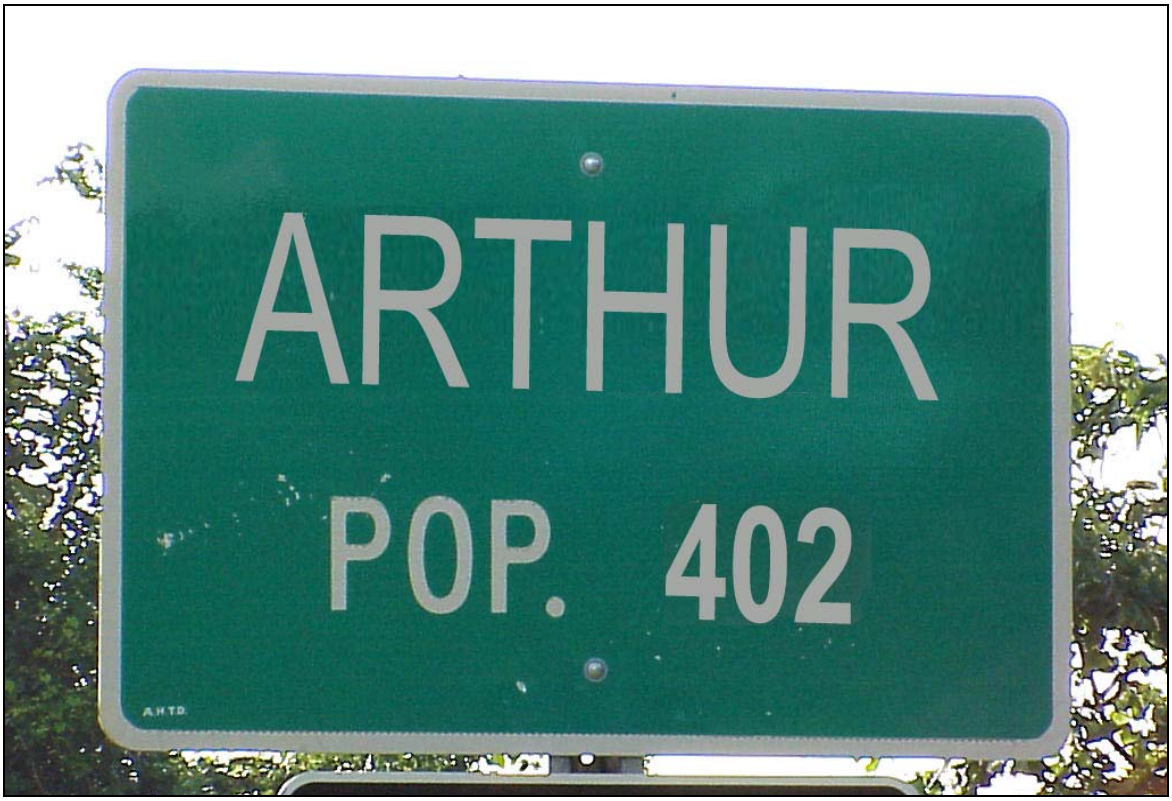
Report on Red River Valley Water Supply Project Needs and Options

Current and Future Population of the Red River Valley Region 2000 through 2050

Final Report – Revised November 2005



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Introduction

On December 15, 2000, the 106th Congress passed the Dakota Water Resources Act of 2000. The act directs the Secretary of the Interior to conduct a comprehensive study of the water quality and quantity needs of the Red River Valley in North Dakota and possible options for meeting those needs. A needs assessment is being conducted as part of these studies to determine the future water needs of the Red River Valley. The service area to be studied includes the 13 counties in the Red River Valley in North Dakota and Moorhead, East Grand Forks, and Breckenridge in Minnesota. Meeting the future water needs of the Red River Valley communities requires a better understanding of the demographic changes taking place within the counties and municipalities. Reclamation has completed population projections under earlier appraisal-level studies, but has refined the estimating methodology in this feasibility level study. Population projections for the period of 2000 through 2050 were developed using North Dakota Data Center, Minnesota State Demographic Center, U.S. Census Bureau, and cohort component methods to project future Red River Valley populations. This report summarizes the population projection results for each of the counties and municipalities included in the study.

Historic Population

The Red River Valley region includes areas that have experienced population growth, areas with a stable population, and areas that have experienced a population decline. The areas that have experienced the greatest amount of growth over the last 40 years are Fargo and West Fargo. Several counties, small cities, and towns have maintained essentially the same population over the last several years. The more rural counties in the region have experienced a steady decline in population, although the rate of decline appears to have lessened somewhat for about one-half of the counties over the last 10 years. Historical population estimates and rates of population change for the Red River Valley area counties are presented in Table 1 and population estimates for municipalities are presented in Table 2.

The county level data presented in Table 1 show that past population growth has generally been concentrated in Cass, Grand Forks, Clay, and Otter Tail Counties. The decrease in the population of Grand Forks County in the later part of the 1990's was a result of the downsizing of the Grand Forks Air Force Base and the 1997 flood. The majority of population growth in the region has occurred in Cass County, with lower levels of growth in Grand Forks, Clay, and Otter Tail counties. The population of Richland and Polk Counties has remained relatively stable while the population of the remaining counties has shown a steady decline over the last 40 years. However, the pattern of decline in some rural counties has become less severe. The data presented in Table 1 indicate there are specific areas of rapid population growth in the Red River Valley, but the rural areas continue to experience a decrease in population.

The municipal population estimates presented in Table 2 show that Fargo, Grand Forks, and Moorhead have accounted for a substantial portion of population growth in the area. However, despite consistently decreasing population in the rural counties, many smaller municipalities have maintained a relatively stable population. Historical population changes can be used as a basis of comparison for population projections.

