Sublette

Recent Growth Trends & Future Growth Projections for Sublette County 2004 to 2014

Photo: PinedaleOnline.com

About the Sonoran Institute

The Sonoran Institute works with communities to conserve and restore important natural landscapes in western North America, including the wildlife and cultural values of these lands. The lasting benefits of the Sonoran Institute's work are healthy landscapes and vibrant communities that embrace conservation as an integral element of their quality of life and economic vitality.

Through community stewardship, the Sonoran Institute contributes to a day when:

- Healthy landscapes, including native plants and wildlife, diverse habitat, open spaces, clean air and water, extend from northern Mexico to Western Canada.

- People embrace stewardship as a fundamental value by caring for their communities, economies and natural landscapes.

- Resilient economies support strong communities, diverse opportunities for residents, productive working landscapes, and stewardship of the natural world.

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Executive Summary

This report seeks to inform policymakers in Sublette County about recent residential growth trends and likely future growth trends. The report provides an analysis of growth trends from 1990 to 2004, and projects the amount and location of future growth from 2004 to 2014 based upon past growth patterns. It also presents several alternative future growth scenarios that vary from past growth patterns. Finally, the report includes an analysis of future infrastructure needs in the Pinedale fringe area, the unincorporated area bordering the city.

Recent Growth Trends

According to the U.S. Census Bureau, Sublette County grew by 22 percent from 1990 to 2000. This growth rate has accelerated since 2000; it is estimated that the county has grown by an additional 11.5 percent since 2000. The total population gain from 1990 to 2004 is estimated at 36 percent.

There were 1,055 new housing units built in the county from 1990 to 2004, a 36 percent increase. About 29 percent of Sublette County's total housing units are within the Pinedale fringe area, which includes the area within two miles of the town's boundaries. That area attracted about 32 percent of the new housing construction and subdivision lots from 1990 to 2004.

About 40 percent of the total residential lots created in the county from 1990 to 2004 were in the Greater Pinedale area, which includes the town and the two mile area surrounding its borders. About 44 percent of the lots created from 1990 to 2004 are located in the rural areas of the county. Twelve percent of new growth occurred in the areas surrounding the county's unincorporated places, Cora, Daniel, and Boulder. Marbleton and Big Piney, the two other incorporated cities in the county, attracted little growth from 1990 to 2004.

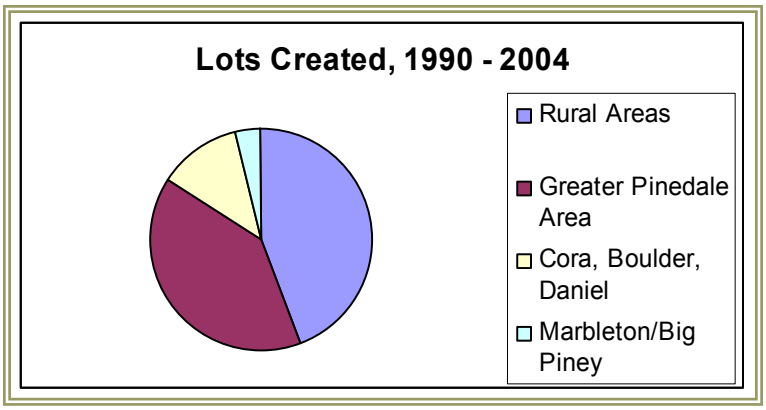


Figure 1: Lots Created by Area, 1990 - 2014

All told, 19,224 acres were converted to residential use in these lot developments. Of the 793 lots created from 1990 to 2004, 85 percent were under 40 acres and 93 percent were under 80 acres. The unincorporated parts of the county accounted for 99.5 percent of the land area converted to residential uses in the county.

The size of the lots in the Pinedale fringe area averaged 10.5 acres, while the average lot size in the city was about 0.6 acres. The average size of lots created in the unincorporated areas of the county from 1990 to 2004 was 39 acres. The average lot size for all lots created in the county, including cities, was 21 acres.

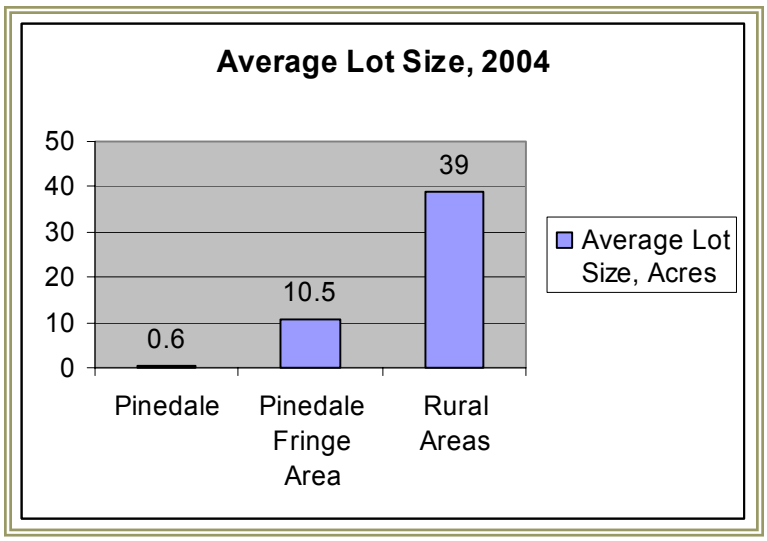


Figure 2: Average Lot Size by Area, 2004

Most of the lots created in the county occurred in areas identified as "prime ranchland" by the American Farmland Trust in a 2001 survey. Of the lots created from 1990 to 2004, 84 percent were under 40 acres and considered as prime ranchland. These new lots converted 16,498 acres, or about 2.5 percent, of the county's 662,585 acres of prime ranchland from agricultural use to residential use. It should be noted that almost half of these lots were within the Pinedale fringe area, a natural growth area.

Future Growth Projections

Population and housing projections performed by the Sonoran Institute for this report indicate that between 676 and 1,201 new housing units will be built in the county from 2004 to 2014, or an increase of 17 percent to 30 percent. Population is projected to grow between 1,106 and 1,933 persons, or an increase of between 17 percent and 29 percent. We believe that the most likely figures are 1,933 additional people, and 1,174 additional houses. Over half of the future growth is attributable to future new natural gas field employment. The national and local economy, interest rates, and future activity in the natural gas fields could impact these numbers down or up.

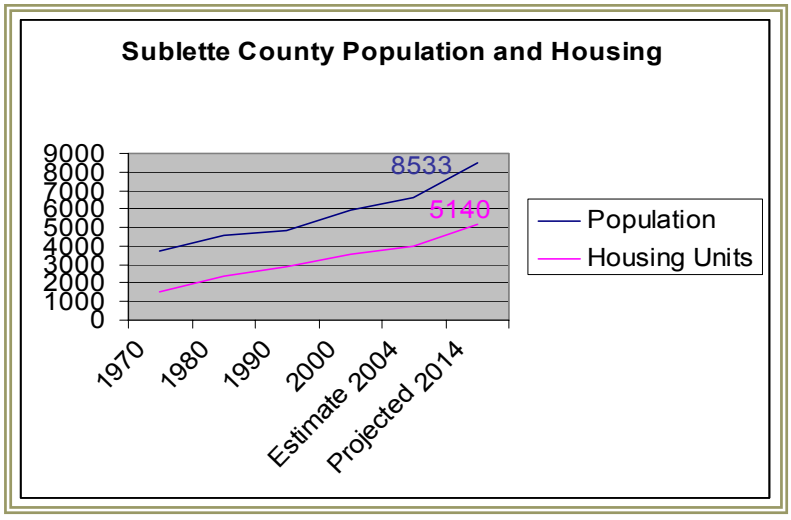


Figure 3: Historic and Projected Population and Housing

If future growth patterns are similar to the recent past, this analysis projects that 45 percent of new houses will be built in the Pinedale fringe area. Much of the remaining growth will continue to occur along transportation corridors linking towns: the corridor from Pinedale to Boulder will attract 13 percent, and from Cora north and west about 8 percent. About 9 percent of the new houses will be built within two miles of Marbleton and Big Piney.

Assuming a constant lot vacancy rate, and the 21 acre average lot size in the county from 1990 to 2004 remains the same, these 1,174 future houses will convert an additional 24,515 acres from agricultural uses to residential uses.

Future growth patterns could shift a greater share of future development toward the incorporated cities of the county so that they could be serviced by city water and sewer. The readily developable areas surrounding the town of Pinedale could easily accommodate all of the county's growth for the next ten years.

	Past Trends Projection	**Scenario 1**	**Scenario 2**	**Scenario 3**
County	21,169	21,169	15,908	10,592
Pinedale	136			
Pinedale Fringe Area	3,161			
Greater Pinedale*		264	299	333
Marbleton/Big Piney	50	50	84	118
Total Acres Converted	**24,515**	**21,482**	**16,290**	**11,043**

Table 1: Acres Converted to Residential, 2014 Scenarios

Under alternative growth scenarios, more future lots would be developed on city water and sewer systems. *Scenario 1* has all of the projected future growth in the Pinedale fringe area serviced by water and sewer and on town-size lots. The result would be about 3,033 fewer acres of ranchland converted to residential development and 301 fewer septic systems installed.

In *Scenario 2*, all future fringe area growth would be at town densities, and 25 percent of projected future rural development would occur in the Pinedale, Marbleton, and Big Piney fringe areas on town-sized lots. The result would be 8,225 fewer acres developed and 137 fewer septic systems.

In *Scenario 3*, all future fringe area growth would be at town densities, and 50 percent of projected future rural development would occur in the fringe areas. The result would be 13,472 fewer acres converted to residential and 274 fewer septic systems.

In order for Scenarios 1 to 3 to occur, the County and its Cities would have to cooperate on land use planning and service provision in the city fringe areas. Significant infrastructure upgrades would be required to shift more growth toward the county's cities, and a variety of land use planning tools such as incentives, education, and flexible zoning regulations would be needed.

Introduction

Sublette County shares the qualities of many areas in the West that are attracting numerous visitors. The spectacular landscape of mountain ranges, pristine rivers, and open spaces charms many of these visitors, who decide to move to the county. While the amount of growth that the county has recently experienced is not as great as other fast-growing places in the West, the pace and pattern of growth is having an effect on the rural, small town character of the area.

In addition to amenity-seekers – those who move to Sublette not for jobs, but for the amenities that the county has to offer – the county is experiencing growth due to the early stages of a boom in natural gas field activity. Natural gas field workers are expected to add significantly to future growth in the county. When combined, amenity-based growth and growth stemming from employment in the natural gas industry presents significant challenges to community leaders planning for and managing growth in a way that maximizes its benefits.

