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"The River of Revenge": The Tension Between Farmers and the Federal Government in the Tula Valley, Mexico, 1992-2014

Note on sources

This paper aspires to accomplish two things: to begin a conversation about the history of wastewater management and usage in the Tula Valley, Mexico, and to demonstrate how that history has resulted in a complex web of interdependencies and tension between the Mexican federal government and farmers in the Tula Valley. The sources in this paper are mostly case and scientific studies, chapters of books, press releases and articles from Mexican publications. The studies focus on the health effects of irrigation with and exposure to wastewater and usually incorporate those topics into a broader discussion of water usage in Mexico City. They only mention historical events in so far as they are relevant to the discussion of the wastewater's impact on human health and Mexico City's water usage. No historian to date has published on this topic, so I have utilized sparse, valuable evidence from multiple sources to reconstruct an approximately twenty-year history of the wastewater conflict between the Tula farmers and the federal government in order to fill that gap in historical literature. The articles and press releases provide glimpses into how the farmers are impacted by the federal government's actions and are used to explore the relationship between both groups. Additionally, the articles have provided the majority of the information on the proposed, contentious Atotonilco Wastewater Treatment Plant and have a bias toward favoring its establishment; the few sources discussing the farmers' reactions are used to counterbalance this bias.

"The River of Revenge": The Tension Between Farmers and the Federal Government in the Tula Valley, Mexico, 1992-2014

> "These crops contain fecal coliforms. We the farmers are able to live off of this, if this water did not exist, we would have to emigrate."
> —Tula Valley corn producer Anastasio Jiménez[1]

> "By the way, now they call it [the Tula River]: 'The river of revenge.' Because they [Mexico City] send us [the Tula Valley] their sewage water and we send it back to them in produce so they can eat it again."
> — Tula Valley businessman Tomás Martín[2]

The above quotes highlight the revolting situation in the Tula Valley (also known as the Mezquital Valley) in the state of Hidalgo, Mexico in which the Tula farmers rely on Mexico City's wastewater to irrigate the very crops they export to the city's markets (see figure one). For more than a century, Mexico City has sent a large portion of its wastewater to the Tula Valley to irrigate crops, primarily maize and alfalfa.[3] The wastewater, called *aguas negras*, contains human waste, toxic chemicals, garbage, and heavy metals; the water is also rich in nutrients that promote plant growth.[4] Consequently, the farmers irrigating with this wastewater receive higher incomes because the wastewater's nutrients result in larger crop yields. The wastewater also forms a crucial economic base for the Tula community, a point that cannot be stressed enough. In the Tula Valley's agriculturally based and poverty-stricken economy, the unnaturally high crop yields that result from irrigating with wastewater enables the community to persist in the Tula

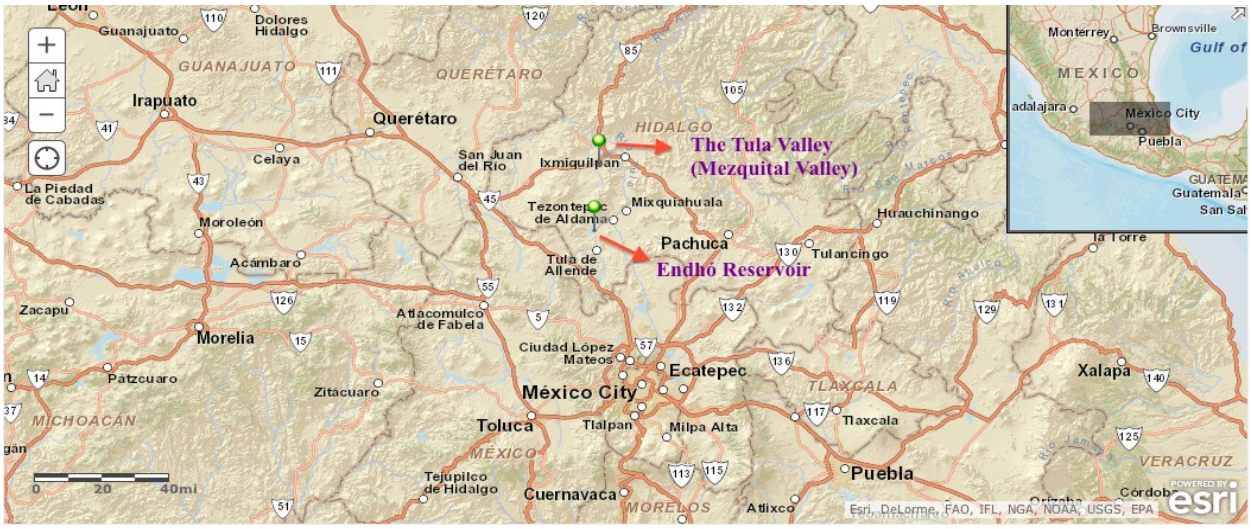
1 Columbia Vértiz de la Fuente, Documental 'H2Omx': Se Agota El Agua Para El DF," *Proceso*, August 28, 2014, accessed December 9, 2014, http://www.proceso.com.mx/?p=380677. The quote reads in Spanish: "Esos cultivos contienen coliformes fecales. Nosotros los campesinos vivimos de esto, si no hubiera agua, tendríamos que enmigrar." I translated the quote.