Table 1 – Historical Population Estimates for Red River Valley Counties

County	*1960*	*1970*	*1980*	*1990*	*2000*	*Annual growth 1960 to 2000*	*Annual growth 1990 to 2000*
North Dakota Counties							
Barnes	16,726	14,669	13,960	12,545	11,775	-0.874%	-0.631%
Cass	66,957	73,653	88,247	102,874	123,138	+1.535%	+1.814%
Cavalier	10,065	8,213	7,636	6,064	4,831	-1.818%	-2.248%
Grand Forks	48,677	61,102	66,100	70,683	66,109	+0.768%	-0.667%
Griggs	5,023	4,184	3,714	3,303	2,754	-1.491%	-1.801%
Nelson	6,993	5,776	5,233	4,410	3,715	-1.569%	-1.700%
Pembina	12,930	10,719	10,399	9,238	8,585	-1.019%	-0.730%
Ransom	8,080	7,102	6,698	5,921	5,890	-0.787%	-0.052%
Richland	18,823	18,089	19,207	18,148	17,998	-0.112%	-0.083%
Sargent	6,856	5,937	5,512	4,549	4,366	-1.122%	-0.410%
Steele	4,722	3,749	3,106	2,420	2,258	-1.827%	-0.690%
Traill	10,587	9,571	9,624	8,752	8,477	-0.554%	-0.319%
Walsh	17,997	16,251	15,371	13,840	12,389	-0.929%	-1.101%
Total for ND counties	***234,436***	***239,015***	***254,807***	***262,747***	***272,285***	***+0.375%***	***+0.357%***
Minnesota Counties							
Clay	39,049	46,585	49,327	50,473	51,313	+0.685%	+0.165%
Kittson	8,347	6,853	6,672	5,741	5,263	-1.146%	-0.866%
Marshall	14,258	13,060	13,027	10,957	10,114	-0.855%	-0.797%
Norman	11,258	10,008	9,379	7,948	7,434	-1.032%	-0.666%
Otter Tail	48,935	46,097	51,937	50,724	57,222	+0.392%	+1.213%
Polk	36,171	34,435	34,844	32,562	31,352	-0.357%	-0.378%
Traverse	7,499	6,254	5,542	4,463	4,119	-1.487%	-0.799%
Wilkin	10,645	9,389	8,454	7,520	7,133	-0.996%	-0.527%
Total for MN counties	***176,162***	***172,681***	***179,182***	***170,388***	***173,950***	***-0.032%***	***0.207%***
Total for RRV region	**410,598**	**411,696**	**433,989**	**433,135**	**446,235**	**+0.208%**	**+0.298%**

Table 2 – Historical Population Estimates for Red River Valley Municipalities

Municipality	***1960***	***1970***	***1980***	***1990***	***2000***
North Dakota Municipalities					
Arthur	324	412	445	400	402
Casselton	1,388	1,485	1,661	1,601	1,855
Cavalier	1,424	1,381	1,505	1,508	1,537
Cooperstown	1,428	1,485	1,308	1,247	1,053
Drayton	944	1,095	1,082	961	913
Enderlin	1,599	1,343	1,151	997	947
Fargo	46,662	53,365	61,383	74,111	90,599
Finley	806	809	718	543	515
Forman	532	596	629	586	506
Grafton	5,885	5,946	5,293	4,840	4,516
Grand Forks	34,451	39,008	43,765	49,425	49,321
Gwinner	242	623	725	585	717
Hankinson	1,278	1,125	1,158	1,038	1,058
Harwood	na	na	326	590	607
Hatton	860	808	787	800	707
Hillsboro	1,283	1,309	1,600	1,488	1,563
Lakota	1,071	964	963	898	781
Langdon	2,160	2,182	2,335	2,241	2,101
Larimore	1,708	1,469	1,524	1,464	1,433
Lidgerwood	1,075	1,000	971	799	738
Lisbon	2,098	2,090	2,283	2,177	2,292
Mapleton	180	219	306	682	606
Mayville	2,168	2,554	2,255	2,092	1,953
McVille	550	583	626	559	470
Minto	642	636	592	560	657
Northwood	1,201	1,189	1,240	1,166	959
Park River	1,806	1,680	1,844	1,725	1,535
Pembina	623	741	673	642	642
Portland	607	534	627	602	604
Thompson	290	291	785	930	1,006
Valley City	7,809	7,843	7,774	7,163	6,826
Wahpeton	5,876	7,076	9,064	8,751	8,586
Walhalla	1,516	1,471	1,429	1,131	1,057
West Fargo	3,328	5,161	10,099	12,287	14,940
Minnesota Municipalities					
Breckenridge	4,335	4,200	3,909	3,708	3,559
East Grand Forks	6,998	7,607	8,537	8,658	7,501
Moorhead	22,934	29,687	29,998	32,295	32,177

Projecting Future Population

A variety of population projection techniques can be used to estimate future population. The reliability of a set of population projections depends on the applicability of the assumptions used in the projection technique. Assumptions are required for migration, fertility, and mortality. All three of these factors, particularly migration, can be affected by economic growth. Therefore, assumptions about future economic conditions must also implicitly be made when projecting future population growth. Migration rates are generally the least predictable of these three factors and mortality rates are typically the most stable.

Migration patterns can change quickly as a result of economic fluctuations, political factors, or social conditions. A decline in the agricultural sector may cause migration from rural to urban areas. An unforeseeable relocation of a large employer into a region or out of a region can have a significant impact on future population. Another aspect of migration with little certainty is the characteristics of the population migrating into (or out of) the area. The migration of a relatively young population into an area will have more of an effect on population growth than the migration of a very old population. As a result, unpredictable and potentially rapid changes in factors that influence migration can easily lead to errors in population projections.

Fertility levels can also change over time, although not generally as rapidly as changes in migration patterns. Changes in birth rates can result from changes in health care, changing attitudes towards having children, the prevalence of dual income families and other factors. These changes have a tendency to occur in cycles that may be somewhat more predictable than changing migration patterns.

Mortality rates are the most stable of the factors influencing population growth. Mortality rates can vary over time because of advances in health care, but these changes are typically fairly gradual and more predictable. It is also more likely that changes in mortality rates will be more pronounced in the youngest age group as reflected through reduced infant mortality and greater survival rates for young children.

Population Projection Techniques

A variety of standard accepted techniques are available for projecting future population. These techniques include:

1. Applying previously completed population projections at the state and county levels to the area under consideration.
2. Simple trend analysis based on historical rates of growth.
3. Demographic modeling, which is typically the cohort-component method. The cohort-component method involves separate projections for mortality, fertility, and migration for separate age-sex groups.
4. Combined demographic/economic models - involves estimation of population changes based on the demographic factors modified by labor supply and demand factors in the economy which may place constraints on future growth.
5. Population projection scenarios - different assumptions are used with trend or demographic projection techniques to produce a range of projections based on a variety of assumptions.
6. Probabilistic techniques - historical data or the judgements of experts are used to estimate the probability of changes in demographic variables that influence population growth.

The combined demographic/economic modeling technique is essentially demographic modeling with a factor built in to reflect the impact of local economic conditions on net migration. Greater levels of economic growth represent increased labor demand and potentially greater net in migration. The population projection scenario technique provides a range of estimates showing the sensitivity of the projections to changes in various assumptions and the use of different techniques. The probabilistic technique relies on judgements of those very familiar with the study area and assumes future patterns of change can be predicted based on that judgement. This analysis relies on the first three projection methods, from which a variety of population projection scenarios are derived.

