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NEW MEXICO'S BORDER WITH MEXICO: CREATING A VIABLE AGENDA FOR GROWTH

**Background Report of the Twenty-Seventh
New Mexico First Town Hall**

November 1-4, 2001

November 1-4, 2001
Las Cruces, New Mexico

**Background Report By:
The Center for Latin American and Border Studies
New Mexico State University**

Jose Z. Garcia, Director

Greg Bloom, Background Report Project Coordinator

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NEW MEXICO FIRST BACKGROUND DOCUMENT

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Introduction

Jose Z. Garcia
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The 1993 opening of the international port of entry at Santa Teresa, New Mexico, adjacent to El Paso and Cd. Juarez, occurred at a critical moment in U.S.-Mexico relations. Promising greater trade between Mexico and the United States, NAFTA was passed that same year by Congress. A third-party presidential candidate, Ross Perot, would later predict the “sucking sound” of jobs moving to Mexico, while others envisioned a huge expansion of the U.S. market into a country with a population of nearly 100 million. As NAFTA went into effect in 1994 a dramatic rebellion in Chiapas broke out, the Mexican economy went into a brief tailspin, and a popular Mexican presidential candidate, Donaldo Colosio, was assassinated. On the U.S. side of the border, law enforcement officials began well-publicized efforts to beef up the entire length of the U.S.-Mexico border against illegal migration and rising drug traffic, pitching the country into a highly controversial debate over the merits and efficacy of these policies. Meanwhile El Paso, a city of well over 600,000, continued spilling over into New Mexico and the population of Cd. Juarez easily surpassed the one-million mark, with growth imperatives that pointed to future development near San Jeronimo, just south of Santa Teresa.

Given these circumstances it is hardly surprising that New Mexicans would have mixed reactions to the development of the Santa Teresa crossing. On the one hand, NAFTA suggested New Mexicans would benefit from the crossing as burgeoning traffic flows shifted to Santa Teresa. On the other hand, it was not clear *which* New Mexicans might benefit significantly from increased trade--Southern New Mexico land developers? Albuquerque high-tech entrepreneurs? The tourist industry in Santa Fe? Moreover, a strong commitment by the state to a large-scale development might be politically risky. It would be costly to taxpayers in a poor state at a moment when a Democratic President had declared “the era of big government is over” and the implied need to deal more closely with Mexico would plunge New Mexico into uncharted waters.

It was against this background that the Santa Teresa border crossing, potentially the largest, single development project in the state’s history, began. And while the project is still in its infancy, nearly a decade later it is possible to make a few generalizations about the undertaking.

First, if a general tone of disappointment is evident in much discussion about the role of government thus far in providing leadership for the project, this role should be seen in perspective. State and local governments--legislatures, executive offices, county commissions, municipalities--have virtually no experience with a project of this scale, nor in dealing with Mexico. In particular, the state has little experience in forging the kinds of creative and transparent partnerships between the private sector, local government units, and the state and federal governments required for a development project of this magnitude.

Moreover, serious development of the Santa Teresa crossing clearly implies strengthening relations with governmental agencies in Northern Mexico as well as with the private sector on both sides. But New Mexico state relations with Mexico have traditionally been largely ceremonial, confined principally to cultural exchanges. Although there are a few notable exceptions, to this day New Mexico state government has no strong cadre of personnel experienced in dealing with Mexican government officials or business elites. Thus, those who have expected instantaneous, strong results from state and local government were simply being unrealistic. Perhaps the strongest leadership so far has come from the New Mexico Congressional delegation, but without enhanced local and state government capabilities and a firmer consensus about the border agenda, the federal government is limited in what it can do.

Second, the private sector in New Mexico, except for a handful of entrepreneurs, also has no sustained tradition of dealing with Mexico--even in areas adjacent to the Mexican border, which until recently have been overwhelmingly rural. New Mexican business interests for more than half a century have relied broadly on jobs and contracts in the defense industry for sustained growth, with pockets of sometimes sporadic, regional growth in mining, oil and gas, agriculture, tourism, and high-tech. Thus, our economic identity has focused to the east, west and north of the state rather than to the south. Serious opportunities await New Mexico businesses that look creatively to the south, but for the most part these have yet to be explored, cultivated, and acted out.

Third, growth in Southern New Mexico is likely to have an uneven impact on other regions of the state. Clearly, as populations expand on the New Mexico-Mexico border the added tax base from gross receipts and income taxes will swell the coffers of the state, benefiting the state as a whole. Whether non-border regions around Farmington, the oil counties of the east, or Albuquerque and the north will enter the stream of the rising border economy will depend in part on two factors: willingness of these regions to explore opportunities to the south, and willingness of state and local governments to create an infrastructure to make these visible and user-friendly.

Moreover, the *kind* of growth that emerges in Southern New Mexico is still in the balance, and will deeply influence the impact of Santa Teresa on the rest of the state. If the border economy grows largely with low-paying jobs and with few real interfaces in Mexico--a scenario possible if the crossing is conceived of only as a link to existing transportation networks--it is unlikely that other regions will benefit significantly. On the other hand, if the border economy connects clearly with dynamic markets in Mexico, exploiting our comparative advantages; that is to say, if Southern New Mexico joins the global economy in regional partnership with Northern Mexico and West Texas, other areas in the state will have ample opportunities to link into the project in highly interesting and profitable ways.

Fourth, it is unrealistic to expect the kind of investment needed to create a dynamic border economy to come solely from Southern New Mexico. Per capita income in Southern New Mexico is more than \$10,000 below Albuquerque's. The region is poor on both sides of the border, including El Paso. Potential sources for investment from the private sector can come from outside or inside New Mexico. If most originate outside the state they are less likely to generate dynamic linkages to other regions of the state and the state is less likely to influence the development process. This raises challenging questions about the proper role of state government in helping

provide adequate infrastructure for attracting growth; in assuming leadership to galvanize creative private-public sector partnerships; and in setting ground rules for the long-term benefit of citizens in the state. It also challenges locally elected officials in the border region to adopt new paradigms of behavior, to create a stronger local consensus, and to expand horizons of expectations.

In presenting this report we have chosen to provide a broad overview of the U.S.-Mexico border in Southern New Mexico. Our conviction is that potential investors, decision makers, New Mexico First participants and citizens should also be aware of the unique and often specifically *border-related* problems that affect bottom-line issues like trade and the need to galvanize public-private sector development partnerships.

For example, water is an important issue throughout New Mexico, but in Southern New Mexico it takes on important international dimensions. The Mesilla Bolson, one of the largest aquifers in the region, straddles the border with Mexico and rules of the game for its exploitation are not established under treaty. Likewise, the Mimbres River basin south of Deming extends under Mexican soil as well. As far as surface water coming through the state is concerned, New Mexico must deliver 60,000 acre-feet of water to Mexico under long-standing treaty provisions, and in the future the quality of that water might become an issue. Thus, in addition to local water issues, such as an outstanding conflict with El Paso, the conversion of irrigation water to urban uses, or the ongoing adjudication of water rights in the Mesilla Valley, Southern New Mexicans must learn to navigate the complicated waters of international relations.

Transportation issues also have international dimensions. Mexican decision makers in Cd. Juarez, Chihuahua, and Mexico City, both in the private and public sectors, are now in the process of determining future highway and railroad linkages to the Santa Teresa project. These decisions will have profound implications for the future development of the New Mexico side of the border and they suggest that we should strengthen our understanding of the public sphere in Northern Mexico. Cooperation in urban planning will require a more comprehensive understanding of Cd. Juarez than we now have.

Disease, of course, does not respect borders. While for many years it has been an economic cliché that “when Cd. Juarez sneezes, El Paso catches a cold,” referring to the growing dependence of El Paso on commerce with Cd. Juarez, it is also literally true in many ways, underlining the need for the development of a stronger and more cooperative international health system in the area.

Agriculture in Southern New Mexico has already been profoundly affected by NAFTA, altering the profitability of crop production in the region as competition from Mexico (especially in chile production) adds a new dimension to decision making by farmers. These developments merit continued attention.

The ability of a region to provide adequate education and job training for emerging work forces is often key to industry and corporate decisions on plant locations. This is a particularly pressing problem for Southern New Mexico and other regions of the state. Dropout rates in Southern New Mexico are exceptionally high, and the local job market for virtually any given level of educational achievement is relatively poor, giving rise to brain drain. Even more dramatic is the fact that, without a more integrated education and job-training system in Southern New Mexico,

potential job-providing industries may opt to locate in El Paso and, in some cases, Cd. Juarez, and thereby accelerate brain drain and aggravate social pressures in the region.

The border region is also the site of a strong buildup of federal security agencies that deal with national issues such as migration control and illegal commerce in drugs. The local impact of these agencies is relatively unstudied, but complaints about abuse are troublesome and some law enforcement measures clearly affect economic interaction with Mexico by delaying traffic on the international bridges and reinforcing negative stereotypes. While these national issues are likely to remain the province of the federal government, it would be helpful for the local civil society, perhaps with local and state government help, to assist federal law enforcement agencies in the definition of security priorities and the design of local operations to avoid such problems.

Finally, if these issues seem daunting, they should be viewed in broad perspective. Las Cruces already live within 50 miles of an urban area with a population larger than the entire state of New Mexico. Thus, Southern New Mexico will inevitably integrate more fully into the Paso del Norte economy. The question is whether the rest of the state is willing to invest in the future of Southern New Mexico, to explore unfamiliar opportunities, to imagine a dynamic New Mexico identity joined with today's Mexico. Global economic forces and the foresight of those who imagined and then built the Santa Teresa border crossing have presented New Mexico with enormous challenges and monumental opportunities.

Summary: New Mexico-Mexico Trade

A former New Mexico trade representative to Mexico City and the present director of marketing for Santa Teresa Real Estate Development, Jerry Pacheco begins his article by providing readers a historical account of New Mexico's trade relations with Mexico. He then explains why New Mexico had explosive trade growth with its neighboring nation from 1990 (\$17.2 million) to 1994 (\$101.99 million) only to see a dramatic decline in trade from 1994 until 1999 (\$55.31 million).

Pacheco partly attributes the growth of the 1990-1994 period to business enthusiasm for NAFTA and the ubiquity of the post-NAFTA, how-to-sell-to-Mexico seminars that took place across the state in those years. According to Pacheco, part of the falloff in trade with Mexico in the last half of the 1990s can be attributed to a lack of experience on the part of New Mexico companies in helping Mexican buyers through a crisis like the one that hit Mexico in 1994 with the Zapatista uprising and the peso's massive loss of value.

Having fumbled the management of the 1994 crisis, and having been scared away from trade with Mexico, New Mexico missed out on a period of spectacular national trade growth with Mexico. Along with West Virginia, New Mexico was the only other state in the nation to have negative trade growth with Mexico between 1994 and 1999. However, as Pacheco explains, things turned around in 2000 and the state's trade with Mexico grew more than 147% between 1999 and 2000 to \$136.9 million (which still leaves it behind non-border states like Mississippi, Oregon, Alabama, and Arkansas).

After a brief description of what New Mexico sells to Mexico, and the encouraging news that the sale of manufactured products to Mexico has increased from \$4.5 million in 1999 to more than \$60 million in 2000 (a gain of over 1100% percent), Pacheco addresses the much asked question of why doesn't New Mexico sell more to the nation at its southern border given what would seem to be geographical, cultural and linguistic advantages over other U.S. states?

Some of the historical reasons for low levels of trade with Mexico have to do with New Mexico's centuries of relative isolation and self dependence along with the fact that the state's central and northern economic and political centers have been little interested in developing trade with Mexico. Other factors are that a comparatively small part of New Mexico's economy is manufacturing and that New Mexico often competes economically with Chihuahua and has not developed maquiladora suppliers for Chihuahua like the ones that exist, for example, in Arizona for its neighboring Mexican state, Sonora. Pacheco also points out that what would appear to be cultural and linguistic advantages are often handicaps as speaking bad or archaic Spanish or Spanglish is poorly received by Mexicans.

Another impediment to the development of cross-border trade is an insufficient border infrastructure. The New Mexico-Mexico border has no major population base and the crossing at Santa Teresa is still in its infancy and lacks an adequate connection to Ciudad Juárez, a hazardous-material designation and sufficient hours of operation. While New Mexican border-region cities such as Carlsbad and Alamogordo want maquiladora supply companies to locate in their communities they face transportation disadvantages in that trucks arriving there can't always pick up a full return load to take out of the city. This makes shipping to these areas more expensive.

Like many New Mexican cities, the state's companies also tend to be too small to take advantage of their proximity to the border. Small companies can have problems producing the large volumes of goods that maquiladoras need and can rarely afford to seek maquiladora-required, quality certification such as ISO 9000. Similarly, New Mexico lacks an export-support industry in the form of freight forwarders, banks, insurance companies and legal firms that know how to work with Mexico.

Discussing problems in public-private sector relations that impede trade growth with Mexico, Pacheco points out that the New Mexico government has only given scant, irregular attention to the issue. New Mexico also puts very little money behind its trade-development projects. For example, the New Mexico Border Authority has a two-person staff, state salaries for trade experts are low and state trade offices in Mexico are underfunded.

Pacheco concludes his piece with a series of commonly-asked questions about New Mexican trade with Mexico. In reply to these questions Pacheco identifies opportunities for New Mexico border development that stem from the lengthening of supply lines into the Mexican interior. By establishing component-production facilities at the New Mexico border, companies recruited to the state can reduce the length of their supply lines into Mexico. The location of these facilities along the New Mexico border offers great economic growth potential to the state. Manufacturing companies that would consider locating to the region are concerned with labor availability, labor productivity, utility costs, suppliers, services and the tax climate, according to Pacheco. Education levels continue to be an important factor in getting corporations to the state.

Background on New Mexico-Mexico Trade

Jerry Pacheco
Santa Teresa Real Estate Development
Director of Marketing

Historical Perspective

Understanding the U.S.-Mexico trade relationship and New Mexico's position in binational trade requires an understanding of historical trading patterns. In the geographic region which forms modern-day New Mexico, evidence exists of trade between the state's Pueblo Indian groups and indigenous peoples from deep in Mexico's interior. Excavation of ancient Pueblo ruins has produced foreign items such as parrot feathers and seashells which can be traced to Mexican jungles and coastal areas.

With the Spanish conquest of North America came a new era of trade. Calculated Spanish exploration and settlement of New Mexico dates back to 1540, when Francisco Coronado and his soldiers pushed the northern limits of Spanish exploration. These early exploratory trips eventually afforded the Spanish crown sufficient confidence to permit Juan de Oñate and his entourage of settlers to travel north to what is today the Española Valley. It was here that the first permanent Spanish settlement in the Southwest, San Juan de los Caballeros, was founded in 1598.

In 1609, the capital of what was then being referred to as the "Kingdom of New Mexico," was moved from San Juan to present-day Santa Fe. For the next 212 years, New Mexico formed the northernmost part of the Spanish empire in the New World. To this day, New Mexicans, particularly from the areas around Santa Fe, still refer to themselves as "norteños," Spanish for "northerners."

New Mexican Spanish settlements such as Santa Fe, Santa Cruz, Ranchos de Taos, Las Trampas, and Truchas, are some of the oldest European settlements in the U.S. These communities also started what was to be a long tradition of trade between what was to become New Mexico and the larger portion of Spain's most prized and lucrative colony, Mexico.

With the settlement of Santa Fe secure, a series of "Caminos Reales" or "royal roads" were established between major settlements throughout Mexico to facilitate trade and Spanish rule. Perhaps the longest and most famous Camino Real was the stretch of highway running from Mexico City to Santa Fe. The connection between these two Spanish government seats allowed for the exploitation of each regions' comparative advantage.

Northern New Mexico, with its high desert plains and valleys, allowed for the successful grazing of livestock such as sheep. Mexico, with its rich mineral and metal resources, produced valued items such as tin. The Camino Real allowed for the trade of tin going north and for fine wool traveling south. Until Mexico's 1821 independence from Spain, the Camino Real and its trade

with Mexico proved to be the supply route for modern products from Mexico's more affluent areas to New Mexico's Spanish settlements.

After Mexico became an independent nation, the Chihuahua Trail, running between Chihuahua City and Santa Fe, emerged as New Mexico's primary Mexican trading route. As was the case with the older Camino Real, finished and value-added products from Mexico were traded for New Mexican commodities.

As important as the Camino Real and the Chihuahua Trail were to early New Mexico's trade, by modern-day standards actual trade flows were infrequent and of low volume. It was not unusual for six months to pass between the departure of caravans to Santa Fe from the Mexican capital. Hardship, theft and harassment were also common companions on the long journey, further complicating increased trade. Also, because of its distance from Mexico City and its reputation as a poorer province with few precious mineral reserves, New Mexico was not coveted as a trading partner by the rest of Mexico.

Later, New Mexico's 27 years of trade as part of the Mexican Empire (from 1821 to 1848) were made famous by the establishment of the Santa Fe Trail, running from Missouri to Santa Fe. Initially, New Mexican government officials were resistant to the American traders that braved the trail's challenges and reached Santa Fe with their goods. Many early American traders were jailed as spies and unceremoniously thrown out of Mexico. However, realizing the lucrative aspects of trade and the state's potential to receive coveted finished goods, officials finally relented and allowed the Santa Fe Trail to flourish.

In 1848, at the conclusion of the Mexican-American War, New Mexico became a U.S. territory. From this point in history to the present, New Mexico's trade focus fully turned east to America's heartland and away from its former mother country. The Santa Fe Trail became an important part of the history of the American West until its eventual decline in the 1870s.

New Mexico's interest in trade with Mexico was not to be rekindled until the North American Free Trade Agreement (NAFTA) negotiations which took place between 1991 and late 1993. As of 1991, New Mexico's exports to Mexico totaled less than \$20 million.

U.S.-Mexico Trade in the 20th Century

During the 20th century, U.S.-Mexico trade has followed a cyclical pattern.

In the 1920s, Mexico was a country recovering from a bloody and divisive revolution blamed on a dictatorship which believed that the only way Mexico could advance socially and economically was through foreign investment. This led to foreign companies dominating many Mexican industrial sectors, often at the expense of the average Mexican.

After the revolution, a one-party system of government emerged, which eventually became the modern PRI majority party in Mexico. Acutely conscious of the perceived negative role that foreign interests played leading up to the revolution, and in an attempt to break out of the vestiges of mercantilism, the government opted for an economy based on import substitution industrialization (ISI). In Mexico's ISI system, foreign imports were replaced by locally produced

and subsidized products in an effort to reduce foreign influence in the economy and to pull its economy up by its “own bootstraps.” Stiff tariffs and quotas on foreign imports heavily protected selected local industries.

From the 1930s through the end of the 1960s, a period commonly referred to as Mexico’s “stabilizing development” period, Mexico’s economy experienced tremendous growth as rated by GNP. At times during this period, Mexico’s exports to the U.S. grew tremendously. One such period was World War II, when Mexico helped fuel the U.S. war machine with its commodities and production inputs. Mexican laborers also substituted for American men and women who were tied up in the war effort. This “bracero” program lasted until the Kennedy administration implemented its cancellation under pressure from labor groups and anti-immigration lobbyists.

On a negative note, ISI’s protectionism allowed local industries to become non-competitive in the world market and to provide Mexicans with shoddy products. During this period, Mexico struggled with economic factors, such as its current account deficit and overvalued currency. However, by the end of the 1960’s Mexico’s impressive GNP growth percentages had made the country a “golden child” of economic development in the developing world.

The Maquiladora Industry

During the early 1960s U.S. industries, under pressure from Asian competitors, pressured the U.S. government to change the tariff code in order to allow U.S. companies to assemble U.S.-produced components into final products in offshore locations. Upon entry to the U.S., these finished products were subject to tariffs only on the value-added provided by the offshore location, not on the total value of the products themselves.

The change in the U.S. tariff code afforded the Mexican government an opportunity of which it promptly took advantage. Mexico was faced with hundreds of thousands of unemployed workers due to the cancellation of the bracero program. Although it shared a nearly 2000-mile long border with the world’s strongest economy, its border region was underdeveloped. Furthermore, the government wished to develop intermediate industries which would provide U.S. companies with value-added production inputs. These were the factors behind the creation of Mexico’s Border Industrialization Program, from which the maquiladora or twin plant industry was born in 1965.

The term maquiladora or “maquila” derives from the Spanish (and earlier Arabic origin) term “maquilar.” In earlier times, a farmer would take his wheat harvest to the local mill for milling into flour. The farmer would then pay the miller for his service with a portion of the flour that was produced. Maquilar was the process through which this was accomplished and maquila referred to the actual payment. Today, the modern meaning of the word refers to any activity such as assembly, packaging or manufacturing that is done by someone other than the original manufacturer.

A Mexican maquiladora is a Mexican company that operates under a special customs system. This system allows a maquiladora to temporarily import into Mexico on a duty-free basis, materials, production inputs, equipment, machinery and components used in the assembly or manufacture of finished products. These products are then exported out of the country. Initially,

the maquiladora program was restricted to a 20-kilometer region south of the Mexican border. Companies were also prohibited from selling their production in Mexico. Eventually, maquiladoras were allowed to locate throughout the country and sell their goods in Mexico.

Originally, the maquiladora industry attracted low-tech industries such as textile firms, coupon stuffers and other labor-intensive industries seeking to capitalize on cheaper Mexican labor. Today, world-class companies such as Siemens, Delphi Automotive, the Big Three automakers, Dell and others, have maquiladora operations in Mexico.

The maquiladora industry allowed foreign companies (particularly of U.S. origin) the ability to ship components or unfinished products into Mexico in-bond (duty free), where they were assembled utilizing economical Mexican labor. The finished products were then shipped back to the U.S. where the appropriate duty was applied only on the value-added portion of the product provided in Mexico.

The maquiladora industry proved to be advantageous to both Mexico and the U.S. For Mexico, maquiladoras would play a key role in the industrialization and population of Mexico's northern border. U.S. automotive, electronics, consumer products and industrial products industries flocked to the maquiladora industry in order to maintain their competitiveness in world markets. Companies especially enjoyed the possibility of producing components and production inputs in a quality-controlled environment in the comfort of the U.S. and then utilizing cheaper Mexican labor for assembly.

Surprisingly, one major objective of the Border Industrialization Program which remained unfulfilled was the development of Mexican industries which were to supply the foreign-owned maquiladoras with production inputs and services. Today, it is estimated that up to 97% of the production inputs utilized in the maquiladoras still have to be imported. Due to this failure, U.S. companies operating maquiladoras maintained their relationship with suppliers, traditionally based in the midwestern U.S.

As of 2000, there were close to 3,700 maquiladoras in Mexico employing approximately 1.3 million people. The gross production value of this industry is nearly \$83 billion dollars. Total raw materials processed by the industry total between \$40 and \$50 billion dollars. U.S. states such as Illinois, Michigan, Ohio and Pennsylvania rank very high in their exports to Mexico because of the high number of locally based companies in these states that supply American maquiladoras in Mexico.

The maquiladora industry has become Mexico's major element in terms of its foreign trade, with maquila exports accounting for nearly 50% of the country's total exports. According to the CIEMEX-WEFA *Maquiladora Industrial Outlook*, maquiladora exports were approximately \$73.5 billion during 2000. The maquiladora industry has become Mexico's number-one, foreign-exchange generator, ahead of petroleum.

The three principle sectors which dominate the maquiladora industry include electric and electronic products, transportation equipment and textiles/apparel. The changing nature of

maquiladoras is evidenced by the fact that the electric and electronic products sector is the industry's top employer and producer.

The two leading cities for maquiladora location and production are Tijuana, Baja California and Juarez, Chihuahua. Together these cities account for approximately 34% of the entire maquiladora workforce in Mexico. Although Baja California has more maquiladoras than any other Mexican state (more than 1,000), the production volume of Chihuahua's approximately 400 maquiladoras is the largest in Mexico.

The future of the maquiladora industry remains bright, as more foreign companies flock to a Mexico that is more stable and open than at any time in its past. The country's push towards trade liberalization has resulted in numerous trade agreements which open up new world markets for maquiladora produced goods.

The Mexican Economy Now

The 1970s witnessed an end to Mexico's golden economic period. Excessive public-sector borrowing and spending based on future oil revenues, along with other loose monetary factors, helped produce a severe recession which resulted in a devaluation of the peso in 1976. The peso, which for almost 30 years had been pegged to the dollar at a rate of \$12.5 pesos to \$1 dollar, fell past a \$20 peso to US\$1 level.

At the beginning of President Lopez Portillo's administration (1976 to 1982), the situation stabilized at the same time Mexico discovered more oil reserves than were previously estimated. Continuing the habits of the previous administration, the Mexican government borrowed millions of dollars that were spent on public-sector projects. During this time, oil hit a high of \$40 per barrel on the world markets. The government couldn't wait to get the oil out of the ground to spend the revenues generated by this nationalized industry. Therefore, it borrowed millions from foreign (mostly U.S.) banks that were more than willing to lend in what many perceived as a "no brainer" situation.

When oil prices started crashing in 1981, Mexico had a foreign debt well over \$100 billion. The bottom fell out in 1982 when the government declared that it could not afford to service its debt. The value of the peso promptly plummeted and the country essentially declared bankruptcy. In order to divert attention away from the country's dire situation, President Lopez Portillo nationalized the banking industry. This further exacerbated Mexico's economic crisis.

Affluent Mexicans who had the means to do so pulled their equity out of Mexican banks as quickly as possible and deposited their money in U.S. financial institutions. Cities north of the border such as San Antonio, Houston, Tucson and San Diego all swelled with Mexican equity. Unfortunately, New Mexican banks received very little of this capital flight.

The 1980s are referred to as Mexico's "lost decade." Indeed, the Mexican crisis was the first domino to fall in the Latin American debt crisis of the 1980s. Until the end of the decade, the de la Madrid administration and later the Salinas administration struggled to restructure Mexico's debt and to jump-start the economy.

One major move by President de la Madrid which was to have major future implications for Mexico was the successful push to have the nation admitted to the General Agreement on Tariffs and Trade (GATT). Membership in this group forced Mexico to start opening previously closed economic sectors. Little-by-little, tariffs began to be eased, and foreign companies again became interested in Mexico outside of the maquiladora industry.

Carlos Salinas continued with the opening of Mexico's economy. In 1990, he surprised both the U.S. and Canada, which had in 1988 signed a U.S.- Canadian Free Trade Agreement, with his desire to be part of a North American Free Trade Agreement (NAFTA). This proved to be the impetus which would spur the NAFTA negotiations, eventually leading to the agreement's implementation on January 1, 1994.

NAFTA proved to be a wake-up call for New Mexico's commercial sectors, as the publicity behind NAFTA generated a tremendous amount of interest in doing business in Mexico throughout the state. In 1993 and 1994, New Mexico's exports to Mexico were to experience tremendous growth, due to the desire of New Mexican companies and organizations to capitalize on the free-trade benefits brought about by NAFTA.

By 2000, U.S.-Mexico trade exceeded \$263 billion, representing a three-fold increase over 1993 levels. On a typical day, more than \$720 million is traded between the two countries. From 1993 to 2000, U.S. trade with Mexico grew at an average annual rate of 16%, faster than trade with any other major U.S. trading partner, including Germany, China, South Korea and the United Kingdom. This spectacular growth has resulted in Mexico becoming the U.S.'s second-most important trading partner, behind only Canada.

Production sharing, as based on the maquiladora model, has made the U.S.-Mexico border one of the most dynamic and important manufacturing regions in the world. Most of the major global companies have some type of representation, relationship or association in or with this border region.

An Analysis of New Mexico's Exports to Mexico

New Mexico's Exports to Mexico 1989 – 2000

<u>Year</u>	<u>New Mexico's Exports to Mexico (in millions)</u>
1989	\$14.50
1990	\$17.2
1991	\$18.2
1992	\$31.65
1993	\$76.77
1994	\$101.99
1995	\$55.22
1996	\$69.85
1997	\$95.40
1998	\$62.11

1999	\$55.31
2000	\$136.9

As can be seen in the table above, New Mexico's exports to Mexico during the past 12 years have been extremely cyclical. Starting from a low base of under \$15 million in 1989, exports to Mexico dramatically increased in the year before NAFTA (1993) and the first year of the agreement (1994).

In 1993, the year before NAFTA was implemented, New Mexico's exports to Mexico rose to \$76.33 million. In 1994, the state's exports hit what was an all-time high of nearly \$102 million. Between 1992 and 1994, New Mexico's exports to Mexico grew by a spectacular 222%.

Throughout the state, every chamber, economic development organization and industry association seemed to be conducting "How to do Business in Mexico" seminars or workshops. Many groups actually ventured into Mexico, taking members on trade missions or fact-finding visits. It seemed that New Mexico was desperately trying to make up for decades of lost time.

The tremendous export gains and public/private sector momentum were to be short-lived as the Mexican economic crisis of 1994-1995 was to have a negative impact on the state's progress. In 1995, the state's exports fell to \$55.2 million, mainly due to the Mexican peso crisis, which began in December 1994. While other states such as Texas also saw their exports to Mexico fall in real or percentage terms, New Mexico's decline was severe. From 1994 to 1995, the state's exports fell by almost 50%. Although export gains were made in 1996 and 1997, by 1999, New Mexico's exports to Mexico again slid to 1995 levels.

According to the Massachusetts Institute of Social and Economic Research, in the period from 1994 to 1999, 29 of the 50 U.S. states saw their percentage growth of exports to Mexico soar into the triple digits, while nineteen were in the double digits. During this period of time, only two U.S. states actually experienced a drop in their exports to Mexico. West Virginia, which is geographically distant from Mexico, saw its Mexican exports decrease by 6 percent. The other state, which led the nation in decline of exports to Mexico during this time period, was New Mexico.

The decline in the state's exports to Mexico during the 1994 to 1995 period is perplexing, given the fact that other states increased their exports to Mexico in the same sectors in which New Mexican exports declined. In order to understand the decline, the nature of New Mexican companies' relationships with their Mexican buyers needs to be examined.

Companies in states such as Texas and Arizona have enjoyed commercial relationships with Mexican buyers for years and sometimes decades, especially in the maquiladora industry. In contrast, only a handful of New Mexican companies have extensive experience selling to buyers in Mexico. When the peso crisis hit, there was a noticeable drop in interest pertaining to Mexico on behalf of the state's business community.

New Mexican companies that had just begun to export to Mexico, nervously curtailed their efforts out of fear that they would not get paid for their exported goods or services. Even though most

maquiladoras are U.S.-owned, there existed a fear that there was a high risk associated with selling to buyers based in Mexico. Companies located in other states that had developed long-standing, solid relationships in Mexico were apt to work with their Mexican buyers by offering more lenient credit terms in an attempt to help their counterparts weather the economic crisis. The Mexican buyers then reciprocated the favor by extending future loyalty to their suppliers. This raises the hurdle when New Mexican companies again come knocking at the door when the economic situation is rosy.

These exporters also realized and took advantage of the fact that during periods of economic recession in Mexico when the peso devalues, the maquiladora industry tends to grow. This can be explained in two ways.

