

4. Environmental Considerations

Introduction

North Central Texas is not only economically and socially diverse, but it is also environmentally diverse. The environment provides services millions of people rely on for clean air, water, and recreational opportunities. The environment is key not just for supporting quality of life for humans, but also for preserving essential habitat for wildlife.

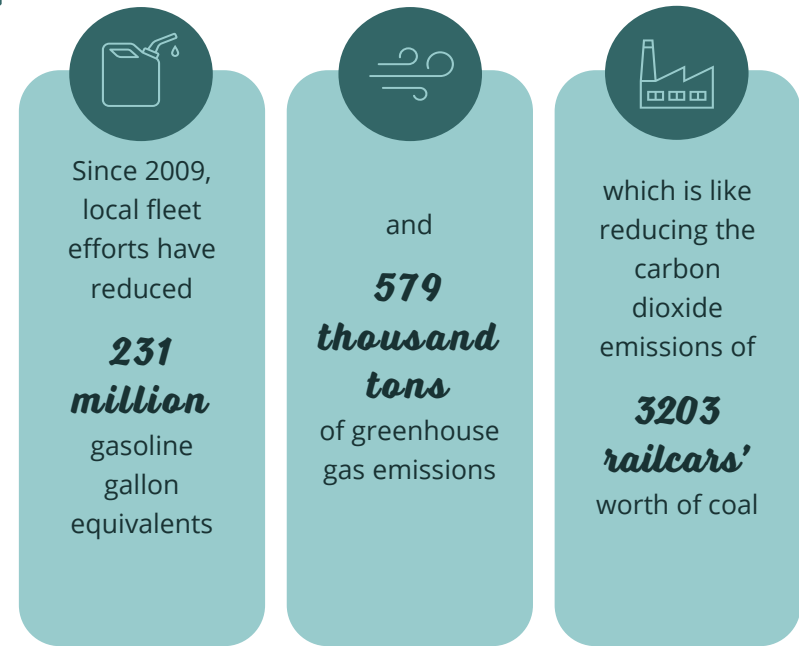
The Mobility 2045 Update defines the “environment” as the natural, human made (or built), historic, cultural, or archaeological components that comprise our surroundings. Environmental considerations, therefore, range from streams and wetlands to artifacts left behind by prehistoric people.

How and where the transportation system is built can negatively impact the environment. Therefore, public health, air quality, and the natural and built environments must be considered when planning and implementing transportation projects.

Implementing infrastructure projects for a growing region is necessary; however, major infrastructure improvements such as highways and transit lines can negatively impact habitat and ecosystems. Similarly, many small improvements can have cumulative impacts on a scale larger than the size of individual projects. Creating infrastructure more sensitive to wildlife and ecosystems through integrated planning and interagency cooperation is an initiative promoting conservation priorities and sustainable uses while exploring a variety of mitigation options.

The Mobility 2045 Update supports expediting the process to approve transportation projects while maintaining compliance with all applicable laws and while promoting safety, environmental health, and effective public involvement.

Did You Know?



A **20 percent** reduction in nitrogen oxide emissions from on-road mobile sources is expected to occur between 2023 and 2045

Source, Top: Environmental Protection Agency Greenhouse Gas Equivalencies Calculator,
Source, Bottom: Dallas-Fort Worth 2022 Transportation Conformity

Mobility 2045 Update Supported Goals

Preserve and enhance the natural environment, improve air quality, and promote active lifestyles.

Encourage livable communities which support sustainability and economic vitality.

Develop cost-effective projects and programs aimed at reducing the costs associated with constructing, operating, and maintaining the regional transportation system.

In This Chapter

- Healthy Communities
- Air Quality
- Environmental Effects, Mitigation, and Stewardship
- Hazard Vulnerability and Resilience

4. Environmental Considerations: Healthy Communities

Many factors influence the health of individuals and communities. These include health behaviors, access to health care, income, employment, air pollution, water quality, access to housing, and the characteristics of an individual's commute to work. The County Health Rankings & Roadmaps¹ project measures how counties score for these factors. The factors listed below are influenced by the transportation system:

- Access to exercise opportunities
- Alcohol-impaired driving deaths
- Driving alone to work
- Income inequality
- Injury deaths
- Long commute – driving alone
- Unemployment

Exhibits C1-1 to C1-7 in the **Environmental Considerations** appendix describe how each county in North Central Texas scores for each of these factors.

Mobility 2045 Update Supported Policies

The Mobility 2045 Update supports the following policies in furtherance of our goals for healthy communities:

ER3-003: Promote transportation programs and projects that encourage healthy lifestyles, including, but not limited to, providing appropriate access to the natural environment.

Designing Transportation Facilities to Support Healthy Communities and the Environment

The way people travel impacts their quality of life in many ways. Reducing the use of motor vehicles, which contribute pollution to the air, promotes healthy communities. Lowering the number of cars and trucks on roadways can help lessen congestion and improve safety. Improving roadway design to accommodate bicycles and pedestrians can help reduce accidents and injuries. Opportunities to use transit, to walk, or to bicycle instead of driving are linked to healthy communities. For example, walking—whether for utilitarian or recreational purposes—can help improve personal health, reduce traffic congestion, and reduce travel costs. **Exhibit 4-1** describes the Mobility 2045 Update chapter sections that support healthy communities.

Through its policies and programs, the Mobility 2045 Update encourages the use of Federal Highway Administration endorsed principles for CSS (context-sensitive solutions) and supports the development and implementation of local Complete Streets policies on both new and reconstructed streets. The CSS process, as defined by the Federal Highway Administration, is a collaborative, interdisciplinary approach that involves all stakeholders in providing a transportation facility that fits its setting. It is an approach that leads to preserving and enhancing scenic, aesthetic, historic, community, and environmental resources, while improving or maintaining safety, mobility, and infrastructure conditions.

¹ County Health Rankings & Roadmaps, <http://www.countyhealthrankings.org/>

Exhibit 4-1: Chapter Sections

Strategy	Chapter	Section
Reduce vehicle miles traveled	Operational Efficiency	Travel Demand Management
	Operational Efficiency	Transportation System Management and Operations
Expand public transportation	Mobility Options	Public Transportation
Promote active transportation	Mobility Options	Active Transportation
Incorporate healthy community design features	Environmental Considerations	Vehicle Air Quality Strategies and Voluntary Initiatives
	Environmental Considerations	Healthy Communities
	Operational Efficiency	Sustainable Development
Improve safety for all users	Operational Efficiency	Transportation System Safety
	Operational Efficiency	Transportation System Security
Ensure equitable access to transportation networks	Social Considerations	Nondiscrimination Efforts

Using the CSS process leads to a Context-Sensitive Design that not only considers the physical aspects or standard specifications of a transportation facility, but also the economic, social, and environmental resources in the community being served by that facility. In short, the design of a roadway should depend on the community and context of the street.

Complete Streets are those designed and operated to enable safe access and travel for users of all ages and abilities, including pedestrians, bicyclists, micromobility device users, transit users, motorists, and freight operators. In addition to travel lanes for motor vehicles, Complete Streets can include some or all of the following components: sidewalks and pedestrian crossings, dedicated on-street bicycle facilities, shared-use paths (sidepaths), accessible transit stops, transit facilities, electric and autonomous vehicle infrastructure, accommodations where appropriate for micromobility and shared mobility devices, and relevant mobility-related technology.

Different design elements may be needed in rural, suburban, and urban areas. For example, in a rural area, providing wide, paved shoulders can accommodate bicyclists and improve safety for

motorists while still providing for the movement of freight. However, in suburban areas, separate multiuse paths and sidewalks may be needed to separate motor vehicles, pedestrians, transit users, and/or bicyclists. In urban areas, denser development and a higher number of users may necessitate the addition of marked or separated bicycle lanes, transit accommodations, on-street parking, and electric and autonomous vehicle accommodations. The goal is to balance the safety and convenience of all road users, regardless of development density. Applying Context-Sensitive Design and Complete Streets principles as projects are developed helps promote safety, mobility, and health, and improves infrastructure conditions for all users while preserving and enhancing scenic, aesthetic, historic, community, and environmental resources. The adoption of a Complete Streets or Context-Sensitive Design policy should be the goal of any agency that wants to promote safety and a holistic approach to transportation.

Other Health Factors in Transportation

Transportation-related businesses also can support healthy communities and the environment. For example, byproducts of transportation that may otherwise be dumped in the natural environment or stored at landfills can be recycled into new

transportation sources such as crumb rubber asphalt or railroad ties. This process promotes healthy communities by eliminating a potential breeding ground for mosquitoes when rainwater collects in abandoned transportation byproducts such as tires. Policy AQ3-007, promoting sustainable tire disposal practices, can be found in the **Air Quality** section of the **Environmental Considerations** chapter.

The Mobility 2045 Update also promotes healthy communities with the Health Accessibility Program and Policy EJ3-004. This program and policy seek to identify and support transportation solutions to improve health outcomes for underserved communities. More information is included in the **Social Considerations** appendix.

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4. Environmental Considerations: Air Quality

Introduction

The negative impacts of poor air quality on health are of great concern in North Central Texas. Air quality is vital to a community's overall quality of life, but the negative impacts of polluted air can more adversely affect sensitive populations such as children and the elderly. For example, a 2018 update from the Center for Children's Health found 14 percent of children aged 0 to 14 in the six-county area of Denton, Hood, Johnson, Parker, Tarrant, and Wise were reported to have an asthma diagnosis at some point in their lifetime.²

While regional air quality has improved in recent years, continued progress is necessary to further benefit both people who have asthma or respiratory problems and those who could also experience health effects when exposed to air pollution.

Beyond health effects, air pollution can have negative economic impacts. North Central Texas is a leader in global and domestic trade (for further discussion, see the **Freight** section of the **Mobility Options** appendix). This trade, while creating approximately 20 percent of the region's employment, has serious implications for regional air quality. Generally, the trucks and trains employed in goods movement are fueled by diesel and, therefore, are major contributors to air pollution. Medium- and heavy-duty on-road vehicles together comprise approximately 59 percent of the total on-road mobile source nitrogen oxide emissions in the region, with locomotives accounting for 38 percent of the total off-road mobile source nitrogen oxide emissions, as illustrated in the **Air Quality** section of the **Environmental Considerations** appendix. Failure to meet federal air quality standards could result in additional emission control requirements negatively impacting local businesses. It may

also result in a freeze on all federally funded transportation projects, costing the region millions of dollars in federal transportation funding and ultimately affecting jobs in the region.

Because the transportation sector is a significant source of air pollutants, NCTCOG (North Central Texas Council of Governments) monitors air quality impacts attributable to transportation and administers a variety of programs to improve air quality in the region. Efforts that monitor and target pollutants result in reductions to regulated and nonregulated pollutants alike. Further descriptions of regulated pollutants and required technical analyses is found in the *Required Technical Analysis* section of this chapter, while the *Vehicle Air Quality Strategies and Voluntary Initiatives* section discusses NCTCOG's efforts to go above and beyond required air quality activities, as well as the numerous projects and programs administered in the North Central Texas region.

