SCENARIO ANALYSIS: EXECUTIVE SUMMARY

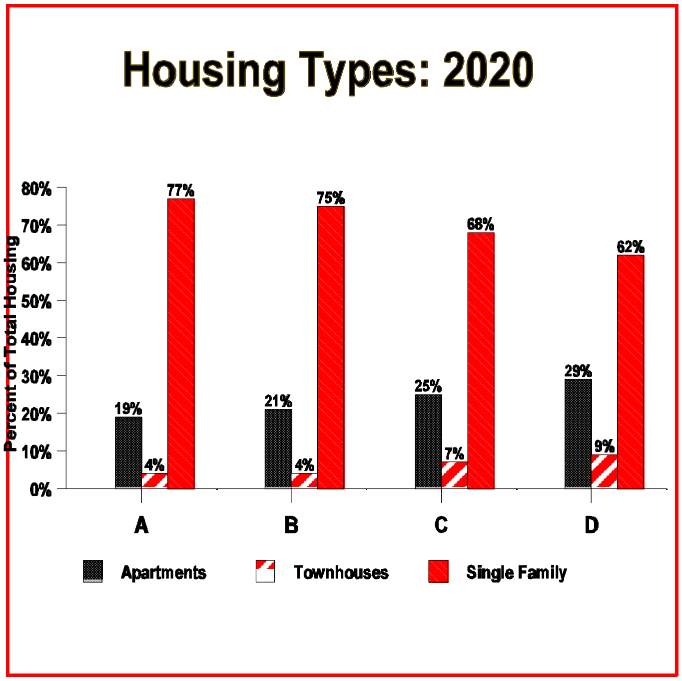
Background

The Greater Wasatch Area is currently home to 1.6 million people (a population slightly smaller than the Portland metro area). By 2020, the population is expected to increase to 2.7 million people (a population roughly equivalent in size to the current population of the San Diego metro area). This means that on average, throughout the period, the population will increase by approximately 43,000 new residents per year, a population the current size of Bountiful. This population growth is expected to occur at a rate twice the national average and two-thirds of the growth will originate from the region's own children and grandchildren.

As part of a regional visioning process, four alternative growth scenarios have been prepared. All of these scenarios utilize the same regional population growth, but distribute this growth differently. Scenario B is the baseline scenario because it portrays the future as planned for in state and local planning documents current as of 1997. As such, it is a benchmark for comparison with other scenarios. All of the scenarios are broad depictions of potential future conditions whose primary value is as a tool for discussing future tradeoffs.

Scenario A

Scenario A shows how the region could develop if the pattern of dispersed development currently occurring in many communities continued in the future. Larger lot sizes will be present and more auto-oriented development will occur. Many think of Scenario A as an extension of the trends of the past three to five years.



Key Attributes – Population densities fall below the current average for the region (5.0 persons per residential acre in 2020 compared to 6.0 presently). Seventy-seven percent of total housing in 2020 is single family residential. People will have larger yards and more private space than other scenarios. The average lot size for a single family residence in 2020 will be 0.38 acre, the largest of all scenarios. The developed area will nearly double by 2020, increasing from 431 square miles currently to 840 square miles in 2020.

Automobile use is higher than all other scenarios (vehicle miles of travel 'VMT' per capita is 31.6 in 2020 compared with 25.1currently). Increased investment in roads results in faster speeds (less congestion) than other scenarios. However, the dispersed development results in longer trips with the end result being about the same amount of time on the road. Air quality is expected to be worse than all other scenarios, although not significantly so. The larger amount of vehicle travel contributes 2,660 tons per day of pollution in the airshed in 2020, 5.9% greater than the baseline estimate (Scenario B). Per capita water use and infrastructure costs are higher than all other scenarios because of the expansive growth patterns that result in additional outdoor watering and increased costs associated with more lineal feet of pipeline, roads, and utilities. Per capita water use in 2020 is 303 gallons per day, 8.6% higher than the baseline. Infrastructure costs for transportation, water, sewer, and utilities are estimated to be $37.6 billion, 26% more than the baseline.

Scenario B

Scenario B is the baseline scenario with minor refinements. It shows how the region is likely to develop based on plans current through 1997. Development continues in a dispersed pattern much like it has for the past 20 years.

Key Attributes – Population densities remain approximately at current levels. Seventy-five percent of total housing is single family residential. Development patterns remain much like they are today. The average lot size for single family residential homes in 2020 will be 0.36 acre, the second largest of all scenarios. The developed area increases by 75% over present, increasing from 431 square miles to 755 square miles in 2020.

Automobile use is the second highest of all of the scenarios with a VMT/capita in 2020 of 29.3 compared with 25.1 today. Street and highway expenditures are less than Scenario A, but speeds are lower as well. Air quality, with total emissions of 2,511 tons per day in 2020, is the second best of all the scenarios. Per capita water use and infrastructure costs are the second highest of all of the scenarios. This is true because the dispersed growth pattern results in additional outdoor watering and higher costs for more lineal feet of pipeline, roads, and utilities.

Scenario C

Scenario C accommodates new growth by increasing the proportion of new development devoted to infill and redevelopment, as well as focusing the development of new lands into walkable development types. Walkable development includes a street layout, transit development, and mix of residential and commercial uses that allow residents to walk more. This more compact development pattern is integrated with a more extensive transit system.

Key Attributes – Population densities increase by 26% from current levels. Sixty-eight percent of total housing in 2020 is single family residential. People will live closer to one another in Scenario C than Scenarios A and B. The average lot size for single family residential in 2020 will be 0.29 acres, the second smallest among the scenarios. The developed area increases by 30%, growing from 431 square miles today to 557 square miles in 2020.

