	√	√			√	√
MeC2	√	√	√	√	√	√
MkC2			√	√	√	√
SaC2	√	√	√	√	√	√

Hydric soils are soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Identifying hydric soils is important for land-use planning, conservation planning, and assessment of potential wildlife habitat. Hydric soils in the project area are identified in ***Table III-54*** and shown on ***Figure III-15***.

Table III-54: Hydric Soils Located Along Project Alternatives

Map Unit	Yellow	Purple	Brown South	Brown North	Green North	Green South
EIA	√	√	√	√	√	√
EmA	√	√	√	√	√	√
Fa	√	√	√	√	√	√
Fs	√	√	√	√	√	√
Jo	√	√	√	√	√	√
Mv	√	√	√	√	√	√
Ot	√	√	√	√	√	√
Po	√	√			√	√
Tm			√	√	√	√

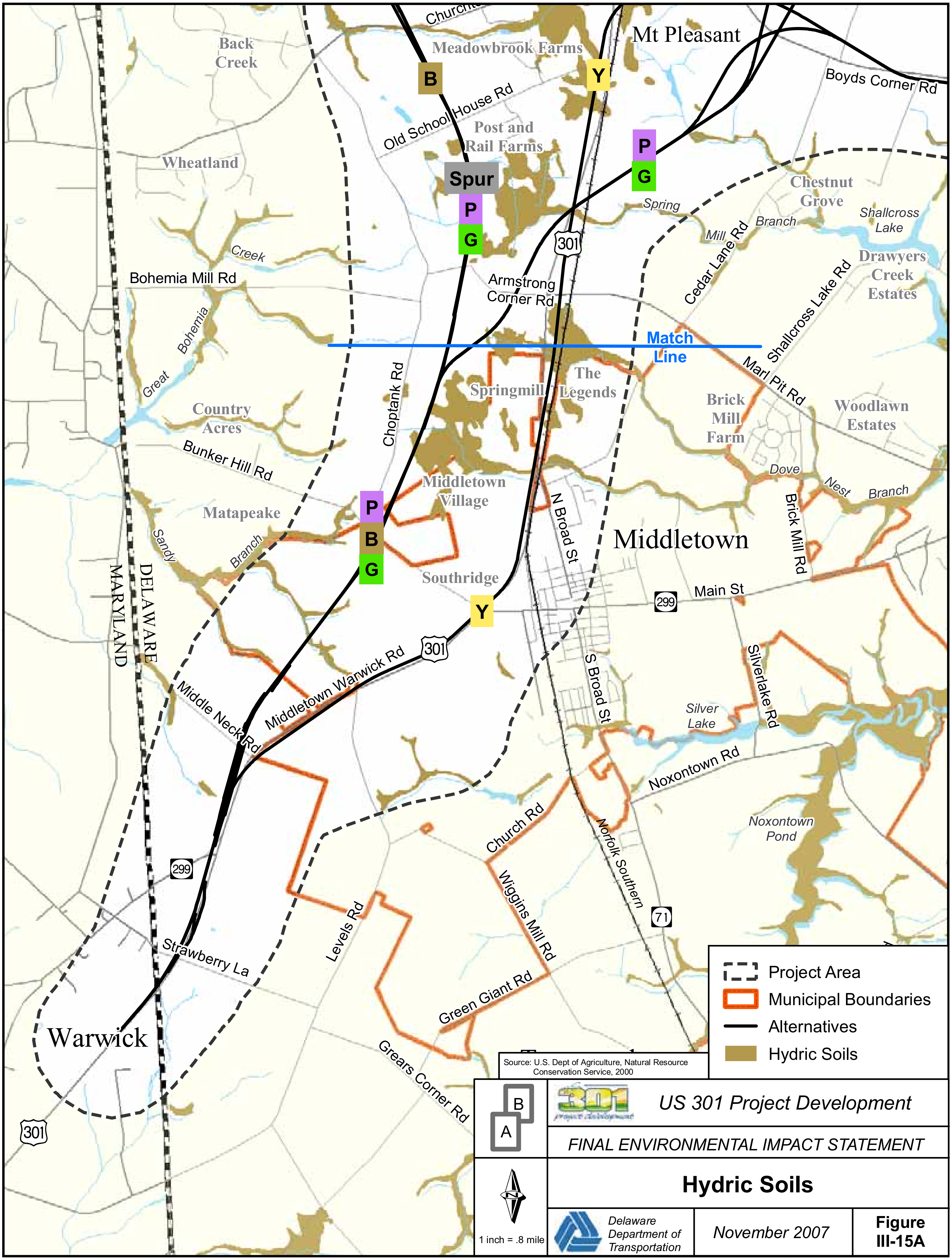
Soils encountered along the alternatives have been evaluated for roadway constructability. All soils along the alignment have some limitations for use as a roadway. Limitations include slope, large stones, frost action, wetness, flooding, low strength, depth to bedrock, and shrink-swell. Soils are also rated for their use as a source of roadfill for embankments generally less than six feet high. Along the alignments within the project area, soils received good or fair ratings with the exception of Elkton, Johnston, and Keyport series which received poor ratings.

b. Environmental Consequences

Impacts to three classes of soils are of concern to the project: prime farmland soils, soils of statewide importance and hydric soils. The No-Build Alternative would have no impact on project area soils.

The Preferred Alternative will impact 616 acres of prime farmland soils, 3 acres of soils of statewide importance and 166 acres of hydric soils. The Preferred Alternative impacts include two potential wetland mitigation sites (**Chapter III.F.6**).

As reported in the DEIS, each of the build alternatives will affect the three classes of soils to varying degrees, as shown in ***Table III-55***. These impacts were considered during the evaluation of alternatives and the selection of a Preferred Alternative.



Source: U.S. Dept of Agriculture, Natural Resource Conservation Service, 2000

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Hydric Soils

Delaware Department of Transportation

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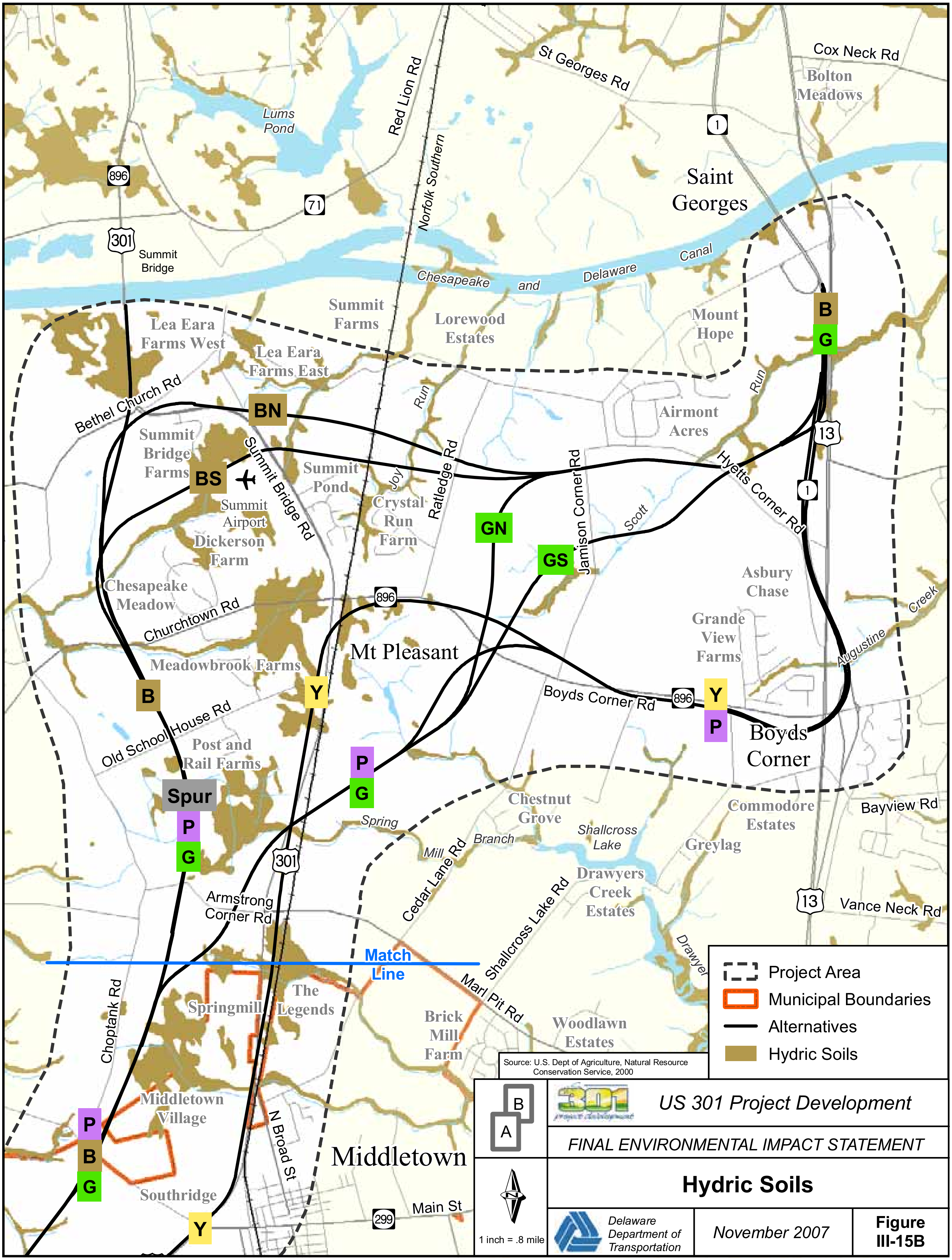
Figure III-15A



St Georges Rd
Cox Neck Rd
Bolton Meadows
Lums Pond
Red Lion Rd
Norfolk Southern
Saint Georges
Summit Bridge
Chesapeake and Delaware Canal
Summit Farms
Lorewood Estates
Mount Hope
Lea Eara Farms West
Lea Eara Farms East
Bethel Church Rd
Airmont Acres
Summit Bridge Farms
Summit Bridge Rd
Summit Pond
Summit Airport
Crystal Run Farm
Ratledge Rd
Jamison Corner Rd
Hyetts Corner Rd
Scott
Dickerson Farm
Chesapeake Meadow
Churchtown Rd
Asbury Chase
Grande View Farms
Mt Pleasant
Meadowbrook Farms
Augustine Creek
Boyds Corner Rd
Boyds Corner
Old School House Rd
Post and Rail Farms
Spur
Chestnut Grove
Commodore Estates
Bayview Rd
Spring Mill Branch
Shallcross Lake
Greylag
Cedar Lane Rd
Shallcross Lake Rd
Drawyers Creek Estates
Armstrong Corner Rd
Vance Neck Rd
Match Line
Marl Pit Rd
Springmill
The Legends
Choptank Rd
Brick Mill Farm
Woodlawn Estates
Middletown Village
N Broad St
Middletown
Southridge
Main St
Project Area
Municipal Boundaries
Alternatives
Hydric Soils
Source: U.S. Dept of Agriculture, Natural Resource Conservation Service, 2000
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Hydric Soils
1 inch = .8 mile
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Figure III-15B

Table III-55: Soils Impacts of the Build Alternatives (Acres)

Soils	No-Build	Yellow	Purple	Brown North	Brown South	Green North (DEIS)	Green South
Prime Farmland Soils	0	203	415	412	424	437	398
Soils of Statewide Importance	0	2	3	4	3	3	3
Hydric Soils	0	158	147	119	115	146	145

Note: Acreage rounded up to nearest whole acre.

Direct impacts to soils related to all build alternatives, including the Preferred Alternative, would result from construction activities such as paving, grading, excavation for stormwater management facilities, and compaction of soils from construction. Grading operations necessary to meet existing roadway grades would result in either the direct removal of soils or their burial under fill. Excavation for stormwater management facilities within the project area would likewise result in the removal or burial of existing soils. Compaction of soils during construction activities could alter soil properties without their removal or burial, and is likely to occur in areas throughout the limit of disturbance.

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

Impacts to soil resources could be minimized through design and construction techniques. Best management practices during construction (such as the implementation of DNREC-approved erosion and sediment control guidelines, the development of comprehensive grading plans, and the use of sediment and soil stabilization techniques) could greatly minimize soil impacts. A comprehensive replanting effort will be implemented during construction to quickly reestablish vegetative cover for erosion control, and immediately after construction to provide long-term tree and shrub revegetation. While the creation of stormwater management facilities would directly impact some soil resources during construction, they would decrease uncontrolled runoff and widespread erosion on adjacent lands, and would provide protection to surface water resources.

c. Farmland Conversion Impact Rating

The submission of Form CPA-106 in compliance with the Farmland Protection Policy Act (FPPA), as amended in 1984 and 1994, is discussed in ***Section A.4*** of this Chapter. [NOTE: Correspondence with the Natural Resources Conservation Service (NRCS) is ongoing. An initial Farmland Conversion Impact Rating (FCIR) Form was submitted to the NRCS on July 12, 2007, and was returned for completion on August 28, 2007, in accordance with the procedure. The NRCS applied a relative value of 90.7 (on a scale of 0-100 points) to the farmland to be converted (Land Evaluation Criterion Relative value of Farmland to Be Serviced or Converted). A copy of the completed form (returned to NRCS) is included in ***Appendix G***. The criteria assessment resulted in a final score of 196 out of a maximum possible score of 260 points.

4. Groundwater

a. Existing Conditions

Groundwater is an important resource and commodity for the State of Delaware, especially south of the C&D Canal where public surface water supply systems are absent and groundwater is used for both domestic supply and farm irrigation. In addition to domestic and farm water supply, wetland dependant wildlife relies on groundwater to create wetland seep habitat. On average, Delaware receives 40 to 44 inches of local rainfall per year, but not all of this water is available for use. From this yearly rainfall supply, approximately 20 inches evaporate, 3 inches are transpired by plants, and 4 to 5 inches are lost to surface runoff. The remaining 13 to 15 inches of rainfall are absorbed into the ground and naturally stored in a system of groundwater aquifers that underlie most of the state.

The Columbia Formation, a relatively thin layer of predominantly sands and gravels that unconformably overlies the older dipping coastal plain sediments presumed to have originated from streams created in the last ice age by melted flowing waters, covers almost all of the Coastal Plain of the state. The Columbia Formation is a groundwater source for water yields ranging from less than 10 gallons per minute (gpm) to excellent water yields greater than 500 gpm where sufficient formation thickness and saturation rates exist. The water yields typically increase in quantity in a general north to south direction, which correlates to formation thickening. This formation also serves a source of recharge for the underlying aquifers.

The Rancocas Group consists of the Vincentown and Hornerstown Formations. These minor aquifers produce well yields adequate for domestic use, but are of little value for large scale water production. The Mount Laurel and the Englishtown Formations, likewise, are capable of producing enough water for domestic use, but are not generally considered to have consistent water supply potential. The Magothy Formation consists of clean sand and it underlies the more recent deposits described above. This aquifer is a major aquifer, but in some areas the depth makes the cost to drill wells prohibitive.

The Potomac Formation is used for water supply in northern Delaware, but not in southern Delaware due to the depth of the aquifer and the groundwater being brackish in nature. Other major aquifer systems that overlie the Potomac Formation are also commonly used.

In the project area, groundwater depths are unusually deeper than what is normal for the Columbia Formation. Vertical recharge is slow even though surface recharge areas cover most of the region; ***Figure III-16*** shows the aquifer recharge areas. There is little to no fluctuation in water levels throughout the year which is most likely due to the presence of the C&D Canal and the surrounding creeks and rivers, particularly Drawyers Creek and its tributaries, located north of Odessa, and the Appoquinimink River and its tributaries, located south of Odessa. These streams and rivers act as natural drains for the water table which dampen any groundwater fluctuation. The following is a summary of existing groundwater conditions along each of the build alternatives alignments:

Green (Preferred) Alternative

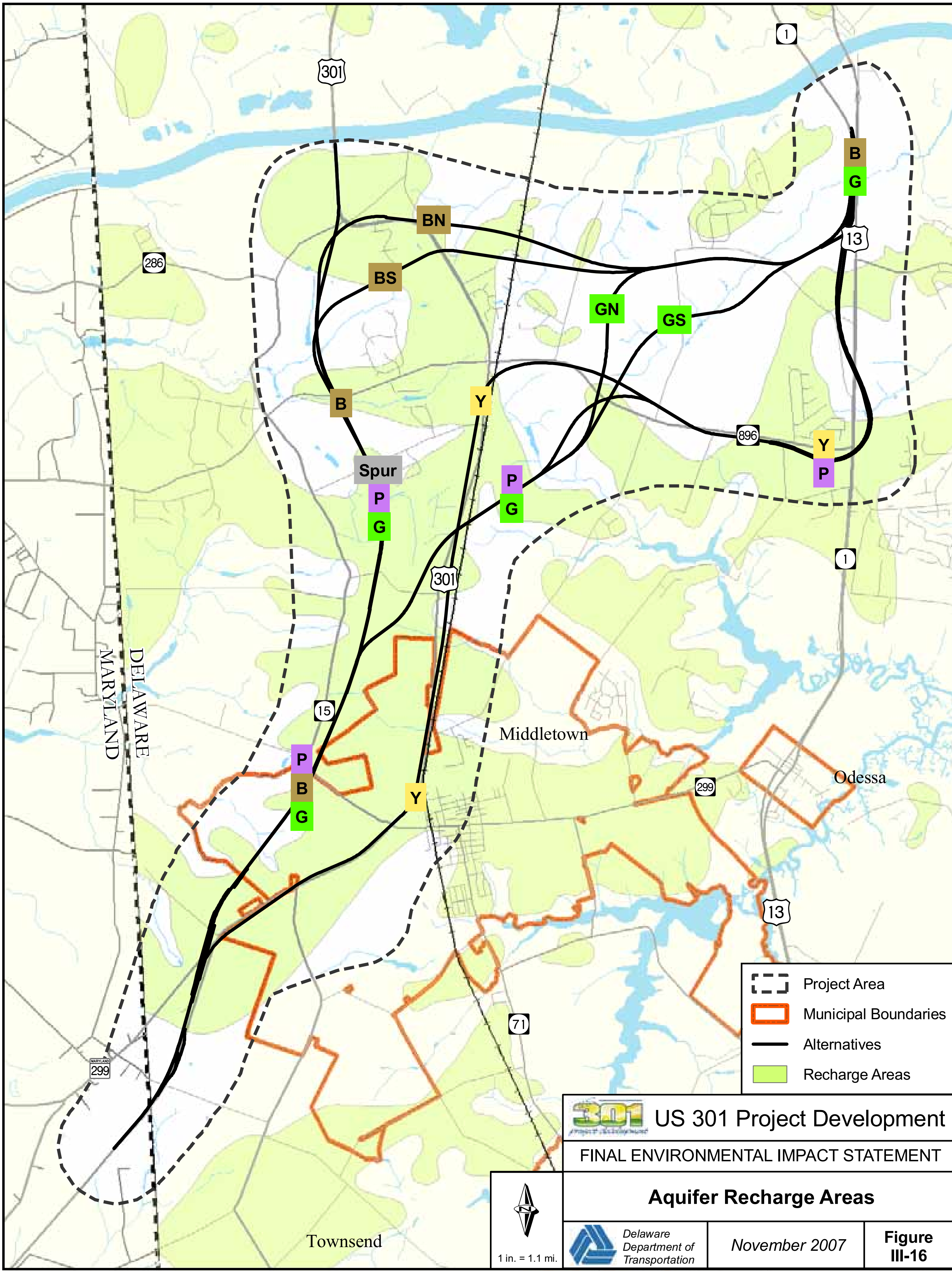
- In the southwest segment from the state line to about Sandy branch, the depth to groundwater ranges from 40 to 60 feet.
- In the mid-section segment, groundwater is present at depths of approximately 40 to 60 feet; south of Bohemia Mill Road the depth to groundwater becomes as deep as 60 feet.
- In the northeast segment from the crossing with Drawyers Creek to the merge with US 301 the depth to groundwater becomes shallower ranging from 40 to 20 feet, respectively.
- Approximately 40 percent of the alignment crosses groundwater recharge zones.

Yellow Alternative

- In the west segment from the state line to about Levels Road, groundwater is present at depths approximately 60 feet or greater becoming as shallow as about 50 feet near Bunker Hill Road and then becoming as deep as 60 feet near Armstrong Corner Road.
- In the mid-section segment, groundwater is present at depths of approximately 40 feet.
- In the east segment from the intersection with SR 896 to the merge with SR 1, groundwater is present at depths ranging from approximately 20 to 40 feet.
- At the Augustine Creek crossing, groundwater is present at depths less than approximately 20 feet below the existing ground surface.
- Approximately 50 percent of the alignment crosses groundwater recharge zones.

Purple Alternative

- In the south end segment from the state line to the merge with SR 896, groundwater is present at depths of approximately 40 to 60 feet.
- At the Sandy Branch crossing, groundwater is present approximately 40 feet or less in depth.
- More than 75 percent of the alignment crosses groundwater recharge zones.



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Aquifer Recharge Areas

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Figure III-16

Brown Alternative

- In the south end segment from the state line to Sandy Branch, groundwater is present at depths of approximately 40 to 60 feet. Minor tributaries for Back Creek are located in this segment.
- In the mid-section segment, groundwater is present at depths of approximately 40 feet.
- From the Scott Run crossing to the merge with US 301, groundwater is present at depths less than approximately 20 feet below the existing ground surface.
- Approximately 50 percent of the alignment crosses groundwater recharge zones.

b. Environmental Consequences

The No-Build Alternative would have no impact on project area aquifers. However, as an unconfined aquifer, the Columbia Formation is vulnerable to contamination from the ground surface. Construction activities involving excavation that result from construction of any of the build alternatives (including the Preferred Alternative) may encounter and/or affect areas with shallow groundwater depths, especially those located near proposed crossings at bodies of surface water. Any excavations that encounter the groundwater may increase the potential for contamination being introduced into the ground water system. All of the proposed alternatives contain water crossings.

The ground surface areas that have been characterized as recharge zones for the aquifer may also allow for introduction of pollutants into the groundwater through permeation during construction. This is an important concern, considering that a high percentage of the proposed alternative routes are located within the recharge zones. The Green (Preferred) Alternative has the least amount of roadway area located within recharge zones; the Purple Alternative has the highest percentage of potential roadway located on recharge zones, followed by the Yellow and Brown Alternatives.

Introducing impervious surface into groundwater recharge zones may also affect recharge rates and percentage of water infiltration. Decreased infiltration may affect the size and quality of groundwater-created wetland seeps that create habitat for some wetland dependent species.

Once construction of the roadways is complete, it is expected that runoff conditions will develop, possibly causing erosive conditions. Runoff conditions can also introduce undesirable materials, including solid particles and chemicals, into the water table by way of infiltration. Stormwater management facilities and drainage ditches assist in catching much of this runoff; they will be properly designed to prevent groundwater contamination in shallow aquifers.

5. Surface Water and Water Quality

a. Surface Water

(1) Existing Conditions - Watersheds

Five different watersheds are located within the project area, including the C&D Canal East Watershed, C&D Canal West Watershed, Bohemia Creek Watershed, Sassafras River Watershed, and the Appoquinimink River Watershed (***Figure III-17***). Land use within these watersheds includes agricultural, forest, wetland, urban/residential, shrubland, and other undefined land uses. According to DNREC, primary watershed concerns include the presence of pathogens, nutrient loading, physical habitat condition, and protection of water supply.

The Chesapeake & Delaware (C&D) Canal East and West Watersheds

The Chesapeake and Delaware Canal is a man-made navigation channel connecting the Delaware River to the Chesapeake Bay. The C&D Canal East and West Watersheds have a combined drainage area of approximately 41,000 acres. The C&D Canal East Watershed drains into the Delaware Bay Basin, while the C&D Canal West Watershed drains into the Chesapeake Bay Basin.

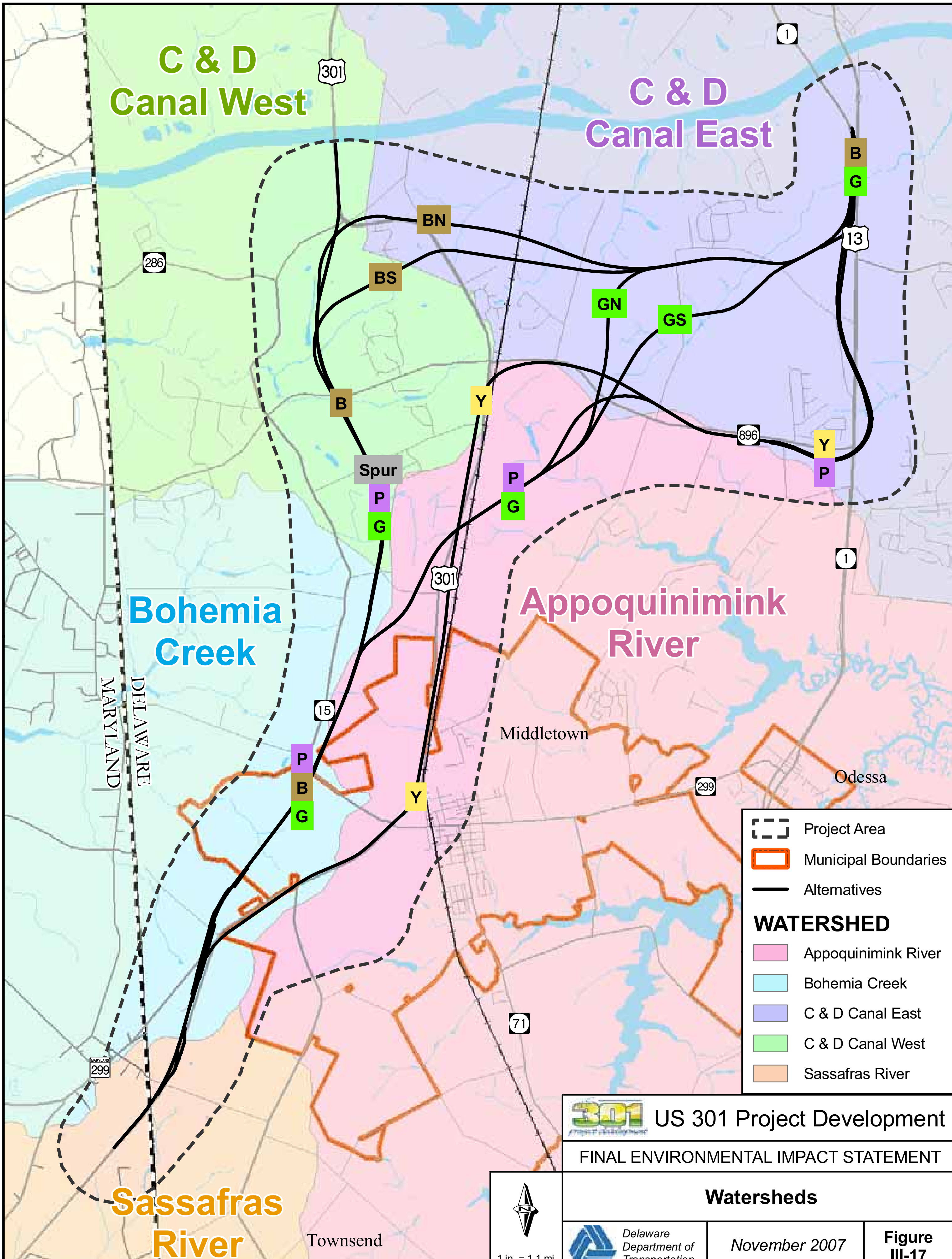
The C&D Canal East Watershed extends south from the SR 40/Porter Road area to approximately SR 896 and from an area outside the project area on the east to approximately US 301 on the west. The C&D Canal West Watershed extends from SR 40/Porter Road on the north to approximately one mile south of Back Creek, and from the vicinity of US 301 on the east, out of the project area into the State of Maryland to the west.

Major surface water bodies in the C&D Canal East Watershed include the C&D Canal and its unnamed tributaries, Crystal Run, Joy Run, Scott Run and its unnamed tributaries and Augustine Creek. Major surface water bodies in the C&D Canal West Watershed include the Chesapeake and Delaware Canal and its unnamed tributaries and Back Creek and its unnamed tributaries.

Lands adjacent to both watersheds consist of federal reservation land currently designated as a wildlife area. Land use within these watersheds is comprised of 56 percent agricultural, 14 percent forest, 10 percent wetland, 9 percent brushland, 4 percent urban/residential and 7 percent other.

Appoquinimink River Watershed

The Appoquinimink River Watershed drains approximately 30,000 acres within the Delaware Bay Basin in southern New Castle County, Delaware. The Appoquinimink River Watershed extends from the C&D Canal East Watershed on the north to approximately one-half mile south of Wiggins Mill Pond on the south, and from an area outside of the project area on the east to an area slightly east of SR 15 on the west.



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Watersheds

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Figure III-17

Major water bodies within the Appoquinimink River Watershed include the main stem of the Appoquinimink River, Drawyers Creek and its unnamed tributaries, Spring Mill Branch and Dove Nest Branch. Man-made ponds and lakes include Shallcross Lake, Noxontown Lake, Silver Lake and Wiggins Mill Pond.

The major land use category in this watershed is agricultural (69 percent) with the remainder consisting of wetland (12 percent), forest (11 percent), urban/residential (3 percent) and other (5 percent). The area is experiencing significant residential growth near its three residential/urban centers, Middletown, Odessa, and Townsend.

Bohemia Creek Watershed

The Bohemia Creek Watershed drains approximately 12,000 acres of western New Castle County, Delaware and eastern Cecil County, Maryland into the Chesapeake Bay Basin. The Bohemia Creek Watershed is bordered by the C&D Canal West Watershed on the north and extends southward to the Sassafras River Watershed approximately one-half mile south of an unnamed tributary of Sandy Branch. The watershed's eastern boundary is located slightly east of SR 15 and extends to the west, outside of the project area, into the State of Maryland. Major surface water bodies within this watershed include Great Bohemia Creek and its unnamed tributaries and Sandy Branch and its unnamed tributaries.

The major land use category in this watershed is agricultural land with forests, wetlands, and residential areas making up the remaining land uses. Pathogens, nutrient loading, physical habitat condition, and water supply are the primary watershed concerns.

Sassafras River Watershed

The Sassafras River watershed drains approximately 48,300 acres within western New Castle County, Delaware and eastern Cecil County, Maryland. The watershed is bordered by the Bohemia Creek Watershed to the north and extends south, outside of the project area. The watershed's eastern boundary roughly parallels SR 15 and extends westward out of the project area into the State of Maryland.

Major surface water bodies within the Sassafras River Watershed include the Sassafras River and several of its unnamed tributaries.

The major land use categories within the watershed include agricultural (68 percent), forest (26 percent), residential (4 percent) and wetlands (2 percent). Pathogens, nutrient loading, physical habitat condition, and water supply are the primary watershed concerns.

(2) Environmental Consequences

The No-Build Alternative would result in no impacts to watersheds within the project area. Impacts to surface water features could potentially result from construction and operation of any of the build alternatives, including the Preferred Alternative. These impacts include: bridge and/or culvert construction at stream crossings, accidental spills of hazardous materials, sedimentation, bridge shading, removal of riparian vegetation, surface water diversions, potential dewatering, lack of surface water recharge along stream headwaters, and from construction of this project's roadways.

The greatest impact to watersheds from the build alternatives would be from the increase in impervious surfaces created during the construction and expansion of new roadways. The Preferred Alternative would create an additional 238 acres of additional impervious surface area.

A substantial increase in the amount of imperviousness would greatly affect hydrologic conditions, including the frequency, intensity and quantity of surface water runoff within the watershed. Increases in impervious surface area also facilitate the introduction of hazardous materials, sediment and eroded soils into the watershed through increased surface runoff. ***Table III-56*** shows the amounts of new impervious surface that would be added with each of the build alternatives, as detailed in the DEIS.

Table III-56: Alternatives Impervious Surface Additions

	Yellow	**Purple**	**Brown North**	**Brown South**	**Green North (DEIS)**	**Green South**
Acres of Additional Impervious Surface	246	226	217	222	216	220

Potential impacts to surface waters (stream and ditch crossings) could result in potential impacts as discussed in the following paragraphs. The No-Build Alternative would not impact surface waters in the project area. The Preferred Alternative would have 46 impacts to streams and ditches in the project area in the five watersheds impacted by the project (see ***Table III-57***).

Table III-57: Numbers of Potential Impacts of the Preferred Alternative to Surface Waters

Watershed		**Impacts**	**Watershed**		**Impacts**
C&D Canal East	Ditches	2	Bohemia Creek	Ditches	5
	Streams	3		Streams	2
C&D Canal West	Ditches	11	Sassafras River	Ditches	8
	Streams	3		Streams	3
Appoquinimink River	Ditches	5	**Total Impacts (46)**	**Ditches**	**31**
	Streams	4		**Streams**	**15**

The numbers of impacts of the four build alternatives to streams and ditches, as shown in ***Table III-58***, were considered during the evaluation of alternatives and selection of a Preferred Alternative. Potential numbers of impacts to surface waters ranged between 57 for the Yellow Alternative and 39 for the Brown South Alternative. These impacts reflect an update over those shown in the DEIS, because the data were reported for a more preliminary level of engineering detail than was completed for the DEIS.

Table III-58: Potential Impacts of the Retained Alternatives to Surface Waters

Alternative		Yellow	Purple	Brown North	Brown South	Green North (DEIS)	Green South
C&D Canal East	Ditches	16	12	6	5	4	3
	Streams	2	2	10	7	3	4
C&D Canal West	Ditches	5	9	10	6	9	9
	Streams	0	5	4	4	5	5
Appoquinimink River	Ditches	14	1	1	1	4	4
	Streams	1	0	0	0	3	4
Bohemia Creek	Ditches	6	2	2	2	2	2
	Streams	3	4	4	4	4	4
Sassafras River	Ditches	8	8	8	8	8	8
	Streams	2	2	2	2	2	2
Total Surface Water Feature Impacts	**Ditches**	**49**	**35**	**27**	**22**	**27**	**26**
	Streams	**8**	**16**	**20**	**17**	**17**	**19**
Total Impacts		**57**	**51**	**47**	**39**	**44**	**45**

NOTE: Ditches and Streams are waters of the US not included in wetlands

Construction of bridges or culverts over stream crossings resulting from any of the build alternatives could affect surface water features by altering stream morphology and stream bank stability. Spills of hazardous materials on roadways during and after construction may directly enter surface waters. Sediment from construction activities and improper erosion controls after construction may lead to grade changes, and increased erosion in surface waters. Bridge shading and riparian vegetation removal can result in a change to the amount and type of riparian habitat cover and affect water temperature potentially leading to a change in the thermal chemistry of the stream. Surface water diversions could potentially affect stream base flow and increase the possibility of flash flood storm events. Impacts along headwater streams may result in a loss of surface water recharge to a stream system or potential dewatering of headwaters. The construction of new roadways and the expansion of existing road surfaces along surface water features could potentially decrease the amount of vegetated riparian buffer and increase the amount of impervious surface.

Additional impacts to surface water features may occur as a result of activities related to each of the build alternatives including: increased stormwater runoff from impervious surfaces, greater influx of pollutants including sediment into surface water features, temporary disturbance resulting from construction activities, and increased stream velocities and bank erosion rates.

The construction of new road surfaces will increase the amount of impervious surface area within the watershed and also the amount and intensity of stormwater runoff entering surface water features within the project area. The increased traffic on these new roadways may lead to a greater amount of water pollution. Pollutants such as oil, grease, heavy metals, sediment, organics, and nutrients transported from road surfaces via stormwater runoff can be released into nearby streams. During construction activities related to the project, temporary impacts may result due to the disturbance of adjacent land areas and in-stream activities. The disturbance of stream banks and an increase in the amount of runoff can result in a dramatic increase in stream velocities, stream discharge rates, erosion potential and other hydrologic stream functions.

(3) Mitigation

Mitigation options for watersheds that will be used include the construction of stormwater management facilities to handle the increased stormwater runoff that will occur due to more impervious surface areas. These stormwater management facilities manage the flow and discharge of stormwater into the streams and rivers located in the project area and reduce the possibility and effects of increased pollution, erosion, and morphological stream changes. In order to meet the stormwater management requirements for the project, a combination of structural and non-structural stormwater management facilities will be utilized. To the extent practicable, the project will incorporate the use of "Green Technology" Best Management Practices (BMPs) in fulfilling the stormwater management requirements for the project. Green Technology practices include filter strips, biofiltration swales, bioretention, and infiltration trenches. More traditional facilities such as wet and dry ponds will be utilized where the use of Green Technologies is not feasible to meet the stormwater management requirements. Due to right-of-way, utility or environmental constraints, the use of underground stormwater treatment structures, such as filtration structures, hydraulic separators and catch basin inserts may be utilized.

In order to prevent stream degradation, water quality impairment, and flooding associated with construction projects, Delaware's Sediment and Stormwater Regulations require that stormwater management measures (BMPs) be implemented. DNREC has delegated approval authority for stormwater management to DelDOT for DelDOT projects. South of the C&D Canal, runoff must be limited to predevelopment levels for the 2-year and 10-year design storms to prevent flooding and channel erosion, referred to as *quantity* management. To address water *quality* impacts of construction, the runoff from the lesser of the one-year, 24-hour design storm, or one inch, must be treated in BMPs to reduce sediment, nutrient, and toxics loadings to waterways. Stormwater management BMPs require additional right-of-way and may sometimes need to be located within wetland or other sensitive areas. Therefore, the build alternatives were assessed to determine stormwater management requirements for each, and identify the size and location of potential stormwater management sites, and resulting effects on the project limits of disturbance.