Mobility 2045 Update Supported Goals

Support travel efficiency measures and system enhancements targeted at congestion reduction and management.

Preserve and enhance the natural environment, improve air quality, and promote active lifestyles.

Air Quality Policies and Programs

AQ3-001: Pursue successful transportation conformity determinations of the Metropolitan Transportation Plan and Transportation Improvement Program consistent with federal and state guidelines.

² The Center for Children's Health,
<https://centerforchildrenshealth.org/data/chna/pages/default.aspx>

AQ3-002: Provide technical assistance and analysis to attain and maintain National Ambient Air Quality Standards and reduce negative impacts of other air pollutants.

AQ3-003: Support and implement educational, operational, technological, and other innovative strategies that improve air quality in North Central Texas, including participation in collaborative efforts with local, regional, state, federal, and private sector stakeholders.

AQ3-004: Support and implement strategies that promote energy conservation, address public health concerns, reduce demand for energy needs, reduce petroleum consumption, and/or decrease greenhouse gas emissions.

AQ3-005: Required for clean fleet funding as contained in Regional Transportation Council Resolution R14-10. Establish a framework for reducing fleet emissions, reducing fuel consumption, partnering with the North Central Texas Council of Governments/Dallas-Fort Worth Clean Cities, and training staff.

AQ3-006: Adopt and implement an idling restriction ordinance, or any other idling restriction measure, to reduce idling within local government jurisdictions as consistent with Regional Transportation Council Resolution R21-06.

AQ3-007: Promote adoption and implementation of an ordinance or guidelines similar to an ordinance that promote sustainable tire disposal practices, including recycling.

AQ3-008: Adopt and implement a comprehensive air quality action plan or various strategies provided in the North Central Texas Council of Governments Comprehensive Air Quality Action toolkit.

F3-002: Incorporate sustainability and livability options during the project selection process. Include additional weighting or emphasis as appropriate and consistent with Regional Transportation Council policy objectives, including, but not limited to, demand management, air quality, natural environment preservation, social equity, or

consideration of transportation options and accessibility to other modes (such as freight, aviation, bicycle, and pedestrian). *(While this is listed as a financial policy, it has specific implications for the air quality portion of the plan.)*

The Mobility 2045 Update supports the following air quality programs:

AQ2-001: Air Quality Initiatives: Fleets

AQ2-002: Air Quality Initiatives: Consumers

AQ2-003: Air Quality Initiatives: Communities

AQ2-004: Air Quality Technical Planning and Analysis

Required Technical Analysis

National Ambient Air Quality Standards and Ozone Nonattainment Status

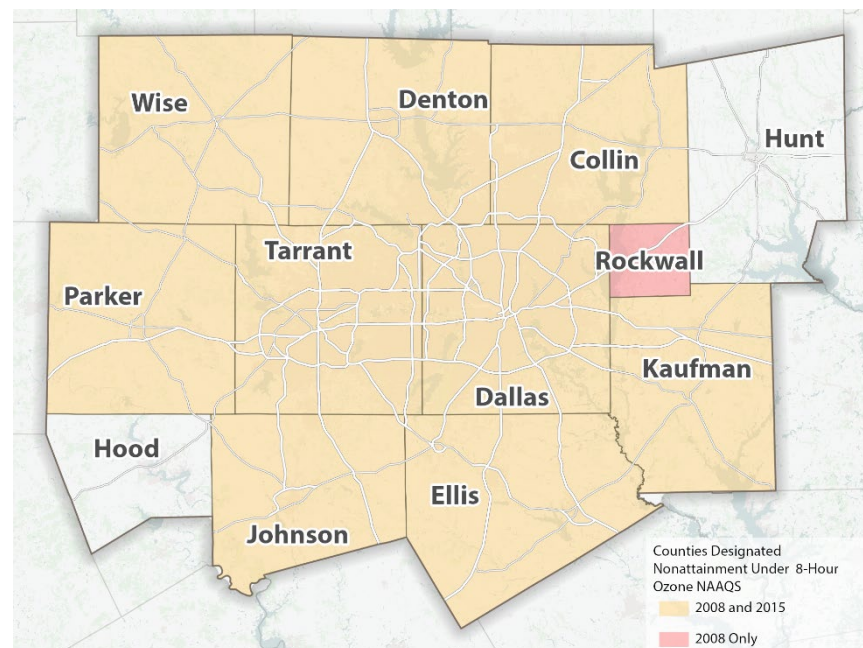
The federal Clean Air Act requires the United States EPA (Environmental Protection Agency) to set NAAQS (National Ambient Air Quality Standards) for outdoor air pollutants considered harmful to public health and the environment. The EPA refers to these pollutants as criteria pollutants, which include carbon monoxide, nitrogen dioxides, ground-level ozone, sulfur dioxide, particulate matter, and lead. Each county in the nation is assessed according to the standards for each criteria pollutant. An area with attainment status has pollutant concentrations within the limits established by the EPA as being protective of human health and the environment. An area with nonattainment status has pollutant concentrations exceeding those limits. Based on the magnitude of a pollutant in a given area, the EPA classifies counties into one of the following categories, listed in order of increasing severity: attainment/unclassifiable, marginal, moderate, serious, severe 15, severe 17, and extreme.

Since the NCTCOG 10-county region is designated nonattainment for ozone, most of the air quality efforts focus on reducing ozone precursor pollutants from the transportation sector, the largest contributor to ozone formation. Ground-level ozone pollution is caused by a photochemical reaction of volatile organic compounds and nitrogen oxides, which are known as ozone precursors, in the presence of sunlight and heat. In 1991, the region's first designation classified four counties in the region as nonattainment under the 1-hour ozone NAAQS. The Clean Air Act requires the EPA to reevaluate criteria pollutant standards periodically, resulting in a change in the ozone NAAQS, the number of counties designated as nonattainment, and the region's classification status.

Since 1991, the standards have become more stringent, and six additional counties were added to the region's nonattainment area. The "Environmental Protection Agency Historical Ozone Standard Timeline," in the **Air Quality** section of the **Environmental Considerations** appendix, presents the timeline of changes to the EPA's ozone standard and the implications for the North Central Texas region.

The timeline illustrates how, as the ozone standard gets lower, more counties in the region are impacted. Under the 2008 8-hour ozone standard, the 10 counties shown in **Exhibit 4-2** are classified as serious nonattainment and had an attainment of July 20, 2021. The region did not meet this deadline and will be reclassified to the severe category. Nine of these 10 Dallas-Fort Worth nonattainment counties (excluding Rockwall County) are classified as marginal nonattainment under the 2015 8-hour ozone NAAQS and had an attainment of August 03, 2021. The 9 counties did not meet this deadline and will be reclassified to the moderate category.

Exhibit 4-2: 8-Hour Ozone NAAQS Nonattainment Area



Despite making significant strides toward improving air quality, the region faces challenges in meeting increasingly stringent air quality standards, especially in consideration of the region's rapid population growth, which is forecasted to grow to 11.4 million residents by 2045. As population grows, vehicle miles traveled also increase, resulting in more vehicle emissions. **Exhibit 4-3** illustrates progress made in reducing ambient ozone concentrations despite population growth. **Exhibit 4-4** provides additional detail on the region's success in reducing ambient ozone concentration since 1998 in efforts to meet the 1997, 2008, and 2015 ozone NAAQS.

Exhibit 4-3: Demographic and Design Value Historical Trends in the Dallas-Fort Worth 10-County Ozone Nonattainment Area

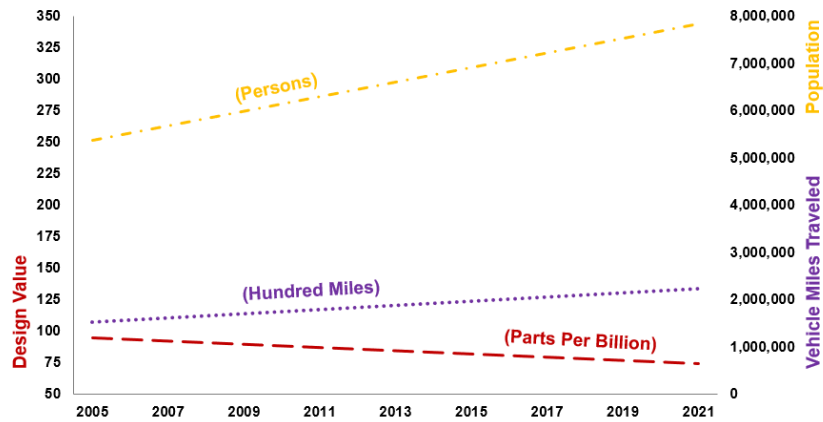
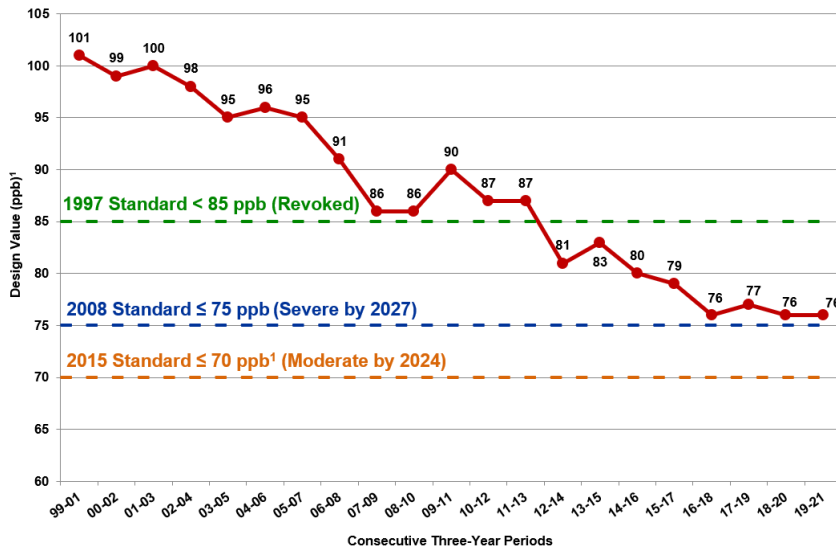


Exhibit 4-4: 8-Hour Ozone NAAQS Trend Line, 1998 to 2017



¹ Attainment goal – According to the US EPA National Ambient Air Quality Standards, attainment is reached when, at each monitor, the *Design Value* (three-year average of the annual fourth-highest day maximum 8-hour average ozone concentration) is equal to or less than 70 parts per billion.

Source: NCTCOG

Air Quality Conformity

NCTCOG participates in a cooperative, collaborative process with local, state, and federal agencies to improve air quality across the region. This partnership includes close coordination as TCEQ (Texas Commission on Environmental Quality) develops the SIP (State Implementation Plan). The SIP, a regional air quality plan required by the Clean Air Act, outlines how ozone concentrations will be reduced in the nonattainment area to a level that complies with the federal standard.

