SECTION 2

Travel Demand Modeling Data & Analysis

This section describes the technical procedures, assumptions and data input needed for the model estimation of future growth and travel patterns in Kootenai County.

KMPO Travel Demand Model

KMPO maintains a travel demand model, which was developed using nationally accepted computer software known as VISUM (*vĭ-zoom'*). The travel demand model allows KMPO to study regional travel patterns and to forecast the effectiveness of different investment strategies for the transportation system. Travel demand analysis assists in determining the need for future roadway improvements by examining traffic flow patterns and by forecasting population and traffic growth.

Model Inputs

The model relies on significant amounts of data inputs. These inputs are divided into land use data (housing unit and employment information) and transportation network data (layout and characteristics of regional roadways).

Land Use Data

A variety of land use data is used for model input and analysis:

- A regional household travel survey is used to estimate current travel behavior. KMPO's most recent survey was performed in 2005 to estimate current travel behavior within Kootenai County and neighboring Spokane County.
- Current housing statistics are gathered annually from Kootenai County.
- Building permit and plat information from local jurisdictions is reviewed.
- Current employment data are collected annually from the Idaho State Department of Labor. These data are evaluated to determine the geographic dispersion of jobs in categories such as retail, finance, insurance, real estate, industrial, utilities, transportation, medical and government.
- Information on recreational opportunities, hotels/motels, school enrollment, colleges, publicly owned properties, agriculture, and other land uses is collected through locally available sources.
- Future population and employment projections are prepared by KMPO staff and adopted by the KMPO Policy Board. The most recent projections, included in this MTP, were adopted in February 2009.
- Comprehensive plans for Kootenai County and other local jurisdictions are also consulted in order to estimate future land uses.

Transportation Network

The transportation network is a computerized representation of the street system. The network includes most routes within the study-area classified as collector or higher by the federal functional classification system (Section 3). Other roads are included to represent important local streets. The network is comprised of street segments that are represented in the computer model as links, and intersections that are represented as nodes. Links on the network contain attributes that influence modeled travel patterns, such as number of lanes, capacity and speed limit. Similarly, nodes are characterized by attributes such as control type (signalized, two-way stop, etc.) and intersection design. The layout and/or attributes of transportation network can be modified in order to study the effects of certain transportation projects.

A network of the study-area's existing (2007) street system was built using VISUM software. For the future model year (2030 Build), the base-year network was modified according to local transportation system plans and capital improvement programs.

Four-Step Model

Land use and transportation network data are input into a traditional four-step travel demand model in VISUM. The four-step modeling process has been used for more than 50 years, and is the methodology currently recognized by the Federal Highway Administration for projecting future travel demand. This method is used by most metropolitan planning organizations in the country.

The four-step process consists of four distinct procedures, generally described as follows:

- *Trip generation* is the first step in the process that determines how many daily trips are generated and attracted to each Transportation Analysis Zone (TAZ). A trip that is produced in a TAZ, such as a trip originating from a household in that TAZ, is called a production. A trip that is attracted to a TAZ is called an attraction. Trip generation produces an estimate of the number of trips produced and attracted to each zone. The number of productions and attractions in each TAZ is based on its residential and employment characteristics.

- *Trip distribution* is the second step in the process, linking the productions and attractions generated during the trip generation step into complete trips. In the KMPO model, trip distribution is based on a gravity model, which assumes that time spent traveling is perceived negatively. In other words, if every TAZ had an identical land use composition, trips between nearby TAZs are more likely to occur than trips between TAZs separated by large distances. The product of trip distribution is a trip table that contains the number of trips between all zonal pairs.

- *Mode choice* is the third step in the process and estimates what travel mode (i.e. transit, car, biking, walking) is being used for each trip, given the modes available. The automobile is the only travel mode available in the KMPO model, although it is possible to add other modes in future model updates.

- *Trip assignment* is the final step in the four-step process in which trips from each zone are assigned to the street network. The assignment is based on three factors: the logical shortest paths between origin and destination; the accumulation of vehicle trips on each link; and the computation of congestion reflected in vehicle speed.

After the initial iteration of the four-step process, the results of the trip assignment step are cycled back through the steps of trip distribution, mode choice and assignment. This feedback looping is repeated until the results of the latest iteration falls within a specified deviation of the previous iterations. When the iterations are complete, the results from the model are used to forecast the level of congestion that will occur. This becomes the basis for assessing overall performance of the transportation system.

KMPO's VISUM travel demand model documentation may be found in Appendix D. KMPO's Model Policy, which was adopted by the Policy Board in 2009, is provided in Appendix E. The policy outlines the model's intended use and establishes realistic expectations for model precision and accuracy.

It is important to note that travel demand projection is not an exact science. Unanticipated or unexpected land use and development patterns can occur. Also, human behavioral patterns with respect to travel may shift over time in response to changing technology and economic factors.

Model Calibration & Validation

Before the results of the model can be used to evaluate existing and future traffic conditions, the model must be calibrated and validated. Calibration is the process of adjusting a model's parameters to replicate goodness-of-fit measures which are a function of observed base-year data. Calibration is completed through a series of model simulation runs. Land use data, household and zonal trip generation rates, gravity model exponents, and various model parameters are reviewed and adjusted following each simulation run.

Once a model has been calibrated, it must be validated using data that was not used during calibration. Most often, this is done by comparing base-year modeled traffic volumes with observed traffic counts from the same time period. Acceptable deviation error by roadway type is established per procedures outlined in National Cooperative Highway Research Program, NCHRP 255.