The Sublette County Commissioners asked the Sonoran Institute to work with the County Planning and Zoning Commission to help it understand the nature of this growth and to offer ideas that can help them implement the County's Comprehensive Plan. This growth analysis is the first phase of this effort; subsequent efforts include a series of community design workshops involving the community in identifying alternative growth patterns and a workshop aimed at identifying appropriate land use planning tools for implementing the Comprehensive Plan.

It is our hope that this report will provide Sublette County Commissioners and the Sublette County Planning and Zoning Commission with information about the county's future land use policy choices as they work with the county's cities to manage future growth.

This report is divided into four sections:

- A brief review of Sublette County's Comprehensive Plan Vision, Goals, and Policies as they relate to land use.

- An analysis of 1990 to 2004 growth and land use trends in Sublette County, based upon U.S. Census Bureau, Sublette County Assessor, and Sublette County Geographic Information Systems (GIS) data.

- The results of a population and housing growth projection conducted by the Sonoran Institute. This analysis projects both the amount and location of future housing based upon past trends. This section also identifies alternative growth patterns that would shift more future growth toward existing developed areas and at higher densities.

- An infrastructure analysis conducted by Rio Verde Engineering of Pinedale. This analysis describes in quantitative and qualitative terms the infrastructure required to service the alternative growth patterns identified in Section Four.

Sublette County Comprehensive Plan Vision, Policies, and Goals

Vision

- Local culture preserved
- Economic freedom – low cost of living
- Healthy environment
- Freedom from excessive regulation

Land Use Goals

- Orderly growth and development patterns which promote efficient services, protect sensitive areas, provide for proper use and conservation of resources.
- Plans and policies that protect private property rights.
- Plans and policies that meet residential needs.
- Value the historical significance of agricultural lands and uses.
- Encourage economic stability of agriculture.
- Foster mutually beneficial relationships between agriculture and wildlife.
- Encourage preservation of working agricultural landscapes.
- Promote ecological stewardship of natural resources.

Land Use Policies

- Encourage orderly development patterns to avoid excessive service costs.
- Encourage development which preserves open vistas.
- Coordinate planning in fringe areas.
- Encourage a variety of housing types and housing affordability.
- Encourage conservation of ranchlands through voluntary incentives.
- Discourage land uses which may result in impaired water quality and long term quantity.
- Consider wildlife habitat and migration corridors when evaluating development proposals.
- Consider soil and ground cover when evaluating development proposals.

Recent Growth and Land Use Trends

Population Growth Trends

Sublette County's population grew from 4843 to 5920 from 1990 to 2000, a 22 percent increase. The population in 2004 is estimated at 6600, which is an increase of 36 percent since 1990, and an 11.5 percent increase since 2000. The annual rate from 1990 to 2000 was 2.0 percent, and from 2000 to 2004 the annual rate is estimated at 2.2 percent. This growth is similar to other counties in the region surrounding Yellowstone National Park, one of the fastest growing areas in the country. The 22 counties in this region grew by 19 percent from 1990 to 2004. Table 2 gives a comparison of county population growth in the Yellowstone Park region.

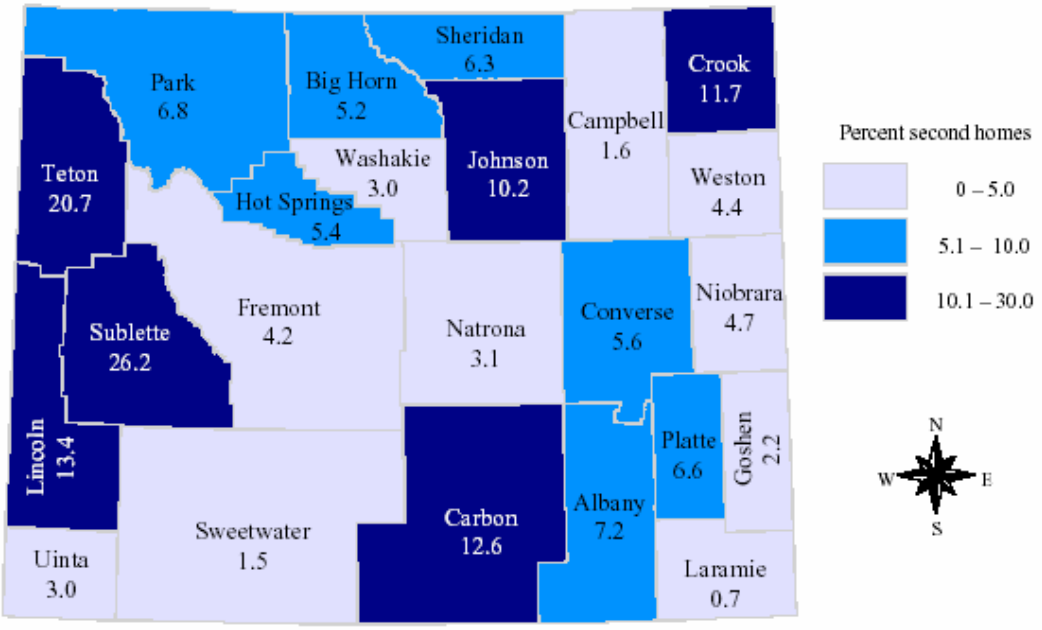
LOCATION	2000 POPULATION	INCREASE SINCE 1990
United States	281,421,906	11.6 %
Wyoming	493,782	8.9 %
Teton, ID	5,999	74.4 %
Teton, WY	18,251	63.3 %
Gallatin, MT	67,831	34.4 %
Clark, ID	1,022	34.1 %
Stillwater, MT	8,195	25.4 %
Franklin, ID	11,329	22.7 %
Sublette, WY	**5,920**	**22.2 %**
Carbon, MT	9,552	18.2 %
Madison, ID	27,467	16.0 %
Lincoln, WY	14,573	15.4 %
Madison, MT	6,851	14.4 %
Sweet Grass, MT	3,609	14.4 %
Bonneville, ID	82,522	14.3 %
Park, WY	25,786	11.3 %
Fremont, ID	11,819	8.1 %
Park, MT	15,694	8.1 %
Bear Lake, ID	6,411	5.4 %
Caribou, ID	7,304	4.9 %
Fremont, WY	35,804	6.4 %
Hot Springs, WY	4,882	1.5 %

Table 2: Population and population gain, Yellowstone Park area counties, Wyoming, and the United States

Housing Growth Trends

The number of housing units in Sublette County increased 22 percent, 2,911 to 3,552 from 1990 to 2000, The number of housing units in 2004 is 3,966, which is an increase of 36 percent since 1990, and 11.7 percent since 2000. The annual growth rate in housing from 1990 to 2000 was 2.0 percent; from 2000 to 2004 it was 2.2 percent.

Housing has grown faster than population because average household size is decreasing and many (26 percent) of these new houses are seasonal homes, in which the owner may or may not declare Sublette County as a primary residence. In 2000, second homes consisted of 26 percent of the total housing units in the county. This is a much higher rate than the State of Wyoming as a whole, in which second homes make up 5.5 percent of total houses.



Map 1: Second homes as a percentage of total housing units for Wyoming counties, 2000[1]

About 29 percent of Sublette County's total housing units are within the Pinedale fringe area, which is the area within two miles of the town's boundaries. That area attracted about 32 percent of the new housing construction and subdivision lots from 1990 to 2004.

The makeup of housing type continues to be dominated by single-family residential, including houses and mobile homes. Multi-family residential made up less than 5 percent of all housing units in the county in both 1990 and 2000.

[1] Second Home Growth in Wyoming, 1990 – 2000, University of Wyoming

Land Development Trends

There were 178 subdivisions created in the entire county from 1990 to 2004, and 61 from 2000 to 2004. The County approved 156 residential subdivisions, lot divisions, large tract developments, maps of survey, and additions containing 627 lots in that period. The City of Pinedale approved 133 residential lots in this period. The total number of residential lots created from 1990 to 2004 in Sublette County, including all towns, was 793. Of the lots created from 1990 to 2004, 17 percent were created in Pinedale and 80 percent were created outside Pinedale's city limits.

About 40 percent of the total residential lots created in the county from 1990 to 2004 were in the Greater Pinedale area, which includes the town and the two-mile area surrounding its borders. About 57 percent of the new lots in the Greater Pinedale area occurred in the two-mile fringe area outside of the city. There were 182 lots created in the Pinedale fringe area from 1990 to 2004 and 133 lots created in the city. The size of the lots in the fringe area averaged 10.5 acres, while the average lot size in the city was about 0.6 acres. Table 3 compares lot sizes in the rural areas of the county, in the Pinedale fringe area, and in Pinedale.

	ENTIRE COUNTY	PINEDALE FRINGE AREA	PINE-DALE	MARBLETON/ BIG PINEY	RURAL AREAS OF COUNTY
Residential Lots Created	793	183	133	29	444
Average Lot Size	21.2 acres	10.5 acres	0.6 acres	.5	39 acres
Acreage Converted	19,224	1,923	82	15	17,204

Table 3: Lots created and acres converted, Sublette County, 1990 - 2004

About 80 percent of the lots created from 1990 to 2004 are located in the unincorporated areas of the county. Most of that growth occurred in the areas surrounding the county's unincorporated places, which include Cora, Daniel, and Boulder. Marbleton and Big Piney, the two other incorporated cities in the county, attracted very little growth from 1990 to 2004.