The goal of the North Central Texas Council of Governments air quality programs is to achieve healthy air quality for North Central Texas residents and the environment by meeting and maintaining federally mandated standards for all criteria air pollutants.

In North Central Texas, the Regional Transportation Council has taken a proactive role in helping TCEQ revise the SIP for the region. NCTCOG assists with air quality technical planning and implements emission reduction control strategies at the local level to enhance federal and state efforts. Numerous other stakeholders throughout the region, including local governments and business coalitions, also support this process and facilitate local implementation.

The federal government requires projects and programs in nonattainment areas, including the 10 counties in North Central Texas, to be analyzed for Transportation Conformity to be approved and implemented. Transportation Conformity air quality analysis must be conducted on federally funded projects; projects requiring federal approval; transportation improvement programs; or projects,

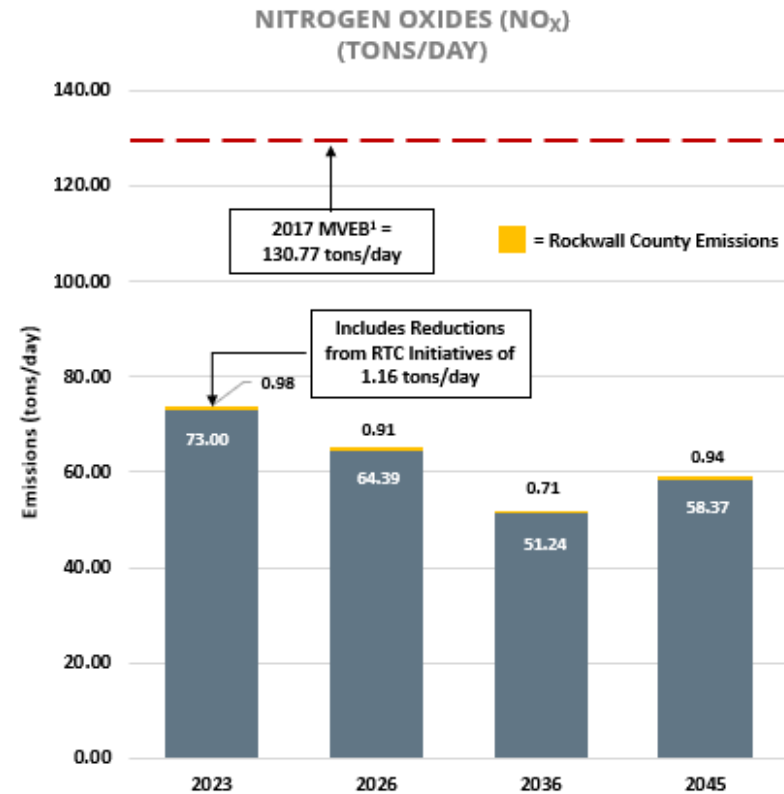
programs, and policies identified in transportation plans. The conformity analysis does not measure ozone directly, but instead measures ozone precursors: VOC (volatile organic compounds) and NO_x (nitrogen oxides). MVEB (Motor Vehicle Emissions Budgets) for NO_x and VOC are established in the regional SIP. Under the MVEB test, vehicle emissions for each analysis year must be less than the applicable air quality budgets.

A conformity determination is a two-step process in metropolitan areas. First, the RTC (Regional Transportation Council), as the policy body of the region's Metropolitan Planning Organization, is responsible for conducting the local-level transportation conformity determination for the North Central Texas counties designated as nonattainment. Second, the Federal Highway Administration and Federal Transit Administration make a federal-level transportation conformity determination. Only after receiving this federal determination can the region's long-range transportation plan and Transportation Improvement Program be implemented.

Vehicle emission results documented below demonstrate the 10-county Dallas-Fort Worth ozone nonattainment area meets the regional air quality conformity requirements of the budget test. Conformity analysis results are shown in **Exhibit 4-5** and **Exhibit 4-6**.

RTC initiatives, such as bicycle and pedestrian facilities, traffic signal improvements, high-occupancy vehicle/managed lanes, and park-and-ride facilities, are important to ensuring a successful conformity determination and assist with the region reaching or maintaining attainment for the EPA's criteria pollutants.

Exhibit 4-5: Emissions of Nitrogen Oxides
Dallas-Fort Worth Ozone Nonattainment Area
Air Quality Conformity Analysis Results

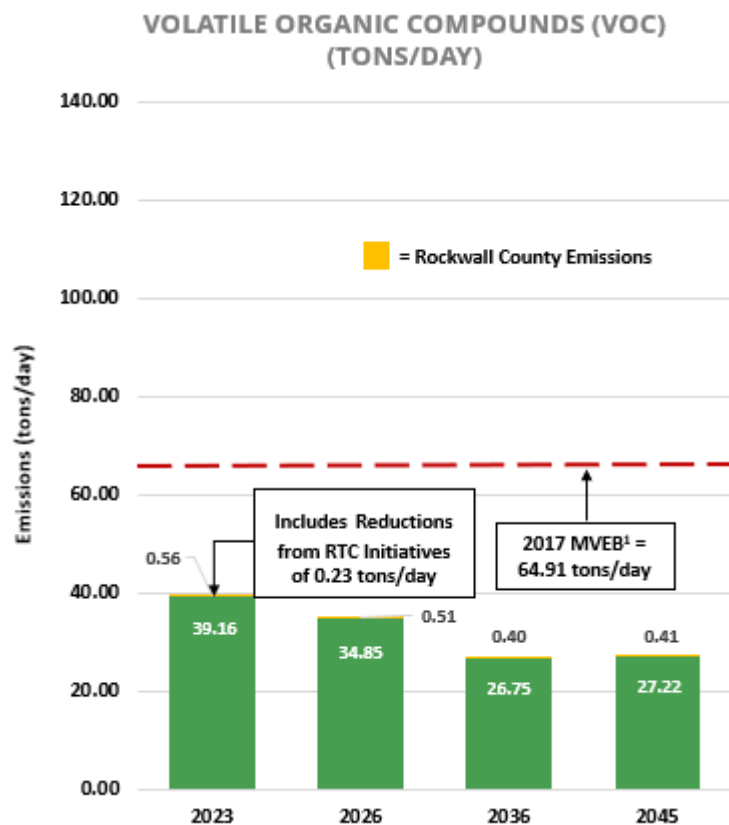


The results of the conformity determination demonstrate the Mobility 2045 Update meets the specific transportation air quality conformity requirements of the Clean Air Act (42 USC 7504, 7506(c) and (d)) and amendments, the applicable revision to the air quality plan (2017 Attainment Demonstration SIP, including the approved 2017 MVEBs³), and the Transportation Conformity rule (40 CFR Parts 51 and 93). This conformity determination was approved by the RTC,

³ Adequacy Status of the Dallas-Fort Worth, Texas Attainment Demonstration 8-Hour Ozone Motor Vehicle Emission Budgets for Transportation Conformity Purposes, 81 FR 78591

along with the Mobility 2045 Update, in June 2022. For additional Transportation Conformity information, refer to the 2022 Transportation Conformity document.⁴

Exhibit 4-6: Emissions of Volatile Organic Compounds
Dallas-Fort Worth Ozone Nonattainment Area
Air Quality Conformity Analysis Results



⁴ North Central Texas Council of Governments, 2022, Transportation Conformity, <http://www.nctcog.org/trans/air/conformity/>. The Transportation Conformity document will be updated at this website upon completion.

Mobile Source Air Toxics

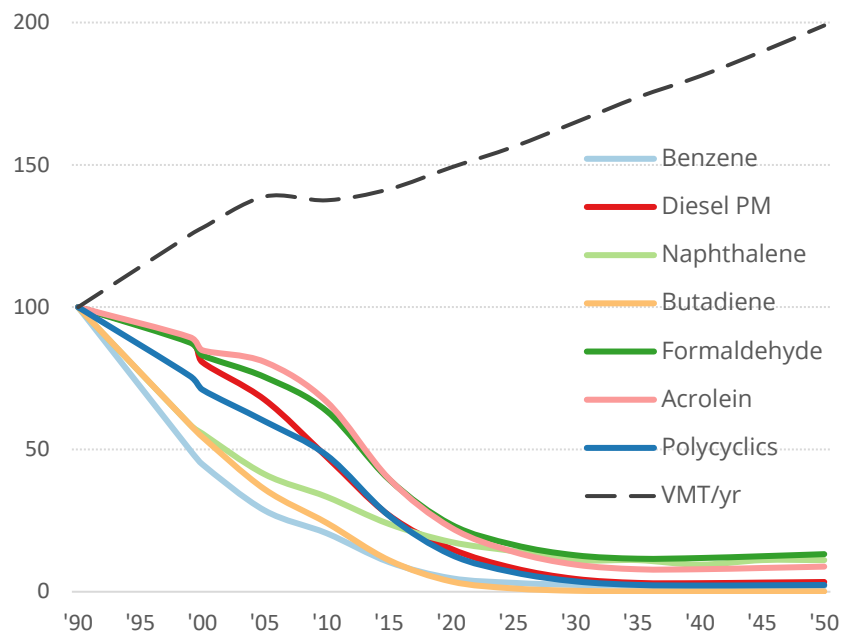
In addition to the criteria air pollutants under NAAQS, the EPA also regulates MSAT (Mobile Source Air Toxics). MSAT account for 7 of the 187 air toxics defined by the Clean Air Act Amendments of 1990. All refineries or importers of gasoline for passenger vehicles must meet specific compliance baselines, established by the EPA, for conventional and reformulated gasoline. The remaining air toxics come from point and area sources.

Of the seven MSAT, some toxic compounds are present in fuel and are emitted into the air when fuel evaporates or passes through an engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. MSAT also result from engine wear or from impurities in oil or gasoline. **Exhibit 4-7** shows that national MSAT emissions are expected to decline drastically over time, despite vehicle miles traveled dramatically increasing. Reductions in MSAT emissions can be attributed to the use of cleaner fuels and more efficient engines.

Vehicle Air Quality Strategies and Voluntary Initiatives

The programs and policies supported by the Mobility 2045 Update not only seek to improve the efficiency of the transportation system, which in turn improves air quality by reducing regulated pollutants, but also serve to reduce non-regulated pollutants (e.g., greenhouse gases) and fuel consumption.

Exhibit 4-7: Index of National MSAT Emission Trends and Vehicle Miles Traveled, 2010 to 2050, for Vehicles Operating on Roadways⁵



Non-Regulated Pollutants

GHGs (greenhouse gases) trap heat in the atmosphere and create a naturally occurring warming phenomenon called the greenhouse effect. This warming may affect the built and natural environment in ways that are potentially broad reaching and unpredictable at a regional level. The North Central Texas region could experience changes in precipitation levels, impacts to human health, and impacts to natural ecosystems.

