



Secondary and Cumulative Impacts Report

In support of the
Environmental Impact Statement

South Mountain Transportation Corridor in Maricopa County, Arizona

Arizona Department of Transportation
Federal Highway Administration
in cooperation with
U.S. Army Corps of Engineers
U.S. Bureau of Indian Affairs
Western Area Power Administration



April 2013

Federal-aid Project Number: NH-202-D(ADY)
ADOT Project Number: 202L MA 054 H5764 01L



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Abstract: This document assesses and describes the cumulative and secondary impacts that would occur as a result of the construction and operation of the proposed South Mountain Freeway, as adopted in the 2003 *Regional Transportation Plan*. Contents of this document will be presented in Chapter 4 of the South Mountain Transportation Corridor Environmental Impact Statement.

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List of Acronyms and Abbreviations

ADOT	Arizona Department of Transportation
C	Central
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
CISA	cumulative impact study area
Community	Gila River Indian Community
E	Eastern
E1	E1 Alternative
EIS	environmental impact statement
EJ	environmental justice
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
FR	Full Reconstruction
I-10	Interstate 10
MAG	Maricopa Association of Governments
MSAT	mobile source air toxic
NEPA	National Environmental Policy Act
PM_{2.5}	fine particulate matter
PR	Partial Reconstruction
SMPP	Phoenix South Mountain Park/Preserve
SMTC	South Mountain Transportation Corridor
SR	State Route
TI	traffic interchange
VMT	vehicle miles traveled
vpd	vehicles per day
W	Western
W101CFR	W101 Alternative, Central Option, Full Reconstruction
W101CPR	W101 Alternative, Central Option, Partial Reconstruction
W101EFR	W101 Alternative, Eastern Option, Full Reconstruction
W101EPR	W101 Alternative, Eastern Option, Partial Reconstruction
W101WFR	W101 Alternative, Western Option, Full Reconstruction
W101WPR	W101 Alternative, Western Option, Partial Reconstruction
W59	W59 Alternative
W71	W71 Alternative

Glossary

capacity	The maximum number of vehicles that a given section of roadway or traffic lane can accommodate.
cumulative impact	The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 Code of Federal Regulations § 1508.7)
direct impact	A change caused by the action that occurs at the same time and same place as the action.
Eastern Section	The portion of the Study Area located east of 59th Avenue.
environmental impact statement (EIS)	Project documentation prepared in accordance with the National Environmental Policy Act when a project is anticipated to have a significant impact on the environment.
Federal Highway Administration (FHWA)	A branch of the U.S. Department of Transportation responsible for administering the Federal-aid Program. The program provides financial resources and technical assistance for constructing, preserving, and improving the National Highway System along with urban and rural roads.
mitigation	An action taken to reduce or eliminate an adverse impact stemming from construction, operation, or maintenance of a proposed action alternative. Mitigation could reduce the magnitude and extent of an impact from a level of significance to a level of insignificance. Mitigation includes <i>avoiding</i> the impact altogether by not taking a certain action or parts of an action; <i>minimizing</i> impacts by limiting the degree of magnitude of the action and its implementation; <i>rectifying</i> the impact by repairing, rehabilitating, or restoring the affected environment; <i>reducing</i> or <i>eliminating</i> the impact over time by preservation and maintenance operations during the life of the action; and <i>compensating</i> for the impact by replacing or providing substitute resources or environments. (40 Code of Federal Regulations § 1508.20)
secondary impact	A change caused by an action that is later in time or farther removed in distance, but is still reasonably foreseeable. Secondary impacts may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and in related effects on air, water, and other natural systems, including ecosystems. Also referred to as indirect impacts.
Study Area	The geographic area within which action alternative solutions to the problem are developed.
Western Section	The portion of the Study Area located west of 59th Avenue.

1. Project Description and Purpose and Need

Project Description

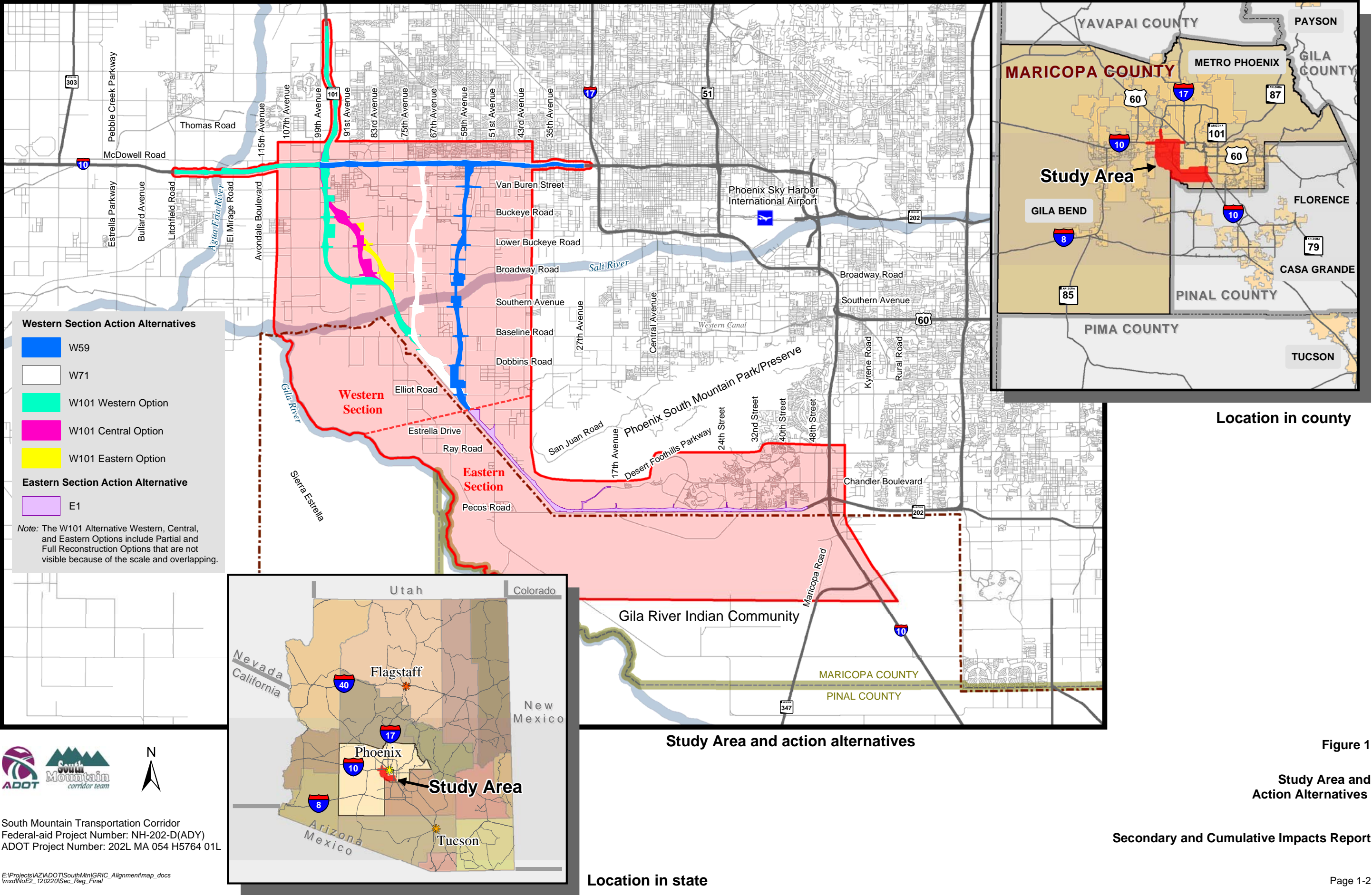
The Arizona Department of Transportation (ADOT) is studying the South Mountain Transportation Corridor (SMTC) in southern Phoenix, Maricopa County, Arizona. The South Mountain Freeway corridor was adopted into the Maricopa Association of Governments (MAG) regional freeway system in 1985 as part of the *MAG Freeway/Expressway Plan* (MAG 1985), at which time it was placed on the state highway system by the State Transportation Board. In 1988, ADOT prepared a design concept report and a state-level environmental assessment for the project, identified at that time as the South Mountain Parkway (ADOT 1988a, 1988b). As presented then, the project would connect Interstate 10 (I-10) (Maricopa Freeway) south of Phoenix with I-10 (Papago Freeway) west of the city, following an east-to-west alignment along Pecos Road through the western tip of the Phoenix South Mountain Park/Preserve (SMPP), then north to I-10 between 59th and 99th avenues. Because of the time elapsed since those documents were approved and to secure eligibility for federal funding for a proposed project within this corridor, ADOT and the Federal Highway Administration (FHWA) are now preparing an environmental impact statement (EIS) in accordance with the National Environmental Policy Act (NEPA). In November 2004, the MAG *Regional Transportation Plan* (2003) was placed before Maricopa County voters, who approved the sales tax funding the plan. The South Mountain Freeway was included in this plan.