2 *H2Omx*, directed by Jose Cohén and Lorenzo Hagerman (2014; Mexico City, Federal District: Cactus Film & Video, 2014), DVD. The documentary vividly portrays Mexico City's impending water crisis and incorporates the Tula Valley's role into that discussion as a victim of the city's poor wastewater management. Despite the film's excellent analysis of the Tula Valley's role in the crisis, it does not offer the background information necessary to understand the Tula Valley's reliance on wastewater.

3 Blanca Jiménez, "Water and wastewater management in Mexico City," in *Integrated Urban Water Management: Arid and Semi-Arid Regions*, ed. by Larry W. Mays. Urban Water Series, v. 3 (Boca Raton: Paris, France: CRC Press; UNESCO Pub, 2009), 95; María Francisca, Naranjo Pérez de León and Asit K. Biswas, Water, "Wastewater, and Environmental Security Problems: A Case Study of Mexico City and the Mezquital Valley," *Water International* 22:3 (1997): 208. The most valuable background information done so far on wastewater management in the Tula Valley comes from research done by internationally renowned water expert Blanca Jiménez, and her research highly informs this essay.

4 Elisabeth Malkin, "Fears That a Lush Land May Lose a Foul Fertilizer," *The New York Times*, May 4, 2010, accessed December 10, 2014, http://www.nytimes.com/2010/05/05/world/americas/05mexico.html?pagewanted=all&module=Search&mabReward=relbias%3As%2C%7B%222%22%3A%22RI%3A16%22%7D

Valley in the face of the continual and ever-increasing alternative to emigrate to the United States. The *aguas negras* pose severe health risks for the Tula farmers and community, but the economic benefits of the liquid waste is so high and the poverty so dire, that the residents prioritize the short-term economic benefits of using wastewater over their health.



Map created by the author, Michelaina Johnson, using ArcGIS software[5]

Figure one: This map uses green peg marks to show the location of the Tula Valley and the Endhó Reservoir in relation to Mexico City.

In the past two decades, Mexico's federal government has taken steps to address the health risks associated with the *aguas negras*, including passing new regulations and constructing a wastewater treatment plant. The proposed solutions have augmented tension between the Tula Valley farmers and the government, as both sides clamber for a solution that benefits their interests. The government has sought to modernize the Tula Valley's wastewater infrastructure to improve water quality and mitigate the health effects, whereas some Tula farmers perceive the recent developments as a threat to their year-round wastewater supply and economic stability. In a region riddled with poverty and historic government exploitation, the wastewater is a means of survival. For this reason, the Tula farmers hesitate to comply with federal regulations and do not

5 ESRI 2011, ArcGIS Desktop: Release 10, Redlands, CA: Environmental Systems Research Institute.

support the wastewater treatment projects. The federal government's desire over the past two decades to improve wastewater management in the Tula Valley reveals the complexity of the interdependencies between both groups and helps to explain the tension between them.-

Surprisingly, no historian to date has analyzed the history of wastewater usage in the Tula Valley, yet the region is the largest agricultural area to irrigate continuously with untreated wastewater in the world.[6] The fact that the duration of the Tula Valley's irrigation with wastewater has earned it that world record merits historical investigation into the factors that facilitated the continuity. This research paper provides the context necessary to understand the Mexican federal government's quest over the past twenty-two years to find a plan that resolves the health concerns associated with irrigating with wastewater. Those two decades, between 1992 and 2014, have been formative in the wastewater management history of the Tula Valley and are the focal point of this paper.

More than a Century in the Making

Before wastewater arrived in the Tula Valley more than a century ago, the farmers irrigated fruit trees and small-scale farms of the naturally semi-arid Tula Valley with clean water from the Tula River and from a local lake called the Endhó Reservoir.[7] Agricultural development was limited, nevertheless, because of a poverty and lack of water in the valley.[8] Mexico City, due to its increasing population in the late nineteenth century, needed a place to expel its wastewater and selected the Tula Valley as the depository for its waste.[9] To ship the water, the General

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6 Blanca Jiménez, "Water reuse in Latin America and the Caribbean," in *Water Reuse: An International Survey of Current Practice, Issues and Needs*, ed. by Blanca Jiménez and Takashi Asano, Scientific and Technical Report, no. 20 (London, UK: IWA Pub, 2008), 181.