First, if the U.S. is experiencing an economic slowdown, it is almost a guarantee that the Mexican economy will also be affected. During these periods, American companies desperately look for ways to cut costs in order to survive the slowdown. One popular method is to have a portion of the company's production subcontract-manufactured by moving production to a Mexican maquiladora.

Secondly, during periods of economic crisis, the peso depreciates against the U.S. dollar thereby making Mexican produced products cheaper in the U.S. and other world markets. Due to the cheaper prices, demand for these products rise. The maquiladora industry then grows accordingly. Many American companies are experienced enough to take advantage of this cycle.

As the maquiladora industry's production grows, more foreign production inputs are needed. Thus, when the 1994-1995 economic recession hit Mexico, strong Mexico exporting states such as Texas experienced a drop in export percentages to Mexico, but still realized an increase in overall real terms.

New Mexico's exporters, which are usually smaller in dollar and production terms, were unwilling to take the risk of working with Mexican buyers to see them through the recession. In addition, many New Mexicans had no knowledge of the counter-cyclical nature of the maquiladora industry. They were not able to take advantage of the increased volumes of production inputs demanded by these twin plants.

Thus, up until 2000, New Mexico's exports to Mexico decreased in real terms compared to the 1993-1994 period. Last year, the state's exports to Mexico made a strong comeback, rising from \$55.31 million to \$136.9 million. While this 147.5% increase is certainly great news, New Mexico with its nearly 200 miles of border with Mexico, still routinely ranks behind other states such as Mississippi, Oregon, Alabama, and Arkansas in total exports to Mexico.

What We Traditionally Export To Mexico

In the pre-NAFTA period (1989-1993), New Mexico's exports to Mexico were dominated by agricultural products, high technology/computer equipment, chemicals, and petroleum products (mostly natural gas).

In 1993 and 1994, New Mexico increased its exports to Mexico in the high technology, processed natural resources, extractive and miscellaneous manufacturing sectors. During this period of time, private and public entities in New Mexico became aggressive in developing the state's natural gas exports to Mexico. This resulted in oil and gas extraction exports nearly doubling from \$11.7 million in 1993 to \$21.1 million in 1994.

In 1995 when exports to Mexico were almost cut in half, nearly every export sector was impacted significantly. All sectors continued to languish until 2000, when the state's exports to Mexico hit a record \$136.91 million, as can be seen in the table below which reviews the 1997 to 2000 export sectors:

	1997	1998	1999	2000	% Chng
TOTAL TO MEXICO	95,405,200	62,117,233	55,319,946	136,914,229	147.50%
HIGH TECHNOLOGY	26,064,005	6,474,789	8,602,077	25,088,539	191.66%
35 INDUSTRIAL/COMMERCIAL/COMPUTER EQMT	6,375,096	3,799,168	5,372,813	13,784,307	
36 ELEC. EQPMT EXCL. COMPUTERS	15,925,160	1,247,201	2,698,934	8,578,187	
38 MEASURING INSTRUMENTS	3,763,749	1,428,420	530,330	2,726,045	
MANUFACTURING	20,446,926	8,979,210	4,558,253	56,284,719	1134.79%
34 FABRICATED METAL PRODUCTS	1,201,021	320,276	111,183	26,107,276	
30 RUBBER/MISC PLASTICS PRODUCTS	2,095,079	4,927,900	3,356,826	24,623,192	
37 TRANSPORTATION EQUIPMENT	3,522,966	3,452,472	612,850	5,235,134	
39 MISC. MFG. INDUSTRIES	9,763,403	103,682	405,301	269,387	
23 APPAREL/OTHER FINISHED PROD	3,057,329	119,787	41,350	39,096	
25 FURNITURE AND FIXTURES	253,713	0	10,571	7,355	
27 PRINTING/PUBLISHING/ALLIED INDUSTRIES	553,415	55,093	20,172	3,279	
PROCESSED NATURAL RESOURCES	37,143,002	33,550,421	31,724,139	34,604,154	9.08%
28 CHEMICALS	21,473,137	25,481,358	24,241,750	22,533,553	
33 PRIMARY METAL INDUSTRIES	551,987	1,253,114	1,374,421	5,175,763	
20 FOOD AND KINDRED PRODUCTS	3,272,292	3,521,574	2,083,119	1,968,813	
22 TEXTILE MILL PRODUCTS	4,917,132	1,776,911	746,496	1,775,793	
32 STONE/CLAY/GLASS/CONCRETE PRODUCTS	1,478,110	55,070	161,432	1,014,334	
26 PAPER/ALLIED PRODUCTS	437,934	1,212,444	2,652,527	972,412	
24 LUMBER AND WOOD PROD/EXCL. FURNITURE	532,009	203,892	322,790	828,506	
29 PETROLEUM REFINING/RELATED INDUSTRIES	1,497,917	46,058	59,643	226,661	
31 LEATHER PRODUCTS	2,982,484	0	81,961	108,319	
PROCESSED GOODS	10,061,296	11,905,516	8,401,745	19,005,801	126.21%
13 OIL AND GAS EXTRACTION	601,924	487,661	3,472,888	6,343,328	
01 AGRICULTURAL PRODUCTION CROPS	3,180,504	4,849,090	1,596,516	6,313,868	
02 LIVESTOCK AND ANIMAL SPECIALTIES	4,416,503	1,801,862	3,246,130	6,037,762	
14 NONMETALLIC MINING/QUARRYING	56,171	3,084	86,211	310,843	
12 COAL MINING	3,845	3,308	0	0	
10 METAL MINING	1,802,349	4,760,511	0	0	
08 FORESTRY					
OTHER GOODS	1,689,971	1,207,297	2,033,732	1,931,016	-5.05%
95 CHARITY/MILITARY/SHIPMENTS <\$10,000 NIK	533,332	971,373	1,830,244	1,318,020	
92 SECOND HAND GOODS	782,399	218,368	86,792	324,019	
91 SCRAP AND WASTE	339,345	4,224	116,696	288,977	
99 MILITARY (NON-CLASSIFIABLE)	34,895	13,332	0	0	

Source: Massachusetts Institute of Social and Economic Research

The recent impressive growth in Mexican exports is particularly encouraging, due to the fact that exports of manufactured products grew by 1134.79% between 1999 and 2000. The \$56.28 million in manufactured goods that the state exported to Mexico last year were dominated by fabricated metal, rubber/miscellaneous plastics products and transportation equipment.

Traditionally, the state's manufacturing base has been centered around New Mexico's largest metropolitan area, Albuquerque. Within the last five years, the Santa Teresa Port of Entry on the state's border with Mexico has received a tremendous amount of public and private investment in infrastructure. This has resulted in Santa Teresa becoming a major export platform to Mexico. In 2001, the Santa Teresa Business Center was the home of 32 companies, 28 of which have a direct logistical and/or manufacturing relationship with a Mexican maquila or manufacturing concern.

From the middle of 1999 to July 2001, approximately 1,000,000 square feet of new industrial space were built around the Santa Teresa Port. Nearly all of this space was dedicated to the processing of goods and/or materials for the maquiladora industry. Much of the increase in manufactured goods exports to Mexico can be explained by this border industrialization.

Why New Mexico's Trade With Mexico Remains Small

Perhaps the most popular question asked pertaining to New Mexico's trade with Mexico is "Why doesn't our state, which is located on the border, shares a common history with Mexico and is so influenced by Hispanic/Mexican culture, export more to Mexico?" There is no one simple answer to this question. However, there are various factors which help explain the state's situation, and they are fascinating as they are perplexing. These can be divided into the following sections:

- Historical factors
- Socio-economic factors
- Infrastructural factors
- Political factors

HISTORICAL FACTORS

Historical isolation: New Mexico was located at the northernmost limits of both the Spanish and later Mexican Empire. Distance and isolationism hampered New Mexico's ability to develop strong trade ties and trade-based industries. These factors also caused New Mexicans to become extremely self-reliant and inward looking. When New Mexico became part of the U.S., it was afforded an image of being remotely located, and with very little to offer the larger U.S. in terms of trade and commerce.

To this day, New Mexico is often omitted from maps of the southwestern U.S. by decision makers unaware of its exact geographic location. In fact, the New Mexico Department of Tourism periodically publishes a book of anecdotes titled *One of Our Fifty is Missing*, which humorously reviews situations where the state's lack of recognition led to compromising situations.

Unfortunately, New Mexico's lack of recognition hampers the state's ability to attract U.S. companies that export to Mexico, such as maquiladora suppliers. It also plays havoc with the

state's ability to attract more Mexican investment and tourists. To date, only a handful of Mexican companies such as Cementos de Chihuahua, McKinley Paper (Grupo Gidusa) and the formerly Mexican-owned Interamerica Bank have invested in New Mexico.

Historical seat of power: Since its establishment in 1609, Santa Fe has been the capital and seat of power in New Mexico. In many ways, New Mexico's power base resembles that of Mexico where there power is centralized in the capital city. Unfortunately, even though members of the executive, legislative and judicial branches have at times expressed interest in fomenting relationships with Mexico, very little has transpired.

When any Mexican or border initiative is undertaken by northern-based politicians and cabinet members, many southern New Mexicans become resentful of what they perceive as power hungry northerners who are pushing their agenda on southerners without having a full understanding of the situation. Many people in Southern New Mexico constantly express a belief that the people in Santa Fe and Albuquerque think that the State of New Mexico ends just south of Socorro. This north-south misunderstanding aids in the disjointed efforts that the state has attempted in the past concerning Mexico.

Although a few major industries such as Volvo's bus plant (Roswell) are located outside of central New Mexico, the lion's share of the state's industrial and commercial sectors lie in the greater Albuquerque area. Although Albuquerque is renowned as a high-tech center and major Southwestern industrial base, the majority of Albuquerque-based companies do not actively explore opportunities south of the state's border. Many companies are satisfied with their current volume of business, while others view Mexico as a "black hole" where risks abound.

Similar products: Unlike the complementary relationship which exists between Arizona suppliers and Sonora maquiladoras/manufacturers, New Mexico has historically produced similar products to those of its sister state, Chihuahua. Today, this plays a role in New Mexico's lack of trade with that state. Since the establishment of the maquiladora program, Chihuahua has rapidly industrialized to become Mexico's maquiladora capital. To date, New Mexico not been successful in establishing a maquiladora supplier base for the manufacturing that is occurring in Chihuahua.

SOCIO-ECONOMIC FACTORS

New Mexico's economy and population base: From a territorial standpoint, New Mexico is the fifth largest state in the United States. However, only 1.8 million people reside in New Mexico. Compared to many other states, New Mexico's gross state product and industrial base is small. Whereas in the average U.S. state, manufacturing accounts for approximately 20 % of the economy, New Mexico's percentage is less than 10%. This signifies that New Mexico does not produce a large volume of manufactured goods that can be exported to Mexico. On the other hand, services are the fastest growing part of the world economy and the state has comparative advantages in environmental technology, engineering and scientific research.

Cultural and language considerations: New Mexico's strong Hispanic/Mexican cultures are descended from the state's long history as part of Spain and Mexico. Today, close to 40% of the state's population claims Hispanic/Mexican heritage. Often this heritage is used as a reason why

New Mexico should be trading more with Mexico. However, close scrutiny reveals that this is an oversimplification.

Many of the state's Hispanos are not sufficiently bicultural or bilingual to feel comfortable doing business in Mexico. Due to New Mexico's isolated past, much of the Spanish spoken throughout areas such as northern New Mexico, is archaic and ill-suited for business purposes in Mexico. The skill with which a person speaks Spanish tends to be very important for the educated classes in Mexico. Unlike the U.S., where English as a language tends to be a means to an end, in Mexico language is an indicator of socio-economic status, and is used to judge a person's social level and capability. Archaic or bad Spanish, especially if spoken by a persona of Hispanic/Mexican heritage, tends not to be received very well in Mexico.

In terms of culture, many Hispanic groups in New Mexico trace their heritage in the state back several hundred years. Many of these groups have developed their own unique Hispanic culture over the centuries, while cultural ties to Mexico have been lost. In areas such as Chicago, Los Angeles and Denver, many Hispanic groups are comprised of Mexican immigrants or descendants of recent Mexican immigrants. The ties to Mexico, as pertains to language and culture, tend to be strong. To assume that New Mexico's Hispanic/Mexican cultural heritage automatically bestows upon the state an ability or advantage when doing business in Mexico is a fallacy.

INFRASTRUCTURE/LOGISTICAL FACTORS

Lack of traditional border infrastructure: Of the four U.S. border states, New Mexico's cross-border traffic volume is the lowest. This can be explained in a couple of ways. First, other than Las Cruces, which sits more than 40 miles from the border, New Mexico does not have a major population base on the Mexican border. This is not conducive to developing export platforms that tend to form around functional ports.

The second issue has to do with the ports themselves in terms of their locations and infrastructure issues. New Mexico has three international ports on its Mexican border:

- Antelope Wells is primarily a cattle crossing located in New Mexico's boot heel, south of Lordsburg. In 2001, the Mexican government started pondering the idea of suspending or severely cutting the budget of Mexican Customs officials at this port to the point that the crossing's future would be in jeopardy. As of now, this port continues to operate.
- Up until the 1990s, Columbus, located south of Deming, had been the state's major border crossing. Columbus's sister city, Palomas, lies immediately across the Mexican side of the border. This port has been challenged by its distance from a major metropolitan area, and also by the lack of infrastructure on the Mexican side. Potable water has been an issue there as has been arsenic levels in underground wells.
- The Santa Teresa Port of Entry, located 15 miles from downtown El Paso, has been a dream of government officials and developers for almost 30 years. It was envisioned that Santa Teresa would capitalize on the El Paso-Juarez manufacturing base, thus providing New Mexico with a major portal to Mexico. However, due to developer bankruptcies,

political intrigue and the slow nature of installing infrastructure, the dream languished until the 1990s.

In 1993, the port had its first official opening, even though the facilities on the U.S. side were temporary, and the highway on the Mexican side was unpaved. The port was again inaugurated in 1998, when the permanent facilities on the U.S. side were completed, and the San Jeronimo Highway on the Mexican side was fully paved. Three years later in September 2000, the Pete V. Domenici Highway, which connects the port to I-10 in north El Paso opened.

In July 2001, the Samalayuca Bypass, which connects the San Jeronimo Highway directly to Highway 45 (the Pan American Highway), was unofficially opened, providing Santa Teresa with a direct connection to the interior of Mexico. This new infrastructure project makes Santa Teresa-San Jeronimo a much closer and quicker port for northbound traffic from the Mexican interior wishing to enter the U.S. It is also a quicker crossing for southbound traffic bound for Mexico's interior. However, the Samalayuca Bypass is a toll road which charges both commercial and passenger traffic. There is a debate whether the current toll of \$160 pesos (almost \$18 dollars) for a regular commercial truck of 5 axles is too high and discourages use of this highway.

Today several infrastructure problems still plague the port and have negatively affected increased port traffic. The two most pressing issues include:

- Port hours for commercial traffic are from 8:00 a.m. to 6:00 p.m. on Mondays through Fridays; and 8:00 a.m. to 2:00 p.m. on Saturdays. Even though many Chihuahua City-based and other interior maquilas want to use the Santa Teresa Port to ship their merchandise, many have shipments that reach the border area after 6:00 p.m. This removes Santa Teresa as a crossing option.
- When it was approved as a crossing, it was agreed that Santa Teresa would eventually be designated as the El Paso-Juarez region's hazardous waste port. The main reason for this designation was that unlike the two other area commercial ports, Zaragosa and Cordoba, Santa Teresa is a land-based port, which does not cross the Rio Grande. The Santa Teresa Port is also removed from the main population base of the region. These features would minimize the impact of a major incident.

Today, even substances such as soda syrup and cloth scraps are designated as "hazmat." Therefore, in order to be in a position to receive cross-border shipments that are designated as hazmat, Santa Teresa must obtain hazmat designation. This has not occurred due to the lack of a hazmat plan and response team at the port. This is a function of the lack of organization on behalf of the local players and an associated budget.

International Flights: In the 1980s, Frontier airlines regularly flew direct flights from Albuquerque to Mexican tourist destinations such as Mazatlan. Frontier subsequently cancelled these flights as it entered into bankruptcy in the late 1980s.

In 1993, Aerolitoral, a subsidiary of Aeromexico, established commuter service between Albuquerque, Juarez and Chihuahua City. Unfortunately, these flights lasted only a matter of months, due to lack of support by the Albuquerque/New Mexico business community and the failure of the company to properly market the flights.

Although it has been trying for several years, the Albuquerque Sunport, the state's largest airport, has failed to secure a direct commercial flight to Mexico. Although charter and cargo flights to Mexico are regularly scheduled, New Mexico is the only border state without a direct commercial flight to Mexico. These flights are essential in order to increase visits by both Mexican businesspeople and tourists to New Mexico.

Cities such as Dallas and Phoenix benefit greatly from the tendency of Mexican citizens to fly into their city on a Friday, go for a medical checkup, spend the rest of the weekend shopping or procuring entertainment and then flying home on Sunday evening. To fly from Chihuahua City, Mexico City or Guadalajara to New Mexico is at least half-day effort.

Cost of Logistics for New Mexico Rural Communities: New Mexico's location as a Mexican border state provides it with a geographic proximity advantage over other U.S. states in terms of trade with Mexico. However, many of New Mexico's rural communities do not benefit from their closeness to Mexico.

Several New Mexican rural communities are desirous of attracting maquiladora suppliers that are being forced to adhere to the just-in-time inventory considerations of their maquiladora's supply chain. Many of these companies have been forced to relocate to the border region in order to be closer to their Mexican buyers. This provides communities throughout New Mexico with a golden opportunity to recruit and relocate the maquiladora suppliers.

However, communities such as Carlsbad, Silver City, Alamogordo and others face a challenge when trying to attract these suppliers. These communities must demonstrate that their total cost of business, as compared to a city like El Paso, can adequately make up for their distance from the Mexican border. Furthermore, a maquiladora supplier located in a rural community will most likely face more expensive freight costs than if it was located in a metropolitan area such as Albuquerque or Santa Teresa (a suburb of El Paso).

Many trucking companies do not like to ship to a city unless they are guaranteed an opportunity to transport a load out of this city to the point of origin. This guarantees that the trucks don't return empty to their base or another region. This is referred to as the "deadhead factor." Shipping charges tend to be higher for rural communities because trucking companies often do not have a subsequent contract to move freight out of these communities once a load is dropped off. Thus, they try to compensate for the lack of business on the return trip.

In general, New Mexico suffers from a lack of outbound freight. Freight companies generally do not like to send containers to New Mexico because they are not guaranteed a full container coming back. Containers tend to be utilized in areas where full or nearly full loads are guaranteed. This results in more profit for the shipper.

The size of New Mexico's companies: Most of New Mexico's companies can be classified as being small, with 80% having 10 or less employees. This makes it difficult to produce the volume demanded by the large maquiladoras located in the state of Chihuahua and the rest of Mexico. A company such as Delphi Automotive, with nearly 76,000 employees in Mexico, will demand large volumes of components and production inputs in a very short time. It is virtually impossible for a smaller New Mexico supplier to ramp up to these requirements in the allowable time.

It is also difficult for smaller New Mexican companies to be part of a supply chain system in terms of just-in-time inventory and quality certification requirements. Only a handful of New Mexican companies have ISO 9000, QS 9000 or other quality certification, because the certification process is time consuming and expensive. Most of the Fortune 100 maquiladoras will not even talk to a prospective supplier unless they are quality certified.

Lack of critical mass of trade-related support industries: In general, New Mexico's trade volume pales when compared to other states. In 2000, New Mexico's worldwide exports totaled \$2.7 billion. In comparison, Arizona's exports to only Mexico were double that figure. This lack of trade aids in the underdevelopment of specialists in trade support industries, which are so critical to exporting.

Most New Mexican banks are very reluctant to lend to firms that are exporting to Mexico. There exists a perception that the risks are too great due to Mexico's economic past. Only a handful of banks actually offer documentary letters of credit which are a common form of structuring payment in an international transaction.

In Albuquerque, only two private customs brokerage firms exist. Santa Teresa, due to its proximity to El Paso and Juarez, has three firms of this type - or one more than the state's largest city and industrial base. This is a reflection on the low volume of international shipments leaving and entering the state.

Other important support industries such as accounting, legal and insurance firms, generally do not have many people on staff that are well-versed in trade with Mexico. These and other types of trade support industries are critical to the development of successful trade relations with Mexico.

Loss of New Mexico's exports on paper: Many of New Mexico's exports to Mexico traveling by ground pass through international ports such as El Paso, Texas, Laredo, Texas and Nogales Arizona. From an administrative standpoint, New Mexico actually loses valid exports to Mexico by inaccurate and lackadaisical reporting on behalf of companies, customs brokerages, and federal officials who tally the results.

Key in this process is the Shippers Export Declaration (SED) form, which tracks the types of U.S. products being exported to their specific foreign destination – in this case, Mexico. The SED asks for the state where the product began its journey to the point of export. According to the Massachusetts Institute for Social and Economic Research, which helps analyze export data, “That state is not necessarily the state of manufacture or where the product was grown or mined. It may in some cases be the state of a broker or wholesaler or the state of consolidation of shipments. This

issue results in some inflation of exports for the major port states and understatement of exports for other states.”

Major gateways to Mexico such as El Paso have this effect on our Mexican exports. Often, New Mexico’s exports pass through El Paso on their way to Mexico. A middleman such as a customs broker then handles the export transaction and records the shipment as a Texas export. Both of these occurrences result in under-representation of New Mexico’s total.

A related problem is that some major companies are currently allowing their headquarters or out-of-state sister companies to fill out their SED. The outside company typically classifies the state of origin as their own. This has the effect of the outside company’s state aggregating the New Mexican exports in its total.

POLITICAL FACTORS

Lack of a state trade strategy which includes Mexico: To date, the public and private sectors have not worked together to develop a unified trade plan in which trade with Mexico is a focus. As economic development experts know, trade is a long-term proposition which requires doing an internal inventory, matching this assessment with a best prospects list in Mexico, implementing the strategy and measuring results. Part of this problem is a political one.

Until 1998, New Mexico’s governors could not run for consecutive terms – this tended to draw attention to issues which had shorter-term implications or widespread popularity. The establishment of trade ties requires time for seeds to be planted and nurtured before the fruits can be harvested. In a poor state such as New Mexico, other issues such as healthcare, welfare, the education system and the prison system take precedence over the development of the state’s trade sector. It wasn’t until the NAFTA negotiations that trade with Mexico even appeared on New Mexico’s radar screen.

In the rare occasions when trade with Mexico becomes a political campaign issue, it usually does not translate into a clear, well-directed plan with strategies, objectives and the necessary measurable results. On the public-sector side, the only way Mexican trade as a focus becomes successful is for the governor and legislature to make it a focus. This focus must then be pushed down through the departments to the state workers who will be required to put the strategy to practice.

Since trade with Mexico actually takes place in the private sector it is incumbent on this sector to work with the state government to develop an overall plan. Unfortunately, the state’s businesses have not used their voice to push for increased relations with Mexico. This is different from many other states where the private sector uses its influence to have the public sector develop efforts in specific trade areas.

The state’s role in Mexican trade could be one of educating private sector prospects as to the opportunities that exist south of the border. In this sense, the state can help generate interest in

Mexico and work as a matchmaker. However, it is the private sector that must take the lead in order to generate the trade which will increase New Mexico's export figures.

The start-stop nature of Mexican initiatives such as the Border Commission, the New Mexico-Chihuahua Commission and the lack of follow-up after trade missions or events hurts the state's credibility in the eyes of Mexican officials. It has been a constant complaint by representatives in Chihuahua's trade, economic development and promotion sectors that New Mexico never follows through on its projects or promises; or is very slow to respond to overtures by the Mexican government.

Compounding the situation is the fact that many New Mexicans in both the public and private sectors have a fear of attempting to do business with Mexico due to ingrained misperceptions. Throughout the state there is a preconceived notion that because Mexico is a developing country, it is too poor to buy U.S. products. During an interim legislative committee meeting last year in Las Cruces, one New Mexico legislator stated, "Why should we be spending money trying to promote New Mexican exports to Mexico? Mexicans make less than five dollars per day and are too poor to buy anything from us." This attitude ignores the fact that Mexico is the U.S.'s second-most important trading partner, and simply promulgates the state's lack of trade relations with Mexico.

Underfunded state agencies: State agencies that are responsible for working with Mexico are severely under funded. The New Mexico Border Authority, which is entrusted with the state's port issues, is staffed by an executive director and an administrative assistant. With only two people, this agency covers nearly 200 miles of New Mexico's border with Mexico. It is currently housed in a former state prison portable building located at the Santa Teresa Port of Entry. Traditionally, the Border Authority has been a political football tossed between various state agencies and political parties.

Due to state budgetary constraints, it is very difficult for state officials to attract and adequately compensate trade experts who could work on building commercial ties with Mexico. At an average starting salary of around \$36,000 and the prospect of dealing with the state bureaucracy, few competent trade experts will jump at the opportunity to work for New Mexico.

Compared to other states with trade offices in Mexico, New Mexico under funds its Mexico City and Chihuahua Trade Offices. The total budget annual for the Mexico City Trade Office is \$55,000, of which the Public Service Company of New Mexico presently contributes \$20,000. This trade office is administered via a contract with a private Mexico City company which also represents the state of Utah.

The former director of the Mexico City Trade Office, who resigned in June 2001, was receiving a salary of approximately \$18,000. This small budget in an expensive city makes it difficult for the office to participate in events, market the state's industries and provide matchmaking for companies. It also makes it nearly impossible to attract an effective director or contractor with the experience necessary to make the office a success.

The Chihuahua Trade Office, also a contract office, has an annual budget of \$104,000. In reality, when Mexican value-added taxes are deducted from this amount, the budget of the office is only \$88,000. In Chihuahua City, which has been ranked as one of Mexico's more expensive cities, these funds are insufficient.

Efforts Taken By New Mexico to Foment Trade Relations With Mexico: The efforts state government and other public/private associations have taken to increase trade ties with Mexico have produced varying results. On the state government side, New Mexico's governors have a strong record of visiting their counterparts in Mexico, at least during the last several administrations.

Since the 1980s, every New Mexican governor has participated in the Border Governors' Conference, which brings U.S. and Mexican border governors and their contingencies together to discuss a wide variety of common issues. These conferences, which used to involve heavy private-sector participation, are now generally attended only by governors and their closest staff. The Border Governors' Conferences have a long track record of issuing joint communiqués to the executive branches of the U.S. and Mexico. Some of these communiqués have influenced policy while others are simply discarded as being too vague.

Governor Toney Anaya (1982-1986) took a strong interest in fomenting relationships with Mexico. This resulted in his attempt to establish a liaison office in Mexico staffed by one of his advisors. Due to other focuses and political pressures from many constituents that he concentrate on local issues, this office in the functional sense failed to materialize.

The NAFTA negotiations took place during Governor Bruce King's third term (1990-1994). Capitalizing on the momentum of the NAFTA publicity, Governor King established a Mexico City Trade Office in 1992. The primary objectives of the office were to increase New Mexico's exports to Mexico, increase Mexican tourism to New Mexico and increase the level of Mexican investment in the state. Although this office continues to operate to this day, its budget has decreased from \$150,000 per year to approximately \$22,000 in 2001. Currently, the office is subcontracted out to a Mexico City-based person that also represents the state of Utah in Mexico.

In 1998, Governor Gary Johnson established the Chihuahua Trade Office in Chihuahua City which had similar objectives as the Mexico City Trade Office. The sole contractor of the office has been AAPI, a Chihuahua City-based company with a dedicated staff which works for New Mexico. Currently, the budget of the Chihuahua City Trade Office is \$104,000.

In 1991, Governor King along with his counterpart Governor Baeza of Chihuahua, established the New Mexico-Chihuahua Commission. The objective of this commission was to bring together, on a periodic basis, the cabinet secretaries and division directors of both state governments in order to discuss and resolve issues affecting New Mexico and Chihuahua. The momentum, which aided in the creation of the commission, quickly dissipated and no further meetings ensued after the commission was signed into effect.

During the King administration, the New Mexico Border Authority was created. This agency is entrusted with the infrastructure, policy and budgetary aspects of New Mexico's three

international ports. Today, the Border Authority consists of a director and an administrative assistant.

A New Mexico Border Commission was also created during the King administration. This entity was entrusted with the discussion of border issues and the recommendation of solutions to any bottlenecks or problems. Many of the members of this committee were non-border residents with little knowledge of the border, making it difficult for hard issues to be addressed in this forum. This commission was disbanded after Governor Johnson's election.

In 1998, Governor Johnson, along with his counterpart in Chihuahua, Governor Martinez, signed into effect a new New Mexico-Chihuahua Commission, which had the same objectives as the original commission. To date, wide-ranging meetings between cabinet secretaries and division directors have been nearly non-existent, although both sides participated in a project to identify complementary industry clusters. Major accomplishments in this project have yet to be noted.

Other state government efforts have been incidental or issue specific. The director of the state's Workman's Compensation Division participated in the attempt to harmonize procedures between NAFTA partners. During the past ten years, several legislative groups have taken trips to Mexico to discuss common issues with their counterparts in Mexico. A few of these missions have been of an educational nature.

It has been recently announced that the Fox administration will establish a trade office in New Mexico to be housed out of the New Mexico Economic Development Department. This trade office, to be directed by a salaried New Mexican, will have as its focus the establishment of trade relationships and strategic partnerships between New Mexican and Mexican entities.

Efforts on behalf of other non-state organizations have been infrequent. Various New Mexican chambers of commerce have led trade missions or fact-finding visits to Mexico. Some of these events have been focused on matchmaking between buyers and sellers, while others have been events designed to foment social and cultural relations.

One of the older efforts has been the sister-city program. Albuquerque, the state's largest city, has sister city agreements with Chihuahua City and Guadalajara. Santa Fe has a sister city agreement with Parral. When sister-city relations take place they are primarily of a social or cultural nature.

The Economic Development Impact of Trade with Mexico

At present, the economic development impact of New Mexico's trade with Mexico exists only as potential. Although New Mexico faces many issues in its efforts to increase trade relations with Mexico, the state does have promising opportunities. In this section, these opportunities and their potential impact will be examined in a question and answer format.

Does an increase in trade numbers automatically mean that economic development is occurring?

Trade by itself does not necessarily advance the economy and the quality of the community. In fact, it does little for communities that trade is flowing through. However, it almost always

improves the economy of the community that it flows to or from. Increased trade by itself doesn't represent economic development unless the community is adding value to the stream of commerce passing through it.

During the last 25 years, the trade numbers at U.S. port cities along the Mexican border have increased exponentially, and yet communities on the U.S. side have become *five of the six* poorest MSA's in the country. For example, El Paso's economy has been under performing the U.S. economy for years, despite tremendous growth in the volume of trade flowing through its ports.

The problem is that local companies and their resident employees are not adding value to the products that are flowing through their communities - they simply move it along. If the only thing El Paso, Texas residents do is move transient pallets of products through the community, household incomes do not rise over time because it is difficult to drive a fork lift twice as well five years from now; and if the employee does not become more productive, he/she cannot earn more money.