Automobile use is the second lowest among the scenarios with VMT/capita of 28.4 in 2020. Average peak period speeds are slightly lower than the baseline because travel is more concentrated and congested. However, trip times are slightly shorter than the baseline for the same reason. One- quarter of the population would be within a half mile of rail transit in 2020 compared with just 2% in the baseline. Air quality is deemed the best of all the scenarios, although not significantly so. The amount of pollution in the airshed in 2020 is estimated to be 2,501 tons per day, 0.4% lower than the baseline. Per capita water use of 231 gallons per day in 2020 is the second lowest among the scenarios because of less outdoor watering. Infrastructure costs of $22.1 billion are the lowest of all of the scenarios because of less highway construction and water development, as well as lower municipal and developer costs because of the compact development pattern.

Scenario D

Scenario D accommodates new growth by significantly increasing current densities. Relatively large amounts of infill and redevelopment occur. New development is concentrated along rail transit infrastructure and incorporates a high degree of walkable development and mixed uses.

Key Attributes – Overall densities increase by approximately one-third from current levels. Sixty-two percent of total housing in 2020 is single family residential. People live closer to one another under Scenario D than all other scenarios. The average lot size for single family residential in 2020 would be 0.27 acres, the smallest of all of the scenarios. The developed area increases by 20% over the present, growing from 431 square miles currently, to 516 square miles in 2020.

Water consumption of 218 gallons per day in 2020 and automobile travel per capita of 28.1 in 2020 are lower than all other scenarios. This occurs because of the compact development pattern and the extensive transit network. One-third of the population would be within a half mile of rail transit in 2020 instead of 2% in Scenario B. Despite less vehicular travel, air quality is worse than Scenarios B and C because of the concentration of activity along the urban core. The air quality differences among scenarios B, C, and D, however, are very small. Infrastructure costs of $23.0 billion are second lowest among the scenarios.

Scenario Analysis: Selected Characteristics: 2020

Greater Wasatch Area

	Measure	Current***	Scenarios A	B	C	D
Demographics						
Population	--	1,687,124	2,695,278	2,695,278	2,695,278	2,695,278
Households	--	549,889	958,454	958,454	958,454	958,454
Land Use						
Population Density	Persons per Residential Acre	6.0	5.0	5.6	7.6	8.2
Total Developed Area	Square Miles	431	840	755	557	516
New Land Developed	1998 to 2020 Square Miles	--	409	325	126	85
Agricultural Land Consumed	1998 to 2020 Square Miles	--	174	143	65	43
Average Lot Size	Single Family Residential, Acre	0.32	0.37	0.35	0.29	0.27
Housing Type						
Single Family	% of Total	68%	77%	75%	68%	62%
Town House	% of Total	4%	4%	4%	7%	9%
Multiple Family	% of Total	28%	19%	21%	25%	29%
Transportation*						
Vehicle Miles Traveled	Millions	40.7	85.3	79.2	76.6	76.0
VMT / per Capita	--	25.1	31.6	29.3	28.4	28.1
Average Peak Speeds**	Miles per Hour	25.7	22.9	20.0	20.9	19.8
Average Trip Time**	Minutes	18.5	21.5	23.2	22.0	22.8
Transit Share of Work Trips**	% of Total	2.6%	2.9%	3.2%	4.2%	4.8%
Population within Half Mile of Rail Transit	--	0	38,755	45,557	664,991	866,765
Percent of Total Population	--	0%	1.5%	1.7%	25.0%	32.0%
Air Quality						
Emissions	Tons per Day	1,869	2,660	2,511	2,501	2,512
Air Quality Score	Lower Score = Better Air Quality	--	9	7	6	8
Water						
Water Demand	Acre-Feet	698,800	1,025,900	954,200	808,600	770,500
Per Capita Water Use	Gallons per Day	319	303	279	231	218
Infrastructure Costs						
Regional Water	Billions of 1999 Dollars	--	0.6	0.6	0.5	0.5
Regional Transit	Billions of 1999 Dollars	--	0.6	0.6	2.3	4.7
Regional Roads	Billions of 1999 Dollars	--	17.0	10.7	10.1	10.6
Municipal and Developer	Billions of 1999 Dollars	--	19.4	17.8	9.2	7.2
Total	Billions of 1999 Dollars	--	37.6	29.8	22.1	23.1

* Population varies slightly among scenarios for transportation modeling.
** Metro counties only.
*** Current represents the base year used for modeling purposes and varies from 1995 - 1998 among measures.

SCENARIO ANALYSIS: BACKGROUND

Purpose
This analysis provides descriptive characteristics on four alternative scenarios for the Greater Wasatch Area. The purpose of the scenarios is to help the public understand the inherent trade-offs associated with alternative future development.

Population Growth
Regional population projections are held constant in each scenario so that the differences among scenarios reflect changes in how the region grows, not how much the region grows. The projections indicate the Greater Wasatch Area will increase from 1.6 million to 2.7 million by about 2020. Reaching the next one million population mark would only be extended by five years if the region's fertility rate converged with the national average.

Origin and Contributors
The Utah Growth Summit in December 1995 initiated this process for state government. The Summit has resulted in an ongoing dialogue regarding growth issues in Utah.