Alternatives considered for the SMTC included past freeway proposals as well as transportation system management, transportation demand management, transit improvements, arterial street network improvements, and land use controls. A freeway facility was determined to best address the project purpose and need. Therefore, this report discusses the potential impacts of a proposed freeway in the SMTC.

The Study Area for the EIS encompasses more than 156 square miles and is divided into a Western Section and an Eastern Section at a location common to all action alternatives (Figure 1). The division between sections occurs just east of 59th Avenue and south of Elliot Road.

Within the Western Section, three action alternatives are being considered for detailed study. These are the W59, W71, and W101 Alternatives. The W59 Alternative would connect to I-10 at 59th Avenue, while the W71 Alternative would connect at 71st Avenue. The W101 Alternative would connect to I-10 at the existing State Route (SR) 101L (Agua Fria Freeway)/I-10 system traffic interchange (TI) and has six associated options. The W101 Alternative options vary geographically among the Western (W), Central (C), and Eastern (E) Options and would vary geometrically based on a Partial Reconstruction (PR) or a Full Reconstruction (FR) of the system TI.

Improvements to I-10 (Papago Freeway) would occur for each Western Section action alternative (W59, W71, and W101). Improvements to SR 101L would occur for each option associated with the W101 Alternative.



Project Description and Purpose and Need

Within the Eastern Section of the Study Area, one action alternative is being considered. The E1 Alternative would begin near Elliot Road and 59th Avenue and proceed to the southeast to Pecos Road, which it would follow to the east until connecting to I-10 (Maricopa Freeway) at the Pecos Road/I-10/SR 202L (Santan Freeway) system TI.

The action alternatives and options are summarized in Table 1.

Table 1. Action Alternatives and Options

Section	Interstate 10 Connection	Action Alternative	Option – Broadway Road to Buckeye Road	Option – State Route 101L/ Interstate 10 Connection Reconstruction	Option Name
Western	59th Avenue	W59	— ^a	—	—
	71st Avenue	W71	—	—	—
	State Route 101L	W101	Western	Partial Reconstruction	W101WPR
				Full Reconstruction	W101WFR
			Central	Partial Reconstruction	W101CPR
				Full Reconstruction	W101CFR
			Eastern	Partial Reconstruction	W101EPR
				Full Reconstruction	W101EFR
Eastern	Pecos Road	E1	—	—	—

^a not applicable

The No-Action Alternative is being considered for the entire Study Area.

Purpose and Need

An analysis of population trends, land use plans, and travel demand shows that a considerable traffic problem in the Phoenix metropolitan area is projected for the future, resulting in the need for a new freeway in the SMTC. This traffic problem is likely to worsen if plans are not made to accommodate the regional travel anticipated. The purpose of a freeway within the SMTC is to support a solution to traffic congestion. Between the early 1950s and the mid-1990s, the metropolitan area grew by over 500 percent, compared with approximately 70 percent for the United States as a whole (MAG 2001). From 1980 to 2005, the Maricopa County population more than doubled, from 1.5 million to 3.7 million. The MAG region has been one of the fastest-growing metropolitan areas in the United States; Phoenix is now the fifth-largest city in the country, and the region ranks as the 12th-largest metropolitan area in the country.

Travel demand and vehicle miles driven in the metropolitan area are expected to increase at a faster rate than the population. MAG projections (conducted in collaboration with the Arizona Department of Economic Security) indicate Maricopa County's population will increase from 3.7 million in 2005 to 6.5 million in 2035 (MAG 2009). It is projected that in the next 25 years, daily vehicle miles traveled (VMT) will increase from 101 million to 185 million.

Project Description and Purpose and Need

Even with anticipated improvements in light rail service, bus service, trip reduction programs, and existing roads and freeways, vehicle traffic volumes are expected to exceed the capacity of Phoenix metropolitan area streets and highways by as much as 11 percent in 2035. A freeway within the SMTTC would accommodate approximately 6 percentage points of the 11 percent of the unmet travel demand and would be part of an overall traffic solution.

2. Secondary Impacts

Regulatory Basis

According to the Council on Environmental Quality (CEQ), a direct impact is one that is caused by the proposed action and occurs at the same time and place. The direct impacts of the action alternatives have been discussed in other resource area technical reports. CEQ also requires consideration of secondary impacts of the proposed action. Secondary impacts (sometimes referred to as indirect impacts) 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 land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems” (40 Code of Federal Regulations [C.F.R.] § 1508.8). Analysis of secondary impacts revealed few differences (with one exception) among the action alternatives. Therefore, except where noted, the impacts discussion focuses on the proposed action, which considers all of the action alternatives.

Resources Not Subject to Secondary Impact Analysis

The relation of the proposed action to social, cultural, technical, economic, and natural components of the environment was reviewed to determine the potential for secondary impacts to occur. Based on this assessment, certain resources were excluded from analysis. The rationale for deciding which resources would not be given further consideration for secondary impact analysis is presented in Table 2.

Table 2. Resources Not Considered for Secondary Impact Analysis

Resource	Rationale
Topography	While the proposed action would alter topography in the Study Area, the direct impacts from the proposed action are adequately presented in the topography section of this chapter. Therefore, no further consideration is given because the proposed action is not expected to cause topographic changes beyond direct impacts.
Energy	While construction and operation of the proposed action would result in the direct use of energy, the proposed action and its alternatives would not use energy at a magnitude or rate beyond consumption as determined if no action were undertaken. Therefore, no further consideration will be given because the proposed action is not expected to vary usage levels considerably from existing and projected traffic patterns.
Utilities	While construction of the proposed action would require the relocation and adjustment of utilities, no new utility projects are identified in the Study Area to support the proposed action. Therefore, no further consideration is given
Environmental justice	The evaluation to determine whether disproportionate impacts on any environmental justice (EJ) population would occur revealed that all action alternatives would have direct impacts on Title VI and EJ populations. Considering the proposed action would be accessible to all populations in the Study Area, the impacts would not be disproportionately high, and mobility benefits would occur. Benefits would include enhanced access to and from employment opportunities and enhanced movement of goods and services for improved access to such goods and services for all population segments. Therefore, no secondary impacts would occur.

Table 2. Resources Not Considered for Secondary Impact Analysis

Resource	Rationale
Recreational land ^a	For purposes of this report, recreational land has been considered [lands eligible for listing in the National Register of Historic Places are addressed in the <i>Cultural Resources</i> section; wildlife refuges as defined by Section 4(f) do not occur in the Study Area and, therefore, do not apply]. Section 6(f) lands would not be affected by the proposed action and, therefore, no further consideration is warranted. The Section 4(f) process required consideration of direct and indirect impacts; therefore, the Section 4(f) evaluation performed for this project adequately considered secondary impacts, and no further consideration is given to recreational land.
Noise	Noise is an unwanted sound that can intrude on and have effects on the resources of the human and natural environments. The noise analysis conducted for the proposed action took into account projected future noise from traffic on the proposed action. No additional, noise would be expected because of the proposed action. Therefore, the noise analysis performed for this project adequately considered secondary impacts and no further consideration is given.
Hazardous materials	Hazardous material sites are a byproduct of the human environment. The hazardous materials section of this chapter considered the direct and indirect potential for the proposed action to disturb such sites; therefore, no further consideration is given.
Demographics	Because this project and other transportation projects have been designed to respond to population forecasts (as opposed to encouraging population growth where it might not otherwise occur), no secondary impacts on demographics have been identified. Therefore, no further consideration is given.
Wild and scenic rivers	No wild and scenic rivers occur in the Study Area; therefore, no secondary impacts would occur. No further consideration is given.
Sole source aquifer	No sole source aquifers occur in the Study Area; therefore, no secondary impacts would occur. No further consideration is given.
Floodplains	The proposed action may cause changes in land use development at select locations adjacent to its alignment. In some instances, such changes may be proposed within the designated floodplains within the Study Area. Ultimately, however, incompatible use or development within floodplains would not be facilitated by the proposed action. Developments within the area must comply with State and local zoning and floodplain ordinances; therefore, no secondary impacts would occur.
Visual quality	The proposed freeway would be a part of the transition in land use from low-density, open uses to residential, commercial, and light industrial uses. This is a trend that is underway and would continue with or without the proposed freeway. The direct impacts resulting from road cuts proposed for the western end of the South Mountains are adequately presented in the topography section of this chapter and no additional impacts would occur; therefore, no secondary impacts would occur.