The US 301 roadway typical section includes 4-foot wide side ditches, which, along with the proposed 4:1 side slopes and available safety grading, provide an adequate section for water quality treatment using non-structural BMPs such as bioswales, in keeping with the DNREC preference for 'green design' type BMPs. Additional structural BMPs are required for quantity management. Potential SWM pond locations were identified based on topography and proposed roadway horizontal and vertical alignments. Wherever possible, wetlands and historic properties were avoided. Using an adaptation of the methods recommended in Maryland SHA Highway Hydraulic's Division April 2003 *Stormwater Management Concept Report Guidelines*, the required stormwater pond sizes were estimated as described below:

- Runoff volumes were estimated for the 2-year and 10-year storm events, assuming a Runoff Curve Number of 90 within the roadway cut/fill limits
- Storage volume was estimated for each storm, using 50 percent of the runoff volume for the 2-year event, and 40 percent of the runoff volume for the 10-year event, both with a safety factor of 1.3.

- Surface area requirements were computed for each storm, assuming 2 feet of depth for the 2-year volume, and 3 feet of depth for the 10-year volume
- The required pond/structural BMP area was estimated as the larger of the 2-year and 10-year computed surface area, times 1.25

Preliminary stormwater management facility locations shown in the DEIS have been refined and modified for the Preferred Alternative. These locations, based on hydrology studies during detailed engineering, are shown on the plan sheets in ***Appendix B***, along with the project limits of disturbance. Using the method outlined above, the approximate area required for stormwater management facilities would be 7 percent of proposed area for each alternative.

By constructing bridges over surface water features, the impact is minimized to a more narrow area. By constructing bridges over sensitive features, the amount of impact to adjacent resources can be avoided completely or greatly decreased.

During construction activities, the implementation of best management practices (BMPs) such as limiting the period allowed for instream construction work can reduce potential impacts to streams and watersheds.

Additional mitigation would include riparian buffer restoration and enhancement. Riparian buffers protect surface waters by reducing thermal impact and attenuating surface runoff. Riparian vegetation would be planted along stream corridors to create new riparian buffers or planted adjacent to existing vegetation to enlarge existing undersized buffers.

b. Water Quality

(1) Existing Conditions

The Delaware Water Quality Standards Program has defined "designated uses" for each water body as specified in the water quality standards. Designated use standards require that potential uses of water are protected, even if they are not currently being attained. There are currently nine designated uses of water in the State of Delaware as follows:

- Public Water Supply
- Primary Contact Recreation (Swimming)
- Secondary Contact Recreation (Wading)
- Agricultural Water Supply
- Industrial Water Supply
- Fish Aquatic Life and Wildlife
- ERESE Waters (Waters of Exceptional Recreational and Ecological Significance)
- Cold Water Fish
- Harvestable Shellfish Waters

DNREC has obtained water quality data for several of the surface water features located within the project area (***Table III-59***). Water bodies in this area are routinely monitored for typical water quality parameters (*i.e.*, pH, temperature, dissolved oxygen (DO), etc.). Water quality data for the Sassafras River and Great Bohemia River were not collected by DNREC. DNREC has also conducted habitat and biological assessments of surface water features in the project area. Based upon these assessments, the water quality of these surface water features has been determined to range from severely degraded to excellent.

Table III-59: Water Quality Data for Surface Water Features within the Project Area

Watershed	Segment Name	Test Parameters								
		Average DO (mg/L)	DO		pH		Temp		Average Total N (mg/L)	Average Total P (mg/L)
			Maximum	Minimum	Maximum	Minimum	Maximum	Minimum		
C&D Canal (East/West)	C&D Canal from Maryland Line to Delaware River	7.9	11.2	1.9	7.7	6.2	27.0	6.0	2.02	0.157
Appoquinimink River	Lower Appoquinimink River	6.9	10.4	3.6	7.6	6.0	26.0	3.0	1.91	0.304
Appoquinimink River	Upper Appoquinimink River	7.0	9.8	4.0	7.8	6.1	28.0	1.0	2.01	0.204
Appoquinimink River	Drawyers Creek and Tributaries	8.4	11.4	5.0	7.3	6.0	25.0	5.5	2.40	0.266
Appoquinimink River	Shallcross Lake	8.9	11.6	7.6	8.1	5.2	24.0	6.0	3.33	0.051
Appoquinimink River	Silver Lake	9.8	11.9	6.6	8.5	6.2	14.0	5.5	5.15	0.097

Surface water quality data reveal that the leading causes of diminished aquatic life in Delaware waters are increased nutrient influx, low dissolved oxygen levels, and biological and habitat degradation. The main sources of the degradation of biological quality and aquatic habitat are the result of non-point source pollution from agricultural and urban runoff.

Although pathogenic indicators are the most widespread contaminant source found throughout the state, nutrients and toxics pose the most serious threat to surface water quality, aquatic habitat, and human health. Toxic contaminants are released into surface water features as the result of pollution from urban and industrial areas. Non-point sources, primarily runoff from agricultural and urban land, and municipal and industrial point sources remain the primary contributors of both nutrients and toxics to surface water features.

Surface waters located in the Appoquinimink River Watershed and C&D Canal East and West Watersheds have shown moderately to severely degraded water quality as a result of pollution from ongoing urban and industrial runoff and prior contamination. Surface water features located in more rural areas, including the Bohemia Creek and Sassafras River Watersheds, exhibit more stable water quality compared to other watersheds in the project area and have water quality impacts primarily from agricultural use.

DNREC, in response to surface water quality degradation, has established fish consumption advisories to the general public for portions of the Appoquinimink River, Drawyers Creek and its tributaries, and the C&D Canal.

(2) Environmental Consequences

Impacts to surface water quality may result from each of the build alternatives, including the Preferred Alternative. Only the No-Build Alternative would result in no impacts to surface water quality. Direct impacts that result from bridge or roadway construction or those involving the disturbance of stream banks or channels will have an adverse impact on water quality by affecting stream flow rates, temperature and nutrient levels. Elevated levels of pollutants such as oil and grease, deicers, heavy metals, organics, sediment and nutrients will accompany increased stormwater runoff from vehicle traffic using these routes.

An increase in impervious surface area will provide a direct means for the introduction of increased levels of hazardous materials, sediment and excess nutrients into surface water bodies. New impervious areas introduced into each watershed will also inhibit the dilution of pollutants and sediment loads by surface and subsurface soils which otherwise could reduce the negative affects of pollutants and sediment loads on water quality.

The construction of roadways and associated infrastructure will include the introduction of additional discharge outlets (*i.e.*, pipes and culverts) for the transmission of polluted runoff from both point and non-point sources. The increased number of discharge points will have as adverse effect on the overall surface water quality within the project area.

Construction activities that occur adjacent to or within the vicinity of surface water features may have effects on surface water features. The construction of new roads, drainage ways, and other impervious surfaces will increase the amount of stormwater runoff entering nearby rivers, streams and lakes. The construction of new transportation routes may result in further land development and promote additional land use changes throughout the project area to address demand for more commercial and residential properties. The clearing and excavation of previously forested or agricultural lands may cause an increase in soil erosion and lead to further sedimentation of surface water features. Similarly, reductions in riparian forest may lead to elevated water temperatures which is directly limiting to cold-water fish, and decreases dissolved oxygen which is limiting to all aquatic life.

(3) Mitigation

The Preferred Alternative will include properly designed and constructed stormwater management facilities that will control the release and amount of runoff entering natural surface water features from newly created highways and drainage ways and reduce the potential for sedimentation impact to receiving waters. In order to obtain proper avoidance and minimization of impacts to surface water quality, the design and construction of each stormwater management facility will be in conformance with the requirements established by DNREC.

During construction activities, the implementation of BMPs will reduce potential negative effects by providing a standard control method that meets the highest degree of pollution reduction possible. The design and construction of routes to limit direct impacts to surface water features will reduce the level of impact to the natural system. In areas of temporary disturbance owing to construction, soil and vegetative cover will be reestablished to return disturbed areas to their natural appearance and function.

Proper erosion and sediment control measures will be employed as a BMP to limit the amount of erosion and the influx of sediment loads into adjacent surface waters. The implementation of these practices during roadway construction will further provide for the protection of water quality within the project area. To ensure proper construction and maintenance, erosion and sediment control measures will be installed in adherence with the requirements of DNREC and be subjected to the examination and authority of DNREC inspectors.

Additional mitigation associated with the Preferred Alternative will include riparian buffer restoration and enhancement. Riparian buffers protect water quality by reducing thermal impact and attenuating surface runoff. Riparian vegetation would be planted along stream corridors to create new riparian buffers or planted to enlarge existing undersized vegetated buffers.

6. Waters of the United States, including Wetlands

a. Existing Conditions

This section includes two areas of study: the *wetland investigation area* and the *project area*. The wetland investigation area is based on a buffer around the potential impact areas of the retained build alternatives. The project area includes a larger area extending beyond the limit of disturbance (LOD) and wetland investigation area for the purpose of more generalized analysis of other natural features. A thorough evaluation of the wetland investigation area can be found in the *US 301 Project Development: Investigation for Wetlands and Waters of the United States and Phase 1 Bog Turtle Habitat Assessment, 2005* (draft, November 2005).

Delaware Office of State Planning and Coordination 2002 GIS Land Use and Land Cover wetlands data were used, in conjunction with Delaware 2002 aerial photography, to initially determine the presence of wetlands greater than one-quarter acre within the wetland investigation area. In addition, three previous wetland delineations were referenced: one for the Whitehall Properties development project carried out in 1998 and provided by Whitehall Joint Venture, the February 2000 delineation for the Village of Bayberry development and a recent delineation for the Pleasanton development. Information on hydric soils was compiled from NRCS and DDA mapping files; detailed soils information can be found in ***Section F.3*** of this Chapter.

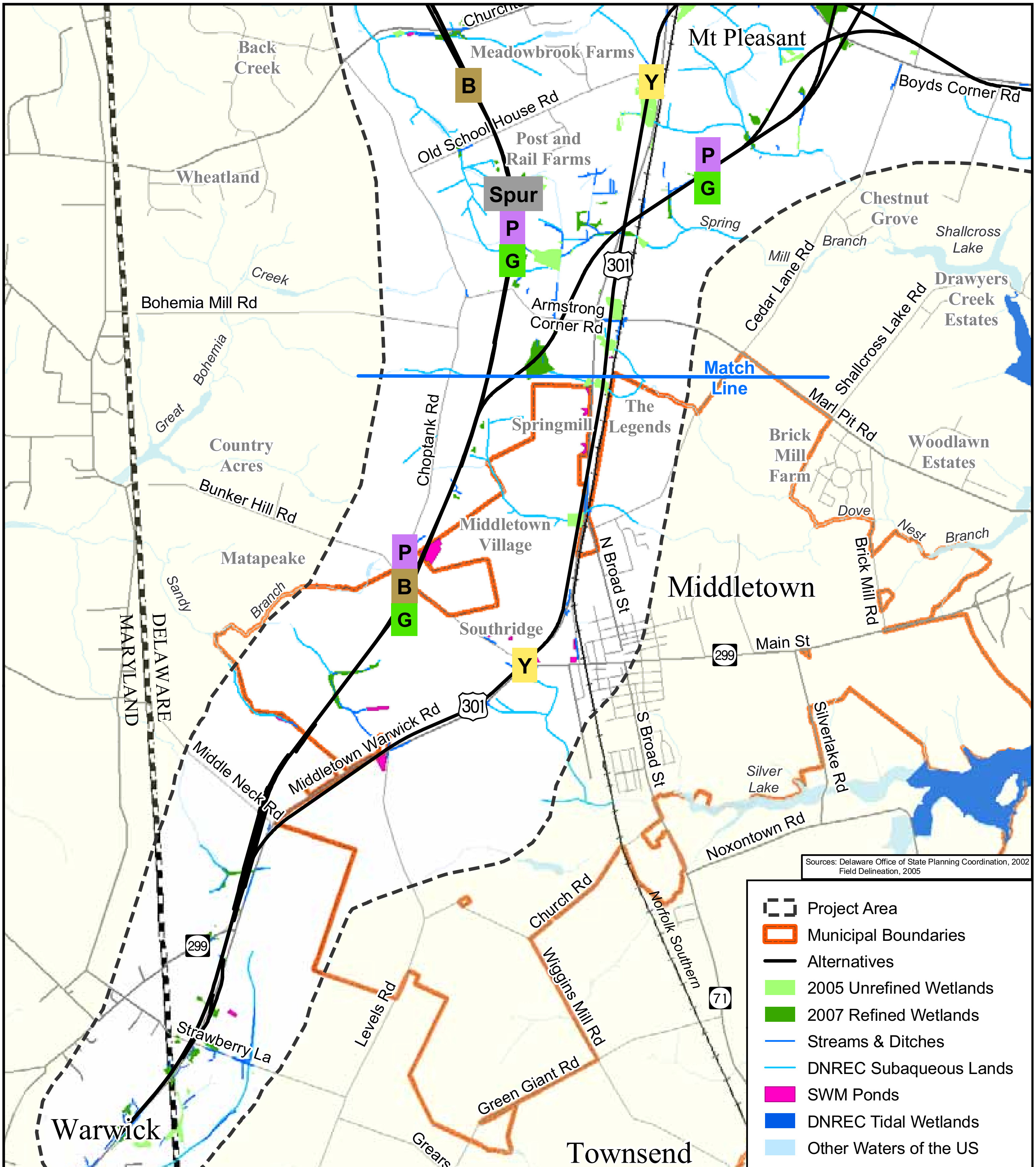
Some wetlands assessed during field investigations contain water features within the wetland boundary, such as streams within a wetland corridor or a drainage ditches within forested wetland tracts. Initially these water features were not identified separately from the surrounding wetlands. This method of grouping as one wetland feature, approved by USACE, DNREC, and EPA, was done to streamline the original alternative assessment. Following the identification of the Preferred Alternative these water features were delineated and surveyed as separate resources *for the Preferred Alternative* only, and are included in the impacts listed for the Preferred Alternative. Ephemeral, intermittent, and perennial waters of the US not surrounded by wetlands were also surveyed. Information on feature hydrologic class, feature description, average width and depth, bottom substrate, and vegetation was collected during the field investigation.

The detailed investigation was conducted according to the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) using the routine on-site method and supplemental guidance issued by the US Army Corps of Engineers (ACOE). The ACOE manual outlines a three parameter approach to delineating wetlands. All three parameters (hydrophytic vegetation, hydrologic indicators, and hydric soils) must be evident for an area to be considered a wetland, unless the site has been disturbed or is considered a problem area. The wetlands identified during the investigation are shown in general on ***Figure III-18*** and in detail in ***Appendix B***. Hydric soils are shown on ***Figure III-15*** (***Section III.F.3***).

Each identified wetland was given a quality rating of high, medium, or low. The quality rating was based on the individual wetland delineator's best professional judgment. The following functions and values were considered when determining wetland quality: groundwater recharge and discharge, flood flow alteration, fish and shellfish habitat, sediment toxicant retention, nutrient removal, production export, sediment and shoreline stabilization, wildlife habitat, recreation, education and scientific value, uniqueness and heritage, visual quality and aesthetics, endangered species habitat and size. The various wetland functional parameters were identified through the joint effort of the project team as the DEIS was being developed. As such, these parameters are expected to address a broad range of functional values. All of the wetland quality ratings developed in response to this effort have not been reviewed by the regulatory and environmental resource agencies; however, several wetlands and their quality ratings were reviewed in the field with the ACOE and DNREC. These included wetlands in the Ratledge Road vicinity and wetlands along the Yellow Alternative.

Twelve field reviews with the ACOE (June 15, June 23, July 12, July 19, August 9, August 19, September 8, November 9, November 16, and December 21, 2005; January 5 and January 10, 2006) were completed for all wetland and waters boundaries for the four build alternatives prior to the publication of the DEIS. DNREC representatives attended many of these meetings as well (see ***Chapter IV B.2*** and ***3***). These field reviews consisted of the wetland delineation team visiting delineated resources with a representative of ACOE and adjusting wetland boundaries if necessary. Each reviewed wetland boundary was then surveyed using mapping-grade Global Positioning System (GPS) receivers.

Following the publication of the DEIS, additional field surveys were completed for the Preferred Alternative between January and March, 2007. ***Figure III-18*** has been updated for the Preferred Alternative only to show the results of these surveys. A detailed conventional survey of these final wetland boundaries was completed in spring 2007 for the purpose of receiving an eventual Jurisdictional Determination (JD) from ACOE. The detailed survey resulted in some minor refinements to wetland boundaries from those mapped in 2005, as well as the addition of several wetland systems, especially low-quality farmed wetlands not visible during the 2005 survey. It is anticipated that the same increase in mapped wetlands would have occurred along the other build alternatives had they undergone the same JD-level survey as the Preferred Alternative.



US 301 Project Development

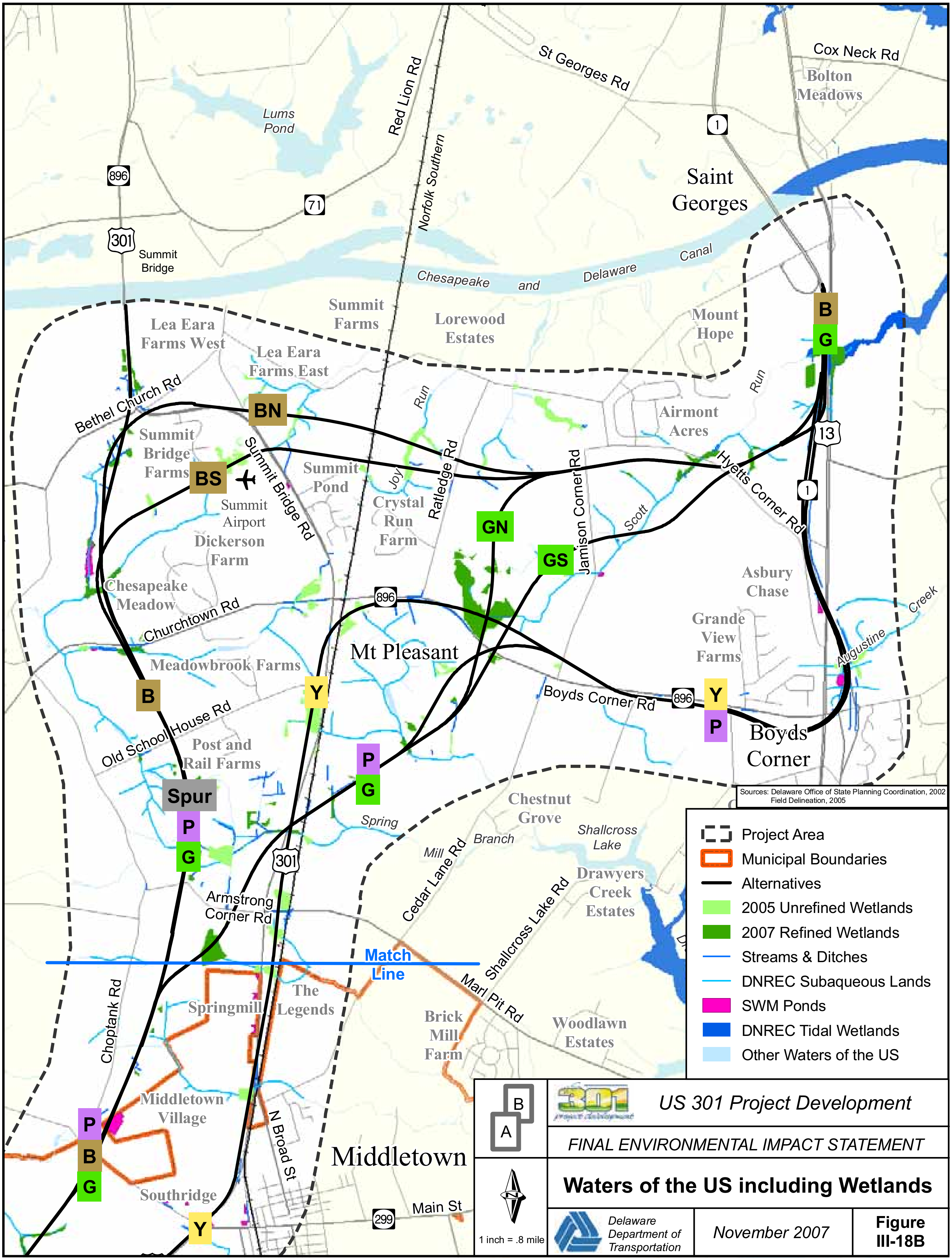
FINAL ENVIRONMENTAL IMPACT STATEMENT

Waters of the US including Wetlands

Delaware Department of Transportation

November 2007

Figure III-18A


US 301 Project Development
FINAL ENVIRONMENTAL IMPACT STATEMENT
Waters of the US including Wetlands
Delaware Department of Transportation
November 2007
Figure III-18B
1 inch = .8 mile
Sources: Delaware Office of State Planning Coordination, 2002
Field Delineation, 2005
Project Area
Municipal Boundaries
Alternatives
2005 Unrefined Wetlands
2007 Refined Wetlands
Streams & Ditches
DNREC Subaqueous Lands
SWM Ponds
DNREC Tidal Wetlands
Other Waters of the US
Match Line
Lums Pond
Red Lion Rd
St Georges Rd
Cox Neck Rd
Bolton Meadows
Saint Georges
Norfolk Southern
Summit Bridge
Chesapeake and Delaware Canal
Lea Eara Farms West
Summit Farms
Lorewood Estates
Mount Hope
Lea Eara Farms East
Bethel Church Rd
Airmont Acres
Summit Bridge Farms
Summit Bridge Rd
Summit Pond
Summit Airport
Joy Run
Ratledge Rd
Crystal Run Farm
Jamison Corner Rd
Scott Run
Hyetts Corner Rd
Dickerson Farm
Chesapeake Meadow
Churchtown Rd
Asbury Chase
Grande View Farms
Augustine Creek
Mt Pleasant
Meadowbrook Farms
Boyds Corner Rd
Boyds Corner
Old School House Rd
Post and Rail Farms
Spur
Chestnut Grove
Spring Mill Branch
Cedar Lane Rd
Shallcross Lake
Shallcross Lake Rd
Drawyers Creek Estates
Armstrong Corner Rd
Marl Pit Rd
Springmill
The Legends
Brick Mill Farm
Woodlawn Estates
Choptank Rd
Middletown Village
N Broad St
Middletown
Southridge
Main St
BN
BS
GN
GS
B
G
Y
P
896
301
71
1
13
299

Wetlands within the wetland investigation area are mostly linear riparian systems associated with stream drainage, or irregular shaped depressions where the water table is close to the surface or surface drainage is poor. The portion of the project area south of Summit Airport and Boyds Corner, including the Yellow, Purple, Brown, and Green alternatives, is situated along the Chesapeake Bay/Delaware River drainage divide and thus in the upper reaches of the watersheds. In these areas, the streams are generally small, with little development of floodplains or stream valleys. There are two types of wetlands in these areas: large, forested wetlands surrounded by agricultural fields or narrow wetlands along ditched or small, straightened streams.

The investigated area north and east of the Summit Airport and Boyds Corner, including portions of the Yellow, Purple, Green, and Brown alternatives, intersects large, well-developed floodplain and wetland corridors along Scott Run and Joy Run. There are also a few flat, forested wetlands immediately east of Boyds Corner.

Tax Ditches

Under Delaware Code Chapter 14, tax ditch organizations are legal entities and subsidiary units of state government, with taxation powers, established by Superior Court order to provide for ownership, construction, and maintenance of tax ditches. Tax ditches are man-made channels, constructed for the purposes of flood control and agricultural drainage. A tax ditch organization is comprised of all landowners (referred to as taxables) of a particular watershed or sub-watershed, and overseen by managers and a secretary/treasurer, elected annually from among the taxables. DNREC's Division of Soil and Water Conservation, Drainage Section, provides technical assistance to the organizations in the review of any proposed changes to ditch flow patterns or drainage boundaries. The organizations have the authority to prevent additional lands and waters from draining into tax ditches. DelDOT is required to maintain highway drainageways to prevent sediment from obstructing tax ditches to the extent possible and to remove obstructing sediment and silt from tax ditches near highways. Tax ditches are also subject to regulation as waters of the US, when so delineated, and as non-delineated floodplains, when shown on the appropriate Soil Survey or USGS quadrangle maps.

b. Environmental Consequences

The No-Build Alternative would not affect any wetlands or other waters of the US. Potential impacts to wetlands and waters resulting from the Preferred Alternative and the other build alternatives were calculated based on LOD defined for each alternative. In areas where grading changes are significant, the LOD is located 25 feet beyond the proposed toe of slopes. Where a bridge spans an environmental resource, the LOD was defined as the footprint of the bridge (i.e., the "shaded" area).

Wetland impacts include the displacement, dredging, filling or shading of an entire wetland or a portion of a wetland. Impacts may also include an interruption to wetland hydrology or interruption to the hydrology of a stream. Additional impacts can result from roadway runoff, sedimentation, alteration of hydrology and shadows cast by bridge structures. Some of these impacts could lead to degradation or a decrease in an available wetland and waterway habitat within the project area and, ultimately, a decrease in plant and animal species inhabiting these areas. These impacts are regulated under the Clean Water Act (CWA) Sections 404 and 401, and associated DNREC and Maryland Department of the Environment (MDE) requirements.

The Preferred Alternative would affect wetlands and other waters of the US to varying degrees described below and in ***Tables III-60*** and ***III-61.*** Public interest factors and community issues raised during the public hearings resulted in some design shifts of the Preferred Alternative in the Ratledge Road area. Factors raised by the public are discussed in ***Chapter IV***. All comments received during the DEIS public comment period are printed in ***Chapter IV*** along with DelDOT responses.

The Preferred Alternative includes Ratledge Road Area Option 4B Modified, as described in ***Chapter II Section D.4***. The Ratledge Road Area design shifts have caused an increase in wetlands impacts for the Preferred Alternative; however, these impact increases are mainly to medium quality wetlands and the amount of impact to high quality wetlands has decreased. Both the ACOE and DNREC support this option provided a package of additional mitigation measures is included (***Section c. Mitigation***). The refinement of the wetland delineation for the Preferred Alternative, as described previously (refer to ***Chapter III.F.6.a.***), has resulted in minor changes to projected impacts to streams and ditches. The coordinated review of this project by the regulatory agencies will continue through final design, which may further reduce these projected impacts. All of the impact changes for the Preferred Alternative are reflected in ***Tables III-60*** and ***III-61.***

In addition, there is an increased footprint for the Preferred Alternative that resulted from detailed engineering that accounted for topography and required that the roadway be raised above existing ground along portions of the alignment to assure proper drainage. See ***Chapter II Section A.1.f, General Engineering Design Concepts*** and the introduction to ***Chapter III***.

As shown in ***Table III-60***, although the total acres of wetlands impacts for the Preferred Alternative increased to 35.0 acres from 26.2 acres described for the Green North Alternative in the DEIS (refer to ***Table III-62***), the number of high quality wetlands impacts decreased from 9.0 acres to 5.7 acres. The number of wetland systems impacted decreased from 43 reported in the DEIS to 33 as a result of the detailed surveys completed in early 2007, and the number of wetland crossings and fragmented wetlands decreased. As indicated, delineating the streams and ditches previously included within wetland systems separately has increased the linear feet of streams to 5,199 from 327 and decreased the linear feet of ditch impacts from 15,188 to 12,684.

Following ***Table III-60*** and ***Table III-61***, ***Table III-62*** and ***Table III-63*** summarize the potential impacts of the four build alternatives. These potential impacts were considered during the evaluation of the build alternatives and during the selection of a Preferred Alternative. The results in ***Table III-63*** below have been corrected from those numbers reported in the DEIS, as the areas of the wetlands were actually reported in square meters, not square feet as shown in the column header. The numbers have been converted to report square feet.

Table III-60: Potential Wetlands Impacts of the Preferred Alternative

Resource	Impact
Total Potential ACOE Wetlands Impacts[1] (acres)	35.0
High Quality Wetlands	5.7
Medium Quality Wetlands	20.5
Low Quality Wetlands	8.7
Number of Wetlands Impacted[2]	33
Number of Wetland Crossings	7
Number of wetlands with complete fragmentation	5
ACOE other waters of the US, Streams,[1,3] (linear feet)	5,199
ACOE other waters of the US, Ditches (linear feet)	12,684
ACOE other waters of the US, Open Waters (ponds, SWM) (acres)	5.0
DNREC Tidal Wetlands[4] (acres)	0
DNREC Subaqueous Lands[5] (linear feet)	8,323

1. *Wetlands are based on field delineations and have been verified by ACOE. Delineated boundaries were initially surveyed by GPS, and confirmed with traditional survey methods.*
2. *Numbers of wetlands reflect systems, not individual wetland segments within the systems. Therefore, the individual wetland segments identified on Table III-54 reflect a larger number than reported above.*
3. *Includes field delineated streams including stream segments within wetlands.*
4. *Tidal wetlands are based on DNREC's Delaware Tidal Wetland Delineation Maps.*
5. *Subaqueous Lands based on Streams shown on USGS quad maps and on New Castle County Soil Survey*

Table III-61: Individual Wetlands Impacts of the Preferred Alternative

Impacted Wetlands				Preferred Alternative	
Code	**Type**	**Class**	**Quality**	**Square Feet**	**Acres**
16B	PFO	Palustrine Forested	High	1,309	0.03
16C	PFO	Palustrine Forested	High	342	0.01
17AA	PEM	Palustrine Emergent	Medium	360,480	8.28
18D	PFO	Palustrine Forested	Medium	71	<0.01
1F	PFO	Palustrine Forested	High	45,415	1.04
1H	PFO	Palustrine Forested	High	517	0.01
1L	PFO	Palustrine Forested	High	1,356	0.03
1M	PFO	Palustrine Forested	High	6,096	0.14

Table III-61: Individual Wetlands Impacts of the Preferred Alternative

Impacted Wetlands				Preferred Alternative	
Code	**Type**	**Class**	**Quality**	**Square Feet**	**Acres**
1R	PEM/PSS	Palustrine Mixed	Medium	11,318	0.26
1S	PEM/PSS	Palustrine Mixed	Medium	11,092	0.25
1T	PEM/PSS/ PFO	Palustrine Mixed	High	13,643	0.31
1U	PEM	Palustrine Emergent	Medium	12,689	0.29
21B	PEM	Palustrine Emergent	High	15,925	0.43
21C	PFO/PEM	Palustrine Mixed	Medium	1,925	0.04
21F	PFO/PEM	Palustrine Mixed	Medium	687	0.02
22B	PFO	Palustrine Forested	High	29,091	0.67
23E	PFO	Palustrine Forested	Low	13,871	0.32
23F	PFO	Palustrine Forested	Medium	14,084	0.32
23G	PEM	Palustrine Emergent	Low	10,648	0.24
23S	PFO	Palustrine Forested	Medium	77,913	1.79
23T	PFO	Palustrine Forested	Low	47,537	1.09
23U	PEM	Palustrine Emergent	Low	18,012	0.41
23V	PEM	Palustrine Emergent	Low	75,775	1.74
28A	PFO	Palustrine Forested	High	21,441	0.49
28B	PEM/PFO	Palustrine Mixed	Medium	22,882	0.53
29D	PEM	Palustrine Emergent	Medium	4,584	0.11
29E	PEM/PFO/ PSS	Palustrine Mixed	High	16,805	0.39
2C	PEM/PSS	Palustrine Mixed	High	6,123	0.14
2E	PEM	Palustrine Emergent	High	44,272	1.02
30C	PFO	Palustrine Forested	Medium	112,028	2.57
37A	PEM	Palustrine Emergent	Medium	47,868	1.10
37C	PEM	Palustrine Emergent	Medium	21,087	0.48
37W	PEM	Palustrine Emergent	Low	375	0.01
38A	PFO	Palustrine Forested	Medium	27,327	0.63

Table III-61: Individual Wetlands Impacts of the Preferred Alternative

Impacted Wetlands				Preferred Alternative	
Code	**Type**	**Class**	**Quality**	**Square Feet**	**Acres**
38Z	PEM	Palustrine Emergent	Medium	4,958	0.11
4H	PFO	Palustrine Forested	High	16,689	0.38
4J	PEM	Palustrine Emergent	Medium	22,929	0.53
4K	PFO	Palustrine Forested	High	14,186	0.33
53A	PFO	Palustrine Forested	High	15,013	0.34
7R	PEM	Palustrine Emergent	Low	4,879	0.11
8B	PEM	Palustrine Emergent	Medium	21	<0.01
11C[1]	PEM/PFO	Palustrine Mixed	Medium	103,781	2.38
11CC[1]	PEM	Palustrine Emergent	Low	44,948	1.03
16D[1]	PFO	Palustrine Forested	High	105	<0.01
17G[1]	PEM	Palustrine Emergent	Low	114	<0.01
17OO[1]	PEM	Palustrine Emergent	Low	9,518	0.22
18AA[1]	PEM	Palustrine Emergent	Low	13	0.00
22H[1]	PEM	Palustrine Emergent	Low	114	<0.01
2A[1]	PEM	Palustrine Emergent	Low	501	0.01
2W[1]	PEM	Palustrine Emergent	Low	8,589	0.20
30CC[1]	PEM	Palustrine Emergent	Low	40,889	0.94
30X[1]	PEM	Palustrine Emergent	Low	19,707	0.45
30Y[1]	PEM	Palustrine Emergent	Low	1,126	0.03
32A[1]	PEM/PFO	Palustrine Mixed	Low	87,728	2.01
40E[1]	PFO	Palustrine Forested	Medium	14,155	0.32
40F[1]	PFO	Palustrine Forested	Medium	22,942	0.53
53J[1]	PFO	Palustrine Forested	Medium	158	<0.01
75W[1]	PEM	Palustrine Emergent	Low	4,226	0.10

1. Additional wetlands delineated since the 2006 DEIS based on detailed survey. See ***Section F.6.a****, Existing Conditions.*

Table III-62: Potential ACOE and DNREC Jurisdictional Impacts (DEIS)

Resource	No-Build	Yellow	Purple	Brown North	Brown South	Green North (DEIS)	Green South
Total Potential ACOE Wetlands Impacts[1] (acres)	0	50.5	24.9	23.9	18.5	26.2	28.3
High Quality Wetlands	0	8.6	7.6	11.5	9.9	9.0	9.6
Medium Quality Wetlands	0	30.6	13.2	4.2	7.3	13.2	13.6
Low Quality Wetlands	0	11.2	4.2	8.2	1.3	4.0	5.1
Number of Wetlands Impacted[2]	0	33	45	39	35	43	40
Number of Wetland Crossings	0	4	9	10	8	8	8
Number of wetlands with complete fragmentation	0	7	6	3	4	6	7
ACOE other waters of the US, Streams[3] (linear feet)	0	215	260	921	1,895	327	521
ACOE other waters of the US, Ditches (linear feet)	0	20,492	15,997	14,237	12,383	15,188	15,805
ACOE other waters of the US, Open Waters (ponds, SWM) (acres)	0	3.4	3.2	3.2	5.8	3.2	3.2
DNREC Tidal Wetlands[4] (acres)	0	0.4	0.4	0.4	0.4	0.4	0.4
DNREC Subaqueous Lands[5] (linear feet)	0	7,167	6,461	7,885	8,232	8,162	8,481

1. *Wetlands are based on field delineations and have been verified by ACOE. Delineated boundaries were surveyed by GPS.*
2. *Numbers of wetlands reflect systems, not individual wetland segments within the systems. Therefore, the individual wetland segments identified on Table III-57 reflect, in most cases, a larger number than reported above.*
3. *Includes field delineated streams and does not include stream segments within wetlands. The boundaries were surveyed by GPS.*
4. *Tidal wetlands are based on DNREC's Delaware Tidal Wetland Delineation Maps.*
5. *Subaqueous Lands based on streams shown on USGS quad maps and on New Castle County Soil Survey.*

Table III-63: Individual Wetlands Impacts of the Build Alternatives – Revised

Impacted Wetlands				Yellow Alternative		Purple Alternative		Brown North Alternative		Brown South Alternative		Green North Alternative		Green South Alternative	
Code	**Type**	**Class**	**Quality**	**Square Feet**	**Acres**	**Square Feet**	**Acres**	**Square Feet**	**Acres**	**Square Feet**	**Acres**	**Square Feet**	**Acres**	**Square Feet**	**Acres**
11B	PEM/PFO	Palustrine Mixed	Medium	125,453	2.88										
14F	PFO	Palustrine Forested	High	2,178	0.05	2,178	0.05								
14I	PEM/PSS	Palustrine Mixed	Medium	2,178	0.05	2,178	0.05								
14L	PEM	Palustrine Emergent	Low	17,424	0.40	16,988	0.39								
16B	PFO	Palustrine Forested	High			2,614	0.06	2,614	0.06	2,614	0.06	2,614	0.06	2,614	0.06
16C	PFO	Palustrine Forested	High			436	0.01	436	0.01	436	0.01	436	0.01	436	0.01
17AA	PEM	Palustrine Emergent	Medium			235,224	5.40					235,224	5.40	235,224	5.40
18D	PFO	Palustrine Forested	Medium			436	0.01					436	0.01	436	0.01
19B	PFO	Palustrine Forested	Medium			3,485	0.08								
19C	PEM	Palustrine Emergent	Low			17,860	0.41								
1B	PEM/PFO	Palustrine Mixed	Medium	20,038	0.46	20,038	0.46	20,038	0.46	20,038	0.46	20,038	0.46	20,038	0.46
1F	PFO	Palustrine Forested	High	45,302	1.04	45,302	1.04	45,302	1.04	45,302	1.04	45,302	1.04	45,302	1.04
1H	PFO	Palustrine Forested	High	4,792	0.11	4,792	0.11	4,792	0.11	4,792	0.11	4,792	0.11	4,792	0.11
1L	PFO	Palustrine Forested	High	1,307	0.03	1,307	0.03	1,307	0.03	1,307	0.03	1,307	0.03	1,307	0.03
1M	PFO	Palustrine Forested	High	2,178	0.05	2,178	0.05	2,178	0.05	2,178	0.05	2,178	0.05	2,178	0.05
1R	PEM/PSS	Palustrine Mixed	Medium	7,841	0.18	7,841	0.18	7,841	0.18	7,841	0.18	7,841	0.18	7,841	0.18

