

SECTION 5: INDIRECT EFFECTS

This section analyzes and discusses the potential indirect effects of the Grand Parkway Segment C project. This analysis was conducted in accordance with FHWA, CEQ, and TxDOT guidance. As defined by CEQ, indirect effects are:

“...effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems” (40 CFR 1508.8).

Indirect effects can be placed in three broad categories. These categories include (1) alteration of the behavior and functioning of the physical environment caused by project encroachment alteration; (2) access-alteration effects; and (3) effects related to project-influenced development. Examples of this include fragmentation of a habitat and functional effects to water quality. The quantitative analysis for indirect effects focused on the induced changes to land use that would potentially result from the construction of the proposed Grand Parkway Segment C.

5.1 METHODOLOGY

The methodology for the indirect impact analysis is based on the findings in the TxDOT’s *Guidance on Preparing Indirect and Cumulative Impact Analyses* (September 2010). Table 5-1 describes TxDOT’s seven-step method that was utilized.

**TABLE 5-1
SEVEN STEPS FOR CONDUCTING AN INDIRECT IMPACT ANALYSIS**

Step 1	Scoping
Step 2	Identify the Study Area’s Goals and Trends
Step 3	Inventory the Study Area’s Notable Features
Step 4	Identify Impact-Causing Activities of Proposed Action and Alternatives
Step 5	Identify Potentially Substantial Indirect Effects for Analysis
Step 6	Analyze Indirect Effects and Evaluate Results
Step 7	Assess Consequences and Consider/Develop Mitigation (when appropriate)

5.2 STEP 1 – SCOPING

Analyzing the likelihood of development in the study area once construction is completed is a key component to evaluating the potential for indirect impacts. To accomplish this, an Expert Panel comprised of local land-use planners and people with firsthand knowledge of planning or development in the government, education, and private sectors was established. An Expert Panel convened in January 2007 and provided information regarding past, current, and reasonably foreseeable future developments; however, based on new indirect and cumulative guidance, the FHWA requested that the Expert Panel be expanded and reestablished in February 2009. The 2009 Expert Panel was contacted to solicit their input on what land-use changes they anticipate that would potentially result from the construction of the proposed Grand Parkway

Segment C. Each member of the Expert Panel received a letter, which included a project description, a location map, historic aerials showing land-use patterns, and a questionnaire requesting their input on past, current, and future development within the area. The 2009 Expert Panel included the following participants.

- ◆ David Gornet – GPA
- ◆ Manny Francisco – TxDOT, Houston District
- ◆ Perri D’Armond – Greater Fort Bend Economic Development Council
- ◆ L.M. “Matt” Sebesta, Jr. – Brazoria County Commissioner Precinct 2
- ◆ Gerald Roberts, PE – Brazoria County Engineer
- ◆ Tom D. Stavinoha – Fort Bend County Commissioner Precinct 1
- ◆ Mary Ruth Rhodenbaugh – Brazoria County Commissioner Precinct 4
- ◆ Patti Worfe – Angleton Economic Development Director
- ◆ Patrick O’Day – Brazoria County Groundwater Conservation District Director
- ◆ Richard Hurd – Brazoria County Parks Department Director
- ◆ Marilyn Kindell – Fort Bend County Community Development Director
- ◆ Nathan Hatcher – Fort Bend County Engineering
- ◆ Michael Davis – Fort Bend County Parks Department Director
- ◆ Ron Neighbors – The Fort Bend Subsidence District General Manager
- ◆ Frank Simpson – Missouri City’s City Manager
- ◆ James Callaway – City of Sugar Land Executive Director of Community Development
- ◆ Theresa Grahmann – City of Rosenberg Planning Director
- ◆ Curtis Rhodes – Needville ISD Superintendent
- ◆ Brenda Teykl – City of Needville
- ◆ Hilmar Moore – Mayor, City of Richmond
- ◆ Dr. Robby McGowen – Alvin ISD Superintendent
- ◆ Dr. Heath Burns – Angleton ISD Superintendent
- ◆ Dr. Timothy Jenney – Fort Bend ISD Superintendent
- ◆ Dr. Thomas Randle – Lamar CISD Superintendent
- ◆ Jamie Schubert – TPWD

- ◆ Casey Cutler – USACE
- ◆ Edith Erfling – USFWS
- ◆ Glen Gilmore – City of Richmond City Manger
- ◆ Delores Martin – City of Manvel Mayor
- ◆ Kevin Sherrodd – Brazoria County Assistant County Engineer

The Expert Panel was contacted to determine what they perceived the development trends would be within their jurisdiction with (Build Alternative) and without (No-Build Alternative) construction of the proposed Grand Parkway Segment C.

For this analysis, the Grand Parkway Segment C project includes existing land use and all projects programmed in the H-GAC 2035 RTP Update (H-GAC, 2011b), the Fort Bend Tollway. The No-Build Alternative includes all existing land use and projects in the H-GAC 2035 RTP Update without the proposed Grand Parkway Segment C. The Expert Panel was asked to consider where future development would be expected to occur within their jurisdictions under each of these two scenarios through 2035, which equates to the planning year for the project (future temporal boundary for the indirect and cumulative impact analyses [CIA]). Development would continue past 2035; therefore, these scenarios do not represent the ultimate development for these jurisdictions.

The National Cooperative Highway Research Program (NCHRP) Report 466, Desk Reference for Estimating Indirect Effects of proposed Transportation Projects (NRC, 2002), states "...linear projects (e.g., new highways or fixed transit guideways) typically have the most extensive effects when compared with new interchanges, transit stations, or bridges, or with new ports, airports and related facilities." The NCHRP Report 466 goes on to say that there are certain general circumstances that may influence the likelihood of induced development shifts (NRC, 2002). These general circumstances include the extent and maturity of existing transportation infrastructure, land availability, and price, state of the regional economy, area vacancy rates, location attractiveness, local political/regulatory conditions, and land-use controls.

5.2.1 AREA OF INFLUENCE

For this analysis, the geographic boundary for which possible indirect impacts could occur has been identified as the AOI. In order to establish the AOI, the Expert Panel recommended a multi-step process. This multi-step process is as follows:

Step 1: Calculate the 15-minute travel distance on the radial network from the proposed project traveling away from Houston (Outer AOI) and traveling towards Houston (Inner AOI). This distance is then marked as an initial boundary point. The travel time output from the H-GAC regional travel demand model 2035 Build Scenario was utilized to develop the travel time contours.

Step 2: Repeat Step 1 for two additional 15-minute increments (30 and 45 minutes).

Step 3: Connect the boundary points for each increment to establish each incremental boundary line. The area between each 15-minute boundary line is then defined as the 15-minute travel contour. (Note: Where a radial roadway is not available to establish a boundary point, boundary lines are kept parallel to the proposed Grand Parkway Segment C corridor alignment.)

Step 4: Refine the boundary for both the Inner and Outer AOI based on the H-GAC's TAZ boundary (Exhibit 21) and the 15-minute boundary line. A TAZ is a special area delineated by state and/or local transportation officials for tabulating traffic-related data, especially journey-to-work and place-of-work statistics. A TAZ usually consists of one or more census blocks, block groups, or CTs.

This four-step process initially produced a reasonable Outer AOI (Exhibit 33). However, the northern boundary of this Inner AOI incorporated large portions of a geographical area north of SH 6 and south of Beltway 8 that was already developed. Therefore, any development in this area is likely the result of existing land use patterns, and not the proposed project. As a result of the evaluation on the existing roadway network and current development the Inner AOI stops at SH 6 (Exhibit 34). Additionally, the 30- and 45- minute travel contours cover and extend beyond the H-GAC travel demand model area and the Houston region; therefore, both travel contours were eliminated from the AOI.

After an evaluation of the roadway system within the project vicinity and an analysis of whether any induced development-shifting circumstances were present, the proposed Grand Parkway Segment C 15- minute travel shed (AOI) incorporates about 588 square miles (376,900 acres) including the communities of Needville, Fairchilds, Pleak, Thompsons, portions of Missouri City, parts of Sugar Land, and Arcola (Exhibit 35). The majority of subdivisions within the AOI are located in the northern portion with some scattered subdivisions on the outside edges of this boundary (Exhibit 35). Additionally, the majority of these subdivisions were developed after 2006. Travel contours in the project area for the 2035 No-Build scenario remained unchanged with respect to the Build 2035 scenario, and therefore, the AOI for the Build and No-Build remains constant. The study area previously identified to determine direct effects was approximately 108,000 acres, while the AOI is 376,900 acres. The previous study area was the geographic boundary within which alternative corridor locations were developed and direct effects were assessed, while the AOI is the geographic boundary within which possible indirect effects could occur.

The Expert Panel was presented with a land-use map, which presents historic snapshots of residential and other development from 1985 through 2006 (Exhibit 35). This map summarizes land development over the past 24 years. The Expert Panel was also presented with a year 2008 base map showing existing residential and commercial development, parks, wetlands, and floodplains, as well as planned developments.

The Expert Panel's goal was to provide a basis for the Study Team's assessment of future land-use changes by predicting where, when and in what manner land within the AOI might develop under both the No-Build and Build Alternative. From this, the Study Team could then determine what growth, and hence, what indirect impacts could be attributed to the development of the proposed Grand Parkway Segment C. The Expert Panel and Study Team determined that land within

the AOI that was already developed would not change, planned developments would continue as planned, and parks, wetlands, and floodplains would not develop due to the additional cost, difficulty, and regulatory constraints associated with their development. The remaining undeveloped land free from constraints comprised approximately 190,200 acres within the AOI. This undeveloped land was analyzed for development potential and land uses were allocated under both the No-Build and Build Alternative.