Population Projections Based on North Dakota State Data Center Projections and Minnesota State Demographic Center Projections

The North Dakota State Data Center has generated population projections at the county level through the year 2020. The North Dakota State Data Center projections are based on a cohort-survival model. The birth rates are based on a 3-year average from 1998 through 2000 at the county level. Death rates are based on the North Dakota state average from 1998 to 2000. Migration rates were developed using age-specific migration patterns from 1990 to 2000. Some migration rates for rural counties were adjusted to better reflect historical trends. The North Dakota State Data Center projections reflect assumptions that there will be a weakening of the flow of North Dakota's rural population into metropolitan areas, resulting in modest population growth over the next two decades. The Minnesota State Demographic Center generates county level population projections to the year 2030 also using a cohort-component model. The North Dakota State Data Center and Minnesota State Demographic Center projections are shown in Table 3.

Population Projections Based on Trends of Bureau of the Census County Estimates

Bureau of the Census population data were obtained for each of the study area counties from 1960 to 2000. The data years included 1960, 1970, 1975 and annual population data from 1980 to 2000. All 24 observations were used to estimate a simple linear trend model where population was estimated to be a function of time. The only exception was Grand Forks County, which did not include population estimates for the years 1997 through 2000. These years were excluded to avoid the population impact of the 1997 flood. Nonlinear models were also estimated, but changing the functional form did not change the significance of the overall model and had little impact on the estimates. Therefore, the linear model was used because of its simplicity.

The trend estimates are useful for comparison with projections using other techniques. However, the trend estimates may not be very accurate because they are based on the assumption that past relationships will continue into the future. Potential changes in birth rates, death rates, and migration patterns are not accounted for in these projections. Population projection techniques that consider components of population change (age, sex, mortality, fertility) separately are considered more desirable than simple trend models (Greenberg, et al., 1978). The census trend estimates are not very realistic for counties which have had consistently decreasing population since 1960, and in some cases the trend estimate results in an estimated zero population. The trend-based projections are shown in Table 4.

Table 3 - Population Projections from State Sources[1]

County	2005	2010	2015	2020	2025	2030
North Dakota						
Barnes	11,574	11,564	11,629	11,675	na	na
Cass	131,097	137,724	144,880	151,651	na	na
Cavalier	4,391	4,070	3,830	3,614	na	na
Grand Forks	66,545	67,551	67,988	68,238	na	na
Griggs	2,557	2,418	2,271	2,099	na	na
Nelson	3,603	3,592	3,559	3,542	na	na
Pembina	8,254	8,125	7,971	7,810	na	na
Ransom	5,834	5,844	5,860	5,840	na	na
Richland	17,715	17,570	17,414	17,218	na	na
Sargent	4,258	4,230	4,225	4,272	na	na
Steele	2,190	2,134	2,102	2,074	na	na
Traill	8,263	8,141	7,987	7,771	na	na
Walsh	11,621	11,239	10,776	10,336	na	na
Minnesota						
Clay	52,230	52,610	52,720	52,820	53,110	53,570
Kittson	5,150	5,100	5,130	5,170	5,210	5,220
Marshall	9,770	9,500	9,330	9,210	9,130	9,050
Norman	7,280	7,180	7,140	7,140	7,160	7,180
Otter Tail	60,030	63,240	67,040	70,890	74,740	78,250
Polk	30,890	30,830	30,990	31,210	31,440	31,650
Traverse	3,930	3,810	3,750	3,740	3,740	3,740
Wilkin	7,000	6,940	6,950	7,010	7,040	7,070

[1] Based on North Dakota State Data Center or Minnesota State Demographic Center projections

Table 4 - Population Projections Based on Trends of Official Bureau of the Census Population Estimates from 1960 to 2000

County	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
North Dakota										
Barnes	11,000	10,400	9,800	9,300	8,700	8,100	7,600	7,000	6,400	5,900
Cass	126,000	133,200	140,500	147,700	155,000	162,200	169,500	176,700	184,000	191,200
Cavalier	3,900	3,100	2,300	1,600	800	0	0	0	0	0
Grand Forks	78,800	81,300	83,900	86,400	89,000	91,600	94,100	96,700	99,200	101,800
Griggs	2,500	2,200	1,900	1,700	1,400	1,100	900	600	300	0
Nelson	3,200	2,800	2,300	1,900	1,500	1,100	700	200	0	0
Pembina	7,700	7,200	6,600	6,100	5,500	5,000	4,400	3,900	3,400	2,800
Ransom	5,200	5,000	4,700	4,400	4,100	3,800	3,500	3,300	3,000	2,700
Richland	18,000	17,900	17,700	17,600	17,400	17,300	17,100	17,000	16,800	16,600
Sargent	3,800	3,400	3,100	2,800	2,400	2,100	1,800	1,400	1,100	800
Steele	1,600	1,300	1,000	700	400	100	0	0	0	0
Traill	8,200	7,900	7,700	7,400	7,200	6,900	6,700	6,400	6,200	5,900
Walsh	12,500	11,900	11,300	10,700	10,100	9,400	8,800	8,200	7,600	7,000
Minnesota										
Clay	53,900	55,200	56,500	57,900	59,200	60,500	61,800	63,100	64,400	65,700
Kittson	4,700	4,400	4,000	3,700	3,300	2,900	2,600	2,200	1,800	1,500
Marshall	9,500	8,900	8,400	7,800	7,300	6,700	6,100	5,600	5,000	4,500
Norman	6,800	6,300	5,800	5,400	4,900	4,400	4,000	3,500	3,000	2,500
Otter Tail	55,900	57,000	58,100	59,200	60,300	61,400	62,500	63,600	64,700	65,800
Polk	30,900	30,200	29,600	29,000	28,300	27,700	27,100	26,500	25,800	25,200
Traverse	3,500	3,100	2,700	2,200	1,800	1,400	1,000	600	100	0
Wilkin	6,600	6,200	5,700	5,300	4,900	4,500	4,100	3,700	3,300	2,900

Population Projections Based on Demographic Modeling

Demographic modeling involves the estimation of relationships between demographic characteristics and population levels to projected future population. Population projections are frequently generated using the cohort-component method. A cohort represents a group of individuals having a specific factor (such as age) in common. For example, males age 19 to 25 represent a cohort. The cohort-component method involves separating the population under consideration into cohorts, looking at the demographic components of each cohort, and projecting the population of each cohort for successive periods into the future.

Demographic modeling is superior to trend analysis because the factors which influence population are identified and can be varied to reflect expectations for the future. Trend analysis simply assumes all the underlying factors that influence population levels are static. Demographic components include mortality, fertility, and migration. The migration component actually represents net migration. These three components are evaluated for each age-sex category. Age categories are typically 5-year intervals. The child-bearing years are generally considered to be 15 to 44 years of age.

The first step in implementing the cohort-component method is to apply specific age-sex survival rates to each group and carry that population forward to the next age group. Next, the net number of migrants is added to the population carried forward in the first step to derive the projected population. Projecting the future 0-to-4 year-old age group is more complicated because this future group does not currently exist in its entirety. Consequently, the future 0-to-4 year-old age cohort is projected by applying the age-specific birth rates to the 15-44 female population of childbearing age. The projected births are then multiplied by the appropriate survival and net migration rates.

