



Capital Improvements Advisory Committee **Staff Report**

Meeting Date: June 6, 2017

Subject: Land use conformance and capital improvements plan review

Applicant: Engineering and Capital Projects Division

Agenda Item Number: 8A

Summary: Review and affirm the Regional Road Impact Fee land use assumptions; and review the Regional Road Impact Fee Capital Improvement Plan and provide comments to the Washoe County Board of County Commissioners.

Recommendation: **For possible action pursuant to NRS 278B.150: (1) to affirm that the Regional Road Impact Fee (RRIF) land use assumptions are in conformance with the Washoe County Master Plan, (2) to review the RRIF Capital Improvements Plan (CIP) and direct staff to file comments on it, (3) to direct staff to file a report concerning the progress of the county in carrying out the CIP, (4) to direct staff to report to the Washoe County Commission any perceived inequities in the implementation of the CIP or the imposition of the RRIF, and (5) to direct staff to advise the Washoe County Commission of the need to update or revise the land use assumptions, CIP, or ordinance imposing the RRIF.**

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Description

The Planning Commission will convene as the Capital Improvements Advisory Committee (CIAC) to review the Regional Road Impact Fee (RRIF) Land Use Assumptions and to affirm that those assumptions are in conformance with the Washoe County Master Plan. The CIAC will also review the RRIF Capital Improvements Plan (CIP), see Exhibit A, and provide comments on the Plan to the Washoe County Board of County Commissioners (Board). Progress on the implementation of the CIP is shown on attached exhibits.

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RTC's Travel Demand Model.....	Exhibit B
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Background

The RRIF was created as a funding mechanism for regional roadway capacity improvements projects which are directly related to new development. Nevada Revised Statutes (NRS) 278B allows the imposition of such a fee. An impact fee is defined as a charge imposed by a local government on new development to finance the cost of a capital improvement or facility expansion necessitated by and attributable to the new development. The RRIF has been in effect since February of 1996.

NRS 278B.150 requires that a Capital Improvements Advisory Committee (CIAC) be established before any local jurisdiction can impose an impact fee. The NRS section further outlines the duties of the CIAC pertinent to reviewing the land use assumptions and the CIP which are the basis of an impact fee.

The duties of the CIAC include (pursuant to NRS 278B.150):

- (a) Review the land use assumptions and determine whether they are in conformance with the master plan of the local government;
- (b) Review the capital improvements plan and file written comments;
- (c) Every three years file reports concerning the progress of the local government in carrying out the capital improvements plan;
- (d) Report to the governing body any perceived inequities in the implementation of the capital improvements plan or the imposition of an impact fee; and,
- (e) Advise the local government of the need to update or revise the land use assumptions, capital improvements plan and ordinance imposing an impact fee.

Land Use Assumption Discussion

Pursuant to State law (NRS 278B.150), the land use assumptions which form the basis for the RRIF CIP and any associated impact fees must be reviewed by each local jurisdiction's CIAC.

This review should occur prior to any actions by the local jurisdiction to amend or modify the RRIF CIP.

As defined in NRS 278B.060, “land use assumptions” means projections of changes in land use, densities, intensities and population for a specified service area, over a period of at least ten years, and in accordance with the master plan of the local government. NRS 278B.100 defines “service area” as any specified area within the boundaries of a local government in which new development necessitates capital improvements or facility expansions and within which new development is served directly and benefited by the capital improvement or facility expansion as set forth in the capital improvement plan. The RRIF Program uses the Truckee Meadows Regional Plan prepared by Truckee Meadows Regional Planning Agency (TMRPA) as the basis for determining growth within the boundaries of the RRIF Service Areas. Washoe County’s regulatory zoning is input into Traffic Analysis Zones (TAZ’s), developing a model & traffic forecast which is included within the Regional Plan. The Regional Plan provides a blueprint for development within Washoe County over the next 20 years. The Regional Plan directs where growth will occur, identifies development constrained areas that are not suitable for future development, sets priorities for infrastructure development and addresses natural resource management.

The TMRPA maintains a regional population and employment projection forecast and coordinates with Reno, Sparks, and Washoe County to ensure their master plans, facilities plans and other similar plans conform to the provisions of the Regional Plan.

The geographic distribution of future population and employment is distributed to each parcel in the region using a land development model which estimates the probability of development using various factors, ie, approved but unbuilt development projects, vacant lands, planned land use and regulatory zones, topography, existing infrastructure, available public services, and other development suitability factors.

Population and employment growth by parcel is assigned to a TAZ within the RTC’s Travel Demand Model (TDM), see Exhibit B. The TDM forecasts travel behavior and travel demand for specific future time frames on the regional road network to determine the routes people will take from start (origin) to finish (destination). The resulting vehicle trips are used to determine which roadways may need capacity improvements over various timeframes.

Regional Road Impact Fee Capital Improvements Plan Discussion

In accordance with the provisions of the Interlocal Cooperative Agreement entered into by the Regional Transportation Commission (RTC), Washoe County, the City of Reno, and the City of Sparks, RTC is responsible for initiating periodic reviews of the RRIF program and proposing fee modifications to the participating local jurisdictions. The review process is undertaken by RTC in conjunction with the RRIF Technical Advisory Committee (RRIF TAC), which includes local government technical experts, development representatives from the private sector, members of the local Planning Commissions, and RTC staff.

Washoe County Code (WCC) Section 110.706.05 regulates regional road impacts fees for the unincorporated County. Washoe County has the responsibility to adopt the latest edition of the RRIF CIP by ordinance as specified in the General Administration Manual (GAM). The amount of the impact fees shall be determined by the local RRIF Administrator in accordance with the applicable provisions of the latest adopted edition of the GAM and the application of the fee schedule identified in the relevant table of the latest adopted edition of the RRIF CIP. The GAM shall contain appropriate definitions, an independent fee calculation study, exemptions, credits,

appeals and review sections for the effective administration of the program. It may subsequently be amended by a resolution approved by the Regional Transportation Commission Board and the Governing Bodies of each Participating Local Government.

Pursuant to State law (NRS 278B.150), the land use assumptions which form the basis for the RRIF CIP and any associated impact fees must be reviewed by each local jurisdiction's CIAC. This review should occur prior to any actions by the local jurisdiction to amend or modify the RRIF CIP. Consequently, the CAIC must review the land use assumptions prior to any actions by the Board of County Commissioners to amend or modify the RRIF CIP. State Law provides that the CAIC must be composed of at least five members, and that the Board may appoint the PC as the CAIC if at least one of its members represents the real estate, development or building industry. The Board took action on November 12, 2014 to appoint the PC as the CAIC. Ken Krater was appointed by the Board on May 9, 2017 to serve on the PC when it convenes as the CIAC to fulfill NRS requirements (Ken is the PC member representing the development industry). PC member

Progress in carrying out the Capital Improvements Plan

Exhibit C shows the progress in the Capital Improvement Plan for the north and south areas. There are 14 projects in the north service area and 20 on the south service area on the existing CIP. In the north area, the McCarren/N. Virginia, and the Sutro St multimodal improvements are complete. Under construction are the 4th St/Prater BRT I-80 to Vista, and the Pyramid Hwy/McCarran Blvd improvements. Annual projects include Intersection capacity improvements, traffic signal timing projects, ADA and bicycle pedestrian improvements. Plans for ramp capacity improvements at US395/Lemmon are initiated. The corridor study is complete and preliminary design has been initiated on Oddie Blvd/Well Ave Pyramid to I-80. Corridor and planning studies are complete on the Sparks Blvd McCarren to I-80, La Posada roundabout, Sun Valley multimodal and the Keystone Ave, I-80 to 7th St, multimodal projects.

In the south area, the McCarren Mira Loma to Greg widening, Sutro St multimodal improvement, and Plumb Lane shared use path are complete. Under construction are the 4th St/Prater BRT Keystone Ave to I-80 improvements, and the Southeast Connector. Annual projects include Intersection capacity improvements, traffic signal timing projects, ADA and bicycle pedestrian improvements. Kietzke Ln Multimodal improvements have a complete corridor study and spot safety improvements are under construction. Damonte Ranch intersections at I-80, Double R Blvd, and Virginia St and ramps at I-580/South Meadows are under design. NEPA has been initiated for Geiger Grade lane widening from Virginia to Toll. Corridor study and preliminary design underway on Oddie/Wells Multimodal Mill to Kuenzli, and Virginia BRT multimodal Plumb to liberty improvements. Corridor studies are complete on the Sparks Blvd Greg to i-80 widening, Mill St/Terminal multimodal improvements, Keystone multimodal California to I-80 and Wells Multimodal Kuenzli to I-80 I-80. US 395/Lemmon ramps have been identified for capacity improvements. Julie Masterpool from the RTC will further discuss the progress on the RRIF CIP at the Planning Commission's meeting.

Action by the Capital Improvement Advisory Committee

There are no guidelines or regulations in NRS or WCC Chapter 110 (Development Code) to guide a determination of conformance with the County's Master Plan, so staff suggests using pertinent findings from WCC Section 110.820.15(d) for the review of a Master Plan Amendment as the foundation for a finding of conformance. The pertinent findings, and associated staff comments, appear below.

1. Consistency with Master Plan. The land use assumptions are in substantial compliance with the policies and action programs of the Master Plan.

Staff comment: Land use assumptions are based on land uses and densities allowed in the Master Plan. The latest version of the Washoe County Master Plan was adapted by the Washoe County Planning Commission on May 20, 2010.

2. Response to Change Conditions. The land use assumptions respond to changed conditions or further studies that have occurred since the plan was adopted by the Board of County Commissioners and the assumptions represent a more desirable utilization of land.

Staff comment: Projected population and employment are based on the 2016 Consensus Forecast, see Exhibit D, which is the latest adopted Consensus Forecast and provides the changed conditions from the current RRIF.

3. Availability of Facilities. There are or are planned to be adequate transportation and other facilities to accommodate the uses and densities projected by the land use assumptions.

Staff comment: Planning Staff reviewed and commented on the draft 2016 Consensus Forecast, based not only on master plan categories within the County's Master Plan but also on adopted regulatory zoning. This allowed staff to comment on the potential transportation facilities required to support future growth within the limits of adopted master plan categories and regulatory zones.

4. Desired Pattern of Growth. The land use assumptions will promote the desired pattern for the orderly physical growth of the County and guide development of the County based on the projected population growth with the least amount of natural resource impairment and the efficient expenditure of funds for public services.

Staff comment: The 2016 consensus forecast is approved by the Truckee Meadows Regional Governing Board and includes the County's Master Plan categories and resulting adopted regulatory zones. RTC translates the consensus forecast into geographic centric areas for projection of growth and resulting demands for future transportation improvements. The RTC geographic areas used in developing the RRIF, therefore, mirror the desired growth pattern as established in the Washoe County Master Plan.

Pursuant to NRS 278B.150, the Washoe County CIAC must review the RRIF CIP and provide written comments on the CIP to the Washoe County Board of County Commissioners. Staff suggests the following possible comments be considered as the CIAC's comments to the Board. The CIAC should modify or drop these comments as appropriate, or add additional comments as needed.

1. *The RRIF Capital Improvement Plan is based on the County Master Plan and the 2016 Consensus Forecast.*
2. *The RRIF Capital Improvement Plan facilitates growth by constructing capacity improvements to the region's streets and highways that will benefit the efficient movement of persons and goods.*
3. *The North Service Area and South Service Area with separate Capital Improvements and Impact Fees are contributing to creating a reasonable nexus which is federal law concerning impacts fees levied on development.*

4. *The RRIF Capital Improvement Plan will not adversely impact the public health, safety, or welfare.*
5. *The RRIF Capital Improvement Plan is based upon a traffic model & traffic forecast. The Regional Plan provides a blueprint for development within Washoe County over the next 20 years; it directs where growth will occur, identifies development constrained areas that are not suitable for future development over the next 20 years.*
6. *A traffic model was used to forecast traffic volume on the existing infrastructure. This data was used to develop the RRIF Capital Improvement Plan.*

Recommendation

It is recommended that the Washoe County Capital Improvement Advisory Committee (CIAC) review the Regional Road Impact Fee Land Use Assumptions and affirm that those assumptions are in conformance with the Washoe County Master Plan. It is also recommended that the CIAC direct staff to provide its review and affirmation of Master Plan conformance to the Washoe County Board of County Commissioners.

It is further recommended that the CIAC review the Regional Road Impact Fee Capital Improvement Plan and direct staff to provide comments from the Committee in writing to the Washoe County Board of County Commissioners and that the CIAC direct the Committee Chair (the Planning Commission Chair) to review the written comments when prepared by staff and sign the comments on behalf of the Committee.

Motion

I move that after giving reasoned consideration to the information contained in the staff report and to information received during the meeting, the Washoe County Capital Improvements Advisory Committee affirm that the Regional Road Impact Fee Land Use Assumptions are in conformance with the Washoe County Master Plan. I also move to direct staff to provide this Committee's affirmation of Master Plan conformance to the Washoe County Board of County Commissioners.

I further move that the Washoe County Capital Improvements Advisory Committee provide the following comments on the Regional Road Impact Free Capital Improvement Plan in writing to the Washoe County Board of County Commissioners, and that the Committee Chair review the written comments when prepared by staff and sign the comments on behalf of the Committee.

xc: Dwayne Smith, Director, Engineering and Capital Projects Division
Mojra Hauenstein, Director, Planning and Development Division

Regional Road Improvements 2017-2021

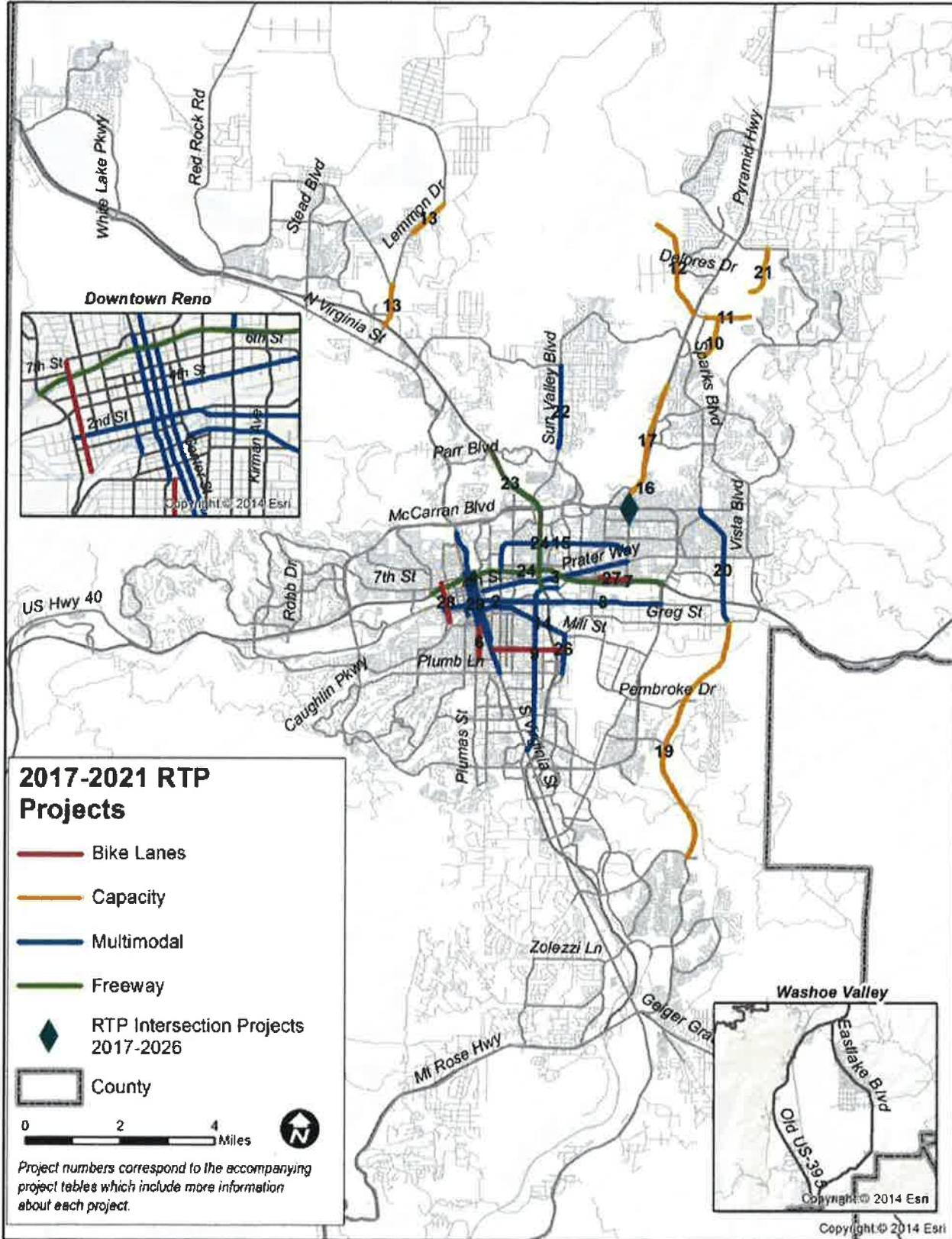
Program	Description	Annual Cost	Total Cost for FY 2017-2021 Period	Potential Funding Source	
A	ADA Accessibility Improvements	Spot improvements systemwide based on ADA Transition Plan	\$1 million per year	Federal/State/Local	
B	Pedestrian & Bicycle Facility Improvements	Spot improvements systemwide based on Bike/Ped Master Plan	\$1 million per year	Federal/State/Local	
C	Traffic Signals, ITS Operations & Intersections	Systemwide, including: La Posada at Cordoba Blvd roundabout; Damonte Ranch Pkwy at I-580 and Double R Blvd; W 4th & Washington, Evans & 9th	\$2.6 million per year	Federal/State/Local	
D	Pavement Preservation	Systemwide	\$18.7 million per year	Local	
E	Debt Service		\$27.3 million per year	Local	
Ref ID	Project	Limits	Description	Year of Expenditure Cost	Potential Funding Source
1	Arlington Ave	At Truckee River Bridge	Replace existing bridges (PE/NEPA)	\$500,000	Federal/Local/State
2	2nd Street	Keystone Ave to I-580	Multimodal improvements (corridor study completed) Phase 1	\$3,000,000	Federal/State/Local
3	4th St/Prater Way Bus RAPID Transit Project	Evans Ave to Pyramid Hwy	RAPID Extension & Complete Street Improvements	\$57,800,000	Federal/Local/State
4	Center Street	S Virginia to I-80	Widen sidewalks & add bike lanes	\$5,400,000	Federal/Local/State
5	Dolores Drive	Existing Dolores west to Lazy 5 Pkwy	New 2 lane road	\$1,500,000	Private
6	Forest Street	California Avenue to Mount Rose Street	Bike facility	\$4,100,000	Federal/Local/State
7	I-80	Rock Blvd to McCarran Blvd	Widen bridges to add travel lane in each direction	\$15,000,000	Federal/Local/State
8	Glendale Ave	Kietzke Ave to McCarran Blvd	Pavement reconstruction & multimodal improvements	\$16,400,000	Federal/State
9	Kietzke Ln	Virginia St to Galletti Way	Multimodal improvements (corridor study complete) Phase 1	\$3,800,000	Federal/Local/State
10	Kiley Pkwy	Wingfield Hills Rd to Henry Orr Pkwy	New 2 lane road	\$6,400,000	Private
11	Wingfield Hills Rd	Existing Wingfield Hills Rd west to David Allen Pkwy	New 4 lane road	\$5,000,000	Private
12	lazy 5 Pkwy	W Sun Valley Arterial to Pyramid Hwy	New 2 lane road	\$18,400,000	Private