Contrast the economy of El Paso, Texas to a community where the companies and the resident employees add value to products for export, and provide high value-added services. The resident employees become increasingly more productive, as their employers invest in machines that produce more, and they invest in training the employees to run the more productive machines.

In summary, increased trade by itself is not necessarily economic development. However, a growing stream of trade-driven commerce does create a major economic development opportunity for any community in its path. It must be kept in mind that there is an important distinction between value-added trade growth and transient trade growth. One type is economic development the other is simply an opportunity.

What are the benefits to New Mexico of increased value-added trade to Mexico and who benefits?

Federal, state and local governments benefit as long as the commercial tax base grows faster than the population. New Mexico economic base enterprises (those enterprises that produce goods and services that are exported or sold outside the state) benefit because they have a bigger market and lower operating costs.

New Mexican enterprises that can lower operating costs by sourcing higher-quality, lower-cost supplies and subcomponents from nearby Mexican producers are ultimately more competitive. Subsequently, they earn more national market share, grow faster, hire more New Mexicans and increase the tax base.

Conversely, New Mexican companies that can effectively supply Mexico's industrial base aid in the creation of an export platform to Mexico. These export platforms help create more jobs for New Mexico's workforce, and bring investment to the communities where they are based.

Companies that lower their operating costs are able to lower their prices. Lower prices result in savings for the consumers, ultimately allowing them to buy more or save more. Although it is

sometimes hard to see, this effect can improve real household disposable income, retail gross receipts, home sales and local tax revenues.

Does anyone in New Mexico lose?

Theoretically, any enterprise in our economy that is producing goods and services for local consumption or export could be at risk to enterprises in Mexico that can produce and deliver the same products for less. In such a case, New Mexico residents might lose their jobs and local government would lose the tax revenue.

However, it should also be understood that most of the factors of production are still much higher in Mexico than in the U.S. Capital in Mexico is three to five times more expensive than in the U.S. Utility services can be nine times more expensive. Land costs and finished industrial space run from 50% to 100% higher. Transportation costs also tend to be more expensive. Corporate taxes are also higher although there are still many loopholes.

Lower labor costs are the primary factor of production advantage that attracts manufacturing to Mexico. Therefore, a New Mexican enterprise that produces a product where part of the production process requires a substantial amount of unskilled or semiskilled labor may find it less expensive to produce or at least perform that part of the process in Mexico. Ultimately, the company must find that the labor cost savings exceed the higher capital, facility, utility, tax and transportation costs that exist in Mexico in order to consider producing there.

What are the nature and scale of the economic opportunity of increased trade between the economies of New Mexico and Chihuahua?

Increased trade with Chihuahua is just that – an opportunity. During the last two decades, there has been a massive shift of manufacturing production assets from the industrialized regions of the U.S to Mexico's northern border communities. This movement of assets primarily represents the labor-intensive processes of durable good manufacturing in the U.S. Had this movement not taken place, U.S. manufacturers would have continued to lose market share to Asian and European Union producers that had lowered their operating costs by using low-cost developing countries' labor in their respective hemispheres.

By 2000, most of the approximately 3,700 manufacturing plants (maquiladoras) employing over 1 million workers were operating within 200 miles of the U.S. border. Most of this production was located in the Mexican border communities of Reynosa, Matamoros, Monterrey, Juarez, Nogales, Mexicali and Tijuana.

However, many of these companies' production processes stayed in the urbanized U.S. areas where they originally developed. Many of these production processes required low-cost reliable power, significant amounts of capital, highly skilled labor, and sophisticated local technical support--all of which existed in their U.S. base. The subcomponents or materials generated by these operations were shipped to Mexico for the labor-intensive part of the production process.

Shipping these subcomponents down to Mexico and back to the U.S. instead of across the street in Chicago as used to take place, is what accounts for much of the commercial traffic through the ports on our southern border.

The plants originally clustered along the U.S. border so they could be closer to their supplier plants and distribution centers up north, and so that they would not have to expatriate their plant management teams. If a plant is located in Juarez, U.S. plant managers can commute to work from El Paso. If the plant is in the interior of Mexico, the managers and their families must live in a foreign country with all the associated complications.

As a result, the Mexican border communities industrialized rapidly, outpacing their infrastructure, exhausting the local labor surpluses and driving up labor costs. During the last decade, many of these operations began to move south in search of cheaper labor. It is this movement of manufacturing to the interior that is creating the economic development opportunity for New Mexico's communities.

When manufacturers move south of the border to the interior, they stretch both their southbound and northbound supply chains, dramatically increasing their transportation costs and time to market. At a border location, they are able to source subcomponents in two days from their suppliers, generally located in the Midwest. For a plant located in the interior this can take up to a week.

As a direct result of this situation, many of these manufacturers are now pressuring their U.S. and foreign suppliers to set up a branch facility in a border state and to get back into two-day range of their Mexican operation. Many are also rethinking whether they should also relocate their distribution centers.

Of the 32 companies currently located in the Santa Teresa Business Center, the majority are manufacturers. All were coerced by their Mexican customers to move closer in order to lower their transportation costs and to get back into just-in-time delivery range. As long as the interior of Mexico continues to attract new industry, the pressure will only increase for U.S. and foreign suppliers to set up branch operations in border states such as New Mexico.

How does this opportunity compare to other past economic development opportunities?

During the last 20 years, New Mexican communities have experienced several opportunities for recruiting new industry. In the early 1980s there was the proliferation of the semiconductor industry. In the mid 1980s California companies fleeing the high costs of doing business in their state created another opportunity. In the 1990s there was the migration of the midwestern dairy industry to eastern New Mexico, followed by the cheese industry. Tele-service, or call-center phenomena, began in the late 1980s in Albuquerque and Rio Rancho and is now moving out to the rural communities.

The maquiladora supplier migration opportunity could turn out to be larger in volume and longer in duration than any of the previous opportunities. It is estimated that 76 of the Fortune 100

companies have some type of maquiladora or manufacturing operation in Chihuahua. This is akin to moving the state of Ohio and its industrial base to New Mexico's southern border.

What is the best way for New Mexico to develop a manufacturing trade relationship with Chihuahua? Should the state and the communities spend their economic development resources encouraging their local companies to venture into Chihuahua and to establish new contract relationships with the U.S. auto and consumer electronics producers? Or, should they spend their resources recruiting out-of-state suppliers that already have the contract relationships?

If a community can't do both, there is no question that there is much more to be gained and a much higher return on investment in the development of a recruiting effort. New Mexico has few existing manufacturers, and as discussed earlier, most are not prepared for the production volumes, the quality standards or the just-in-time delivery standards of the auto and consumer electronics industries.

For a variety of reasons, it has proven very difficult for New Mexican companies with no international experience to succeed at developing a business base in Mexico. This is not to say that companies or chambers of commerce should be discouraged from looking for new customers in Mexico. However, it is just very unlikely given the huge number of outside companies that will be compelled to consider setting up branch operations in border states, that a local industry initiative will yield anywhere near enough new contracts and new economic base jobs to make a real difference in the state economy.

This is one of those opportunities tailor-made for a traditional industrial recruiting program approach.

What does New Mexico have to do to take advantage of the opportunities presented by this migration of maquiladora suppliers?

The state cannot do much without well-funded, sharply focused, industrial-recruiting initiatives, initially at the community level. A minimum of five communities need to focus on specific supplier sectors where they can prove that the operational cost savings possible in their communities are greater than competing communities and that those savings exceed start up costs.

The New Mexico Economic Development Department's recruiting team is already focusing on the maquiladora supplier migration opportunity. More state resources need to be allocated proportionally to this effort as New Mexican communities and the private sector step forward with their own initiatives.

New Mexico's ports of entry and the connecting infrastructure on both sides of the border must develop ahead of demand to prevent the congestion occurring at competing ports. Being able to clear commercial traffic through our ports of entry faster than our competition will be critical if we are to attract high value-added manufacturers. The more valuable the product being produced, the more important time is to the producer and customer. Over the course of a year, a three-hour wait

for clearing commercial, high- value shipments becomes a real deterrent, compared to twenty-minute crossing times at an un-congested port.

How can other communities in New Mexico hope to compete with Las Cruces, El Paso or Santa Teresa?

It is true that communities removed from the border will have a difficult time competing for warehousing and distribution-related business because cubic rent (real estate costs) and transportation are the only variable costs. However, the Midwest subcomponent manufacturers are much more concerned about labor availability, labor productivity, utility costs, suppliers, services and tax climate than are the logistics companies.

Almost all of the border communities have serious labor-quality problems. For example, while El Paso economic developers promote a relatively high (8%+) unemployment rate, 37 % of the adult population does not have a high school diploma or GED. Therefore, the labor market is much thinner than it looks like on paper. Conversely, the quality of the labor surplus in most of New Mexico's communities is high compared to most border communities. Las Cruces, El Paso, and Santa Teresa will be hard pressed to satisfy many of the high value-added manufacturers in this opportunity stream without first addressing their workforce development and quality of life issues.

If a community such as Farmington can show a client that the long-term operating advantages from better labor economics exceed the additional transportation costs to Las Cruces, El Paso or Santa Teresa, they will have a chance to attract maquiladora manufacturers. If they are unable to effectively do this, their chances of success are slim.

Transportation Summary

Without transportation infrastructure such as international crossings and highways at the New Mexico-Mexico border, there would be no growth opportunities for the state at the border. While this seems obvious, Santa Teresa--which is perhaps the most significant development project currently underway in the state--was nothing more than an idea throughout much of the 1960's and its international port did not open until 1993.

While outlining the development and current state of New Mexico's ports and border highway infrastructure, New Mexico Border Authority Director Jim Coleman also explains that New Mexico can never stand still at the border. Yearly increases in the number of crossings at the state's two busiest ports, Santa Teresa and Columbus, will continue into the future and if the state wishes to keep its ports free of long waits and congestion it will have to increase infrastructure at the border and certainly increase the number of processing lanes there. Another transportation-related development possibility that Coleman mentions is the growth of intermodal centers in which train, truck and air transportation can combine to move material in the ways most desired by suppliers or customers.

One new aspect of border growth and the passage of NAFTA will be the presence of Mexican trucks on US interior highways. From the time of its signing, NAFTA promised to open US highways to Mexican trucks in 1999 but this has been delayed because of concerns over the safety of Mexican trucks and other issues. A new date for the possible arrival of Mexican trucks to the US interior is January 1, 2002.

What is certain is that Mexican trucks will soon be driving the highways that cross New Mexico and this will affect the trucking industry, the trucking-support industry and the warehousing industry. New Mexico will also have to examine issues such as highway safety, demand on infrastructure and environmental impact.

Border Transportation and Support Facilities

**Jim Coleman, Director
New Mexico Border Authority**

Then and now

Just ten years ago vehicles driving directly from New Mexico to Mexico, or vice versa, were limited to only one paved road within the entire state to take them directly to or from the U.S.-Mexico border. Today, that has changed and three paved highways now provide access to the state's international border with Chihuahua. These roads are the original 34 mile, Deming to Palomas, Chihuahua highway via Columbus, NM, the 9.8 mile Pete Domenici Highway in Santa Teresa, completed in the year 2000 and which connects through Texas to IH-10, and finally the 65 mile NM 146 & 81 highway route to Antelope Wells from IH-10 just east of Lordsburg where the final 400' at the international border were paved in 1997.

Lifblood

Putting this into perspective the cornerstone of every international border economy is the recognition that **transportation activity is the critical lifblood upon which the success or failure of all border development depends.** If facilitation of such transportation activity is among the highest priorities of an international border-development effort, then it is both reasonable and realistic to anticipate broader overall success in industrial facilities development, job creation, housing, tax-base expansion and retail-sales areas. Border economies thrive or fail to develop based almost exclusively upon their ability to facilitate and efficiently manage international commercial and non-commercial traffic demand.

It takes two to tango

Having essentially started from nothing ten years ago, it is fair to conclude that New Mexico has made progress in improving highway access to the U.S.-Mexico border. Yet even with these improvements, neither new business opportunities, vehicular traffic volume increases nor trade activity (at least in Santa Teresa) have been particularly spectacular, nor for that matter even close to what many government and private development interests predicted they would be by now. So what happened?

It has been said that to correctly dance a tango one must have a partner. Not unlike dancing the tango, for a border economy to develop successfully there must also be appropriate transportation access on both sides of the international boundary. Yet this truism went completely ignored amid the hyperbole surrounding early efforts to put Santa Teresa on the map as a commercial border-crossing location. "Build it and they will come" was heralded as the inevitable outcome if only an international port-of-entry could be established. What went unsaid was, that until Mexico decided on its own or could be convinced to provide new highway access to San Jeronimo-Santa Teresa, the best that could be expected would be that these two ports were destined to remain as secondary border-crossing alternatives.

A rising tide

While there is still a need in Chihuahua for better highway access to its border with New Mexico, there is at least one location where that Mexican state has taken very significant strides in making improvements to their border highway system. This is the recent construction of a US\$18 million, all-concrete, 28 km (17 mile) by-pass toll road opened in July, 2001 that goes from approximately 40 km (24 miles) south of Ciudad Juarez to an intersection with Mexico Highway #2 just south of San Jeronimo-Santa Teresa. As a result of this new highway, Chihuahua transportation officials are estimating an additional 1200-2000 vehicles will require processing every day at San Jeronimo and Santa Teresa by mid-2002. Currently 300-320 vehicles per day pass through these international ports.

As attached port traffic documents illustrate [Appendix A, page 112], the largest number of vehicle crossings at Santa Teresa was during the 1998-1999 fiscal year when 112,000+ northbound vehicles were processed through the ports. In the 2001 fiscal year the northbound crossing total is expected to increase to 135,000 and, if Chihuahua transportation officials' 2002 projections are correct, some 400,000-700,000 northbound vehicle crossings could be expected at Santa Teresa. In sum, this means that total traffic at Santa Teresa will have jumped from 224,000 combined north/south traffic movements in the period 1998-1999 to 270,000 in 2001 and possibly very close to 1,000,000 by the end of 2002. This is both rapid and rather dramatic traffic growth by anyone's standards and yet it is not uncommon for these kinds of overnight growth figures to be experienced at an international border. However, so as to keep these numbers in some sort of perspective, please know that northbound vehicle crossings at the bridges in neighboring El Paso average 750,000 every month.

Because the federal port facilities at Santa Teresa will be pushed significantly beyond current operational limits by the projected increase in traffic volume, responsibility to keep traffic flowing without delays now shifts back to New Mexico. Thus it is "back to the well" for the state to look for additional federal funding to expand the federal port facilities and insure that future increases in vehicular traffic, at the port, will be dealt with efficiently and effectively.

Like changing a flat tire driving at 70 mph

Having noted some of the foreseeable limitations of the federal port facilities at Santa Teresa, it is appropriate to note that similar and certainly more immediate facility challenges already exist at the Port of Columbus. Constructed in 1988, the existing federal port facilities there were never designed to process the almost 400,000 vehicles that now cross the border at this location every year. For example, in the commercial truck inspection area, the space-limited, six truck-bay inspection dock is frequently overwhelmed during produce-shipping season by 40 or more trucks waiting to be processed. On the other side of the port, where more than 390,000 private vehicles are currently being processed every year, it is not uncommon, at certain times of the year, for vehicle waiting lines to extend back into neighboring Palomas, Chihuahua for more than a mile.

When a port is as swamped by traffic as Columbus frequently can be, it is like changing a flat tire driving at 70 mph to make improvements while day-to-day operations continue. That challenge notwithstanding the first step being taken to relieve this long overlooked traffic congestion is a

new, \$2.5 million, 100% federally funded truck by-pass that should already be under construction as this report goes to press. An additional \$7.6 million in new port expansion and improvements has also been identified to follow over the next two years effectively tripling the size of the existing federal port facilities.

What dreams are made of

Ever since people began discussing the idea of developing a multi-modal transportation hub at Santa Teresa there has been continued speculation about the viability of establishing such a facility there. In the ensuing years over a million dollars have been spent developing other studies to justify this concept. Just a year or so ago the Mayor of Ciudad Juarez attempted to close-down or remove the rail tracks to El Paso that pass through the middle of his downtown. This again rekindled speculation that a rail line linking Mexico to the U.S. through Santa Teresa was perhaps in the offing. So far, none of these projects have come to fruition possibly for a number of reasons not the least of which would be the enormous costs involved on both sides of the border.

What appears to hold a more realistic promise in the area of developing a relatively integrated transportation system is the possible establishment of the Dona Ana County Airport at Santa Teresa as a major airfreight shipment hub. Toward that end, the airport taxiways are currently undergoing widening in preparation to accept large cargo aircraft up to and including DC-10 size planes. When this first phase construction is completed--the estimate is for April, 2002--airport officials advise that widening and lengthening of the runway will begin with an estimated completion date of mid-2003. And while not directly related to on-going construction at the airport, the Santa Teresa Real Estate Development Partnership reports that it will open a new, rail-served industrial park during early fall 2001. This park will immediately border the airport.

In sum, while none of this new activity precisely meets the original all-in-one "hub concept," the credibility of that earlier vision is perhaps being gradually confirmed over the years albeit in the development of one transportation system component at a time.

Crawl, walk, run

New Mexico's border transportation and its support infrastructure and systems have really only entered into infancy and from this point forward is when real growth demands will begin to become apparent. While the basic rudiments of required operational infrastructure are symbolically in-place (highways and ports, for example), all indicators suggest that the long-awaited transition from being symbolically involved in cross-border transportation and trade activity to being an actual has begun. And even at this early developmental stage it is apparent that what is in place will need to be continually built upon and improved if New Mexico is serious about developing and sustaining a recognized border economy.

Attached charts documenting vehicular border crossing activity at each of New Mexico's three international border ports will confirm that while there are expected ups and downs, the general traffic trends at both Santa Teresa and Columbus are moving steadily upward.

As the provided data confirms and as this briefing has hoped to illustrate, the time is quickly arriving when hard decisions will need to be made to commit the resources required to build upon the investment already made in roads and highways that provide access to border ports. And while this is easy enough to say \$15-20 million is not an inconsequential sum. Fortunately there are federal highway programs that can bear 80% of such costs.

Also on the federal level, additional investments of \$8-15 million and \$7-8 million in Santa Teresa and Columbus port facilities, respectively, should “keep the wolves away from the door” for perhaps another decade. However, everyone should recognize that nothing is ever static at international borders.

In sum

For New Mexico, the international border region is the state’s new land of opportunity if the populace will recognize that transportation activity is the critical lifeblood upon which the success or failure of all border development depends.

Summary: Santa Teresa

Most New Mexicans have only a vague understanding of the Santa Teresa border project and yet by examining its beginnings one gains an appreciation of the many collaborations between the private sector, local, state, and federal governments that were and will be necessary to create strong growth. In this article the authors--two former directors of the New Mexico Border Authority and one long-standing border observer--provide a brief sketch of the history of the project and a commentary on the role of government in assisting economic development on the border. Myles Culbertson was Director of the Border Authority during the administration of Bruce King, and Samuel Reyes was Director of the agency in the late 1990s during the administration of Gary Johnson. Jose Garcia is director of the Center for Latin American and Border Studies at New Mexico State University.

The authors begin by looking at how the Santa Teresa development project came about and discuss how commercial land holdings were first established there. They note that the construction and opening of the international port of entry required state action, the help of unpaid volunteers and finally the entry of the federal government. The authors then examine the relationship between the Santa Teresa development project and the southern New Mexico and tri-state regional water scenario. They conclude with a commentary about the efficacy of government action in the development of the project to date and discuss possible roles for government to play in the future.

The Santa Teresa Crossing: A Thumbnail Sketch and Comment

Myles Culbertson, former Director, New Mexico Border Authority

Samuel Reyes, former Director, New Mexico Border Authority

Jose Z. Garcia, Director, Center for Latin American Studies, NMSU

Background

Until the border crossing was opened at Santa Teresa there were only two linkages between New Mexico and Chihuahua--the crossings at Columbus/Palomas and Antelope Wells/El Berrendo. The Columbus crossing was established in order to facilitate Mormon migration into Mexico in the 1880s. In the 1930s, Antelope Wells/El Berrendo was established as an international port of entry to facilitate imports of cattle from Chihuahua into the United States. Efforts were initiated to create a crossing in New Mexico near El Paso, Texas beginning in 1941 and continuing during the 1950s and 1960s, but these failed.

In the early 1960s, Mexican President Adolfo Lopez Mateos approved a border industrialization initiative for Northern Mexico which would permit duty-free importation of capital goods from the U.S. for firms willing to invest in manufacturing facilities near the U.S.-Mexico border. The idea was to create jobs for Mexicans in the relatively poor border region, acquire know-how from participating U.S. firms, and encourage Mexican entrepreneurs to gradually serve the purchasing needs of new factories (later known as "maquilas") locating on the border as part of the program. New Mexico businessman Charles L. Crowder, who conferred extensively with President Lopez Mateos as these plans were being implemented, began to conceptualize a large-scale development project that would function on both sides of the border between New Mexico and Mexico.

Origins of the Santa Teresa Crossing

By the late 1960s, Crowder began taking steps to consolidate ownership and control of land on both sides of the border and to acquire preliminary resources for a border industrial complex in the Santa Teresa area. He acquired portions of the colonial-era Santa Teresa Land Grant located in New Mexico on the west side of the Rio Grande, near El Paso. A country club was built, with some participation by El Paso golf champion Lee Trevino. Residential construction followed. Later, Crowder structured a land exchange with the federal government, acquiring approximately 21,000 acres on the west side of the country club. In exchange, the federal government acquired land in Arizona which was used to settle a territorial dispute between the Navajo and Hopi tribes.

Crowder also entered into an arrangement with landowners on the Mexican side, at San Jeronimo, to cooperate in the development of approximately 47,000 acres adjacent to the border. Thus, Crowder hoped to be able to plan development within a total area of some 70,000 acres, straddling the border, anticipating that an international port of entry would be placed within its limits.

In order to strengthen the case for a port of entry at Santa Teresa, Crowder began construction of roads to the border. Indeed, hoping to speed up the project, he constructed a road from the border into Mexico, from San Jeronimo to the Casas Grandes Highway, in 1990. Creation of the Santa Teresa international port of entry was approved by the federal government in 1987, and the site

was used to by Crowder to cross goods in 1989 although border crossing facilities had not yet been financed or approved.

As the Santa Teresa-San Jeronimo project was about to enter the construction phase, speculation about the full impact of the crossing increased and pockets of opposition surfaced. In 1989 the governors of New Mexico and Chihuahua declared jointly that the border crossing should be placed at Sunland Park-Anapra, closer to El Paso-Cd. Juarez--a site favored by some interests. The governors had no authority to make decisions affecting a federal government binational project. Plans for the Santa Teresa crossing continued but the declarations caused confusion and delay.

Completion of the Crossing

At one point the Mexican government appeared to be hesitant to begin construction of the San Jeronimo port of entry, fearing the U.S. might renege on its plans to build the Santa Teresa facilities. Mexican officials felt this had already occurred once at a designated crossing further down the river and wanted to see tangible signs the U.S. was beginning construction. The U.S. government, however, has normal construction procedures which require about three years from approval to construction. Facing what appeared to be a temporary impasse, Crowder donated a piece of land to the state of New Mexico for a temporary port of entry to be built by the state and leased to the federal government. Governor Bruce King approved this measure, but offered no specific funds to do so. Thus, the first, temporary, international port of entry at Santa Teresa was completed through the authority of the state of New Mexico, by private citizens who agreed to oversee the project for no pay, and who obtained donations of materials for the construction of the site from various government agencies. As construction began on the U.S. side the Mexican government began to construct their side. The port of entry began operations in January 1993. The permanent federal facility was placed into service in 1996. In 2000 the Texas highway department completed the extension of Artcraft Road which links the New Mexico portion of the highway to Santa Teresa with Interstate 10, near El Paso.

Eventually, other business interests took ownership positions in the Santa Teresa project. Some 22,000 acres were acquired by the Lyons family of Connecticut. Catalina Development, an El Paso company, secured other property in the area of the Santa Teresa Country Club. Additional property developers included John O'Donnell of Los Angeles, POST Land Ltd. Of Las Cruces, Martini-Tamboni of Boston, and others.

Water and the Crossing

To support his long-term development project, Crowder drilled 33 water wells into the Mesilla Bolson in the 1970s. Hoping to develop water rights through these wells, Crowder projected a capacity for these to extract 110,712.85 acre feet per year, nearly twice the amount delivered annually to Cd. Juarez from New Mexico. In 1980 the City of El Paso, through the El Paso Public Service Board, filed suit against New Mexico, challenging a statute prohibiting transfer of ground water outside state boundaries. In part because of this action, State Engineer Steve Reynolds immediately "declared" the basin, a legal device that would bring it under stricter state control. Soon after, in July 1981, Crowder filed a declaration of ownership of pre-basin water rights of

110,712 acre feet per year, based on his demonstrated intent to develop the 33 wells for industrial, residential, recreational, and temporary agricultural purposes.

In 1983 Federal District Judge Howard Bratton ruled that the New Mexico statute prohibiting interstate transfers of groundwater interfered with interstate commerce. El Paso filed applications to the state engineer's office to drill wells in the Mesilla Bolson sufficient to produce 246,000 acre feet per year. The state engineer then declared he had the authority to determine whether the El Paso applications, if approved, might impair senior, "pre-basin," water rights. Crowder's claim to 110,000 acre feet, by far the largest pre-basin claim, would almost certainly be found to be impaired by approving El Paso's applications. El Paso eventually withdrew its applications and entered into an agreement for provision to El Paso of some 60,000 acre feet per year of surface water from Elephant Butte Reservoir. The New Mexico-Texas Water Settlement Commission was established to devise a plan for ultimate delivery of the water to El Paso. The Commission is still functioning.

In 1994 State Engineer Eluid Martinez testified before the legislature's Agriculture and Water Resources Committee and, later, before the Taxation and Revenue Stabilization Committee, providing background on water issues in the border area from the perspective of his office. Martinez suggested the Crowder wells could produce some 26,000 acre feet per year, not 110,000; however, he suggested there might be room to argue between the two figures. While these remarks, which did not have legal standing, suggested Crowder's claim might not hold for the full amount of water, they also strengthened the credibility of his claim to be able to develop water rights up to the 26,000 acre feet level.

In 1992, the New Mexico Border Authority began discussions with the area utility, Santa Teresa Services Company, to acquire its water and wastewater facilities, along with the utility's access to the source of water, Crowder's water rights claims. Although agreement in principle had been reached between the Border Authority and the utility's owner, Charles Crowder, the effort met substantial political opposition in Santa Fe and was never consummated. In 1994 the Border Authority negotiated a preliminary agreement with Crowder that would have allowed that agency to fully control Crowder's water rights claims in the interests of regional economic planning. Again, the effort was thwarted.

The Santa Teresa port of entry received water and wastewater services through an agreement between Santa Teresa Services Company and the U.S. General Services Administration. It anticipated an eventual need for 26 acre feet of water per year under full operation. When Gary Johnson became governor his administration drilled a "domestic" well adjacent to the port of entry to provide water for the construction project. The state subsequently sought transfers of water rights to that site from a variety of sources, including some held by New Mexico State University. The Board of Regents, however, voted against this proposal.

In mid-1997 State Engineer Tom Turney approved a 10 acre feet per year transfer to the port of entry well, from a water right that had been leased by the NM Border Authority from a Las Cruces businessman. This arrangement was the result of a Border Authority "request for proposals" seeking water rights for this purpose, but which specifically excluded the existing pre-basin water rights (including Crowder's) claims from consideration. Later that year Dona Ana County leased

the well from the state and applied to the State Engineer for transfer of an additional 200 acre feet per year to it, citing an emergency condition due to lack of adequate fire protection for the Santa Teresa Port of Entry Facility. The application for transfer has been protested by pre-basin water right claimants, including the City of Sunland Park as well as Charles Crowder. At the time of writing it has not yet been acted upon by the state engineer.

In 1996 Sunland Park condemned Santa Teresa Services Company's water and wastewater assets, stating the municipality's intention to provide stability of service and consistent supply of water to the border area. But Dona Ana County declared its intention to create its own utility in the area, using the leased well at the port of entry. This would compete with or bypass the existing providers, the Santa Teresa Services Company and the Sunland Park Municipal Utility. As part of its plan the county built a wastewater treatment plant with funds from a 1994 grant from a federal EPA colonia remediation fund, to serve Santa Teresa industrial development projects. The condemnation of the utility company by Sunland Park continues to be tied up in litigation initiated by parties favoring the county's utility position.

In 1997 Sunland Park began construction of a water line from a city well to the port of entry area, having acquired the necessary permits to lay the line in state highway right of way. This project was well under way when the permits were suddenly withdrawn, a new emergency county ordinance was put into effect, the contractor was forced to cease work, and the Mayor of Sunland Park was arrested for trespass on orders of the country manager. Relations between Sunland Park and Dona Ana County government are still plagued by tensions which can be traced to this dispute.

In 1998, Dona Ana County attempted to condemn 200 acre feet of water rights belonging to Charles Crowder, as part of an effort to increase the capacity of the state-owned well at the port of entry. The process is not completed and the outcome is, at this writing, uncertain. The county continues to assure area investors and developers of their intention to become the regional provider of services.

Water activity on the Mexican side has involved less conflict and fewer players. Much of the land mass over the Mesilla Bolson on the Chihuahua side of the border belonged to members of the Villegas family, longtime ranchers in that area. A major Mexican industrialist, Eloy Vallina, has secured portions of the Villages property for purposes of commercial development.

In the late 1980's and early 1990's, the Juarez regional water agency, *Junta Municipal de Agua*, drilled 26 wells in the Mesilla Bolson at San Jeronimo, west of the highway that runs between the port of entry and the Juarez-Casas Grandes Highway. These wells are intended for future use by the City of Juarez. It is estimated that a maximum of one cubic meter per second of water will be pumped from that well battery. Besides the well field, two water wells have been drilled at the cattle crossing (one in 1992 and one a few years later) near the port of entry, and one well was drilled near the San Jeronimo Port of Entry in 1989 for use by the port facility but was not used; instead, a water line was built to the facility from a well in the above mentioned well field.

These details about control of water at the port of entry are not unrelated to the larger development project at Santa Teresa. In order to grow, Southern New Mexico needs access to water. Yet, with

the basin almost certainly fully appropriated, access to water can no longer be considered automatic. Tensions between New Mexico and Texas over access to water have been evident for more than two decades. New Mexico and Mexico share an aquifer with limited quantities of available water. As Juarez and Southern New Mexico grow, so will the need for water. The overall regional water scenario, however, is far from clear.