The simple formula applied to each cohort in the cohort-component method is:

$P_1 = P_0 + B - D + NM$

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
NM = Net migration during the period.

The components of a demographic modeling analysis include:

X *Birth rates* - Birth rates are used in demographic models to project births within specific age groups. The birth rate for an age group combined with the population of females within that age group can be used to estimate births. Birth rates for the female population of child-bearing age are available by age group and race from the Department of Health and Human Services. Birth rates are also available by state. Projections of future birth rate are available by race and age group for the United States from the U.S. Bureau of the Census. The projections of future birth rates can be combined with current birth rates to project future birth rates in the study area. The birth rates used to project future population are presented in Table 5.

Table 5- Birth Rates Used to Project Red River Valley Population

Age of Woman in years	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
North Dakota Counties					(Births per 1,000 women)						
15 - 17	54.25	55.03	55.83	56.64	57.46	58.30	58.36	58.43	58.49	58.56	58.62
18 - 19	54.25	55.03	55.83	56.64	57.46	58.30	58.36	58.43	58.49	58.56	58.62
20 - 24	83.42	84.63	85.85	87.10	88.36	89.65	89.74	89.84	89.94	90.04	90.14
25 - 29	98.05	99.47	100.91	102.38	103.86	105.37	105.48	105.6	105.72	105.83	105.95
30 - 34	79.87	81.03	82.21	83.40	84.61	85.84	85.93	86.03	86.12	86.22	86.31
35 - 39	40.98	41.58	42.18	42.79	43.41	44.04	44.09	44.14	44.19	44.24	44.28
40 – 44	9.90	10.05	10.19	10.34	10.49	10.64	10.66	10.67	10.68	10.69	10.70
Minnesota Counties					(Births per 1,000 women)						
15 - 17	33.21	33.71	34.21	34.71	35.20	35.70	35.83	35.86	35.90	35.94	35.98
18 - 19	33.21	33.71	34.21	34.71	35.20	35.70	35.83	35.86	35.90	35.94	35.98
20 - 24	94.67	96.09	97.50	98.92	100.34	101.75	102.12	102.2	102.34	102.45	102.56
25 - 29	134.1	136.1	138.07	140.08	142.09	144.09	144.62	144.8	144.92	145.08	145.23
30 - 34	118.1	119.8	121.60	123.36	125.13	126.90	127.36	127.5	127.63	127.76	127.90
35 - 39	45.46	46.14	46.82	47.50	48.18	48.86	49.04	49.09	49.14	49.19	49.25
40 – 44	8.94	9.07	9.20	9.34	9.47	9.61	9.64	9.65	9.66	9.67	9.68

X *Mortality* - Mortality rates are applied to specific age-sex groups to estimate survival for each group. Mortality rates indicate the percentage of a specific age-sex group that would be expected to die. The current mortality rates used in this analysis for North Dakota were obtained from the Department of Health and Human Services, Centers for Disease Control. Current mortality rates for the Minnesota counties were obtained by age-group from Minnesota Department of Health, 2000 health statistics. The Census Bureau has historical death rates by age, sex, and race for the U.S. population, and projects life expectancy at birth and at age 65 through the year 2050 for the U.S. population. The Census Bureau projections were used to adjust future mortality rates. The estimated current and future mortality rates were use in the projections and are shown in Table 6.

X *Migration* - Generally, changes in birth and mortality rates are slow and somewhat predictable. However, outside influences can cause rapid and significant changes in migration rates with little advance warning. Therefore, migration is the most difficult demographic component to project with confidence. In addition, there is a general lack of time-series data which reports accurate migration patterns by age and sex at a detailed level of analysis.

Table 6 - Current and Projected Future Mortality Rates

Age	2000 females	2000 males	2010 females	2010 males	2020 females	2020 males	2030 females	2030 males	2040 females	2040 males	2050 females	2050 males
North Dakota Counties					(Deaths per 100,000 population)							
< or = 1 year	.00588	.00714	.00548	.00666	.00512	.00621	.00502	.00610	.00501	.00608	.00470	.00571
10 yrs	.00013	.00015	.00012	.00014	.00011	.00013	.00011	.00013	.00011	.00013	.00010	.00012
20 yrs	.00049	.00123	.00045	.00115	.00042	.00107	.00042	.00105	.00041	.00105	.00039	.00098
30 yrs	.00052	.00120	.00049	.00112	.00045	.00104	.00045	.00102	.00045	.00102	.00042	.00096
40 yrs	.00104	.00186	.00097	.00173	.00090	.00162	.00089	.00159	.00088	.00158	.00083	.00149
50 yrs	.00212	.00377	.00198	.00352	.00185	.00328	.00182	.00323	.00181	.00322	.00170	.00302
60 yrs	.00642	.01052	.00599	.00982	.00559	.00916	.00549	.00899	.00547	.00896	.00514	.00842
70 yrs	.01621	.02586	.01512	.02413	.01411	.02251	.01385	.02210	.01381	.02203	.01297	.02069
80 yrs	.04301	.06241	.04013	.05822	.03743	.05431	.03676	.05334	.03665	.05317	.03442	.04994
85+yrs	.15351	.18735	.14322	.17479	.13360	.16305	.13120	.16012	.13079	.15961	.12283	.14991
Minnesota Counties					(Deaths per 100,000 population)							
< or = 1 year	.00493	.00661	.00460	.00616	.00429	.00575	.00422	.00565	.00420	.00563	.00395	.00529
10 yrs	.00014	.00020	.00013	.00019	.00012	.00018	.00012	.00017	.00012	.00017	.00011	.00016
20 yrs	.00423	.00112	.00039	.00105	.00037	.00098	.00036	.00096	.00036	.00096	.00034	.00090
30 yrs	.00047	.00102	.00044	.00095	.00041	.00089	.00040	.00087	.00040	.00087	.00038	.00082
40 yrs	.00115	.00202	.00108	.00189	.00101	.00176	.00099	.00173	.00098	.00172	.00092	.00162
50 yrs	.00292	.00452	.00272	.00421	.00254	.00393	.00250	.00386	.00249	.00385	.00234	.00362
60 yrs	.00748	.01177	.00697	.01098	.00651	.01024	.00639	.01006	.00637	.01003	.00598	.00942
70 yrs	.01995	.03179	.01861	.02966	.01736	.02766	.01705	.02717	.01699	.02708	.01596	.02544
80 yrs	.05343	.08531	.04985	.07959	.04650	.07425	.04567	.07291	.04552	.07268	.04276	.06826
85+yrs	.14152	.17562	.13203	.16385	.12316	.15284	.12095	.15010	.12057	.14962	.11324	.14052

Population Projections Based on a Cohort-Component Model and Assuming Zero In-Migration

For these projections it was assumed there was zero in-migration occurring for each of the Minnesota and North Dakota counties except Cass County, North Dakota. The Cass County projections were based on net international migration that matched estimates from the Federation for American Immigration Reform, which was estimated to be approximately 200 people. This pattern may be the result of the influence of North Dakota State University. Population projections based on a cohort-component model and assuming zero in-migration, except as noted for Cass County, are presented in Table 7.