Regional Road Improvements 2017-2021

Ref ID	Project	Limits	Description	Year of Expenditure Cost	Potential Funding Source
13	Lemmon Drive	US 395 to Military Rd and Fleetwood Dr to Arkansas St	Widen 4 to 6 lanes from US 395 to Military Rd and Widen 2 to 4 lanes from Fleetwood Dr to Arkansas St (PE & NEPA)	\$3,000,000	Federal/Local/State
14	Mill St/Terminal Way	Reno-Tahoe International Airport to Lake St (downtown Reno)	Multimodal improvements, intersection improvements, additional eastbound lane from Kietzke Ln to US 395, PE/NEPA (corridor study complete)	\$1,600,000	Federal/Local
15	Oddie Blvd/Wells Ave	I-80 to Pyramid Way	Multimodal improvements (corridor study complete)	\$37,600,000	Federal/Local
16	Pyramid Hwy	@ McCarran Blvd	Improve capacity, safety & multimodal access (under construction)	\$30,000,000	Federal/Local/State
17	Pyramid Hwy/US 395 Connector Phase 1	Queen Way to Golden View	Widen Pyramid to 6 lanes from Queen Way to Golden View (PE/NEPA)	\$5,000,000	Federal/Local/State
18	Sierra Street	California Ave to 9th St	Widen sidewalks & add bike lanes	\$4,400,000	State/Federal/Local
19	SouthEast Connector	South Meadows Pkwy to Greg St	New 6 lane road (under construction)	\$130,000,000	Local
20	Sparks Blvd	Greg to Baring	Multimodal improvements, widen 4 to 6 lanes from Greg to I-80, widen 4-6 lanes I-80 to Springland on the east side PE/NEPA (corridor study complete)	\$1,600,000	Federal/Local/State
21	Stonebrook Parkway	La Posada Dr to N/S Connector Rd	New 2 lane road	\$11,300,000	Private
22	Sun Valley Blvd	7th Ave to Pyramid Hwy/US 395 Connector	Multimodal improvements PE/NEPA (corridor study complete)	\$3,000,000	Federal/Local
23	US 395	N McCarran to Parr Blvd	Freeway widening PE/NEPA	\$1,500,000	Federal/Local/State
24	US 395/I-580/I-80	Spaghetti Bowl (Kietzke to N McCarran, Keystone to Pyramid)	Capacity expansion at Spaghetti Bowl, PE/NEPA	\$12,800,000	State/Federal
25	US 395/I-580/I-80	System wide ramps and freeways ITS	Freeway management/ITS project	\$14,600,000	Federal/Local/State
26	Vassar Street	Holcomb Avenue to Terminal Way	Bike lanes	\$4,300,000	Local
27	Victorian Avenue	16th Street to Pyramid Way	Bike lanes	\$2,300,000	Local
28	Vine Street	Riverside Drive to University Terrace	Bike lanes	\$3,200,000	Local
29	Virginia St Bus RAPID Extension	Plumb Ln to 17th St	Pedestrian improvements & pavement reconstruction	\$77,800,000	Federal/Local/State
Estimated Cost for Regional Road Improvements Plan FY 2017-2021				\$744,100,000	

- Purple Shading indicates annual programs
- Blue shading indicates multimodal projects
- Gold shading indicates capacity projects
- Pink shading indicates bike lanes
- Green shading indicates freeway projects

RTP Projects (2017 - 2021)



Regional Road Improvements 2022-2026

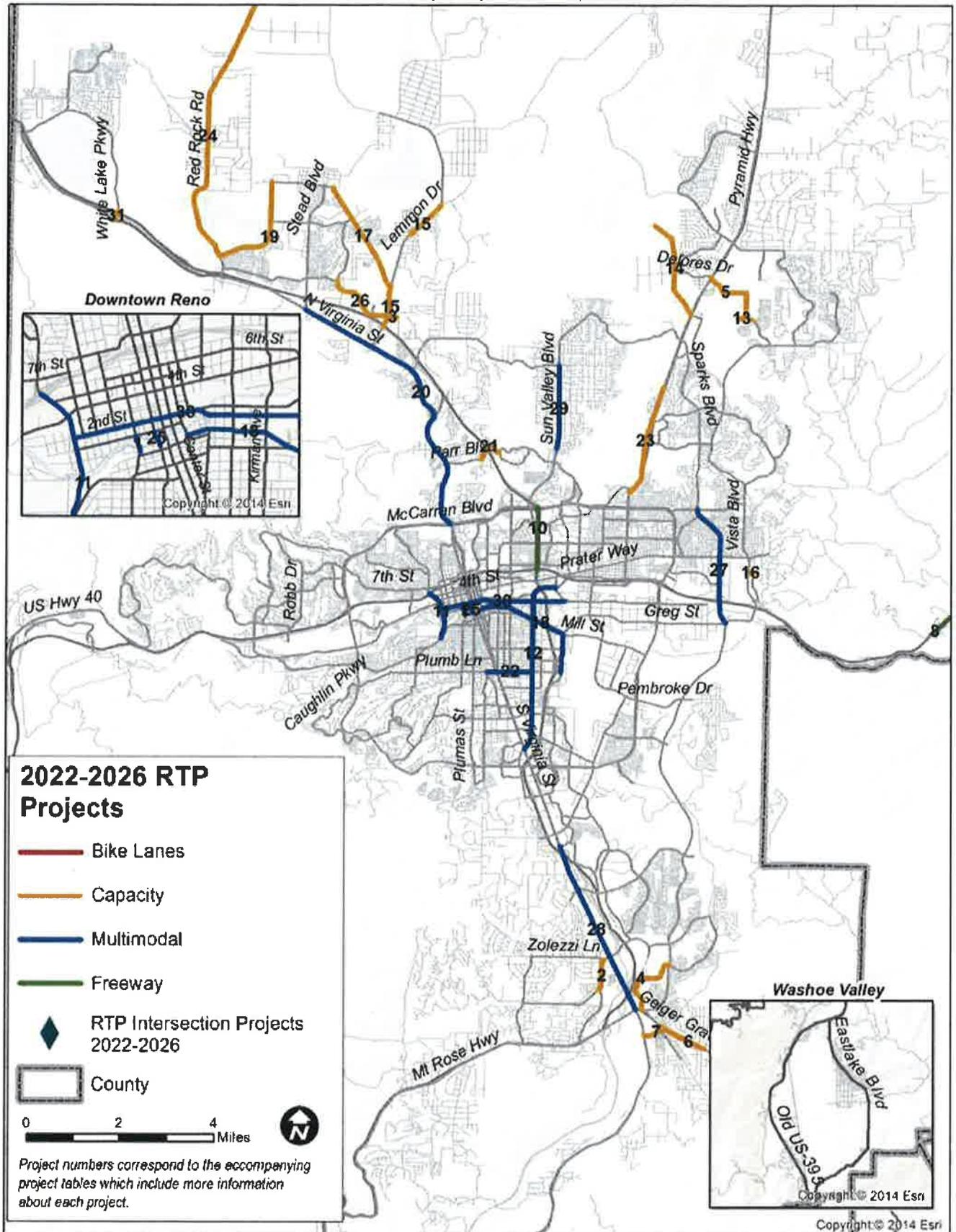
Ref ID	Program	Description	Annual Cost in Year of Expenditure Dollars	Total Cost for FY 2022-2026 Period	Potential Funding Source
A	ADA Accessibility Improvements	Spot improvements systemwide based on ADA Transition Plan	\$1.28 million per year	\$6,400,000	Federal/State/Local
B	Pedestrian & Bicycle Facility Improvements	Spot improvements systemwide based on Bike/Ped Master Plan	\$1.28 million per year	\$6,400,000	Federal/State/Local
C	Traffic Signals, ITS Operations & Intersections	Systemwide	\$3.32 million per year	\$16,600,000	Federal/State/Local
D	Pavement Preservation	Systemwide	\$23.8 million per year	\$119,000,000	Local
E	Debt Service		\$27.4 million per year	\$145,800,000	Local
Ref ID	Project	Limits	Description	Year of Expenditure Cost	Potential Funding Source
1	Arlington Ave	At Truckee River Bridge	Replace existing bridges	\$25,500,000	Federal/Local/State
2	Arrowcreek Pkwy	Wedge Pkwy to Zolezzi Ln	Widen 2 to 4 lanes	\$8,300,000	Private
3	Buck Dr	Lemmon Dr to N Hillis Blvd	Widen 2 to 4 lanes	\$1,700,000	Federal/Local/State
4	Damonte Ranch Pkwy	Veterans Pkwy to Rio Wrangler Pkwy	New 2 lane road	\$7,100,000	Private
5	Stonebrook Pkwy	N/S Connector Rd to Pyramid Highway	New 2 lane road	\$8,100,000	Private
6	Geiger Grade	Toll Rd to Rim Rock	Widen 2 to 4 lanes	\$26,300,000	Federal/Local/State
7	Geiger Grade Realignment	Virginia St to Toll Rd	New 4 lane road	\$75,100,000	Federal/Local/State/Private
8	I-80	East Truckee River Canyon	Safety improvements - add shoulders	\$9,000,000	Federal
9	I-80	Patrick Interchange	Interchange improvements	\$11,600,000	Private
10	I-80/I-580/US 395 (Spaghetti Bowl)	I-80/I-580/US 395 interchange & southbound lanes on US 395 from I-80 to McCarran Blvd	Operational & capacity improvements - widen US 395 to 8 lanes, Phase 1	\$93,500,000	Federal/Local/State
11	Keystone Ave	California to I-80	Multimodal improvements and Truckee River bridge replacement	\$58,600,000	Federal/State
12	Kietzke Ln	Virginia St to Galletti Way	Multimodal improvements (corridor study initiated) Phase 2	\$10,700,000	Federal/Local/State
13	N/S Connector Rd	Stonebrook Pkwy to Wingfield Hills Rd	New 2 lane road	\$8,400,000	Private
14	Lazy 5 Pkwy	W Sun Valley Arterial to Pyramid Hwy	Widen from 2 to 4 lanes	\$14,700,000	Private

Regional Road Improvements 2022-2026

Ref ID	Project	Limits	Description	Year of Expenditure Cost	Potential Funding Source
15	Lemmon Dr	US 395 to Military Rd and Fleetwood Dr to Arkansas St	Widen 4 to 6 lanes from US 395 to Military Rd and Widen 2 to 4 lanes from Fleetwood Dr to Arkansas St	\$12,300,000	Federal/Local/State/Private
16	Loop Rd	Salomon Circle to Eastern Slope Rd	New 2 lane road	\$4,900,000	Private
17	Military Rd	Lemmon Dr to Echo Ave	Widen 2 to 4 lanes	\$22,600,000	Federal/Local/State/Private
18	Mill St/Terminal Way	Reno Tahoe International Airport to Lake St (downtown Reno)	Multimodal improvements; construction (corridor study complete)	\$17,500,000	Federal/Local
19	Moya Blvd	Red Rock Rd to Echo Ave	Widen 2 to 4 lanes	\$17,500,000	Federal/Local/State/Private
20	North Virginia St	Stead Blvd to McCarran Blvd	Sidewalks and bike lanes. An off-street shared-use path may be considered	\$28,100,000	Federal/Local/State
21	Parr Blvd	Ferrari McLeod to Raggio Pkwy	Interchange improvements	\$7,700,000	Federal/Local/State
22	Plumb Lane	Lakeside Drive to Kietzke Lane	Sidewalks and bike lanes	\$8,200,000	Federal/State/Local
23	Pyramid Hwy/Sun Valley/US 395 Connector Phase 1	Queen Way to Golden View	Widen Pyramid to 6 lanes from Queen Way to Golden View	\$50,500,000	Federal/Local/State
24	Red Rock Rd	Moya Blvd to Evans Ranch Access	Widen 2 to 4 lanes	\$51,800,000	Federal/Local/State/Private
25	Sierra St	At Truckee River Bridge	Replace existing bridge	\$19,100,000	Federal/Local/State
26	Sky Vista Pkwy	Lemmon Dr to Silver Lake Rd	Widen 2 to 4 lanes	\$8,900,000	Federal/State/Local
27	Sparks Blvd	Greg to Baring	Multimodal improvements, widen 4 to 6 lanes from Greg to I-80, widen 4-6 lanes I-80 to Springland on the east side (corridor study complete)	\$56,200,000	Federal/Local/State
28	South Virginia Street	E Patriot Blvd to Mt. Rose Hwy/Geiger Grade	Add sidewalks and bike lane, convert travel lane to bus/bike lane	\$18,000,000	Federal/Local/State
29	Sun Valley Blvd	7th Ave to Pyramid Hwy/US 395 Connector	Multimodal improvements (corridor study complete)	\$52,700,000	Federal/Local
30	W 2nd Street (Reno)	Keystone Avenue to Galletti Way	Enhanced sidewalks, landscaping, bike lanes	\$10,500,000	Local/State
31	Whitelake Parkway	Between US 395 ramp terminals	Widen 2 to 4 lanes	\$7,700,000	Private
Estimated Cost for Regional Road Improvements Plan FY 2022-2026				\$1,047,000,000	

- Purple Shading indicates annual programs
- Blue shading indicates multimodal projects
- Gold shading indicates capacity projects
- Pink shading indicates bike lanes
- Green shading indicates freeway projects

RTP Projects (2022 - 2026)



APPENDIX G

Technical Documentation for the Population/Employment and Travel Demand Models and Level of Service Standards

Appendix G: Technical Documentation for the Population/Employment and Travel Demand Models and Level of Service Standards

The regional travel demand model is an essential tool for long-range planning, engineering, and public transportation operations. The model projects future travel demand and conditions on regional roads, which is essential data for scenario studies and policy analysis. The RTC TransCAD activity-based travel demand model incorporates demographic data from the 2010 U.S. Census, 2015 American Community Survey, and 2016 Washoe County Consensus Forecasts for population and employment developed by the Truckee Meadows Regional Planning Agency (TMRPA).

Population and Employment Model

TMRPA developed the population and employment forecasts used in the regional travel demand model in partnership with RTC, NDOT, Washoe County, Reno, and Sparks. TMRPA developed an allocation based model to visually display a variety of population growth scenarios. The Washoe County Consensus Forecasts were developed in 2016 and establish the long range total population projections for Reno, Sparks, and unincorporated Washoe County. Full documentation of the Consensus Forecasts is available on the TMRPA website at <http://www.tmrpa.org/2016-consensus-forecast/>.

The geographic distribution of future population was based on issues such as approved building permits, existing land use, zoning, topography, existing and planned infrastructure, and public services. Historical growth trends and the transit oriented development (TOD) district policies that seek to direct future growth to the urban center were incorporated.

Table G-1. 2016 Consensus Forecast Totals

Households, Population and Employment within the Reno/Sparks Travel Demand Modeling Area						
Model Year	2015	2020	2025	2030	2035	2040
Households	178,903	191,376	202,373	212,233	220,946	228,916
Population	417,047	454,270	481,466	505,871	527,559	547,413
Employees	267,029	287,958	307,279	329,331	355,863	384,590

Travel Demand Model

The RTC travel demand model uses the tour-based or activity-based travel demand modeling (ABM) approach, which provides better model reliability. In contrast to the traditional, aggregated, and 4-step modeling procedures developed beginning in the 1950s Urban Transportation Planning Package, the ABM focuses primarily on trip behaviors and travel patterns of disaggregated individuals.

To better capture and explain regional traffic patterns, ABM incorporates sub-procedures such as choice of travel time of day, destination and mode selection of travel, and choice of activity patterns. Those sub-procedures are based on individual travel characteristics. As a result, this modeling tool provides better model predictability with more realistic, individual traffic patterns.

This travel demand model requires a wide variety of data inputs. The major data categories that fed the construction of the model are shown in Table G-2.

Table G-2. Major Input Data Descriptions for the Travel Demand Model Conversion/Upgrade Project

Data No.	Input Data Description	Main Data Source/Provider
1	Household survey data for 2005	RTC Planning Department
2	Area road network coding data for 2005, 2010, 2015, 2020, 2025, 2030, 2035, and 2040	RTC Planning Department
3	EMME program codes	RTC Planning Department
4	Land use/socio-economic data	TMRPA
5	2005 Washoe County transportation profiles	American Community Survey
6	District/TAZ group information	RTC Planning Department
7	Intersection turn movement volume data	RTC Engineering Department
8	Transit network and operations statistics	RTC Public Transportation Department
9	Transit ITS field data (2005, 2010; number of passengers boarding/ alighting per stop, bus stop location)	RTC Public Transportation Department
10	Truck field count data	Nevada Department of Transportation
11	Traffic field count data, location list from HPMS (2005, 2010)	Nevada Department of Transportation
12	Maps of transit oriented development (TOD) and Regional Centers	TMRPA
13	Regional road information	RTC Engineering Department
14	Student, faculty, and employee information (origin-destination information) from UNR	University of Nevada, Reno
15	Student, faculty, and employee information (origin-destination information) from TMCC	Truckee Meadows Community College
16	Number of workers by origin TAZ (home location)	TMRPA
17	Special events, Ball Park game day, time, and patron origin information	EDAWN, Aces Ballpark
18	Air passenger future demands (Reno-Tahoe & Reno-Stead)	Reno-Tahoe Airport Authority
19	Area type base map for area type road classification	RTC Planning Department
20	School bus schedule	Washoe County School District
21	Truck road (industrial dedicated road) map & data	City of Reno, City of Sparks, Washoe County

For data item No. 1 in Table G-2, RTC provided the latest, comprehensive and area-wide transportation survey, which was conducted in 2005. The Washoe County Travel Characteristics Study consists of four sub-surveys: Household Travel Survey, Transit On-board Survey, Visitor Travel Survey, and External Station Study. The survey data was utilized as major input data for development of parameters and coefficients of the model calibrations as well as filed data to validation of model estimations.

In this process, RTC defined six future study years for this RTP; 2015, 2020, 2025, 2030, 2035, and 2040.