A successful calibration and validation process confirms the suitability of the model in forecasting existing traffic patterns. Once the model can be shown to reasonably

replicate existing conditions, it can be used to forecast future conditions using forecasted land uses and planned network improvements.

KMPO's base model was most recently calibrated and validated in 2009.

Modeling Analysis Years

2007 Base Model

KMPO's base-year model (model year 2007) simulates existing traffic conditions using 2007 land use and population and the roadway infrastructure network as it existed in 2007. The base-year model provides a baseline from which to examine future traffic impacts of population growth and changes in land use and the transportation network. Current transportation conditions are described in Section 3.

2030 No-Build Model

The 2030 No-Build model simulates future traffic conditions assuming land use and population continue to grow and no improvements are made to the existing roadway infrastructure network.

2030 Build Model

The 2030 Build model simulates future traffic conditions, assuming land use and population continue to grow and improvements are made to the existing roadway infrastructure. Network improvements incorporated into the 2030 Build model are limited to financially-constrained project lists submitted by each jurisdiction. The future year models (2030 No-Build and Build) are described in Section 4.

Land Use Assumptions

The overall transportation system serves the underlying land use of an area. As such, there is a direct relationship between land use and transportation. Under the Federally enacted Safe and Efficient Transportation Equity Act - Legacy for Users (SAFETEA-LU), core metropolitan and statewide transportation requirements mandate the study of the relationship between land use and transportation. This act requires that transportation plans reflect land use plans, and prescribes a balance between future land use development and infrastructure needs.

As indicated at the beginning of this section, detailed land use data is one of the primary inputs into the regional travel demand model. Accurate information on existing and planned land use is the basis for KMPO's evaluation of existing system performance and is necessary to ensure that regional transportation investments are made appropriately.

Land Use Data and Forecasting

2007 Base Model

Travel patterns in the region are primarily defined by where people live, work and shop. Although people make many other types of trips – for medical, recreational and social purposes, for example – travel to and from our homes, places of work and retail centers dominate the regional transportation network. Table 2.1 identifies the categories of land use data used by KMPO to develop and maintain the regional travel demand model.

Table 2.1 Land Use Categories

Land Use Type	Description	Unit
1	Single Family Housing	# of housing units
2	Multi-family Housing	# of housing units
3	Retail Space	# of employees
4	Commercial Space (Office Space)	# of employees
5	Industrial / Other Space	# of employees
6	Schools	# of students
7	Hotel/Motel	# of rooms
8	Recreation	# of spaces
9	Outer Single Family Residential	# of housing units
10	Post Secondary Schools	# of students
11	Agriculture	# of acres
12	Waterfront Units*	# of housing units
13	Publicly Owned Land	# of acres
14	Utilities and Transportation	# of employees
15	Medical	# of employees
16	Government	# of employees

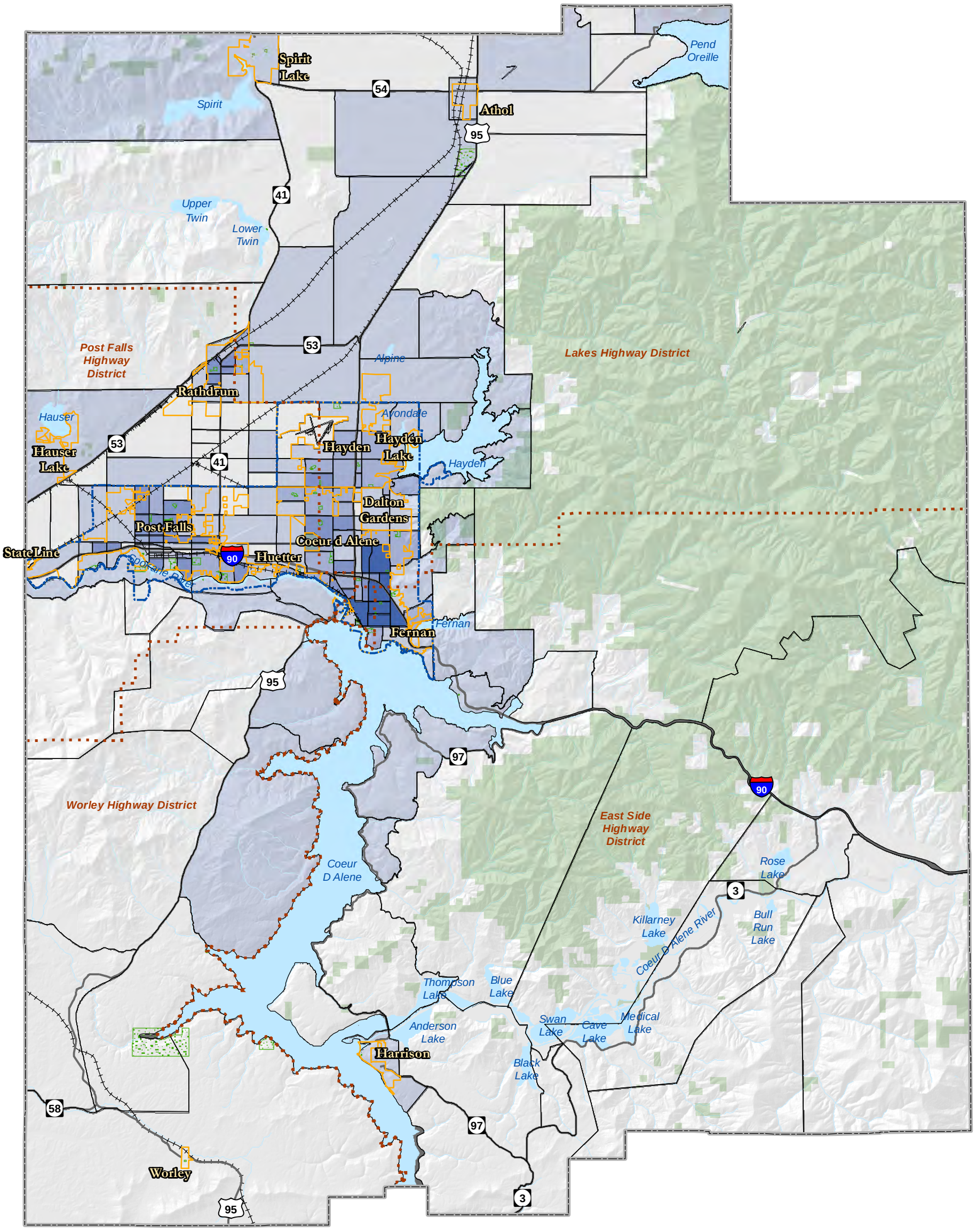
*Waterfront Units are not currently used as a separate land use category in the regional travel demand model. For trip generation, waterfront dwellings are currently treated as either single or multi-family dwellings.