Table III-63: Individual Wetlands Impacts of the Build Alternatives – Revised

Impacted Wetlands				Yellow Alternative		Purple Alternative		Brown North Alternative		Brown South Alternative		Green North Alternative		Green South Alternative	
Code	Type	Class	Quality	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres
1S	PEM/PSS	Palustrine Mixed	Medium	6,098	0.14	6,098	0.14	6,098	0.14	6,098	0.14	6,098	0.14	6,098	0.14
1T	PEM/PSS/ PFO	Palustrine Mixed	High	13,068	0.30	13,068	0.30	13,068	0.30	13,068	0.30	13,068	0.30	13,068	0.30
1U	PEM	Palustrine Emergent	Medium	11,326	0.26	11,326	0.26	11,326	0.26	11,326	0.26	11,326	0.26	11,326	0.26
20O	PEM	Palustrine Emergent	High	61,855	1.42										
20Q	PEM	Palustrine Emergent	Low	87,991	2.02										
20S	PEM	Palustrine Emergent	Medium	871	0.02										
21B	PEM	Palustrine Emergent	High			80,586	1.85	57,935	1.33	74,488	1.71	80,586	1.85	80,586	1.85
21C	PFO/PEM	Palustrine Mixed	Medium			5,227	0.12	5,227	0.12	5,227	0.12	5,227	0.12	5,227	0.12
21F	PFO/PEM	Palustrine Mixed	Medium			4,792	0.11	4,792	0.11	4,792	0.11	4,792	0.11	4,792	0.11
22B	PFO	Palustrine Forested	High			32,234	0.74	59,242	1.36	57,064	1.31	32,234	0.74	32,234	0.74
22C	PFO	Palustrine Forested	Medium							50,965	1.17				
23E	PFO	Palustrine Forested	Low	5,227	0.12	10,454	0.24	11,761	0.27	9,148	0.21	10,454	0.24	10,454	0.24
23F	PFO	Palustrine Forested	Medium					17,424	0.40	1,307	0.03				
23G	PEM	Palustrine Emergent	Low			6,970	0.16	32,670	0.75	14,810	0.34	6,970	0.16	6,970	0.16
23H	PEM	Palustrine Emergent	Low					27,443	0.63	9,148	0.21				
23S	PFO	Palustrine Forested	Medium	22,216	0.51	92,347	2.12	38,333	0.88	5,227	0.12	92,347	2.12	92,347	2.12
23T	PFO	Palustrine Forested	Low	16,553	0.38	46,609	1.07	26,572	0.61	22,216	0.51	46,609	1.07	46,609	1.07

Table III-63: Individual Wetlands Impacts of the Build Alternatives – Revised

Impacted Wetlands				Yellow Alternative		Purple Alternative		Brown North Alternative		Brown South Alternative		Green North Alternative		Green South Alternative	
Code	**Type**	**Class**	**Quality**	**Square Feet**	**Acres**	**Square Feet**	**Acres**	**Square Feet**	**Acres**	**Square Feet**	**Acres**	**Square Feet**	**Acres**	**Square Feet**	**Acres**
23U	PEM	Palustrine Emergent	Low			13,939	0.32	18,731	0.43			13,939	0.32	13,939	0.32
23V	PEM	Palustrine Emergent	Low			57,064	1.31	10,454	0.24			57,064	1.31	57,064	1.31
23W	PEM	Palustrine Emergent	Low			3,920	0.09	229,997	5.28			3,920	0.09	3,920	0.09
24D	PFO	Palustrine Forested	High					27,443	0.63	3,049	0.07				
25A	PEM	Palustrine Emergent	High					57,935	1.33						
26B	PEM	Palustrine Emergent	High					30,056	0.69						
28A	PFO	Palustrine Forested	High					42,689	0.98	42,253	0.97	39,204	0.90	16,553	0.38
28B	PEM/PFO	Palustrine Mixed	Medium					21,780	0.50	21,780	0.50	21,780	0.50	21,780	0.50
29D	PEM	Palustrine Emergent	Medium	7,405	0.17	6,970	0.16	9,148	0.21	9,148	0.21	9,148	0.21	9,148	0.21
29E	PEM/PFO/ PSS	Palustrine Mixed	High	22,651	0.52	22,216	0.51	43,560	1.00	43,560	1.00	42,253	0.97	42,253	0.97
2C	PEM/PSS	Palustrine Mixed	High	23,087	0.53	1,742	0.04	2,178	0.05	2,178	0.05	1,742	0.04	1,742	0.04
2D	PEM	Palustrine Emergent	Low	2,614	0.06										
2E	PEM	Palustrine Emergent	High	69,260	1.59	45,302	1.04	44,867	1.03	44,867	1.03	45,302	1.04	45,302	1.04
30A	PEM	Palustrine Emergent	Low	9,583	0.22										
30C	PFO	Palustrine Forested	Medium	297,950	6.84										
31B	PEM/PFO	Palustrine Mixed	High											52,272	1.20
31E	PEM/PFO	Palustrine Mixed	Medium											27,878	0.64

Table III-63: Individual Wetlands Impacts of the Build Alternatives – Revised

Impacted Wetlands				Yellow Alternative		Purple Alternative		Brown North Alternative		Brown South Alternative		Green North Alternative		Green South Alternative	
Code	Type	Class	Quality	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres
33A	PFO	Palustrine Forested	High							37,897	0.87				
33C	PEM/PFO	Palustrine Mixed	High							8,276	0.19				
35A	PFO	Palustrine Forested	Medium							109,336	2.51				
35 Airport1	PFO	Palustrine Forested	Medium							25,265	0.58				
35 Goodwin2	PFO	Palustrine Forested	High					44,867	0.40						
37A	PEM	Palustrine Emergent	Medium	871	0.02	42,689	0.98					42,689	0.98	42,689	0.98
37C	PEM	Palustrine Emergent	Medium			15,682	0.36					15,682	0.36	15,682	0.36
37W	PEM	Palustrine Emergent	Low			1,742	0.04					1,742	0.04	1,742	0.04
38A	PFO	Palustrine Forested	Medium			47,045	1.08					47,045	1.08	47,045	1.08
38Z	PEM	Palustrine Emergent	Medium			5,227	0.12					5,227	0.12	5,227	0.12
39H	PFO	Palustrine Forested	High	3,049	0.07	3,049	0.07	3,049	0.07	3,049	0.07	3,049	0.07	3,049	0.07
4H	PFO	Palustrine Forested	High			26,136	0.60	25,700	0.59	25,700	0.59	26,136	0.60	26,136	0.60
4I	PEM/PFO	Palustrine Mixed	High			10,019	0.23	10,019	0.23	10,019	0.23	10,019	0.23	10,019	0.23
4J	PEM	Palustrine Emergent	Medium			13,939	0.32	13,939	0.32	13,939	0.32	13,939	0.32	13,939	0.32
4K	PFO	Palustrine Forested	High			10,890	0.25	10,890	0.25	10,890	0.25	10,890	0.25	10,890	0.25
53A	PFO	Palustrine Forested	High			30,492	0.70					30,491	0.70	29,185	0.67
53G	PEM	Palustrine Emergent	Low			436	0.01							75,359	1.73

Table III-63: Individual Wetlands Impacts of the Build Alternatives – Revised

Impacted Wetlands				Yellow Alternative		Purple Alternative		Brown North Alternative		Brown South Alternative		Green North Alternative		Green South Alternative	
Code	Type	Class	Quality	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres	Square Feet	Acres
6A	PFO/PEM	Palustrine Mixed	Medium	123,275	2.83										
7A	PFO/PEM/ PSS	Palustrine Mixed	Low	225,641	5.18										
7D	PEM/PFO	Palustrine Mixed	Medium	145,055	3.33										
7H	PEM	Palustrine Emergent	Low	3,485	0.08										
7I	PEM	Palustrine Emergent	Low	119,354	2.74										
7J	PEM/PSS	Palustrine Mixed	Medium	15,246	0.35										
7L	PEM	Palustrine Emergent	Low	1,307	0.03										
7R	PEM	Palustrine Emergent	Low	4,792	0.11	4,356	0.10					4,356	0.10	4,356	0.10
8A	PEM/PSS	Palustrine Mixed	Medium	20,909	0.48										
8B	PEM	Palustrine Emergent	Medium	39,640	0.91	436	0.01					436	0.01	436	0.01
8E	PEM	Palustrine Emergent	Medium	5,227	0.12										
9A1	PFO	Palustrine Forested	Medium	388,555	8.92										
9A2	PEM/PSS	Palustrine Mixed	High	129,373	2.97										
9A3	PFO	Palustrine Forested	Medium	67,518	1.55										
DPWX	PSS/PFO	Palustrine Mixed	Medium			27,443	0.63								

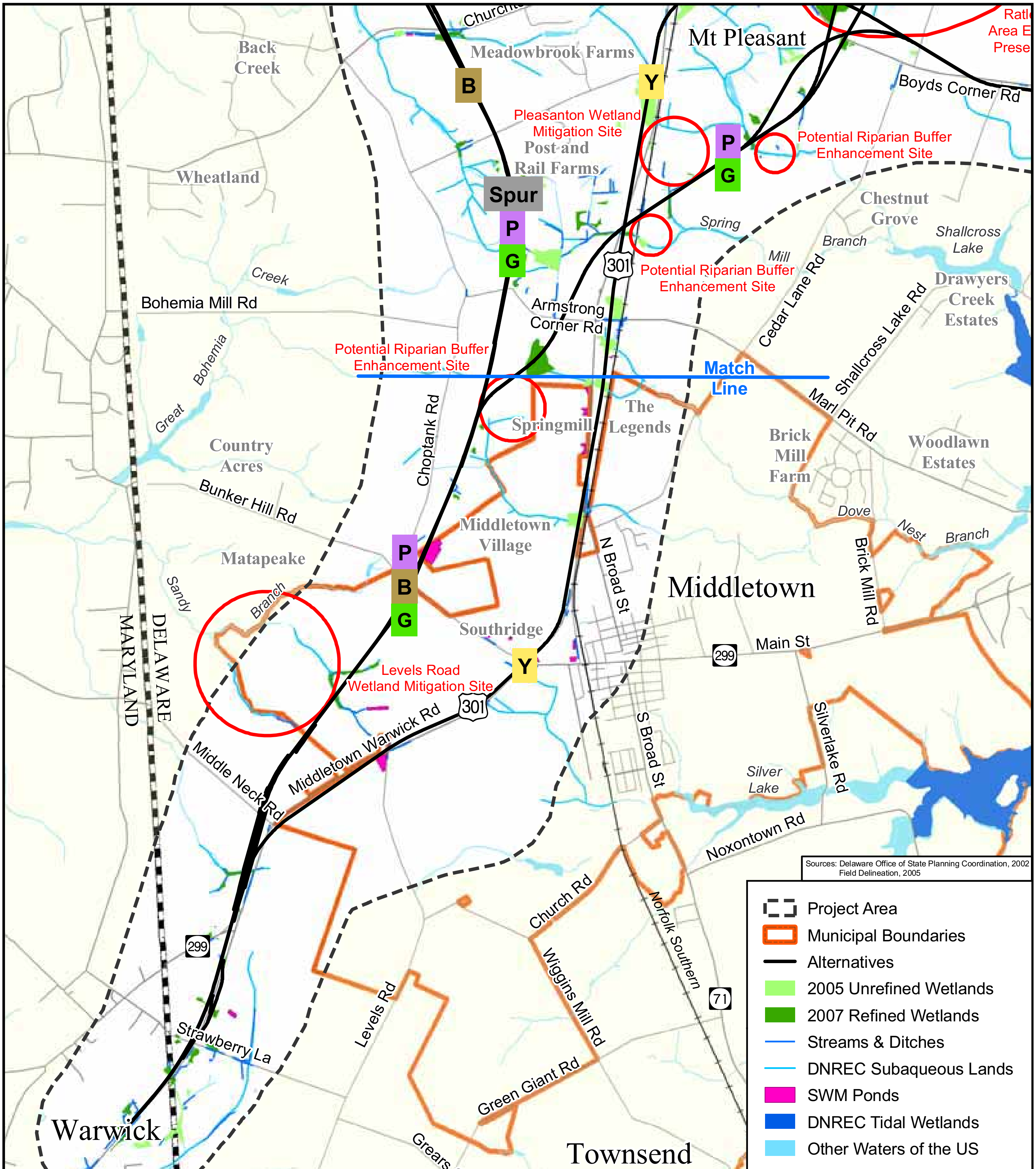
c. Mitigation

The large number of surface water and wetland features within the wetland investigation area makes complete avoidance of resources impractical for any of the build alternatives, including the Preferred Alternative. However, a variety of alternatives have been generated in an effort to minimize and avoid impacts to these resources. Alignment changes and retaining walls will be evaluated where even the steepest slopes (2:1) will cause severe resource impacts. In addition, stormwater management ponds will be located to avoid wetland resources. In accordance with federal and state regulations, avoidance and minimization measures to reduce impacts to wetlands and waters would continue to be implemented for all phases of the project and will continue through final design.

Appropriate and practicable compensatory mitigation is required for unavoidable adverse impacts to wetlands as well as perennial and intermittent waters. Compensatory mitigation is being evaluated in accordance with state and federal regulations and guidance. Compensatory mitigation focuses on the replacement of the functions and values provided by an aquatic resource or wetland in addition to the acreage affected. Traditionally, mitigation requirements under Section 404 have been determined by the ratio of wetland acres replaced to wetland acres lost. Emergent wetlands are typically mitigated on a 1:1 replacement basis, while forested and scrub-shrub wetlands are mitigated on a 2:1 replacement basis. Other waters of the US, streams and ditches, are typically mitigated with a 1:1 replacement ratio when removed or dewatered; however, when impacts result in minor function and value reductions, mitigation focuses on function and value replacement.

Based on the ratios described above, the Preferred Alternative's impacts, and coordination with the regulatory agencies, the following mitigation requirements are anticipated. The Preferred Alternative will include a minimum of 53.4 acres of wetland, including forested and emergent areas, some of which must be permanently saturated and some of which must be seasonally saturated. ***Figure III-19*** shows the areas selected for mitigation of wetlands impacts. To compensate for function and value losses in the Ratledge Road Area, the Preferred Alternative will include seven acres of wetland enhancement and 20 acres of wetland conservation in the Scott Run watershed. The project shall mitigate impacts to other waters of the US (streams) through the restoration of approximately 55 linear feet of stream restoration and creation of approximately 50 acres of new riparian buffer. The project shall provide mitigation for impacts to other waters of the US (ditches) through the creation of new ditches along the roadway.

The wetland mitigation site selection process focused on locating areas with the highest potential for wetland creation and stream restoration with emphasis on "in-kind" replacement within the watersheds potentially affected by the project. The mitigation site search and agency coordination meetings resulted in the identification of two wetland creation sites, one wetland enhancement location, one wetland preservation location and one stream restoration location. Using these sites, the project plans to create approximately 88 acres of wetlands, enhance approximately seven acres of wetlands, preserve approximately 20 acres of high quality wetlands, and restore approximately 55 feet linear feet of stream.



US 301 Project Development

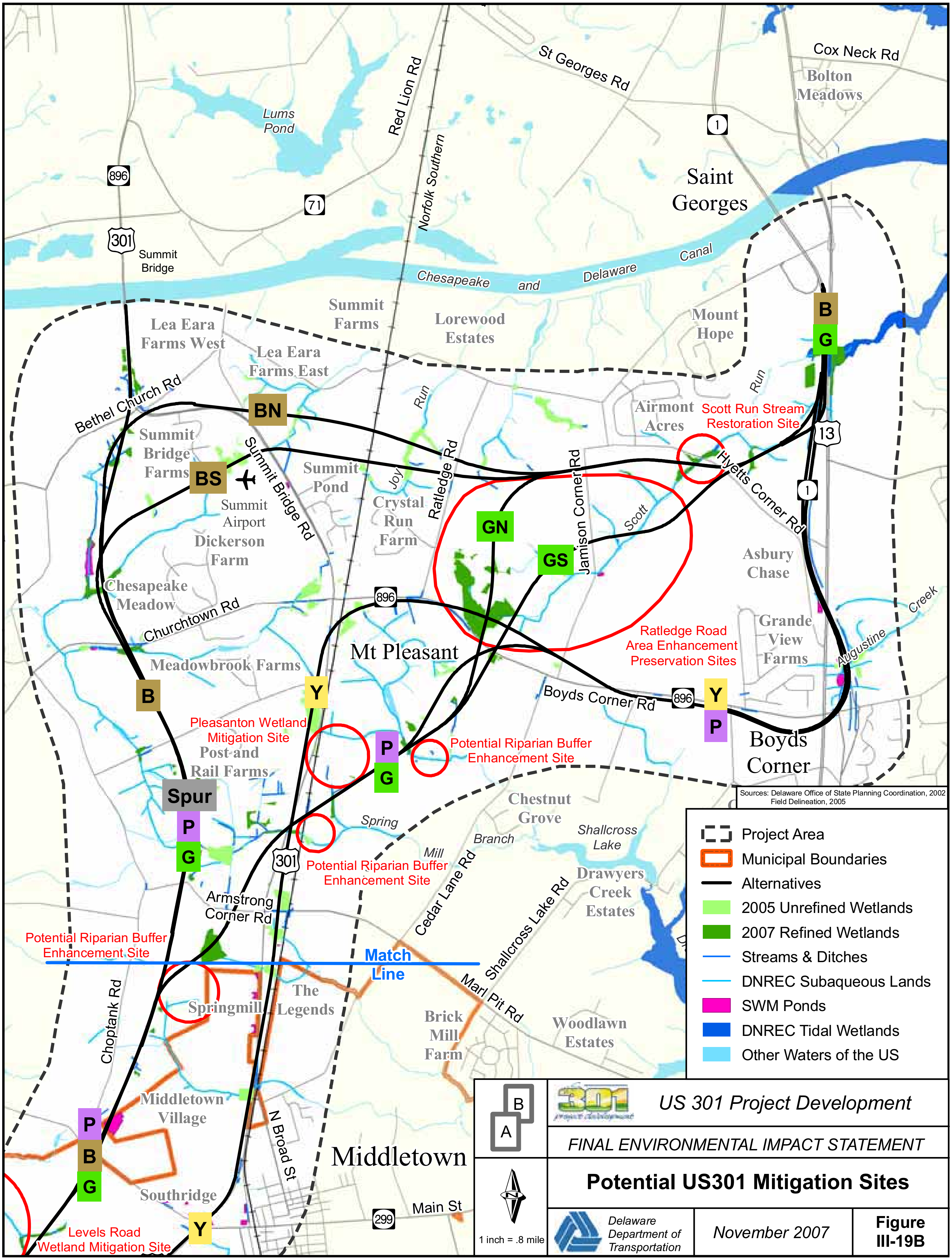
FINAL ENVIRONMENTAL IMPACT STATEMENT

Potential US301 Mitigation Sites

Delaware Department of Transportation

November 2007

Figure III-19A



US 301 Project Development

FINAL ENVIRONMENTAL IMPACT STATEMENT

Potential US301 Mitigation Sites

Delaware Department of Transportation

November 2007

Figure III-19B

As noted, the wetland compensation and mitigation plan is preliminary at this time since additional data must be collected. Following the ROD and data collection, mitigation concept plans will be developed for the wetland creation and stream restoration sites. The concept plans shall include site specific water budgets and hydrogeomorphic modeling along with clear goals and success criteria. It is expected that there will be permit conditions in addition to the commitments in this FEIS that will require continued agency coordination through the development of concepts and final design process to assure the approval of final plans. The mitigation opportunities described below also distribute the potential stream and wetland mitigation throughout the various watersheds within the project area. The mitigation opportunities are described in detail below.

The largest wetland creation mitigation site is located to the west of the new Levels Road interchange with new US 301. The 90-acre site is located in a farm field situated between two tributaries of Sandy Branch. The site will require up to 14 feet of excavation and is expected to yield approximately 80 acres of wetland creation. The site will be designed primarily as a permanently saturated forested wetland; however open water channels and emergent areas may be incorporated in the final design. Hydrology will be a combination of ground water, direct precipitation, and treated storm water. The site will outlet to both the north and south tributaries of Sandy Branch through wide low saddle structures with incorporated Clemson Beaver Pond Levelers to prohibit hydrology disruption. While the minimum required acreage of mitigation could be compensated for at this site, a second site was selected to achieve full function and value replacement of the impacted wetlands.

The smaller wetland creation mitigation site is located northwest of new US 301, east of the Norfolk Southern Railroad, and south of a northern tributary to Drawyers Creek on a severed portion of the current Pleasanton Development parcel. The 29-acre site is a gently sloping, well drained farm field with some hydric soils. The site will not require any excavation, but will require drainage alteration through ditch plugging and low berm placement. The site is expected to yield between 8 and 16 acres of wetland following drainage alteration. The site will be designed as a seasonally saturated forested wetland. Standing water and emergent areas may be incorporated in the final design. Hydrology will be supplied by direct precipitation over the 29-acre site. The site will outlet to the north into the northern tributary to Drawyers Creek.

The Preferred Alternative will include enhancement to approximately seven acres of wetland in the Scott Run watershed. The enhancement site or sites will be located near the Ratledge Road Area. Enhancement shall be achieved by converting a low quality farmed wetland into a forested wetland through tree planting and invasive species control efforts. The site or sites will be chosen based on property availability, size and quality of adjacent forested wetlands and agency preferences.

The Preferred Alternative will include conservation of approximately 20 acres of high quality forested wetlands located in the Scott Run watershed near the Ratledge Road Area. The conservation site or sites will be selected based on property availability, quality of wetlands, and agency preference. These wetlands shall be conserved through conservation easement deed restrictions. The details of the conservation easement restrictions shall be coordinated and approved by the ACOE and DNREC.

The Preferred Alternative will include restoration 55 linear feet of Scott Run where Hyetts Corner Road crosses Scott Run. Currently Scott Run flows through a set of culverts under Hyetts Corner Road. These culverts impede flow causing a backwater effect upstream, and concentrate flow causing a scour condition downstream. The culvert and road also act as a barrier to wildlife and, to a lesser extent, aquatic organisms by impeding movement along the stream corridor. To restore this section of stream, Hyetts Corner Road will be elevated and placed on structure over Scott Run and a natural stream channel will be created under the structure with a combination of hard and soft engineering techniques.

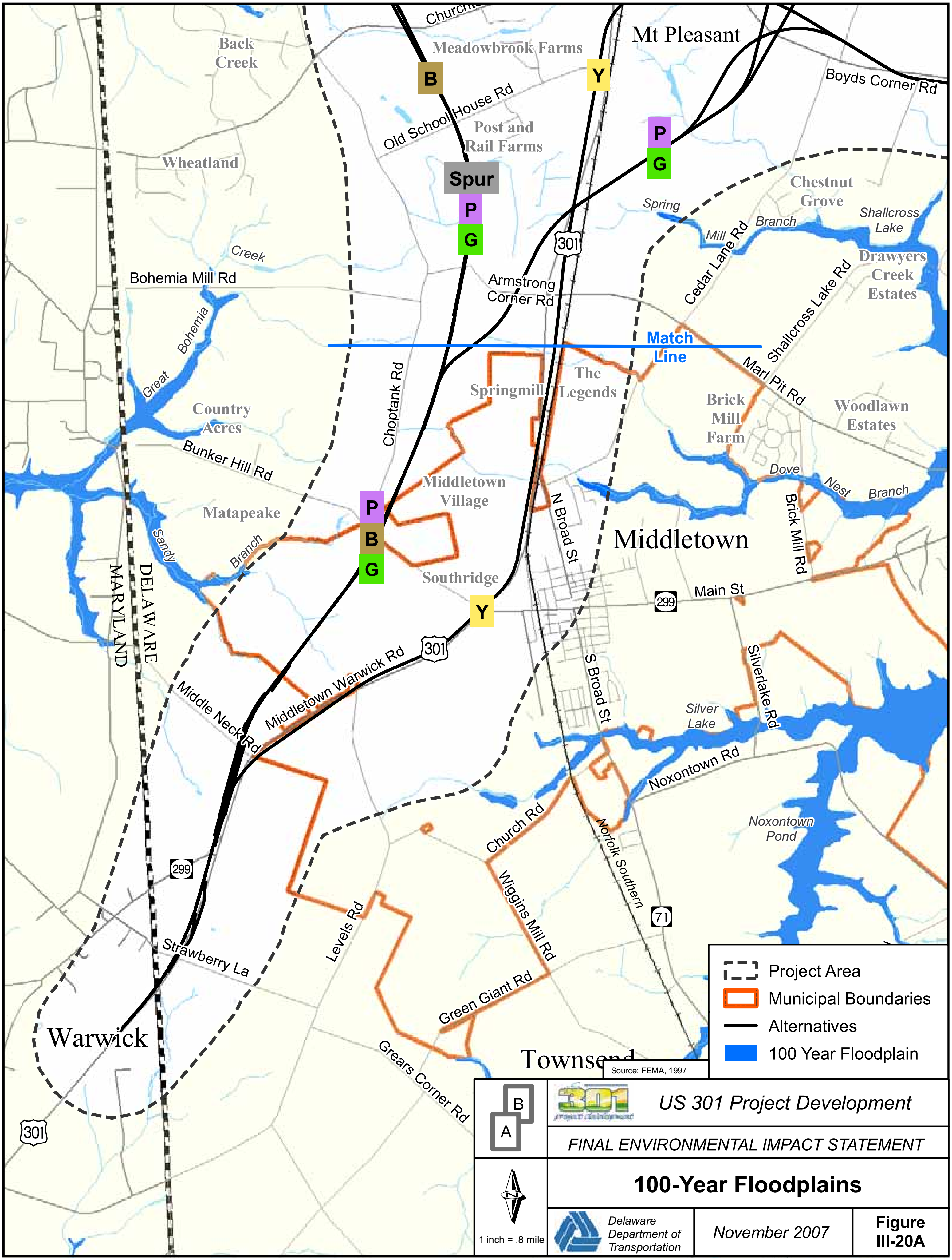
The Preferred Alternative will include creation of approximately 50 acres of new riparian buffer. The new buffer areas will be located along the northern and southern tributaries to Drawyers Creek, east of the Norfolk Southern Railroad. These buffer areas will be planted with tree and shrub species and invasive species will be controlled. In addition, the project will create new stormwater management drainage ditches to compensate for impacts to the existing drainage ditch network.

7. Floodplains

a. Existing Conditions

Floodplains have been identified using Federal Emergency Management Agency (FEMA) Q3 GIS data, a digital depiction of Flood Insurance Rate Map (FIRM) mapping. ***Figure III-20*** shows the FEMA 100-year floodplains in the project area. The project area is bisected by numerous low-gradient streams and their associated floodplains. Natural floodplains in New Castle County are typically forested and relatively wide, with extensive wetlands. The project area is roughly centered on the drainage divide between the Chesapeake Bay and Delaware Bay. Streams west of the divide drain westward to the Chesapeake Bay; while streams east of the divide drain eastward to the tidal Delaware River. A few streams drain northward, directly into the C&D Canal. West of the divide, FEMA regulatory floodplains in the project area include Back Creek, Great Bohemia Creek, and Sandy Branch. East of the divide, FEMA regulatory floodplains in the project area include Scott Run, Augustine Creek, and Drawyers Creek (alternatively Drawer's Creek or Drawyer's Branch) and its tributaries, including Dove Nest Branch. In addition, a floodplain is delineated for the C&D Canal, accounting for the effects of storm surges originating in the Chesapeake Bay or Delaware River.

Federal, state, and local regulations govern fill and construction in floodplains. These regulations include Federal Executive Order 11988; US Department of Transportation Order 5650.2; the National Flood Insurance Act of 1968; and the New Castle County Unified Development Code, Section 40.



US 301 Project Development

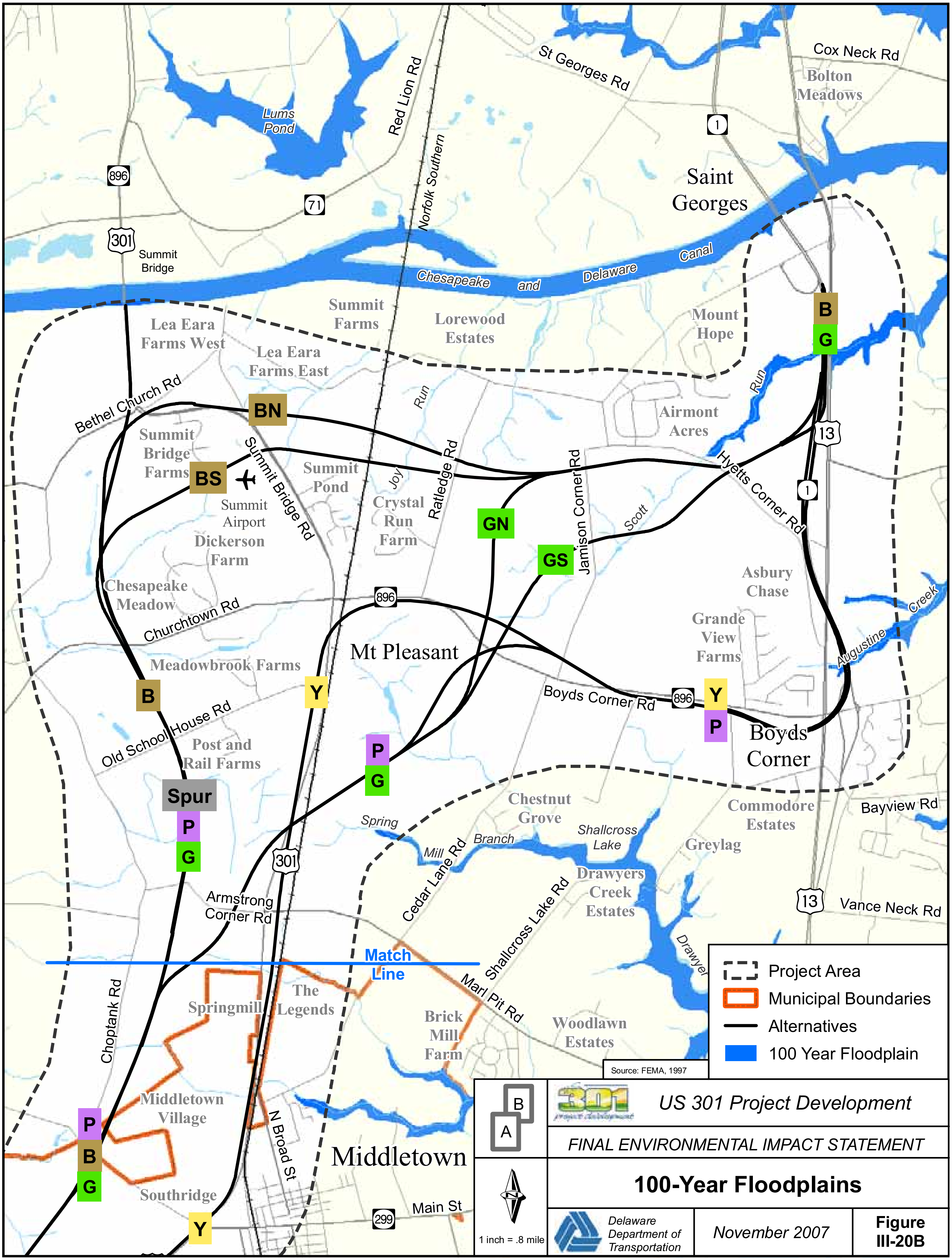
FINAL ENVIRONMENTAL IMPACT STATEMENT

100-Year Floodplains

Delaware Department of Transportation

November 2007

Figure III-20A



US 301 Project Development

FINAL ENVIRONMENTAL IMPACT STATEMENT

100-Year Floodplains

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Figure III-20B

b. Environmental Consequences

The significance of floodplain encroachment was evaluated with respect to the criteria in Executive Order 11988 (Floodplain Management) and DOT Order 5650.2. Floodplain encroachments were also analyzed according to the Federal Aid Highway Program Manual, which recommends that longitudinal encroachment (encroachment that parallels the stream channel) be avoided whenever possible. Project alternatives are not configured in such a manner that major longitudinal floodplain encroachments will occur. The majority of floodplain encroachments will be from transverse crossings for each of the alternatives (encroachment from roadway development that crosses the valley widths of floodplains).

Floodplain impacts are estimated fill areas associated with the construction of the US 301 project. Final impacts to the 100-year floodplain will be determined based on hydrologic and hydraulic modeling, when the design of each structure is complete. Encroachments of non-delineated floodplains cannot be determined without such detailed studies; however, the number of such encroachments is assumed based on the number of streams crossed, as identified by blue lines on USGS maps within New Castle County.

The No-Build Alternative will not impact any floodplains or tax ditches within the project area.

The Preferred Alternative will impact 0.7 acres of FEMA-designated floodplains and will result in 11 crossings of non-delineated floodplains. The only delineated floodplain crossing for the Preferred Alternative is located at the SR 1 tie-in over Scott Run, where detailed engineering of the structured crossing over Scott Run has enabled a lowering of impacts. The Preferred Alternative will cross or cause the relocation of 1,603 linear feet of tax ditches within the Drawyers Branch tax ditch system, representing an impact to 67 acres within the watershed served by the impacted tax ditches.

Table III-64 presents the potential encroachment into FEMA-designated 100-year floodplains for each of the build alternatives, as shown in the DEIS. These impacts were evaluated and compared during the evaluation of the build alternatives and the selection of a Preferred Alternative.

Table III-64: Floodplain and Tax Ditch Impacts

Alternative	Yellow	Purple	Brown North	Brown South	Green North (DEIS)	Green South
Floodplain Impact						
Area of FEMA (Q3) Floodplain (acres)	1.5	1.5	1.0	1.0	1.0	1.0
Non-Delineated Floodplain (Number of Crossings)	5	12	11	10	11	14
Tax Ditch Impact						
Tax Ditches Crossed or Relocated (linear feet)	81	1,455	0	192	624	1,455
Tax Ditch Watershed Area (acres)	12	67	28	56	67	67

FEMA floodplain impacts identified in the DEIS for the build alternatives ranged from 1.0 acres for the Brown and Green Alternatives to 1.5 acres for the Yellow and Purple Alternatives. Non-delineated floodplain impacts range from 5 crossings for the Yellow Alternative to 14 crossings for the Green South Alternative. Tax ditch impacts range from zero for the Brown North Alternative to 1,603 linear feet for the Green North Alternatives. Finally, tax ditch watershed impacts range from 12 acres for the Yellow Alternative, to 67 acres for the Purple and Green Alternatives.

Project impacts to two tax ditch systems include direct crossings of the ditches, and contribution of runoff that ultimately drains to a tax ditch. The crossings/relocations for the Purple and Green Alternatives have been re-evaluated with regard to the Drawyers Creek tax ditch system, accounting for the increases in those impacts. One project stream crossing, common to all alignments, is located in Maryland, on an unnamed blue-line stream without a FEMA floodplain. At this location, an existing culvert may be extended or upgraded to accommodate highway widening and lane transitions. No new stream crossing is proposed within Maryland.

Efforts to avoid and minimize impacts to 100-year floodplains are ongoing, and will continue throughout the planning and engineering process. Longitudinal crossings have been avoided because they would result in more floodplain fill, reducing conveyance and floodplain storage. Where permitted by the surrounding topography and environment, proposed bridge lengths are well in excess of the minimum hydraulic opening required to pass the design flood flows, thus preserving sensitive wetlands and floodplains. The studied alignments also minimize floodplain impacts by their location near the Chesapeake-Delaware drainage divide, where stream and floodplain crossings tend to be narrower than further downstream.

Techniques to further minimize or avoid impacts during final design may include additional bridging of floodplains to further reduce encroachment and allow for unrestricted passage of floodwaters, and minimization of embankment footprint via retaining walls and soil stabilization. Through compliance with local design requirements to convey the 100-year flood discharge unimpeded, offsite floodplain impacts will be minimized. Hydrologic and hydraulic studies will be conducted to determine the bridge or culvert opening sizes for the various alternatives.

c. Mitigation

All construction resulting from the Preferred Alternative or other build alternatives that occurs within the FEMA-designated 100-year floodplain and New Castle County non-delineated floodplains will comply with FEMA-approved local floodplain construction requirements, including the prohibition on fill in the floodway and passage of the 100-year flood without increasing water surface elevations. Any increases would require easement purchase. If required by New Castle County, compensatory storage may be excavated from floodplains to mitigate the effects of embankment fill. Affected tax ditches will be relocated along the toe of the highway embankment, or passed beneath the proposed highway in culverts, in order to maintain present ditch flow patterns.