TMRPA provided land use and socio-economic data. The agency developed a socio-economic and land use forecasting model to allocate the Consensus Forecast population and employment totals by jurisdiction to parcels and traffic analysis zones as shown below. TMRPA also provided future estimates of for the socio-economic data. These socio-economic data include:

- Number of households within the TAZ during the year specified
- Number of people (not living in group quarters) within the TAZ during the year specified
- Number of people living in group quarters within the TAZ during the year specified
- Number of households of size X within the TAZ during the year specified
- Numbers of people in age groups 0 to 19, 20 to 54, and 55 and older living within the TAZ during the year specified
- Number of students enrolled in elementary school and middle school within the TAZ during the year specified
- Number of students enrolled in high school within the TAZ during the year specified
- Number of students enrolled in college (UNR and TMCC) within the TAZ during the year specified
- Numbers of households with income in the low range (less than or equal to \$35,000), medium range (\$35,000 to \$75,000), and high range (greater than \$75,000) within the TAZ during the year specified
- Number of employees within the TAZ during the specified year, in categories of:
 - Agriculture, mining and construction
 - Manufacturing, transportation, communications, utilities, and wholesale
 - Retail
 - Service and office
 - Gaming
 - Other

RTC included a truck travel demand sub-model in the main model to better understand the freight movement in and out of the region. NDOT collected, processed and summarized daily truck traffic data from the Highway Performance Measurement System. It was combined with truck-dedicated road networks from the City of Reno, City of Sparks, and Washoe County, yielding a well-performing truck travel sub-model.

After the final model program was developed, RTC, TMRPA, and NDOT staff validated the model outputs. The model output was utilized for the input data for Motor Vehicle Emission Simulator (MOVES), the air quality conformity analysis modeling tool developed by the U.S. Environmental Protection Agency and used by the Washoe County Health District -Air Quality Management District.

Level of Service

Level of service (LOS) is a term commonly used to measure the operational conditions for traffic flow, generally in terms of speed and travel time, freedom to maneuver, traffic interruptions and comfort and convenience. LOS is represented by the letters A to F; with A generally representing free flowing traffic

and F representing bumper to bumper traffic. The qualitative description of the conditions that correspond to each level of service is shown in Table G-3.

Table G-3. Level of Service Definitions

LOS	Condition of Traffic Flow
A	Free flow; individual users are virtually unaffected by the presence of others in the traffic stream
B	Reasonably free flow; the presence of other users in the traffic stream begins to be noticeable
C	Stable flow; each user is significantly affected by the presence of others
D	Approaching unstable flow; users experience poor level of comfort and convenience
E	Unstable flow; users experience decreasing speed and increasing traffic
F	Forced or breakdown flow; users experience frequent slowing and vehicles move in lockstep with the vehicle in front of it

The level of service standards used for assessing the need for street and highway improvements at a planning level are shown in Table G-4. These are the same standards that were first adopted in 2008. Design of the specific facilities will be based on more detailed operational analysis.

Table G-4. Adopted Level of Service Standards

Regional Level of Service Standards	
LOS D	<ul style="list-style-type: none"> All regional roadway facilities projected to carry less than 27,000 ADT at the latest RTP horizon
LOS E	<ul style="list-style-type: none"> All regional roadway facilities projected to carry 27,000 or more ADT at the latest RTP horizon
LOS F	<ul style="list-style-type: none"> Plumas Street—Plumb Lane to California Avenue Rock Boulevard—Glendale Avenue to Victorian Avenue South Virginia Street—Kietzke Lane to South McCarran Boulevard Sun Valley Boulevard—2nd Avenue to 5th Avenue Intersection of North Virginia Street and Interstate 80 ramps
<p>Except as noted above, all intersections shall be designed to provide a level of service consistent with maintaining the policy level of service of the intersecting corridors.</p>	

TransCAD allows the RTC to perform more a refined analysis of the level of service on the region's roadways. The current method of establishing the level of service on a roadway is based on the ratio of the volume of traffic to the capacity of the road (V/C). This methodology is widely accepted in the industry as a more accurate method of calculating level of service. Table G-5 shows LOS based on V/C.

Table G-5. Level of Service by Volume to Capacity

LOS	V/C
A	0.00 to 0.60
B	0.61 to 0.70
C	0.71 to 0.80
D	0.81 to 0.90
E	0.91 to 1.00
F	Greater than 1.00

INRIX is a web-based data product that allows agencies to support operations, planning, analysis, research, and performance measures generation using probe data mixed with other agency transportation data. The suite consists of a collection of data visualization and retrieval tools. These web-based tools allow users to download reports, visualize data on maps or in other interactive graphics, and even download raw data for off-line analysis. Each tool has its own unique purposes. Among many other uses, INRIX can provide insight on:

- Real-Time Speed Data
- Travel Time Index
- Travel Time Reliability Metrics
- Queue Measurements
- Bottleneck Ranking
- Other metrics that agencies can use to communicate effectively with the public or decision-makers

INRIX is utilized to analyze congestions in the RTP process. Using the archive of reported speed readings, the average speed, 95th percentile speed, and total number of readings are aggregated for each road segment. These values are broken down per month, day of week, and hour of the day to calculate various performance measures.

5th Edition
RRIF Capital Improvement Plan
South Service Area

<i>Project Description</i>	<i>Limits</i>	<i>Status</i>
Additional Ramps	Systemwide - (5 ramps)	I-580/South Meadows
McCarran Blvd (4 to 6 lanes)	Mira Loma Dr to Greg St	Complete
Mill St Extension (4 lanes)	McCarran Blvd to SE Connector	
Pembroke (2 to 4 lanes)	McCarran Blvd to SE Connector	
Additional Intersections	Systemwide - (5 intersections)	Annual TE Spot projects
Oddie/Wells Ave Multimodal Improvements	Mill St to Kuenzli Ln	Corridor Study Complete; Prelim Design Underway
Traffic Signals / ITS / Roundabouts	Systemwide - (avg of \$500,000 per year)	ITS Pilot Project; Annual Signal Timing Project
Kietzke Ln Multimodal Improvements	Virginia St to Galletti Way	Corridor Study Complete; Spot Safety Improvements under construction (NDOT)
4th St/Prater BRT Way Multimodal Improvements	Keystone Ave to I-80	Under Construction
Virginia St BRT Multimodal Improvements	Plumb Ln to Liberty St	Corridor Study Complete; Prelim Design Underway
Sparks Blvd (4 to 6 lanes) & Multimodal Improvements	Greg St to I-80	Corridor Study Complete
Mill St/Terminal Way Multimodal Improvements	Airport to Lake St	Corridor Study Complete
Damonte Ranch Pkwy Intersections	@ I-580, Double R Blvd, Virginia St	I-580/Damonte Ranch under design

**5th Edition
RRIF Capital Improvement Plan
South Service Area**

<i>Project Description</i>	<i>Limits</i>	<i>Status</i>
Keystone Ave Multimodal Improvements	California Ave to I-80	Corridor Study Complete
Oddie Blvd/Wells Ave Multimodal Improvements	(Phase 2 Kuenzli to I-80	Corridor Study Complete
Pedestrian & Bicycle Facilities within ROW	Systemwide - ADA & Bicycle-Pedestrian Master Plans	ADA upgrades as a part of Street & Highway projects
Sutro St Multimodal Improvements	4th St to I-80	Complete
Geiger Grade (4 lanes)	Virginia St to Toll Rd	NEPA/PE initiated
Plumb Ln (Rehab & Shared Use Path)	McCarran Blvd to Ferris Ln	Complete
SouthEast Connector (6 lanes)	South Meadows Pkwy to Greg St	Under Construction

**5th Edition
RRIF Capital Improvement Plan
North Service Area**

<i>Project Description</i>	<i>Limits</i>	<i>Status</i>
Additional Ramps	Systemwide - (5 ramps)	US 395/Lemmon
Sparks Blvd (4 to 6 lanes) & Multimodal Improvements	I-80 to Baring Blvd	Corridor Study Complete
Additional Intersections	Systemwide - (5 intersections)	Annual TE Spot projects Ongoing
Traffic Signals / ITS / Roundabouts	Systemwide - (avg of \$500,000 per year)	ITS Pilot Project; Annual Signal Timing Project
McCarran Blvd Intersection	@ N Virginia St	Complete
4th St/Prater BRT Way Multimodal Improvements	I-80 to Vista Blvd	Under Construction
Oddie Blvd/Wells Ave Multimodal Improvements	Phase 1 - US 395 to Pyramid Way	Corridor Study Complete; Prelim Design Underway
Oddie Blvd/Wells Ave Multimodal Improvements	Phase 2 - I-80 to US 395	Corridor Study Complete; Prelim Design Underway
La Posada Dr Roundabout	@ Cordoba Blvd	Planning Study Complete
Sun Valley Blvd Multimodal	2nd Ave to Pyramid/Sun Valley/395 Connector	Corridor Study Complete; Package 1 Under Design
Pedestrian & Bicycle Facilities within ROW	Systemwide - ADA & Bicycle-Pedestrian Master Plans	ADA upgrades as a part of Street & Highway projects; Evans Ave Bike/Ped project
Sutro St Multimodal Improvements	I-80 to McCarran Blvd	Complete
Keystone Ave Multimodal Improvements	I-80 to 7th St	Corridor Study Complete
Pyramid Hwy	@ McCarran Blvd	Under Construction

Washoe County Consensus Forecast 2016 - 2036



September 2016

Acknowledgments

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Thanks To

Chad Giesinger, AICP, Senior Planner, Washoe County

Bill Thomas, Assistant City Manager, City of Reno

Armando Ornelas, Assistant Community Services Director, City of Sparks

Jim Rundle, Planning Manager, City of Sparks

Jim Smitherman, Northern Nevada Water Planning Commission

Aric Jensen, AICP, Director of Community Development, City of Reno

Bill Whitney, Division Director, Community Services Department, Washoe County

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Introduction

The Consensus Forecast for Washoe County uses a number of leading forecasts, which has several advantages over using a single source for forecasting population. Not only does the consensus approach minimize the risk of large forecast errors, but consensus forecasts consistently outperform individual forecasts across a range of variables. The consensus approach is discussed in further detail in the article titled “Consensus Forecasts in Planning,” found in Appendix A.

Four reputable sources of long-term forecasts for Washoe County were used: IHS Global Insight, a national forecasting firm in Massachusetts that prepares national, state and county forecasts; Woods and Poole, a national forecasting firm in Washington, DC, that forecasts for every county in the United States, as well as state and national forecasts; Truckee Meadows Water Authority’s *Population and Employment Econometric Model*; and the 2015 Nevada State Demographer’s Forecast.

The *Washoe County Consensus Forecast 2016-2036*, uses these sources and outlines the projected population, employment and income for Washoe County through the year 2036. The forecasts in this document are for all of Washoe County including both the cities of Reno and Sparks and the unincorporated areas of Washoe County, including Incline Village. A summary of the consensus forecast for Washoe County is shown in Table 1.

Table 1

Washoe County Consensus Forecast Summary

Year	Total Population	Total Employment	Total Personal Income (2009 \$)*	Per Capita Income (2009 \$)*
2016	450,747	272,484	\$20,301,242,000	\$47,601
2021	479,393	298,024	\$23,830,280,000	\$54,497
2026	503,900	314,975	\$26,985,326,000	\$57,289
2031	526,723	330,961	\$30,651,233,000	\$61,525
2036	548,159	347,411	\$34,666,063,500	\$65,854

**Note: Total Personal Income is reported in 2009 dollars to control for inflation and allow comparison across the 20-year planning timeframe.*

The population forecasts prepared by Global Insight, Truckee Meadows Water Authority, Woods and Poole, and the 2015 Nevada State Demographer’s Forecast were compared for consistency and then averaged to arrive at a consensus number. When comparable numbers were not available from each of the four sources, only the numbers that were comparable were averaged. It is noted when less than four sources are used. Only Woods and Poole and Global Insight provided data for Total Establishment-Based Employment, Total Personal Income, and Per Capita Income.

Table 2

The 2015 Nevada State Demographer’s Forecast of Washoe County Population

(2016 – 2036)

Year	Population
2016	446,281
2017	452,767
2018	459,054
2019	464,898
2020	470,557
2021	475,902
2022	480,933
2023	485,594
2024	489,902
2025	493,776
2026	497,314
2027	500,564
2028	503,598
2029	506,131
2030	508,510
2031	510,788

2032	513,019
2033	515,176
2034	517,274
2035*	519,343
2036*	521,420

Source: Nevada State Demographer.

**Note: The Nevada State Demographer's Forecast is only projected to the year 2034. Therefore, to match the forecast horizon of the other sources, the last two years of the forecast depicted above were extrapolated. The number of new persons added for each year from 2034 to 2036 was calculated using a growth rate of 0.4%. This rate is based on the growth reported in the last 4 years of the demographer's forecast and was applied to this existing forecast in order to extend the population figures from 2034 through 2036.*

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Population

Total population in Washoe County is projected to grow from 450,747 in 2016 to 548,159 in 2036. This represents an average annual growth rate of 1.06 percent. The highest forecasted population for 2036 was 568,151 from Woods and Poole, and the lowest forecasted population was 521,420 from the NV State Demographer. The 2016 and 2036 forecasted population by each source is shown in Table 3. The consensus population forecast for each year is shown in Table 4.

Table 3

Population by Forecast Source

Forecast Source	2016 Forecast Population	2036 Population
IHS - Global Insight	456,845	554,878
Truckee Meadows Water Authority (TMWA)	450,488	548,187
Woods and Poole	449,373	568,151
2015 State Demographer's Forecast	446,281	521,420*
Consensus Forecast (Four Sources)	450,747	548,159

Source: Global Insight, Woods and Poole, 2015 State Demographer's Forecast, and TMWA.

**Note: The Nevada State Demographer Forecast is only projected to the year 2034. Therefore, to match the forecast horizon of the other sources, the last two years of this forecast were extrapolated.*

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Table 4

Washoe County Population (Consensus Forecast), 2016 – 2036

Year	Population
2016	450,747
2017	456,844
2018	462,741
2019	468,354
2020	473,884
2021	479,393
2022	484,527
2023	489,586
2024	494,413
2025	499,261
2026	503,900
2027	508,613
2028	513,269
2029	517,789
2030	522,286
2031	526,726
2032	531,092
2033	535,412
2034	539,687
2035	543,931
2036	548,159

Source: Global Insight, Woods and Poole, TMWA, and 2015 State Demographer's Forecast.

The age distribution of the population is expected to shift over the next two decades, primarily in the working and retired age groups (Table 5). Changes of note include the continued aging of the baby boomer population, a decrease in the working group (ages 20-64) and a marked increase in the retired group (ages 65 and older). The percentage of population in the preschool (ages under 5) and school (ages 5-19) groups will remain relatively flat with only slight growth (.2%) or no change (0%), respectively. Population by cohort data is available from Global Insight and Woods and Poole. Population by 5-year Age Cohort for 2016 - 2036 is shown in Table 6 on pages 8-9.

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Table 5

Population and Percent Composition of Total Population by Generalized Age Groups

Generalized Age Group	2016		2036	
	Population	Percent of Total	Population	Percent of Total
Preschool (Ages 0-4)	27,784	6.1%	35,691	6.4%
School (Ages 5-19)	85,348	18.8%	105,493	18.8%
Working (Ages 20-64)	268,681	59.3%	310,860	55.4%
Retired (Ages 65 and older)	71,296	15.7%	109,472	19.5%
Totals*	453,109	100%	561,515	100%

Source: Global Insight, and Woods and Poole.

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Table 6**Consensus Population Forecast by 5-year Age Cohort, 2016 – 2036**

Age	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
0-4	27,784	28,615	29,463	30,149	30,696	31,113	31,468	31,817	32,138	32,456
5-9	27,982	27,811	27,727	27,973	28,353	28,976	29,635	30,299	30,832	31,288
10-14	27,964	28,265	28,533	28,601	28,698	28,688	28,643	28,637	28,908	29,306
15-19	29,402	29,512	29,631	29,825	29,925	30,177	30,489	30,816	30,952	31,143
20-24	31,335	31,634	32,126	32,577	32,782	32,866	32,883	32,961	33,168	33,306
25-29	33,784	33,955	33,595	33,087	32,816	33,034	33,493	34,152	34,722	35,009
30-34	30,601	31,269	32,199	33,257	34,228	34,825	34,950	34,594	34,116	33,943
35-39	27,857	28,489	29,168	29,706	30,263	30,990	31,687	32,638	33,709	34,725
40-44	27,036	27,057	27,268	27,660	28,139	28,563	29,071	29,666	30,148	30,691
45-49	29,173	29,123	28,824	28,380	28,037	27,897	27,886	28,064	28,404	28,839
50-54	30,134	29,685	29,319	28,977	28,886	28,898	28,836	28,561	28,148	27,870
55-59	30,610	30,627	30,626	30,685	30,450	30,106	29,723	29,411	29,098	29,033
60-64	28,153	28,550	28,716	28,759	28,865	28,932	28,871	28,844	28,902	28,703
65-69	25,600	25,560	25,893	26,281	26,705	27,138	27,575	27,802	27,920	28,136
70-74	18,599	19,839	20,626	21,385	22,044	22,648	22,665	23,004	23,354	23,735
75-79	12,339	13,171	14,070	14,892	15,657	16,304	17,333	18,024	18,687	19,293
80-84	7,601	8,089	8,626	9,188	9,801	10,360	10,954	11,621	12,238	12,828
85+	7,158	7,524	7,811	8,030	8,278	8,528	8,795	9,090	9,406	9,745
Total	453,109	458,768	464,217	469,410	474,620	480,037	484,953	489,997	494,847	500,046

Age	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
0-4	32,752	33,064	33,370	33,668	33,977	34,286	34,582	34,876	35,159	35,429	35,691
5-9	31,620	31,975	32,334	32,697	33,059	33,421	33,776	34,119	34,448	34,777	35,104
10-14	29,902	30,584	31,261	31,828	32,312	32,691	33,070	33,459	33,849	34,237	34,622
15-19	31,185	31,227	31,268	31,606	32,045	32,707	33,463	34,222	34,840	35,364	35,767
20-24	33,569	33,995	34,456	34,733	35,038	35,176	35,235	35,283	35,674	36,169	36,908
25-29	35,064	35,107	35,222	35,494	35,690	36,044	36,514	37,027	37,317	37,620	37,719
30-34	34,275	34,891	35,666	36,367	36,747	36,921	37,032	37,179	37,470	37,672	38,015
35-39	35,353	35,574	35,308	34,937	34,873	35,296	35,971	36,796	37,529	37,912	38,071
40-44	31,376	32,091	33,063	34,179	35,219	35,880	36,094	35,825	35,456	35,401	35,857
45-49	29,205	29,708	30,293	30,789	31,331	32,056	32,776	33,752	34,866	35,899	36,581
50-54	27,716	27,737	27,939	28,311	28,764	29,150	29,656	30,238	30,740	31,294	32,012
55-59	28,972	28,882	28,558	28,116	27,789	27,654	27,646	27,819	28,148	28,542	28,858
60-64	28,413	28,136	27,924	27,710	27,721	27,786	27,788	27,552	27,202	26,962	26,841
65-69	28,292	28,386	28,510	28,742	28,713	28,539	28,352	28,238	28,128	28,219	28,287
70-74	24,113	24,530	24,743	24,881	25,088	25,212	25,274	25,358	25,544	25,488	25,351
75-79	19,853	19,947	20,307	20,685	21,071	21,432	21,806	22,000	22,119	22,301	22,449
80-84	13,337	14,170	14,759	15,328	15,839	16,273	16,372	16,673	16,981	17,285	17,599
85+	10,091	10,505	11,030	11,510	11,989	12,442	13,221	13,898	14,549	15,177	15,788
Total	505,084	510,505	516,007	521,575	527,260	532,963	538,625	544,310	550,014	555,746	561,514

Source: Global Insight and Woods and Poole.