Base-year land use data were derived from the Kootenai County Assessor's Office and GIS Department, Idaho Department of Labor, and KMPO staff research. Structure data from Kootenai County was used as the primary source for housing unit data. Manipulation of the dataset was done by KMPO GIS staff to remove non-residential and other extraneous structures, as well as to categorize structures into their respective Land Use Category with the correct number of units. The Idaho Department of Labor provided data used to populate Land Use categories 3-8, 10, 11, & 13-16. A number of these categories were completed or supplemented with additional staff research and/or Kootenai County Assessor's Office information. Using Spatial Overlay, all Land Uses were aggregated into their respective TAZ. These categorized Land Use values by TAZ are entered into the model as the base Land Use.

For population estimation, dwelling units were used as a starting point. With the total number of dwelling units calculated per TAZ, population estimates were derived by

multiplying the total number of units within each TAZ by the regional average number of persons per household according to the US Census Bureau.

Figures 2.1 through 2.3 display residential, employment and retail density for 2007.



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WHERE PEOPLE LIVE - 2007
BY TRANSPORTATION ANALYSIS ZONE

Housing Units Per Acre by TAZ

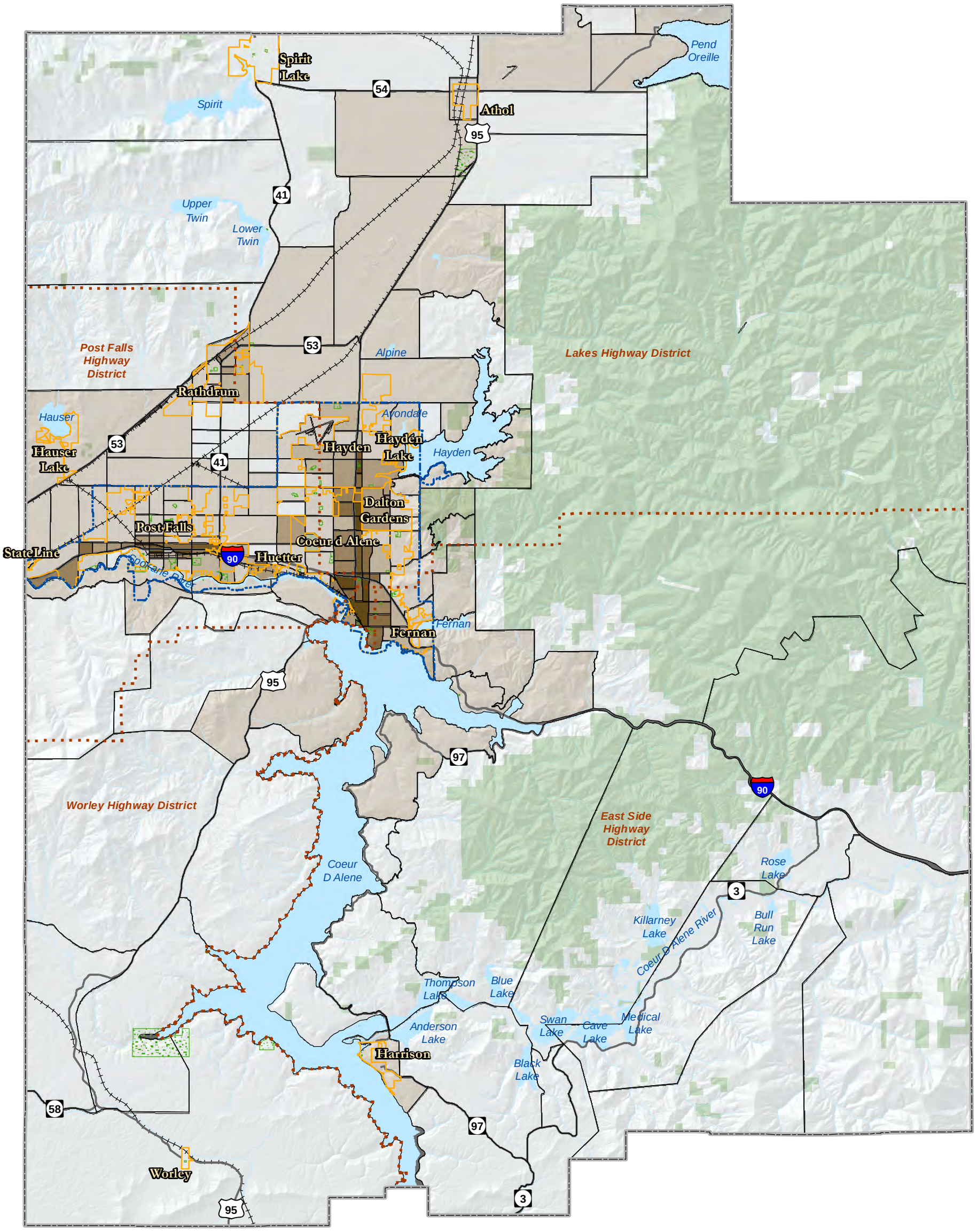
- < 0.05
- 0.05 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- > 5