During public involvement activities (see Section 7 of this volume), citizens indicated that they would use the proposed project as a link to the existing interstate or state highways for travel to areas outside Houston. Major roadways located within or bordering the AOI include US 59, SH 6, FM 2759 (Crabb River Road), FM 762, FM 521, FM 1462, and SH 288. US 59 and SH 288 are two radial highways connecting Houston to its suburbs and beyond. No reasonable freeway alternative connecting major radial facilities exists in the AOI and travelers are forced to access SH 6 or Beltway 8 for east-west travel. Secondary roads include FM 2759, FM 762, FM 521, and FM 1462; however, none provide a continuous connection from US 59 to SH 288 and the majority of AOI lacks transportation infrastructure.

To refine the evaluation to identify the potential for indirect effects attributed to the Grand Parkway Segment C project in a partially developing area, the guidance in NCHRP Report 466, Desk Reference for Estimating Indirect Effects of Proposed Transportation Projects (NRC, 2002) was utilized as a second evaluation. NCHRP Report 466 states, "development effects are most often found up to 1 mile around a freeway interchange, up to 2 to 5 miles along major feeder roadways to the interchange, and up to ½ mile around a transit station." Based on this development scenario, the Area of Potential Indirect Effect was developed for the Grand Parkway Segment C project that included a 1-mile buffer around the Grand Parkway Segment C interchanges with US 59, and SH 288 and a 5-mile buffer placed along major feeder roadways with new intersections/interchanges (Sansbury Boulevard, FM 762, FM 521, and CR 48) (Exhibit 36). The Area of Potential Indirect Effect was then refined and other major roadways such as the remaining portion of US 59, SH6, and the remaining portion of SH 288 were not included due to the difficulty in discerning the effects of these established roadways from Grand Parkway Segment C. These roadways already have substantial development and are continuing to develop. Once the basic area was defined, further refinement was conducted based on the factors such as the potential for an area to support development considering existing and planned utilities and other infrastructure and availability of developable land. Consideration was also given to general access and mobility opportunity based on the inclusion of frontage roads associated with the proposed Grand Parkway Segment C project. The resulting Area of Potential Indirect Effect (Exhibit 36) is approximately 83,918 acres. For evaluation of the potential for indirect effects attributed to the Grand Parkway Segment C project, both the AOI, which is based on the 15-minute travel shed, and the Area of Potential Indirect Effect will be provided for each resource.

The land-use categories used by the Expert Panel are described in Table 5-2. They were evaluated in terms of their response to change; stresses imposed and their capacity to withstand these stresses; pertinent regulations, standards, and development plans that establish thresholds; and their current status.

**TABLE 5-2
LAND-USE CATEGORIES**

Land-Use Category	Definition
R1	High-density single family
R2	Low-density single family
R3	Multifamily
Master Planned Community	A suburban plan that includes homes and commercial, work, educational, and community facilities
Commercial	Retail, office, or industrial
Undeveloped	Would remain undeveloped due to a lack of demand
Undeveloped/Constrained	Would remain undeveloped due to a form of an environmental constraint (e.g., parks, wetlands, and floodplains)

Source: Study Team (2012).

Transportation improvements often reduce the time-cost of travel, enhancing the attractiveness of surrounding land to developers and consumers. Development on undeveloped land, or conversion of the built environment to more intensive uses, is often a consequence of highway projects (NRC, 2002). Changes in the traffic patterns and alteration of accessibility to the proposed Grand Parkway Segment C could influence the location of residential and commercial growth; subsequently, making the AOI more attractive to development.

Subsequently, the linear form of transportation corridors can result in a unique impact on ecosystems. Linear corridors may function as specialized habitats, conduits of movement, barriers or filters to movement, or sources of effects on surrounding habitats. Indirect effects of transportation projects that can have important consequences for ecosystems include (1) habitat fragmentation; (2) lethal, sublethal, and reproduction effects from pollution; (3) disruption of ecosystem functioning from direct mortality impacts; and (4) disruption of natural processes from altered energy flows (NRC, 2002).

5.3 STEP 2 – IDENTIFY THE STUDY AREA’S GOALS AND TRENDS

Existing zoning, future land use plans, and comprehensive plans identify the goals for the cities within the AOI. The cities of Needville, Rosenberg, and Arcola; villages of Fairchilds and Pleak; town of Thompsons; as well as portions of Missouri City and Sugar Land (**Exhibit 35**) lie within the AOI for the project. Many of these entities have developed plans that identify goals and objectives for the area and some include provisions for the proposed project.

5.3.1 City Goals

City of Sugar Land

The City of Sugarland has adopted the first five chapters of the “Vision 2025 City of Sugarland Comprehensive Plan” (July 2012). These chapters document the economic and demographic baseline, history of the city and planning initiatives, as well as the goals and objectives for the city. These goals and objectives support the Vision 2025, which was approved by Council in 2009. In general, they desire to have an attractive community that is safe and environmentally friendly and provides a living environment for citizens, which contains business, education, cultural, and recreational activities.

Additionally, they recognize that superior mobility is an important goal. They want to effectively move traffic through and to and from the city. While their land use section of the plan (Chapter 6) has yet to be approved by the Council, the past “Sugar Land 2021 – Our Vision” (City of Sugar Land, 2003) included a land use plan that provided for the consideration of the Grand Parkway project.

Missouri City

The City of Missouri City has adopted the “Missouri City Comprehensive Plan” (September 2009). The Comprehensive Plan provides information on the history and demographic trends of Missouri City, as well as addresses land use and community character, growth capacity, parks and recreation, mobility, and an overall strategy for executing the Comprehensive Plan. The Comprehensive Plan serves as a guide for the development of the City with respect to land use, thoroughfares and streets within the city and its ETJ as well as advocates mobility within the region. Key planning considerations for area’s mobility include:

- ◆ Achieving long-term solutions to traffic along regional corridors given continued population growth and development around the greater Houston area.
- ◆ Coordinating with other entities including other area cities, Fort Bend County, Harris County, the Fort Bend and Harris County Toll Road Authorities, and TxDOT to ensure that regional roadways can adequately accommodate projected future traffic volumes in the area.
- ◆ Developing and maintaining a system of arterial and collector streets that provide for multiple connections and travel options within and through the community versus concentrating traffic on only a few primary roadways.
- ◆ Maximizing flow and reducing traffic conflicts on existing roadways and ensuring carrying capacity is preserved on any future facilities through access management and other TSM strategies.

Although the Grand Parkway Segment C project is not within the City of Missouri ETJ, the implementation of the Grand Parkway Segment C appears to be consistent with the key planning considerations as discussed above.

City of Manvel

The City of Manvel has adopted a visionary future Comprehensive Development Plan (2007). This plan addresses future land use, transportation, utilities, drainage, governance, economic development, public facilities, and open space, as well as community image. As the city is located outside of the Grand Parkway Segment C construction area, the city plan does mention the Grand Parkway within the drainage section, which suggests that storm drain systems associated with the Grand Parkway would outfall into primary drainage systems in the area. The plan also notes that in the past, the City of Manvel has relied heavily on the state and county for planning of its transportation corridors.

Village of Pleak

The Village of Pleak Comprehensive Plan was published in March of 2009. The plan focuses on project growth, land use, infrastructure, transportation, roadway planning, and parks. The Village of Pleak is located at the intersection of the proposed Spur 10 extension, proposed Fort Bend Parkway extension and SH 36. The plan defers roadway infrastructure and transportation to Fort Bend County and TxDOT, since they maintain or control most major roadways within the village. The Grand Parkway is referenced throughout the Comprehensive Plan.

Village of Fairchilds

The Village of Fairchilds does not currently have a comprehensive plan or thoroughfare plan available for review.

City of Arcola

The City of Arcola does not currently have a comprehensive plan or thoroughfare plan available for review. They do provide ordinance relating to platting and development within the city.

City of Rosenberg

The City of Rosenberg does not currently have a comprehensive plan available for review. They have developed a thoroughfare plan that depicts the existing city limits and roadways along with the proposed ETJ for the city and area roadways. The Grand Parkway Segment C is included on the thoroughfare plan map.

City of Needville

The City of Needville does not currently have a comprehensive plan or thoroughfare plan available for review.

Town of Thompsons

The town of Thompsons does not currently have a comprehensive plan or thoroughfare plan available for review.

Regional Planning Efforts - Houston Galveston Area Council

The H-GAC 2035 RTP Update defines transportation systems and services in the area containing the boundaries of the AOI. The RTP Update addresses regional transportation needs that are identified through forecasting current and future travel demand, developing and evaluating system alternatives, and selecting those options, which best meet the mobility needs of the region. The proposed facility is included in this plan.

5.3.2 Trends

The majority of the AOI is located in the southeast portion of Fort Bend County with a smaller portion located in northwest Brazoria County. The area falls within Gulf Coast State Planning Region 16 and is governed by the H-GAC. Based on the

review of aerial photography from the years 1985 to 2006, the northern reaches of the AOI have seen elements of new residential growth from the Houston metropolitan area, while much of the area is still characterized by sparse commercial and residential development, with the bulk of the land being level farmland.