Employment

According to the Woods and Poole forecast and the calibrated Global Insight forecast (see Appendix F for information about calibration), total employment for all of Washoe County is projected to grow from 272,484 in 2016 to 347,411 in 2036. This represents an average annual growth rate of 1.26 percent.

The 2016 and 2036 forecasted employment and percent of total employment by industry group is shown below in Table 7. To allow for consistency within employment sectors, only employment data from the Woods and Poole forecast is used in this table as the methodologies of Woods and Poole and Global Insight use different employment assumptions to generate industry sectors data.

Table 7
Employment and Percent Composition of Total

Total Employment by Industry Group

Employment by Industry Group	2016		2036	
	Jobs	Percent of Total	Jobs	Percent of Total
Natural Resources	2,390	.91%	3,014	.89%
Construction	14,032	5.34%	19,134	5.66%
Manufacturing	12,975	4.94%	15,060	4.45%
Transportation, Communication and Public Utilities	15,655	5.95%	20,070	5.93%
Wholesale Trade	10,287	3.91%	13,621	4.03%
Retail Trade	27,837	10.59%	37,394	11.06%
Finance, Insurance, & Real Estate	30,551	11.62%	38,266	11.31%
Services	119,179	45.33%	152,284	45.02%
Government	30,008	11.41%	39,381	11.64%
Totals	262,914	100%	338,224	100%

Source: Woods and Poole – Non-farm employment.

Note: The employment data include wage and salary workers, proprietors, private household employees, and miscellaneous workers of full and part-time jobs. Because part-time workers are included, a person holding two part-time jobs would be counted twice. Jobs are counted by place of work and not place of residence of the worker. Therefore, a job in the Reno Metropolitan Area is counted in Washoe County, regardless of where the worker resides. Due to rounding, the "Percent of Total" may not add up to 100%.

Industry sectors remain remarkably stable from 2016 to 2036 with less than .5% change projected for all sectors. The largest growth (as a percentage of total employment) can be seen in the Retail Trade, and in Construction sectors with .47% and .32% growth, respectively. The largest declines are in the Manufacturing, as well as Finance, Insurance and Real estate and in Services which show -.48%, -.31% and -.31%, respectively. The Services sector represents by far the largest percentage of total employment in 2036 at 45.02% followed by the Government (11.64%), Finance, Insurance and Real Estate (11.31%), and Retail Trade (11.06%) industry sectors. The largest numeric increase is in the Services sector where 33,105 jobs are added.

The industries that represent the smallest percentage of total employment in 2036 are Natural Resources (.89%), Wholesale Trade (4.03%), Manufacturing (4.45%), and Construction (5.66%). No overall job losses are reported for any industry category.

The consensus total employment forecast by year is provided on the next page in Table 8.

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Table 8

Washoe County Consensus Total Employment 2016 – 2036

Year	Employment
2016	272,484
2017	278,565
2018	283,871
2019	288,867
2020	293,907
2021	298,024
2022	302,102
2023	305,693
2024	309,005
2025	311,935
2026	314,975
2027	318,225
2028	321,388
2029	324,590
2030	327,798
2031	330,961
2032	334,231
2033	337,537
2034	340,834
2035	344,119
2036	347,411

Source: Woods and Poole and Global Insight (calibrated). For more information see Appendices B, C and F.

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Income

Total personal income is expected to grow from \$20,301,242,000 in 2016 to \$34,666,063,500 in 2036. This represents the total personal income received by persons from wages and salaries, other labor income, and transfer payments less personal contributions for social insurance as adjusted for place of residence. All personal income data are presented in 2009 dollars. This is used to measure the “real” change in earnings and income when inflation is taken into account. The consensus forecast for total personal income for each year is shown in Table 9.

Table 9

Washoe County Total Personal Income, 2016 –2036

Year	Total Personal Income (2009 \$)
2016	\$20,301,242,000
2017	\$21,027,628,000
2018	\$21,748,873,500
2019	\$22,443,965,000
2020	\$23,140,864,500
2021	\$23,830,280,000
2022	\$24,477,268,000
2023	\$25,097,928,500
2024	\$25,703,971,500
2025	\$26,326,553,500
2026	\$26,985,326,000
2027	\$27,678,188,000
2028	\$28,421,347,500
2029	\$29,179,529,500
2030	\$29,897,616,500

2031	\$30,651,233,000
2032	\$31,419,871,000
2033	\$32,187,514,000
2034	\$32,987,309,500
2035	\$33,814,315,500
2036	\$34,666,063,500

Source: Global Insight and Woods and Poole.

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The consensus forecast for per capita personal income for each year is listed below:

Table 10

Washoe County Per Capita Personal Income, 2016 –2036

Year	Per Capita Personal Income (2009 \$)
2016	\$47,601
2017	\$49,937
2018	\$51,258
2019	\$52,825
2020	\$53,450
2021	\$54,497
2022	\$55,110
2023	\$55,839
2024	\$56,131
2025	\$56,706
2026	\$57,298
2027	\$57,819
2028	\$58,870
2029	\$59,770
2030	\$59,853
2031	\$61,525
2032	\$62,608
2033	\$63,608
2034	\$64,525
2035	\$65,299

2036	\$65,854
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Source: Global Insight and Woods and Poole.

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Jurisdictional Splits

Reno, Sparks and Washoe County use the Governor’s certified population estimates of 2015 as a starting point for determining jurisdictional forecast splits for the year 2036.

Table 11

2015 Governor’s Certified Population Estimates*

Washoe County Total 2015	441,946
Reno City Total 2015	238,615
Sparks City Total 2015	93,581
Unincorporated Washoe County Total 2015	109,750

**Note: Cooperatively, Washoe County and the Nevada State Demographer prepare annual population estimates for Washoe County for July 1 of each year.*

In 2015, each jurisdiction contained the following percent of total population:

Table 12

2015 Jurisdictional Percent of Total Population

Reno Percent of Total	53.99%
Sparks Percent of Total	21.17%
Unincorporated Washoe County Percent of Total	24.83%

An analysis of historic census and estimated population figures since 1980 shows these jurisdictional percentages have remained relatively stable over time, with little apparent impact attributable to previous regional plans (prior to the 2012 Truckee Meadows Regional Plan Update) or conforming jurisdiction master plans.

In this 2016 Consensus Forecast, there is a desire to reflect a potential impact of the 2012 Truckee Meadows Regional Plan, as amended, on jurisdictional shares of population through the year 2036. The influence of plan policies on growth and development patterns, and the possible impacts on future settlement patterns are the subject of significant debate and reflect a different approach to forecasting in a multi-jurisdictional environment than forecasts based on a mere reflection and continuation of historic trends. While all forecasts reflect inherent uncertainties, especially in regions with highly

variable decadal growth rates, forecasts associated with regional plan policies can provide a useful guide, over time, as to the effectiveness and need for amendment of such growth policies.

The year 2036 Washoe County Consensus Forecast of 548,159 persons exceeds the 2015 Governor’s certified estimate of 441,946 by a growth increment of 106,213 persons.

Reno, Sparks and Washoe County have decided to allocate the growth increment of 106,213 persons in the following manner:

Table 13

Growth Increment Allocation

25% of Growth Increment (25,553 persons) at Year 2036	Allocate to Centers, TOD Corridors, Emerging Employment Centers in Reno and Sparks
75% of Growth Increment (79,660 persons) at Year 2036	Allocate based on adjusted jurisdictional shares of population of 50% City of Reno, 24% City of Sparks and 26% Unincorporated Washoe County.

The approach that allocates 25% of the growth increment to Centers, TOD Corridors and Emerging Employment Centers recognizes that the 2012 Regional Plan policies may have increasing impact over time. Thus, the growth increment attributed to these policies increases from 2016 to 2036 in a linear fashion. Interpolation of jurisdictional population forecasts from 2016 to 2036 is the responsibility of each jurisdiction and is addressed in local population master plan elements, if desired. This consensus forecast establishes only the beginning (2015 certified estimates) and end points (allocated 2036 consensus forecast by jurisdiction) of that forecast series for each jurisdiction through the year 2036.

Analysis of the 25% population increment (25,553 persons) allocated to each jurisdiction’s Centers, TOD Corridors and Emerging Employment Centers (EECs) yielded the following assumptions based on corridor, center and emerging employment center land areas and density assumptions:

- 21.3% (i.e. 85.2% of 25,553) of the increment will be allocated to the City of Reno (22,623 persons);
- 3.7% (i.e. 14.8% of 25,553) of the increment will be allocated to the City of Sparks (3,930 persons).

While the City of Sparks has major emerging employment centers in its jurisdiction, it is recognized that these EECs have lower densities than centers and corridors and that these EECs are located in or near to Sparks’ traditional growth areas. Spark’s EECs, however, are extremely important to jobs-housing balance and trip reduction policies.

Recent changes, implemented during the 2012 Regional Plan update, allow for the creation and designation of Secondary Transit Oriented Development Corridors. Although these areas correspond with principal transportation routes, they are typically further from core areas such as downtown Reno and exhibit lower densities when compared to Primary Transit Corridors. Portions of the existing Transit Oriented Development Corridors within the City of Reno were downgraded to Secondary Transit Corridors following the adoption of the 2012 Regional Plan.

In the future, Washoe County is expected to designate at least one Secondary Transit Corridor and to designate Infill Opportunity Areas under the policies of the 2012 Regional Plan. Under the forecast approach of the Consensus Forecast, Washoe County may analyze the impact of these designations and include any appropriate and related population shares in its Population Element to be submitted to the Regional Planning Agency.

Allocation of the remaining (non-centers, corridors and EEC) growth increment (75% or 79,660 persons) to the jurisdictions is based upon a minor modification of the historic jurisdictional distribution of population, as follows:

Table 14

2036 Jurisdictional Distribution of Population (of remaining growth increment)

City of Reno Year 2036 Allocation	50%	39,380 persons
City of Sparks Year 2036 Allocation	24%	19,118 persons
Unincorporated Washoe County Year 2034 Allocation	26%	20,712 persons

Table 15

Year 2036 Total Jurisdiction Forecasts

Jurisdiction	2015 Certified Estimates	Centers, Corridors and EEC Increment	Remaining Increment	2036 Jurisdiction Forecast
Reno	238,615	22,623	39,830	301,068
Sparks	93,581	3,930	19,118	116,629
Unincorporated Washoe County	109,750	N/A	20,712	130,462
Total County	441,946	26,553	79,660	548,159

Consensus Forecasts in Planning

By Michael R. Sykes*

Externally produced macroeconomic forecasts are frequently used as an input to the planning process, often to provide the broad framework within which more specific questions can be addressed. However, the quality of the output is partially dependent on the quality of the macroeconomic inputs chosen. A consensus forecast aggregates the views of a number of leading macroeconomic forecasters who use different approaches and attach different weights to the importance of the various factors that impact the economy. Research suggests that few, if any, individual forecasters consistently outperform the consensus across a range of variables, although some forecasters may perform well for some individual series. Studies also suggest that the use of a consensus minimizes the risk of large forecast errors, which has obvious benefits for firms operating in sectors of the economy particularly sensitive to swings in overall economic activity. The consensus approach allows the user to examine the range or distribution of forecasts, and also permits comparison of individual forecasts, whether produced by external advisers or internal analysts, with the mainstream view.

MACROECONOMISTS generally summarize the economic outlook by producing projections for a handful of very broad aggregate indicators. On their own, these projections represent only a general template for planners looking at the outlook for a (comparatively) narrowly defined sector of the economy. But as most corporate and strategic

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planners know, in many industries macro forecasts are regularly used as inputs to the planning process, often to establish a starting point or a broad framework of assumptions within which the more specific problems under consideration can be examined.

For many businesses, product demand in a given market that is sensitive to the strength of economic activity may be well correlated with the behaviour of one or more broad macroeconomic indicators. For example, demand for semiconductor chips in many markets has historically been relatively well correlated with growth in overall industrial production, which is therefore often considered by sector analysts as the best indicator to use in predicting future chip demand. One major industrial company also focuses on expected industrial production growth in various (mainly European) markets, as an indicator of future demand for ball bearings and other products widely used in the industrial production processes.

Obviously, obtaining a reliable set of forecasts for a macroeconomic variable in various countries or markets is far from being the whole story: the relationship between industrial production and demand for computer chips may vary quite widely across markets, depending, for example, on the level of technology employed. Information or knowledge that is more specific to the industry, or to the past experience of the individual firm, also will be necessary. Thus, extrapolating historical relationships between demand for a product and a macroeconomic indicator is a widely used approach but is dependent upon the quality of both the interpretation of events and the macro benchmark forecasts used.

THE ECONOMIC CYCLE

In the short term, predictions of the timing of turning points in the economic cycle also can be invaluable in reaching decisions on production, inventory and manning levels, marketing strategies

and pricing. In the trough of an economic cycle, weak demand is likely to mean that producers are facing strong competition for the few available orders, are running plant at well below full capacity and have cut inventory and manning levels. In spite of the rising unit labour costs that usually accompany a downturn in output, producers may be under considerable pressure either to cut prices or to offer significant discounts, and profit margins are inevitably squeezed. The question of whether to cut employment further in order to reduce costs, or possibly to close or scrap plant, will depend to a considerable extent on when and from what level the economy is expected to begin recovering. Producers will not wish to find themselves having cut capacity and employment as the economy is about to turn up, and also will wish to be well positioned from a marketing standpoint as demand begins to revive.

The economic cycle in different industrial sectors is frequently out of phase with that of the economy overall, however. In many countries, for example, construction sector activity turns down ahead of demand in the economy as a whole and often leads the revival. Producers of construction-related materials and equipment therefore also will feel the effects of a downturn and the subsequent revival relatively early. On the other hand, business investment often responds more slowly to a recovery in overall output, as producers first take up the excess capacity resulting from recession before investing in new plant. But even so, in examining either the short-term influence of economic cycles or the longer-term outlook, once a general relationship between demand for a particular product and a broad indicator of total output (such as gross domestic product [GDP] or industrial production) has been established, macroeconomic forecasts adjusted for leads or lags can be used to "drive" a more specific model of demand for the individual sector or product.

CROSS COUNTRY COMPARISONS

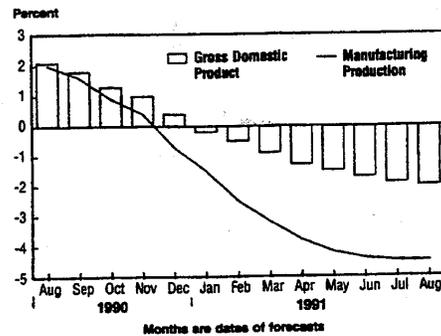
Over a longer time horizon, the expected *relative* performance of various economic indicators in different countries can be a useful guide in reaching decisions about the location of production units, distribution networks and marketing investment. Equally, expected developments in relative wage costs and inflation rates may have a significant bearing on investment or other location decisions. One of the problems here is likely to lie in finding forecasts for the individual countries under consideration that have been produced on as simultaneous and consistent a basis as possible.

CHANGING EXPECTATIONS

Expectations regarding future trends in output, inflation or other macro variables can change quite rapidly over time, suggesting that forecasts for demand growth in different countries made even a few months apart might provide misleading comparisons. The outbreak of the Gulf crisis in August 1990, for example, marked the beginning of a nine-month period during which 1991 growth forecasts for most economies were revised sharply and continuously downwards. In the United Kingdom, where the gathering gloom was compounded by the realization that tight monetary policy was finally beginning to bite, the deterioration in the consensus outlook for GDP growth and Manufacturing Production was particularly severe (see Figure 1).

Such rapid shifts in expectations can obviously pose problems for companies where the planning cycle involves relatively infrequent reviews of the forecasts underlying the plan. A company conducting an annual forecast review for the United States in August 1990, for example, would, by the beginning of 1991, have found itself with a plan based on assumed GNP growth for 1991 of 2 percent. In the meantime, however, the average independent growth forecast had deteriorated to the point where the economy was expected to contract by around 0.3 percent. Changes in expectations of this magnitude, and wars in the Gulf, are thankfully relatively rare occurrences, but even under more normal circumstances, expectations can shift quite rapidly over a few months. Since the beginning of 1992, for example, consensus forecasts for growth in Japanese industrial production have declined

Figure 1
Consensus Forecasts for U.K. Growth
1991



from an average of +1.3 percent to the -3.0 percent now being predicted (early June 1992). Such developments highlight the need for a reliable stream of regularly updated forecasts and the close monitoring of shifts in expectations. In such circumstances a flexible approach to reviewing established plans outside the normal six months or one year cycle and a willingness on the part of business economists to raise the red flag are clearly important. It should at least be possible to draw the attention of others involved in later stages of the planning process to such developments, even if a full scale review is impractical. In view of the difficulties that may be involved in disrupting the planning process in this way, however, it is important that the forecasts used to trigger such changes derive from a consistent and credible source. The choice of this source is therefore an important decision.

THE FORECAST SOURCE

The choice of forecast source is complicated by the large number and wide diversity of economic forecasting operations. These may be large international consultancy-type firms specializing in economic forecasting and analysis, government or semigovernment institutions such as the OECD, university research units, divisions of major banks or securities firms, or the in-house economic units of large industrial companies. Our company surveys over 180 economic forecasters based in the G-7 countries and Australia every month (of which about 25 are in the United States), and this is by no means an exhaustive list of the available sources. Blue Chip Economic Indicators covers about 50 U.S. forecasters in its principal American panel.

Comparing forecasters' track records is made more complicated by the fact that forecast errors vary in type and can have different consequences for the forecast user. For example, forecasters may correctly predict the direction of change in a series, but get the magnitude wrong (under or overpredicting investment growth, for example). This kind of forecasting error is, however, probably less damaging to the forecast user than a prediction that gets the direction of change wrong (forecasting a rise when the series in fact falls). From the users' point of view, a forecaster who accurately predicts trends but fails to spot turning points may well deserve a lower rating than another who correctly predicts turning points but has a poorer track record at other times. More generally, a good track record does not guarantee consistent success. The fact that a forecaster performed well in predicting economic developments for one or two years does not mean that he or she will continue to do so. Indeed, some of

the more recent evidence from studies of forecasting accuracy (reviewed below) indicates that past success is no guarantee of future accuracy. The problem is compounded when forecasts for a range of different variables are considered. One forecaster may have a better track record on production growth, but a poor record on inflation. These results might be combined or weighted in some way, but how is a percentage error in forecasting inflation to be rated vis-a-vis an absolute error in volume terms in a forecast for housing starts, for example? The relative importance of the different variables will vary from user to user.