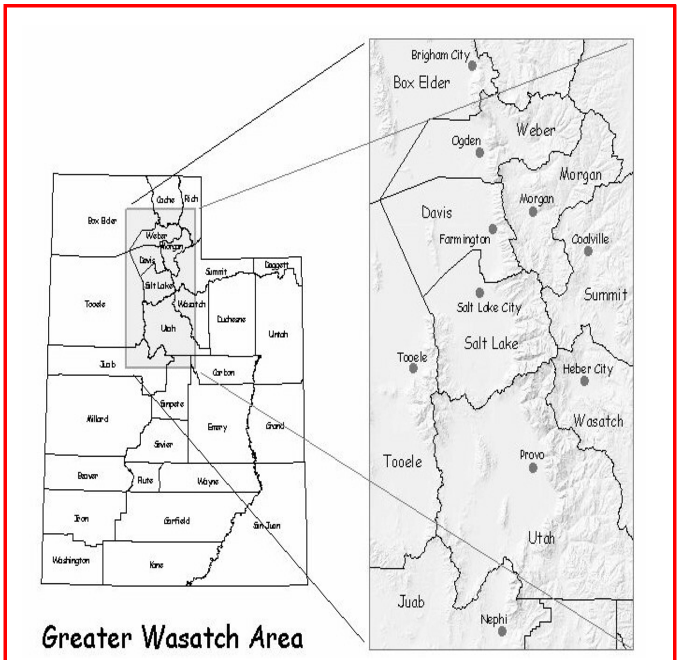
This scenario analysis is a product of Envision Utah, a public-private partnership for quality growth, with technical support provided by the Quality Growth Efficiency Tools (QGET) Technical Committee, a group of state and local experts who specialize in the technical analysis useful for long range planning.

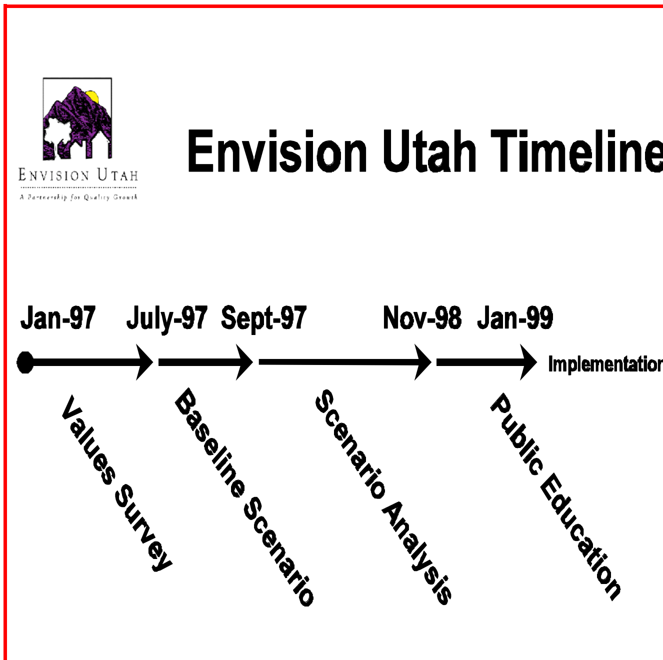
Since the original release of the Baseline Scenario in September 1997, members of the QGET Technical Committee have spent approximately 20,000 hours preparing this Scenario Analysis. The analysis includes contributions from 79 local government entities, eight state government departments, multiple private entities, and the consulting assistance of Fregonese Calthorpe Associates.

Study Area and Scope
The analysis has been prepared for the Greater Wasatch Area, a 10-county area that includes four counties within and six counties adjacent to the Salt Lake-Ogden and Provo-Orem metropolitan areas. It is the combined area of what is commonly referred to as the Wasatch Front and Wasatch Back, including the population living on the front (west) and back (east) side of the Wasatch Mountain Range. This area is the emerging commutershed for the extended Salt Lake area.

The scope is limited to the subject areas of demographics, economics, transportation, air quality, water, sewer, and land use. Other relevant subject areas and issues are being addressed qualitatively by Envision Utah.

Major Limitations
This analysis is meant to inform, not dictate, future development. Land use decisions are and will continue to be made by local government. Infrastructure decisions will continue to be made by the relevant government entity. Accordingly, this analysis should be viewed as part of a regional visioning process to form a growth strategy for the future. As such it cannot be used to determine the feasibility of specific projects or developments.





SCENARIO ANALYSIS: LAND USE

Background

Each scenario includes varying assumptions about future development and the design characteristics. Important distinctions include the residential density and lot size, land area consumed, agricultural land converted to urban use, the level of infill and redevelopment, and the type of development (walkable or non-walkable).

Residential Density and Lot Size

Currently, the Greater Wasatch Area has a residential density of approximately 6.0 person per residential acre. Residential density excludes land area used for parks, schools, commercial use, streets, cemeteries, golf courses, roads, and other non-residential land uses.

The overall density in the year 2020 varies among the scenarios from 5.02 persons per residential acre for Scenario A to 8.16 persons per residential acre for Scenario D. By way of comparison, the current residential density of the avenues neighborhood in Salt Lake City is about 7.0 per acre. The average lot size in 2020 for single family residential homes in Scenario A is 0.37 acre, followed by 0.35, 0.29, and 0.27 for B, C, and D, respectively.

Land Consumption

Approximately 431 square miles of land is currently urbanized within the Greater Wasatch Area. Based on the assumptions about land use, Scenario A converts an additional 409 square miles to urban use by 2020, followed by Scenario B (325 additional square miles), Scenario C (126 additional square miles), and Scenario D (additional 85 square miles). Land consumption varies according to the amount of infill, redevelopment, and density of new development.

Agricultural Lands

Approximately 457 square miles of irrigated agricultural lands exist in the Greater Wasatch Area today. As more land is converted to urban use, the amount of land devoted to agriculture diminishes. Scenario A converts 174 square miles to urban use by 2020, followed by 143 for Scenario B, 65 for Scenario C, and 43 square miles for Scenario D.