Some GHGs occur naturally in the atmosphere, while others result from human activities. Naturally occurring GHGs include water vapor,

⁵ Federal Highway Administration, 2016, https://www.fhwa.dot.gov/ENVIRONMENT/air_quality/air_toxics/policy_and_guidance/msat/nmsate_trends.cfm

DFWCC (Dallas-Fort Worth Clean Cities Coalition),

which was established in 1995, works with vehicle fleets, fuel providers, community leaders, and other stakeholders to reduce transportation energy use and improve air quality. DFWCC collaborates with both the public and private sector to increase the use of alternative fuels, advanced technology vehicles, improve fuel economy and the use of technologies that reduce idling, and reduce vehicle miles traveled.

Staff accomplishes this work through support, education, and training of fleet staff, education and awareness-building for consumers, and planning support and sharing of best practices among the cities and other organizations that have a role to play in creating regulations and policies that can help or hinder alternative fuel and electric vehicle adoption.

DFWCC has a target of increasing reductions in petroleum consumption among local fleets by 16 percent more than the previous year, each year. Progress is documented in the DFWCC Annual Report, available at <https://www.dfwcleancities.org/annualreport>.

See the **Air Quality** section in the **Environment Considerations** appendix for an overview of DFWCC impacts summarized from the 2020 Annual Survey of local fleet activities.

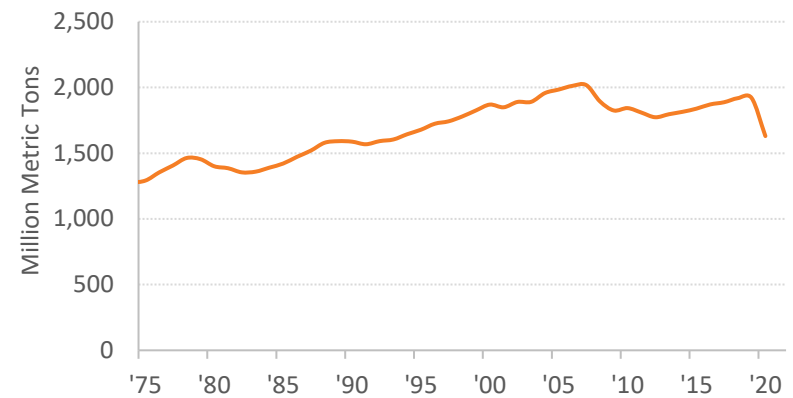
CO₂ (carbon dioxide), CH₄ (methane), N₂O (nitrous oxide), and ozone. Certain human activities associated with transportation, however, add to the levels of most of these gases:

- CO₂ is released to the atmosphere when fossil fuels (oil, natural gas, and coal) are burned.
- CH₄ is emitted during the production and transportation of coal, natural gas, and oil.
- N₂O is emitted during combustion of fossil fuels.

GHGs that are not naturally occurring include chlorofluorocarbons and hydrofluorocarbons, which are by-products of foam production, refrigeration, and air conditioning; and perfluorocarbons, which are generated by industrial processes. In the United States, the transportation sector is the lead source of GHG emissions, accounting for 29 percent of national GHG emissions in 2019, according to the EPA.⁶ As **Exhibit 4-8** shows, CO₂ emissions from the transportation sector peaked in 2006 and remained relatively stable from 2008 to 2019. However, in 2020, CO₂ emissions dropped to levels seen in 1994. This drop in emissions is likely largely due to the decline in transportation activity during the COVID-19 pandemic, as passenger trips, transit, and air travel was substantially reduced. This suggests that substantial emissions reductions could be achieved if large-scale shifts toward telecommuting, virtual conferences, and other non-single-occupant vehicle modes of travel became permanent.

NCTCOG is working on the first regional GHG emissions inventory to determine the emissions from various sectors. This inventory will assist in the development of a GHG emissions reductions toolkit for local governments, private industries, and the general public to assist in the reduction of emissions.

Exhibit 4-8: Total US Transportation Sector Carbon Dioxide Emissions⁷



Technology and Air Quality

Aside from monitoring impacts, the RTC has taken a proactive stance in supporting implementation of projects and programs designed specifically to improve air quality rather than for transportation purposes.

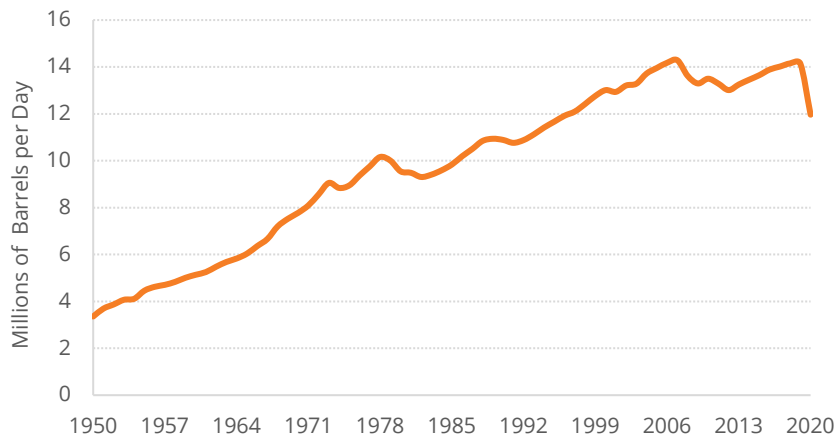
According to the US Energy Information Administration, in 2021, 68 percent of total US petroleum consumption was from the transportation sector.⁸ **Exhibit 4-9** depicts the substantial increase in petroleum consumption for transportation since 1949, but also shows this consumption has leveled off somewhat in recent years. Additionally, the impact of COVID-19 can be realized with the drop in petroleum consumed by the transportation sector from 2019 to 2020. Some of the increase in consumption expected from higher vehicle miles traveled is offset by increases in fuel efficiency and use of electricity and other alternative fuels.

⁶ US Environmental Protection Agency, <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

⁷ US Energy Information Administration, August 2021 Monthly Energy Review, Figure 3.7, <https://www.eia.gov/totalenergy/data/monthly/>

⁸ US Energy Information Administration, August 2021 Monthly Energy Review, <https://www.eia.gov/totalenergy/data/monthly/>

Exhibit 4-9: Petroleum Consumed by the Transportation Sector in the US⁹



Vehicle technologies can help reduce petroleum, increase efficiency, and reduce pollutants in several ways. Technologies help keep vehicles operating properly, which helps keep emissions lower. Technologies are also available to increase fuel economy and reduce idling. Finally, advanced technology vehicles such as hybrids, electric vehicles, and other alternative fuels (e.g., propane Autogas, compressed natural gas, and biofuels) produce lower emissions than their conventional counterparts. This is true even when accounting for upstream emissions such as those associated with generating electricity at a power plant. One of the major programs housed at NCTCOG is the DFWCC (Dallas-Fort Worth Clean Cities) Program. NCTCOG is designated by the Department of Energy as the host agency for DFWCC. As part of the national Clean Cities network, DFWCC works to improve efficiency and reduce emissions from the transportation sector. Most of these impacts are realized through use of alternative fuel, hybrid, and electric vehicles.

⁹ *Ibid*

Alternative Fuels

Use of alternative fuel vehicles is only possible if alternative fuel infrastructure exists to support their operation. Beginning in 2016, the Federal Highway Administration was required to designate [Alternative Fuel Corridors](#) as either “ready” or “pending” for [electric vehicle charging](#), [hydrogen](#), [propane](#), and [natural gas](#) fueling. This designation indicates the degree to which refueling infrastructure for a particular fuel is available along highway corridors. NCTCOG has participated in this initiative since 2016, in collaboration with the Texas Department of Transportation. After the first five years of nominations, Texas boasts a robust network of designations, including 16 Interstate Highways, 1 US Highway, and 1 State Highway, covering 13,000 miles of National Highway System (all fuels combined). A map of the currently designated Alternative Fuel Corridors can be found in the **Air Quality** section of the **Environmental Considerations** appendix. These corridor designations have become critically important with the passage of the Bipartisan Infrastructure Law, as they open the door to funding eligibility for development of additional fueling stations along these highways.

NCTCOG is doing more extensive corridor work through a planning project along Interstate Highway (IH) 45, which connects the Dallas-Fort Worth area to Houston. Through a planning grant from the Federal Highway Administration, NCTCOG is developing a Zero-Emission Vehicle Corridor Deployment Plan, which will outline how best to build out infrastructure along IH 45 to support both battery electric and fuel cell electric vehicle travel with a focus on supporting medium- and heavy-duty zero-emissions vehicle travel. This corridor is key to advancing air quality efforts in both the Dallas-Fort Worth and Houston areas, as both face ozone nonattainment challenges that are heavily impacted by heavy-duty diesel vehicles. NCTCOG is working with the Houston-Galveston Area Council and a

variety of stakeholders, including original equipment manufacturers, station providers, and utilities to advance this project and leverage IH 45 Infrastructure Deployment Plan work with other planning efforts led by organizations statewide.

Autonomous Vehicles

The emergence of AVs (autonomous vehicles) could have a positive impact on transportation sector emissions. Most AVs will be built on electric or hybrid powertrains and are likely to be first deployed in large numbers through fleets managed by shared mobility providers. The intensive use of electrified fleet vehicles to handle a substantial portion of trips in the region would mean the share of trips handled by zero-tailpipe-emission AVs may be significantly higher than the percentage of AVs in the overall vehicle fleet.

The air quality benefits of AVs will be much higher if shared-ride and micro-transit forms of shared mobility gain a significant market share. There is a real possibility that automated surface transportation may result in an increase in vehicle miles traveled due to 1) greater convenience, 2) lower cost, 3) the ability to work and consume media while traveling instead of driving, and 4) use by persons unable to drive a conventional car. Increasing average vehicle occupancy levels will be key to counteracting this possibility. For further discussion on AVs, see the *Vehicle Automation and Related Developments* section of the **Transportation Technology** chapter.

Technology and Air Quality Programs

Regional planning goals such as increasing mobility, supporting economic vitality, enhancing the environment, promoting energy conservation, and improving the quality of life also influence air quality impacts. Many programs, policies, and projects described in other chapters of this document improve air quality by increasing efficiency in the transportation system. The following efforts are among those that reduce transportation-related emissions:

- Mitigating congestion

- Reducing the number of vehicles driven by individual commuters through the use of alternative transportation options or technology advancements (e.g., remote work or virtual meetings enabled by stable broadband connection and access)
- Improving roadway design to facilitate traffic flow

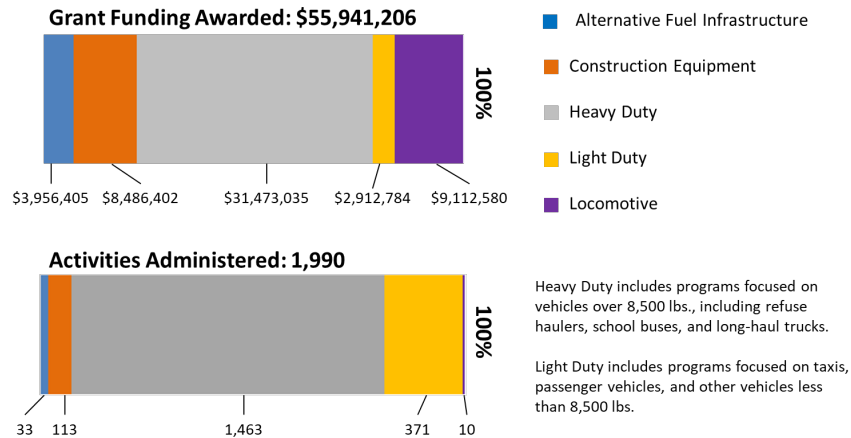
These strategies are discussed in the **Operational Efficiency** chapter. Many of these programs and projects are included as voluntary control strategies in the region's SIP. These strategies improve how the transportation system operates and have a secondary benefit of improving air quality.