^a Recreational land is defined as resources afforded protection under Section 4(f) of the Department of Transportation Act and under Section 6(f) of the Land and Water Conservation Fund Act.

Resources Subject to Secondary Impact Analysis

Critical resources warranting secondary impact analysis are presented in this section. The resource, the proposed action impact and reasonably foreseeable impact are presented in the following sections.

Biological Resources

Habitat

By improving the regional transportation network, the proposed action could enhance access to natural land planned for development and, therefore, contribute to an increase in planned land conversion, although the conversion of natural land to residential and commercial development would be expected with or without the proposed action. Data pertaining to habitat loss in the region can be found in the *Cumulative Impacts* section.

Vehicle-animal Collisions

The proposed action also could enhance access to natural land planned for development and, therefore, contribute to an increased number of conflicts between humans/vehicles and wildlife, although the conversion of natural land to residential and commercial development would be expected with or without the proposed action.

Native Plants

Because the proposed action would improve the regional transportation network, access to natural land planned for development could be enhanced. Therefore, the proposed action could contribute to an increase in planned land conversion, although the conversion of natural land to residential and commercial development would be expected with or without the proposed action.

Water Resources

Surface Water

Access to natural land planned for development could be enhanced because of the proposed action and, therefore, could contribute to an increase in the alteration of natural drainage features, although the conversion of natural land to residential and commercial development would be expected to occur with or without the proposed action.

Groundwater

The profile of the proposed action would be depressed in certain portions of the Study Area that have relatively high groundwater tables. Water falling on the freeway would be concentrated into low areas along depressed sections instead of draining off the freeway onto adjacent land and percolating into the groundwater. Water would then drain by gravity from the depressed sections of the freeway to the river.

The proposed action would improve the regional transportation network. Current and planned land uses in the Study Area use and are anticipated to use groundwater supplies. The proposed action could enhance access to land planned for development and, therefore, contribute to an increase in planned land conversion, although the conversion of natural land to residential and commercial development would be expected with or without the proposed action. Increased development would entail an increased presence

of impervious surfaces, such as roads, streets, roofs, parking lots, driveways, etc. Much of the runoff collected from such surfaces and conveyed off site would become water lost to local groundwater.

Air Quality

The transportation demand models used to project future traffic volumes consider demographic, employment, housing, and other related socioeconomic trends for the MAG region; the proposed action is one part of the model components. By improving the regional transportation network, the proposed action could enhance access to undisturbed land planned for development and, therefore, contribute to an increase in planned land conversion. Construction activities for this development would be expected to result in short-term secondary impacts to air quality. Additional data associated with source emission reductions can be found in the *Cumulative Impacts* section of this report.

Cultural Resources

Proposed residential, commercial, and industrial developments (private sector) may result in the conversion of undisturbed land. It is reasonable to conclude some undisturbed land has not been surveyed for cultural resources. Developments could result in land survey and discovery of previously unidentified cultural resources, an informational benefit from a cultural resources standpoint; however, certain parties may consider any disturbance of a cultural resource as detrimental to the resource. Depending on the condition of the resources identified during future surveys, data recovery may be completed, resulting in detailed resource documentation and removal as appropriate.

By improving the regional transportation network, the proposed action could enhance access to undisturbed land planned for development and, therefore, contribute to an increase in planned land conversion. The proposed freeway could also provide public access to sites that had been previously protected from potential vandalism and interfere with access to culturally important places used by Gila River Indian Community (Community) members. The E1 Alternative would serve as a physical barrier between sensitive sites and populated areas to the north. Project construction could result in accelerated erosion of sites through changes in drainage patterns or through vibration effects. The proposed action would contribute to secondary impacts to cultural resources, although the development of undisturbed land would be expected with or without the proposed action.

Land Use

Agricultural Land

Agricultural land in the MAG region has been subject to ongoing development (see the agricultural land discussion in the *Cumulative Impacts* section and the *Purpose and Need* section). As of 2010, 20 percent of the land in the Study Area (including the Community portion of the Study Area) was in agricultural use. However, after considering what is planned by local municipal zoning ordinances, only 12 percent of the Study Area is planned for future agricultural use. Particularly in the Western Section, local zoning ordinances promote planned transition from an agricultural-based community to a more contemporary residential community characterized by relatively large homes situated on small lots. The *Land Use*

Report discloses that over 140 developments encompassing 18,400 acres were approved by the local municipalities and are in various stages of planning; these developments have been prompted more by economic conditions than by transportation network improvements. In fact, growth has continued to occur despite diminishing operational performance of the region's roadway network.

The proposed action would improve the regional transportation network; its proposed location is an area planned for primarily residential, commercial, and industrial development. The proposed action would, enhance opportunities to expand the future planned regional transportation network, which in turn could enhance access to agricultural areas planned for development. This enhanced access could contribute to an increase in planned land conversion, although the development of agricultural land would be expected with or without the proposed action.

The proposed action also may result in the conversion of isolated remnants of farmland to a more intensive urban use. However, the conversion of farmland to residential and commercial development would be expected to occur with or without the proposed action.

Land Use Types

Although not directly leading to further development, the proposed action could affect land use conversions by affecting planned land development. Land use conversion is recognized by affected municipalities as necessary to accomplish their long-range planning goals as well as to accommodate the continued population growth anticipated in the area. In some locations, because of freeway proximity, the proposed action location could promote rezoning and general plan amendment applications by the development community in hopes of taking economic advantage of the freeway operation (approval to allow for more intensive uses would be the responsibility of the local municipalities). This could convert current land uses to more intensive land uses (e.g., conversion of a vacant parcel zoned for residential to a convenience store).

Community Character and Cohesion

The proposed freeway condition could affect community character in the Study Area in several ways. For example, the relocation of a neighborhood facility within the same general area could be perceived by some as a detriment, although some would perceive the relocation as a benefit, and some would not have an opinion. The provision of a shared-use stormwater detention/open space park facility that could be used by the community to improve quality of life and increase opportunities for interaction could be perceived as a benefit. The introduction of intensive land uses (including a freeway) into a pastoral community could be perceived as a detriment.

Economic Conditions

The proposed action would enhance the movement of people and goods, both locally and regionally. Retail and office space would likely be concentrated near new TIs and would likely be a mix of new and relocated businesses as planned for and permitted by local jurisdictions. However, because the transportation capacity seriously lags behind transportation demand in the Study Area, it can be assumed

the proposed action would not induce growth but may facilitate some increase in the rate of planned growth under current or projected growth environments. Further, growth is geographically constrained by the presence of the existing urbanized area, Community land, and SMPP. As reported in the *Economic Impacts Report*, the action alternatives in the Western Section would convert taxable land base to a nontaxable land base. The reductions experienced by municipalities by the western alternatives were determined to be approximately the same with the exception of the W101 Alternative and Options and the potential effect on the City of Tolleson. The direct impact of land conversion to a nontaxable land base would lead to a substantial reduction in the City's tax revenues. The secondary effect would be sufficient to lead to possible reductions in the provision of public services to city residents.

However, for any of the action alternatives, the improved travel times and enhanced movements of goods and services would result.

Conclusion

As a result of the proposed action, secondary impacts on biological resources, water resources, air quality, cultural resources, land uses, community character, and economic conditions would occur.

3. Cumulative Impacts

Regulatory Basis

The CEQ's *Regulations for Implementing the Procedural Provisions of NEPA* define cumulative impacts as: "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 C.F.R. § 1508.7). Cumulative impacts are considered direct impacts, which are "caused by the action and occur at the same time and place" (40 C.F.R. § 1508.8). The CEQ regulations also require including a discussion of cumulative actions and connected actions in the scope of the environmental review. These terms are defined as:

- ▶ Cumulative actions are those "which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same [environmental review]" [40 C.F.R. § 1508.25(a)(2)].
- ▶ Connected actions are those that are closely related. "Actions are connected if they: (i) automatically trigger other actions which may require environmental review; (ii) cannot or will not proceed unless other actions are taken previously or simultaneously; or (iii) are interdependent parts of a larger action and depend on that larger action for their justification" [40 C.F.R. § 1508.25(a)(1)].

FHWA has developed interim guidance on cumulative impact analysis (FHWA 2003). This interim guidance is presented in a question-and-answer format that reviews current NEPA requirements regarding the consideration, analysis, documentation, and mitigation of direct, secondary, and cumulative impacts. Much of the guidance is based on individual state department of transportation procedures and the approach followed by other federal agencies. The FHWA interim guidance supplements the CEQ guidance; combined, they provide the primary basis for analysis.