7 Timothy J. Downs et al, "Effectiveness of Natural Treatment in a Wastewater Irrigation District of the Mexico City Region: A Synoptic Field Survey," *Water Environment Research* 72, no. 1 (January 1, 2000): 4. Jstor (25045332). This source constructed the history of the Tula Valley's early water usage by interviewing the area's long-time residents.

8 Jiménez, "Water reuse," 181.

9 *Ibid*.; Blanca Jiménez et al., "Unplanned aquifer recharge in El Mezquital Valley/ Tula Valley, Mexico," in *Water Reclamation Technologies for Safe Managed Aquifer Recharge*, ed. by Christian Kazner, Thomas Wintgens and P. J. Dillon (London; New York: IWA Publishing, 2012), 143.

Drainage System was constructed and continues to operate to this day. The system consists of three conducts: the Eastern Interceptor (built in 1889), the Gran Canal Sewer (1898) and the Central Sewer (1975).[10] The Tula Valley began to improve economically due to the higher crop yields resulting from irrigating with wastewater. Due to the economic benefits of this exchange, the federal government in 1920 officially recognized that the Tula farmers irrigated with wastewater.[11] In 1920, the Tula farmers requested that more water be sent to the valley for irrigation purposes, and, as a result, the Endhó Reservoir was transformed into a wastewater storage reservoir.[12] The wastewater enables farmers to sustain large-scale agriculture and has improved the valley's economy. The current irrigation infrastructure has expanded over the century and today comprises nine dams (six specifically for wastewater), three rivers and 858 kilometers of unlined canals (see figure two).[13] The Tula River, mentioned in Martín's quote above, is one of those three rivers. The growth of Mexico City's population necessitated the expansion of the original wastewater infrastructure and instigated the enlargement of land irrigated with untreated wastewater in the Tula Valley (see figure three).[14] The state of Hidalgo currently receives 3.6 billion liters of sewage daily from the nation's capital, and the majority of that water is used to irrigate agriculture.[15]

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10 Ibid.

11 Jiménez, "Water reuse," 181.

12 Jiménez, "Water and wastewater management in Mexico City," 94; Blanca Jiménez, "The unintentional and intentional recharge of aquifers in the Tula and the Mexico Valleys: The Megalopolis needs Mega solutions," *Rosenberg Symposium, Buenos Aires, Argentina*. 2010; Downs et al, "Effectiveness of Natural Treatment," 4.

13 Jiménez, "Water and wastewater management in Mexico City," 94.

14 Jiménez et al., "Unplanned aquifer recharge," 143.

15 *H20MX*

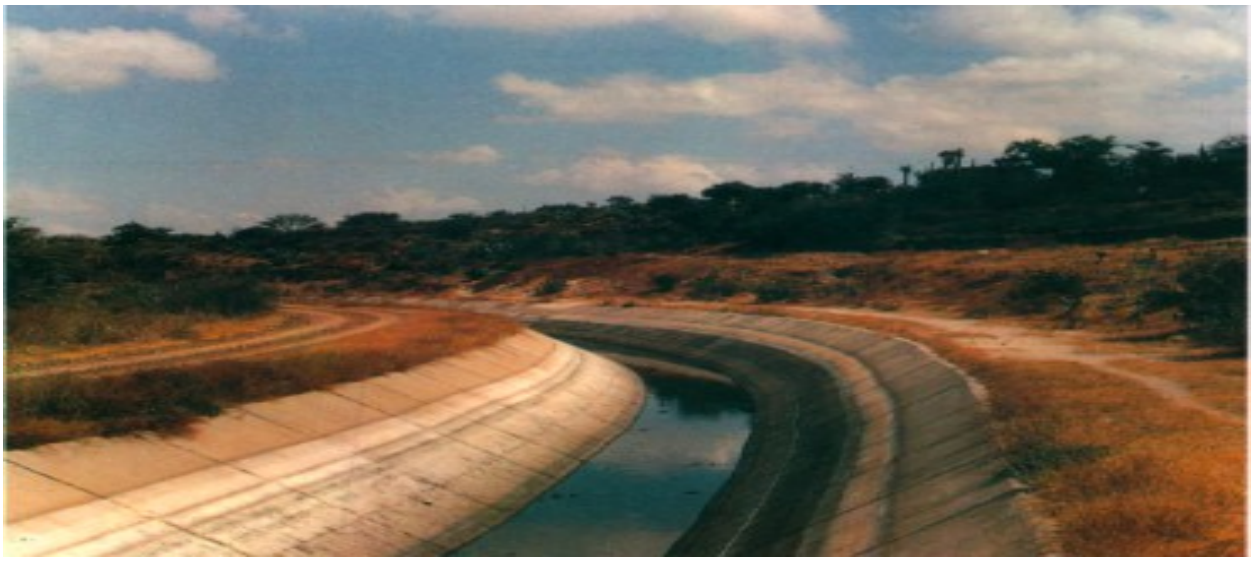

Photo from *Síntesis geográfica del estado de Hidalgo*[16]

Figure two: This lined canal is an example of one of the canals that transport wastewater from Mexico City to the Tula Valley.