8. Vegetation and Wildlife

a. Terrestrial Habitat and Wildlife

(1) Existing Conditions

Terrestrial habitat types were classified according to aerial mapping as well as field observations. Forested areas were characterized during field investigations. Forest data were then analyzed and classified according to associations described in the Society of American Foresters *Forest Cover Types of the United States and Canada* (Eyre (ed.), 1980). Several different habitat types occur throughout the project area. An overview of each habitat type, as well as the general type of wildlife each supports, is included below.

Developed Habitat

Developed habitat includes commercial, residential, industrial and park areas. This comprises the majority of the habitat found within the project area along existing US 301. Wildlife found in developed habitat includes species adapted to "edge habitats" created when developed habitat is adjacent to agriculture or forest. These species include: white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), mice (*Mus sp*.), as well as birds such as European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), house finch (*Carpodacus mexicanus*), and eastern bluebird (*Sialia sialis*).

Vegetation in developed habitat includes both native and invasive exotic plants. Common native trees include yellow poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*), sweetgum (*Liquidambar styraciflua*), Willow oak (*Quercus phellos*), Pin oak (*Quercus palustris*), Loblolly pine (*Pinus taeda*), black willow (*Salix nigra*), black locust (*Robinia pseudoacacia*), and smooth alder (*Alnus serrulata*). Common native shrubs include silky dogwood (*Cornus ammonum*), witch hazel (*Hamamelis virginiana*), inkberry (*Ilex glabra*), winterberry (*Ilex verticillata*), Virginia sweetspire (*Itea virginica*), spicebush (*Lindera benzoin*), wax myrtle (*Myrica cerifera*), northern bayberry (*Myrica pensylvanica*), black chokeberry (*Photinia melanocarpa*), beach plum (*Prunus maritima*), staghorn sumac (*Rhus hirta*), common elderberry (*Sambucus canadensis*), steeplebush (*Spiraea tomentosa*), and arrowwood (*Viburnum dentatum)*. Common native herbaceous plants include Christmas fern (*Polystichum acrostichoides*), sweet fern (*Comptonia peregrina*), panic grass (*Dichanthelium commutatum*), Virginia wild rye (*Elymus virginicus*), switchgrass (*Panicum virgatum*), little bluestem (*Andropogon scoparius*), common milkweed (*Asclepias syriaca*), nodding beggar-ticks (*Bidens cernua*), golden aster (*Chrysopsis mariana*), gayfeather (*Liatris spicata*), phlox (*Phlox maculata*), and black-eyed Susan (*Rudbeckia hirta*).

Common invasive exotic trees include Bradford pear (*Pyrus calleryana Bradford*), Norway maple (*Acer platanoides*), princess tree (*Paulownia tomentosa*), tree of heaven (*Ailanthus altissima*), and silk tree (*Albizia julibrissin*). Common invasive shrubs and vines include honeysuckle shrub and vine (*Lonicera spp.*), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), porcelain berry (*Ampelopsis brevipedunculata*), wisteria vines (*Wisteria spp*.), creeping euonymus (*Euonymus fortunei*), bittersweet (*Celastrus orbiculatus*), English ivy

(*Hedera helix*), and winged burningbush (*Euonymus alata*). Common invasive exotic herbaceous plants include garlic mustard (*Alliaria petiolata*), Japanese stiltgrass (*Microstegium vimineum*), lesser celandine (*Rununculus ficaria*), purple loosestrife (*Lythrum salicaria*), Canada thistle (*Cirsium arvense*), common daylily (*Hemerocallis fulva*), common reed (*Phragmites australis*), kudzu (*Pueraria montana*), and kile-a-minute (*Polygonum perfoliatum*).

Agricultural Land

Agricultural land comprises the majority of habitat found within the project area. Agricultural land is comprised of crop fields, hayfields, and pasture land. Large areas of agricultural land are found south of the C&D Canal and are often separated by narrow tree rows, roadways, stream valleys, residential or commercial areas. Wildlife which typically dwell or feed in agricultural land includes white-tailed deer, red fox, raccoon, various rodent species, and upland game birds.

Meadow Habitat

Meadow habitat is mostly comprised of former agricultural land abandoned for several years. These areas are classified as early successional upland habitat or herbaceous upland habitat. Vegetation in these areas consists of pioneering grasses and forbs, including panic grass, Virginia wild rye, switchgrass, little bluestem, common milkweed, nodding beggar-ticks, golden aster, gayfeather, phlox, and black-eyed Susan. Wildlife species found in meadow habitat include woodchuck (*Marmota monax*), kildeer (*Charadrius vociferous*), and in areas where the rodent population is abundant, various birds of prey such as red-tailed hawk (*Buteo jamaicencis*) and American kestrel (*Falco sparverius*). Reptiles such as the eastern garter snake (*Thamnophis sirtalis*) may also inhabit meadows.

Forest Habitat

Forest habitat occurs sporadically throughout the project area and consists mainly of small fragmented forest stands or narrow tree rows between agricultural fields. Linear forests occur in the stream valleys of several streams, including Scott Run, Joy Run, Crystal Run, Back Creek, Sandy Branch, Dove Nest Branch, and Drawyers Creek. Large tracts of forest are located southeast of the intersection of US 301 and Boyds Corner Road, west of US 301 north of the town of Middletown. Forests within the project area are generally characterized as early- to mid-successional. Forests were characterized during field investigations and were classified by associations based on the Society of American Foresters *Forest Cover Types of the United States and Canada* (Eyre, 1980). ***Table III-65*** lists the number of stands identified in each association. Forest cover in the project area has been updated for the Preferred Alternative only as a result of more recent (2006) aerial photography which more accurately delineates forest boundaries. Forest cover is shown on ***Figure III-21***.

The dominant association found throughout the project area is the Red Maple Association. Other associations in order of occurrence include: Yellow Poplar, White Oak, Sweetgum-Willow Oak, Pin Oak-Sweetgum, Loblolly Pine, Black Willow, and Black Locust. Stands which could not be classified as a single association are described as "Mixed." The Society of American Foresters *Forest Cover Types* description for each association is listed below.

Table III-65: Forest Stands by Association

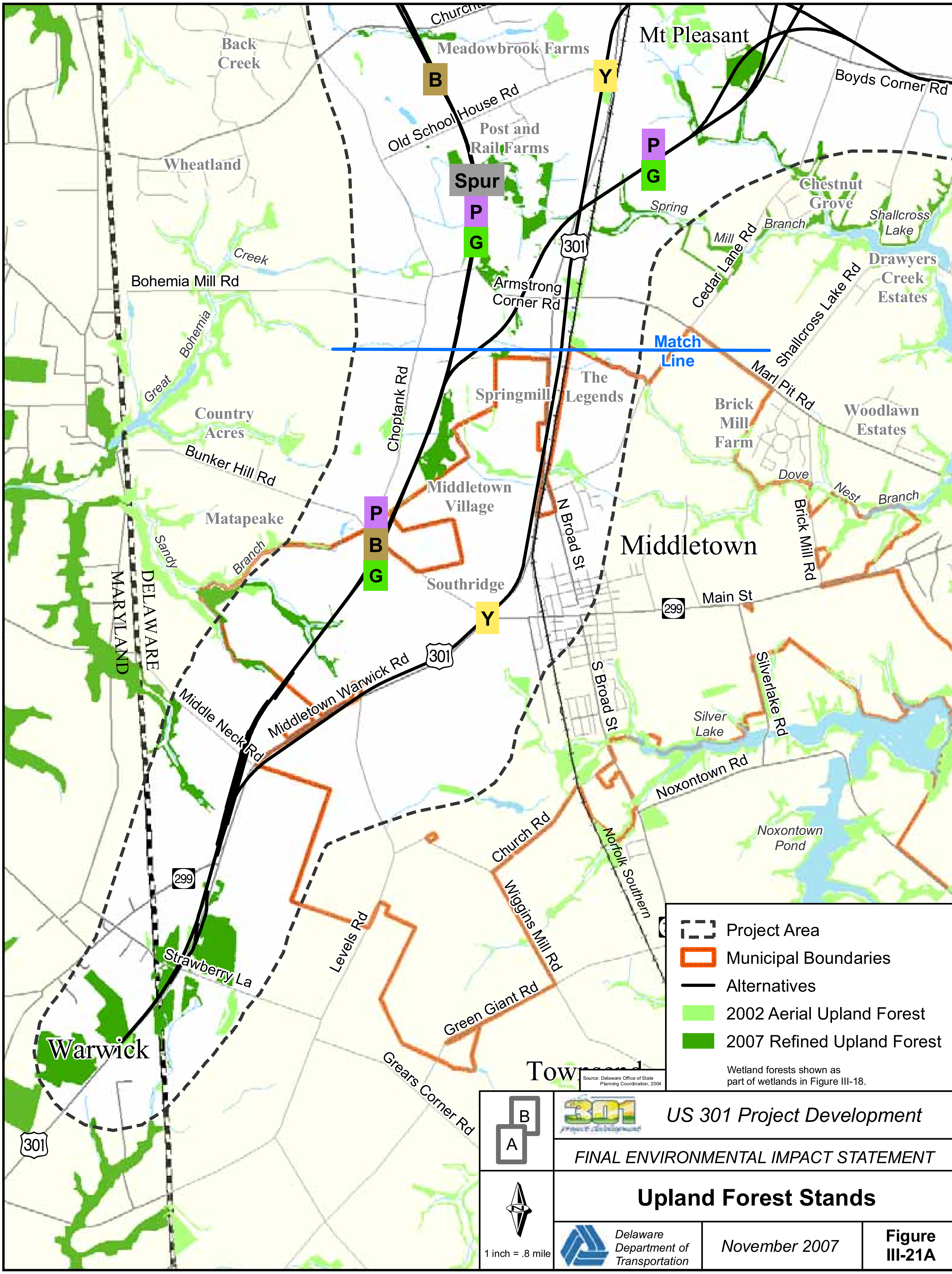
Association	Number of Forest Stands Identified in Project Area
Red Maple	41
Yellow Poplar	9
White Oak	7
Sweetgum-Willow Oak	4
Pin Oak-Sweetgum	3
Loblolly Pine	1
Black Willow	1
Black Locust	1
Mixed	7
Total Number of Stands Identified	**74**

The Red Maple Association, while dominated by red maple (*Acer rubrum*), is associated with other tree species including white pine (*Pinus strobus*), black cherry (*Prunus serotina*), northern red oak (*Quercus rubra*) and sweetgum. This association can be found on sites ranging from extremely wet to dry because of the adaptable nature of the red maple tree. Soils range from poorly drained bottomland soils to well drained upland soils. Since the red maple is a relatively short-lived tree, this association is generally considered an early- to mid-successional forest type (Powell & Erdmann; in Eyre, 1980). This association occupies an extensive numbers of forests throughout the project area.

The Yellow Poplar Association is dominated by the yellow poplar and often occurs in large, uninterrupted stands. Other tree species associated with yellow poplar include American beech (*Fagus grandifolia*), northern red oak, blackgum (*Nyssa sylvatica*) and hickories (*Carya ovata*). Soils in this association are derived primarily from sandstones or shales and tend to be moderately deep to deep, moist, well-drained, and medium to fine in texture. This association is more responsive to site quality than other northeastern hardwoods and is typically found on higher quality sites (Tryon; in Eyre, 1980). The Yellow Poplar Association is found in several areas along Joy Run and an unnamed tributary to the C&D Canal east of Joy Run, as well as along Spring Mill Branch north of Marl Pit Road.

The White Oak Association often occurs in pure stands. Other trees associated with white oak include northern red oak, scarlet oak (*Quercus coccinea*), blackgum, yellow poplar, and white pine. This association is found on a wide variety of sites ranging from dry to moderately wet, and is sometimes found on poorly drained bottomland soils with high clay content (Sander; in Eyre, 1980). The White Oak Association is found along Spring Mill Branch north of Marl Pit Road and in several areas east of SR 15 north of the town of Middletown.

The Sweetgum-Willow Oak Association includes sweetgum and willow oak as the key species. Green ash (*Fraxinus pennsylvanica*) and American elm (*Ulmus americana*) are also associated with this association. This association is common on relatively poorly drained bottom ridges, terrace flats, and transitional sites (Johnson; in Eyre, 1980). The Sweetgum-Willow Oak Association is found east and west of existing US 301, north of Marl Pit Road.



US 301 Project Development

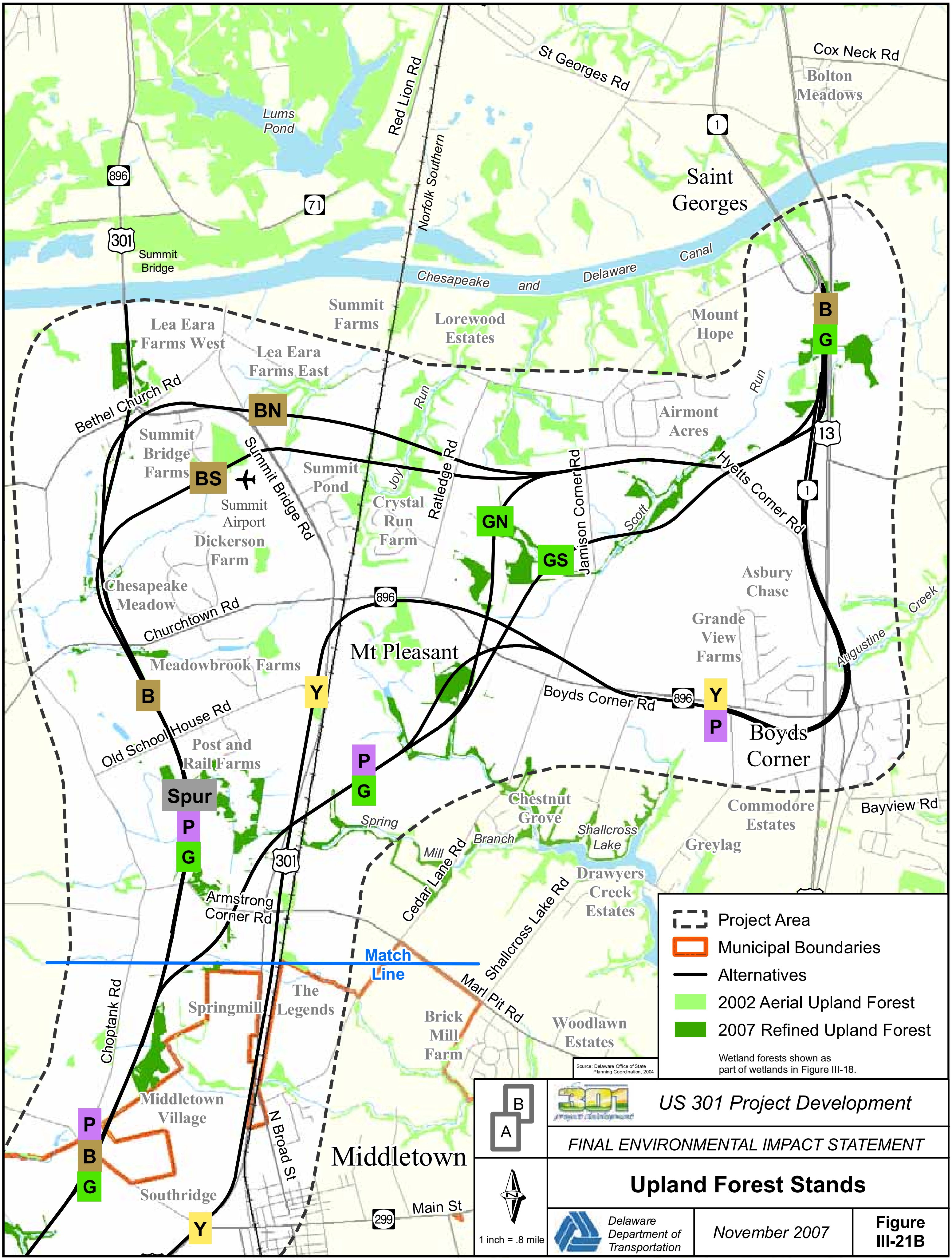
FINAL ENVIRONMENTAL IMPACT STATEMENT

Upland Forest Stands

Delaware Department of Transportation

November 2007

Figure III-21A



Cox Neck Rd
Bolton Meadows
St Georges Rd
Red Lion Rd
Lums Pond
Norfolk Southern
Saint Georges
896
71
301
1
13
Summit Bridge
Chesapeake and Delaware Canal
Summit Farms
Lorewood Estates
Mount Hope
Lea Eara Farms West
Lea Eara Farms East
Bethel Church Rd
Summit Bridge Farms
Summit Bridge Rd
Summit Airport
Summit Pond
Joy Run
Ratledge Rd
Crystal Run Farm
Airmont Acres
Jamison Corner Rd
Hyetts Corner Rd
Scott Run
Dickerson Farm
Chesapeake Meadow
Churchtown Rd
Mt Pleasant
Asbury Chase
Grande View Farms
Augustine Creek
Meadowbrook Farms
Boyds Corner Rd
Boyds Corner
Old School House Rd
Post and Rail Farms
Spring Mill Branch
Cedar Lane Rd
Chestnut Grove
Shallcross Lake
Shallcross Lake Rd
Commodore Estates
Bayview Rd
Greylag
Drawyers Creek Estates
Armstrong Corner Rd
Match Line
Choptank Rd
Springmill
The Legends
Marl Pit Rd
Brick Mill Farm
Woodlawn Estates
Middletown Village
N Broad St
Middletown
Southridge
Main St
299
BN
BS
B
G
GN
GS
Y
P
Spur
Project Area
Municipal Boundaries
Alternatives
2002 Aerial Upland Forest
2007 Refined Upland Forest
Wetland forests shown as part of wetlands in Figure III-18.
Source: Delaware Office of State Planning Coordination, 2004
B
A
1 inch = .8 mile
US 301 Project Development
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Figure III-21B

The Pin Oak-Sweetgum Association, dominated by pin oak and sweetgum, is associated with other trees including red maple, American elm and willow oak. This association is typically an early-successional forest type in the regrowth of bottomland forests and is found in broad stream valleys and poorly-drained depressional areas (Weaver; in Eyre, 1980). The Pin Oak-Sweetgum Association is found along existing US 301 north of the town of Middletown and along Scott Run near Jamison Corner Road.

The Loblolly Pine Association is typically characterized by pure stands of loblolly pine or forests stands where loblolly pine dominates. Sweetgum is associated with this association. This association occurs on soils ranging from somewhat poorly drained to well-drained uplands (Crow; in Eyre, 1980). The Loblolly Pine Association is found near US 301 at the Delaware/Maryland state line as a narrow hedgerow feature.

The Black Willow Association, dominated by black willow and other species of willow, is a rapid growing pioneer tree species. Trees associated with this association include green ash, sycamore (*Platanus occidentalis*) and red maple. In the Eastern US, it is most commonly found in swamps, along newly formed sandbars and along river margins (Krinard; in Eyre, 1980). The Black Willow Association is found along Scott Run near Hyetts Corner Road.

The Black Locust Association, dominated by the black locust, is a pioneer forest type. It is typically found in disturbed areas along roadways and in medians (Roach; in Eyre, 1980). The Black Locust Association is found along existing US 301 just south of the C&D Canal.

Mixed forested areas cannot be classified as a specific association since they are generally comprised of combinations of the species listed above. Mixed associations are found throughout the project area.

(2) Environmental Consequences

The No-Build Alternative will not cause any impacts to forests. The build alternatives, including the Preferred Alternative, will cause destruction of vegetation in non-forested habitat from the construction of paved road surfaces. Impacts to wildlife will be indirect through habitat loss or modification. Other habitat impacts could include the introduction of exotic and invasive species to areas of increased human disturbance. Three of the largest uninterrupted tracts of upland forest in the project area, at Mount Pleasant (150+ acres), south of Post and Rail Farms (80+ acres) and just north of Middletown Village (100+ acres) are not directly impacted by any alternative.

No impacts to forested habitat will occur as part of the No-Build Alternative. Based upon the 2006 aerial photography, the Preferred Alternative will impact 63.7 acres of forest, an increase over the impacts reported for the Green North Alternative in the DEIS (34 acres). Of these 63.7 acres, 56.7 acres are deciduous forest and 7.0 acres are mixed forest. Reasons for the increased impacts are three-fold:

- 18.5 acres of additional impact can be attributed to refinement of the forest layer to reflect current forest coverage. This increase resulted from a change in classification for several forested wetlands to forest and inclusion of hedgerows not previously incorporated in the DEIS.

- Refinements to the profile and limits of disturbance as well as accurate placement of stormwater management ponds added 6.5 acres of forest impacts.
- Lastly, modifications to the alignment in the Ratledge Road Area account for an increase of about 5 acres.

Impacts of the build alternatives, as reported in the DEIS, are summarized on ***Table III-66***. The differences in impacts to forests were factored into the evaluation of the alternatives and the selection of a Preferred Alternative.

The greatest numbers of impacts to non-forested habitat and wildlife will occur as part of the off-alignment alternatives, namely the Purple, Brown, and Green Alternatives, since these alternatives will have the highest amounts of habitat reduction and/or fragmentation. Impacts to non-forested habitat resulting from the Yellow Alternative would be less because most construction will occur adjacent to existing US 301.

Table III-66: Potential Forest Impacts (in acres)

Forest Type	No-Build	Yellow	Purple	Brown North	Brown South	Green North (DEIS)	Green South
Deciduous Forest	0	21.4	39.2	35.8	46.6	33.4	36.1
Evergreen Forest	0	9.2	0	1.0	3.7	0	0
Mixed Forest	0	6.3	0.7	0.7	0.7	0.7	0.7
Total	**0**	**36.9**	**39.9**	**37.5**	**51**	**34.0**	**36.8**

With the additional 30 acres of impact, the Preferred Alternative appears to have the greatest impact on forests when compared to the results reported in the DEIS. However, based on the refinements in the delineation of forest cover, an additional 22 acres of impact would be expected on all alternatives:

- 15.5 acres of additional impact occur in two areas common to all alternatives at the southern end of the project near the Delaware-Maryland state line and at the northern end near the Summit Bridge.
- An additional 6.5 acres of increase are attributable to profile refinement and accurate stormwater management pond placement, which would be expected for all alternatives.

The remaining eight acres of increase are due to the addition of hedgerows (1 acre), forest area refinements in areas specific to the Preferred Alternative (2 acres), and alignment modifications in the Ratledge Road Area (5 acres). Some forest area increases could also be expected for the other retained alternatives due to the addition of hedgerows and other forest area layer refinements: however, this quantity is not estimated. Therefore, the forest impacts of the Preferred Alternative are still comparable to those of the non-preferred alternatives.

Direct and indirect impacts of the build alternatives (including the Preferred Alternative) on fauna include habitat loss and alteration, changes in animal populations and communities, and mortality from wildlife-vehicular collisions. The No-Build Alternative would have no impact on fauna. The greatest impact to fauna resulting from the build alternatives would be habitat loss. Alteration of existing habitat rendering fauna unsuited to their original faunal assemblages is also considered loss of habitat. Construction activities will result in actual acreage losses of habitats and habitat alterations.

Habitat fragmentation or compartmentalization, especially in relation to large woodland tracts, is a consequence of transportation corridor projects since new roadways cross habitat and form barriers for wildlife travel. Since much of the landscape in the project area is a mosaic of open fields, hedgerows, scattered forests commonly connected to wetlands, and scattered residential areas, fragmentation resulting from any of the alternatives would be minor. Most of the wetland crossings associated with the build alternatives will be bridged which will help maintain corridor passage for fauna. There are a few instances where wetlands will be filled and wildlife corridors will be interrupted. In such instances the roadway, acting as a barrier, will likely result in increased roadkills, especially for smaller animals. The severity of such impacts cannot be quantified without extensive study of existing and post-construction animal movement patterns. Increased barrier width of roadways and habitat fragmentation would cause larger animals, such as deer, to travel parallel to the roadways until bridges or crossing points are found. This may be particularly problematic at the few roadways where forested wetlands are filled and a bridge is not provided. However, cutting off or blocking of travel access for terrestrial wildlife would not impact common regional wildlife populations because, despite the increased difficulty, many animals would still cross successfully and many suitable crossing areas would remain.

(3) Mitigation

Forest impacts in Delaware are regulated by the Delaware Forest Conservation Act (Delaware State Senate Bill #324). Mitigation requirements as outlined by the Delaware Forest Conservation Act are:

- 1-10 trees removed = 1:1 tree replacement ratio;
- 11-49 trees removed = 2:1 tree replacement ratio;
- 50 or more trees removed = acre for acre forest area replacement ratio.

Mitigation for impacts to forest areas will be determined during the design phase of the project following detailed delineation of forest stands. Impacts to forest areas have been divided among upland and wetland forests. Wetland forest data are described in ***Section F.6*** of this chapter and are not included as part of the forest impact data provided in this section.

The large number of terrestrial habitat areas within the project area makes complete avoidance of resources impractical for all build alternatives, including the Preferred Alternative. However, a number of design options have been and will be used to avoid and/or minimize impacts, including alignment changes, use of steeper slopes and retaining walls. In some locations where wildlife passage may be problematic, further evaluation will occur during final design to determine whether wildlife passageways can be improved. Appropriate fencing to deter animals entering the highway will also be included in the final design. Stormwater management pond locations have been refined to avoid forest resources where possible, and final design may replace many of the ponds with alternative “green technology” BMPs. Avoidance and minimization measures to reduce impacts to upland forest will continue to be implemented for all phases of the project through final design.

Appropriate and practicable compensatory mitigation is required for unavoidable adverse impacts to forest. Compensatory mitigation is being evaluated in accordance with state regulations and guidance. Because more than 50 trees will be removed for the road improvement, an acre for acre forest replacement mitigation plan will be implemented. Following this requirement, the project should create a minimum of 64 acres of new forest.

The mitigation site selection process focused on locating severed, unforested parcels along the Preferred Alternative alignment. Preferred sites also buffer a stream or existing community or enlarge a contiguous forest tract. The mitigation site search and community and resource agency commitments resulted in the identification of six forest creation sites, together providing 67.22 acres. These sites will be reforested with deciduous hardwood and climax tree species such as oak, hickory and maple.

The project will impact 2.6 acres of forest in Maryland. Under the Maryland Reforestation Law and Roadside Tree Law, a 1:1 replacement of forest will be required for any forest areas removed by implementation of the Preferred Alternative. There are no severed parcels along the alternative in Maryland, making on-site mitigation in this location unlikely. Coordination with Maryland state agencies will determine the solution to compensate for the impacted forest.

A desktop search using GIS mapping of existing features identified 25 unforested parcels along the alternative for potential mitigation. Together, these 25 parcels provide 373.74 acres of potential forest mitigation. The sites were prioritized based on community and resource agency commitments. Six (6) sites were chosen that provide approximately 67 acres for reforestation mitigation.

- <u>Site 1</u> is 5.30 acres of an agricultural field located just north of Bunker Hill Road between existing US 301 and Choptank Road, east of the Preferred Alternative alignment and west of Middletown Village. This parcel buffers the community as well as enlarges a continuous tract of forest surrounding wetlands and streams and buffers the Dove Nest Branch stream system at its headwaters.
- <u>Sites 2, 3, and 4</u>, totaling approximately 24 acres, are located in the Ratledge Road Area. The selection of Option 4B Modified in this area created an additional 4.7 acres of forest impacts. These sites meet DNREC's request that mitigation occur in the vicinity and within the Scott Run watershed. They enlarge a continuous forest tract and provide a buffer to the stream headwaters and surrounding wetlands.
- <u>Site 5</u> is 21.73 acres of an agricultural field located north of the Preferred Alternative just south of Hyetts Corner Road near Jamison Corner Road. Reforestation at this site would benefit the Airmont community of single family homes located just to the north as well as provide some protection to the Scott Run watershed.
- <u>Site 6</u> is 15.85 acres of agricultural fields located east of the Spur Road, south of the existing US 301/SR 15 intersection. Forest mitigation at this site would provide a buffer for the Summit Bridge Farms community.

b. Aquatic Biota

Aquatic biota within the project area have been historically affected through population growth, industrial and urban development, and harvesting of natural resources beginning in the 19th century. In recent years, a resurgence of beaver have modified forested wetland corridors and affected aquatic biota because of flooding, directly destroying trees, and threatening infrastructure. Beaver populations were noted throughout the project area. Aquatic biota commonly observed in the project area includes fish, reptiles, mammals, birds and amphibians that live in and around these freshwater systems.

(1) <u>Existing Conditions</u>

Fish

Common types of fish found in New Castle County, Delaware consist of warm-water species typically observed in the Coastal Plain Province of the Mid-Atlantic United States. Fish populations consist of both native and non-native species. Common freshwater species identified in the Delaware include American eel (*Anguilla rostrata*), brown bullhead (*Ictalurus nebulosus*), pumpkinseed (*Lepomis gibbous*), bluegill sunfish (*Lepomis macrochirus*), black-nosed dace (*Rhinichthys atratulus*), white sucker (*Catostomus commersoni*), white perch (*Morone Americana*), largemouth bass (*Micropterus salmoides*), and tessellated darter (*Etheostoma olmstedi*). Common non-native species found in the project area surface waters include the common carp (*Cyprinus carpio*) and the grass carp (*Ctenopharyngodon idella*).

Data inventories of fish and other aquatic life and aquatic habitats within project area surface water features were limited. Fish species most commonly observed during field investigations included minnow species (*Cyprinidae sp*.) and largemouth bass in the larger perennial streams. Dominant populations of minnows and sunfishes species were also observed in smaller, low-gradient streams and eutrophic ponds where floating emergent vegetation was prominent.

No federally listed endangered fish species are found in the project area. The shortnose sturgeon (*Acipenser brevirostrum*) is the only federally listed endangered species in the state and is found only occasionally in Delaware tidal waters.

No state listed endangered fish species were found in the project area. The blackbanded sunfish (*Enneacanthus chaetodon)* is the only state listed endangered species that may potentially be found within the project area.

No Essential Fish Habitat is found in the project area. Essential Fish Habitat has been identified in Delaware Bay and in the Delaware Inland Bays, both of which lie outside the project area.

Benthic Macroinvertebrates

DNREC's Division of Water Resources monitors the health of non-tidal streams throughout the state through an ecological assessment of the benthic macroinvertebrate community and physical habitat evaluation. Habitat evaluation is determined by assigning a rating to stream conditions such as habitat depletion, stream alteration, bank erosion, and the presence/lack of vegetation. The condition of biological communities is assessed according to such factors as habitat, pollution impact, and the occurrence of extreme hydrologic events. DNREC uses the results of these monitoring events to gauge future stream and habitat restoration projects and to assess future water quality monitoring efforts.

Through DNREC assessment, scores from 0-20 are assigned for each habitat parameter to derive a Habitat Comparison Index (HCI). Sites are then classified on a range from severely degraded to excellent based on their HCI score. Benthic macroinvertebrates are collected to complete a biological assessment of the stream community. A total of five measurement parameters are compared to regional reference values to determine a Biotic Comparison Index (BCI). Sites are then classified from severely degraded to excellent based on their BCI score.

As part of their statewide ecological assessment, DNREC's Division of Water Resources has conducted macroinvertebrate sampling of a number of streams located within the project area including: Dove Nest Branch, Spring Mill Branch, Crystal Run, Joy Run, Scott Run, Great Bohemia Creek and tributaries of Back Creek and Sassafras River. Sandy Branch, a tributary to the Great Bohemia Creek in the Chesapeake watershed was not sampled. Macroinvertebrate data, collected by DNREC, shows that benthic populations consist of a diverse range of sensitive to tolerant species in these streams. Dove Nest Branch was listed as moderately degraded, and one station on the Sassafras River was listed in good condition. An additional station on the Sassafras River, along with Spring Mill Branch, Crystal Run, Joy Run, Scott Run, Back Creek, and Great Bohemia Creek were listed as severely degraded.

Habitat assessments conducted by DNREC showed that streams located in the project area were classified from good condition to severely degraded. Spring Mill Branch and one station on the Sassafras River were classified as severely degraded. A different station on the Sassafras River was classified in good condition. Dove Nest Brach, Crystal Run, Joy Run, Scott Run, Back Creek and Great Bohemia Creek were classified as moderately degraded. The moderate to severely degraded status of many of these streams indicates ongoing anthropogenic impacts including habitat loss, pollution and increased development and urbanization.

Aquatic Plants

A variety of aquatic vegetation can be found throughout the freshwater streams, lakes and ponds located in the project area. Wetland vegetation is consistent with that found in freshwater marshes, swamps and bogs of wetlands in the Coastal Plain of the Mid-Atlantic United States.

The invasion of natural plant habitats from non-native plants is the most common problem facing Delaware's native aquatic plant species. Exotic vegetation, often fueled by nutrient enrichment, out-competes beneficial native vegetation and can clog waterways, diminish fishing, and degrade water quality. The most harmful exotic aquatic invaders include filamentous algae and two species of submerged aquatic vegetation (SAV): hydrilla (*Hydrilla verticillata*) and cabomba or Carolina fanwort (*Cabomba caroliniana*). Control methods including the use of aquatic herbicides and mechanical harvesting, have been shown to be the best way to mitigate the impacts of these exotic aquatic plants.

(2) Environmental Consequences

Impacts to aquatic biota may result from each of the build alternatives, including the Preferred Alternative. Only the No-Build Alternative would result in no impacts to aquatic biota. Direct impacts that result from bridge or roadway construction, land development or other related activities may cause the direct loss of aquatic plants and animals located within the project area. The extent of impacts from construction activities related to this project will depend on the type of construction activity and individual tolerance and pollutant sensitivity of fish, macroinvertebrates and other aquatic life.

Additional impacts that may occur as a result of the build alternatives include increased stormwater runoff and pollution resulting from an increase in impervious surfaces along with car and truck traffic. This can affect overall water quality for project area surface waters, in turn affecting the food sources of fish and other aquatic life. A population decrease of one species integral to the food chain can affect other species along with the success of the aquatic community.

(3) Mitigation

Minimizing impacts to aquatic biota can help ensure that native plant and animal species found in the project area can be maintained. Design modifications to the Preferred Alternative will be investigated in sensitive areas and appropriate mitigation would be implemented when impacts cannot be avoided. BMPs would be implemented before, during and after construction to reduce impacts to aquatic biota. Proper steps will be taken to eliminate or reduce non-native species. A program to remove non-native plants and reestablish native populations would be implemented to mitigate those areas where native species have been removed due to construction activities.

9. Rare, Threatened and Endangered Species

The following section identifies the federal and state listed rare, threatened and endangered (RTE) species potentially occurring within the project area and potential impacts to RTE species resulting from the project alternatives. Rare, threatened or endangered species and unique or critical habitat is regulated at the federal level through Section 7 of the Endangered Species Act (1973; 50CFR17) and at the state level through Title 7 of the Delaware Code (7 Del.C. §§ 601 – 605).

a. Existing Conditions

Information on rare, threatened or endangered species and critical habitat within the project area was obtained through agency coordination. Response letters were received from US Fish and Wildlife Service (USFWS), Delaware Department of Natural Resources and Environmental Control (DNREC), DNREC Natural Heritage and Endangered Species Program (DNHP), Maryland Department of Natural Resources (DNR), and DNR Environmental Review Unit (ERU). Information on rare, threatened, or endangered species within the project area was also acquired through field observations.

Letters requesting information on rare, threatened or endangered species, and critical habitat were sent on May 13, 2005 to USFWS and DNHP. Agency correspondence is attached in ***Appendix C***.

USFWS indicated, in a response dated August 17, 2005, that the federally threatened bog turtle (*Clemmys muhlenbergii*) may be present within the project area. According to the USFWS response, bog turtles "…primarily inhabit palustrine wetlands comprised of a muddy bottom or shallow water, and tussocks of vegetation." The response suggested that a survey evaluating bog turtles and their habitat may be appropriate. USFWS also noted the presence of a federally threatened bald eagle (*Haliaeetus leucophalus*) nest within the vicinity of the project area, located along Scott Run approximately 1 mile east of US 301. A second bald eagle nest was discovered by a DNREC representative on January 22, 2007 southwest of Middletown and approximately one mile east of existing US 301 near the proposed Levels Road interchange.

DNHP indicated in a letter dated July 25, 2005 that several rare, threatened or endangered species are known to occur within or adjacent to the project area. DNHP indicated that the project area contains State Wildlife Area Lands which are managed by DNREC's Division of Fish and Wildlife. DNHP recommended consultation with the State's Regional Wildlife Biologist to minimize impacts to State Wildlife Area Lands.

Letters requesting information on rare, threatened or endangered species were sent to the Maryland DNR Environmental Review Unit and Wildlife & Heritage Division on October 20, 2005. DNR indicated in a letter dated December 7, 2005 that there were no records of state or federal species within the portion of the project located in Maryland.

There has been ongoing consultation with both USFWS and DNREC as part of several Agency Review Meetings (April 14, May 23, July 12, August 23, November 8, and December 8, 2005 and January 17, March 21, June 8 and August 15, 2006) and field views (August 8, August 12, September 8 and September 22, 2005 and February 23 and May 11, 2006). Rare, threatened, and endangered species coordination for this project will continue throughout the project development process.

Additional information was requested and received from DNREC concerning the potential presence of a bald eagle nesting site along Scott Run near SR 1 and/or the presence of bald eagles at the headwaters of Shallcross Lake adjacent to existing US 301.

On June 28, 2007 the US government officially removed the bald eagle from the federal list of threatened and endangered species. While this action signifies that the bald eagle is no longer protected under the Endangered Species Act, other laws such as the Migratory Bird Treaty Act and the USFWS Bald and Golden Eagle Protection Act still protect this animal.