Methodology

A cumulative impact analysis should consider the following:

- ▶ environmental resources that would be directly affected by the proposed action
- ▶ the area in which effects of the proposed action would be felt
- ▶ impacts that would result from the proposed action
- ▶ other past, proposed, and reasonably foreseeable future actions that have, had, or could be expected to affect the same area
- ▶ expected impacts from the other actions
- ▶ the overall expected impact if the individual impacts were allowed to accumulate (Eccleston 2001)

To conduct the impact analysis, data were gathered through a review of existing literature and aerial photography, direct contact with pertinent agency staff and landowners, review of input received through

public involvement efforts, and Internet searches. Data limitations were identified in the collection process.

To conduct the analysis, parameters were established. They are:

- ▶ Assessment of those critical, or at-risk, resources expected to substantially contribute to a cumulative impact on a given resource. Logically, if a given project does not directly affect a particular environmental resource, the project would not contribute to a cumulative impact on that resource. This form of screening focuses the analysis on critical, or at-risk, resources, as described in greater detail in this report. This approach fulfills CEQ (2005) guidance that agencies should use scoping to focus on the extent to which information is “relevant to reasonably foreseeable significant adverse impacts” and is “essential to a reasoned choice among alternatives.”
- ▶ Identification of critical, or at-risk, resources—the social, cultural, technical, economic, and natural components of the environment. The cumulative analysis follows two principles outlined by CEQ guidance (1997) in considering critical conditions: (1) focus only on the effects and resources within the context of the proposed action, and (2) present a concise list of issues that have relevance to the anticipated effects of the proposed action or eventual decision. Based on this guidance, each resource technical report was reviewed to determine whether the proposed action, if implemented, would directly affect the resource.
- ▶ Establishment of a geographic, or spatial, boundary for impact assessment. The creation of a cumulative impact study area (CISA) aids in establishing a frame of reference for study. The size of the CISA will vary depending on the application to the critical resource. For example, the SMTC Study Area may be sufficient in size for the CISA for environmental justice while a more appropriate CISA for wildlife habitat may be the Phoenix metropolitan area or Maricopa County.
- ▶ Determination of temporal boundaries. A time frame for which to assess cumulative impacts is driven by CEQ guidance to consider past, present, and reasonably foreseeable changes that could result in cumulative impacts when combined with the effects of the proposed action.
- ▶ Identification of past, existing, and proposed relevant actions. Specifically, activities are identified in order to evaluate when, in combination with the potential impacts of the proposed action, they could result in significant cumulative impacts.

It is important to distinguish the proposed action as just one factor potentially affecting the Study Area. Although each impact on a resource must be weighed according to its extent, intensity, and/or duration (detailed later in this report), it is essential the assessment give careful consideration to all factors influencing the future of the Study Area. Therefore, as emphasized by FHWA guidance, when evaluating mitigation, it is important to distinguish the proposed action’s contribution to the impact.

Definition and Establishment of Geographic, or Spatial, Boundaries

The creation of a CISA aids in establishing a frame of reference for study. The proposed action's defined Study Area is sufficient as a CISA boundary for most of the critical resources. Exceptions will be noted under specific resources.

The start of the general urbanization of the greater Phoenix metropolitan area beginning in the 1950s is established as the historic time limit. Although not a specific individual action, the general urbanization of the Study Area is noteworthy because it highlights the "current aggregate effects of past actions without delving into the historical details of individual past actions" (CEQ 2005). In addition, the design year (estimated time period over which a feature would provide its intended traffic capacity) of 2035 is used as the minimum projected time limit.

Identification of Past, Existing, and Proposed Relevant Activities

The CEQ definition of cumulative impacts drives consideration of past, present, and reasonably foreseeable changes that could result in cumulative impacts when combined with the environmental effects of the proposed action. Specifically, activities are evaluated when, in combination with the potential impacts of the proposed action, they could result in significant cumulative impacts. Reasonably foreseeable changes were limited to projects that are currently planned and funded. The following types of activities that could result in cumulative impacts were reviewed:

- ▶ other highway projects initiated by the proposed action
- ▶ planned mass transit projects in the Study Area
- ▶ other major infrastructure projects (e.g., utility expansion)
- ▶ other general development patterns

Other proposed transportation projects within or near the Study Area include high-capacity transit on I-10, median and outside widening of I-10 (Papago Freeway) between SR 85 and SR 101L, SR 30 freeway, I-10 Local/Express lanes, SR 303L extension, Interstate 17 expansion project, and the Avenida Rio Salado project. No other major infrastructure projects were identified aside from local arterial street widenings to serve existing growth.

In addition to known future projects, an understanding of population and land use patterns is necessary. The following overview of historic and future conditions in the Study Area is limited to demographic data and land use resources. Existing conditions are described in detail in the respective technical reports. Much of the Study Area was converted to agricultural use prior to the 1950s. Agricultural and undeveloped land predominate in the Study Area, at 20 percent and 35 percent of the Study Area, respectively. Population in the Study Area is projected to grow by 72 percent from 2005 to 2035, as compared with 80 percent from 1990 to 2000. Employment is projected to grow by 114 percent from 2005 to 2035. In line with these projections, 144 development proposals, largely consisting of new residential subdivisions, were identified for the Study Area.

Resources Not Subject to Cumulative Impact Analysis

As mentioned earlier in this report, if the proposed action would not directly affect a particular environmental resource, the project would not contribute to a cumulative impact on that resource. Based on the assessment described as a parameter above, certain resources were excluded from analysis. The rationale for deciding which resources would not be given further consideration for cumulative impact analysis is presented in Table 3.

Table 3. Resources Not Considered for Cumulative Impact Analysis

Resource	Rationale
Energy	While construction and operation of the proposed action would result in the direct use of energy, the proposed action and its alternatives would not use energy at a magnitude or rate beyond consumption as determined if no action were undertaken. Therefore, no further consideration will be given because the proposed action is not expected to vary usage levels considerably from existing and projected traffic patterns.
Utilities	While construction of the proposed action would require the relocation and adjustment of utilities, no new utility projects are identified in the Study Area to support the proposed action. Therefore, no further consideration is given.
Hazardous materials	Hazardous materials are not considered a resource upon which impacts from the proposed action or from other known projects would occur. Instead, hazardous material sites are a byproduct of the human environment. The hazardous materials report prepared for the proposed action considered the direct and indirect potential for the proposed action to disturb such sites; therefore, no further consideration is given.
Demographics	Because this project and other transportation projects have been designed to respond to population forecasts (as opposed to encouraging population growth where it might not otherwise occur), no cumulative impacts on demographics have been identified. Therefore, no further consideration is given.
Economics	The proposed action would not induce economic growth nor facilitate any increase in the rate of growth under the growth environment because the proposed action only provides a portion of the capacity shortfall in transportation support infrastructure that has been experienced throughout the region and in particular in the southwestern metropolitan area. In addition, growth is geographically constrained by the presence of the existing urbanized area, Gila River Indian Community land, and South Mountain Park/Preserve. Therefore, no cumulative impacts would occur.
Wild and scenic rivers	No wild and scenic rivers occur in the Study Area; therefore, no cumulative impacts would occur. No further consideration is given.
Sole source aquifer	No sole source aquifers occur in the Study Area; therefore, no cumulative impacts would occur. No further consideration is given.
Floodplains	Incompatible use or development within floodplains would not be facilitated by the proposed action. Developments within the area must comply with State and local zoning and floodplain ordinances; therefore, no cumulative impacts would occur.

Resources Subject to Cumulative Impact Analysis

Critical resources warranting cumulative impact analysis are presented in this section. It should be noted that the action alternatives and options use similar land configurations but vary in location. Despite the location variation, they are closely spaced in the Study Area and thus are each expected to result in very

similar cumulative impacts. Although these designs have differing potentials to cause immediate, direct effects (such as residential relocations), in larger space and time boundaries, the design variations become decreasingly discernible.

Biological Resources

Habitat Loss

Construction and operation of the proposed action would irrevocably convert existing natural habitat to a transportation use and, therefore, contribute to a reduction in the amount of wildlife habitat in the region (U.S. Environmental Protection Agency [EPA] 2004). From 1975 to 2000, the proportion of land in human-related uses (e.g., urban) increased by an estimated 15 percent (the rate of increase to human-related uses was greatest during the “pre-freeway” period of 1975 to 1986). During this period, natural land uses decreased by 5 percent. Ongoing planned and permitted residential, commercial, and transportation development would likely further this trend of habitat loss through direct conversion, habitat isolation (addressed below), and native plant loss (addressed below). Also, wildlife typically is displaced, causing either increased competition among species members and/or population reduction.