Population Projections Based on a Cohort-Component Model and Assuming Past Migration Patterns will Continue into the Future

The population projections described in this section are based on the cohort-component methodology described. The difference between the two cohort-component projections is the in-migration assumptions. For all North Dakota counties except Cass County and Grand Forks County there has historically been a negative net migration, where the number of people leaving the county has been greater than the number of people moving into the county. The current and future net migration patterns used in this analysis for all of the counties except Cass and Grand Forks Counties were based on estimates from the U.S. Bureau of the Census, Department of

Commerce population projections (1997, 2000). The state average migration patterns and projected patterns were applied to each year. The percentage of total population change at the state level attributable to net migration patterns were estimated to be 35.5 percent from 2000 to 2004 (a net loss), 2.02 percent from 2005 to 2009 (a net loss), 28.45 percent from 2010 to 2014 (a net gain), 7.26 percent from 2015 to 2019 (a net gain), 7.78 percent from 2020 to 2024 (a net loss), and 26.69 percent from 2025 to 2050 (a net loss). These percentages represent the portion of change attributable to net migration, not the percentage change in population attributable to migration. For example, if population changed by 10 percent from 2005 to 2009, then the percentage of change attributable to migration would be 0.202 percent.

Net migration population data were obtained from the Federation for American Immigration Reform for Cass County. These data indicate net total in-migration of about 800 people each year. Net migration decreased considerably from 2000 to 2002. Census data indicate that over a 5-year period from 1995 to 2000 there was large number of people moving into and out of Cass County, which is likely explained by the location of North Dakota State University in Fargo. In the year 2000, there is an estimated positive net migration of 800 people. Net migration is then projected to increase steadily from 800 people per year in 2000 to 2,900 people per year in 2050.

Current migration patterns for the Minnesota counties are based on 1990 to 2000 migration estimates presented in the Minnesota State Demographic Center population notes publication "Migration a major factor in Minnesota's population growth" (July, 2002). This publication indicates only Otter Tail County has shown positive net migration over the last 10 years, a 1.32 percent increase each year. The other seven Minnesota counties in the study area showed annual net migration decreases of 0.33 percent per year to 0.80 percent per year. The population projections based on a cohort-component model and assuming nonzero in-migration are presented in Table 8.

The population estimates assuming zero net migration for rural areas and past net migration for urban areas can be combined to account for the potential stabilization of the rural population and the continuation of growth and positive net migration patterns in the most urbanized areas of the region. Thus, the results presented in Tables 7 and 8 are combined to create a set of projections based on the assumptions of a stabilized rural population and continued growth of the urban population. These results are presented at the regional level in Table 9.

Current and future migration can be very difficult to estimate and population projections are sensitive to the assumed migration rates. It is difficult to project movement into and out of a state and the challenge of estimating migration rates becomes even more difficult at the county and local level. As a result, the projections presented in Tables 7 and 8 are best viewed in terms of the total population for the entire region, as presented in summary Table 9. From 1960 to 2000 the entire Red River Valley as defined in this analysis grew at an average annual rate of 0.208 percent. When the population of only Moorhead, East Grand Forks, and Breckenridge are included on the Minnesota side, the growth rate from 1960 to 2000 was 0.402 percent annually. The regional population is projected to grow 0.407 percent annually based on zero net migration, 0.638 percent annually using the past migration scenario, and 0.719 percent using the most optimistic estimate of future population.

Table 7 - Population Projections Based on Cohort-Component Model and the Assumption of Zero In-Migration Rates

County	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
North Dakota										
Barnes	11,700	11,700	11,800	11,900	11,900	11,900	11,800	11,700	11,600	11,600
Cass	131,800	140,700	149,100	157,200	165,200	174,000	183,400	193,300	203,500	214,100
Cavalier	4,700	4,600	4,500	4,500	4,400	4,300	4,200	4,100	4,000	4,000
Grand Forks	69,200	72,400	75,100	77,300	78,900	80,200	81,200	81,600	81,500	81,100
Griggs	2,600	2,600	2,500	2,500	2,400	2,400	2,300	2,300	2,200	2,200
Nelson	3,500	3,400	3,300	3,200	3,200	3,100	3,000	2,900	2,900	2,900
Pembina	8,500	8,400	8,400	8,400	8,400	8,400	8,200	8,100	8,000	7,900
Ransom	5,800	5,700	5,700	5,600	5,700	5,600	5,600	5,500	5,400	5,300
Richland	18,100	18,400	18,700	19,000	19,300	19,400	19,300	19,200	19,000	18,800
Sargent	4,300	4,300	4,300	4,300	4,300	4,300	4,200	4,100	4,000	4,000
Steele	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,100	2,100	2,100
Traill	8,400	8,400	8,400	8,500	8,500	8,500	8,500	8,400	8,300	8,300
Walsh	12,200	12,100	12,100	12,100	12,100	12,000	11,900	11,700	11,500	11,300
ND Total	***283,000***	***294,900***	***306,100***	***316,700***	***326,500***	***336,300***	***345,800***	***355,000***	***364,000***	***373,600***
Minnesota										
Clay	52,100	53,300	54,700	55,500	55,800	56,000	56,100	56,100	56,100	56,300
Kittson	5,100	4,900	4,800	4,800	4,800	4,800	4,700	4,600	4,600	4,600
Marshall	10,000	10,000	10,000	10,000	10,000	9,900	9,800	9,600	9,500	9,400
Norman	7,300	7,200	7,200	7,300	7,400	7,400	7,300	7,300	7,200	7,300
Otter Tail	56,300	55,800	55,800	55,800	55,600	54,900	53,800	52,700	51,800	51,100
Polk	31,300	31,400	31,900	32,400	32,700	32,800	32,700	32,600	32,400	32,400
Traverse	4,000	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900
Wilkin	7,200	7,200	7,400	7,600	7,700	7,800	7,900	7,900	7,900	8,000
MN Total	***173,300***	***173,700***	***175,700***	***177,300***	***177,900***	***177,500***	***176,200***	***174,700***	***173,400***	***173,000***
RRV Total	**456,300**	**468,600**	**481,800**	**494,000**	**504,400**	**513,800**	**522,000**	**529,700**	**537,400**	**546,600**

Table 8 - Population Projections Based on Cohort-Component Model and the Assumption that Past Net Migration Patterns will Continue into the Future

