STEP

Stillwater Transportation Enhancement Plan

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Chapter 1 – Introduction

The transportation network is a vital component of a community's basic infrastructure as it provides for the movement of people and goods through and within the community. The logical development of the transportation network and the choices of modes that it offers have a strong influence on a community's social, physical, and economic development pattern. Therefore, a well coordinated and planned transportation system is instrumental in enhancing mobility, providing for economic development opportunities, and increasing a community's quality of life.

With continued growth and development occurring throughout the community, the City of Stillwater is experiencing increased congestion and other transportation and safety related problems on its roadways. In addition to population growth within the City, there are a large number of commuters from neighboring communities who travel to and from the City on a daily basis for employment, shopping and educational purposes. To address these issues and accommodate future growth, the City of Stillwater and Oklahoma State University (OSU) are preparing a Transportation Enhancement Plan to identify current and future transportation needs and improvements within the community. The Stillwater Transportation Enhancement Plan (Plan) will evaluate the existing transportation system and identify needed improvements to accommodate projected growth within the area.

Study Purpose

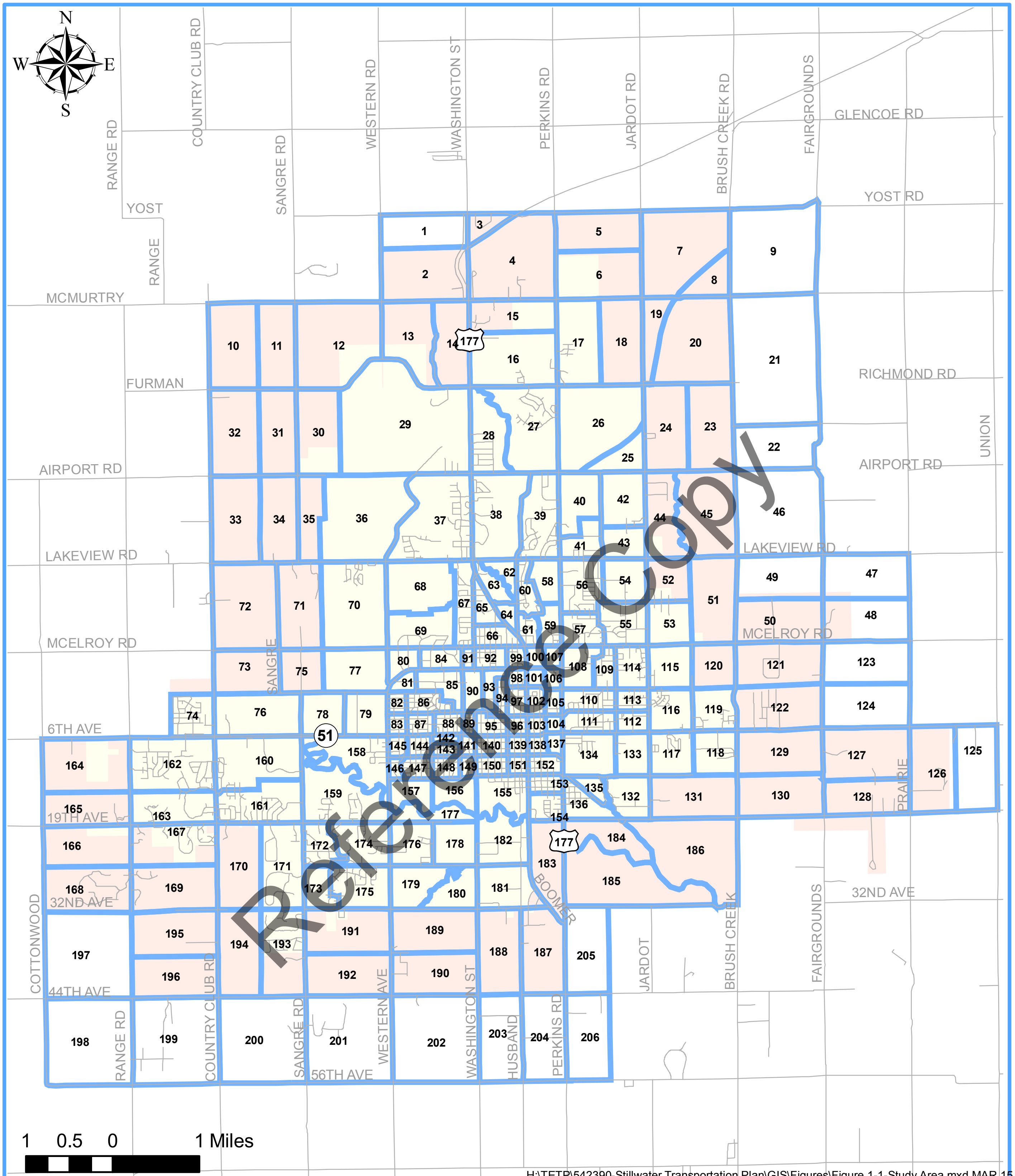
With an increasing level of development activity, it has become evident that the City of Stillwater is in need of an overall study that encompasses all aspects of determining improvement needs for current and future transportation conditions. New developments continue to be constructed along the existing infrastructure and development is expected to further continue in emerging growth areas around the City as identified in the Comprehensive Community Development Plan (Comprehensive Plan). Current development issues consist of capacity of existing infrastructure, increased densities of developments, and an increase in conflicts relating to funding of requested or required capital improvements.

The purpose of the Plan is to identify and recommend transportation improvements needed to accommodate future travel demands. The Plan will include an implementation program which will prioritize improvements according to short- and long-term objectives of the study, and the feasibility of project implementation. Additionally, the Plan will identify funding mechanisms to pay for the identified improvements.

The Plan ensures the preservation of future corridors for transportation system development, as the need arises, but does not recommend or prioritize the timing for future land use development. Potential roadway improvements include the widening of some roadways, extensions of others, or construction of new facilities.

Study Area

As shown in **Figure 1-1**, the study area encompasses the City of Stillwater, which includes an area of approximately 28 square miles, and the Urban Growth Area (Area) as identified in the City of Stillwater's Comprehensive Community Development Plan. The City is located in north central Oklahoma, approximately 50 miles north of Oklahoma City.



Stillwater Transportation Enhancement Plan

Traffic Analysis Zones

City Limits

Urban Growth Boundary

Figure 1-1
Study Area

Major thoroughfares in the community include State Highway 51, which traverses the City in an east-west direction and US Highway 177, which extends in a north-south direction through the community.

Goals and Objectives

One of the initial tasks of this study was to establish a series of goals and objectives that would serve as a framework for developing and evaluating alternative transportation systems. Goals and objectives provide a long-term vision for a desired transportation system in the community and they set forth value judgments and direction to guide staff and local government officials in planning and implementing transportation improvements.

Future growth and development in Stillwater is guided by the City's Comprehensive Plan. The Stillwater Transportation Enhancement Plan was developed in coordination with the Comprehensive Plan and in particularly with its goals, objectives and policies related to future development and transportation improvements. The Comprehensive Plan identified one goal and a series of objectives related to transportation. These objectives served as the basis for the development of the Stillwater Transportation Enhancement Plan:

Goal:

To provide attractive linkages between the community's diverse uses and people, providing for transit, walking and biking so that all people have access to essential services.

Objectives:

- to pave all streets;
- to improve east-west cross-town connections;
- to reduce curb cuts along the major corridors;
- to improve the capacity of existing major thoroughfare intersections with current deficits;
- to provide a recreational trail system within appropriate greenways that is compatible with pedestrian, biking, and elderly/disabled activities;
- to provide a bikeways system utilizing designated streets and specially designed bikeways to serve leisure, work, and school commuting activities;
- to provide sidewalk and other pedestrian improvements within neighborhoods and appropriate activity centers, and link these neighborhoods and activity centers;
- to link recreational trails, bikeways, and sidewalks in creating an integrated communitywide system;
- to identify appropriate types of service and levels for providing a public transit system;
- to enhance airport services and to protect airport flight zones;
- to link roadway, pedestrian, bicycle, public transit, rail, and airport provisions in creating a comprehensive and integrated transportation system;

- to link a comprehensive transportation system with regional access, economic development, educational, health care, and recreational objectives of the community;
- to increase transportation services for the elderly, persons with disabilities, and anyone who may have limited access to essential services, employment, and recreation; and,
- to provide mixed uses to promote pedestrian access and reduce vehicular trips.

STUDY PARTICIPANTS

The development of the Stillwater Transportation Enhancement Plan was a cooperative effort between the City of Stillwater and Oklahoma State University. An Advisory Committee was appointed for this study and included local residents, developers, business owners, and representatives from OSU, the City of Stillwater and the Bike Club. The committee provided technical guidance, expertise, and review throughout the development of the Plan. Members of the Advisory Committee include:

John Houck, *OSU*

Hugh Kierig, *OSU*

Monty Karns, *OSU*

David Thomas, *Thomas Ford*

Don Norvelle, *Bike Club*

Kevin Wisner

Ron Walker, *residential developer*

Rusty Kraybill, *residential developer*

Terry Deer, *Mercruiser*

Greg Fox, *Planning Commissioner*

Mikki Couch, *Planning Commissioner*

Tom Dugger, *City Commissioner*

Tom Williams, *City Commissioner*

Mark Lambert, *Lambert Construction*

David Barth, *City of Stillwater*

Paula Dennison, *City of Stillwater*

Dan Blakenship, *City of Stillwater*

Norman McNickle, *City of Stillwater*

The City of Stillwater has retained the services of C.H. Guernsey and Company (GUERNSEY) and Wilbur Smith Associates (WSA) to assist with the Transportation Enhancement Plan.

Members of the consulting team participating in the Plan include:

Karl Stickley, GUERNSEY, *Project Manger and Traffic Engineer*

Ken Senour, GUERNSEY, *Quality Assurance and Control*

Ken Bryan, GUERNSEY, *Environmental Scientist*

Bob Hamm, WSA, *Traffic Engineer and Planner*

Laura Kulecz, WSA, *Transportation Planner*

Ashish Loney, WSA, *Traffic Modeler*

PURPOSE AND BENEFITS OF TRANSPORTATION PLANNING

Transportation planning is the process used by municipalities and other governmental entities to provide for the development of an efficient and appropriate transportation system to meet existing and future travel needs. The primary purpose is to ensure the orderly and progressive development of the urban and rural street system to serve the mobility and access needs of the public. Transportation planning is interrelated with other components of the urban planning and development process.

The Stillwater Transportation Enhancement Plan is a 25-year transportation planning document that provides a framework for addressing the area's transportation needs. The Plan will serve as the City's guide for transportation system improvements, including the existing and planned extension of major roadways. The transportation system is comprised of existing and planned freeways/expressways, arterials, collectors, and local streets, which could require wider or new rights-of-way for needed improvements, transit services, and bicycle and pedestrian facilities. One objective of the Plan is to ensure the preservation of adequate right-of-way (ROW) on appropriate alignments and of sufficient width to allow the orderly and efficient expansion and improvement of the transportation system to serve existing and future transportation needs.

The benefits provided by effective transportation planning are realized by achieving the following objectives:

- Maximizing mobility while minimizing the negative impacts of street widening and construction on neighborhood areas and the overall community by recognizing where future improvements may be needed and incorporating thoroughfare needs;
- Preservation of adequate rights-of-way for future long-range transportation improvements;
- Making efficient use of available resources by designating and recognizing the major streets that will likely require improvements;
- Minimizing the amount of land required for street and highway purposes;
- Identifying the functional role or class for each street in order to promote and maintain the stability of traffic and land use patterns;
- Informing citizens of the streets that are intended to be developed as arterial and collector streets, so that private land use decisions can anticipate which streets will become major traffic facilities in the future;

- Providing information on thoroughfare improvement needs, which can be used to determine priorities and schedules in the City's Capital Improvement Program (CIP); and,
- Providing an implementation program to prioritize improvements and identify funding sources.

ELEMENTS OF THE TRANSPORTATION PLAN

The Stillwater Transportation Enhancement Plan delineates a system of thoroughfare classes, representing the location, alignment, and functional relationship for different types of roadways, including freeways, arterial streets, collectors and local streets. It consists of an officially adopted thoroughfare system map, along with supporting design criteria and implementation policies. Typically, thoroughfare system maps indicate the planned extensions of thoroughfares on new alignments where right-of-way needs to be acquired in the future. Development of the Plan involved careful consideration of the community's growth and traffic patterns, availability of right-of-way, and impacts on surrounding land uses.

An implementation program was also developed, which prioritizes improvements for short-term and long-term projects. Order-of-magnitude construction costs were developed for the improvements and environmental impacts were evaluated. Finally, funding mechanisms to finance the recommended improvements were identified and evaluated.

RELATIONSHIP BETWEEN TRANSPORTATION AND LAND USE PLANNING

Coordinating land use and transportation decisions serves as an important role in improving mobility needs, promoting economic development, and enhancing quality of life. Recommended future roadway alignments, street cross sections, and the location and design of major intersections will influence future development patterns in a community and benefit or hinder existing neighborhoods and developed areas. Transportation improvements require careful consideration of impacts to:

- neighborhood quality and integrity;
- pedestrian and bicycle mobility and safety;
- community aesthetics;
- corridor quality;
- accessibility to shopping and entertainment districts; and,
- accessibility to major public facilities including linear park and trail opportunities coordinated with the roadway network.

The basic purpose of thoroughfare planning is to ensure the orderly and progressive development of roadways to serve mobility and access needs. Such planning is also critical to future land use, housing, environmental protection, public utilities management, and other key components of urban and regional planning. Roadway functional classifications, design, and access management strategies must all be geared toward the prospective development and associated regulations for the area to be served. This ranges from high-capacity, controlled access facilities for longer distances to local streets, possibly with sidewalks, trails or bikeways, accommodating limited vehicular traffic and encouraging safe, enjoyable short-distance trips close to home or work.

Land use impacts and growth patterns were carefully considered in the development of the Stillwater Transportation Enhancement Plan. The Plan along with other development tools, such as the City's subdivision and zoning ordinances, will help the City effectively continue to coordinate land use and transportation decisions.

PUBLIC INVOLVEMENT

Public involvement is an important component of the Plan and included several activities to involve the general public, public agencies, and stakeholders throughout the Plan development process. Public involvement activities center on obtaining meaningful input from key stakeholders and users on transportation issues in the area.

Public outreach and involvement activities for the Stillwater Transportation Enhancement Plan included the following:

- **Interviews –** Interviews were held with key institutions in the community including, OSU, Stillwater Medical Center, Oklahoma Department of Career and Technology Education, Quebecor World, Armstrong, National Standard, Mercruiser, Stillwater Public Schools, Meridian Technology Center, and the Stillwater Chamber of Commerce to solicit input and gather any available information on existing traffic conditions and future growth projections and patterns. Summaries of these interviews are included in this report.
- **Presentations to Advisory Committee** – Periodic meetings were held with the Advisory Committee at key milestones through the Plan development process. These meetings serve as a forum to identify transportation issues and improvements, review elements of the Plan, and prioritize improvements.
- **Public Meetings** – A public meeting was held on January 19, 2006 to introduce the Stillwater Transportation Enhancement Plan project and solicit input from the public on key issues and trends in the community. Approximately 35 people attended the meeting and 20 comments were received regarding transportation issues throughout the City.
  A second public meeting was held on September 12, 2006 to present the draft transportation plan, especially the four scenarios developed up to that time. Thirty three people attended the meeting and 11 comments were received, summarized and addressed as a result of the presentation of the four improvement scenarios. The result of this public input an additional five scenarios were evaluated and are discussed in detail in Chapter 4 of the Plan.

Chapter 2 – Existing Conditions

Understanding the existing physical features and transportation system in the City of Stillwater is an important step in developing the transportation plan and in making recommendations regarding future improvements. Existing environmental and physical features may impact transportation improvements while the existing street network and traffic patterns serve as the basis in identifying future transportation conditions and needs.

General Features and Topography

The City of Stillwater is located in central Payne County approximately 50 miles north of Oklahoma City, Oklahoma. The City has many unique features that create varying environmental settings throughout the City. The region is characterized by gently rolling or sloping topography typically associated with a drainage basin. Major surface water resources include Stillwater Creek and Boomer Lake, which lies on Boomer Creek, and the Cimarron River lies several miles south of Stillwater. The City's varying landscape and abundant source water resources provide habitat for a wide range of flora and fauna.

Land Use

Future development trends within a community are partially influenced by current land use patterns, development regulations and policy, and a City's future land use plan. A review of existing and proposed land uses within the City of Stillwater will help guide projected growth and direct transportation needs within the community.

Over the past decade, the City has grown seven percent from a population of 36,700 in 1990 to 39,100 in 2000. As shown in **Figure 2-1** the majority of this growth has occurred southwest of Oklahoma State University with single family residential homes as the primary land use. Commercial development has occurred primarily along the 6th Avenue, Main Street and the Perkins Road corridors. South and southwest of the OSU consists primarily of single family residential, agricultural areas, and undeveloped land. The area south of Oklahoma State University and east of Perkins Road can be characterized by both single and multi-family residential as well as manufactured housing, commercial areas, and both agriculture and undeveloped land. The northeast section of the City, north of 6th Avenue and east of Perkins Road, is comprised of a mixture of industrial, agriculture, commercial and single family residential uses.

The City of Stillwater will continue to experience growth and development over the next several decades. The majority of this development, both residential and commercial, is anticipated to continue to occur to the southwest and northeast of the City. However, based on the City's land use plans, it is anticipated that some growth will occur east of Oklahoma State University, including some commercial development along the Perkins Road corridor.

Environmental & Development Constraints

There are some environmental features that could create constraints to development or warrant additional study. There are floodplains associated with Stillwater Creek and Boomer Creek.

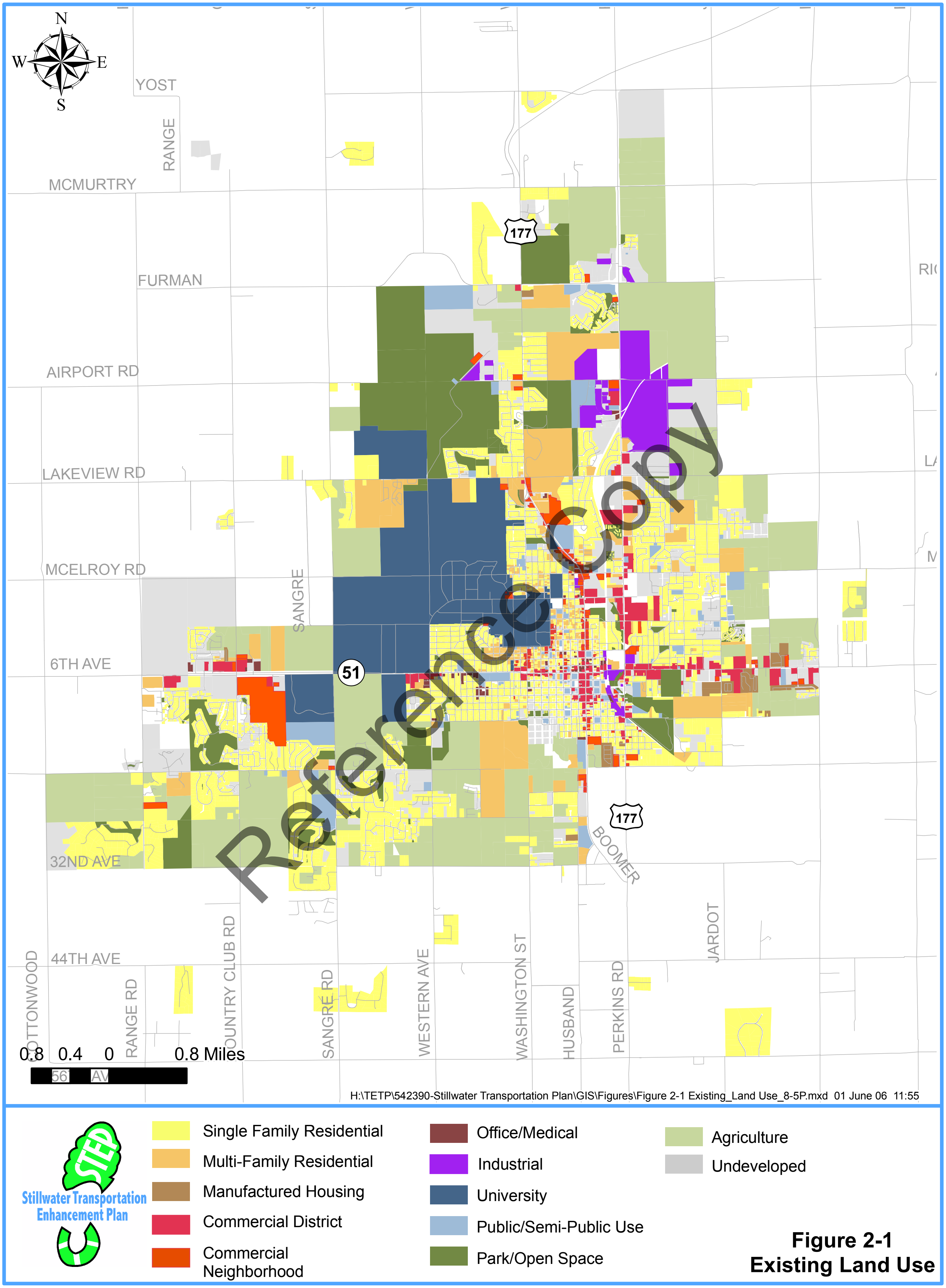


Figure 2-1
Existing Land Use

Chapter 2 – Existing Conditions

The US Fish and Wildlife Service (USFWS) identified Payne County as providing favorable habitat for federally protected species, including the Whooping Crane, Piping Plover, and the Interior Least Tern. Planning or development activities in areas favorable to these species should be sensitive to the potential presence of these species. Historical and environmental sites are typical occurrences in urbanized areas. Several documented historical sites exist in Stillwater. Also, several documented environmental sites are located in the City and are currently shown to be resolved in accordance with state and federal regulations. **Figure 2-2** shows the location of identified planning constraints such as the environmental sites, historic locations or properties and floodplains.

Roadway Network

The City is served by a network of roadways which includes one tollway facility, one US highway, one state highway and an arterial grid system that serves as the basic transportation network in the City. The Oklahoma Department of Transportation (ODOT) maintains the state facilities. Within the study area, primary roadways range from a freeway/toll road (Cimarron Turnpike) to two-lane local streets. Existing travel lanes on the roadway network are shown in **Figure 2-3**.

Freeway and Tollway Facilities

The City of Stillwater is served by one freeway/toll facility, the Cimarron Turnpike. The Cimarron Turnpike extends from I-35 North to Keystone Lake, with a spur that extends into Stillwater at Perkins Road/US 177. It is a controlled access facility with grade-separated interchanges at several crossings including US 177 and Perkins Road.

US and State Highways

US 177 serves the entire City of Stillwater running north-south through the center of town. US 177 is a four lane arterial with posted speed limits between 40 to 65 mph. SH 51 also serves the entire City but runs in an east-west direction south of the OSU. SH 51 is a four lane arterial that offers a direct route to I-35, approximately 15 miles west of Stillwater and offers a continuous north-south route from San Antonio, Texas to Duluth, Minnesota.

Arterials

The road network for the City of Stillwater primarily consists of an arterial grid system. The arterial system connects residential neighborhoods within each grid to retail centers and special generators[1]. Stillwater's arterial roadways range from two-lane undivided paved streets to four-lane divided streets with curbs and gutters. **Table 2-1** lists major arterials by direction of travel.

[1] Special generators are those locations or facilities that create a unique or atypical traffic impact. A list of special generators in Stillwater is located in Table 3-2.

Table 2-1
Major Arterials
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

East-West	North-South
Richmond Road	Range Road
Airport Road	Country Club Road
Lakeview Road	Sangre Road
McElroy Road	Western Road
Hall of Fame Avenue	Washington Street
6th Avenue	Main Street
12th Avenue	Perkins Road
19th Avenue	Jardot Road
32nd Avenue	Brushcreek Road
44th Avenue	Fairgrounds Road

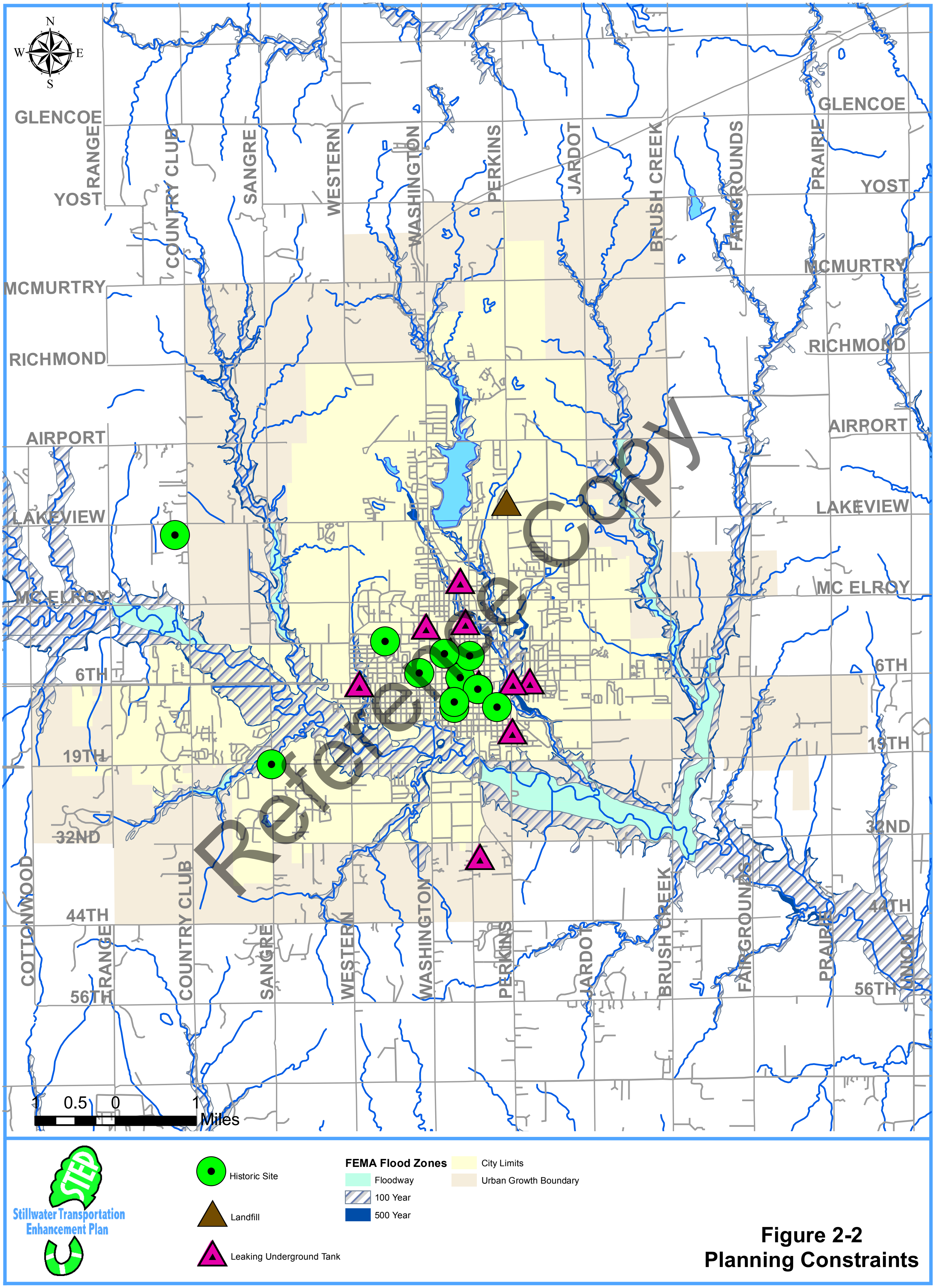


Figure 2-2
Planning Constraints

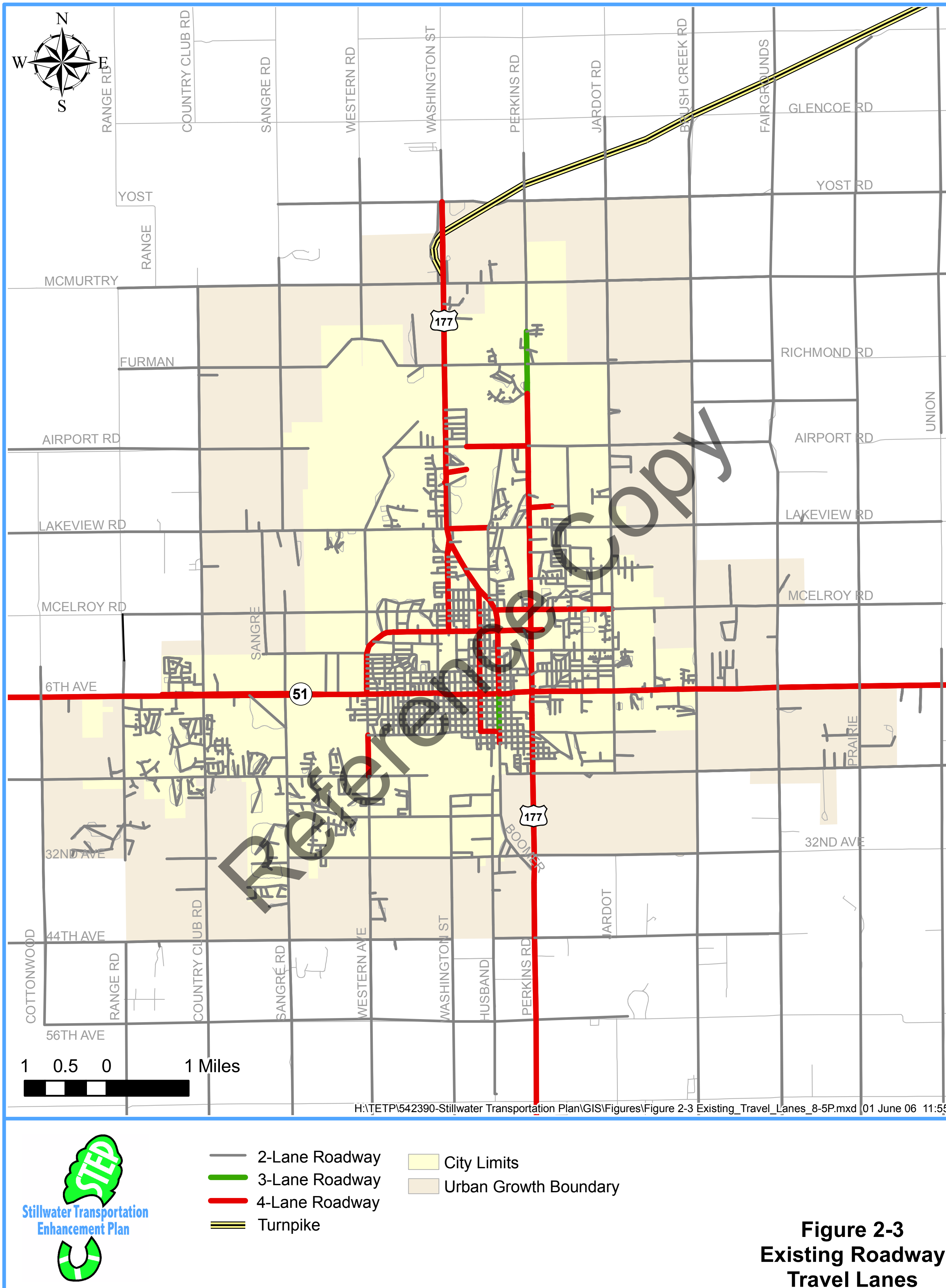


Figure 2-3
Existing Roadway Travel Lanes

Chapter 2 – Existing Conditions

EXISTING FUNCTIONAL CLASSIFICATION

Functional classification of transportation facilities describes the hierarchical arrangement and interaction between various roadways. Classification is based on each roadway's functional role in the overall network, including traffic movement and access. These classifications may change over time, as the function of roadways changes to serve different land uses or other transportation facilities. As an area becomes more developed, roads that have previously been classified in one category may be reclassified to a higher category.

Figure 2-4 displays the relationships and hierarchy between traffic volume, speed, and property access across the functional classifications. The current functional classification system for the City of Stillwater is shown in **Figure 2-5**.

Freeways

Freeway facilities, including interstate highways, freeways, and expressways, provide for the rapid and efficient movement of large volumes of traffic between regions and across the urban area. Direct access to abutting property is not an intended function of these facilities. Design characteristics support the function of traffic movement by providing multiple travel lanes, a high degree of access control, and few or no at-grade intersections.

Tollways

Tollway facilities generally serve the same purpose as freeways. However, access control may be more restrictive and allow for higher speeds and traffic flow. Toll plazas along the main lanes and access ramps of the tollway manage the access control.

Arterial Streets

Arterials primarily provide for traffic movement with a secondary function being the provision of direct access to abutting property. Major arterials typically serve as connections between major traffic generators and land use concentrations, and facilitate large volumes of through traffic traveling across the community. Minor arterials typically serve as connections between local/collector streets and major arterials, and facilitate the movement of large traffic volumes over shorter distances within the community. Minor arterials may allow a higher degree of access to abutting property. Because direct access to abutting property is a secondary function of arterial streets, access should be carefully managed to avoid adverse impacts on the movement function intended for these facilities.

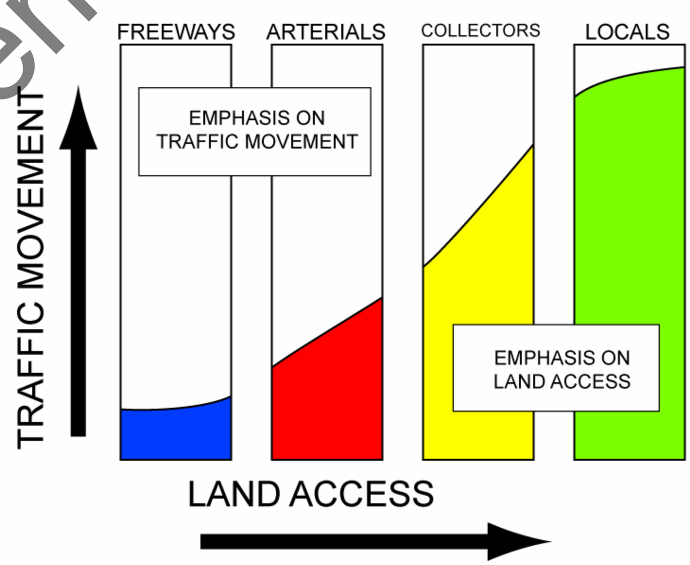


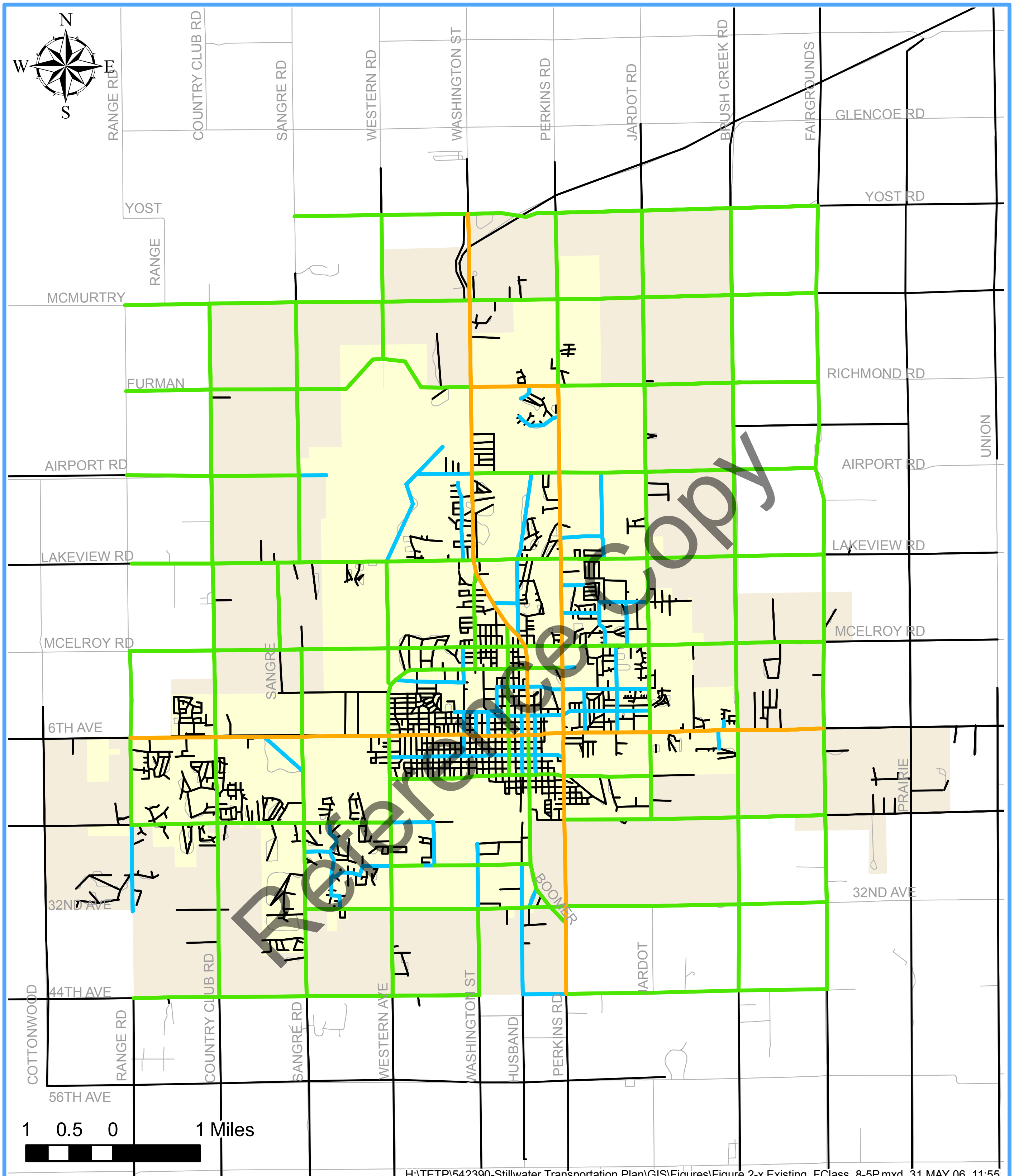
Figure 2-4: Functional Classification Hierarchy

Collector Streets

Collector streets provide for a balance of the traffic movement and property access functions. Traffic movement is often internal to local areas and connects residential neighborhoods, parks, churches, etc., with the arterial street system. As compared to arterial streets, collector streets accommodate smaller traffic volumes over shorter distances.

Local Streets

Local streets function to provide access to abutting property and to collect and distribute traffic between parcels of land and collector or arterial streets. The primary function of local streets is to provide access, so travel speeds and traffic volumes are low and travel distances on local streets are short.



Stillwater Transportation Enhancement Plan

Functional Class:

- Local
- Collector
- Minor Arterial
- Major Arterial

- City Limits
- Urban Growth Boundary

Figure 2-5
Existing Functional Classification of Roads

Chapter 2 – Existing Conditions

TRAFFIC VOLUMES

Figure 2-6 displays existing daily traffic volumes along major roadways in the study area. These volumes were derived from counts provided by the City of Stillwater for the Years 2001 through 2006. As shown, existing daily traffic volumes along major roadway facilities within the study area range from 27,000 vehicles per day (vpd) on 6th Avenue, between Washington and West, to 200 vpd along West 26th Avenue, in the southern part of the City. Traffic volumes along the most heavily traveled roadways are discussed below:

Perkins Road/Parts of US 177 – US 177/Perkins Road is one of the most heavily traveled arterials in the City. Average daily traffic volumes along US 177/Perkins road range from 19,000 vpd south of McElroy Road to 9,200 vpd south of Richmond Road.