Habitat Connectivity

Construction and operation of the proposed action would bisect existing natural habitat for the purposes of a transportation use and, therefore, would contribute to habitat isolation and would inhibit the movement of wildlife for life requirements. This effect would likely be most prevalent in the areas between the South Mountains and Sierra Estrella. Ongoing planned and permitted residential, commercial, and transportation development are reviewed and permitted by local jurisdictions on a case-by-case basis; however, most are too small in size to consider a single development proposal’s contributing effects on habitat connectivity. However, when considered together, this ongoing development would contribute to continued adverse effects on habitat connectivity. The provision of mitigation for the proposed action in the form of multi-use crossings to be situated in cooperation with federal and state wildlife officials would minimize these impacts.

Vehicle-animal Collisions

The movement of wildlife for life requirements in the Study Area suggests the construction and operation of the proposed action would increase the potential for vehicle-animal collisions in the region. This potential impact would likely be most prevalent along the segment of the freeway that would be between the South Mountains and Sierra Estrella. Ongoing planned and permitted development in this area would also contribute to an increase in collisions; however, it would be expected that the number of fatalities would be lower because of (1) slower travel speeds on the current and future local arterial street network; (2) lesser concentrations of wildlife in developing areas; and (3) the provision of mitigation for the proposed action in the form of multi-use crossings to be situated in cooperation with federal and state wildlife officials. However, together, the proposed action and future projects (e.g., SR 30, Avenida Rio Salado) would place high volumes of traffic near undisturbed areas along the Gila and Salt rivers. Therefore, these planned projects and the ongoing development would contribute to increasing numbers

of vehicle-animal collisions. Over time, as western Maricopa County develops, the incidence of this type of impact would likely diminish as habitat decreases and becomes less able to sustain large wildlife populations.

Native Plants

Ongoing conversion of natural areas to human-based development contributes to continued loss of native plants in the region. The proposed action would contribute to the loss of native plants because it would convert land known to have native plants to a transportation use (although the impact would be offset somewhat by project-specific proposed mitigation). Future residential, industrial, commercial, and transportation projects in conjunction with the proposed action can be reasonably expected to contribute to a loss of native vegetation, as defined and protected under the Arizona Native Plant Act (Arizona Revised Statutes § 3-901 et seq.). Notably, the proposed action as currently planned would convert natural areas around the South Mountains to a transportation use.

Invasive Species

The conversion to nonnative species and noxious weeds has occurred since the 1950s as a result of agricultural, industrial, and residential uses. Executive Order 13112 requires the presence of noxious weeds to be evaluated for any federally funded projects and that mitigation measures be implemented as required to prevent the spread of exotic seed (also enforced for State-funded projects within Arizona). The native plant species within and adjacent to SMTC would decrease in both number and diversity, which could have an impact on endemic animal species, especially songbirds, that depend on them for food, shelter, and nesting. Nonnative trees and shrubs tend to attract nonnative bird species such as the house sparrow, European starling, and rock dove, and these bird species compete with native species for resources. The nonnative species readily adapt to their new environments and most have prospered around the Study Area for many years. This is not always the case with endemic species and, over time, competition can lead to the depletion of a particular native species. If individuals of a native animal species present in the SMTC Study Area have another habitat to move to, with more available food and shelter, they stand a better chance of survival (Robbins 2003). Areas such as Tres Rios, Rio Salado, SMPP, and the Sierra Estrella are viable areas for native birds and small mammals that do not typically have large movement corridors. Therefore, federally funded and State-funded transportation projects in the state would serve to increase the existence and spread of noxious plants. Future residential, industrial, and commercial development and transportation projects without federal or State funding can be reasonably expected to contribute to the potential introduction and spread of invasive species.

Threatened and Endangered Species

Several other projects in the Study Area could contribute to cumulative effects on the Yuma clapper rail and yellow-billed cuckoo. The proposed SR 30 project, from SR 303L to SR 202L (proposed South Mountain Freeway), is located between the Gila and Salt rivers and Lower Buckeye Road; NEPA requirements will be addressed in an environmental assessment for that federally funded project. Also, the Rio Salado Oeste and Tres Rios wetlands projects will help restore wetlands and riparian areas along the

Salt and Gila rivers from 83rd Avenue to the west. The restoration of the Salt and Gila rivers' riparian and wetland habitat could improve habitat conditions for the Yuma clapper rail and yellow-billed cuckoo. Effects on the Yuma clapper rail and yellow-billed cuckoo would be addressed in NEPA documentation for these projects as well.

Piers for the proposed freeway bridge structure of the W59 (Preferred) Alternative would cross the Salt River through the eastern half of a 192-acre Bureau of Land Management (BLM) parcel leased to the City of Phoenix under the provisions of the Recreation and Public Purposes Act for inclusion in the proposed Rio Salado Oeste project. The City of Phoenix is aware of, planned for, and had incorporated the proposed South Mountain Freeway in the City of Phoenix General Plan and designated the Rio Salado Oeste Project as incorporating the proposed freeway. Although the lease does not include a reference to the proposed freeway, the BLM would support working in concert with the City of Phoenix to take the steps necessary to amend the lease in a manner that would allow the proposed freeway to pass through the property, if the W59 Alternative were identified as the selected alternative in the EIS and ROD. Both parties concurred with this approach in August 2005 (see Appendix A). As a result of this coordination and co-planning, no impacts to the proposed uses of this land or other planned wetlands and riparian restoration projects would occur.

Cumulative impacts as a result of future State or private actions are anticipated to include noise impacts and general human disturbance due to continuing development. No critical habitat is designated within the Study Area for any listed species (within the limits of disturbance, the proposed action may affect individuals of the Sonoran desert tortoise population occurring in the Study Area). The proposed action would have no effect on any other threatened or endangered species as defined under Section 7 of the Endangered Species Act

Surface Water

Contaminants from Stormwater Runoff

Existing sources affecting water quality include drainage from the South Mountains through development areas, Gila Drain Floodway discharge, sand and gravel pit operations in and upstream of the Study Area, and the 91st Avenue Wastewater Treatment Plant treatment ponds. The proposed action, along with other planned roadway improvements (e.g., local arterial roadway widening and new roadway projects such as the proposed SR 30 and Avenida Rio Salado), would also be a contributing factor to cumulative impacts on water quality. Regionally, the presence of urban uses near water courses has increased by 8 percent from 1975 to 2000 (EPA 2004). Specifically, stormwater flow from other projects or other physical jurisdictions would combine with stormwater flow directly from the proposed action. Flush runoff from the freeway during infrequent rain storms would likely include lead, zinc, filterable residue, and total nitrogen. Other projects may include transportation, commercial, and residential development, which would result in less permeable surfaces to accommodate recharge and the associated increase in impervious surfaces that act as pollution collection surfaces. The result of this associated development would be higher runoff volumes and a higher potential for pollutant discharges into receiving streams.

However, these impacts would be minimized by providing best management practices during construction, following current design standards for detention facilities, and by complying with federal and state permits for storm water discharges.

Natural Drainage Features

Continued conversion of undisturbed land to human-based development in the region has resulted in continued alteration to surface drainage features, particularly ephemeral washes. The proposed action would contribute to such effects by altering natural drainage features immediately adjacent to the project (although the impact would be offset somewhat by project-specific proposed mitigation).

Future residential, industrial, commercial, and transportation projects would also result in modification to natural drainageways. Unlike the proposed action, the ability to manage and mitigate impacts from some ongoing planned and permitted residential and commercial development would be limited and, therefore, less likely subject to regulatory compliance that could reduce effects. These impacts would be minimized by providing best management practices during construction, following current design standards for detention facilities, and by complying with federal and state permits for storm water discharges.

Groundwater

Groundwater is a source of public water supply in Arizona. In 1995, groundwater withdrawal in the Phoenix Active management Area supplied 39 percent of the total consumption of the 2.29 acre-feet (ADWR 1999). About 64 percent of the withdrawal was used for agriculture. The remainder was used for public water supply, industrial, domestic and other purposes. Population growth has resulted in the retirement of agricultural land and the conversion of the intended use of groundwater supplies to urban uses. Issues created by groundwater overdraft include decreased water levels in aquifers and increased well drilling and pumping costs. Some wells within the Study Area would have to be fully replaced in accordance with 2006 ADWR well spacing and well replacement rules. Known land development planned in the Study Area as presented in the Land Use section of this chapter would likely contribute to increasing demands on groundwater supply; the proposed action could place further demand on water supplies temporarily during construction and for maintenance purposes. These demands on supply would be likely offset through the application of water reuse best management practices.