Bald Eagles and Other State-Listed Species

While bald eagles were not observed during field investigations, nests were discovered near SR 1 at Scott Run and near the proposed Levels Road interchange proposed under the Preferred Alternative. Other active nest locations identified by DNHP are located outside the project area.

Most of the species identified by DNREC as having been observed in the project area (four-toed salamander, great purple hairstreak, Mitchell's sedge, alewife floater, marsh marigold, hairy woodrush, abruptly bent backed flatsedge) were also not observed within the project area during field investigations. While a few field investigations on select wetlands were conducted with DNREC to identify state rare species or likely habitat, it should be noted that most field investigations were not conducted specifically to identify rare species and most of the field investigators were not trained to identify rare species. However, the state listed queen snake was identified during Phase II and Phase III bog turtle surveys (described below) on Scott Run, Back Creek, Crystal Run, and Joy Run. In addition, cattail sedge (*Carex typhina*), a state rare plant not identified in correspondence with DNREC, was identified in the project area near Mount Pleasant.

Bog Turtle Survey and Biological Assessment

To comply with the recommendations of DNHP regarding bog turtles, a Phase I Bog Turtle Survey was completed in Fall 2005 and Winter 2006. USFWS Bog Turtle Habitat Evaluation Forms were completed for each delineated wetland in the project area. The survey evaluates those areas identified as potential bog turtle habitat during wetland field investigations. The project area for the Phase I assessment includes areas up to one-half mile from the proposed Yellow, Purple, Brown and Green alignments. Assessment protocols were field reviewed with DNHP on August 8, 2005. Phase I results were reviewed with DNHP during a meeting conducted on December 8, 2005.

The Phase I Survey completed forms and final report are included in *Investigation for Wetlands and Waters of the United States and Phase I Bog Turtle Habitat Assessment* (DelDOT, 2006). The survey was conducted according to methods outlined by DNHP in *Bog Turtle Survey Procedures - Delaware* (Revised January 2005) and by USFWS in *Guidelines for Bog Turtle Surveys* (Revised April 2006). Potential habitat was assessed by a state-approved bog turtle surveyor. Twenty-seven areas in approximately ten wetland systems were identified by DelDOT as potential bog turtle habitat. Most of these areas were reviewed in the field with DNHP on February 23, 2006 to ascertain that all potential habitat had been identified. Potential bog turtle habitat was identified in the following areas:

- In the eastern section of the project study area along Scott Run near SR 1,
- Along Crystal Run, Joy Run and another tributary of the C&D Canal east of Joy Run (north and south of Lorewood Grove Road),
- Along Back Creek and its tributaries near Choptank Road in the northwestern section of the project study area,
- Several areas adjacent to existing US 301 (north of the town of Middletown and south of Boyds Corner Road),
- Along Sandy Branch and its tributaries.

Based on these findings, Phase II and Phase III Bog Turtle Surveys were completed by state-approved bog turtle surveyors for the 27 areas of potential habitat. The survey was conducted between April 15 and June 15, in compliance with the requirements specified by USFWS and DNREC. At select areas of potential habitat, Phase III (trapping) surveys were conducted by DNREC and USFWS-approved surveyors.

No bog turtles were discovered during any of the Phase II or Phase III surveys within one-half mile of the proposed alternatives. Details of the Phase II/III survey locations, methods, and results are included in *Phase II/III Bog Turtle Surveys for US 301 Corridor Improvement Project* (DelDOT, August 2006). However, bog turtles were identified in 1972 at one location within one of the watersheds potentially affected by the alternatives. The historical record location and the specific watershed will not be identified in this document in compliance with the Endangered Species Act. Bog turtles are directly threatened by poaching activities and disclosing the location of the historical population may constitute a threat to that population. Based on the historic occupation and the bog turtle life span, the entire watershed is evaluated as a "potentially occupied" bog turtle area. Impacts to the watershed resulting from the build alternatives are evaluated below.

b. Environmental Consequences

Bog Turtles

A biological assessment for the US 301 Project (*Delaware US 301 Project Biological Assessment*, DRAFT, May 2007) details whether the roadway improvement may affect any of the threatened, endangered, proposed or sensitive species in the vicinity of the project area. Because no bog turtles were found during the intensive searches, but the Scott Run watershed has an historic record of bog turtles, the impacts expected from the construction of the Preferred Alternative are minimal.

The No-Build Alternative will not impact the potentially occupied watershed and have no impacts to bog turtles or bog turtle habitat.

All of the build alternatives, including the Preferred Alternative, will impact the potentially occupied watershed which could result in direct bog turtle impacts and in indirect and direct bog turtle habitat impacts. Based on the 1972 historical record, and the results of the 2006 Phase II/III survey, bog turtles may or may not be present in the potentially occupied area. If they are present, population levels are likely low. Therefore, the potential for impacts to the bog turtle may be minimal. As a result of findings of the Biological Assessment, the project "May Affect but is Unlikely to Adversely Affect" the bog turtle. Potential direct bog turtle impacts could include road mortality and construction related mortality. Direct bog turtle habitat impacts include filling of wetlands. Indirect bog turtle habitat impacts include wetland hydrology alteration and introduction of invasive plant species. Each type of potential impact to bog turtles and bog turtle habitat is described below.

Road Mortality

All of the build alternatives, including the Preferred Alternative, have the potential to cause turtle road mortality because each alternative crosses the potentially occupied watershed where turtles could, if they exist, climb up onto the road. The Yellow and Purple alternatives have the fewest crossings and the lowest potential for road mortality. Green South has most crossings and the highest potential for road mortality. Brown North, Brown South and Green North each have an intermediate number of crossings and moderate potential for road mortality. Road mortality should be limited since all the crossings will consist of elevated bridges over the wetlands. These crossings could be designed to allow unrestricted turtle movement under the road and maintain travel corridors for any future turtle movements.

Other measures such as fencing or solid barriers could be placed along the new roadway to ensure that turtles cannot cross the road.

Mortality During Construction

All of the build alternatives, including the Preferred Alternative, have the potential for construction-related mortality when work is being conducted within wetlands in the potentially occupied watershed. The Yellow and Purple alternatives have the smallest limit of disturbance and the lowest potential for construction mortality. Green South has the largest limit of disturbance and the highest potential for construction mortality. Brown North, Brown South and Green North have an intermediate sized limit of disturbance and moderate potential for construction mortality. Disturbance to wetlands along the potentially occupied watershed and potential construction mortality has been minimized by spanning the wetlands with bridges and limiting the placement of fill in wetlands along the potentially occupied watershed.

Other measures to ensure minimal mortality during construction include installing silt fencing around the construction area within the potentially occupied watershed's wetlands and having a qualified bog turtle surveyor present to conduct a pre-construction survey of the construction area for turtles. This exclusionary fence and the construction area could also be monitored by a qualified bog turtle surveyor for the duration of the construction.

Hydrologic Changes

All of the build alternatives, including the Preferred Alternative, have the potential to cause hydrologic changes because they cross the potentially occupied watershed and introduce impervious surface within the potentially occupied watershed. As reported in the DEIS, the Yellow and Purple alternatives would introduce the smallest additional impervious area and would have the lowest potential for hydrologic changes. Green South had the largest additional impervious area and the highest potential for hydrologic changes, while the Brown North, Brown South and Green North had an intermediate amount of additional impervious area and intermediate potential for hydrologic changes. It is important to note that beavers are very active within the potentially occupied watershed (and all project area watersheds) and are continually altering hydrology within the wetlands by alternately flooding and drying up wetlands as dams are created and breached.

Stormwater management is a key component of this project and would be included in all build alternatives. Stormwater management facilities would be designed to manage both water quantity and quality. Stormwater runoff would be directed to these facilities prior to entering the wetlands along the potentially occupied watershed and the facilities would be designed to maintain the existing water regime with the incorporation of infiltration and discharge facilities. Maintenance of the existing water regime would help to maintain the groundwater levels and recharge necessary to continue to supply these groundwater-fed seeps within the wetlands along the potentially occupied watershed. All road-related runoff would be directed into stormwater management facilities.

Any hazardous materials in the stormwater runoff would also be captured in the stormwater management facilities and allowed to settle out prior to the water reentering the nearby wetland systems. In case of an accidental hazardous materials spill from trucks, spills could be contained with the stormwater management facilities until emergency response cleanup is completed.

Introduction of Invasive Plant Species

All of the build alternatives, including the Preferred Alternative, have the potential to introduce invasive plant species into the potentially occupied watershed. Invasive plants can be introduced by seeds in foreign soils used as fill material, through seed transport along road corridors, and through soil disturbance permitting invasive species to establish before native species. Invasive species encroachment on bog turtle habitat can negatively change the plant composition resulting in habitat that is undesirable or unusable to bog turtles. It is important to note, however, that many of the wetlands along the potentially occupied watershed already have invasive species within the wetland. Invasive plant species introductions would be minimized by limiting disturbance to wetlands along the potentially occupied watershed and limiting the amount of fill placed in wetlands along the potentially occupied watershed.

<u>Bald Eagle and Other Species</u>

The build alternatives, including the Preferred Alternative, would not impact the bald eagle nest site which is known to occur along Scott Run. The nest along Scott Run would be located outside of the area of potential impact for these alternatives, and would be outside of the buffer requirements. USFWS normally recommends that a year-round buffer of 750 feet remain undisturbed around bald eagle nests to avoid direct impacts (a “take”). In addition, a time-of-year restriction on construction activities within a quarter mile of an eagle nest has been established from December 15 through June 15 to avoid disturbance to nesting eagles and ensure successful incubation and rearing of young. Disturbances to the nest and surrounding area will be avoided.

The bald eagle nest discovered near Levels Road is within the tier 2 impact zone of the Preferred Alternative. Tier 2 protection extends a buffer around the nest of 1,320 feet. The end of the Levels Road interchange LOD was within 1,296 feet of the nest. To avoid and minimize impact to this nest, the roadway design was modified to shorten the Levels Road interchange in that area so the LOD no longer extends into the nest buffer.

Because of the locations of bald eagle nest sites in proximity to the Preferred Alternative, a year-round buffer of 750 feet will be maintained during all construction activities, and time-of-year restrictions on construction activities (from December 15 through June 15) within a quarter mile of an eagle nest will be observed.

The build alternatives, including the Preferred Alternative, are located within the area identified by DNHP where several rare, threatened, or endangered species have been previously identified. There are no anticipated impacts to the following state listed species: four-toed salamander, great purple hairstreak, Mitchell's sedge, alewife floater, marsh marigold, hairy woodrush, and abruptly bent backed flatsedge; these species were not incidentally observed within the project area during field investigations. These field investigations were not focused on rare species and were conducted by biologists not specifically trained to identify rare species. All of the retained alternatives have the potential to impact the queen snake; the Brown North Alternative would impact all the wetlands in which the queen snake was identified. The Yellow Alternative would impact the queen snake along Scott Run while the rest of the alternatives would impact the queen snake along Scott Run and Back Creek. The queen snake is a wetland dependant species and avoidance, spanning, and minimization of impacts to wetlands along with compensatory wetland mitigation would limit impacts to the queen snake. The Yellow Alternative would impact cattail sedge, a state rare species identified during field investigations.

10. Wild and Scenic Rivers

a. Existing Conditions

National Wild and Scenic Rivers System information is maintained by the National Parks Service (NPS) and categorized by state. Furthermore, the NPS manages the Nationwide Rivers Inventory (NRI) which lists more than 3,400 free-flowing river segments in the United States.

Wild and Scenic Rivers of the United States, along with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, and cultural values. They are to be preserved in a free-flowing state, and they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations.

The Nationwide Rivers Inventory (NRI) lists river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance. Under a 1979 Presidential directive, and related Council on Environmental Quality guidance, all federal agencies must seek to avoid or mitigate actions that would adversely affect one or more NRI segments.

White Clay Creek has received the Federal Wild and Scenic River designation. The White Clay Creek Wild and Scenic Rivers System Act designated approximately 190 miles of segments and tributaries of the White Clay Creek as components of the national system. This includes virtually the entire watershed, a first time occurrence in the national system. The White Clay Creek watershed comprises approximately 70,000 acres or 100 square miles in Pennsylvania and Delaware. White Clay Creek joins the Christina River near Newport, Delaware, which in turn flows into the Delaware River near Wilmington.

Nineteen miles of the Sassafras River, from its headwaters in Kent and Cecil Counties, Maryland and New Castle County, Delaware, to its confluence with the Chesapeake Bay, were listed in 1982 on the NRI and considered to have outstandingly remarkable recreational, fish, wildlife, and other values. The watershed drains approximately 48,326 acres within a portion of western New Castle County. The watershed's eastern boundary roughly parallels SR 15 and extends westward out of the project area into the State of Maryland.

b. Environmental Consequences

White Clay Creek and its entire watershed is located north and east of the project area and will not be impacted by the US 301 project. The watershed for the Sassafras River, listed on the NRI, lies within the project area boundaries. Headwaters would be impacted by the southern portion of all build alternatives.

There would be no direct impacts to the Sassafras River or its tributaries resulting from any of the build alternatives, including the Preferred Alternative. Impacts to the Sassafras River watershed could result from roadway runoff, sedimentation, and alterations to hydrology. These impacts could potentially contribute to a decrease in scenic value, recreational use, and plant and animal species that inhabit these areas.

11. Coastal Zone Management Area

a. Existing Conditions

As mandated by Section 307 of the Federal Coastal Zone Management Act (CZMA) of 1972, each coastal state must develop a federally approved Coastal Zone Management Program (CZMP). Any federal action which is reasonably likely to affect any land or water use, or natural resource of a state's coastal zone, must be conducted in a manner that is consistent with the state's federally approved CZMP. Activities are reviewed by the appropriate agency to ensure consistency with the state's CZMP as part of the Federal Consistency process. In Delaware, the consistency review is initiated through submittal of a separate application to the *Delaware Coastal Management Program* (DCMP). A representative of the Delaware CZMP has participated in the US 301 Project Development effort and has been involved in the development and review of this FEIS. In Maryland, the consistency process is initiated through application for a federal permit.

The limits of the Coastal Zone in Delaware are defined as the entire state for the purposes of the federally approved coastal management program (DCMP, 2004). In Maryland, the Coastal Zone includes Cecil County, and therefore the area where existing US 301 is located (MDE, 2004). Because the entire project area lies within the Coastal Zones of Maryland and Delaware, all activities will be subject to the Federal Consistency Process. The review process will analyze the proposed activity for consistency with existing land uses and impacts to coastal resources.

b. Environmental Consequences

No impacts to the Coastal Zone are anticipated as a result of the No-Build Alternative. A small portion of the Yellow, Purple, Brown, and Green (Preferred) Alternatives is located within the Coastal Zone of Maryland. The remainder of these alternatives is located entirely within the Coastal Zone of Delaware.

Because impacts to federally regulated wetlands are anticipated as part of this Preferred Alternative, a Coastal Zone Consistency Statement will need to be obtained before any federal permit activities could occur as part of any alternative. In Delaware, a Consistency Statement will need to be applied for separately from any application for a permit for wetland impacts. The Consistency Statement application will be submitted in Delaware when the final ACOE permit is submitted. In Maryland, this process will occur as part of the application for a federal permit. The Preferred Alternative would be designed and constructed in a manner that remains consistent with the policies of both Delaware's and Maryland's Coastal Zone Management Programs.

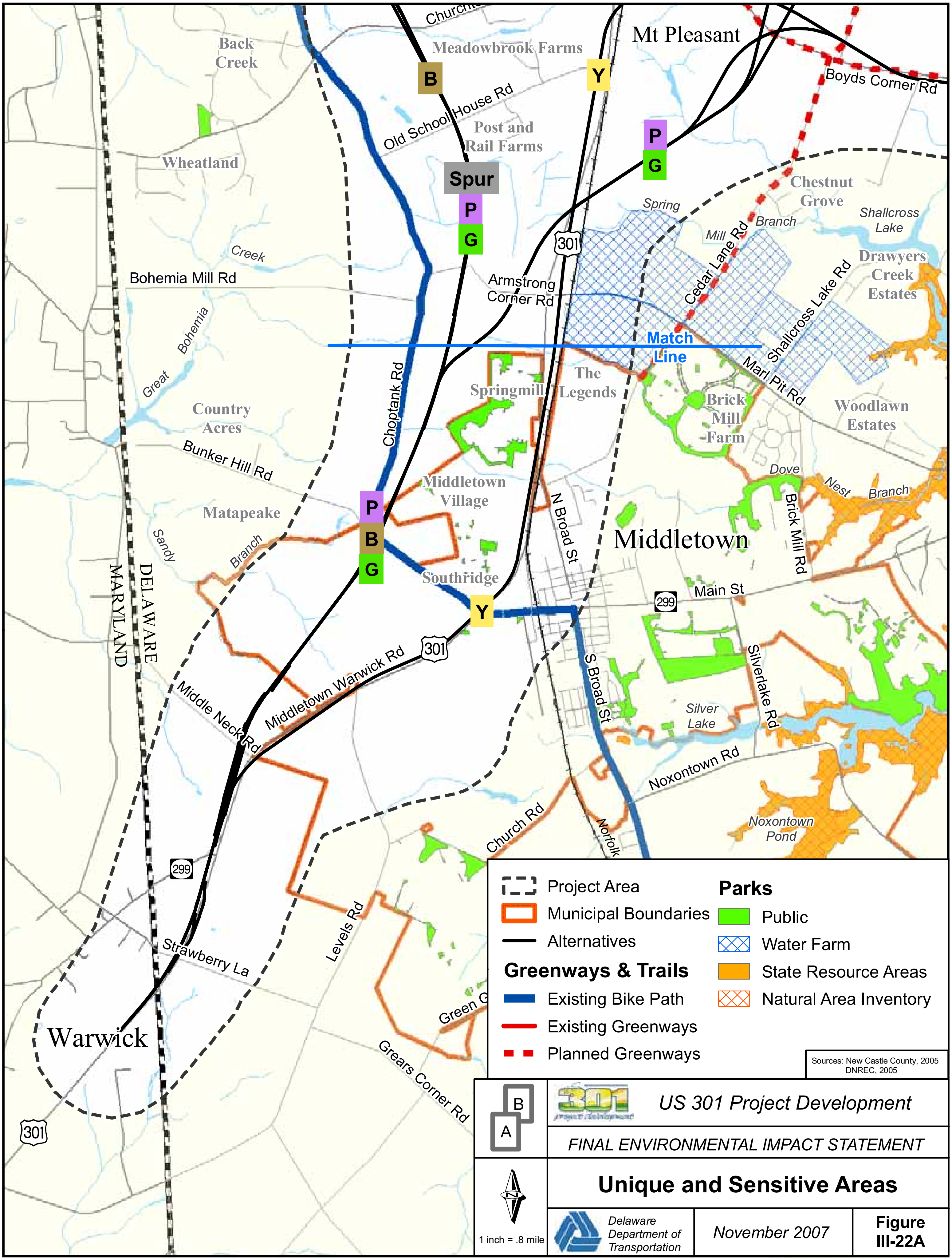
12. Unique, Sensitive and other Natural Areas

a. Existing Conditions

Unique and Sensitive Areas include areas with special environmental qualities or historical uniqueness and sensitivities. Some of these areas may be represented in other sections of the DEIS. Unique and Sensitive Areas need special attention during the planning, design and management phases of the project to avoid or minimize impacts wherever possible in order to maintain their remarkable character. A variety of areas are included in this section including state resource areas, state wildlife area lands, greenways and trails, sensitive wildlife habitat, and designated natural areas. ***Figure III-22*** shows the unique and sensitive areas in or adjacent to the project area.

Delaware's *State Strategies for Policies and Spending* (1999, updated 2004), also known as *Livable Delaware*, directs the focus of state development and land use programs to those areas most suitable. "Green Infrastructure", defined in Executive Order #61, defines those areas that focus on croplands, forestlands and natural resources and recreation lands by mapping, and uses that mapping to develop goals and strategies for preservation of natural resource areas, recreational lands and working lands.

A variety of resources were used to develop the Unique, Sensitive and Other Natural Areas section. The GIS database for New Castle County and Delaware provided designated environmental features and boundaries within the project area. DNREC and Maryland DNR websites provided details on the unique and sensitive areas. Unique and Sensitive Areas are described below by category.


Mt Pleasant
Back Creek
Meadowbrook Farms
Boyds Corner Rd
Old School House Rd
Post and Rail Farms
Wheatland
Spur
Chestnut Grove
Spring Branch
Mill
Cedar Lane Rd
Shallcross Lake
Creek
Bohemia Mill Rd
Armstrong Corner Rd
Drawyers Creek Estates
Shallcross Lake Rd
Bohemia
Great
Match Line
The Legends
Springmill
Marl Pit Rd
Country Acres
Choptank Rd
Brick Mill Farm
Woodlawn Estates
Bunker Hill Rd
Dove
Nest
Branch
Middletown Village
Matapeake
Sandy
Branch
N Broad St
Middletown
Brick Mill Rd
MARYLAND
DELAWARE
Southridge
Main St
299
Middletown Warwick Rd
301
S Broad St
Silverlake Rd
Middle Neck Rd
Silver Lake
Noxontown Rd
Church Rd
Norfolk
Noxontown Pond
299
Levels Rd
Strawberry La
Green
Warwick
Grears Corner Rd
301
Project Area
Municipal Boundaries
Alternatives
Greenways & Trails
Existing Bike Path
Existing Greenways
Planned Greenways
Parks
Public
Water Farm
State Resource Areas
Natural Area Inventory
Sources: New Castle County, 2005 DNREC, 2005
B
A
1 inch = .8 mile
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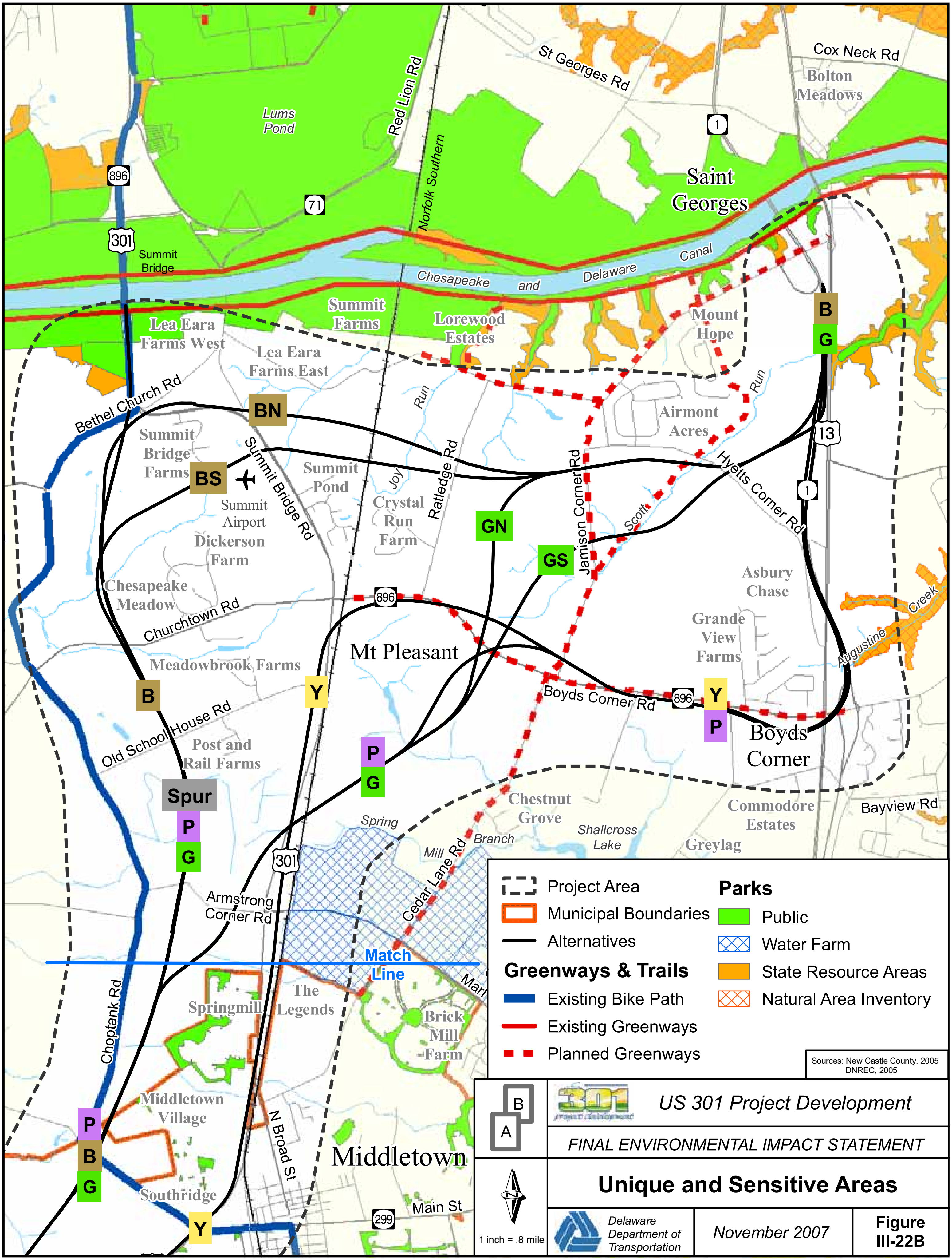
November 2007
Figure III-22A



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Unique and Sensitive Areas

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Figure III-22B

State Resource Areas

The development of State Resource Area (SRA) maps was authorized in 1990 by the Delaware Land Protection Act (7 Del Code, Chapter 75). The maps are used to guide local land use planning in the protection of unique ecological functions and for guiding acquisition of property or rights in real property through the Open Space Program. SRAs include existing protected state, federal, local and private conservation organization lands. SRA maps were updated in 2006, and include some of the finest examples of Delaware's diverse natural and cultural heritage, unspoiled wetlands, mature forests, rare plant and animal habitats, geological and archaeological sites, open space for recreation and greenway connectors. The updated SRAs in the project area are shown on ***Figure III-22***.

Noxontown Pond is a 493-acre designated State Resource Area located south of the project area.

The *C&D Canal State Resource Area* includes 1,760 acres of freshwater marshes (Dragon Run and Thousand Acre Marsh), 20.3 miles of shoreline, significant geological features, three state Natural Areas, and approximately 1,500 acres of forestland. The alternatives cross the C&D Canal SRA at the base of Summit Bridge, and the Green and Brown Alternatives cross Scott Run within the C&D Canal SRA.

Lums Pond State Park is a 1,790 acre state park located north of the C&D Canal, outside of the project area. This park encompasses the largest freshwater pond in Delaware and features a variety of recreational sports facilities and hiking trails. Lums Pond is a management unit within the C&D Canal SRA.

Natural Areas

In 1978, the State of Delaware enacted the Natural Areas Preservation System (7 Del. Code, Chapter 73) to establish an inventory of natural areas statewide and a system of nature preserves. A natural area is defined as an "area of land or water, or of both land and water, whether in public or private ownership, which either retains or has reestablished its natural character, or has unusual flora or fauna, or has biotic, geological, scenic or archaeological features of scientific or educational value." Nature preserves are those natural areas that have been formally dedicated or transferred to DNREC for and on behalf of the State.

Augustine Creek is a Natural Area. The Yellow and Purple Alternatives cross Augustine Creek at their tie-in with SR 1.

Noxontown Pond is a Natural Area and is described above under State Resource Areas.

State Wildlife Area Lands

State Wildlife Area Lands were designated for a number of reasons to serve the public and manage wildlife. These lands provide management and refuge areas for upland animals, provide biological diversity through the maintenance of varied ecosystem habitats, and provide hunting grounds. The project area contains State Wildlife Area Lands, managed by the DNREC Division of Fish and Wildlife (Natural Heritage and Endangered Species (DNREC), personal communication, July 25, 2005).

The C&D Canal is a designated State Wildlife Area. The canal connects the Delaware River, south of Delaware City, to the Chesapeake Bay. The north and south banks of the canal include more than 5,100 acres of protected lands, managed by both the Divisions of Fish and Wildlife and Parks and Recreation. The C&D Canal Wildlife Area has been divided into specified areas used for wildlife refuge, waterfowl hunting, deer hunting, and dog training.

Greenways and Trails

Delaware Greenways identifies publicly-owned corridors for the protection of open space. These areas often contain water features, are managed for conservation and recreation, and often link parks, cultural or historic sites with populated areas. Greenways usually contain trails for walking and biking.

Twelve miles of greenway trails are located on both the north and south banks of the C&D Canal. These greenways are managed by the Divisions of Fish and Wildlife and Parks and Recreation.

b. Environmental Consequences and Mitigation

Based on information received from DNREC to date, impacts to unique and sensitive areas would occur with all of the build alternatives, including the Preferred Alternative. All of the alternatives could impact the C&D Canal SRA near the Summit Bridge. Both the Brown Alternative and the Green (Preferred Alternative) could impact Scott Run within the C&D Canal SRA. The Yellow and Purple Alternatives would impact the Augustine Creek State Natural Area near SR 1. Other impacts could include those associated with shade, noise and bridge runoff. There are no impacts to "green infrastructure" areas under any of the retained alternatives.

There are no standard mitigation requirements for State Resource Areas and State Natural Areas (E. Butler (DNREC), personal communication, August 17, 2006). Mitigation for impacts to State Resource Areas, Natural Areas, State Wildlife Area Lands, and Greenways and Trails have been addressed under other resources including community facilities, waters of the US, forested lands, surface waters and habitat resources. Coordination with DNREC to further avoid, minimize or mitigate impacts will continue during the Preferred Alternative development and design process.

G. Traffic, Travel Patterns and Toll Diversions

A summary of existing and anticipated traffic is included in ***Chapter I***, Purpose and Need. The following section details the traffic analysis performed for the project.

1. Traffic Forecasts

Year 2030 traffic forecasts were developed for all of the alternatives using Delaware's state-of-the-art regional transportation model, which is maintained by DelDOT. DelDOT's regional transportation model, commonly referred to as the Peninsula Model because it encompasses the entire Delmarva Peninsula, is based upon the latest approved land use projections available for the region (which at the time the US 301 forecasts were approved by WILMAPCO in 2003) and includes all roadway improvement projects listed in the state's *Capital Improvements Program FY 2005-2010 Final*. For the US 301 analysis, the state's "B model" was used, which is still the most up-to-date version of the Peninsula Model. DelDOT conducted a large scale origin-destination study throughout the US 301 project area in November 2004; the results of that study were used to help calibrate the Peninsula Model to reflect observed traffic patterns on the roads being studied.

When the US 301 DEIS was published in November 2006, the Project Team described the intention to develop updated traffic forecasts prior to the publication of this FEIS. The new forecasts would have used the latest updated land use data and the latest version of the regional transportation model. However, as of the publication of this document, the new version of the regional transportation model is still undergoing a process of development, refinement and calibration by DelDOT and is not yet available for official use. Therefore, the latest available travel forecasting model for the project remains the state's B model, which was used for traffic forecasting for the DEIS.

A comparison was made of the land use assumptions in the current B model (which were approved by WILMAPCO in 2003) with more recent land use projections as of June 2005. This comparison was made to assess the magnitude of change that might be expected in the travel forecasts by using more recent development assumptions, even if they have not been officially adopted in the state's regional travel demand model. The comparison focused on the traffic analysis zones (TAZs) in the M-O-T Planning District. Results of the comparison showed that the new 2005 land use assumptions resulted in a net 13 percent increase in housing, but a 2 percent decrease in the total number of employees. Generally, these new land use assumptions indicate the potential for slightly higher overall volumes throughout the project area than the current 2030 traffic forecasts developed for this study, indicating an even greater need to address and relieve congestion, and better manage truck traffic on US 301 throughout the project area.

For the study of travel patterns and traffic diversions, DelDOT's Peninsula Model was further calibrated based on output from a larger, multi-state transportation model, which included the I-95 and US 301/US 50 corridors as far south as Washington, D.C. The multi-state transportation model was based on a similar model that was developed previously for the Maryland Transportation Authority (MdTA) for their study of the potential shifts in traffic between I-95 and US 301. The multi-state model also provided additional detail by explicitly modeling the behavior of heavy truck traffic under tolling, a feature not currently available in the Peninsula Model. The multi-state model was reviewed by an independent consulting firm at the request of the Maryland State Highway Administration (SHA). The independent consultant indicated that the process used to develop, calibrate and post-process the model was reasonable.

a. Land Use

The approved land use projections that are used in the regional transportation model are provided by WILMAPCO, the regional transportation planning agency (Metropolitan Planning Organization) for Cecil County, Maryland and New Castle County, Delaware. For this analysis, DelDOT carefully reviewed the approved land use projections with the most recent list of individual proposed and approved developments south of the C&D Canal (***Section A.3***). The data matched well, with one exception: the Westown Project, a large, mixed use project in Middletown including approximately 2,400 residential units and educational, retail, commercial and industrial uses. Considering the magnitude of this approved development, DelDOT recognized that the regional model needed to be adjusted to include the proposed Westown development in order to develop more realistic traffic forecasts. It should be noted that more recently, after the traffic forecasts were developed for this document, WILMAPCO did update their approved land use projections to reflect development in the Westown area.

b. Network/Roadway Improvements

In July 2005, the Delaware State Senate passed Senate Bill No. 190, which amended Chapter 14 of the Delaware Code to allow tolls to be collected on US 301 between Maryland and the tolled portion of SR 1 (see 2 Del. C. §1403(6)). Accordingly, the Peninsula Model was also adjusted to include tolls on US 301 at the state line and on all of the north-serving ramps at each of the interchanges south of the C&D Canal along the future access-controlled US 301. US 301 is assumed to be a toll facility for all of the alternatives evaluated (***Chapter II***).

c. Daily Forecasts

Daily traffic forecasts were developed using the output from the Peninsula Model applying the adopted traffic forecasting methodologies outlined in *NCHRP 255 – Highway Traffic Data for Urbanized Area Project Planning and Design* (Transportation Research Board). These procedures are recognized as the accepted practice for developing future traffic volumes for planning and design purposes. These procedures refine the raw traffic forecasts from the regional transportation model based on recent existing traffic count data. For the US 301 Project, an extensive data collection effort was undertaken, obtaining 2005 traffic data at over 30 intersections (peak hour data) and on more than 100 roadway links (daily traffic data). The large database of current traffic data enabled a determination of specific traffic flow characteristics (truck percentages, peak hour factors, directional distributions, and the percentage of daily traffic that is present in the AM and PM peak hours) on individual roadway links. The Peninsula Model also provides sufficient level of detail to allow the projection of the future (2030) percentage of trucks on each roadway link. ***Table III-67*** provides a comparison of 2030 daily traffic volume projections at numerous locations throughout the project area for each of the retained alternatives. ***Figure III-23*** shows the locations of these key roadway segments.

Table III-67: 2030 Daily Traffic Projections (ADT)[1]

Roadway Segment		2003 Existing	2030 Projections				
			No-Build	Yellow	Purple	Brown	Green
1	US 301 at DE/MD State Line	10,300	14,800	15,200	16,500	16,800	16,800
2a	Existing US 301, North of SR 299	18,300	38,900	32,900	23,100	24,000	21,300
2b	New US 301, North of Middletown [2]			37,600	53,700	56,000	56,700
3a	Boyds Corner Road, West of Cedar Lane	12,100	27,500	20,900	20,400	18,900	18,100
3b	New US 301, West of Cedar Lane [2]			33,400	31,200	34,000	42,200
4	Cedar Lane, South of SR 896	4,500	9,700	6,100	5,600	5,500	4,500
5	Choptank Road, South of Churchtown Rd	3,100	15,200	12,800	5,300	5,100	5,100
6	SR 299, West of SR 1	17,300	26,600	16,700	15,900	15,600	13,600
7	Summit Bridge	26,300	65,500	58,100	64,000	64,000	59,500
8	SR 896, North of Porter Road	30,400	59,200	52,400	55,800	55,900	52,700
9	SR 896, South of Old Baltimore Pike	35,200	54,500	49,100	50,200	49,500	48,900
10	I-95, East of SR 896	117,500	166,800	164,400	165,600	165,000	164,500
11	I-95, East of SR 72	117,500	188,600	185,700	186,200	186,300	184,800
12	SR 1, South of SR 896	38,900	63,000	54,600	53,000	53,100	51,300
13	US 13, South of SR 896	24,500	42,600	39,400	39,400	39,200	37,700
14	SR 1 Bridge	55,200	89,500	100,500	98,000	96,900	104,300
15	St. Georges Bridge (US 13)	10,500	21,600	21,500	21,500	20,800	19,600
16	SR 1, South of SR 72	62,000	99,000	108,200	107,000	107,300	111,400
17	SR 1, South of US 40	47,300	84,100	93,600	92,200	92,100	96,000
18	SR 1, South of SR 273	65,800	104,200	110,300	108,900	108,900	111,800

1. Projections are forecast with Westown development added and with ramp and mainline tolls.
2. Roadway segment is located on build alternative; existing and No-Build are not applicable.

