

1.0 INTRODUCTION

1.1 Purpose of the Preliminary Engineering Report

This Preliminary Engineering Report (PER) has been prepared for the City of Natalia for the following purposes:

- To assess the current condition and performance of the wastewater collection and treatment systems;
- To consider improvement alternatives within these systems; and
- To make recommendations for such improvements within these systems.

This PER was prepared in accordance with all applicable requirements of the United States Department of Agriculture Rural Utility Services (USDA-RUS), and the guidelines of RUS Bulletin 1780-2. It is anticipated that this PER will accompany the City's application for funding from the USDA-Rural Development Program.

This report has been prepared in conjunction with a similar report detailing recommended improvements to the City's water distribution and production systems.

2.0 PROJECT PLANNING AREA

2.1 Location

The City of Natalia is located within Medina County, Texas at a distance approximately 30 miles southwest of San Antonio, Texas. A Vicinity Map is provided for review as Exhibit No. 1 within Appendix "A." Natalia is generally bordered between Interstate 35 and State Highway 132 (TX-132). The municipal water system is supplied with drinking water by two primary groundwater wells located at a single site approximately 4.5 miles north of the City. The municipal service area is approximately 1 (one) square mile in size, and is composed mostly of residential customers with few commercial customers. The average base elevation within the service area is 710 feet above Mean Sea Level (MSL).

2.2 Current Service Count

The City of Natalia currently serves a total of 492 connections. Of these, 64 connections are classified as commercial, and 428 are residential.

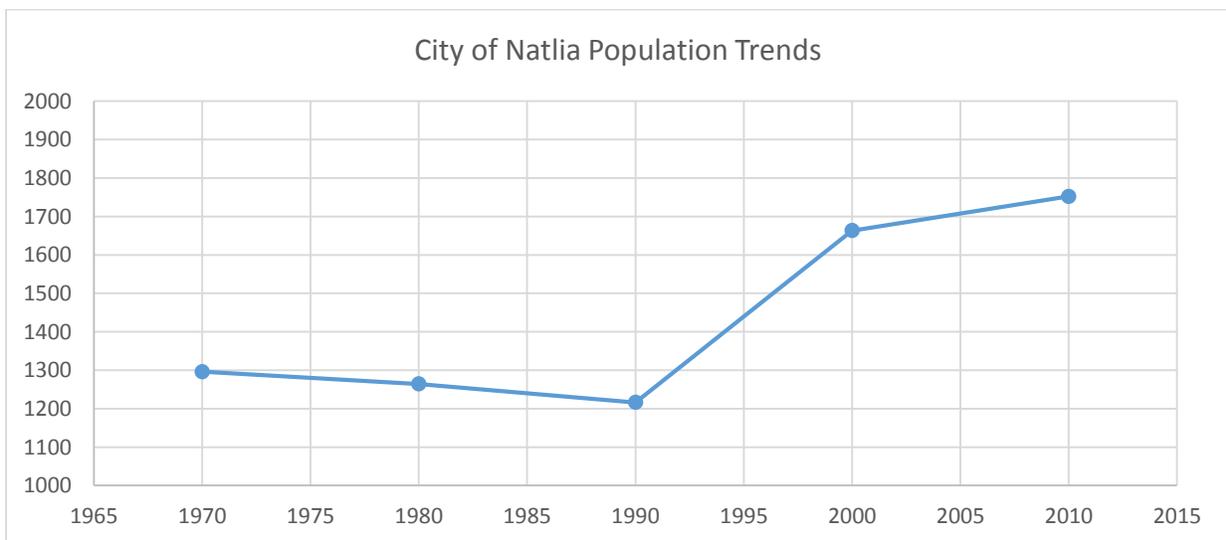
2.3 Environmental Resources Present

An Environmental Report (ER) for the proposed wastewater system improvements project has been prepared by Kelley Environmental Consulting, LLC. A copy of the stand-alone ER document has been submitted under separate cover to accompany this PER document. Based solely upon an onsite survey of the proposed project sites, there have been no identified potential significant impacts on any biological, cultural, historical or natural resources, nor has there been any determination of adverse effects to the human environment which may be a result of the proposed improvements.