Photo from *Síntesis geográfica del estado de Hidalgo*[17]

Figure three: The photo features fields of alfalfa and corn that are irrigated by wastewater and located to the east of the Endhó Reservoir.

As Mexico City's population has increased, the amount of irrigated land in the Tula Valley has enlarged steadily.[18] For instance, the amount of land irrigated by wastewater was

16 Instituto Nacional de Estadística, Geografía e Informática (Mexico), *Síntesis Geográfica Del Estado de Hidalgo* (Aguascalientes, Ags: Instituto Nacional de Estadística, Geografía e Informática, 1992), 78.

17 Ibid.

18 Downs et al, "Effectiveness of Natural Treatment," 4.

14,000 hectares (ha) in 1926, 28,000 ha in 1950 and 42,460 ha in 1965.[19] The amount peaked at 90,000 ha in the early 1900s and has subsequently decreased to 76,119 ha in 2004 because some farmers have migrated to the United States; the number of farmers working in the Tula Valley in 2004 was 73,632.[20] Other sources state that the amount of land irrigated by wastewater was about 95,000 in 2010 and 85,000 ha in 2012, which would suggest that the amount has continued to grow and did not peak in 1992.[21] Though the number is contestable, one fact remains clear: the former steady growth trend has either reversed or drastically slowed over the past two decades. This trend will be addressed later.

As seen in the data above, this exchange benefitted both sides: Mexico City expelled its sewage 100 kilometers north to the Tula Valley and the valley received a subsidized, nutrient-rich water source as well as a market for its produce in Mexico City.[22] The nutrient-rich wastewater contains phosphorous and nitrogen due to its high concentration of human waste. The elements promote plant growth but also present health risks to the human population.[23] The year-round availability of Mexico City's wastewater has doubled and in some cases tripled the annual crop harvests and has increased crop yields from 67% to 150% for multiple crops in comparison to those irrigated with clean water.[24] The farmers sell "an important part of the produce" in Mexico City and consume a portion of it locally.[25] Thus, the farmers not only rely on the high crop yields

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19 Ibid. A hectare is the equivalent of 10,000 square meters and, in this case, refers to amount of land irrigated by wastewater.

20 Blanca Jiménez, "Unplanned reuse of wastewater for human consumption: The Tula Valley, Mexico," in *Water Reuse: An International Survey of Current Practice, Issues and Needs*, ed. by Blanca Jiménez and Takashi Asano, Scientific and Technical Report, no. 20 (London, UK: IWA Pub, 2008), 415.

21 Blanca Jiménez, "The unintentional and intentional recharge of aquifers in the Tula and the Mexico Valleys: The Megalopolis needs Mega solutions," *Rosenberg Symposium, Buenos Aires, Argentina*, 2010, 13; B. Jiménez and D. Birrichaga, "Water services in Mexico City: The need to return to the IWRM principles of Tetnochtitlan (700 years of water history)," in *Evolution of Water Supply throughout the Millennia*, ed. by Andreas N. Angelakis (London; New York: IWA Publishing, 2012), 544.

22 Jiménez, "Water and wastewater management in Mexico City," 93.

23 Ibid., 97.

24 Jiménez, "The unintentional and intentional recharge", 14.

25 Jiménez, "Water and wastewater management in Mexico City," 95; Jiménez, "The unintentional and intentional recharge," 14.

for sales but also for feeding their families and the greater Tula community. Furthermore, the wastewater "has been extensively used [for irrigation] since it improves drainage conditions and satisfies the increasing demand for water in the agricultural sector [of the Tula Valley]" as well as recharging the regional aquifer, according to a 1997 report by the Institute of Engineering, National Autonomous University of Mexico.[26] The wastewater recharge of the local aquifer is beyond the scope of this paper but suffice it to say the aquifer has been exploited extensively and, for that reason, groundwater recharge is crucial to providing potable water to the 400,000 people who live in the Tula Valley.[27] The untreated wastewater being the source of the recharge, nevertheless, has raised serious concerns regarding the quality of water currently inside the aquifer and the health consequences associated with using that water.[28] Moreover, thanks to the economic benefits of wastewater, land that can be irrigated with the *aguas negras* is leased at a price of $455 a year whereas the rain-fed land rents for $183 a year.[29] The landowner thus profits nearly 2.5 times more by renting land irrigated with wastewater than land fed by rain.[30] In this regard, the Tula farmers rely on the constant wastewater supply to maintain large crop outputs to sell and to support continual growth of the agriculture sector through sales and land leases.