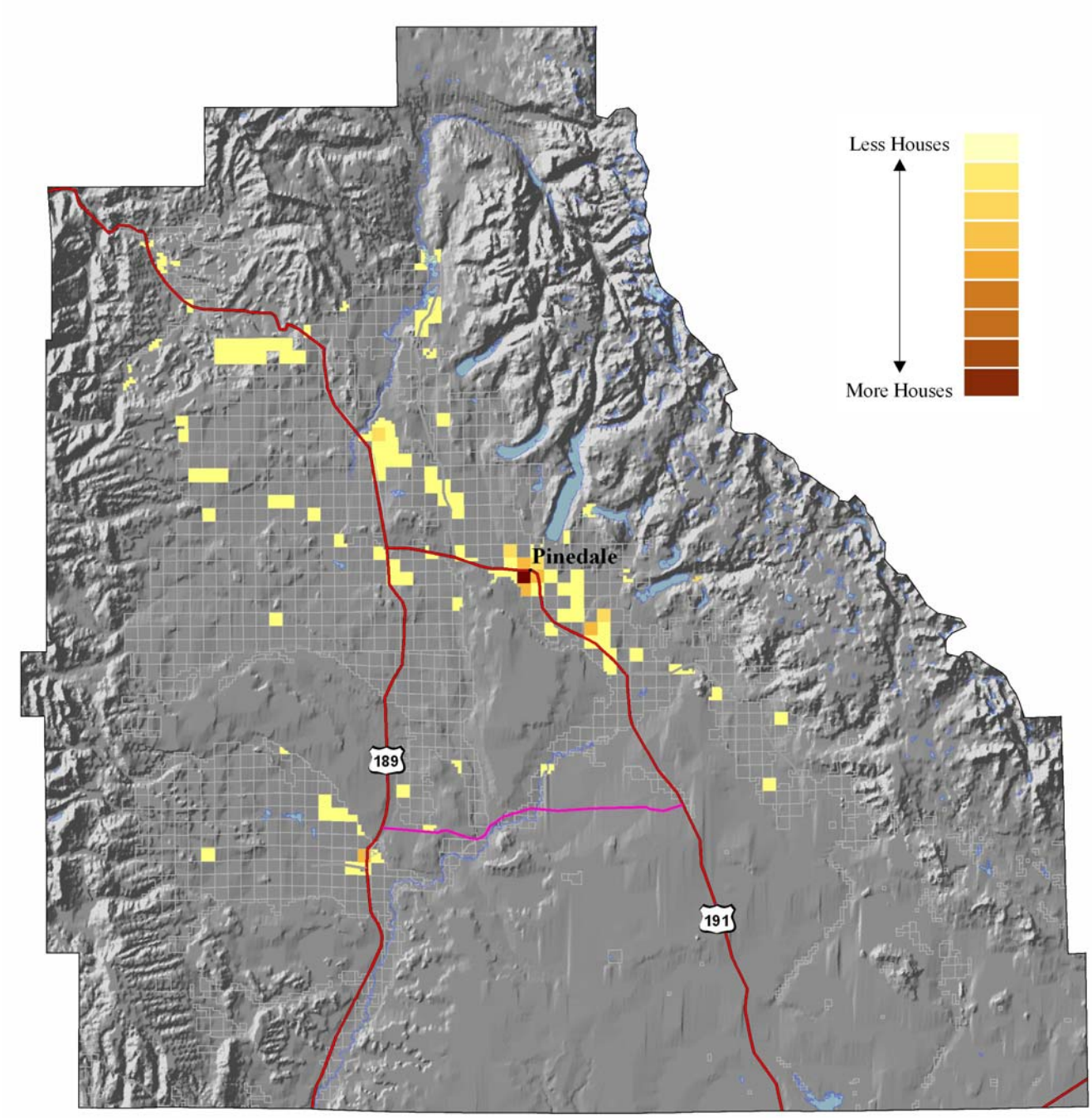
There were 19,224 acres developed for residential uses in the county from 1990 to 2004. Of these acres, 99.5 percent of them occurred in the unincorporated parts of the county, and most on what American Farmland Trust (AFT) identifies as prime ranchland[2]. AFT uses year-round water availability, mixed grass and tree cover, proximity to publicly owned lands and variety of vegetation as variables in determining the extent of prime farmland. From 1990 to 2004, 16,498 acres of prime ranchland were converted from agricultural uses to residential uses. Much of this conversion occurred within the Pinedale fringe area.

There are 3,565 parcels under 40 acres without homes in Sublette County. Of these vacant parcels, 479 are located in the Pinedale fringe area. Ninety-four percent of these vacant parcels are under 20 acres in size. There are 717 vacant parcels, averaging 4 acres in size, between Pinedale and Boulder.

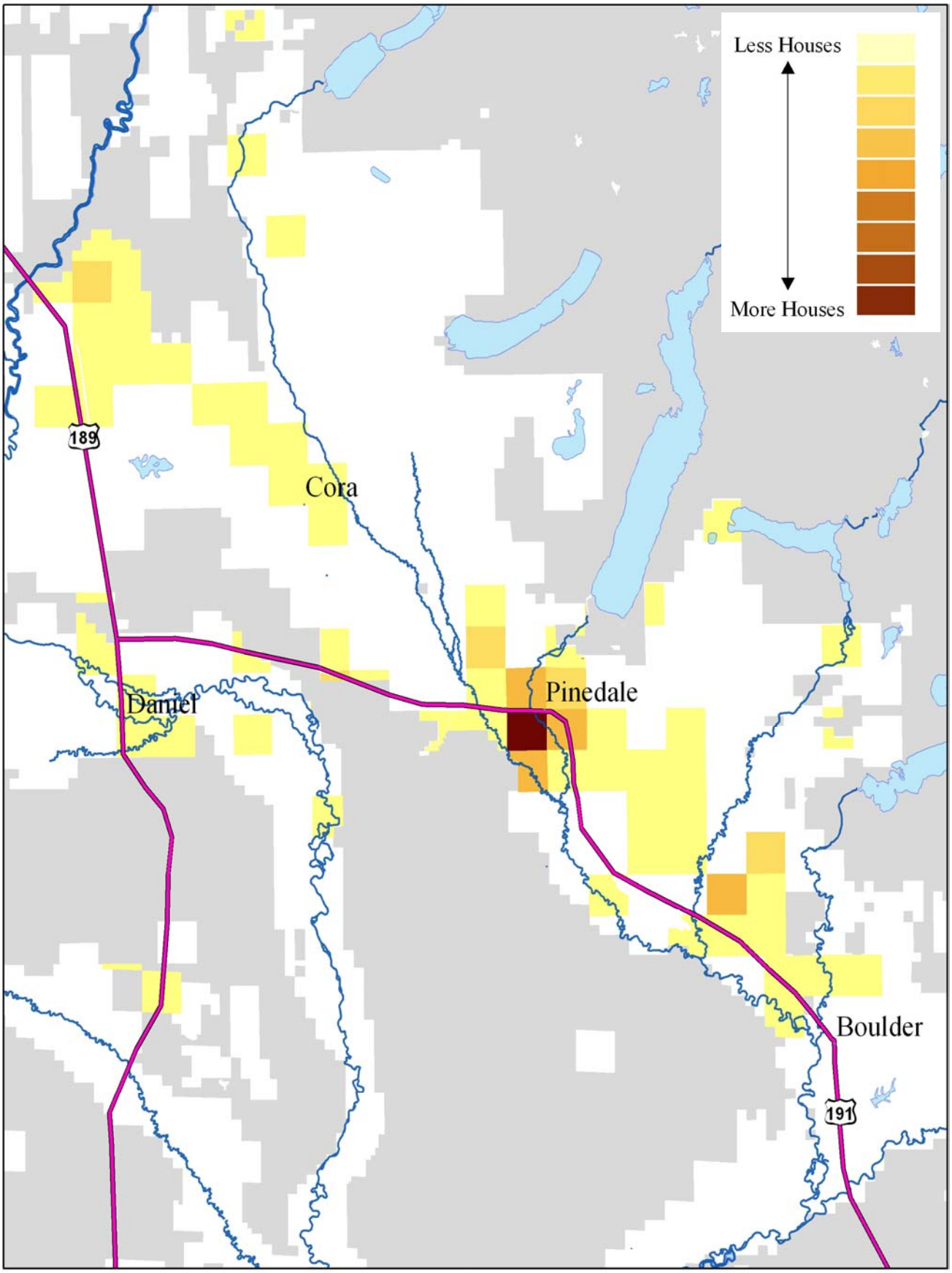
[2] Strategic Ranchland in the Rocky Mountain West, American Farmland Trust 2001

The following pages include:

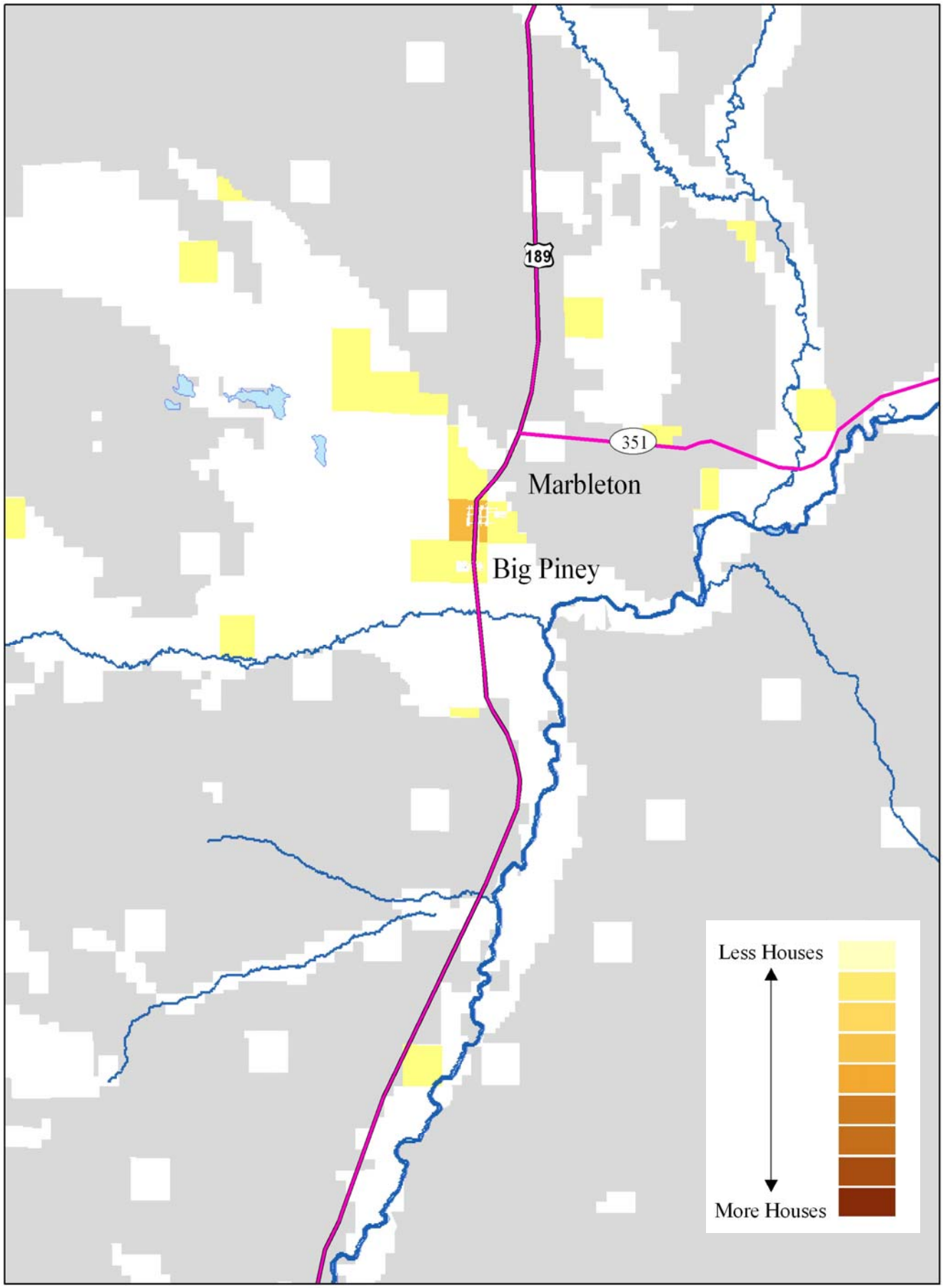
- Map 2 which illustrates the areas of housing growth in the entire county from 1990 to 2004
- Map 3 which illustrates the areas of housing growth in the Pinedale area
- Map 4 which illustrates the areas of housing growth in the Marbleton and Big Piney areas



Map 2: Sublette County Areas of Housing Growth, 1990-2004



Map 3: Pinedale Areas of Housing Growth, 1990 to 2004



Map 4: Marbleton/Big Piney Areas of Housing Growth, 1990 to 2004

Future Growth Projections

Sublette's growth since 1990 has been rapid. As mentioned above, the County's population and housing stock grew by 22 percent. Until recently almost all of that growth was amenity-based. People were moving to the county not for jobs, but for amenities. While the traditional model of community growth holds that people follow jobs, the amenity-based growth model has jobs following people.