2.4 Growth Area and Population Trends

There is not a significant amount of undeveloped land and platted (but unoccupied) lots within the City of Natalia’s utility service area. At this time, there are no immediate plans to expand the municipal utility service area. Some localized expansion could occur in the future if development occurs in areas around the Interstate 35 / FM 471 interchange.

Municipal population trends were evaluated using the 2010 United States Census Bureau information for the City of Natalia. Historic decennial census data from 1970 to 2010 was plotted using a Microsoft Excel spreadsheet. Using the most current ten-year growth rate of 5.4% between 2000 and 2010, the population data is projected out to 1,945 at the year 2030 for the purposes of this PER.



2.5 Community Engagement

A comprehensive Master Plan for the City of Natalia was last completed by Community Development Management Co. in 1996. It included an analysis of the current drinking water production, storage, and distribution systems as well as the wastewater collection system and treatment plant. No other studies have been completed on the City's wastewater system to date.

At the time of Master Plan development, the information presented indicated that the plant was in violation of the state rule requiring the initiation of a planning process or design for treatment plant expansion, by the time the plant reaches 75% of its discharge capacity. This has since been rectified through recent expansion efforts and the associated re-rating of allowable discharge to the Fort Ewell Creek.

Also, the Master Plan mentioned that the City had an inflow/infiltration (I/I) issue. Inflow is defined as water entering sanitary sewers through inappropriate connections or via manhole lids, wet well hatches, etc, whereas infiltration is ground water intrusion into collection pipes due to old/leaking infrastructure. I/I is common in older systems made up primarily of clay sanitary sewers and results in the City's wastewater plant exceeding its discharge capacity during and following major rains.

The overall goal of this system improvements project is to improve the reliability and performance of both the water distribution and wastewater collection and treatment systems through system modifications, rehabilitation, and enhancements and the replacement of failing system components. The details of various system improvements were presented to City staff during a meeting on August 12, 2015. From this meeting, the projects were prioritized and presented at a special meeting of the City Council held on September 2, 2015. This meeting was open to the public.

3.0 EXISTING FACILITIES

3.1 Location Maps

Location maps showing the location of the City's wastewater infrastructure have been included as part of Appendix "A". Photographs of major system elements are also included as part of Appendix "B".

3.2 History

The sewer system was first constructed in 1976, as documented by the plan set titled “Construction Plans Sewage Treatment Plant and Collection System” by Groves, Fernandez, Barry, Telford, and Associates, Inc. The primary gravity collection system was constructed of vitrified clay (VC) pipe. Today, these types of installations commonly show cracking, root intrusion, and joint failure due to aging. The collection system transferred flows to a wastewater treatment plant constructed under the same project. The plant included an onsite pumping station, oxidation ditch, clarifier, and chlorine contact tank to treat flows before discharging to Fort Ewell Creek. The City’s original discharge permit allowed for up to 91,000 gpd. Through multiple plant expansions, including an additional oxidation ditch and a filter. The current discharge permit stands at 260,000 gpd.

Projects were chosen based on known ongoing system maintenance issues and deficiencies. Additional system wide audits to determine water loss, energy use, and system efficiencies were not conducted as part of the development of this preliminary engineering report.

3.3 Existing Infrastructure

The City’s wastewater system is composed of approximately 42,500 feet of gravity sewer ranging in diameter from 6-inches to 10-inches, 100 manholes, two (2) duplex lift stations, 7,000 feet of force main, and a wastewater treatment plant (WWTP). The primary components of the City’s wastewater collection and treatment systems were visited by M&S staff on July 14, 2015. The following assessments on the condition of existing infrastructure are based on visual observations of major system components along with discussions with field maintenance staff.