County	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
North Dakota										
Barnes	11,300	11,300	11,500	11,600	11,600	11,300	11,000	10,700	10,400	10,100
Cass	132,800	142,800	152,500	161,700	171,100	181,200	192,000	203,400	215,300	227,500
Cavalier	4,500	4,400	4,400	4,400	4,300	4,100	3,900	3,700	3,500	3,400
Grand Forks	70,400	75,000	79,300	83,100	86,800	90,600	94,700	99,000	103,100	107,100
Griggs	2,500	2,400	2,400	2,400	2,400	2,300	2,100	2,000	1,900	1,900
Nelson	3,400	3,200	3,200	3,200	3,100	2,900	2,800	2,600	2,500	2,400
Pembina	8,200	8,100	8,200	8,300	8,300	8,000	7,700	7,300	7,000	6,800
Ransom	5,600	5,500	5,500	5,500	5,500	5,400	5,200	5,000	4,800	4,600
Richland	17,600	17,900	18,400	18,800	18,900	18,700	18,300	17,700	17,100	16,500
Sargent	4,200	4,200	4,200	4,300	4,200	4,100	3,900	3,800	3,600	3,400
Steele	2,200	2,100	2,200	2,200	2,200	2,100	2,000	1,900	1,900	1,800
Traill	8,100	8,100	8,200	8,300	8,300	8,200	8,000	7,700	7,400	7,200
Walsh	11,800	11,700	11,800	11,900	11,800	11,500	11,100	10,600	10,100	9,800
ND Total	***282,600***	***296,700***	***311,800***	***325,700***	***338,500***	***350,400***	***362,700***	***375,400***	***388,600***	***402,500***
Minnesota										
Clay	52,000	53,300	54,700	55,400	55,800	55,900	56,000	56,000	56,000	56,200
Kittson	5,200	5,100	5,100	5,200	5,300	5,400	5,400	5,400	5,400	5,600
Marshall	10,000	9,900	9,800	9,900	9,800	9,700	9,500	9,300	9,100	9,000
Norman	7,200	7,000	6,900	6,800	6,800	6,700	6,500	6,400	6,200	6,200
Otter Tail	60,100	63,600	67,900	72,600	77,200	81,300	85,200	89,000	93,300	98,200
Polk	30,600	30,200	30,000	29,900	29,600	29,100	28,500	27,800	27,100	26,500
Traverse	3,900	3,700	3,600	3,600	3,500	3,500	3,400	3,300	3,300	3,200
Wilkin	6,900	6,800	6,700	6,600	6,500	6,400	6,200	6,000	5,800	5,700
MN Total	***175,900***	***179,600***	***184,700***	***190,000***	***194,500***	***198,000***	***200,700***	***203,200***	***206,200***	***210,600***
RRV Total	**458,500**	**476,300**	**496,500**	**515,700**	**533,000**	**548,400**	**563,400**	**578,600**	**594,800**	**613,100**

Due to the difficulty in projecting migration patterns at the local and county level, the distribution of future population may not be accurately represented in Tables 7 and 8. The future population projections in Tables 7 and 8 show a progressively decreasing percentage of total regional population in Cass County, which may not occur. To evaluate the potential of incorrectly projecting the distribution of future population, the trend of percentage of Cass County population compared to the total region was applied to the future regional population projections for the entire study area. One of the two Cohort-Component based model projections were similar to the historical population trends for all of the counties except Cass County. Therefore, only the Cass County population was adjusted to correspond to the historical distribution of population in the Red River Valley region. The result of this procedure is to basically assume the most optimistic regional growth and distribute that growth to Cass County. The results are shown in Table 9. However, adjusting the population projections to account for past trends in population distribution may result in artificially large population projections because of the importance placed on the distribution of population rather than the demographic characteristics that actually influence population growth. Therefore, the projections presented in Table 9 may overstate future population in the Red River Valley region.

Projecting Future Population Changes of Municipalities

Population projections for cities and towns are subject to greater error than projections at the county and state level for a variety of reasons. One major reason is the smaller population base represented by a municipality compared to the larger population of the entire county. As the population base becomes smaller, site-specific differences in demographic characteristics can lead to very different patterns of growth or decline compared to the county. Typically, birth, immigration, and death rate data are available at the county or state level. Projections of future changes in birth and death rates are available at the regional or national level. Applying these estimates of regional demographic characteristics to small populations is likely to introduce a high level of error in municipal projections.

Municipal projections may also be subject to greater error due to the potential impact of business location decisions on a city or town. These impacts are spread out over a larger population base at the county level while they are concentrated in an urban area. There is also the potential for a large variation in migration patterns in urban areas and difficulty in projecting these patterns.

Possible Methods to Project Municipal Population

Several methods can be used to project future municipal population. These methods are similar to the methods described in the county population sections. However, the level of detail associated with projections at the municipal level presents a unique set of problems. The methods are described below.

- Component-cohort modeling - If detailed data are available at the municipal level, a component-cohort model can be estimated as was done for the county level projections. However, as mentioned, migration and birth/death rate assumptions must typically be used from larger geographic regions, which reduce the accuracy of the projections.
- Application of county level model to municipalities – This method is the equivalent of modeling individual municipalities using county and/or state level immigration, birth, and

Table 9 –Projections Based on Optimistic Growth and Current Distribution of Population

County	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
North Dakota										
Barnes	11,700	11,600	11,400	11,100	10,900	10,400	10,000	9,500	8,400	7,200
Cass	132,700	143,300	154,700	166,200	177,500	190,300	203,400	217,000	235,300	254,800
Cavalier	4,700	4,500	4,400	4,200	4,000	3,800	3,500	3,300	2,900	2,400
Grand Forks	70,400	75,000	79,300	83,100	86,800	90,600	94,700	99,000	103,100	107,100
Griggs	2,600	2,500	2,400	2,300	2,200	2,100	2,000	1,900	1,600	1,400
Nelson	3,500	3,400	3,200	3,000	2,900	2,700	2,600	2,400	2,100	1,800
Pembina	8,500	8,400	8,200	7,900	7,700	7,300	7,000	6,600	5,700	4,900
Ransom	5,800	5,700	5,500	5,300	5,200	5,000	4,700	4,500	3,900	3,300
Richland	18,100	18,400	18,700	19,000	19,300	19,400	19,300	19,200	19,000	18,800
Sargent	4,300	4,300	4,200	4,100	3,900	3,800	3,600	3,400	2,900	2,500
Steele	2,200	2,200	2,100	2,100	2,000	1,900	1,800	1,700	1,500	1,300
Traill	8,400	8,300	8,200	8,000	7,800	7,500	7,200	6,900	6,000	5,100
Walsh	12,200	12,000	11,700	11,400	11,100	10,600	10,100	9,500	8,300	7,000
ND Total	***285,100***	***299,600***	***314,000***	***327,700***	***341,300***	***355,400***	***369,900***	***384,900***	***400,700***	***417,600***
Minnesota										
Clay	53,900	56,800	60,300	64,000	67,400	70,600	73,600	76,600	79,800	83,600
Kittson	5,700	5,500	5,400	5,200	5,000	4,700	4,500	4,200	3,900	3,600
Marshall	10,900	10,600	10,300	10,000	9,600	9,100	8,600	8,000	7,500	6,900
Norman	8,000	7,800	7,600	7,300	7,000	6,700	6,300	5,900	5,500	5,100
Otter Tail	55,400	57,900	61,200	64,500	67,600	70,400	73,000	75,600	78,300	81,700
Polk	31,300	31,400	31,900	32,400	32,700	32,800	32,700	32,600	32,400	32,400
Traverse	4,400	4,300	4,200	4,100	3,900	3,700	3,500	3,300	3,000	2,800
Wilkin	7,700	7,500	7,300	7,000	6,800	6,400	6,100	5,700	5,300	4,900
MN Total	***177,300***	***181,800***	***188,200***	***194,500***	***200,000***	***204,400***	***208,300***	***211,900***	***215,700***	***221,000***
RRV Total	**462,400**	**481,400**	**502,200**	**522,200**	**541,300**	**559,800**	**578,200**	**596,800**	**616,400**	**638,600**