Much of the recent growth in population, jobs and income in the rural West has been driven by natural and social amenities, in contrast to the historical dependence on resource extractive industries and agriculture. This shift has been fueled by an increase in service occupations, retirement and investment income.

Unlike other amenity-based counties, however, Sublette County has considerable extraction-based job growth. The county is in the early stages of an employment boom stemming from natural gas activity. New technologies that make the county's tight sands geological formations accessible to natural gas recovery, as well as high market prices for natural gas, have led to considerable drilling in the county's natural gas fields.

The employment due to natural gas drilling is expected to be an additional source of population and housing growth in the future. We believe that the combination of amenity-based growth and natural gas field employment-based growth will lead to higher population and housing gains than has been the case in the recent past. However, it has been suggested that natural gas field activity may dampen amenity growth in the future. Because we have no way of quantifying this potential dampening effect, we do not use it in our growth projection calculations.

The County's objective in this growth projection is to inform its land use planning activities. Therefore, we chose as a measure of growth the number of new houses it can expect in the future. To arrive at a housing projection, we first projected population and then calculated the future housing units by a ratio that is based upon recent persons-to-housing data.

Methodology

There are two sources of population change: natural change and migration. Natural change is simply the number of births compared to the number of deaths in the area in a given time period. If there were more births than deaths, the natural change would be positive; if there were more deaths than births, the natural change would be negative. In other words, if no people moved out of or into the county in a given period, population change would be measured by births versus deaths.

Of course, people do move in and out of areas. This type of population change is measured by migration. In-migration is defined as people moving into an area, and out-migration is defined as people moving out of an area. If more people move into an area than move out in a given period, the net migration change would be positive; if more people move out of an area than into an area in a given period, the net migration change would be negative. Together, natural change and migration change make up an area's total population change.

In the past, migration has been the dominant source of population gain for Sublette County. Since 1990, migration has accounted for about 80 percent of the county's growth.

To capture both components of population change in the county, we used a cohort component model (CCM). The CCM is the most commonly used population projection method because it incorporates a broad range of data sources. This mathematical model examines separately the two components of population change. More simplistic approaches, which project growth exponentially or logistically, are limiting because they assume a constant birth and death rate. In reality, birth and death rates vary by age.

A CCM begins with a base population separated by male and female age groups, which are projected forward in time by the application of historic birth rates and death rates. Applying historic birth and death rates, population growth excluding migration was calculated for 2000. The net migration during 1990-2000 was quantified by calculating the difference between the 2000 population projected by natural change and the actual 2000 population. The resulting model is further described in Appendix A.

We adjusted the CCM by adjusting its migration component to account for new natural gas employment. We assumed that amenity-based growth rates would be similar to past rates. To arrive at a projection of population growth due to natural gas employment, we interviewed numerous natural gas companies as to their future employment expectations, hoping that summing these results would allow us to arrive at a projection of natural gas activity. The results of this approach were not satisfactory; it was clear that the sum of all the interview results did not reflect the potential for natural gas field employment

Instead, we used a ratio developed by the BLM in its Environmental Impact Statement for the Jonah Gas Field infill proposal and confirmed its reasonableness with representatives of the natural gas industry and experts in natural gas production. That ratio was applied to a variety of assumed natural gas drilling activity over the next ten years. We assumed three different levels of drilling activity over the next ten years: low (5,000 new wells), medium (7,500 new wells), and high (10,000 new wells). The projections stemming from the different well activity levels are likewise termed low, medium, and high. We believe that the high well figure provides the most reasonable result, and those results will be used in the rest of this discussion. The methodology we used to project natural gas employment and population gain is detailed in Appendix B.

The expected population gains due to natural gas industry employment were then used to adjust the CCM. We added this expected new population into the annual population tables in the model. This produced a population projection to the year 2014. We then converted the population figure into housing units by dividing future population by 1.66, which is the rate of persons per housing unit in the recent past, assuming that that ratio would remain the same in the future. See Appendix A for details on this step.

In order to test the reasonableness of our CCM results, we also developed an econometric model as an alternative method of projecting growth. An econometric model uses historical data to identify relationships between economic variables. Because population and housing change is to some extent a function of employment and income change, we sought to quantify that relationship.

This model also used the projection, described above and in Appendix B, for natural gas industry employment. In addition, a projection for nonlabor income was developed using a long-term trend analysis. We projected total employment as a function of nonlabor income and natural gas industry employment, and projected population as a function of total employment. Housing was then projected as function of population and nonlabor income.

To project the location of these homes, we used a locational model developed by Patty Gude of the Sonoran Institute. Data was gathered on rural homes from county tax assessor records and a statistical technique known as generalized linear modeling was used to identify the drivers of recent growth patterns. We found that many factors influence the location of growth, including agricultural suitability, transportation infrastructure, services, natural amenities, and nearby existing development. After identifying the drivers of growth, we created a simulation of future development to 2014 using Geographical Information Systems software. This methodology is further described in Appendix B.

Results

The adjusted CCM projects a population gain of between 1,106 and 1,933 persons from 2004 to 2014. This projection results in a potential population of between 7,706 and 8,533, which represents a percentage increase of between 17 percent and 29 percent.

Using the past ratio of persons per housing unit, we project between 676 and 1,174 additional housing units in the county by 2014, an increase of between 17 percent and 30 percent. The econometric model projects an increase in housing of 1,201 units, or a percentage increase of 30 percent. We believe that the projection figure stemming from a 10,000 natural gas well scenario is the most likely, and use it in the calculations below. Over half of the projected future growth is attributable to natural gas employment. Table 4 gives projected population and housing results for all four projections.

	2014 Total Population	2000-2014 Population Increase	2000-2014 Percentage Increase	2014 Total Housing Units	2000 to 2014 Housing Increase	2000 to 2014 Percentage Increase
Low	7,706	1,106	17	4,642	676	17
Medium	8,073	1,473	23	4,863	897	23
High	8,533	1,933	29	5,140	1,174	30
Econometric				5,167	1,201	30

Table 4: Projected housing and population

Using our locational model, we project that almost half of the growth in housing will occur in the Greater Pinedale area. The analysis projects that 45 percent, or 528, of the total 1,174 houses will be built in the Greater Pinedale area, which includes the town of Pinedale and its fringe area. Marbleton and Big Piney and their fringe areas will attract 11 percent, or 99, new houses. Most of the remaining growth will continue to occur along transportation corridors linking towns – from Pinedale to Boulder, including the Bargerville area, which will attract 7 percent, and the corridor from Cora north and west attracting about 10 percent.

Table 5 quantifies projected housing growth by area. Map 5 illustrates the projected locations of future housing in the entire county. Maps 6 and 7 illustrate the projected locations of future housing in the Pinedale and Marbleton/Big Piney areas.

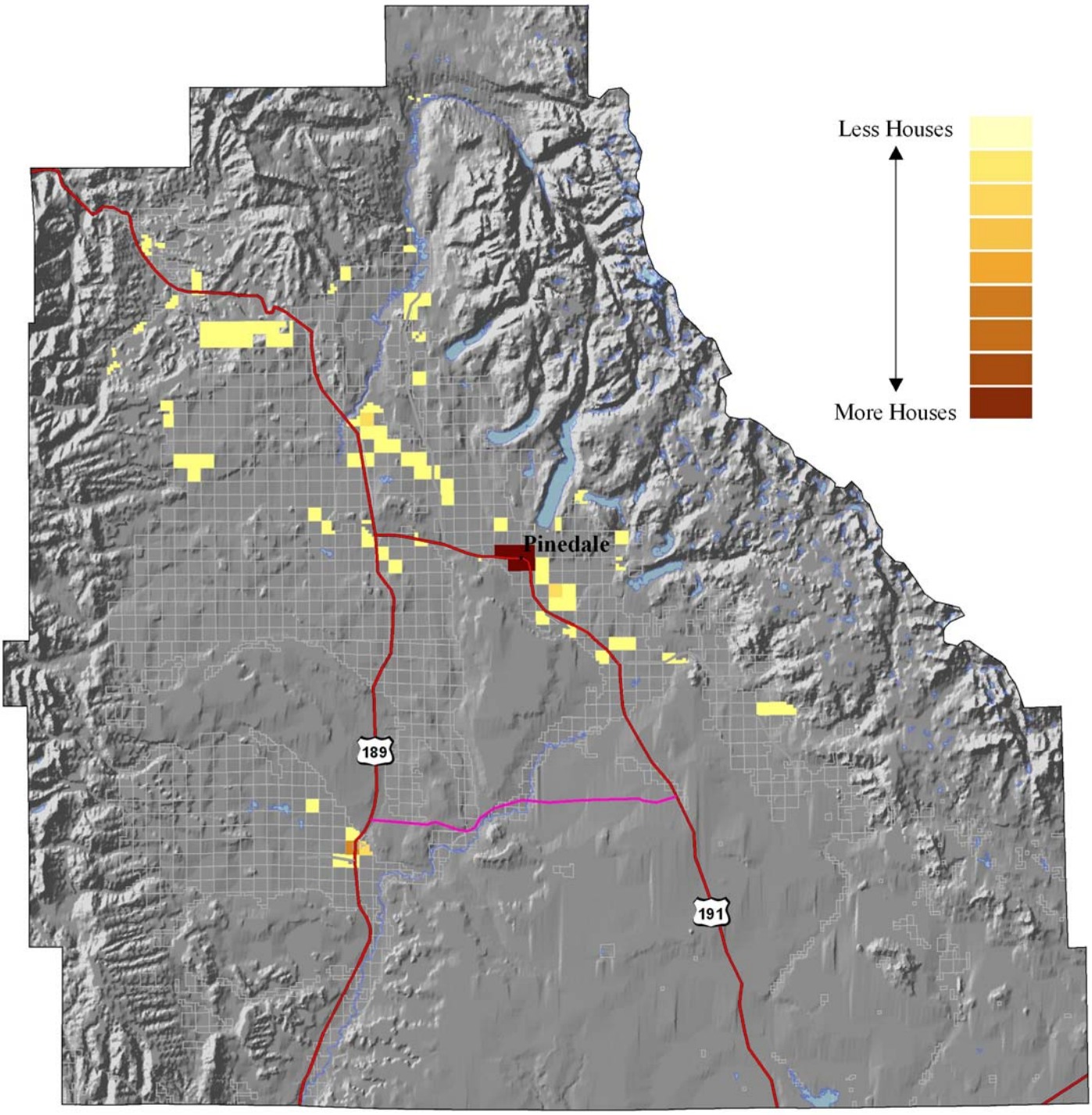
	GREATER PINEDALE AREA	MARBLETON BIG PINEY FRINGE AREA	CORA CORRIDOR	PINEDALE-BOULDER CORRIDOR	REMAINING AREAS
New Houses	528	99	116	99	332