THE CONSENSUS APPROACH

All of this suggests that successfully differentiating among the large number of different forecasts available is a complex and challenging task. One possible solution to this problem of "picking winners" is to use aggregated or consensus forecasts, combining the predictions of a number of different forecasters into a single, mean forecast. The idea of using consensus projections is fairly well established in a number of countries, notably in the United States, where surveys of forecasters have been running for some time. Aside from reducing some of the problems of choice and weighting discussed above, the use of a consensus projection also appeals to many users because it does not rest on one particular view of the way an economy functions, but attempts to capture the information implicit in a range of forecasts. The results of these surveys have also attracted a good deal of academic interest and analysis, and several studies of the merits of consensus forecasting as an approach have been conducted.

Much of this work has concentrated on forecasts produced by various time series methods of extrapolation for individual series, although there have also been other studies comparing econometric and/or judgmental forecasts with the consensus. Most of these studies are based on data for the United States, where a long run of consistent back data is available from the surveys published in Blue Chip Economic Indicators over the past fourteen years.

As regards the accuracy of the consensus, the verdict of most of the academic work in this area has generally been favourable. In his study covering forecasts for seven variables made by twenty-two forecasters over nine years (1978 through 1986) Stephen McNees¹ concluded that "only four of the twenty-two individual forecasters were more accurate than the consensus in more than half their forecasts." For all seven variables weighted equally,

¹See footnote at end of text.

the consensus forecasts ranked 6 (out of 23, including the consensus) on the basis of the RMSE (root mean squared error) criterion.

In addition, McNees noted that:

"For any particular variable, the Blue Chip consensus was more accurate than most individual forecasters but less accurate than a minority of varying size depending on the predicted variable . . . Every forecaster, [except one], was more accurate than the consensus for at least one variable but none of the forecasters outperformed the consensus for all seven variables."²

Another study³ comparing seventy-nine individual forecasts of six macroeconomic variables with the group mean found that, on average, the consensus was more accurate than around three-quarters of the individual forecasts, although again this proportion varied depending on the variable considered. On the basis of this evidence, which is broadly consistent with our own experience, it seems reasonable to assume that for some variables some of the individual forecasts making up the consensus will prove to be more accurate than the group mean when the results become known. However, the problem for a user of external forecasts remains how to determine *in advance* which individual forecasters will be more accurate. This would be a relatively simple task if some forecasters were clearly superior to the others and consistently achieved better results.

In fact, the evidence on this question is rather mixed. Victor Zarnowitz⁴ examined forecasts submitted to the survey conducted by the American Statistical Association (ASA) and the National Bureau of Economic Research (NBER) from 1968 to 1979, and concluded (by comparing rank correlations of relative RMSEs across variables and forecast horizons) that "a small number of the more regular participants in the ASA-NBER surveys did perform better in most respects than the composite forecasts from the same surveys."

On the other hand a later analysis conducted by Roy Batchelor of the City University Business School⁵ in London concluded that there were "no significant differences in the accuracy rankings of individual forecasters." This conclusion supports the argument that, without the benefit of hindsight, it is extremely difficult to pick out an individual forecaster who is likely to outperform the consensus across a range of variables and time horizons. As noted above, however, for certain variables considered in isolation the evidence does suggest that selected forecasters can perform consistently well.

THE MARKET FOR FORECASTS

There are a number of problems involved with the use of consensus forecasts. One is the choice of which forecasters to include in the consensus. However, given the competitive nature of the forecasting business (large numbers of suppliers, fairly standardized products, very low or nonexistent barriers to entry, etc.) inaccurate forecasters, or those lacking professional credentials, might be expected to be driven out of business, leaving a group of forecasters producing work of a similar quality. This is supported by the Batchelor study, which finds no evidence of significant differences in forecasters' track records. In a separate study,⁶ Batchelor also finds that, perhaps because of this high level of competition in the forecasting business, some forecasters may attempt to differentiate their work by deliberately adopting a stance that is either pessimistic or optimistic in relation to their peers. Far from moving towards the consensus, some forecasters display "variety seeking" behaviour and attempt to distance themselves from the middle ground to some extent. Those that are determinedly optimistic year after year will almost certainly, at some stage, be proved correct when the outcome is better than the consensus predicted. Intuitively, this also ties in with the results showing that few forecasters beat the consensus consistently; neither the optimists nor the pessimists can always be right. This kind of behaviour probably reflects the fact that forecasts, like other types of information, are themselves a marketable commodity. From some perspectives, the middle ground may appear less valuable or interesting and thus more difficult to sell commercially. Thus accuracy may not always be the only consideration for the forecast producer, given that he is operating in a competitive market.

This leads to another caveat regarding the interpretation of consensus projections. The range or spread of different forecasts, which is often measured by the standard deviation of the sample, is frequently used as a measure of the "risk" or uncertainty attached to a consensus forecast. Clustering around the mean might, however, produce a range of forecasts that considerably understates the wide dispersion of likely outcomes, with the result that the deviation in the sample is considerably lower than the "risk" inherent in the forecast. This is reflected in the fact that the actual outcome for a particular variable is frequently outside the range of forecasts. In our experience, we have noted that the dispersion of forecasts may also vary widely from country to country. For example, the forecasts for the French economy produced (on a monthly basis) by a group of around sixteen French-based fore-

casters over the past two years have typically been much more closely grouped around the mean than those produced by a similar group of United States forecasters looking at the American economy. This may reflect structural differences between the two economies (the French economy may be more predictable, for example) or it may reflect more widespread attempts at product differentiation in the U.S. forecasting industry. So caution should be exercised when using forecast ranges to assess the uncertainty attached to the consensus. As always with a table of comparative forecasts, moreover, the astute analyst will endeavour to look past the numbers at the reasoning that lies behind them.

FOOTNOTES

¹Stephen McNees, "The Tyranny of the Majority," *New England Economic Review*, Federal Reserve Bank of Boston, Nov/Dec 1987.

²*Ibid.*

³Victor Zarnowitz, "The Accuracy of Individual and Group Forecasts from Business Outlook Surveys," *Journal of Forecasting*, Vol 3 (Jan-March 1984).

⁴*Ibid.*, pp. 23-24.

⁵Roy A. Batchelor, "All Forecasters Are Equal," *Journal of Business and Economic Statistics*, 1990.

⁶Roy Batchelor and Pami Dua "Conservatism and Consensus-Seeking Among Economic Forecasters," Paper presented to the Ninth International Symposium on Forecasting, Vancouver, June 1989.

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Appendix B

March 2016

Long-Term Forecast

Prepared by IHS ECONOMICS

Washoe County, NV

P R E F A C E

This analysis accompanies a forecast prepared by IHS ECONOMICS for the Washoe County Office of the County Manager. The forecast pertains to Washoe County, which comprises the cities of Reno and Sparks, and the unincorporated remainder of the county. Some sections of this document will refer to the Reno-Sparks Metropolitan area, using it as an approximation of activity in Washoe County. These sections will be clearly marked using the notation Reno MSA.

R E C E N T P E R F O R M A N C E

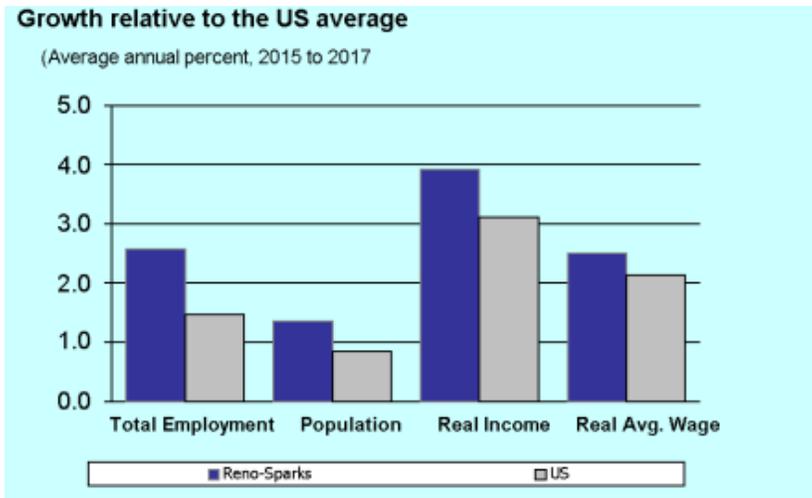
Employment growth in Washoe County has been impressive in recent years. In 2015, Washoe County employment surged 2.9% year-over-year (y/y), marking the third consecutive year of at least 2.5%. Employment growth was well ahead of the US average but slightly behind Nevada on the whole. Payroll gains in recent years have been broad-based but fastest in the leisure/hospitality, construction, and business service sectors. These sectors were also among the hardest hit during the recession and thus are coming back from depressed levels. Despite a streak of annual payrolls gains going back to 2012, Washoe County still has not recouped all of the jobs it lost during the recession. Employment plunged by about 19% from early 2007 to late 2010 and employment levels in late 2015 are still about 7% below their previous peak. Nevertheless, employment growth has been moving in the right direction and will remain strong over the medium-term and get an extra boost when the Tesla factory ramps up operations.

The unemployment rate in the Reno metropolitan area (MSA), which is comprised primarily of Washoe County, continues to recede from the painfully high rates during the recession that reached a peak of 13.2% in December 2010. By January of 2016, unemployment had edged down to 5.5%, a product of continual progress over the past few years. While unemployment remains above the US average it is less than half the rate it was during the peak of the recession and a good indicator of the economic progress that has been made.

Looking more closely the local economy, we can see where the recession hit the hardest, and where future growth is likely to come from:

- **Personal Income:** Personal income in Washoe County increased by 5.7% in 2014, according to the Bureau of Economic Analysis, the latest data available. This is a good result, on par with Nevada and ahead of the US average, buoyed by strong growth in the labor market. From 2015 to 2020 personal income growth will average about 5.5% annual as continued strength in the job market helps keep growth above the national pace according to IHS Economics analysis.

- **Trade, Transportation, and Utilities:** This sector, which is the largest in the Washoe County economy, at 22% of total employment, saw payroll declines from 2008 through 2011. The sector managed to turn around and squeak out a 0.7% gain in 2012 and 1.1% gain in 2013. Growth finally came on strong in 2014 and 2015, averaging 2.7%, and will continue to be an important source of job gains in the years to come. Washoe County is becoming a hub for logistics and warehousing thanks to its strategic location and low cost of doing business.
- **Tourism and Gaming:** Leisure and hospitality employment, which includes jobs in accommodation and eating and drinking establishments, is the second largest employment sector in Washoe County and in the Reno MSA, accounting for 18% of total employment. This sector saw employment growth decline during the first recession of the decade, beginning in 2001 and reaching its lowest point in 2005. Thereafter, a strong national economy and expansion in the region's gaming industry helped employment rebound through 2007, before the Great Recession brought growth to a halt again in 2008. A subsequent decline in 2009 was a result of weak economic conditions and restrained consumer spending. Growth in leisure and hospitality then essentially remained flat from 2010-2012, as still-shaky consumer confidence sapped demand from Washoe County's large gaming industry. However, with the recession behind us, the leisure and hospitality sector took a sharp upward turn in 2013, and has continued to accelerate since with payrolls surging 3.9% y/y in 2015. Gaming revenues have also been trending higher, as travel and spending begins to pick back up across the nation in tandem with a broader recovery in the national economy.
- **Services:** The professional and business services sector was also hit hard during the recession after having being an economic strong point. The rebound was slow early on but hit its stride in 2011 and has been very strong since, notching 5.5% growth in 2015 as one of the top performing sectors. The education and health services sector, accounting for 12% of total employment, was the only major sector that remained healthy during the recession, thanks to largely inelastic demand for its services. Its job growth has been steady, advancing another 2.8% y/y in 2015.
- **Housing:** The combined construction/mining employment sector in Washoe County slipped 1.2% y/y in 2015. This follows what had been a good stretch for construction hiring, the sector gained an average of 8.3% annually from 2012-14. The 2015 construction hiring represents a soft patch in what will continue to be a multi-year recovery from the harsh recessionary declines. Construction employment plunged 64% from early 2006 to mid-2011. Construction employment has increased by 22% from 2011 to 2015 but still remains less than half of the 2006 peak. While strong growth in construction is on the horizon over the medium-term, it will take over a decade before construction employment levels even approach the pre-housing speculation levels.
- **Manufacturing:** This sector accounts for almost 6% of total employment in Washoe County, and had flat-to-positive job growth between 2003 and 2007 – indeed, the Reno MSA is one of the few metro areas in the nation that did not see significant declines in manufacturing through the early years of the decade. In 2008, however, the sector felt the impacts of the recession, leading to payroll losses that topped out in 2009, although declines continued in 2010 and 2011. Things have turned around since: the sector then saw solid gains from 2012 to 2014. While growth decelerated in 2015 the next-term outlook is very positive and will see an enormous boost from the Tesla factory.



DEMOGRAPHICS AND LABOR FORCE

The Census Bureau and IHS Economics estimated Washoe County’s population to be 440,800 residents in 2014, up from 434,500 persons in 2013. The annual population growth rate between 2013 and 2014 was 1.4%, ranking 4th out of the seventeen counties in the state. Comparatively, growth rates in the Las Vegas metro area, in Nevada, and in the United States over the same period were 2.0%, 1.8%, and 0.8%, respectively.

Population data from the Census Bureau show that Reno’s population increased by 6,331 over the year, to reach a total of 444,062 as of July 1, 2014, a growth rate of 1.5%. This was an acceleration from the 1.1% growth seen from 2012-13 in tandem with improving economic conditions. Looking back, from 2000 to 2009, Reno experienced population growth of 22%, which placed it 39th out of the 381 metro areas. This robust growth can mostly be attributed to the rapid expansion in the housing market that took place during that decade. A similar expansion was happening in other parts of Nevada as well: from 2000 to 2009, Las Vegas saw an increase in population of 39%, ranking them 3rd in the nation.

Another way of looking at population data is at the total number of households, a primary driver of demand for housing units, infrastructure, and government services. In Washoe County, household numbers rose from 134,700 in 2000 to 164,700 in 2010, according to American Community Survey data. The average household size in Washoe County increased slightly from 2.55 persons in 2000 to 2.59 persons in 2010. The county is getting a little older as well – in 2000, 70.9% of the population were 21 years and older, while 10.5% were 65 years and older; by 2010, these proportions had risen to 71.8% and 12.2%, respectively.

As Washoe County’s population has grown so has its population density which increased from 52.4 persons per square mile in 2000 to 67.3 persons per square mile in 2014. This is much higher than the state average; Nevada’s population density in 2014 was only 25.9 persons per square mile. However, the county still trails the US average by a wide margin with the national population density registering 90.2 persons per square mile.

Both Reno's and Nevada's unemployment rates surged during the recession, but rates have come down markedly over the past few years. In the Reno MSA, the seasonally adjusted unemployment rate was down to 5.5% in January 2016; by comparison, the rates for Nevada and the United States were 6.2% and 5.0%, respectively, in January. Despite declines from double-digit rates, the forces lowering the jobless rate have not been entirely good news. Stubbornly high joblessness and tepid job growth has led to a flat lining of Reno's labor force growth. From early 2011 to late 2014 Reno's labor force was essentially flat, signaling that many people that lost their jobs during the recession have given up looking and thus are not counted in the unemployment rate estimates. However, that trend changed in 2015 with labor force growth finally picking up. This is a great sign for the metro economy and indicates that confidence in the labor market is returning. Growth in the labor force will be strong over the medium-term.

INCOME AND WAGES

According to the Bureau of Economic Analysis, in 2014 per capita personal income in the Reno MSA was \$46,050, the 79th highest in the United States, well above the Nevada figure of \$40,700, and on par with the US (\$46,000). In terms of growth rates, the Reno MSA's 2014 per capita personal income was up 4.2% over 2013, compared to increases of 3.8% in Nevada and 3.6% for the United States. According to the BLS, in the third quarter of 2015, the average weekly wage of private industries in Washoe County was \$841, up 2.7% from the third quarter of 2014. The average weekly wage in Clark County (Las Vegas) was lower, at \$815, while the figure for the United States was higher at \$965. Wages in Reno and Nevada are weighed down by the high concentration of lower paying hospitality jobs.

The Bureau of Labor Statistics has released the following average weekly wage data for private industries in Washoe County and Nevada for the third quarter of 2015:

Average Weekly Wages, 2015Q3		
Sector	Washoe County	Nevada
Natural Resources and Mining	\$998	\$1,557
Construction	973	1,018
Manufacturing	1,024	1,010
Trade, Trans, & Utilities	790	763
Information	1,128	1,166
Financial Activities	1,240	1,148
Professional & Business Svcs	1,023	1,003
Education & Health Services	969	971
Leisure & Hospitality	459	601
Other Services	726	666
Total, All Private Industries	841	833

ECONOMIC STRUCTURE

Washoe County's 20 largest employers are listed below (as reported by the state of Nevada for the third quarter of 2015).

- Washoe County School District, elementary and secondary schools: 8,500 to 8,999 employees
- University of Nevada-Reno, colleges and universities: 4,500 to 4,999 employees
- Renown Regional Medical Center, general medical and surgical hospitals: 3,000 to 3,499 employees
- Washoe County Comptroller, executive and legislative combined: 2,500 to 2,999 employees
- Peppermill Hotel and Casino, casino hotels: 2,000 to 2,499 employees
- Grand Sierra Resort and Casino, casino hotels: 1,500 to 1,999 employees
- Silver Legacy Resort, casino hotels: 1,500 to 1,999 employees
- International Game and Technology, misc. manufacturing: 1,500 to 1,999 employees
- Atlantis Casino Resort, casino hotels: 1,500 to 1,999 employees
- St. Mary's Hospital, general medical and surgical hospitals: 1,000 to 1,499 employees
- Eldorado Hotel and Casino, casino hotels: 1,000 to 1,499 employees
- City of Reno, executive and legislative combined: 1,000 to 1,499 employees
- Sierra Nevada Healthcare Systems, general medical and surgical hospitals: 1,000 to 1,499 employees
- John Ascuagas Nugget Sparks, casino hotels: 1,000 to 1,499 employees
- Circus Circus Casinos - Reno, casino hotels: 1,000 to 1,499 employees
- United Parcel Service, couriers: 1,000 to 1,499 employees
- Amazon.com, general warehousing and storage: 800 to 899
- Truckee Meadows Community College, Junior Colleges: 800 to 899 employees
- Integrity Staffing Solutions, temporary health services: 700 to 799 employees
- City of Sparks, executive and legislative offices: 600 to 699 employees

Of the county's 20 largest employers, seven are casinos. Because of the dominant presence of the casino industry, Washoe County has a unique economic structure compared to the US economy. As mentioned above, the leisure and hospitality sector, which includes accommodations and eating and drinking establishments, accounted for 18% of Washoe County's total employment in 2015, close to double the US economy's 11%. The construction industry also used to be a major presence here, but because of the large layoffs during the recession, the construction and mining sector accounted for only 5.5% of Washoe County's total employment in 2015, down about 50% from 10.8% in 2006. This concentration is now near the US average and is about the same size as the county's relatively small manufacturing sector, which accounts for 6.0% of Washoe County's 2015 employment, compared to 8.6% in the United States.