6th Avenue/SH 51 – 6th Ave is the most heaviest traveled arterial in the City with average daily traffic volumes ranging from 27,000 vpd between Washington and Western to 4,800 vpd towards the eastern limits of the study area between Prairie and Union.

Hall of Fame Avenue – Traffic volumes along Hall of Fame Avenue in the OSU area range from 13,100 vpd to 21,000 vpd.

Washington/Boomer Road – Traffic volumes along Washington/Boomer Road range from 12,200 vpd between Airport Road and Lakeview Road to 17,600 vpd along Boomer Road south of Lakeview Road.

EXISTING RAILROAD FACILITIES

The City of Stillwater has one railroad track that begins in the southeast part of the town, heading north parallel to Perkins Road then heading in a northeastly direction at Airport Road. The Stillwater Central Railroad provides rail service to Stillwater via a 20 mile spur connecting with the Burlington Northern Santa Fe Railroad just north of Stillwater.

OKLAHOMA STATE UNIVERSITY

The Oklahoma State University Stillwater Campus (OSU) began in December 1890 as a land-grant institution and after undergoing several collegiate changes, OSU became a formal university in 1957. OSU currently provides associate, bachelor's, master's, doctoral, and professional degrees in a number of different colleges including the agriculture sciences and natural resources, arts and science, health sciences, veterinary health sciences, education, engineering, architecture and technology, human environmental sciences, business, and liberal arts. OSU enrolls about 20,000 students and maintains approximately 5,000 employees including over 1,000 faculty and staff. OSU ranked as one of America's top 20 values in public higher education by Consumers Digest Magazine. Most of OSU students live locally, with approximately 5,000 students residing in on-campus housing.

Most commuters access the OSU campus from McElroy Road, Hall of Fame Avenue, Washington Street and Western Road. These corridors have a fairly equal distribution of commuting students attending morning, afternoon, and evening classes. However, most of the traffic congestion occurs during the 8:30-1:30 peak time period on Monday, Wednesday, and Friday and during the 9:00-2:00 peak time period on Tuesday and Thursday.

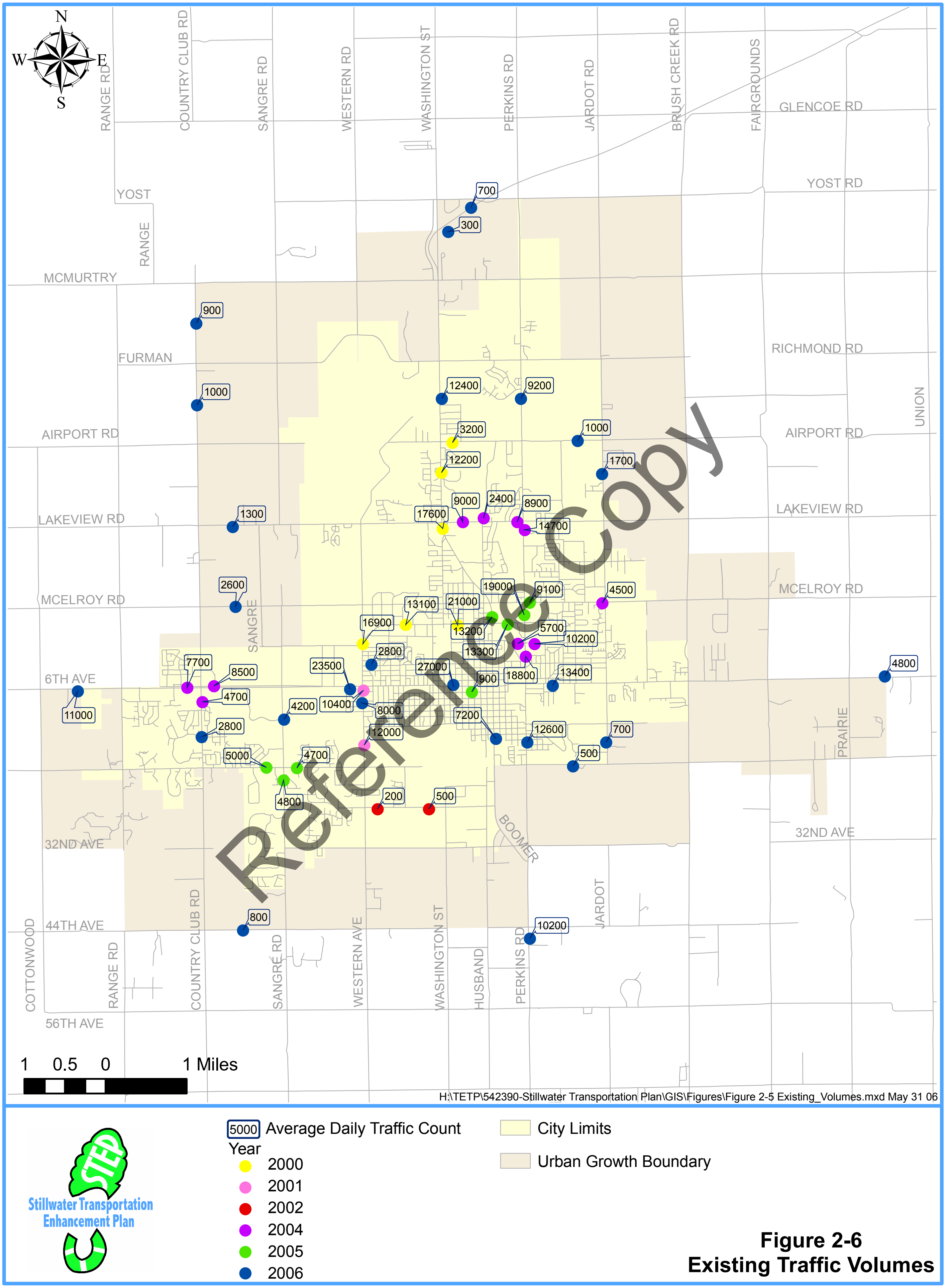


Figure 2-6
Existing Traffic Volumes

Bicycle activity has increased in the last year, and students are able to use The Bus transit system and Stillwater/Tulsa Shuttle for alternatives for commuting to and from Stillwater.

STILLWATER PUBLIC SCHOOLS

Over the past 20 years the Stillwater Public School System has grown from an enrollment of about 4,730 in 1985 to 5,500 in 1995 and decreased to 5,300 in 2005. Currently, the Stillwater School District has the following number of schools and enrollment by school type: six elementary schools with 2,700 students; one middle school(grades 6 and 7) with 760 students; one junior high (gardes 8 and 9) with 730 students; and one high school (grades 10 through 12) with 1,060 students. Stillwater high schools serve the entire Stillwater area and Lincoln Academy offers an alternative to the traditional school setting for grades 6-12.

EXISTING TRAFFIC OPERATIONS

Existing traffic operations are evaluated by conducting a capacity/level-of-service analysis. Roadway capacity is defined as the maximum number of vehicles that can be accommodated on a roadway facility during a particular time period under prevailing roadway, traffic, and control conditions. An important result of a capacity analysis is the determination of level-of-service.

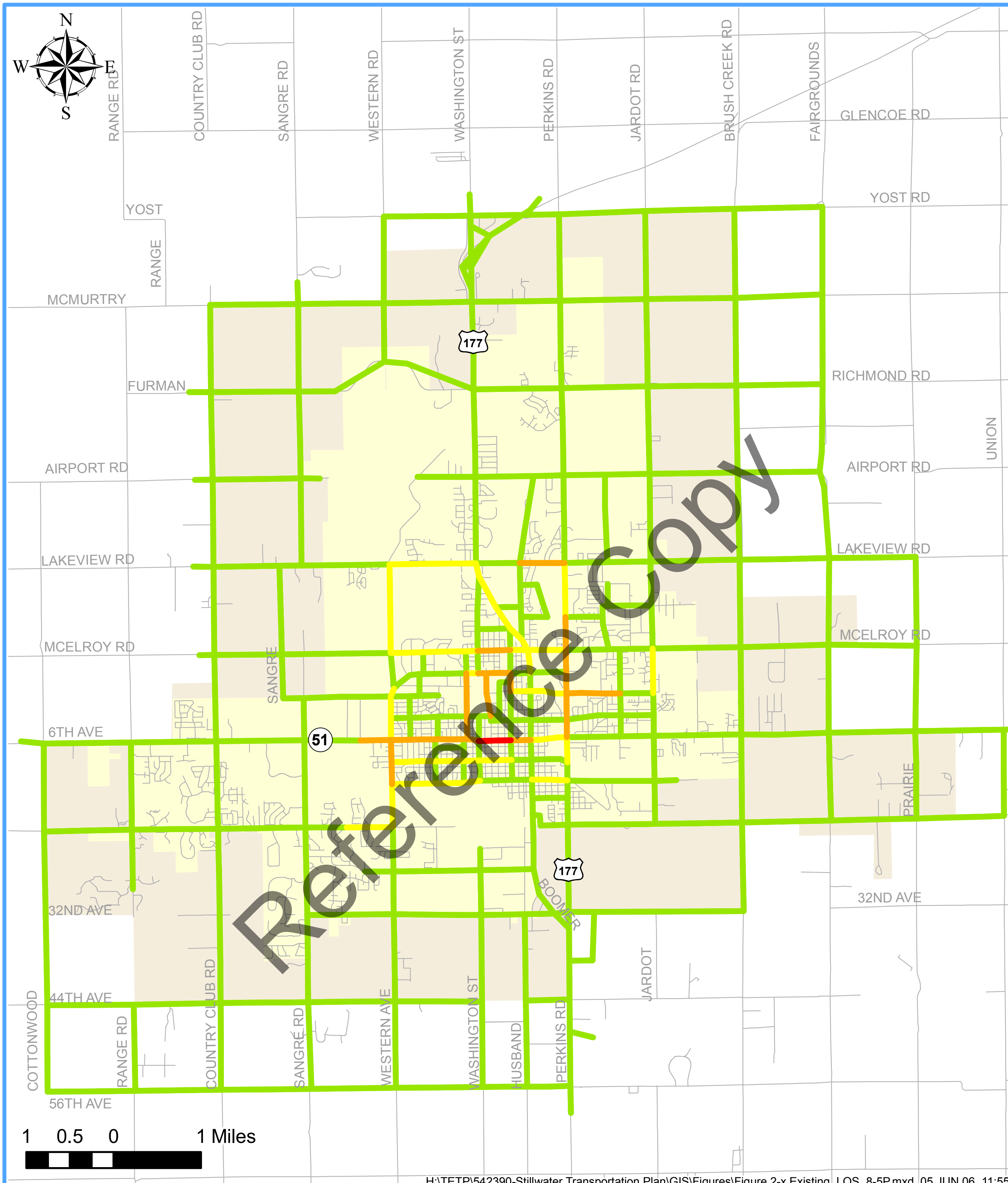
Level-of-Service (LOS) is a qualitative measure of operating conditions at a location and is directly related to the volume-to-capacity ratio along roadways, as shown in **Table 2-2**. LOS is given a letter designation ranging from A to F (free flow to heavily congested), with LOS D considered in most urban areas as the limit of acceptable operation. For example, LOS can be related to the grading scale of a report card: A – Excellent, B – Good, C – Average, D – Acceptable, E – Needs improvement, and F – Failing. The level-of-service was determined for major roadways within the study area utilizing procedures identified in the 2000 Highway Capacity Manual and the available traffic data identified previously.

Figure 2-7 identifies existing LOS for major roadways within the City of Stillwater. As shown, the majority of roadways are operating at an LOS of A to D, meaning that traffic volumes are below capacity and the roadways are providing acceptable traffic operations. Roadways approaching or exceeding capacity with an LOS of E or F are located within the central part of the City and include portions of 6th Avenue, Perkins Road, Western, Hester, Monroe, Hall of Fame, and Virginia.

Table 2-2
Level-of-Service Definitions for Principal Roadways
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Level-of Service (LOS)	Maximum Volume-to-Capacity Ratio (v/c)			Description
	Two-Lane Roadways	Multi-Lane Arterials	Freeways	
A	0.10	0.35	0.35	Very low vehicle delays, traffic signal progression extremely favorable, free flow, most vehicles arrive during given signal phase
B	0.25	0.50	0.50	Good signal progression, more vehicles stop and experience higher delays than for LOS A.
C	0.40	0.65	0.70	Stable flow, fair signal progression, significant number of vehicles stop at signals.
D	0.60	0.80	0.85	Congestion noticeable, longer delays and unfavorable signal progression, many vehicles stop at signals.
E	1.00	1.00	1.00	Limit of acceptable delay, unstable flow, poor signal progression, traffic near roadway capacity, frequent cycle failures.
F	> 1.00	> 1.00	> 1.00	Unacceptable delay, extremely unstable flow, and congestion, traffic exceeds roadway capacity, stop-n-go conditions.

Source: Adapted from Highway Capacity Manual, Transportation Research Board, 2000



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Stillwater Transportation Enhancement Plan

LOS:

- A-C
- D
- E
- F

- City Limits
- Urban Growth Boundary

Figure 2-7
Existing Level of Service (LOS)

Chapter 2 – Existing Conditions

Transit Services

The City of Stillwater receives urban transit service from the OSU Stillwater Community Transit, also known as "The Bus". The OSU Stillwater Community Transit service began operating The Bus in August 2003 providing ten routes, four serving the Stillwater area, and seven that provide transit service within the campus area. The Bus currently provide service to more than 600,000 riders per year throughout the Stillwater area. The OSU Tulsa/Stillwater shuttle also provides transit services to Tulsa, OK, linking the OSU campuses in Stillwater and Tulsa. This shuttle serves on average 540 passengers a day.

The Bus provides in total nine routes that operate daily from Monday through Friday (no Saturday or Sunday service provided) within the City of Stillwater as shown in **Figure 2-8**. The Bus offers five community routes that operate from 6:20 am until 7:00 pm and one community route that offers night service from 7:00 pm until 10:30 pm. The community routes provide access to and from the OSU campus to the airport, many residential areas, retail/activity centers, medical centers and hospitals, and park systems. In addition, there are three campus routes, two of which offer service from 6:20 am until 7:00 pm and one nightly service from 6:45 pm until 10:30 pm. The campus routes provide access around the OSU campus including parking areas, on-campus housing, main educational buildings, and the student union.

The bus charges a regular fare of 50 cents per person for the general public, 25 cents for children under 18 years of age, the elderly, and disabled persons, and is free for OSU students and staff if they provide a valid ID.

Average monthly ridership data by route and patron was summarized from OSU/Stillwater Community Transit Ridership for the time period from January 2006 through November 2006, excluding July 2006. There were 638,448 riders in total with a daily average of 3,196 on a total of nine service routes and three specialty routes. The Orange route experienced the highest number of riders with an average of 1,279 riders a day while the Brown route experienced the fewest number of riders with an average of 53 riders a day. **Table 2-3** summarizes Stillwater's transit ridership data.

Table 2-3
Ridership for Stillwater Transit Services – All Routes
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Time Period	Total Number of Riders	Average Daily Ridership
January 2006	69,693	3,384
February 2006	80,233	3,785
March 2006	67,291	2,813
April 2006	68,309	3,305
May 2006	23,165	1,025
June 2006	20,047	796
August 2006	64,555	4,801
September 2006	94,687	4,411
October 2006	88,343	3,773
November 2006	62,125	3,869
Total	**638,448**	**3,196**

Source: OSU Transit

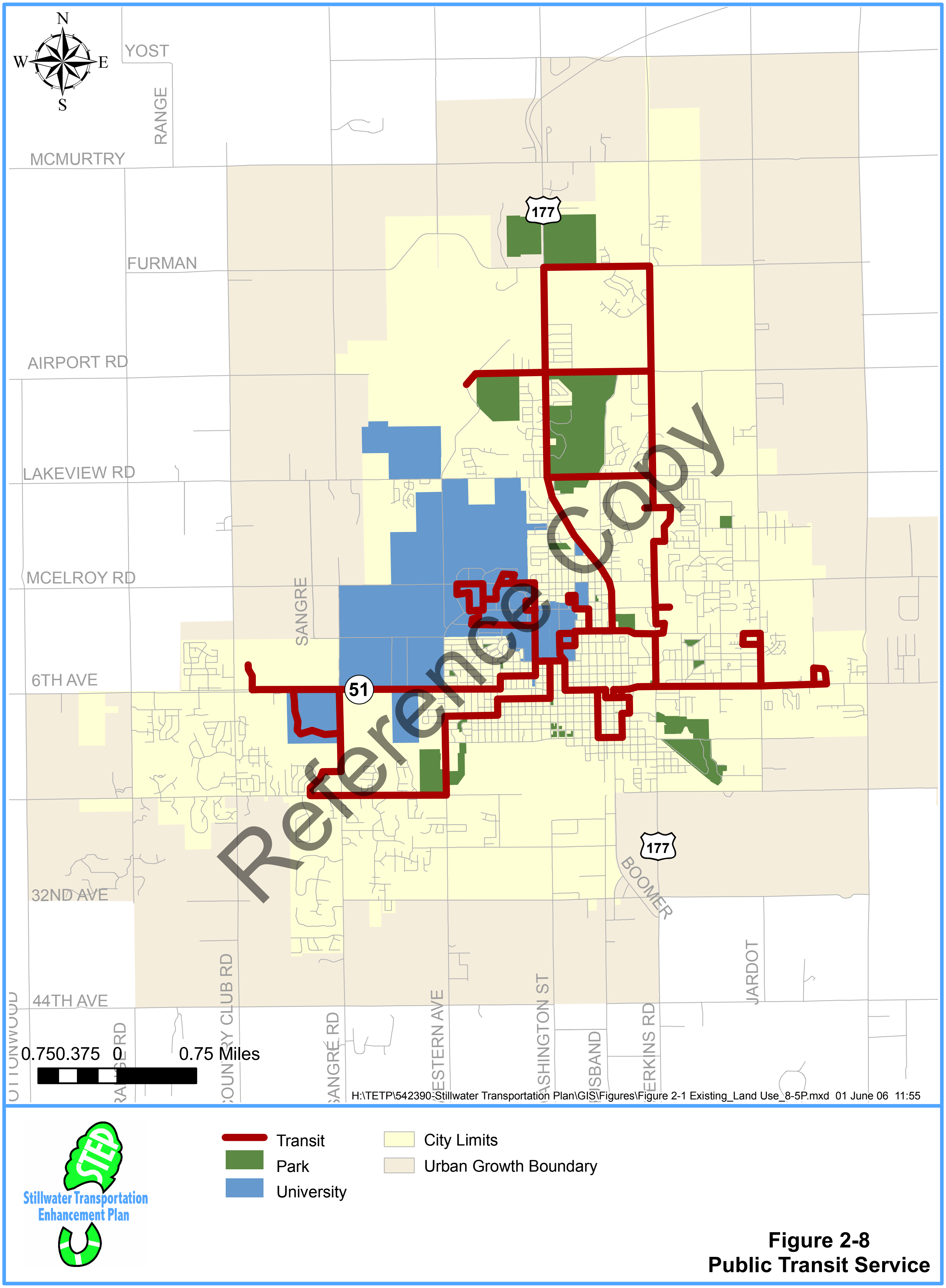


Figure 2-8
Public Transit Service

Chapter 2 – Existing Conditions

BICYCLE AND PEDESTRIAN INFRASTRUCTURE

Bicycle and pedestrian facilities are important components of the City's transportation system. They serve as alternative modes of travel and provide for recreational opportunities for local residents. Bicycle and pedestrian planning should be highly coordinated with thoroughfare planning to ensure bicycle and pedestrian routes are safe and efficient and serve the varying needs of the community. The City should utilize opportunities to improve bicycle facilities in areas that are developing or redeveloping, or where roadway improvements are occurring. Future opportunities for bicycle and pedestrian improvements should therefore be planned for in conjunction with the recommended thoroughfare improvements in this Plan.

The City of Stillwater's Trail Task Force is currently working with the NPS River, Trails and Conservation Assistance Program to develop a new master plan. Although the Master Plan has not yet been finalized or adopted, the draft plan identifies a series of on street bike routes along several of the community's roadways including Perkins, Lakeview, Airport, McElroy, 9th, and Western. Additionally, the plan identifies a series of trails connecting the community's parks and other key destinations such as OSU.

Chapter 3 – Demographics and Travel Demand Model

As part of the Stillwater Transportation Enhancement Plan, a travel demand model was developed to simulate existing traffic patterns and projected future travel demand. One of the major inputs for the travel demand model includes existing and projected demographic data, which are used to generate vehicle trips on the roadway network. This chapter describes the development and calibration of the transportation model and the development of the socioeconomic forecasts which serve as the basis for determining future transportation demands in Stillwater.

Demographic Data

The purpose of this section is to review existing and future demographic characteristics that were used as inputs to the area travel demand computer model. Demographic variables discussed in this section include population, employment and school enrollment. Analysis of these variables and development of forecasts assisted in simulating future traffic patterns and in identifying and evaluating future transportation needs in Stillwater. The transportation network and travel demand model developed for this study are discussed in further detail later in this chapter.

Methodology

Demographic estimates were prepared for the base year, 2005, and forecasts were prepared for the years 2015 and 2030. Base year estimates and forecasts were developed for the Stillwater area at the Traffic Analysis Zone (TAZ) level. Traffic Analysis Zones (TAZs) define geographic areas (similar to census block groups) which are used to relate travel demand to socioeconomic characteristics. As shown in **Figure 3-1**, 206 TAZs were developed for the Stillwater study area. These zones define geographic areas appropriate for transportation analysis and are smaller in more urban/developed areas with denser population and employment, and larger in rural areas.

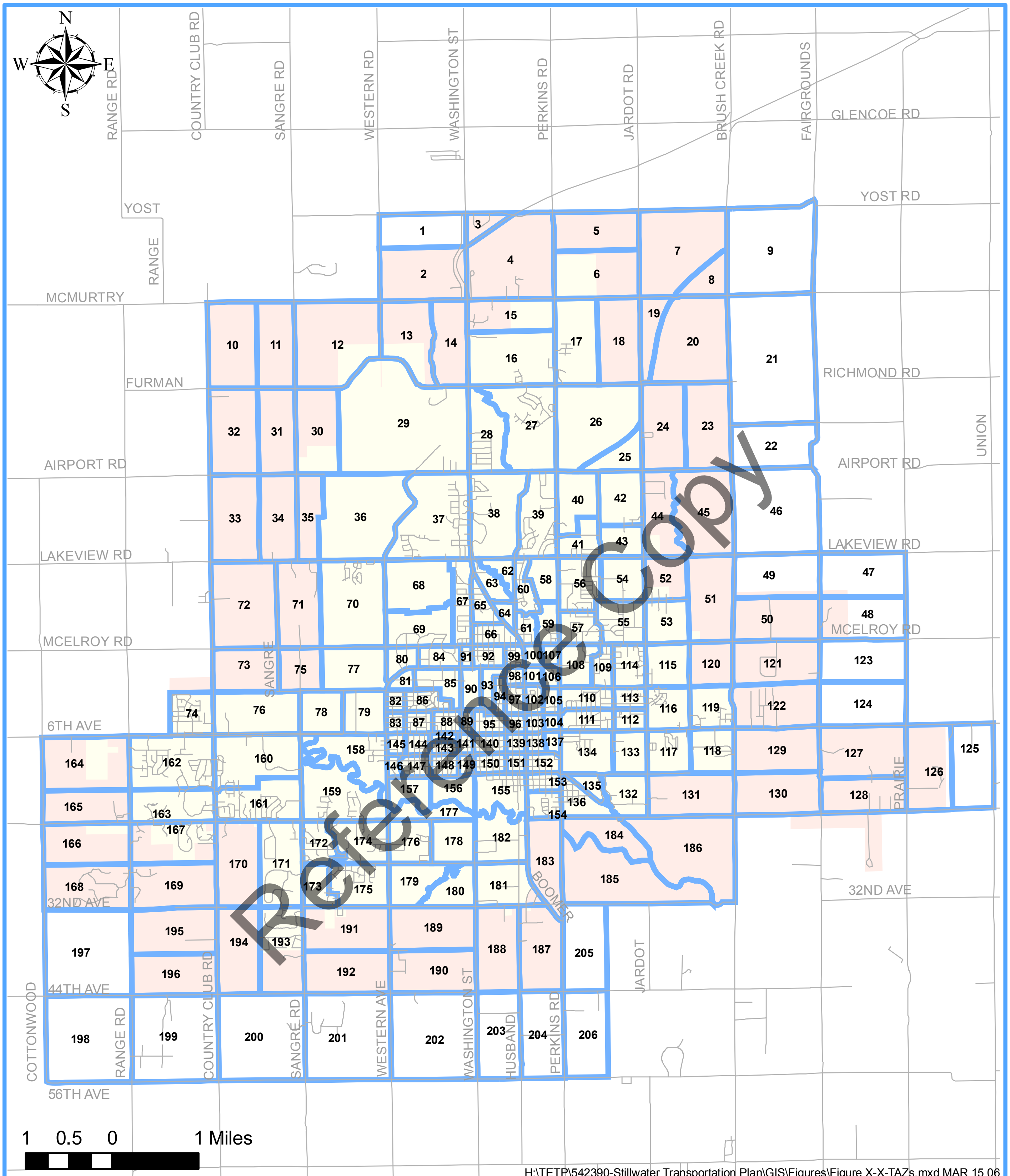
Demographic variables examined within each TAZ include:

- Population
- Households
- Total Employment
- Retail Employment
- School Enrollment

Base Year Estimates

Population and Households

An initial step in developing year 2005 estimates for population and households involved using a Geographic Information System (GIS) to aggregate 2000 US Census Bureau block level data to the TAZ level. For census blocks that were split by TAZ boundaries, a sub-block was created. Data for this block was disaggregated based on the share the sub block represented of the total block area. Sub-blocks were then aggregated to the TAZ level. Using the year 2030 control total developed for the study area, an annual growth was calculated between the Years 2000 and 2030. This annual growth rate of 1.5% was then applied to the year 2000 population figures to arrive at the base year, 2005, estimates.



STEP Stillwater Transportation Enhancement Plan

Traffic Analysis Zones

City Limits

Urban Growth Boundary

Traffic Analysis Zones (TAZs)

Employment

Developing base year employment data by place of work involved obtaining a geographically referenced database of employers in Stillwater from an outside vendor. Employee size and their Standard Industrial Classification (SIC) Code were provided for each employer in the study area. Utilizing GIS, this data was overlaid onto the City's parcel layer and existing street network and cross checked for accuracy in terms of location. In many cases actual data points fell on a TAZ boundary as opposed to within a TAZ and were therefore assigned to the appropriate TAZ by address matching the employment point layer to the City's parcel level data. Employment was also verified for accuracy (and revised where appropriate) with employment data received from the City, OSU and other special generators in the community. Once the employment data was verified for accuracy, it was aggregated to the TAZ level.

Enrollment

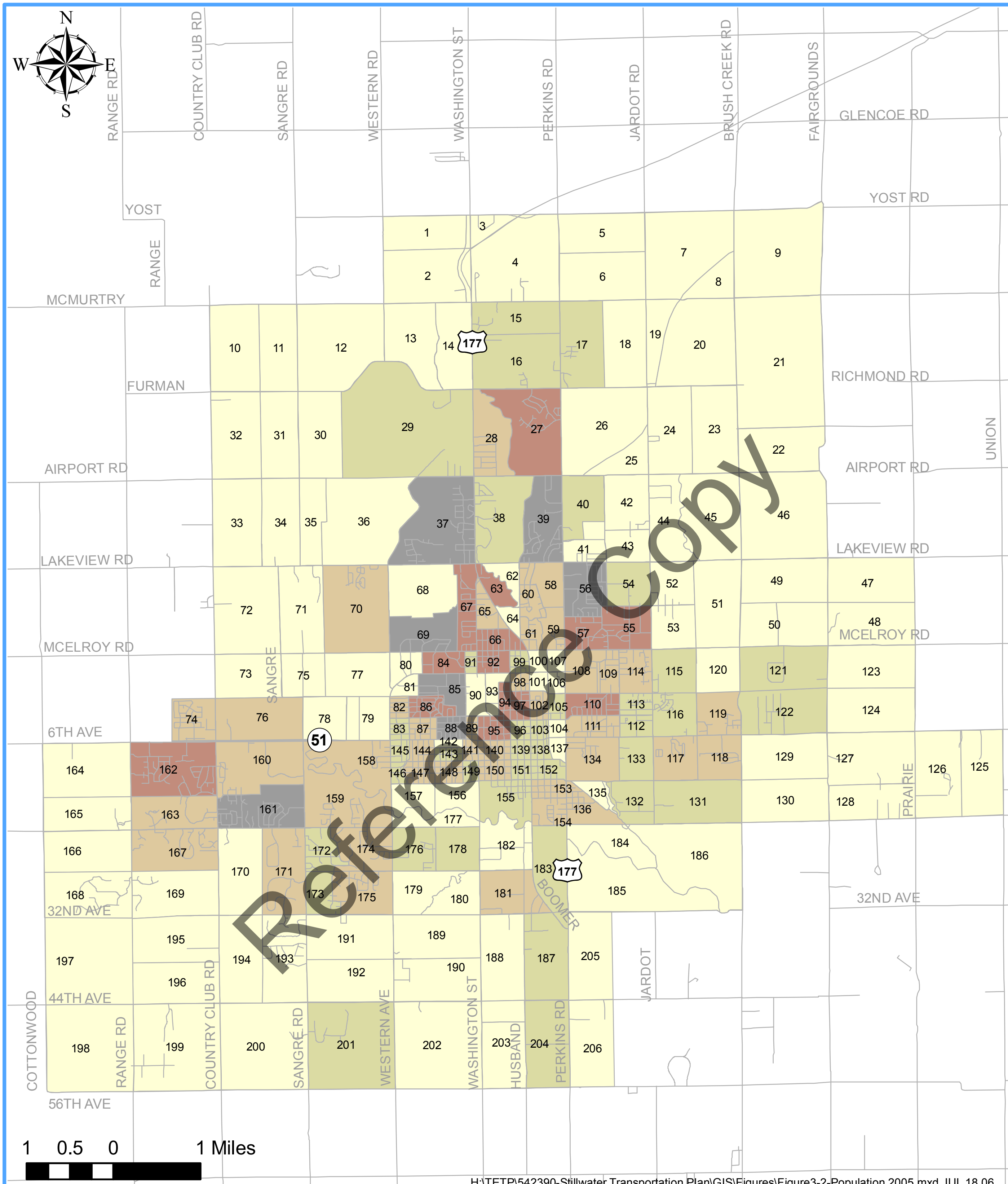
School enrollment for the Year 2005 was obtained from Stillwater Public Schools, Meridian Technology Center, and Oklahoma State University.

Base Year Data

Table 3-1 displays base year estimates for the Stillwater Area. As shown, population is estimated at 45,810 people. Employment is estimated at 25,964, with retail employment accounting for 20 percent of total employment. **Figures 3-2** and **3-3** display year 2005 total population and employment, respectively, by TAZ for the study area. Detailed demographics by TAZ is in the Appendix.

Table 3-1
Base Year Data
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Variable	Year 2005
Population	45,810
Household Population	39,457
Households	18,240
Group Quarters Population	6,352
Total Employment	25,964
Retail Employment	5,301

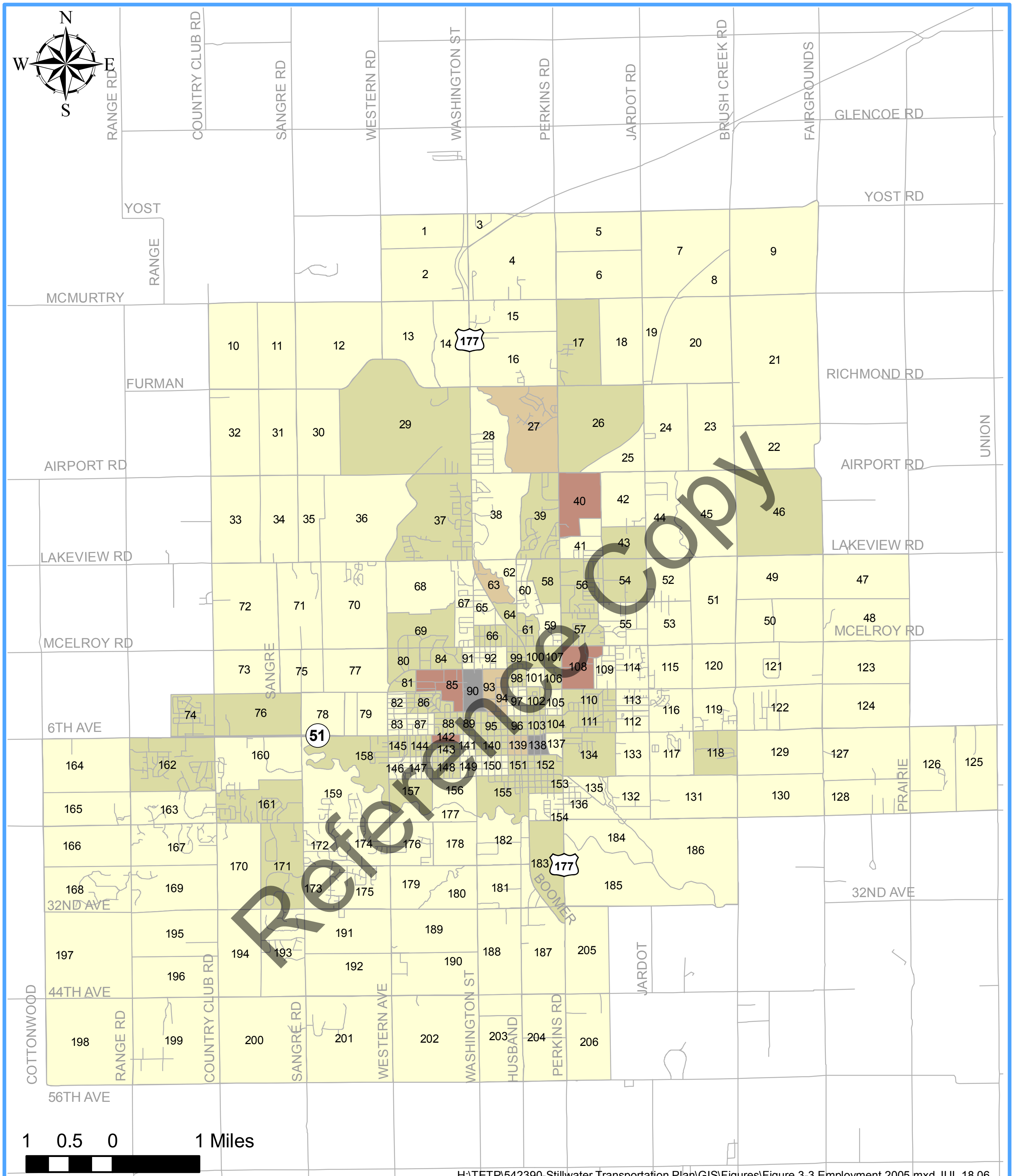


Stillwater Transportation Enhancement Plan

Population

- 0 - 100
- 101 - 250
- 251 - 500
- 501 - 1000
- > 1000

Figure 3-2
Population 2005



Stillwater Transportation Enhancement Plan

Total Employment

- 0 - 100
- 101 - 500
- 501 - 1000
- 1001 - 1500
- > 1500

Figure 3-3
Employment 2005

SPECIAL GENERATORS

Special generators are major employers, institutions and attractors which create unique travel patterns. These include high schools and post-secondary schools that have peak travel times other than the typical rush hours. Regional shopping malls also have heavy traffic during mid-day rather than from 7:00 am to 9:00 am and 4:00 pm to 6:00 pm. Regional/state parks and entertainment centers also create unique traffic patterns and peak times. Additionally, hospitals work around the clock creating heavier-than-normal traffic in the off-hours. Special Generators in Stillwater are shown in **Table 3-2.**

Table 3-2
Special Generators
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

TAZ	Special Generator
Educational Institutions	
69/80/84/81/85/ 90/93/92/91	OSU
93	OSU - Stadium
111	Highland Park Elementary School
27	Richmond Elementary School
171	Sangre Ridge Elementary School
54	Skyline Elementary School
87	Westwood Elementary School
65	Will Rogers Elementary School
171	Middle School
54	Junior High School
64	High School
153	Lincoln Academy
161	Meridian Technology Center
142	Oklahoma Department of Career and Technology Education
Medical Facilities	
142	Stillwater Medical Center
Other	
40	Mercruiser
27	National Standard Co.
17	Stillwater Designs
27	Quebecor World
26	Armstrong

FORECASTS

The initial step in developing socioeconomic data for the study area was to establish "control totals" for existing and future population and employment. Control totals are area wide forecasts of each of the socioeconomic variables, which are accepted totals used to disaggregate to the traffic analysis zone (TAZ) level. Control totals were developed for total population and employment.

For the purposes of the Stillwater Transportation Enhancement Plan, projections prepared by the Oklahoma State Data Center were initially used as control totals. The Oklahoma State Data Center uses a cohort-component projection model to develop their forecasts. Three series of projections are calculated for the state and counties under different sets of migration assumptions (high, medium, low). The State Data Center recommends the medium scenario for most communities. The study area for this project encompasses the City of Stillwater, and the Urban Growth Area identified in the City of Stillwater's Comprehensive Community Development Plan. Projections for the study area were developed by applying the State Data Center's annual growth rate identified for the City of Stillwater until the year 2030 to the Urban Growth Area. Utilizing the State Data Center's projections results in a 0.8 percent annual growth rate in the study area. Upon review of these control totals by the Advisory Committee and staff, it was concluded that they reflected a lower growth rate than anticipated by the community. It was therefore decided that an annual growth rate of 1.5 percent would more appropriately reflect the projected development trends in the community. An annual growth rate of 1.5 percent results in a population of 66,468 in the year 2030. **Table 3-3** lists these projections and shows a comparison to that from the State Data Center (population only).

Table 3-3
Demographic Projections
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Year	Population		Employment
	State Data Center	1.5 Percent Growth Rate	0.8 percent growth rate
2005	44,919	**45,810**	25,964
2010	47,554	**49,351**	27,487
2015	49,578	**53,164**	28,657
2020	51,174	**57,273**	29,579
2025	52,952	**61,699**	30,607
2030	54,976	**66,468**	31,777

Employment forecasts were not readily available for the area and therefore were initially developed as a function of population by applying the annual growth rate for population to employment. However, based on input received from the Advisory Committee and city staff, employment in Stillwater is expected to grow at a slower rate than population due to the expectation of an increasing retired population. As a result of this input forecasts were developed using the State Data Center's population forecast growth rate for the City of Stillwater (0.8 percent).

It should be noted that population and employment forecasts developed for the Stillwater Transportation Enhancement Plan were based on the best available information at the time the study was prepared. Forecasts are a prediction of future circumstances based on existing trends and policies. Local conditions, trends and policies could change at any time and therefore influence and change growth patterns in the community. As a result population and employment projections should be revisited and revised on a regular basis to ensure they still reflect current local conditions.