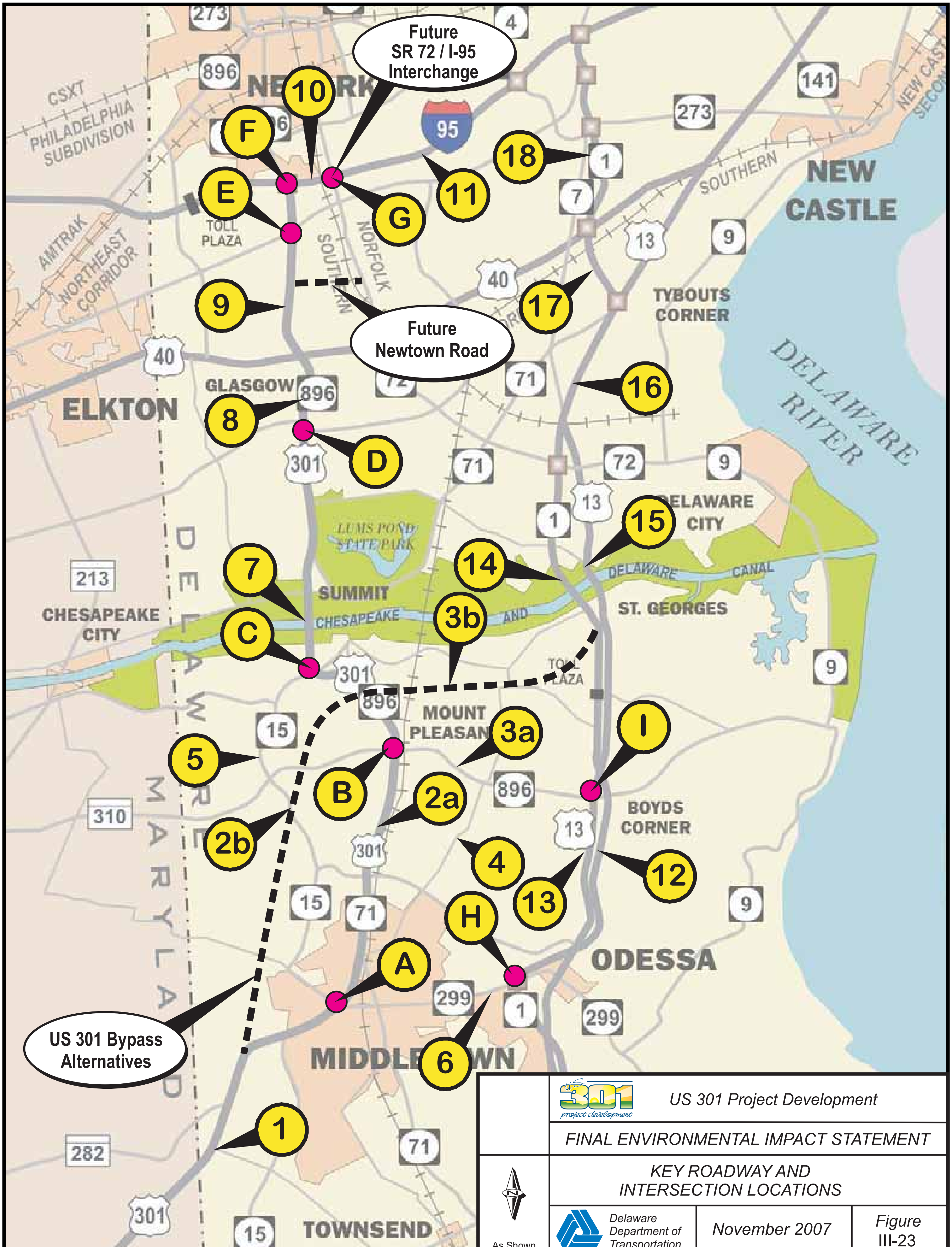
d. Peak Hour Forecasts

Year 2030 peak hour forecasts were developed for numerous intersections and roadway links for each of the project alternatives and used as the basis for conducting traffic capacity analyses. The peak hour volumes were generated by factoring the daily traffic projections based on the detailed existing traffic data collected (truck percentages, peak hour factors, turning movement volumes, directional distributions, and the percentage of daily traffic that is present in the AM and PM peak hours).

2. Traffic Analysis

a. Methodology

Traffic congestion for this project was quantified using the capacity analysis procedures contained in the *2000 Highway Capacity Manual* (HCM) (Transportation Research Board), the state and national standard for evaluating traffic operations. Capacity analyses were performed for all key roadway links and all key intersections south of the C&D Canal, as well as at select locations on or near SR 896 and SR 1 north of the Canal. Capacity computations were performed for all mainline roadway sections (freeways, multilane highways and two-lane



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KEY ROADWAY AND
INTERSECTION LOCATIONS

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Figure III-23

highways), and for all freeway ramp and weaving sections using the *Highway Capacity Software* (HCS), *version 4.1d* (© 2003 by the McTrans Center, University of Florida). This traffic analysis software, which is based on the HCM procedures, is used extensively by public and private agencies, including DelDOT. All signalized and unsignalized intersections were analyzed using *Synchro version 6.0, Build 612* (© 1993-2003 by Trafficware). Like the HCS, Synchro is also based on HCM procedures and is widely used and accepted by public and private agencies, including DelDOT.

All traffic analysis results for this project are reported in terms of Level of Service (LOS). Level of Service is a measure of the efficiency of traffic flow through an intersection or along a roadway segment. LOS is represented by letter grades ranging from A (best) through F (worst). Factors influencing LOS include traffic characteristics (*e.g.,* volumes, direction distribution, and vehicle type) and roadway characteristics (*e.g.,* number and width of lanes, terrain, design speeds and passing zones).

b. Results

A total of 26 intersections, ten roadway segments and one interchange were analyzed south of the C&D Canal. ***Table III-68*** and ***Figure III-23*** summarize the capacity analysis results for key locations south of the C&D Canal for all of the alternatives.

Table III-68: Traffic Peak Hour Operational Analyses at Key Locations

Location		Time Period	2003 Existing	2030 Projections LOS				
				No-Build	Yellow	Purple	Brown	Green
1	US 301 at DE/MD State Line[1]	AM	E	A	A	A	A	A
		PM	E	A	A	A	A	A
A	<u>US 301/SR 299</u>[2]	AM	C	C	C	B	B	B
		PM	C	C	C	B	B	B
2a	US 301, North of Middletown	AM	E	E	E	E	E	E
		PM	E	E	E	E	E	E
2b	Bypass, North of Middletown	AM			B	C	C	C
		PM			B	C	C	C
B	<u>US 301/SR 896 (Boyds Corner Road)</u> [3]	AM	D	D	C	C	C	B
		PM	D	E	D	C	C	C
C	<u>US 301/SR 896/SR 15</u>[4]	AM	B	E	C			
		PM	A	B	D			
3a	Boyds Corner Road, West of Cedar Lane	AM	E	E	E	E	E	E
		PM	E	E	E	E	E	E
3b	Bypass, West of Cedar Lane	AM			B	B	B	B
		PM			B	B	B	B
4	Cedar Lane, South of SR 896	AM	C	E	D	D	D	C
		PM	C	E	D	D	C	C
5	Choptank Road, North of Middletown	AM	C	E	E	C	C	C
		PM	C	E	E	D	D	D
6	SR 299, West of SR 1	AM	E	E	E	E	E	E
		PM	E	E	E	E	E	E
7	Summit Bridge[5]	AM	B	E	D	D	D	D
		PM	B	D	D	D	D	D
D	<u>SR 896/Porter Road</u>	AM	E	F	F	F	F	F

Table III-68: Traffic Peak Hour Operational Analyses at Key Locations

Location			Time Period	2003 Existing	2030 Projections LOS				
					No-Build	Yellow	Purple	Brown	Green
			PM	E	F	F	F	F	F
8	SR 896, North of Porter Road		AM	B	D	D	D	D	D
			PM	B	C	C	C	C	C
9	SR 896, South of Old Baltimore Pike[6]		AM	C	E	D	D	D	D
			PM	B	C	C	C	C	C
E	SR 896/Old Baltimore Pike		AM	F	F	F	F	F	F
			PM	E	F	E	E	E	E
F	SR 896/ I-95[6,7]	NB SR 896 to NB I-95 merge	AM	C	C	C	C	C	C
		SB I-95 to SB SR 896 diverge	PM	B	C	C	C	C	C
		SB SR 896 over I-95 weave	AM	E	D	D	D	D	D
			PM	F	E	E	E	E	E
10	I-95, East of SR 896[6]		AM	C	D	D	D	D	D
			PM	C	C	C	C	C	C
G	I-95/ SR 72	SR 72 to NB I-95 merge	AM		C	C	C	C	C
		SB I-95 to SR 72 diverge	PM		D	D	D	D	D
11	I-95, East of SR 72		AM	C	D	D	D	D	D
			PM	B	D	D	D	D	D
H	SR 1/SR 299[8]		AM	B	B	A	A	A	A
			PM	B	B	A	A	A	A
12	SR 1, South of SR 896		AM	B	D	C	C	C	C
			PM	B	C	C	C	C	C
13	US 13, South of SR 896		AM	B	D	D	D	D	C
			PM	B	C	C	C	C	C
I	SR 896/US 13[9]		AM	F	F	F	F	F	F
			PM	C	F	E	E	D	E
14	SR 1 Bridge		AM	B	D	D	D	D	D
			PM	B	C	D	C	C	D
15	St. Georges Bridge (US 13)		AM	A	C	C	C	C	C
			PM	A	B	B	B	B	B
16	SR 1, South of SR 72		AM	C	D	E	E	E	E
			PM	B	C	D	D	D	D
17	SR 1, South of US 40		AM	C	C	D	C	C	D
			PM	B	C	C	C	C	C
18	SR 1, South of SR 273		AM	D	D	E	E	E	E
			PM	D	D	D	D	D	D

Refer to ***Figure III-22***

Projections are forecast with Westown development added and with ramp and mainline tolls.

1. 2030 projections based on 4 lanes
2. 2030 includes 301 widening to 4 lanes due to Westown.
3. 2030 based on intersection improvements (2^{nd} through land NB/SB).
4. Intersection is replaced with interchange for these alternatives.
5. All analyses based on 4-lane bridge.
6. 2030 affected due to Newtown Road and SR 72 interchange.
7. All analyses based on existing interchange.
8. Worst LOS of the diamond intersection.
9. Analyses assume no improvements.

Capacity analyses were also performed at locations north of the C&D Canal on the SR 896, I-95 and SR 1 corridors; seven intersections, eight roadway segments and one interchange were analyzed. ***Table III-68*** and ***Figure III-23*** also summarize the capacity analysis results for key locations north of the C&D Canal for all of the alternatives.

A comprehensive description of the traffic forecasting and analysis methodology and complete documentation of all results are included in *US 301 Project Development Draft Travel Analysis Technical Report* (DelDOT, November 2006).

While ***Table III-68*** summarizes the operational analysis results for key locations, ***Table III-69*** and ***Table III-70*** compare the operational analysis results for all of the intersections, interchanges and roadway sections that were analyzed for this project. ***Table III-69*** summarizes the operation of existing intersections and roadway segments under each of the alternatives, and ***Table III-70*** summarizes the operation of newly created intersections and roadway segments as a result of each alternative. The analysis results are grouped into three categories:

- Locations with LOS between A and D in both peak hours (representing locations with traffic conditions that are generally considered "acceptable" by state and federal agencies);
- Locations projected to operate at LOS E in at least one of the peak hours, representing locations that are approaching capacity, but have not yet reached LOS F; and
- Locations projected to operate at LOS F in at least one of the peak hours, where volumes exceed capacity and operational failure has occurred.

<u>No-Build Alternative</u>

Currently, of the 53 key intersections, interchanges and roadway segments that were analyzed for this study, 40 (75 percent) operate between LOS A and D in the peak hours; eight (15 percent) are approaching capacity, reaching LOS E in at least one of the peak hours; and the remaining five locations (10 percent) are currently failing (LOS F).

By 2030, the No-Build Alternative results in more than twice as many locations either approaching or exceeding capacity when compared to existing conditions. Specifically, 25 percent of the analysis locations will fail (LOS F) in at least one peak hour, while 21 percent of the analysis locations will approach capacity (LOS E) in at least one peak hour. Only 54 percent of the locations will continue to operate at an acceptable level of service. The primary reason for this degradation in operational performance is the lack of mainline capacity on US 301, and the corresponding increase in traffic on many of the local roads throughout the project area south of the C&D Canal.

Table III-69: Traffic Analyses Results – Existing Intersections, Interchanges and Roadway Segments

			North of C&D Canal									South of C&D Canal									
			# of Intersections Analyzed [1]			# of Roadway Segments Analyzed			# of Interchanges Analyzed [2]			# of Intersections Analyzed [3]			# of Roadway Segments Analyzed			# of Interchanges Analyzed		
			Total	LOS	(%)	Total	LOS	(%)	Total	LOS	(%)	Total	LOS	(%)	Total	LOS	(%)	Total	LOS	(%)
Existing (2003)		LOS A-D	7	4	57%	8	8	100%	1	--	--	26	21	80%	10	6	60%	1	1	100%
		LOS E		2	29%		--	--		--	--		2	8%		4	40%		--	--
		LOS F		1	14%		--	--		1	100%		3	12%		--	--		--	--
2030	No-Build	LOS A-D	6	3	50%	8	6	75%	2	1	50%	26	13	50%	10	5	50%	1	1	100%
		LOS E		--	--		2	25%		1	50%		3	12%		5	50%		--	--
		LOS F		3	50%		--	--		--	--		10	38%		--	--		--	--
	Yellow	LOS A-D	6	3	50%	8	6	75%	2	1	50%	23	18	78%	10	6	60%	1	1	100%
		LOS E		--	--		2	25%		1	50%		1	4%		4	40%		--	--
		LOS F		3	50%		--	--		--	--		4	18%		--	--		--	--
	Purple	LOS A-D	6	3	50%	8	6	75%	2	1	50%	25	19	76%	10	7	70%	1	1	100%
		LOS E		--	--		2	25%		1	50%		3	12%		3	30%		--	--
		LOS F		3	50%		--	--		--	--		3	12%		--	--		--	--
	Green[4]	LOS A-D	6	3	50%	8	6	75%	2	1	50%	25	21	84%	10	7	70%	1	1	100%
		LOS E		1	17%		2	25%		1	50%		1	4%		3	30%		--	--
		LOS F		2	33%		--	--		--	--		3	12%		--	--		--	--
	Brown[4]	LOS A-D	6	2	33%	8	6	75%	2	1	50%	25	21	84%	10	7	70%	1	1	100%
		LOS E		1	17%		2	25%		1	50%		1	4%		3	30%		--	--
		LOS F		3	50%		--	--		--	--		3	12%		--	--		--	--

1. US 40 and SR 896 is currently a signalized intersection. In the future it is an interchange.
2. The SR 72 interchange does not exist currently. In the future it is an interchange.
3. Bethel Church Road @ US 301/SR 896 becomes an interchange with Purple, Green and Brown.
4. North and South Options for the Green and Brown Alternatives yield similar conditions.

Table III-70: Traffic Analyses Results – New Intersections, Interchanges and Roadway Segments South of the Canal*

Alternative (2030)	# of Intersections Analyzed			# of Roadway Segments Analyzed			# of Interchanges Analyzed		
	Total	LOS A-D	(%)	Total	LOS A-D	(%)	Total	LOS A-D	(%)
		LOS E	(%)		LOS E	(%)		LOS E	(%)
		LOS F	(%)		LOS F	(%)		LOS F	(%)
No-Build	0	N/A	--	0	N/A	--	0	N/A	--
Yellow	8	8	100%	3	3	100%	3	3	100%
		--	--		--	--		--	--
		--	--		--	--		--	--
Purple	6	6	100%	3	2	66%	5	5	100%
		--	--		1	33%		--	--
		--	--		--	--		--	--
Green[1]	8	8	100%	4	3	75%	6	6	100%
		--	--		1	25%		--	--
		--	--		--	--		--	--
Brown[1]	8	8	100%	5	5	100%	5	5	100%
		--	--		--	--		--	--
		--	--		--	--		--	--

** New ramp intersections at the proposed interchanges along the new US 301 alignment.*
1. North and South Options for the Green and Brown Alternatives yield similar conditions.

Build Alternatives, including the Preferred Alternative

The Green (Preferred), Purple, and Brown Alternatives, which all provide a new north-south connection to the west of Middletown and a new east-west roadway connection between existing US 301 and SR 1, are projected to result in similar operational characteristics. Compared to the No-Build Alternative, all three of these build alternatives result in substantially improved operational conditions at a number of key locations throughout the project area.

By 2030, the Green (Preferred) Alternative and the Brown Alternative result in 12 percent of the analysis locations failing (LOS F) in at least one peak hour, while 15 percent of the analysis locations will approach capacity (LOS E) in at least one peak hour. The remaining 73 percent of the locations will continue to operate at an acceptable LOS.

By 2030, the Purple Alternative results in 12 percent of the analysis locations failing (LOS F) in at least one peak hour, while 17 percent of the analysis locations will approach capacity (LOS E) in at least one peak hour. The remaining 71 percent of the locations will continue to operate at an acceptable LOS.

When compared to the No-Build Alternative, all three of these build alternatives provide a similar level of reduction in east-west traffic on local roads south of the C&D Canal, and all provide a similar level of reduction in north-south traffic volumes on existing US 301 and other north-south local roads.

The Yellow Alternative, which provides additional roadway capacity parallel to US 301 north-south and parallel to SR 896 (Boyds Corner Road) east-west between existing US 301 and SR 1, results in improved operational conditions at a number of key locations throughout the project area. By 2030, the Yellow Alternative results in 8 percent of the analysis locations failing (LOS F) in at least one peak hour, while 16 percent of the analysis locations will approach capacity (LOS E) in at least one peak hour. The remaining 70 percent of the locations will continue to operate at an acceptable LOS.

While these operational results project better conditions than the No-Build Alternative, the Yellow Alternative does less to reduce north-south traffic volumes on existing US 301 or other north-south local roads, when compared to the Purple, Brown or Green Alternatives. The Yellow Alternative provides a similar level of reduction in east-west traffic on local roads south of the Canal when compared to the other three build alternatives.

3. Safety Analysis

To determine the potential safety implications of constructing each alternative, a formula was developed for estimating the future number of accidents expected within the project area based on existing accident rates. Accident statistics were obtained from DelDOT for the base year of 2003. For this part of the study, five roadways were analyzed, including:

- US 301 – from the Maryland state line to Red Lion Road (SR 71) just north of Summit Bridge
- Boyds Corner Road (SR 896) – from US 301 to SR 1
- SR 299 – from US 301 to SR 1
- Choptank Road (SR 15) – from Bunker Hill Road to US 301
- MD 213 – from the Kent County Line to US 40

a. Existing Roads

A total of 283 reported accidents occurred along these five roadways in the year 2003. Using the accident data, the roadway lengths, and the 2003 average daily traffic (ADT) values, accident rates for each roadway segment were generated in terms of accidents per million-vehicle-miles (MVM). These existing accident rates were then used in conjunction with the year 2030 forecast ADT volumes to estimate the number of accidents expected in the year 2030 on these four existing roads. The results are shown in ***Table III-71***.

Table III-71: 2030 Estimated Number of Traffic Accidents per Million-Vehicle Miles (MVM) on Existing Roads

Roadway	**Alternative**				
	No-Build	**Yellow**	**Purple**	**Brown**	**Green**
US 301	221	218	200	204	195
SR 896	34	26	25	23	22
SR 299	85	53	51	50	43
SR 15	83	70	29	28	28
MD 213	118	114	103	102	100
Total	**540**	**482**	**408**	**407**	**388**
Reduction vs. No-Build	**N/A**	**-58 (-11%)**	**-132 (-24%)**	**-133 (-25%)**	**-152 (-28%)**

Note: North and South Options for the Green and Brown Alternatives yield similar conditions.

The estimates provided in ***Table III-71*** are approximations that are based on several assumptions. Perhaps the most significant of the assumptions is that the existing accident rates would remain the same for each roadway over the next 25-plus years, despite the likelihood that the surrounding land use will change and the existing number of access points to/from the roadways is also likely to increase. Despite these shortcomings, the future collision estimates are presented as a planning-level tool to help compare the possible safety benefits of each alternative.

The results indicate that each of the build alternatives, including the Preferred Alternative, would be expected to reduce the number of accidents on existing routes, as compared to the No-Build Alternative. The Green (Preferred) Alternative results in the fewest accidents on each of the roadways, with a total accident reduction of approximately 28 percent versus the No-Build for the roadways studied. The Purple and Brown Alternatives are also expected to significantly reduce the number of accidents, with an overall reduction of approximately 25 percent each versus the No-Build. Similar benefits would be expected on other roadways in the project area where traffic volumes would be reduced due to the presence of a US 301 bypass.

b. Existing Roads plus Build Alternatives

The number of accidents expected on the proposed build alternative segments was also approximated for each alternative using the current statewide average accident rates for similar facilities. These values were combined with the values presented in ***Table III-71*** to determine an overall accident rate (including existing and proposed routes) for each alternative. The Preferred Alternative is anticipated to achieve an accident rate of 1.13 accidents per million-vehicle-miles (MVM) when compared to the No-Build Alternative (1.31 MVM).

Table III-72 lists the accident rates for existing conditions and the projected accident rates for the No-Build Alternative and each of the four build alternatives. The results indicate that each of the build alternatives is expected to result in a lower overall accident rate compared to existing conditions and the No-Build Alternative. The Brown Alternative is anticipated to achieve the lowest projected accident rate per MVM.

Table III-72: Existing (2003) and Estimated 2030 Accident Rates along Major Study Area Routes

Alternative	Existing (2003)	No-Build	Yellow	Purple	Brown	Green
Accidents per MVM	1.31	1.31	1.18	1.15	1.12	1.13

The values presented in ***Table III-71*** and ***Table III-72*** account for all reported accidents, including property damage accidents, personal injury accidents, and fatal accidents. Accident estimates specifically regarding injuries and fatalities are more difficult to quantify. However, it is anticipated that the number of serious accidents would be reduced proportionally as the overall number of accidents is reduced. Furthermore, because each of the build alternatives separates truck traffic from local traffic and the severity of an accident generally increases when a heavy vehicle collides with a smaller vehicle, having a reduced percentage of heavy vehicles in the traffic stream should further reduce the likelihood of injury and fatal accidents under the build alternatives.

4. Travel Patterns

The introduction of a new 4-lane, tolled limited access US 301 from the state line to SR 1 as part of the Preferred Alternative and other build alternatives would alter both local traffic patterns within the project area as well as long-distance regional travel patterns by shifting traffic between I-95 and US 301.

A study of existing travel patterns and analysis of projected future travel patterns was performed to determine what changes would occur with the Preferred Alternative or any build alternative (toll road) and the potential for regional toll diversion issues. To evaluate these potential changes, the project team utilized both the existing DelDOT Peninsula Model and a larger, multi-state transportation model, which included the I-95 and US 301/US 50 corridors as far south as Washington, D.C. The multi-state transportation model was based on a similar model that was developed previously for the Maryland Transportation Authority (MdTA) for their study of the potential shifts in traffic between I-95 and US 301. The study included potential mitigation measures to minimize the impacts on potential diversion routes.

a. Existing Conditions

Within the project area there are four main routes for north-south travel: US 301, SR 71, US 13 and SR 1 listed below.

- US 301 enters southern New Castle County on the west side at the Delaware/Maryland state line and travels through the west side of the Town of Middletown, parallel to the Norfolk Southern rail alignment. US 301 crosses the C&D Canal on the Summit Bridge. Approximately 5 miles north of the Canal, US 301 joins US 40 and continues east, terminating at US 13.
- SR 71 traverses New Castle County from its beginning at US 13 south of Townsend, passes through Middletown and across the C&D Canal on the US 301 alignment, and terminates at US 13 at Tybouts Corner.
- US 13 traverses the entire state from the southern border of Delaware and Maryland in Sussex County to the northeastern border of Delaware and Pennsylvania. US 13 crosses the Canal on the St. Georges Bridge approximately 4.5 miles east of the Summit Bridge (US 301).
- SR 1 is a limited access tolled highway. SR 1 parallels US 13 from south of Dover to Churchmans Crossing at I-95, a distance of 51 miles. SR 1 crosses the Canal on a tolled bridge (Roth Bridge) just west of the St. Georges Bridge.

An additional important north-south travel route that is affected by regional traffic patterns is MD 213, which extends along Maryland's Eastern Shore through Queen Anne's, Kent and Cecil Counties.

East-west travel through the project area primarily takes place on two-lane local roads. SR 299, which enters Delaware from Kent and Cecil Counties in Maryland, joins US 301 to Middletown, where it turns east-west to continue through Middletown (as Main Street) to interchange with SR 1 before entering Odessa. Churchtown Road and Boyds Corner Road (SR 896) cross the area north of Middletown, approximately three miles south of the Canal, interchange with SR 1 on the east, and terminate at SR 9. At the Delaware/Maryland state line, Churchtown Road is designated as MD 310 (Cayots Corner Road), and terminates at MD 213.

Between the state line and Boyds Corner Road, US 301 is a two-lane road, with no access control and numerous driveways. North of Boyds Corner Road, US 301 is a four-lane road with no access control. There are five traffic signals along existing US 301 south of the C&D Canal and four north of the Canal before US 40. There are currently no tolls on any part of US 301 in Delaware.

Existing traffic volumes were evaluated at the I-95 Newark Toll Plaza, US 301 at the state line, and at various alternate routes to existing US 301. ***Table III-73*** shows the estimated daily volume of cars and trucks on each route.

Table III-73: Daily (2006) Traffic Volumes

Route	Autos	Trucks		Total
I-95 Toll Plaza	66,735	10,040	13%	76,775
US 301 at state line	7,485	2,770	27%	10,255
MD 213 (north of Cecilton)	4,485	955	18%	5,440
MD 282 at state line	2,185	190	8%	2,375
MD 330	1,105	285	20%	1,390

Existing traffic in the study area was evaluated to determine the percentage of truck versus automobile traffic. Data collected on US 301 at the state line shows that automobiles account for 73 percent of traffic and trucks 27 percent. At the I-95 Toll Plaza, automobiles account for 87 percent of traffic and trucks 13 percent.

b. Methodology for Evaluation of Impacts

Data Collection

To adequately evaluate the potential for changes in travel patterns due to the US 301 project, a significant data collection effort was undertaken. Existing traffic volumes were collected on numerous routes throughout the study area. Travel time data was collected on both local and regional competing routes for use in estimating the utility of these routes. A postcard Origin-Destination (O-D) Survey was conducted on US 13, at the toll-free ramps south of the C&D Canal, in July 2006. This O-D survey was used to help establish the tolling characteristics of drivers in the study area, and found that local auto trips are much more likely to divert around tolls than regional or long-distance trips.

Visual surveys were conducted on potential diversion routes. Existing speed limits, truck restrictions, and important geometric characteristics were among the data collected on these visual surveys. These surveys were used to ensure that these facilities were modeled appropriately during the forecasting process.

Travel Forecasting

The travel forecasting process for evaluating the effects of US 301 on travel patterns involved the use of two forecasting models: the DelDOT Peninsula Model, which is the basis for all the US 301 projections in this DEIS but which does not explicitly model autos and trucks separately; and an “Expanded” Peninsula Model, developed by the US 301 Project Team, which incorporates a set of proprietary toll elasticity equations, and which extends the modeling coverage area to Washington, D.C. to capture the primary decision point between I-95 and US 301 for long-distance trips, which also separately models auto and truck traffic. The output from the multi-state model was used to estimate the expected shift in traffic from I-95 to US 301, as well as the truck diversion patterns in the project area.

Projected 2030 traffic volumes were developed for the project area to evaluate the alternative alignments. Additionally, 2030 traffic volumes were projected for a series of local routes in Maryland that were identified as potential diversion routes during the modeling process. The projected traffic volumes for these routes are summarized in ***Figure III-24.***

c. Results

No-Build Alternative

By not addressing the Purpose and Need of congestion relief, the No-Build Alternative would affect travel patterns. Traffic volumes on existing US 301 are projected to increase significantly (over 90 percent) by 2030, resulting in increased congestion in the Middletown area. This congestion is likely to encourage drivers to seek alternate routes around the congested areas, resulting in increased traffic on other routes. For example, the congestion on US 301, combined with the growth in housing and population in southwestern Cecil County and northwestern Kent County in Maryland, results in a significant increase in traffic from existing levels on MD 213 in Maryland.

Build Alternatives

All of the proposed build alternatives, including the Preferred Alternative, will result in changes in travel patterns within the project area. The new US 301 will be a limited access road with a mainline toll plaza near the Delaware/Maryland state line and toll plazas on the north-serving ramps at all the interchanges. The construction of a new major thoroughfare will provide significant additional traffic carrying capacity and will provide a new alternative route for motorists using many existing roads (existing US 301, SR 896 (Boyds Corner Road), SR 299, plus a number of smaller two-lane local roads). Proposed US 301 will also provide improved connectivity between existing US 301 in Maryland and SR 1/I-95 via a limited access facility, making it a more attractive route for longer distance (regional) travel. However, the introduction of interchange ramp tolls will have the opposite effect; discouraging some motorists from using the new facility. Similarly, the implementation of mainline tolls on US 301 will also create the potential for travel diversion to alternate routes. A comparison of data in ***Table III-67*** between the existing, no-build, and build conditions demonstrates this change in travel patterns. Additional information is provided below.

Toll Facilities

The introduction of a toll on new US 301 has the potential to divert traffic to alternate routes, particularly trucks, which generally pay higher tolls than autos and which are, therefore, more likely to divert around a toll barrier. Accordingly, early in the project development process, the US 301 Project Team identified several local roads in Delaware that should have truck restrictions to discourage trucks from leaving US 301 to avoid paying a toll. A preliminary assessment indicated that the highest potential for auto diversions is on local routes, particularly

Sassafras Road and MD 282 (Warwick Road), close to the mainline US 301 toll plaza; while the highest potential for truck diversions (given the network of assumed truck restrictions on nearby local roads) appears to be on MD 213, which connects to US 40 and MD 330, which connects to SR 6 and eventually US 13 in Delaware. The magnitude of these diversions is summarized in ***Figure III-24.***

Improved Connectivity for Through Traffic

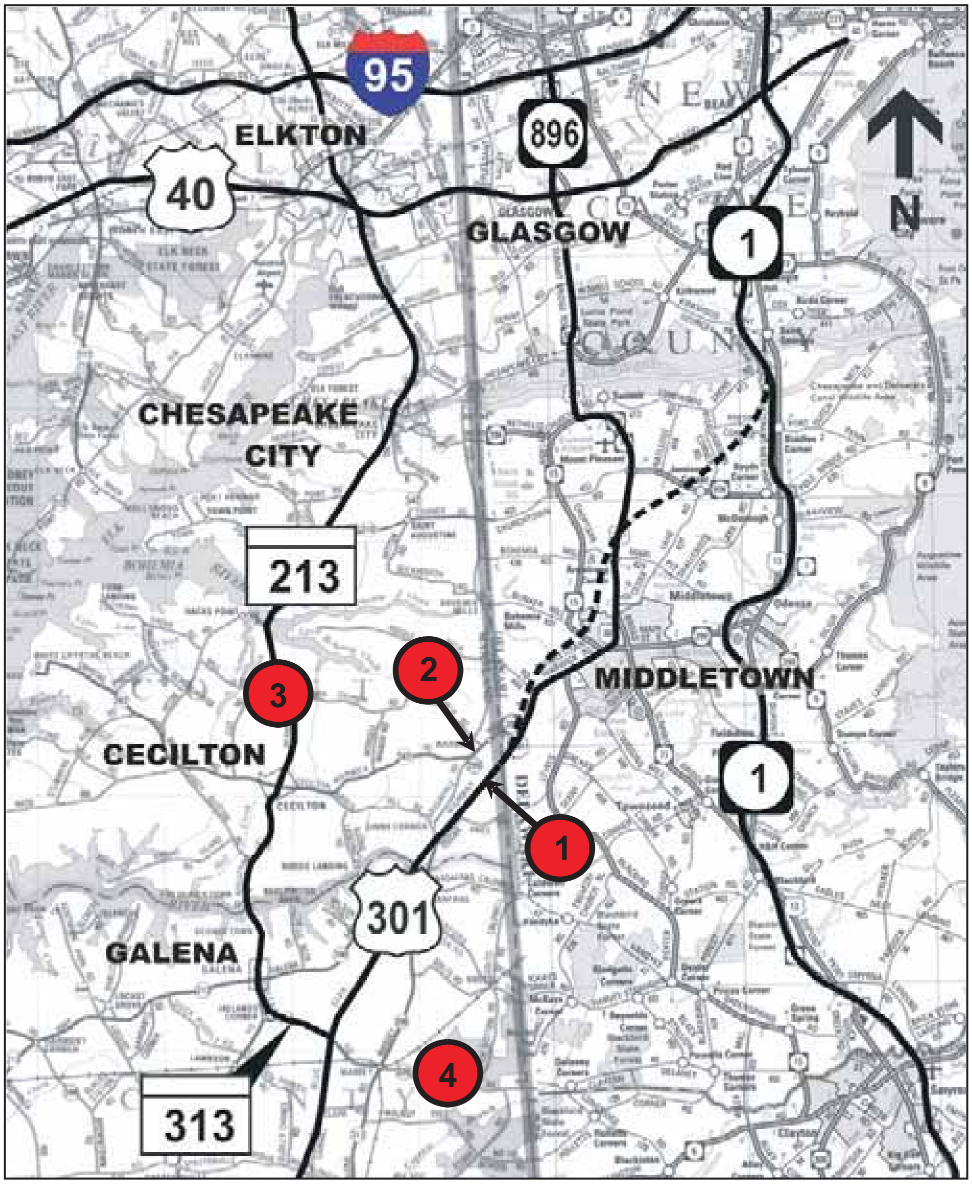
The new tolled US 301 under the Preferred Alternative, with controlled access, would provide enhanced freeway connectivity from the Maryland/Delaware state line to SR 1, just south of the C&D Canal. SR 1 is also a freeway facility, which ties directly into I-95, the primary north-south corridor on the east coast. By providing a bypass of the congested segment of existing US 301 and a direct connection to SR 1, the new facility has the potential to attract long-distance traffic away from I-95, which is heavily utilized and prone to periods of congestion in the metropolitan areas of Washington, D.C. and Baltimore, Maryland. Currently, travel time is approximately 5 to 15 minutes faster using I-95 rather than US 301 from Washington, D.C. to Wilmington, Delaware. With the implementation of a US 301 build alternative, this difference is expected to decrease. Additionally, a number of improvements to SR 1 and I-95 are planned that would further improve the travel time for through traffic entering Delaware on US 301 regardless of the alternative selected for the US 301 project. These planned improvements are listed in ***Table III-74***.

Table III-74: Planned Improvements in Project Area

Location	Planned Improvement	Schedule
SR 1	Widened from the US 13/SR 1 split to I-95	2010-2030
I-95/SR 1 Interchange	Reconstructed	2009-2011
I-95 from SR 1 to I-495	Widened with an additional lane in each direction	2007-2008

Source: WILMAPCO Regional Transportation Plan 2030 (March 22, 2007)

This improved connectivity could be offset somewhat by the inclusion of a toll on new US 301 in Delaware. However, based on the existing toll rates structures on US 301 and I-95 (currently, it is $5 to $7.50 cheaper for autos to travel on US 301 and $18 to $28 cheaper for trucks, depending on the direction of travel), it is expected that the total tolls on new US 301 would still be considerably lower than those on I-95. The travel forecasting results indicate a 4 percent increase in daily traffic in 2030 crossing the William Preston Lane Jr. Memorial Bridge on US 50/US 301 with a US 301 build alternative when compared to the No-Build Alternative, and a corresponding 3 percent decrease in daily traffic crossing the Susquehanna River on I-95 in Maryland with a US 301 build alternative when compared to the No-Build alternative. This shift in traffic from I-95 to US 301 is most likely the result of the travel time savings that would result on the US 301 corridor due to the proposed improvements. A study of the sensitivity of this shift to the toll rate on US 301 found a low elasticity, with only a 1 percent decrease in traffic on the Bay Bridge across the entire range of tolls studied.