Physical Characteristics

- Highway Districts
- Interstate
- US/State Highways
- Railroad
- Municipal Boundaries
- County Boundary
- Urban Area Boundary
- National Forests
- Water Features
- Parks

*Data based on best available information.*Data for illustrative purposes only.

Figure 2.1



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WHERE PEOPLE WORK - 2007
BY TRANSPORTATION ANALYSIS ZONE

Employees Per Acre by TAZ

- < 0.01
- 0.01 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

Physical Characteristics

- Highway Districts
- Interstate
- US/State Highways
- Railroad
- Municipal Boundaries
- County Boundary
- Urban Area Boundary
- National Forests
- Water Features
- Parks

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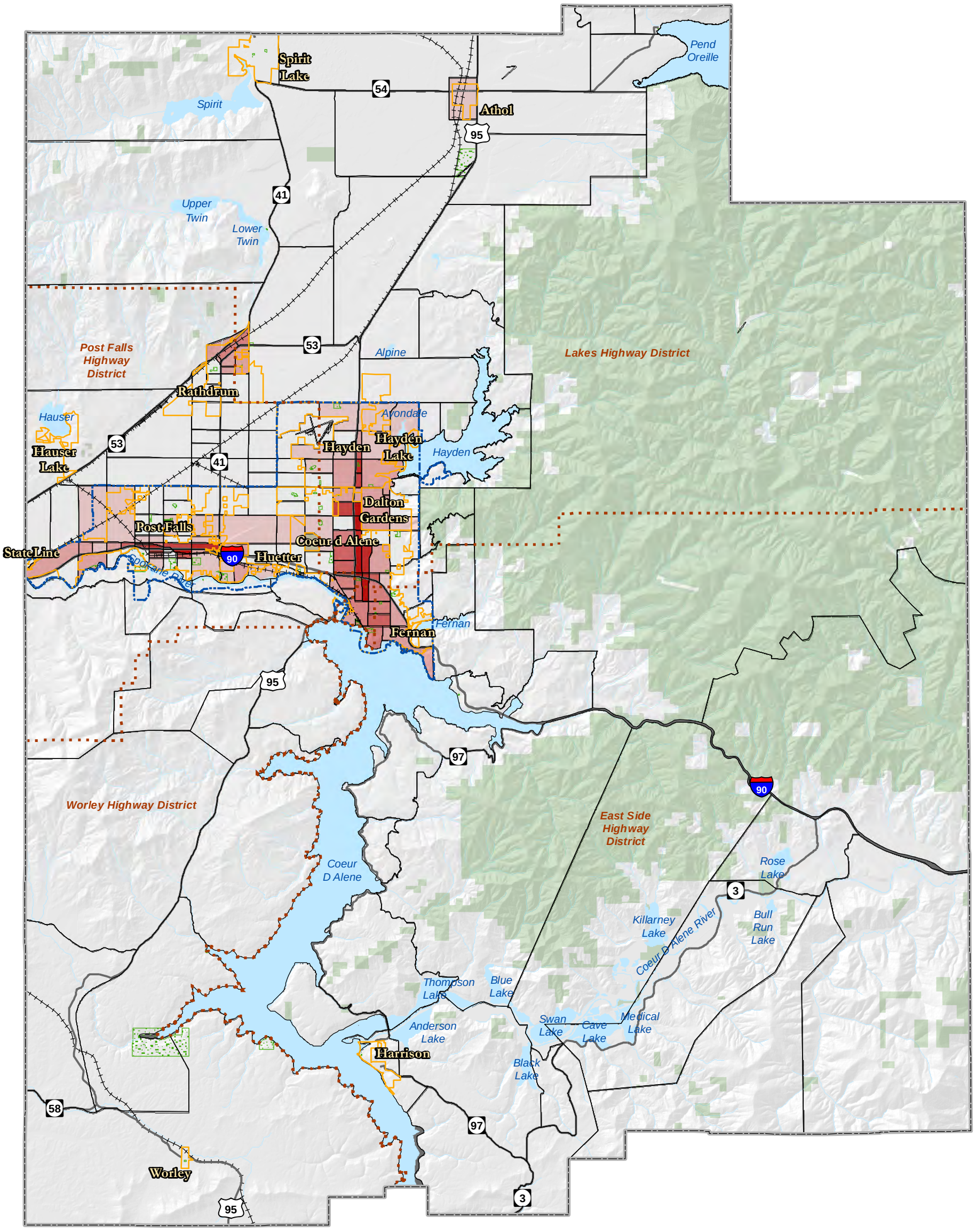
Figure 2.2



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WHERE PEOPLE SHOP - 2007
BY TRANSPORTATION ANALYSIS ZONE

Retail Employees Per Acre by TAZ

- < 0.02
- 0.02 - 0.1
- 0.1 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 5
- > 5

Physical Characteristics

- Highway Districts
- Interstate
- US/State Highways
- Railroad
- Municipal Boundaries
- County Boundary
- Urban Area Boundary
- National Forests
- Water Features
- Parks

*Data based on best available information.*Data for illustrative purposes only.