Market mechanisms for the sale or transfer of water are either not in place or in a fledgling state. Each component part of the tri-state region is bound by different legal traditions; water planning interfaces between them are difficult to achieve. Mutual suspicions abound. There are no groundwater agreements between the U.S. and Mexico. It seems clear that in order to safeguard our water resources New Mexico must view itself within a regional, that is, tri-state context. The creation of mechanisms to encourage tri-state cooperation in water are far more optimal than recourse to expensive litigation with unknown outcomes. But if cooperation fails, we need the protection of the state and the state needs to understand its neighbors. From this vantage point, the energy expended on some of the conflicts over water we have observed between local governments in Southern New Mexico seem not only petty, they seem downright dangerous to the overarching goal of protecting water resources for the citizens of the state.

The Role of Government in Border Development: Policy Options

While this brief sketch cannot convey the full range of activities of federal, state, and local governments in the development of the Santa Teresa crossing, we would make the following generalizations about the effort. First, the state of New Mexico, through the Governor's office, was decisive in providing the leadership to open the temporary crossing in 1992 and the permanent crossing in 1996. Moreover, the state legislature, at the Governor's request, enacted legislation to fund the New Mexico Border Authority, giving it ample powers to assist in the development of New Mexico ports of entry.

Unfortunately, the Border Authority was not funded at levels commensurate with its powers, and for the next few years public and private entities competed with each other and with the Border Authority over access to border development policy. Thus, no true lead agency emerged to create political consensus and overall policy, there was no unity of purpose among state agencies, and state government efforts on the border fragmented. The Johnson administration tried to address these issues by consolidating the border effort, including the Border Authority, under the control of the Department of Economic Development. However, the department developed only limited linkages to both public and private local border efforts, and was therefore unable to provide a common rallying point for a wide variety of interests. Thus, a common agenda and common goals failed to materialize.

Second, in the absence of strong statewide leadership, local governments attempted to fill the vacuum. Sunland Park city government, in particular, took energetic steps to establish creative partnerships for developing badly needed infrastructure, and to explore development options for the future. Sometimes, however, turf battles among competing local entities seemed more pronounced than efforts to create viable local agendas with specific price tags on them. On balance, local governments have had difficulty establishing cooperative inter-governmental partnerships for border development. Of the three levels of government, the federal government,

mobilized by our Congressional delegation, has provided the most consistent leadership and has certainly brought the most dollars to the table, although this effort has sometimes been frustrated by the combination of local bickering and statewide fragmentation of efforts. This underscores the value of a common agenda and goals.

Third, while there are many conceivable roles for federal, state, and local governments to play in the development of the border, we believe state government has the greatest chance of emerging as a strong catalyst for development. Only the state, for example, has the legal and financial resources to mobilize water stakeholders toward common goals in an extremely precarious policy environment. Only statewide leadership can orchestrate common action by state agencies for economic development. Only state government can adapt educational and training facilities to meet changing labor force needs. Part of effective leadership is the galvanizing of support. State leaders, in order to play a catalytic role, must sell border development as a worthy goal and mobilize broad political support for it.

The federal government can play prominent roles as well. Creating a U.S. Customs management center in New Mexico would help mobilize the federal effort on the New Mexico border. Moreover, our Congressional delegation can play a key role in obtaining federal funds for the effort. Local governments can play effective roles in public-private partnerships and in galvanizing local constituencies behind development goals. Civil society has a role to play, as well. News media need to inform the public, help set the public agenda, establish priorities, and hold officials accountable. Universities can play a pivotal role in improving our knowledge about our neighbors and about our changing region. Citizens can elect effective leaders at all levels.

Finally, we should keep in mind that New Mexico is not isolated from contemporary global trends. In the largest sense, the Santa Teresa development project implies a redefinition of Southern New Mexico and sectors of the rest of New Mexico as part of a dynamic network of global activity centered in the tri-state region, a view that has implications for our identity as New Mexicans. Seeing ourselves as part of an expanded Southwest that includes Mexico and El Paso has implications for how we might better educate our children, how we might relate to Chihuahua, how we might reexamine ourselves. In short, Santa Teresa might profitably be seen not only as a development project but also as a new chapter in the evolving relationship between New Mexico and the rest of the world.

Summary: Personnel and Labor Issues along the New Mexico-Mexico Border

The following article by NMSU Professor Marie Mora shows that workers with the same skills in Northern and Southern New Mexico earn about the same wage. The reason Doña Ana residents earn less than people in other parts of the state is because, on average, they have less education.

Mora explains that by acquiring more education and other skills, Southern New Mexicans can improve their incomes. One possible way of getting people in the region to acquire more skills is by letting them know that learning more can make them wealthier over time. The state can also help Southern New Mexicans gain more skills by helping them afford education.

Indeed, the Doña Ana Branch Community College has already reached out to workers in Santa Teresa by establishing an education and training center in one of the Santa Teresa Real Estate Development industrial parks. Other such programs are also easy to imagine: convenient night-time classes and programs, low-cost returning-student programs, and programs that assist non-traditional students in the return to the class room.

As another way to draw business to the area, the state may want to consider allowing people without high school diplomas or GEDs to participate in worker-training programs. Currently, the program will only pay partial salaries (at new companies) for employees that have a GED or high-school degree. Perhaps this should be rethought in a state where many people have not obtained GEDs or high school diplomas.

Access to transportation may be one more problem keeping New Mexicans from taking advantage of growth along the international border at Santa Teresa. Since Santa Teresa is closer to El Paso than Las Cruces (Doña Ana's population center), many potential workers may find they have trouble getting to border industrial parks. Also, childcare near border sites could provide stimulus for Doña Ana residents to work in Santa Teresa.

Indeed it may be a combination of education, transportation and other factors that has created the situation in which roughly 75% of the people working in Santa Teresa are from El Paso.

Finally, labor shortages in Santa Teresa have led various groups like the Mesilla Valley Economic Development Alliance (MVEDA) to discuss the possibility of low-skilled Mexicans working on the US side of the border once they get the appropriate visa. However, this move could be politically and socially volatile as Mexican workers might be seen as possible threats to low-skilled New Mexico and US labor.

Earnings and Education along the New Mexico-Mexico Border

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Introduction and Background

During the past couple of decades, social scientists have identified a host of vexing socioeconomic issues that persist along the U.S.-Mexico border, such as high poverty rates and low income levels, and New Mexico's border does not appear exempt from such problems.¹ To illustrate, New Mexico consistently ranked as one of the poorest states in the U.S. in the 1990s, and the average poverty rate in its border counties exceeded that of the average of the interior counties. Indeed, as seen in Table 1 (on the following page), an estimated 26.9 percent of residents in New Mexico's border counties were impoverished in 1997 (the most recent year for which county poverty rates are available), compared to 18.3 percent of people residing in other New Mexican counties.²

Extant studies exploring metropolitan areas along the Texas-Mexico border have argued that relatively low skill levels (education in particular), as well as cost-of-living differences, labor immobility, and the seemingly infinite supply of Mexican labor (legal and illegal), explain a considerable proportion of the depressed labor market conditions.³ Later in this study, I provide empirical evidence that differences in education levels seem to contribute to income differentials between border and non-border counties in the state of New Mexico.

¹ The three New Mexican counties that border Mexico are Doña Ana, Hidalgo, and Luna. Doña Ana County by far has the largest population of the three, with nearly 7 times more residents than Luna County and 29 times more than Hidalgo County according to the 2000 decennial census.

² It should be noted, however, that the poorest counties in the state are not necessarily along the U.S.-Mexico border. According to the U.S. Census Bureau, in 1997 three counties (McKinley, Socorro, and Mora) had higher average poverty rates (34.7, 31.4, and 29.9 percent) than any of the border counties; Luna County had the fourth highest poverty rate at 29.8 percent, but this rate was not statistically different from the other three counties.

³ For examples of these studies, see Fullerton (forthcoming), Flota and Mora (2001), Taylor (2001), Dávila and Mora (2000), Sharp (1998); Dávila and Mattila (1985), Hansen (1982), and Smith and Newman (1977).

Table 1: Poverty Rates in New Mexico for People of All Ages

Year	Entire State of NM	NM-Mexico Border Counties	Non-Border NM Counties	Entire U.S.
1997	19.3%	26.9%	18.3%	13.3%
Average between 1997-1999	20.8%	n/a	n/a	12.6%

Notes: The poverty rates for the state of New Mexico and for the U.S. are provided by the U.S. Bureau of the Census (2000a). The border and non-border county figures were estimated by utilizing weighted averages of the county poverty rates provided by the U.S. Bureau of the Census (2000b). Currently, 1997 is the most recent year for which county poverty rates are available.

Before analyzing income, however, it is useful to first mention that many labor economists view education as a classic form of human capital which represents skills that can be acquired to increase a person's productivity.⁴ A basic premise is that people face both monetary and opportunity costs while investing in (e.g., acquiring) human capital. Once the investment is made, individuals tend to reap the returns in the form of higher earnings and a better selection of job opportunities because of their increased productivity.⁵

During the past couple of decades, employment opportunities in the U.S. have become increasingly skill-intensive. Consequently, the returns to human capital (particularly education) have been rising in the U.S.⁶ such that low-skilled workers are relatively worse off now than their similar counterparts had been in earlier decades. It follows that if workers along the New Mexico-Mexico border have lower skill levels on average than those in the rest of the state, New Mexicans residing in border municipalities may experience a relative worsening of their socioeconomic conditions in the near future.

⁴ See Becker (1993) for a classic discussion on the human capital model.

⁵ It should be noted that human capital investments have value beyond the labor market. For example, the education of parents seemingly affects the subsequent schooling investments of their children. Moreover, attaining certain education landmarks like a college degree has an unmeasured benefit of allowing the recipient to serve as a role model.

⁶ For example, the U.S. Census Bureau reports that among workers aged 18 years and older, college graduates earned 77 percent more than high school graduates (\$40,478 versus \$22,895 per year) in 1997. In 1987, college graduates earned 69 percent more than high school graduates, while college graduates in 1977 earned 58 percent more.

An Analysis of Earnings in New Mexico

Detailed income and education data from the 2000 decennial census will not be available until 2002 at the earliest. As such, in this section I rely on data for the state of New Mexico from the 1990 U.S. census: the 5% Public Use Microdata Sample (PUMS).⁷ While some labor market trends may have changed over the past decade, I remain confident that 1990 census data remain useful to analyze factors that affect earnings in the state today. My sample of interest involves individuals 25-64 years old who reported wage and salary income for the previous year (i.e., for 1989).

Admittedly, a potential problem with using the PUMS to analyze the New Mexico-Mexico border region is that the structure of the dataset only permits the unique identification of only one of the three border counties (Doña Ana); both Hidalgo and Luna Counties are grouped with five other counties in an identifiable public-use microdata area (PUMA). Nevertheless, given the large population in Doña Ana vis-à-vis the other border counties (see Footnote 1), patterns observed in the county undoubtedly reflect trends for the New Mexico border area as a whole. Moreover, when excluding workers in the PUMA category that contains Hidalgo and Luna Counties from the analysis altogether, the empirical results presented below are unaffected.

As Table 2 shows, the average annual income of workers was about \$2,600 less in Doña Ana County than in other New Mexican counties (\$17,561 versus \$20,176); a similar pattern can be observed with respect to average hourly wages (\$10.24 in Doña Ana County versus \$11.49 in the rest of the state). Such earnings differences are consistent with other studies (such as those in Footnote 3) on Texas-Mexico border communities. The Appendix provides the definitions of the variables utilized in the analysis.

One of the explanations for the lower earnings is the border/non-border difference in educational attainment. Table 2 shows that in Doña Ana County, nearly 18 percent of workers in the sample had not graduated from high school, compared to less than 12 percent of workers in other New Mexican counties. Given the link between education and earnings discussed above, it is not surprising to observe the income differentials between the border county and the rest of the state. It is interesting to note that the average potential labor market experience (the approximate number of years a person has worked since leaving school) was similar between Doña Ana County and other areas, suggesting that average experience levels may not be a significant underlying factor of border/non-border earnings gaps.

⁷ PUMS data are a stratified sample of the population that received long-form census questionnaires. While all questionnaires queried individuals over basic demographic topics, the long form asked detailed information on items such as income and educational attainment.

Table 2: Selected Average Characteristics for New Mexican Workers in the PUMS

Characteristic	Doña Ana County	Other NM Counties	Significantly Different?*
Annual income	\$17,561.01	\$20,176.09	Yes
Hourly wages	\$ 10.24	\$ 11.49	Yes
Education (in years)	12.8	13.2	Yes
Did not complete high school (or equivalent)	17.8%	11.8%	Yes
Potential job market experience (in years)	21.5	21.4	No

* T-tests were used to determine if the averages were statistically different between Doña Ana County and the rest of the state; the specific results can be obtained from the author.

Source: The author's estimations using the 1990 5% PUMS for workers in New Mexico aged 25-64 years old who reported wage and salary income. The PUMS-provided statistical weights are utilized to obtain these averages as well the tests for statistical differences.

To analyze the effects of education and experience on wages in Doña Ana County *vis-à-vis* other New Mexican counties, I estimate a standard earnings function for the two areas.⁸ Table 3 provides the empirical results, which indicate that earnings do not significantly differ between Doña Ana County and the rest of the state when accounting for workers' skills.⁹ That is, workers with similar levels of schooling and experience appear to be rewarded equally on average

⁸ This earnings function takes the form of: $\ln(Wages) = B_0 + B_1 Education + B_2 Experience + B_3 Experience^2 + B_4 Female + e$, where $\ln(Wages)$ represents the natural logarithm of hourly wages. B_0 indicates the constant (or intercept) term; B_1 , B_2 , and B_3 represent the returns to skills; B_4 reflects the gender-related earnings gap; and finally, e represents the stochastic error term (where $e \sim N(0, \sigma^2)$).

⁹ One exception here pertains to women; while they earned less than their otherwise similar male counterparts in the state, the gender-related earnings gap was *smaller* in Doña Ana than in other counties. The issue of why New Mexican women appear to be favored in particular labor markets goes beyond the scope of this study; however, future studies investigating socioeconomic outcomes in the state or along the U.S.-Mexico border should explore this topic.

between Doña Ana County and other counties in New Mexico,¹⁰ such that the earnings differences reported in Table 2 seem to mainly reflect education-differentials.

This analysis suggests that investments in human capital represent a clear means to enhance the earnings of workers along the New Mexico-Mexico border. Moreover, recall from above that the returns to education increased during the 1990s at the national scale. Presumably a similar pattern occurred in the state of New Mexico; if so, the analysis presented in Table 3 (based on 1990 census data) might *understate* the importance of schooling acquisition as a vehicle to improve the socioeconomic conditions of workers along the U.S.-Mexico border.

Table 3: Earnings Regression Results for New Mexican Workers in the PUMS
(Dependent Variable = Natural Logarithm of Hourly Earnings)

Characteristic	Doña Ana County	Other NM Counties	Significantly Different? [†]
Education	0.087*** (0.005)	0.095*** (0.002)	No
Experience	0.020*** (0.006)	0.023*** (0.002)	No
Experience ² /100	-0.020* (0.012)	-0.024*** (0.004)	No
Female	-0.287*** (0.029)	-0.354*** (0.010)	No
Constant	0.753*** (0.092)	0.691*** (0.046)	Yes**
R ²	.199	.170	
N (unweighted)	2,268	25,321	

¹⁰ For example, in Doña Ana County, the returns to education in Table 3 are approximately 8.7% (i.e., each year of schooling related to an earnings increase of 8.7%). While on the surface this figure is lower than the 9.5% reported for other counties, statistically the difference is indistinguishable from zero.

N (weighted)

44,373

498,912

⁺ The tests for whether the coefficients significantly differed between Doña Ana County and the rest of the state involved estimating a third earnings function that included a binary variable equal to one for residents in Doña Ana, as well as interactions between this binary variable and the other variables in the table. T-tests on the coefficients of the interaction terms determined the statistical significance level.

***, **, * Statistically significant at the one, five, and ten percent levels.

Source: The author's estimations using the 1990 5% PUMS for workers in New Mexico aged 25-64 years old who reported wage and salary income. The PUMS-provided statistical weights are utilized in the analysis.

Concluding Remarks

The analysis in this study points to an obvious policy prescription to enhance the socioeconomic conditions of individuals residing along the New Mexico-Mexico border: encourage the residents to acquire additional skills. Of course, this is easier said than done. From a human capital perspective, policymakers could approach this issue from two sides: reducing the costs and increasing the awareness of the benefits associated with skill acquisition

On the cost side, while New Mexico lottery scholarships help reduce the monetary costs of college for recent New Mexican high school graduates, such scholarships may not impact the schooling investments of individuals already in the labor market. Workers tend to face relatively high opportunity costs to acquire human capital because their forgone earnings and value of time often exceed those of students fresh out of high school. Expanding the availability of scholarships and other financial aid alternatives for non-traditional students in border areas may encourage more individuals in the state to attend and complete college. In addition, New Mexico's high schools and universities could coordinate scheduling to offer a wider array of evening or weekend classes; this would lower the opportunity costs for many workers to attend school because they would not be forced to take time off from work.

On the benefits side, information on the growing importance of education could be made more readily available to the public. It may be that misconceptions about the value of education have deterred some individuals from completing high school or attending college. Perhaps policymakers could find methods to disseminate information in border communities regarding the strong role that education plays in the border, state, and national labor markets; greater availability of information on financial aid alternatives may also encourage some workers to return to school.

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Appendix: Definitions of Variables Utilized in the Analysis

Variable	Definition
Annual income	Total wage and salary income reported for 1989
Hourly wages	Annual income divided by annual hours worked (the usual hours worked per week times the number of weeks worked in 1989)
Years of education	See the category-to-continuous schooling translations constructed by Park (1994). (The 1990 PUMS does not specifically provide the actual number of schooling years; instead, it categorically presents the highest level of education attained.)
Did not complete high school (or equivalent)	= 1 for individuals without a high school degree or equivalent (e.g., GED)
Years of potential job market experience (experience)	Age - education - 5. (This is a standard proxy for labor market experience utilized by labor economists; it reflects the amount of time an individual could have been employed since completing his or her education.)
Experience ²	Experience-squared. (This term is usually included in earnings functions under the assumption that wages increase with experience at a decreasing rate.)
Female	= 1 if the individual is female; = 0 otherwise. (This variable should pick up the gender-related earnings gap that is not explained by the other factors in the earnings function.)

Water Policy Summary

Water is potentially the most complex and least understood issue in the Texas-New Mexico-Chihuahua tri-state region. Indeed, water is often viewed as two separate issues, groundwater and surface water, and yet these two systems are often linked and extracting water from one source can affect another.

Jose Z. Garcia, director of the Center for Latin American and Border Studies at New Mexico State University, and one of the original founders of the Paso del Norte Water Task Force, examines the tri-state region's present water scenario. While a water market already exists in inchoate form, Garcia suggests that a more fluid and dynamic water market could help meet future demand for water if it allowed for an easy transfer of water rights between today's agricultural water users and tomorrow's commercial and residential water users throughout the region.

Garcia also mentions some of the tensions and complexities of tri-state water policy and resources. For example, Ciudad Juárez relies on the Hueco Bolson (aquifer) for almost all of its commercial and residential water but an unsustainable rate of use means that Cd. Juárez will soon reach brackish water that will need to be treated before it can be used for human consumption. El Paso also relies on the Hueco for much of its water but has been diversifying and assuring its future water supply over the course of the last few years. Doña Ana County, New Mexico gets its drinking water from the Mesilla Bolson but El Paso has begun to draw on that aquifer in recent years near Anthony, Texas and Cd. Juárez has the intention of getting most of its future water from the Mexican side of the aquifer.

Water in the Paso del Norte Region

**Jose Z. Garcia, Ph.D., Director, Center for Latin American and Border Studies,
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Although water is not plentiful in the Paso del Norte region (which includes Dona Ana County, NM, El Paso, TX, and Cd. Juarez, Chih.) the Rio Grande (called the Rio Bravo in Mexico) should continue to provide enough water to maintain population growth for the foreseeable future. However, water use appears to be fully appropriated in the region as a whole and current levels of agricultural production *and* population growth cannot be sustained barring major investment in conservation measures. Furthermore, groundwater supplies in some water jurisdictions are not keeping up with demand; as water tables fall decision makers must reallocate surface water, reduce demand, or transfer water from other areas. These constraints have generated continuing tensions within and between various areas in this tri-state, binational region. As might be expected under such circumstances the water scenario in the region is complex and controversial.

The Rio Grande snakes through Southern New Mexico, near the boundary between New Mexico and Texas for several miles south of Anthony; then near the point of intersection of New Mexico, Texas, and Mexico; and then, further south, forming the boundary between El Paso and Cd. Juarez. The river charges the Hueco and Mesilla underground aquifers, the principal sources of municipal supply in the three component parts of the region. Water in the Hueco Bolson, which straddles El Paso and Cd. Juarez, is being withdrawn much faster than it is being recharged, and is projected to produce brackish water in Juarez within about five years and eventually to cease being a major source of supply altogether at current levels of withdrawal. El Paso has firm plans to construct a desalinization facility to treat the future arrival of inferior water from the Hueco Bolson.

West of the Hueco Bolson is the Mesilla Bolson, which straddles the border between New Mexico and West Cd. Juarez. It has not been used extensively in Cd. Juarez, although city planners there contemplate doing so soon. In New Mexico the Mesilla Bolson has been **Declared** by the state engineer, meaning that overall water usage on the New Mexico side will be carefully controlled by the state. Intricately connected with the Rio Grande, Mesilla Bolson hydrology is complex. Although a great deal is known about it, the consequences of different levels of water usage on recharge rates or on the flow of the river are not yet fully understood. A treaty was signed with Mexico in 1906, whereby Mexico has first priority to receive 60,000 acre-feet of surface water per year. This treaty is monitored by the International Boundary and Water Commissions of both countries. However, language in the treaty does not specifically deal with the right to use groundwater.

Southern New Mexico, El Paso, and Cd. Juarez all have irrigation districts which distribute surface water for farming, supplemented by groundwater. Quantities of water apportioned from New Mexico (the upstream party) to El Paso and Cd. Juarez are distributed according to agreements made through treaties, through the Rio Grande Project, which created rules of the

game governing the use of water flowing south of the Elephant Butte dam, and through established practices.

For the last two decades tensions have erupted between New Mexico and El Paso, involving several parties and multiple issues involving both surface water and groundwater. One lawsuit, involving the right of El Paso to transfer groundwater from New Mexico, was settled in 1991. As part of the settlement a New Mexico-Texas Water Commission was created to carry out the terms of the settlement. Since then other tensions have surfaced over such issues as ownership of the water in Elephant Butte reservoir and the quality of surface water delivered from New Mexico to El Paso.

The Elephant Butte dam, completed in 1916, was built as a reclamation project for irrigation and to fulfill treaty obligations with Mexico. At that time farming dominated the downstream landscape. Populations were much smaller than they are today, and the relationship between underground water basins and surface water was not well understood. Municipal water was simply pumped from underground aquifers; farmers irrigated with surface water and supplemented irrigation with wells.

Today the hydrology is better understood: groundwater withdrawals affect the volume of surface water in the river; surface water irrigation practices affect recharge rates to underground aquifers; and water quality tends to diminish as water tables fall. Thus, as the Hueco aquifer used by El Paso and Cd. Juarez draws down, it is clear that unregulated use of the nearby Mesilla Bolson as a substitute would create long-term sustainability problems. Some relief can be provided by the conversion of surface water from irrigation to domestic use. However, since the surface water regime evolved as an irrigation project, the legal and administrative mechanisms to do so have only recently begun to emerge, often in an environment of conflict.

In New Mexico, until recently, it was assumed that underground supplies of water were sufficient to support uninhibited increases in the volume of pumping for municipal use; surface water flows, while limited, were usually enough to sustain agricultural demand, and in case of drought farmers shared reduced supplies of surface water equally. In recent years the State Engineer's office, the official water authority in the state, has determined to rationalize the use of water in various ways. Under New Mexico law, water users who first appropriate water for beneficial use have legal priority over later appropriators in case of drought or restriction. A legal process of adjudication is currently under way in the Mesilla Valley, to determine who has the *right* to use how much water from where, and the *priority* rank of the users. In conjunction with this process a hydrographic study is being conducted to determine as best as possible *who* is using *how much* water, and from where the water is being appropriated. Thus, the rights of parties to use underground and surface water will be established at quantifiable levels. This will permit the creation of a more rational water market whereby those with defined rights to surface or groundwater will be able with relative ease to sell their allocations to other parties. Market-driven allocation of water, in turn, is likely to have a profound effect on agriculture-urban space ratios since population increases imply conversion of agricultural use of water to municipal use.

In El Paso, where water law is significantly different from New Mexico's, steps toward the creation of a water market have been taken. Hundreds of small landholders (primarily urban dwellers) have leased their rights to water from their water rights lands to the El Paso Public Service Board and the Lower Valley Water District for municipal purposes under a 1962 contract. Moreover, under a third-party conversion implementation contract the El Paso Public Service Board has recently begun purchasing water in bulk from the El Paso irrigation district. In 2001 a fledgling water market was structured at an initial price of \$193.40 per acre foot. Of the three parts of the region, El Paso has gone farthest in creating the legal and administrative framework for a relatively comprehensive water market.

In Cd. Juarez, where water law and rights are established by the federal government rather than by states or private owners, a free water market has not yet been established. The 60,000 acre-foot of water delivered to Cd. Juarez from the U.S. is allocated to farmers for irrigation and is supplemented by groundwater pumping by the federal government. Water for municipal use is taken from Hueco Bolson underground supplies, although some mechanisms for the conversion of irrigation water to municipal use exist and are being refined. Cd. Juarez also shares the Mesilla Bolson with New Mexico. The Mexican portion is located on the west side of Cd. Juarez near San Jeronimo, just south of Santa Teresa. Water planners are contemplating pumping water from the Conejos Medanos region, part of the Mesilla bolson, and there has been journalistic speculation about securing supplies from the U.S. side. Complicating matters, in recent years the water regime in Mexico has changed in the direction of granting more authority to state governments in water planning and usage. These changes, however, have not yet been fully articulated. Cooperation in water planning has begun between the El Paso water utility company and the Junta Municipal de Aguas of Cd. Juarez.

Thus, all three segments of the Paso del Norte region are struggling with similar issues of future water supply and the creation of future water markets whereby waters used for irrigation could be diverted for domestic consumption. Moreover, each area is seeking to find the proper balance between groundwater and surface water use. Clearly, a shared *regional* perspective on major water issues and solutions is preferable to the current pattern of subregional conflict, inadequate levels of inter-jurisdictional communications, and insular rather than cooperative traditions among many of the major players. There are literally dozens of private, public, inter-agency, and interstate groups in place addressing relatively narrow portions of the overall regional water agenda. Moreover, the creation of a transparent new water regime will also require a redefinition of some aspects of the relationship between farmers and federal, state, and local governments, some give-and-take between the component parts of the region, and the creations of better mechanisms for regional cooperation. All of these suggest a lively political environment. For the foreseeable future, urban developers and potential developers in the region will closely monitor the unfolding water scenario.

The author would like to thank Dr. Bobby Creel, Dr. Karl Wood, Edd Fifer, Ing. Oscar Ibañez, Ing. Ramón Grijalva, Dr. Tom Bahr, and others for helpful comments in earlier drafts of this paper. However, factual and interpretive errors are solely the responsibility of the author.

Water Resources of the Border Region--Summary

The bi-national border region of New Mexico extends from east of El Paso, Texas to the Arizona-New Mexico state line, and approximately 60 miles (100 km) north and south of the International Boundary. It includes portions of Otero, Doña Ana, Luna, Grant and Hidalgo counties, as well as adjacent parts of Texas and Chihuahua. This background paper focuses on our surface- and underground-water resource base and the pivotal role that water availability plays in sustaining the “viability” of an arid region whose economic and environmental health is of vital concern to both our state and its neighbors. The major sites of past and projected water use (mainly irrigation-agriculture and urban-industrial) are located along the Las Cruces-El Paso-Ciudad Juárez corridor of the Rio Grande Valley. However, water (primarily groundwater) is also the lifeblood of the region’s smaller but equally important urban and rural communities, including Chaparral, Deming, Columbus-Palomas, Silver City, Lordsburg, Animas-Cotton City, Playas, and (yes!) Antelope Wells and Hachita. The seven intermontane-basin (bolson) systems described herein are each formed by structural depression of Earth crustal blocks relative to adjacent mountain ranges. From east to west, they are the Hueco-Tularosa, Jornada del Muerto, Mesilla, Mimbres, Hachita-Moscós, Playas and Animas basins. Where saturated with fresh water, the poorly consolidated sediments and interbedded volcanics that partly fill these basins form one of the major aquifer units of New Mexico.

Surface and subsurface flow systems are well integrated along major stream valleys and adjacent to high-mountain watersheds. These areas are the major sites of both groundwater discharge and recharge. The only large perennial streams, the Rio Grande and the Rio Casas Grandes (in NW Chihuahua), are the most reliable surface-water resources and contributors to recharge of groundwater reservoirs. The upper reaches of the Mimbres River and Animas Creek, in eastern Grant and southern Hidalgo counties, respectively, are relatively small perennial to intermittent stream systems but they still serve as primary recharge sources for the large aquifers of the Mimbres and Animas basins. Allocation of surface-water and most groundwater resources is managed by several state and federal agencies, including the Interstate Stream Commission and the New Mexico Office of the State Engineer. The Reclamation Act of 1902, the 1906 Treaty with Mexico, and the 1938 Rio Grande Compact provide the legal and administrative structure for water management in the Rio Grande Valley below Elephant Butte Dam.

As rates of water consumption increase, concerns about both the quantity and the quality of the resource have also increased. During the past 20 years there has been a concerted effort by public institutions and the private sector to better characterize the hydrology of the surface-water system and the hydrogeologic framework of the basin- and valley-fill aquifers that form such an enormous, but finite groundwater reservoir. This reservoir, which comprises the major aquifer units in the region’s seven large structural basins, contains at least 400 million acre-feet of fresh water in the upper 500 feet of saturated basin fill. However, a substantial part of this resource may not be economically recoverable *and* only a small amount can be replenished on a human-time scale. The ultimate goal of current research is development of numerical models of the region’s geohydrologic system that can serve as water-management tools in a real world setting.