Air quality programs are designed to target three major audiences: fleets (both public and private), consumers, and communities. Many projects within these programs seek to facilitate the use of the cleanest available technologies either directly (e.g., providing incentives to scrap and replace high-polluting vehicles, or to purchase zero-emission vehicles) or indirectly (e.g., providing education on features and benefits of cleaner transportation technologies to encourage adoption).

As an example, **Exhibit 4-10** illustrates the total number of activities and total funding awarded to local fleets through competitive funding programs for the 2006 to 2021 period.

Numerous communication strategies help explain the importance of these measures to stakeholders and the public, including Air North Texas, education campaigns, newsletters, and social media. This comprehensive approach to reducing emissions will become increasingly important as the region balances population and economic growth with the need to continue to improve air quality.

Exhibit 4-10: Total Vehicle/Equipment/Technology Grant Funding Awarded and Activities Administered by Activity Type (2006 to 2021)



Electrification

Electric drive vehicles, which include BEVs (battery electric vehicles), PHEVs (plug-in hybrid electric vehicles), and hydrogen fuel cell vehicles, have the potential to gain great market share and help reduce concentrations of criteria pollutants, and also continue trends in both petroleum and CO₂ reductions. Within its work as the DFWCC Coalition, NCTCOG oversees an initiative called Electric Vehicles North Texas, which began around 2011, as a way to pull stakeholders together to plan for and support adoption of BEVs and PHEVs. Beyond education and information sharing, key activities include outreach and consumer-facing events such as National Drive Electric Week. Current forecasts predict BEVs and PHEVs could comprise 30 percent of all vehicles on the road by 2040, based on policy and technology assumptions, but the rate of adoption may be substantially impacted by state and local measures.¹⁰ Additionally, the Biden Administration announced a national goal for 50 percent of all passenger vehicle sales in the United States to be electric by 2030. According to the 2021 Environmental Protection Agency Automotive

¹⁰ Bloomberg New Energy Finance, Electric Vehicle Outlook 2020, <https://about.bnef.com/electric-vehicle-outlook/>

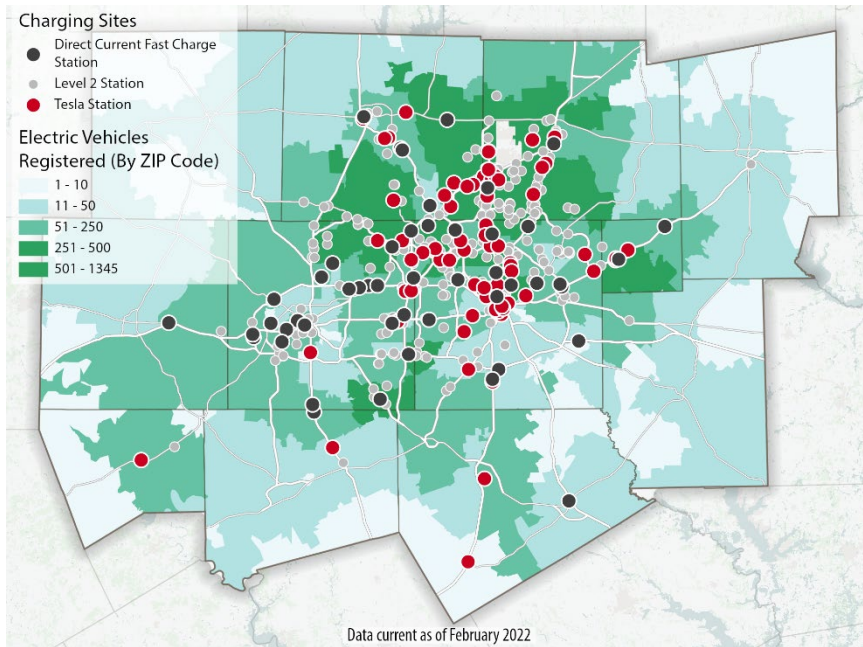
Trends Report, 5 percent of new car sales in 2021 were electric vehicles (EVs) and by 2025, it is estimated that 30 percent of new car sales could be EVs.¹¹ North Texas observed a 32.5 percent average annual growth for EV registration from 2015 to 2020, showing that EV adoption is growing quickly within the region. As of January 2022, BEVs and PHEVs constitute approximately 0.62 percent of the overall passenger vehicle fleet in the NCTCOG region, comprising over 40,000 vehicles.

NCTCOG seeks to support strong EV adoption through local planning and resources, especially regarding how local governments can support EV readiness in their communities to reduce EV barriers and increase EV charging accessibility to all populations. **Exhibit 4-11** shows the geographic distribution of EV registration by zip code, publicly available Level 2 and Direct Current Fast Charge charging infrastructure, and Tesla charging infrastructure, as of January 2022. Note that Tesla charging stations are classified separately because the charging equipment at Tesla sites is proprietary and can only be used by Tesla drivers. Thus, those sites are not considered ‘publicly accessible.’

As depicted in the map, most EV infrastructure locations mimic areas of higher EV registration rates, clustering EV infrastructure accessibility most densely toward the areas where Dallas, Denton, and Collin counties meet. This pattern has left many areas across the region with limited availability of publicly accessible charging infrastructure.

¹¹ US Environmental Protection Agency 2021 Automotive Trends Report, <https://www.epa.gov/automotive-trends/download-automotive-trends-report>

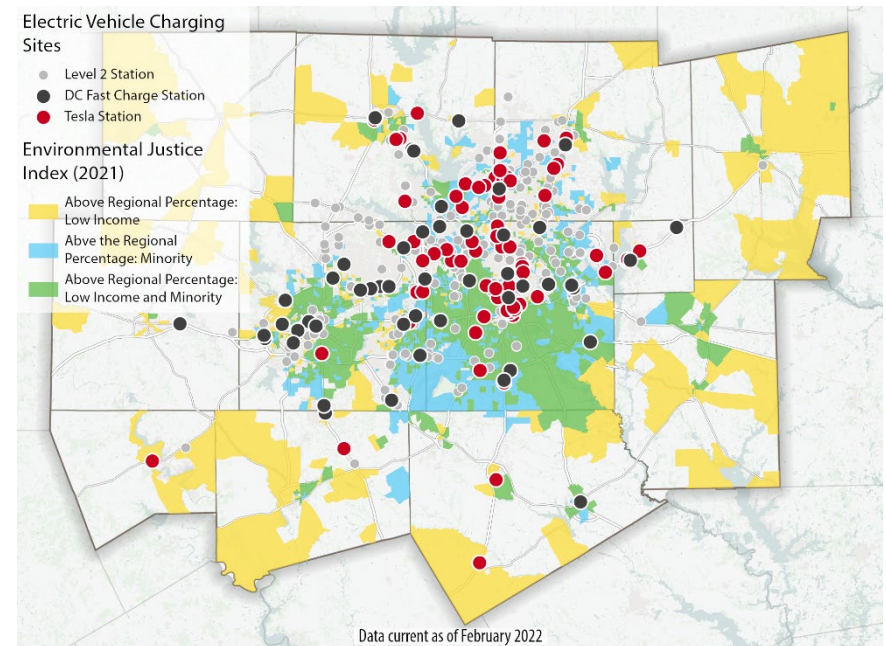
Exhibit 4-11: EV Registration by Zip Code and Publicly Accessible EV Charging Infrastructure in the 12-County North Texas Metropolitan Planning Area



A gap analysis, found in the **Air Quality** section of the **Environmental Considerations** appendix, highlights areas that fall within a five-mile radius of publicly available charging infrastructure across the 12-county Metropolitan Planning Area boundary. This further showcases gaps where there is minimal access to publicly available charging sites. Furthermore, as most registered electric vehicles and their corresponding charging infrastructure have trended greater in areas of higher income populations, the North Central Texas Council of Governments seeks to concordantly increase equitable accessibility of charging by ensuring geographic gaps within environmental justice areas are supported by needed infrastructure. **Exhibit 4-12** shows the existing public charging infrastructure in comparison to the 12-county Metropolitan Planning

Area boundary environmental justice areas to highlight areas of greater equitable charging needs. There are over 1,400 publicly available EV charging plugs dispersed over 600 charging stations within North Texas as of January 2022. However, based on current technology, if EV growth forecasts predicting up to 30 percent market penetration of EVs by 2045 come to fruition, North Texas may need as much as 75 times¹² the amount of public access EV charging plugs currently available. This is based on ratios of infrastructure needed to support EV adoption developed by the National Renewable Energy Laboratory in 2017. As technology evolves, including advances in battery storage and EV range, this estimate is certain to change. It does provide a sense of the magnitude of planning and investment needed to develop this infrastructure.

Exhibit 4-12: Publicly Accessible EV Charging Infrastructure and Environmental Justice Areas in the 12-County North Texas Metropolitan Planning Area



¹² [National Renewable Energy Lab National Plug-In Electric Vehicle Infrastructure Analysis](#)

With the passing of the Bipartisan Infrastructure Law, \$7.5 billion was allocated for electric charging infrastructure across the country. Approximately \$408 million will be allocated to the Texas Department of Transportation through the National Electric Vehicle Infrastructure Formula Program, which is designed to help build a nationwide network of charging stations along highways. Another \$2.5 billion will be available via competitive grants through the Grants for Charging and Fueling Infrastructure for Corridors and Communities. This funding may be used either along highways or to serve community charging needs and is likely to have an emphasis on filling gaps in underserved communities. The North Central Texas area is certain to compete for a share of this funding, and it is likely that a portion of the formula funding will be used to support charging site development along highways in the 12-county Metropolitan Planning Area boundary. These dollars will provide critical investments needed to increase electric vehicle charging accessibility for equitably across the region and enable more seamless EV travel without range limitations.

Aside from the substantial funding authorized through the Bipartisan Infrastructure Law to these two electric vehicle infrastructure deployment programs, substantial funding for the electrification of transportation has been scoped into other programs across agencies, including the Department of Energy and the EPA. The EPA will administer \$2.5 billion over five years for zero-emission buses, and another \$2.5 billion for “clean” school buses, which may include electric, along with other alternative fuels. Emphasis on electrification has also been built into programs focused on ports and other freight-heavy sectors.