Infill and Redevelopment

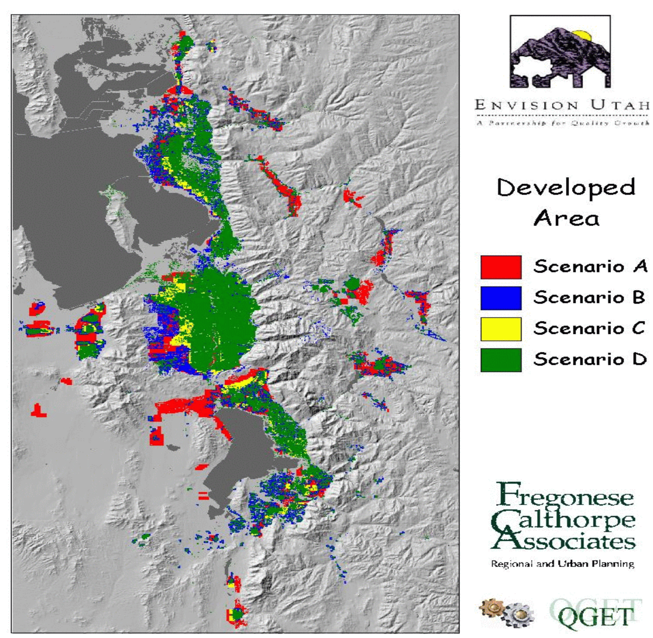
In Scenarios A and B, the vast majority of new growth is at the edge of the existing urban area. Consequently the level of infill and redevelopment is minimal. Scenario C and D, in contrast, place a relatively significant amount of new development in infill and redeveloped areas.

Walkable Development

Non-walkable development includes most of what currently exists in the Greater Wasatch Area. Walkable development includes a street layout, transit development, and a mix of residential and commercial uses that allow residents to walk more. The scenarios have been designed using seven development types (shown on the following page).

Land Use Characteristics (2020)

	A	B	C	D
Population Density (Persons per Residential Acre)	5.02	5.58	7.56	8.16
Average Lot Size (acres)	0.37	0.35	0.29	0.27
New Land Consumption (Square Miles)	409	325	126	85
Agricultural Land Consumption (Square Miles)	174	143	65	43



SCENARIO ANALYSIS: DEVELOPMENT TYPES

Walkable Types

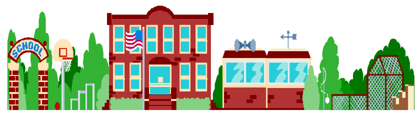
Downtown

Net Density: 50 du/acre*

Example: SLC Central Business District

The Downtown designation exhibits a high level of integration of uses, with a mix of residential, employment, and commercial uses within a pedestrian and transit-friendly environment. Residents and other users can easily walk for daily needs and activities, and are well connected to other parts of the community via transit service.

Town



Net Density: 15 du/acre*

Example: Downtown Provo, Old Downtown Kaysville

The Town designation maintains the integration of uses and walkability of the Downtown type, but with lower densities. The town development type, is a pedestrian friendly mixed-use core surround by fairly integrated medium density housing

Village

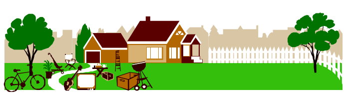
Net Density: 8 du/acre*

Example: Lehi or Avenues

Like its higher density counterparts, the Village development type exhibits a mix of residential, commercial, and employment uses into a walkable environment. Though density is lower, including a large percentage of single-family residential development, the spacing of uses and street connectivity maintain a pedestrian-friendly landscape and the potential for efficient transit service.

Non-Walkable Types

Large Lot Subdivision



Net Density: 2 du/acre*

Example: Portions of Bluffdale or Draper

This single-use residential development type is notable for its very low density, large lots (1/2 acre+), and separation from other uses. Travel to and from other uses, and even within the development, is primarily by automobile. This type is also characterized by its lack of street connectivity and a streetscape that is designed for the needs of the auto rather than the pedestrian, bicycle, or other form of transportation.

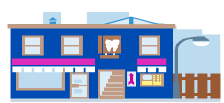
Residential Subdivision

Net Density: 5du/acre*

Example: Portions of West Jordan or Murray

The Residential Subdivision type is also wholly residential, with access to and from other uses primarily via automobile. Density is fairly low, with standard lots of between 1/8-1/4 acre, and street connectivity is generally poor.

Activity Center

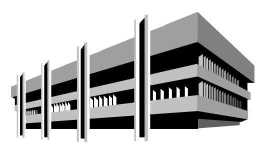


Net Density: 20 du/acre*

Example: Holladay or Sugar House

A suburban Activity Center is a medium density agglomeration of jobs and housing, but unlike its Town counterpart, is not walkable or pedestrian-friendly. Most access to and within an activity center is via automobile, though in some regions centers may be located on major transit lines. Activity usually falls off after work hours, and street connectivity is generally poor.

Industrial/Office Park



Net Density: 0 du/acre*

Example: The International Center

This designation is employment-oriented, with access to and from other uses via automobile. Low to medium density agglomerations of office buildings and industrial facilities are often organized into campus-like settings, with large numbers of employees commuting to the site from around the region.

Note: * du/acre = dwelling units per acre
Net density excludes land use for streets and public opens space in the land area portion of the calculation.
Source: Calthorpe Associates

SCENARIO ANALYSIS: TRANSPORTATION

Background

The transportation analysis considers the implications of varying development patterns on the performance of the transportation system, the associated amount of transportation investment, and the mix of highway and transit options. Two important limitations must be considered: the regional scale of the analysis and the application of the transportation models. Despite these limitations, the analysis is valid and helpful in understanding general differences in regional development patterns.

Regional Scale -- The analysis has been completed at the regional scale. This means that project, alignment, and type (such as transit technology) specific decisions cannot be inferred from the analysis. Estimates of ridership on individual rail lines or traffic on specific streets or highways cannot be used at this juncture to conclude that specific facilities are or are not warranted.

Transportation Models -- The transportation models utilized were calibrated to analyze alternative regional transportation improvements. While these models provide valuable information and are the only models currently developed for application in this area, their ability to predict the full range of responses to alternative land use and transportation scenarios is limited. Consequently, the transportation analysis depicts conservative estimates of the range of travel demand. Vehicular travel reductions and transit ridership for Alternatives C and D, for example, will be at least as large as those estimated.