The City’s two lift stations are duplex stations (two pumps at each station) and each site is equipped with an onsite generator. The City’s Ballfield Lift Station is located at the north end of town and pumps through a 6-inch force main southwest to a discharge manhole. From there, flows are conveyed by gravity to the WWTP. The Love’s Travel Center lift station is located near the FM 471/I-35 interchange and discharges through a 6-inch force main to a terminal manhole. Flows are then conveyed via gravity to the Ballfield Lift Station before being re-pumped to the WWTP.

3.4 Financial Status of Existing Facilities

The following items have been provided by the City of Natalia and included in Appendix “C”, as a synopsis of the City’s financial status:

- The City of Natalia’s current utility billing rate structure
- Detailed water usage by customer

- Utility fixed asset list
- 2014/2015 budget vs. actual
- 2015/2016 budget
- Current financial audit (completed for the 2013/2014 fiscal year)

The audit covering the 2014/2015 fiscal year will be available in February, 2016. The City does not have an asset management plan.

Based upon customer usage data provided for the month of August 2015, there were 552 water meter connections within the service area, consuming a monthly average of 5,116,277 gallons of water during that time period. 492 (or approximately 89%) of those serviced customers also receive sewer service. Water meter records show that residential services (including multi-family housing) account for approximately 76% of the volume of water used. This percentage estimate should apply for wastewater flow generations as well.

4.0 NEED FOR PROJECTS

The City of Natalia is committed to providing safe and reliable wastewater collection and treatment services at all times to all of its customers, and the general public at large.

4.1 Health, Sanitation, Security, and Regulatory Compliance

Safe and reliable wastewater collection is essential to providing proper health and sanitation to customers within the municipal service area. In the event that natural or man-made disasters occur near or within the City's corporate boundaries, critical services such as emergency medical care at hospitals and nursing homes must be maintained on a continuous basis at or near full capacity, as required. The disruption of such critical services due to inadequate or inoperable wastewater system facilities and/or the exposure of citizens to untreated waste water resulting from spills or overflows would create a significant risk to the health and safety of residents and visitors within the City of Natalia. In addition to health risks, wastewater overflows also pose a significant risk to the environment. Spills can place heavy loads of nutrients and metals into nearby lakes, creeks, and rivers that can result in impacts ranging from excessive algae and plant growth to threats to native flora and fauna.

Wastewater collection and treatment systems must be planned, designed, constructed, operated, and maintained in accordance with all applicable standards and practices, as well as be in compliance with all local, state, and federal regulations and codes. Specifically, the City of Natalia's system is required to meet or exceed all applicable TCEQ regulations for wastewater collection, treatment, and disposal.

The written findings from TCEQ from their most recent compliance inspection of Natalia's wastewater treatment plant has been included as Appendix "D". Per City staff, these noted deficiencies will be addressed during an upcoming treatment plant rehab project using CDBG funding, and completed by others.

4.2 System Operation and Maintenance

The City's WWTP and two (2) lift station sites are monitored by SCADA, allowing for remote monitoring of operations and quick response in the case of mechanical failures.

For the majority of the gravity collection system, maintenance is performed on an, "as needed," basis. Wastewater collected by gravity requires no mechanical assistance, and therefore only incidents involving plugged lines and/or leaks normally require maintenance from City personnel. The City's two pump station sites, along with the processes at the WWTP are monitored both in person through regular site visits and by SCADA to ensure constant, normal operation. At these sites, pumps, motors, and other ancillary equipment is serviced and/or replaced as needed.

Operational manpower for the wastewater collection and treatment systems is provided by municipal employees who are responsible for conducting limited maintenance and monitoring of the utility system. The operators respond to customer inquiries, perform minor maintenance activities, collect system operational data when required, and perform minor repairs as needed.

4.3 Existing Facilities Conditions

Most of the City's buried wastewater collection infrastructure is generally aged, and believed to be in need of repair. This belief stems from the significant flow spikes experienced at the wastewater treatment plant during major rain events; a clear indicator of I/I into the collection system. The City has not completed TV inspections of lines on a regular basis to identify locations of leaks and where infiltration is the greatest.