Table 5: Projected number of houses, 2004 to 2014

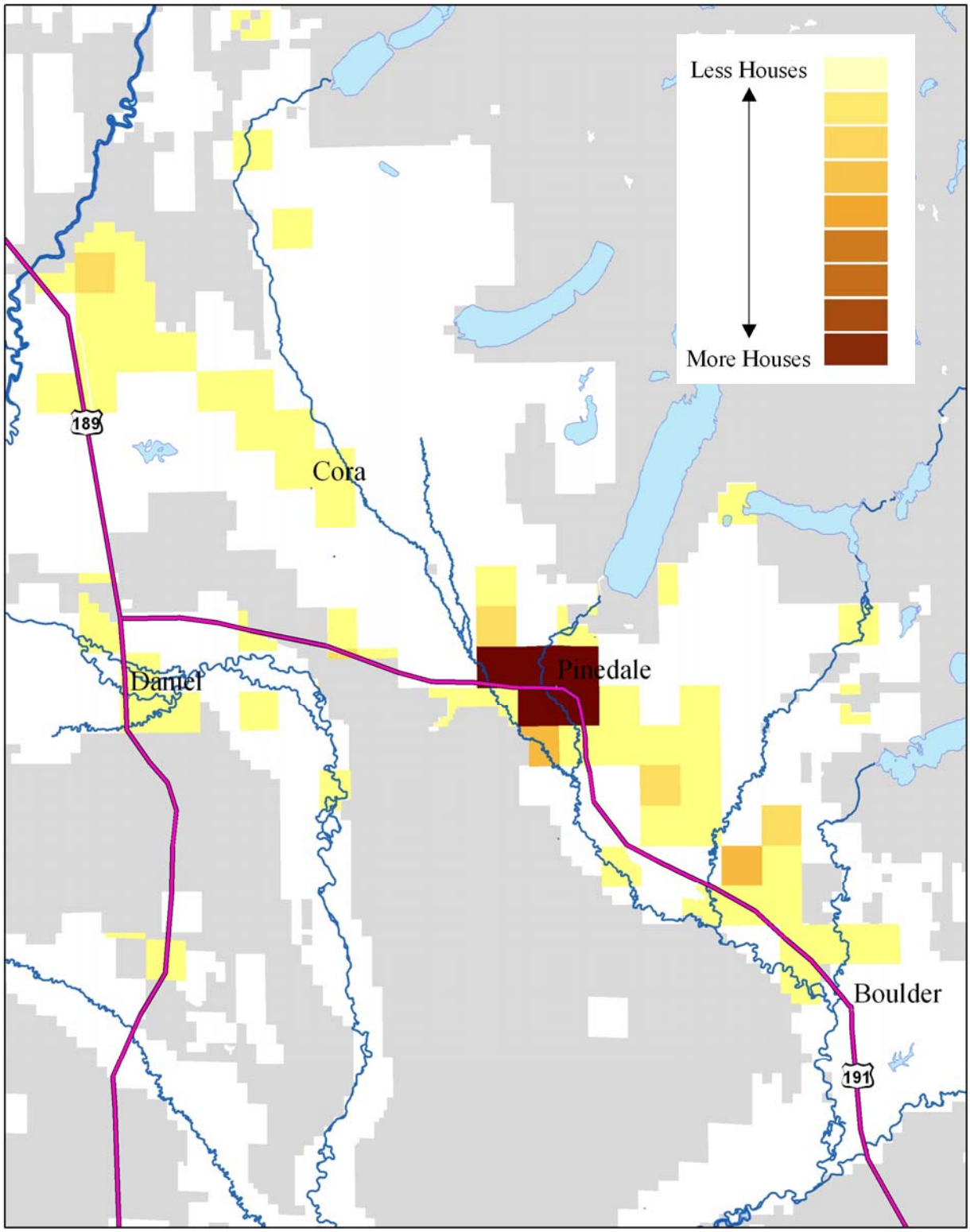
Assuming a constant lot vacancy rate, a constant ratio between single-family housing and multi-family housing, and a constant average lot size, these 1,174 houses will result in the development of an additional 24,515 acres of land. Assuming the same rate of land is developed on prime ranchlands, the amount of prime ranchlands developed would be 21,038 acres. Again, it must be noted that many of these acres are in fringe areas that are appropriate for development.

The following pages include:

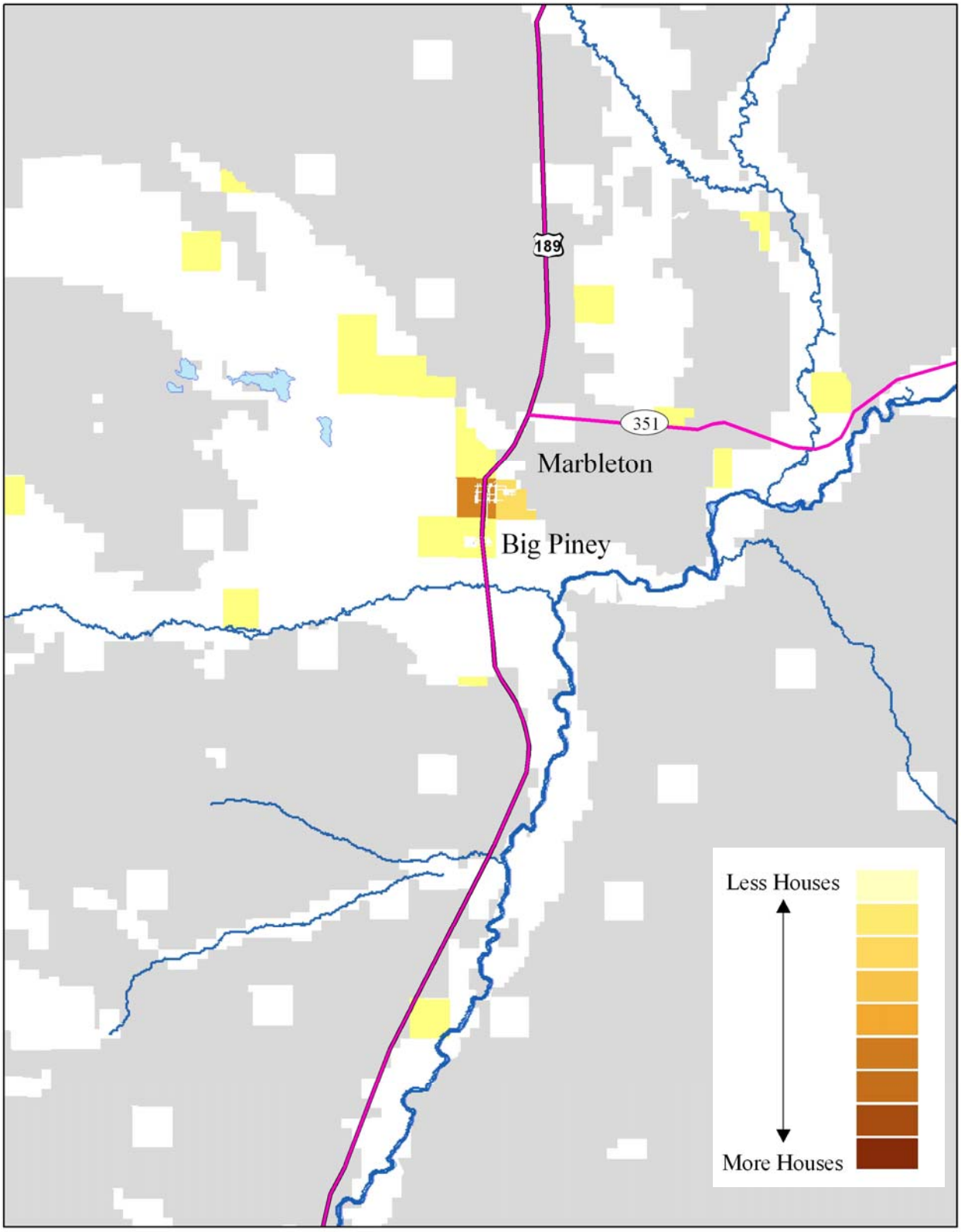
- Map 5 which illustrates the projected areas of housing growth in the entire county from 2004 to 2014
- Map 6 which illustrates the projected areas of housing growth in the Pinedale area
- Map 7 which illustrates the projected areas of housing growth in the Marbleton and Big Piney areas