death rate assumptions. This method works best if the municipality accounts for a large percentage of the county population.

- Statistical analysis of past trends in municipal population – This is a trend analysis where it is assumed that a statistically significant change in population over time is a reasonable predictor of future changes. This method may be best applied to cities and towns that have not shown statistically significant trends in the past. The insignificant trend is an indicator of a stable population.
- Application of past county level growth rates to municipalities which have shown changes that are very similar to county level changes.

Projecting Future Population of Individual Municipalities

Municipal population data were collected for 1960 to 2000. Regression analysis was then used to determine if there were statistically significant time trends. For those municipalities which did not have a statistically significant trend, a stable population was projected regardless of the projected change in the overall county population.

The Grand Forks projection is based on a trend analysis from 1960 to 1997. Projections for Casselton, Cavalier, Gwinner, Harwood, Hillsboro, Lisbon, and Moorhead are based on trends for those cities since 1960. Population trends for these towns vary considerably from past county level trends. The populations of Fargo and West Fargo were based on the historical trend of population as a percentage of the total county population. Those towns with a historically decreasing population were projected to decline at a rate equal to the county level projection with a zero net migration rate. This is a somewhat optimistic assumption given the negative net migration that has been observed in many rural counties, but it is supported by the recent stabilization in population indicated by the 2000 census estimates. The techniques described were used to represent past changes as closely as possible while trying to project foreseeable changes and trying not to undercount future urban population. The municipal population projections are presented in Tables 10 and 11.

Population Projection Summary

Five different sets of county level population projections have been presented in this analysis. Each of these projection scenarios are based on different assumptions and each has advantages and disadvantages. The simplest but potentially most unreliable population projection scenario is the trend analysis based on U.S. Bureau of the Census estimates of past population. Use of trend analysis assumes past patterns of growth or decline will continue into the future and ignores potential changes in underlying demographic characteristics such as the age structure, ratio of males to females, and migration patterns. The population of some Red River Valley counties were projected to drop to zero using the trend methodology, which is clearly not likely to occur. Trend analysis is the least rigorous projection technique and the simplifications discussed above are likely to reduce the accuracy of these projections.

Population projections prepared by the North Dakota Data Center and the Minnesota State Demographic Center are based on demographic modeling. The North Dakota projections appear to be based on assumptions of continued significant out-migration from the region. However, the

Table 10 – Municipal Population Projections Based on Cohort-Component Results and Historical Net Migration Patterns

Municipality	2000 Census	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Arthur	402	400	400	400	400	400	400	400	400	400	400
Casselton	1,855	1,880	1,900	1,920	1,950	1,970	2,000	2,020	2,050	2,080	2,100
Cavalier	1,537	1,550	1,570	1,590	1,610	1,620	1,640	1,660	1,680	1,690	1,710
Cooperstown	1,053	1,010	980	960	950	940	920	900	870	860	840
Drayton	913	920	920	920	920	920	920	920	920	920	920
Enderlin	947	930	910	910	900	910	910	900	880	870	860
Fargo	90,599	97,200	104,200	111,800	119,900	128,500	137,900	147,900	158,600	170,100	182,400
Finley	515	510	500	500	500	500	500	490	480	480	470
Forman	506	510	510	510	510	510	510	510	510	510	510
Grafton	4,516	4,450	4,420	4,410	4,420	4,410	4,380	4,330	4,250	4,180	4,130
Grand Forks	49,321	52,000	54,800	57,800	61,000	64,300	67,800	71,500	75,300	79,400	83,800
Gwinner	717	760	810	850	900	940	990	1,040	1,080	1,130	1,170
Hankinson	1,058	1,040	1,050	1,080	1,100	1,110	1,100	1,070	1,040	1,010	970
Harwood	607	640	670	700	740	780	800	860	910	950	1,000
Hatton	707	680	670	690	690	700	680	660	640	620	600
Hillsboro	1,563	1,600	1,640	1,670	1,710	1,750	1,790	1,820	1,860	1,900	1,930
Horace	915	980	1,040	1,110	1,190	1,260	1,350	1,440	1,540	1,640	1,750
Lakota	781	740	720	700	680	670	650	630	620	610	600
Langdon	2,101	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100
Larimore	1,433	1,430	1,410	1,380	1,350	1,320	1,300	1,270	1,240	1,210	1,190
Lidgerwood	738	720	730	750	770	770	760	750	730	700	680
Lisbon	2,292	2,320	2,340	2,360	2,390	2,410	2,430	2,460	2,480	2,500	2,530
Mapleton	606	610	610	610	610	610	610	610	610	610	610
Mayville	1,953	1,870	1,860	1,900	1,920	1,920	1,880	1,830	1,780	1,720	1,660
McVille	470	470	470	470	470	470	470	470	470	470	470
Minto	657	660	660	660	660	660	660	660	660	660	660
Northwood	959	960	930	910	880	860	830	810	780	760	730
Park River	1,535	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540
Pembina	642	640	640	640	640	640	640	640	640	640	640
Portland	604	600	600	600	600	600	600	600	600	600	600
Thompson	1,006	1,070	1,140	1,210	1,260	1,320	1,380	1,440	1,510	1,570	1,630
Valley City	6,826	6,540	6,540	6,670	6,740	6,720	6,570	6,390	6,200	6,010	5,840
Wahpeton	8,586	8,940	9,300	9,650	10,010	10,360	10,720	11,070	11,430	11,780	12,140
Walhalla	1,057	1,040	1,030	1,030	1,040	1,040	1,030	1,010	1,000	980	970
West Fargo	14,940	16,000	17,200	18,500	19,800	21,300	22,800	24,500	26,300	28,200	30,300
Northwood	533	530	530	530	530	530	530	530	530	530	530
Minnesota											
Breckenridge	3,559	3,460	3,360	3,250	3,150	3,050	2,950	2,850	2,740	2,640	2,540
East Grand Forks	7,501	7,700	7,900	8,100	8,300	8,600	8,800	9,000	9,300	9,500	9,800
Moorhead	32,177	34,700	35,800	36,800	37,900	38,900	40,000	41,000	42,100	43,100	44,200