Primarily rural until the 1970s, the suburban growth of Fort Bend and Brazoria counties has been closely tied to the economic prosperity of Houston. The lower cost of land in Fort Bend and other counties surrounding Houston has drawn residential development away from the central city to areas more affordable for the developer and homeowner. As bedroom communities increased throughout the 1980s, decentralization of Houston continued as jobs and retail sales began to follow homeowners to the suburbs. Over time, the Houston region has become a central city surrounded by smaller edge cities, large enough to support shopping and labor markets.

As shown in Exhibit 35, in 1985 there were only nine residential developments within the AOI. These included Brazos Landing, Colony Meadows, Crescent Lakes, First Colony, Greatwood, Lake Point, Laurel Oaks, Sandy Point Estates, and Williams Glen. By 1996, residential development included the following subdivisions: Alcorn Bend, Austin Meadows, Brazos Town Center, Avalon Villages of Avalon, Belgrand Estates, Bridgewater, Clairmont Acres, Commonwealth Estates, Dove Meadows, Fairchild Estates, Fairchild Manor, New Territory, Oaks of Rosenberg, Palmcrest, Plantation Lakes, Rivers Mist, Royal Meadow Lakes, Sandy Point Estates, Schlumberger, Seven Oaks, Sovereign Shores Estates, Sunrise Meadows, Sutton Forest, Sweetwater, Villages at Rosenberg, and Villages at Town Center. By 2006, expansion of residential development among the existing developments included Benton Park, Brazos Bend Oaks, Brazos Lake, Bridlewood Estates, Canyon Gate at the Brazos, Double M Ranch, The Lakes, Lincoln Park, Oak Lake Village, Randy Ridge, River Park, River Park West, Royal Lakes Estates, Royal Lakes Manor, Sienna Point, Sterling Lakes, Summer Lakes, Suncreek Ranch, and Valley Vistas Estates.

The residential pattern of recent developments, master-planned communities, contrasts sharply with the rural nature of traditional residences, clusters of homes or individual farm homesteads along FM roads located within the southern and eastern portions of the AOI. Many of the residences in more rural settings include farm-related structures such as garages, barns, storage buildings, and other agricultural outbuildings. Many also appear to be smaller than the new homes more recently built in the northwestern portion of the AOI. Commercial and industrial land uses in the AOI are minimal and the bulk of the commercial land uses are in the northern portion of the AOI near US 59 and FM 762. Travel-related gas stations and fast food restaurants are concentrated near US 59 and along Crabb River Road. Extending south along Crabb River Road are additional commercial services including auto mechanic shops, dry cleaners, storage areas, and mini-markets.

An important aspect of this growth is the conversion of rural land to developed land, a shift that is readily apparent within the AOI. As previously described in Section 3.3.1, the population growth forecasted over the next 30 years (98.3 percent for Fort Bend County and 45.6 percent for Brazoria County) suggests that the trend toward urbanization within the AOI would likely continue in the foreseeable future thereby continue to convert agricultural land and open space land to more urban land uses.

The H-GAC 2035 RTP Update defines transportation systems and services in the area containing the boundaries of the AOI. The RTP addresses regional transportation needs that are identified through forecasting current and future travel demand, developing and evaluating system alternatives and selecting those options, which best meet the mobility needs of the region. The proposed facility is included in this plan.

5.4 STEP 3 – INVENTORY THE STUDY AREA'S NOTABLE FEATURES

Indirect effects to resources outside the project area could occur within the AOI. Of these resources, the indirect effects analysis requires an assessment of potential indirect effects of the Grand Parkway Segment C project on the area's notable features. Notable features are generally described as sensitive species or habitats, valued environmental components that we seek to use, protect, or enhance, unique or unusual resources, or vulnerable elements of the human population, such as elderly, children disabled, low-income or minority populations.

Below is a list of notable features within the study area followed by a more detailed discussion of the features:

- ◆ Manford Elementary School
- ◆ Reading Jr. High School
- ◆ George Ranch High School
- ◆ Brazos Bend State Park
- ◆ The George Observatory
- ◆ A paintball course
- ◆ Private recreational parks and trails within the planned communities of Greatwood, Riverpark, Canyon Gate, and Bridlewood
- ◆ The Lake Worthington Conservation Area
- ◆ The Brazos River
- ◆ Austin's Woods
- ◆ Prime farmlands
- ◆ Wetlands
- ◆ Vegetation
- ◆ Wildlife habitat (including Bald Eagle and the Texas prairie dawn-flower habitat)
- ◆ Floodplains.

There are a number of schools in the study area. Manford Elementary School, located approximately 0.25 mile west of US 59 on FM 762, is in the Lamar CISD. Manford Elementary School serves grades pre-K through 5 and enrolled 632 students in 2011 (Great School, 2012). Reading Jr. High School and George Ranch High School, located along FM 762 east of Bridlewood Estates, both also in Lamar CISD, enrolled 1,540 and 1,783 students in 2011, respectively (Lamar CISD, 2012). The University of Houston Sugarland is located south of US 59 at University Boulevard. The University of Houston Sugarland enrolled 2,626 students in the fall semester of 2011 (University of Houston Sugarland, 2012).

There are a number of parklands in the study area. Brazos Bend State Park covers 4,897 acres, with an eastern boundary of 3.2 miles fronting the Brazos River on the southeast border of Fort Bend County. Open to the public since 1984, the park has facilities for campers, a 21.6-mile hike/bike trail, group picnic pavilions, and a ½-mile wheelchair accessible nature trail. While most of the park is in the Brazos River floodplain, there are also areas of flat upland coastal prairies. In addition to the Brazos River, Big Creek runs diagonally through the park and creates, in combination with man-made levees, numerous lakes, sloughs and bayous (TPWD, 1999).

The George Observatory, owned and operated by the Houston Museum of Natural Science, is located here and houses a 36-inch telescope built primarily for public viewing and education. The George Ranch Historical Park, which is open to the public, is owned by the George Foundation (privately owned) and encompasses 500 acres. It is located within the 23,000-acre George Ranch. Located in the Brazos Bend State Park, because of the area's dark night skies and proximity to Houston, the observatory houses one of the largest telescopes consistently available for public viewing in the nation.

Other recreation facilities in the area include a paintball course located just south of US 59 at Williams Wire Boulevard. There are a number of private recreational parks and trails within the planned communities of Greatwood, Riverpark, Canyon Gate, and Bridlewood.

The Lake Worthington Conservation Area, also within Fort Bend County, is a privately owned tract of land. The landowners have negotiated a conservation easement with the USFWS, which restricts development of the property. It is not open to the public.

Austin's Woods is considered a sensitive natural community found within Brazoria and Fort Bend counties. These coastal bottomland hardwoods are approximately 70-year old forest stands and are located throughout the study area. Due to the rapid urbanization of southeast Texas, wildlife resource agency staff have identified forested community types as a priority for protection, restoration and creation. Due to the rural nature of the AOI, prime farmlands would be considered a notable feature as would the Brazos River, wetlands, vegetation and wildlife habitat (including Bald Eagle and the Texas prairie dawn-flower habitat), and floodplains.

5.5 STEP 4 – IDENTIFY IMPACT-CAUSING ACTIVITIES OF THE PROPOSED ACTION AND ALTERNATIVES

Steps 2 and 3 of the indirect effects assessment have focused on the identification of trends, goals, and notable features. The next steps involve identification and assessment of impacts that may come into conflict with these goals and features. This step consists of listing the impact-causing actions of the project, the general types of impact-causing activities, and a description as to how they relate to the project (Table 5-3).

**TABLE 5-3
IMPACT CAUSING ACTIVITIES**

Type of Activity	Project Specific Activity	Relevant Details
Modification of Regime	Alteration of Ground Cover	Approximately 1,117 acres of existing land uses including approximately 955 acres of prime farmland converted to roadway ROW. Ground cover adjacent to the proposed project would be temporarily disturbed because of construction activities. BMPs would be in place to control soil erosion. When construction is complete, ground cover would be reestablished according to EO 13116 – Invasive Species.
Modification of Regime	Modification of Habitat	Approximately 26 acres of jurisdictional wetlands and waters of the U.S. would potentially be permanently impacted. These wetlands would most likely be impacted by the placement of fill material in the wetland to elevate the road. 872 acres of pastureland/grassland/ cropland and 153 acres of forestland would be directly affected by roadway ROW.
Modification of Regime: Resource Extraction	Flow Modification	Increase of impervious cover due to the construction of roadway ROW would result in an increase in runoff. Approximately 997 acres draining into individual streams. In addition, 349 acres of 100-year floodplains affected by proposed project.
Land Transformation and Construction: Land Alteration Access Alteration	New or Expanded Transportation Facility	New location four-lane controlled access highway with interchanges at US 59, FM 521, FM 762, and SH 288. Total ROW required is 1,117 acres. The air quality in the AOI is currently considered in poor health, because it is within the nonattainment area for ozone. In addition, the proposed project will result in changes in land use designations/increase mobility and access. All such actions can result in changes of traffic patterns and thus have the potential to indirectly impact air quality in the area.
Processing	Storage of Construction Materials	The contractor is responsible for all impacts to project specific locations, which may include storage areas, waste sites, and material sources outside the project limits. In addition, the contractor must certify compliance with all applicable laws, rules, and regulations pertaining to the preservation of cultural resources, natural resources, and the environment as directed in the TxDOT Standard Specification for Construction of Highways, Streets, and Bridges (2004). If the contractor chooses to use undeveloped land or another site for the storage of materials, impacts to natural resources may increase.