Highway and Transit Use

The amount of vehicle miles traveled (VMT) and transit use follows the intended design of each scenario. Scenario A was designed to be auto-oriented with relatively more highway construction. In contrast, Scenario D was designed to reduce the growth in vehicular travel and maximize transit use. VMT is highest for Scenario A, followed by Scenario B. VMT for both C and D are approximately the same.

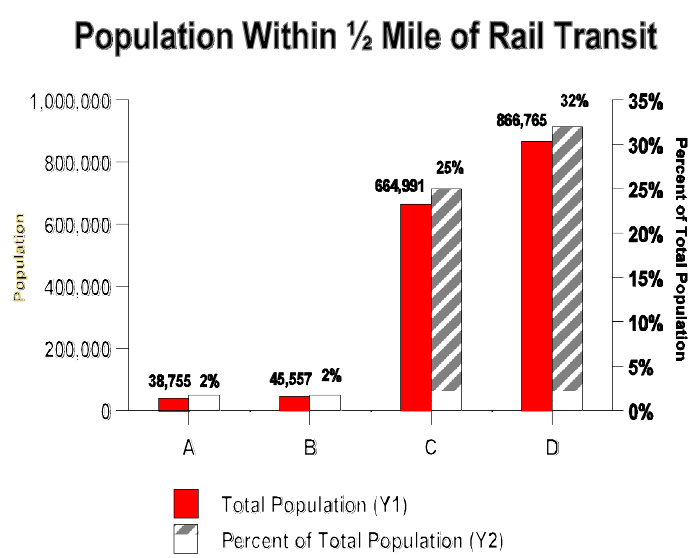
Transit ridership and shares increase significantly under Scenarios C and D. The major explanation for this increase in ridership is the significant amount of transit developed under both alternatives and the increased proximity of the population to rail transit. The population within half mile of rail transit increases from approximately 2% of the total under the baseline, to 25% and 32% under Scenarios C and D, respectively.

Congestion

Peak period speeds are highest for Scenario A because of the significant amount of highway development and the dispersed pattern of development (more travel on the periphery of the urban area where roads are less congested). The dispersed development, however, also results in longer trips with the end result being about the same amount of time on the road. Scenarios B, C and D all have similar average peak speeds and trip times. In the case of Scenarios C and D, speeds are lower than Scenario A because of less highway construction and more development concentrated within the urban core where traffic is already congested. Average speeds in Scenario B are lower than Scenario A because of less

Transportation Characteristics (2020)

	Base Year	A	B	C	D
VMT Per Day (millions)	40.7	85.3	79.2	76.6	76.0
VMT Per Day Per Capita	25.1	31.6	29.3	28.4	28.1
Transit Trips Per Day (thousands)	54	99	120	136	162
Transit Share of Work Trips	2.6%	2.9%	3.2%	4.2%	4.8%
Average Peak Speeds (MPH)	25.7	22.9	20.0	20.9	19.8
Average TripTime (min.)	18.5	21.5	23.2	22.0	22.8



investment in highways.

Scenario Analysis: Transportation (con't)

Investment

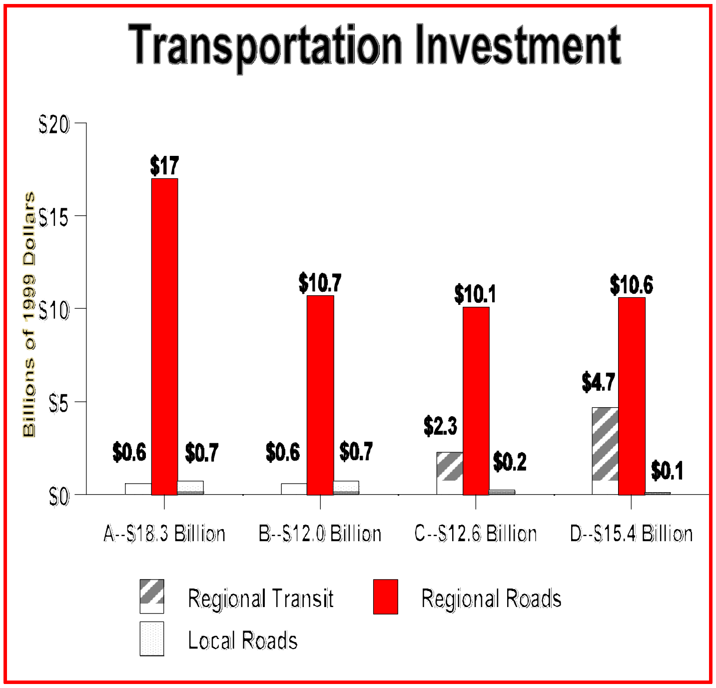
Transportation investment among the scenarios varies significantly in the dollar amount and the mix of highway and transit development. Scenario A includes $17 billion of regional roads, $742 million in local roads, and $600 million in transit improvements (north-south TRAX line currently under construction and expanded bus service). Scenario B has less highway construction ($10.7 billion) and local roads ($718 million), and the same transit assumptions as Scenario A. Scenario C includes $10.1 billion in regional roads, $249 million in local roads, and a significantly expanded transit network. This includes approximately 30 miles of new, medium capacity rail transit, as well as nearly 100 miles of commuter or some other type of rail or express bus. Total transit costs for Scenario C are $2.3 billion and transit development occurs along existing rights-of-way. Scenario D includes slightly more highway infrastructure than Scenario C because the concentration of population within the urban core requires expansion of already existing facilities. Regional highway cost for Scenario D is $10.6 billion and local road costs are $128 million. Scenario D includes the most extensive transit network with 75 miles of medium capacity rail transit, for a total transit investment of $4.7 billion. Enhanced transit service is provided to downtown Ogden and Brigham Young University. New right-of-ways would need to be purchased.