At the time of inspection, both of the City's lift stations were found to be in acceptable working condition. Minor repairs/upgrades will allow for these stations to maintain reliable service for the foreseeable future. At the City's ballfield station, visual inspection found the station to be in good condition overall with all major components in working order. One item that is in need of immediate attention, however, are the wall brackets that secure the stainless steel pump rails in place. These brackets are heavily corroded and should be replaced. While the work may be relatively minor, the impact of these brackets failing would be lost capability to pull pumps for servicing and possibly damage to the pump rails. City staff also reports that the station can struggle to keep up with incoming flows at times. This lift station not only collects from the northern section of the City, but also accepts pumped flow from the Love's Travel Center lift

station. The Ballfield Station does not overflow, but pumps do have to run for longer periods of time than what would be preferred for a properly-sized lift station. The City's lift station at the Love's Travel Center was also found to be in good condition overall with no equipment in need of replacement at this time. However, this site was not constructed in an area that also tends to drain higher ground to the west. This results in high levels of inflow entering the wet well during periods of active drainage, another contributing factor to high flow spikes witnessed at the wastewater treatment plant during rain events.

The City's wastewater treatment plant is located just south of the City off of FM 772. Visual inspection found a few minor issues that should be considered for improvement. The stations back-up generator was in disrepair and in need of replacement. Without reliable back-up power, a power outage could result in an overflow of the plant site's collection pump station and a possible discharge of untreated wastewater into Fort Ewell Creek. It was also noted that one of the brush aerators (spinning brush used to agitate surface flow and generate aeration in the oxidation ditch) does not effectively reach the surface of the water due to improper leveling. These deficiencies, along with a few other minor improvements, are currently scheduled for completion as part of a separate contract through a Community Development Block Grant.

4.4 Growth

There is not a significant amount of undeveloped land and platted (but unoccupied) lots within the City of Natalia's utility service area. At this time, there are no immediate plans to expand the municipal utility service area. Some localized expansion could occur in the future if development occurs in areas around the I-35 / FM 471 interchange.

Municipal population trends were evaluated using the 2010 United States Census Bureau information for the City of Natalia. Historic decennial census data from 1970 to 2010 was plotted using a Microsoft Excel spreadsheet. Using the most current ten-year growth rate of 5.4% between 2000 and 2010, the population data is projected out to 1,945 at the year 2030 for the purposes of this PER.

5.0 PROJECTS CONSIDERED

There have been very few CIP projects completed over recent years focused on upgrading or maintaining the City's wastewater collection and treatment infrastructure. However, the City is currently making upgrades and repairs at the WWTP using monies from a CDBG grant. Using a USDA search grant, the City hired M&S Engineering to develop a prioritized list of suggested wastewater projects, focused primarily on the collection system since the WWTP is being upgraded as a separate effort. In selecting and prioritizing the project list, sustainability, system

reliability, infrastructure criticality (impact to public should a failure occur), and long term maintenance, were all considered. Specific sustainability-related benefits considered include the use of PVC pipe for pipeline replacements. PVC, when installed correctly, has a very long life expectancy and has a relatively minimal environmental load in terms of CO2 emission, when compared to metal products for the same application. Included below (section 5.2) are the different projects that were considered to improve the functionality and reliability of the City's wastewater collection system.

5.1 No Improvements within the Wastewater Collection System

The City of Natalia could certainly continue to operate and maintain the existing wastewater collection system in its current form and condition. This option would require the City to achieve a higher level of preparedness to respond to any potential emergency situations, such as leaks in the gravity collection system, pump ragging or motor failure at the two lift stations, and overflows due to major weather events or mechanical failure. An increase in the number and frequency of gravity main leaks in the future should be anticipated by the City if this option is chosen, as the aging clay pipes continue to deteriorate. Selection of the, "Do Nothing," option would result in the likely increase in inflow and infiltration into the collection system. This increase would then result in an increase in severity of the flow spikes that currently occur at the WWTP during major rain events, which could then result in an increase in the number of events that exceed the peak discharge volumes permitted by TCEQ.