TABLE 5-3, CONT'D

Type of Activity	Project Specific Activity	Relevant Details
Land Alteration	Pavement Placement	The primary impact to vegetation resulting from site preparation and construction of the proposed project is the removal of existing vegetation from the ROW and any construction staging areas. Four vegetation community types would be impacted by the Preferred Alternative: pastureland/grassland/cropland, nonforested wetland, forested wetland, and forestland.
Resource Renewal	Revegetation	Seeding and replanting would be conducted in accordance with EO 13112 – Invasive Species. Other mitigation alternatives associated with on-site mitigation and off-site mitigation would continue to be investigated and evaluated by the GPA, TPWD, USFWS, EPA, and USACE. A compensatory mitigation plan will be submitted to the USACE as part of the Section 404 and Section 10 permit review process. It is anticipated that a nonwetland component would be incorporated, at the discretion of the TxDOT Houston District, into the mitigation plan to compensate for unavoidable impacts to nonregulated natural resources (riparian habitat, upland forest, etc.).
Changes in Traffic	Traffic Patterns/Environmental Justice	A Build Alternative would increase capacity and improve mobility throughout the project area. With these improvements, travel time on the local roadway network would also improve. In addition, mainlines and access roads provide motorists with new commute options as well as provide for changes in access on the existing roadway network. As such, some traffic patterns would change in the project area. The EJ communities would not experience a highly adverse disproportionate impact based on the project; but the proposed changes may be considered disproportionate.
Waste Emplacement and Treatment	Land fill	No impact or displacement of waste material is anticipated.
Chemical Treatment	Chemical Usage	No use of fertilizer is anticipated during revegetation. Periodic use of herbicide may occur during routine maintenance for the Build Alternative, as necessary.
Access Alteration	Travel	The Build Alternative would improve travel between US 59 and SH 288. Access throughout the area would be improved with the Build Alternative as there is currently no major transportation facility in the area.

Source: Study Team (2012).

5.6 STEP 5 – IDENTIFY POTENTIALLY SUBSTANTIAL INDIRECT EFFECTS FOR ANALYSIS

This step summarizes the methods used to identify indirect impacts and presents the framework for determining which impacts merit further analysis, or conversely, which impacts require no further analysis. The methods used to identify indirect impacts are primarily qualitative. This technique focused on the elements or indicators that characterize the AOI using ecological and social data from the baseline investigations. The discussion of indirect impacts is organized by three different types of impacts: encroachment-alteration impacts, induced growth impacts, and impacts related to induced growth.

5.6.1 Encroachment-Alterations Impacts

There are two major types of direct encroachment impacts as a result of transportation projects: changes in travel patterns and access, and direct relocation of homes, businesses, or public facilities. Indirect effects are commonly related to changes in land use, including conversion of land to transportation use. Changes in travel patterns may also occur in conjunction with transportation projects, including those where tolling is involved. When a transportation project is constructed, improved accessibility (direct effect) and the availability of undeveloped land may make an area more attractive for development.

The increased access anticipated to be provided by the project could be a sufficient condition for the intensification of development already occurring or planned. This might be especially true of the central and eastern portion of the AOI, which has a lower density of development, and therefore, the greatest potential for additional growth. However, based on the current economic conditions, the opportunity for project-caused intensification of development already occurring is minimal.

Ecological impacts may also occur with the increases in development. Vegetation and wildlife habitat would be replaced by urban development through a continuing net loss of established, late successional woody and herbaceous vegetation, fragmentation of remaining vegetation resources, and reduction of habitat connectivity in the larger area. Although the upland woods are less diverse and of lower value than riparian woods, they provide the important wildlife habitat component of cover for escape and concealment, particularly in areas subject to fragmentation due to development.

Furthermore other ecological effects to area waterways could occur with any increase in development. The area waterways could face water quality degradation from increased impermeable surface and increased nonpoint source pollution. Increased stormwater runoff could potentially introduce pollutants leading to toxicity and behavioral effects of various species resulting in degradation of habitats, which could elicit changes in reproductive behavior and rates, as well as changes in food sources. Ultimately, this trend could result in changes in ecosystem structure and function. The alteration of natural hydrological processes would indirectly alter energy flows, which would potentially change immigration and emigration of species and change the vegetative structure of the AOI.

While the location of the Grand Parkway Segment C was designed to minimize impacts to existing neighborhoods and residential subdivisions during the planning phases of the project, the proposed project could influence the perceived "rural nature" of the certain areas of the AOI. The rural portions of the AOI may have a more "suburban feel," which may be a concern to the existing residential communities.

5.6.2 Induced Growth Impacts

As previously discussed, indirect impacts related to land use that may occur within the AOI include development within the central and eastern portion of the AOI, which has a lower density of development, and therefore, the greatest potential for additional growth.

The research is mixed as to whether transportation improvements spur development, or if development creates the need for transportation improvements (Handy, 2002). For widening of existing roadways, as in the case of US 183, studies conducted by the University of Texas Center for Transportation Research and University of California at Davis found little relationship between this type of activity and local development permitting (Handy, 2002; Kockelman et al., 2000). Real estate professionals interviewed for the University of Texas Center for Transportation Research study agree in their assertions that accessibility provided by roadway projects is a necessary, but not sufficient condition for development of surrounding land. They state that other factors such as zoning and development regulations play a much more important role in the timing and location of development. However, the researchers caution that “. . . it would not be prudent to conclude that highway expansions have no impact on development.” Similarly, the University of California at Davis study concluded that urban highway expansion shows no evidence of generating new growth; however, it affects the pattern or distribution of existing growth.

Factors such as transportation access, visibility, utility availability, and zoning and development regulations provide a foundation for determining the timing and location of development. Within the AOI local land use planning efforts reflect the ongoing local transition from rural to suburban land use. However, the information gathered in chapter 3 and 4 and steps 1 and 2 indicate that the project area and AOI are developing and will continue to develop. Because the Grand Parkway project has been in the planning stages for several years, the study area cities have developed land use plans to accommodate the Build Alternative.

Local land use planning reflects the ongoing local rural to urban land use transition. Commercial and industrial land uses are influenced by transportation improvements as mobility and accessibility are key factors in the determination of transportation costs for businesses. Industrial and commercial land uses do not represent a substantial percentage of developed land within the AOI and the transition of rural areas to commercial and industrial uses along Grand Parkway Segment C would not be expected to be substantial.

The anticipated regional growth and new accessibility may bring economic benefits to the AOI cities in the form of new employment opportunities, which in turn may increase the local tax base. However, the development would change the land use patterns and may affect the current rural to suburban landscape.

According to the Urban Land Institute, transportation improvements are factored into planning but are not the driving force in these processes (Urban Land Institute, 2004). The general consensus is that regional economics is the primary driving force for regional development. The major effect of highways is seen in the distribution of the development within a region (FHWA, 2004). The proposed project would enhance mobility, potentially enhancing the rate at which planned development occurs; however, this would not constitute inducement of substantial net new growth. If improvements were not implemented, development within the area would likely continue, but at a potentially slower rate.

5.6.3 Effects Related to Induced Growth

The third type of indirect impact is related to induced growth. These are similar to encroachment-alteration effects, but occur as a result of induced growth. An example would be habitat fragmentation as a result of development induced by the proposed project. As previously discussed, no substantial induced development is anticipated based on historical development patterns and the current economic recession. As described in Step 2, residential and commercial development is consistent with area goals; therefore, the increased access and mobility of Grand Parkway Segment C is expected to compliment and facilitate the area's goals.

The third type of indirect impacts is the impacts that project-influenced land development and growth could have on the environment.

Discussions with the Expert Panel revealed that area cities are expected to experience induced growth as a result of the proposed Grand Parkway Segment C project. In addition, many notable features identified within the AOI during Step 3 evaluations may be impacted as a result of the induced growth. The following provides a summary of the potential induced growth development impacts associated with the information received from Expert Panel when considered against the notable features.

Induced growth effects have the potential to create substantial socioeconomic effects. New development would impact the current "rural nature" for portions of the area AOI. Community cohesion may be affected as well by the influx of new residential developments and commercial centers influencing how current residential communities view their neighborhoods. Improved mobility may also expand what resident's view as their community. However, the new development could also improve the economic conditions of the community by providing new patrons to local businesses, adding new business opportunities to stimulate the local economy, and converting existing land to higher tax assessment land uses for community tax collection.

Induced development could also impact cultural resources including nonarcheological historic-age resources and archeological resources. This impact could include changes to the historic setting as well as direct removal of the resource.

Ecological resources would also be impacted by induced growth. New developments could further fragment the existing habitat and vegetation as well as impact waters of the U.S. and water quality throughout the AOI. Additionally, farmlands would be substantially impacted by the induced development, as much of the development may occur on farmed parcels.

The AOI is part of the EPA designated eight-county HGB nonattainment area for O₃. The AOI is currently in attainment for all other NAAQS pollutants, refer to Section 4.6. Based on the results of steps 1 through 4 that evaluated the possible project-related actions that can indirectly impact air, it was determined that the proposed project would not be anticipated to cause indirect air quality impacts in the AOI. No change in attainment status is anticipated within the AOI area as the result of emissions associated with the proposed project. In order for the region to achieve O₃ attainment, a variety of point, nonpoint, and mobile source emission reduction strategies must be implemented for the entire HGB area as outline in the

SIP. Indirect air quality impacts from MSATs are unquantifiable due to existing limitations to determine pollutant emissions, dispersion, and impacts to human health. Emissions would likely be lower than present levels in future years as a result of the EPA's national control regulations (i.e., new light-duty and heavy duty on road fuel and vehicle rules, the use of low sulfur diesel fuel). Even with an increase in VMT and possible temporary emission increases related to construction activities, the EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions of on road emissions, MSATs, and the O₃ precursors VOC and NO_x. As the proposed project is not anticipated to result in indirect air quality impacts, further discussion in steps 6–7 below is not necessary.