DEVELOPMENT OF GROWTH SCENARIO

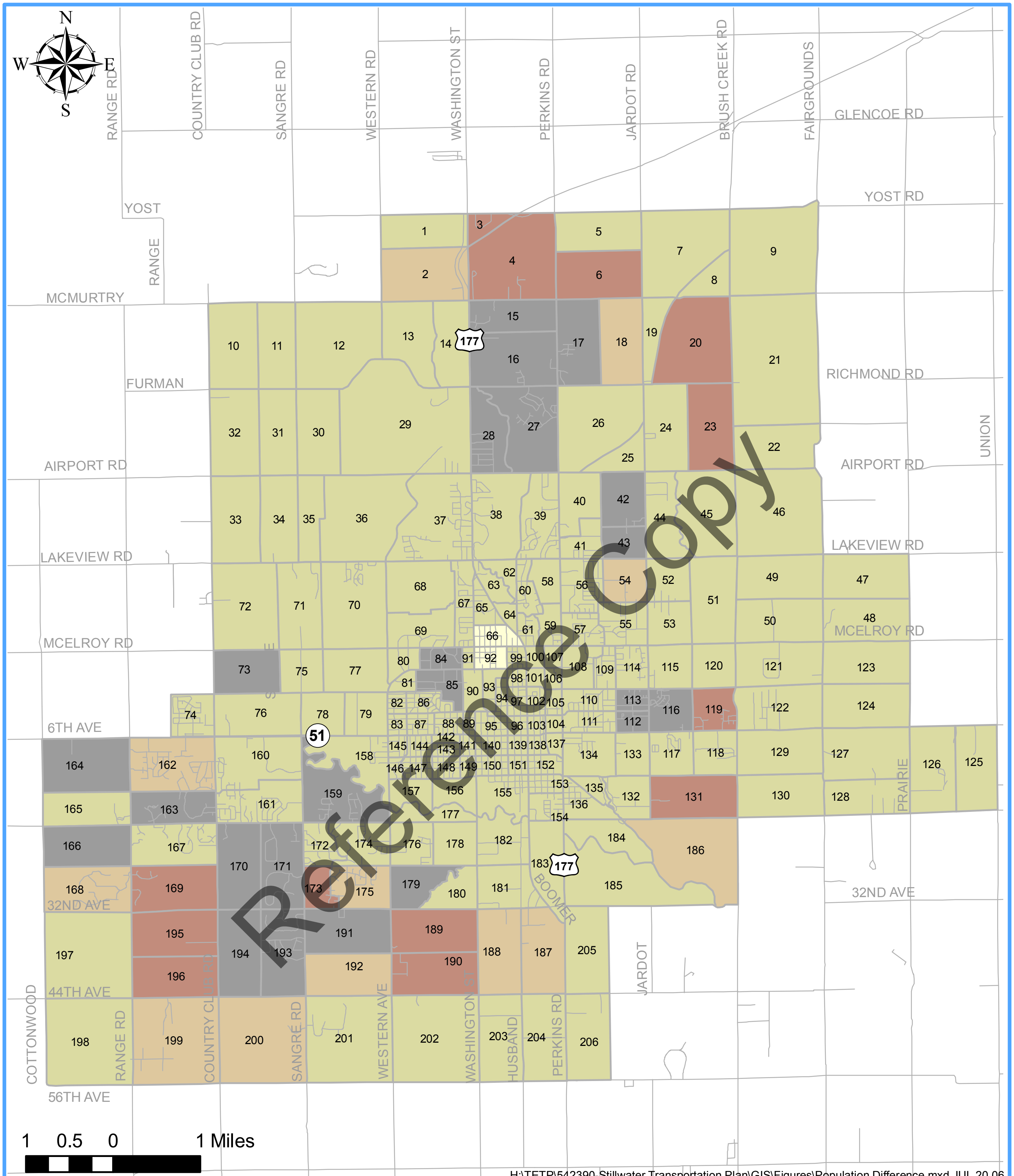
Once the control totals were determined, a growth scenario was developed for the City based on known and planned developments and existing and projected trends. The City's growth scenario reflects the community's anticipated development pattern until the year 2030 based on existing policies and plans. Development of the growth scenario was accomplished by first identifying key trends and development patterns in the community through meetings with stakeholders, city staff, and the Advisory Committee.

Key developments and trends identified by the community as influencing future growth in the City of Stillwater include the following:

- Majority of residential growth is occurring in the southwest and northeast areas;
- Minimal growth will occur south of 44th because this area is in a different drainage basin and the cost of utilities would be more expensive;
- The community has an aging population, therefore employment will grow at a slower rate than population;
- Will experience a significant increase in retail during the next two years and then it will level off;
- Employment growth will occur along US 177 South/Perkins Road;
- Future growth on the north side of town is expected to be mostly industrial;
- Commercial and residential growth are expected to occur to the west on SH 51;
- Manufacturing is currently in expansion mode:
  - Mercruiser will expand by the year 2030
  - National Standard is anticipated to double in size by the year 2030
  - Stillwater Designs is relocating to east of Boomer Lake
- OSU will continue to grow – enrollment is expected to be 25,000 in the Year 2025. OSU expansion plans include buying houses in TAZs 66 and 92 and therefore population will decline and employment will increase in this area (this project is already underway and the residential population has relocated);
- At the intersection of 6th and Country Club a new Wal-Mart Supercenter has opened and is projected spur additional retail growth in the area; and,
- Oklahoma Technology and Research Park will continue to develop and attract businesses and industry over the next 20 years.

A workshop was then held with the Advisory Committee at which the committee identified specific areas suitable for future development and most likely to develop by the years 2015 and 2030. The advisory committee identified TAZs as high or moderate growth for both residential and nonresidential development and for forecast years 2015 and 2030. The moderate and high growth areas are those vacant areas with pending development or those with appropriate zoning and availability of utilities and transportation access. TAZs not identified as high or moderate growth areas were assumed to have limited growth primarily due to lack of developable land, environmental constraints, lack of infrastructure/utilities, and/or they were projected to remain rural by the year 2030.

In addition to the Advisory Committee's input, the consultant team reviewed the City's Future Land Use Plan and Utilities Plan for Water to determine additional areas of moderate growth potential. Additionally, growth and relocation plans of major generators were taken into account. **Figures 3-4** and **3-5** display the growth scenarios for population and employment.

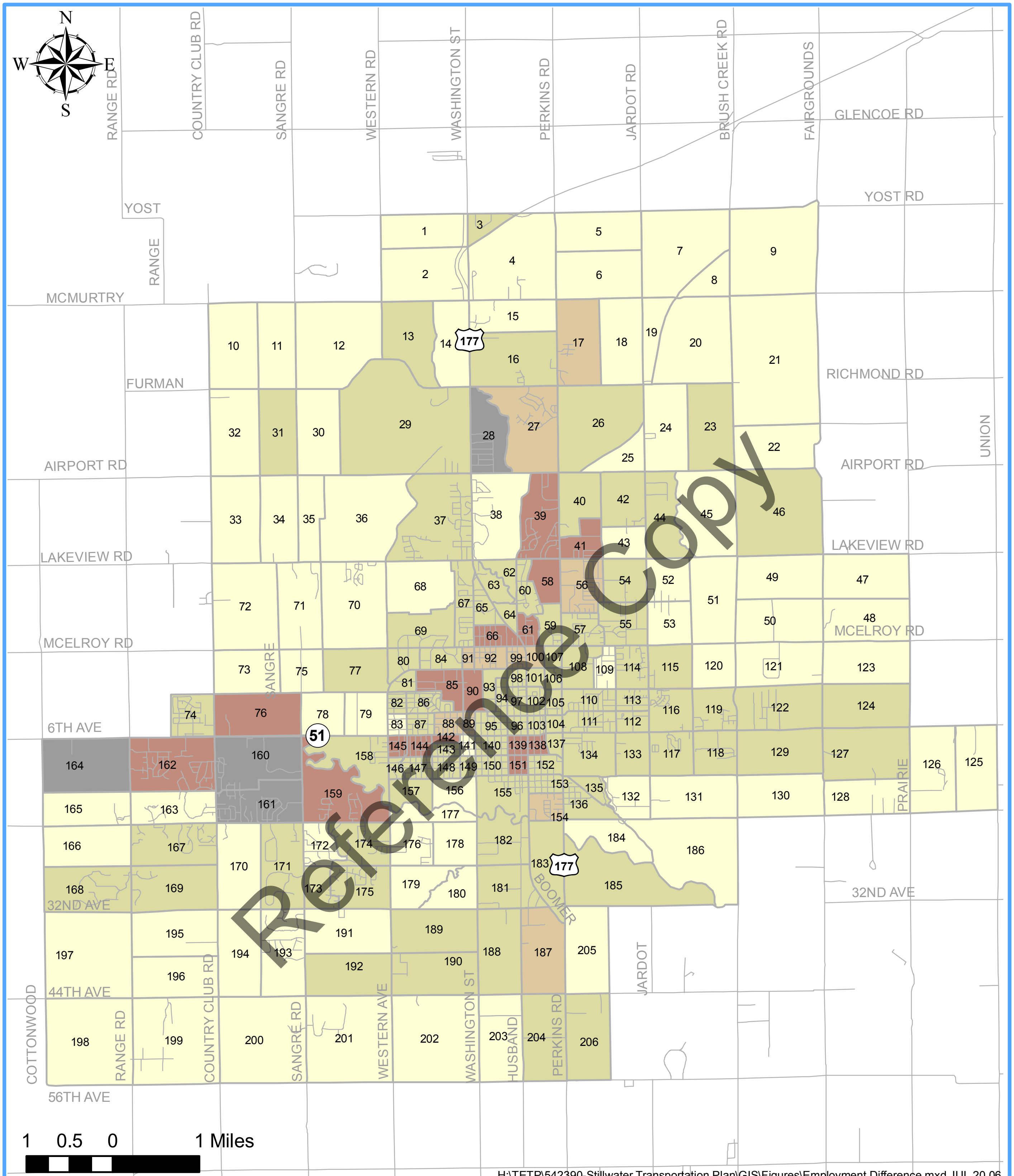


STEP
Stillwater Transportation Enhancement Plan

Population Growth

- <0
- 0 - 100
- 101 - 200
- 201 - 300
- 300 - 619

Figure 3-4
Population Growth 2005-2030



Stillwater Transportation Enhancement Plan

Employment Growth

- 0
- 1 - 50
- 51 - 100
- 101 - 200
- 201 - 440

Figure 3-5
Employment Growth 2005-2030

Allocation of Control Totals

Population and Households Forecasts

In disaggregating the Year 2030 population control total to the TAZ level, population growth was distributed first to the high growth planning sectors with a smaller secondary allocation distributed to the moderate growth areas. The issue of the residential population north of Hall of Fame where OSU is planning its Athletic Village created a unique growth pattern. The year 2005 population in TAZs 92 and 66 was dispersed to nearby TAZs prior to applying the growth estimates. Specifically, 20 percent of the population growth increment between base year 2005 and forecast year 2030 was allocated across all populated TAZs, not identified as high or moderate growth areas. The remaining 80 percent of the population growth increment was distributed with 70 percent to the high growth planning sectors and 30 percent to the moderate growth planning sectors. Upon review of this allocation, the Advisory Committee and staff made further refinements and revisions to these allocations based on local knowledge of existing trends.

Once population was disaggregated to the TAZ level, group quarters population for the Year 2030 was calculated by applying the Year 2005 group quarters to total population ratio to the Year 2030 total population. Households were then calculated by applying the 2005 persons per household ratio to total household population (*household population = total population – group quarters population*).

Population forecasts for the 2015 interim year were calculated by allocating 40 percent of the growth increment between 2005 and 2030 to the year 2015 forecast.

Forecast Year Data

A summary of forecast year data is presented in **Table 3-4**. Detailed demographic data by TAZ is included in the Appendix.

Table 3-4
Forecast Year Data
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

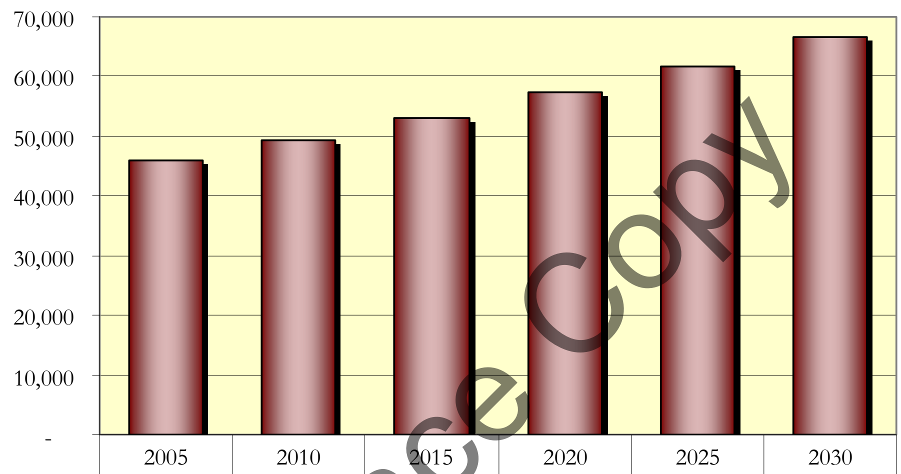
Category	2005	2015	2030
Population	45,810	53,161	66,468
Group Quarters	6,352	6,606	7,048
Households	18,240	21,003	26,390
Employment	25,964	28,657	31,777
Retail Employment	5,301	5,854	6,497
Enrollment*	33,629	38,179	46,176

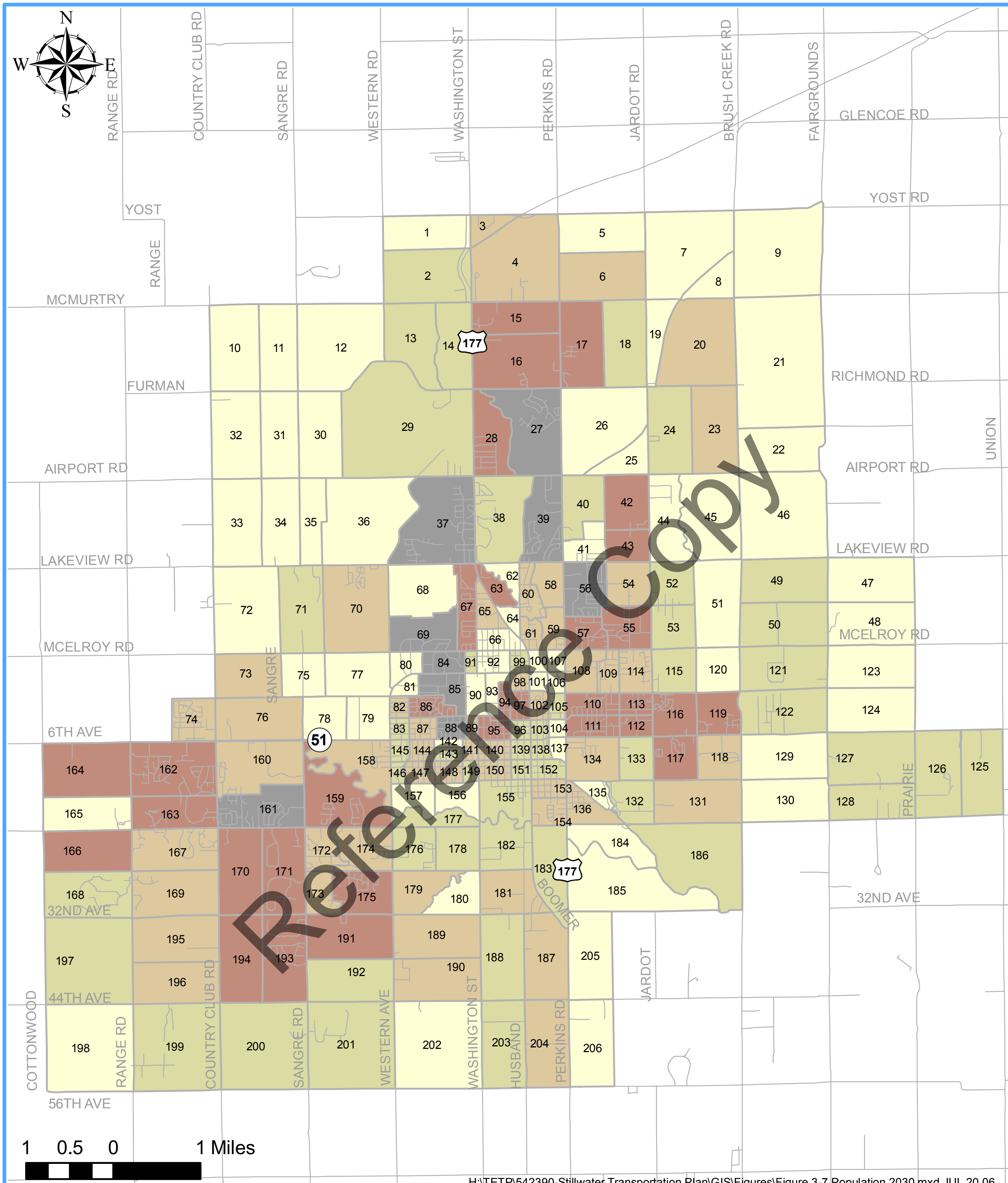
*Enrollment includes Meridian Technology Center and OSU

Population

Figure 3-6 displays base and forecast year population for the Stillwater study area. As shown, Stillwater is expected to experience continued growth over the next several decades. Population is projected to increase from 45,810 in the Year 2005 to 66,468 in the Year 2030, an annual increase of 1.5%. Population by TAZ for the Year 2030 is shown in **Figure 3-7**.

Figure 3-6
Projected Population
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma





Stillwater Transportation Enhancement Plan

Population

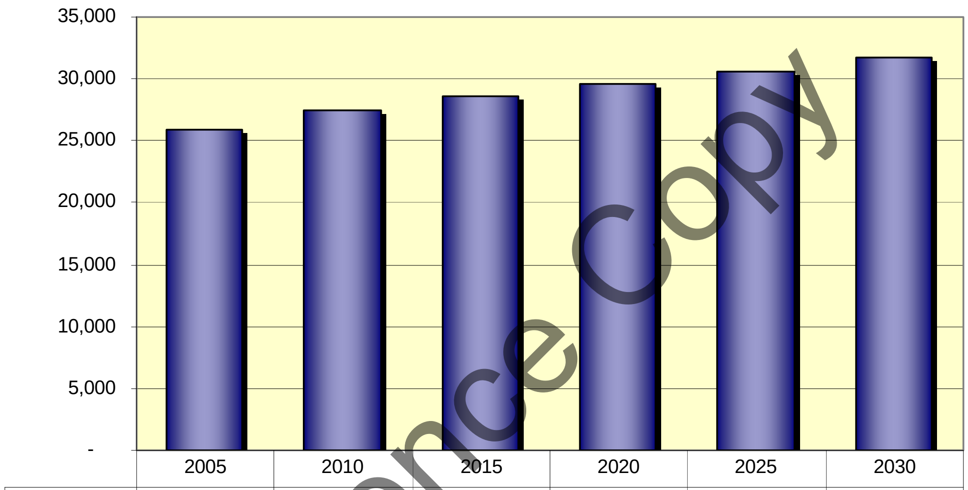
- 0 - 100
- 101 - 250
- 251 - 500
- 501 - 1000
- > 1000

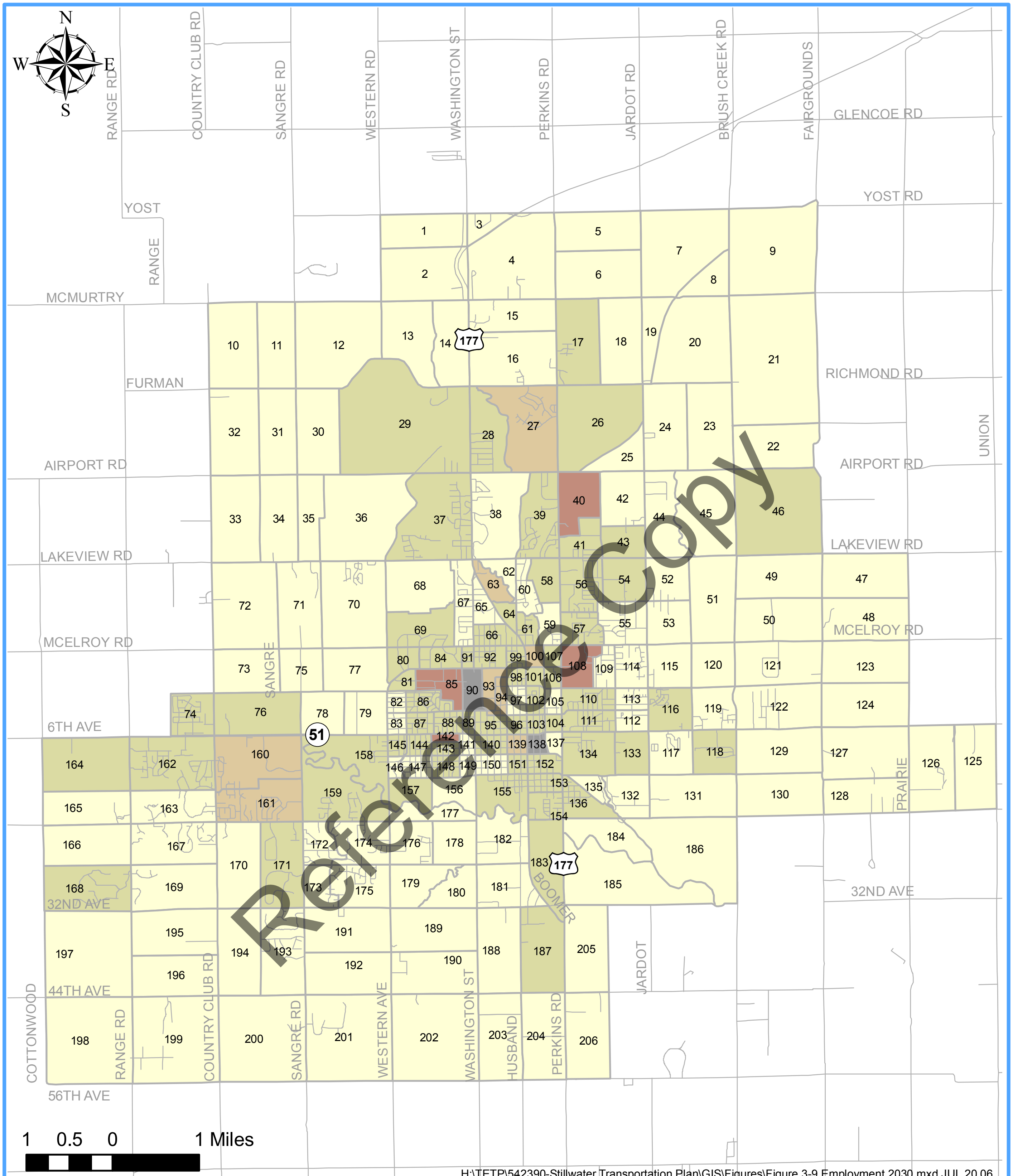
Figure 3-7
Population 2030

Employment

As shown in **Figure 3-8**, Stillwater is expected to experience continued growth in employment over the next several decades. Within the area, over 5,000 jobs are expected be added to the economy by the year 2030, increasing employment from 25,964 in the year 2005 to 31,777 in the year 2030. This represents an annual increase of 0.8 percent. Employment by TAZ for the year 2030 is shown in **Figure 3-9.**

Figure 3-8
Projected Employment
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma





Stillwater Transportation Enhancement Plan

Total Employment

- 0 - 100
- 101 - 500
- 501 - 1000
- 1001 - 1500
- > 1500

Figure 3-9
Employment 2030

TRAVEL DEMAND MODEL DEVELOPMENT

In addition to the demographics previously discussed, another major input to the travel demand model is the transportation network. The following section describes development and refinements to these networks and validation of the transportation model that was used for evaluating existing travel conditions and forecasting future travel demand for the City of Stillwater. The development of mathematical models capable of simulating existing traffic patterns and projecting future travel demand is a very important phase of the transportation planning process.

MODEL NETWORKS

One of the most important aspects of travel demand modeling is the network to represent the transportation system. The model network used in this study is a geographical depiction of the City of Stillwater roadway system. A travel demand model compares demand for travel to the supply of the roadway system within a defined study area. Travel demand is derived from population and employment, while the supply side of the equation is the roadway system on which travel occurs. Similar to socioeconomic and demographic data previously described, network attributes describe the characteristics of the roadway system.

For this study, a transportation model was developed for the City of Stillwater study area using *Cube Voyager* travel demand forecasting software. As discussed earlier in this chapter, a total of 206 TAZs were developed to provide better coverage and to enable the model to be more focused in the study area. The TAZ structure and roadway network were defined to allow analysis of arterial and collector roadways within the City of Stillwater.

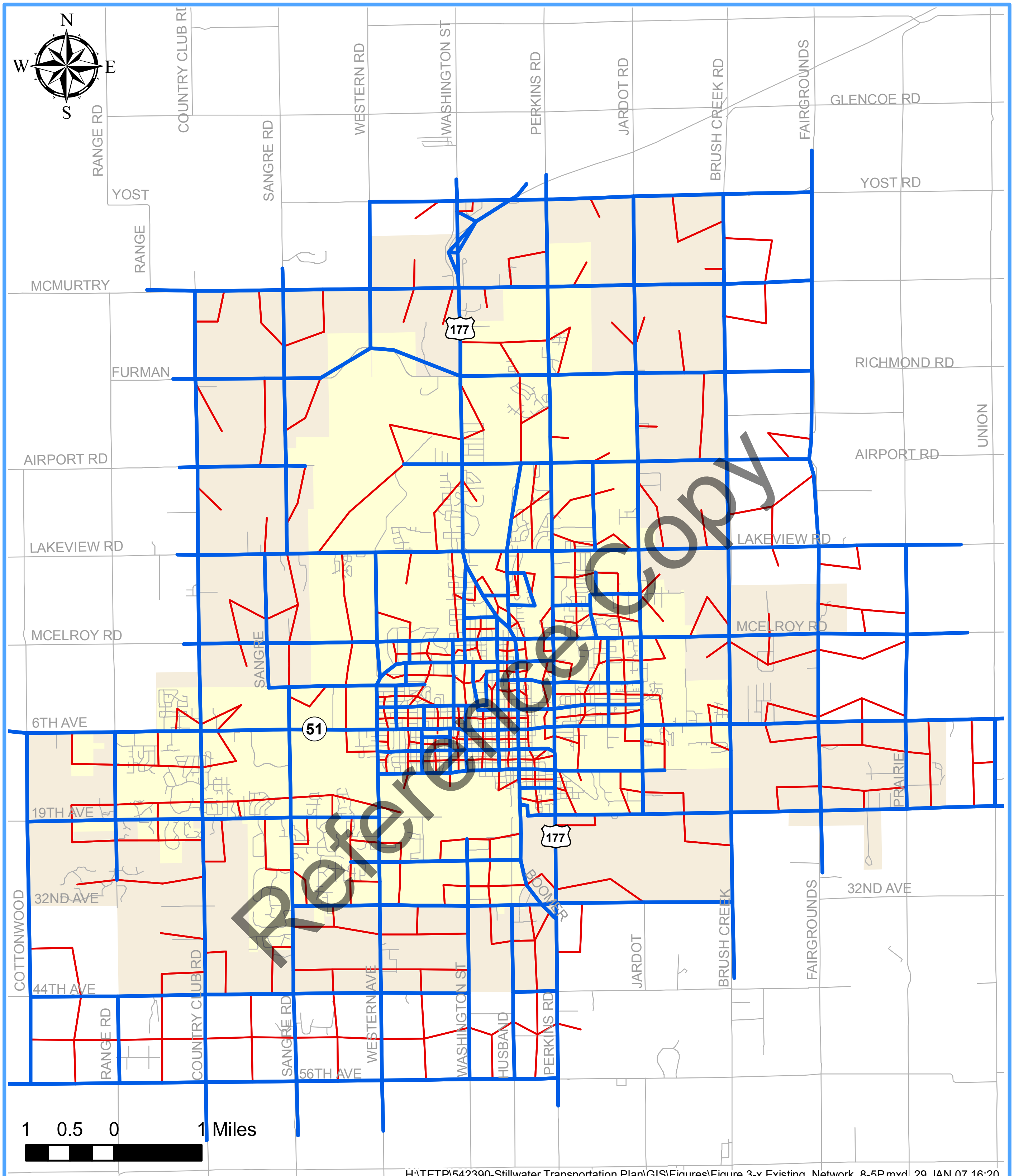
The following model network features are used to develop a geographical representation of a road thoroughfare system:

- Links;
- Nodes;
- Centroid Connectors; and,
- Centroids.

Links are used to represent roadway sections. Nodes are used to split links where roadway attributes differ (i.e., speed limits, number of lanes, or facility type) or where intersections or interchanges occur. Interchanges differ from intersections in that multiple links and nodes are needed. Interchanges require links representing access and egress ramps and require nodes where those ramp connections occur with the intersecting roadway.

Special links and nodes are used to "load" traffic onto the network. TAZs represent the origins and destinations of travel activity in the study area. Special nodes called "centroids" are used to represent TAZs in the network. Special links called "centroid connectors" are used to represent local streets contained in a TAZ and provide access between centroids and the network. Also, a centroid can have more than one centroid connector.

Figure 3-10 presents the layout for the year 2006 base network. In addition to the graphical depiction of the network, a database is also associated with the model network.



Road Network
Centroid Connector
City Limits
Urban Growth Boundary

Stillwater Transportation Enhancement Plan

Figure 3-10
Year 2006
Base Network

The database is used to store link attribute data including but not limited to node numbers; length (typically in feet); direction of flow (one-way vs. two-way), functional class; number of lanes; posted speeds; model-adjusted speeds and travel times (typically in minutes); roadway capacities; and observed traffic count data where available.

The most important factor in determining the distribution of trips throughout the network is travel time. The travel time is a function of link distance and link speeds.

The number of lanes is also an important roadway feature, representing network supply. Generally, the more lanes a facility has; the greater its carrying capacity. These three variables – functional class, area type, and number of lanes – are used to assign speed and capacity values to a network link. In this model, the link capacities were defined by functional classification and number of lanes and are summarized below in **Table 3-5**. Link speeds used in the model were based on posted speeds. However, the link speeds were adjusted during the calibration process to simulate prevailing traffic volume on the link. Area type distinction (such Downtown, Urban, Sub-urban, and Rural) was not considered for this model due to the nature of the land use intensity in the study area.

Table 3-5
Daily Link Capacities by Functional Classification and Number of Lanes
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Functional Classification	Number of Lanes			
	2 lanes (vpd)	4 lanes (vpd)	5 lanes (vpd)	6 lanes (vpd)
Interstate/Turnpike	22,000	42,500	-	64,000
US Highway	16,000	31,500	33,500	48,000
Principal/Major Arterial	13,500	27,000	30,400	40,500
Minor Arterial	12,500	25,000	28,100	34,500
Collector	11,500	23,000	-	-
Unimproved Collector	8,500	17,500	-	-

Source: Wilbur Smith Associates

Model Validation

The entire network development and review process described above is often referred to as 'network coding'. Once network coding is completed, the model network is used as an input to the travel demand model. Prior to forecasting travel demand, the base year model results should be compared to existing traffic patterns of the base year, which is a process referred to as 'model validation'.

In order to test the ability of the model to predict future behavior, validation requires comparing the model predictions with information other than that used in estimating the model. This step is typically an iterative process linked to model calibration. It involves checking the model results against observed data and adjusting parameters until model results fall within an acceptable range of error.

For this study purpose, an existing base year 2006 model was developed for validation that contained a transportation network (ready for coding proposed transportation improvements) and existing year 2005 population, household, and employment data developed using 2000 US Census Bureau block level data (as discussed earlier in this Chapter). Comparisons of observed counts (actual ground counts collected from the field) and assigned daily volumes (24-hour traffic flows from the model) for the existing year model run were compared. Overall, the estimated trips are within one percent of observed traffic.

Typically the validation processes focus only on the overall performance of the travel demand model, especially the flow of trips from/to the study area at screenline crossings. Screenline analysis compares the results of trip assignment with the actual traffic count data collected from the field. It is a process of comparing the sum of ground counts across a screenline with the sum of the assigned traffic volumes across the same screenline. Screenline analysis is a useful tool for the calibration and validation of trip assignment models, and it can also be used for more general purposes of calculating flows that cross a screenline.

The following five screenlines were established to intercept major traffic flows across the City of Stillwater study area. **Figure 3-11** depicts the following five screenlines used in the validation of the existing model.

1. Airport Road – east-west screenline;
2. Country Club Road – north-south screenline;
3. 12th Avenue – east-west screenline;
4. US 177 – north-south screenline; and,
5. University Avenue – east-west screenline.

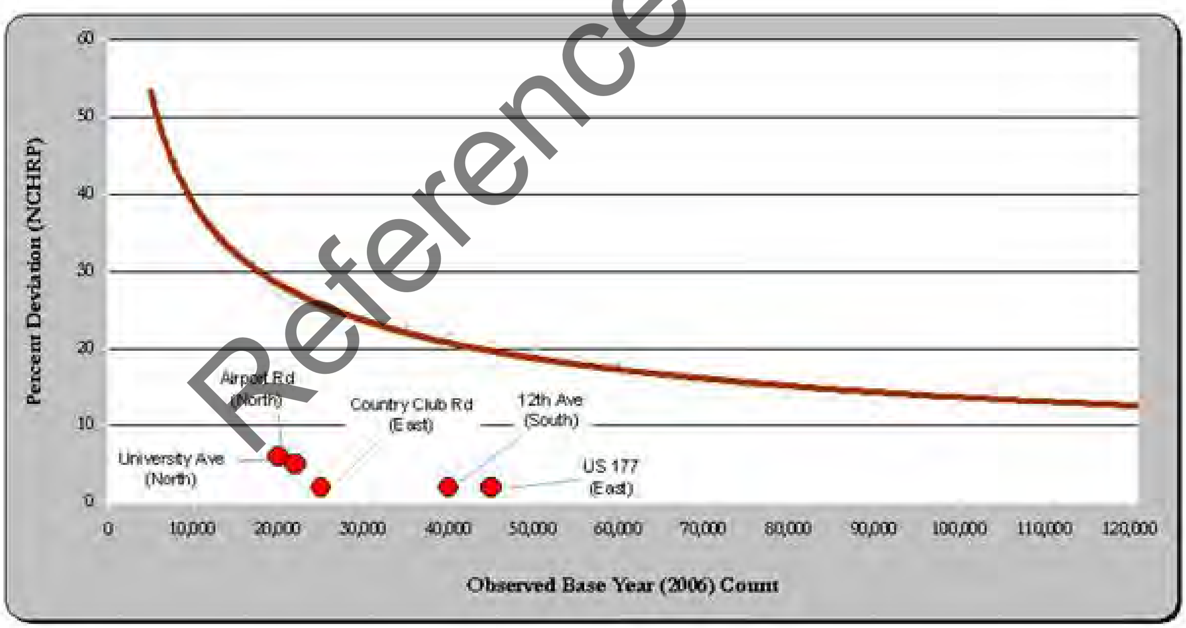
The National Cooperative Highway Research Program (NCHRP) established guidelines for screenline volumes in 1982 that have been used extensively in validating travel demand models. The comparison of the City of Stillwater screenline volumes with the maximum desirable deviation for screenline volumes established by these guidelines are summarized in **Table 3-6** and illustrated in **Figure 3-12**.

Table 3-6
Comparison Of Observed Versus Assigned Traffic Volumes
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Screenline	Number of Count Locations	Total Observed Volume	Total Assigned Volume	Difference	Absolute % Difference	NCHRP Targets
Airport Rd (North)	3	22,600	23,700	1,100	5%	26%
Country Club Rd (East)	5	24,300	24,800	500	2%	25%
12th Ave (South)	6	42,600	41,600	-1,000	-2%	22%
US 177 (East)	8	45,900	45,200	-700	-2%	21%
University Ave (North)	5	19,400	20,600	1,200	6%	27%
TOTAL	**27**	**154,800**	**155,900**	**1,100**	**1%**	**13%**

Source: Wilbur Smith Associates

Figure 3-12
Maximum Desirable Deviation in Screenline Volumes
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma



Source: NCHRP Report 255 and Wilbur Smith Associates

As can be seen, all locations fall far below the curve of maximum desirable deviation as defined in the National Cooperative Highways Research Program (NCHRP) 255 report.

The validation results indicate that the model is performing within the acceptable range. Once confident in its performance, the model can be used to test the adequacy of proposed transportation improvements for serving projected demand. Travel model forecasting also works in conjunction with land use forecasts, since both depend largely on the following factors:

- Socioeconomic conditions affecting trip productions and attractions;
- Land use patterns based on locations and intensities of use; and,
- The type, extent and quality of transportation networks and facilities.

Model Forecasting

The Stillwater model forecasting process is based on a traditional four-step analysis. This forecasting process includes trip generation, trip distribution, mode choice and traffic assignment steps, as well as a model validation procedure previously described.

Trip generation is the initial modeling step, which provides an estimation of the amount of travel. This method determines the number of trip ends produced from and attracted to each TAZ, and also classifies these trip ends by trip purposes. The trip generation model used for Stillwater uses five trip purposes:

1. Home-Based Work (HBW);
2. Non-Home Based (NHB);
3. Home-Based Non-Work (HBNW);
4. Other;
5. External (includes internal-external and external-internal trips); and,
6. Total (includes total trips; sum of all above).

Trip generation models consist of two sub-models including the trip-production model and trip-attraction model. Trip productions are the trip ends associated with traveler's home (population driven). Trip attractions are the trip ends associated with non-home end such as workplace, shopping areas, or school (enrollment and employment driven).

Productions are estimated using the disaggregated (household based) cross-classification model. Trip production for HBW and NHB trips is based on household production rate stratified by number of persons per household and auto ownership. The auto ownership data by number of households for Stillwater was derived using the Census 2000 tract household/auto ownership stratification data and applied at the TAZ level. The trip production rates by trip purpose were adopted from the Association of Central Oklahoma Governments (ACOG) regional model which is based on 1995 National Personal Transportation Survey (NTPS). **Table 3-7** shows the cross-classification matrix by trip purpose with trip production rates.

Table 3-7
Average Daily Person Trips by Household size and Auto-ownership
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Home-Based Work (HBW) Trip Purpose

Auto/Household	Persons/Household			
	1	2	3	4+
0	0.28	0.53	1.50	0.96
1	0.72	0.62	1.27	1.82
2	1.38	1.66	1.93	2.03
3+	1.07	1.24	2.56	2.62

Non Home Based (NHB) Trip Purpose

Auto/Household	Persons/Household			
	1	2	3	4+
0	0.84	2.06	1.14	3.25
1	1.56	2.37	3.88	4.86
2	2.24	2.58	4.05	5.95
3+	3.18	2.99	4.38	6.11

Source: Association of Central Oklahoma Governments (ACOG) regional model

Trip attractions (trip destinations) are calculated using a multiple regression analysis. The following person-trip attraction estimating relationships were used based on NCHRP Report 365 "Travel Estimation Techniques for Urban Planning".

HBW Attractions = 1.45 x Total Employment

NHB Attractions CBD = (1.40 x CBD RE) + (1.2 x SE[1]) + (0.5 x OE[1]) + (0.5 x HH)

NHB Attractions NBD = (4.10 x NBD RE) + (1.2 x SE[1]) + (0.5 x OE[1]) + (0.5 x HH)

HBO Attractions CBD = (2.0 x CBD RE) + (1.7 x SE[1]) + (0.5 x OE[1]) + (0.9 x HH)

HBO Attractions NBD = (9.0 x NBD RE) + (1.7 x SE[1]) + (0.5 x OE[1]) + (0.9 x HH)

CBD – Central Business District (Downtown)

NBD – Non Central Business District

RE – Retail Employment

SE – Service Employment

OE – Other Employment (Basic and Government)

HH – Households

[1]Note: The service employment and other employment were estimated as a percentage of total employment for estimating trip attractions.

The person trips were converted to vehicle trips by applying the automobile-occupancy factors. A rate of 1.12 persons per vehicle was used, based on National Cooperative Highway Research Program (NCHRP) Report 365.