The profile of the proposed action would be depressed in certain areas of the Study Area that have relatively high groundwater tables. Water falling on the freeway would be concentrated into low areas along depressed sections instead of draining off the freeway onto adjacent land and percolating into the groundwater. Water would then drain by gravity from the depressed sections of the freeway to the river. With development ongoing in the areas where depressed freeway sections are being considered, it is possible the proposed action could contribute to reductions in groundwater supply. Because surface drainage from storms would drain by gravity to the river, it is expected the proposed action would have little cumulative effect on groundwater and these effects would be minimized by providing best management practices during construction, following current design standards for detention facilities, and by complying with federal and state permits for storm water discharges.

Water Availability

Ongoing planned and permitted residential, commercial, and industrial development in the region would likely continue to place a demand on water availability. The proposed action would have little cumulative effect on water availability.

Air Quality

Air quality may be a local, regional, or global issue depending on the particular pollutants or issue. At the local and regional level, air quality issues are normally related to criteria pollutants for which national air quality standards have been established and Mobile Source Air Toxics. From 1990 to 1999, mobile emissions of the criteria pollutants have generally decreased in the Phoenix metropolitan area, as shown in Table 4.

Table 4. Mobile Emissions (Tons/Year)

Year	Carbon monoxide	Ammonia	Nitrogen oxides	Particulate matter	Fine particulate matter	Sulfur dioxide	Volatile organic compounds
1990	413,486	1,711	62,230	3,281	2,702	5,225	58,548
1999	358,835	2,422	67,663	2,489	1,908	3,202	42,521

Source: <www.epa.gov/urban/phx/indicators.htm>

The decreases shown in Table 4 may largely be associated with cleaner fuels and lower-emission vehicles. More gains may be achieved, except that VMT will likely increase and may continue to offset the emissions decreases in the future. (Note that VMT decreased by approximately 5 percent during the economic recession that began in 2007.)

A future increase in overall traffic volumes can be expected in the region following construction of planned residential and commercial developments. The proposed action is intended to reroute existing traffic patterns and accommodate future traffic volumes (as opposed to generating additional volumes) and, therefore, is not expected to contribute to a cumulative impact on air quality. Transportation projects planned in the region would minimize subsequent increases in vehicular emissions by reducing congestion and vehicle idling. In heavily congested conditions, where traffic speeds are below 20 miles per hour, emissions increase with decreased speeds. More fuel is consumed because automobile engines do not operate optimally at low speeds and more emissions are emitted. Additionally, a vehicle's emissions control equipment is not as effective at low speeds as it is at typical freeway speeds.

Future emission levels would also be reduced by the use of cleaner-burning fuels, technological advances in automotive design, stricter enforcement of emission standards during inspections, etc. (all such factors were included in the modeling completed and documented in the *Air Quality Assessment*). The proposed action and other planned transportation projects are subject to conformity requirements; each project is analyzed to determine whether exceedances of the National Ambient Air Quality Standards would occur. Therefore, no cumulative impacts on air quality for the criteria pollutants were identified.

The Clean Air Act identified air toxics, also known as hazardous air pollutants. EPA has identified priority mobile source air toxics (MSATs): acetaldehyde, benzene, formaldehyde, diesel particulate matter plus diesel exhaust organic gases, acrolein, naphthalene, polycyclic organic matter, and 1,3-butadiene. EPA has already placed requirements into law that will limit future emissions of these contaminants from motor vehicles. While these MSATs are considered the priority transportation toxics, the EPA stresses that the lists are subject to change and may be adjusted in future rules.

As part of its 2001 rulemaking, EPA studied the effect of current programs on future expected MSATs emissions. Such programs included reformulated gasoline, national low-emission vehicle program, and heavy-duty diesel engine and on-highway diesel sulfur control programs. While these programs were initially designed and intended to reduce National Ambient Air Quality Standards pollutants such as carbon monoxide, nitrogen oxides, and particulate matter, EPA estimates that these programs “have reduced and will continue to reduce on-highway emissions of air toxics significantly.” For example, federal hydrocarbon tailpipe standards for light-duty vehicles were 3.0 grams/milliliter in 1972, and by 2004 the standard was reduced to 0.125 grams/milliliter.

EPA expects that new fuel benzene standard and hydrocarbon standards for vehicles and gas cans will together reduce total emissions of MSATs by 330,000 tons in 2030, including 61,000 tons of benzene. As a result of this rule, new passenger vehicles will emit 45 percent less benzene, gas cans will emit 78 percent less benzene, and gasoline will have 38 percent less benzene overall. In addition, the hydrocarbon reductions from the vehicle and gas can standards will reduce volatile organic compound emissions (which are precursors to ozone and can be precursors to fine particulate matter [PM_{2.5}]) by over 1 million tons in 2030. The vehicle standards will reduce direct PM_{2.5} emissions by 19,000 tons in 2030 and could also reduce secondary formation of PM_{2.5}. Once the regulation is fully implemented, EPA estimates that these particulate matter reductions will prevent nearly 900 premature deaths annually.

Between 1999 and 2050, FHWA projects that even with a 145 percent increase in VMT, these programs will produce a combined reduction of 72 percent in the total annual emission rate for the priority MSATs.

Therefore, the proposed action is not expected to contribute to cumulative impacts relating to MSATs.

At the global level, the potential change in greenhouse gas emissions is very small in the context of the affected environment. FHWA is working to develop strategies to reduce transportation’s contribution to greenhouse gas emissions —particularly carbon dioxide emissions—and to assess the risks to transportation systems and services from climate change. FHWA will continue to pursue these efforts as productive steps to address this important issue. In addition, construction best practices to be implemented represent practicable project-level measures that, while not substantially reducing global greenhouse gas emissions, may help reduce greenhouse gas emissions on an incremental basis and could contribute in the long term to meaningful cumulative reduction when considered across the Federal-aid highway program.

Cultural Resources

The proposed action may contribute to an increase cultural resources impacts. However, the proposed action and other major planned transportation projects would potentially create preservation in place (enhancement) opportunities not otherwise associated with private-sector development projects. The opportunity to preserve in place would be the result of federal and State regulations promoting preservation of such resources when associated with a publicly funded project; however, these federal and State regulations generally are not applied to privately funded projects. Although the types of impacts would be typical of those experienced in constructing and operating other parts of the region's freeway system, some of these impacts would be effectively mitigated through the implementation of the enhancement and management plans and other strategies.

Land Use

Agricultural Land

The amount of agricultural land in the Phoenix metropolitan area has decreased from over 50 percent in 1975 to just over 35 percent in 2000 (EPA 2004). With the exclusion of reservation land and, possibly, ranches, Maricopa County in 2007 had only 8 percent of its land as farmland (National Agricultural Statistics Services 2009). After considering what is planned by local municipal zoning ordinances, only 12 percent of the Study Area is planned for future agricultural use. Urban growth in the metropolitan area is contributing to the conversion of farmland to urban uses. The proposed action would contribute by converting farmland within the proposed right-of-way to a transportation use. Other planned transportation projects (e.g., SR 30, Avenida Rio Salado, I-10 Widening) would also contribute to the farmland conversion. Future residential, industrial, and commercial development projects and local street improvements would also contribute to farmland conversion, most of which is planned for in local jurisdictions' planning documents.

Recreational Land

Recreational lands and facilities are valued in the Phoenix metropolitan area. This value is established through identification of recreation as an important and key element in local and regional land use plans and its recognition as an important component of the region's tourist industry. In the region, recreational resources take the form of a wide array of facilities such as: neighborhood, community, and regional parks; active playfields (e.g. baseball fields); equestrian, bicycle, and multiuse trails; and mountain preserves and open space. In the past, some of these resources have been converted to residential, commercial, and transportation uses. The enactment of the Phoenix Mountain Preserve Act in 1990 (see Chapter 5, *Section 4(f)*) was intended to curb the loss of mountain preserve resources from land development encroachment. The proposed action, by design, takes measures to minimize its contribution to further loss of recreational resources. With the exception of the South Mountain Park/Preserve (where avoidance was determined not feasible), all recreational resources were avoided. Measures to minimize harm to the South Mountain Park/Preserve, including the provision of replacement lands as described in Chapter 5, *Section 4(f)*, would reduce impacts to the lowest level possible and would ensure that active recreational areas within South Mountain Park/Preserve would not be affected. As development continues

in the study area and surroundings, it is reasonable to conclude that such developments (as permitted by local jurisdictions on a case-by-case basis) may use recreational land in the future. Conversely, many new residential developments are setting aside land for future park development; some of which may be transferred to public ownership and access. Transportation projects in the region have resulted in uses of some recreational facilities, but in many cases these projects have resulted in improved access or provided additional protection to recreational lands.

Land Use Types

The proposed action is considered a contributing factor to the cumulative impacts on residential and business displacements. Other primary contributors to displacement impacts would be other planned transportation projects (e.g., SR 30, Avenida Rio Salado, and some arterial street widening projects). Future residential, industrial, and commercial development projects and local street improvements are not expected to result in substantial relocations because the vast majority of this development would occur within existing transportation right-of-way or on vacant parcels or land in agricultural use.