Map 5: Areas of Sublette County Growth 2004-2014



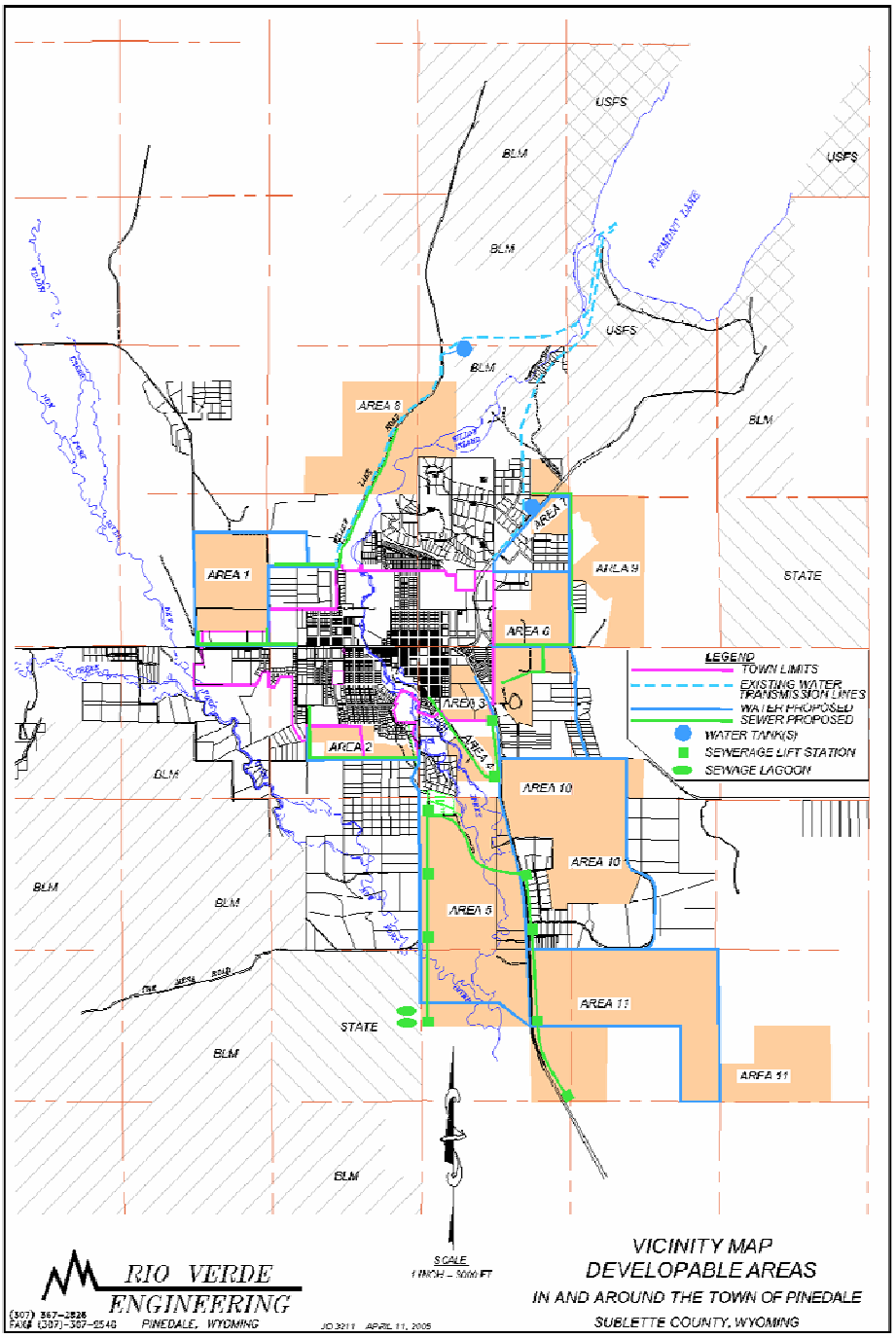
Map 6: Projected Pinedale Vicinity Growth Areas, 2004 to 2014



Map 7: Projected Marbleton, Big Piney Vicinity Growth Areas, 2004 to 2014

After running the locational model, we analyzed the potential for an alternative growth pattern that reflects several of the goals and policies of the Sublette County Comprehensive Plan. That alternative growth pattern projects a greater share of future growth toward the cities of Pinedale, Marbleton, and Big Piney occurring on town-size lots and served by town water and sewer.

We identified several developable areas in the fringe area of Pinedale for this analysis. These areas, shown in Map 8, have locations, topography, soils, and proximity to potential water and sewer extensions that make them readily developable.



Map 8: Pindale Fringe Developable Areas (Developable areas shaded)

These areas total about 3,250 acres. If these areas were developed at densities of roughly 2 units to an acre, about the average density of existing subdivisions in town, they would accommodate approximately 6,500 housing units. At two units per acre, the average lot size would be approximately 12,000 to 15,000 square feet, accounting for streets, trails, green spaces, and undevelopable areas. By comparison, the recently approved Pinedale subdivisions of Fox Willow Park and The Meadows average about 2 units per acre each, with lot sizes of roughly 11,000 to 14,000 square feet.

If these areas were developed at slightly higher average densities, with some of them mixing in multi-family or attached units, the amount of housing that could be accommodated by this area increases significantly. For instance, average densities could easily increase to 2.5 units per acre, simply by mixing in some condo, townhouse, or apartment units, while keeping average single-family lot sizes at the 10,000 to 12,000 square foot range. If the average density were to increase to this level, these areas would accommodate approximately 8,000 housing units.

Given this infrastructure upgrade, we have developed several alternative growth scenarios. As noted above, based upon past growth patterns, projected future growth converts 24,515 acres of ranchland to residential uses. Under all of the Alternative Growth Scenarios, all fringe area growth in both the Pinedale and Marbleton/Big Piney areas would be developed to town densities. Under Alternative Growth Scenarios 2 and 3, 25 percent and 50 percent, respectively, of development projected to occur in the county is distributed equally to those three cities. These scenarios are presented in Table 6 on the following page.

Projected Based on Past Trends			
	Lots	**Average Lot Size**	**Acres Converted to Residential**
County	547	38.7	21,169
Pinedale	227	0.6	136
Pinedale Fringe Area	301	10.5	3,161
Marbleton/Big Piney	99	0.5	50
Total	**1174**	**20.9**	**24,515**

Alternative Growth Scenario 1			
	Lots	**Average Lot Size**	**Acres Converted to Residential**
County	547	38.7	21,169
Greater Pinedale	528	0.5	264
Marbleton/Big Piney	99	0.5	50
Total	**1174**	**18.3**	**21,482**

Alternative Growth Scenario 2			
	Lots	**Average Lot Size**	**Acres Converted to Residential**
County	410	38.7	15,908
Greater Pinedale	597	0.5	299
Marbleton/Big Piney	167	0.5	84
Total	**1174**	**13.9**	**16,290**

Alternative Growth Scenario 3			
	Lots	**Average Lot Size**	**Acres Converted to Residential**
County	273	38.7	10,592
Greater Pinedale	665	0.5	333
Marbleton/Big Piney	236	0.5	118
Total	**1174**	**9.4**	**11,043**

Table 6: Comparison of Alternative Growth Scenarios

As the table shows, by developing all projected fringe area development at town densities the amount of land converted to residential development decreases considerably while creating the same number of housing units. The projected pattern would encompass 3,275 acres in Pinedale and its fringe area. Under *Scenario 1*, only 264 acres would be developed in the Greater Pinedale area or 92 percent less.

Under *Scenario 2*, in addition to all fringe area developing at town densities, 25 percent of the growth projected for the county is distributed equally between Pinedale, Marbleton, and Big Piney. The result is 8,225 fewer acres converted to residential compared to the projected pattern.

In *Scenario 3*, all fringe area growth is again at town densities, and 50 percent of the growth projected for the county is distributed equally between the three cities. This scenario results in 13,472 fewer acres converted to residential compared to the projected pattern, or 55 percent less.

These scenarios demonstrate that County/City coordination in planning could reap significant benefits: a wider array of housing types, more affordable homes in the market, less agricultural land developed, more efficient provision of public services, and fewer conflicts with wildlife. It appears as if the County's Comprehensive Plan Vision, Goals, and Policies would be more achievable if future development were to resemble the alternative growth scenarios rather than the projected scenario.

Infrastructure Analysis

As has been noted, in order for these alternative growth scenarios to happen, significant infrastructure upgrades would be required. To illustrate and quantify these upgrades, we asked Rio Verde Engineering to analyze the infrastructure required to service those developable areas in the fringe area of Pinedale. Rio Verde estimates that the cost to service these areas would be $51.3 million. These infrastructure investments would be done in phases, and a variety of funding mechanisms and sources would be used.

The infrastructure identified in this analysis could serve many years of growth in the county. If *Scenario 1* were to occur, for instance, 528 homes would be served over the next 10 years by this infrastructure. As noted above, this infrastructure would serve 6,500 to 8,000 homes. At this growth rate, this infrastructure included in this analysis would last over 100 years. Again, this infrastructure would be provided in phases over many years.

DENSITY SERVED BY INFRASTRUCTURE	APPROXIMATE LOT SIZE	TOTAL HOMES SERVICED	COST PER LOT
2 houses per acre	14,000	6,500	$7,900
2.5 houses per acre	12,000	8,000	$6,400
3 houses per acre	10,000	9,800	$5,235
Septic and Well	NA	NA	$10,000 - $20,000

Table 7: Comparison of Infrastructure Cost per Lot

Using a per lot calculation helps put these costs in perspective. If this infrastructure were to service 6,500 homes, the per lot cost would be approximately $7,900 per lot. If it were to service 8,000 homes, it would cost $6400 per lot, and if it were to service 9,800 homes, it would cost $5,200 per lot. These are very favorable prices compared to rural development on sewer and individual wells. Table 7 provides an estimated comparison of these costs.

Conclusion

This analysis projects that Sublette County's growth rate will increase in the next 10 years. While most of the growth in the 1990s was due to people seeking amenities, over half of the growth in the next ten years will be attributable to new natural gas field employment. Based upon past growth patterns, most of this new growth will occur in Pinedale and the fringe area surrounding Pinedale. If past trends hold, over half of the Greater Pinedale growth will be in larger lots outside of city limits, on septic systems and wells.

Alternatives to this growth pattern would have more future growth occur in the Greater Pinedale and Marbleton/Big Piney areas on town-sized lots served by city water and sewer systems. For these alternatives to occur, significant infrastructure upgrades would be necessary. However, even with these costs, the per-lot cost of water, sewer, and transportation infrastructure to serve town-sized lots compares favorably to septic and well infrastructure.

These alternative growth patterns would convert considerably less land from agricultural uses to residential uses. The growth projected in this analysis would convert over 24,000 acres to residential uses. Alternative growth patterns could result in significantly fewer acres developed in residential uses. The County and the Cities would have to cooperate in land use and infrastructure planning for these alternatives to be possible.

APPENDICES

Appendix A

Cohort Component Model

A cohort component population growth model was used for this project. It involves the direct simulation of the demographic processes of fertility, mortality, and migration that produce changes in population size. The CCM requires age-specific data on reproduction and survival. More simplistic approaches (exponential and logistic) are limiting because they assume a constant birth and death rate. In reality, birth and death rates vary by age.

The equation used in the model is:
$P_1 = P_0 + B - D + M$
P_1 = Population at the end of the period
P_0 = Population at the beginning of the period
B = Births during the period
D = Deaths during the period
M = Net migration during the period

Data were collected from the US Census Bureau* and the State of Wyoming Department of Health** that described the birth rates and death rates for 10 age classes (under 5, 5 to 14, 15 to 24, etc.) in 1990 and in 2000. Based on the age structure of the population in 1990 and the probability of reproduction or death per age class, the population growth not including migration was calculated for 2000. The net migration during 1990-2000 was quantified per age class by calculating the difference between the projected 2000 population and the actual 2000 population.

The 2014 projections were calculated by starting with the actual population in 2000 and running the model based on age-specific birth and death rates. Each year, individuals were assumed to migrate from other regions, and the model accounted for the likelihood that these individuals would survive and reproduce.

For every projection period, the base population--disaggregated by single year age by gender, is survived to the next year period by applying the appropriate survival rates for each age and gender group. Next, net migrants by age and gender are added to the survived population, as is the population under age one. The populations under one year of age were created by applying age specific birth rates to the females of childbearing age. The entire process is then repeated for each year of the projections.