Water Resources of the Border Region of New Mexico

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Introduction

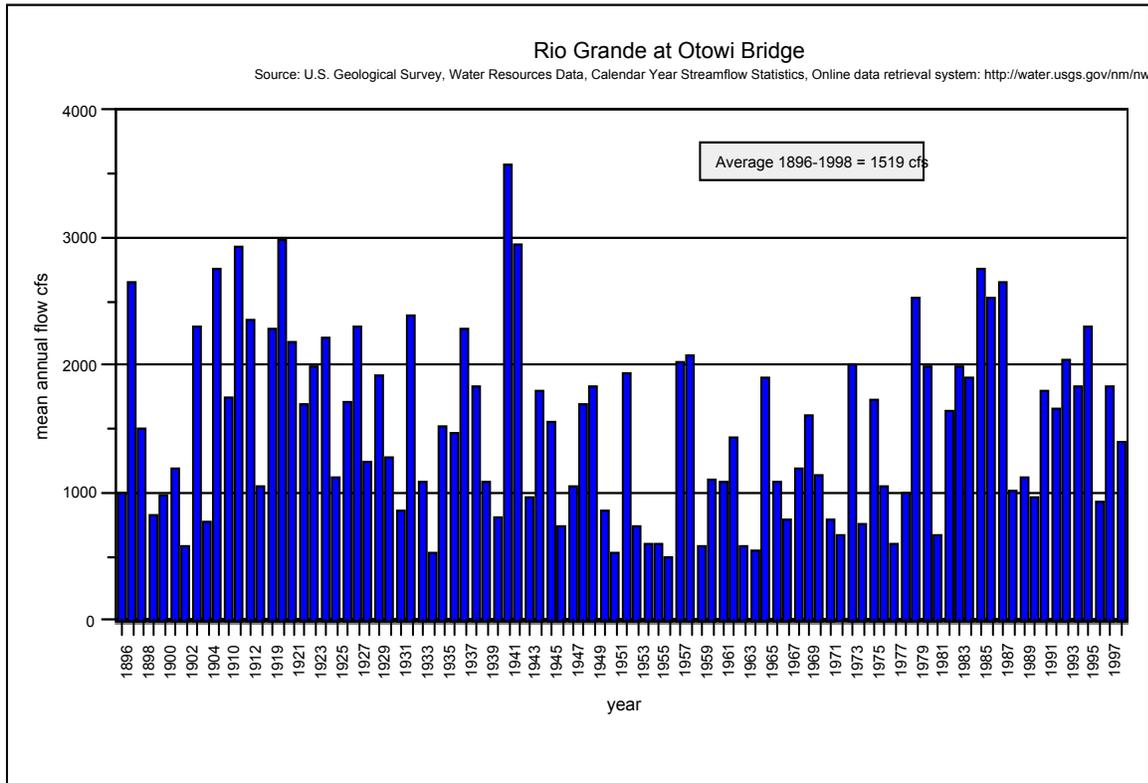
Much of the information contained in this brief overview of the water resources of the area is drawn from several comprehensive reports. Four of which are: Hibbs and others (1997), Hawley and Kernodle (2000), Hawley and others (2000) and Kennedy and others (2000). A number of other relevant references are also cited in the text (see reference section).

The bi-national border region of New Mexico is generally defined as an area, which extends from east of El Paso to the Arizona-New Mexico state line, and about 100 km (60 miles) north and south of the International Boundary. The region includes portions of Otero, Doña Ana, Luna, Grant, and Hidalgo counties in New Mexico, adjacent parts of El Paso County, Texas and the states of Chihuahua and Sonora in Mexico. The water resources of this area consist of both surface water and groundwater.

Surface-Water Resources

Perennial surface waters (rivers) in the area include the Rio Grande and the upper Mimbres River. Numerous other surface water courses (streams, creeks, arroyos and draws), which range from small perennial to ephemeral streams gages, which are typical of the arid southwest, typically terminate in playa-lake plains or floors of the basins.

The Rio Grande, which originates in the northern New Mexico and southern Colorado Rocky Mountain region, flows southerly through New Mexico then shifts from generally north-south to southeastward where it flows through the Paso del Norte between the Franklin Mountains and Sierra Juarez. The river forms the International Boundary between the United States and Mexico from the tri-state (New Mexico-Texas-Chihuahua) boundary near El Paso to the Gulf of Mexico. The flow of the Rio Grande is extremely variable from year to year depending primarily upon snowpack in the mountains of southern Colorado and northern New Mexico. Its flow has been measured at the Otowi Bridge, located northwest of Santa Fe, New Mexico since 1896. During the period 1896-1998 the mean annual flow has averaged 1,519 cfs (ft³/sec) with a high of 3,580 cfs in 1941 and a low of 495 cfs in 1957. This flow of 1,519 cfs is about 1,100,455 acre-feet/year. The chart below presents the mean annual flow record for the U. S. Geological Survey gage at Otowi Bridge and the accompanying table (adapted from Stone 20001) includes some basic water-unit definitions, conversion factors, and rates of water use.



WATER-UNIT DEFINITIONS AND EXAMPLES OF RATES OF USE

Definitions and Conversion Factors

- 1 inch of rain per acre = 27,200 US gallons or 3.78532 liters/hectare
- 1 cubic-foot of water = 7.48 US gallons, or 28.31 liters
- 1 gallon of water = 0.13368 cubic feet, or 3.78532 liters
- 1 cubic-foot per sec (cfs) = 1.9835 acre-feet per day, or 724.46 acre-feet per year
- 1 cubic-foot per sec = 448.83 gallons per minute, or 28.317 liters per sec
- 1 acre-foot = 325,851 gallons, 1,233,500 liters, 1,233.5 cubic meters
- 1 gallon/minute (gpm) = 1.6130 acre-feet/year or 0.063 liters/second

Examples of Use and/or Consumption

Average daily groundwater pumpage (general estimates)

- Las Cruces 20,000,000 gallons/day
- El Paso 100,000,000 gallons/day
- Ciudad Juarez ~110,000,000 gallons/day

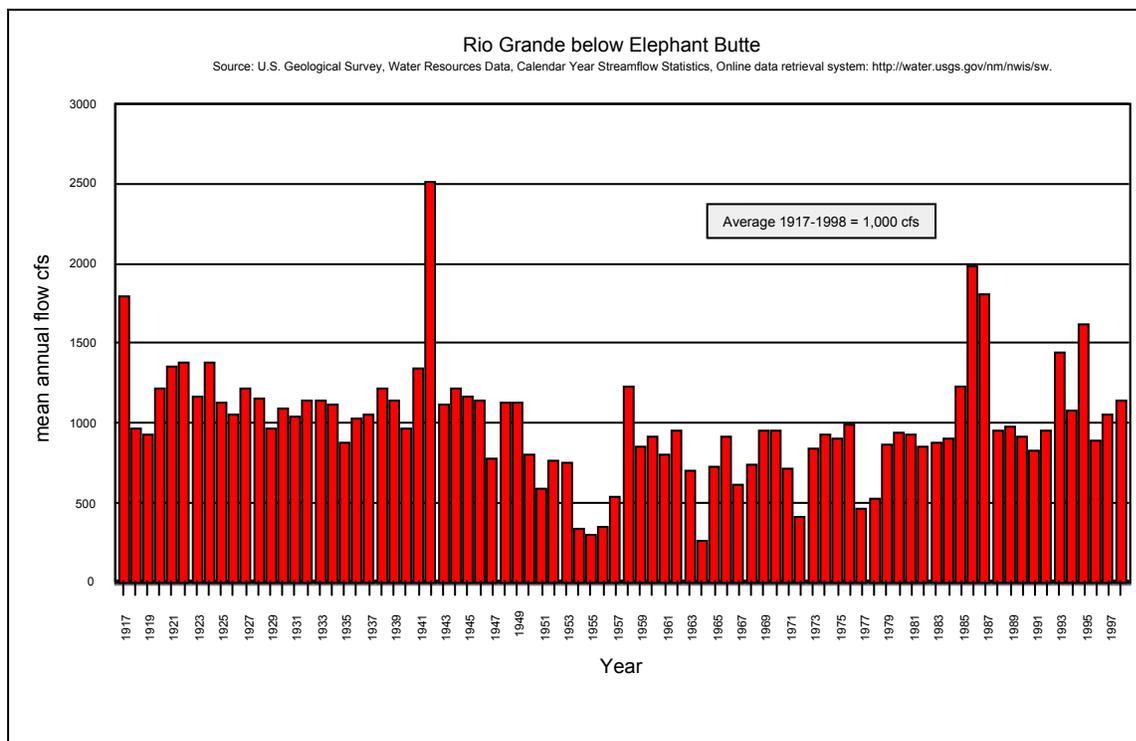
Estimated maximum USA water use = 700 billion gallons/day

Average in-home water use = 10-80 gpd

Average overall water use (excluding electric power generation) = 100-265 gpd

- 1 toilet flush = up to 6 gallons
- 1 bath = 30-40 gallons
- 1 shower = 20-30 gallons
- 1 dishwashing, by hand = 2-4 gallons
- 1 dishwasher cycle = 10 gallons
- 1 laundry cycle = 20-30 gallons

- 1 horse consumes 12 gallons/day (gpd)
- 1 steer consumes 9 gpd
- 1 milk cow consumes 36.5 gpd
- 1 hog consumes 2 gpd
- 1 sheep consumes 2 gpd
- 1 egg needs 120 gallons



In the border region, the flows of the Rio Grande are stored in Elephant Butte and Caballo Reservoirs for the benefit of the Rio Grande Project (Project). The Project was authorized by Congress under the Reclamation Act of 1902 to provide irrigation water to farms in Texas and New Mexico by capturing flood-flows and storing them in Elephant Butte Reservoir. Elephant Butte Reservoir, at the time of its construction, had a capacity of over 2.6 million acre-feet, but sediment from up-stream lands has reduced the effective storage to just over 2 million acre-feet in recent years. Caballo Reservoir (about 28 miles down-stream) was constructed in 1938 to hold waters released from Elephant Butte for power generation and to provide additional flood-storage capacity. The usable capacity of Caballo Reservoir, including 100,000 acre-feet of flood storage, is 331,500 acre-feet. These reservoirs serve to store and regulate the normal spring flows for release during the irrigation season.

Flow measurements of releases from Elephant Butte Reservoir have been kept since 1917 and are summarized in the chart above. The average mean annual flow for the period 1917 through 1998 was 1,000 cfs with a low of 253 cfs in 1964 and a maximum of 2,512 cfs in 1942. This flow of 1,000 cfs is about 724,460 acre-feet/year. The Project includes diversion dams, a canal delivery system, and return-flow drains. A comparison of the two charts reveals that the reservoirs have served to soften the peaks and valleys of the quite variable flow from upstream and provide a more consistent supply. The Project also provides supplemental water (Project return-flow) to about 18,000 acres in the Hudspeth County Conservation and Reclamation District No.1 below El Paso.

Another primary objective of the Project was to ensure that the United States could deliver water to Mexico under the provisions of the Treaty of 1906. The Treaty requires the delivery of 60,000 acre-feet of water annually at the Acequia Madre ditch that heads below the principal diversion at El Paso.

In 1938 Colorado, Texas and New Mexico entered into an interstate compact that divided the supply of the Rio Grande between the three states by providing sliding-scale, delivery-tables.

New Mexico's deliveries at Elephant Butte Dam were to "Texas", or in reality to the Project, as it was the "unit" beneficially using all of the surface water below that point (Littlefield, 1987). The Compact (Ortega Klett 2000) did not further divide the water supply between New Mexico users (Elephant Butte Irrigation District) and the Texas users (El Paso County Water Improvement District #1). The Compact did recognize the delivery requirement to Mexico. Article VIII of the Rio Grande Compact, defined the "normal release" of "usable water" for the Project from Elephant Butte Reservoir to be 790,000 acre-feet per year (Hill 1968). This amount provided for the "full Project" allocation of 730,000 acre-feet per year plus 60,000 acre-feet for delivery to Mexico.

The Mimbres River, which flows southward from its headwaters in the eastern flanks of the Pinos Altos Range and the western slopes of the Black Range, terminates on the Mimbres Basin floor east of Columbus near the International Boundary. The river is perennial only in its upper reach and rarely flows past Deming. From its headwaters, the river flows south to the vicinity of Black Mountain (NW of Deming) where its channel turns to the east and goes north of Deming and the Little Florida Mountains. Any well-defined river channel terminates about 10 miles east of Deming. Major tributaries include San Vicente Arroyo, which drains the northwest part of basin watershed, Seventysix Draw in the southwestern part, and Macho Draw in the north Florida Subbasin.

The annual flows of the Mimbres River measured at the USGS gauging station at Mimbres have averaged about 21 cfs over the period 1979 through 1998, with a low of 5.6 cfs in 1982 and a high of 41.7 cfs in 1992. This flow of 21 cfs is about 15,214 acre-feet/year. Most of the flows are diverted for irrigation of farms adjacent to the river. Wilson and Lucero (1997) reported that in 1995, 10,550 acres were irrigated with surface water, while 600 acres were irrigated with both surface water and groundwater. Diversions of surface water for irrigation were estimated at 21,785 acre-feet in 1995.

Groundwater Resources

The primary groundwater resources of the southern New Mexico "border region" are the saturated parts of stream-deposited fills (alluvial aquifers-Wilkins 1986, Kernodle 1992) of eight intermontane basins and one river valley in the southern Basin and Range province. From east to west, the basin-fill aquifer systems are designated the: **Hueco-Tularosa, Jornada del Muerto, Mesilla, Mimbres, Hachita-Moscós, Playas, and Animas** (see index map in pocket). The very important alluvial aquifer associated with the entrenched Rio Grande Valley system includes the parts of the Rincon, Mesilla, and El Paso Valleys that are located in the Jornada del Muerto, Mesilla, and Hueco basins (Hawley and Kernodle 2000), while the much smaller Mimbres River and Animas Creek valleys are restricted to highland margins of their respective basins.

Some basins have no surface outlets and the lowest parts of their floors contain ephemeral-lake plains (*playas*). Others contain axial drainageways that occasionally discharge to lower external areas. In this part of North America the terms "bolson" and "bolson fill" are used, respectively, as alternative designations for large intermontane-basin landforms and their sedimentary fill. Geohydrologists in this region use the terms *open* and *closed* solely to describe basin topography and surface-flow systems; and *undrained*, *partly drained*, and *drained* refer only to groundwater flow in basins that may be either *open* or *closed* (Hawley and Kernodle, 2000). Two large *open* basin systems, the Mesilla and Hueco Basins, have segments that are occupied by the Mesilla

and El Paso Valleys of the through-flowing Rio Grande. The Tularosa, Jornada del Muerto, Mimbres, Playas and Animas Basins are *closed* systems with no exterior surface flow. In terms of groundwater flow, however, most of these are in the *partly drained* category, because some component of subsurface discharge is to contiguous basins.

The major aquifer units of the region are:

1. Thick basin fill in *Rio Grande rift* fault-block depressions that include segments of the Rio Grande Valley (**Santa Fe Group**-Hawley and Kernodle 2000), and correlative deposits in basins west of Doña Ana County (**Gila Group**-Kennedy et al. 2000);
2. Overlying deposits of the Mimbres River and Animas Creek systems; and
3. Shallow alluvial fill in the Mesilla and El Paso Valleys of the Rio Grande.

Fractured volcanic rocks that immediately underlie or are interlayered within the basin fill also form productive aquifers in a few areas. Solution-enlarged fractures in carbonate rocks of Paleozoic and Cretaceous Age are rarely significant groundwater reservoirs. The occurrence of groundwater in most consolidated rocks of the region is limited to water-filled fracture zones of very low yield. Such zones occur in a wide variety of bedrock units including sedimentary, volcanic, intrusive igneous, and metamorphic types. The only major roles played by bedrock units are in the formation of surface and buried basin boundaries and as ultimate source areas for most of the transported sediment that form the basin fill.

Basin Systems of the Border Region

HUECO-TULAROSA BASIN

Overview

The Hueco-Tularosa aquifer system includes water-bearing strata in both the flanking highlands and basin fill of the Santa Fe Group (Bedinger et al, 1989; Hibbs et al 1997). Total surface area of this aquifer system is about 4,160 square miles. Approximately 67% of its land area is in New Mexico, 22% is in Texas, and 11% is in Mexico. A surface divide near the New Mexico-Texas state line separates the Tularosa Basin (a *closed* basin) and the Hueco Bolson (an *open* basin) topographically. The surface divide does not correspond to a structural or groundwater divide, and the two basins are connected by interbasin groundwater flow from New Mexico into Texas. Because of the interconnection, the saturated fill of the Tularosa and Hueco basins is defined as one aquifer system. This complex groundwater reservoir is the primary source of water for the City of El Paso and Ciudad Juarez, and for military installations and smaller cities in New Mexico, Texas, and Mexico. Recharge occurs primarily from precipitation and infiltration of mountain runoff through major arroyos; and recharge rates are much less than groundwater withdrawals.

Well yields in the New Mexico part of the Tularosa-Hueco aquifer system vary greatly. Most of the wells produce water from piedmont alluvial deposits that flank the Sacramento and Organ Mountains. Well yields of 1,400 gpm are reported from piedmont deposits near the mountain fronts, with yields decreasing to 300 to 700 gpm at the lower edges of the piedmont slope. Well yields in the mud-rich sediments toward the center of the Tularosa Basin are usually much less than 100 gpm. In the Hueco Bolson just east of the Franklin Mountains, where coarse-grained

deposits of the ancestral Rio Grande form the bulk of the aquifer system (Seager et al 1987; Collins and Raney 2000), well yields are as much as 1,800 gpm. Wells underlying Ciudad Juarez yield from 300 to 1,500 gpm from ancestral river sediments. In most of the area outside the Rio Grande Valley, depths to groundwater range from 300 to 400 ft. In addition, plumping of large (municipal, industrial, irrigation) wells produces temporary “drawdowns” below “static” groundwater-surface (water-table) levels.

Drawdowns in the Hueco Bolson near the New Mexico-Texas state line have been relatively small, not exceeding 30 feet. Current depth to groundwater beneath the City of El Paso is usually between 250 and 400 feet at distances from the Rio Grande. Present depth to groundwater beneath Ciudad Juarez varies from about 100 to 250 feet, except near the Rio Grande where depths are often less than 70 feet. In heavily developed parts of the Hueco-Tularosa aquifer, drawdowns since 1940 are up to 150 feet. Pumping cones of depression in municipal well fields are the focal points of drawdown and vary between 50 and 100 feet.

Groundwater Quality

Water with a total dissolved solids (TDS) content of less than 1,000 milligrams/liter is usually classed as “fresh” or “potable,” while higher TDS values indicate slight to greater amounts of salinity. Groundwater north of the New Mexico-Texas state line is usually greater than 1,000 mg/L TDS except in mountains and along mountain fronts where water is generally fresh. Many samples along the interior of the southern Tularosa and northeastern Hueco basins have TDS greater than 10,000 mg/L. Near and extending across the state line to the entrenched Rio Grande Valley, groundwaters recharged from the Organ and Franklin Mountains are characteristically less than 700 mg/L TDS. Basinward from these mountain-front recharge areas groundwater salinity increases to over 1,000 mg/L in many wells. Concentrations of over 1,500 mg/L TDS are reached in wells along and east of the Hueco Bolson axis. The salinity of groundwaters underlying the Ciudad Juarez area are generally less than 1,000 mg/L TDS.

Chloride and other dissolved ions have increased over time in many of the municipal wells in El Paso and Ciudad Juarez. Chloride now exceeds 250 mg/L in several of the wells in the area. Mixing due to pumpage, leakage from mud interbeds and artesian confining beds, cascading waters along well casing and screens, lateral salt water encroachment, and potential upcoming waters have started to degrade the freshwater zone. Nitrate data collected between 1994 and 1995 indicate nitrate problems in some parts of El Paso County. Water pumped from a cluster of wells in the vicinity of the Old Mesa Well Field in southwestern El Paso County exceed the 10 mg/L $\text{NO}_3\text{-N}$ drinking water standard. Many of the samples in El Paso County tested between 5 and 10 mg/L $\text{NO}_3\text{-N}$. All of the wells in Ciudad Juarez and immediate vicinity are reported to produce water of less than 5 mg/L $\text{NO}_3\text{-N}$.

In the Ciudad Juarez area, residential water supplies were tested in 1987 for possible contamination of groundwater by sewage. Fecal coliform was used as an indicator parameter. Forty-two samples were obtained; 30 from tap water and 12 from raw groundwater. Ninety-one percent of raw groundwater samples were fecal coliform positive. Sixty percent of tap water samples were fecal coliform positive. The percentage of positive bacteria detections in these samples suggested that groundwater beneath Ciudad Juarez was contaminated by sewage.

Water Development and Use in the El Paso-Ciudad Juarez Area

For the past half century, groundwater production from the Hueco-Tularosa aquifer system has greatly exceeded natural recharge and will continue to do so for the foreseeable future. Better quantification of this complex groundwater-flow and -use system is an ongoing process on an international scale. Most groundwater discharge from the Hueco Bolson is due to pumping withdrawals for municipal and military water supply. Quantities of groundwater pumped from the Hueco Bolson for municipal and other purposes have increased by a factor of almost 6 since 1950. Recent trends indicate that municipal pumpage in Mexico increased about 12.5% between 1990 and 1994. Municipal and military pumpage in the United States decreased 24.0% during the same time interval. Pumping trends reflect the increased dependence on groundwater in Mexico, and partial conversion from groundwater to surface-water use in the United States.

For many decades the Hueco Bolson has served as the principal source of public and self-supplied domestic water for the city of El Paso and Ciudad Juarez as well as communities in Doña Ana and Otero counties of New Mexico. The City of El Paso has actively pursued development of alternative supplies, rigorous conservation programs, and recharge programs to prolong the life of the aquifer. In New Mexico, the expanding community of Chaparral, small acreages of irrigated cropland, private wells, and livestock are the principal users of Hueco basin water. In the Tularosa Basin a number of municipal systems, the White Sands Missile Range, as well as self-supplied uses depend on the groundwater resource for domestic supplies. Because the quality of the water in the Tularosa Basin (at least in the central floor area) is extremely saline (exceeding 10,000 mg/L TDS) most systems attempt to capture groundwater near the mountain-front recharge areas.

JORNADA DEL MUERTO BASIN

Overview

The Jornada del Muerto (Jornada) Basin lies west of the Tularosa Basin and northeast of the Mesilla Basin in south-central New Mexico (King et al 1971, Seager et al 1987). The basin-fill (Santa Fe Group) aquifer system has no interstate or trans-international boundary groundwater-flow component. Except for small parts of the basin adjacent to the Rincon and northern Mesilla valleys, this Rio Grande rift basin is a *closed* and *partly drained* structural depression. The basin covers approximately 3,344 square miles and is approximately 12 miles across at its widest section. Its southern boundary is transitional with the northeastern edge the Mesilla Basin.

Groundwater flow in the central part of the Jornada Basin aquifer system is southward down the basin axis and then westward toward the Rio Grande Valley near Rincon (Wilson et al 1981). Groundwater from the southernmost part of the basin generally moves northwestward toward the Rincon area, but a small component also discharges as underflow to the northeastern Mesilla Basin. Recharge occurs primarily from precipitation and infiltration of mountain runoff through major arroyos. Groundwater in the southern section of the Jornada del Muerto Basin is classified as fresh, and water in the northern section of the basin is classified as slightly saline.

Water use in the Jornada Basin is limited to public, self-supplied domestic, industrial, commercial, and livestock. Currently no agricultural activity is present, but there have been limited acreages irrigated in the past. Shomaker and Finch (1996) estimate that the amount of

aquifer recharge in the southern part of the basin is 5,350 acre-feet/year. This area borders the Las Cruces metropolitan area of the northeastern Mesilla Basin and it is a potential source of additional groundwater for urban use. Shomaker and Finch also calculated the amount of water stored in the basin-fill aquifer using an assumed specific yield of 15%. Their estimated volume of groundwater in storage prior to major development is 100,400,000 acre-feet. Since the amount withdrawn (pumped) between 1962 and 1994 is about 39,850 acre-feet, they estimate that the amount remaining in storage is 100,360,000 acre-feet.

MESILLA BASIN

Overview

The Mesilla Basin aquifer system includes the largest rechargeable groundwater reservoir in the border region. It comprises an extensive intermontane basin-fill unit, which is part of the Santa Fe Group (Seager et al 1987), and it extends from central Doña Ana County into northern Chihuahua, Mexico (King et al 1971, Wilson et al 1981, Hawley and Lozinsky 1992, Frenzel and Kaehler 1992, Hawley et al 2001). It is bounded by the Organ-Franklin-Juarez mountain chain on the east, a group of volcanic highlands on the west, and the more-isolated, Robledo and Doña Ana mountains to the north. The southern boundary of the basin-fill aquifer system in the Los Chontes area west of Sierra Juarez is poorly defined because of lack of detailed geological and geophysical studies. The most productive parts of the Mesilla Basin groundwater system are the (1) Upper Quaternary alluvium of the inner Rio Grande Valley (valley-fill aquifer), and (2) poorly consolidated sedimentary deposits of the Santa Fe Group (basin-fill aquifer). The area of the basin's surface watershed is about 1,100 square miles.

The Rio Grande alluvial aquifer underlies the Mesilla Valley floor. Aquifer materials are river-channel and floodplain deposits ranging in texture from sand and gravel to silt and clay. The base of this inner-valley fill is about 60 to 80 feet below a valley floor that is as much as five miles wide. A basal gravel and sand layer, which is as much as 30 to 40 feet thick, was deposited about 15 to 30 thousand years ago during the period of maximum valley incision near the end of the Late Pleistocene ice age. Depths to the water table typically range from about 10 to 25 feet below the floodplain. Both the river and the network of irrigation-water conveyance channels perennially recharge the valley-fill aquifer system, except in times of extreme drought. Most importantly, the Mesilla Valley (shallow) alluvial aquifer system is the major source of recharge to underlying and adjacent parts of the basin-fill aquifer system.

Groundwater within the Mesilla Valley fill is generally unconfined and typically moves southward down the valley towards its termination at El Paso del Norte. However, local-flow direction is also influenced by nearby hydraulic conditions such as the river, drains, canals, well pumpage and heavily irrigated fields. Recharge to the valley-fill aquifer occurs primarily as vertical flow from the surface water system (river, canals, laterals, and drains) and irrigated cropland fields. The majority of discharge from the alluvium occurs as evapotranspiration by irrigated crops, flows to drain systems, irrigation pumping, and industrial pumping. The quality of the water generally reflects the quality of the surface water system, ranging from about 500 mg/L TDS to over 1,000 mg/L TDS.

The major source of fresh groundwater in the Mesilla Basin is Santa Fe Group basin fill. The Santa Fe Group includes thick sequences of clay and silt facies that interfinger with coarser-

grained fluvial facies. The most-productive aquifer zones vary in thickness from about 300 feet in the northern and southernmost parts of the basin to over 2,000 feet in the eastern basin area, which underlies the Mesilla Valley corridor from the Las Cruces metro-area to near Canutillo, Texas. The basic properties of this aquifer system are very similar to those of the Hueco-Tularosa and Jornada de Muerto systems, with which it is locally interconnected. The extent of these systems, and the amount of interbasin groundwater flow is controlled in great part by the hydraulic properties of basin-boundary faults and bedrock units. Fault zones and fine-grained sediments commonly form effective barriers to interbasin flow; however, a small amount of flow may enter or leave the basin at low barrier points associated with zones of high permeability.

The Mesilla Basin-Santa Fe Group aquifer system has three major subdivisions (Hawley and Lozinsky 1992, Hawley et al 2001). These units reflect the geologic history and sedimentary environments of basin-fill deposition. Where saturated, the upper (youngest) part of the Santa Fe Group is the most productive aquifer zone, because it consists primarily of ancestral Rio Grande channel deposits. Dominant textures are sand and gravel, and most beds are unconsolidated; however, this very permeable unit only extends below the water table in the northern third of the basin. Aquifer hydraulic properties range from unconfined to semi-confined, while subjacent aquifer zones are confined.

The middle part of the Santa Fe Group (intermediate or medial aquifer zone) is dominated by fine-grained alluvial-flat and playa-lake sediments. These deposits are less permeable than the upper part of the basin fill sequence due to a greater degree of cementation and the widespread presence of interbedded silty clay layers. This unit, however, probably forms the major aquifer zone in at least the eastern part of the Mesilla Basin, because it is almost entirely below the water table, and extensive layers of clean, permeable sand are present. The lower Santa Fe (or deep-aquifer) unit is primarily fine grained and partly consolidated throughout much of the basin. It, therefore, does not form a significant part of the aquifer system in most areas. The sole exception is a thick, eolian sand (buried ancient dune field), which forms the very productive “deep aquifer” zone of Leggat and others (1962), which extends to as much as 1,000 to 1,500 feet below the Mesilla Valley floor between Mesquite (NM) and Canutillo (TX).

Based on review of data in the Frenzel and Kaehler (1992) groundwater-flow model, Balleau (1999, p. 46) estimated that about 14 million acre-feet of groundwater is stored in the upper 100 feet of saturated basin fill beneath the “West Mesa” surface. Since the upper and middle Santa Fe aquifer system in that area ranges up to 1,000 feet in thickness, there is a very large amount of potable to slightly saline groundwater stored in this part of the basin. Much of the water stored in thicker aquifer units, however, may be very old (up to tens of thousands of years); and has not been effectively recharged during the past 10,000 years except in areas contiguous with major streams. The majority of recharge occurs through mountain-front mechanisms and through vertical groundwater flow from river-valley fill that forms the “shallow” alluvial aquifer.

Groundwater Quality

The quality of the groundwater varies both with depth and across the basin. Water quality in the upper part of the Santa Fe Group generally reflects the groundwater chemistry in adjacent parts of the shallow alluvial (valley-fill) aquifer since this unit is its most significant recharge source. Quality varies greatly, however, because of the varying influence of fine-grained confining zones and many other factors, including inflow from deep groundwater-circulation systems as well as

local water-management practices. Much of the groundwater pumped for irrigation is derived from the unconfined to semi-confined part of the (shallow) aquifer system that includes the river-valley fill and contiguous parts of the upper basin-fill unit. The middle Santa Fe unit is the most heavily developed aquifer zone, in terms of public and private drinking-water production. Water in this unit is generally of better quality than in overlying valley-fill and basin-fill deposits, particularly in the northern part of the basin. Near the basin's southern end, however, available information indicates a significant deterioration in groundwater quality. Water quality in the lower Santa Fe unit is generally poorer than the middle unit except beneath the Mesilla Valley area between Mesquite and Canutillo where the thick deep aquifer sand zone is present. Most of the discharge from the lower Santa Fe unit occurs as municipal and industrial pumping in the Anthony to Canutillo area.

Water development and Use

The Mesilla Basin groundwater is used extensively for all purposes. The largest use is for irrigated agriculture both as a sole source and as supplemental source for the surface water. Agriculture makes use of both the shallow alluvial aquifer as well as the deeper Santa Fe Group aquifer. All public and private domestic water uses depend on this groundwater system as well with most using the deeper aquifer because of its better quality. Groundwater use reported by Wilson and Lucero, 1997 for Dona Ana County was 49,150 acre-feet for irrigated agriculture, 20,716 acre-feet for public water supply, 769 acre-feet for domestic self-supplied, 3,385 acre-feet for livestock, 3,038 for commercial, industrial, and mining, and 2,439 for power. These volumes are for Doña Ana County and are not exclusively from the Mesilla Basin but also include pumping from portions of the Hueco-Tularosa and Jornada Basins.