Substantial indirect impacts to socioeconomic resources, cultural resources, ecological resources, air quality, and farmland resources may occur within the AOI. These resources will be further examined in steps 6 and 7, as appropriate.

5.7 STEP 6 – ANALYZE INDIRECT EFFECTS AND EVALUATE RESULTS

5.7.1 Land Use

Transportation projects located in rural areas such as the proposed Grand Parkway Segment C are likely to stimulate complementary land development. Complementary land development, such as highway-oriented businesses (gas stations, convenience stores, fast-food restaurants, motels), is more likely near interchanges in rural areas where property values were originally low. Factors influencing the likelihood and rate of development near rural interchanges include (1) the distance to a major urban area or regional center; (2) traffic volume on the intersecting road; (3) presence of a frontage road (greater potential for intensive development); and (4) availability of water and sewer and other infrastructure (NRC, 2002).

The AOI covers approximately 376,900 acres with approximately 189,200 acres (50.2 percent of AOI) being developed land.

The pattern of development anticipated for the proposed Grand Parkway Segment C includes interchange quadrants with US 59, FM 762, and SH 288. These quadrants have a higher visibility for motorists approaching the interchange from the main road and are often developed first (NRC, 2002). The Expert Panel has determined development at these interchanges would likely be new commercial development.

The proposed action is only one factor in creating favorable land development conditions. Other prerequisites for land development opportunities include the demand for new development, favorable local and regional economic conditions, adequate utilities, and supportive local land development regulations and policies.

Decisions to change current land-use patterns along these roadways could be a result of the indirect effects associated with travel demand of the Grand Parkway Segment C project. These effects on land use could mean that local jurisdictions would find opportunities to modify zoning, accommodate higher intensity uses, change local land-use type, or increase the

density of existing uses at these high-volume interchanges. These potential changes to land-use patterns, however, remain within the purview of local agencies.

Land-use controls exist in the form of comprehensive plans and zoning ordinances; therefore, proposed development would take place through the typical platting process. Cities within or adjacent to the AOI have adopted comprehensive plans and land-use plans including “Our Vision 2025 Comprehensive Plan (City of Sugar Land, 2012), the “2009 Comprehensive Plan” (City of Missouri City, 2009), and “Manvel A Visionary Future 2007 Comprehensive Plan” (City of Manvel, 2007); however, their ETJ only cover a portion of the AOI that may be affected by growth.

Based on discussions with the Expert Panel, it is anticipated under the Grand Parkway Segment C project, undeveloped land at or near entrance/exit ramps at highway interchanges and intersections would be anticipated to be developed for residential and commercial uses over time. Currently, there is a limited amount of undeveloped land at the US 59/Grand Parkway interchange with Riverpark Shopping Center located on the northeast corner of the interchange and Memorial Sugar Land Hospital on the northwest corner. Some undeveloped land exists northwest of the interchange (land along Ransom Road and US 59), with additional undeveloped land southeast of the interchange (land along US 59 service road), and on both sides of FM 2759. Current development at the proposed FM 762 interchange includes Brazos Gardens subdivision to the north and Bridlewood Estates to the south with undeveloped land along the existing Crabb River Road (FM 2759). It is anticipated that residential and commercial development would occur over time. Further south at the proposed Reading Road intersection there is currently residential development (Bridlewood Estates) to the west with undeveloped land north, east, and south. It is anticipated that residential development would occur over time. South of George Ranch a proposed interchange with FM 762 is located in an undeveloped area that would most likely be developed as residential over time. An additional FM intersection located south of Brazos Lakes subdivision is proposed in a currently undeveloped area. Over time, this area may become residential in nature. Just north of Brazos Bend Oaks subdivision, a proposed intersection with a future extension of Peters Road would provide access to Brazos Bend Oaks. Currently the land is undeveloped and it is anticipated that this area would become residential development over time. There is currently no development at the proposed interchange with FM 521. TDCJ Darrington Unit owns the land in all directions of this interchange; therefore, residential and commercial development is not anticipated to occur as a result of Grand Parkway Segment C in this area. Currently the area near the proposed intersection with CR 48 is comprised of scattered residential development and this type of development is anticipated over time. At the proposed SH 288 interchange, there is no current development; therefore, it is anticipated that potential commercial and residential development would occur over time.

Approximately 16,300 acres of developed land are within the Area of Potential Indirect Effect (4 percent of total AOI). Within the Area of Potential Indirect Effect, there are 67,626 acres of undeveloped land (18 percent of the total AOI) that could be indirectly impacted as a result of the Grand Parkway Segment C project. While nearly 18 percent of the AOI is available for development, indirect development would likely occur at interchanges and include a variety of land-use intensities such as convenience stores, gas stations, and residential. Due to the limited new access, exclusion of frontage

roads, indirect development as a result of the Grand Parkway Segment C project is only anticipated to occur along existing roadways and interchanges/intersections. There would be no indirect effects as a result of the No-Build Alternative.

5.7.2 Geology, Soils, and Farmlands

Construction of the proposed Grand Parkway Segment C and associated indirect development at proposed entrance/exit ramps and highway interchanges would result in a direct loss of some soils due to grading and soil removal at construction sites. Future construction may expose some geologic resources to erosion, but this type of exposure would be of short duration and is usually associated with grading, excavation, and placement of fill material. Typically, soils would be removed from the ROW and the remaining soils would be subject to compaction and increased erosion potential. These effects would be short term, localized, and manageable. Soil erosion and increased sedimentation of area waterbodies from indirect development that disturbs 1 or more acres are required to obtain authorization under the TPDES stormwater construction general permit; these impacts would be minimized through the requirement to prepare and obtain a TCEQ TPDES permit and associated SW3P.

Based on the development forecasted under the Grand Parkway Segment C project, additional prime farmland soils at proposed interchanges with US 59, FM 762, CR 48, and SH 288 would be converted to nonagricultural uses. Currently within the AOI, there are approximately 264,000 acres of prime farmland, of which 66,882 acres are within the Area of Potential Indirect Effect (18 percent of total AOI) that might be indirectly impacted as a result of the Grand Parkway Segment C project. There would be no indirect effects as a result of the No-Build Alternative.

5.7.3 Social

Indirect development may occur as a result of the Grand Parkway Segment C project and could affect residents nearby. Induced growth changes the intensity of the use of land caused by the project. For this proposed project, "induced growth is attributed to changes in accessibility caused by the project, which influences where development occurs" (NRC, 2002). The degree to which indirect development may occur is dependent on many variables and is difficult to predict. As previously mentioned, indirect development would likely occur at interchanges and include a variety of land-use intensities such as convenience stores, gas stations, and residential. In addition, indirect effects may include an increase in the density of existing residential areas as well as increases in utility and social service demands and the conversion of rangeland, cropland, and/or undeveloped land to additional residential or other urban forms of land use (NRC, 2002). Under the No-Build Alternative, land development would still occur in these interchange areas, but would likely be residential in nature as well as ancillary commercial development to support the anticipated residential growth.

Indirect development that may occur as a result of the proposed Grand Parkway Segment C could affect the daily lives of residents currently living within the AOI, particularly those that live in rural areas. The degree to which indirect development may occur is dependent on many variables and is difficult to predict. Existing residential areas may become more densely populated, utility and social service responsibilities may increase, and forest, pasture, and croplands may be converted to

additional residential areas or other urban forms of land use; thereby, decreasing area opportunities for a more rural lifestyle.

As suburbanization/development of the rural area continues, the rural connections between existing “neighbors” may be impacted as the forecasted development would occur in open areas and could potentially change the rural nature of the AOI. This could be perceived as a negative change to the existing rural community, if the community favors a rural lifestyle rather than a suburban lifestyle. To others, new development often means potential new jobs, increased economic utility, reduced travel times for users of the new roadway, and potentially reduced travel times for users on the current roadway network because of reduced congestion. For others, this change is unwanted and development is undesirable as land is converted to residential and commercial uses and area populations increase.

Within the AOI, there are minority and low-income communities that could be indirectly impacted by the Grand Parkway Segment C project. The minority communities are generally located adjacent to existing major thoroughfares and would not be directly impacted by the proposed project but could face changes in their existing travel patterns and commuting options. Additionally, communities and individuals that are considered to be low-income also exist in the AOI. These individuals could be indirectly impacted as they would pay a larger percentage of their income in tolls when compared to the general population, given the same level of use. If the toll is beyond the affordability of certain low-income travelers, they would have the alternative of utilizing the existing nontolled transportation network, along with the discontinuous access roads being developed as part of this project. As a result, those who are unable to afford the toll or could not maintain a toll tag could be denied the travel benefit (full reduction in travel time delay) associated with using the tolled facility. However, improvement in the local economy as discussed below could provide benefits to minority and low-income populations in the form of new job opportunities.

There would be no indirect effects as a result of the No-Build Alternative.

5.7.4 Economics

Indirect economic impacts would be tied to potential indirect development. An increase in commercial development would provide increased income, employment and earnings opportunities, and additional tax revenues. Residential growth could also increase tax revenues, which local governments could turn into increased and/or improved community services, use to maintain and improve local roadways, and improve and provide public recreational opportunities. Growth in residential/commercial development could increase the demand for consumer services, including but not limited to retail, banking, medical, and recreational. The Grand Parkway Segment C project would most likely encourage a mixture of residential and commercial, thereby potentially increasing the new employment and additional services within the AOI. There would be no indirect effects as a result of the No-Build Alternative.