Migration was adjusted using projected population gains stemming from natural gas industry employment. These projected migrants were incorporated into the growth model by distributing them equally in the 15 – 24, 25 – 34, and 35 – 44 male and female age cohorts. The methodology for projecting natural gas workers is detailed in Appendix B.

To convert projected population into housing units, the projected population was divided by 1.66, the ratio for persons per housing unit in the 2000 census. The persons per household ratio was not used because it was assumed that all new population would reside in an occupied housing unit and not group quarters and that all of the new homes would be occupied.

Econometric Model

The goal of this exercise was to model the effect that new natural gas employment will have on housing. The best data source for this natural gas employment over the entire historical period was for mining employment from the Bureau of Economic Analysis, largely because this data source includes proprietors and is available back to 1969. We verified that the majority of mining employment in Sublette County was due to natural gas production. We forecast this driver based on an industry forecast of the number of wells that are expected to be drilled and assumptions relating to the average number of workers that will be required to drill the wells and then maintain them.

Using mining as our only model driver would tend to overemphasize the impacts of mining, and would ignore all of the other factors that are driving housing demand in the area. Our goal was to find a second model driver that was significant, was largely independent of the natural gas boom, and would be possible to forecast. We chose nonlabor income, which is income derived from transfer payments, dividends, interest and rent. Nonlabor income is a significant factor in Sublette County and it has been steadily growing in significance. In 1970, 22% of total personal income was from nonlabor sources. By 2002, it had grown to 41% of total personal income.

Housing stock in these equations was derived from the tax assessor's office. We were given data for each single family and mobile home housing unit in the county and when it was built. We used that data to calculate total housing stock over time. In using this approach, we assumed that there has been no significant amount of housing demolition. The housing stock data in this model does not count multi-family housing units, which are less than 5 percent of total housing.

The steps in this methodology include:

1. Derive a forecast for mining employment based on industry estimates on how many wells will be drilled each year.
2. Derive a forecast for nonlabor income using a long-term trend analysis. Nonlabor income growth is very constant and using a trend analysis yielded a good fit.
3. Forecast total employment as a function of nonlabor income and mining employment.
4. Forecast population as a function of total employment.
5. Forecast housing as function of population and nonlabor income. Nonlabor income is a very significant predictor of housing stock. The effects of the natural gas boom are reflected in the population variable indirectly.

The resulting equation, data used, and statistical details can be obtained through the Sonoran Institute, 201 South Wallace Street, Bozeman, MT, (406) 587-7331.

* Census 2000 Table SF1 – File 2
* Census 1990 Table SF1 – File2
** State of Wyoming, Dept. of Health, Vital Statistics Services, Lucinda McCaffrey

Appendix B

Natural Gas Employment Projections

To quantify the amount of new population and housing stemming from the natural gas industry, we needed to project the amount of new natural gas industry employment from 2004 to 2014. To arrive at this projection, we first interviewed 14 representatives of natural gas industry companies. These individuals represented Operator, Construction, Drilling, and Well Completion firms. In addition, we interviewed several experts on the natural gas industry from the University of Wyoming, the Bureau of Land Management, and the Department of Energy. A list of the individuals interviewed and their affiliations is given below.

It was our hope that by contacting the natural gas industry companies, we could ascertain from them their projected employment, sum the results, and come to a projection of new natural gas employment over the next ten years. However, we found the results to be unsatisfactory. Not all of the companies were able to give what they considered a reliable estimate of their future workforce needs, citing uncertainty in natural gas prices, governmental restrictions, and other constraints such as workforce availability and pipeline capacity. The sum of the future workforce needs was not a reasonable amount in our opinion, and in the opinion of others familiar with the industry.

We then reviewed workforce requirements as given in the Draft Environmental Impact Statement for the Jonah Infill Drilling Proposal, developed by TRC Mariah Associates for the BLM. The methodology used by this DEIS to develop workforce requirements for the Jonah Infill proposal involves an estimate of workforce needs for the entire 3,100 well proposal. Separate workforce requirements for the project are given for the development, production, and reclamation phases. The total estimated workforce requirements for the Jonah Infill proposal is 16,863 worker years[3]. Interviews with experts in the natural gas industry and the University of Wyoming confirmed the reasonableness of this approach and these numbers.

From this estimate, we expressed workforce requirements in terms of worker year per well for both the development and production phases. We did not project any new employment for the reclamation phase over the next ten years. For the development phase, the ratio is 3.2 worker years per well. For the production phase, the ratio is 2.05 worker years per year over the life of the well, which is assumed at 40 years. Per year, that ratio becomes .05 worker years per well. The table below breaks down the production phase workforce requirements further.

Worker Days per well for 40 years	Worker Days per well, 1 year	Worker Hours per well, 1 year	Average Hours per well per week
515	13	103	2.0

Table: Workforce requirements, natural gas field development phase

[3]Draft Socioeconomic Analysis Technical Support Document for the Jonah Infill Drilling and South Piney Projects Environmental Impact Statements, BLM, January 2005

With the ratios calculated, the next step in the projection was to multiply the per well workforce requirements by the number of new wells expected every year for the next ten years. Because we wanted the number of new workers only, the workforce requirement in the development phase is directly calculated from the number of wells drilled. For the production phase, the number of new workers is calculated by the cumulative number of new wells. For the purposes of this projection, we assumed three different levels of drilling activity: high (10,000 new wells), medium (7,500 new wells), and low (5,000 new wells).

Finally, once the new annual workforce requirement for the different drilling levels was calculated, we projected the number of those workers who would reside in Sublette County and contribute to housing demand. Because Sublette County's unemployment rate is so low, 2.1 percent, we assumed that all new gas field workers would come from outside the county.

For the development side, we assumed that a relatively low percentage of workers would move to Sublette County. The development phase is much shorter, and according to industry representatives, these jobs are more transient. After consulting gas industry representatives as well as area realtors, we assumed that 25 percent of new development workers would move to Sublette County.

On the production side, we assumed that a much higher rate of new workers would move to Sublette County and contribute to housing demand. The average life of these wells is estimated at 40 years, and it is likely that many of these new workers would choose to reside in Sublette County. Again, we talked to gas companies and area realtors to arrive at an assumption that 75 percent of new production workers would move to Sublette County.

Finally, we assumed that each new worker who moves to Sublette County would arrive with a household. The projected new resident worker totals were divided by 1.66, the ratio for persons per housing unit in the 2000 census. This is the same figure for household size that was used to convert total projected population into housing units.

The results of this projection are given below:

WELL ACTIVITY, 2004 - 2014	NEW DEVELOPMENT WORKERS	NEW PRODUCTION WORKERS	NEW RESIDENT WORKERS	NEW RESIDENTS
High (10,000 wells)	391	293	684	1,093
Medium (7,500 wells)	231	221	452	703
Low (5,000 wells)	71	182	253	372

Individuals interviewed for this projection include:

Brian Ault, *Ultra Resources, Inc*
Mike Golas, *Questar Exploration and Production*
Callie McKee, *Encana Oil and Gas*
Steve Halse, *Nabors Drilling Company*
Jeff Chambers, *Exxon Mobile Corporation*
Jeff Strange, *Halliburton Company*
Jennifer Bundy, *Caza Drilling, Incorporated*
Walter Werner, *University of Wyoming*
Philip Budzik, *United States Department of Energy*
Kirby Hedrik, retired energy company executive
Bob Jones, *Shell Oil Company*
Jim Schaeffer, *EOG Resources*
Keith Bonati, *Anschutz Corporation*
Dallas Bennett, *Chevron USA*
Kent Fox, *Schlumberger Incorporated*
Pete Guernsey, *TRC Mariah Consultants*
Gene George, *Yates Petroleum*
Jim Wakely, *Duke Energy*

APPENDIX C

Simulation of Future Residential Development

The simulation of future growth in housing was based upon the drivers of growth during the 1990s. This information was adapted from a previous study of rural residential development patterns in the 20 counties in the Yellowstone National Park region. That study was a collaborative project between Montana State University and the Sonoran Institute, and a detailed report is available online at http://www.montana.edu/etd/available/hernandez_04.html.

To simulate alternative future scenarios of rural development within Sublette County, we applied knowledge of the drivers of rural development in the 1990s within the Yellowstone National Park region. The methods for the simulation are summarized in the following paragraphs.

Time Frame and Spatial Extent

The tax assessor database (GIS layer) describing the locations of homes was updated to 2004 for Sublette County. Four alternative development scenarios were generated for all square mile sections containing private lands within Sublette County for the year 2014. These scenarios were based on the spatial patterns of housing that occurred during the 1990s. The rates of development were based on the population and housing projections detailed in Appendix A.

Modeling Approach and Results

Using the best generalized linear model of growth during the 1990s, the simulation was run for one decade, in order to forecast development patterns for 2014. Specifically, the simulation, which consists of interacting Java and ARC/INFO programs, was used to implement growth management regulations that affected allowable housing densities, and to calculate the "past development" variables that were used as model inputs. The simulation was designed to facilitate the manipulation of growth inducing and limiting factors in order to generate maps of alternative future scenarios. Four alternative scenarios were generated for the purpose of visualizing the potential for growth in Sublette County and assessing existing and hypothetical growth management policies.

Simulation Assumptions				
Scenario	Years Simulated	Rate of Rural Home Construction	Limiting Factors	Driving Factors
High (10,000 Wells)	2014	1,174	Existing zoning districts and conservation easements	Variables from statistical model of 1990s growth
Medium (7,500 Wells)	2014	897	Existing zoning districts and conservation easements	Variables from statistical model of 1990s growth
Low (5,000 Wells)	2014	676	Existing zoning districts and conservation easements	Variables from statistical model of 1990s growth
Econometric	2014	1,201	Existing zoning districts and conservation easements	Variables from statistical model of 1990s growth

Table: The future growth scenarios generated by the RDS use different assumptions of growth rates, limiting, and driving factors

APPENDIX D

PINEDALE AREA - FUTURE GROWTH SEWER AND WATER REQUIREMENTS

WATER SUPPLY BACKGROUND

In 1998, the Town of Pinedale completed the installation of a new 24-inch ductile iron water transmission line from Fremont Lake to the northwest corner of the town. This line has the capability of delivering 10,000 gallons per minute (gpm) from Fremont Lake to the town. The design of the transmission line was intended to supply the regional growth for the Town of Pinedale and the area surrounding Pinedale.

One issue addressed by the new water line was chlorine contact time. The new water line in conjunction with the old water line can produce 4,000 to 4,500 gpm and still have adequate chlorine contact time. Current maximum flows are 3,000 to 3,500 gpm. One solution that would address contact time under maximum flow conditions would be to install a tank. Adding a tank on the 24" transmission line would provide the required contact time. The timing of the tank may be postponed by the installation of flow meters which would typically reduce the maximum flows for the same growth.