Trip distribution is the second major step performed by the travel demand model. Trip distribution uses the TAZ productions and attractions output from trip generation, and assigns each production to a destination and each attraction to an origin for all possible zones in the study area. The trip distribution process is based on the gravity model for distribution of internal-internal and internal-external trips. The gravity model analyzes the frequency of trip interchange between zone pairs based on the relationship between each zone's productions and attractions and the travel time between the zones. The friction factor is the primary independent variable and quantifies the impedance or measure of separation between zone pairs. As the travel time between zones increases, the friction factor decreases. It reflects that the willingness of the traveler to spend time or distance on a trip varies by trip purpose. The friction factors used in this model are based on NCHRP Report 365.

Mode choice which encompasses transit is typically the third step. A detailed traffic transit demand modeling was not part of the scope. However, mode choice was considered during trip generation and distribution of the travel demand model.

Traffic assignment is the final step and is an iterative process. The trip productions and attractions (from trip generation) are converted to origins and destinations (from trip distribution). The output of trip distribution is an origin-destination (O-D) matrix which contains total vehicle trips for each O-D pair. The O-D matrix is assigned to the network using a minimum path algorithm based on travel time and capacity restraints. The Oklahoma City Area Regional Transportation Study (OCARTS) model uses an equilibrium load technique for assignment, which runs iterative minimum path assignments and readjusts travel times according to link delays.

Link delays increase as a result of congestion on a particular link. As link volumes approach link capacity, the V/C ratio increases for that link. The result is a decrease in the LOS on that link and travel time is reduced. As travel time is reduced due to congestion, vehicles divert to other links with faster travel times. This process is continued until no one vehicle can further reduce their travel time. At this point, the assignment is said to have reached 'equilibrium'. The results of the equilibrium assignment are displayed in the network database for further analysis and for presentation purposes.

The results obtained from the assignment are then compared back to the ground counts for validation of the base model (previously discussed). Once the model has been validated it is ready for use in the planning and development of forecast networks.

External Travel Estimation

External trips are trips with at least one end outside the study area. When only one end of the trip is outside the study area, the trip is called an 'external-internal' or 'internal-external' trip. When both ends of the trip are outside the study area, that trip is classified as 'external-external' trip i.e. a through trip. A total of 22 external stations were used in the Stillwater model for external travel estimation. An estimation of average daily traffic (ADT) volume at these stations was obtained from the City. The estimation of through trips at external stations (or zones) was based on NCHRP, report 365 methodology. The model used functional classification of the roadway, average daily volume at the station, the percentage of trucks, and population of the study area. The equation for estimating the percent through trips at an external station is shown as follows:

$$Y_i = 76.76 + 11.22 \text{ x } I - 25.74 \text{ x } PA - 042.18 \text{ x } MA + 0.00012 \text{ x } ADT_i + 0.59 \text{ x } PKTS_i - 0.48 \text{ x } PPS_i - 0.000417 \text{ x } POP$$

Where,

Y_i = percentage of the ADT at external station i, that are through trips
I = interstate (0 or 1);
PA = principal arterial (0 or 1);
MA = minor arterial (0 or 1);
ADT_i = average daily traffic at external station *i;*
$PTKS_i$=percentage of trucks excluding vans and pickups at external station *i*;
PPS_i = percentage of vans and pickups at external station *i;*
POP = population in the study area.

The distribution of the estimated through trips from each external station to each of the other external stations were conducted using equations provided in NCHRP, Report 365 as follows:

Interstate:

$$Y_{ij} = -2.70 + 0.21 \text{ x } PTTDES_j + 67.86 \text{ x } RTECON_{ij}$$

Principal/Major Arterial:

$$Y_{ij} = -7.40 + 0.55 \text{ x } PTTDES_j + 24.68 \text{ x } RTECON_{ij} + 45.62 \text{ x } \frac{ADT_j}{\sum_{j=1}^{n} ADT_j}$$

Minor Arterial:

$$Y_{ij} = -0.63 + 86.68 \text{ x } \frac{ADT_j}{\sum_{j=1}^{n} ADT_j} + 30.04 \text{ x } RTECON_{ij}$$

Where,

Y_{ij} = percentage distribution of through-trip ends from origin station i to destination station j,
$PTTDES_j$ = percentage through-trip ends at destination station j,
$RTECON_{ij}$ = route continuity between station i and j (1 = Yes, 0 = No)
ADT_j = average daily traffic at destination station j.

The final external travel trip table was then balanced using the Fratar technique (or matrix balancing). This external trip table was added to the person trip matrix which is an output from the trip distribution step. The result is a final origin-destination trip table which is used in the trip assignment stage to obtain traffic flows along the network links.

Chapter 4 – Future Traffic Impacts

In identifying appropriate and effective transportation improvements for the Stillwater area, a series of test network scenarios, comprised of a varying transportation projects, were developed in order to evaluate their impacts on travel demand. Projects identified in the scenarios included roadway capacity improvements – widenings, extensions, and intersection enhancements – as well as enhanced transit. The transportation model was an important factor in evaluating the alternatives and was used to develop future travel demand forecasts based on projected land use and development patterns in the area. In addition to traffic service, factors such as maximum utilization of the existing transportation system, community acceptance, impact from land development, and conformance with growth policies and community goals and objectives were considered in developing and evaluating transportation plan scenarios.

TRANSPORTATION IMPROVEMENT NEEDS

One of the initial steps in identifying transportation improvements in the City of Stillwater was to determine future deficiencies by projecting 2030 traffic demands and needs along the existing roadway network.

Future deficiencies were determined by conducting a capacity/level-of-service analysis of the roadway system. Roadway capacity is defined as the maximum number of vehicles that can be accommodated on a roadway facility during a particular time period under prevailing roadway, traffic, and control conditions. Roadway capacity is determined by several contributing factors, including the functional class of the roadway, type and intensity of adjacent development, and the number of travel lanes. Other contributing factors of roadway capacity include intersection spacing, efficiency of signalized intersections, traffic composition, traffic controls and regulations. Capacities along the roadway network that were utilized in calculating level-of-service in the City of Stillwater are shown in **Table 4-1**.

Table 4-1
Roadway Capacities
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Lanes	Major Arterial	Minor Arterial	Major Collector
2-lane roadway	13,500	12,500	11,500
3-lane roadway	15,780	14,610	13,450
4-lane Undivided	27,000	25,000	23,000
4-lane Divided	31,050	28,750	-
5-lane roadway	30,400	28,100	-

An important result of a capacity analysis is the determination of level-of-service. Level-of-Service (LOS) is a qualitative measure of operating conditions at a location and is directly related to the volume-to-capacity ratio along roadways. LOS is given a letter designation ranging from A to F (free flow to heavily congested), with LOS D considered in most urban areas as the limit of acceptable operation. For example, LOS can be related to the grading scale of a report card: A – Excellent, B – Good, C – Average, D – Acceptable, E – Needs improvement, and F – Failing. LOS criteria used to evaluate projected future traffic deficiencies were identified previously in Chapter 2.

FUTURE COMMITTED PROJECTS

In determining the transportation improvement needs for the City of Stillwater, a base network of the existing roadway system in year 2006 was developed. All added capacity and regionally significant roadway projects that would be completed by the end of the year were also added to the base network.

Upon completion of the base network an Existing Plus Committed (E+C) Network was developed. The E+C Network includes the existing roadway network plus facilities under construction or committed (programmed) for implementation.[1] Roadway widening projects and intersection improvements in the City of Stillwater included in the E+C Network are shown in **Table 4-2** and **Figure 4-1**. All short and long-term projects outside the study area's limits were also included in the E+C Network.

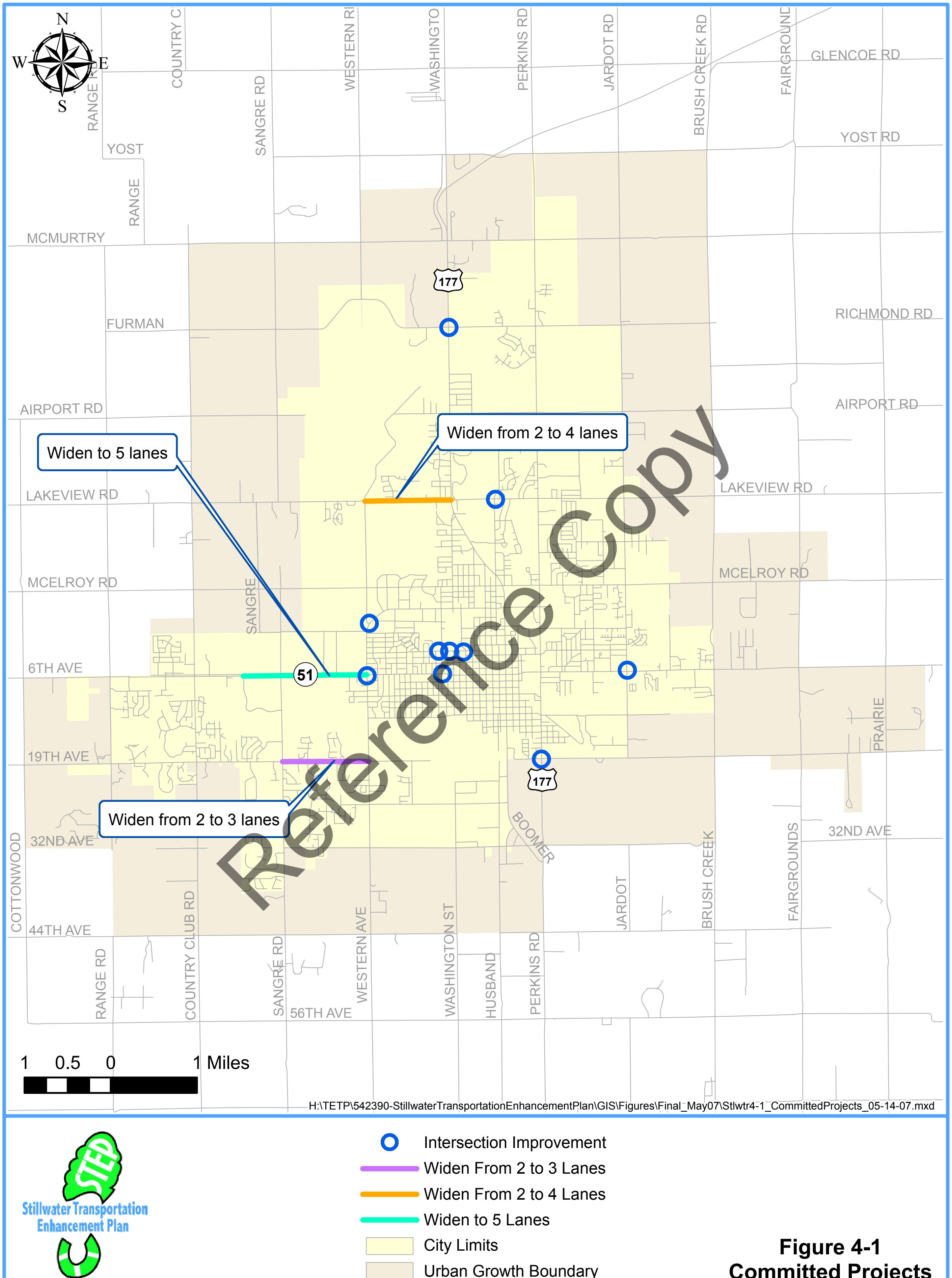
Table 4-2
Committed Projects
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Street	From	To	Description
Lakeview	Western	Washington	Widen from 2 to 4 lanes
19th	Sangre	Western	Widen from 2 to 3 lanes
6th	S. Range	Western	Widen from 4 to 5 lanes

In addition to these roadway widening projects, programmed intersection improvements were also integrated in the travel demand model and include the following:

- 6th and Monroe – Realign Monroe to straighten the offset, widen to allow two through lanes westbound and dedicated right and left turn lane for westbound traffic;
- 6th and Jardot – Improve vertical alignment primarily of Jardot to the north, widen to allow left turn movements for 6th and Jardot;
- 6th and Western – intersection modification for additional thru lane southbound, additional right turn lane from southbound, additional left turn lane from eastbound;
- Washington and Richmond – signal and addition of a southbound through lane and left turn lane from southbound;
- University, Monroe to Knoblock – Reconstruct existing facility, add left turns at Monroe, Washington, Hester, & Knoblock;
- 19th, Main to Jardot – 2-lane open section, add four-lane approaches at Main and Perkins, add 10-foot bike lane on south side, widen bridge to four-lane (2 phases)
- Lakeview and Husband – Left turn lanes on north and south-bound Husband, signalization, if required; and,
- Western and Hall of Fame – Add signal and modify intersection to include a left turn and right turn onto Western from Hall of Fame and a left turn onto Hall of Fame from Western.

[1] During the course of developing this Plan, two projects became committed – one on 12th Avenue and one on Jardot – these projects are not included in E+C Network because they were programmed after the development of the base traffic model. Both of these projects are represented in the short-term plan as described in Chapter 5.



Stillwater Transportation Enhancement Plan

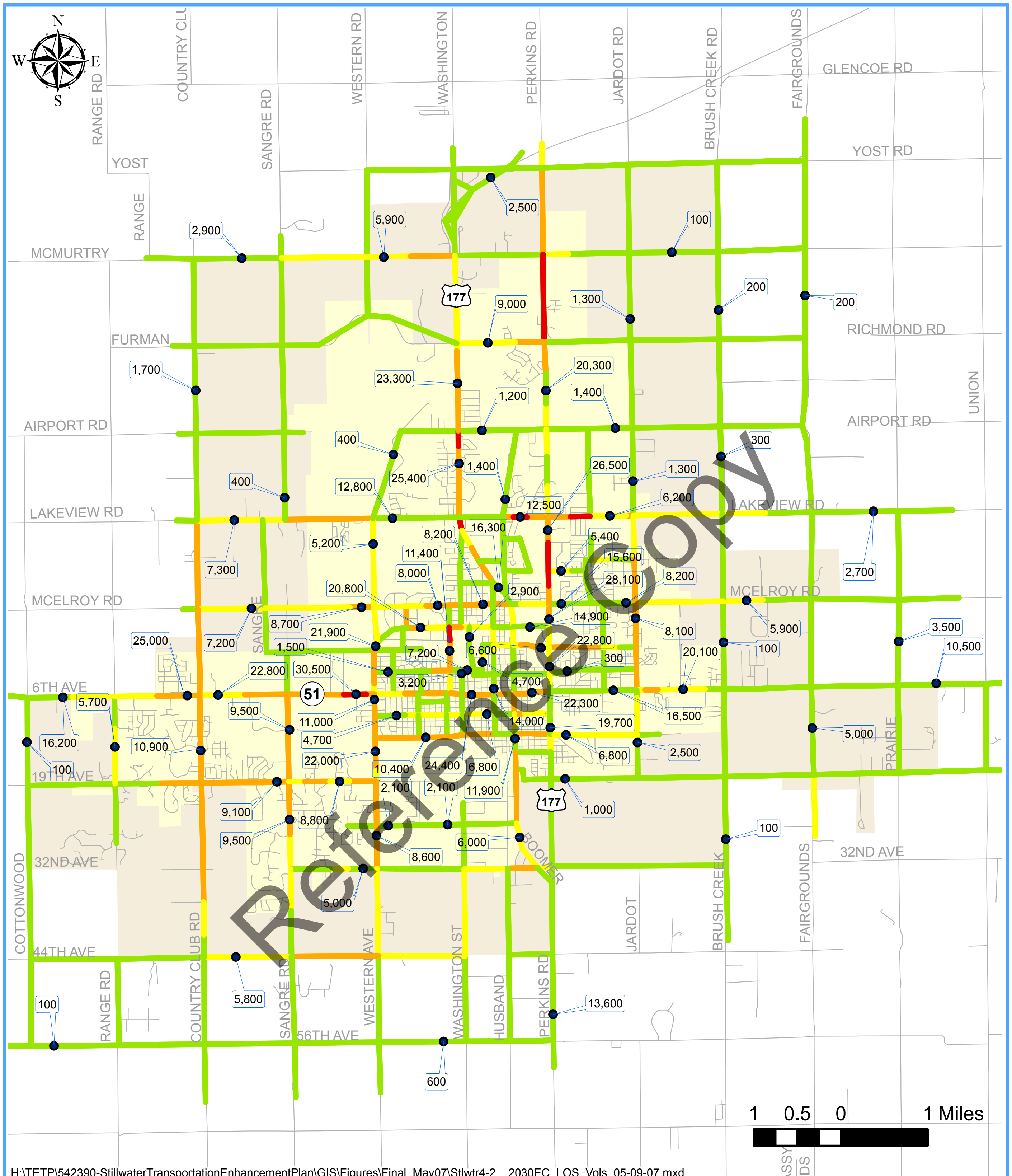
Figure 4-1
Committed Projects

Chapter 4 – Future Traffic Impacts

Once the E+C Network was developed, projected capacity deficiencies were identified along the roadway system using the year 2030 demographic forecasts and travel demand model developed for the study area, as outlined in Chapter 3. This condition shows how future traffic volumes were distributed on the existing network if only the committed transportation improvements were implemented during that time period. The year 2030 E+C network served as the base network for which all other scenario test networks were compared.

Projected future year 2030 daily traffic volume assignments and LOS on the E+C network are shown in **Figure 4-2** The traffic volume and LOS distributions for each network are based on trip assignments that are described as part of the travel model forecasting process in Chapter 3: Demographics and Travel Demand Model. The trip assignments utilize data inputs that are originally based on demographic data for year 2030 forecast years.

With continued growth and development occurring over the next 25 years, traffic conditions along area roadways will worsen throughout the core area – roughly delineated by McElroy, Perkins Road, 12th Avenue, and Western – as well as in the western, southwestern, and north central portions of the Urban Growth Boundary. Volumes along most roadways are projected to increase between one and two percent, as shown in **Table 4-3**. If only the committed roadway improvements are implemented over the course of the next 25 years, many of the area roadways are projected to operate at unacceptable LOS conditions (E or F) by year 2030, as shown in **Figure 4-2**. Given these conditions, the City of Stillwater is in need of transportation improvements to help accommodate existing and projected traffic growth in the area.



Stillwater Transportation Enhancement Plan

LOS:

- A-C
- D
- E
- F

City Limits

Urban Growth Boundary

Figure 4-2
Year 2030 E+C
Traffic Volume Forecasts
And LOS

Table 4-3
Projected Growth in Volumes
City of Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Location	2006 Daily Model Volume	2030 E+C Daily Volume	Projected 2030 LOS	Compounded Annual Percent Growth
East-West Corridors				
6th Avenue *(west of County Club)*	14,600	23,500	E	2.0%
6th Avenue *(between Sangre and Western)*	24,200	30,500	F	1.0%
6th Avenue *(west of Perkins)*	17,400	22,100	E	1.0%
19th Avenue *(west of Sangre)*	5,400	9,100	E	2.2%
W. Hall of Fame *(between Western and Monroe)*	17,400	20,800	E	0.8%
McElroy *(between Boomer and Washington)*	8,900	10,200	E	0.6%
Lakeview *(between Husband and US 177)*	8,600	12,500	F	1.6%
North-South Corridors				
Country Club *(between 6th and 19th)*	5,600	10,900	E	2.8%
Sangre *(between 19th and W 32nd)*	4,300	9,500	E	3.4%
Western Ave *(between 6th and 9th)*	7,900	11,000	E	1.4%
S. Monroe *(between Miller and W. University)*	9,500	11,400	E	0.8%
Perkins *(south of McElroy)*	20,400	28,100	E	1.3%

DEVELOPMENT OF TEST NETWORK SCENARIOS

A total of nine different scenarios were developed and modeled to test traffic reactions to various combinations of improvements. These improvements represent capacity enhancements to the existing streets, usually by adding additional lanes and/or by improving traffic signal timing. This testing is required because traffic will not continue in the same pattern when one or more streets is improved. The enhanced capacity of the improved street will attract additional traffic from parallel routes. Thus, volumes will increase on the enhanced street and decrease on parallel streets. Because the traffic is diverting from the current pattern, the streets perpendicular to the improved streets will also show changes in volume, either increasing or decreasing. The volume changes will generally diminish as distance from the improvement increases. By modeling the various scenarios, the effects of each set of improvements can be compared and lead to a recommended set of improvements.

SCENARIO 1

Scenario 1 attempted to attract traffic away from the heavily traveled 6th Avenue south to 19th Avenue as well as enhance some problem areas along Perkins Road and McElroy. Scenario 1 included the following improvements:

- 19th Avenue widened to 4 lanes from Sangre to Brush Creek, including an extension from Walnut to Lewis
- Sangre Road widened to 4 lanes from 6th Avenue to 32nd Avenue
- Brush Creek widened to 4 lanes from 6th Avenue to 19th Avenue
- McElroy widened to 4 lanes from Washington to Boomer
- Perkins widened to 5 lanes from Lakeview to McElroy
- Lakeview widened to 4 lanes from Husband to Perkins

Scenario 1 improvements are shown in **Figure 4-3**.

SCENARIO 2

Scenario 2 attempted to attract traffic away from 6th Avenue by making improvements both in the north and south portions of the City, creating a quasi-loop. Scenario 2 included the following improvements:

- Country Club widened to 4 lanes from Lakeview to 6th Avenue
- Lakeview widened to 4 lanes from Country Club to Western and Husband to Jardot (Western to Husband is already included as a committed project)
- Western widened to 4 lanes from Lakeview to Hall of Fame, from 6th to 12th, and from 19th to 32nd (12th to 19th is already included as a committed project)
- Western widened to 6 lanes from Hall of Fame to 6th
- Intersection of Western and Hall of Fame modified to a traditional 'T'
- 32nd widened to 4 lanes from Western to Perkins
- 19th widened to 4 lanes from Perkins to Jardot
- Jardot widened to 4 lanes from 19th to Lakeview

Scenario 2 improvements are shown in **Figure 4-4**.

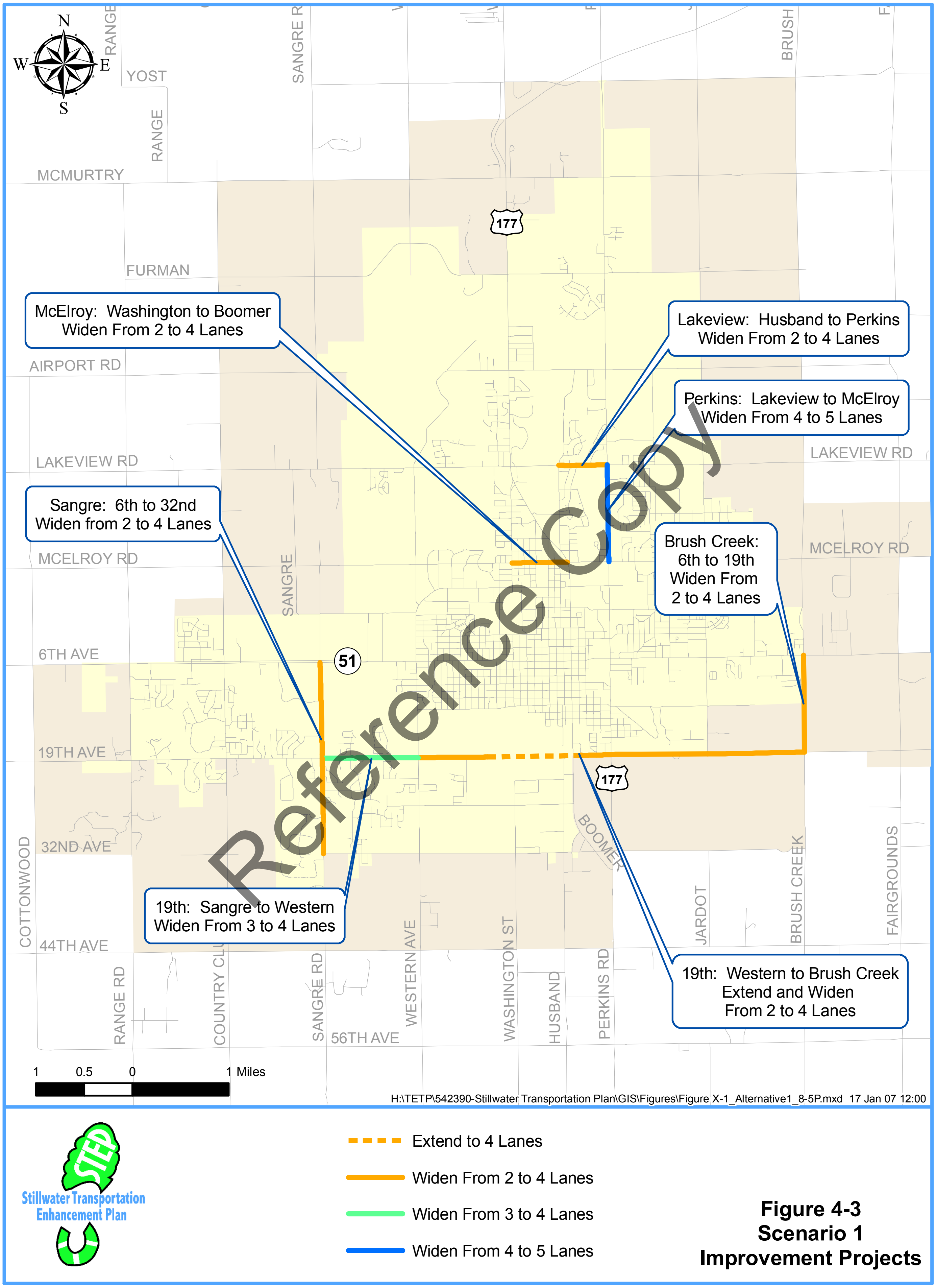


Figure 4-3
Scenario 1
Improvement Projects

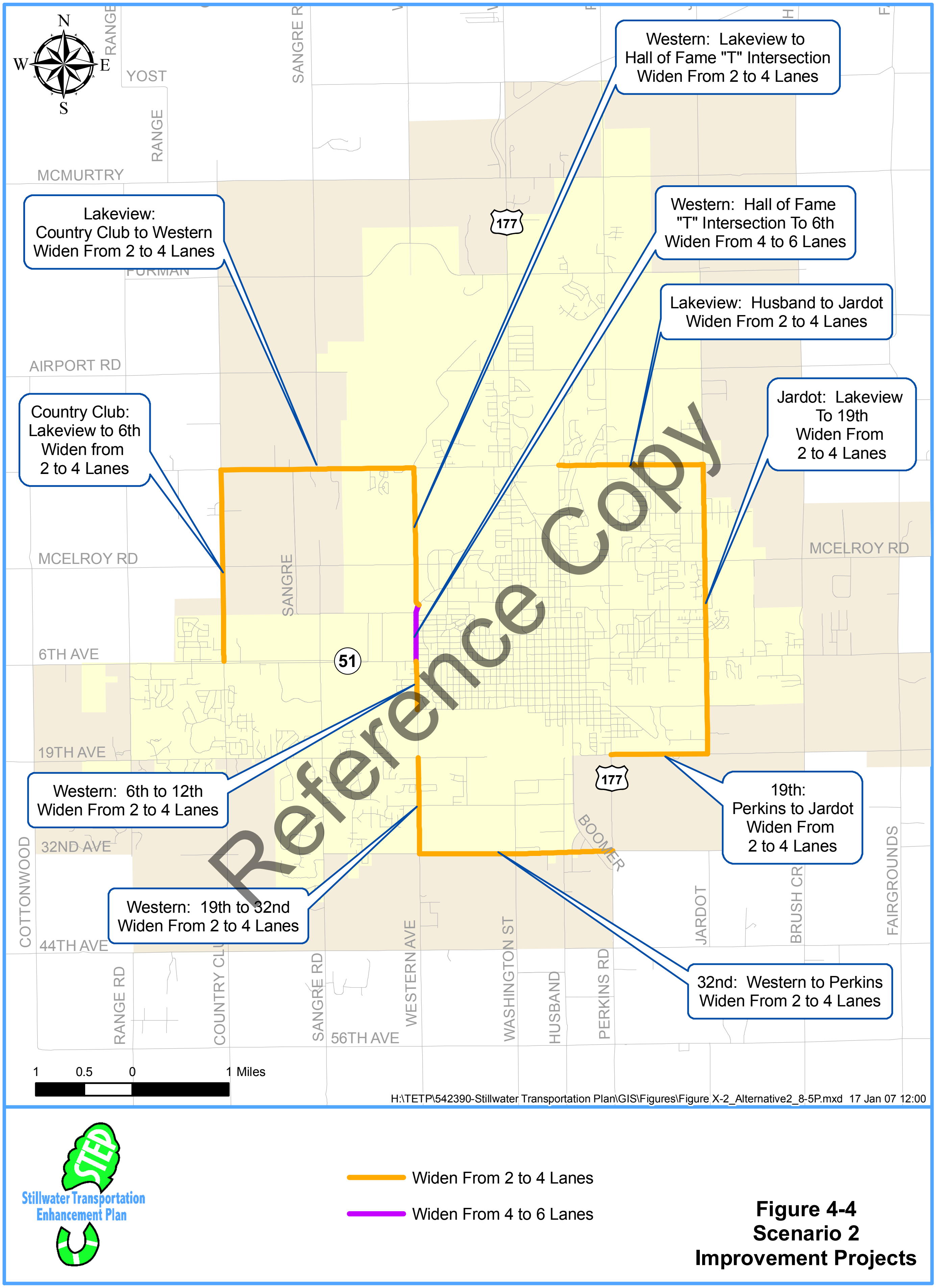


Figure 4-4
Scenario 2
Improvement Projects

Scenario 2B

Scenario 2B differed from Scenario 2 by moving the improvements south of 6th Avenue from 32nd Avenue to 19th Avenue. Scenario 2B included the following improvements:

- Country Club widened to 4 lanes from Lakeview to 6th Avenue
- Lakeview widened to 4 lanes from Country Club to Western and Husband to Jardot (Western to Husband is already included as a committed project)
- Western widened to 4 lanes from Lakeview to Hall of Fame, from 6th to 12th, and from 19th to 32nd (12th to 19th is already included as a committed project)
- Western widened to 6 lanes from Hall of Fame to 6th
- Intersection of Western and Hall of Fame modified to a traditional 'T'
- 19th widened to 4 lanes from Western to Jardot and extend from Walnut to Lewis
- Jardot widened to 4 lanes from 19th to Lakeview

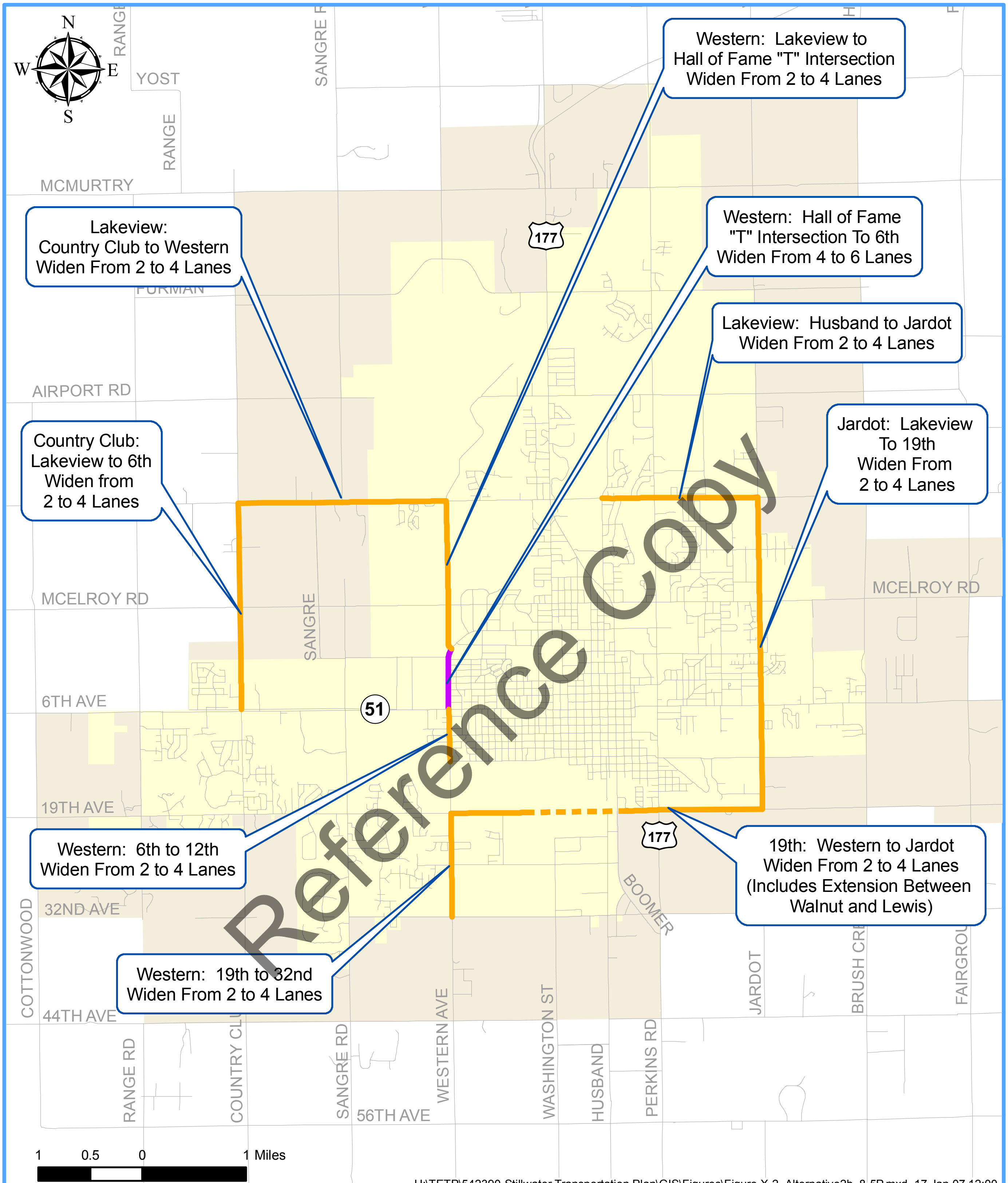
Scenario 2B improvements are shown in **Figure 4-5**.

Scenario 3

Scenario 3 attempted to attract traffic away from 6th Avenue via an 'inner loop' and provide for a long distance loop for access to rural and developing areas as well as provide a bypass for semi-truck traffic that currently travels through Stillwater on 6th Avenue. Scenario 3 included the following improvements:

- Range widened to 4 lanes from 6th Avenue to McMurtry
- McMurtry widened to 4 lanes from Range to Fairgrounds
- Fairgrounds widened to 4 lanes from McMurtry to 6th Avenue
- Western widened to 4 lanes from Hall of Fame to McElroy
- Intersection of Western and Hall of Fame revise to create a traditional 'T'
- McElroy widen to 4 lanes from Western to Boomer
- McElroy widen to 5 lanes from Boomer to Perkins
- Monroe widen to 4 lanes from McElroy to Hall of Fame
- 3rd Avenue extend 2 lanes through from Western to Perkins
- Hester widen to 4 lanes from University to 6th Avenue
- Western widen to 4 lanes from 6th Avenue to 12th Avenue
- 12th Avenue widen to 4 lanes from Western to Jardot
- Jardot widen to 4 lanes from 12th Avenue to McElroy
- Washington widen to 4 lanes from 12th Avenue to 32nd Avenue

Scenario 3 improvements are shown in **Figure 4-6**.



Stillwater Transportation Enhancement Plan

Extend to 4 Lanes

Widen From 2 to 4 Lanes

Widen From 4 to 6 Lanes

Figure 4-5
Scenario 2B
Improvement Projects

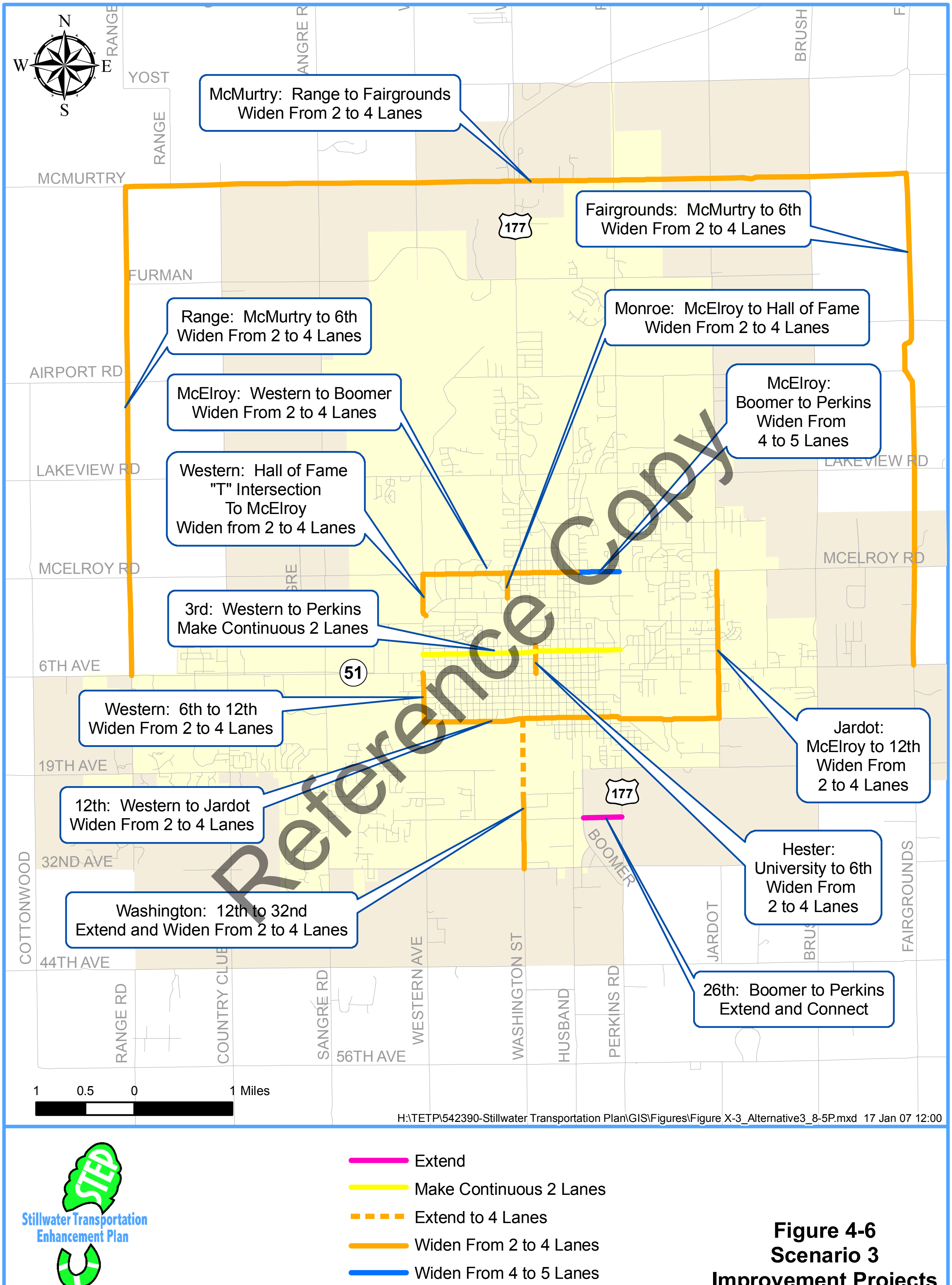


Figure 4-6
Scenario 3
Improvement Projects

SCENARIO 4

Scenario 4 improved the existing heavily traveled roadways with no attempt to attract traffic away from them. Scenario 4 included the following improvements:

- Western widened to 4 lanes from Lakeview to Hall of Fame
- Intersection of Western and Hall of Fame reconfigured to traditional 'T'
- Western widened to 4 lanes from 6th Avenue to 12th Avenue
- Western widened to 4 lanes from 19th Avenue to 32nd Avenue
- 6th Avenue widened to 5 lanes from Western to Brush Creek, excepting Perkins to Stallard which is already 5 lanes
- Lakeview widened to 4 lanes from Husband to Perkins
- Perkins widened to 5 lanes from Lakeview to McElroy
- McElroy widened to 4 lanes from Washington to Boomer

Scenario 4 improvements are shown in **Figure 4-7**.