5.2 Project Analysis

5.2.1 Prioritized Project List

1. Redirect the Love's Travel Center Lift Station Through New Pipeline to WWTP: A new sewer pipeline (combination force main and gravity main) would allow the Love's lift station to pump in a dedicated line to the WWTP. This project would require new pumps at Love's Travel Center lift station sized for the new discharge force main and approximately 6,400 feet of new pipe line along FM 6717, discharging to the wet well at the Plant pump station at the City's WWTP. Pipeline line sizing has been estimated at 8-inch diameter. This would be confirmed during final design. This project would also include curbing around the lift station to keep surface stormwater inflow from entering the wet well, helping to reduce flow spikes at the WWTP during major rain events. The primary purpose for this project is to reduce wastewater flows entering the City's Ballfield lift station. The Love's lift station flows currently are repumped at the Ballfield lift station, and the project would remove this burden. Should any new flows be added at the south end of the City, through development or through new connections from residents currently on septic systems, the new pipeline could also serve as a primary collector for

this area of the City. This project is considered of the highest priority in that it not only fills the immediate need of relieving flows into the Ballpark lift station, but also adds system flexibility by establishing a second primary conveyance to the WWTP as well as a collector for any new development along the I-35 corridor.

2. Replace the Utility Crossing of Fort Ewell Creek: The condition of the current aerial gravity sewer crossing of Fort Ewell Creek is of concern. There are signs of erosion around the base of the pipe supports, which are located in the flow line of the creek. A failure of this pipeline would result in a discharge of untreated wastewater into the Creek, the environmental effects of which could include impacts to both flora and fauna. This project would construct a new crossing with supports located out of the primary flow line of the creek, if possible, and installed with enough depth to ensure erosion is not an issue. Additional room could be left to install a water main alongside the wastewater main, as the existing water main is located with minimal cover below the creek bottom. This line is not a major concern at this time, but leaving room allows for ease of construction should future erosion expose the line. This project is considered of high priority due to the possible environmental impacts to the Fort Ewell Creek should one of the existing supports collapse and a discharge occur.
3. Reduction of Non-Wastewater Treatment at WWTP: The City's WWTP experiences high flow spikes, often times exceeding the permitted discharge flow allowance, during periods of heavy rain. It is believed that these flow spikes are due to inflow and infiltration into the gravity collection system. Replacing aged wastewater gravity mains reduces infiltration of ground water into the system. Similarly, rehabbing or replacing manholes showing signs of deterioration helps reduce both groundwater infiltration and stormwater inflow (in cases of deteriorating rims and lids). The project would likely run in 3 phases:
 - TV inspection of selected gravity sewer lines and inspection of manholes to determine condition,
 - Cleaning/jetting of select lines,
 - Lining and/or replacement of select lines along with lining or replacement of select manholes.

This project area was selected to match the project area of a proposed water main replacement project (included in a separate Preliminary Engineering Report as part of another application for USDA funding for the City of Natalia). The area for both replacements was selected based on the frequency of leaks, breaks, and repairs for both the water mains and gravity sewers. Completing both projects within a given area allows the construction efforts to run in parallel, which will limit impacts to surrounding

residences and businesses to a single project timeframe. This also effectively reduces the cost of construction of both projects through bidding the projects together and allowing one contractor to perform both efforts. This project is of high priority due its long term effect on loadings into the WWTP and the resulting long term energy cost savings and plant treatment efficiencies. Discussion with City staff suggests that the entire system will be inspected at a later date, as funding allows.