Figure 2.3

2030 Build and No-Build Models

Population and land use projections for Kootenai County are based on observations of where growth has occurred, where it is now occurring, and where it can and is likely to occur in the future.

Projecting the population for Kootenai County from 2007-2030 required a number of sources, including the US Census population count for 2000 and estimates for 2007. For the purposes of forecasting future transportation needs, KMPO used the following population growth assumptions:

- An average overall annual growth rate of 2.1% was assumed for Kootenai County.

- We have assumed that Kootenai County's largest city, Coeur d'Alene, will grow at an overall annual rate of about 1.8% through 2030.

- The highest increases in urban population and dwelling units are assumed to occur over the Rathdrum Prairie, as the cities of Post Falls, Rathdrum, Hayden annex additional land. Overall annual growth rates of 2.8%, 3.0% and 3.0% are assumed for these cities, respectively.

- Population levels within unincorporated portions of Worley Highway District and East Side Highway District are expected to remain relatively stable. These areas roughly correspond to the Worley, Mica, Bitterroot, East Lake Coeur d'Alene, and southern portion of Fernan Sub-Areas of Kootenai County's comprehensive plan. In these locations, a relatively slow rate of development in outer rural areas is expected to be offset as rural areas closer to Coeur d'Alene, Worley and Harrison are annexed.

- Although Post Falls Highway District will lose some rural lands to annexation near Post Falls, Rathdrum and Hayden, continued high rural growth rates are expected to occur within the remaining rural portions of this district. The County's comprehensive plan envisions concentrated development throughout the Rathdrum Prairie. KMPO assumed an overall annual rural growth rate of 2.1% for Post Falls Highway District, with higher growths over the Prairie balanced by lower growth rates in the northern portion of the district.

- Lakes Highway District is also expected to see additional rural growth, some of which will be offset by annexation of areas near Rathdrum, Hayden, Spirit Lake and Athol. Rural areas within Lakes Highway District roughly correspond to the Selkirk, North Kootenai and northern portion of Fernan Sub-Areas of Kootenai County's comprehensive plan. An overall annual rural growth rate for this highway district is assumed to be about 1.7%, with rural

development predominantly concentrated within the rough rectangle formed by Spirit Lake, Rathdrum, Hayden and Athol.

With these assumed population growth rates, Kootenai County is expected to add 25,036 new dwelling units by 2030. This will bring the county's overall population from its current (2007) total of 148,955 to approximately 241,845 by the year 2030 (Table 2.2). This represents a 2.1% annual growth rate, and total growth of 62%.

Table 2.2 Population Estimates, 2007-2030*

Location	2007	2030	Magnitude of Growth	% Growth
Kootenai County	148,955	241,845	92,890	62%
Coeur d'Alene	46,521	70,121	23,600	51%
Post Falls	24,688	46,594	21,906	89%
Hayden	13,496	26,636	13,140	97%
Rathdrum	7,153	14,118	6,965	97%

*Estimates derived by staff using data from jurisdictions and US Census

Figure 2.4 graphically depicts Kootenai County's existing and projected housing densities by TAZ.

KMPO staff developed population growth forecasts for the year 2030 as shown in Appendix F. The KMPO Board adopted the population growth forecasts in March 2009.

All land use categories (Land Use 1-16) were grown up at an overall annual growth rate of 2.1%. New Residential growth placement for MFDU's and SFDU's were typically placed at 20% and 80% respectively, depending on the land use zoning, existing build out or infill within in each TAZ of the jurisdictional boundaries. New Retail (Land Use 5) and Medical (Land Use 8) growth was typically placed at 70% in existing TAZ locations where growth was already occurring and 30% was hand-placed where new growth was expected to occur. Agriculture (Land Use 4) was estimated to decrease by 3% in the future out years. Figure 2.5 depicts Kootenai County's existing and projected commercial and industrial density by TAZ.

Various references were used to assist in the process, including but not limited to: Land use maps, subdivision maps, zoning maps, demographic analysis, project studies, strategic plans, comprehensive plans and Avista ortho photos.

The population and employment growth forecast totals were originally presented to each jurisdiction for placement. All jurisdictions elected that KMPO distribute and place all future growth and later presenting it to them for review. KMPO staff worked with each jurisdiction during the entire land use update process. All jurisdictions reviewed the draft land use forecasts, distribution and corrections made by KMPO staff. The final land use was recommended by KCATT and approved by the KMPO Board on August 6, 2009.