The extent to which EV adoption provides air quality benefits depends somewhat on when and how EVs will charge, especially as heavier vehicles electrify. EVs represent a new load on the electrical grid when charging. It will be important to add this additional load during off-peak times when there is latent grid capacity, rather than

adding additional load during peak afternoon hours, which would result in a need for additional peak electricity generation, and could prolong the use of higher emitting electric generating units. Outreach and education about the “best” time to charge will be essential, along with “smart” charging and managed charging strategies that shift the EV load to optimum times. Policy measures, such as utility rates and incentives for off-peak charging, could also be powerful, and the extent to which these measures may be adopted in the deregulated portion of the Texas electrical grid remains to be seen. Technologies such as off-grid or solar-integrated EV charging and bi-directional vehicle to grid capabilities provide an opportunity for EVs to help increase resilience and efficiency of the electrical grid and provide power during emergencies. NCTCOG collaborates with a variety of stakeholders across the state to plan for integration of transportation with the electrical grid in a way that not only serves transportation needs, but also accounts for grid resource constraints. The Bipartisan Infrastructure Law directs funding to the Department of Energy, in particular, to study issues related to integration of transportation and electric grid infrastructure.

Hydrogen Fuel Cell Technology

Hydrogen fuel cell vehicles are another application of electric drive vehicles that can help reduce emissions in the transportation sector and offer a comparable driving range to conventional vehicles. As hydrogen fuel cells become feasible in transportation, especially in the heavy-duty truck sector, NCTCOG is working with a variety of stakeholders on planning efforts to support hydrogen project deployments. The Interstate Highway 45 Zero-Emission Vehicle Corridor Deployment Plan described earlier is a key example of this work.

Summary

Air quality is vital to a community's overall quality of life. The federal Clean Air Act requires the United States to set NAAQS for outdoor air pollutants considered harmful to public health and the environment. NCTCOG participates in a cooperative, collaborative process with local, state, and federal agencies to improve air quality across the region.

By implementing air quality policies and programs and monitoring advancements in technology and related factors, NCTCOG takes a proactive stance in supporting regional efforts to improve air quality for North Texans.

All air quality policies, programs, projects, and maps are included in the **Air Quality** section of the **Environmental Considerations** appendix.

4. Environmental Considerations: Environmental Effects, Mitigation, and Stewardship

Transportation rules and regulations¹³ require the long-range transportation planning process to:

- Take place in consultation with environmental resource and regulatory agencies
- Consider and implement programs and projects that protect and enhance the environment and improve quality of life
- Improve the resiliency and reliability of the transportation system
- Reduce or mitigate stormwater impacts
- Discuss potential mitigation activities and locations

Mobility 2045 Update's environmental policies and programs support these requirements.

Environmental Policies

The Mobility 2045 Update supports the following environmental policies:

ER3-001: Enhance quality of life by protecting, retaining, restoring/mitigating, or enhancing the region's environmental quality during planning and implementation of transportation programs and projects.

ER3-002: Work cooperatively with regulatory and conservation partners to develop innovative approaches that meet their conservation priorities and facilitate the delivery of transportation projects.

ER3-003: Promote transportation programs and projects that encourage healthy lifestyles, including, but not limited to, providing appropriate access to the natural environment.

ER3-004: Facilitate federally recognized tribal nations' meaningful participation through Regional Transportation Council Policy P19-01, Policy Position to Support Communication with Tribal Nations.

F3-002: Incorporate sustainability and livability options during the project selection process. Include additional weighting or emphasis as appropriate and consistent with Regional Transportation Council policy objectives, including, but not limited to, demand management, air quality, natural environment preservation, social equity, or consideration of transportation options and accessibility to other modes (such as freight, aviation, bicycle, and pedestrian). *(While this is listed as a financial policy, it has specific implications for the environmental considerations portion of the plan.)*

Coordination with Environmental Resource and Regulatory Agencies

Federal, state, regional, and local agencies are tasked with regulating and ensuring the health of both human and natural environments. For example, the Clean Water Act and its regulations are monitored and regulated by agencies, including the Environmental Protection Agency, US Army Corps of Engineers, and the Texas Commission on Environmental Quality. Agencies such as the Texas Parks and Wildlife Department and the US Fish and Wildlife Service regulate other state

¹³ 23 CFR 450.306(b)(5), 23 CFR 450.306(b)(9), 23 CFR 450.316(b), and 23 CFR 450.324(f)(10)

and federal laws such as the Texas Parks and Wildlife Code and the Endangered Species Act.

Long-range transportation plans are developed in coordination¹⁴ with agencies such as these, in addition to local municipalities, special districts, and non-governmental organizations. **Exhibit C-15** in the **Environmental Considerations** appendix provides a summary of federal and state resource agencies that are stakeholders in the transportation planning process.

NCTCOG (North Central Texas Council of Governments) uses the PEL (Planning and Environment Linkages) process to engage stakeholders in the planning process. PEL seeks to include environmental, community, and economic priorities early in transportation planning.¹⁵ More than 200 stakeholders were invited to the environmental coordination meeting for the Mobility 2045 Update conducted in October 2021. Attendees discussed Mobility 2045 Update projects and their potential impacts to the environment. This discussion will guide further coordination between NCTCOG and resource and regulatory agencies.

Federal regulations state that consultation should include comparison with state conservation plans or maps, and inventories of natural or historic resources. Comparisons to this information, where available, are included in the **Environmental Considerations** appendix and incorporated into the *Natural Environment Screening* in the **Environmental Considerations** appendix.

Natural Environment Screening

Roadway and public transportation recommendations from the Mobility 2045 Update were screened to identify potential future needs for environmental coordination. The Natural Environment Screening can assist in achieving federal goals to sustain and restore

the health of ecosystems through an ecosystem-based approach and to promote environmental stewardship in the transportation system. The Natural Environment Screening provides a preliminary tool to identify potential impacts to natural environment resources that may result from the roadway and transit recommendations made in the Mobility 2045 Update. Early consideration of environmental effects may assist in identifying resource agencies that may be of interest for ongoing environmental coordination and collaboration throughout the planning and project development process. Potential opportunities for mitigation activities may also be identified through preliminary screening. The methodology and results of the Natural Environment Screening are found in the **Environmental Considerations** appendix.

Coordination with Federally Recognized Tribal Nations

In March 2019, the Regional Transportation Council adopted a policy position on communications with tribal nations. The policy position sought to facilitate meaningful participation by tribal nations in the transportation planning process. This would be accomplished through collaboration with tribal nation governments, with tribal nation citizens residing in North Central Texas, and between tribal nations and transportation partners. Also in 2019, NCTCOG staff developed and distributed a document that describes existing opportunities for federally recognized tribal nations to engage in transportation planning in North Central Texas. "Having a Say in Metropolitan Transportation Planning: Opportunities for Federally Recognized Tribal Nations" also explains NCTCOG's role in transportation planning in the 12 counties neighboring Dallas-Fort Worth. NCTCOG also provides spatial data files to be included in TxDOT's (Texas Department of Transportation's) Early Tribal

¹⁴ While federal regulations call for consultation, in Texas, that word is generally reserved for the National Environmental Policy Act process. The Mobility 2045 Update uses the term coordination instead of consultation.

¹⁵ Federal Highway Administration, *Environmental Review Toolkit Planning and Environment Linkages Program Overview*, <https://www.environment.fhwa.dot.gov/integ/index.asp>

Coordination Tool. The data files identify NCTCOG-led projects and studies that have the potential to impact cultural resources and historic or prehistoric remains. These projects' inclusion in TxDOT's online tool provides another opportunity for tribal nations to engage in transportation planning. Finally, NCTCOG staff attend annual TxDOT tribal consultation meetings.

Exhibit C-15 in the **Environmental Considerations** appendix lists federally recognized tribal nations with areas of interest within North Central Texas. NCTCOG invited these tribal nations to two conference calls in March 2022 to discuss the Mobility 2045 Update.

Programs and Projects

Coordination with environmental resource and regulatory agencies goes beyond developing the long-range transportation plan. These agencies participate in NCTCOG programs and projects that protect and enhance the environment and improve quality of life.

Regional Ecosystem Framework: An Ecosystem Approach

Federal agencies encourage transportation and conservation planning agencies to collaborate to restore or sustain the health of ecosystems. This ecosystem approach also expands the agencies' focus to a broader, ecosystem scale as opposed to one confined by project boundaries, allowing for more efficient and cost-effective avoidance and minimization strategies. Agencies also can identify more meaningful mitigation and conservation opportunities.¹⁶

North Central Texas' REF (Regional Ecosystem Framework) is a preliminary screening tool developed to streamline efforts to identify opportunities for mitigating the impact of infrastructure projects at

an ecosystem level, opportunities that may not have been evident using a traditional project-level approach.

NCTCOG collaborated with the Environmental Protection Agency, Texas Parks and Wildlife Department, and other resource and regulatory agencies to identify 10 factors that indicate the relative environmental value of subwatersheds, which are surface water drainage basins at the tributary scale.¹⁷ These factors were grouped into three categories:

- **Water Considerations**, including the REF layers flood zones, impaired water segments, surface water density, and wetlands
- **Green Infrastructure**, including the REF layers agricultural lands, natural areas, and wildlife habitat
- **Ecosystem Value**, including the REF layers diversity, rarity, and ecosystem sustainability

NCTCOG acquired data on these environmental factors from federal and state agencies, including the Federal Emergency Management Agency, Texas Commission on Environmental Quality, and the United States Geological Survey's National Land Cover Database.

Each of the region's 281 subwatersheds received a score for the 10 REF layers based on the quantity of the environmental factor present in the subwatershed, as shown for wetlands in **Exhibit 4-13**.

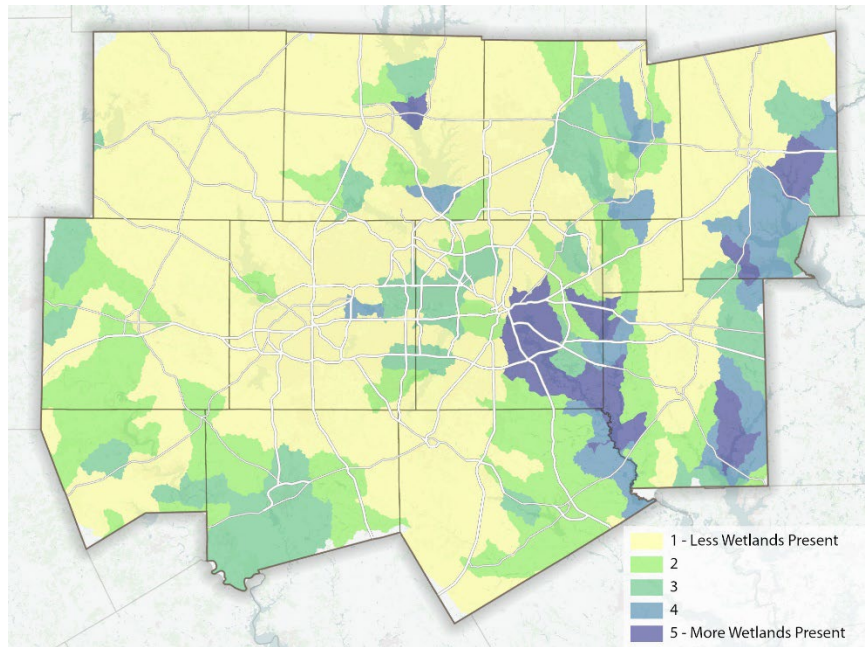
Additional REF maps can be found in the **Environmental Considerations** appendix. A detailed description of the REF methodology can be found at www.nctcog.org/REF.