The following table compares employment distribution by major sector for Washoe County, Nevada; the Mountain Census region (i.e., AZ, CO, ID, MT, NV, NM, UT, and WY); and the United States. The table confirms the importance of the leisure and hospitality sector in both Washoe County and in Nevada, and shows clearly how much the structure of their economies varies from the rest of the Mountain region states and from the United States.

Employment by Sector, Annual 2015 (NAICS) Sector				
	Washoe County	Nevada	Mountain	US
Construction and Mining	5.5%	6.5%	7.0%	5.1%
Manufacturing	6.0%	3.4%	5.8%	8.6%
Trade, Transportation, and Utilities	21.5%	18.7%	18.5%	18.9%
Information	1.0%	1.1%	1.9%	1.9%
Financial Activities	4.8%	4.6%	5.9%	5.7%
Professional and Business Services	14.0%	12.8%	13.8%	13.8%
Educational and Health Services	11.9%	9.7%	13.3%	15.6%
Leisure and Hospitality	18.0%	28.1%	13.5%	10.7%
Other Services	2.8%	2.9%	3.5%	3.9%
Government	14.6%	12.3%	16.8%	15.7%

To gain even greater insight in to the local economy, IHS Economics conducted a shift-share analysis to identify the changes in Washoe County's economic structure during the last 25 years. This change, as measured by the distribution of private sector employment by three-digit NAICs code, was compared to the employment changes that occurred in the United States over the same period. The purpose of the analysis was to identify four crucial types of economic sectors, enumerated below.

Type D: Competitive Advantage and Specialized. Competitive advantage means that an individual sector's employment growth rate in Washoe County over the last 25 years was higher than its employment growth rate at the US level over the same period. Specialized means that the same sector's percent share of total Washoe County employment is higher than the sector's percent share of total US employment (i.e., its location quotient is >1.0). Sectors in this category are major sources of growth in a regional economy, as they have both above-average shares of regional activity, and above-average growth rates. Higher growth rates for these sectors presumably occur because of the competitive advantages (e.g., labor costs, agglomeration effects, skilled labor, proximity to market, lower cost of living, etc.) that attracted them into a region in the first place. Approximately 26% of Washoe County's 2015 employment are in sectors classified as type D. The top-five sectors in this category, based on total employment, are:

- Administrative and Support Services (NAICS 561)
- Warehousing and Storage (NAICS 493)
- Retail Trade – Motor Vehicle and Parts (NAICS 441)
- Miscellaneous Manufacturing (NAICS 339)
- Truck Transportation (NAICS 484)

Type C: Competitive Advantage but not Specialized. This type consists of sectors whose employment growth rate in Washoe County over the past 25 years was higher than the sector's growth rate at the US level, but also where the current shares of total county employment are less than their shares of total US employment. Economic sectors classified as Type C present targets of opportunity, as Washoe County may have competitive advantages that enable these sectors to achieve above-average growth rates. Approximately 41% of Washoe County's employed persons in 2015 are classified as Type C. The top-five private sectors in this category, based on total employment, are:

- Food Services & Drinking Places (NAICS 722)
- Professional, Scientific, and Technical Services (NAICS 541)
- Ambulatory Health Care Services (NAICS 621)
- Hospitals (NAICS 622)
- Retail Trade – General Merchandise Stores (NAICS 452)

Type B: Competitive Disadvantage but Specialized. This type is comprised of sectors whose employment growth rates in Washoe County over the last 25 years were below their employment growth rates at the US level, but whose share of total Washoe County employment is higher than their shares of US employment. Type B sectors often comprise major parts of a region's economy, but their boom years are in the past. Approximately 21% of Washoe County's 2015 employment is classified as Type B. The top five private sectors in this category, based on total employment, are:

- Accommodations (NAICS 721)
- Specialty Trade Contractors (NAICS 238)
- Amusement, Gambling and Recreation (NAICS 713)
- Real Estate (NAICS 531)
- Retail Trade – Misc. Stores (NAICS 441)

Type A: Competitive Disadvantage and not Specialized. This type is comprised of sectors whose employment growth rates in Washoe County over the last 25 years were below their employment growth rates at the US level and whose share of total Washoe County employment is less than their shares of US employment. Type A economic sectors make little contribution to new regional economic growth, and sectors in this class comprised only 12% of Washoe County's total employment in 2015. The top five sectors in this class are:

- Social Assistance (NAICS 624)
- Retail Trade – Food and Beverage (NAICS 445)
- Credit Intermediate and Related Activities (NAICS 522)
- Religious, Civic, and Professional Organizations (NAICS 813)
- Retail Trade – Building Material and Garden Eq. (NAICS 444)

Our IHS Economics analysis also estimated that the high-technology sector (by NAICS definition) would be classified as Type A, accounting for 4.6% of the Reno MSA's total non-agricultural employment in 2015, below the sector's average share of 6.4% for the United States.

Additionally, IHS Economics calculated the Hachman Index of structural diversity for the Reno MSA in 2015. The closer the index value is to 1.0, the more similar the structure of the MSA or state economy is to the structure of the US economy. In general, larger economies such as in big states or MSAs tend to be more economically diverse and have higher index values than the economies of smaller states and MSAs that may specialize in certain industries based on their competitive advantages. Economic structure is measured by the distribution of an economic indicator, such as employment, income, output, or business establishments, by NAICS code. IHS Economics used private employment at the three-digit NAICS code level as obtained from our Business Markets Insight database.

Given its unusual dependence on the tourism and gaming industry, one would expect that Washoe County's index of structural diversity would be low, making the structure of its economy significantly different than the structure of the US economy. Indeed, in 2015, the index of structural diversity for Washoe County was 0.583. Similarly, the structure index value for the State of Nevada was 0.355 in 2015, the second lowest value among all the states. These results show that Washoe County's economy is far less diverse than the nation, although it is more diverse than the state economy. As a basis of comparison with its neighbors, the structural index value for the State of California was 0.901 in 2015, the 13th highest value among all the states; in Utah the index was 0.909, the 10th highest in the nation; and in Arizona the index was 0.921, the 4th highest.

REGIONAL ECONOMIC OUTLOOK

Washoe County is within the Mountain region, which was hit especially hard during the Great Recession due in large part to the collapse in the housing market, especially in Arizona and Nevada. The region has seen strong growth coming out of the recession but because of the severity of the decline, it did not reach its prerecession employment peak until late 2014, or about six months after the US on the whole. As measured by payroll growth, the recovery has been strong and steady with payrolls averaging 2.4% growth over the past four years. This compares to 1.8% for the nation. Across sectors growth has been widespread but most impactful in construction which continues to battle back from ultra-lean levels after the devastating recessionary declines. The region has outpaced much of the rest of the nation in job growth over the past year, ranking second to the Pacific region. The Mountain states continue to be an attractive destination for companies due to their relatively low costs of doing business and ample supplies of labor.

All eight states in the region have seen job growth over the past year, with most of the states above the national average. Nevada and Arizona continue to dig out from the blizzard of delinquencies and foreclosures caused by the housing bust with a lot of progress made in recent years. The significant increases seen in housing prices over the past few years are helping many sectors of the states' economies, especially those dependent on consumer spending.

The region's ample natural resources provide many outdoor recreation opportunities, drawing skiers, hikers, and other enthusiasts from a wide area. The national economic recovery has provided a huge

boost the region's tourism business, helping to spur hiring in the leisure and hospitality sector. The national parks system is a major presence in the region. The abundance of recreational opportunities is also cited as a factor in the region's ability to attract young workers, playing a prominent role in the development of the region's high-tech hubs. On the downside, the region's robust economic growth is directly tied to robust population growth, which also translates into increasing demands for water. Allocation of the region's water resources is the subject of ongoing debate among policymakers in the western states who are concerned about future water issues, which will rapidly become present ones unless weather and usage patterns change.

The Mountain region saw economic pain spread to nearly all sectors of its economy during the recession, and the recovery so far has been almost equally widespread. The professional and business services sector and the trade, transportation, and utility sector, which together account for more than one-third of the region's total jobs, have grown consistently and have been a major source of payroll gains. The leisure and hospitality sector accounts for 13.5% of the regional employment, the largest share among the nine regions, and well above the national average of 10.7%. This sector has been a top performer in recent years, up 4.1% y/y in 2015 to mark the fastest pace of any major employment sector. Nevada, which accounts for just 13% of the Mountain region's employment, comprises a fourth of its leisure and hospitality payrolls. In 2009, during the height of the recession, Nevada's ever important gaming industry was hit hard by shaky consumer confidence, which kept people away from the tourist hotspots, in addition to people cutting back on such luxuries such as eating out and travel. However, this has worked in the opposite direction, with tourism ramping back up as consumer sentiment improves and pent-up demand for leisure activities is attracting people back to the Mountain region. Meanwhile, jobs in education and health services continue to expand heartily thanks to the region's fast growing share of residents over the age of 65.

The Mountain region is made up of states that were at the forefront of the housing boom, and thus were affected by the bust more so than other areas. From 2007 to 2010, the region purged 340,000 construction jobs, with more than half of those losses coming from Arizona and Nevada alone. While these deep cuts are painful, with bubbles come extremes at the top and bottom – meaning that as the housing market continues to recover there will be more room for growth because it is coming back from a low base.

Over the next five years, employment gains in the region will outpace the national average. We expect Utah, Nevada, Arizona, and Colorado to be among the leading states nationally through 2021 in terms of payroll employment growth rates. With domestic migration trends returning to favor the South and West, many of the states in this region will undergo large investments in housing, and the construction sector will also be a major driver of job creation.

Between 2016 and 2021, the region will see 1.7% average annual job gains, compared with the national average of 1.0%. The housing recovery, combined with robust development in commercial real estate development and infrastructure, will boost average annual payroll growth in the construction sector by 4.6%, while professional and business services grow by 3.4% annually.

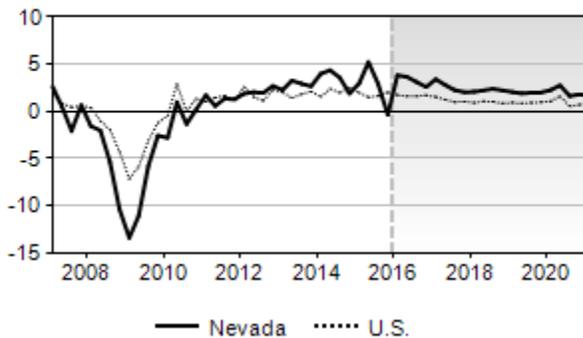
Nevada

Economy in 2016: As the recovery continues in Nevada, we expect that payroll growth will register gains of 2.8% this year. The state's employment gains will outpace much of the nation in 2016, when Nevada will rank second in the country in total payroll growth. Service sector gains will dominate hiring this year. Professional/business services, education/health services, and leisure/hospitality services will add 3.6%, 3.0%, and 4.7%, respectively, to total payrolls. Of the 35,000 new jobs that the state labor market will create this year, almost 26,000 will come from these three sectors alone. Construction employment will decelerate from the outsized gains seen in previous years but remain strong, gaining 3.8% this year. The solid labor market gains will continue to put downward pressure on the unemployment rate which will recede to 5.7% by the end of the year.

Nevada's growth has been a bit different during the current expansion than it was during the early 2000s. Although resurgent housing and gaming sectors have been key pieces of the state's recovery, the state has seen growth in other areas that represent the beginnings of a diversification away from these sectors. A burgeoning high-tech hub in Las Vegas has created new growth in the information and business services sectors. The city of Reno in northern Nevada, decimated by the Great Recession, has found new life as a manufacturing, logistics, and data warehousing hub. This of course is anchored by Tesla's Gigafactory, which will ramp up production in 2017.

Total Employment

(Quarterly change, compound annual rate)



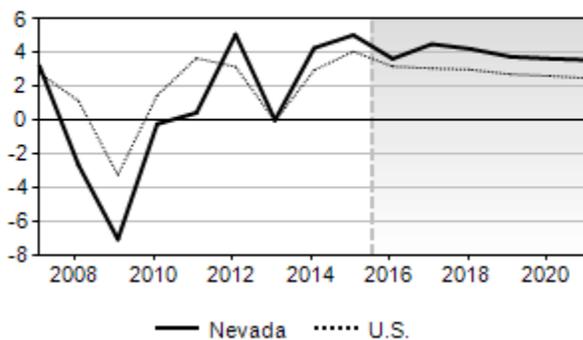
Economy through the Next Five Years:

Nevada took a huge hit during the Great Recession and the housing bust, but it has and will continue to experience strong growth in the coming years as it climbs back out of that massive hole. Although the influx of new residents will not return to its pace prior to the collapse, the state will nevertheless rank sixth in the US in terms of population growth over the next five years, at 1.4%. These two factors will drive employment growth here, which will easily outpace the nation, increasing 2.2% on an average annual basis through 2021. This pace of payroll expansion will place Nevada first in the nation.

The state's prominent service sector will play a key role in its recovery. Professional and business services will come roaring back to life, adding 4.0% to payrolls, on average, each year. Strong population gains and an aging population will fuel demand for education and health services, and this sector will add jobs at a 1.9% annual pace. The all-important leisure and hospitality services segment will expand by 2.0%, a good result but slower than the recent pace – growth will decelerate as the post-recession recovery begins to cool over the next few years. Construction gains, meanwhile, will continue to be impressive. It will add 6.7% to payrolls on average thanks to strong residential building and construction activity related to the improving economic conditions in the state.

Despite the rapid payroll growth in recent years Nevada employment levels are still below the pre-recession peak. The good news is that the state will finally recoup all of the recessionary jobs losses this year, some six-plus years since employment bottomed out. This is a testament to just how severe the job losses were with the state losing over 174,000 jobs from the 2007 peak to 2010 bottom. The unemployment rate will continue to decline, but remain elevated relative to the nation.

Real Personal Income
(Percent change, annual rate)



Housing:

Thanks to the abysmal decline in home values during and after the mortgage crisis and housing bust, the residential real estate market in Nevada has been on a tear now that home prices have reversed course. After turning the corner in mid-2012, year-over-year (y/y) home values have been appreciating at double-digit rates. According to the Federal Housing Finance Agency's purchase-only home price index, the sale price of existing homes rose 12.8% year on year during the fourth quarter of 2015, continuing the streak of double digit gains. Despite the rapid gains, home values stand at just 72% of their peak in 2006 (in nominal terms). Nevada homes were certainly overvalued back then; so a return to those levels anytime soon is entirely unrealistic. Nevertheless, the impact of the foreclosure crisis is still being felt although labor market gains are alleviating the situation and eliminating some of the backlog. Also, rising values are lifting many homeowners out from underwater mortgages, and helping stem the tide of new foreclosure activity.

Builders broke ground on more homes in 2015 than in 2014, with starts reaching 14,500. That is still a far cry from the pace of construction set prior to the housing bust but represents continued

improvement from the 2011 low which was a dismal 6,100 units. We expect new construction to continue to ramp up this year, with total starts hitting almost 17,400. Because so much excess homebuilding occurred during the years of the housing boom, we do not expect new construction to reach the bubble inflated 2003-06 levels again during the forecast period.

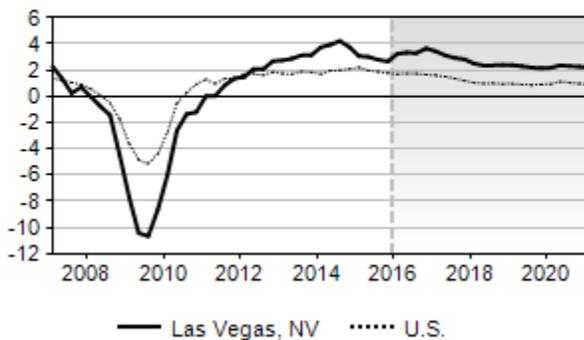
Las Vegas

Economy in 2016:

On the heels of 2.9% job growth in 2015, we forecast an acceleration to 3.4% job growth in 2016. Strong gains in leisure and hospitality services (4.9% growth), education and health services (4.4%), and professional and business services (4.4%) will significantly boost the metro economy this year and represent the vast majority of gains. Professional and business services will show consistent payroll additions and will be one of the city's fastest-growing sectors in the near and mid-term. Education and health, which is typically a consistent source of new jobs, will continue to perform well over the medium term. Ultimately, however, the Las Vegas economy will only go as far as the leisure and hospitality sector can take it. Representing 32% of total employment, sustained growth in leisure and hospitality is essential to an employment recovery in Vegas. Fortunately, solid consumer confidence is helping to bring tourists back to the metro and driving the strong payroll growth this year. Development is booming and boosting construction payrolls, which will grow another 6.1% in 2016. A number of new building projects are going up, including the new T-Mobile Arena and multiple casino developments on the resort corridor. While construction growth has slowed from the 2013-15 pace it will continue to be a key driver over the medium term.

Total Employment

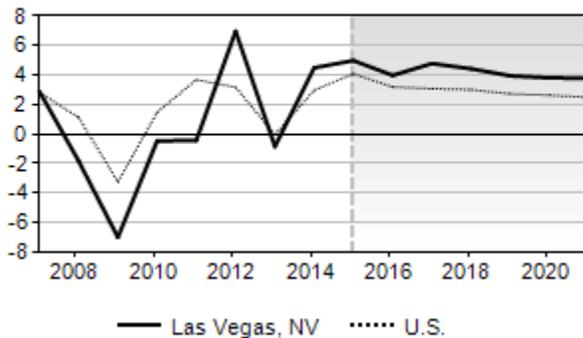
(Quarterly change, compound annual rate)



Economy through the Next Five Years:

After accelerating to 3.4% in 2016, payroll growth in Las Vegas will slow in the coming years, yet remain at least twice as fast as the nation. Strong population growth combined with the fact that the metro area is still digging its way out of recessionary job losses means that the region will easily outperform the country over the next five years. Between 2016 and 2021, Las Vegas will add to payrolls at a 2.4% average annual pace, well above the US pace of 1.0%. Construction will be a key driver during this time, climbing 7.8% per year. Business services will add 4.3% as the metro slowly diversifies its economic base away from gaming. Strong population gains will drive 2.1% growth in education and health services. Leisure and hospitality will also add 2.1% per year.