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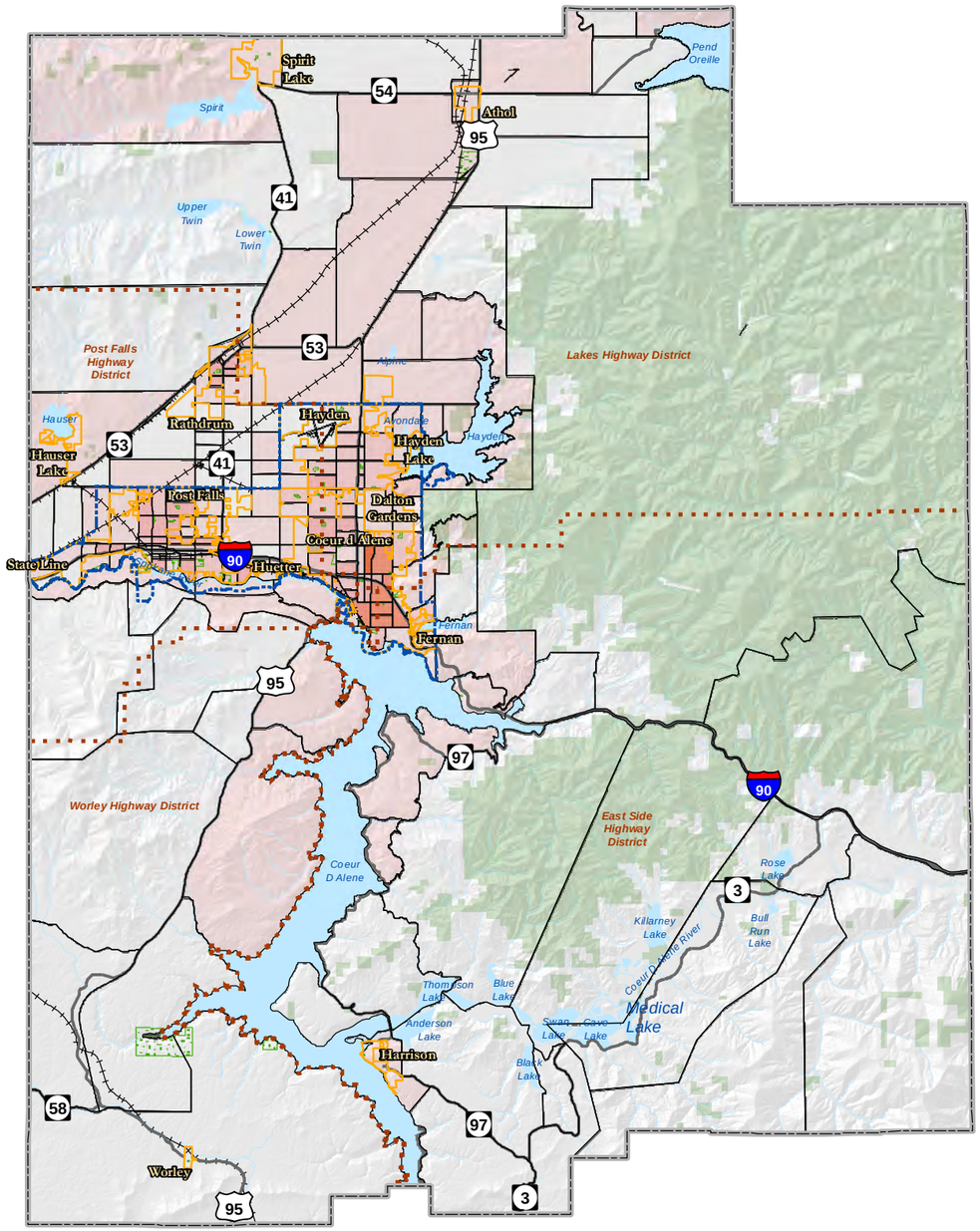
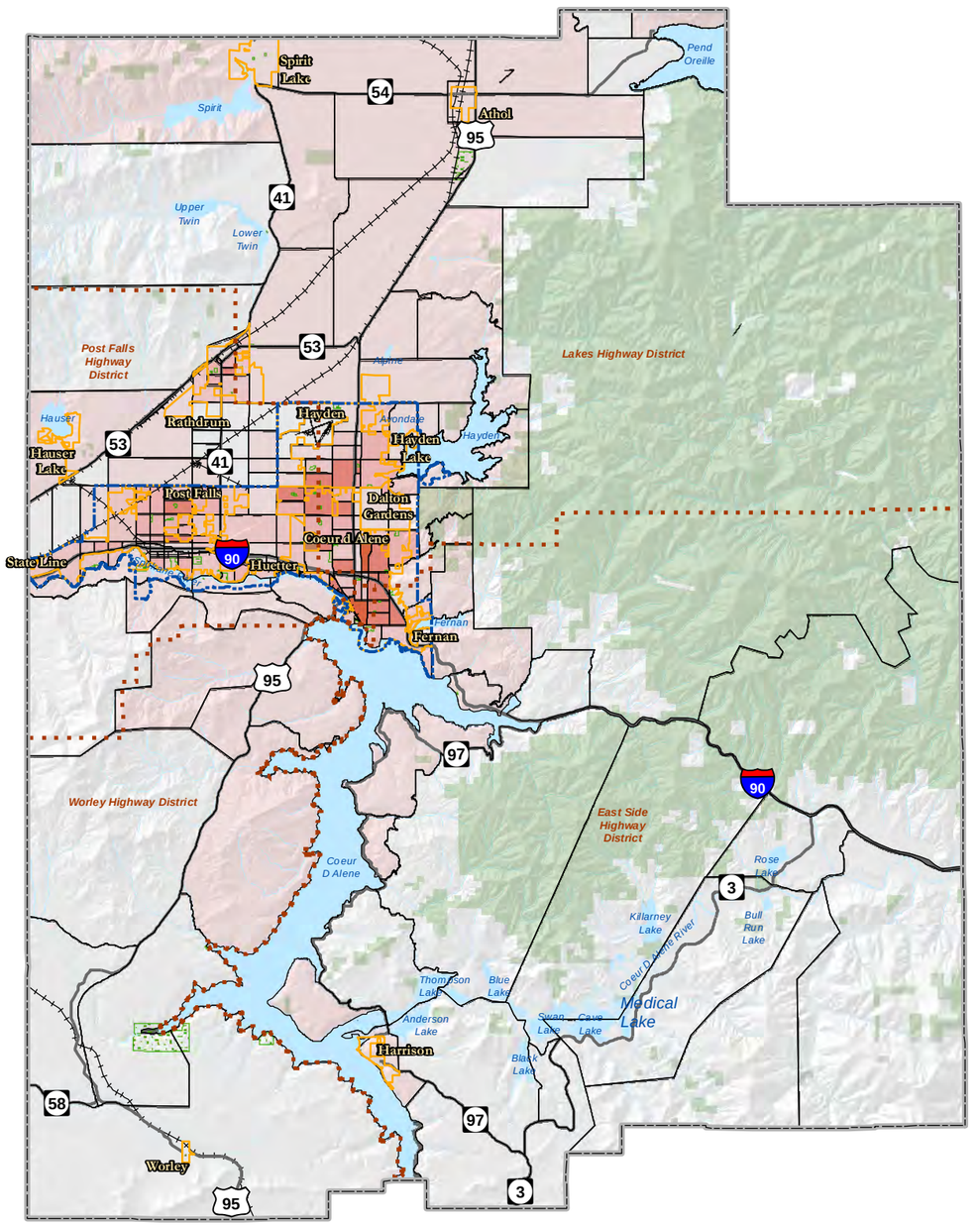
2007