Legacy Parkway – This scenario analysis has occurred at the same time as significant public interest and debate about the development of the Legacy Parkway. Because of the sweeping, regional scale of this analysis, it is not well-suited to project specific decisions such as the justification and need for the Legacy Parkway or any other major development (for instance the feasibility and alignment of a light rail spur stretching from West Valley City to Sugarhouse). The analysis does, however, include varying portions of the Legacy Parkway in each of the scenarios. Scenario A includes the entire Parkway stretching from Box Elder County to Juab County. Scenario B includes portions of Legacy in Weber, Davis, Salt Lake, and Utah County. Scenario C includes the South Davis portion only.

Scenario D has been modeled without and with the South Davis portion of Legacy. This analysis cannot be used to make final decisions about the rationale for building or not building this portion of Legacy because of the general regional level of the modeling. The analysis does, however, include several relevant findings:

- Inclusion of the South Davis portion increases regional road costs by approximately $300 million
- Removal of the South Davis portion results in 1,000 fewer vehicle trips per day and 1,500 additional transit trips per day in 2020
- Removal of the South Davis portion decreases average peak period speeds by 0.9 mph
- Congestion on I-15 in Davis County, even after adding two additional lanes, is worse without the Legacy Parkway

Ultimate decisions about South Davis Legacy will require additional study.



SCENARIO ANALYSIS: AIR QUALITY

Background

Evaluating air quality for the Greater Wasatch Area requires the consideration of several pollutants, each of which has unique physical and chemical characteristics, as well as varying effects on human and ecosystem health.

This analysis considers three types of pollutants: fine particulates (PM), carbon monoxide (CO), and ozone (O_3). Each of these, at times, exceed federal health and safety standards. PM and CO are modeled to simulate air quality problems experienced during the winter months when frequent temperature inversions occur. Ozone is modeled for the summer months when other contributing pollutants combine to form ground-level ozone. The analysis of all three pollutants incorporates the wind patterns that have been present during past high pollution episodes.

Air quality varies among the scenarios primarily because of the amount, location, and level of congestion of automobile travel in each scenario. Contrasts among the scenarios are evaluated by comparing total emissions, the distribution of these emissions, and the proximity of the emissions to the population.

The analysis results in only small variations in the air quality among the scenarios. For instance, total emissions in all of the scenarios are within a 6.5% range.

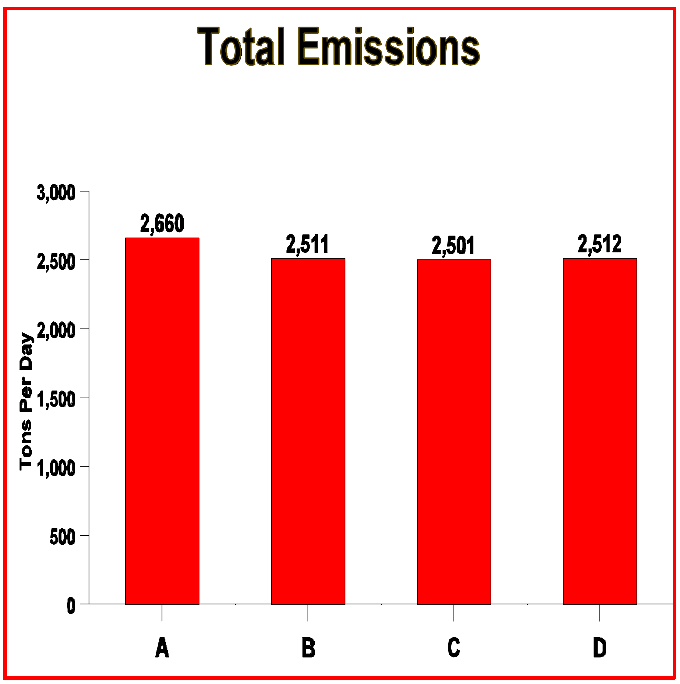
One explanation for the narrow ranges found in the analysis may be the conservative nature of the transportation modeling. Transportation experts believe that vehicular travel reductions and increases in transit use for Alternatives C and D will at least be as large as those estimated. Still, the differences among scenarios are instructive and helpful in understanding how different patterns of development impact air quality in the region.

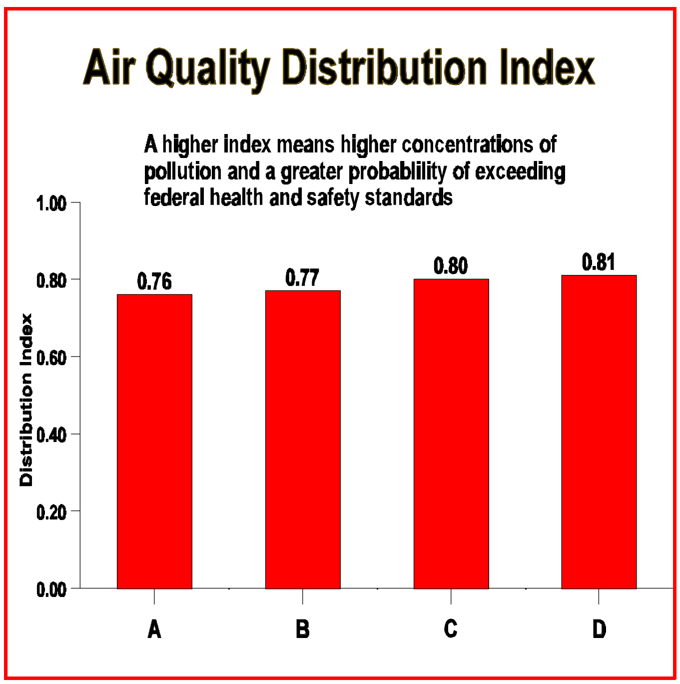
Emissions

Emissions include the amount of pollution in the airshed of the Greater Wasatch Area produced from all sources. It is measured here as tons per day. The primary reason for the variation is the vehicle miles of travel (VMT) and the average speeds in each scenario. This is best illustrated by considering Scenario D. Scenario D has the second lowest VMT, but the second highest emissions. Emissions are high in Scenario D because congestion is higher (measured by lower average speeds). Automobiles omit more pollution when they stop, idle, and accelerate.