Information from the REF is incorporated into the preliminary environmental screening of roadway and transit projects included in the Mobility 2045 Update. More information can be found in the *Natural Environment Screening* section of the **Environmental Considerations** appendix.

¹⁶ USDOT/Volpe National Transportation Systems Center, 2006, Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects

¹⁷ Environmental Protection Agency, EnviroAtlas Hydrologic Unit Codes: HUC 4, HUC 8, and HUC 12, <https://enviroatlas.epa.gov/enviroatlas/DataFactSheets/pdf/Supplemental/HUC.pdf>

Exhibit 4-13: Regional Ecosystem Framework Wetlands Layer



NCTCOG provides the REF layers to transportation partners and other users via the online REF Interactive Viewer, a one-stop-shop for environmental data. The Interactive Viewer includes about 40 spatial data layers in addition to the REF layers. A link to the Interactive Viewer is found at www.nctcog.org/REF.

In 2021, NCTCOG staff surveyed users and potential users of the REF and Interactive Viewer. The survey sought to identify modifications to the tools that could increase their usefulness for transportation and infrastructure planning. NCTCOG will change how it provides environmental data to respond to survey-takers' feedback.

Infrastructure Voluntary Evaluation Sustainability Tool

Transportation infrastructure reduces and fragments wildlife habitat. On roadways crossed by wildlife, the safety of motorists and animals is at stake.

Addressing these issues early in the transportation planning process can reduce the impacts projects have on the environment.¹⁸

A planned roadway in Denton County will cross a conserved greenbelt that serves as a wildlife corridor between Lewisville Lake and Ray Roberts Lake and protects the water quality in the Elm Fork of the Trinity River. The greenbelt is located in one of the most frequently visited state parks in Texas.

NCTCOG engaged stakeholders from tribal nations, nonprofit groups, environmental resource agencies, and municipalities to integrate their feedback into a study of transportation needs and potential alignments, or routes, for the roadway. An online tool,¹⁹ created by FHWA (Federal Highway Administration) was used by planners to identify sustainability and environmental stewardship best practices that can be incorporated into planning for the roadway. The project was funded by a grant from FHWA. The feasibility study and grant report can be found at <https://www.nctcog.org/trans/quality/environmental-coordination/planning-and-environmental-linkages>.

INVEST, or the Infrastructure Voluntary Evaluation Sustainability Tool, has been used previously by NCTCOG to identify sustainability focus areas to add to the long-range planning process. This resulted in new programs and projects on infrastructure resiliency, PEL, and the link between asset management and planning.

Following completion of the INVEST study, NCTCOG staff remain engaged in the Denton County corridor, participating in meetings

¹⁸ National Cooperative Highway Research Program Synthesis 305, Interaction between Roadways and Wildlife Ecology, http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_305.pdf

¹⁹ Federal Highway Administration, INVEST, <https://www.sustainablehighways.org/>

with TxDOT regarding parallel corridors and testing a geospatial tool that identifies corridors with the least potential for environmental impact. Work also has begun to identify strategies to promote sustainability in the corridor.

Section 214 Program

The North Central Texas Council of Governments has entered into an agreement with the US Army Corps of Engineers to expedite permits for regionally significant transportation projects. The increased communication resulting from this program has reduced the impact of transportation projects on the aquatic environment and reduced the time and cost for mitigation efforts.

Wetland and Stream Mitigation Assessment

Federal laws require agencies that construct transportation projects to mitigate for unavoidable impacts those projects have on wetlands and streams that are Waters of the United States. Under Section 404(b)(1)²⁰ of the Clean Water Act, the preferred form of mitigation to compensate for unavoidable impacts is the purchase of mitigation bank credits. If appropriate mitigation bank credits are not available, agencies building transportation projects may create their own mitigation sites; this can be financially risky and delay construction.

In 2016, NCTCOG assessed whether sufficient credits existed to meet the potential demand for credits that may be generated by roadway projects planned for North Central Texas through the years 2027 and 2040. The project was funded by FHWA's Strategic Highway Research Program Implementation Assistance Program. The project also identified potential locations for mitigation banks that could compensate for planned transportation projects while providing the greatest ecological benefit. More information on this project can be found in the *Potential Mitigation Activities and Locations* section of this chapter and at www.nctcog.org/REF.

Environmental Stewardship Program

NCTCOG's Environmental Stewardship Program provides \$1.6 million to fund private-sector efforts related to mitigating the effects of transportation infrastructure. These efforts include restoring wetlands, planting and tracking trees to reduce the urban heat island effect, and educating the private sector about environmental stewardship. The education component seeks to help members of the private sector understand ways they can enhance and preserve the natural environment and address effects created by infrastructure projects.

Environmental Stewardship Program efforts also have addressed needs identified by the Wetland and Stream Mitigation Assessment. In 2019, NCTCOG launched the Permittee Responsible Mitigation Database. This online tool connects landowners with government entities or businesses with permits to impact wetlands or streams. The tool promotes communications between these parties that may lead to permittee responsible mitigation in cases where mitigation banking credits are unavailable or less beneficial than permittee responsible mitigation. The database can be found at <http://prmd.nctcog.org>.

More information on the Environmental Stewardship Program can be found at <https://www.nctcog.org/trans/quality/environmental-coordination/planning-and-environmental-linkages>.

Quantifying the Benefits of Environmental Stewardship

Mitigation is not mandatory for all effects to the environment, but voluntary environmental stewardship efforts can reduce the environmental effects of transportation infrastructure and provide a benefit to the communities that engage in the stewardship.

To educate transportation partners about the value of environmental stewardship, NCTCOG developed an online tool that calculates the

²⁰ 40 CFR 230 Subpart J

economic and environmental benefits of stewardship activities. The Economic & Environmental Benefits of Stewardship tool was launched in 2019 at <http://eebs.nctcog.org>. Users can map a transportation or other infrastructure project in the tool, which then identifies stewardship strategies relevant to the affected potential environmental effects of the project. The economic benefit of these strategies also is estimated. The tool output can be compiled into a report to help inform decisionmakers.

Stormwater Impacts

The TriSWM (Transportation *integrated* Stormwater Management)²¹ framework was created to address regional issues with stormwater management by creating common stormwater criteria to address runoff from the region's roadway system.

TriSWM provides planning, design guidance, and frameworks for incorporating environmentally sensitive designs into standard stormwater management for roadway systems. The program was developed for cities, counties, and the private sector.

The goals of TriSWM:

- Provide safe driving conditions
- Minimize downstream flood risk to people and properties
- Minimize downstream bank and channel erosion
- Reduce pollutants in stormwater runoff to protect water quality

The primary pollutants from roadway runoff include:

- **Particulates:** pavement wear, sediment disturbance
- **Nitrogen and phosphorus:** roadside fertilizer
- **Metals:** gasoline and diesel, rusting automotive metals, engine wear, oil
- **Sodium and calcium:** de-icing salts, grease

- **Chloride:** de-icing salts
- **Sulfate:** roadway beds, fuel, de-icing salts
- **Petroleum:** spills and leaks, antifreeze, hydraulic fluids, asphalt surface
- **Pathogenic bacteria:** soil litter, bird droppings, livestock from hauling

To reduce the pollution entering the water system and address excessive stormwater runoff, TriSWM provides three levels of stormwater practices based upon traffic volumes on a roadway facility and the sensitivity of the receiving water system. These practices include grass channels, filter strips, bioretention areas, enhanced swales, stormwater wetlands, and infiltration trenches.

Potential Mitigation Activities and Locations

Major transportation infrastructure allows residents to travel to conduct business, transport goods, and carry out daily activities, including recreation. As the region's human population grows, new infrastructure must be constructed and can negatively affect the environment. Efforts must be made to avoid these impacts. However, some impacts are unavoidable, and laws and rules can require mitigation for unavoidable impacts to some environmental resources.

Exhibit C-19 in the **Environmental Considerations** appendix summarizes regional mitigation strategies that transportation agencies can employ to minimize, rectify, reduce, or compensate for transportation project impacts that cannot be avoided. These strategies are intended to be regional in scope; however, mitigation may address and be applied to project-level impacts.

NCTCOG coordinates with federal, state, and local resource agencies to develop a regional, ecosystem-based mitigation approach that

²¹ NCTCOG, iSWM™ Criteria Manual TriSWM Appendix, https://www.nctcog.org/nctcg/media/transportation/docsmaps/plan/landuse/greeninfrastructure_TriSWM_Appendix.pdf

expedites the delivery of transportation projects while encouraging preservation and restoration of high-priority ecosystems. Programs such as the Regional Ecosystem Framework, Wetland and Stream Mitigation Assessment, Environmental Stewardship Program, and Quantifying the Benefits of Non-Regulatory Mitigation provide examples of NCTCOG's efforts to integrate conservation priorities early in the planning process.

As individual transportation projects advance toward further planning and development, the federal government requires a detailed environmental analysis consistent with the National Environmental Policy Act. During this analysis, project features may be narrowed and refined, and environmental impacts and mitigation strategies will be appropriately ascertained for individual projects.

Potential Mitigation Locations

The Wetland and Stream Mitigation Assessment identified potential locations for mitigation activities, such as restoration or enhancement, to compensate for unavoidable impacts to wetlands or streams. These locations, displayed in the **Environmental**

Considerations appendix, were identified as providing the greatest ecological benefit to the region. Ecological factors were identified with feedback from federal, state, and local resource agencies.

Mitigation Assessment of Mobility 2045 Update

Potential credit demand and availability were reanalyzed for roadway projects in the Mobility 2045 Update that are expected to be constructed by 2026. This interim year was chosen because it reflects the time scale on which mitigation banks operate better than the plan's horizon year of 2045. **Exhibit 4-14** estimates which subbasin-level watersheds in the region may face the greatest demand for mitigation credits. It also identifies the number of wetland and stream credits available in each subbasin at the time the data was downloaded from RIBITS (Regulatory In-Lieu Fee and Bank Information Tracking System), which was developed by the US Army Corps of Engineers. The number of available credits can change daily as credits are purchased from or made available for sale by mitigation banks. RIBITS also does not reflect credits that have been purchased but are not yet associated with a permit.