5.7.5 Pedestrians and Bicyclists

Pedestrians and bicyclists could benefit from the indirect development of residential and commercial development including streets associated with the proposed Grand Parkway Segment C. This benefit could be further realized if pedestrian walkways and bicycle facilities are incorporated into plans for these new developments. Under the Grand Parkway Segment C project, proposed pedestrian walkways and bicycle facilities would be considered for incorporation where determined safe, reasonable, and feasible. The Grand Parkway Segment C project would not disrupt existing and planned pedestrian and bicycle facilities within the AOI. There would be no change in access to pedestrian and bicycle facilities under the No-Build Alternative.

5.7.6 Air Quality

Direct impacts on air quality and MSATs from the project are primarily those associated with the increased capacity and accessibility, as well as the resulting projected increases in VMT. EPA's new fuel and vehicle standards projected to reduce emissions of air pollutants and MSATs are expected to offset these impacts resulting from the increases in VMT. These net emissions reductions are expected to contribute to continued maintenance and improvement of air quality and MSAT levels in the AOI.

The potential indirect impacts on air quality and MSATs are primarily related to any expected development/redevelopment resulting from project's increased accessibility or capacity to the area. The project might be expected to cause an increased development in the area. This development would primarily consist of residential and commercial development. However, any increased air pollutant or MSAT emissions resulting from the potential development of the area must meet regulatory emissions limits established by the TCEQ and EPA, as well as obtain appropriate authorization from the TCEQ. Regulatory emission limits set by TCEQ and EPA are established to attain and maintain the NAAQS by assuring any emissions sources resulting from new development or redevelopment will not cause or contribute to a violation of those standards.

Therefore, because the project's potential direct and indirect impacts on air quality and MSATs are projected to be offset by federal fuel and vehicle control programs or state and federal regulatory programs, negative impacts on air quality are not anticipated.

5.7.7 Noise

Future increases in ambient noise levels associated with projected residential development are anticipated, especially in proximity to the proposed Grand Parkway Segment C. Under the Grand Parkway Segment C project, the network of future roadways and development would be expected to contribute to an increase in ambient noise levels. The density and type of future development within the AOI would contribute to the overall changes in noise levels. Current ambient noise levels would remain the same under the No-Build Alternative.

5.7.8 Water Quality

Development under the Grand Parkway Segment C project would result in some effects to water resources associated with projected regional and local developments resulting in increases in stormwater runoff levels and nonpoint source pollution. Development effects that contribute to water quality degradation include increased impermeable surface and increased nonpoint source pollution (e.g., from fertilizers, pesticides, sediments, and vehicle residues), which would result in increased stormwater runoff velocities and pollutant loads leading to impacts to surface waters, and subsequently, groundwater.

Increased stormwater runoff could potentially introduce pollutants leading to toxicity and behavioral effects of various species resulting in degradation of habitats, which could elicit changes in reproductive behavior and rates, as well as changes in food sources. Ultimately, this trend could result in changes in ecosystem structure and function.

The network of future roadways and subdivision streets associated with indirect development could contribute both the direct and indirect effects; however, the density and type of future development within the AOI would determine the amount and type of the runoff. Currently, there are approximately 1,059 miles of streams within the AOI, of those, approximately 307 miles of streams occur in the Area of Potential Indirect Effect. Regional and local stormwater regulations would minimize development effects as undeveloped land is developed; therefore, there are no substantial differences anticipated in water quality between the Build and No-Build alternatives.

5.7.9 Waters of the U.S., Including Wetlands

With the construction of the Grand Parkway Segment C project, some degradation of waters of the U.S., including wetlands, may occur from induced development within the AOI. Potential effects to waters of the U.S. from development include loss of wetland habitat as a result of placement of fill and degradation through encroachment and as a result of increased runoff.

The alteration of natural hydrological processes would indirectly alter energy flows, which would potentially change immigration and emigration of species and change the vegetative structure of the AOI. There are approximately 38,400 acres (10 percent of total AOI) of wetlands that occur within the AOI, of these, 9,633 (3 percent of total AOI) occur within the Area of Potential Indirect Effect. As described in Step 4 above, the proposed project is not anticipated to induce substantial new development in the AOI. Because planned development, rather than the proposed Grand Parkway Segment C, are driving changes in land use within the AOI, indirect effects to water resources from induced development associated with the proposed project would be insubstantial. However, the rate at which this planned development occurs could be enhanced by the proposed project, resulting in a faster occurrence of planned development.

Regardless of whether the indirect development would be public or private, these developments would have to comply with Sections 404 and 401 of the CWA, which regulates the filling of and encroachment on these resources. The USACE administers Section 404 of the CWA and operates under “no net loss” policy for wetlands, requiring avoidance and

minimization of impacts, and compensatory mitigation for unavoidable impacts. Compensatory mitigation may include mitigation banking under specific criteria defined and approved by the EPA and USACE; therefore, substantial indirect impacts to waters of the U.S., including wetlands, are not anticipated as a result of the Grand Parkway Segment C project. There would be no indirect effects to waters of the U.S., including wetlands as a result of the No-Build Alternative.

5.7.10 Vegetation and Wildlife Habitat

Development under the Grand Parkway Segment C project would impact vegetation and wildlife habitat through a continuing net loss of established, late successional woody and herbaceous vegetation, fragmentation of remaining vegetation resources, and reduction of habitat connectivity in the larger area.

With the construction of the Grand Parkway Segment C project, wildlife habitat is anticipated to be impacted by the indirect development resulting from the conversion of connected habitat to urban land uses. Currently, approximately 284,500 acres of pastureland/grassland/cropland and 74,600 acres of forestland exist within the AOI. Approximately 62,504 acres of pastureland/grassland/cropland (17 percent of total AOI) and 13,485 acres of forestland (4 percent of total AOI) occur within the Area of Potential Indirect Effect that would be potentially developed. There would be no indirect effects as a result of the No-Build Alternative.

5.7.11 Floodplains

The 100-year floodplains would pose a constraint to development under the Build and No-Build Alternative. This constraint relates to the regulation of these floodplains through federal, state, county, and local ordinances. While these ordinances do not prohibit development within the 100-year floodplain, they limit and regulate development to eliminate or reduce potential damage from future floods. There are approximately 135,800 acres of 100-year floodplains within the AOI, of which 26,328 acres (7 percent of total AOI) occur within the Area of Potential Indirect Effect.

EO 11988 (1977), Floodplain Management, and county and local ordinances would minimize floodplain encroachment to the extent allowable within the regulations, thereby preserving some of a floodplain's natural values. These values include retention of riparian vegetation buffers, which preserve wildlife habitat and provide natural filtration for improved water quality. Any indirect impacts to the 100-year floodplains would be required to comply with federal, state, county, and local regulations; therefore, indirect impacts as a result of the Build and No-Build Alternative are not anticipated.

5.7.12 Wild and Scenic Rivers

The proposed project is not situated in the vicinity of any river on the National Inventory of River Segments included in the National Wild and Scenic River System; therefore, no direct or indirect impacts to Wild and Scenic Rivers would occur.

5.7.13 Coastal Barriers

The proposed project is wholly outside any coastal barrier systems and would not directly or indirectly impact coastal barrier resources.

5.7.14 Coastal Zone Management

The proposed project is not within the Coastal Management Program boundary, and therefore coordination with the Coastal Zone Management Act is not required.

5.7.15 Essential Fish Habitat

The proposed project does not intersect tidally influenced coastal waters and would have no direct or indirect impact on EFH. Coordination with the NMFS is not required.

5.7.16 Threatened and Endangered Species

Upon review of information and maps provided by the TPWD, NDD, and USFWS, it was determined that two species, the Bald Eagle and the Texas prairie dawn-flower, would likely occur in the AOI and thus could potentially be impacted by the project.

To determine the potential indirect effects to threatened or endangered species, known occurrences of federally and state-listed species provided by the TPWD's NDD (TPWD, 2011b) were compared with forecasted development. This comparison revealed documented occurrences of threatened or endangered species within the forecasted development. Under the Grand Parkway Segment C project, any proposed development, public or private, would be subject to regulation under the ESA. Based on the protection provided under the ESA, indirect effects to threatened and endangered species are not anticipated. There would be no indirect effects as a result of the No-Build Alternative.

5.7.17 Cultural Resources

5.7.17.1 Nonarcheological Historic Resources

Potential indirect impacts to nonarcheological historic resources may include visual, noise, or other types of effects at distances well removed from the area of project construction. Increased development could increase incidences of looting and vandalism of historic resources. With the construction of the Grand Parkway Segment C project, the addition of commercial development near interchanges could have an indirect impact on nonarcheological historic resources. There would be no indirect effects as a result of the No-Build Alternative.

5.7.17.2 *Archeological Resources*

Indirect development could increase incidences of looting, vandalism, and nonscientific collecting of archeological resources. However, based on assumptions made by the Expert Panel, indirect project impacts would not be located within the AOI 100-year floodplains, which have a high probability for archeological resources. Under the Grand Parkway Segment C project, the addition of commercial development near interchanges could have an indirect impact on archeological resources. There would be no indirect effects as a result of the No-Build Alternative.