Despite the economic benefits of the *aguas negras*, the pathogen infections and diseases stemming from wastewater have negatively impacted the Tula farmers, their families, the Tula community and the consumer. Wastewater exposure and ingestion have resulted in health problems for both the farmer and consumer, including diarrhoeal diseases from worms.[31] Three scientists in a 1999 study of the Tula Valley's wastewater identified the risk for potential cholera

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26 Naranjo Pérez de León, María Francisca and Asit K. Biswas, "Water, wastewater, and environmental security problems: A case study of Mexico City and the Mezquital Valley," *Water International* 22.3 (1997), 210.
27 Jiménez, "Unplanned reuse of wastewater," 414.
28 Ibid.
29 Jiménez, "Water reuse," 181.
30 Ibid.
31 Jiménez, "Water and wastewater management in Mexico City," 95.

infection and gastrointestinal disease, among other health hazards, due to wastewater exposure.[32] The scientists identified sources of direct and indirect human exposure to wastewater and pathogen infection for Tula's inhabitants as "canals and flooded fields, especially dermal contact for bathing children and barefoot farmers and indirect exposure by ingestion of crops, cow's milk, beef and sheep's meat."[33] The practice of flood and furrow irrigation put farmers in direct contact with the wastewater and at high risk of infection, in part because the farmers do not use any bodily protection when working in the wastewater flooded fields.[34] The ingestion of crops nourished by wastewater also exposes consumers to the wastewater's pathogens though most consumers boil the produce, which kills the pathogens.[35] Recent population growth in the Tula Valley also has forced people to "move much more closer to the irrigated areas and the dams that store the wastewaters of Mexico City," which has caused the inhabitants living near the storage facilities to face health risks resulting from wastewater exposure.[36] As the Tula Valley population grows, the number of reported infections increases, including 115, 231 new registered cases of intestinal infections and amebiasis in Hidalgo in 2009.[37] These health concerns attracted the government's attention in the late 1980s, and, as a result, the Mexican federal government intervened to address these problems with both legislation and a regional project.

Time to Make Some Changes

32 Timothy J. Downs, Enrique Cifuentes-García and Irwin Mel Suffet, "Risk Screening for Exposure to Groundwater Pollution in a Wastewater Irrigation District of the Mexico City Region," *Environmental Health Perspectives* 107, no. 7 (July 1, 1999): 558-9. Jstor (3434397).

33 Ibid., 560.

34 Ibid., 553.

35 Ibid.

36 Pérez de León, Francisca and Biswas, "Water, wastewater, and environmental security problems," 207.

37 Armando Sánchez, "Se riegan con aguas negras 60% de cultivos agrícolas en Hidalgo," *La Jornada*, March 12, 2011, accessed December 10, 2014, http://www.jornada.unam.mx/2011/03/12/estados/032n1est.

In 1989, the Mexican federal government under President Carlos Salinas de Gortari initiated a reform aimed at modernizing the national water sector and making it sustainable.[38] The administration established the National Water Commission (CNA) that year to oversee these reforms, promote hydro-agriculture infrastructure and uphold federal water laws, among other federal tasks.[39] As a part of these reforms, the administration passed the National Water Law and Ecological Technical Standards 32 and 33, which fall under the CNA's jurisdiction and help to "ensure sustainable agricultural development in the Mezquital [Tula] Valley," according to a case study of the Tula Valley by Humberto Romero-Alvarez.[40] The National Water Law, passed in December 1992 and implemented the following year, has a section devoted to the prevention and control of water contamination.[41] The Ecological Technical Standards 32 and 33 establish conditions for wastewater usage in agricultural irrigation and prohibit the use of wastewater for irrigation of vegetables that could be eaten raw.[42] In accordance with these regulations, the federal government, the Federal District and the State of Mexico started a project to treat all of Mexico City's wastewater with the goal of eliminating the health risks associated with the wastewater. Subsequently, several treatment plant options were proposed and designed to extract numerous pathogens and all of the nitrogen and phosphorous from the liquid.

Though the laws were meant to improve the Tula Valley residents' health, the farmers were opposed to the proposal for several reasons. First, some farmers still grow certain vegetables that can be consumed raw, such as lettuce and carrots, even though the Ecological Technical Standards 32 and 33 prohibit such because most vegetables are lucrative and have a higher

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38 *Thirst for Reform? Private Sector Participation in Providing Mexico City's Water Supply*, Policy Research Working Papers, The World Bank, 1999, 7, 33, accessed December 10, 2014, http://elibrary.worldbank.org/doi/book/10.1596/1813-9450-2654.