MIMBRES BASIN

Overview

The Mimbres Basin system is an interconnected group of intermontane subbasins that occupies an area of about 5,140 square miles with about 4,360 square miles in New Mexico (Luna, Grant, Doña Ana, and Sierra Counties) and 770 square miles in Chihuahua. Flow in the basin-fill aquifer system had a significant trans-boundary component (~ 6,500 ac-ft) prior to intensive groundwater exploitation in the Silver City, Deming, and Columbus-Palomas areas for metallic-mineral processing and irrigation agriculture (Hansen et al 1994, Kennedy et al 2000). Most of the region is in the section of the Basin and Range physiographic province that is west of the *Rio Grande rift* structural depression. Much of the western and the entire northern boundary of the basin system are formed by the Continental Divide and most of the eastern border is the surface-water divide with the Rio Grande watershed. The latter area includes parts of the Jornada del Muerto and Mesilla Basin systems and the Rincon Valley of the Rio Grande.

The entire southern boundary of the *open* and *partly-drained* Mimbres Basin system is poorly defined in terms of both surface-and subsurface-flow regimes. Subbasins east and southeast of the Columbus-Palomas area straddle the international boundary and merge southward with the extensive bolson plains of northwestern Chihuahua, which were flooded by “pluvial Lake Palomas” in Late Pleistocene time. This area includes the regional sink for the ancestral Mimbres River system and the terminus of the Rio Casas Grandes at Laguna Guzman. The latter stream

heads in the Sierra Madre Occidental and is the major source of recharge to basin-fill aquifers in this part of Chihuahua.

A mosaic of very deep structural subbasins, with fill thicknesses locally exceeding 5,000 feet, characterizes the hydrogeologic framework of the Mimbres system (Seager 1995). Intervening bedrock highs form not only insular mountain ranges (e.g. the Florida Mountains) and hilly uplands but also buried sills where saturated basin fill is relatively thin and groundwater flow is restricted. The primary aquifer system is formed by unconsolidated to partly indurated sediments of the basin fill, which includes the Gila Group and surficial deposits of the ancestral Mimbres River. The aquifer system is laterally extensive, but its thickness is quite variable and it has unconfined, semiconfined and confined components. Basaltic volcanics interbedded with the middle and lower parts of the basin-fill sequence also form important local aquifer zones, particularly in the Columbus-Palomas area, and in northern parts of the Mimbres Basin.

Coarse-grained, unconsolidated Upper Gila and post-Gila fluvial deposits of the ancestral Mimbres River in the upper 300 feet of the saturated zone near Deming form very productive aquifer units. Basin-fill deposits penetrated at depths below 300 to 600 feet, however, are mostly conglomeratic sandstones and mudstones in the middle and lower parts of the Gila Group, which rarely form good aquifers. A very liberal estimate of available water of good quality in storage is about 30 million acre-feet. This assumes an average thickness of saturated basin-fill of about 300 feet and a specific yield value of 10%. At many localities, however, part of the upper basin fill is either fine grained or partly indurated, and poorer quality groundwater under semi-confined to confined conditions may better characterize the aquifer system.

The Mimbres Basin system is typical of the other basins of the border region in that only a very small percentage of basinwide precipitation and surface runoff contributes to groundwater recharge. Data indicate that this contribution is less than 2% of the average precipitation, or about 63,000 acre-feet, with the mountain-front component being about 55,000 acre-feet. Groundwater in the Mimbres Basin system generally moves from the northern highlands to the interior basins and southward toward the International Boundary. Isolated interior mountains also locally modify the regional flow pattern by adding minor amounts of recharge and altering the width and depth of the basin-fill aquifer. As previously noted, much of this flow has been intercepted by irrigation wells in the Deming and Columbus-Palomas area during the past century.

Groundwater Quality

The groundwater in the northern half of the Mimbres Basin is usually less than 500 mg/L TDS and is especially dilute (<250 mg/L TDS) along the Mimbres River (Hibbs et al 1999). Near and extending across the border, groundwater is usually greater than 500 mg/L TDS reaching concentrations greater than 1,000 mg/L in the southernmost part of the Basin. The alkali hazard is low and the salinity hazard is medium in most groundwater samples collected. The salinity risk increases from medium to high hazard toward the border and the alkali hazard also becomes higher. Nitrate is not a serious threat to the health of the basin's residents with nearly all of the analyses well below 5 mg/L NO₃-N. Only two reported analyses exceed the recommended drinking limit of 10 mg/L NO₃-N.

Water Development and Use

The Mimbres Basin system represents a wide array of land use and landcover categories with forest areas dominating the higher elevations in the north and rangeland in the transition zone to drier, lower-elevation areas to the south. Lowlands contain a mix of irrigated farmland, rangeland and alkali-flats. Rangeland accounts for the majority of the area. Major urban areas include Deming, Silver City, and Hurley, with a few smaller rural communities scattered, such as Columbus, throughout the basin. The Silver City-Hurley area has been one of the largest metallic-mineral producing centers of the American Southwest for more than a century. Copper remains the top mineral commodity but the region has also been the site of significant amounts of lead, zinc, and silver production. It includes the enormous open-pit mines at Tyrone and Santa Rita as well as large related mineral-processing centers at Hurley and Tyrone.

Most of the irrigated cropland is located in the area south of Deming and along the Mimbres River. Cropped acreage in the basin was reported at 35,141 irrigated acres in 1998. The principal crops were pasture 12,204 acres, chile 6,671 acres, cotton 6,380 acres, and small grains 5,420 acres (Hawkes and Libbin 1999). Water use was not reported by hydrologic area for 1998; however, in 1995 the water depletions for irrigated agriculture in the basin were reported at 64,242 acre-feet (Wilson and Lucero 1997). This included 11,657 acre-feet from surface water sources and 52,585 acre-feet from groundwater sources. Hanson and others (1994, p11-13) report that during the 1975 to 1985 period, about 77% of water use in the Mimbres Basin was for irrigated agriculture, with about 16-17% being used for mineral extraction and processing, and less than 4% for urban use. Groundwater provided about 75% of the developed water resources during this time.

HACHITA-MOSCOS BASIN

Overview

The Hachita-Moscós Basin system is southwest of the Mimbres system and it also contains a significant trans-boundary aquifer component (Kennedy et al 2000). The system is an interconnected group of subbasins that cover an area of about 1,040 square miles with about 620 square miles in southwestern New Mexico and 420 square miles in Mexico (Kennedy et al 2000). The northeastern and eastern boundaries of the northern (Wamel-Moscós) subbasin are formed by the Cedar Mountains and Sierra Alta (in Mexico). The western boundary of the Upper Hachita Subbasin is formed by the Little and Big Hatchet ranges. Sierra Rica and the Apache Hills are insular highlands located in the central part of the basin system. This group of fault-block basins is topographically *open*, with ephemeral axial streams (draws) carrying surface flow to a *closed* depression in Chihuahua occupied by the ephemeral-lake plain (*playa*) of Laguna los Moscos. The Upper Hachita Subbasin also receives a small component of surface flow (and groundwater discharge) from the southern part of the Playas Basin system through Hatchet Gap (between the Big and Little Hatchet Mountains).

Ephemeral streams in the Lower (southern) Hachita Subbasin, which straddles the New Mexico-Chihuahua boundary east of the Alamo Hueco Mountains, flow northward toward Laguna los Moscos. This subbasin's eastern border is poorly defined in terms of both surface- and subsurface-flow regimes. The basin system in this area is transitional eastward with the

Ascensión-Boca Grande reach of the lower Rio Casas Grandes and is part of a broad alluvial plain constructed by the ancestral (Pleistocene) Casas Grandes system.

The primary aquifer system is formed by unconsolidated to partly indurated basin-fill deposits of the Upper and Middle Gila units and it has both unconfined and confined hydraulic components. Aquifer zones are laterally extensive, but their thicknesses are quite variable. While the basin-fill aquifer system is as much as 3,000 feet thick, the maximum thickness of the primary groundwater production zone appears to be less than 600 feet. Underlying materials are interpreted as partly indurated and well-consolidated deposits of undivided Middle and Lower Gila units, which have very low hydraulic conductivities and storage coefficients indicative of semiconfined to confined hydraulic conditions. A very liberal estimate of available groundwater of good quality in storage is about 5 million acre-feet. A provisional estimate of annual recharge in this basin system is about 4,800 acre-feet. This estimate assumes that 1% of the mean annual precipitation of 12 inches distributed (unevenly) over a watershed of 770 square miles is available for recharge.

Groundwater flow in much of the basin system generally mimics surface topography and is southward toward the *closed* depression that is occupied by Laguna los Moscos. The latter depression is a *partly drained playa* complex that discharges an undetermined amount of underflow to the contiguous part of the lower Rio Casas Grandes basin. A very preliminary estimate of annual trans-boundary groundwater flow from the United States into Mexico from the combined Upper Hachita and Wamel-Moscos Subbasins is no more than 2,000 acre-feet.

Groundwater Quality

The total dissolved solids (TDS) content of sampled groundwater in the Upper Hachita Subbasin varies from 250 to 1,000 mg/L TDS. In the United States part of the Wamel-Moscos Subbasin, all groundwater has less than 500 mg/L TDS, and several sampled wells produced water with less than 250 mg/L TDS. Near and extending across the International Boundary in the Lower Hachita Subbasin, as well as the two other subbasin areas proximal to Laguna los Moscos, water quality is highly variable with respect to TDS with values ranging from 250 to over 1,000 mg/L. Most of the groundwater samples collected from the Upper Hachita and Wamel-Moscos subbasins have low alkali hazard and medium salinity hazard. Groundwater in the Lower Hachita Subbasin is quite variable in terms of alkali and salinity hazards. These hazards are very high only in the vicinity of Laguna los Moscos. No water samples had nitrate contents exceeding the recommended drinking-water limit of 10 mg/L NO₃ -N, and only one sample (in the Upper Hachita Subbasin) had a value exceeding 5 mg/L NO₃ -N.

Water Development and Use

Land use/landcover in the Hachita-Moscos Basin system is predominantly rangeland with some barren and playa areas. The only urban area is the village of Hachita, and there is no cropland in the basin. Water use is not reported for the area, but consists primarily of domestic wells and livestock water supplied by windmills.

PLAYAS BASIN SYSTEM

Overview

The Playas Basin system comprises two north-trending structural basins and flanking ranges with no significant trans-boundary aquifer components. The groundwater and surface-water divide at the south end of the Upper Playas Subbasin near the Antelope Wells Port of Entry essentially coincides with the International Boundary. All but about 4 square miles of the 925 square miles of the Playas Basin system is in Hidalgo County, New Mexico. The Continental Divide forms the area's western and northern border, following the crest of the Sierra San Luis and Animas Mountain ranges over much of its length. The *open* and *drained* Upper Playas Subbasin contributes surface and subsurface flow to both the Lower Playas and Hachita subbasins (via Hatchet Gap). The South Playas Draw complex occupies much of the upper basin floor and it terminates in a broad alluvial plain west of Hatchet Gap which forms a transition zone between the Upper and Lower Playas subbasins. The *closed* and *partly* drained Lower Playas Subbasin is the *sink* for nearly all of the surface-water and groundwater flow in the basin system. The Playas Lake depression in the central part of the subbasin is the site of "pluvial" Lake Playas, which flooded that area during Late Quaternary intervals that were cooler and wetter than the Historic past. Playas Lake itself comprises a complex subsurface-flow system with *undrained* well as *partly drained playa* components.

As in the Hachita-Moscós and Mimbres Basins to the east, the primary aquifer system is formed by unconsolidated to partly indurated deposits of the upper and middle parts of the Gila Group. The north-central part of the Upper Playas Subbasin appears to have the greatest potential for sustained groundwater production in the entire basin system. The maximum saturated thickness of the aquifer zone is about 1,000 feet. Most production, however, comes from the upper, poorly consolidated layer of basin fill. These deposits are no more than 500 feet thick. A very liberal estimate of available groundwater of good quality that is stored in the Playas Basin aquifer system is about 5 million acre-feet. Only a small percentage (1-2%) of combined basinwide precipitation, runoff from adjacent highlands, and infiltration from axial drainageways contributes to recharge. A provisional estimate of annual recharge is about 5,670 acre-feet. The dominant direction of groundwater flow from the basin-system divide near the International Boundary at Antelope Wells is northward toward the Playas Lake depression in the Lower Playas Subbasin. In predevelopment time, the major discharge process was evapotranspiration loss from a zone of springs and seeps along the southwestern edge of Playas Lake.

A very small component of discharge from the Upper Playas Subbasin, estimated at less than 8 acre-feet/year, spills across a buried bedrock sill at Hatchet Gap and contributes to recharge of the Upper Hachita Subbasin aquifer system. Prior to its interception by irrigation agriculture and mineral processing developments of the past century, a small amount of groundwater also appears to have leaked into the northern Animas Basin system from the northern end of the Lower Animas Subbasin. A provisional estimate of northward flow through the northern part of the Upper Playas Subbasin is about 4,730 acre-feet per year (Hawley et al 2000).

Groundwater Quality

The TDS content of groundwater sampled in the Upper Playas Subbasin varies from less than 250 to 500 mg/L. The southern half of the Lower Playas Subbasin is also characterized by

groundwater salinity values in this TDS range. In the northern part of the Lower Playas Subbasin several samples exhibit salinities greater than 500 mg/L TDS. Even in that area, however, some samples have less than 250 mg/L TDS. Groundwater has low-to-medium salinity hazard and low alkali hazard in the Upper Playas Subbasin; and it has medium salinity and low-to-medium alkali hazards in the Lower Playas Subbasin. Alkali and salinity hazards are higher in the latter subbasin because groundwater is probably older, having had sufficient residence times to dissolve additional mineral matter as water moves northward in the basin system. These data suggest that irrigation water quality is fair to good for most crop varieties in the basin area between Antelope Wells and Playas Lake. Nitrate in all groundwater samples is well below the USEPA drinking water standard of 10 mg/L NO₃ -N in the Playas Basin system. Most samples have less than 1 mg/L NO₃ -N.

Water Development and Use

The Playas Basin system has a moderate array of land use and landcover components, including some forest areas in the Animas Mountains and Sierra San Luis along the western border, and extensive rangeland both on the lower-elevation mountain and piedmont slopes, and on central-basin floors. Large barren, ephemeral-lake plains with alkali flats are also present on basin floors in the Lower (northern) Playas Subbasin. The border community of Antelope Wells-El Berrendo and the industrial town of Playas (Phelps Dodge Corporation) are the only urban centers. Completion of Mexico's Federal Highway 2 across the "San Basilio" Basin to the south will soon link the Casas Grandes Valley (including Ascensión and Janos) and the Douglas, Arizona-Agua Prieta, Sonora areas. This should have a significant impact on near-future development of this segment of the southwestern New Mexico border region.

Most cropland areas that had been developed in the Upper Playas Subbasin are not currently cultivated. Many irrigation water rights have been acquired for mineral processing uses following the construction of the Playas Smelter at the south end of Playas Lake. The annual water use for mineral processing increased from about 3,961 acre-feet in 1990 to about 4,913 acre-feet in 1995. However, the current decline in copper production throughout the region suggests that groundwater production for mine/mill uses (including urban use at Playas) will be curtailed for an unknown period of time.

ANIMAS BASIN SYSTEM

Overview

The Animas Basin system (Hibbs et al 2000, Stone 2000) has no significant trans-boundary aquifer component. The system is an inter-connected group of four geohydrologic subbasins and bordering mountain ranges that covers a watershed area of about 2,448 square miles. Very small portions of the basin system extend into Arizona, Chihuahua and Sonora. The western Lower Animas, Upper Animas and Cloverdale (San Luis) subbasin group is bounded by the Peloncillo and Guadalupe mountain chain which closely follows the New Mexico-Arizona border. The Lordsburg Subbasin to the northeast is bounded by the Big Burro uplift and the Pyramid Mountains. The latter range also separates parts of the Lordsburg and Lower Animas subbasins which merge northwest of Lordsburg. The Continental Divide forms the entire eastern border of the Animas Basin system and in most places it marks the boundary between basin systems (Playas, Hachita Moscos, and Mimbres) with International Boundary aquifer components and

groundwater-flow regimes that ultimately discharge northward to the Gila River Valley (Kennedy et al. 2000).

The *closed* and *drained* Cloverdale Subbasin at the extreme southern end of the basin system has an area of about 177 square miles and is the highest structural depression in the border region. It is separated from the San Bernardino Basin to the west by the Guadalupe Mountains and from the San Basilio Basin and Upper Playas Subbasin on the east by the Sierra San Luis and the San Luis Mountains. The basin floor is the site of pluvial Lake Cloverdale and is now occupied by a large *playa* underlain by a shallow (perched) local aquifer (Hibbs et al 2000, Kennedy et al 2000). This suggests that some groundwater can discharge to both the Upper Animas Subbasin and the Rio San Bernardino Basin (to the southwest via Guadalupe Canyon and Cajon Bonito).

The Upper Animas Subbasin is an *open* and *drained* geohydrologic unit that contains the only perennial and intermittent streams in the basin system. The large watersheds in higher parts of the southern Animas and Peloncillo ranges that flank this subbasin are major contributors to both surface flow and groundwater recharge. The transitional boundary between the Upper and Lower Animas subbasins is located about 6 miles south of the town of Animas near the end of the entrenched valley of Animas Creek. The Lower Animas Subbasin, with an area of about 847 square miles, includes an extensive (Pleistocene) basalt flow and broad alluvial flats. The latter include an extensive network of anastomosing-channels that mark the lower reach of Animas Creek in the Animas-Cotton City area. A very large playa-lake complex north of I-10 is the ultimate *sink* for much of the storm runoff in the basin system. The lowest part of the subbasin (4,130 feet) is occupied by two large *playas* (South and North Alkali Flats). During wetter and cooler parts of Late Quaternary time basin-floor areas below an elevation of 4,196 feet (about 150 mi²) were episodically inundated by pluvial Lake Animas. Lordsburg Draw, the ephemeral axial drainageway of Lordsburg Subbasin also contributes runoff to the South Alkali Flat area.

The hydrogeologic framework of the Animas basin-fill aquifer system is controlled by a linked series of half-grabens and grabens with fill thicknesses probably not exceeding 2,000 feet. Fault-block basins and ranges are the dominant structural features in the Cloverdale-Upper Animas and Lordsburg subbasin areas. The Lower Animas Subbasin and northern end of the Upper Animas Subbasin in the Animas-Cotton City-Alkali Flat area form the deepest part of the basin system. Prominent basin-constrictions, with shallow depths to bedrock and older basin fill (Lower Gila conglomerate) in the Upper Animas and Cloverdale subbasins contribute to “perched-aquifer” conditions of the upper Animas Creek and Cloverdale Playa areas.

The south-central part of the Lower Animas Subbasin (Animas-Cotton City area) appears to have the greatest potential for sustained groundwater production in the entire basin system. The maximum saturated thickness of this aquifer zone is about 1,000 feet. Most production, however, probably comes from the upper, poorly consolidated layer of basin fill, which comprise post-Gila, Animas Creek deposits and the uppermost part of Upper Gila Group. Published maximum discharge ranges for most of the wells in this area are 500 to 1,000 gpm. This extensive aquifer zone is typically less than 500 ft, and it has unconfined, semiconfined and confined hydrologic components. It is laterally extensive but quite variable in thickness. Underlying basin fill comprises well consolidated and partly indurated Middle and Lower Gila units that have very low hydraulic conductivities. Storage coefficients reflect semiconfined and confined aquifer conditions.

A very liberal estimate of available groundwater of good quality that is stored in the Animas Basin aquifer system is about 9.5×10^6 (9.5 million) acre-feet. As has been observed in adjacent basin systems, only a small percentage of combined basinwide precipitation, runoff from adjacent highlands, and infiltration from axial drainageways contributes to recharge. A provisional estimate of annual recharge in parts of the Animas Basin system that constitutes the bolson-plain area of the Lower Animas Subbasin is about 12,700 acre-feet (Kennedy et al 2000). Groundwater flow is generally northward in both “perched” and “deep” aquifers of the Cloverdale and Upper Animas subbasins, and it continues through the Lower Animas Subbasin aquifer system toward the major center of irrigation agriculture between Animas and the Alkali Flats. Groundwater also flows northwestward toward this area through the Lordsburg Subbasin. In predevelopment time, a significant amount of underflow from the Lower Animas Valley-Alkali Flat area moved northward into the Virden-Duncan Subbasin of the Gila River Basin. The published estimate of this outflow component is about 12,700 acre-feet (Kennedy 2000).

There is also probably a very small amount of outflow from a “deep” aquifer in the Cloverdale Subbasin that leaks southwestward across the International Boundary into the Guadalupe Canyon and Cajon Bonito drainages which are tributary to Rio San Bernardino in Sonora. A provisional estimate of northward predevelopment flow across the section of the Lower Animas Subbasin is about 5,913 acre-feet per year. This discharge rate is very close to published estimates of mountain-front and tributary recharge for the central Lower Animas Subbasin.

Groundwater Quality

The TDS content of groundwater sampled in the Cloverdale and Upper Animas subbasins are less than 250 mg/L while water quality in the Lower Animas and Lordsburg subbasins is highly variable, ranging from dilute to moderately saline (Hibbs et al 2000). Only four samples in the Lower Animas Subbasin (NW side) and two samples from the Lordsburg Subbasin exceed the USEPA drinking water standard of 250 mg/L for chloride.

Sampled groundwater has low alkali and low-to-medium salinity hazards in the Cloverdale Subbasin, and it generally has low alkali and medium salinity hazards in the Lordsburg, Upper Animas, and southern Lower Animas subbasins. Groundwater in the northern half of the Lower Animas Subbasin is older and has dissolved evaporite minerals in the Alkali Flat area. In this area the quality varies from low-to-very high alkali hazard and from medium-to-very high salinity hazard. These data suggest that irrigation water quality is fair to good for most crop varieties in the Lordsburg Subbasin and southern half of the Lower Animas Subbasin.

Nitrate is well below the USEPA drinking water standard (10 mg/L NO_3^- -N) in most of the groundwater samples collected in the basin system. Most samples were less than 1 mg/L NO_3^- -N with only two exceeding the USEPA standard near Lordsburg.

Water Development and Water Use

The Animas Basin system represents a moderate array of land use and landcover categories ranging from Ponderosa Pine forest in the higher parts of the Burro Mountains in the north and in the southern Animas, Peloncillo, and Guadalupe mountains adjacent to the Cloverdale and Upper Animas subbasins. Mixed Piñon-Juniper woodlands and grasslands on lower mountain slopes grade rapidly into semidesert-grass and desert-scrub vegetative cover in the rangelands on lower

piedmont slopes and basin floors. A large playa-lake plain including North and South Alkali Flats dominates the floor of the Lower Animas Subbasin and large areas have little or no vegetative cover. Rangeland accounts for the majority of the land cover in the area. Lordsburg is the major urban center with smaller communities of Animas and Cotton City located in the agricultural area of the Lower Animas Subbasin. Most of the irrigated cropland is located in the lower Lordsburg and Animas Valleys. Irrigated crop acreages were reported at 1,015 acres in the Lordsburg Valley and 7,322 acres in the Animas Valley in 1995. Water use for this irrigation in the Lordsburg Subbasin was reported at 2,040 acre-feet and in the Lower Animas Subbasin at 14,542 acre-feet in 1995 (Wilson and Lucero 1997).

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Solid Waste and Air Pollution Summary

Air pollution and hazardous and solid waste disposal and management are, and will continue to be, formidable challenges for the tri-region, Paso del Norte area formed by Doña Ana County, NM; El Paso, TX and Ciudad Juarez, Chihuahua.

Good news in terms of solid waste management, according to authors Carlos Rincon and Luis Raul Cordova, is that Cd. Juarez and Doña Ana County have acceptable landfills and that there are organizations dedicated to the border capable of financing solid-waste related projects. There is also a good level of knowledge about some of border environmental problems, although the region's inhabitants could make better environmental decisions if they had more knowledge of air pollution and solid-waste problems. Some regional environmental weaknesses are related to high levels of solid waste production and a lack of incentive to recover and sell recyclable materials. Possible future programs would aim at reducing waste generation and would weigh the benefits of having local, hazardous waste treatment facilities like the ones that have been deemed necessary by some New Mexico and Chihuahua organizations and businesses. Northern Mexico, for example, has only one hazardous waste disposal site and it is in the state of Nuevo Leon, hundreds of miles from Ciudad Juarez. This distance raises hazardous waste disposal costs and may contribute to illegal dumping.

Air pollution is an environmental issue of great concern to Paso del Norte residents. Already in place to confront the problem is the Joint Advisory Committee (JAC) for the Improvement of Air Quality in the Ciudad Juárez, Chihuahua, El Paso, Texas, and Doña Ana County, New Mexico Air Basin. This organization, the JAC, has already made a number of recommendations on how to improve air quality in the Paso del Norte. Some of these suggestions target mobile (vehicular) and point (factory, commercial and stationary) sources of contamination. Examples of programs that could help reduce the amount of vehicular emissions are vehicle importation regulations, strengthened vehicle inspection and maintenance programs and the construction of more express lanes at border crossings aimed at reducing the amount of exhaust emitted by sitting traffic. Appropriate seasonal gasolines could also help reduce air pollution as would better and reworked traffic flows. Point sources of air pollutant emissions could be reduced by market-based mechanisms such as Basin-wide Emissions Reduction Credits Trading and the development of low-interest loans for environmental projects. The authors also recommend further air-pollution related epidemiological studies.

Solid Waste Management and Air Quality
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Municipal solid and hazardous waste in the Chihuahua and New Mexico border region

The Paso del Norte area is a unique binational community located between the Franklin Mountains and the Sierra de Juarez and is comprised of three political jurisdictions: El Paso, TX; Dona Ana County, NM and Ciudad Juarez, Chihuahua. The Rio defines most of the border between the United States and Mexico within the boundaries of the Paso del Norte community.

During the colonial era the Paso del Norte region was considered a strategic place in the Mexico–New Mexico Camino Real. Later, when part of the region came to belong to the United States, the Paso del Norte became an important border crossing for migration and the exchange of goods and services. Today, increasing globalization and binational agreements such as the North American Free Trade Agreement (NAFTA) offer challenges and opportunities that require a binational focus.

The New Mexico–Chihuahua border region is contained within the Chihuahuan Desert which stretches from the Rio Grande Valley in Southern New Mexico to the San Simon Valley of Southeastern Arizona to an area just north of Mexico City. The Chihuahuan Desert is predominantly a shrub desert and is rich in animal life. The Paso del Norte typically receives 8 inches of rain per year, 90% of which falls between July and October. The area is prone to sand and dust storms due to changes in land use and extensive agriculture. Urbanization and low annual rainfall are always a threat to a fragile ecosystem typical of an arid to semi-arid region.

In the last three decades, the economic development models adopted in the region and the resulting presence of the maquiladora industry have caused high demographic growth, dynamic commercial activity, growing pressure on the natural environment, the deterioration of air quality and insufficient infrastructure expansion to attend to basic urban needs such as water, sewage systems, electricity, transportation, and waste disposal and management. Because of these pressures, air quality and the management and disposal of solid and hazardous wastes have been ever-present issues in a Paso del Norte area which is searching for environmental health progress through binational environmental institutions and programs. While various programs attempt to minimize, reuse, recycle, treat and adequately dispose of waste and try to allow for open communication between regional governments, they are still insufficient in attending to the challenges presented by the development process and the effects of globalization.

Municipal and Industrial Solid Waste

The Chihuahua and New Mexico portion of the Paso del Norte region has a population of nearly 2 million people of which 85% corresponds to Mexico and 15% to the US. This zone registers 2,000 tons of municipal solid waste daily which goes to landfills for final disposal. 1,500 tons of this waste correspond to Chihuahua and 500 tons correspond to New Mexico. This implies an average per capita generation in the region of 0.9 kg per person per day on the Mexican side of the border and 2.2 kg per person per day on the US side.

The origin of the waste and its composition also presents small differences derived mainly from cultural consumption patterns. Waste origin is classified as follows (Mexican% - US%): household waste 60%-55%; industrial waste 24%-20%; commercial waste 14%-24%; uncollected waste 2%-1%. The composition of municipal solid waste is the following (Mex%-US%): organic 45%-35%; cellulose 15%-23%; plastic 10%-15%; glass 7%-10%; metal 5%-7%; other 18%-10%.

In Mexico, state governments set municipal solid waste regulations while municipalities are in charge of enforcing regulations. Municipalities also have the authority to give waste-disposal service concessions to private, authorized companies which pay a fee to dispose of waste in municipal landfills. Municipalities offer free waste-disposal services to homes. These services include collection, transportation and the final disposal of waste. An individual can also go to public transfer stations or directly to the landfill to dispose of waste.

In the case of industry and commerce, waste disposal is contracted through private companies and the waste they collect is disposed of at the municipal landfill. In Juarez, the city landfill is operated by the city and county. It has a surface area of 400 acres and a 37-year service life. The other Chihuahua-New Mexico border municipalities of Janos and Ascención have open-air dumps operated by the city and county.

It should also be mentioned that under current regulations, waste generated from material brought into Mexico for the maquiladora industry must be returned to the country of origin. Thus a US automotive harness manufacturer has to return to the US any packaging that the wire had when it was brought into Mexico. Some organizations are currently looking at the possibility of allowing this waste to be disposed of in Mexico. While the disposal of foreign-origin maquiladora waste in Mexico is permitted under NAFTA, there are still many concerns about whether such waste would be properly handled if left in Mexico.

In the case of Dona Ana County, all residences outside of areas with regular waste pick-up are charged \$12.60 per month whether or not they take their solid waste to one of the county's eight waste transfer stations. Waste from these eight stations is then taken to the South Central Solid Waste Authority (SCSWA) transfer station in Las Cruces where recyclables and reusables are taken out of the waste stream while the rest of the material goes to the Corralitos landfill. County residents not living in areas with regular waste pick-up can independently contract with commercial haulers in which case they do not have to pay the \$12.60 county fee but pay haulers for their services instead. The commercial haulers pay the county a \$1 per month franchise fee for each residence they service. The mandatory \$12.60 fee was recently enacted as a way to get people to dispose of their solid waste in a county facility and not leave on their property or dump it illegally.

Las Cruces, the largest city in Dona Ana County, offers curbside waste pick up for its residents and this waste is taken to the South Central Solid Waste Authority (SCSWA) transfer station in Las Cruces. County, commercial and city waste is weighed at the station and all entities that use the facility are charged a fee for leaving material there. Non-reusable and non-recyclable material from the Las Cruces transfer station is disposed of in the Corralitos landfill. This SCSWA landfill has a total land area of 640 acres, and is operating a permit for 200 acres with an estimated life of 75 to 80 years for the first permit of 200 acres.

Dona Ana County's other notable waste management site is the Camino Real Landfill in Sunland Park, NM near where Texas, New Mexico and Mexico meet. According to its own literature the Camino Real Landfill is "a privately owned solid waste disposal facility that accepts non-hazardous residential, commercial and industrial waste. Camino Real mainly serves southern Doña Ana County and El Paso County, and also accepts certain maquiladora wastes from Juarez and Chihuahua City, Mexico." The site has approximately 480 acres of terrain. Of this full amount, 126.1 acres are currently permitted for use as landfill.