1

US 301 (@ MD / DE Stateline)			
Scenario	Total Volume	Trucks	Autos
Existing	10,252	2,768	7,484
2030 No-Build	18,700	3,200	15,500
2030 Toll	18,800 - 19,700	3,600 - 3,900	15,200 - 15,800

3

MD 213 (North of Cecilton & South of MD 310)			
Scenario	Total Volume	Trucks	Autos
Existing	5,440	957	4,483
2030 No-Build	8,700	1,400	7,200
2030 Toll	5,600 - 5,900	1,400 - 1,600	4,200 - 4,300

2

MD 282 (Cecilton-Warwick Rd) in Warwick			
Scenario	Total Volume	Trucks	Autos
Existing	2,375	190	2,185
2030 No-Build	1,650	*	1,650
2030 Toll	5,200 - 6,000	*	5,200 - 6,000

4

MD 330, Between Massey and MD / DE Stateline			
Scenario	Total Volume	Trucks	Autos
Existing	1,388	283	1,105
2030 No-Build	2,900	800	2,100
2030 Toll	2,600 - 2,800	1,100 - 1,200	1,500 - 1,600

** Heavy trucks (>3 axles) would be restricted on MD 282, per the recommendation from the Toll Diversion Working Group*

0 1 2 3 4 5 6 7 8
SCALE IN MILES

As Shown

US 301 Project Development

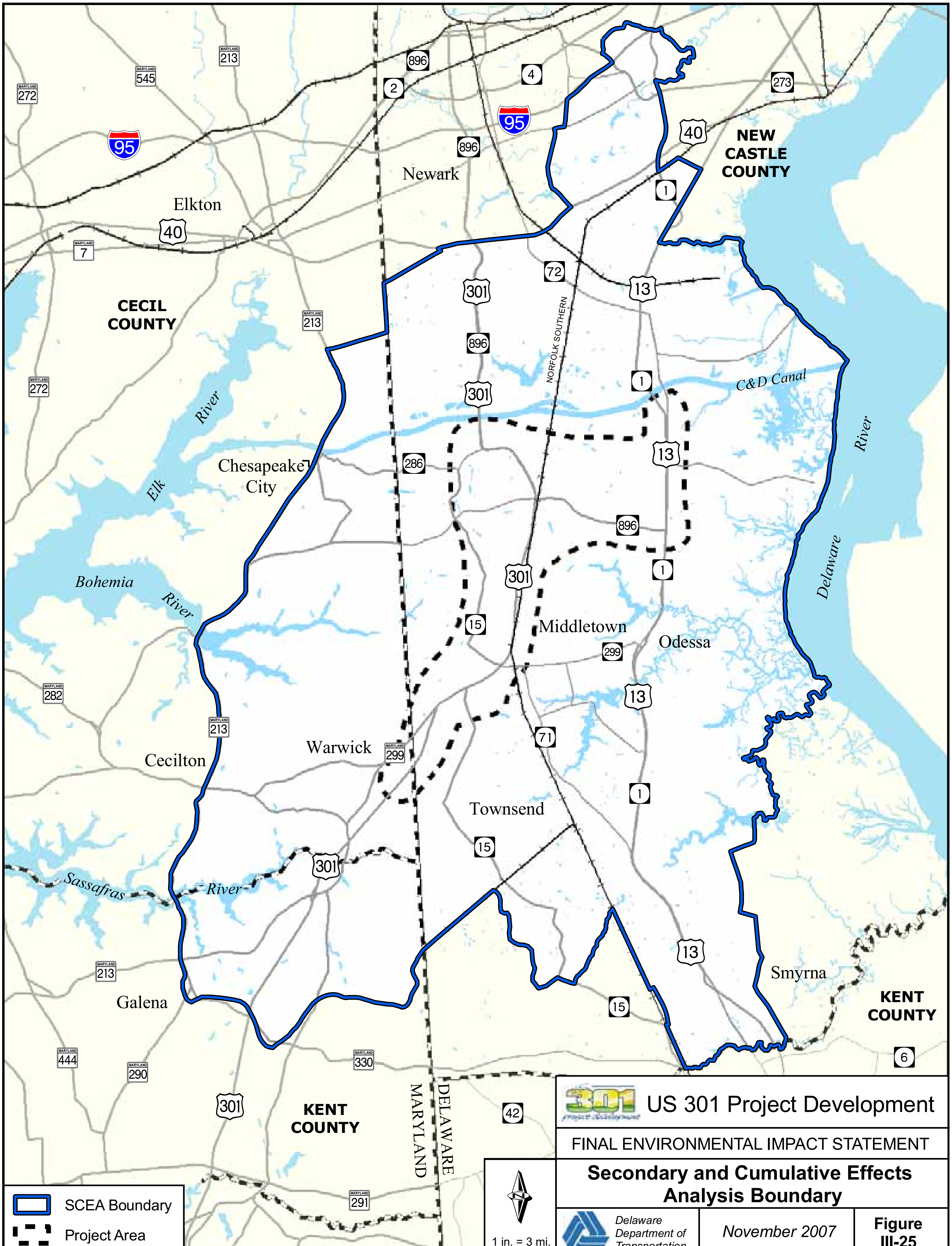
FINAL ENVIRONMENTAL IMPACT STATEMENT

PROJECTED DAILY TRAFFIC FOR POTENTIAL TOLL DIVERSIONS

Delaware Department of Transportation

November 2007

Figure III-24



US 301 Project Development

FINAL ENVIRONMENTAL IMPACT STATEMENT

Secondary and Cumulative Effects Analysis Boundary

Delaware Department of Transportation

November 2007

Figure III-25

- Auto Diversions

MD 282 (Warwick Road) is the facility which is projected to have the most significant increase in auto traffic due to the construction of the Preferred Alternative or other build alternative. Traffic is projected to increase from 1,650 under the No-Build Alternative to 6,000 with a new US 301. Approximately 15 percent of the projected 2030 traffic on MD 282 in the Warwick, Maryland area would be from US 301, which would divert onto Sassafras Road to avoid the toll plaza. The remaining traffic is local traffic from the southern Cecil County and northern Kent County areas. Under the No-Build Alternative, this traffic tends to avoid the US 301 corridor and uses MD 213 instead for north-south travel to avoid congestion in the Middletown region. With the US 301 improvement; a portion of this local traffic would shift back to US 301, accessed via MD 282, resulting in a significant increase in traffic projected for MD 282. Correspondingly, upon completion of a US 301 build alternative, a significant reduction in auto traffic is projected for the MD 213 corridor north of MD 282 when compared to the No-Build Alternative.

- Truck Diversions

MD 213 and MD 330 are the two primary truck diversion routes identified during the modeling process. MD 213 and MD 330 are two-lane roads which tie into alternate toll-free routes through Delaware. As noted previously, during the modeling process, a series of new axle-based truck restrictions were assumed in the model on a number of the local roads in Delaware around the proposed mainline US 301 toll plaza; this truck restriction plan was developed based on a structural evaluation of pavement cores that showed these local roads could not physically carry any significant truck volumes. These proposed truck restrictions have been adopted as part of the diversion mitigation plan.

Truck traffic is projected to increase by up to 200 vehicles per day on MD 213, from 1,400 vehicles per day under the No-Build Alternative and up to 1,600 vehicles per day under any of the build alternatives, including the Preferred Alternative. Likewise, truck traffic is projected to increase by up to 400 vehicles per day on MD 330, from 800 vehicles per day under the No-Build Alternative to up to 1,200 vehicles per day under the build alternatives. Conversely, auto traffic is projected to decrease on both of these roads, by up to 3,000 vehicles per day on MD 213 and by up to 600 vehicles per day on MD 330.

While these MD 213 and MD 330 present an alternative travel route to US 301, several characteristics of these facilities serve as disincentives for their use by trucks including: lower prevailing speeds than on existing (and especially an improved) US 301; seven traffic signals on MD 213; the Sassafrass River Drawbridge (opens on demand approximately 3,800 times per year); and lack of access control on MD 213 and MD 330, with numerous driveways and intersections. A more detailed discussion of the truck diversion study can be found in Chapter 4 of the *US 301 Project Development Draft Travel Analysis Technical Report* (DelDOT, November 2006).

d. Mitigation

DelDOT's goal is to keep as much traffic as possible on the new US 301 facility proposed under the Preferred Alternative or other build alternative. To facilitate this, a number of key design features, including median separation and open road tolling (ORT), are being considered to enhance the attractiveness of the build alternatives for through traffic. Additionally, the planned improvements to SR 1 and I-95, while not part of the US 301 project, would help to create a high-speed freeway system from where US 301 enters Delaware to I-95. This contrasts with the existing uncontrolled access US 301 from the state line to US 40. While these features are likely to attract and keep traffic on US 301, there remains the potential for traffic diversions due to the toll facility.

A Toll Diversion Working Group, including local elected officials from Maryland, residents, and Maryland transportation agencies, was formed to address the potential traffic diversion issues identified during this evaluation (see ***Chapter IV, Section C***). Maryland SHA conducted an independent review of the toll diversion forecasts and the forecasting process. A more detailed discussion of SHA's independent technical review can be found in Section 4.B.1 of the *US 301 Draft Travel Analysis Technical Report* (DelDOT, November 2006). As the Working Group progressed through its efforts and the traffic forecasts showed relatively minor differences in truck and auto volumes on most of the roads in Maryland (when comparing future No-Build/Non-Toll forecasts with future Build/Toll forecasts), the focus shifted from potential toll diversions due to the US 301 build alternatives to a more immediate concern related to truck traffic diversions to avoid a pair of truck weigh and inspection stations on US 301. Maryland opened a weigh station on southbound US 301 at the US 301/MD 299 intersection in May 2007. Delaware plans to open a weigh and inspection station on northbound US 301, just north of the state line, in 2008. Therefore, the series of recommendations developed by the Working Group to be incorporated into the US 301 project focus on the weigh and inspection stations; however, these same recommendations should be useful in mitigating future toll diversions associated with the US 301 build alternatives and the Preferred Alternative. The recommendations of the Working Group include:

<u>Traffic Monitoring Program</u>

A traffic count program is recommended to collect data (vehicle types, volumes, and speeds) before and after the opening of each of the US 301 weigh and inspection stations, the virtual weigh stations (see below), and US 301 toll plaza proposed under the build alternatives.

<u>Truck Restriction Signage</u>

The evaluation and implementation of additional truck restrictions on local roads in both Maryland and Delaware which may qualify for axle-based restrictions are recommended. Coordination will be required for county roads. These routes include:

- Bunker Hill Road
- Middle Neck Road
- Warwick Road
- Strawberry Lane
- Levels Road
- Green Giant Road
- Caldwell Corner Road
- Ebenezer Church Road
- Lloyd Guessford Road
- Chesapeake City Road

Consideration should be given to posting truck length restrictions on MD 213. There should be ongoing communication between the Maryland State Highway Administration, DelDOT, Cecil and Kent counties, and the municipalities on the issues raised and discussed by the Working Group.

Excessive Speeds on MD 282

Consideration should be given to various engineering measures along MD 282 from Cecilton to Warwick to address excessive traffic speeds.

Virtual Weigh Stations

The construction and operation of a reasonable number of virtual weigh stations (VWS) (1-3 sites northbound & southbound corresponding with the mainline weigh stations) on those routes identified through the Traffic Monitoring Program as having significant truck diversions due to the opening of the US 301 weigh and inspection stations, either in Maryland or Delaware. At a minimum, VWSs should be installed in both directions on MD 213 south of Cecilton.

Enhanced Truck Restriction Enforcement Efforts

Delaware should provide additional staffing and extended hours of operation at the northbound US 301 Weigh and Inspection Station to better match the proposed staffing level and shifting hours of operation at Maryland's southbound Weigh and Inspection Station.

Both Maryland and Delaware should provide sufficient dedicated enforcement (officers) to adequately monitor and enforce the Virtual Weigh Stations (VWS) and the truck restrictions on local roads, thereby discouraging diversion.

The Working Group encourages Maryland to explore ways to make funding available for additional local law enforcement staffing (new hiring) and equipment to support the Maryland State Police (MSP) in enhanced truck enforcement efforts.

The Working Group encourages DelDOT to seek additional funding for truck diversion enforcement.

Sassafras Road/US 301 Median Closures

The full median closure at the junction of Sassafras Road and US 301 and the full closure of Sassafras Road just west of US 301, including the implementation of U-turns on US 301 north and south of MD 299 (the US 301/MD 290 intersection may provide an alternate location for U-turns on southbound US 301) and including the provision for right turns to/from Sassafras Road via the truck weigh and inspection station ramps. Emergency vehicle access should be carefully considered.

Potential Truck Length Restrictions on MD 213

The Working Group recommended that consideration be given to restricting over-length trucks on MD 213.

Continued Coordination

The Working Group recommended ongoing inter-jurisdictional communication between SHA, DelDOT, Cecil and Kent Counties, and the municipalities, on issues raised by the Working Group.

The full list of Working Group recommendations were presented to and approved by the Delaware Secretary of Transportation and the Administrator of the Maryland State Highway Administration.

In accordance with these recommendations, the US 301 project team initiated the first phase of a traffic monitoring program at 14 key locations in both Delaware and Maryland in November/ December 2006. The results from the first phase were distributed to the members of the Working Group in May, 2007. The second phase of the traffic monitoring program was conducted in late June/early July 2007, after the May 2007 opening of the southbound US 301 weigh and inspection station. The results have not yet been compiled and distributed.

H. Energy

Initially, the No-Build Alternative would require the least amount of energy expended compared to the considerable energy consumed during construction of the Preferred Alternative or other build alternative. In the long term, however, the energy expended due to projected traffic congestion in the design year due to the No-Build Alternative is likely to exceed the energy expended with one of the build alternatives in place, and may exceed the initial energy expended for construction. There would be no noticeable difference in energy consumption among any of the build alternatives.

I. Temporary Construction Impacts

There would be no temporary construction impacts from the No-Build Alternative. Each of the build alternatives, including the Preferred Alternative, would have temporary impacts on resources, residences, businesses and travelers within the immediate vicinity of the project due to construction activities. These impacts would include traffic detours, potential air and fugitive dust emissions, increased noise levels, impacts to socioeconomic and natural resources, and impacts to visual quality.

1. Traffic Detours and Maintenance of Traffic

Traffic detours and road closures during construction of any build alternative (including the Preferred Alternative), would create temporary inconveniences for residents, business owners and travelers. Maintenance of traffic plans will be developed during final design of a build alternative to mitigate access impacts and minimize traffic delays throughout the construction zones. These plans would include appropriate signs, pavement markings, worker safety barriers, and media announcements. Access to all businesses and residences would be maintained throughout the scheduled construction periods.

2. Air Emissions

The operation of heavy equipment would have minor, temporary impacts on air quality during the construction of the Preferred Alternative or other build alternative. The primary impact would be windblown soil and dust in active construction zones, and the second source of air emissions would be from increased levels of machinery exhaust pollutants.

Measures would be taken to reduce levels of fugitive dust and windblown soil generated during construction by wetting disturbed soils, staging soil disturbing activities, and prompt re-vegetation of disturbed areas. The contractors, in accordance with state and federal regulations, would control emissions from construction equipment.

3. Construction Noise

Temporary noise impacts would occur in the project area during construction of the Preferred Alternative or other build alternative. Sources of noise would include earth-moving equipment, vibratory rollers, pavers, trucks, pile-drivers, jackhammers, and compressors.

In most cases, the effect of increased noise levels associated with construction equipment is limited to within 300 feet of the source. To limit the effects, construction activities would typically be limited to weekday daylight hours in accordance with local ordinances. Some mitigation measures that may be employed to minimize the temporary construction noise include adjustments to equipment, provision of temporary noise barriers, distribution of noise events, good communication with the public, and monetary incentives to contractors. These measures could be examined during final design to minimize annoyances from temporary noise impacts.

4. Construction Impacts on Natural Resources

Temporary construction-related impacts to soils, wetlands, and surface waters would be anticipated to occur as a result of the implementation of any build alternative including the Preferred Alternative. Temporary and permanent impacts to natural resources have been addressed throughout this section.

Temporary impacts to soils could include increased erosion potential in areas cleared of vegetation for construction activities. Standard erosion and sediment controls measures would be implemented in accordance with state and local regulations to minimize adverse effects. Soil compaction could also occur in areas set aside as contractor staging areas. Temporary staging areas would be restored to their previous condition upon completion of the project.

Temporary construction impacts to wetlands could occur indirectly as a result of increased sedimentation, any construction work in-stream or within wetlands related to construction of abutments or bridges, and temporary construction crossings. The use of surface mats, clean rock fills and other measures would be determined during final design to minimize temporary impact areas. Native vegetation would be reestablished upon completion of the construction.

Temporary impacts to surface waters would be anticipated due to construction-related activities. Temporary impacts would result from temporary stream crossings, dikes and cofferdams, temporary channel relocations, and increases in suspended solids from increased soil erosion, and sedimentation. Runoff from disturbed areas could contain high sediment loads, which could affect the numbers and diversity of organisms in the aquatic environment. Physical impacts such as temporary crossings and installed cofferdams would disrupt the natural stream flow and could affect fish migrations through the areas, could eliminate benthic macro-invertebrates during the construction period and for a short time thereafter while the areas are naturally repopulated. Changes in channel widths as a result of coffer dam installations may result in excessive scouring and generate sediment impacts downstream from the disturbance location.

During final design, efforts to avoid these impacts would include design of structures to limit the amount of work needed to be performed in streams. Erosion and sediment control measures would limit the amount of runoff from disturbed areas. Restoration and mitigation of temporary impacts to surface waters following completion of construction activities would be completed in accordance with the requirements of the Section 404 permit.

J. Secondary and Cumulative Effects Analysis (SCEA)

Secondary (or indirect) impacts are described in the CEQ regulation (40 CFR § 1508.8(b)) as those effects *"…caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.*"

The CEQ regulations define cumulative effects as "…*the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal, or non-Federal) or person undertakes such actions."* (40 CFR 1508.7 and Federal Highway Administration January 2003 Memo)

A secondary and cumulative effects analysis (SCEA) was conducted to evaluate these effects on the environment which may result from the US 301 project and other past, present and reasonably foreseeable actions. Guidance for this analysis was obtained from the following publications:

- Council on Environmental Quality's (CEQ) regulations (40 CFR Sections 1500-1508) implementing the procedural provisions of the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. Sections 4321 *et seq.*)
- Council on Environmental Quality 1997 guidelines, *Considering Cumulative Effects Under the National Environmental Policy Act.*
- Federal Highway Administration Position Paper: *Secondary and Cumulative Impact Assessment in the Highway Project Development Process*, April 1992.

1. SCEA Scoping

Scoping for secondary and cumulative effects consisted of identifying the geographic area (geographic boundary) and the time frame (temporal boundary) for which the analysis is to be conducted. Environmental resources impacted directly or secondarily by the project form the basis for resources that are examined in the SCEA, including natural and human resources. An investigation was also conducted to identify other projects and "reasonably foreseeable future actions" that could have an influence on the resources within the SCEA boundary to assess potential cumulative effects.

a. Geographic Boundary

The geographic boundary for the SCEA (referred to as the SCEA Boundary), or the area in which secondary and cumulative effects were analyzed, is a synthesis of resource boundaries. The SCEA boundary, shown in ***Figure III-25***, is based on overlays of multiple sub-boundaries, including the 2000 Census tract boundaries, planning district boundaries the region's watershed and sub-watersheds, and the area of traffic influence. Each sub-boundary represents a group of resources that could be secondarily or cumulatively affected by the project.

Planning district, census tract, and state, county and municipal boundaries were overlaid and incorporated in the SCEA boundary to capture the extent of the socioeconomic and cultural resources potentially affected by the US 301 project. The watersheds and sub-watershed boundaries represent the natural environmental resources potentially affected by the project. Lastly, the area of traffic influence (ATI) is based on potential changes in traffic volumes by Traffic Analysis Zones (TAZs). The ATI is incorporated in the SCEA boundary to represent the area in which vehicular traffic could be affected by the build alternatives. The ATI is the most important sub-boundary because resources located beyond the ATI will not be affected by the project, and, in general, no other sub boundaries extend beyond the ATI.

The synthesis of the overlaid information results in a SCEA boundary appropriate for the analysis of cumulative effects and possible secondary effects from the US 301 project. The SCEA boundary encompasses 172,952 acres (270 square miles) and includes the entire US 301 project area.

b. SCEA Temporal Boundary (Time Frame)

The time frame for the SCEA considers the past, present, and reasonably foreseeable future actions (40 CFR 1508.7). A review of historic population, employment and land use trends was undertaken to define the temporal boundary of the SCEA.

The past time frame was established based on historic data that were readily available. Historical population data were collected for Delaware and New Castle County to determine gross changes in population. ***Figure III-26*** shows the trend in population change increases in New Castle County compared to state trends and identifies the decade between 1970 and 1980 as the beginning of an upward trend in the relative population increases. In 1997, New Castle County adopted its *Unified Development Code* along with, in December of that year, comprehensive rezoning of land below the C&D Canal from a “holding” category to Suburban and Suburban Reserve development categories that has enabled further expansion of development.

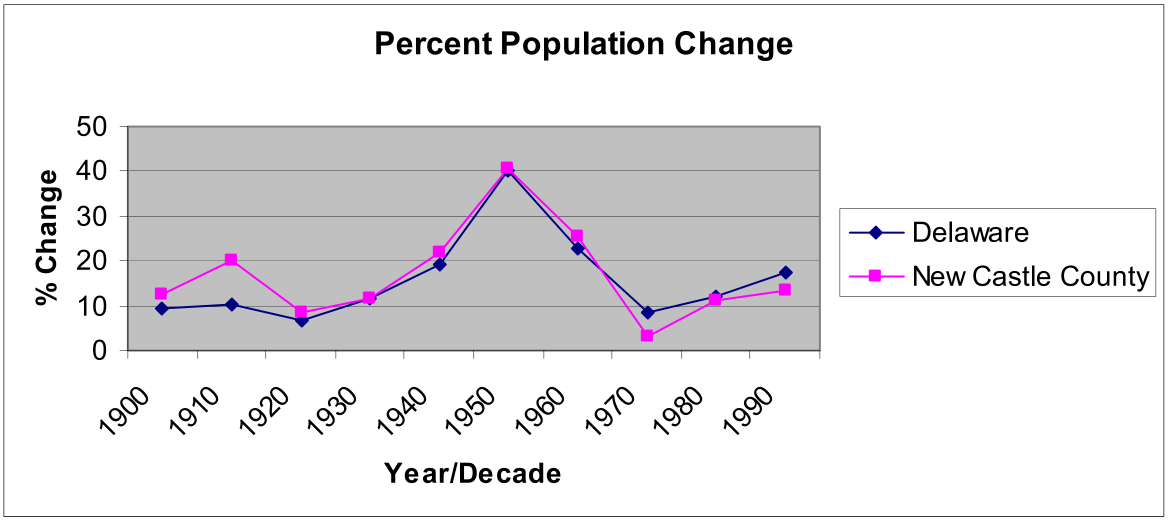


Figure III-26: Population Growth Trends in Delaware and New Castle County

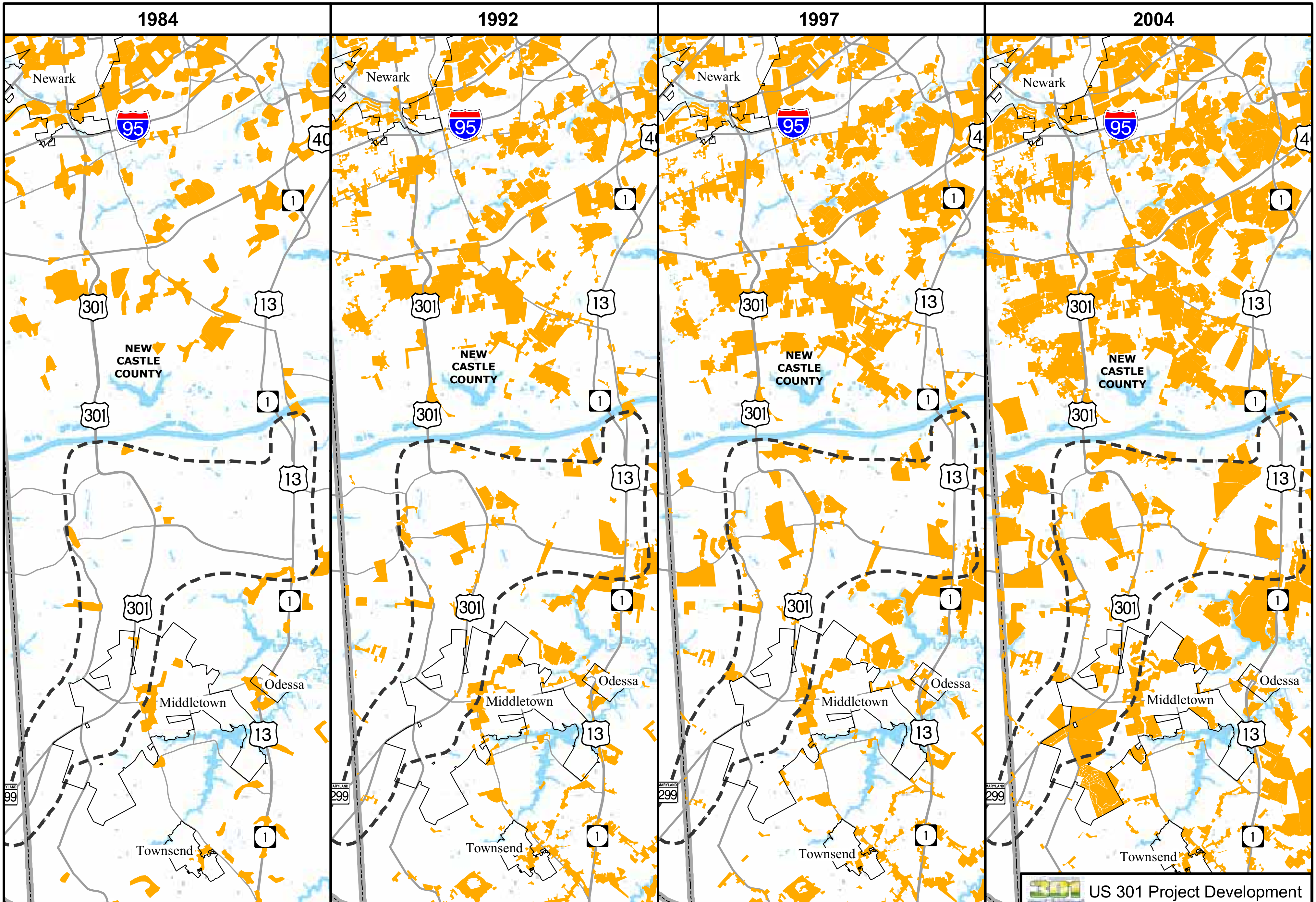
As the data do not identify a specific decade or event that influenced growth in the project area, an historical past temporal boundary of 1980 is suggested. This date was selected based on population changes and trends in New Castle County and on gross land use changes that have been mapped since early 1980 (*Gross Land Use Changes in Delaware 1992 to 1997*, Delaware Office of State Planning Coordination, August 1999) and the present. These land use changes are shown on ***Figure III-27***.

For the purpose of this analysis, the present time frame covers between 2000 and 2006. Census data for the entire SCEA area is from 2000. The most recent land use data from Delaware Office of State Planning Coordination is from 2002. County development permit data bases and community Master Plans (all developed post 2001) were accessed to obtain planned development occurring within the SCEA boundary.

The future temporal boundary is identified as the design year for the project, 2030. Therefore, SCEA evaluates a 50-year time span (1980 – 2030) to understand past trends in the project area and provide an analysis of the potential secondary and cumulative effects from the project.

c. Resources Directly Affected by the Alternatives

Resources impacted directly or secondarily by the build alternatives form the basis for resources that are examined in the SCEA. The SCEA analyzed the potential for secondary and cumulative effects to land use and how those effects may impact socioeconomic, cultural, and natural resources.



Residential Land Use
Municipal Boundary
Project Area

Sources: Delaware Office of State Planning Coordination, 1984, 1992, 1997 & 2002
New Castle County, 2005

1 in. = 3 mi.

US 301 Project Development

FINAL ENVIRONMENTAL IMPACT STATEMENT

New Castle County: Residential Land Use Trends

Delaware Department of Transportation

November 2007

Figure III-27

Resources directly impacted by the implementation of any of the build alternatives and the Preferred Alternative are summarized in the Executive Summary in ***Tables S-1*** and ***S-2***. Natural resources affected by the project include waters of the US and wetlands, farmland, forests, habitat areas, State Resource and State-Designated Natural Areas, and floodplains. Affected resources of the built environment include historic properties and individual homes and businesses, neighborhoods and communities.

d. Other Projects within the SCEA Boundary

Planned or programmed projects that are located within the SCEA boundary have been identified for their consideration in the secondary and cumulative effects on resources.

Development Projects

Residential and non-residential development projects, both proposed and approved, were identified based on information from the departments of land use and planning of New Castle County, Delaware, and Cecil and Kent Counties, Maryland, and through the offices of the various incorporated towns and cities within the SCEA boundary. A summary of these projects is presented in ***Table III-75***; additional information on planned development is located in the socioeconomic effects section of this FEIS, in ***Chapter III, Section A***. Although there are some planned developments that will be affected by the project that will incorporate the new US 301 roadway in their plans, there are currently no developments proposed or in any stage of review by New Castle, Cecil, or Kent Counties that require the construction of the US 301 project to allow the development to occur. Thus, there are no development projects that would cause secondary effects related to the US 301 project to environmental resources.

Table III-75: Development Projects within the SCEA Boundary

Location	Residential Development	Non-Residential Development
New Castle County	19,700 units	11.7 million square feet
Cecil County, Maryland	135 units	None Identified
Kent County, Maryland	None Identified	None Identified

Note: Based on available information provided by relevant county planning departments in 2006 for areas within the SCEA boundary only.

Programmed Transportation Improvements

Planned roadway and other transportation improvements within and adjacent to the project area are described in ***Chapter II, Section B.1.b***. Additional projects that are programmed within the SCEA boundary were identified in the Delaware *Capital Transportation Plan FY 2008-2013.* There were no incomplete projects identified in the Maryland Department of Transportation *Consolidated Transportation Program FY 2007-2012* (CTP) within the SCEA boundary. The projects listed below may contribute to the cumulative effects upon community and natural resources within the SCEA boundary if constructed.

- SR 72 from McCoy Road to SR 71, Red Lion Road – Sidewalk construction
- I-95/SR 1 Interchange Improvements – Includes construction of SR 1 to I-95 directional ramps
- US 40, Maryland State Line to US 13 – Corridor Improvements
- Roadway improvements on School Bell Road from SR 7 to US 40
- SR 7 and US 40 Area Improvements to address planned growth
- Howell School Road from SR 896 to SR 1 – Realign and widen, some intersection improvements

2. Analysis Methodology

A combination of analysis methodologies were employed to fully assess and quantify secondary and cumulative effects. The analyses were based on readily available data and are described below.

a. Trend Analysis

Trend analysis was used to identify effects over time and to determine likely future secondary and cumulative effects. Historic data were collected and compiled to understand past effects and the rates at which these effects occurred; these rates, or trends, were then used to project future effects.

b. Interviews

Interviews were conducted with agency representatives, planning officials and others to gather data not readily available through traditional sources (publications, internet sources, and library references, etc.). This additional information was useful in determining the possible effects of growth and change within the SCEA boundary.

c. Map Overlays

Map overlays as part of a Geographic Information System (GIS) were used to combine land use projections with land use controls such as zoning, development ordinances, critical areas and natural environmental constraints, to create a reasonable and foreseeable future scenario to analyze.

3. Land Use and Development Trends

Understanding the relationship between land use and transportation, and how one influences the timing and location of the other, is based on understanding the land use changes of the past and current uses and applying those trends to forecast future land use. Projections of future population and employment growth were used to estimate development potential for housing and employment space. Land available for development was estimated, based on current uses and zoning, potentially available acreage already zoned for future development, and land protected from development under various constraints.

a. Past Land Use: Historic Changes and Trends

Historic land uses and the changes and trends in land uses within the SCEA boundary were viewed within the regional context of New Castle County, Delaware, and Cecil and Kent Counties, Maryland. A qualitative overview of changes in New Castle County and within the SCEA boundary shows that there has been substantial residential development in the areas north and south of the C&D Canal between 1984 and 2004 (***Figure III-27***). Some of this development may be the result of increased transportation opportunities afforded by the completion of SR 1 in 2003 and facilitated by the changes in zoning that came about following the adoption of the *Unified Development Code* in 1997. In December 1997, following the adoption of the Code, much of the land that was formerly held from development was rezoned to either Suburban (allowed development density of one unit per acre) or Suburban Reserve (allowed density of one unit per five acres).

In Cecil County, Maryland, development within the SCEA boundary south of the C&D Canal has been concentrated in the towns of Chesapeake City and Cecilton and several small suburban developments in rural areas near the Delaware/Maryland state line. In Kent County, Maryland, resource conservation and the Maryland Smart Growth Regulations have focused and encouraged development elsewhere in the county than in the area within the SCEA boundary. Similarly, the more developed areas of Kent County include the town of Galena, the village of Georgetown, and the hamlet of Sassafras. The trend in land development in these counties has been preservation of existing agriculture and forest uses.

b. Existing Land Uses

Existing land uses can be described by identifying the land use, committed acreage, protected acreage, and potentially available land within the SCEA boundary. Understanding the existing pattern of land use is important for determining what resources may be affected by secondary and cumulative effects and where those effects might occur.

<u>Land Use</u>

Existing land use within the SCEA boundary reflects the transitional nature of land use in the New Castle County portion of the SCEA to developed uses and the large portion of generally undeveloped land (in either agricultural use or forested land) in the Cecil County/Kent County portion. ***Table III-76*** identifies the existing land use within the SCEA boundary.

In the Delaware portion of the SCEA, agriculture (42 percent) and forest (13 percent) makes up 55 percent of the total land use. Approximately 90 percent of the land use in the Maryland portion of the SCEA is agriculture (68 percent) or forest (22 percent). Residential land use in the Delaware portion of the SCEA covers almost ten times the acreage as in the Maryland portion.

In the Maryland portion, residential, commercial, industrial and institutional uses include only about five percent of the land within the SCEA boundary, while in the Delaware portion, developed uses include 27 percent of the land area.

Table III-76: Current (2002) Land Use within the SCEA Boundary

Land Use	DE Acres	MD Acres	Total Acres	Percent
Agriculture	52,791	31,719	84,510	48.9
Barren Land		136	136	0.1
Commercial	2,046	93	2,139	1.2
Forest	16,474	10,182	26,657	15.4
Industrial	2,248	7	2,255	1.3
Institutional	727	38	766	0.4
Open Space	852	122	974	0.6
Residential	21,921	2,207	24,128	14.0
Transitional	2,600		2,600	1.5
Transportation/Utilities/Communication	2,688		2,688	1.6
Urban – Built Up	2,152		2,152	1.2
Water	4,769	1,918	6,687	3.9
Wetlands	16,742	357	17,100	9.9
Total			**172,794**	**100.0**

Source: Delaware Office of State Planning and Coordination, 2002 and Maryland Department of Planning GIS Land Use Layers 2002.

Committed Acreage

Committed land includes land that is already developed. Land uses include residential (24,128 acres), commercial (2,139 acres), industrial (2,255 acres), infrastructure (2,688 acres), urban and transitional (4,752) and institutional (766 acres). The total committed land within the SCEA boundary is 36,728 acres.

Protected Acreage

Protected acreage includes the land uses that are under some resource protection level, such as wetlands, agricultural preserves, resource protection district zoning, critical area zones, natural areas, and others. However, impacts to these resources can in some cases, (wetlands for example), be permitted and mitigated.

Delaware/New Castle County

In Delaware, the adoption of the *Unified Development Code* in 1997 established resource protection levels for a variety of environmental features, such as wetlands, water courses, riparian buffers, floodplains, steep slopes, critical natural areas and forested lands. The most sensitive areas, floodplains, wetlands, steep slopes and erosion hazard areas, critical aquifer recharge areas, critical natural areas and riparian buffers, are "100% protected" under the UDC. Disturbance within these areas is strictly limited. Within some of the less sensitive areas, such as forests, drainageways, steep slopes with less erosion potential, disturbed lands and old fields, partial protection means that some disturbance is permitted in these areas on a limited basis and mitigation is often required. As of the *2002 Comprehensive Development Plan Update,* 67,000 acres in New Castle County were designated as fully protected and 118,000 acres were partially protected.

In 2004, the Governor of Delaware signed Executive Order #59, approving the Delaware Strategies for State Policies and Spending, which identifies land uses within the state which are designated for various levels of development. Levels 1, 2, 3 and 4 identify areas where growth is favored at varying levels of intensity and density (in Level 1, state policies encourage development and reinvestment; in Level 4, retention of rural landscapes and preservation of open space is favored). "Out of play" areas, i.e., publicly-owned lands, or lands with legal constraints to development or forms of permanent open space protection, or land identified in the UDC as "100% constrained", are not available for development. A large portion of the area within the SCEA boundary is designated as "out of play" or Level 4.

Additional protections reinforce the state and county-wide levels of protection identified in the UDC, Comprehensive Plan, and Executive Order #59. These include farmland preservation programs at state and county levels and resource protection areas (such as natural areas, habitat areas, water recharge areas, state resource areas, forests) identified through DNREC.

Maryland/Cecil County and Kent County

In Maryland, most of the land in Cecil County within the SCEA boundary is designated as Resource Protection District (RPD) and another large portion of the land is designated Rural Conservation District (RCD). These designations are described in the *Cecil County 2005 Land Preservation, Parks and Recreation Plan*, adopted May 2005, and *Cecil County, Maryland Comprehensive Plan*, December 1990 and updates. The primary purpose of the RPD is to encourage retention of agricultural land and activities related to agriculture; the primary purpose of the RCD is to maintain the rural character of the area by encouraging forestry and agriculture uses. Within the SCEA boundary in Kent County, protected lands include Agricultural Priority Areas, Maryland Agricultural Land Preservation Foundation (MALPF) districts and easements, and Maryland Environmental Trust (MET) easements. Locally-designated Habitat Protection Areas and areas of state-listed species habitat protection (*Kent County Comprehensive Plan Update*, adopted May 2, 2006) are also within the SCEA boundary.

In addition to those protections afforded the various land use categories through the Comprehensive Plans, Maryland's Smart Growth policies provide for the direction of growth within areas identified as Priority Funding Areas (PFAs), or areas where growth is encouraged and permitted, thus enforcing and enhancing the restraints of preservation areas. Kent County's *Comprehensive Plan* includes those principles that guide growth to occur in and around existing towns and villages to preserve the rural character of the surrounding countryside. Maryland's Department of Natural Resources and SHPO also provide similar state and national protection programs for natural and cultural resources.

Potentially Available Land

Land potentially available for future development includes all land that is undeveloped but planned or zoned for development as well as land that is partially developed, including areas available for infill developments. Generalized zoning for areas within the SCEA boundary are shown on ***Figure III-28***.