39 Ibid., 33; Humberto Romero-Alvarez, "Case Study VII--The Mezquital Valley, Mexico," accessed December 10, 2014, http://www.who.int/water_sanitation_health/resourcesquality/wpccasestudy7.pdf.

40 Ibid.

41 Ibid.

42 Ibid.

productivity rate than maize-alfalfa crops when irrigated with wastewater. For instance, the productivity rate of vegetables was six times larger than that of maize-alfalfa in 1990.[43] Some farmers still grow vegetables because the government seldom enforces the regulations. In addition to defying the law, the growers "abide by an elastic interpretation of the regulations, planting broccoli and cauliflower, for example," according to Mexico City based reporter Elisabeth Malkin in a *New York Times* article published on December 10, 2014 that addressed the Tula Valley farmers' reaction to a new wastewater treatment plant.[44] The farmers' unwillingness to obey the regulations demonstrates that their priority is on their short-term economic interests and not on their health. When the CNA actually does enforce the restriction on irrigating with wastewater, the tension between the government and farmers intensifies. Recently, the CNA enforced the regulations following an outbreak of cholera, which spurred a "social conflict" between the government and farmers as the growers "saw their income severely reduced by the restriction of their cash crops without viable alternatives being proposed."[45] The lack of economic substitutes for agriculture contributes to the farmers' wariness toward the federal government.

Besides the regulations, a water treatment project that was proposed in 1993 also fostered friction between the federal government and farmers. The growers interpreted the project as a threat to their economic stability because the purification of wastewater was not in their interest, for it would significantly decrease their crop yields. For this reason, farmers protested the project, "requesting two things: first, to continue to receive the same amount of water; and second, to receive it with the same 'substance' that increased crop yields"; that 'substance' was

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43 Ibid.

44 Pérez de León, Francisca and Biswas, "Water, wastewater, and environmental security problems," 208; Malkin, "Fears That a Lush Land May Lose a Foul Fertilizer."

45 Romero-Alvarez, "Case Study VII."

nitrogen and phosphorous.[46] Because the regulation required the removal of those elements, the farmers' request to keep them in the treated water contradicted the law and thus put the growers in conflict with the government. In response, the federal government drafted a new regulation in 1996, NOM-001 SERMANAT-1996, that functioned as a compromise between both groups' interests; the regulation established new guidelines for the maximum permissible concentrations of certain matter in the irrigation water, including fecal coliforms, and allowed phosphorous and a limited amount of nitrogen to remain in the water.[47] In accordance with this new policy, the government redrafted plans for the wastewater treatment plant and settled on a plan to construct four water treatment facilities by 2000.[48] However, political changes from new political parties coming into power since 1996 continuously impeded the plan's implementation until 2010; that year a new plan was proposed.[49] In the meantime, farmers have continued to use Mexico City's wastewater to irrigate their crops.

The federal government reinitiated the wastewater project on January 7, 2010, when CNA, along with other entities, signed agreements to build the Atotonilco Wastewater Treatment Plant (PTAR Atotonilco) in Atotonilco, Hidalgo, Mexico.[50] The plant, slated to be ready for commercial operation by early 2015, fulfills the government's interest in mitigating the health risks in the Tula Valley through modernization of the wastewater infrastructure.[51] However, it also re-instigates the tension between the farmers and the government. PTAR Atotonilco, already four years into construction, will treat 60% of the wastewater from the metropolitan area of

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46 Jiménez, "Water and wastewater management in Mexico City," 97.
47 Ibid.
48 Jiménez and Birrichaga, "Water services in Mexico City," 544.
49 Ibid.
50 "Atotonilco Wastewater Treatment Project, Mexico," *Water Technology*, accessed December 10, 2014, http://www.water-technology.net/projects/atotonilcowastewater/.
51 "Atotonilco Wastewater Treatment Plant and Agricultural Irrigation Reuse Project," *CH2MHill*, accessed December 10, 2014, http://www.ch2m.com/watermatch/(S(zmyxqs45cmnrkf55ljkpwe55))/docs/CH2M-HILL-Agricultural-Irrigation-Mexico.pdf.