Strengths in solid waste management:

1. The largest population centers (Cd. Juarez and Dona Ana) have acceptable landfills according to their corresponding regulations and have experience in management and disposal.
2. There are national and binational organizations capable of financing projects related to municipal solid waste.
3. The Border Environment Cooperation Commission (BECC) is developing a project to improve comprehensive service conditions in Cd. Juarez and Dona Ana.
4. Waste management and disposal can be improved.
5. There is a considerable level of public education in the areas of waste management and disposal. This could be increased at a relatively low cost.
6. There is a binational environmental agenda that includes the municipal solid waste issue.

Weaknesses:

1. There are high levels of municipal solid waste generation.
2. There is insufficient applied research for waste management and disposal.
3. There is a lack of incentive for waste recovery and marketing.
4. There is insufficient installed waste-disposal capacity.
5. There exists misinformation regarding economic and environmental benefits of municipal solid waste management.
6. There is as a lack of knowledge about national and international institutions that finance waste management.

Possible Solutions:

1. Establish strategies to reduce waste generation as much as possible. This should be guided towards specific waste production: cellulose, plastics, etc.
2. Promote research and adaptation of existing waste recovery and disposal technologies from other countries.
3. Establish waste marketing chains.
4. Increase private participation in Mexico for waste management and disposal.
5. Increase training in management and disposal.
6. Satisfy landfill equipment needs.
7. Continually update and promote public information on municipal solid waste management and disposal.
8. Increase waste collection and transportation capacity.

Hazardous Waste

During the year 2000, 22,000 tons of hazardous waste were returned to the U.S. from the Chihuahua maquiladora industry. Of this total, 85% was generated in Cd. Juarez and 15% in the interior of the state. This return of hazardous maquiladora waste to the U.S. is in accord with the Mexican Federal Environmental Law which states that hazardous waste derived from materials imported to the country through the Temporary Import Program (the maquiladora program) should be returned to its country of origin. Also, 4,700 tons of hazardous waste from Mexican materials and definitely-imported materials were registered in Juarez. This waste was sent to national disposal centers.

Juarez's hazardous waste is generated in 336 maquiladoras and 88 Mexican plants. Seventeen of these are considered medium and large industrial facilities. The remainder is small facilities.

The group classification of returned hazardous waste was as follows: 45% solids, some of which (paper, cardboard, wood, containers, rags, glass, etc.) is contaminated with hazardous waste, 20% oils and solvents, 10% sludge from processes, 5% metal slag contaminated with oil (burr from cuttings) and 20% other hazardous waste. The final destination of registered hazardous waste was as follows: generation of alternate fuel, 43%, recycling, 17%, and final disposal in landfills or incineration, 40%.

During the 1995-2000 period, a 7% increase can be observed in the return of hazardous waste, without a determination if this corresponds to a real increase in hazardous waste generation or to an increase in the reported return of hazardous waste. During that same period it can be observed that 75% of hazardous waste is classified as intrinsic low hazard. However, due to the sheer volume of hazardous waste being managed, there is still a considerable risk to the area.

Follow-up on hazardous waste transboundary movements in is carried out through the Mexican Hazardous Waste Tracking System for the Return of Hazardous Waste (SIRREP). This system includes information on the source of hazardous waste, type, volume, destination, route, transporter, transfer station, shipment date, etc. The system is congruent with the U.S.'s Haztrack with differences mainly due to differing environmental regulations in both countries. Nevertheless, while the administrative procedure for the return of hazardous waste has been simplified, bureaucratic paperwork is still complicated and presents a very high financial expense for companies.

The Mexican Environmental Law foresees that hazardous waste from the maquiladora industry can be treated and disposed of in Mexico as long as the materials that give origin to it are definitely imported and as long as treatment infrastructure is available. If these conditions are not met then hazardous waste must be returned to its place of origin. The first condition is met with NAFTA provisions while for the second condition it is necessary to promote environmental safety and the establishment of a feasible technology infrastructure. It should also be mentioned that there are geo-hydrological conditions in the region which would allow for the citing of a hazardous waste facility.

Some organizations believe that it is important to establish regional systems for the management and disposal of municipal and hazardous wastes given the continued growth of the maquiladora industry, the urban development project that is being promoted by the State of Chihuahua for San Jeronimo, the growth of Santa Teresa, NM and growth towards New Mexico that is being carried out in the urban area of El Paso, TX and Sunland Park, NM. In this sense it is necessary to generate legal and administrative ordinances in both nations. Technical studies must be done and the financial and public sectors should be informed of the advantages of the safe regional treatment and disposal of hazardous waste produced in the Paso del Norte region

Strengths:

1. From a financial perspective there is an important generation of hazardous waste that could draw hazardous-waste treatment and disposal companies to the region.
2. There is basic information regarding the generation and transboundary movement of hazardous waste.
3. There are investors (from Chihuahua and New Mexico) interested in hazardous waste management and disposal.
4. Waste could be used to satisfy the demand for alternate fuels.
5. In the framework of environmental health there are permanent binational cooperation work groups to deal with the hazardous waste.
6. There exists a good level of knowledge of environmental law in both countries.
7. Certain sectors of the population support the regional management and disposal of hazardous waste and there are binational agreements to support these types of initiatives which make compliance easier for small industrial, commercial and service businesses.

Limitations:

1. Scarce management by local governments.
2. Population confused with regards to environmental and health risks.
3. Environmental regulations are confusing and incongruent between both countries.
4. There is an inaccurate idea of the existing potential for hazardous waste treatment in the region.
5. Monopoly attitudes in which new projects are discredited by supporters of the current waste management paradigm.

Possible Solutions:

1. Specify existing hazardous-waste management opportunities and specific investment possibilities.
2. Greater analysis and management of the current hazardous waste situation by local authorities.
3. Review, update and simplify the environmental regulations already in force.
4. Make progress in the standardization of both countries' laws.
5. Update both nation's hazardous waste tracking systems (SIRREP and Haztrack).
6. Create manuals for hazardous waste minimization and the safe environmental management of hazardous waste at the source.
7. Improve and expand sampling systems and analysis laboratories for the identification of hazardous waste.
8. Strengthen existing institutional capacities.
9. Accelerate the participation of binational environmental institutions in regional projects.
10. Elaborate proposals for hazardous-waste management and disposal strategies. Channel these through different routes to environmental authorities from the three levels of government (local, state and federal).
11. Promote scientific research projects and technology adaptation.

Air Quality

Topography, meteorology, economic and population pressures all combine to influence the quality of the air that all Paso del Norte residents breathe. U.S. and Mexican health-based air quality standards are frequently exceeded in the Paso del Norte air basin posing a risk to sensitive individuals such as children, the elderly and those with cardiovascular and lung disease. Because air pollution knows no political boundaries, the binational, tri-state nature of this region poses a significant challenge to the community in addressing its shared air pollution problem.

Air quality is the environmental issue of greatest concern to Paso del Norte residents. In fact, the region's development has led to the deterioration of air quality during the past 20 years. El Paso exceeds the U.S. National Ambient Air Quality Standards (U.S. NAAQS) for ozone, particulate matter and carbon monoxide, portions of southern Dona Ana County exceed the NAAQS for ozone and particulate matter, and Juarez does not meet the Mexican Official Norms for air quality. Long-term exposure to these air pollutants threatens even healthy individuals. Air pollution also causes environmental welfare effects such as visibility impairment, decreased worker productivity, and ecosystem impacts. Growth at Santa Teresa-San Jeronimo will extend the effects of unhealthy air and will bring Dona Ana County to a nonattainment status unless measures are taken in conjunction with neighboring Juarez and El Paso County.

As a result of the grassroots organizing efforts of the Paso del Norte Air Quality Task Force, the Joint Advisory Committee (JAC) for the Improvement of Air Quality in the Ciudad Juárez, Chihuahua, El Paso, Texas, and Doña Ana County, New Mexico Air Basin was established to provide the local community with the means to participate as partners in the improvement of air quality in the Paso del Norte region. The JAC is a binational committee made up of private citizens, private-sector representatives, university officials, federal, state, and local government officials, and non-governmental environmental and public health organizations. The JAC is charged with developing and recommending air quality improvement projects and programs to the U.S.-Mexico La Paz Agreement Air Work Group. The JAC serves as the local community-based organization overseeing the process to achieve cleaner air for the Paso del Norte region.

There are limited personnel and financial resources to address air quality problems in the Paso del Norte air basin. Thus, in order to leverage resources and not duplicate ongoing efforts, the Joint Advisory Committee focused its activities on areas that offer the greatest "bang for the buck." A Strategic Plan Technical Commission was formed to organize and guide the development process which was developed openly with representation from all sectors of the Paso del Norte community. The resulting strategic plan outlines the JAC's mission and objectives, addresses priority air quality planning and management issues and proposes specific actions that the Air Work Group undertake.

As per the JAC strategic plan, mobile sources are the main cause of air pollution within the Paso del Norte region. Urban sprawl and the future development of Southern New Mexico and Chihuahua will increase pollutants due to the resultant rises in vehicle use and commercial and passenger vehicle border crossings. The plan recognizes that to protect public health for all Paso del Norte residents it is important to design strategies and undertake actions aimed at pollution prevention and control within the air basin. It is also necessary to direct resources and efforts toward a basin-wide approach while respecting jurisdictions and sovereignty within a framework

of binational cooperation.

Because of the JAC's tristate, binational approach to air-basin management, air quality has been improving in the last decade. This is why it is important to include measures described in the strategic plan throughout the three communities: Dona Ana, El Paso and Ciudad Juarez. Below is a list of measures now in place within the El Paso and Juarez communities which could also be enforced in Dona Ana County to mitigate the effects of urban sprawl and development in Southern New Mexico.

Opportunities:

Mobile Sources:

1. Enforce vehicle importation regulations.
2. Strengthen vehicle inspection and maintenance programs.
3. Promote dedicated commuter lanes (express lanes) to expedite crossing at international bridges and thereby reduce the amount of exhaust emitted by sitting traffic.
4. Require the distribution of seasonally appropriate gasoline such as low-RVP (Reid vapor pressure) gasoline during summer and oxygenated gasoline during the winter.
5. Improve and promote the transit system.
6. Improve vehicle traffic flow.

Industrial / Commercial / Service Sector -- Area / Point Sources:

7. Recommend to the industrial, commercial, and service sectors, as well as government, the implementation of voluntary programs, beyond compliance with rules and regulations, for the reduction of total combustion emissions, suspended particles and VOCs.
8. Regulate the use of fuels in the fabrication of brick.
9. Strengthen reforestation programs.

Health

10. Conduct epidemiological studies to assess the health impacts of current exposure to air pollutants.
11. Develop health education programs to achieve changes in personal habits regarding care for the environment with a special emphasis on air quality.
12. Institute an epidemiological surveillance program associated with air pollution.

Air Quality Planning

13. Procure resources to expand and update a basin-wide emissions inventory.
14. Update and improve a basin-wide VOC emissions inventory.

Outreach:

15. Identify and promote pollution prevention and reduction incentive programs that can be used in conjunction with public and industry outreach efforts to achieve voluntary compliance and emissions reductions.

Legislation / Regulation

16. Adapt the State of Chihuahua Ecological Law to coincide with reforms of the General Law of Ecological Equilibrium and Environmental Protection (LGEEPA).
17. Update Juarez environmental regulations.
18. Promote reforms to regulations, specifically for air pollution prevention and control.
19. Implement reforms and standards regarding volatile organic compounds (VOCs) emissions.

Economic Incentives

20. Promote the Voluntary Environmental Audit Program, follow up on resulting agreements and certify "clean industries."
21. Promote economic mechanisms of a fiscal, financial & market-based character (e.g. low-interest rate loans, Basin-wide Emissions Reduction Credits Trading, etc.) to provide incentives for the prevention and control of air pollution in each country according to its rules and regulations.
22. Establish guidelines to promote and implement a basin-wide Clean Air Investment Fund.

Applied Research and Special Studies

23. Promote research projects to characterize the nature of particulate matter (PM) in the PM_{2.5} and PM₁₀ fractions within the airshed. Determine PM ambient concentrations, size and mass distribution, spatial and temporal distribution, and chemical composition (organic and inorganic).
24. Develop studies for the determination of VOC emissions factors.
25. Coordinate monitoring and research activities within the airshed. Establish a regional clearing house.

26. Undertake a study of the socio-economic and cultural factors which may determine compliance and non-compliance with air quality rules and regulations.

Financing

27. Identify potential funding sources for priority projects.

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Border Health Summary

Jeffrey Brandon, Dean of the College of Health and Social Services at NMSU, concludes his article by making the point that, ultimately, it will be improved economic conditions that will make for a better public health situation in Southern New Mexico. While this need for, and the path to, new and better employment opportunities in the region is something that this Town Hall meeting will address, there are immediate health problems that need to be confronted with a variety of programs. Indeed, the very force of globalization which is bringing development and the possibility of more development to Southern New Mexico is partly to blame for a public health crisis in the region because of the way in which globalization necessitates an increased number of border crossings, and rapid, border population gain which, especially in Mexico, overwhelms public-health, water and housing infrastructure.

Brandon mentions three chronic diseases that are more prevalent on the border than they are nationally. These are cervical cancer, liver disease and diabetes, one of the border's biggest health problems. Brandon also states that breast cancer is often diagnosed late in its development thus making it harder to combat. Tuberculosis, drug-resistant Tuberculosis and HIV are also significant infectious diseases in the US-Mexico borderlands.

New Mexico's border region also faces severe challenges in the area of environmental health, particularly in areas without services known as colonias. Many people in these low-income areas and others do not have access to safe water and many homes throughout the state's border region are not connected to a public sewer system. Air pollution is another cause of health problems, especially in Sunland Park, NM.

Hopes on both sides of the border region are high for the United States-Mexico Border Health Commission which met for the first time in the year 2000. Also, some of the U.S. border states are working with Border Health Offices to develop health objectives for the region. Finally, in the past, Brandon himself has recommended the use of culturally sensitive intervention approaches such as the use of community health workers (promotoras), community organization and community empowerment models to help improve public health in the borderlands. These community-based efforts also lend themselves to bi-national approaches.

Health Challenges Along the U.S.-Mexico Border

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What are the public health disparities and needs along the U.S.-Mexico border, in short, what distinguishes this part of New Mexico? The U.S.-Mexico border populations face numerous health problems which are a function of the rapidly increasing population, frequent movement between the two countries, the higher levels of unemployment and poverty, the higher percentage of uninsured and under-insured living here, language and cultural differences which occasionally are challenges in interacting effectively with health care providers as well as with our fragmented and complex health care systems. What are these problems and health disparities?

The U.S. Health Resources and Services Administration head, Dr. Claude Earl Fox, said in his introduction to Assuring a healthy future along the U.S.-Mexico border (HRSA, 2000), "Because of poverty, poor housing, inadequate sanitation, and environmental health risks, border residents have a higher incidence of disease and disability and far less access to the essential preventive and primary health care they need. These problems are now escalating with recent population growth, which makes the situation even more demanding of our attention." This report went on to state:

If made the 51st State, the border area (which we define ... as 62.5 miles or 100 kilometers north of the border) would rank last in access to health care, second in death rates due to hepatitis, and third in deaths related to diabetes. Tuberculosis, which is becoming drug resistant, is six-times the national rate on the border. And vaccine-preventable measles and mumps are twice the national rate. In addition, HIV/AIDS is spreading rapidly, especially in large to mid-sized U.S.-Mexico sister cities and among farmworkers. As a State, the border area also would rank last in per capita income, first in numbers of school children living in poverty, and first in numbers of children who are uninsured. Environmentally, the picture is not much brighter. Raw sewage and toxic waste contaminate rivers and land, and air pollution levels greatly exceed standards set by the Environmental Protection Agency.

Most of these issues are rooted in poverty, lack of a good education, and inadequate access to health care and public health services. The inability of the region's public health infrastructure to keep up with the rapid growth is a particular challenge, as is the realization that simply bringing in standard interventions from other parts of the nation would be inappropriate without addressing the language and cultural differences. According to Dr. Hugo Vilchis, Director of the Border Epidemiology and Environmental Health Center located on the campus of New Mexico State University in Las Cruces, A...the difficulty is that the increasingly porous border and the high influx of immigrants, many from impoverished villages from Mexico's interior has created a highly fluid population, in which many families with members in both countries regularly travel back and forth, legally and illegally, to visit, work, and shop (p. 1021, McCarthy, 2000)."

The 167 mile border New Mexico shares with Mexico is comprised of five counties. The area is

largely rural and desert, with Dona Ana county being the largest population center with 169,175 persons. The only major urban area along this border is Las Cruces. This city, along with Sunland Park (both in Dona Ana County), has experienced considerable growth. Dona Ana county has grown by almost 25% between 1990 and 1998. Both are also part of the Las Cruces-El Paso-Juarez corridor or Asister cities complex. This region suffers higher poverty rates. Twenty-seven percent of the population in Dona Ana county and 32% of the population in Luna county live at or below the poverty level. The median household income in the border area here is \$14,000 compared to \$16,346 for the state, with Luna county having the highest unemployment rate in the state (28.2% for Luna and 8.5% for Dona Ana counties versus 6.4% statewide) (HRSA, 2000). An estimated 30% of this state's border region is uninsured or underinsured. Fifty-eight percent of the population's ethnicity in Dona Ana County is of Hispanic descent, with 38% being white, non-Hispanic.

The major chronic disease confronting border populations is diabetes. Type II diabetes has a prevalence among Mexican-Americans that is three times greater than the population as a whole (Furino & Munoz, 1991). A report entitled "A Health on the U.S.-Mexico border: Past, present, & future" preparatory report to the future United States-Mexico Border Health Commission (OIRH, 2000), stated that diabetes is one of the leading causes of death in both countries, and that the chronic disease conditions more prevalent along the border when compared to national rates included cervical cancer and liver diseases as well as diabetes. The mortality rate from diabetes is two to three times more prevalent among Mexican-Americans than non-Hispanic whites, and for both males and females, is higher in Dona Ana county than the rest of the state (HRSA, 2000). The area's large Hispanic population has risk factors known to lead to Type II diabetes, namely obesity, physical inactivity, and diet (HRSA, 2000). For example, according to this HRSA report, one in three in Dona Ana county report obesity, compared with one in every five people statewide. Certain diseases, such as breast cancer among women, are also diagnosed at a later stage, which limits treatment options and prognoses. The four U.S. border states have statistically significant higher rates of brucellosis, hepatitis A, measles, mumps, pertussis, botulism, salmonellosis, shigellosis, and streptococcal disease (Doyle, Ellinas & Bryan, 1998), and sexually transmitted diseases, HIV/AIDS and tuberculosis are also serious health problems along this border (CDC as cited in OIRH, 2000).

Tuberculosis incidence, complications in case management, and lack of coordinated care among this highly mobile population are receiving increased interest. A recent "Morbidity and Mortality Weekly Report" (CDC, 2001) reported that TB among foreign-born persons living in the U.S. was increasing, and that the factors contributing to this increase included the previously referenced factors as well as Mexico's higher TB rate. Tuberculosis cases in Dona Ana, Otero and Grant counties are approximately at the state's average of 4 cases per 100,000, but Luna county has a TB rate more than double the New Mexico average with 9 cases per 100,000. Yet the rates for New Mexico's border region are less than other areas along the shared border. Rates (per 100,000 population) are reported to be 22.9 in Laredo and 39.7 in Nuevo Laredo; 21.8 in Brownsville and 70.3 in Matamoros; 15.1 in McAllen and 43.9 in Reynosa; 10.1 in El Paso and 17.8 in Juarez; 10.3 in San Diego (with 23.5 cases/100,000 among Hispanics of predominately Mexican descent) (CDC, 2001).

The other infectious disease receiving increased attention is HIV/AIDS. In 1992, the prevalence rate of AIDS cases in the Mexican border states was 9.1 cases/100,000 with the rate being 14.6

cases/100,000 in the U.S. border states, and rates have been increasing in the past few years (Barnes, Buckingham, & Wesley, 1997). Along the U.S.-Mexico border, HIV infection is the seventh principal cause of death, particularly apparent in the Hispanic, 25-44 age group (CDC, 1995), and according to Ortega (1995), AIDS is the sixth leading cause of death on the Mexican side of the border. California and Texas are among the highest in the U.S. for cumulative AIDS cases (Barnes et al, 1997). While the cumulative AIDS cases are 1,046 for New Mexico, with 30 % among Hispanics compared to 21% for the nation, there is limited epidemiological data in the border area.

Environmental health issues also distinguish the border area of New Mexico. Water shortages require many New Mexican border residents to rely upon surface water rather than ground water, with about 19% of our border residents using water from non-regulated, private drinking wells (HRSA, 2000). This is a concern because studies have identified high levels of bacterial contaminants, viruses, and metals in well water (HRSA, 2000). In a local border health environmental survey conducted and reported by the NM Border Health Office (2000), 17% of households in the region reported reliance on well water and 27% reported not being connected to a public sewer system. This same local survey reported that 9% of the households had a family member diagnosed with asthma, with 32% of the adult population reporting respiratory problems associated with dust. Air pollution is a problem in the El Paso/Sunland Park, NM area (which has been designated by the EPA as a critical area for air quality monitoring), largely caused by open-air burning of trash and solid waste, carbon monoxide and ozone (HRSA, 2000).

A question raised by residents from the more distant areas of New Mexico and other U.S. border states, is how might being a border state affect the health of the rest of the state, or in what we call border Aimpact@ zones or regions? Infectious diseases are not limited to one side of the border or the other, but are shared concerns. Due to the large number of border crossings found in the dozen or so border-wide sister cities, as well as due to the high immigration rates, infectious diseases and re-emerging infectious diseases are becoming global problems (OIRH, 2000). According to this report, as more people travel frequently across our border, not only do they spread disease, they also make it more difficult for epidemiologists to track the origin of a disease.

Health conditions in our border communities can easily affect the health status of our more distant communities. As Santa Theresa and nearby border communities in southern New Mexico and in the Las CrucesBEl Paso--Juarez sister city corridor continue to experience population growth and increased mobility due to the new crossing and the growth of economic opportunities created by NAFTA and the expansion of maquiladora industries, the State of New Mexico will share the health risks of this region. This rapid growth was the focus of a recent article in The Economist (Special Report, 2001), which indicated that within the past decade, the population on the Mexican side of this border has increased by nearly half, compared with one-fifth across the boundary and with just 13% living outside the ten biggest cities.

What is being done to address and solve the health challenges of this rapidly increasing and changing border region? The recognition that solutions must come bi-nationally has led to the formation of joint, U.S.-Mexico, efforts such as the U.S.-Mexico Bi-national Commission (BNC), the Border Environment Cooperation Commission (BECC) and its associated North American Development Bank (NAD Bank), as well as the recently launched U.S.-Mexico

Border Health Commission. The US-Mexico BNC was created in 1977 to be a forum for cabinet level officials. It includes 14 working groups in such areas as agriculture, education and cultural affairs, environment and natural resources, transportation and health. The BECC and NAD Bank, created under NAFTA, were to work with communities to develop and finance environmental challenges between the two nations. PL 104-300, the ABorder Health Commission Act@ was passed in 1994. It authorized the President to negotiate an agreement with Mexico to establish the United States-Mexico Border Health Commission (OIRH, 2000). This organization was to institutionalize a domestic focus on border health and to create a venue for bi-national discussion to address public health issues and problems that affect the border population. Mexico=s senate approved their version of this act in July of 2000, and the first bi-national meeting of this body was held on November 27, 2000 in the El Paso home of the U.S. Section=s hub office. The U.S. Section of this Commission was charged with identifying, evaluating, preventing, and resolving health problems and potential health problems that affect the populations of this area, as well as to implement the actions recommended through needs assessments.

Three of the four border states on the U.S. side have created outreach offices that work in collaboration with the Border Health Offices in their respective states. The first effort of this group was to develop health goals or objectives for the border region. This document, soon to be released, will most likely be called AHealthy Border 2010," with its predecessor being referred to as AHealthy Gente 2010." Dr. Sam Notzon from the National Center for Health Statistics, with assistance from staff of the four Border Health Offices, is coordinating this effort. Selected objectives were presented (Brandon & Torres, 2001) at the regional conference entitled ABorder Environmental Health@ held in Las Cruces. An upcoming presentation of these objectives will be made in the fall, 2001 during the American Public Health Association=s annual meeting in Atlanta. With support from the New Mexico Outreach Office of the U.S.-Mexico Border Health Commission, residents in Columbus are developing and implementing intervention plans as part of the AHealthy Gente 2010" project.

The U.S.-Mexico Border Health Commission will be involved in identifying ABenchmarks@ and in identifying model public health intervention programs to help address these health issues and meet these health objectives. Brandon (1997) has recommended the use of culturally sensitive intervention approaches such as the use of community health workers (promotoras), community organization and community empowerment models, which lend themselves to bi-national approaches. HRSA=s ABorder Vision Fronteriza@ outreach project is one such model that uses promotoras from border cities to enroll children in the Children=s Health Insurance Program (CHIP) and Medicaid (HRSA, 2000). Such bi-national efforts are consistent with the systems approach to solutions proposed for addressing border health problems (Bruhn, 1997). This approach allows us to:

- (1) focus on several problems simultaneously;
- (2) provides a holistic perspective for planning and forecasting;
- (3) it shifts the emphasis from quick-fix solutions to long-term ones;
- (4) it examines the process and effects of change; and
- (5) it involves all levels of complexity of a living system. Border health problems are simultaneously local and international; therefore, interventions in one country or at one level within a country will not bring about lasting solutions (p. 186).

Dr. Bruhn began his chapter by referencing a statement that AAs Mexico and the United States become more interdependent, there is an emergence of a ‘Mexamerica,’ a binational, bicultural, and bilingual regional complex that shares opportunities as well as ecology and the quality of life (McCarthy, 1983).” Local interventions and cross-border cooperation, as well as governmental and public-private support from both countries will be instrumental in addressing and improving the shared health issues along this border. Yet, the root cause of these many health problems must also be addressed. Improved employment opportunities, supported by improved public school education, public health and health care systems, are needed to reduce the devastating impact of poverty. Quoting the former director of New Mexico=s Department of Health=s Public Health Office for District III, Dr. David Steffen, AUltimately, it will be workB and the kind of work availableB that will turn the health and social problems around for people living in the border communities of New Mexico (p. 1022, McCarthy, 2000).”

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Immigration Summary

Professor Alison Newby's article makes a case for resources being directed to the study of foreign immigration to New Mexico. As Newby points out, there is little data available about many aspects of immigration to the state. For example, information on the legal status of the foreign-born population residing in the state is lacking. There is also a paucity of information about how long immigrants stay and plan to stay in the state. Without such necessary information it will be hard for the state to make good decisions in the realm of immigration.

Another part of the immigration equation that has not been well explored is whether or not an increased law enforcement presence at the border truly keeps undocumented people out of the US. Also, Border Patrol checkpoints, typically located a few miles away from the border, may have an effect on migration patterns. The checkpoints may cause undocumented immigrants to accept lower-paying jobs south of the checkpoints because they do not want to risk apprehension by moving north. Undocumented migrants already to the north of the checkpoints may end up making less visits to Mexico than they otherwise would because of fears related to having to cross through checkpoints on their return trips to the US.

Another aspect of immigration in the state is that although people may cross into the US through New Mexico they do not want to stay in the state. Much higher wages and established communities (often filled with people from the same Mexican state or even city) often await migrants in the north.

Other aspects of immigration's impact on New Mexico have to do with education, health and other services. As undocumented people do live in the border states and will continue to do so whether or not they receive social services, might it not be wise for the US to provide education for people that could spend their entire lives here? Might it not make sense to provide vaccinations to ward off epidemics? Might it not be less expensive and more humane to provide prenatal care for women whose children will be born US citizens? Might it not be wise from the standpoint of road safety to let people take a driver's license test and become licensed drivers as Texas recently attempted?

Finally, economic growth on both sides of the New Mexico-Mexico border will bring more people to the region. The arrival of these people may challenge New Mexicans to confront their ethnic and historic ties to Mexico. Perhaps New Mexico will want to decide what level of immigration law enforcement it is comfortable with on and near the border. Will New Mexicans want California-style barriers of two high, steel walls with a raised Border Patrol road between them dividing twin cities such as Palomas and Columbus, San Jeronimo and Santa Teresa? Will New Mexicans whose families have lived for generations in small towns throughout the area want an increased Border Patrol presence?

Immigration is not just an economic matter but is also a phenomena that will affect the feel, tone and quality of life in Southern New Mexico and it may challenge New Mexicans to decide what relationship they want with people from the neighboring country.

Immigration in the New Mexico Border Region¹¹

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While New Mexico's border with Mexico has been of little interest to policymakers in the past, recent trends in immigration from the south (principally Mexico) along with media coverage of border events bring attention to the region. Although the length of New Mexico's border may not equal that of other states, as the state grows, increasingly larger numbers of the state's residents will be affected by their proximity to this national boundary. Of New Mexico's thirty-three counties, three (Dona Ana, Luna and Hidalgo) share a 225-mile border with Mexico. These counties differ greatly in terms of population, levels of urbanization, and the potential impact of increasing immigration to the region. Dona Ana is the largest border county with a population of over 174,000 according to the 2000 census and continues to be one of the most rapidly growing counties in the state. Although immigration plays the largest role in local growth, Las Cruces' development as a retirement community also serves to attract population. Hidalgo is the smallest county with a population of a little over 5,900 and has actually lost population in the past 10 years.

Immigration has been one of the main factors in growth throughout New Mexico, and the border region is no exception. Between 1980 and 1990 New Mexico's overall population grew by about 16 percent, while its foreign-born population grew by close to 54 percent. In 1990, Mexico accounted for five-eighths of the state's total foreign-born population with the city of Las Cruces having the highest foreign-born concentration (nearly 15 percent of its population). It is important to keep in mind that these numbers include all foreign-born with or without documents and tell us nothing about the time of residence in the United States. Unfortunately, numbers of foreign-born are not yet available from the 2000 census.

Policymakers should expect continued growth on both the U.S. and Mexican sides of the border. The port of entry at Santa Teresa, New Mexico has the potential to become a major industrial, commercial and pedestrian crossing. Plans for development on the Mexican side (San Jeronimo) will serve to attract population there as well. Although some migrants to Mexico's northern border may eventually cross into New Mexico, their primary destination is within Mexico, especially those areas like the border with growing employment opportunities.

Despite initial objections¹², in 1997 the Border Patrol completed a 1.3 mile long, 10 foot tall, steel-mesh fence that separates Mexico's Anapra neighborhood from Sunland Park, New Mexico; both residential areas. More physical barriers are likely over the next few years, especially in anticipation of the expected growth in San Jeronimo. While it is impossible to predict the exact nature of the barriers, it is doubtful that New Mexico will see the construction of metal walls like the California case. Although the political climate could change, many Southern New Mexico residents have important familial ties to Mexico which influence their views on the construction of a barrier such as a wall between the two countries.

¹¹ The scope of this report is limited by data availability. There is little specific information of immigration to the New Mexico border region and even less on the specific characteristics of immigrants, their legal status and tendency towards permanent settlement in the area.