SCENARIO 5

Scenario 5 included improvements on 6th Avenue and the heavily traveled roadways north of 6th. Some attempt was made to create a 'northern loop' that included 6th Avenue and Perkins. Scenario 5 included the following improvements:

- Country Club widened to 4 lanes from 6th Avenue to Lakeview
- Lakeview widened to 4 lanes from Country Club to Western and from Husband to Jardot
- Western widened to 4 lanes from Lakeview to Hall of Fame
- Intersection of Western and Hall of Fame reconfigure to traditional 'T'
- Western widened to 6 lanes from Hall of Fame to 6th Avenue
- 6th Avenue widened to 5 lanes from Sangre to Brush Creek, excepting Perkins to Stallard which is already 5 lanes
- Perkins Road widened by 1 additional lane from Yost to McElroy, specifically:
    - Perkins Road widened to 3 lanes from Yost to Richmond
    - Perkins Road widened to 4 lanes from Richmond to 1/3 mile north of Airport
    - Perkins Road widened to 5 lanes from 1/3 mile north of Airport to McElroy

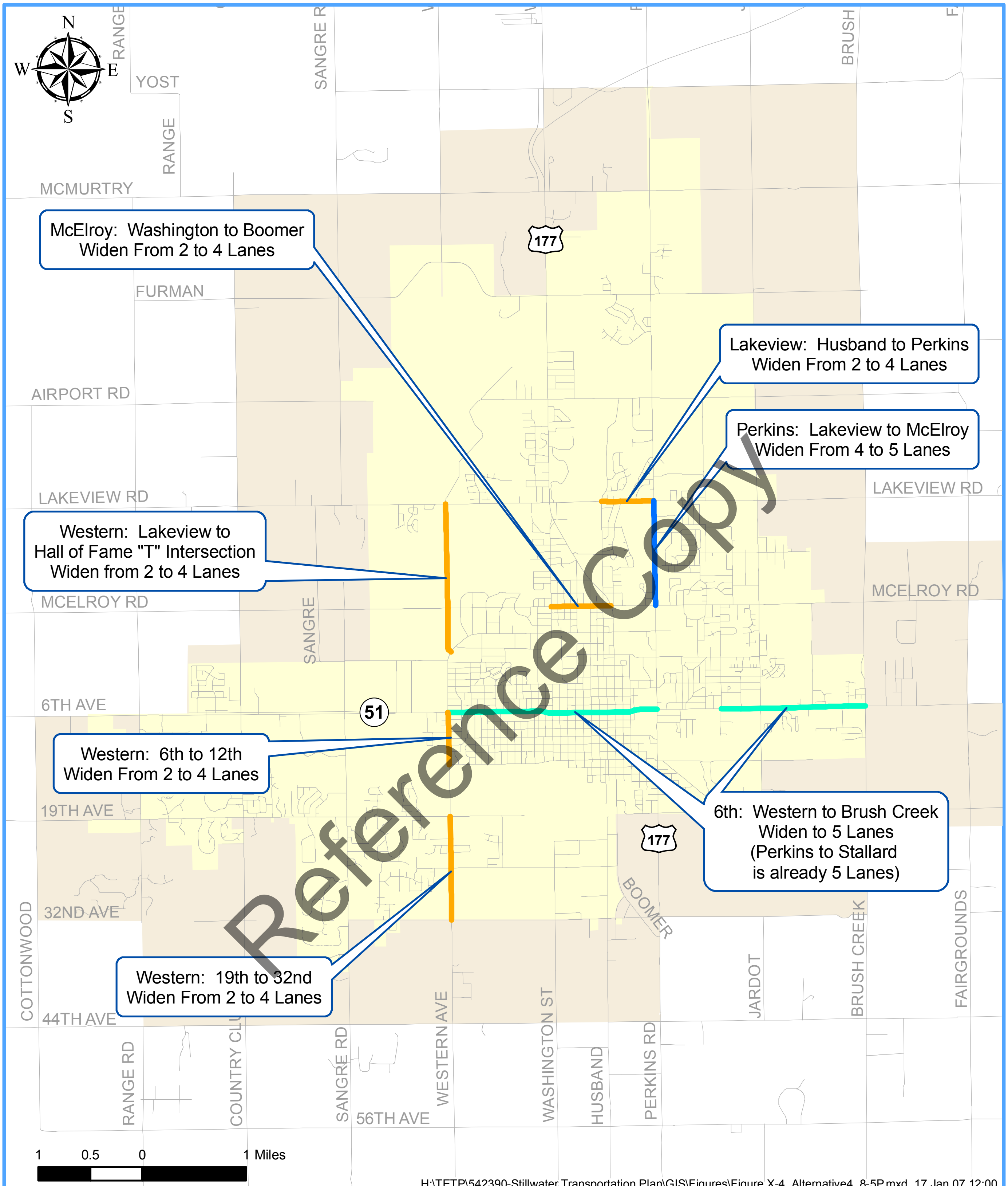
Scenario 5 improvements are shown in **Figure 4-8**.

SCENARIO 6

Scenario 6 included the addition of a new expressway connecting SH 51 west of the City with the Cimarron Turnpike spur north of Stillwater. Improvements were made to allow access to the new expressway. Scenario 6 included the following improvements:

- Add an expressway connecting SH 51 (6th Avenue) and Cottonwood with the Turnpike spur; includes an interchange at Lakeview
- Lakeview widened to 4 lanes from Country Club to Western
    - 6th Avenue widened to 5 lanes from Sangre to Brush Creek, excepting Perkins to Stallard which is already 5 lanes

Scenario 6 improvements are shown in **Figure 4-9**.



STEP
Stillwater Transportation Enhancement Plan

Widen From 2 to 4 Lanes
Widen From 4 to 5 Lanes
Widen to 5 Lanes

Figure 4-7
Scenario 4
Improvement Projects

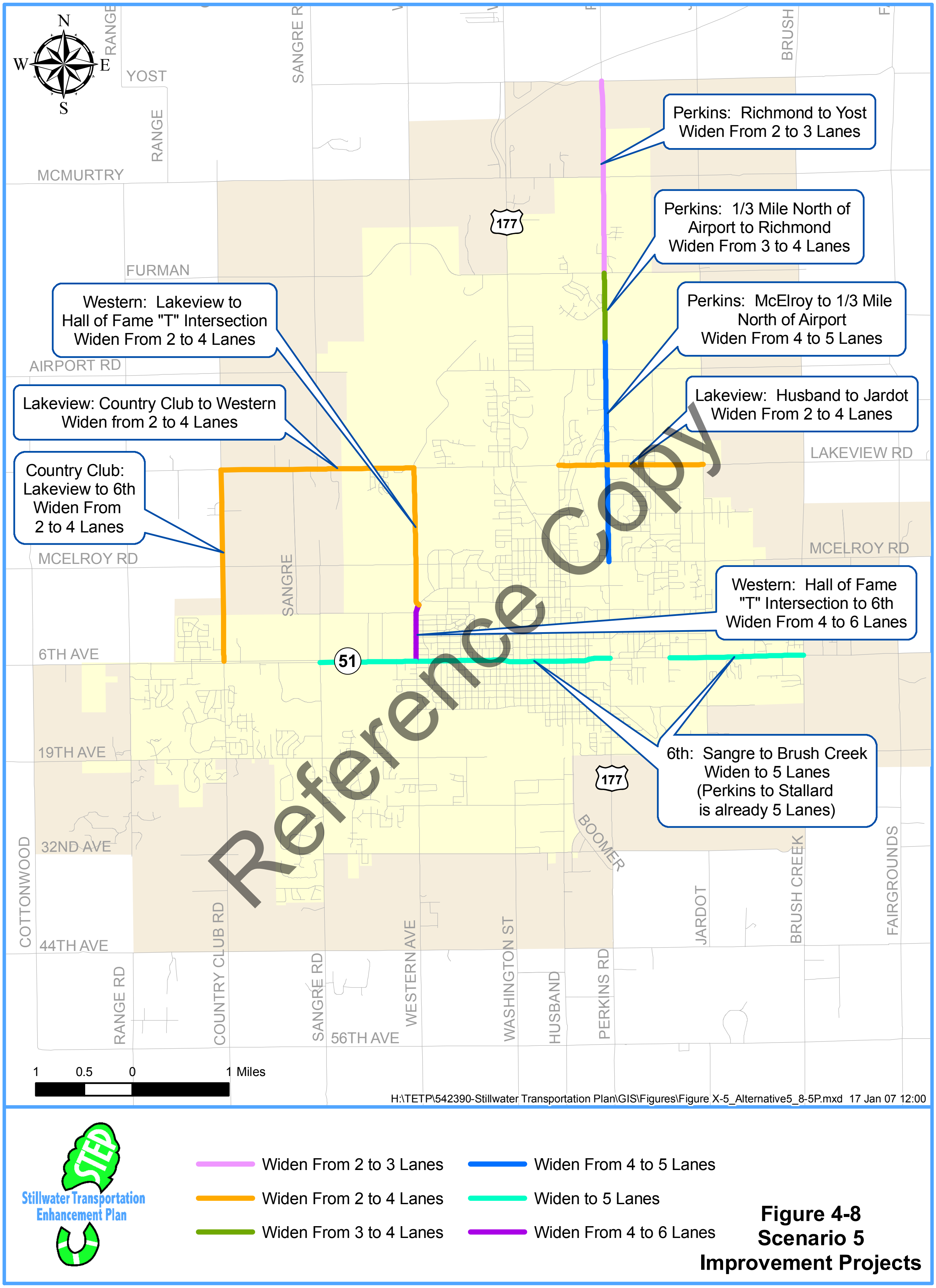
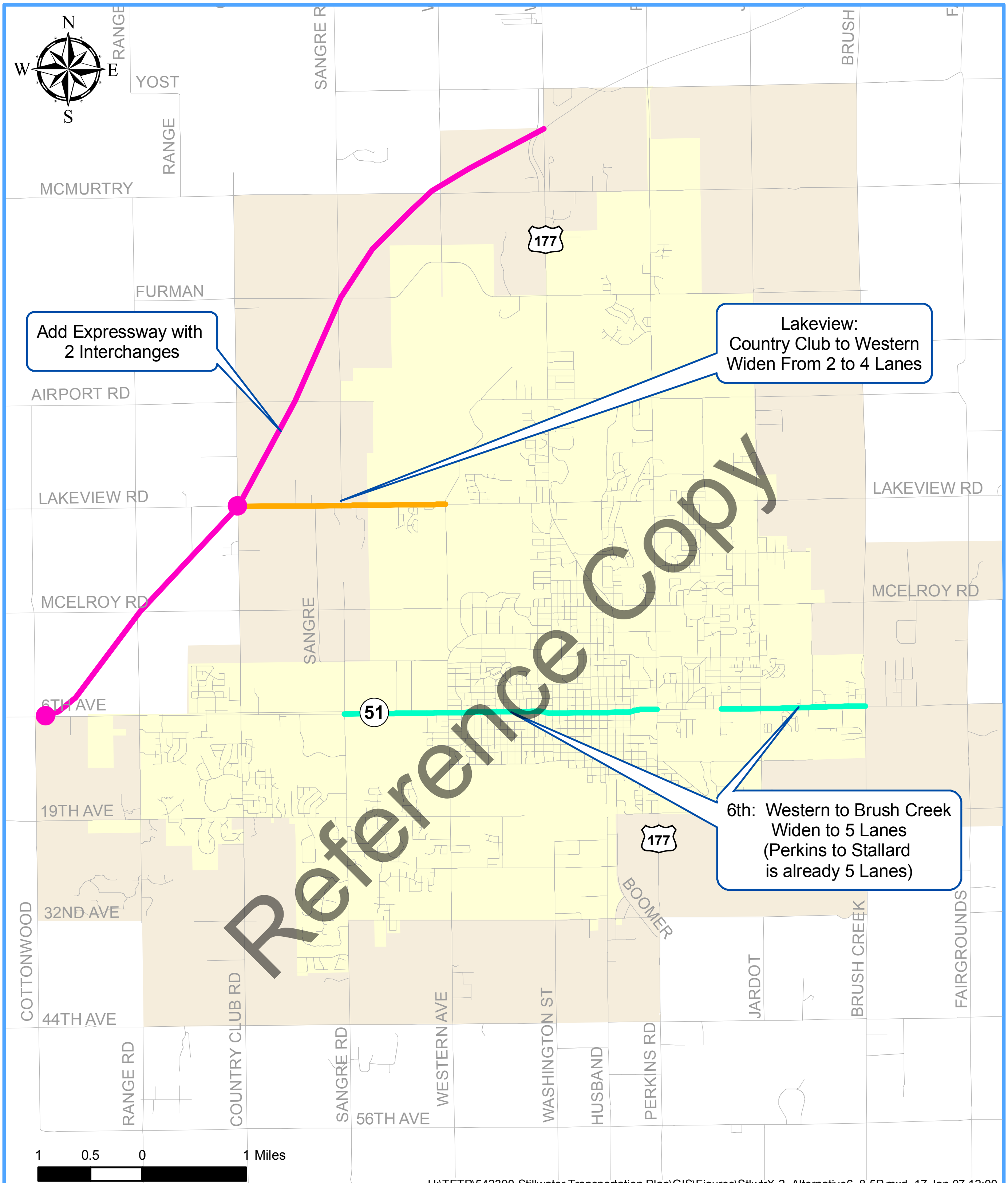


Figure 4-8
Scenario 5
Improvement Projects



Stillwater Transportation Enhancement Plan

Figure 4-9
Scenario 6
Improvement Projects

SCENARIO 6B

Scenario 6B included additional interchanges on the expressway and improvements to the east-west roads connected to the expressway. Improvements to 6th Avenue were removed. Scenario 6B included the following improvements:

- Add an expressway connecting SH 51 (6th Avenue) and Cottonwood with the Turnpike spur; includes an interchanges at McElroy, Lakeview and Furman/Richmond
- McElroy widened to 4 lanes from Range to Husband
- Lakeview widened to 4 lanes from Country Club to Western and from Husband to Perkins
- Furman/Richmond widened to 4 lanes from Washington to Perkins

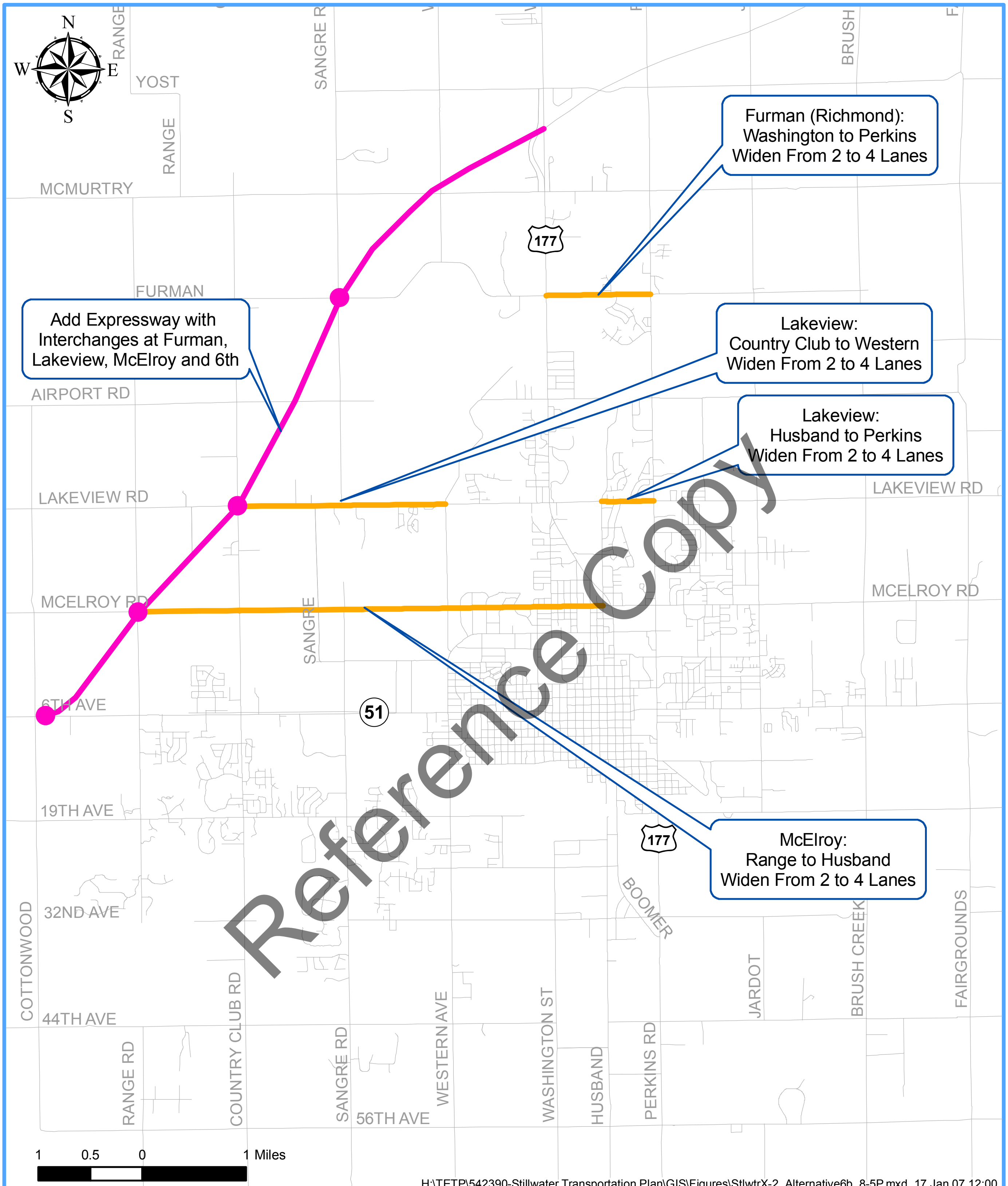
Scenario 6B improvements are shown in **Figure 4-10**.

SCENARIO 7

Scenario 7 included improvements to transit services. Scenario 7 included the following improvements:

- Current daily transit ridership doubled

Scenario 7 improvements are shown in **Figure 4-11**.



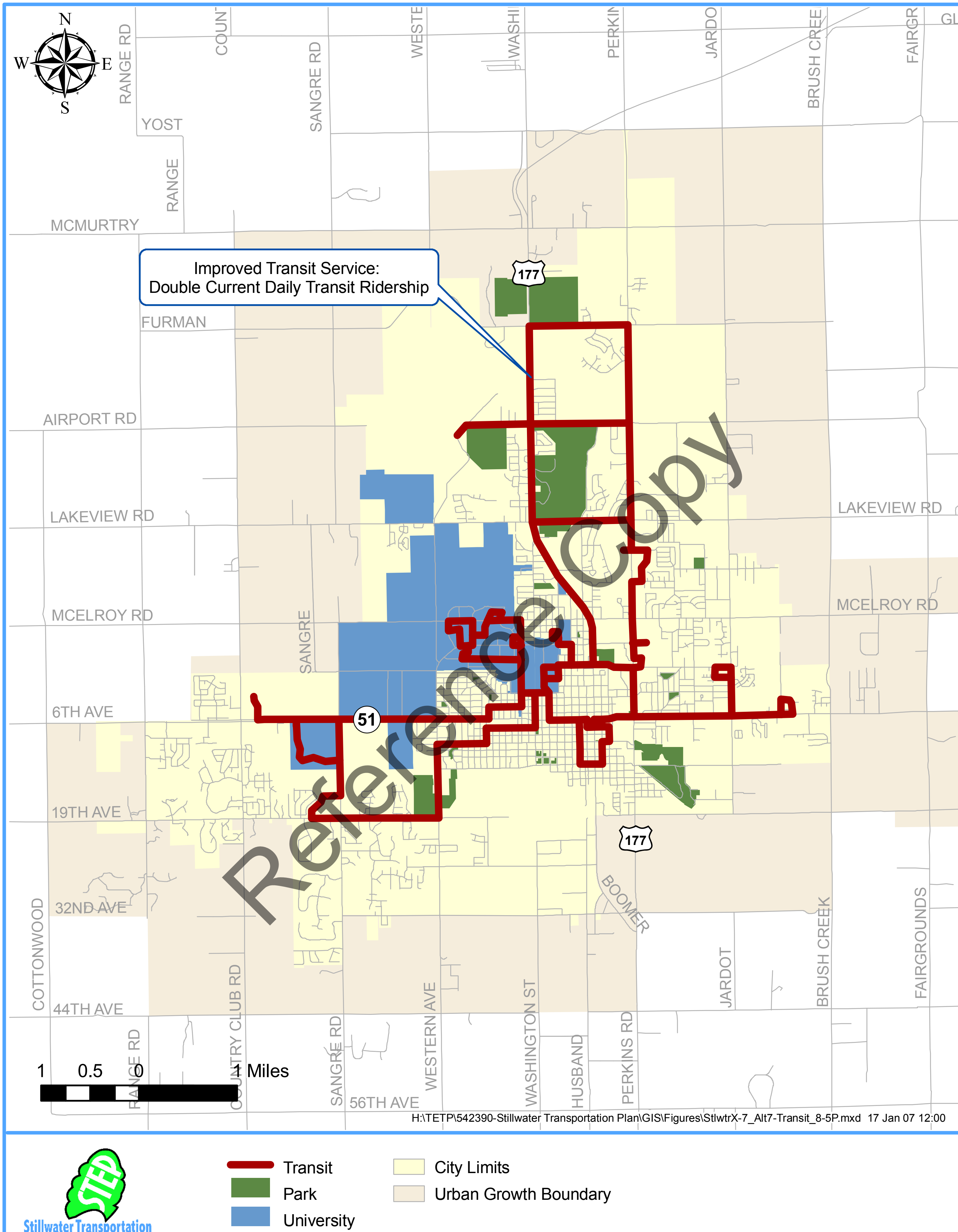
STEP
Stillwater Transportation Enhancement Plan

Widen From 2 to 4 Lanes

Widen to 5 Lanes

Add Expressway

Figure 4-10
Scenario 6B
Improvement Projects



STEP
Stillwater Transportation Enhancement Plan

Figure 4-11
Scenario 7
Improvement Projects

Chapter 4 – Future Traffic Impacts

FUTURE TRAFFIC IMPACTS OF SCENARIO TEST NETWORKS

Once the nine test network scenarios were developed, projects in each of the scenarios were added to the E+C Network, and a model assignment was run to determine their effectiveness in improving traffic mobility. All scenario networks provided improved traffic operations in the Stillwater area, with certain improvements performing better than other improvements. Level-of-service improvements and changes in future traffic volume forecasts varied for the various scenarios as shown in **Figures 4-12 through 4-20**.

To evaluate the differences or improvements in traffic flow the E+C network LOS in year 2030 was compared to each Scenario LOS in year 2030.

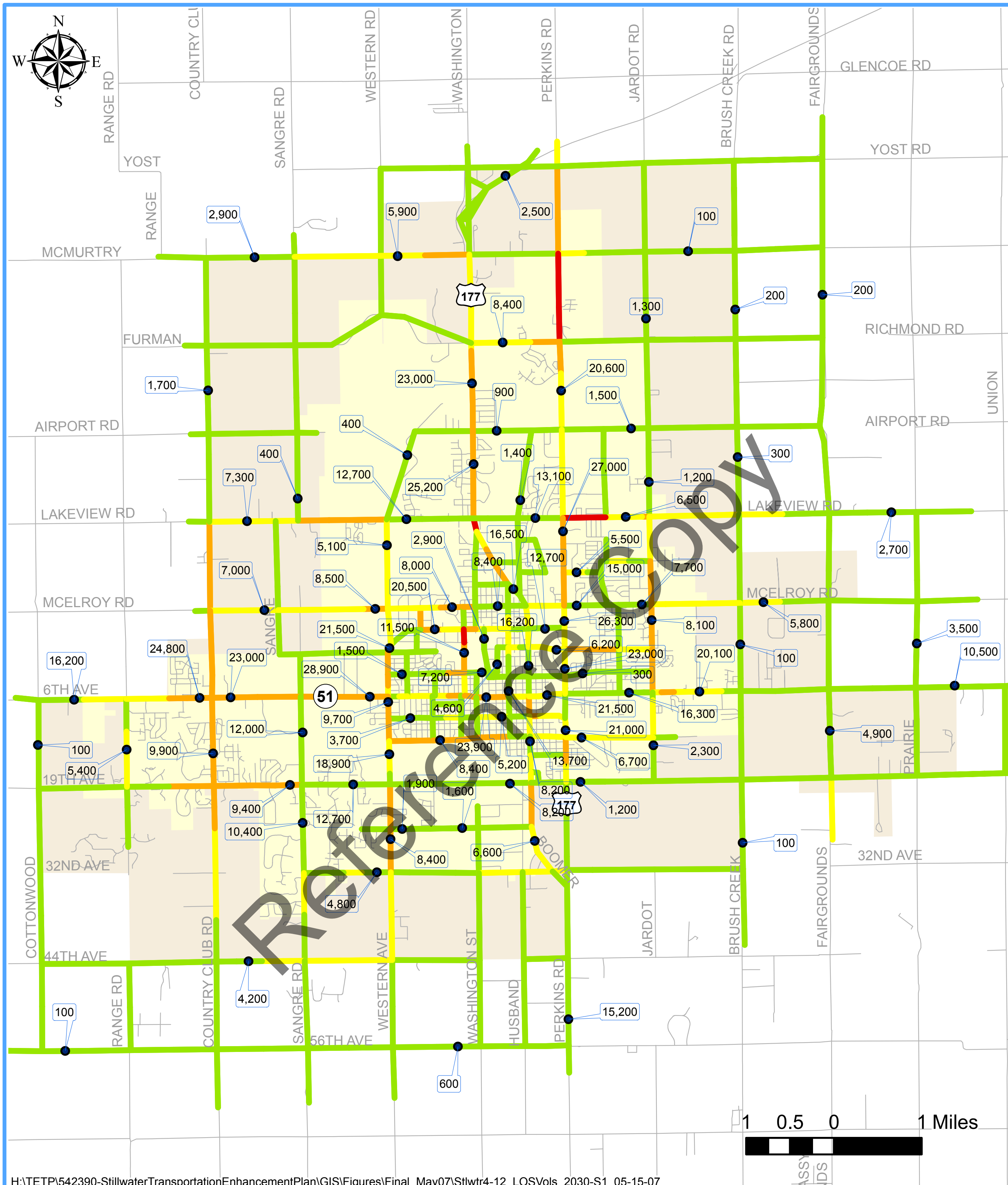
The effectiveness of a given test network scenario can be evaluated by reviewing projected traffic volumes and level-of-service and can be measured in terms of daily vehicle-miles traveled and daily vehicle-hours traveled. Daily vehicle travel can be reported in terms of total vehicle miles of travel (VMT) and is a function of the traffic volume and travel distance for each alternative. This measure represents the length of vehicle trips and the distance motorists travel to get to their destination. VMT provides an indication of total travel demand (in terms of both the number of trips and the length of the trips) for the study area transportation system. Increases in VMT generally indicate increased demand for travel.

Total daily vehicle hours of travel (VHT) is a function of traffic volume, travel speed, and travel distance. This measure is representative of the total amount of travel time for each alternative and the amount of time motorists spend traveling in their vehicles. VHT provides an estimate of the amount of time expended traveling on the area transportation system. Decreases in VHT generally indicate improved system performance and reduced traveling costs for the public.

A comparison of the year 2030 E+C network and the year 2030 alternative networks are presented in **Table 4-4**. Implementation of the various alternatives is estimated to save area motorists between 10 and 212 hours of time each day spent traveling in their vehicles. In addition, most alternatives saw increases in the VMT, indicating that people are willing to drive further distances to reach a destination as long as they save time. The exception was Alternative 7, which resulted in a decrease in both VMT and VHT. Alternative 7 included transit improvements, with the VMT reduction caused by fewer OSU students driving to campus and more OSU students using The Bus.

SCENARIO 1 IMPACTS

Scenario 1 showed improvement in both carrying capacity and LOS especially south of 6th Avenue. The attempt to remove traffic from 6th Avenue showed moderate success; however, volumes on 6th between Country Club and Perkins were enough to hold the LOS to unacceptable E. Improvements to Lakeview appear to have placed more traffic on Perkins north of Lakeview causing a decrease in LOS from A-C to D, when compared to the E+C network. Lakeview just east of Perkins is no longer congested. Improvements to Sangre south of 6th have improved both the capacity and the LOS, which is now in the acceptable A-C range. **Table 4-4** shows an increase of 970 VMT per day and a decrease of 152 VHT per day for Scenario 1. The LOS resulting from Scenario 1 is shown in **Figure 4-12**.



Stillwater Transportation Enhancement Plan

LOS:

- A-C
- D
- E
- F

- City Limits
- Urban Growth Boundary

Figure 4-12
Scenario 1
Future Year 2030
Traffic Volume Forecasts and LOS

SCENARIO 2 IMPACTS

Scenario 2 showed moderate improvement in most of the arterials north of 6th Avenue. Some traffic did appear to be attracted to the northern Country Club-Lakeview-Jardot loop and seemed to distribute along the north-south improvements on Country Club, Western, and Jardot. Additionally the improvement to Western and 32nd was successful in attracting more vehicles and maintaining an acceptable LOS. Only modest improvements to the LOS and volumes on 6th Avenue resulted from Scenario 2. As shown in **Table 4-4**, VMT decreased by 511 miles per day and VHT decreased by 182 hours per day. **Figure 4-13** shows the resulting LOS from Scenario 2.

SCENARIO 2B IMPACTS

Scenario 2B showed similar improvement and results as Scenario 2. East-west traffic that was previously using 12th and 32nd Avenues distributed to the 19th Avenue extension and widening. **Table 4-4** shows that VMT increased by 1,630 miles per day while VHT decreased by 207 hours per day. **Figure 4-14** shows the LOS resulting from Scenario 2B.

SCENARIO 3 IMPACTS

Scenario 3 showed some improvement in some LOS problem areas. Only a small amount of traffic was attracted to the 'outer loop'. Traffic was attracted to the improved 12th Avenue and the capacity was able to improve the LOS to the acceptable A-C range. **Table 4-4** shows that VMT increased by 11,899 miles per day probably due to the length of the 'outer loop' and VHT decreased by 68 hours per day. **Figure 4-15** shows the resulting LOS associated with Scenario 3.

SCENARIO 4 IMPACTS

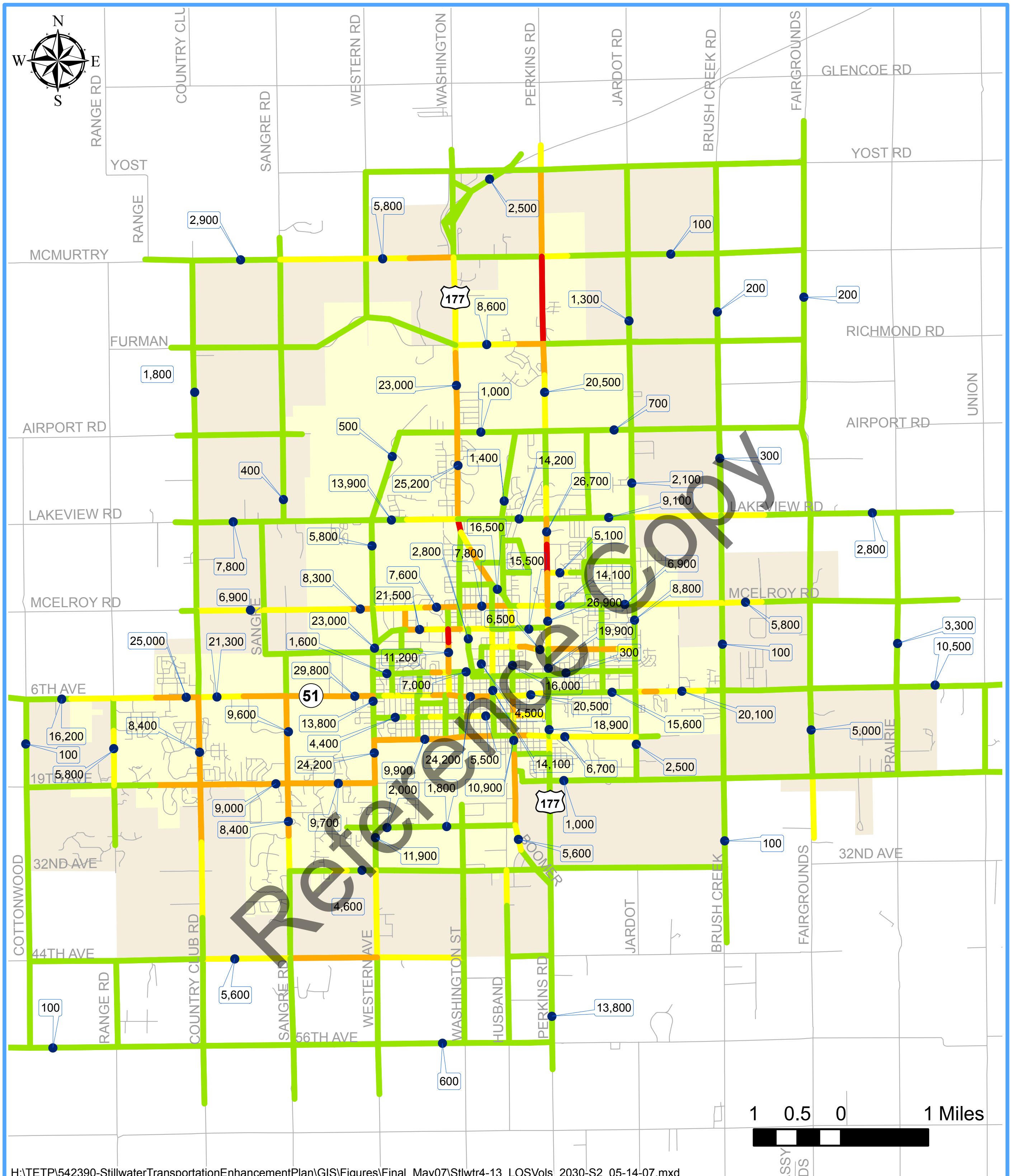
Scenario 4 showed both improvements in capacity and LOS along the routes where projects occurred. This Scenario tests simply improving those roadways that are already heavily traveled. 6th Avenue and Perkins Road were able to carry a few hundred to a few thousand more vehicles and improve LOS approximately one grade, from E to D for example, throughout most of the portions that were improved. Other areas of the City remain similarly congested as in the E+C scenario. **Table 4-4** shows a decrease of 211 miles per day in VMT and a decrease of 120 hours per day in VHT. **Figure 4-16** shows the resulting LOS from Scenario 4 projects.

SCENARIO 5 IMPACTS

Scenario 5 resulted in LOS improvements along the roadways that were widened. Capacity improvements on Perkins allowed an increase in traffic flow resulting in moderate improvements in LOS – most of the roadway remains at D or below. Improvements to 6th Avenue and Western had similar results for those arterials – more traffic and moderate improvement in LOS. **Table 4-4** shows that Scenario 5 resulted in an increase in VMT of 1,189 miles per day and a reduction in VHT of 183 hours per day. **Figure 4-17** shows the LOS resulting from Scenario 5 projects.

SCENARIO 6 IMPACTS

The addition of an expressway coupled with improvements to 6th Avenue resulted in very slight improvements to the LOS along 6th; although, the heavily used portion between Country Club and Perkins remains at LOS D or E while the volume was essentially the same as the 2030 E+C network. Some traffic in the southwest and north portions of the City was able to use the expressway resulting in slight improvements in LOS along Perkins Road north of Lakeview and in the region around Country Club and 19th. **Table 4-4** shows that VMT increased by 5,765 miles per day and VHT decreased by 401 hours per day. **Figure 4-18** shows the resulting LOS from Scenario 6 projects.