Real Personal Income
(Percent change, annual rate)



Housing:

The real estate downturn was a major economic blow for many metros in this past recession, and Las Vegas was at the forefront. The metro's housing market has been recovering but it will take time before it fully rebounds—from its pre-recession peak of \$326,000, the existing median home price plummeted 63% to \$121,000 by the end of 2011. But signs of a bottom were finally seen in 2012, and by the fourth quarter of 2015 home prices were back up over \$200,000. This left them still 33% lower than late 2006, but it is a good start especially considering that the 2006 prices were overvalued. The housing boom left the metro area with an excess inventory of housing that will need to be burned off before the market can return to a consistently positive growth trend. The metro area was a hotspot for speculative activity, and as these investors pulled out of the market, inventory buildup occurred. Foreclosure activity, which soared in the state, has also left many homes on the market. As a result of the excess supply of homes, construction activity slowed, with housing starts down substantially.

Home price gains in Las Vegas have slowed in 2015, a result of the initial post-recession bounce back beginning to lose some steam. According to the Federal Housing Finance Agency's purchase-only home price index home prices in Las Vegas increased by 5.6% y/y during the fourth quarter of 2015. This is well off the 13% y/y pace during the fourth quarter of 2014 and the whopping 25% y/y pace in the fourth quarter of 2013. With that said, the double-digit pace of home price gains was unsustainable over

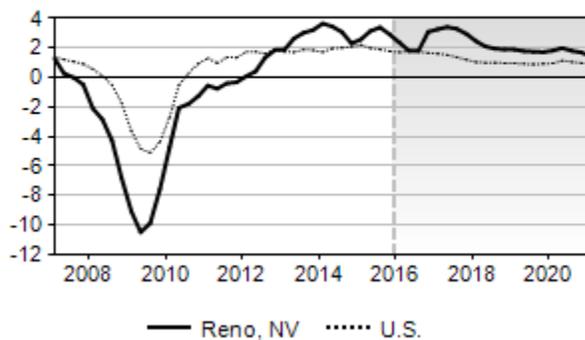
a long period of time so it is not a surprise that prices would begin to moderate after the outsized rebound in the prior years. The region still has a long way to go before its housing market reaches conditions that can be considered normal. Home values here stand at only 65% of their peak during the housing boom, and Las Vegas has one of the highest shares of mortgages in negative equity among all US metro areas. A full recovery in home values is likely still more than a decade away for Sin City

FORECAST SUMMARY

Economy in 2016:

Payroll growth in Reno has picked up significantly in recent years. Employment increased by at least 2.7% from 2013-2015 and is expected to grow another 2.3% this year. While 2016 growth will represent a slight deceleration, employment growth will be back above 3% in 2017 as activity related to the new Tesla factory picks up. Key sectors this year include professional/business services, manufacturing, leisure/hospitality, and construction. Also, the metro’s burgeoning transportation and warehousing sector will continue to experience solid gains. The metro area is quickly becoming a hub for logistics and data centers due to its strategic geographic location. A low cost of doing business means that this trend will likely continue. The transportation and warehousing sector will create a large number of jobs for the region. In addition to the jobs created by Tesla, the Gigafactory is expected to attract other facilities from firms with ties to battery manufacturing.

Total Employment
(Quarterly change, compound annual rate)

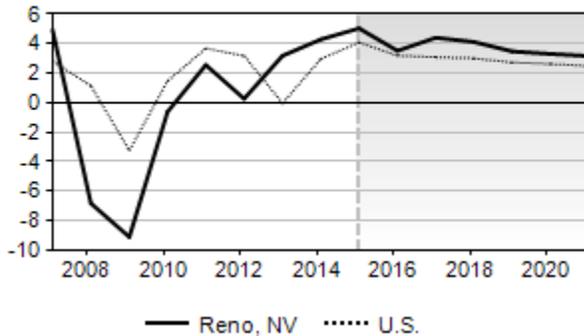


Economy through the Next Five Years:

Reno’s long-term economic growth will be led by its services sectors. Leisure and hospitality services has been a major employment generator in recent years and will continue to create jobs at a 1.6% pace over the forecast period. However, the metro is diversifying away from its traditional leisure/hospitality sector and will see strong growth elsewhere. We expect professional and business services to lead gains, adding an average of 4.0% annually to payrolls from 2016 through 2021. The education and health

services sector will see solid growth as it keeps up with a population that is progressively getting older, averaging 1.2% job gains annually during 2016–21. The manufacturing will really shine over the medium-term with employment gains sprinting 4.5% annually over the next five years thanks to especially strong growth from 2017-18. We expect the construction sector to continue its protracted recovery with payrolls surging 7.4% annually, on average.

Real Personal Income
(Percent change, annual rate)



Housing:

After taking a severe beating during the housing crisis, home prices in Reno, like the rest of the state, are rebounding. Indeed, home values have been appreciating at double-digit year-on-year (y/y) rates since the middle of 2012. According to data from the Federal Housing Finance Agency, prices climbed 16% y/y in the fourth quarter of 2015. Strong labor market growth, dwindling supplies of for-sale existing homes and limited new construction are pushing values up rapidly. Housing starts continued to climb higher in 2015, when nearly 2,800 new homes were constructed, more than double the 2012 level. This year, we expect demand to quicken the pace of new homebuilding again to more than 3,200.

LONG-TERM OUTLOOK

Table 1 shows that we forecast employment growth in Washoe County to expand by an average rate of 2.3% between 2015 and 2020, with employment growth decelerating to 0.9% annually after 2025 as the post-recession boost tapers off. The highest long-term employment growth will be seen in the service sectors. The personal income growth rate will remain steady over the 25-year forecast horizon at a shade under 5%, although it could rise if the county is able to attract a larger share of higher-paying jobs to the region. Momentum related to current big-ticket investments could potentially attract additional investment down the road as other firms cluster in the region. Finally, we forecast that real gross county-level product will grow at an annual rate of 3.7% over the next five years, on par with Nevada's real GSP growth during that time.

Table 2 presents a special population forecast prepared by IHS Economics for 2015 through 2040. Over the next five years, we forecast an annual population growth rate of 1.2%, which is a departure from the 2.2% annual growth rate recorded between 1990 and 2015. Over the longer term, we forecast that total population will also grow at an annual rate of 1.0% over the next 10 years, and remaining at that pace over the 25-year period between 2015 and 2040. The fastest-growing age cohorts over the next 25 years will be the over 85 years old, 80 to 84 years old, 75 to 79 years old, and 70 to 74 years old cohorts. By contrast, annual population growth rates in the cohorts containing working age population between the ages of 25 and 55 will be much lower, with the highest growth rates in the 35 to 39 years old, and 40 to 44 years old cohorts. The growing share of the population in the older cohorts is not just a local phenomenon but something that is also playing out nationally and does represent a downward pull on overall economic growth.

As shown in Table 2, over the 25-year forecast period, we forecast that Reno's annual household growth rate will be 1.1%, close to the population growth rate over the same period. However, between 2015 and 2020, the differential between the household and population growth rates will be greatest, with households growing at 1.5% during this period compared to annual population growth of 1.2%. This differential is due to the household size decreasing following the Great Recession. An improving housing market will spur pent up demand for new units and in turn drive household growth as young adults move out of their parents' house, roommates disband to get their own residence, and homelessness eases. After 2025, we forecast an average annual household growth rate of 1.1%, with the largest growth rates occurring in the 65 years and older cohorts

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Appendix C

Woods and Poole Background Data

Chapter 2. Technical Description of the Woods & Poole Economics, Inc. 2015 Regional Projections and Database

Introduction

The Woods & Poole Economics, Inc. database contains more than 900 economic and demographic variables for every county in the United States for every year from 1970 to 2050. This comprehensive database includes detailed population data by age, sex, and race; employment and earnings by major industry; personal income by source of income; retail sales by kind of business; and data on the number of households, their size, and their income. All of these variables are projected for each year through 2050. In total, there are over 200 million statistics in the regional database. The regional model that produces the projection component of this database was developed by Woods & Poole. The regional projection methods are revised somewhat year to year to reflect new computational techniques and new sources of regional economic and demographic information. Each year, a new projection is produced based on an updated historical database and revised assumptions.

The fact that the proprietary Woods & Poole economic and demographic projections rely on a very detailed database, makes them one of the most comprehensive county-level projections available. A description of some characteristics of the database and projection model is contained in this chapter.

Overview of the Projection Methods

The strength of Woods & Poole's economic and demographic projections stems from the comprehensive historical county database and the integrated nature of the projection model. The projection for each county in the United States is done simultaneously so that changes in one county will affect growth or decline in other counties. For example, growth in employment and population in Houston will affect growth in other metropolitan areas, such as Cleveland. This reflects the flow of economic activity around the country as new industries emerge or relocate in growing areas and as people migrate, in part because of job opportunities. The county projections are developed within the framework of the United States projection made by Woods & Poole. The U.S. projection is the control total for the 2015 regional projections and is described in the "Overview of the 2015 Projections" chapter included in Woods & Poole publications.

The regional projection technique used by Woods & Poole — linking the counties together to capture regional flows and constraining the results to a previously determined United States total — avoids a common pitfall in regional projections. Regional projections are sometimes made for a city or county without regard for potential growth in surrounding areas or other areas in the country. Such projections may be simple extrapolations of recent historical trends and, as a result, may be too optimistic or pessimistic. If these county projections were added together, the total might differ considerably from any conceivable national forecast scenario; this is the result of each regional projection being generated independently without interactive procedures and without being integrated into a consistent national projection.

Woods & Poole Economics, Inc. is a small, independent corporation that specializes in long-term county economic and demographic projections. Woods & Poole's database for every county in the U.S. contains projections through 2050 for more than 900 variables.

The methods used by Woods & Poole to generate the county projections proceed in four stages. First, forecasts to 2050 of total United States personal income, earnings by industry, employment by industry, population, inflation, and other variables are made. Second, the country is divided into 179 Economic Areas (EAs) as defined by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). The EAs are aggregates of contiguous counties that attempt to measure cohesive economic regions in the United States (a list of all EAs and their component counties can be found in Appendix 6 following this chapter); in the 2015 Woods & Poole model, EA definitions released by the BEA in May 2007 are used. For each EA, a projection is made for employment, using an “export-base” approach; in some cases, the employment projections are adjusted to reflect the results of individual EA models or exogenous information about the EA economy. The employment projection for each EA is then used to estimate earnings in each EA. The employment and earnings projections then become the principal explanatory variables used to estimate population and number of households in each EA.

The third stage is to project population by age, sex, and race for each EA on the basis of net migration rates projected from employment opportunities. For stages two and three, the U.S. projection is the control total for the EA projections. The fourth stage replicates stages two and three except that it is performed at the county level, using the EAs as the control total for the county projections.



The “Export-Base” Approach

The specific economic projection technique used by Woods & Poole to generate the employment, earnings, and income estimates for each county in the United States generally follow a standard economic “export-base” approach. This relatively simple approach to regional employment projections is one that has been used by a number of researchers (see [5] and [9]). Although this approach has been criticized by several empirical studies (e.g., [8]), given the availability of regional data it remains one of the most feasible methodologies.

Certain industrial sectors at the regional level are considered “basic.” This means that these sectors produce output that is not consumed locally but is “exported” out of the region for national or international consumption. This assumption allows these sectors to be linked closely to the national economy, and hence follow national trends in productivity and output growth. Normally, the “basic” sectors are mining, agriculture, manufacturing, and the Federal government. In contrast, “non-basic” sectors are those such as retail trade, utilities, real estate, and construction, the output of which is usually consumed locally. The growth of the “non-basic” sectors depends largely on the growth of the “basic” sectors that form the basis of the region’s economy.

Intuitively, this approach has great appeal and there are numerous examples that seem to support the “export-base” theory. Automobile production in Detroit, for instance, is obviously much more sensitive to national and international price and demand for transportation equipment than to local demand. In Texas, oil and natural gas exploration and

production are tied closely to the worldwide demand and supply of petroleum resources and not tied primarily to energy consumption in Texas.

Although the theory is appealing, some shortcomings do exist in the “export-base” approach. For example, some “basic” commodities produced locally are consumed locally. Producers of durable equipment used in other manufacturing processes are often affected not by the national demand for their product but by the regional demand. Machine tool makers that supply the local automobile industry in Detroit will prosper to the extent Detroit’s automobile producers prosper. In Houston, the strength of the local oil industry will affect the demand and production of equipment for oil and natural gas production and exploration. In both of these instances, some durable manufacturing industries exist to serve local, not national, markets.

However, despite the shortcomings, the availability of relatively clean data for sub-national geographic areas makes the “export-base” approach very useful. The analytical framework for projections using the “export-base” approach entails estimating either demand equations or calculating historical growth rate differentials for output by sector. The principal explanatory variable, or the comparative data series for growth rate differentials, is the national demand for the output of that sector. Employment-by-sector data are often used as a surrogate variable since county output-by-sector data are not available; employment-by-sector data are used by Woods & Poole. Earnings projections are then obtained by using earnings-per-employee data either estimated as part of the model or imposed exogenously on the system. The complementary relationship could also be estimated, i.e., using an earnings forecast to derive employment based on earnings-per-employee data; this procedure has been used previously in some Woods & Poole regional models.

A modification of the “export-base” approach is used by Woods & Poole to account for regional variants to normal “basic”/“non-basic” industry definitions. Some “non-basic” sectors can be more appropriately modeled as “basic” sectors in certain regional economies. The finance and insurance sector or wholesale trade sector in New York City, for example, and the accommodation and food services sector in Las Vegas, are cases in which traditionally “non-basic” sectors are really “basic.” New York is a worldwide financial and trade center and thus “exports” these services outside of the region; Las Vegas, as a vacation and entertainment center, similarly “exports” the output of its accommodation and food services sector to other parts of the country. Activity in these sectors, in these specific geographic areas, is therefore linked more closely to the performance of these same sectors in the surrounding regions and the nation as a whole than to the other “basic” industries in the region.

A list of Economic Areas that have traditionally “non-basic” sectors modeled as “basic” sectors is presented in Table 1. Areas with “non-basic” sectors modeled as “basic” are those areas with a proportion of “non-basic” sector employment relative to total employment greater than 1.5 standard deviations above the national mean for a specific sector. With the exception of two sectors that are always considered “non-basic,” construction and state and local government, all “non-basic” sectors are evaluated for each EA using this method (see [5]).

The remainder of the Woods and Poole technical documentation is available upon request.

Appendix D

The Nevada State Demographer’s projections are developed using the Regional Economic Models, Incorporated (REMI) model through 2034.

The REMI model is a comprehensive model that encompasses a wide range of demographic and economic activity. It relates a region or set of regions to each other and the nation as whole. It also comes with differing levels of industrial detail. The model is used by the Nevada Commission on Economic Development, the Nevada Department of Administration, and the University of Nevada, Las Vegas. The model used in producing these projections is a 17 region model with a breakdown into 23 industrial sectors. Documentation about the model can be found at <http://www.remi.com/support/documents.shtml>.

The overall linkages of the REMI model are shown in Figure 1.

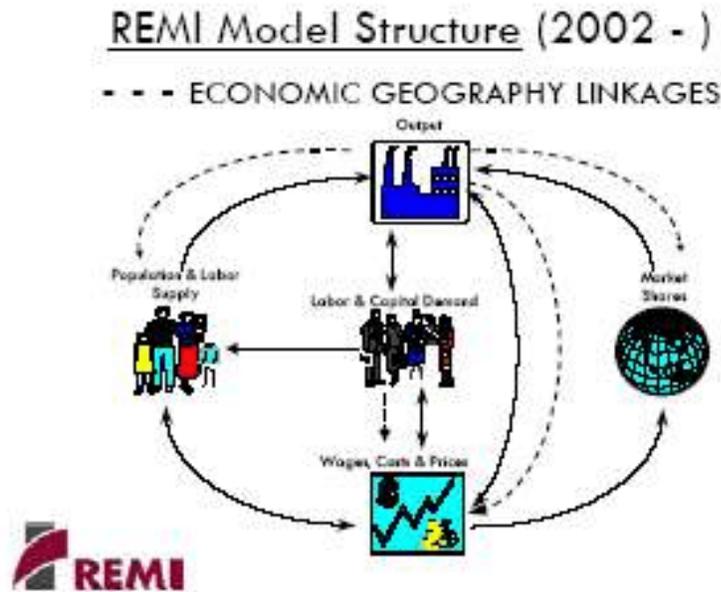
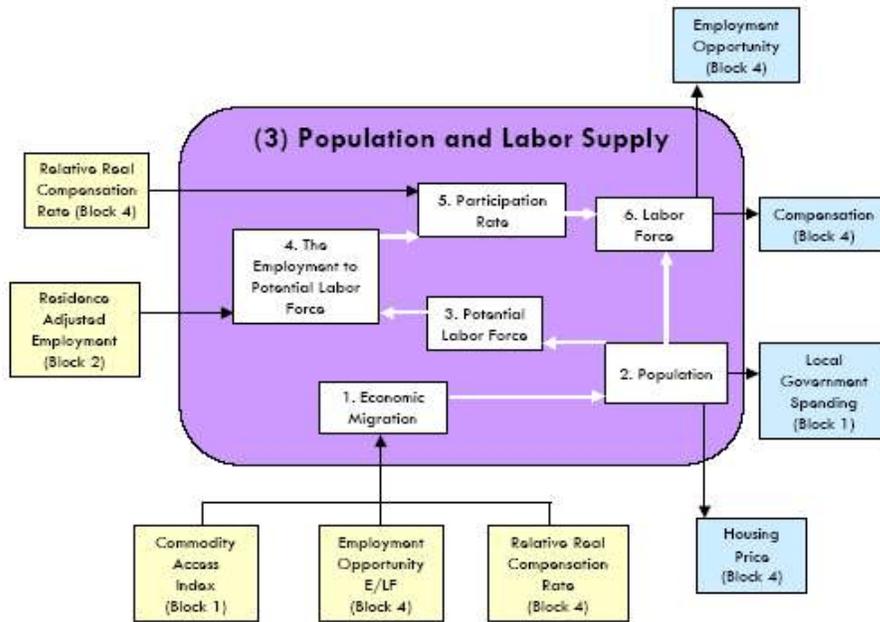


Figure 1

The REMI model comes with a baseline forecast, what has come to be referred to as an out of the box projection (see Appendix pages). The user can do things such as update employment for all sectors and by specific sectors through what are called policy variables. For the most part, those kinds of changes were made to the model in producing the projections. One area of concern in looking at the model was the performance of the Population and Labor Supply Block which is illustrated in Figure 2.

Figure 2:

Block 3. Population and Labor Supply



LIMITATIONS TO THE PROJECTIONS

REMI has a number of strengths. The model is under constant research and has been available for over 25 years. It has been examined and reviewed through peer-reviewed articles. The User Guide and other information is available to anyone with a computer, that is much of the detail of their methodology is publicly available. One of the major limitations with the model is that there is currently limited historic data from which it is built. This is because of the change from the Standard Industrial Classification (SIC) to the North American Industrial Classification System (NAICS) in 2001. Limited history limits the amount of information that a model can be constructed from for portraying the area that is being modeled. Another limit is that Nevada has a number of small counties as well as areas with limited numbers of employees or employers in various economic sectors. This leads to missing information through data suppression which REMI and this office has to then estimate values to substitute for that missing information.