5.7.18 **Hazardous Materials**

Potential indirect impacts from hazardous materials locations could occur because of land disturbing activities from potential development, infrastructure, or utility improvements an indirect result of the proposed Grand Parkway Segment C construction. Under the Grand Parkway Segment C project, this risk could be minimized or avoided by conducting a Phase I ESA to identify potential hazardous materials prior to property acquisition and development. Under the No-Build Alternative, no indirect development would occur.

5.7.19 **Visual and Aesthetic**

The proposed Grand Parkway Segment C would alter the rural setting in which it is constructed. Effects to visual quality would take two forms: views of the proposed facility from various points, and views from the proposed facility of the surrounding landscape. With the construction of the Grand Parkway Segment C project, indirect development could alter the current visual landscape within the AOI. These developments, particularly commercial developments, would likely include streetlights and/or security lighting that would be expected to result in incremental and localized increases in ambient light levels, glare, and nightglow. The lighting, signage, landscape, and roadway designs would be used to enhance the aesthetics of the proposed AOI, not destroy it; therefore, indirect effects are anticipated to be minimal. Additional visual effects would potentially result from the elevated interchanges with US 59, FM 762, Reading Road, Peters Road, FM 521, CR 48, and SH 288. However, based on surrounding roadways, US 59, SH6, SH 288, and the urbanization of Brazoria and Fort Bend counties, these types of visual impacts would not be considered substantial. There would be no indirect effects as a result of the No-Build Alternative.

5.8 **STEP 7 – ASSESS CONSEQUENCES AND CONSIDER/DEVELOP MITIGATION**

5.8.1 **Land Use**

Long-term changes would occur to the land as a result of the Build Alternative and the No-Build Alternative. These changes are consistent with the goals/trends for the AOI as they would be approved and advanced by the impacted cities in accordance with a majority of the community planning initiatives. The land development would generally be private ventures and impacts that require mitigation would be included in the site design and construction. Although land changes

would occur as a result of the Build Alternative, it is anticipated that community planning initiatives would oversee and regulate the impacts to ensure that the changes are not adverse.

5.8.2 Geology, Soils, and Farmland

Prime farmland soils and local farm operations would be affected by the forecasted development under the Build Alternative. However, the farmers and ranchers of the various operations would be willing sellers as these ventures are private developments. Therefore, the resource of concern is actually the loss of prime farmland soils. The NRCS and other private entities are making concerted efforts to support the preservation of farmland by funding programs designed to purchase easements to limit land development. Additionally, the NRCS is working in partnership with local conservation districts and Resource Conservation and Development Councils to provide local jurisdictions with natural resource information, land use planning tools, and other technical assistance that can help communities develop comprehensive growth management plans.

It is anticipated that the Grand Parkway Segment C induced development would indirectly impact prime farmland soils within the AOI. However, as the induced development will primarily be associated with interchange areas, the indirect effects to prime farmland soils from induced growth resulting from the Grand Parkway Segment C would be considered moderate.

5.8.3 Social

It is anticipated that the construction of Grand Parkway Segment C project would increase the rate of development within the AOI, which may alter the sense of rural community that currently exists in some locations. Development in the AOI is already underway and more development is expected to occur both with and without the proposed Grand Parkway Segment C facility. However, the location and speed of development would also be dependent on how and where the communities within the AOI upgrade infrastructure, such as water, wastewater, and adjoining transportation facilities to support this new development. While forecasted development under the Build Alternative and the No-Build Alternative would potentially change the rural nature of the AOI, this development would potentially lead to additional supporting community services, such as recreational and emergency services throughout the AOI. Accordingly, increased community and recreational facilities would likely result in increased community and civic interaction. It is not anticipated that the induced development resulting from the implementation of the Build Alternative would have an adverse indirect effect on community cohesion or neighborhoods within the AOI. However, the induced development could be perceived as having adverse effects on those communities and persons who prefer a rural lifestyle to a more suburban lifestyle.

5.8.4 Economics

Long-term employment and economic benefits would be favorable as a result of the Grand Parkway Segment C project. Current industrial development and educational opportunities are transitioning this area from small suburban and semi-rural communities to a more suburbanized area. This transition would result in the area cities serving as residential and

service-providing supporting communities whose futures are more fully integrated into the economic dynamics of the Houston area. Although tax revenues could initially decrease within the AOI as a result of the Grand Parkway Segment C, this initial reduction would be offset by future increases in tax revenues anticipated with the new development, which would in turn pay potentially higher tax revenues. It is anticipated that the induced development resulting from the implementation of the Build Alternative would have a beneficial indirect effect on economic conditions within the AOI.

5.8.5 Pedestrians and Bicyclist

There is minimal potential for indirect impacts to existing pedestrian and bicyclist facilities. Some of the forecasted residential development would likely provide additional pedestrian and bicycle facilities. It is not anticipated that the induced development resulting from the implementation of the Build Alternative could have an adverse indirect effect on pedestrian and bicyclist facilities within the AOI.

5.8.6 Air Quality

The indirect impacts on air quality from the Build Alternative are addressed at the regional level by analyzing the air quality impacts of transportation projects in the H-GAC's 2035 RTP Update approved on January 25, 2011, and FY 2011–2014 TIP, as amended and proposed by H-GAC. The RTP and TIP were found to conform to the SIP on July 21, 2010.

A variety of federal, state, and local regulatory controls as well as local plans and projects have had a beneficial impact on regional air quality. The CAA, as amended, provides the framework for federal, state, tribal, and local rules and regulations to protect air quality. The CAA required the EPA to establish NAAQS for pollutants considered harmful to public health and the environment. In Texas, the TCEQ has the legal authority to implement, maintain, and enforce the NAAQS. The TCEQ establishes the level of quality to be maintained in the state's air and to control the quality of the state's air by preparing and developing a general comprehensive plan. Authorization in the Texas Clean Air Act (TCAA) allows the TCEQ to do the following: collect information and develop an inventory of emissions; conduct research and investigations; prescribe monitoring requirements; institute enforcement; formulate rules to control and reduce emissions; establish air quality control regions; encourage cooperation with citizens' groups and other agencies and political subdivisions of the state as well as with industries and the federal government; and to establish and operate a system of permits for construction or modification of facilities. Local governments having some of the same powers as the TCEQ can make recommendations to the commission concerning any action of the TCEQ that may affect their territorial jurisdiction, and can execute cooperative agreements with the TCEQ or other local governments. In addition, a city or town may enact and enforce ordinances for the control and abatement of air pollution not inconsistent with the provisions of the TCAA or the rules or orders of the TCEQ.

The CAA also requires states with areas that fail to meet the NAAQS prescribed for criteria pollutants to develop a SIP. The SIP describes how the state would reduce and maintain air pollution emissions in order to comply with the federal standards. Important components of a SIP include emission inventories, motor vehicle emission budgets, control strategies to reduce emissions, and an attainment demonstration. The TCEQ develops the Texas SIP for submittal to the EPA. One

SIP is created for each state, but portions of the plan are specifically written to address each of the non-attainment areas. These regulatory controls, as well as other local transportation and development initiatives implemented throughout the Houston area by local governments and other entities provide the framework for growth throughout the area consistent with air quality goals. As part of this framework, all major transportation projects, including the Build Alternative, are evaluated at the regional level by the H-GAC for conformity with the SIP.

5.8.7 Noise

Changes in the development within the AOI are anticipated to increase the ambient noise for the entire area. However, such impacts are not anticipated to be substantial.

5.8.8 Water Quality

Section 401 of the CWA Water Quality Certification of Federal Actions, such as permits for work in jurisdictional waters, requires BMPs be used to control erosion, sedimentation, and post-construction total suspended solids. In addition, water quality effects from development would be minimized by implementing an SW3P in compliance with TPDES requirements and Municipal Separate Storm Sewer System (MS4) in conjunction with city improvements. For construction projects disturbing more than 5 acres under the TPDES, an NOI is required to be submitted to the TCEQ prior to construction. In addition to the federal and state regulations in place, many local government ordinances include provisions that provide some level of water pollution prevention. This includes varying levels of water quality protection measures through processes such as site plan approval and construction site inspections to verify implementation of SW3Ps. Substantial indirect effects to water quality are not anticipated. The potential exists for some indirect effects to water resources from induced growth or from roadway contaminants from the Grand Parkway Segment C facility. However, by implementing mitigation measures these impacts would be considered minimal.

5.8.9 Waters of the U.S. including Wetlands

Changes in land use and related effects on wetlands and waters of the U.S. are currently occurring and are expected to continue. Induced development and corresponding excavation or increases in stormwater flow could encroach upon and/or affect aquatic resources by changing vegetation/wildlife habitat or hydrology and therefore potentially changing the size, functions, or value of the resources.

Regardless of whether the forecasted development would be public or private, these developments would have to comply with sections 401 and 404 of the CWA, which regulate the filling of and encroachment on these resources. The USACE administers Section 404 of the CWA and operates under a "no net loss" policy for protected wetlands, requiring avoidance and minimization of impacts, and compensatory mitigation for unavoidable impacts. Because of the USACE regulations, any potential loss of waters of the U.S. from the indirect developments would be mitigated to compensate the loss by the entity advancing the development.

5.8.10 Vegetation and Wildlife Habitat

The proposed project would indirectly affect undeveloped land or potential wildlife habitat through permanent conversion of these habitats into homes and commercial sites. Although no current direct mechanisms exist to mitigate directly for impacts to vegetation and wildlife habitat, some vegetation and habitat is protected. Any vegetation associated with a federal threatened or endangered species habitat would be protected under the ESA and would require mitigation, if impacted. Additionally, the USACE regulates wetlands, which can include bottomland hardwood forest, and other wetland areas defined by the USACE. This vegetation and associated wildlife habitat would be mitigated for through the USACE permitting process for any impacts to these resources. Additionally, forecasted indirect development could incorporate parks, green space, and tree coverage into their developments to provide some wildlife shelter and habitat and potentially offset some of the impacts to vegetation and wildlife habitat that was incurred.