2030



Kootenai County Existing & Projected Housing Density by TAZ 2007 and 2030

Housing Units Per Acre by TAZ

- < 0.05
- 0.05 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- > 5

Physical Characteristics

- Highway Districts
- Interstate
- US/State Highways
- Railroads
- Municipal Boundaries
- County Boundary
- Urban Area Boundary
- National Forests
- Water Features
- Parks

*Data based on best available information.
*Data for illustrative purposes only.

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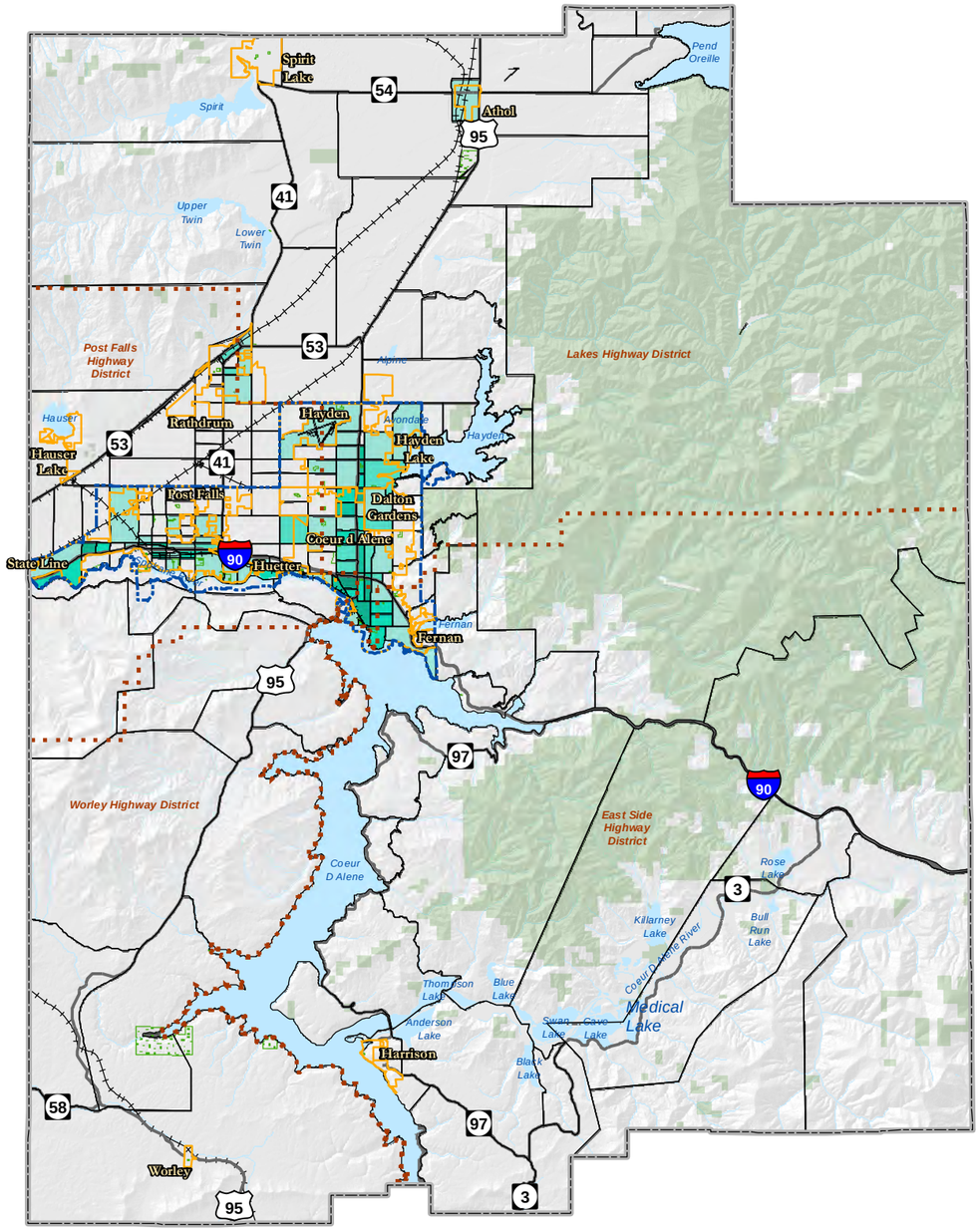
KOOTENAI METROPOLITAN TRANSPORTATION PLAN
2010-2035