4. Minor Repairs at the Ballfield Lift Station: During an onsite visual inspection of the Ballfield Lift Station, the station was found to be in good condition overall with all major components in working order. One item that is in need of immediate attention, however, was the wall brackets that secure the stainless steel pump rails in place. These brackets are heavily corroded and should be replaced. While the work may be relatively minor, the impact of these brackets failing would be the inability to pull pumps for servicing and possibly great expense if there is future damage to the pump rails. The existing brackets will be replaced with stainless steel brackets to ensure the longevity of the repair. This project is of high priority due to the possible damage caused (and additional repair expense required) if the brackets were to fail.
5. Sewer Expansion Crossing West of I-35: Contingent upon redirecting Love's Lift Station to the WTP through a new pipeline (project #1 in this list), service could then be extended under I-35 to serve areas east of the Interstate, including the Mustang Ridge subdivision. This would require a bored force main crossing of the interstate as well as a new lift station west of I-35. This new lift station would act as a primary point of collection for the existing Mustang Ranch Subdivision (which would require a gravity collection system separate from this project) as well as any future commercial development in the area that could develop from the availability of a public wastewater collection service. This project was given lower priority due to the limited benefits to the overall City wastewater collection system outside of the ability to service new areas.
6. Mustang Ridge Wastewater Collection System: Contingent upon redirecting Love's Lift Station to the WTP (project #1 in this list) and extending sewer service across I-35 (project #5 in this list), the Mustang Ridge Subdivision (approximately 60 lots) could be served by gravity collection. Project elements would include approximately 8,000 feet of gravity main, associated manholes, and single services for each lot. This project was given lower priority due to the limited benefits to the overall City wastewater collection system outside of the ability to service the Mustang Ridge subdivision.
7. Extend Sewer Service to Sepulveda parcel NW of I-35 Interchange: Contingent upon redirecting Love's Lift Station to the WTP (project #1 in this list), service could then be extended northwest to serve the large parcel, encouraging commercial development. The project would likely include a grinder station and small diameter force main extending south to the new Love's Lift Station force main. This project was given lower priority due

to the limited benefits to the overall City wastewater collection system outside of the ability to service the specific new areas.

8. Extend Sewer Service to T5M parcel SW of 1-35 Interchange: Contingent upon redirecting Love's Lift Station to the WTP (project #1 in this list), service could then be extended southwest, encouraging commercial development. The project would likely include a grinder station and small diameter force main extending north to the new Love's Lift Station force main. This project was given lower priority due to the limited benefits to the overall City wastewater collection system outside of the ability to service the specific new areas.

5.2.2 Design Criteria

Summarized below is a listing of the relevant hydraulic design criteria that will be applied to wastewater collection system design to optimize system performance and meet or exceed all applicable regulatory guidelines and requirements.

- Average Daily Water Demand per Service (ADF): 250 Gallons per Day (GPD)
- Maximum Peaking Factor Applied to ADF: 4
- Minimum Force Main Flow Rate: 2.5 Feet per Second (FPS)
- Maximum Force Main Flow Rate: 7 FPS
- Minimum Gravity Sewer Slope: Per TCEQ 217.53, Table C.1
- Maximum Gravity Sewer Slope: Per TCEQ 217.53, Table C.1
- Gravity Sewer Manning's n-value: 0.013
- Maximum Manhole Spacing: 500 feet
- Pump sizing shall accommodate peak flow (ADF x 4) with a single pump running.

All infrastructure materials shall be suitable for wastewater application. In general, gravity piping, including services, shall be rigid PVC, colored green, to ensure straight runs (consistent slopes) between manhole structures. Force main shall be PVC or HDPE; materials that will not corrode in a wastewater environment. The interiors of ductile iron fittings and valves shall be lined with ceramic-epoxy material to protect the metal against corrosion. Other metal, wetted surfaces shall be coated (fusion bonded epoxy or other suitable coating) for wastewater application per manufacturers' recommendations. Pumps will be submersible with non-overloading motors. All miscellaneous hardware, including but not limited to bolts, nuts, fasteners, bracing, etc., shall be 316 stainless steel.