5.8.11 Cultural Resources

5.8.11.1 Nonarcheological Historic-Age Resources

The forecasted development in the AOI under any alternative, including the No-Build Alternative, may fall under federal or state regulatory resource protection review based on development funding sources. Transportation projects using federal funding require consideration of effects to historic (NRHP-listed or -eligible) resources under Section 4(f) of the DOT Act and under Section 106 of the National Historic Preservation Act. Additionally, most development requiring federal permits would also require consideration of historic properties under Section 106. Finally, development using state or county funds could require consideration of impacts to significant resources qualifying for SAL designation under the Antiquities Code of Texas. If development in the AOI was sponsored by federal, state, or local entities or used federal funds or permits, the historic properties in the AOI could be protected or preserved. However, if development was privately sponsored and no federal permit or action was necessary, the historic resource could be impacted with no investigation or mitigation. The potential exists for indirect impacts from forecasted development for both the Build and No-Build Alternatives. As mentioned above, these impacts could be offset depending on the type of development advanced. Overall, the impacts to these resources would not be considered substantial.

5.8.11.2 Archeological Resources

A possibility exists for indirect impacts to archeological resources in the AOI as land is converted to residential and commercial uses. Development in the floodplain would be minimized, thereby protecting the areas with some of the greatest potential for buried and preserved archeological resources. Some of the development under these alternatives may fall under federal or state regulatory resource protection review; therefore, future archeological investigation for induced development would be conducted for archeological sites for integrity and significant by others. Mitigation of the sites that offer potential to provide additional scientific information would be conducted by others.

5.9 SUMMARY

The degree to which indirect development may occur is dependent on many variables. Based on discussions with the Expert Panel, indirect development would likely occur at the interchange with US 59, FM 762, CR 48, and SH 288 and include a variety of land uses such as convenience stores, gas stations, retail strip malls, restaurants, office buildings, and residential, including multifamily. In addition, indirect effects may include an increase in the density of existing residential areas as well as increases in utility and social service demands and the conversion of rangeland, cropland, and/or undeveloped land to additional residential or other urban forms of land use.

This summary does not account for the potential decreases or increases in impacts associated with the potential redistribution of development from other parts of the region. The effects of induced development from the proposed Grand Parkway Segment C include increased development at or near interchanges resulting in loss of farmland and ecological resources, such as streams and wetlands and wildlife habitat; a shift in the rural character of the corridor as development occurs; and a degradation of water quality, due to changes in land use and increased impervious surfaces.

While the proposed Grand Parkway Segment C could potentially cause indirect effects from induced development, this development and its resulting effects are not considered substantial due to the continual urbanization of Brazoria and Fort Bend counties, including planned developments within the AOI, when compared with the No-Build Alternative. The anticipated indirect effects to the resources evaluated in this analysis are not likely to be substantial. Table 5-4 summarizes the indirect effects anticipated as a result of the proposed Grand Parkway Segment C.

**TABLE 5-4
SUMMARY OF INDIRECT EFFECTS**

Resource/Issue	Indirect Impacts
Land Use	67,626 acres of indirect impacts (18% of the AOI). Indirect development in the AOI would be consistent with all local and state government plans and policies.
Geology, Soils, and Farmlands	66,882 acres of indirect impacts to prime farmlands (18% of the AOI).
Social	In the AOI, rural areas are anticipated to continue to transition into a suburban setting near the intersections of US 59 FM 762, CR 48, and SH 288. New development would provide services, offices, and some housing for residents living within the AOI.
Economics	An increase in commercial development would provide increased income, employment and earnings opportunities, and additional tax revenues within the AOI. Residential growth could also increase tax revenues, which local governments could turn into increased and/or improved community services, maintain and improve local roadways, and improve and provide public recreational opportunities.
Pedestrians and Bicyclists	Pedestrians and bicyclists could benefit from the indirect development of future residential and commercial development including streets associated with the proposed Grand Parkway Segment C. However, because the proposed project would be on new location it would not indirectly impact existing pedestrian or bicyclist facilities.
Air Quality	The MSAT analysis does not indicate an appreciable difference in MSAT emissions in 2035 between the Build and No-Build alternatives.

TABLE 5-4, CONT'D

Resource/Issue	Indirect Impacts
Noise	Future increases in ambient noise levels associated with projected development are anticipated, especially in proximity to the proposed Grand Parkway Segment C. The network of future roadways and development would be expected to contribute to an increase in ambient noise levels.
Water Quality	307 miles of streams have been identified within the Area of Potential Indirect Effect. Development could result in adverse effects to water resources through degradation of surface water and groundwater, more rapid discharge to stormwater, and additional pollutant loadings of waterways
Waters of the U.S. including Wetlands	Some degradation of waters of the U.S., including wetlands from induced development potentially affecting 9,633 acres of wetlands (2% of the total AOI) occur in the Area of Potential Indirect Effect.
Vegetation and Wildlife Habitat	Induced development may affect approximately 62,504 acres of pastureland/grassland/cropland (17% of the AOI) and 13,485 acres of forestland (4% of the AOI) in the Area of Potential Indirect Effect.
Floodplains	Indirect development would not occur within 100-year floodplains. Access points to the proposed Grand Parkway Segment C are limited to intersection with US 59 and SH 288, outside of the 100-year floodplains to minimize any potential for future floodplain development.
Wild and Scenic Rivers	The AOI is outside of any river on the National Inventory of River Segments included in the National Wild and Scenic River System; no indirect impacts to wild and scenic rivers.
Coastal Barriers	The AOI is outside of any coastal barrier systems; no indirect impacts to coastal barrier systems.
Coastal Zone Management	The AOI is outside of any coastal zone management; no indirect impacts to coastal zone management.
Essential Fish Habitat	The AOI is outside of any tidally influenced coastal waters; no indirect impacts to EFH.
Threatened and Endangered Species	Based on the limited occurrence of the Bald Eagle and the Texas prairie dawn-flower within the AOI and the protection provided under the ESA, indirect effects to threatened and endangered species are not anticipated.
Nonarcheological Historic Resources	There is a possibility for indirect impacts to nonarcheological historic resources in the AOI as land is converted to residential and commercial uses.
Archeological Resources	There is a possibility for indirect impacts to archeological resources in the AOI as land is converted to residential and commercial uses. Development in the floodplain would be minimized; thereby, protecting the areas with some of the greatest potential for archeological resources.
Hazardous Materials	Risk associated with land disturbing activities could be minimized or avoided by conducting a Phase I ESA to identify potential hazardous materials prior to property acquisition and development.
Visual and Aesthetics	Effects include alteration of the rural setting and indirect development would result in increases in ambient light levels.

Source: Study Team (2012).

5.10 REGIONAL INDIRECT EFFECTS OF TOLL FACILITIES AND MANAGED LANES

The freeway and toll road system is a major component of the Houston-Galveston regional roadway network. Currently, the freeway/toll road system represents nearly 19 percent of regional lane miles. The 2009 regional roadway network consists of nearly 24,571 total lane miles. This includes nearly 658 tolled lane miles and 289 managed lane miles (Table 5-5). By 2035, these numbers are expected to increase to 27,997 lane miles of which 1,584 are tolled lane miles, and 425 are managed lane miles.

**TABLE 5-5
REGIONAL ROADWAY NETWORK (LANE MILES)**

	Freeway	Toll Roads	Managed Lanes	Arterial	Total Lane Miles
2009 Network	3,669	658	289	19,955	24,571
2035 Network	3,862	1,584	425	22,126	27,997

Source: GP-GEC (2012).

Note: Table data is based on the 2035 RTP Update conducted by H-GAC in 2011.

In addition, the transit system has 485,000 daily passenger boardings and is expected to increase to nearly 725,000 by 2035. This increase will be attributed to:

- ◆ Expansion of transit services (increased bus and rail transit services),
- ◆ New transit modes (commuter rail transit and signature express bus service),
- ◆ Transit connectivity to multiple employment centers, and
- ◆ Coordination of transit services among regional public transportation providers.

METRO's 2035 Long Range Plan recommends significant expansion of the current transit system and includes a network of integrated high capacity transit facilities on major travel corridors. This plan also identifies service expansions beyond the METRO service area. New improvements scheduled for implementation through the year 2035 include high-occupancy tolls, a new intermodal terminal, park-n-ride facilities, and several new high capacity transit corridors throughout the region. Additional key elements of the plan include:

- ◆ 89 miles of fixed guideway transit – Light Rail Transit (LRT)
- ◆ 84 miles of Commuter Rail Transit (CRT)
- ◆ 40 miles of Signature Bus (H-GAC, 2009)

Figure 5-1 shows the future corridor and capital facilities projects in the 2035 METRO Long Range Plan.

Figure 5-1
2035 Future Corridor and Capital Facilities Projects



Source: H-GAC (2009).

Conclusion

The expanding regional roadway network, including tolled facilities and managed lanes, along with the expanding transit network could have indirect and cumulative impacts. However, the impacts are not isolated to one location and would be better considered at the regional level. As a result, the consideration of the regional tolled roadway network is included in the cumulative impacts portion of this document.

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