¹² Many area residents objected to a fence dividing an area with strong cross-border ties.

Increased presence of Border Patrol

Much of recent U.S. immigration policy has focused specifically on the border region (and those who cross into the United States without documents). Overall, most immigrants enter the country legally with student or tourist visas, but remain in the U.S. after their visas have expired. The escalation of border enforcement has influenced where, how, and how often illegal immigrants cross the border. At the same time, tighter control of the border does not indicate that large numbers of would-be border crossers are giving up their efforts, nor that they will do so in the near future. Border buildup has shifted unauthorized crossings to less-visible areas, including those in New Mexico, making the urban crossing points (El Paso and San Diego, for example) appear more orderly. For the migrants who cross without documents, the trip has become much more dangerous.

The INS focus on the border has brought about unprecedented growth in the size of the agency and the number of agents stationed in border areas. Consequently, to the extent that immigration policy remains focused on controlling the border specifically, Southern New Mexico residents should be prepared for increased Border Patrol presence throughout the region.

Despite the fact that New Mexico has not been known as an important destination for Mexican immigrants, the historical relationship between the two areas, along with their shared border have influenced Mexicans to migrate to New Mexico. Available data (mainly from the U.S. Bureau of the Census) provide few insights into trends in migration into the New Mexico border area. INS apprehension data shows an increase in illegal alien apprehension. This may or may not reflect an actual increase in undocumented crossings, since it only reflects the number of people actually caught by the INS. It does not provide information on the tendency of those without documents to actually settle in New Mexico¹³. An increase in apprehensions could also reflect the fact that increased Border Patrol surveillance in more urban areas has forced migrants to attempt crossing the more isolated desert areas of the border. At the same time, the increasing difficulty (and expense) of crossing the border without legal documents has encouraged migrants to extend their stay or perhaps even settle permanently.

Increased Border Patrol presence will have a number of potential consequences for the local population, including established Mexican-American communities. The experiences of other border communities with an established Mexican American presence (like El Paso) should be taken as examples of the potential for conflict. Even the *possibility* of de facto racial profiling by the INS affects people's sense of security within their community and their willingness to participate fully as community members.

Residents of Southern New Mexico are subject to a much higher frequency of interaction with law enforcement agents than persons residing in other areas of the United States, especially with increasing border enforcement efforts. Current immigration policy focusing on the border places a special burden on the population residing in the region. Local residents (especially those from a Mexican background) pay the price for a national policy. Although one cannot predict the outcome of increasing Border Patrol presence with certainty, there will be an enormous potential for misunderstanding and violation of human rights. Individual Border Patrol agents and the agency as a whole must be held accountable for their actions in the course of performing their duties and recent sensitivity training efforts should be continued. Local residents (both documented and undocumented) should also be informed of their rights in situations involving the Border Patrol.

¹³ It is important to remember that INS apprehension data can be interpreted in various ways. This data tells us nothing about potential settlement in Southern New Mexico.

It is difficult to arrive at any real conclusion as to the extent of immigration to New Mexico in the future. Current proposals for different types of amnesty could obviously affect both immigrant stocks (the number of migrants already here) and flows (the number entering and leaving) if eventually passed. At the same time, the demand for agricultural workers, and the increase in Border Patrol checkpoints on highways leading to the interior of the U.S. could serve to retain large numbers of undocumented migrants close to the border in what could be considered a type of “buffer zone.”

As mentioned previously, the relatively high levels of unemployment in Southern New Mexico combined with the abundance of low-skilled workers does not make the region an attractive destination in economic terms. There are a number of issues that do not encourage Mexican immigrants to settle in New Mexico. Although economics play an important role in migration they do not provide the whole picture. Migration is essentially a social process and migrants tend to settle in specific regions because of existing network connections between sending and receiving areas. Of course there are migrants who settle in Southern New Mexico, but preliminary studies appear to indicate that many are from the northern Mexican states and are taking advantage of long-standing family and friendship connections to the area. This is a very different scenario from larger urban centers which may attract large groups of immigrants from specific regions within Mexico. It is likely that the Southern New Mexico area will see an increase in a “floating” population of immigrants who may spend some time in the region on their way to the interior and better jobs with higher wages.

It is unfortunate that at the present time there is little data on New Mexico’s immigrant population and its characteristics. Potential changes in immigration and border policy will necessitate a better understanding of this population, especially in the southern part of the state which will see itself most affected by new legislation. Many potential problems could be addressed before becoming crisis if better information were available for analysis.

Summary of Agriculture in New Mexico

In the coming years, New Mexico farms will face a number of challenges in the form of international trade, agricultural labor costs and availability, competition for natural resources, and environmental issues, according to NMSU professor and agricultural economist Rhonda Skaggs. In addition to these obstacles, New Mexico's approximately 14,000 farms will continue to comprise an ever-smaller portion of the state's gross product which could result in their political and economic marginalization. The changing economics of agriculture will also squeeze out medium-size farms while large, commercial farms will produce almost all of the state's agricultural commodities.

Competition for land and water, in which land and water rights could pass from agriculture to urban or commercial use, could alter the landscape and character of New Mexico. Lost would be a number of agricultural-related benefits that Skaggs cites as "agricultural open space and landscape amenities, wildlife habitat, cultural or social heritage, relationship to local tourism, and rural lifestyle opportunities." Faced with decreasing future importance for agriculture—farm income as a percentage of all personal income in the state decreased from 4.3% in 1970 to 1.8% in 1999—New Mexicans may want to decide if or how they preserve state agriculture and farms.

A combination of increased international trade as brought about by NAFTA and an increase in the price of agricultural labor in New Mexico has already changed the mix of crops that are produced in the state. For example, since the mid-1990s, chile imports to the US from Mexico have increased while the number of New Mexico acres planted in chile peaked in 1992. If New Mexico decides that it wishes, for economic and/or cultural reasons, to remain in chile production, short-term hope for the crop exists in the mechanization of harvesting and cleaning. Future declines in chile production may prevent state chile processors from remaining open, according to Skaggs. While free trade along the lines of NAFTA appears inevitable, New Mexico may want to join in on the discussion of the various immigration scenarios that could affect the price of agricultural labor.

The growth of large livestock commodity producers will also mean changes for the state. Currently, New Mexico ranks eleventh in terms of total state milk production, fifth in milk production per cow, and tenth in total milk production. Future growth in this area is expected although state residents may want to decide where this growth occurs. As Skaggs writes, "the dry-lot dairies of Southern New Mexico produce enormous quantities of milk, however, there are numerous significant negative environmental and aesthetic externalities that result from large animal confinement operations. The term landscape "disamenity" has been used to describe these types of farms – particularly when they are compared with the bucolic landscapes usually associated with smaller farms, including small dairies."

The following article also looks at future changes to the size and nature of New Mexico farms, cattle operations, and agricultural differences between Southern New Mexico counties.

Agriculture in New Mexico

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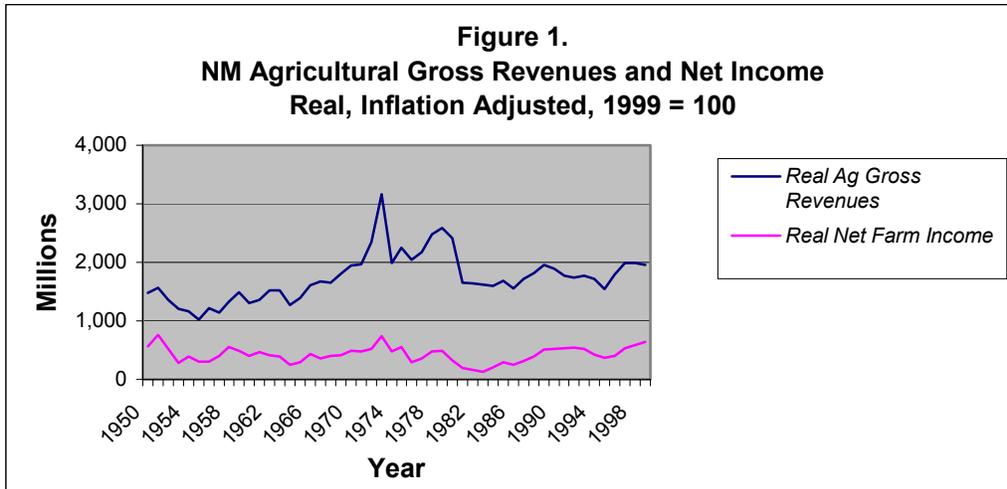
Production Agriculture in New Mexico Relative to the Rest of the Economy

Production agriculture is that part of the economy that involves the production of raw food and fiber commodities on farms and ranches. Production agriculture is also referred to as the “farm sector” and includes both crop and livestock products. Since 1950, the size of the U.S. farm sector has decreased to where it now accounts for approximately 1% of total US gross domestic product (GDP), and employs 1% of the U.S. workforce. Over the last several decades, the value of agricultural output in the U.S. has grown in absolute size; however, the overall economy has become so much larger that production agriculture is relatively smaller than it ever has been.

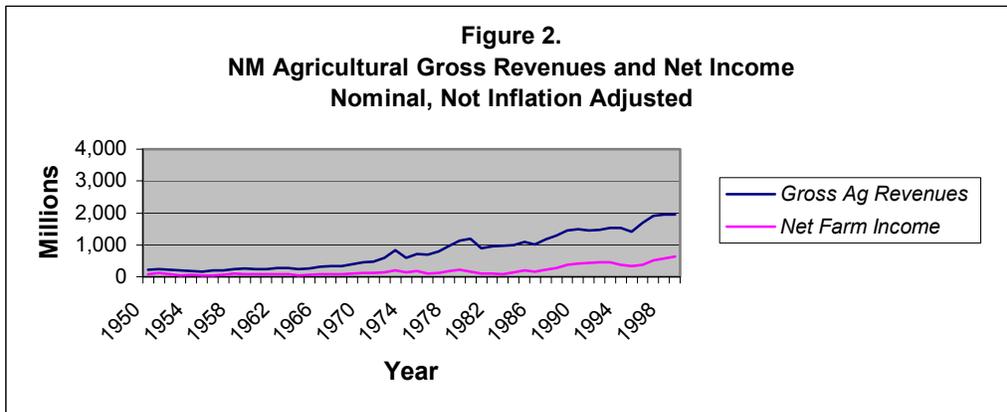
New Mexico production agriculture (i.e., the farm sector) accounted for 1.6% of gross state product (GSP) in 1998, while approximately 3.5% of the state’s employment was found in production agriculture, farm input supply, and food processing. In New Mexico, farm income as a percentage of all personal income in the state decreased from 4.3% in 1970 to 1.8% in 1999. The border counties (Doña Ana, Luna, Hidalgo) saw a decrease from 7.0% to 4.6% over the same period.

In nominal terms, the value of agricultural gross revenues in Doña Ana, Luna, and Hidalgo Counties increased from \$56.5 million to \$363.6 million from 1970 to 1999, an increase of 543%. In constant dollar or real terms (after adjustment for inflation between 1970 and 1999), agricultural gross revenues in the three counties increased 50%. In 1999, agricultural gross revenues in the three border counties were 19% of statewide agricultural gross revenues.

For the state as a whole, inflation-adjusted agricultural gross revenues have trended slightly upward since 1950, while inflation-adjusted net farm income has been flat for the last 50 years (figure 1). Without adjusting for inflation, figure 2 shows that both gross revenues and net farm income have trended upward since the 1970s. The inflation-adjusted figure (#1) better illustrates relative changes in purchasing power by the New Mexico farm sector. Worldwide, the purchasing power of agricultural commodities has decreased over the last several decades due to increased productivity and total output.



Source: New Mexico Agricultural Statistics.



Source: New Mexico Agricultural Statistics.

As a result of economic development and diversification throughout the United States and in other developed economies, production agriculture has shrunk as a percentage of their overall economies, regardless of the measurements used (i.e., employment, GNP, income, population). This has happened in New Mexico and the border region, and will continue to occur as the state and regional economy grows and diversifies. Reduced political influence can also be expected as a result of these changes in the economy

The Structure of Agriculture in New Mexico and its Ramifications

The 1997 Census of Agriculture reported 14,094 farms in the state of New Mexico. The current definition of “farm” is any place from which \$1,000 or more of agricultural products were produced and sold or normally would have been sold during the census year. This definition includes both crop and livestock producing operations. The definition has been criticized nationwide for several years as providing an unrealistic picture of U.S. agriculture. Clearly, the census currently counts many rural residences as farms, even though they do not provide any amount of livable farm income, regularly have negative net farm incomes, and do not produce significant quantities of food and/or fiber.

The 1997 Census reported 1,290 farms in Doña Ana County, 192 in Luna County, and 146 in Hidalgo County. The census also breaks the gross total of farms into “value of sales” categories. This distribution is shown in table 1 for New Mexico and the three border counties.

The distribution of New Mexico farms by sales class is similar to that of the entire U.S. farm sector at the current time. Over half the farms (61%) in New Mexico have annual sales of less than \$10,000, while 88% have sales of less than \$100,000. Farms with sales over \$100,000 have traditionally been considered “commercial” farms that are capable of generating a relatively low, but positive, net farm income after production expenses. A general rule of thumb is that net farm income is about one third of gross farm sales. Clearly, even \$100,000 in gross sales does not generate a very high net farm income, and probably leaves a farm household exposed to large swings in net farm income from year to year. While consisting of only 12.2% of farms in New Mexico, farms with sales over \$100,000 account for 90.5% of all commodity sales by farms in the state.

The middle sales categories of farms are becoming smaller locally and nationally as a result of farm consolidation, which is contributing to growth in numbers of the largest size farms. Consistently negative and/or very unstable net farm incomes characterize farms in all sales categories except the largest. The smaller sales category farms are typically supported through off-farm employment. At the national level, the definition of a viable commercial farming operation is moving upward to the \$250,000 annual gross sales level. Farms with less than \$250,000 in annual gross sales have a difficult time generating steady, acceptable net farm incomes, tend to be supplemented by off-farm incomes, and are subject to consolidation with larger farming operations. Using this higher gross sales value as a cutoff point for commercial farming operations, there are fewer than 900 of these operations in New Mexico, and they account for 82% of all the value of all commodities sold, while the remaining 93.6% of farming operations generate 18% of sales. In Doña Ana, Luna, and Hidalgo Counties there are 108, 41, and 13 farms in the over \$250,000 annual sales categories. Yet, in Doña Ana County, these farms make 91% of sales. In Luna County they contribute 86% of sales, and in Hidalgo County they account for 70% of sales. Production of some individual commodities in these counties is even more concentrated on a small number of farms.

Due to the wide dispersion of New Mexico farming operations by size and sales category, any calculations of average per-farm net income is very misleading. For instance, the 1997 Census of Agriculture shows that the average per-farm net cash return from agricultural sales for the farm unit was \$29,148 for the state. For Doña Ana, Luna, and Hidalgo Counties, the 1997 average per-farm net cash returns from agricultural sales were \$45,607, \$64,494, and \$35,022, respectively (table 2). Complex differences among farms in the state and the border region make average net farm return unusable as a descriptor of the farm sector. As mentioned above, the majority of New Mexico farms have gross sales that cannot generate net incomes anywhere near the average figures cited above.

The average net cash return calculated by the census thus includes many “farms” that cannot produce livable net farm incomes. It includes multimillion dollar industrialized farming operations. It also includes residents of many rural households that engage in commodity production, but who have no intention of earning a living from farming (or ranching). Many of these people have rural residence lifestyles, and production agriculture is more properly classified as a *consumptive* activity rather than a *productive* one.

Table 1. Distribution of farms by value of sales, both crop and livestock producers (1997).

	Doña Ana County				Luna County				Hidalgo County				New Mexico			
	# farms	% farms	\$ total sales (1,000)	% total sales	# farms	% farms	\$ total sales (1,000)	% total sales	# farms	% farms	\$ total sales (1,000)	% total sales	# farms	% farms	\$ total sales (1,000)	% total sales
Less than \$1,000	348	26.98	84	0.04	20	10.42	2	0.00	16	10.96	2	0.01	3,092	21.94	629	0.04
\$1,000 - 9,999	520	40.31	1,981	0.84	47	24.48	181	0.37	36	24.66	172	0.94	5,526	39.21	21,773	1.35
\$10,000 - \$49,999	185	14.34	4,194	1.78	41	21.35	1,110	2.26	44	30.14	1,103	6.02	2,854	20.25	67,336	4.16
\$50,000 - \$99,999	65	5.04	4,491	1.91	16	8.33	1,119	2.28	18	12.33	1,281	7.00	896	6.36	63,318	3.91
\$100,000 - \$249,000	64	4.96	9,892	4.2	27	14.06	4,357	8.88	19	13.01	2,866	15.65	847	6.01	134,007	8.28
\$250,000 - \$499,000	29	2.25	10,282	4.37	20	10.42	7,234	14.74	5	3.42	1,722	9.40	394	2.80	137,983	8.53
\$500,000 or more	79	6.12	204,559	86.87	21	10.94	35,063	71.46	8	5.48	11,166	60.98	485	3.44	1,192,662	73.73
Totals	1,290	100.0	235,483	100.0	192	100.0	49,066	100.0	146	100.0	18,312	100.0	14,094	100.0	1,617,708	100.0

Source: 1997 Census of Agriculture.

Table 2. Farm income in New Mexico and the border counties, 1997.

	Doña Ana County	Luna County	Hidalgo County	New Mexico
Total farms	1,290	192	146	14,075*
Average net farm income per farm	\$45,609	\$64,494	\$35,022	\$29,148
Number of farms with net gains	624 (48.41%)	106 (55.21%)	98 (67.12%)	6,533 (46.42%)
Average gain per farm (for those with + or 0 net gains)	\$100,167	\$126,912	\$57,982	\$71,531
Number of farms with net losses	665 (51.59%)	86 (44.79%)	48 (32.88%)	7,542 (53.58%)
Average loss per farm (for those with net losses)	-\$5,589	-\$12,439	-\$11,855	-\$7,564

Source: 1997 Census of Agriculture. *Number of farms varies due to some farms not reporting farm income information to the Census of Agriculture.

In New Mexico overall, the number of farms in the less than \$10,000 annual sales category increased 2% between 1992 and 1997. In Doña Ana County, numbers of farms in that sales category increased 12% over the same period, while in Luna and Hidalgo Counties, the increases were 40% and 68%, respectively.

Of the 14,094 New Mexico farm operators enumerated in the 1997 Census of Agriculture, 51% have agricultural production as their principal occupation. The other 49% of farm operators reported that another occupation was their primary activity. Forty percent of Doña Ana County farm operators indicated that agriculture was their primary occupation, and the same measure was 58% for Hidalgo County and 69% for Luna County.

Almost 84% of New Mexico's farms are individual or family operators (i.e., sole proprietorships). Another 8.2% are operated as partnerships. There are 754 family-held corporations in the state, accounting for 5.3% of farms. Other types of organizations such as nonfamily corporations, estates, trusts, or institutions, account for another 2.8% of farms. For the border counties, the breakdown of farming operations by organizational type is shown in table 3.

The structure of New Mexico agriculture is very similar to that of the United States overall, and is often referred to as a "dual farm structure." The New Mexico and national farm sectors are considered "dualistic" because the vast majority of "farms"

don't produce very much commodity output, while a small minority of large, commercial operations is responsible for most of the production.

Table 3. Distribution of New Mexico and border county farms by type of organization, 1997.

	Doña Ana County	Luna County	Hidalgo County	New Mexico
Total farms	1,290	192	146	14,094
Sole proprietorship	1,095	137	114	11,783
Partnership	90	29	17	1,158
Family corporation	72	18	13	758
Other than family corporation	10	4	0	94
Cooperative, estate, trust, institution	23	4	2	305

Source: 1997 Census of Agriculture.

Dramatic increases in agricultural productivity throughout the last century have reduced per unit production costs, decreased real prices for raw agricultural commodities (because supply increases have outpaced demand growth) and have led to many adjustments in the U.S. and New Mexico farm sectors. The four basic responses by people in the farm sector have been: 1) leave agriculture; 2) stay in agriculture, adopt new output-increasing technologies, increase the scale of the operation to generate a livable net farm income, and employ various price risk management strategies; 3) obtain off-farm employment so as to earn a livable household income; and 4) develop strategies (such as niche marketing, branding, and vertical integration) to avoid being a “price taker” in the commodity markets.

In New Mexico, as well as throughout the United States, successful commercial farms have traditionally responded as described in #2 above, but are also making greater use of strategy #4. The majority of these large and very large farms are still family owned and operated, despite the popular misconception that they are owned by non-local corporate entities. Throughout the U.S., most of the people who actually left agriculture did so in the 1950s and 1960s.

The dual-farm structure is also related to the type of externalities that arise from production agriculture. For example, the dry-lot dairies of Southern New Mexico produce enormous quantities of milk, however, there are numerous significant negative environmental and aesthetic externalities that result from large animal confinement operations. The term landscape “disamenity” has been used to describe these types of

farms – particularly when they are compared with the bucolic landscapes usually associated with smaller farms, including small dairies. Conversely, while many small farms don't produce very much food and/or fiber, these farms do result in picturesque vistas, agricultural open space, and are visually pleasing to casual observers. They also may be an important part of a region's cultural, historical, or social heritage (such as in New Mexico and the border counties).

The future of agricultural structure in New Mexico and the rest of the United States will be such that the two extreme size categories of farms (very small and very large sales) will continue growing, with most growth in numbers in the smallest sizes. More food and fiber will be produced on fewer and larger farms, but the total number of farms will be dominated by the smallest operations. Increasing numbers of farms in all size categories will learn to exploit existing and as yet unidentified market niches. However, the structure of agriculture locally and nationally will continue to become more dualistic, with more production concentrated on fewer farms.

In the future, many local farming communities will have more of an agricultural image or character than an agricultural economy of any significant size. In areas where natural resources traditionally have been allocated to crop and livestock production, there will be increased pressure to reallocate resources away from agriculture to other uses, and simultaneous calls to preserve the nature of the local farming system by maintaining traditional resource uses. If efficiency and "higher uses" are narrowly defined in terms of the value of food and fiber output, many local farming systems will lose their historic claim to resources such as irrigation water and public rangelands.

In some regions, the large numbers of farming operations that do not contribute significantly to food and fiber output may become more appreciated for their non-food outputs. These non-food (and non-fiber) outputs or contributions can include agricultural open space and landscape amenities, wildlife habitat, cultural or social heritage, relationship to local tourism, and rural lifestyle opportunities.

Crop and Livestock Commodities Produced in New Mexico and their Futures

A diverse mix of crop and livestock commodities is produced in New Mexico. In 1999, total cash receipts from all commodities produced in the state were \$1.95 billion. Livestock commodities account for almost 75% of the market value of all agricultural commodities produced and sold in the state, with crops accounting for the remainder.

Beef cattle numbers in the state have been very stable over the last several decades, while sheep and lamb numbers and wool production all have decreased by two-thirds since the late 1960s. In recent years, New Mexico has become a major dairy production state. New Mexico ranks eleventh in terms of total state milk production, fifth in milk production per cow, and tenth in total milk production. The U.S. Department of Agriculture also rates the state high in terms of future dairy output and industry growth. Milk cow numbers in the state continue to grow, with an 8% increase from 1999 to 2000. Chaves and Doña Ana are the leading dairy counties.

Some crop production trends in the state are related to dairy industry growth, such as increases in alfalfa hay and corn silage production. Chile pepper production increased in southern New Mexico, as food preferences nationally evolved to include greater amounts of spicy, ethnic items. However, chile pepper production varies widely between years due to disease and weather conditions. For example, harvested chile acreage in Doña Ana County was 36% lower in 1999 than in 1998. The value of state's chile crop also decreased (by 41%) between 1998 and 1999. Chile production in the state is concentrated in Doña Ana, Hidalgo, and Luna Counties, which accounted for 84% of the state's production in 1999.

Onion growers in the state continue to successfully exploit narrow national market windows. Ninety-two percent of New Mexico's onion production occurs in Doña Ana and Luna Counties. Ninety-five percent of the state's lettuce production typically occurs in Doña Ana County, although lettuce production varies greatly from year to year depending on market and weather conditions. In 1999, total pecan production in New Mexico was almost five times larger than it was in 1970. Seventy-three percent of pecan production is found in Doña Ana and Luna Counties.

Cotton continues to be produced in New Mexico and the border counties, but low prices have made it difficult for growers to profitably produce the crop. Almost 100% of the state's Pima cotton is produced in Doña Ana County while production of upland cotton is distributed throughout eastern and southern New Mexico. Small acreages of various food and feed grains are produced in the three border counties, however, low market prices prevent growers from earning significant income from them, and the grains are used primarily as rotational crops in combination with higher-value vegetable crops.

The majority of agricultural commodities produced in New Mexico account for a very small percentage of total national output. The notable exception is the state's pecan crop, which comprised 19% of the value of the total U.S. pecan crop. Even the large and growing New Mexico dairy industry only generates 3% of total U.S. milk production.

A number of factors will affect the production and marketing systems for New Mexico agricultural commodities in the future. These factors include, but are not limited to: international trade, agricultural labor costs and availability, competition for natural resources (particularly land and water), and environmental issues.

The North American Free Trade Agreement (NAFTA) and the devaluation of the Mexican peso in the mid-1990s led to large increases in chile pepper imports into the United States from Mexico. Chile pepper processing in the state currently uses large quantities of imported Mexican fresh chiles and jalapeños. The dried red chile processing industry also imports raw material from suppliers in Africa and Asia. Hand-harvesting accounts for approximately 50% of a New Mexico chile pepper grower's production costs. Liberalized trade between the U.S. and lower-cost chile producing countries has greatly reduced the competitiveness of New Mexico pepper production.

New Mexico's chile pepper acreage peaked in 1992. Trade pressures, difficulties and costs of obtaining harvest labor, and numerous yield-reducing production problems have contributed to the acreage declines. Some members of the industry are concerned that the state's chile production sector will not be able to produce sufficient quantities of peppers to support the local presence of the processing sector. Mechanization of some field-level production or cleaning processes and increases in local yields may help to sustain the local industry in the short run. For the longer run, as technologies cross international borders and U.S. labor costs increase, competitiveness of the state's chile pepper industry is not guaranteed.

The dualistic structure of agriculture in the state, particularly in the fast growth, rapidly urbanizing counties of the Rio Grande corridor (including Doña Ana) will strongly influence the types of crops produced. In agricultural areas characterized by large numbers of small, non-commercial, part-time farmers, the production of capital, labor, and management intensive crops is likely to decrease. Many of these limited resource (capital and/or time) rural residents will shift to producing alfalfa or other hay crops, if they have not already done so. Alfalfa production preserves the agricultural character of a lifestyle farming operation, requires less management, can be custom harvested by others, is storable, and is not subject to the market and yield uncertainties which affect most of the agricultural commodities discussed above.

Competition for land and water resources will also affect the Rio Grande corridor, including Doña Ana County. The agricultural character of the area is attractive to old and new residents alike. However, some of the water supplies currently used for agricultural irrigation will eventually be transferred to municipal and industrial uses. International market conditions will continue to work against local production of many agricultural commodities, including high value vegetable crops, cotton, and grains. Forage production is likely to continue due to strong regional demand. Pecan production is also likely to continue and increase in magnitude. Like alfalfa, pecans are well suited to small, part-time, rural lifestyle farming operations. Several years into the future, it is possible that Doña Ana County crop production will consist primarily of pecans and alfalfa. The illusion of a thriving chile production sector may exist, simply because of numerous small, non-commercial producers in the county. However, the chile pepper industry, including processing, may be greatly reduced in size and impact.

Crop production in Luna and Hidalgo Counties is subject to other problems, including international competition, the need to reduce labor costs, and reductions in ground water supplies for irrigation. However, farmers in those counties face minimal urbanization pressure, fewer field-level production problems, and thus higher yields.

The dairy industry in southern New Mexico is likely to continue growing, although dairy cow populations may eventually be moved from fast growing areas such as southern Doña Ana County to more distant rural areas. The beef cattle industry in the border counties is not likely to increase or decrease in animal numbers or total size in the near or distant futures. Doña Ana, Hidalgo, and Luna Counties have relatively small numbers of beef animals compared to other areas in New Mexico. Like their counterparts throughout

the state, cattle producers in the border counties are likely to continue to face pressure from environmental groups who want to reduce or eliminate public lands ranching. Beef cattle prices in the U.S. will continue to be subject to dramatic cyclical swings in prices that result in financial hardship for many producers.

Doña Ana and Luna Counties are home to two international cattle crossings. The ports-of-entry at Santa Teresa and Columbus are both locations at which livestock are traded between Mexico and the United States. In 2000, 27% of the 1.2 million feeder/stocker beef animals imported from Mexico entered the United States at Santa Teresa, while 3.5% crossed at Columbus. The Santa Teresa facility (and its counterpart San Gerónimo on the Mexican side) is owned and operated by the *Unión Ganadera Regional de Chihuahua*, which is a federation of smaller cattlegrowers' associations located in the state of Chihuahua.

The imported Mexican feeder animals are estimated to comprise approximately 1% of total U.S. beef supplies (carcass weight basis). By comparison, the carcass weight equivalent of beef animals imported from Canada makes up 6.5% of total U.S. beef supplies. U.S. imports of feeder cattle from Mexico increased steadily from 1985 until 1995 (the pre-NAFTA) period, but averaged about 1.1 million animals per year during that 10-year period. In 1995, the number of Mexican feeder cattle entering the United States increased dramatically as a result of peso devaluation, drought, and Mexican herd liquidations, and peaked at 1.6 million animals. In 1996, following the 1995 liquidations, 456,000 Mexican feeder animals entered the United States. Since 1995, the Mexican cattle producers have been rebuilding cattle numbers, and imports to the U.S. have recovered to their pre-1995 level. Most of the Mexican feeder animals leave New Mexico, destined for small grain pastures and feedlots in the Northern and Southern Plains, and throughout the West.

In 2000, there were also 21,000 slaughter cattle exported from the U.S. to Mexico through the Santa Teresa port. Most of these animals were destined for immediate consumption in Ciudad Juarez. Exports of meat animals to Juarez have increased in recent years, due to growing demand for meat in private homes, restaurants, and *maquiladora* workers' cafeterias. Many of the animals exported from New Mexico to Ciudad Juarez are dairy cows no longer suitable for milk production.

The feeder cattle that enter the United States from Mexico are primarily European breeds. Many of these animals are the close or distant relatives of cattle in the United States, due to widespread Mexican imports of U.S. breeding stock. For instance, in the last several years, over 8,000 breeding animals were exported from New Mexico cattle producers to Northern Mexico.

U.S. imports of feeder cattle from Mexico are likely to grow in the future, however, these imports will vary with weather and pasture conditions in Mexico, the state of the Mexican economy, beef demand, prices, and market cycles in the United States. The Santa Teresa livestock crossing facility will continue to handle large volumes of animals, due to the high quality infrastructure located there, and the ease of crossing at that

location. There is also a high probability that the numbers of slaughter cattle exiting the U.S. for Mexico at Santa Teresa will increase in future years.