Distribution of Emissions

Understanding the distribution of pollution is important because higher concentrations of pollution are more dangerous to the public's health. Air quality scientists have created an index of the localized build up of emissions in certain areas. This index represents the differences in the distribution of pollution across the study area. A higher index means higher concentrations of pollution and a greater probability of exceeding federal health and safety standards.





SCENARIO ANALYSIS: AIR QUALITY (CON'T)

An interesting result of the distribution analysis is that the dispersed development pattern depicted in Scenario A helps to disperse pollutants rather than concentrating them in a central urban core. From a distribution perspective, Scenario A has favorable air quality characteristics, while Scenario D has less favorable characteristics because it concentrates pollutants along a more dense corridor of population and urban activity. For instance, in Scenario A, 58% of the average hourly emissions occur in 10% of the geographic region. This compares to 66% for Scenario D within the same area.

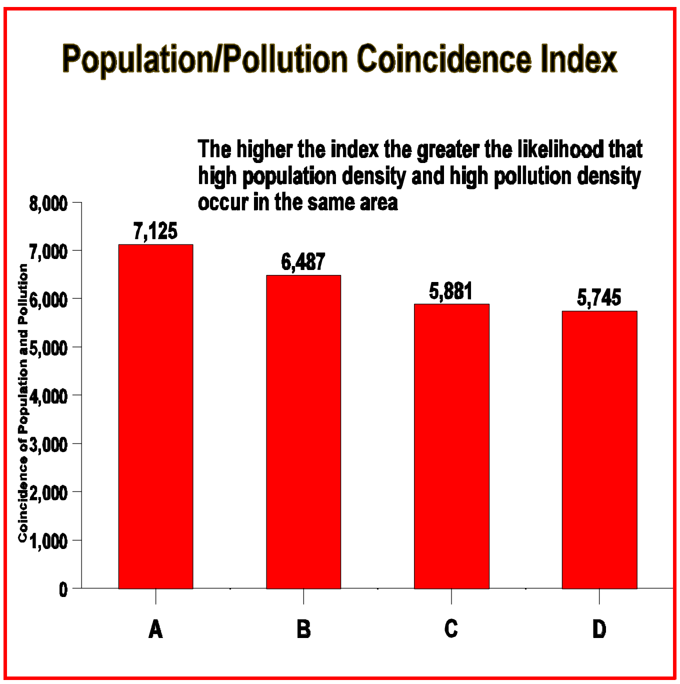
Proximity of Population to Pollution

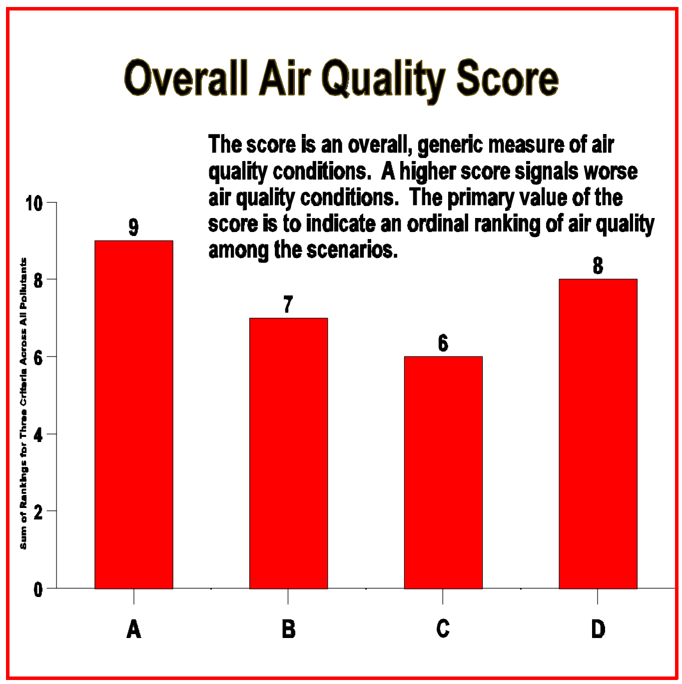
In addition to the amount and distribution of the pollution, the proximity of the pollution to the population is also relevant. Air quality analysts have overlaid a mapped grid of population density onto a mapped grid of average daily emissions. From this overlay they have calculated a population/pollution coincidence index. A higher value for this index indicates that there is a greater coincidence of population and pollution among the individual grid cells of these maps. The index is highest for Scenario A and B, respectively, and lowest for Scenarios C and D.

Overall Air Quality Ranking

Air quality analysts have considered the total emissions, distribution of these emissions, and proximity of the emissions to the population to derive an overall, generic air quality assessment. This assessment was done by averaging the score for each criteria (total emissions, distribution, and proximity to population) across pollutants and summing the ranked values. The final score assumes the health effects of each pollutant and the relative importance of each criteria are equal.

Scenario C has the best overall performance, followed by Scenario B (the baseline), Scenario D, and Scenario A.