Land Ownership

Rapid growth in population, housing, and employment occurred in the Study Area through the mid-2000s, but this growth has been reduced as a result of the nationwide economic downturn experienced in the late 2000s. Regardless, a transition from rural agricultural to moderate density homogeneous single-family residential use has continued to occur. Several factors appear to contribute to what will likely eventually be a resumption of a solid rate of growth: affordable cost of living, employment opportunities, mild climate, reasonable accessibility, and a development-oriented regulatory environment. Examination of data comparing population and land use between 1975 and 2000 suggests major transportation infrastructure projects like the proposed action are not major contributors to or inducers of growth in the region. For example, from 1975 to 2000, population increased by 211 percent from just over 1 million people to over 3.1 million people. The extent of urban area increased from nearly 226,000 acres to just over 549,000 acres (143 percent increase). During this same time frame (and actually dating back to development patterns of the 1950s), population densities have remained constant at two households per acre. While newer development between 1991 and 2000 is at four households per acre, the overall densities remain well below what transportation planners use as a rule of thumb for the minimum density needed to support a public transit-based network: seven households per acre. VMT has increased from 17 miles per day to approximately 21 miles traveled daily (a 24 percent increase), and traffic delay and related congestion costs increased 350 to 360 percent in that same time period. Until the economic downturn that began in 2007, the past rate of growth and development far exceeded the ability of any major transportation infrastructure to keep pace. While the recession has slowed growth in the Phoenix metropolitan area—and theoretically provided an opportunity for transportation infrastructure to catch up with the demographic forces that have historically fueled high growth—it has also cut off resources at all levels of government that are the sources of funding for expansion of the regional transportation infrastructure. Locally, Proposition 400 funding for transportation development in the MAG region depends on revenues from a tax on retail sales, which are substantially lower than prerecession

projections. Nationally, the federal fuel tax, which in part provides funding for highway development, has decreased from 6 to 4 percent since the recession began (FHWA 2009). The use of more fuel-efficient vehicles and overall lower vehicle usage has also contributed to the national decline in revenues. Because transportation capacity seriously lags transportation demand in the Study Area, it can be assumed the proposed action would neither induce growth nor facilitate any increase in the rate of growth under current or projected growth environments (see further discussion in the *Induced Travel Discussion* and *Induced Growth Discussion* sections of this report).

Community Character and Cohesion

The proposed action would displace residences, businesses, public and quasi-public facilities; alter current access patterns; and introduce a major transportation facility where one does not currently exist. Other planned transportation projects (e.g., SR 30, Avenida Rio Salado) would have similar effects. The construction and operation of these projects would have a cumulative effect on the region's communities that maintain distinct characteristics. The planned projects, including the proposed action, could affect distinct communities' characteristics through displacements (noted above), noise intrusion, the introduction of a high-intensity land use that may conflict with more passive community land uses, and alteration of a community's sense of place and/or internal circulation.

Environmental Justice

The evaluation to determine whether there are disproportionate impacts on any population with Environmental Justice characteristics revealed that all action alternatives would have direct but not disproportionate impacts on such populations. Considering the proposed action would be accessible to all populations in the Study Area, the impacts would not be disproportionately high, and mobility benefits would occur. Benefits would include enhanced access to and from employment opportunities and enhanced movement of goods and services for improved access to such goods and services for all population segments.

Some populations with environmental justice characteristics have specific needs associated with identity tied directly to geographic setting. For American Indian populations near and adjacent to the proposed action, association with cultural values of the South Mountains is important to identity and is established through direct, spiritual and visual access to the Mountains. Land developments in the area have encroached upon the South Mountains and the proposed action would contribute to further encroachment on the southern side of the Mountains. The contribution of the proposed action to this cumulative effect would be offset some by the provision of freeway underpasses allowing individuals from the populations to continue unrestricted access to the Mountains and by the provision of right-of-way fences along the border with the Gila River Indian Community which would prevent some of the unlawful trespass that currently occurs. Continued land development in the area also would contribute to a cumulative modification to the visual access to the resource and the proposed action also would contribute to the alteration of views to the Mountains (although the effect would be offset by measures to be undertaken to minimize harm to the resource as described in Chapter 5, *Section 4(f) Evaluation*).

Visual Resources

The area has experienced and will continue to experience a rapid transition in land use from low-density, open uses to residential, commercial, and light industrial uses. Large subdivisions have been developed in open agricultural land, and residential development has encroached onto the south side of the South Mountains. These actions would all generally contribute to the continuation of the rapid development of the Southwest Valley from an agricultural-oriented past to a suburban-urban-appearing present and future. The proposed freeway would be a part of this trend. The perception of open spaces with distant mountain backdrops would change to one of expanding suburban and urban development. The backdrop would remain, but the fore- and middle ground would change so substantially that the visual perception, over time, would change dramatically. This is a trend that is underway and would continue with or without the proposed freeway. Sensitive views along the E1 Alternative would be impacted; however, the road cuts proposed for the western end of the South Mountains would incorporate the newly exposed rock faces characteristic of the adjacent natural rock features, including scale, shape, slope, and fracturing to the extent that could be practicable and feasible as identified through geotechnical testing and constructibility reviews. Rounding and blending of new slopes to mimic the existing contours to highlight natural formations and warping slopes at intersections of cuts and natural grades to transition with natural ground surfaces would be attempted. Because of the enactment of the Phoenix Mountain Preserve Act in 1990 (see Chapter 5, *Section 4(f)*), it is unlikely that additional impacts to the South Mountains of this magnitude would occur.

Noise

Noise is an unwanted sound that can intrude on and have effects on the resources of the human and natural environments. The noise analysis conducted for the proposed action takes into account existing and projected future ambient (or background) noise from proposed growth and traffic on the proposed action. The transportation demand model used to predict traffic volumes on the proposed freeway would redistribute traffic on regional freeways and arterial streets in response to the construction of the proposed action. Therefore, increases or decreases in traffic (and noise) on these facilities would also be predicted. With the planned growth and urbanization in the study area, noise levels would be expected to increase because of the increased density of human activities.

Conclusion

As a result of the proposed action, cumulative impacts may occur to biological resources, water resources, cultural resources, land uses, visual resources, noise, and air quality.

4. Induced Travel and Growth

Induced Travel Discussion

“Induced travel” is a phrase used to describe observed traffic volume increases occurring on a new highway after it is opened. The observation is prominent in areas where congestion is already evident (the Phoenix metropolitan area is a prime example).

The proposed action would be constructed where existing traffic congestion has already decreased travel speeds throughout much of any given day on most of the regional freeway system and the major arterial street network. To avoid the congestion, over time, some travelers have diverted to alternative routes, changed the time they make their trips, switched to different travel modes, traveled to other destinations, or decided not to make a particular trip at all. Because the proposed action would carry substantially more traffic before it would become congested, many of these travelers may switch to the new facility when opened to take advantage of decreased travel times. Some travelers using transit as a choice may also switch and, further, some may choose to travel to different (more distant) destinations (e.g., for shopping) or take a trip that they previously avoided altogether because it was previously “too much trouble” to make. The behavior influencing this “switch” is often associated with drivers’ perceiving decreases in the generalized cost of travel, including both travel time and out-of-pocket costs. However, it is commonly recognized the cause of this switch is more complex, involving various travel behavior responses, evolving individual needs, residential and business location decisions, and changes in regional population and economic growth.

Some induced travel would represent new trips. However, most of the increase in traffic caused by induced travel is expected to come from trips already being made before the proposed action were put into operation (predictable traveler behavior accounted for in the travel demand forecasts conducted for the proposed action). The resulting traffic increase on the South Mountain Freeway is also expected to be largely offset by decreases in traffic volumes on parallel routes and at other times of the day. It is fully expected that the net effect on daily VMT in the Phoenix metropolitan area as a result would be minimal. Local examples of where this phenomenon has been experienced include the recent openings of the Pima Freeway in Scottsdale and Red Mountain Freeway in Mesa.

In 2002, the Pima Freeway was opened to traffic from the Red Mountain Freeway to Interstate 17. The section from the Red Mountain Freeway to Shea Boulevard was opened in 1999. Upon these openings, a change in traffic volumes was experienced on Hayden and Scottsdale roads (both parallel the Pima Freeway 1 mile and 2 miles to the west, respectively). Both are major arterial streets with cross sections of four to six lanes.