Exhibit 4-14: Mitigation Assessment

Subbasin-Scale Watersheds Reflecting Ecoregion Divisions	Wetlands		Streams					
	Available Credits*	Potential Demand	Perennial		Intermittent		Ephemeral**	General Legacy***
			Available Credits	Potential Demand	Available Credits	Potential Demand		
11140301 Sulphur Headwaters	1406.65	None	0	None	0	None	0	1
12010001 Upper Sabine Blackland Prairies	6776.94	None	2191.9	None	0	None	0	1
12010001 Upper Sabine East Central Texas Plains	7419.51	None	19041.2	None	5656.9	None	0	1
12010003 Lake Fork Blackland Prairies	6776.94	None	2191.9	None	0	None	0	1
12010003 Lake Fork East Central Texas Plains	7419.51	None	19041.2	None	5656.9	None	0	1
12030101 Upper West Fork Trinity	444.36	None	0	None	0	None	0	110.25
12030102 Lower West Fork Trinity Blackland Prairies	471.647	Medium	1408.41	Medium	2261.84	High	11855.6	110.25

Subbasin-Scale Watersheds Reflecting Ecoregion Divisions	Wetlands		Streams					
	Available Credits*	Potential Demand	Perennial		Intermittent		Ephemeral**	General Legacy***
			Available Credits	Potential Demand	Available Credits	Potential Demand	Available Credits	Available Credits
12030102 Lower West Fork Trinity Cross Timbers	471.647	Low	1408.41	None	2261.84	Low	11855.6	110.25
12030103 Elm Fork Trinity Blackland Prairies	468.86	Low	916.58	Low	740.49	Medium	7566.08	110.25
12030103 Elm Fork Trinity Cross Timbers	468.86	None	916.58	Low	740.49	Low	7566.08	110.25
12030104 Denton Blackland Prairies	444.36	Medium	0	Low	151.14	Low	1233.43	110.25
12030104 Denton Cross Timbers	444.36	None	0	None	151.14	Low	1233.43	110.25
12030105 Upper Trinity Blackland Prairies	471.647	High	1408.41	High	2261.84	High	11855.6	110.25
12030105 Upper Trinity East Central Texas Plains	471.647	None	1408.41	None	2110.7	None	10622.17	110.25
12030106 East Fork Trinity Blackland Prairies	468.86	Low	916.58	High	740.49	High	7566.08	110.25
12030106 East Fork Trinity East Central Texas Plains	468.86	None	916.58	None	589.35	None	6332.65	110.25
12030107 Cedar Blackland Prairies	468.86	Low	916.58	None	589.35	Low	6332.65	110.25
12030107 Cedar East Central Texas Plains	830.35	None	1744.58	None	889.35	None	6332.65	110.25
12030108 Richland	352.887	None	1408.41	None	2110.7	None	10622.17	0
12030109 Chambers Blackland Prairies	471.647	None	1408.41	None	2110.7	None	10622.17	110.25
12030109 Chambers Cross Timbers	471.647	High	1408.41	None	2110.7	Medium	10622.17	110.25
12060201 Middle Brazos - Palo Pinto	0	None	47269	None	224122.8	None	53409	0
12060202 Middle Brazos - Lake Whitney	118.76	None	0	None	0	None	0	110.25

*Data on available credits was downloaded from the US Army Corps of Engineers Regulatory In-Lieu Fee and Bank Information Tracking System on January 25, 2022.

**Potential demand for ephemeral credits cannot be estimated because data on the location of these streams is not available.

***General legacy stream credits can be used to mitigate for impacts to any kind of stream. The watersheds in which these credits are available are approximated.

NCTCOG will analyze potential credit demand and availability with each Metropolitan Transportation Plan. This will identify a potential lack of credits early in the planning process and allow NCTCOG to

coordinate with mitigation bankers, transportation partners, and the US Army Corps of Engineers as necessary.

4. Environmental Considerations: Hazard Vulnerability and Resilience

Introduction

Transportation systems, usually defined as extensive physical infrastructure and/or arrays of expected services, are desired to have longevity, durability, and meet the various needs to modern society. These systems have always been exposed to a wide range of hazards, as well as the inevitable extremes among those hazards. However, a variety of natural and human-induced environmental factors, particularly through climate change, are compounding the extent, intensity, and sensitivity of those hazards. Such factors are increasing risks for cascading events, where multiple hazards can interact or even magnify certain outcomes, and they are creating new stressors on transportation assets originally implemented and calibrated for different expected conditions. Meanwhile, the daily demands for safe and efficient transportation resources persist or grow in scale and complexity. Numerous transportation assets across the country have long outlasted their planned service lives, yet continue to be critical for economic vitality, essential mobility/service needs, and emergency responses, while accommodating traffic levels unimagined during their original planning and design. Under these circumstances, capabilities for the transportation system to withstand, recover from, or adapt to adverse conditions and events have become more important, yet more challenging, than ever before.

According to the National Oceanic and Atmospheric Administration, the United States experienced a record-breaking \$22 billion natural disaster events in 2020 (shattering the previous record of 16 events

in both 2011 and 2017), with half of them occurring in the State of Texas (which also beat the previous record of nine events in both 2011 and 2016).²² To varying degrees, each of these events substantially damaged and/or disrupted the operations of transportation infrastructure vital for emergency services, evacuations, and the movement of key supplies. Costly asset repairs and restoration strained budgets at all government levels, disruptions to transportation networks and services adversely affected economies of all scales, and the safety and well-being of people in impacted communities was further degraded beyond the already unprecedented burdens inflicted by the worldwide COVID-19 pandemic. Furthermore, the events accentuated the disparity of impacts and rates of recovery historically perceived among areas with economically disadvantaged and/or predominately minority populations. Such outcomes highlight the growing necessity for routine, deliberate, and comprehensive integration of resilience considerations within transportation and land use planning, asset management, hazard mitigation efforts, sustainability initiatives, and the prioritization of major transportation investments.

Mobility 2045 Update Supported Goals

Ensure adequate maintenance and enhance the safety and reliability of the existing transportation system.

²² National Oceanic and Atmospheric Administration National Centers for Environmental Information US Billion-Dollar Weather and Climate Disasters, 2020, <https://www.ncdc.noaa.gov/billions>, DOI: 10.29921/stkw-7w73

Develop cost-effective projects and programs aimed at reducing the costs associated and constructing, operating, and maintaining the regional transportation system.

Policies and Programs

The Mobility 2045 Update supports the following Streamlined Project Delivery policies:

SPD2-001: Increase resiliency of ancillary infrastructure included within or immediately adjacent to the transportation system's right-of-way or easement, including improving stormwater management.

TSSC3-003: Identify regional transportation components of key resources and critical infrastructure and develop protective methodologies to reduce risk to assets from damage due to natural or human-implemented attacks.

The Mobility 2045 Update supports the following Streamlined Project Delivery programs:

SPD2-004: Increased transportation system resiliency for critical facilities and vulnerable locations.

Federal Guidance

Existing federal statutes and regulations provide ample guidance and justification for the incorporation of resiliency in the metropolitan transportation planning process, as well as a framework for assessing transportation system vulnerability and identifying critical infrastructure. Through various administrative orders, surface transportation legislation, and executive orders, the federal government has outlined the expectations and ways in which Metropolitan Planning Organizations can incorporate resiliency into their planning programs. Additional details on specific orders and legislation pertaining to resiliency can be found in the **Environmental Considerations** appendix.

North Central Texas Council of Governments Resilience Efforts

NCTCOG (North Central Texas Council of Governments) staff has incorporated resilience into its transportation planning and asset management processes in the following ways:

Resilience Studies: Since 2010, FHWA (Federal Highway Administration) has partnered with state Departments of Transportation, Metropolitan Planning Organizations, and other planning agencies on multiple rounds of pilot programs aimed at the continued refinement and deployment of an infrastructure vulnerability assessment and adaptation framework for transportation planning, asset management, and sustainability purposes. NCTCOG was one of 19 pilot teams who participated in the second program round during 2013 to 2015, and the collective efforts and outcomes generated a community of practice for transportation agencies seeking to increase resilience to extreme weather events, a community that continues to grow in familiarity, resources, and applications upon completion of each program round.

NCTCOG's pilot study was conducted through collaboration with the University of Texas at Arlington, the city of Dallas, and Trinity Metro to assess current and future flooding and extreme heat vulnerability of roads, passenger rail, and airports in Dallas and Tarrant counties. The study concluded that increasingly severe precipitation and heat events, combined with continued urbanization and congestion near floodplains, will place a greater number of transportation assets at risk. By correlation, potential changes to the region's urban heat island effect and plasticity (shrinking/swelling) of area soils would only exacerbate infrastructure damage or disruption.

This study spurred subsequent local, regional, and state initiatives, all while benefitting from the pilot program community's ongoing expansion in data, tools, lessons learned, and best practices. The collective experiences and contributions from the community

culminated in FHWA's publishing of a third edition to the Vulnerability Assessment and Adaptation Framework Manual in 2017, an in-depth practitioner's guide for resilience incorporation and decision making that continues to be of significant use and benefit.

Other resilience studies with regional implications include Dallas Area Rapid Transit's Severe Weather Action Plan (2008) and TxDOT's (Texas Department of Transportation) Statewide Freight Resiliency Plan (2011).

Texas Resilience and Planning Workshop: In 2017, NCTCOG staff exchanged information about extreme weather vulnerability assessments, data sources, and other resilience strategies with TxDOT and other metropolitan planning agencies in this FHWA-organized workshop.²³

Statewide Flood Plan: NCTCOG is coordinating with the Texas Water Development Board to develop the first statewide plan to ensure the cumulative effects of and impacts to transportation, urban development, and other infrastructure are fully integrated.

North Central Texas Emergency Management Working Group: NCTCOG hosts this group of local stakeholders.

Advocacy Committees: As a participant in FHWA's Transportation Asset Management Expert Task Group, NCTCOG staff coordinates with other Metropolitan Planning Organizations, state Departments of Transportation, other transportation providers, and resource agencies to integrate extreme weather vulnerabilities and resilience into asset management practices and performance measurement processes. NCTCOG plays a similar role with advocacy committees associated with the Transportation Research Board and the American Association of State Highway Transportation Officials.

Suggested resilience strategies are listed in the **Environmental Considerations** appendix. These strategies were derived from the March 2015 report, "Climate Change/Extreme Weather Vulnerability and Risk Assessment for Transportation Infrastructure in Dallas and Tarrant Counties," and the June 2017 Texas Resilience and Planning Workshop: Summary Report.

Additional information about emergency preparedness and response to natural disasters is included in the **Transportation System Security** section of the **Operational Efficiency** chapter.

Summary

The Mobility 2045 Update supports policies and programs that adhere to federal resiliency requirements and will improve the region's transportation system resilience through comprehensive strategies and partnerships. In addition, the Mobility 2045 Update supports and presents initiatives to facilitate project delivery while enhancing resiliency for key environmental resources adjacent to transportation facilities in North Central Texas. This process will support resilient, adaptable transportation assets and services for all residents. NCTCOG will continue to coordinate with resource and regulatory partner agencies to develop innovative approaches to infrastructure development that are resilient against natural hazards. In addition, NCTCOG will continue to collaborate with other public agencies and private entities to share data and strategies for transportation infrastructure resiliency.

All resilience policies, programs, projects, and maps are included in the **Environmental Considerations** appendix.

²³ https://www.fhwa.dot.gov/environment/sustainability/resilience/workshops_and_peer_exchanges/