5.2.3 Environmental Impacts

As will be discussed in greater detail in sections 6.0 and 7.0, projects # 1-3 have been selected to move forward for the funding application to USDA based on priority, criticality to the system, and

the desired loan limitations of the City of Natalia. All of the wastewater collection system improvements described above shall be located either directly upon / under property currently owned by the City of Natalia, or they will be located upon / under property within public rights-of-way corridors. Thus, no apparent environmental impacts resulting from implementation of the system improvements listed and described above are anticipated to occur within the project location boundaries. Additional information regarding the environmental impacts of the improvements listed above can be found in the Environmental Report for the proposed projects, submitted under separate cover.

5.2.4 Land Requirements

Generally, all projects will be installed and/or constructed on land owned currently by the City of Natalia, or within public right-of-ways. A permanent easement, however, could be required for the construction of a new lift station east of I-35. As will be made clear in section 6 of this report, this project has not been prioritized for USDA funds. While the need for easements is not foreseen, new utility easement agreements for corridors located outside of established public rights-of-way would be coordinated through the City of Natalia, in conjunction with the property owners.

5.2.5 Potential Construction Problems

Progressive utility work along some moderate slopes may be required during trench excavation for wastewater pipeline installation. During trench excavation, some hardened rocks and limestone formations may be encountered by men and equipment, and seasonal groundwater just below grade may be present.

Pipeline utility work along existing narrow streets and roadways may be difficult, and will probably require the use of temporary traffic barricades, warning signs with lights, and flagmen during the time construction work is underway. Driveway access for private property owners and businesses must be maintained at all times during construction. Access to rear lots, alleyways, and other easement corridors may be constrained by existing above-grade structures, fences, etc.

Existing property improvements, including landscaping and mature trees, might be impacted at many public and private properties during construction. Trenchless pipeline construction, particularly for force main installation, could be required in some specific locations.

Installation of a temporary bypass pumping system (pump and piping) will likely be required when pumps are being replaced at the Love's Travel Center lift station and when minor improvements are being made at the Ballpark lift station. The same holds true for work involving

gravity pipeline replacement and/or manhole rehabilitation or replacement. Bypass pumping for work associated with existing gravity pipeline and manholes would be analyzed on a case-by-case basis, following the results of initial condition assessments and pipe televising inspections.

Property owners adjacent to project locations might have to contend with elevated levels of dust and noise during storage of construction materials at each of the sites; however, it is anticipated that most residents will be understanding and cooperative when they are made aware of the pending improvements and long-term benefits to the wastewater collection system.

5.2.6 Cost Estimates

A summary of estimated costs for all projects listed in section 5.2.1 has been included below.

City of Natalia - Preliminary Project Cost Estimates	
Project Description	Estimated Initial Capital Cost
Redirect the Love’s Travel Center Lift Station Through New Pipeline to WWTP	\$374,000
Replace the Utility Crossing of Fort Ewell Creek	\$87,000
Reduction of Non-wastewater Treatment at WWTP	\$399,000
Minor Repairs at the Ballfield Lift Station	\$12,000
Sewer Expansion Crossing East of I-35	\$389,000
Mustang Ridge Wastewater Collection System	\$412,000
Extend Sewer Service to Sepulveda Parcel NW of I-35 Interchange	\$79,000
Extend Sewer Service to T5M Parcel SW of I-35 Interchange	\$51,000

5.2.7 Project Advantages and Disadvantages

Redirect the Love’s Travel Center Lift Station Through New Pipeline to WWTP: The addition of this new pipeline will allow the redirecting of flows entering the Love’s Lift Station south and then west to the WWTP, effectively offloading the Ballfield Lift Station. According to City staff, the station’s pumps have problems at times keeping up during periods of higher inflows. The new pipeline also gives the City flexibility to direct additional flows southward, should development occur in the eastern portion of the City along the I-35 corridor. New pumps at the Love’s Lift Station would be sized to accommodate current peak flows and possible future flows, meaning both stations should operate reliably for some time. Pumps sized for possible future flows leaves

the City in a beneficial position to make this station a regional collector should the I-35 corridor experience growth.