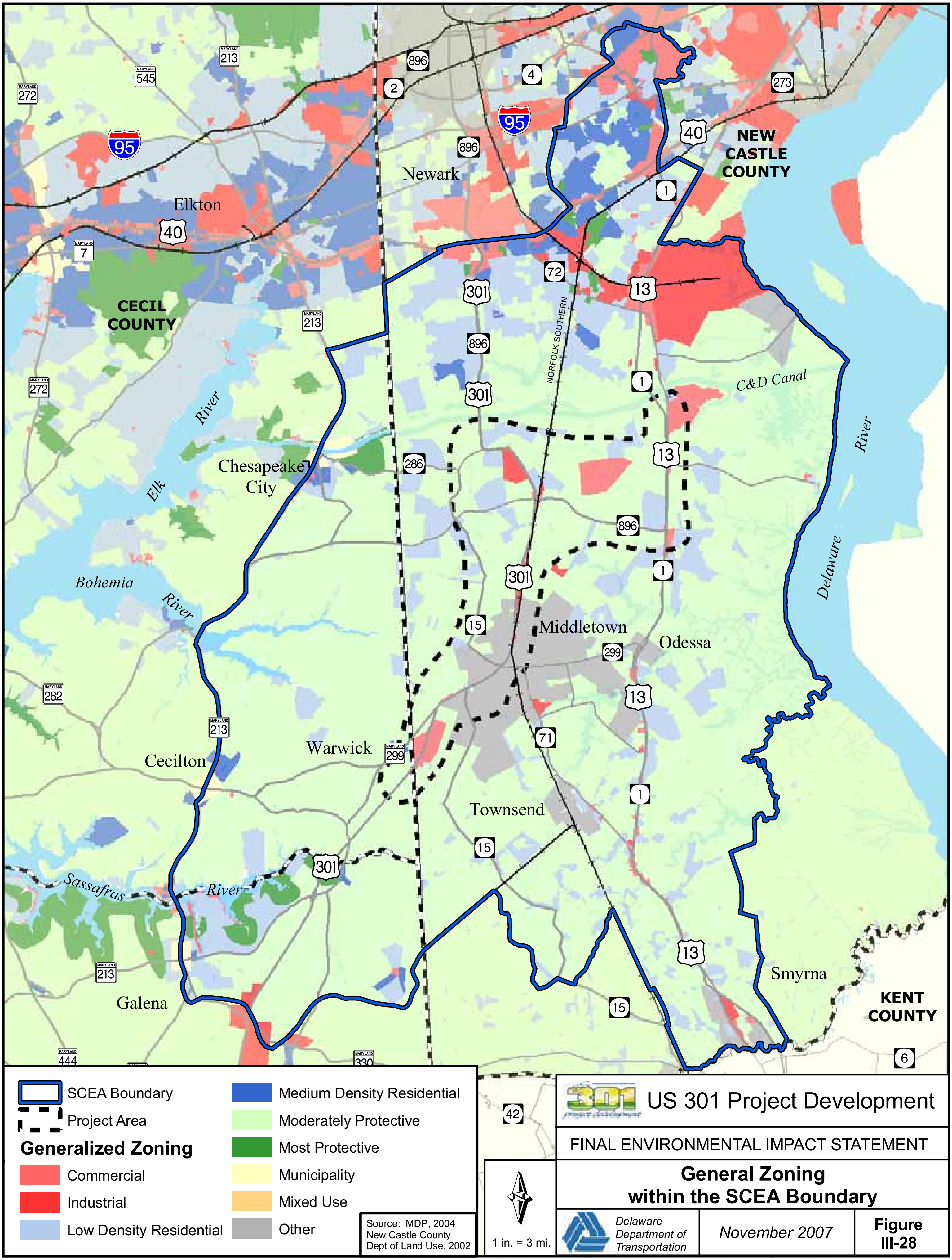
As detailed in the *New Castle County 2002 Comprehensive Plan Update*, there is an adequate acreage of land zoned to accommodate projected residential and employment growth through 2030. As of the time of the adoption of the plan, there were approximately 30,640 acres zoned for nonresidential uses and roughly 42 percent of that acreage (12,770 acres) was yet to be developed; most of the existing developed nonresidential properties remained underdeveloped. For residential uses, the plan identified approximately 200,000 acres of residentially zoned land with roughly 140,000 acres undeveloped. Of these acres, approximately 30 percent must be allotted to open space and environmental resources with 100 percent protection levels, allowing the remaining acres (under specified density constraints) to accommodate approximately 61,690 households.

Kent County's comprehensive plan draft also indicates that the number of existing undeveloped lots zoned for residential and commercial use in the county could satisfy projected population growth for more than the next 30 years. Cecil County, Maryland is undergoing an update of its comprehensive plan, in which land availability will recognize the adequacy of land for projected growth.

c. Areas of Future Development

Development within the SCEA boundary should continue to occur within those areas zoned for residential, commercial and industrial uses. Within the Maryland portions of the SCEA boundary, development is planned and directed to occur within the town districts surrounding Chesapeake City and Cecilton, as well as in the Village of Warwick and several smaller areas near the Delaware/Maryland state line that are zoned Rural Residential (RR).

In the areas within the SCEA boundary in Delaware, continued residential development will occur in the available zoned areas north and south of the Canal (***Figure III-28***). The *2007 New Castle County Comprehensive Plan Update* identifies the area north of Middletown, bounded by the Town of Middletown on the south, SR 1 on the east, the C&D Canal on the north and existing US 301 to the west, as a "New Community Development Area" in which to focus growth. The SR 1 corridor, north of the Canal, may also experience further development and infill in areas already being developed.



US 301 Project Development

FINAL ENVIRONMENTAL IMPACT STATEMENT

General Zoning within the SCEA Boundary

Delaware Department of Transportation

November 2007

Figure III-28

d. Land Use Conclusions

Substantial land use changes have occurred or will occur within the SCEA boundary over the 50-year time frame considered in this analysis as land within the SCEA boundary is converted from agriculture and woodland to residential, commercial, institutional, and industrial land. The land use changes are associated with the development in the area and are a consequence of the population increases the area has experienced. The development in the area will continue into the 2030 future time frame. However, given the projected growth in population and development, it is anticipated that the pace and extent of the future land use change will likely be less than that experienced during the past 25 years.

There are numerous planned developments within the SCEA boundary that are expected to occur regardless of whether improvements are made to US 301. In general, land use change could result from many factors, including available roadway capacity, available sewer capacity, zoning, population change, employment availability, and property values. While it is clear that the rate of household and job growth would be influenced by increased capacity on regional roadways, there are no indications that the pattern of development would be influenced by changes to roadway capacity. The land use trends that are currently occurring within the SCEA boundary have been occurring since at least 1980 and are generally expected to continue for the foreseeable future.

New Castle, Cecil, and Kent Counties have current zoning plans, which regulate the location and type of development that can and will occur within the SCEA boundary as well as the rest of the counties. Changes to existing zoning could be proposed at any time, and may be granted on a case-by-case basis by county Departments of Planning. The annexation of lands by municipalities, such as the Town of Middletown, while guided by the comprehensive planning process, may also result in changes in zoning that would affect the locations and types of development that could occur within the SCEA boundary.

4. Analysis of Secondary and Cumulative Effects

This section discusses the potential secondary and cumulative effects to environmental resources within the SCEA boundary and associated with the US 301 project. Secondary effects are caused by the action (construction of any build alternative, including the Preferred Alternative, for the US 301 project), and are later in time or farther removed from the immediate study area, but still reasonably foreseeable. Secondary effects could include growth-inducing effects and changes in land use, zoning, population, or growth rate. In other words, secondary effects focus on known development proposals or land use changes that can only occur if the Preferred Alternative or other build alternative is constructed, or if the project changes the rate of the development. Coordination with New Castle, Cecil, and Kent County planning agencies has determined that there are no transportation, residential or commercial development projects dependent upon any of the US 301 alternatives.

The extent, pace, and location of development within the SCEA boundary will primarily be influenced by state, county, and local land use regulations. Growth is expected to occur regardless of the alternative chosen for the project. Therefore, the US 301 project would not induce secondary development from dependent projects, land use changes, or zoning changes. However, the US 301 build alternatives, including the Preferred Alternative, could potentially increase the rate of current private development, within the framework of the existing pattern of land use. This would occur because less congestion and ease of travel would encourage people and businesses to move to designated growth areas within the project area. Thus, the US 301 project may induce secondary effects caused by changes to the rate of development.

In general, these secondary effects caused by a change in development rate are expected to be minimal for several reasons:

1) The build alternatives, including the Preferred Alternative, would only affect the rate of development within areas currently designated for growth by state and local planning authorities;
2) Improvements to US 301 would not influence the pattern of development, and there are no known development projects dependent upon improvements to US 301;
3) The final completion date for the US 301 project would potentially occur after most of the areas currently designated for growth have been built out. Therefore, the developable area that would be present within the SCEA boundary at the design year would be much less than today and be similar among the No-Build and build alternatives; and
4) Secondary effects to natural, socioeconomic, and cultural resources would be avoided, minimized and mitigated by owners through applicable regulations.

Another type of secondary/indirect effect could be caused by a change in travel patterns and traffic volumes on the regional roadway network. These changes could result in indirect effects to communities and historic resources even though there would be no physical impact to those resources. The area around Warwick, Maryland near the southern portion of the SCEA Boundary could experience an increase in automobile traffic from travelers avoiding the US 301 northbound toll plaza. This change in travel patterns could be the result of any of the build alternatives, including the Preferred Alternative.

Cumulative effects include impacts on the environmental resources which will result from incremental impacts of the construction of the Preferred Alternative or other build alternative when added with other past, present, and reasonable foreseeable actions. Cumulative impacts would result from any public or private development that may or may not be associated with the US 301 project. If the US 301 project directly or secondarily affects the resource, then cumulative effects would occur if another development affects the same resource.

In the following sections the potential secondary and cumulative effects of the project are assessed for those resources affected by the construction of one of the alternatives. These resources include floodplains, waters of the US including wetlands, agricultural districts and preservation easements, prime farmland soils, forests, proposed State Resource Areas, Natural Areas, property (residences and businesses) and historic properties.

a. Floodplains

In both states included within the SCEA boundary, federal and local regulations restrict development within the floodplain, and any proposed encroachment in the floodplain would have to be permitted by the local jurisdiction. The direct impacts of the project's Preferred Alternative is 0.7 acre of floodplain impacted, which will contribute a small incremental area to cumulative impacts caused by other development within the SCEA boundary. The introduction of stormwater management facilities, including ponds, ditches and linear runoff retention areas would minimize the effects of storm events on the holding capacity or areal extent of the floodplain.

There are no planned development projects in the SCEA boundary that are dependent on improvements to US 301 for completion; therefore, there would be no secondary effects to floodplains as a result of a change in land use pattern. However, the build alternatives, including the Preferred Alternative, could induce an increased rate of development within planned growth areas, which could result in secondary effects to floodplains. Most floodplain areas are protected from development through zoning and land use regulations; however, there may be some floodplains that incur secondary effects as a result of a change in development rate in adjacent planned growth areas and subsequent disturbance to hydrologic function.

Cumulative effects to floodplains are possible from the build alternatives combined with other transportation and development projects. Disturbance to floodplain vegetation and landscapes may cause loss of hydrologic function. This loss of function can cause increased flooding, excess erosion and sedimentation, and damage to downstream channel morphology. Future development will have minimal impact to 100-year floodplains due to existing Federal and State legislation and review by ACOE, DNREC and Maryland Department of the Environment (MDE). Permits requiring avoidance, minimization, and/or mitigation to individual floodplains would offset most floodplain disturbances caused by cumulative effects.

b. Waters of the US including Wetlands

The conversion of open space and farmed or forested areas to impervious areas as a result of the implementation of one of the build alternatives or the Preferred Alternative would be anticipated to increase surface runoff and peak storm flow and introduce pollutants and sediment into waterways. These effects would be mitigated by required compliance with regulations for stormwater management quality and quantity treatments in the form of stormwater management facilities included in the design of the Preferred Alternative and by the use of erosion and sediment control plans. Stormwater flow regulations are administered in Delaware through DNREC and in Maryland through the MDE and county-specific regulations.

The build alternatives, including the Preferred Alternative, could cause secondary effects to wetlands through an increased rate of development within areas already planned for development. This rate change could result in faster conversion of wetlands to uplands than would occur under the No-Build Alternative. Given current land use regulations, wetlands in areas that are not designated for growth would not incur secondary effects. Thus, the overall area of wetlands potentially affected by development would be the same whether the project is completed or not. In addition, because there are no projects dependent upon improvements to US 301 for completion, there will be no secondary effects to wetlands as a result of a change in the pattern of development.

The build alternatives, including the Preferred Alternative would have minimal cumulative effects on wetlands, as all wetlands impacts will be mitigated through the creation of new wetlands and enhancement of additional wetlands within the area. Cumulative effects would occur through planned or other future development within the SCEA boundary. In most cases, cumulative effects would occur in areas designated for growth or where there is potential for build-out. Both secondary and cumulative wetland impacts that occur as a result of public or private development would require review by the USACE, DNREC and/or the MDE.

c. Farmland

The number of farms within the SCEA boundary and the states of Delaware and Maryland have been on the decline since prior to 1980. According to the 2002 Census of Agriculture, the state of Delaware lost 17.6 percent of its farmland and Maryland lost 18.8 percent of its farmland between 1982 and 2002. The loss in farmland within the SCEA boundary is due to the increase in primarily residential and commercial growth that resulted from an increase in population and subsequent sprawl during this time frame. Continued losses are occurring and will occur in areas zoned for development.

Secondary effects to farmlands within the SCEA boundary could occur as a result of any build alternative, including the Preferred Alternative. The rate of development for areas zoned for residential use could increase as a result of improved access and capacity to US 301. The result would be a faster conversion of the land already designated for residential development. Areas that are not designated for residential use or that are under an agricultural preservation easement would not sustain secondary effects. The rate of farmland loss associated with secondary effects of the Preferred Alternative and other build alternatives is not expected to be greater than the historic rate of farmland loss. As there are no projects dependent upon improvements to US 301 for completion, there will be no secondary effects to farmlands as a result of a change in the pattern of farmland conversion.

Cumulative effects to farmlands would occur as a result of any public or private land development within the SCEA boundary that would convert farmland to urban land. Cumulative effects are most likely to occur in existing farmland areas that are designated for development. Given the current land use and pattern of land use development, the farmland areas most likely to incur cumulative effects are located in the northern portion of the SCEA boundary, between Boyds Corner Road and the C&D Canal.

d. Forests

Forested lands account for approximately 15.4 percent of the land area within the SCEA boundary. Most of the forest occurs as small remnant forest tracts surrounded by agriculture or urban development.

Secondary effects to forests could occur as a result of the build alternatives, including the Preferred Alternative. Because there are no development projects dependent upon the completion of the US 301 project, secondary effects to forests would not occur as a result of a change in the land use pattern. However, compared to the No-Build Alternative, the rate of development for areas zoned for residential use could increase as a result of improved mobility resulting after the completion of any of the build alternatives. This could create a faster conversion of forests to residential and commercial uses in areas designated for growth. A change in the rate of development would adversely affect forest species by changing the time that habitat is available for wildlife population establishment and dispersal into other habitats.

Cumulative effects to forests and habitat would occur with completion of the build alternatives, including the Preferred Alternative, combined with other transportation and development projects. Cumulative effects would most likely occur in existing woodland areas which are designated for development. Wildlife species would be impacted from continued loss and fragmentation of habitat.

The cumulative effects on woodland habitat would result in cumulative effects on woodland species. Some species have threshold population levels below which reproductive capacity and immigration are not able to overcome stresses from adverse environmental effects. Cumulative fragmentation of woodland habitat and increased woodland edge habitat can result in changes to animal movement patterns, predation and decreased reproductive success of woodland species.

In Delaware, secondary and cumulative impacts to forests will be minimized and mitigated for under the Delaware Forest Conservation Act. Impacts to woodlands will be minimized and mitigated for in Maryland under the Maryland Reforestation Law and Maryland Forest Conservation Act of 1991.

e. Rare, Threatened and Endangered Species

Each of the build alternatives, including the Preferred Alternative, has the potential to affect potential habitat areas suitable for the endangered bog turtle (*Clemmys muhlenbergii*). The build alternatives could also affect habitat for the queen snake, a Delaware state-listed species. Secondary effects to rare, threatened and endangered species could occur as a result of changes to the rate of development located near their habitat. Cumulative effects could include the increased pressure for potential development to occur in additional areas of potential habitat or in areas identified as supporting the growth of other RTE species. Passage of the Endangered Species Act in 1973 requires consideration and avoidance of known occurrences of listed species, thus lessening the recent cumulative effects.

f. Historic Properties

There are no direct physical impacts to historic properties (architectural resources) with the Purple Brown or Green (Preferred) Alternatives. Other effects to historic properties, such as changes in viewshed or noise, are discussed in ***Section B*** of this chapter. Direct impacts of the implementation of the Yellow Alternative would result in the loss of two historic properties within the SCEA boundary and incremental loss of some of the land associated with two others. The Brown Alternatives will have a direct effect on one historic property, the J. Biggs House (N06320), for which eligibility has not yet been determined. The Purple, Brown and Green (Preferred) Alternatives will directly affect one archaeological site for which eligibility has not yet been determined.

Implementation of either the Brown Alternative or Green (Preferred) Alternative will include the provision of an interchange with existing Jamison Corner Road, north of State Bridge Number 383, an historic structure eligible for listing in the National Register of Historic Places. This proposed access will service the proposed communities and developments of Bayberry and Whitehall, north of Boyds Corner Road. The increased traffic from these developments may bring about the need to replace the two-lane bridge to accommodate traffic; however, this need would occur regardless of whether or not build alternatives from the US 301 project are implemented. Roadway improvements to Jamison Corner Road, Lorewood Grove Road and Road 412A in this area are currently in the design phase.

Because there are no development projects dependent on the US 301 project, there will be no secondary effect to historic resources caused by land use changes due to secondary development. However, the build alternatives, including the Preferred Alternative, may cause secondary effects to historic resources by increasing the rate at which potential build-out areas are developed. Known and unknown cultural resources in areas that are not designated for growth would not incur secondary effects. Thus, the extent of historic resources potentially affected by development would be the same regardless of the alternative.

The area within the SCEA boundary has not been thoroughly surveyed for historic resources that may be eligible for inclusion in the National Register of Historic Places. There may be additional historic resources that have not been identified. As the population within the SCEA boundary increases and commercial and residential development pressures rise, there may be cumulative effects to these unrecorded resources.

In general, cumulative effects to historic resources caused by development within the SCEA boundary, or from traffic and truck diversions in towns such as Warwick, are likely under any of the build alternatives. The potential for cumulative effects to historic resources arise from the effects of the US 301 project together with additional, unrelated development within the SCEA boundary. Effects to historic resources could also occur where adjacent zoning allows for development that is incompatible with the historic settings of the resources.

Cumulative effects that occur to any known or unknown sites would be regulated through existing laws that facilitate the protection of historic resources, such as the provisions of county historic preservation ordinances. Section 106 of the National Historic Preservation Act requires federal and state agencies to consider the effects of their actions on historic properties. Section 4(f) of the 1966 Department of Transportation Act prohibits the use of significant historic resources, including archaeological resources, for federal transportation projects unless there is a thorough alternatives analysis to avoid and minimize harm. Although both Section 106 and Section 4(f) protections will protect historic resources from federally funded, permitted, authorized or otherwise approved projects (and specifically FHWA transportation projects in the case of Section 4(f)), most of the approved or proposed development projects within the SCEA boundary do not fall into this category, nor would these laws protect historic resources from increased future development projects that could be encouraged by the completion of the US 301 project. In addition, county preservation ordinances may not be effective if resources are annexed into municipalities where the preservation ordinances may be less effective.

g. Community and Socioeconomic Resources

Within the SCEA boundary, secondary and cumulative impacts as a result of the implementation of a build alternative, such as changes in accessibility and changes in the greater community structure (cohesion, interactivity, changes in locations of some businesses) are not anticipated to occur outside of the immediate area of direct impacts. Within the SCEA boundary, cumulative changes in community structure or potential unplanned development that could result in additional stresses on community infrastructure (water, sewer) and facilities (recreational areas, libraries, emergency response capacity).

Secondary impacts to communities may be experienced as a result of the diversion of traffic from the new US 301 tolled road onto alternate, untolled routes under any of the build alternatives, including the Preferred Alternative. Traffic analyses have demonstrated (see the discussion in ***Section G*** of this Chapter) that there is likely to be less diversion of truck traffic than automobile traffic upon completion of a build alternative. This additional traffic on secondary routes, such as Maryland Routes 213 and 282, and in towns such as Warwick, could have secondary effects on the communities, on roadway infrastructure, on air quality, and on traffic noise. Changes in the number of vehicles passing each day may produce visual and aesthetic changes. Although measures to lower the amount of diverted traffic have been recommended by the Toll Diversion Working Group (a joint effort between Maryland and Delaware to address these issues), the implementation and effectiveness of these measures will have to be monitored. A description of recommended measures to address potential diversion issues is located in ***Section G.4*** of this chapter.

Traffic analyses have also shown that there would, in some cases, be less future traffic on some roadways within the SCEA boundary, such as other portions of MD 213, with the completion of a build alternative (including the Preferred Alternative) compared to the No-Build Alternative. This would result in a beneficial indirect effect for those local roadways and the communities through which they pass.

5. Secondary and Cumulative Effects Analysis Conclusions

In general, the construction of the Preferred Alternative or other build alternative will not directly influence the amount or location of development anticipated to occur within the SCEA boundary. The transportation and traffic benefits forecast as a result of the implementation of any build alternative would provide adequate public roadway capacity for permitting purposes, thus allowing approval of development that may have been disallowed under existing or No-Build conditions. The improved transportation facility may result in future zoning change requests for higher density developments in areas not currently zoned for such development. Among the effects of this project, therefore, is the potential for secondary development that would not occur without the construction of a new four-lane limited access roadway to relieve existing and future traffic volumes on existing roads, especially in areas easily served by access ramps.

In Kent County, Maryland, there will be continued pressure for development in those areas where improved access to a direct commuting route to Philadelphia and employment areas in New Castle County may be seen to encourage the development of housing. With the completion of the existing plans for growth of employment development in Middletown and unincorporated areas of southern New Castle County, these stresses may become more evident as employees seek housing convenient to these locations. The resulting improvements in the transportation network as a result of the implementation of a build alternative for US 301 may exacerbate those stresses that are already identified, as noted in the *Kent County Comprehensive Plan Update (*Adopted May 2, 2006):

> "…improvements to U.S. Route 301 in Delaware may make Kent County a more attractive location for people working in New Castle County. However, the County's priority is to not view Route 301 as a housing corridor. We remain cognizant of the potential effects of transportation improvements in neighboring areas on growth in Kent County."

In Cecil County, Maryland, the county's general framework for land use is designed to encourage intensive development within designated districts, such to relieve the pressure to develop in rural, protected districts (*Cecil County 2005 Land Preservation, Parks and Recreation Plan*, adopted May 2005) that make up the majority of the SCEA portion within the county.

> "…it is widely known that land prices are rising with the development pressure from Baltimore and Harford Counties and also from the Newark/Wilmington areas. This pressure is being partly relieved … by the ability to develop in the RPD and the RCD [which] in turn, has made it harder for landowners to choose preservation over development...

> "Cecil County is at an important crossroads: Before 2010, the County's population is projected to top 100,000 … Cecil County is no longer a small, rural County. The rate of growth and

development is projected to continue, putting pressure on farmland protection efforts and on resource land…"

In New Castle County, Delaware, adequate land zoned for development, protection strategies included in the UDC and the *State Strategies for Policies and Spending* ordinance will continue to provide some protection from development pressures in areas not designated for growth that may be felt as a result of the completion of a build alternative.

K. Mobile Source Air Toxics (MSATs)

In addition to the criteria air pollutants for which there are National Ambient Air Quality Standards (NAAQS), EPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries.

Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the Clean Air Act. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The EPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The EPA has issued two MSAT Rules under Section 202 of the Clean Air Act. In these rules, EPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline (RFG) program, its national low emission vehicle (NLEV) standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Between 2000 and 2020, FHWA projects that even with a 64 percent increase in VMT, these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel PM emissions by 87 percent, as shown in ***Figure III-29***.

EPA has made some changes regarding vehicle emissions and fuel standards, which will continue the significant reduction of vehicle emissions as outlined in the MSAT Rule released February 26, 2007 (FR8428).

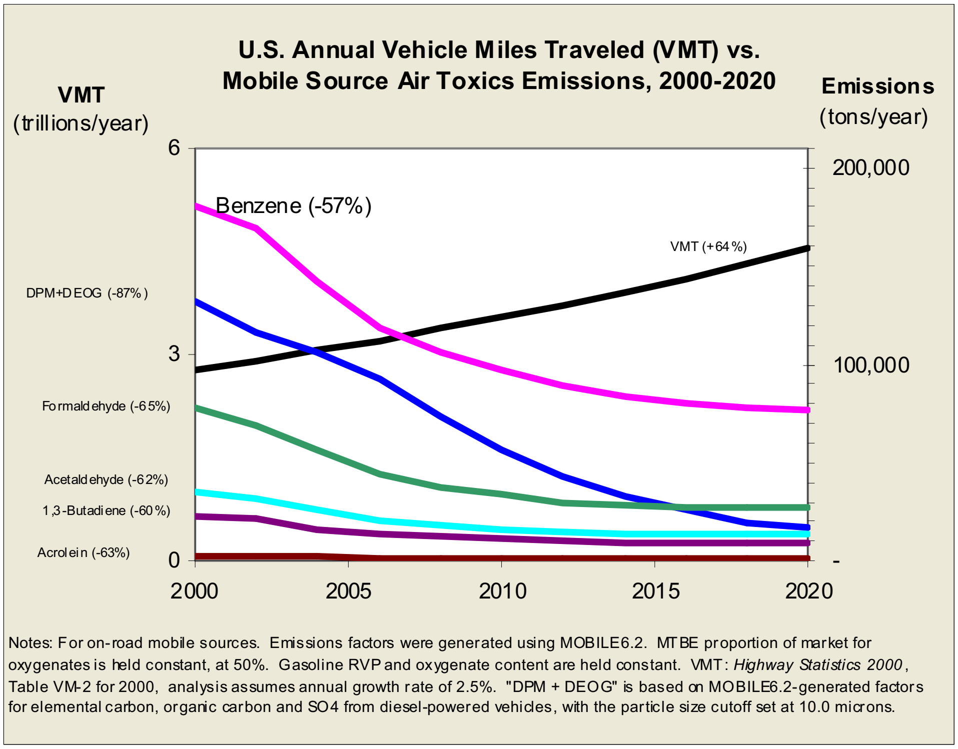


Figure III-29: U.S. Annual Vehicle Miles Traveled vs. Mobile Source Air Toxics Emissions, 2000 – 2020

1. Level of Project Specific MSAT Impact Analysis

The US 301 improvements will provide a new controlled-access, grade separated freeway that will carry a projected design year traffic volume of approximately 57,000 vehicles per day at the location with the highest projected volume (north of the Levels Road interchange, prior to the Spur Road split). This volume is considerably lower than FHWA's Level 3 threshold of 140,000 to 150,000 vehicles per day. Furthermore, the primary impact of the US 301 improvements will be to *shift* traffic, especially large, diesel trucks, away from existing local roads and onto a new roadway of higher functional class. This shift will reduce traffic volumes on roads with lower travel speeds, that are often congested in the peak periods, and which have traffic control devices (signals and stop signs) resulting in the need to accelerate and decelerate, and will place those vehicles on a higher speed facility with consistent travel speeds.

Table III-77 below provides a comparison of projected 2030 Average Annual Daily Traffic (AADT) volumes for a cross section (screenline) of roadways north of Middletown, Delaware for all of the Alternatives.

Table III-77: Projected 2030 Average Annual Daily Traffic (AADT) on Roadways North of Middletown

Screenline – North of Middletown	**No-Build**	**Yellow**	**Purple**	**Brown**	**Green**
Choptank Road	15,200	12,800	5,300	5,100	5,100
Existing US 301	38,900	32,900	23,100	24,000	21,300
Cedar Lane Road	9,700	6,100	5,600	5,500	4,500
SR 1	63,000	54,600	53,000	53,100	51,300
US 13	42,600	39,400	39,400	39,200	37,700
New US 301		**37,600**	**53,700**	**56,000**	**56,700**
TOTAL	169,400	183,400	180,100	182,900	176,600
% Increase from No-Build		8%	6%	8%	4%

Similarly, the Vehicle Miles Traveled (VMT) was calculated for 48 miles of existing key roadways throughout the US 301 project area for each of the alternatives, as well as the complete length of the new US 301 alignments. A summary of the VMT is provided in ***Table III-78***.

Table III-78: Summary of Projected (2030) Vehicle Miles Traveled (VMT)

	No-Build	**Yellow**	**Purple**	**Brown**	**Green**
2030 VMT on Existing Roads	1,359,000	1,132,000	1,030,000	1,006,000	978,000
2030 VMT on New US 301		428,000	516,000	570,000	523,000
Total	1,359,000	1,560,000	1,546,000	1,576,000	1,501,000
Total Change in VMT	0%	15%	14%	16%	10%
Reduction in VMT on Existing Roads		-17%	-24%	-26%	-28%

While the Build Alternatives are all projected to result in a small increase in total VMT (10% to 16%), those increases would be at least partially mitigated by the shift in total VMT away from existing, often congested roads, and onto an uncongested higher speed roadway with consistent travel speeds.

The preceding data indicates that there would only be minimal differences in the regional MSAT emissions for the US 301 Project Alternatives. Therefore, in accordance with FHWA *Interim Guidance on Air Toxic Analysis in NEPA Documents* (February 3, 2006), the US 301 project is one "… that serve[s] to improve operations of highway…without adding substantial new capacity or creating a facility that is likely to meaningfully increase emissions." and the project would be considered a "Project with Low Potential MSAT Effects" and subject to a qualitative discussion of localized MSAT impacts.

2. Unavailable Information for Project Specific MSAT Impact Analysis

This FEIS includes a basic analysis of the likely MSAT emission impacts of this project. However, available technical tools do not enable us to predict the project-specific health impacts of the emission changes associated with the alternatives in this FEIS. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

a. Information that is Unavailable or Incomplete

Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

- **Emissions:** The EPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE 6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE 6.2 is a trip-based model - emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip. This means that MOBILE 6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE 6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects and cannot adequately capture emissions effects of smaller projects. For particulate matter the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emissions rates used MOBILE 6.2 for both particulate matter and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of PM under the conformity rule, EPA has identified problems with MOBILE 6.2 as an obstacle to quantitative analysis.

  These deficiencies compromise the capability of MOBILE 6.2 to estimate MSAT emissions. MOBILE 6.2 is an adequate tool for projecting emissions trends, and performing relative analyses between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

- **Dispersion.** The tools to predict how MSATs disperse are also limited. The EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.

- **Exposure Levels and Health Effects.** Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude us from reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

b. Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs

Research into the health impacts of MSATs is ongoing. For different emission types, there are a variety of studies that show that some either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or State level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at http://www.epa.gov/iris. The following toxicity information for the six prioritized MSATs was taken from the IRIS database Weight of Evidence Characterization summaries. This information is taken verbatim from EPA's IRIS database and represents the Agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- **Benzene** is characterized as a known human carcinogen.
- The potential carcinogenicity of **acrolein** cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- **Formaldehyde** is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- **1,3-butadiene** is characterized as carcinogenic to humans by inhalation.
- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- **Diesel exhaust** (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- **Diesel exhaust** also represents chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes - particularly respiratory problems[1]. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more comprehensive evaluation of the health impacts specific to this project.

c. Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of Impacts based upon Theoretical Approaches or Research Methods Generally Accepted in the Scientific Community

Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emissions impacts on human health cannot be made at the project level. While available tools do allow us to reasonably predict relative emissions changes between alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT

[1] South Coast Air Quality Management District, Multiple Air Toxic Exposure Study-II (2000); Highway Health Hazards, The Sierra Club (2004) summarizing 24 Studies on the relationship between health and air quality); NEPA's Uncertainty in the Federal Legal Scheme Controlling Air Pollution from Motor Vehicles, Environmental Law Institute, 35 ELR 10273 (2005) with health studies cited therein.

concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health impacts. (As noted above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects.) Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether any of the alternatives would have "significant adverse impacts on the human environment."

In this document, DelDOT has provided a qualitative analysis of MSAT emissions relative to the various alternatives, and has acknowledged that all of the project alternatives may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.

3. Project Specific MSAT Information

As discussed above, technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project. However, even though reliable methods do not exist to accurately estimate the health impacts of MSATs at the project level, it is possible to qualitatively assess the levels of future MSAT emissions under the project. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions among Transportation Project Alternatives*, found at:
www.fhwa.dot.gov/environment/airtoxic/msatcompare/msatemissions.htm

For each alternative in this FEIS, the amount of MSATs emitted would be proportional to the vehicle miles traveled, or VMT, assuming that other variables such as fleet mix are the same for each alternative. While the Build Alternatives are all projected to result in a small increase in total VMT relative to the No-Build throughout the project area (10 percent to 16 percent increase in VMT), those increases would be at least partially mitigated by the shift in total VMT away from existing, often congested roads, and onto an uncongested higher speed roadway with consistent travel speeds (17 percent to 28 percent decrease in VMT), shown previously in ***Table III-78***.

In addition, because the estimated VMT under each of the Build Alternatives are nearly the same, varying by less than five percent, it is expected there would be no appreciable difference in overall MSAT emissions among the various alternatives. Regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 percent from 2000 to 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in virtually all locations.

Because of the specific characteristics of the project alternatives (i.e. new connector roadways), there may be localized areas under each alternative where VMT would increase, and other areas where VMT would decrease. Therefore, it is possible that localized increases and decreases in MSAT emissions may occur. The localized increases in MSAT emissions would likely be most pronounced along the new US 301 alignments. However, even if these increases do occur, they too will be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations. Furthermore, MSAT emissions should be reduced, compared to the No-build, on several existing roads in the project area which are closer in proximity to numerous homes, businesses and schools than the proposed US 301 alignments.

Sensitive receptors include those facilities most likely to contain large concentrations of the more sensitive population. These include hospitals, schools, licensed day cares, and elder care facilities. Dispersion studies have shown that the "roadway" air toxics start to drop off at about 100 meters (328 feet). By 300 meters (984 feet), most studies have found it very difficult to distinguish the roadway from background toxic concentrations in any given area. There are three (3) sensitive receptors within 100 meters of the proposed US 301 Preferred Alignment, and there are also three (3) sensitive receptors within 300 meters of the road. These sensitive receptors are listed in ***Table III-79***. However, as noted previously, MSAT emissions should be reduced, compared to the No-Build Alternative, on many of the existing roads in the project area, including Cedar Lane Road, Bunker Hill Road, Summit Bridge Road (existing US 301) and Hyetts Corner Road, which are immediately adjacent to these sensitive receptors.

Table III-79: Sensitive Receptor Locations within the US 301 Project Area

Within 100 Meters of Preferred Alternative	
1.	Appoquinimink High School - Opening 2008 (Bunker Hill Road)
2.	Children at Work Day Care (4922 Summit Bridge Road)
3.	St. George's Technical High School (Hyetts Corner Road)
Within 300 Meters of the Preferred Alternative	
1.	Cedar Lane Early Childhood Center (1221 Cedar Lane Road)
2.	Cedar Lane Elementary School (1259 Cedar Lane Road)
3.	Alfred G. Waters Middle School (1259 Cedar Lane Road)

In sum, under all build alternatives in the design year it is expected there would be only minor increases in MSAT emissions in the immediate area of the project, relative to the No-Build Alternative, due to the reduced VMT on the existing, congested roadway network, which helps to offset the increase in VMT associated with the build alternatives. Any potential increase in MSAT emissions associated with the build alternatives would be further reduced by the 2030 design year due to EPA's MSAT reduction programs.

On a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels due to motor vehicles to be significantly lower than today.

L. Relationship between Local Short-Term Uses of Man's Environment and the Maintenance of Enhancement of Long-Term Productivity

The expected short-term impacts, due to construction of the Preferred Alternative or other build alternatives, include localized noise and air pollution during construction and temporary traffic delays. With the implementation of proper controls, these short-term impacts would not have a lasting effect on the environment.

The long-term benefits of the build alternatives would include increased safety, decreased congestion, and improved mobility. The project would be completed in accordance with the goals and objectives in the *New Castle County 2002 Comprehensive Development Plan Update*, which considers the need for present and future traffic demand within the context of existing and future land use and development. The local short-term impacts and use of resources by the implementation of the proposed action are consistent with the long term goals and objectives of the plan for future continued mobility, productivity and economic growth.

M. Irreversible and Irretrievable Commitment of Resources

The construction of the Preferred Alternative or other build alternative would require the irreversible and irretrievable commitment of natural, human and fiscal resources. The build alternatives would require the commitment of land for the construction of the highway, which is considered an irreversible commitment during the time period the land is used for a highway facility. If a greater need for the land should arise, or the highway no longer be needed, the land could be converted to another use; however, this scenario is not anticipated.

Fossil fuels, labor, highway construction materials, and natural resources will be expended during the construction of a build alternative. The materials used in highway construction are irretrievable; however, these materials are not in short supply and their use should not have long term impacts on continued availability of these materials. The build alternatives would require an irretrievable use of federal and state funds for the purchase of right of way, construction materials, and construction labor. Upon completion, funds would be required for routine maintenance. The commitment of these resources is based on the benefits that would be conferred upon the local and regional residents, commuters, travelers and businesses as a result of the proposed improvements. The benefits, which outweigh the burdens of expenditure and loss of these resources, would include safety, increased mobility, accident reduction, separation of through traffic, management of truck traffic, and improvements in traffic flow.