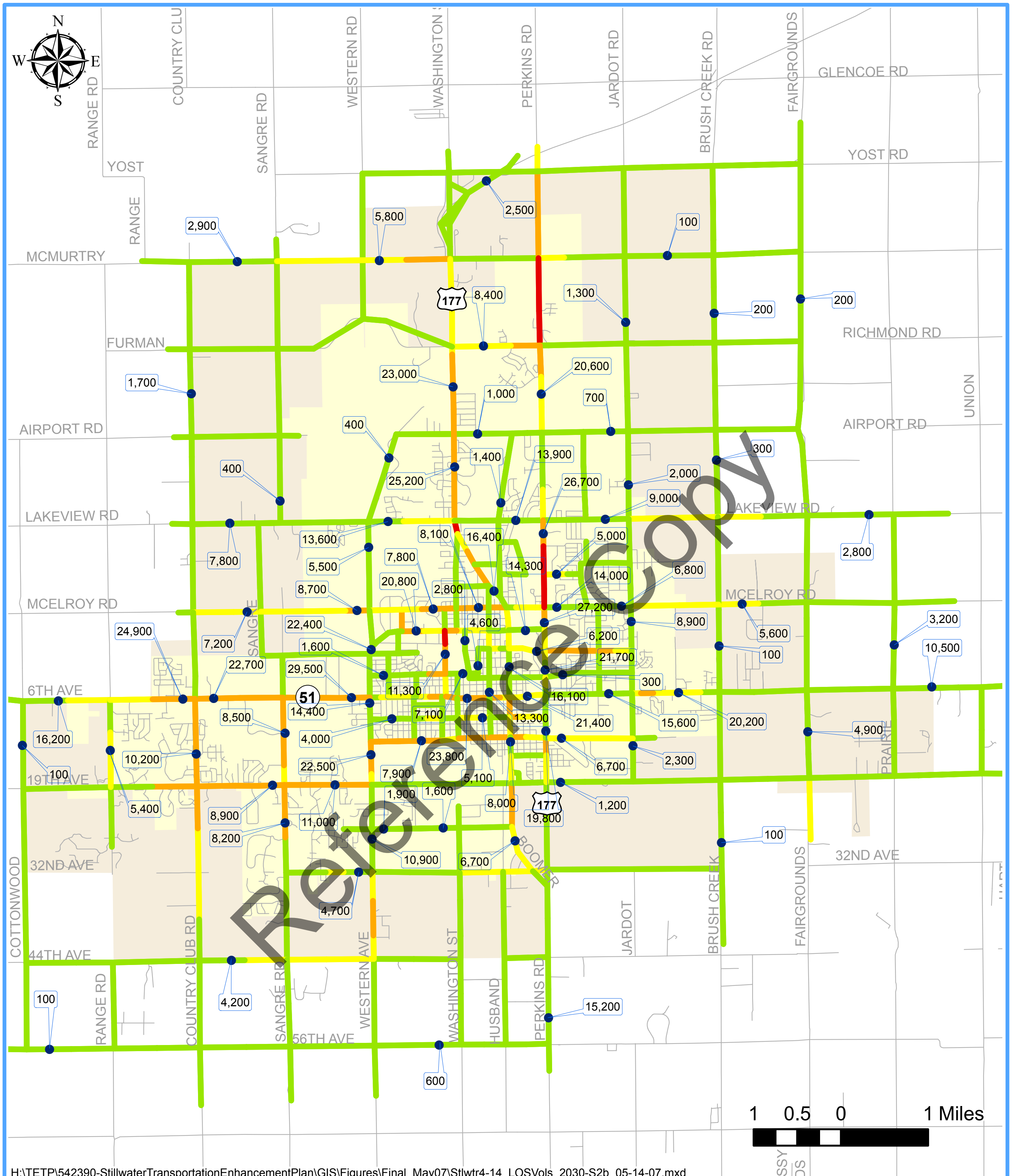
Stillwater Transportation Enhancement Plan

LOS:

- A-C
- D
- E
- F

- City Limits
- Urban Growth Boundary

Figure 4-13
Scenario 2
Future Year 2030
Traffic Volume Forecasts and LOS



Stillwater Transportation Enhancement Plan

LOS:
- A-C
- D
- E
- F

City Limits

Urban Growth Boundary

Figure 4-14
Scenario 2B
Future Year 2030
Traffic Volume Forecasts and LOS

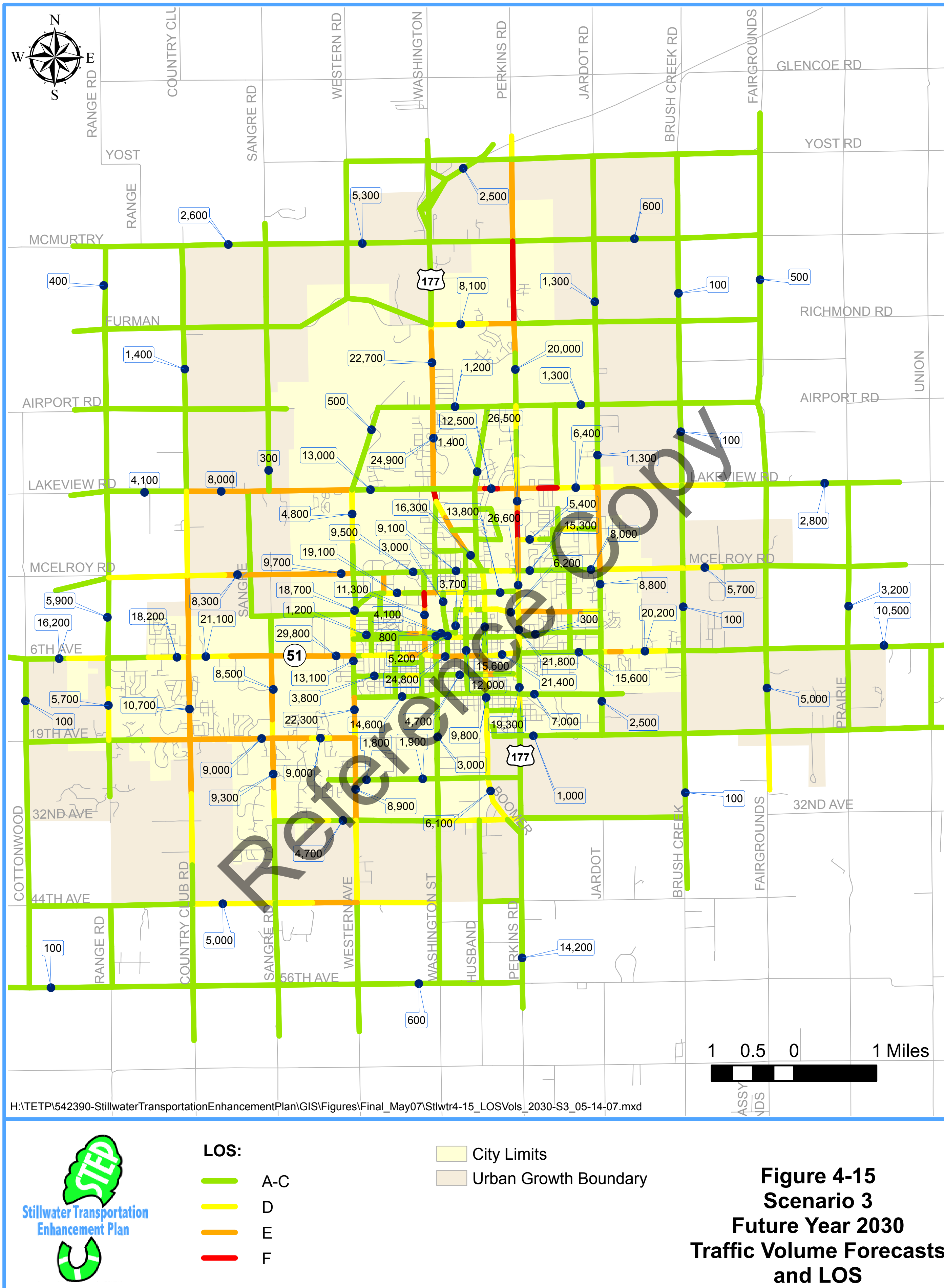
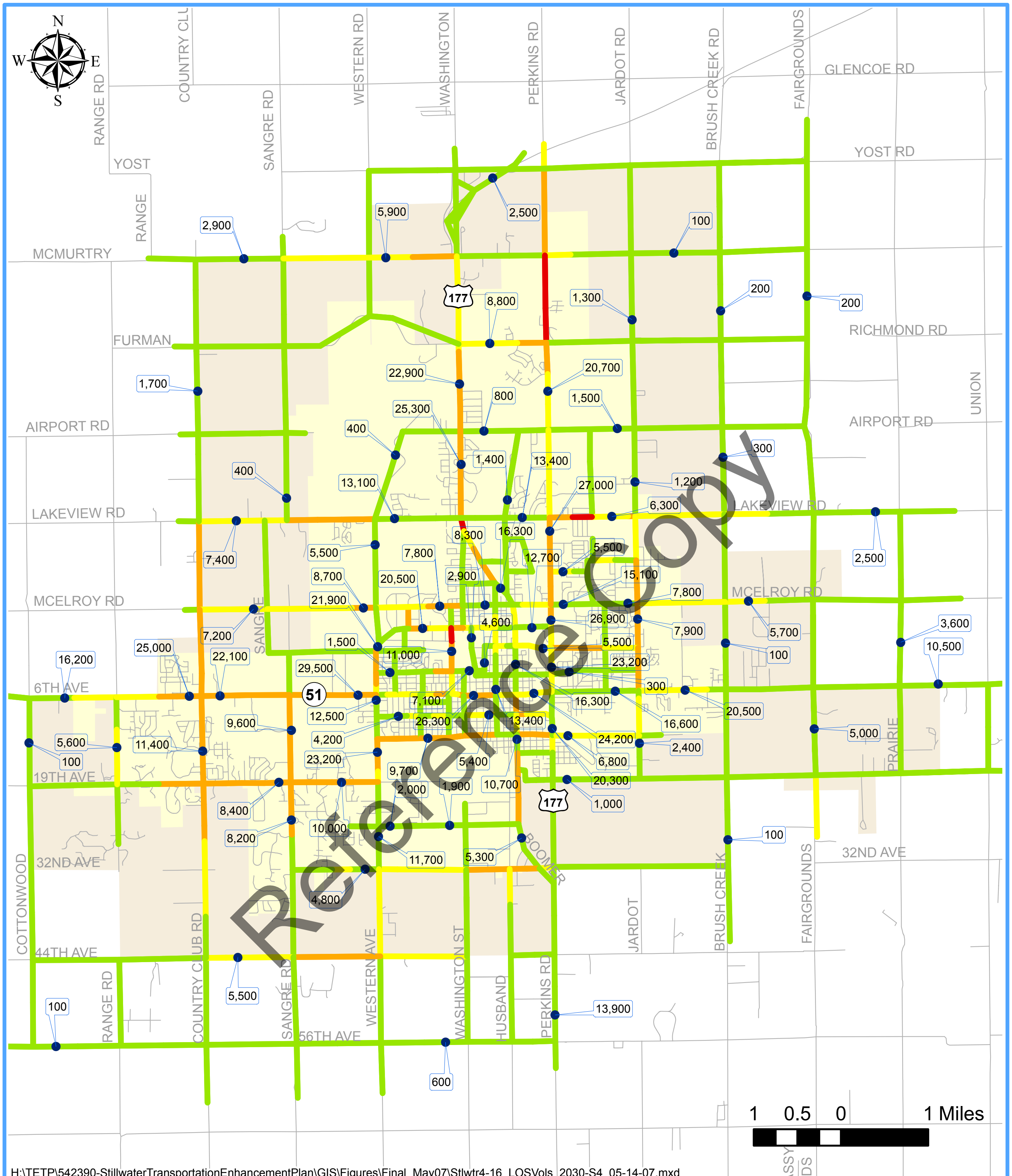


Figure 4-15
Scenario 3
Future Year 2030
Traffic Volume Forecasts and LOS

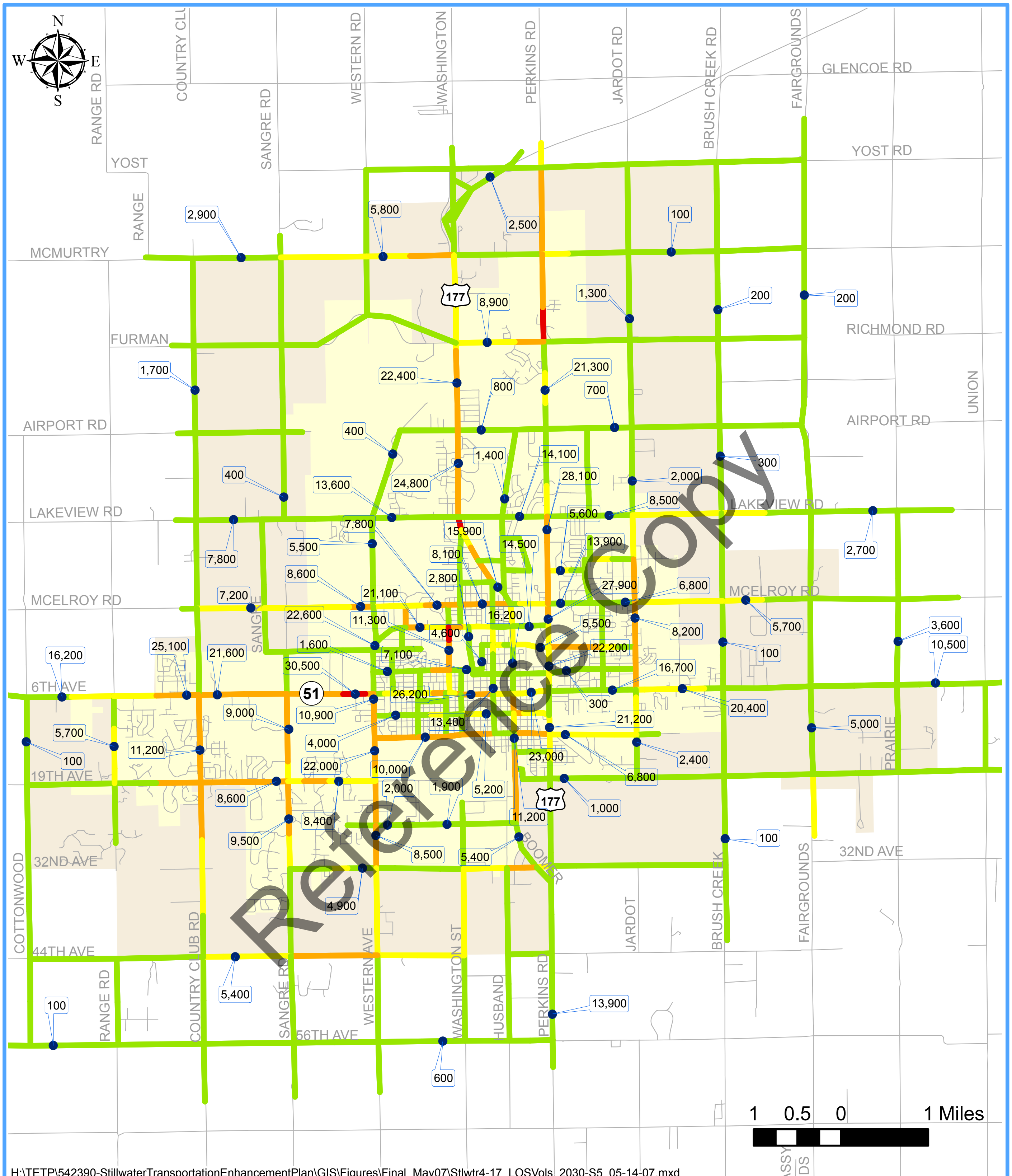


Stillwater Transportation Enhancement Plan

LOS:
- A-C
- D
- E
- F

City Limits
Urban Growth Boundary

Figure 4-16
Scenario 4
Future Year 2030
Traffic Volume Forecasts and LOS

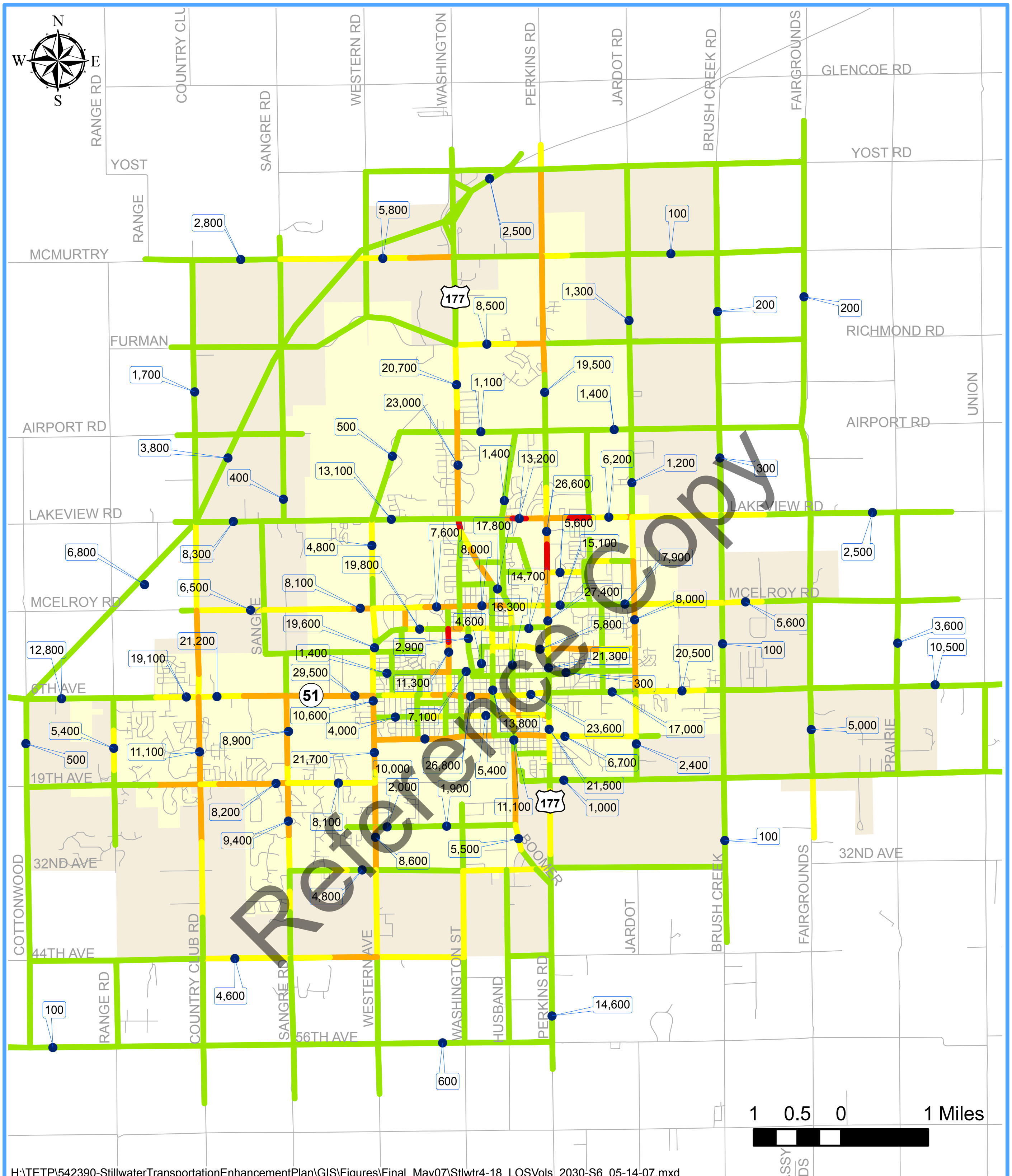


Stillwater Transportation Enhancement Plan

LOS:
- A-C
- D
- E
- F

City Limits
Urban Growth Boundary

Figure 4-17
Scenario 5
Future Year 2030
Traffic Volume Forecasts and LOS



Stillwater Transportation Enhancement Plan

LOS:

- A-C
- D
- E
- F

- City Limits
- Urban Growth Boundary

Figure 4-18
Scenario 6
Future Year 2030
Traffic Volume Forecasts and LOS

SCENARIO 6B IMPACTS

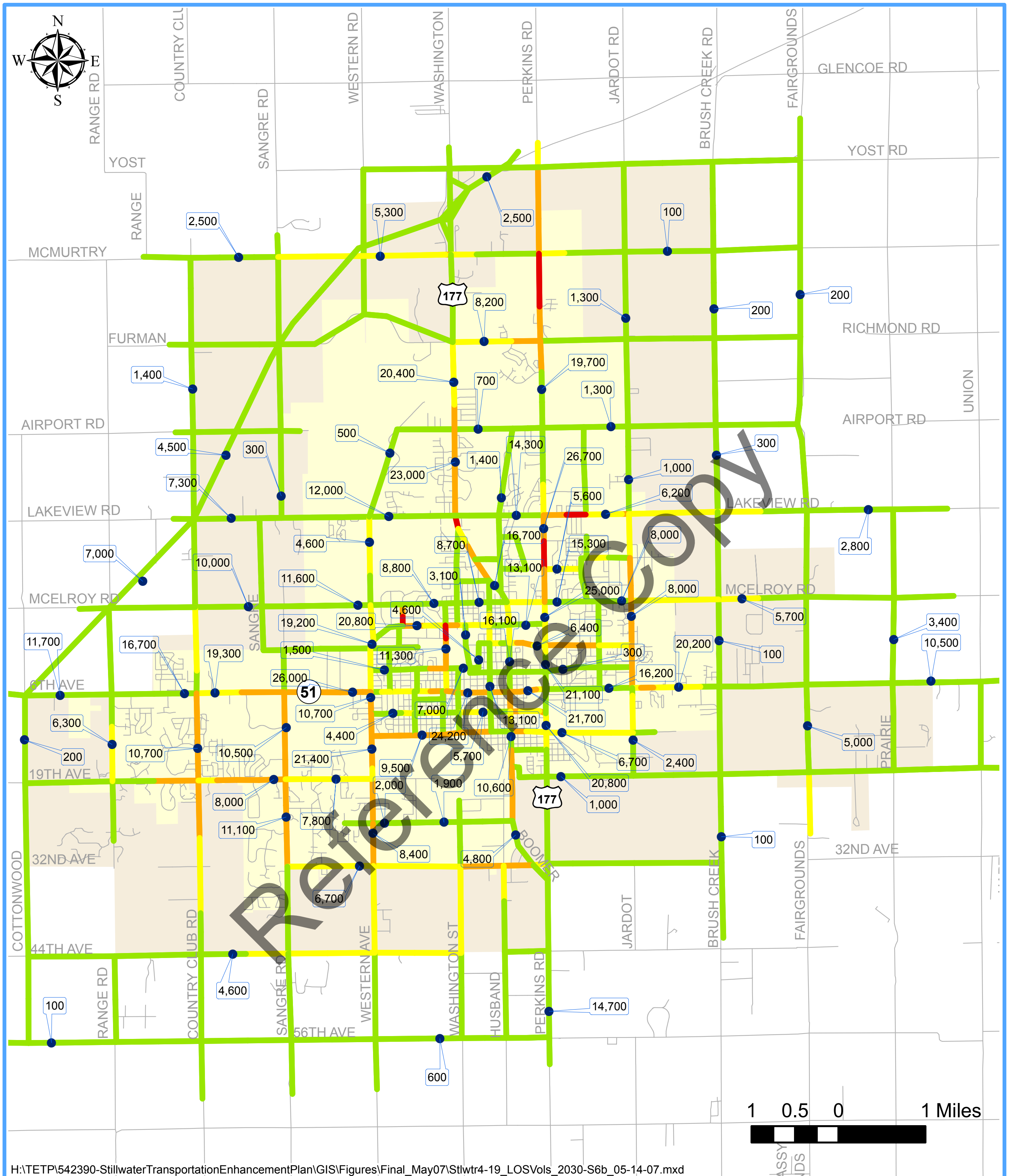
Scenario 6B which enhanced the expressway scenario with additional interchanges and improvements to east-west connecting roads, but did not include any improvements to 6th Avenue. McElroy and Lakeview show a noticeable improvement in both capacity and LOS in this scenario. Enough traffic is pulled away from 6th, 9th, and 12th to show slight improvements in LOS. **Table 4-4** shows that VMT increased by 9,078 miles per day while VHT decreased by 395 hours per day. **Figure 4-19** shows the LOS resulting from Scenario 6B projects.

SCENARIO 7 IMPACTS

Increasing the amount of transit ridership coupled with no other capacity or volume enhancements had no noticeable impact on LOS throughout Stillwater. **Table 4-4** shows that VMT decreased by 1,567 miles per day and VHT decreased by 64 hours per day. **Figure 4-20** shows the resulting LOS from Scenario 7.

Table 4-4
Year 2030 Projected Change in VMT and VHT
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

	Daily Change from Year 2030 E+C Network	
	VMT	**VHT**
Scenario 1	971	(152)
Scenario 2	(511)	(183)
Scenario 2B	1,631	(207)
Scenario 3	11,900	(68)
Scenario 4	(211)	(121)
Scenario 5	1,190	(183)
Scenario 6	5,766	(402)
Scenario 6B	9,079	(395)
Scenario 7	(1,567)	(64)

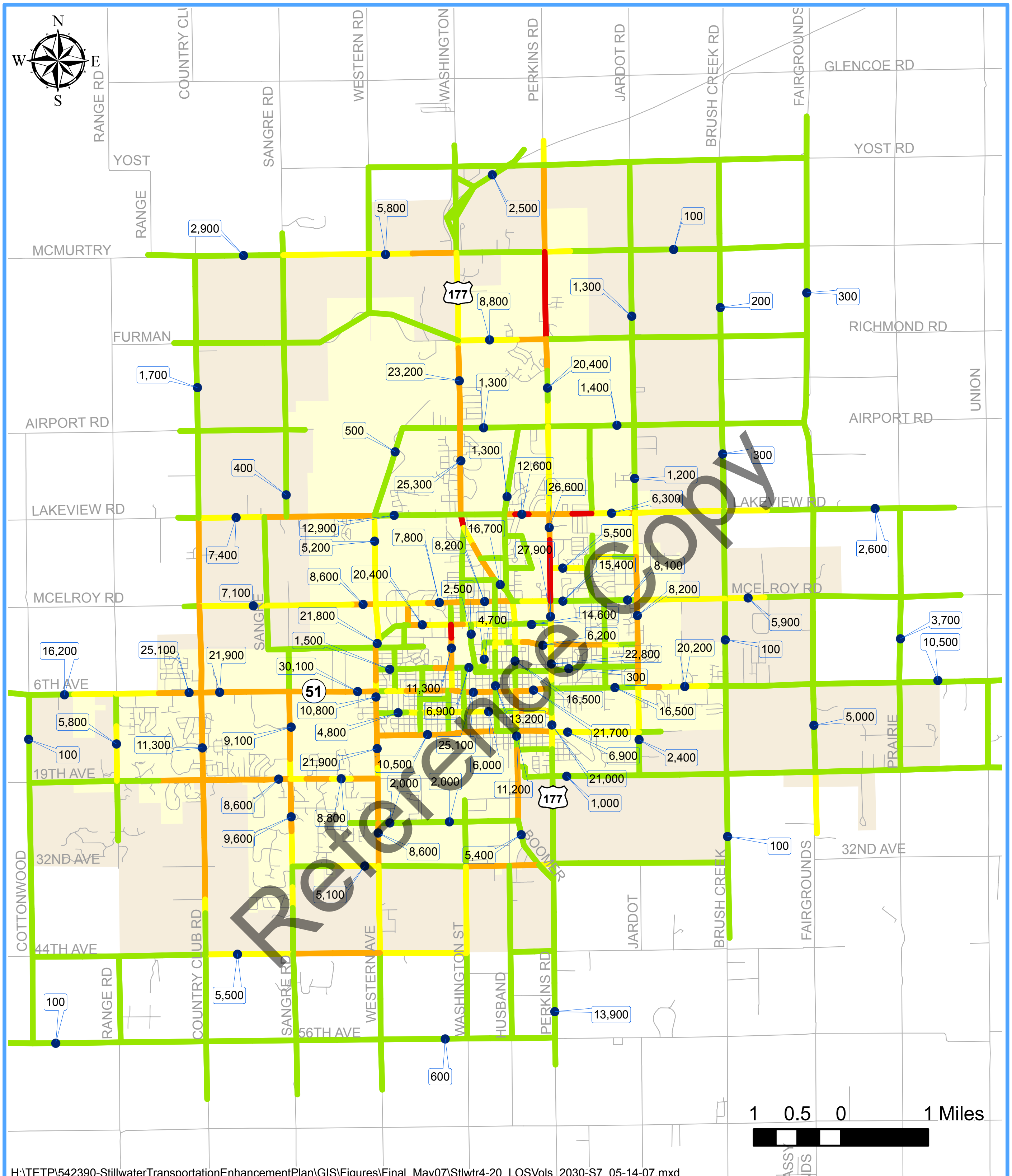


Stillwater Transportation Enhancement Plan

LOS:
- A-C
- D
- E
- F

City Limits
Urban Growth Boundary

Figure 4-19
Scenario 6B
Future Year 2030
Traffic Volume Forecasts
and LOS



STEP
Stillwater Transportation Enhancement Plan

LOS:
- A-C
- D
- E
- F

City Limits
Urban Growth Boundary

Figure 4-20
Scenario 7
Future Year 2030
Traffic Volume Forecasts and LOS

EVALUATION OF SCENARIOS

After the nine scenarios were developed, projects were evaluated based on traffic impacts (including projected volumes and level of service), local community acceptance and consistency of the proposed projects with the community's goals, objectives, and policies. A recommended scenario, which includes a combination of projects from all scenarios, was then developed. The recommended scenario provides the greatest level of congestion relief to the area while taking into account the community's goals and policy considerations. A key policy of the community that served as the basis for the recommended transportation plan was the discouragement of widening roadways at the expense of local businesses, such as along portions of 6th Avenue and Perkins Road. The result of this process (the Recommended Transportation Enhancement Plan) is documented in Chapter 5.

Chapter 5 – Recommended Transportation Plan

INTRODUCTION

The recommended Transportation Enhancement Plan for the City of Stillwater consists of improvements that best meet the projected mobility needs of the community over the next 25 years. The development of the recommended plan was based on projected future traffic volumes and level-of-service, transportation network continuity, environmental constraints, community acceptance, impact from land development, and conformance with growth policies and community goals and objectives. This chapter identifies the recommended transportation enhancement plan. Appendix A discusses the funding and financial aspects of the recommended transportation plan. Appendix B contains recommendations pertaining to design standards for various functional classifications. Finally, Appendix C discusses other considerations for improving traffic conditions such as implementation of transportation system management measures, intelligent transportation systems technology, and access management measures.

Discussions with the Advisory Committee lead to a general acceptance that an acceptable guideline should be used in developing alternatives for consideration, and therefore reflected in the Recommended Transportation Enhancement Plan. The guideline states that potential right-of-way acquisitions requiring purchases of significant numbers of houses or businesses should be avoided. These purchases are typically triggered when the depth of the right-of-way take includes all of a home's front or back yard, or a significant portion of a business' parking space. The effect of this guidance was to eliminate from consideration six-lane arterials in areas with significant current development. In-lieu-of the six-lane arterials, four-lane arterials with either a divided median or a continuous center turn lane would be implemented. To determine which section would be used would be dependent upon the number of intersecting streets and driveways.

RECOMMENDED TRANSPORTATION ENHANCEMENT PLAN

The recommended Transportation Enhancement Plan for the City of Stillwater includes the implementation of roadway improvement to guide the orderly development of the region's transportation system. The plan includes five primary types of improvements: roadway widenings, continuous turn lanes, new roadway facilities, transit improvements, and bicycle/pedestrian improvements.

Roadway widenings provide for additional travel lanes to relieve congested roadway conditions and were recommended in locations where future projected traffic volumes exceeded roadway capacities. Roadway widenings provide for more efficient travel and in most cases were recommended in locations where additional right-of-way could be acquired with minimal impact to adjacent land uses.

New roadway facilities included both new roadway alignments as well as extensions of existing facilities. The only new roadway facility recommended in the Transportation Enhancement Plan is the extension of the tollway as an expressway from Washington to 6th Avenue. Other new roadway facilities will be needed within the City of Stillwater in the coming years (primarily collector and local streets), and will typically be implemented as part of new developments.

Chapter 5 – Recommended Transportation Plan

The Recommended Transportation Enhancement Plan was developed based on the analysis of alternative transportation projects, public involvement efforts, consideration of social and environmental impacts, and evaluation of project costs. The Recommended Transportation Enhancement Plan is illustrated in **Figure 5-1** and summarized in **Table 5-1** and **Table 5-2** on the following pages.

RECOMMENDED PLAN PROJECT TYPES

The projects in the recommended plan fall into a few main types.

Roadway widening projects follow a similar pattern and method. Standard practice is to remove the existing surface material and widen the roadbed and then construct the road. This method is distinguished from simply adding additional lanes to the outside of an existing roadway. Typically, intersection improvements would be incorporated into widening projects where appropriate. The cross sections in the Transportation Enhancement Plan will be followed to allow adequate room for utilities, bike lanes, and sidewalks.

Intersection improvements basically include the addition of turn lanes. Typically these improvements would be included with a roadway widening project; however, there are a few intersections that require additional improvement, generally where a major arterial intersects another major arterial. At the intersections of 6th Avenue and Western, 6th Avenue and Boomer, and 6th Avenue and Perkins Road accommodation and construction of double left turn lanes and a dedicated right turn lane will remove turning traffic from the through lanes and allow more traffic to move through the intersection. At the intersections of Washington and Richmond and Perkins and Richmond enough right-of-way should be required to allow these improvements if needed beyond the Year 2030 planning horizon.

Signal improvements are a relatively simple way to improve traffic flow and are typically required in a community the size of Stillwater. The recommended plan includes signal improvements which specifically call for the installation of video detection systems, fiber optically interconnected, and connected to and control by a centralized control facility.

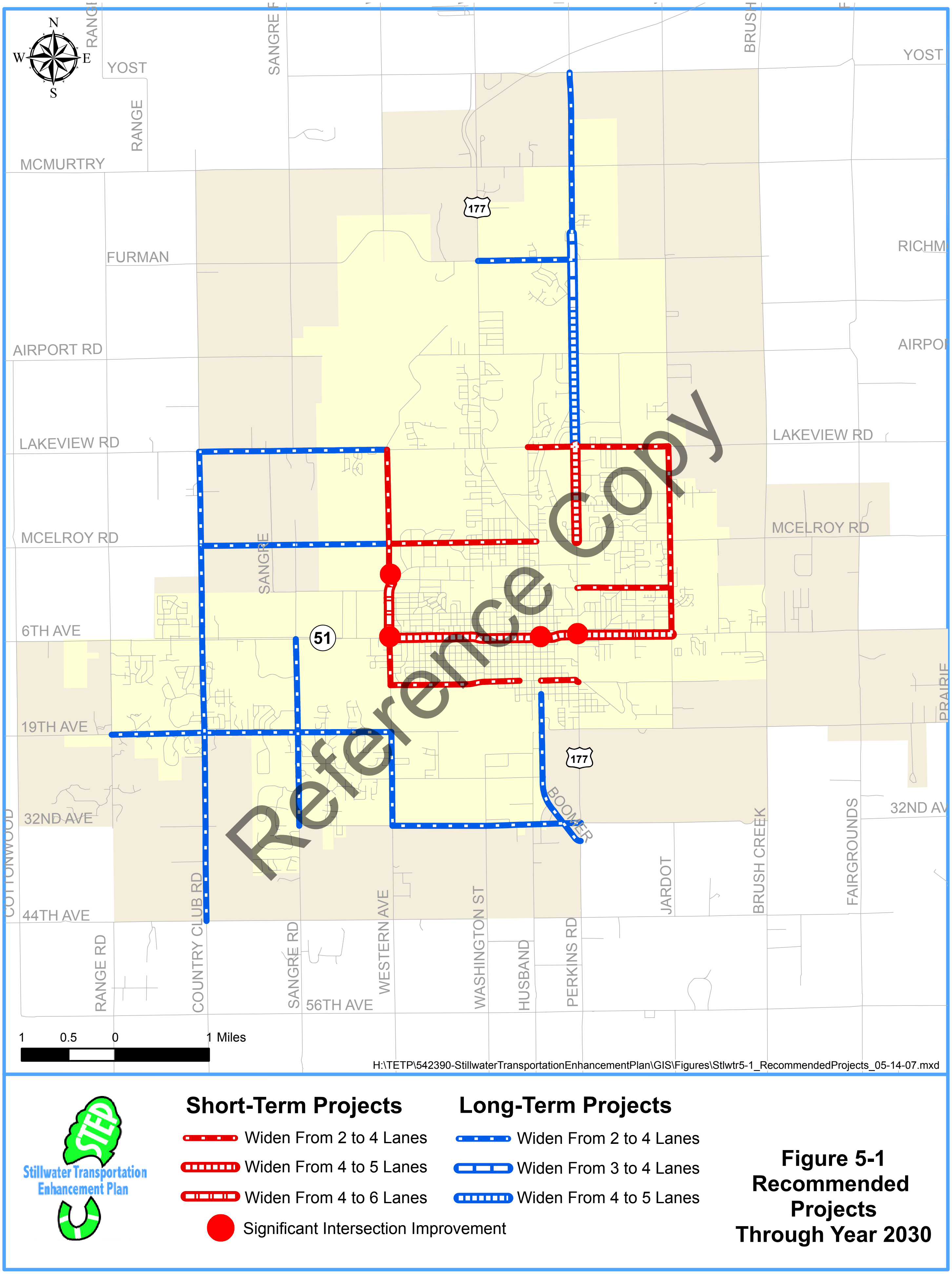


Figure 5-1 Recommended Projects Through Year 2030

Table 5-1
Recommended Short Term Improvement Program (2007 to 2019)
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Roadway	Limits	Improvement	Order-of-Magnitude Construction Cost*	Responsible Agency
Jardot	McElroy to 6th†	Widen 2 to 4 lanes	$5.7M	City
12th Avenue	Western to Duck†	Widen 2 to 4 lanes	$6.4M	City
6th Avenue	Sangre to Jardot	Signal timing optimization improvements	$310,000	City
Perkins	6th Avenue to McElroy	Signal timing optimization improvements	$195,000	City
N/A		Centralized Signalization Control	$300,000	City
12th Avenue	Main to Perkins	Widen 2 to 4 lanes	$1.64M	City
Jardot	Lakeview to McElory	Widen 2 to 4 lanes	$3.65M	City
6th Avenue	Western to Jardot	Widen 4 to 5 lanes	$9.0M	City, ODOT
Perkins	Lakeview to McElroy	Widen 4 to 5 lanes	$2.75M	City, ODOT
McElroy	Western to Boomer	Widen 2 to 4 lanes	$7.9M	City
Western	6th Avenue to 12th Avenue	Widen from 2 to 4 lanes	$2.9M	City
Lakeview	Husband to Jardot	Widen from 2 to 4 lanes	$5.5M	City
Western	Lakeview to Hall of Fame	Widen 2 to 4 lanes	$6.5M	City
Western	Hall of Fame to 6th Avenue	Widen 4 to 6 lanes	$4.3M	City, ODOT
Virginia	Perkins to Jardot	Widen from 2 to 4 lanes	$4.2M	City
Transit Service Improvements	Current transit service area	Encourage ridership with transit service technology; Restrict on-campus parking	$500,000	City, OSU, grants may be available
Bicycle/ Pedestrian Improvements	Master Bicycle and Pedestrian Plan	Implement Recommended Projects from the Plan		City, OSU, grants may be available

*Includes estimate of right-of-way and utility relocation requirements
† This project became committed during the course of the development of the Plan.

Table 5-2
Recommended Long Term Improvement Program (2020 to 2030)
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Roadway	Limits	Improvement	Order-of-Magnitude Construction Cost*	Responsible Agency
32nd Street	Western to Perkins	Widen from 2 to 4 lanes	$7.4M	City
Lakeview	Country Club to Western	Widen from 2 to 4 lanes	$7.4M	City
McElroy	Country Club to Western	Widen from 2 to 4 lanes	$7.5M	City
Perkins Road	1/2 mile north of Airport to Lakeview	Widen from 4 to 5 lanes	$3.0M	City, ODOT
Perkins Road	Richmond to 1/2 mile north of Airport	Widen from 3 to 4 lanes	$1.5M	City, ODOT
Perkins Road	Yost to Richmond	Widen from 2 to 4 lanes	$7.6M	City
Richmond	Washington to Perkins	Widen from 2 to 4 lanes	$3.6M	City, ODOT
Western	19th to 32nd	Widen from 2 to 4 lanes	$3.6M	City
19th Avenue	Range to Western	Widen from 2 to 4 lanes	$11.1M	City
Country Club	Lakeview to 44th	Widen from 2 to 4 lanes	$17.8M	City
Sangre	6th to 32nd	Widen from 2 to 4 lanes	$7.1M	City
Boomer	15th to Perkins	Widen from 2 to 4 lanes	$6.8M	City
Transit Service Improvements	City of Stillwater and beyond	Continue to implement transit friendly services		City, OSU, grants may be available
Bicycle/ Pedestrian Improvements	Master Bicycle and Pedestrian Plan	Implement Recommended Projects from the Plan		City, OSU, grants may be

*Includes estimate of right-of-way requirements

Stillwater Expressway

Test network scenarios 6 and 6B included the construction of an expressway on the northwest portion of the City. Similar improvements to the level-of-service and traffic efficiency were obtained by improving surface streets in the northwest and southwest portions of the City. The long-term recommended plan reflects these improvements. The expressway did not, at this time, provide the type of improvement in LOS that would justify the expense. However, Stillwater should consider that it will be ready for an expressway in the years beyond 2030, with this in mind the City should acquire right-of-way in that area as opportunities arise in preparation for such a project.

Multi-Modal Considerations

In testing alternative improvement scenarios, one improvement which provided a significant decrease in both VMT and VHT was an increase in transit service usage. Increased usage of the transit service by OSU students and faculty would have a significant impact on the overall congestion levels throughout the City of Stillwater over the next 25 years. Therefore, this Transportation Enhancement Plan recommends that OSU and the City of Stillwater provide for improved transit service to the university area to encourage higher levels of student ridership. In addition, the City and OSU should consider new parking policies (such as higher parking rates or reducing the number of available parking spaces on campus) to encourage higher transit ridership.

Bicycle and pedestrian facilities are also important components to the City's transportation system. The City of Stillwater's Trail Task Force is currently developing a new master plan. The results of this master planning effort should be incorporated into the Transportation Enhancement Plan upon its conclusion.

Construction Cost Estimates

Construction costs included in the tables are based on 2006 dollars and should be considered to be order-of-magnitude estimates. Development of the estimates is based on recent bid prices and discussions with both City and State officials. Changes in material and labor costs in future years will need to be taken into account in budgeting these projects. Budgets will need to be established for design-related activities, such as geotechnical investigations, surveying, and engineering. Additionally, budgets will need to be established for construction-related activities, such as supervision, inspection, and overhead.