SCENARIO ANALYSIS: WATER

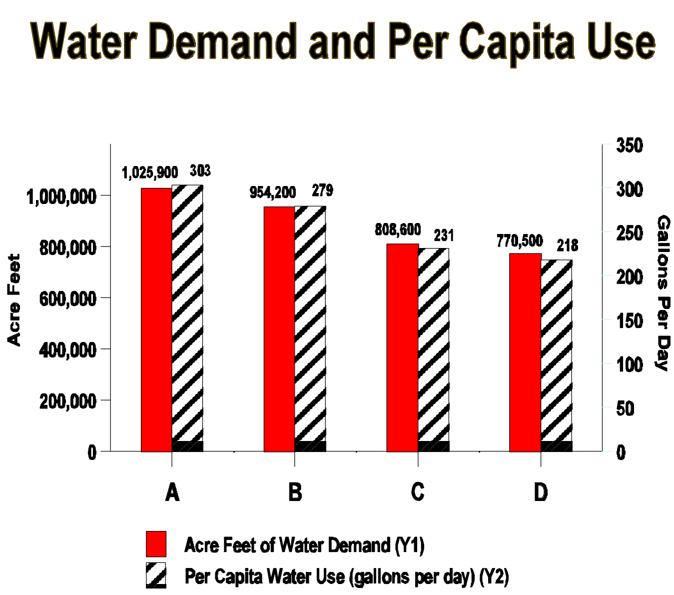
Background

The Wasatch Front Water Demand/Supply Model was used to project water demands for each scenario. Separate calculations are made for residential uses and for commercial/industrial uses. Residential demand is calculated as a function of persons per household, lot size, assessed value of property, soil type, and season of the year. Industrial and commercial demand is calculated as a function of employment.

These water demand functions are combined with the population distribution, water pressure system zones, and changing land use categories to yield a forecast of water demand.

All scenarios assume a 12.5% reduction by 2020 in per capita water use because of low flow plumbing, gradual increases in xeriscaping, and price increases. Real water rate assumptions are also constant among scenarios. All scenarios assume a 50% increase in real water rates by 2020.

Since the price and water conservation assumptions are the same in each scenario, per capita water use varies among scenarios because of changes in land use. This includes differences in the lot size and allocation of population and employment in each scenario.



Water Demand

Water demand is the acre feet of residential, commercial, industrial, and secondary water required to meet the needs of a constant regional population within each scenario. Total water demand includes water used by large, self-supplying industrial facilities such as Kennecott Copper, but per capita calculations exclude self supplied users.. The amount of water demanded varies primarily because of differences in the amount of outdoor watering.

Among the scenarios the amount demanded varies by one-third. Scenarios A and B assume a higher proportion of new development will be large lot residential. This type of development requires more water development. Consequently, Scenarios A and B require the most water, followed by C and D.

Per Capita Water Use

Current per capita residential, commercial, industrial, and secondary water use in the Greater Wasatch Area is approximately 319 gallons per day. Precipitation is a primary factor influencing water consumption and Utah presently ranks as the second highest state in per capita water consumption. Under Scenarios A and B, Utah would likely maintain this ranking. Under Scenario C, Utah would still have high per capita water use relative to many western states. Under Scenario D, Utah's per capita water use ranking would drop from second to sixth highest, based on current rankings.

Water Development

Each scenario requires varying levels of state and regional infrastructure investment to supply the needed water. All scenarios include the completion of the Central Utah Project, as currently envisioned.

Scenario A requires full development of the Bear River, as well as treatment of Utah Lake water. State and regional water infrastructure costs for Scenario A are $619 million.

Scenario B requires full development of the Bear River, but postpones treatment of Utah Lake water until after 2020. State and regional water infrastructure costs for Scenario B are $606 million.

Scenario C postpones the development of the Bear River and treatment of Utah Lake water until after 2020. Scenario D does the same, although the concentration of the population within Salt Lake County raises the question about the need for Bear River water sooner. State and regional water infrastructure costs are the same for both scenarios at $526 million.

SCENARIO ANALYSIS: INFRASTRUCTURE COSTS

Background

Infrastructure costs vary by scenario because of the varying locations and densities of residential development in each scenario.

Infrastructure Defined -- Infrastructure has been divided into regional and sub-regional categories. Regional infrastructure includes:

highways	arterial streets	mass transit
reservoirs	major pipelines	

It also includes other types of development that are regional in scope and service multiple jurisdictions.

Sub-regional infrastructure includes:

wells	storage tanks	small reservoirs
pumps	treatment plants	sewer lines
septic tanks	storm drain lines	detention basins
minor pipelines	manholes	streetlights
utility trenches	local roads	

It also includes other types of development initiated by developers, municipalities, and special districts.

Infrastructure for other public facilities such as schools, parks, police, and fire have not been estimated. Cost estimates include capital costs for new residential development only; estimates have not been made for operating and maintenance costs.

Research and Methodology – Analysts have examined similar research throughout the country, as well as reviewing a sampling of capital facilities plans for local municipalities in Utah. Several engineering firms were contacted and interviews were held with several city managers and public works director. In total, six state agencies, seven special districts, 15 municipalities, all major utilities, and three engineering firms contributed to these estimates.

The methodology includes a two-step approach where developer and municipal costs were estimated with a mathematical model, while regional costs were based on engineering estimates of specific infrastructure projects. Specifically, developer and municipal costs were estimated using a cost function derived from actual developments within the study region. Psomas Engineering, a national recognized engineering firm, provided these actual costs and assisted with all developer cost estimates. The cost functions relate infrastructure costs per dwelling unit to housing densities. Separate estimates are made for development on raw land, infill, and reuse.

Limitations – These infrastructure cost estimates are more elaborate and incorporate more local specificity than many others that have been utilized as part of a regional visioning process. These estimates must still, however, be viewed as regional approximations of the magnitude of infrastructure costs associated with alternative forms of development. Actual costs will vary and updates to this analysis will be made as warranted.

Findings

Scenario A results in the highest infrastructure costs. Scenario A includes the most extensive road network and developer and utility costs are higher for large lot residential homes that often have a longer setback from the street. Scenario B is the second most expensive; it too includes a dispersed development pattern. Other similar studies have found that dispersed development patterns result in more lineal feet of pipeline, roads, and utility lines. Scenario C results in the lowest infrastructure costs. The road network is similar to Scenario B and regional transit costs are higher, but these are more than offset by the less expensive water and municipal and developer costs. Scenario D is the second least expensive. Its costs are higher than Scenario C because of the even more extensive transit network and the need for more road construction within the central urban core where the population is concentrated.