Table 11 – Municipal Population Projections Based on Optimistic Growth and Current Distribution of Population

Municipality	2000 Census	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Arthur	402	400	400	400	400	400	400	400	400	400	400
Casselton	1,855	1,910	1,960	2,010	2,060	2,120	2,170	2,220	2,270	2,320	2,380
Cavalier	1,537	1,550	1,570	1,590	1,610	1,620	1,640	1,660	1,680	1,690	1,710
Cooperstown	1,053	1,010	980	960	950	940	920	900	870	860	840
Drayton	913	920	920	920	920	920	920	920	920	920	920
Enderlin	947	930	910	910	900	910	910	900	880	870	860
Fargo	90,599	98,800	107,100	116,700	126,400	136,900	147,400	159,200	171,000	187,700	204,300
Finley	515	510	500	500	500	500	500	490	480	480	470
Forman	506	510	510	510	510	510	510	510	510	510	510
Grafton	4,516	4,450	4,420	4,410	4,420	4,410	4,380	4,330	4,250	4,180	4,130
Grand Forks	49,321	52,000	54,800	57,800	61,000	64,300	67,800	71,500	75,300	79,400	83,800
Gwinner	717	760	810	850	900	940	990	1,040	1,080	1,130	1,170
Hankinson	1,058	1,040	1,050	1,080	1,100	1,110	1,100	1,070	1,040	1,010	970
Harwood	607	650	700	750	800	840	890	950	1,000	1,060	1,120
Hatton	707	680	670	690	690	700	680	660	640	620	600
Hillsboro	1,563	1,600	1,640	1,670	1,710	1,750	1,790	1,820	1,860	1,900	1,930
Horace	915	1,020	1,120	1,220	1,330	1,430	1,540	1,640	1,750	1,850	1,950
Lakota	781	740	720	700	680	670	650	630	620	610	600
Langdon	2,101	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100
Larimore	1,433	1,430	1,410	1,380	1,350	1,320	1,300	1,270	1,240	1,210	1,190
Lidgerwood	738	720	730	750	770	770	760	750	730	700	680
Lisbon	2,292	2,320	2,340	2,360	2,390	2,410	2,430	2,460	2,480	2,500	2,530
Mapleton	606	610	610	610	610	610	610	610	610	610	610
Mayville	1,953	1,870	1,860	1,900	1,920	1,920	1,880	1,830	1,780	1,720	1,660
McVille	470	470	470	470	470	470	470	470	470	470	470
Minto	657	660	660	660	660	660	660	660	660	660	660
Northwood	959	960	930	910	880	860	830	810	780	760	730
Park River	1,535	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540
Pembina	642	640	640	640	640	640	640	640	640	640	640
Portland	604	600	600	600	600	600	600	600	600	600	600
Thompson	1,006	1,070	1,140	1,210	1,260	1,320	1,380	1,440	1,510	1,570	1,630
Valley City	6,826	6,540	6,540	6,670	6,740	6,720	6,570	6,390	6,200	6,010	5,840
Wahpeton	8,586	8,940	9,300	9,650	10,010	10,360	10,720	11,070	11,430	11,780	12,140
Walhalla	1,057	1,040	1,030	1,030	1,040	1,040	1,030	1,010	1,000	980	970
West Fargo	14,940	16,400	17,800	19,400	21,000	22,800	24,500	26,500	28,500	31,200	33,900
Northwood	533	530	530	530	530	530	530	530	530	530	530
Minnesota											
Breckenridge	3,559	3,460	3,360	3,250	3,150	3,050	2,950	2,850	2,740	2,640	2,540
East Grand Forks	7,501	7,700	7,900	8,100	8,300	8,600	8,800	9,000	9,300	9,500	9,800
Moorhead	32,177	34,700	35,800	36,800	37,900	38,900	40,000	41,000	42,100	43,100	44,200

primary drawback is that the projections were only available to the year 2020 for North Dakota and 2030 for Minnesota. Therefore, problems associated with these projections are similar to the problems with the trend analysis, as discussed above.

Projections based on the cohort-component demographic modeling method account for potential changes in underlying demographic components that affect future population growth or decline. The two sets of modeling based projections are based on two different migration scenarios. The first assumes zero net migration and the second assumes that past migration patterns will continue. For areas that have experienced general population growth and have attracted new residents such as Cass County, the assumption that past net migration patterns will continue into the future will result in higher population projections than assuming zero net migration. For areas that have experienced population loss due in part to out-migration such as most of the rural counties, assuming zero net migration will result in higher population projections. Recent population data indicate that the loss of population in rural areas of the Red River Valley region may have stabilized somewhat, although it is difficult to say if this stabilization is permanent. The range of future population estimates indicates the sensitivity of the projections to different migration assumptions.

A fifth projection of future regional population was based on a combination of cohort-component modeling results and represents the most optimistic assumptions of growth for each county. It was assumed for this projection that past net migration patterns for the "urban" counties will continue and the decline in "rural" county population will stabilize, as represented by the zero net migration scenario for rural counties. These assumptions were used to project future population for the entire region. The annual growth rate for the entire study area to the year 2050 is projected to be about 0.719 percent using this method.

The municipal projections presented in this analysis are based on methodologies that best match the historical patterns observed for each community. For those municipalities that did not have a statistically significant trend of historical population change, a stable population is projected. Projections for Casselton, Cavalier, Gwinner, Harwood, Hillsboro, Lisbon, and Moorhead are based on trends for those cities since 1960. The county cohort-component model assumptions were used with the city population estimates for Grand Forks while the percentage of total county population was used for Fargo and West Fargo. The projected county level cohort-component method growth rates assuming zero net migration was used for all other cities.

The population projections based on the cohort-component demographic modeling method and assuming past migration patterns will continue, along with projected changes in birth and mortality rates, are the most defensible and are conceptually the most consistent projections. Assuming zero net migration is has the potential to understate future population in the larger urban areas, where the large majority of the population resides. The two cohort-component based projections can be used to provide an estimated range of future population. Using the most optimistic assumptions of migration with cohort-component modeling and distributing that population based on current population patterns may inflate future population projections for the region because the combination of those assumptions would require the movement of people from rural to urban areas to continue while the rural area populations stabilize.

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