Table 5-3
Typical Facility Costs
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Facility Type	Order-of-Magnitude Construction Cost ($ million/mile)	Responsible Entity
Freeway/Expressway	$ 10 M	State – ODOT, OTA
Major Arterial	$ 4.5 M	City and/or State
Minor Arterial	$ 4 M	City
Collector	$ 2 M	City

Right-of-Way and Utility Relocation Needs

The recommended projects will require a wide range of right-of-way and utility relocations. To the extent possible, adequate right-of-way should be obtained from developers based on the functional classification of the adjacent street as discussed in the next section. Due to the extent of existing development, some right-of-way purchases will be required for almost all projects. The budget for each individual project needs to include the anticipated right-of-way costs and the engineering services required to develop right-of-way plans and to secure the acquisitions. Utility relocations must also be budgeted for each individual project. This will entail relocation of City-owned utilities and private utilities. Payment must be made for private utilities with previously-established rights. The budget also needs to allow for utility relocation coordination.

Effectiveness of Recommended Transportation Plan

The effectiveness of the Recommended Transportation Plan can be evaluated by reviewing projected traffic volumes, level-of-service, and can be measured in terms of daily vehicle-hours and miles traveled. A comparison of the existing year 2006 network, year 2015 and 2030 E+C network, and the year 2015 and 2030 recommended transportation plan networks is presented in **Table 5-4**. Implementation of the recommended year 2030 transportation plan is estimated to save area motorists more than 403 hours of time each day spent traveling in their vehicles. Projected future traffic volumes and LOS for the 2015 and 2030 recommended transportation plan networks are presented in **Figure 5-2** and **Figure 5-3**, respectively. **Figure 5-4** shows the projected future traffic volumes and LOS resulting from the construction of the expressway for comparison to the 2030 recommended plan.

Table 5-4
Comparison of Daily Vehicle Hours of Travel
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Year	Network	Vehicle Miles of Travel	Vehicle Hours of Travel (hours per day)	Hours Saved Per Day Verses E+C
2006	Base Year	729,349	17,632	---
2015	Existing Plus Committed	896,479	21,798	---
	Recommended Transportation Plan	896,478	21,799	---
2030	Existing Plus Committed	1,175,253	29,132	---
	Recommended Transportation Plan	1,175,706	28,729	403
	Plan with Expressway	1,182,958	28,582	550

Stillwater Transportation Enhancement Plan

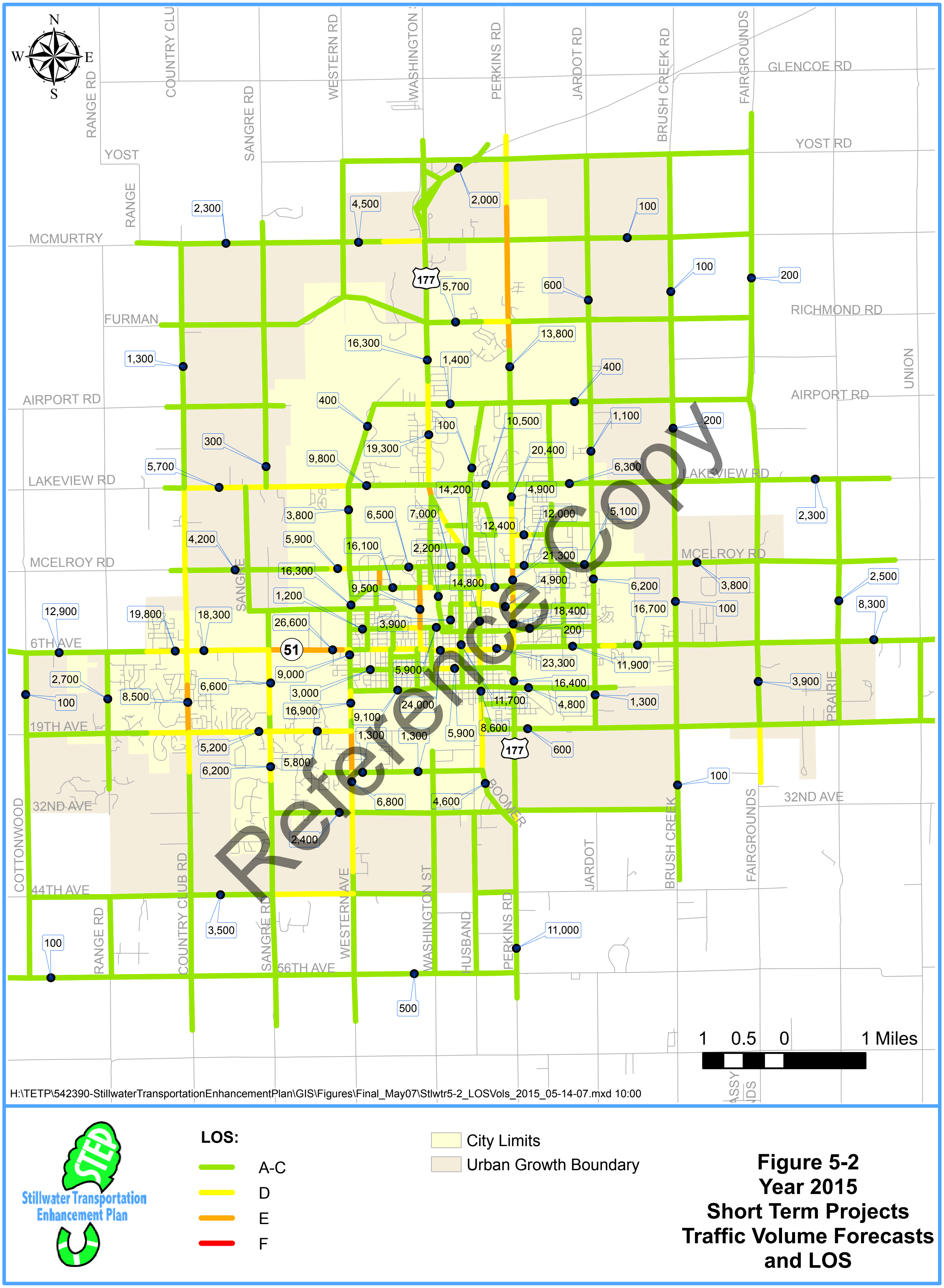
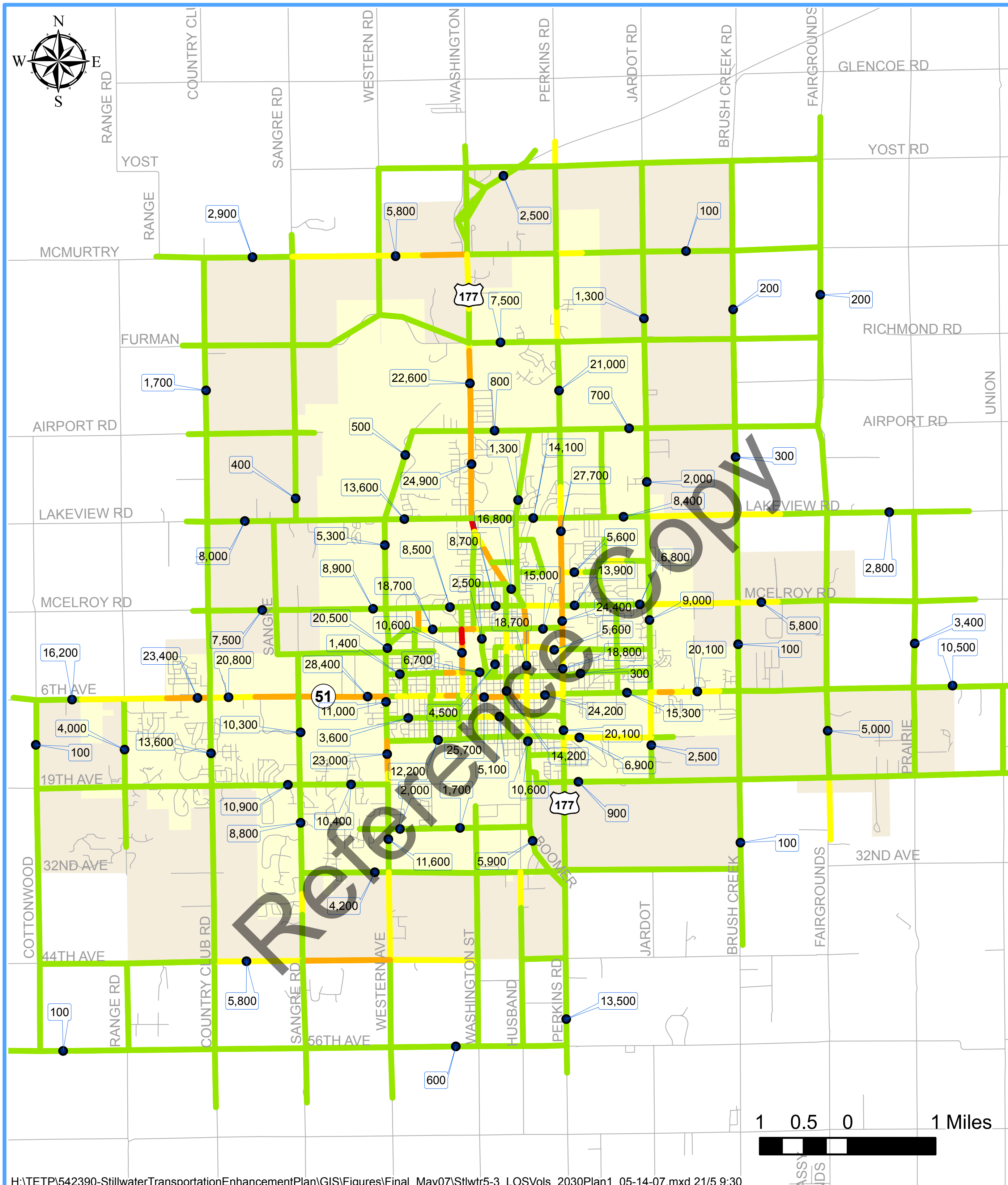


Figure 5-2
Year 2015
Short Term Projects
Traffic Volume Forecasts
and LOS



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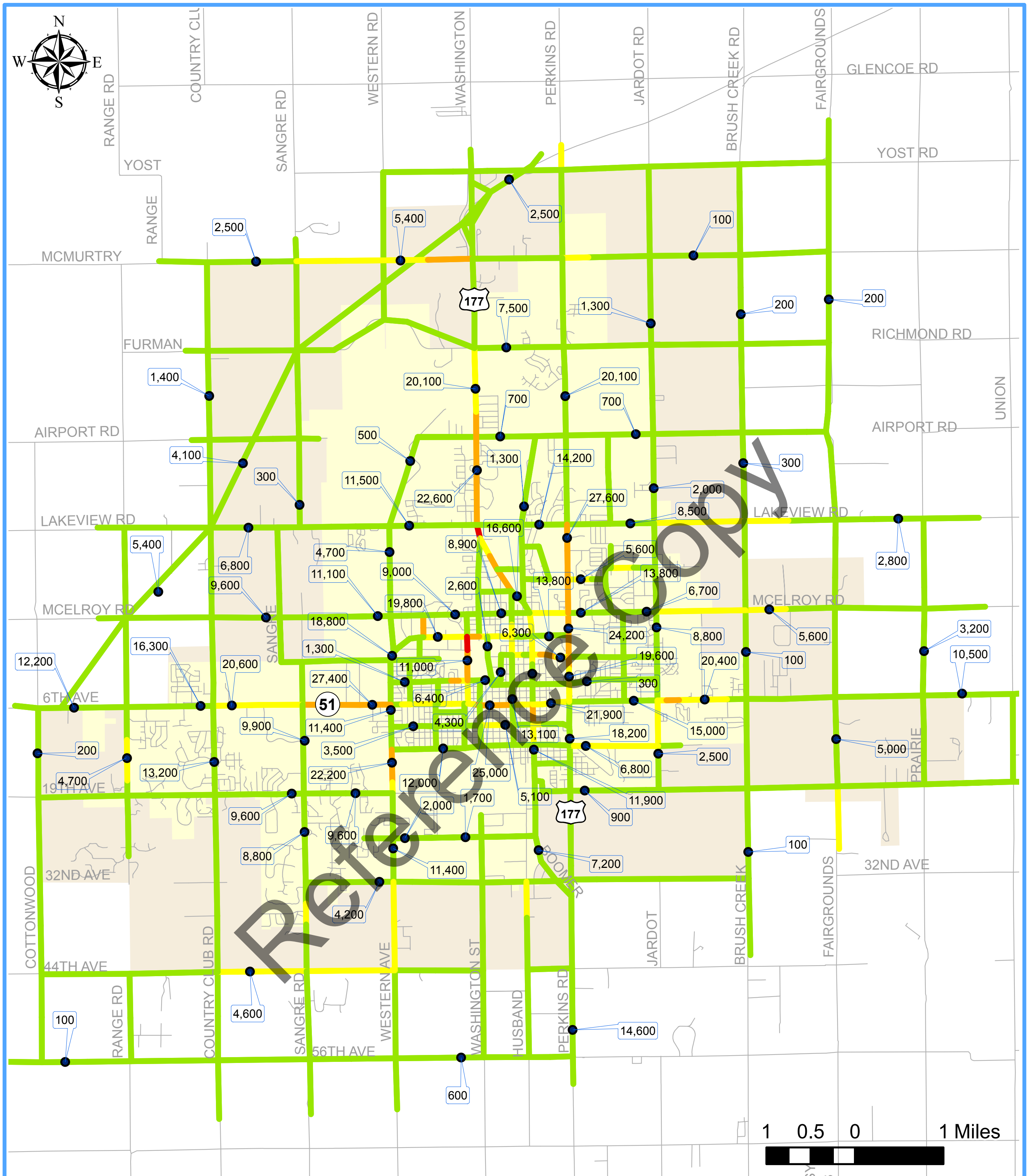
STEP
Stillwater Transportation Enhancement Plan

LOS:

- A-C
- D
- E
- F

- City Limits
- Urban Growth Boundary

Figure 5-3
Year 2030
Long Term Projects
Traffic Volume Forecasts
and LOS



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STEP
Stillwater Transportation Enhancement Plan

LOS:

- A-C
- D
- E
- F

- City Limits
- Urban Growth Boundary

Figure 5-4
Year 2030 Long Term Projects with Expressway Traffic Volume Forecasts and LOS

Functional Classification

The functional classification system is a hierarchical organization of streets and highways that facilitates the safe and efficient operation of vehicles along different types of facilities. As indicated in **Figure 5-5**, a functional roadway system facilitates a progressive transition in the flow of traffic from the provision of access to the provision of movement. Freeway and arterial facilities are at one end of the spectrum, primarily providing the function of moving vehicles. Collector and local streets are at the opposite end of the spectrum, providing access to property. **Figure 5-6** shows schematically how various street classifications relate to each other in terms of movement and access.

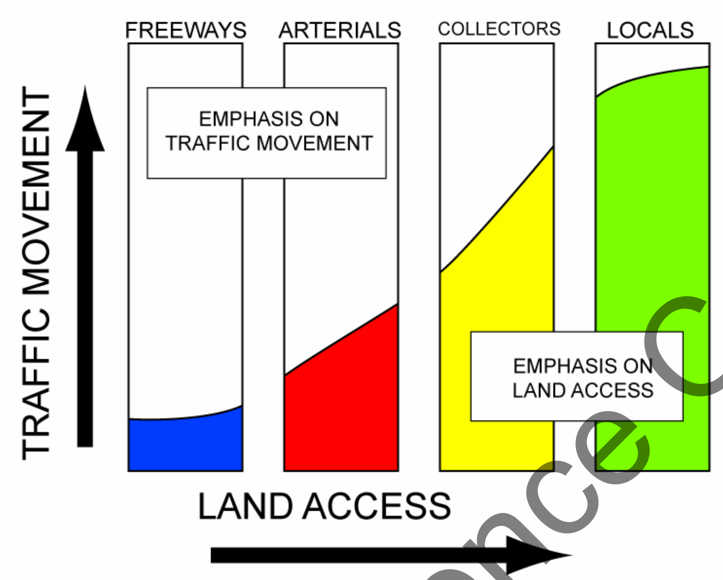


Figure 5-5
Functional Classification System Hierarchy

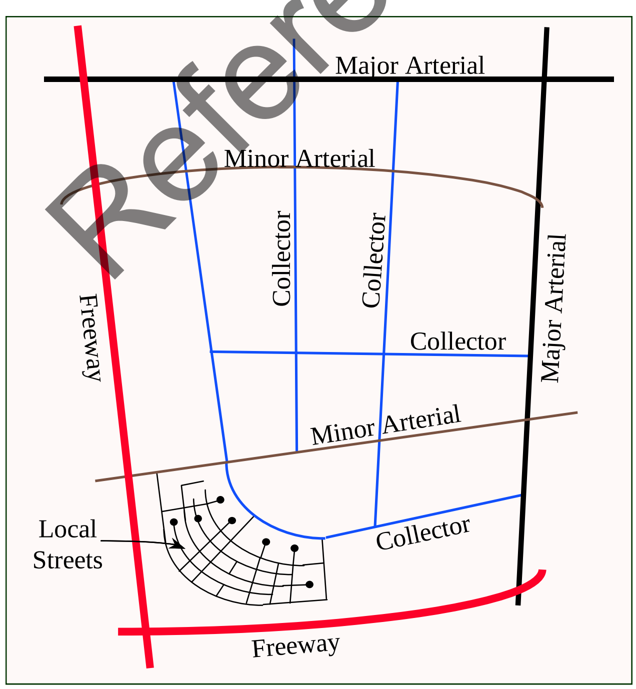


Figure 5-6
Hierarchical Functional Classification System

To enable streets and highways to accomplish their intended function, the planning and design of the facilities should consider those elements that support the intended functions. Descriptions of the various roadway functional types and related planning and design considerations are provided in the following section.

Freeways

These facilities include interstate highways, freeways, expressways and parkways, and provide for the rapid and efficient movement of large volumes of traffic between regions and within one region. Direct access to abutting property is not an intended function of these facilities. Design characteristics support the function of traffic movement by providing multiple travel lanes, a high degree of access control, and no at-grade intersections.

Arterials

Arterials primarily provide for traffic movement, with a secondary function of providing direct access to abutting property. Major arterials typically serve as connections between major traffic generators and land use concentrations, and facilitate large volumes of through traffic traveling across a community. Minor arterials typically serve as connections between local and collector streets and the major arterials, and facilitate the movement of large traffic volumes over shorter distances within the community. Because direct access to abutting property is a secondary function of arterial streets, access should be carefully managed to avoid adverse impacts on the movement function intended for these facilities.

Major Arterials - Major arterials are streets and highways that provide a high degree of mobility, serve relatively high traffic volumes, have high operational speeds (45 mph or greater), and serve a significant portion of through travel or long-distance trips. They are continuous over long distances and serve trips entering and leaving the area as well as trips within it. These facilities generally serve high volume travel corridors that connect major traffic generators, but lower volume roadways that are continuous over long distances may also function as major arterials, particularly in fringe and rural areas. They may vary from multi-lane roadways with four to six lanes or more, down to two-lane roadways in developing fringe and rural areas, where traffic volumes have not increased to the point that additional travel lanes are needed. Functional classification is not dependent on the existing number of lanes, since the functional role served by a roadway typically remains constant over time, while the roadway's cross section is improved to accommodate increasing traffic volumes. Major arterials form an interconnecting network for citywide and regional movement of traffic, including connections to freeways and expressways, and to minor arterials and collectors. A one- to two-mile spacing is generally desirable between major arterials, with a one-mile spacing between a major arterial and a minor arterial or freeway.

Since traffic movement, not land access, is the primary function of major arterials, access management is essential. The number of driveways connecting directly onto a major arterial should be minimized to avoid traffic congestion and delays caused by turning movements for vehicles entering and exiting driveways. Off-peak travel speeds on major arterials are typically 40 to 55 mph, and peak period speeds are about 30 to 40 mph. Intersections with other public streets and private access should be designed to limit speed differentials between turning vehicles and other traffic to no more than 10 to 15 mph. Signalized intersection spacing should be long enough to allow a variety of signal cycle lengths and timing plans that can be adjusted to meet changes in traffic volumes and maintain traffic progression (desirably one-third to one-half mile consistent spacing). Also, major arterials should be constructed or retrofitted with raised medians where possible to increase roadway safety and improve traffic operations.

Minor Arterials - Minor arterials are similar in function to major arterials, except that they provide a higher degree of local access than major arterials. Minor arterials include all remaining arterial streets and highways in the urbanized area and serve less concentrated traffic generating areas, such as neighborhood shopping centers and employment centers. Although minor arterials are very similar in function to major arterials, this class typically distributes medium traffic volumes for shorter distance trips than major arterials. In general, the projected future traffic volumes on minor arterials will be lower than the volumes carried by major arterials.

Minor arterials are generally continuous over shorter distances than major arterials. Travel speeds along minor arterials are typically 30 to 45 mph in off-peak periods, and 20 to 35 mph in peak periods. Minor arterials serve as boundaries to neighborhoods and collect traffic from collectors and local streets. Although a minor arterial typically provides more local access than a major arterial, the primary function is still traffic movement. Major and minor arterials are generally spaced at one mile intervals in an alternating grid pattern. In addition, any minor arterial that currently exceeds a daily ADT of 20,000 or is forecasted to reach that traffic volume should have a raised median for safety and to improve traffic operations.

Collectors

Collector streets provide for a balance of traffic movement and property access functions. Traffic movement is often internal to localized areas, with collectors connecting residential neighborhoods, parks, churches, etc. with the arterial system. As compared to arterial streets, collectors accommodate smaller traffic volumes over shorter distances. Collector streets are the connectors between arterials and local streets that serve to collect traffic and distribute it to the arterial network. Collectors also serve to provide direct access to a wide variety of residential, commercial and other land uses, and their design involves site-specific considerations. They provide service to neighborhoods and other local areas, and may border or traverse neighborhood boundaries. Parking may be permitted on-street in residential areas.

Since collectors are used for short distance trips between local streets and arterials, they should be continuous in the spaces between arterials. Collectors may also extend across arterials. To provide efficient traffic circulation and preserve amenities of neighborhoods, collectors should desirably be spaced at about one-quarter to one-half mile intervals. Subdivision street layout plans should include collectors as well as local streets in order to provide efficient traffic access and circulation. Operating speeds for collectors are typically about 30 to 35 mph. Since speeds are slower and more turning movements are expected, a higher speed differential and much closer intersection/access spacing can be used than on arterials. On-street parking may be permitted in residential areas.

Direct access to abutting land is essential; parking and traffic controls may be necessary for safe and efficient through movement of moderate to low traffic volumes at key intersections.

Collectors may be constructed with or without center turn lanes, and may permit or restrict parking, depending on the cross section design chosen. Collectors serve an important role in collecting and distributing traffic between major/minor arterials and local streets. Their identification is essential in planning and managing traffic ingress/egress and movement within residential neighborhoods as well as commercial and industrial areas.

Local Streets

Local streets function to provide access to abutting property and to collect and distribute traffic between individual parcels of land and collector or arterial streets. Local streets include all other streets and roads that are not included in higher functional classes. They include internal and access streets that allow direct access to residential and commercial properties, and similar traffic destinations. Direct access to abutting land is their primary role, for all traffic originates or is destined to abutting land. On-street parking may be permitted. Trip lengths on local streets are short, volumes are low, and speeds are slow (generally between 20 and 30 mph). Local streets typically comprise between 65 to 80 percent of the total roadway system.

Through traffic and excessive speeds should be discouraged on local streets by using appropriate geometric designs, traffic control devices, curvilinear alignments, and discontinuous streets. Local streets should be designed for low speed traffic with an emphasis on providing access. One factor in the functional classification of roadways is their existing and proposed traffic volumes. **Table 5-5** shows ranges of vehicles per day along with the corresponding roadway functional classification.

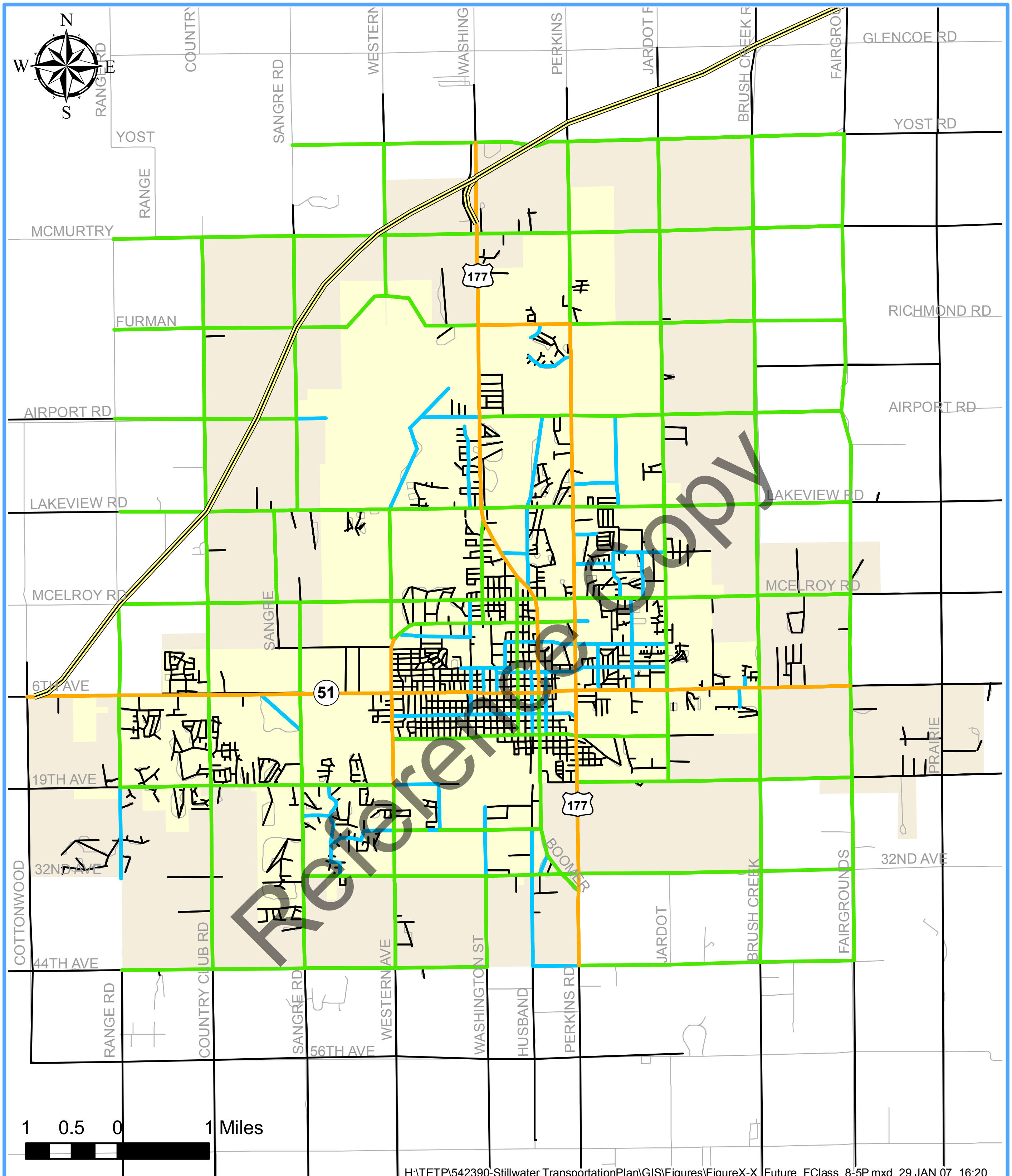
Table 5-5
Traffic Volumes and Functional Classification

Functional Classification	Vehicles Per Day (vpd)
Local Streets	< 2,500 vpd
Residential Collectors	2,500 to 5,000 vpd
Major Collectors	5,000 to 8,500 vpd
Minor Arterials	8,500 to 24,000 vpd
Major Arterials	24,000 to 36,000 vpd
Freeways/Expressways	> 36,000 vpd

Recommended Functional Classification System

The proposed functional classification system is shown in **Figure 5-7**. The City's existing functional classification system is shown in Figure 2-4 in Chapter 2. This existing functional classification system was used as the basis for developing the recommended Functional Classification System, which also incorporates the recommended improvements discussed earlier in this chapter. This proposed system was developed based on field reconnaissance, physical characteristics, traffic volumes, and input from City Staff and the Advisory Committee.

Key recommended changes to the existing Functional Classification System include revising functional classification so it is based on function rather than number of lanes and consolidating collectors into one category. Major roadways primarily used for through movement and that carry higher volumes of traffic were classified as Major Arterials. In Stillwater these roadways include 6th Street, Perkins Road, Washington/Boomer north of 6th Avenue, Western between Hall of Fame and 19th Avenue, and Richmond/US 177 between Washington and Perkins Road. The remaining section line roadways were classified as minor arterials.



Stillwater Transportation Enhancement Plan

Functional Class:
- Local
- Collector
- Minor Arterial
- Major Arterial
- Freeway

- City Limits
- Urban Growth Boundary

Figure 5-7
Proposed
Future Functional
Classification of Roads

Coordinating Transportation Planning Activities and Current Development Activities

Transportation planning activities including the implementation of the Stillwater Transportation Enhancement Plan should be highly coordinated with current and future development activities within the community. As previously mentioned, coordinating development activities including land use planning and transportation decisions serves as an important role in improving mobility needs, promoting economic development, and enhancing quality of life. The extent to which future land uses follow the year 2030 development projections will determine, to a large degree, the actual implementation schedule of the Transportation Plan. Conversely, the extent to which major components of future land use projections are realized will be dependent upon the adequacy of the transportation system.

Additionally, improved coordination and cooperative efforts among various local and state officials, including the City of Stillwater and nearby municipalities such as Perkins and Cushing, Payne County, and ODOT, must be continued to fully realize the benefits of the Transportation Plan. Coordinating with these local and state officials on their current and future development activities and transportation improvements and needs, will contribute to a regionally efficient and effective transportation system.

Importance of Adopting a Transportation Plan

The Stillwater Transportation Enhancement Plan will be formally considered for adoption by the City Council, in accordance with the City's policies and procedures. Adoption of the Transportation Plan is necessary to officially recognize and confirm the status of the Plan as a part of the policies of the local community. While it is recognized that unforeseen developments can and do call for periodic revisions to the Transportation Plan, this does not invalidate the need for the Plan to be officially adopted and enforced.

Transportation planning practices typically require long range transportation plans to be "financially constrained," meaning the estimated implementation costs for the planned transportation improvements are in balance with the projected revenues available from identified sources. This section identifies funding sources, projected revenues, and estimated project costs required to implement this Transportation Enhancement Plan.

Existing Funding Sources

Historically, transportation activities have been financed using a combination of capital grants, motor fuel tax revenues, and commercial vehicle revenues. Sales tax represents another potential source of funds for transportation activities. As a whole, the City of Stillwater receives 3.5 cents in sales tax revenues—2 cents are retained by the General Fund, 1 cent is transferred to the Stillwater Utilities Authority as required by bond indentures, and ½ cent which is transferred to the Transportation Fund which can be used to finance new roadway and street projects. The latter sales tax increase was approved by voters in September 2001 and the City of Stillwater began to receive revenues from this tax in December 2001. In addition, the City receives funds from gasoline excise and commercial vehicle taxes. By law, this source of funds can only be used for improvements to streets and alleys.

Since 1997, the City of Stillwater has also received funds from a use tax in accordance with Ordinance #2562. The City has an agreement with Oklahoma State University, which results in the transfer of up to $600,000 annually to OSU. However, the City can retain any use tax revenues in excess of $600,000. This agreement with OSU is scheduled to expire on December 31, 2012. Sales and use tax revenues are collected by the Oklahoma Tax Authority and are then transferred to the City of Stillwater. Additional available sources of existing funds include funds provided by the Oklahoma Department of Transportation (ODOT) and the Federal Highway Administration (FHWA), and bond issuance backed by general tax revenues or general obligation bonds (G.O. bonds).

In addition, developers are currently charged $350 per new housing unit as a transportation fee into a contribution fund. These funds could be used to finance street projects adjoining and/or near planned subdivisions. For commercial development, the tax rate is 3.5 cents per square foot on land that is being developed. This source of funds has been available to the City of Stillwater since 2003 and there does not appear to be any restrictions associated with these funds.

Although the City of Stillwater collects a significant amount of funds through property tax revenues ($1.4 million in FY 2006), these funds cannot be directly used to finance transportation activities. In accordance with State law, municipalities in Oklahoma can use property tax only to cover principal and interest payments associated with general obligation bonds and court imposed judgments.

Table A-1 summarizes the historical revenues from FY 2000 through FY 2006 for the sales tax revenues dedicated for transportation activities, use tax revenues, and total sales and use taxes. FY 2003 corresponds to the first full year that revenues were collected from the half cent sales tax. From FY 2003-06, the amount of revenues collected from this revenue source has increased at annual average growth rate of 4.28 percent. Moreover, the average annual growth rate for use tax was 5.23 percent.

Table A-1
Historical Sales and Use Tax Receipts, FY 2000-2006
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Year	½¢ Sales Tax Dedicated to Transportation Projects	Use Tax Revenues	Total Sales and Use Tax Revenues
FY 2000	N/A	627,093	13,509,061
FY 2001	N/A	444,089	14,414,975
FY 2002	1,401,908	354,107	15,900,559
FY 2003	2,430,423	390,404	17,005,078
FY 2004	2,562,464	513,685	17,929,640
FY 2005	2,680,771	686,910	18,744,546
FY 2006	2,874,256	942,795	20,100,550

FUTURE FUNDING FORECASTS USING EXISTING SOURCES

Future funding forecasts are based on the potential availability of sales tax revenues dedicated for transportation activities, developer contributions, and State and Federal funds. Sales tax revenues have been estimated using an annual average growth rate of 4.28 percent. For the purposes of this analysis, it has been assumed that this source of funds would be available to the finance proposed short- and long-term projects through year 2030. The City of Stillwater uses other sources of funds (i.e. from the General Fund) to pay operation and maintenance costs, so these other revenues are not included in this analysis.

Although small in comparison to sales tax revenues, transportation fee contributions are also available to fund transportation activities, with a growth rate of 1.5 percent per year for residential and 0.8 percent per year for commercial assumed through year 2030. The availability of revenues generated from the residential developer transportation fee has been estimated to be relatively minimal—about 275 houses per year (grown at 1.5 percent) multiplied by $350 per house. For the first forecast year, this amount is about $96,250. By 2030, it is estimated that this amount is about $135,500. The 1.5 percent growth rate is comparable to the pattern of new home construction as discussed in Chapter 3.

For commercial developments, the developer impact fee revenues were estimated based on the average commercial development pattern over the last four years, for an average revenue stream of $86,000 per year. The growth of this revenue source is estimated at 0.8 percent per year, which is consistent with the 0.8 percent growth in employment as discussed in Chapter 3. For the first forecast year, this amount is estimated at $86,000. By 2030, it is estimated that this amount is about $103,300 per year.

Finally, there are State and Federal funds that could be made available through 2030 for eligible projects. In developing the financial estimates, we have only included an 80 percent contribution for those projects which may be eligible in the future to receive State and/or Federal funds. These projects include improvements along Perkins Street and 6th Avenue.

Estimated funding forecasts using only existing revenue sources are identified in **Table A-2** for selected years. It should be noted that the funding forecasts do not include potential depreciation, operation and maintenance costs associated with the facilities nor do they include increases due to inflation. The amounts listed are in year 2006 (or real) dollars.

Table A-2
Future Funding Forecasts for Selected Years Using Only Existing Funding Sources
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Year	Projected Sales Tax Revenues Available for Transportation	Projected Developer Impact Fee Revenues	Projected State or Federal Funds for Eligible Projects*	Total Available Revenues from Existing Funding Sources
2006	2,997,342	190,471	0	3,067,342
2010	3,399,139	188,727	398,720	3,986,586
2020	5,169,848	212,190	3,696,720	9,078,759
2030	7,862,971	238,853	0	8,101,824

*Note: State or Federal Funds are assumed to be available only for eligible projects along 6th and Perkins and vary from year to year depending upon the implementation schedule of those projects.

Project Cost Estimates

The total cost of developing short-term projects is estimated to be approximately $61.3 million, as discussed in Chapter 5. These projects would be implemented sequentially each year from 2007 through 2019. Project cost estimates include not only construction costs, but also estimated right-of-way acquisition costs and utility relocation costs. The construction costs used in the financing plan are considered order-of-magnitude. The specific investments covered for these projects are delineated in **Table A-3**. The amounts listed in Table A-3 are listed in year 2006 (or real) dollars.

The total cost of long-term projects is estimated to be about $84.3 million. The long term projects would be implemented between 2020 and 2030. **Table A-4** summarizes the estimated costs for the proposed long-term projects, as discussed in more detail in Chapter 5. The amounts listed in Table A-4 are listed in year 2006 (or real) dollars.

Table A-3
Estimated Construction and Right-of Way Cost for Short-Term Projects
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Year	Project and Limits	Projected Cost ($)
2007-08	Jardot 2 to 4 lanes - McElroy to 6th	5,700,000
2008-10	12th 2 to 4 lanes - Western to Duck	6,385,000
2010	6th Ave Signal Improvements	200,000
2010	6th Ave Interconnect	105,600
2010	Perkins Signal Improvements	140,000
2010	Perkins Interconnect	52,800
2010	Centralized Control	300,000
2010-2011	12th 2 to 4 lanes - Main to Perkins	1,635,500
2011-2012	Lakeview 2 to 4 lanes - Husband to Jardot	5,485,600
2012-2013	Western 2 to 4 lanes - 6th to 12th	2,900,000
2013	Perkins 4 to 5 lanes - Lakeview to McElroy	2,741,900
2013-2015	McElroy 2 to 4 lanes - Western to Boomer	7,939,900
2015-2016	Jardot 2 to 4 lanes - Lakeview to McElroy	3,637,100
2016	6th 4 to 5 lanes - Western to Jardot	9,067,600
2016-2018	Western 2 to 4 lanes - Lakeview to Hall of Fame	6,535,300
2018-2019	Western 4 to 6 lanes - Hall of Fame to 6th	4,320,900
2019	Virginia 2 to 4 lanes - Perkins to Jardot	4,180,600
Total Short Term Projects		**$ 61,327,800**

Table A-4
Estimated Construction and Right-of Way Cost for Long-Term Projects
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Year	Project and Limits	Projected Cost ($)
2020	Perkins 3 to 4 lanes - Richmond to .5mi N Airport	1,530,900
2020	Perkins 4 to 5 lanes - .5mi N Airport to Lakeview	3,090,000
2020	Western 2 to 4 lanes - 19th to 32nd	3,547,800
2020-2022	19th 2 to 4 lanes - Range to Western	11,127,300
2022-2024	McElroy 2 to 4 lanes – Country Club to Western	7,470,400
2024	Perkins 2 to 4 lanes - Yost to Richmond	7,600,000
2024-2025	32nd 2 to 4 lanes - Western to Perkins	7,354,800
2025-2026	Lakeview 2 to 4 lanes - Country Club to Western	7,370,000
2026-2027	Richmond 2 to 4 lanes - Washington to Perkins	3,575,000
2027-2028	Sangre 2 to 4 lanes - 6th to 32nd	7,118,200
2028-2030	Country Club 2 to 4 lanes - Lakeview to 44th	17,795,500
2030	Boomer 2 to 4 lanes - 15th to Perkins/US177	6,755,000
Total Long Term Projects		**$ 84,334,900**

FUNDING PLAN

Future funding forecasts using existing funding sources were compared to project cost estimates to determine if existing funding sources were adequate to finance the recommended Transportation Enhancement Plan. Future funding sources only include the dedicated sales tax, developer contributions, and State and Federal funds. All amounts listed are in year 2006 (or real) dollars and neither revenues nor costs have been adjusted for inflation. Both revenues and costs would increase due to inflation, since revenues are primarily based on sales taxes. This assumes that inflation of project costs (asphalt, concrete, etc.) occurs at a similar rate as inflation of consumer goods (which translates to increased sales tax revenue).