Mexico City and will supply treated water to the Tula Valley for the purpose of irrigating 80,000 hectares.[52] The modernization component of the project also entails lining the wastewater canals from Mexico City to the Tula Valley to decrease the amount of wastewater that seeps into the groundwater and recycle the saved water for other purposes, including irrigation of agriculture.[53]

PTAR Atotonilco does have the potential to benefit the Tula farmers and the greater community by making the agricultural sector in compliance with federal agricultural regulations, providing jobs and improving the Tula community's health.[54] The treated water will allow the Tula Valley farmers to once again legally grow vegetables to sell in markets in Mexico City because the water will no longer contain the prohibited contaminants; the produce in turn will enable the farmers to earn more money.[55] The plant will also provide more than 11,000 direct and indirect jobs and spur ecotourism and fish farming, which will support the local Tula economy.[56] In these regards, the farmers have the potential to benefit economically long-term from PTAR Atotonilco's construction though the farmers may face a reduction in crop quantity resulting from irrigating with treated water. Furthermore, the governor of Hidalgo, Francisco Olvera, stated that the Tula farmers will continue to receive the same volume of treated water as they do of wastewater and emphasized that, according to an *El sol de Hidalgo* article published on April 29, 2011, "the level of water sanitation will enable the farmers of this region to cultivate products

52 Ibid.

53 "En Hidalgo la Conagua construye la PTAR Atotonilco," *El Sol de Hidalgo,* April 29, 2011, accessed December 10, 2014, http://www.oem.com.mx/elsoldehidalgo/notas/n2058429.htm.

54 "Avanza 30.5 por ciento construcción de la planta Atotonilco: Conagua," *La Informacion,* December 6, 2011, accessed December 10, 2014, http://noticias.mexico.lainformacion.com/mexico/avanza-30-5-por-ciento-construccion-de-la-planta-atotonilco-conagua_xpcRcUoABMn52TU3i4VF23/.

55 Malkin, "Fears That a Lush Land May Lose a Foul Fertilizer."

56 Juan Garciaheredia, "Planta de Tratamiento de Aguas en Tula generará 11 mil empleos," *La Prensa*, November 6, 2011, accessed December 10, 2014, http://www.oem.com.mx/laprensa/notas/n2298067.htm.

of higher economic value in the market, so that the incomes improve, there is a healthier environment and the quality of life gets better."[57]

Despite these benefits and assurances, some farmers fear that the treated water will be sent back to Mexico City instead of to the Tula Valley, will be privatized and will no longer contain the same nutrients available in the *aguas negras*. The *New York Times* article cites a Tula farmer named Gregorio Cruz Alamilla who verbalizes the growers' concerns: "If they take away the black waters [*aguas negras*] we will die of hunger … We don't know how to do anything else."[58] This quote and Mr. Jiménez's and Martín's quotes from the beginning reveal the harsh reality of life in the Tula Valley: the local economy relies on the wastewater to allow for the survival of the valley's agricultural sector, livelihoods and community. As highlighted in the statistics on page three, the trend of land irrigated with wastewater increasing over a century either reversed or drastically slowed over the past two decades, starting in the 1990s. This trend coincides with the passing of the 1992 legislation—the National Water Law and Ecological Technical Standards 32 and 33—which suggests that the recent federal legislation and infrastructure project have impacted agricultural growth negatively in the Tula Valley. The consequence has been "farmer migration to the United States," according to Jiménez.[59] Significantly, large-scale migration out of the state of Hidalgo began mid-1990s and, by 2000, the state had the "second highest rate of growth of out-migration from Mexico to the United States," according to a 2004 investigation conducted by anthropology professor Ella Schmidt and professor of international affairs María Crummett.[60] The study also found that "over the past ten

57 "En Hidalgo la Conagua construye la PTAR Atotonilco." I translated the article. In Spanish, the quote reads, "El nivel de saneamiento del agua permitirá que los agricultores de la región cultiven productos de mayor valor económico en el mercado, así se mejoran sus ingresos, se tiene un ambiente más saludable y se incrementa la calidad de vida."

58 Malkin, "Fears That a Lush Land May Lose a Foul Fertilizer."

59 Jiménez, "Water and wastewater management in Mexico City," 94.

60 Ella Schmidt and María Crummett, "Heritage Re-Created: Hidalguenses in the United States and Mexico," in *Indigenous Mexican Migrants in the United States*, ed. by Jonathan Fox and Gaspar Rivera-Salgado (La Jolla, Calif:

years, approximately one-fifth of the Ixmiquilpan's residents, the vast majority of them Hñahñu, have migrated to Clearwater, a tourist city located on Florida's gulf coast.[61] Ixmiquilpan is a city located in the Tula Valley with population of about 100,000 people and the Hñahñu is the name of the fifth largest indigenous group in Mexico.[62] About 20,000 Hñahñu people emigrated to the United States due to poverty and a lack of opportunity in the Tula Valley and selected Clearwater as their destination because of labor demand and personal connections with immigrants who are already established in the city.[63] This fascinating study, though it does not directly address the trends in wastewater management in the Tula Valley, clearly shows how poverty-stricken and economically disadvantaged the Tula Valley is. It also demonstrates that the situation in the valley is so drastic that about 20,000 people chose to relocate their lives to the United States. More than likely, the CNA's implementation of the National Water Law and of Ecological Technical Standards 32 and 33 has contributed to the lack of opportunities and extreme financial strain in the Tula Valley. These facts suggest that the enforcement of wastewater regulations has forced some farmers to migrate to the United States because they see no other viable option. Further research is needed to investigate the relationship between changes in wastewater management and emigration from the Tula Valley to the United States.