2007



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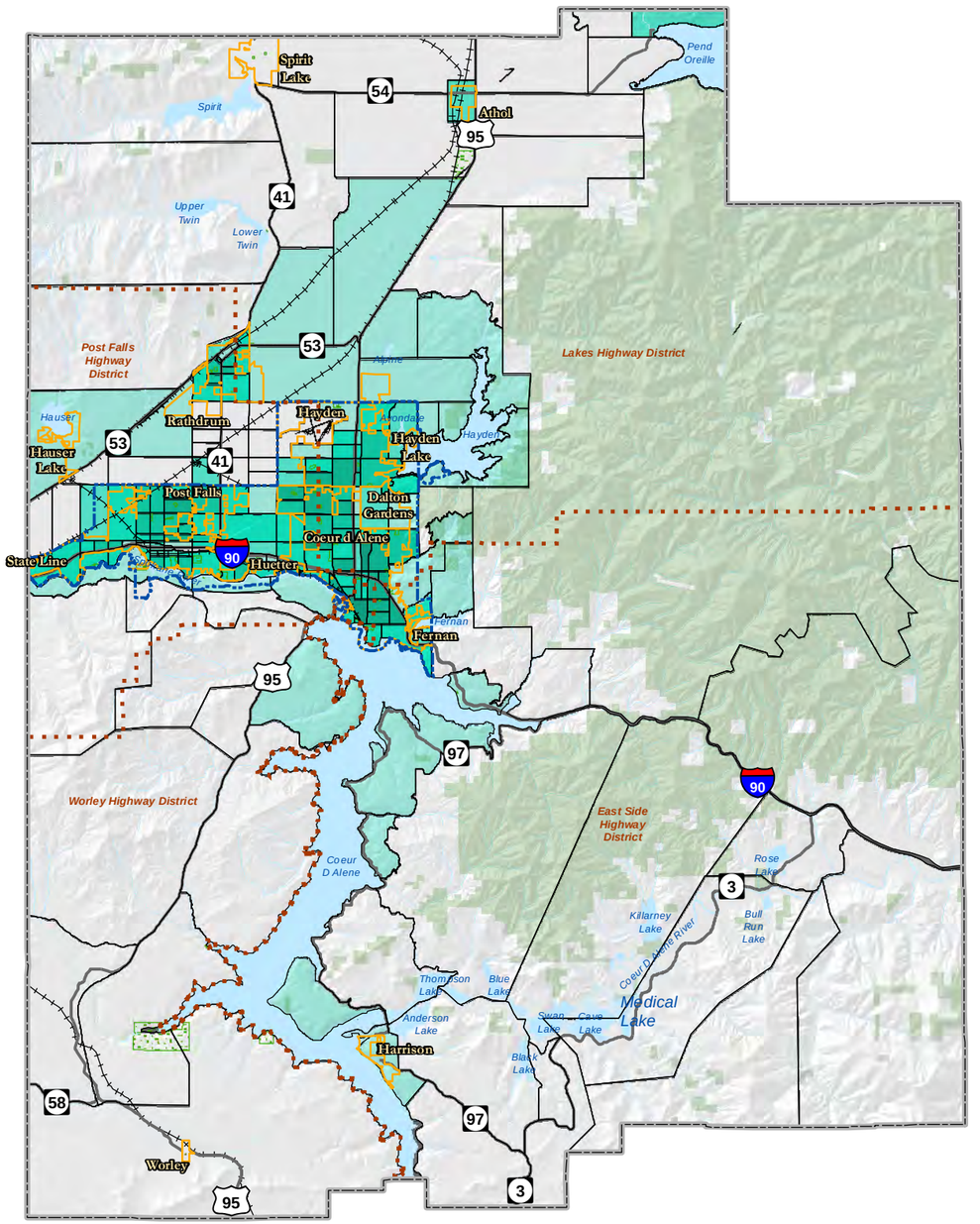

Kootenai County Existing & Projected Commercial & Industrial Density by TAZ 2007 and 2030

Employees Per Acre by TAZ

- < 0.1
- 0.1 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

Physical Characteristics

- Highway Districts
- Interstate
- US/State Highways
- Railroads
- Municipal Boundaries
- County Boundary
- Urban Area Boundary
- National Forests
- Water Features
- Parks

*Data based on best available information.
*Data for illustrative purposes only.

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Anticipating Growth Patterns

KMPO recognizes that actual growth and development may not occur exactly as forecasted due to fluctuating market conditions, infrastructure funding availability, and other factors. To keep current with changing conditions, KMPO collects annual housing and employment land use data to reflect ongoing building and platting activity approved by local agencies and jurisdictions. Future growth projections are revised accordingly with each update to the model.

Sometimes, developments are proposed which require amendments to adopted comprehensive plans. At other times, large development proposals may be consistent with local comprehensive plans, but inconsistent with localized growth patterns assumed for regional transportation planning. Consequently, major development proposals and potential comprehensive plan amendments can have unanticipated impacts on the regional transportation system. When this occurs, local jurisdictions may request KMPO to assist in reviewing the proposal's impact on the regional transportation system. The KMPO Policy Board has adopted a checklist that outlines KMPO's role in assisting local agencies with these analyses. This checklist is provided in Appendix G.