The analysis, conducted by the City of Scottsdale, illustrates a reduction in traffic along both major arterial streets after the freeway was completed. The traffic reduction on Hayden Road ranged from 13,900 vehicles per day (vpd) to 48,300 vpd, with an average reduction of 31,000 vpd. Scottsdale Road,

which is farther from the freeway, experienced a reduction of between 2,100 vpd and 13,300 vpd, with an average of 10,000 vpd.

The Red Mountain Freeway, from its interchange with SR 101L to Gilbert Road, was opened to traffic in 2002, and the extension to Higley Road was opened in 2003. Upon these openings, a change in traffic volumes was experienced on McDowell, McKellips, and Brown roads (all generally parallel the Red Mountain Freeway 1, 2, and 3 miles to the south, respectively). All are major arterial streets with cross sections of four to six lanes.

The analysis, conducted by the City of Mesa, illustrates a reduction in traffic along all three major arterial streets after the freeway opened. The traffic reduction on McDowell Road ranged from 6,300 vpd to 9,900 vpd, with an average reduction of 8,600 vpd. The traffic reduction on McKellips Road ranged from 2,300 vpd and 33,900 vpd, with an average reduction of 19,000 vpd. The traffic change on Brown Road ranged from an increase of 300 vpd at the eastern end and a reduction of 9,700 vpd, with an average reduction of 4,500 vpd. The largest reduction was on the western end, near Country Club Drive.

Both examples provide insight to general driver behavior. At the time of opening, both freeways represented to drivers a savings in time and/or cost in travel. Consequently, drivers moved from the arterial street network to the freeway system. Over time, it would be expected that some drivers would return to the arterial street network as more vehicles travel on the freeways. For the South Mountain Freeway project, a net reduction on the arterial street network is anticipated through the design year of 2035 as traffic volumes on the arterial street network are projected to be less with the proposed action in place than without the proposed action.

For the proposed action, the minimal contribution to overall traffic use by induced travel is expected to have both positive and negative consequences (positive effects on the neighboring road network have been previously addressed). Changes in driving behavior leading to the use of the proposed action would be the result of perceived benefits, which could include reduced total daily travel time and cost or an increased value associated with a new destination (e.g., a previously “inaccessible” shopping area with more variety or lower prices).

As a negative consequence, each user of the proposed action would contribute to increased congestion on the freeway. As congestion grows on the new facility, the benefit attributable to potential travel time savings would be expected to decline. Congestion-related impacts (e.g., reduced air quality) would also increase over time. However, the overall contribution to projected traffic volumes on the proposed action is anticipated to be minimal (some of which is accounted for in regional travel models).

It is important to consider that improvements proposed for any type of transportation system (e.g., a new bus route, rail transit line, or commuter rail service) would likely lead to changes in travel behavior, which in turn would lead to increased use of the particular system. Improvements made to a given transportation system are meant to attract new users to the improvement. If this were not a primary goal, the improvement would not be effective nor warranted. For the proposed action, a goal is to attract users

of other segments of the regional freeway system and the local arterial network, now and in the future, to the project to optimize, in part, the entire regional transportation system (as outlined in the project's purpose and need). Further, it is important to consider that as improvements are made to all transportation systems, cyclical benefits and impacts would occur. For example, as auto trips are diverted to transit (either due to direct improvements or increased congestion), traffic congestion on parallel highway facilities may lessen, at least temporarily. The resulting reduction in highway traffic congestion may, in turn, attract additional highway trips, similar to an increase in highway capacity.

FHWA's current position relative to induced travel is consistent with the consensus of the transportation planning and travel behavior research community—induced travel is neither more nor less than the cumulative result of individual traveler choices and land development decisions made in response to an improved level of transportation service. Many of the travel choice decisions are accounted for in current travel forecasting models or land use-transportation interaction models.

Induced Growth Discussion

Unplanned growth is often termed “urban sprawl.” Generally, the reference is made in the context of the rapid and uncontrolled urban growth onto previously undeveloped land—usually on the outskirts of an existing urban area. Construction of projects like the proposed action is pointed to as a major contributor to urban sprawl. Freeway projects are often cited as making land at the urban fringe more accessible and, therefore, more attractive for development.

But as with issues surrounding induced growth, the relationship between transportation improvements and land development is complex. Land accessibility in a particular area as a result of a freeway project may make land more attractive for development, but other factors such as utility infrastructure, quality of public services, land acquisition and development costs, economic conditions, and entitlement costs play major roles in determining where and how development would occur. In many cases, new development being attracted to one part of a metropolitan region often represents development that has been redirected from other parts of the region.

Until the economic downturn that began in 2007, the past rates of growth and development far exceeded the ability of any major transportation infrastructure to keep pace (factors like affordable cost of living, employment opportunities, mild climate, reasonable accessibility, and a development-oriented regulatory environment will contribute to the resumption of a solid rate of growth). Examination of data comparing population and land use between 1975 and 2000 suggests major transportation infrastructure projects like the proposed action are not a major contributor to or inducer of growth in the region. For example, from 1975 to 2000, population increased by 211 percent from just over 1 million people to over 3.1 million people. The acreage of urban area increased from nearly 226,000 acres to just over 549,000 acres (143 percent increase). During this same time frame (and actually dating back to development patterns of the 1950s), population densities remained constant at two households per acre. While newer development between 1991 and 2000 is at four households per acre, the overall densities remain well below what transportation planners use as a rule of thumb for the minimum density needed to

support a public transit-based network: seven households per acre. VMT has increased from 17 miles per day to approximately 21 miles traveled daily (a 24 percent increase), and traffic delay and related congestion costs increased 350 to 360 percent in that same time period.

While the recession has dramatically slowed growth in the Phoenix metropolitan area—and theoretically has provided an opportunity for transportation infrastructure to catch up with the demographic forces that have historically fueled high growth—it has also affected resources at all levels of government that are the sources of funding for expansion of the regional transportation infrastructure. Federal economic stimulus funding has benefitted projects that were far along in the planning process. Locally, Proposition 400 funding for transportation development in the MAG region depends on revenues from a tax on retail sales, which are substantially lower than prerecession projections. Nationally, the federal fuel tax, which in part provides funding for highway development, has decreased from 6 to 4 percent since the recession began (FHWA 2009). The use of more fuel-efficient vehicles and overall lower vehicle usage has also contributed to the national decline in revenues. Because transportation capacity seriously lags behind transportation demand in the Study Area, it can be assumed the proposed action would neither induce growth nor facilitate any increase in the rate of growth under current or projected growth environments (see further discussion in the *Induced Travel Discussion* section).

The proposed action would occur in a historically quickly urbanizing area (most noticeably in the Western Section of the Study Area). In the Eastern Section of the Study Area, the proposed action abuts public parkland and a nearly fully developed community and, therefore, any contribution to accelerated or induced growth is restricted. The proposed action would occur in an area planned for urban growth as established in local jurisdictions' land use planning activities for as much as the last 25 years. If, on the other hand, the proposed action were to be located in a rural area, it may provide access to large tracts of undeveloped land. Some similar types of projects in other parts of the country, in fact, were developed specifically to promote nonhighway economic development. In two such cases, FHWA is monitoring where a substantial highway improvement was completed whose purpose was to promote economic development. In the case of the proposed action, the purpose of the project is not to promote economic development but to respond to a growing need for additional transportation capacity as a result of area growth occurring now and as projected.

5. Summary Matrix

Table 5 summarizes the assessment of secondary impacts described in this report. The reader may refer to the main text of the report for clarification of the information provided in this table.

As a result of the proposed action, cumulative impacts may occur for biological resources, water resources, cultural resources, land uses, visual resources, noise, and air quality.

Table 5. Summary of Secondary Impacts

Resource	Proposed Action Impact	Past, Present, and Reasonably Foreseeable Impact
Biological Resources	Wildlife population reduction	Vehicle-animal collisions
	Loss of native vegetation	Construction of all types of projects
Water	Loss and/or alteration of natural drainage features	Loss from urban development
	Modification of groundwater tables (pumping to drain a depressed freeway could lower the water table by conveying runoff water off-site)	Groundwater drawdown from continued development, which could affect water availability
Air quality	All predictable measures below federal and State standards; mobile source air toxics may have adverse effects on nearby residences	Development related to continued rapid urban growth in the region
Cultural resources	Disturbance to known historic and prehistoric sites	Permanent loss due to ongoing urban growth
	Discovery of previously unknown cultural resources	Discovery of previously unknown cultural resources related to ongoing urban development
Land use	Conversion of agricultural land to a transportation use	Ongoing residential, industrial, and commercial development
	Land use conversions and displacements and relocations	Ongoing residential, industrial, and commercial development and other transportation and public infrastructure projects
	Community character and cohesion alteration	
Economic conditions	Enhanced movement of goods and delivery of services, property value changes	Aggregate past and projected growth in land values and economic activity in Study Area

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