Some Tula farmers, nevertheless, have taken matters into their own hands to protect their agriculture interests by "switching from traditional agriculture practices to conservation agriculture-based methods," according to a 2012 press release by CGIAR Consortium, a global partnership aimed at unifying organizations researching food issues, among other topics.[64] The

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Center for U.S.-Mexican Studies, UCSD/Center for Comparative Immigration Studies, UCSD, 2004), 401.

61 Ibid.

62 Ibid.

63 Ibid., 401, 406.

64 "Conservation Agriculture: A Revolution in the Making," *CGIAR.org*, May 3, 2012, accessed December 10, 2014, http://www.cgiar.org/consortium-news/conservation-agriculture-a-revolution-in-the-making/.

release also lists a Tula farmer named Geraldo Gálvez Orozco as an example of a conservation agriculturalist who has adopted conservation techniques, including zero-tillage and leaving crop scraps on the soil's surface to improve soil quality.[65] These techniques will operate as a supplement, and maybe even a substitute, for the wastewater by providing the farmers who adopt these measures with some of the same nutrients that wastewater contains, such as phosphorous.

Reflections: Where Does Mexico Go From Here

The Tula Valley historically has been Mexico City's toilet, in a matter of speaking. The Tula residents became accustomed to this role and have developed an interdependent relationship with the city. The liquid waste irrigates the farms, the crops double and triple in yield, the farmers harvest and sell the produce in the city and consume some of it locally. Since the city's bowels never cease year-round, the Tula Valley thrives agriculturally and survives economically. However, the Tula community's health suffers immensely. This cycle continued, and actually grew, for more than a century until the federal government decided to intervene in the early 1990s with legislation and wastewater treatment projects aimed at what the CNA perceived as improving the wastewater system and management between the Tula Valley and Mexico City. In that statement rests the underlying issue this paper has been grappling with: how can both sides —the Tula Valley farmers and the CNA—find a solution that mutually benefits them. This paper offers no solutions but rather serves as a vehicle to expose the complexity of both sides' interests and uses the history of wastewater management in the Tula Valley to contextualize the discussion.

By using the lens of history to view the wastewater conflict in the Tula Valley, one sees that the conflict actually fits into several larger narratives in Mexico's history. For instance, the

65 Ibid.

historical tension between Mexico's indigenous population and the federal government plays a divisive role, as about 20,000 Hñahñu people have had to migrate to the United States due to economic strain, which seems to correlate with the federal restrictions of the early 1990s that limited irrigation with wastewater. That narrative points to a fundamental challenge facing Mexico's federal government: the unequal access to potable water between the citizens in Mexico City and the outlying regions. A 2014 documentary, H2OMX, powerfully shows how the water projects in the country have favored Mexico City over the surrounding rural regions because the city is the nation's economic powerhouse.[66] The rural communities around the capital have suffered inequality due to a lack of access to potable, cheap water even though every Mexican citizen has "the right to the access and provision of sufficient, clean and affordable water," according to the documentary.[67] The fact that the Tula Valley is the recipient of the city's waste and that the federal government has taken more than a century to address the health risks associated with wastewater irrigation certainly support that idea.

The situation in the Tula Valley is just one component of the impending water crisis Mexico faces in the next twenty years, a crisis that will only worsen as the population increases.[68] The government has created a plan called the 2030 Water Agenda, which attempts to tackle the water crisis now in order to ensure a sustainable and healthy water future for all of Mexico's citizens.[69] PTAR Atotonilco is a key component of that plan, and is meant to incorporate the Tula Valley farmers, among other groups in the state of Hidalgo, into the country's larger national movement toward a sustainable and healthy water future. What does this agenda mean for the Tula Valley community? To answer this question, more historical

66 *H2OMX*
67 Ibid.
68 Jiménez, "Water and wastewater management in Mexico City," 89.
69 "En Hidalgo la Conagua construye la PTAR Atotonilco."

research needs to be conducted in addition to the engineering and scientific studies that are already grappling with the same question but from a different perspective. The historical studies are important for revealing the larger trends and narratives in which the Tula Valley's current wastewater situation plays out, and for providing the context necessary to understand the roots of the farmers' reliance on wastewater.

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