A year by year summary of revenues verses expenditures is provided in **Table A-5** for the short term program and **Table A-6** for the long term program. As illustrated in the tables, existing funding sources provide the necessary funds to completely fund the short-term program between 2007 and 2019 and fund the long-term program between 2020 and 2030.

Table A-5
Short Term Funding Plan – 2007 to 2019
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
REVENUE AND FUNDING SOURCES (in $)														
Local Funds														
Sales Tax	2,997,342	3,125,699	3,259,553	3,399,139	3,544,703	3,696,500	3,854,798	4,019,875	4,192,021	4,371,538	4,558,744	4,753,966	4,957,548	50,731,427
Developer Impact Fee - Residential	96,250	97,694	99,159	100,646	102,156	103,688	105,244	106,822	108,425	110,051	111,702	113,377	115,078	1,370,293
Developer Impact Fee - Commercial	86,000	86,688	87,382	88,081	88,785	89,495	90,211	90,933	91,661	92,394	93,133	93,878	94,629	1,173,270
Caryover from Previous Year	-	179,592	289,673	340,767	458,954	579,098	693,183	815,056	932,686	1,054,892	1,173,255	1,296,834	1,427,755	
Subtotal Local Funds	**3,179,592**	**3,489,673**	**3,735,767**	**3,928,634**	**4,194,598**	**4,468,783**	**4,743,436**	**5,032,686**	**5,324,792**	**5,628,875**	**5,936,834**	**6,258,055**	**6,595,010**	
State & Federal Funds			-	398,720	-	-	2,193,520	-	-	7,254,080	-	-	-	9,846,320
TOTAL PUBLIC FUNDS	**3,179,592**	**3,489,673**	**3,735,767**	**4,327,354**	**4,194,598**	**4,468,783**	**6,936,956**	**5,032,686**	**5,324,792**	**12,882,955**	**5,936,834**	**6,258,055**	**6,595,010**	**63,121,310**
CAPITAL EXPENDITURES														
Short Term Projects														
Jardot 2 to 4 lanes - McElroy to 6th	3,000,000	2,700,000												5,700,000
12th 2 to 4 lanes - Western to Duck		500,000	3,395,000	2,490,000										6,385,000
6th Ave Signal Improvements				200,000										200,000
6th Ave Interconnect				105,600										105,600
Perkins Signal Improvements				140,000										140,000
Perkins Interconnect				52,800										52,800
Centralized Control				300,000										300,000
Jardot 2 to 4 lanes - Lakeview to McElroy									1,760,000	1,877,100				3,637,100
6th 4 to 5 lanes - Western to Jardot										9,067,600				9,067,600
Perkins 4 to 5 lanes - Lakeview to McElroy							2,741,900							2,741,900
McElroy 2 to 4 lanes - Western to Boomer							1,330,000	4,100,000	2,509,900					7,939,900
12th 2 to 4 lanes - Main to Perkins				580,000	1,055,500									1,635,500
Western 2 to 4 lanes - 6th to 12th						850,000	2,050,000							2,900,000
Western 2 to 4 lns - Lakeview/Hall of Fame										765,000	4,640,000	1,130,300		6,535,300
Western 4 to 6 lanes - Hall of Fame to 6th												3,700,000	620,900	4,320,900
Lakeview 2 to 4 lanes - Husband to Jardot					2,560,000	2,925,600								5,485,600
Virginia 2 to 4 lanes - Perkins to Jardot													4,180,600	4,180,600
TOTAL CAPITAL EXPENDITURES	**3,000,000**	**3,200,000**	**3,395,000**	**3,868,400**	**3,615,500**	**3,775,600**	**6,121,900**	**4,100,000**	**4,269,900**	**11,709,700**	**4,640,000**	**4,830,300**	**4,801,500**	**61,327,800**
FINANCING SURPLUS/(GAP) (nominal $)	**179,592**	**289,673**	**340,767**	**458,954**	**579,098**	**693,183**	**815,056**	**932,686**	**1,054,892**	**1,173,255**	**1,296,834**	**1,427,755**	**1,793,510**	**1,793,510**

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Table A-6
Long Term Funding Plan – 2020 to 2030
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOTAL
REVENUE AND FUNDING SOURCES (in $)												
Local Funds												
Sales Tax	5,169,848	5,391,240	5,622,113	5,862,873	6,113,942	6,375,764	6,648,798	6,933,524	7,230,443	7,540,077	7,862,971	70,751,592
Developer Impact Fee - Residential	116,804	118,556	120,334	122,139	123,972	125,831	127,718	129,634	131,579	133,552	135,556	1,385,676
Developer Impact Fee - Commercial	95,386	96,149	96,918	97,694	98,475	99,263	100,057	100,858	101,665	102,478	103,298	1,092,241
Caryover from Previous Year	1,793,510	1,674,569	1,810,514	1,932,581	2,065,286	2,196,276	2,329,334	2,464,907	2,600,923	2,738,409	2,877,516	1,793,510
Subtotal Local Funds	**7,175,549**	**7,280,514**	**7,649,881**	**8,015,286**	**8,401,676**	**8,797,134**	**9,205,907**	**9,628,923**	**10,064,609**	**10,514,516**	**10,979,340**	
State & Federal Funds	3,696,720	-	-	-	6,080,000	-	-	-	-	-	-	9,776,720
TOTAL PUBLIC FUNDS	**10,872,269**	**7,280,514**	**7,649,881**	**8,015,286**	**14,481,676**	**8,797,134**	**9,205,907**	**9,628,923**	**10,064,609**	**10,514,516**	**10,979,340**	**84,799,740**
CAPITAL EXPENDITURES												
Long Term Projects												
Perkins 2 to 4 lanes - Yost to Richmond					7,600,000							7,600,000
Perkins 3 to 4 lanes - Richmond to .5mi N Airport	1,530,900											1,530,900
Perkins 4 to 5 lanes - .5mi N Airport to Lakeview	3,090,000											3,090,000
32nd 2 to 4 lanes - Western to Perkins					4,254,000	3,100,800						7,354,800
Richmond 2 to 4 lanes - Washington to Perkins							2,738,000	837,000				3,575,000
Western 2 to 4 lanes - 19th to 32nd	3,547,800											3,547,800
Lakeview 2 to 4 lanes - Country Club to Western						3,367,000	4,003,000					7,370,000
McElroy 2 to 4 lanes - Country Club to Western			1,089,000	5,950,000	431,400							7,470,400
19th 2 to 4 lanes - Range to Western	1,029,000	5,470,000	4,628,300									11,127,300
Country Club 2 to 4 lanes - Lakeview to 44th									6,399,000	7,637,000	3,759,500	17,795,500
Sangre 2 to 4 lanes - 6th to 32nd								6,191,000	927,200			7,118,200
Boomer 2 to 4 lanes - 15th to Perkins/US177											6,755,000	6,755,000
TOTAL CAPITAL EXPENDITURES	**9,197,700**	**5,470,000**	**5,717,300**	**5,950,000**	**12,285,400**	**6,467,800**	**6,741,000**	**7,028,000**	**7,326,200**	**7,637,000**	**10,514,500**	**84,334,900**
FINANCING SURPLUS/(GAP) (nominal $)	**1,674,569**	**1,810,514**	**1,932,581**	**2,065,286**	**2,196,276**	**2,329,334**	**2,464,907**	**2,600,923**	**2,738,409**	**2,877,516**	**464,840**	**464,840**

Analysis of New Financing Measures

It is important to note, as discussed above, that a major assumption in this financial plan is that inflation of project costs (asphalt, concrete, etc.) occurs at a similar rate as inflation of consumer goods (which translates to increased sales tax revenue). Project costs have already been adjusted to account for the dramatic construction cost increases seen in recent years, and it has been assumed that these large increases will level off in future years and closely follow inflation of consumer goods. The City of Stillwater should monitor these cost increases carefully in the coming years. Should sales tax revenues not grow consistent with historical levels or project costs increase at a rate higher than inflation, new financing measures will need to be implemented in order to fund the Transportation Enhancement Plan.

Alternative funding sources were analyzed in regards to their ability to supplement the existing sources of funds the City of Stillwater uses for transportation projects. These include the following:

- **Use Tax –** Since 1997, the City of Stillwater has received funds from a use tax in accordance with Ordinance #2562. The City has an agreement with Oklahoma State University, which results in the transfer of up to $600,000 annually to OSU, with the City retaining any use tax revenues in excess of $600,000. However, the funds in excess of $600,000 that are retained by the City are not dedicated to transportation improvements and are requested by many different City Departments to fund various City needs and services.

  Use taxes have grown at a historical annual average rate of 5.23 percent. To maintain conservative estimates of future use tax revenues, it has been assumed that the agreement with OSU will be extended through the forecast period. In this matter, only revenues that exceed $600,000 have been included in this analysis. If the agreement with OSU is not extended, the entire revenue stream generated from use tax could be used to finance the proposed investments. Assuming the use tax revenues continue to grow at the historical growth rate, use tax revenues available to the City would total more than $12 million between 2007 and 2030, with available funds ranging from an estimated $26,000 in 2008 to $1.3 million in 2030. Should additional transportation improvement funds be needed due to sales tax revenue shortfalls or project cost increasess, a portion of the use tax revenues could be requested.

- **Debt** - City of Stillwater officials have cited that new debt issuances could be used to finance transportation improvements. Based on discussion with City officials, it has been estimated that the city could potentially issue up to $20 million in debt financing for transportation activities. The debt would be repaid with general funds.

  The City's ability to issue new debt is impacted by a number of factors, which include the amount of outstanding debt, the legal debt margin, and coverage ratio, among other factors. The City's debt for nonpublic utility bonds is 10 percent of the

Stillwater Transportation Enhancement Plan

assessed value of the taxable property within the jurisdictional limits of the City of Stillwater (as certified by the Payne County Assessor) less the applicable debt.[1] In FY 2006, the City's net total assessed value was $215.1 million, the legal debt limit was $21.5 million, and the legal debt margin was $10.1. **Table A-7** summarizes the historical debt position of the City of Stillwater from FY 2000 through FY 2006.

Although the City's debt margin was as low as $0.5 million in FY 2001, the city's overall debt position has improved somewhat as assessed valuation has increased and the debt applicable to the debt margin has been gradually reduced. Notwithstanding, debt coverage ratios (both without and with the transfer of sales tax revenues) have decreased steadily since FY 2000.

Table A-7
City of Stillwater's Historical Debt Position, FY00-06
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Year	Debt Limit ($M)	Debt Applicable to Debt Limit ($M)	Legal Debt Margin ($M)	% of Debt Applicable to the Limit as % of Debt Limit	Debt Coverage Ratio w/o Sales Tax Transfer	Debt Coverage Ratio w/ Sales Tax Transfer
2000	14.5	8.5	6.0	58.7%	3.46x	5.51x
2001	15.5	15.0	0.5	96.7%	4.18x	6.25x
2002	16.2	14.6	1.6	90.2%	3.90x	5.89x
2003	17.5	13.8	3.7	78.8%	5.56x	8.37x
2004	18.4	13.0	5.4	70.5%	3.24x	4.79x
2005	19.7	12.2	7.5	61.9%	2.02x	3.81x
2006	21.5	11.4	10.1	53.0%	1.75x	3.48x

Source: City of Stillwater, Comprehensive Annual Financial Report for FY 2006

- **Gasoline Taxes and Vehicle Registration Taxes –** Both of these taxes are collected at the State level and distributed to Cities and Counties based on State law and apportionment formulas. This source of funds must be used to cover street and alley improvements, and is currently used by the City of Stillwater for maintenance activities through the general fund. Between both of these taxes, the City currently receives approximately $350,000 per year from the State.
- **Motor Vehicle Stamps** - Upon assignment of ownership of a vehicle, including transfers to other dealers, a motor vehicle tax stamp is required to be affixed by the selling dealer. A $3.50 revenue stamp to certificates of origin of the following new vehicles at the time of first sales includes: automobiles, trucks, motorcycles, travel trailers, manufactured homes, recreational vehicles, boats, and motors. All used vehicles, except manufactured homes and commercial trailers, require a revenue stamp also. This is a local government levy in lieu of ad valorem tax on inventories and is collected by county treasurer through the sales of revenue stamps.

1 Assessed taxable property represents the aggregate value real property, personal property, and public service property minus the aggregate value of the homestead exemption.

Used vehicle dealers must affix the revenue stamp to the title being assigned to the purchaser at the time of sale. This source of revenue currently goes directly to Payne County and does not provide revenue to the City of Stillwater.

- **Hotel/Motel Taxes –** The City of Stillwater hotel/motel tax was authorized by the City of Stillwater and a vote of the people in 1985. The 4 percent tax currently provides approximately $300,000 per year in revenues, which are transferred to the Stillwater Chamber of Commerce. The Chamber in turn is contracted with the Stillwater Convention and Visitors Bureau to use this tax to attract visitors, conventions and events to the Stillwater area. State law requires revenues from hotel/motel taxes to be used for economic development purposes. Using hotel/motel tax revenues to fund transportation improvements would require the improvement project to be directly related to economic development, such as a roadway improvement to improve access to a new industry or business.

- **Traffic Impact Fees –** The legislature has authorized cities to impose a traffic impact fee on new developments through the enablement of land development statues and police power regulations. Traffic impact fees ensure that new developments bear a proportionate share of the cost of new or improved roadway facilities needed to accommodate traffic demands generated by such development. In Oklahoma, several cities have instituted a traffic impact fee for new development based on a per unit fee system, such as a fee per single family residential unit or fee per square foot of retail development. Implementation of traffic impact fees vary widely throughout the country, as each state regulates the methodology in which traffic impact fees can be implemented.

The City of Moore, for example, passed a transportation impact fee ordinance in 1999 which requires developers to pay a fee according to the schedule in **Table A-7.** Transportation Impact Fees in the City of Moore are updated annually at the discretion of the Community Development Director. The Director adjusts the fees based on the most recent consumer price index published by the bureau of labor statistics.

The City of Moore also requires large scale developments to conduct a traffic impact study. The impact fees for those developments do not necessarily follow the fee formula in the table above, and, depending on the results of the study, may actually be higher than the calculated fee if additional roadway improvements are needed.

Table A-8
City of Moore Transportation Impact Fee Program
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Type of Use	Type of Assessment	Impact Fees	Impact Fees (1-06)
RESIDENTIAL			
Single Family R-1	Per Lot	$588.00	$647.00
Multi Family R-2, R-3, R-4	Per Unit	$588.00	$647.00
RETAIL AND COMMERCIAL*			
Fast Food, Gas or Convenience Stores (Generally less than 5,000 square feet)	Gross Square Feet	3.13	3.44
All other retail or commercial	Gross Square Feet	0.23	0.25
Office**	Gross Square Feet	0.23	0.25
Industrial***	Gross Square Feet	0.33	0.36
Institutional	Gross Square Feet	0.23	0.25

SOURCE: City of Moore, OK - (Ord. No. 247(99), 1/19/99; Ord. No. 511(05), 7/5/05)
*Commercial or Retail Developments that either generate two hundred (200) trips or greater per peak hour (A.M. or P.M.) or two thousand (2,000) or greater trips per day, or are fifty thousand (50,000) gross square feet or larger shall require the performance of a traffic impact study (TIS). The TIS shall be conducted by a qualified traffic engineer. Transportation impact fees or improvements shall be assessed based on the results of the study in lieu of the above impact fee.
**Office developments that are fifty thousand (50,000) square feet or larger shall require the performance of a TIS. The TIS shall be conducted by a qualified traffic engineer. Transportation impact fees or improvements shall be assessed based on the results of the study in lieu of the above impact fee.
***Industrial developments that are fifty thousand (50,000) square feet or larger shall require the performance of a TIS. The TIS shall be conducted by a qualified traffic engineer. Transportation impact fees or improvements shall be assessed based on the results of the study in lieu of the above impact fee.

Currently, the City of Stillwater collects a developer transportation fee (as described previously in this Appendix) of $350 per unit for new residential developments, which is almost half the amount collected by the City of Moore. The fee was implemented to replace the previous requirement of developers to construct roadway improvements directly along their frontage (i.e. the half street paving requirement). As discussed earlier, the total amount collected during the first program year (2007) is estimated at about $96,250, and by 2030, it is estimated that this amount is about $135,500 per year. This totals to approximately $2.7 million in additional funds between 2007 and 2030 to fund transportation enhancement projects. By doubling the impact fee requirements to approach the fees currently charged by the City of Moore, a total of approximately $2.7 million in additional funds would be available through year 2030.

- **Tolls –** A final source of new funds would be tolls. This potential source of funds is primarily only applicable to the proposed Stillwater Expressway project, which is recommended for inclusion beyond the 2030 time period of this financial plan. In addition, toll revenues could be secured to support the issuance of revenue bonds.

Appendix B – Functional Class Design Standards

Recommended Roadway Design Standards for Major Arterials

Major arterial standards need to reflect the primary function of a major arterial – movement of vehicles through the corridor. As discussed in earlier chapters of this report, all of the major arterials can be justified to be six lanes. However, existing land uses along most of the length of each street prevents the use of six lanes. If it is determined that some segments can be built to this standard, the typical section shown in **Figure B-1** should be adopted. With the total traffic volumes that warrants a six lane street, a dividing median as shown for this typical section should be used. This median is wide enough to protect most vehicles that would be trying to make a left turn from an intersecting street. The median also allows sufficient width for left turn lanes and can accommodate most U-turn movements.

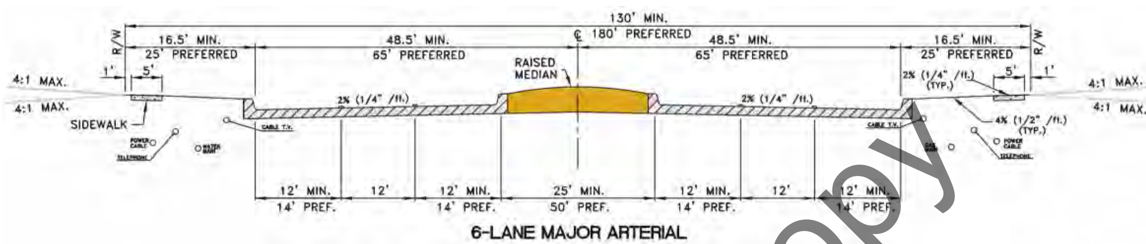

Figure B-1 Major Arterial Preferred Cross Section

Major arterials that are four lanes need to have either a median or a continuous left turn lane, also as shown on **Figure B-2.** The preferred median width will allow functions similar to those mentioned above for the six lane typical section. Only if additional right-of-way absolutely cannot be obtained should the minimum median width be used. Implementation of an access management policy should minimize the need for continuous left turn lane sections. Where existing development has resulted in closely spaced streets and drives, the five lane section may be the only viable alternative.

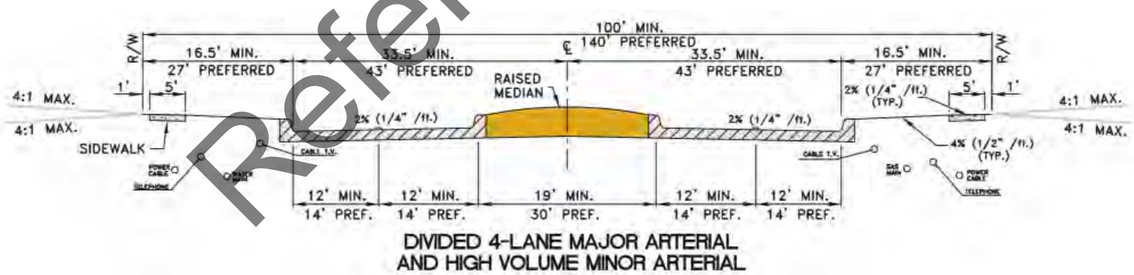

Figure B-2 Major Arterial Minimum Cross Section or High Volume Minor Arterial

Recommended Roadway Design Standards for Minor Arterials

Figure B-3 also shows the recommended standards for minor arterials. These sections can typically be built in a 100-foot right-of-way, but may require more due to terrain. For locations with higher traffic volumes and a number of street or driveway intersections, the five-lane section will be appropriate. The character of the land development in the arterial corridor will dictate if the "urban" or "rural" typical section will be used in locations that do not require a five lane section. Even in "rural" areas, these standards recommend the addition of a paved shoulder for all two lane arterials.

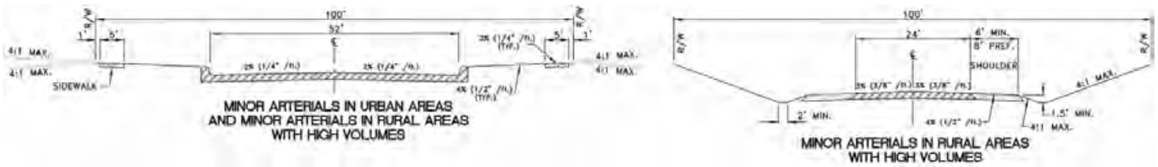

Figure B-3 Minor Arterial Preferred Cross Sections

Minor arterials are the highest classification of street for which bike lanes should be considered. **Figure B-4** shows the additional pavement that is required for a bike lane. This additional widening will be needed on both sides of the street. A critical feature is to pave the bike lane continuously with the same material, thereby minimizing edges. This results in offsetting the bike lane from the curb when a standard concrete gutter pan is used on an asphalt street.

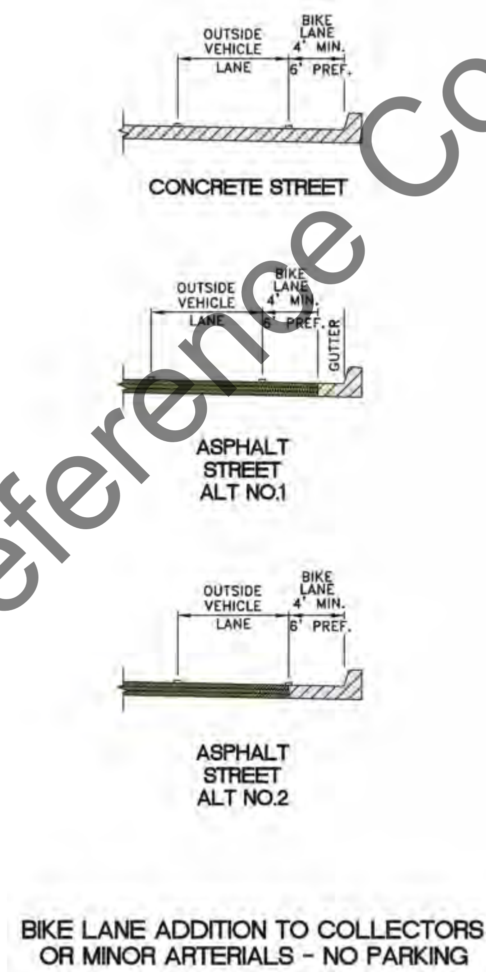

Figure B-4 Bike Lane Alternatives

Recommended Roadway Design Standards for Collectors

Figure B-5 shows the recommended typical sections for collectors. The 32-foot wide section can be used for access and parking. A 32-foot to 36-foot wide collector can be used for access and bike lanes. As shown, in **Figure B-6** a wider section is required if access, parking, and bike lanes are to be accommodated. **Figure B-7** shows the plan view.

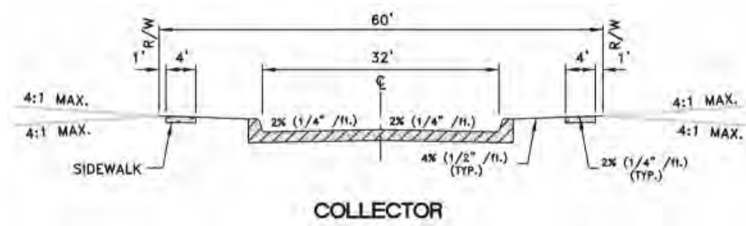

Figure B-5 Collector Minimum Cross Section

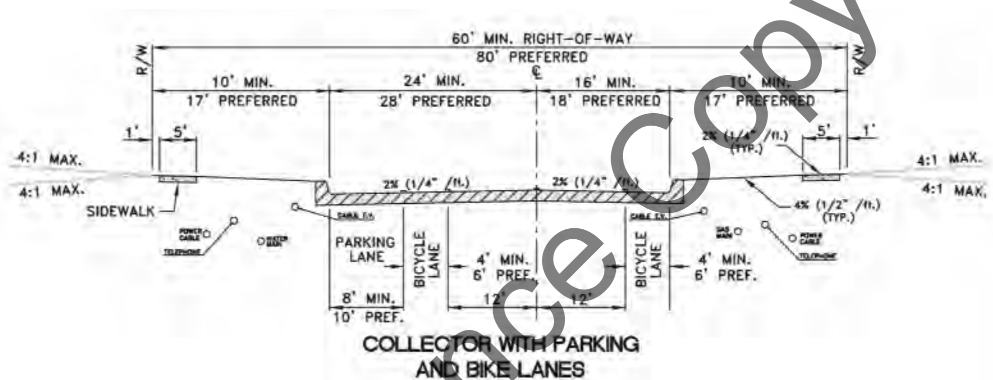

Figure B-6 Collector with Parking and Bike Lanes

Figure B-7 Plan View Collector with Parking and Bike Lanes

Appendix C – Policy and Performance Considerations

In addition to the roadway, transit, and bicycle/pedestrian improvements, it is recommended that the City of Stillwater implement a series of policy and performance improvements to help alleviate deficiencies that may remain with the Transportation Enhancement Plan improvements. These recommendations are summarized in three categories: transportation system management and ITS technology improvements, access management and driveway access control, and traffic impact analysis guidelines.

Transportation System Management and ITS Technology Improvements

In addition to the roadway, transit, and bicycle/pedestrian improvements, it is recommended that traditional traffic operational practices and transportation system management (TSM) techniques be employed at critical locations to alleviate deficiencies that may remain with the Transportation Enhancement Plan improvements. These types of improvements are typically cost effective methods that improve traffic flow by making better use of the existing transportation system. Examples of these improvements include provisions of intersection turn lanes and other geometric improvements, coordinated signal systems that efficiently accommodate travel demands and improve safety, effective utilization of traffic control devices, lane channelization, on-street parking prohibitions, and turn restrictions. Operational improvements are also important considerations in the interim when partial implementation of some thoroughfare improvements may cause capacity overloads on other system facilities. TSM improvements (including traffic signal timing upgrades, interconnect, and synchronization and the addition of left turn lanes at intersections) are recommended for 6th Avenue between Brush Creek and Sangre and for Perkins Road north of 6th Avenue.

An additional method to make better use of the existing roadway capacity is by the implementation of Intelligent Transportation Systems (ITS) technology. ITS measures use information technology to enhance travel and transportation system efficiency. ITS strategies maximize the public's capital investment in roadway facilities, reduce the immediate need for roadway expansion, lower some types of auto emissions, and reduce user costs due to traffic delay.

There are numerous types of ITS measures; however, not all are suitable for all types of land uses and transportation networks. For example, in a highly urbanized area closed circuit television cameras and ramp metering would be appropriate. Closed circuit television cameras are typically located to provide a complete coverage of a major roadway. The information on roadway conditions is then transmitted to a transportation center who conveys the roadway information either on-line, or via television or radio. Ramp metering uses traffic signals to control the flow of traffic at freeway entrance ramps so the combined freeway and ramp traffic does not exceed the capacity of the freeway. Obviously, these types of freeway related improvements are not applicable to the City of Stillwater. ITS measures that are appropriate for the City of Stillwater include:

- Dynamic Message Signs;
  - Traffic Signal Communication Systems; and,
  - Transit Technology Improvements.

Dynamic Message Signs are changeable signs used to communicate directly with motorists advising them of roadway conditions. Strategically located, they can provide up-to-date information that may cause motorists to change their travel route to avoid traffic congestion due to accidents, roadway construction, or weather conditions. The signs can either be constructed to be a permanent fixture or can be a moveable sign that can be transported. Potential uses in the Stillwater area include locations along US 177 and SH 51, particularly to direct traffic flow on OSU football game days.

Traffic Signal Communication Systems – Traffic Signal Optimization is a coordinated effort designed to make the most efficient use of signalized intersections by improving existing traffic signals with current traffic data and taking advantage of new technologies. Optimization usually involves re-timing and/or synchronizing traffic signals and coordinating each intersection throughout an entire corridor. The result will be smoother and quicker trips for volumes of traffic with maximum green time. Signal timing can be adjusted to improve mobility conditions during an isolated event. For example, for a major occurrence at OSU such as a football game, signal timing could be adjusted to provide improved traffic flow during the event.

ITS technology is useful to provide the communication infrastructure (both hardware and software) to make real-time traffic signal timing changes from a central control facility. Communication technology, such as fiber optic cable or radio transmissions, can connect traffic signals along a corridor together and provide for more efficient traffic flow. Signal corridors along 6th Avenue, Perkins, Hall of Fame, Western, Lakeview and McElroy all have potential applications for ITS technology. In the short term time frame, the Transportation Enhancement Plan has recommended implementation of traffic signal communication system improvements along 6th Avenue from Sangre to Brush Creek and along Perkins Road north of 6th Avenue.

Transit Technology Improvements – Transit ITS services include surveillance and communications, such as automated vehicle location (AVL) systems, computer-aided dispatch (CAD) systems, and remote vehicle and facility surveillance cameras. These systems enable transit agencies to improve the operational efficiency, safety, and security of transit service. In Stillwater, AVL and CAD systems would help the reliability of transit service and provide bus riders (particularly OSU students) with advance notice of bus arrival times at bus stops. This communication technology could also be incorporated into the City's traffic signal systems to provide for timing priority for transit vehicles. OSU has already begun the process of implementing transit ITS services for The Bus transit system.

Access Management and Driveway Access Control

In addition to the proposed roadway improvements identified in this plan, there are other non-capacity transportation-related recommendations that can enhance the transportation system in Stillwater, such as access management and driveway control. Access management is defined as protecting the capacity of existing transportation routes and systems by controlling access rights from adjacent properties. Access management techniques serve to limit and separate vehicle, as well as pedestrian conflict points, reduce locations requiring vehicle deceleration, remove vehicle turning movements from through lanes, create intersection spacings that facilitate signal progression, and provide adequate on-site capacity to accommodate ingress and egress traffic movements.

Limiting access of new developments will not require additional costs from the City. However, elimination of access rights will require compensation by the City.

Access management techniques are extremely important for managing congestion on existing transportation facilities. The implementation of applicable techniques, or a combination of techniques, can eliminate the need for expensive roadway widenings or potential right-of-way acquisitions. Studies have shown that increasing the signalized intersection spacing to uniform intervals of one-half mile and the use of a non-traversable median to restrict left-turns will increase the capacity of a four-lane urban arterial by about 50 percent as compared to quarter-mile signal spacing and unrestricted left-turns. This is the same increase in capacity that can be obtained by widening a four-lane divided arterial to six lanes. Also, safety will be increased and congestion reduced to a greater extent than by the roadway widening. Research has consistently shown that access management helps to reduce the rate and severity of traffic accidents and improves pedestrian and bicycle safety.

From a land development perspective, access management assists in the orderly layout and use of land and helps to discourage poor subdivision and site design. Poorly designed entrances and exits to major developments not only present a traffic hazard, but also cause increased congestion, which can create a negative image of the development. In addition, access management techniques, such as reducing the number and frequency of driveways and median openings, improve the appearance of major corridors. Scenic and environmental features can be increased, which improves the image of streetscapes and can attract additional economic development.

Access management relies on a variety of access control techniques to promote efficient vehicular movements. These include the following:

- Limit number of conflict points;
- Separate conflict points;
- Limit deceleration;
- Remove turning vehicles from through lanes;
- Space major intersections to facilitate progressive travel speeds along arterials; and,
- Provide adequate on-site storage to accommodate both ingress and egress traffic.

The City of Stillwater currently enforces some of these access management techniques through the Code, Codified through Ordinance No. 2889, adopted Aug. 15, 2005 (Supplement No. 31, Revision). **Table C-1** identifies access management techniques that are recommended to be implemented within the City of Stillwater, as well as their current status and enforcement.

Table C-1
Access Management Recommendations

Strategy	Existing Policy	Specifications	Application/ Purpose	Recommended Action
Signal Coordination and Signalized Intersection Spacing				
Signal Coordination	None	Traffic Signal Synchronization Programs and Actuated Signal Control	Improved progression on existing arterial streets.	Continue signal coordination efforts, primarily along 6th Avenue and Perkins
Signal Spacing	None	Major Arterials – Consistent ½ mile Minor Arterials - Consistent ¼ to ½ mile	New signal installations and proposed arterial roadways.	Develop policy to maintain consistent signal spacings on major and minor arterials
Medial Access				
Median Type	None	Major Arterials – Raised Medians Minor Arterials - Raised Medians (future volume > 20,000 vpd) or CTWLTL (future volume < 20,000 vpd)	Develop designated major arterials with raised medians and minor arterials with appropriate median type.	Adopt new roadway cross sections standards
Median Width	None	Major Arterials - Minimum 24 feet Minor Arterials - Minimum 24 feet	Median widths consistent with recommended roadway cross section standards.	Adopt new roadway cross sections standards
Median Channelization (Left-Turn Bays)	None	Major Arterials - At cross streets and major mid-block median openings Minor Arterials - Primarily at cross streets	Left-turn channelization provided to remove turning vehicles from traffic stream to improve vehicle flow.	Develop policy in conjunction with new roadway cross sections standards
Spacing of Median Openings	None	Major Arterials –Minimum 600 feet Minor Arterials - Minimum 450 feet	Minimum median spacing needed to limit speed differential between vehicles and reduce accident rate.	Develop policy in conjunction with new roadway cross sections standards
Marginal Access				
Driveway/ Unsignalized Intersection Spacing	Code, City of Stillwater, Updated August 15, 2005	The number of unsignalized intersections/driveways should be limited to 12 to 15 per mile for Arterials (minimum of 325 feet between intersections).	Reduces speed differential between through and turning vehicles and reduces accident rate.	Consider increasing driveway/ intersection spacing to 325 ft. on Major Arterials.
Right-Turn Bays	Code, City of Stillwater, Updated August 15, 2005	Provided at major intersections and major mid-block developments with high turning volumes (generally greater than 100 vph).	Improved traffic operations and reduced delay at signalized and unsignalized intersections.	Consider decreasing requirement from 500 peak hour vehicles to 250 peak hour vehicles.
Subdivision Access				
Collector Streets within a Subdivision	None	Connectivity through large subdivisions should be provided with collector streets that provide multiple access points to the arterial street system.	Reduces congestion at arterial access points and better distributes traffic flow to the adjacent roadway system.	Modify subdivision regulations to require collector streets without driveway access where appropriate.

Driveway access control should be considered by the City of Stillwater, including appropriate recommendations regarding the location, spacing, width, radius, and other design considerations for driveways on arterials, collectors, and local streets. The development of this type of policy or ordinance should include input from local officials, local residential developers, and local commercial developers and should be compatible with the Transportation Enhancement Plan.

TRAFFIC IMPACT ANALYSIS REQUIREMENTS

With an increasing level of development activity and an increase in traffic congestion, it has become evident that the City of Stillwater is in need of guidelines triggering the requirement for a TIA for new commercial and residential development. A review of other similar sized cities in Oklahoma reveals that TIAs are typically required only on a case by case basis, at the discretion of city staff, as shown in **Table C-2**. Larger cities do require TIAs, but the development size that requires a TIA varies from city to city. A comparison of development size to number of daily trips is presented in **Table C-3**, while a comparison of development size to number of peak hour trips is presented in **Table C-4.**

TIA requirements for development activity should be formally adopted by the City of Stillwater. Criteria should be developed for what type of activity will trigger the need for a TIA (zoning, subdivision platting, site plan approval, etc.), what level of development will trigger the need for a TIA (acreage, number of units, square footage of buildings, etc.), and who will perform the TIA (developer's consultant, on-call consultant, City staff, etc.). The Transportation Enhancement Plan recommends the city implement TIA requirements based on the number of trips generated by the proposed development during the project development phase, before a development gets approval for a site plan. The performance of a TIA for a particular development should be the responsibility of the developer, with the City responsible for review and approvals.

Table C-2
Existing Traffic Impact Analysis (TIA) Requirements in Other Cities
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

City	Approx. Population	Development Activity	When a TIA is Required	Development Size to Trigger TIA*
Bartlesville, OK	35,000	At the discretion of the City Engineer	None – Case by case basis	None – Case by case basis
Muskogee, OK	38,000	Case by case basis	None – Case by case basis	None – Case by case basis
Moore, OK	41,000	Case by case basis	None – Case by case basis	None – Case by case basis
Round Rock, TX	61,000	Zoning cases, site plans, subdivision platting	A traffic impact study shall be required for developments that generate 100 or more peak hour vehicle trips	Commercial – 27,000 sq. ft. shopping center Residential – 100 single family or 161 apartment units
Norman, OK	96,000	Any development (residential, commercial, mixed use)	When a development results in 100 vph increase or more	Commercial – 27,000 sq. ft. shopping center Residential – 100 single family or 161 apartments
Plano, TX	222,000	Zoning changes or preliminary site plan approvals, comprehensive plan amendments, annexations	Prepared for any project that generates more than 5,000 daily trips or where a development project could cause significant impacts.	Commercial – 116,000 sq. ft. shopping center Residential – 522 single family or 744 apartment units
Arlington, TX	333,000	Rezoning, platting, development plan approvals, Thoroughfare Plan amendments, and annexations	Required for any development proposal expected to generate 5,000 or more vehicle trips daily. For rezoning the trip generation of the proposed zoning must increase by 1,000 vehicle trips daily over the current zoning.	Commercial – 116,000 sq. ft. shopping center Residential – 522 single family or 744 apartment units
Oklahoma City, OK	506,000	Any development (at the direction of the traffic department)	Any development that is greater than ¼ section. Developments smaller than ¼ section may require an impact study if they are high traffic generators (ie. apartments)	At the discretion of the traffic department

* Source: Wilbur Smith Associates phone interviews, 2006.

Table C-3
Daily Trip Generation Rates for Common Land Use Codes
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Land Use	ITE Code	Size	Daily Trips (vpd)			
			Rate	In	Out	Total
Shopping Center	820	50,000 sq. ft.	42.94	1,074	1,073	2,147
	820	300,000 sq. ft.	42.94	6,441	6,441	12,882
Discount Superstore	813	200,000 sq. ft.	49.21	4,921	4,921	9,842
Single Family Residential	210	100 units	9.57	479	478	957
	210	500 units	9.57	2,393	2,392	4,785
Multi-Family Residential	220	100 units	6.72	336	336	672
	220	500 units	6.72	1,680	1,680	3,360
Fast Food w/Drive	934	3,750 sq. ft.	496.12	930	930	1,860

*Based on ITE Trip Generation Manual, 7th Edition.

Table C-4
Peak Hour Trip Generation Rates for Common Land Use Codes
Stillwater Transportation Enhancement Plan
Stillwater, Oklahoma

Land Use	ITE Code	Size	Peak Hour Trips (vph)**			
			Rate	In	Out	Total
Shopping Center	820	50,000 sq. ft.	3.75	90	98	188
	820	300,000 sq. ft.	3.75	540	585	1,125
Discount Superstore	813	200,000 sq. ft.	3.87	379	395	774
Single Family Residential	210	100 units	1.01	64	37	101
	210	500 units	1.01	318	187	505
Multi-Family Residential	220	100 units	0.62	40	22	62
	220	500 units	0.62	202	108	310
Fast Food w/Drive	934	3,750 sq. ft.	53.11	102	97	199

*Based on ITE Trip Generation Manual, 7th Edition.
**Peak Hour Trips are for PM Peak Hour, with the exception of the Fast Food Restaurant w/Drive Through in which they are AM Peak Hour trips.

Stillwater Transportation Enhancement Plan