Also, REMI is built on federal data including the annual estimates that are done by the Census Bureau. So any projections done within the model have to be re-based off of Nevada’s generated estimates.

Appendix E

TMWA Forecast Information – excerpted from the “[2016 – 2035 TMWA Water Resource Plan](#)” pages 95 – 100.

Logistic Curve Model

Many of the extrapolation methods that can be used to project populations are not constrained by any limits on growth. This implies that population growth (or decline) can go on forever and in many cases this is not a reasonable assumption. The logistic curve, one of the best-known growth curves in demography, solves the resource constraint problem by including an explicit ceiling on population. It is a symmetric sigmoid shape (S-shape) curve that has an initial period of slow growth, followed by increasing growth rates, followed by declining growth rates that eventually approach zero as population size levels off at its upper limit. The idea of limits on growth is intuitively plausible and is consistent with many theories of population growth, geographic impediments such as public lands and unbuildable terrain, growth constraints created by water resources and government policies, and in-fill of existing vacant residential sites. The population model developed for Washoe County is called a Keyfitz (1968) curve and is described as:

$$Pop_t = \alpha / (1 + \beta_1 * e^{-\beta_2 t})$$

Where t is time index (1950 = 1), Pop_t is population in time t, α is population ceiling, β₁ and β₂ are shape parameters.

Using population values from 1950 to 2014 the model was estimated as:

$$Pop_t = 612,579.8 / (1 + 11.93398 * e^{-0.0536284 t})$$

Where “t” is time in years starting at t = 1 for 1950. The R² = 0.9995 shows that this model is a very good fit to the historic data. Figure 4-3 plots the estimation results of this model.

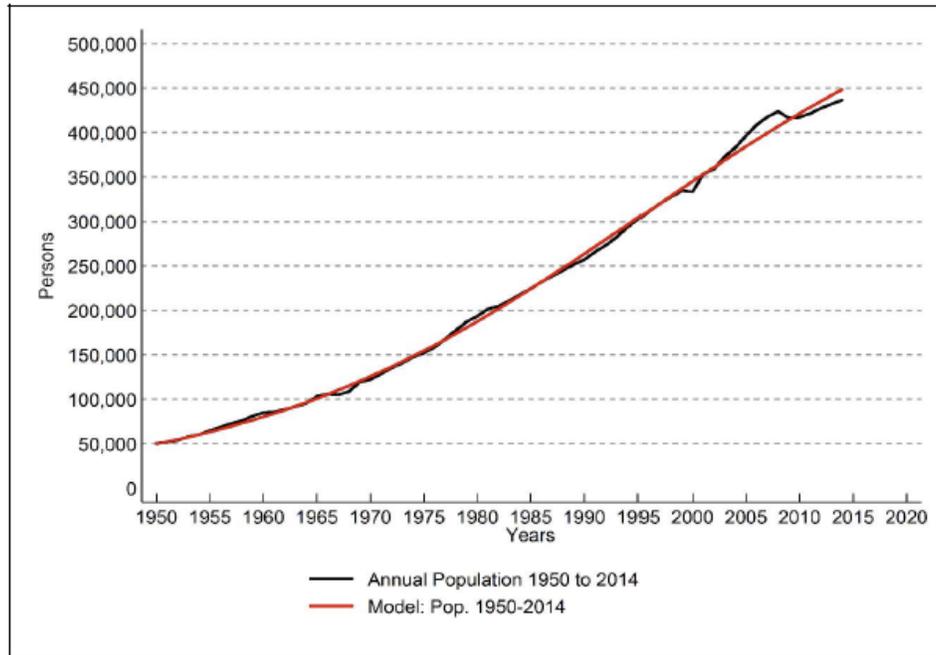


Figure 4-3. Population Logistic Curve Models Results

The results of the logistic model are shown in Figure 4-3. The model fits the data well and has a $R^2 = 0.99$. Figure 4-4 compares the model with the State Demographer’s projection (“SDP”) and the 2014 Consensus Forecast; the results of these three different models provide essentially the same projection through 2025.

The State Demographer’s population projection is one of two other population projections produced locally for planning; the other projection is the Washoe County Consensus Forecast. The consensus forecast was last published by the Truckee Meadows Regional Planning Agency in 2014 based on data that was provided by TMWA, the State Demographer in early 2014 and two national sources Global Insight, and Woods and Poole. The national sources are based on slightly older data due to the nature of the time to provide a forecast on such a large scale. TMWA and the State Demographer are able to provide timelier forecast by using more locally derived data sources.

The Demographer’s projections are based on the REMI model and were last published in the fall of 2014. The REMI model is based on economic data since 2001 and thus has a limited ability to project population during this recession but is based on detailed local employment and economic data and can be compared with the logistic model.

As shown in Figure 4-4, through the year 2025 there is no statistical difference between the logistic curves and the SDP. For the years 2025 to 2035 the SDP takes a more linear path and trends upwards. Since there is no statistical difference between the logistic curve and the SDP, (the SDP is contained entirely within the 95 percent confidence interval), the logistic curve model is used as the population model for this 2035WRP.

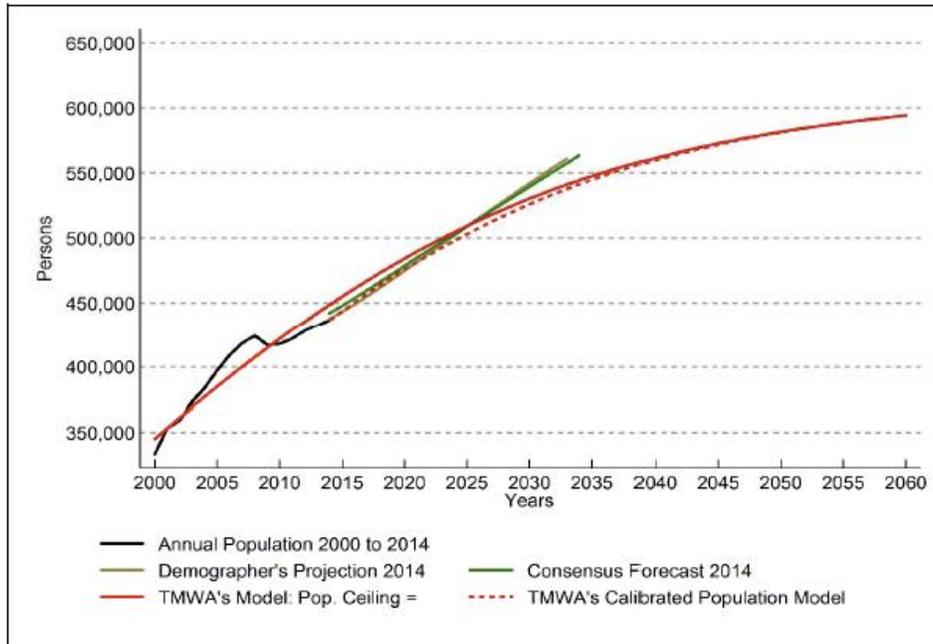


Figure 4-4. Comparison of Logistic, Demographer's, and Consensus Projections

Figure 4-5 shows the population projected to 2100 and compares the general trend with the SDP and the historic data used to estimate the model. The projected county population is expected to level out over time consistent with a logistic curve growth model. This model estimates the long-run population ceiling of 612,579 persons estimated to occur after 2100 with a 95 percent confidence interval of 576,493 to 648,666 persons.

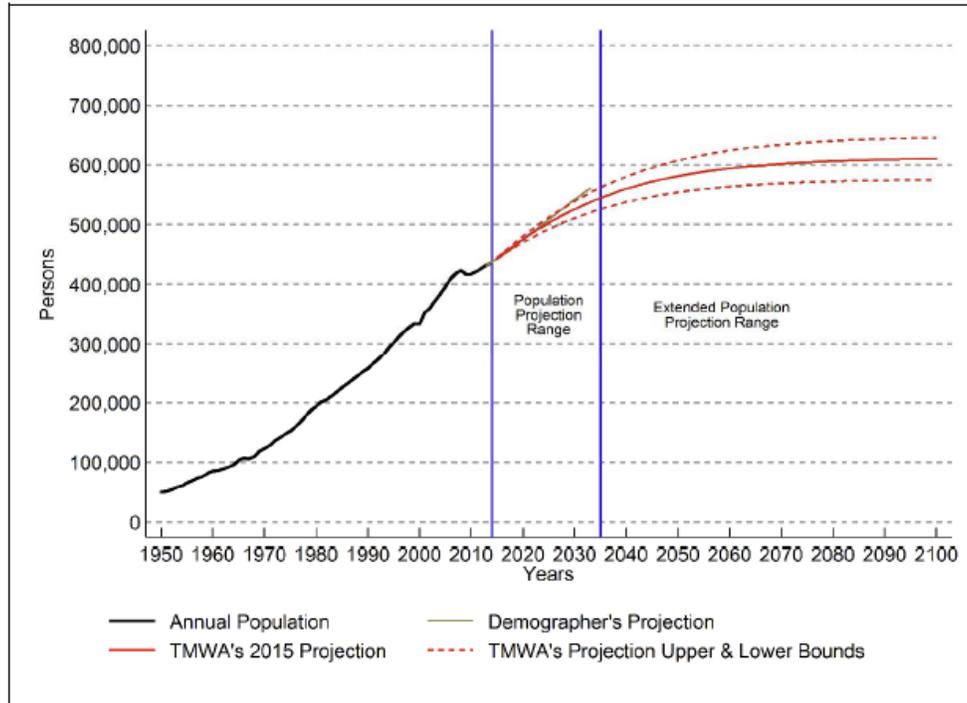


Figure 4-5. Population Projection Results

Table 4-1 provides the Washoe County projections for 2015 to 2060 to be used as the basis for the water demand projection. Washoe County is projected to gain a total of 150,630 persons between 2016 and 2035. This represents a 33.9 percent increase in population with an annual average increase of 0.65 percent.

Table 4-1. Population Projections 2015 to 2060

	Washoe County	TMWA (TRA+non-TRA)		Washoe County	TMWA (TRA+non-TRA)
	----a----	----b----		----c----	----d----
2015	443,729	386,752	2038	554,358	483,278
2016	450,488	392,607	2039	557,241	485,708
2017	457,072	398,383	2040	559,995	488,085
2018	463,476	403,965	2041	562,624	490,398
2019	469,699	409,397	2042	565,133	492,545
2020	475,740	414,720	2043	567,526	494,637
2021	481,596	419,797	2044	569,807	496,646
2022	487,267	424,740	2045	571,981	498,606
2023	492,754	429,457	2046	574,052	500,363
2024	498,058	434,052	2047	576,024	502,057
2025	503,178	438,515	2048	577,901	503,752
2026	508,118	442,905	2049	579,688	505,389
2027	512,879	447,048	2050	581,387	506,785
2028	517,463	451,094	2051	583,003	508,225
2029	521,874	454,825	2052	584,539	509,457
2030	526,115	458,450	2053	585,999	510,795
2031	530,188	462,016	2054	587,387	512,116
2032	534,099	465,610	2055	588,705	513,095
2033	537,850	468,748	2056	589,956	514,356
2034	541,445	472,037	2057	591,145	515,373
2035	544,890	474,929	2058	592,273	516,199
2036	548,187	477,712	2059	593,344	517,261
2037	551,342	480,497	2060	594,359	518,160

The disaggregation of population within TMWA's retail and its one wholesale area and the balance of the county is a function of the location of dwelling units. An analysis of land use and distribution of the buildings in the different utility service areas and hydrographic basins provide the base data for projecting dwellings, commercial buildings, and the general consumption of land.

Data Construction and Trends

The Washoe County population is projected using a time-series from 1950 to 2014. Since no formal similar time-series for land use or building construction in Washoe County exists, it was constructed using information embedded in the County Assessor's data files. The County Assessor is the only source of detailed land use and building inventory for the entire county. A July 2014 snapshot of the assessor's data was downloaded from Washoe County's website for use in developing the projection of land consumption and building structures. The data provides a very detailed snapshot of what is known about each parcel and buildings that currently exist on each parcel. This database, when combined with a GIS parcel boundary database provides sufficient information for developing building(s) and dwelling unit history that can be used as part of the water demand projections.

Using a GIS application, each parcel was attributed with a utility service area and hydrographic basin. In this manner the database was used to model Washoe County land use, dwelling unit history, profile and distribution, and the distribution and development of commercial buildings. Figure 4-6 shows the constructed historic data from 1955 to 2014, historic population, and the general trend in persons-per-dwelling unit. The persons-per-dwelling unit is used to disaggregate the population into utility service areas and hydrographic basins. The construction of the persons-per-dwelling unit time-series was possible because of the long-life of buildings. The statistical models of dwellings and building presented below uses data from 1955 to 2014 due to a stable statistical relationship between numbers of dwellings to growth in population during that time span.

The Assessor's building data is reclassified into four classes that map to TMWA's customer classes. Dwelling units on domestic wells, while not served by any utility, are accounted for in the projection. Single-family dwelling units (generally single family homes, townhouses, or condominiums) are serviced under the TMWA Residential Metered Water Service ("RMWS") rate class. Multi-Family dwelling units are apartments, duplexes, and any multi-family structure that would be billed on TMWA's Multi-family Metered Water Service ("MMWS") rate. Last is the commercial building group which includes any non-residential buildings that would receive water on the General Metered Water Service ("GMWS") rate. Figure 4-6 and Figure 4-7 show the data used for the models and the projected units.

Appendix F

July 28, 2016

Calibration of Global Insight Employment Forecast

Jeremy M. Smith, GIS Coordinator - TMRPA

Background: The Global Insight Forecast is a key input to the Consensus Forecast (CF) as it provides a second projection of job growth by sector when combined with data sourced from Woods and Poole. Local sources (e.g. NV State Demographer) have only recently begun to publish sector-level employment forecasts and these will likely be of great benefit in subsequent versions of the CF. Nevertheless, for this rendition of the CF we have opted to follow historic protocols. Historically, these two outside sources of employment information have been more closely aligned, however in this delivery from Global Insight the disparities with Woods and Poole and other 3rd party employment data sources (e.g. Infogroup business points) were quite wide (c. 60k jobs).

After discussion with the NV State Demographer and staff from Global Insight it was determined that the base year (2016) value for number of employees was principally determined using data from the U.S. Bureau of Labor and Statistics Quarterly Census of Employment and Wages (BLS). Job counts done by BLS tally only covered employees (i.e. jobs where unemployment insurance is paid) which leads to underestimation of total employment by omitting many job types that are not required to pay into unemployment. Some notable examples include sole proprietorships and part-time positions. Since this CF will be used to inform traffic demand modeling and other regional planning efforts, it is imperative that we have an accounting of all jobs. Both Woods and Poole and the NV State Demographer retrieve base data from the Bureau of Economic Analysis (BEA). The BEA uses a more inclusive methodology, not limited to covered employment, for tallying jobs by sector and is therefore more indicative of total jobs in the region.

Since the Consensus Forecast approach is basically an average of totals, we determined that averaging a subset of jobs (i.e. Global Insight based on BLS) with a forecast based on all potential jobs would provide a spurious output average. Thus, we concluded that a calibration process was required to factor up the base year estimation from Global Insight to account for the disparity.

Methodology: In order to calibrate the Global Insight forecast we examined employee counts from both the Bureau of Labor and Statistics (BLS) and Bureau of Economic Analysis (BEA) by sector for 2014, the most recently available common year of reporting between the 2 sources (**Table 1**). Data listing employee counts by 2-digit (or groups of 2-digit) NAICS sectors were acquired from both sources and compared by first calculating an absolute difference and then by calculating the ratio of BLS jobs reported to those reported by BEA. The BEA counts were consistently higher and up to 12 times greater than employee counts reported by BLS (e.g. NAICS 21 – Mining, quarrying, and oil and gas extraction).

We then used two approaches to determine a reasonable calibration factor from the comparison of these two datasets. Our first approach factored the BLS data sector by sector using the included NAICS designations and factors listed in Table 1. This created a calibrated total employment value of 259,272 jobs in 2014. We then created a calibrated value of 259,747 for year 2014 by applying a factor of 1.36 to the total employment reported by Global Insight. The factor of 1.36 represents the ratio of total BEA employees to total BLS employees reported in 2014.

We opted to use the second approach because the ratio of total employment produced a calibrated value for Global Insight employment in 2016 that was closer in numeric space to the 2015 value from both the NV State Demographer and our Infogroup business data points. We applied the 1.36 factor to the annual projection values from Global Insight across the 20-year CF projection horizon. We then averaged the calibrated Global Insight employment values with the employment values reported by Woods and Poole for each year until 2036 to derive the yearly employment values to be reported in the 2016-2036 Consensus Forecast document. Since each year was factored by the same value we expect very little change to the employment growth rate forecasted by Global Insight and therefore maintain its validity in the consensus forecasting approach.

Table 1. Comparison of employment counts by industry sector from the Bureau of Labor and Statistics (BLS) and Bureau of Economic Analysis (BEA) for Washoe County, NV in 2014.

Washoe County, NV - North American Industry Classification System (NAICS) sectors	BLS Employee Count (2014) ¹	BEA Employee Count (2014) ²	Difference	Factor
NAICS 11 Agriculture, forestry, fishing and hunting	114	223	109	1.96
NAICS 21 Mining, quarrying, and oil and gas extraction	167	2,007	1,840	12.02
NAICS 22 Utilities	415	456	41	1.10
NAICS 23 Construction	11,293	14,273	2,980	1.26
NAICS 31-33 Manufacturing	12,107	13,227	1,120	1.09
NAICS 42 Wholesale trade	8,914	9,903	989	1.11
NAICS 44-45 Retail trade	21,988	26,440	4,452	1.20
NAICS 48-49 Transportation and warehousing	10,943	12,510	1,567	1.14
NAICS 51 Information	2,008	2,819	811	1.40
NAICS 52 Finance and insurance	5,592	14,835	9,243	2.65
NAICS 53 Real estate and rental and leasing	3,536	15,130	11,594	4.28
NAICS 54 Professional and technical services	9,670	17,137	7,467	1.77
NAICS 55 Management of companies and enterprises	2,739	3,088	349	1.13
NAICS 56 Administrative and waste services	14,493	18,551	4,058	1.28
NAICS 61 Educational services	1,973	3,143	1,170	1.59
NAICS 62 Health care and social assistance	21,027	24,207	3,180	1.15
NAICS 71 Arts, entertainment, and recreation	5,205	8,149	2,944	1.57
NAICS 72 Accommodation and food services	29,905	31,159	1,254	1.04
NAICS 81 Other services, except public administration	5,464	13,433	7,969	2.46
NAICS 92 Public administration	23,438	28,582	5,144	1.22
Total	190,991	259,272	68,281	1.36

¹ <http://www.bls.gov/cew/>

² <http://www.bea.gov/itable>

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