GROWTH AREAS – WATER SUPPLY

A requirement by the Town of Pinedale is that all water lines must be looped which means that no dead end lines are allowed unless a plan for looping the line exists for the near future. With this in mind, the plan to supply water to the various growth areas includes looped main water lines. The actual distribution system must be designed to fit the specific subdivision.

AREA 1

This area requires constructing a main line west of the current town system. Looping must occur by connecting below the Town of Pinedale's chemical supply location on the northwest corner of the town and connecting either north of the highway at Country Club Lane or south across the highway on the Wrangler Annexation.

AREAS 2 AND 3

Both of these areas can be developed without a mainline being installed. However, development south of either area may require the installation of a main line. Supply to both of these areas will be improved with the completion of the Tyler Avenue Project which will include a new water supply line from the north edge of town to the south edge. This project is funded with construction to begin in the Fall of 2005

AREA 4

This area may also be developed without a main line being installed. However, looping will have to be creative.

AREA 5

A mainline is required to develop this area. Looping will require cooperation with areas 10 and 11. Much of this area is wetlands along Pine Creek.

AREA 6

This area requires that a main line be installed with looping below the town's chemical supply location on the northeast corner of the town. Elevations may create pressure problems.

AREA 7

This area is difficult to provide water for two reasons. First, the elevation of this area will create pressure problems. Second, unless the main supply line is installed at a point below the chemical supply location, a tank will be required. Either the longer supply line or the tank will provide the required chlorine contact time.

AREA 8

The problems of water supply to this area are the same as Area 7. The main tank will need to be installed on the transmission line prior to development of this area for chlorine contact time. Elevations will create pressure problems for part of the area. Finally, the chemical supply location addresses the EPA's lead and copper rule which is a problem that may have to be addressed if a tank is installed above that location.

AREA 9

This area also has some elevation problems. Looping will be used to develop this area.

AREAS 10 AND 11

As mentioned in Area 5, cooperation between the three areas will be important to their development. Elevations, although higher in the north part of Area 10, should not create pressure problems. The contrary, high pressure, may need addressed.

SEWER COLLECTION

Sewer collection from the growth areas is driven by elevations and by the need to deliver the effluent to the Town of Pinedale's lagoon system for treatment. An analysis of the cost of on-site effluent treatment methods against the cost of the infrastructure required to deliver the effluent to the lagoon will provide the answer as to which would be the best method. Modifications to the Town's lagoon system, which are a result of the Town's plan to accommodate growth, will be completed during the 2005 construction season. These modifications will improve the effluent treatment through the lagoon system and increase the capacity of the existing system.

Development of these areas will eventually require more improvements to the existing lagoon system or construction of a new lagoon system. The final solution will depend on technology developed in the future. To provide service to the growth areas similar to the water supply lines, major lines are planned that can be accessed by gravity collection systems.

AREA 1

A project that will have an impact on the development of this area is the Pinedale West Main Line Project. This project has been submitted to the State Land and Investment Board for funding in June of 2005. Increasing the line size which is planned for this project will allow the gravity to line to reach further west on the north side of the highway. This may allow the total area to be served by a gravity collection system.

AREA 2
This area can be serviced by gravity if a 24-inch line is installed along the south line. Elevations will determine how far west a 24-inch line can be installed.

AREA 3
A lift station may be required to service the south half of this area. Gravity sewer lines exist through the northern portion and on the west side.

AREA 4
This area will require a lift station. However, this area can be serviced without crossing Pine Creek.

AREA 5, 10, AND 11
These areas require lift stations. Cooperation between the areas will be important to properly plan for the possible growth which includes crossing Pine Creek and lift station sizing.

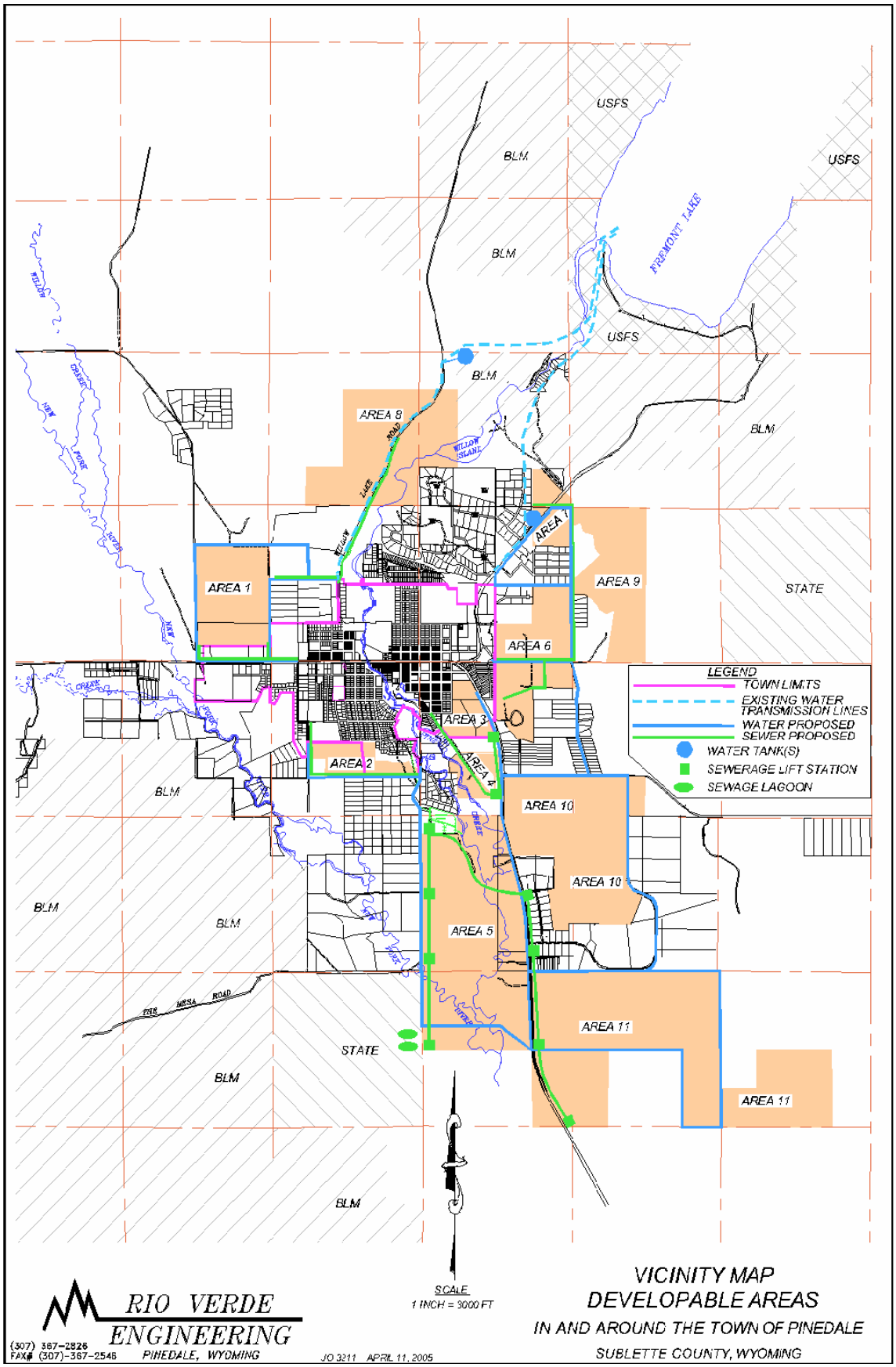
AREA 6
Depending on elevations, this area may be serviced by gravity lines to the west side of the rodeo grounds.

AREAS 7 AND 9
These areas may be serviced by gravity to the sewer lines by the clinic. Once again, it depends on the elevations.

AREA 8
This area can be serviced by gravity to the line on North Jackson Avenue.

SUMMARY

All of the development of the specific areas will require proper planning to supply the particular subdivision and cooperation to be able to supply the next subdivision. Whether it is sewer or water, future growth must be considered beyond the proposed subdivision to properly size the required infrastructure.



Map: Pinedale Vicinity Developable Area and Infrastructure Needs (Developable Areas Shaded)

2005 INFRASTRUCTURE (SEWER AND WATER) TO BUILDABLE AREAS
ENGINEER'S ESTIMATE

WORK OR MATERIAL	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Mobilization	1	LS	$2,000,000.00	$2,000,000.00
Type 2 Bedding-Unsuitable trench subgrade	50,000	CY	$16.00	$800,000.00
Crushed Base	80,000	TN	$16.50	$1,320,000.00
Fire Hydrant Assembly - Complete	100	EA	$3,500.00	$350,000.00
10" Waterline D.I.P.	53,200	LF	$55.00	$2,926,000.00
12" Waterline D.I.P.	45,250	LF	$70.00	$3,167,500.00
10" Gate Valve	90	Ea	$2,000.00	$180,000.00
12" Gate Valve	75	Ea	$3,000.00	$225,000.00
10"x10"x10" Tee D.I.P.	55	Ea	$1,000.00	$55,000.00
12"x12"x12" Tee D.I.P.	46	Ea	$1,500.00	$69,000.00
10" Tie-In to Existing Waterline	8	Ea	$3,000.00	$24,000.00
12" Tie-In to Existing Waterline	4	Ea	$2,000.00	$8,000.00
PRV Vault	1	Ea	$50,000.00	$50,000.00
Air Relief Valve & Vault	8	Ea	$1,500.00	$12,000.00
Water Tank	1	Ea	$5,000,000.00	$5,000,000.00
10" PVC Sewerline	17,700	LF	$55.00	$973,500.00
15" PVC Sewerline	8,000	LF	$80.00	$640,000.00
18" PVC Sewerline	4,000	LF	$85.00	$340,000.00
24" PVC Sewerline	5,900	LF	$100.00	$590,000.00
Sewer Manhole	115	Ea	$3,000.00	$345,000.00
Extra Manhole Depth	157	Ea	$300.00	$47,100.00
4" Pump HDPE Line	17,500	LF	$40.00	$700,000.00
6" Pump HDPE Line	11,000	LF	$60.00	$660,000.00
Manhole and Cleanouts for Pump Lines	72	Ea	$6,000.00	$432,000.00
Tie to Existing Manhole	15	Ea	$2,000.00	$30,000.00
Lift Station	12	Ea	$250,000.00	$3,000,000.00
Sewerline Crossing Waterline	20	Ea	$1,000.00	$20,000.00
Lagoon Modifications	1	LS	$10,000,000.00	$10,000,000.00
Pine St/Hwy 191/Pine Creek Crossings	14	Ea	$50,000.00	$700,000.00
Road Surfacing	200,000	SY	$24.00	$4,800,000.00
Construction Total				**$39,464,100.00**
Engineering Design (10%)				**$3,946,410.00**
Construction Management (10%)				**$3,946,410.00**
Contingency (10%)				**$3,946,410.00**
Total Cost				**$51,303,330.00**

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