One disadvantage of the proposed new pipeline is the additional maintenance and attention that would be required with the installation of new infrastructure. The proposed pipeline would be part force main and part gravity main due to the elevation of the proposed route. Wastewater force mains require air release valves and isolation valves, and gravity sewers require manholes at least every 500 feet. All of these items require regular exercising (valves) and routine maintenance.

Replace the Utility Crossing of Fort Ewell Creek: The primary advantage gained by replacing the existing gravity sewer aerial crossing of the creek is the avoidance of a failed gravity sewer line and the resulting discharge of untreated wastewater into the creek. Erosion from flowing water in the creek is evident around at least one of the supports of the existing crossing. A new crossing, with base supports installed deep enough to withstand the effects of the creek, will ensure a discharge is avoided.

A disadvantage to this type of utility work within environmentally sensitive areas are that there will be significant clearing needed to get equipment back to the site, extensive permitting needed, and a high expense to construct relative to the short length of pipeline to be replaced. An additional factor adding the high expense is the high level of care required during construction to ensure that wastewater is not discharged to the creek when the existing gravity sewer line is taken offline (removed), and the new one put into service. These disadvantages will still be present in the future when emergency work would be required, if the existing line were to fail, as would likely occur sometime in the future should nothing be done to address it.

Reduction of Non-Wastewater Treatment at WWTP through Gravity Collection System Rehab:

Reducing the volume of non-wastewater flows treated at the WWTP is accomplished by reducing inflow and infiltration (I&I) into the wastewater collection system. The primary benefits of reducing these flows include a reduction in the number of times the WWTP's discharge into the Fort Ewell creek exceeds its permitted discharge, a reduction in energy used at the WWTP, and improved treatment efficiency as biological processes can suffer from diluted inflows. The reduction of I/I is accomplished through the repair or replacement of leaking/broken pipe segments and manholes. Added benefit to these actions include a reduction of wastewater flows to the surrounding environments.

Potential disadvantages to a I/I reduction project is the maintenance of existing wastewater service to active lines during work and the challenges in limiting interruptions to wastewater services when new infrastructure is being brought online.

Minor Repairs at the Ballfield Lift Station: Advantages to replacing the existing, corroded bracing for the pipe rails will allow continued reliability of the railing system. These rails are used to remove pumps for routine maintenance. Failure of the braces would result in the inability to service pumps, and the possibility of additional damage to the rails themselves.

Disadvantages to this improvement are moot compared to the need to make the repair. There are challenges present in making a repair in a wet well, including provisions for a confined space entry and bypassing incoming wastewater flows should the repairs require emptying the wet well prior to work.

Sewer Expansion Crossing East of I-35: This project would include a force main crossing I-35 from the Love's Lift Station as well as a new lift station east of the highway acting a collector of flows from this area. The primary project advantage would include the ability to serve the Mustang Ranch Subdivision (approximately 60 lots) with the addition of an onsite collection system, and a secondary advantage would be the added incentive (the availability of sewer service) for commercial development east of the interstate.

The project disadvantage is the high cost of crossing I-35 to service only around 60 lots. Working within TXDOT right-of-way, specifically boring a new pipeline across the highway, poses costly construction challenges. Also, easements could be required for a new lift station should a suitable site not be available within rights-of-way. Also, a new lift station itself is an expensive proposition, requiring new power service, pumps, panels, valving, and SCADA. The disadvantages associated with costs would be reduced should the availability of sewer service spur additional development in this area, the economic impacts of which would benefit the City and help recover project costs.

Mustang Ridge Collection System: Associated with the Sewer Expansion Crossing West of I-35 is the need to construct an onsite collection system within the Mustang Ridge Subdivision. The advantages of these efforts are limited only to serving the approximately 60 lots of this subdivision. Providing sewer collections limits the number of septic tank / leach field systems in the area and reduces related discharges from surrounding soils.

Extend Sewer Service to Sepulveda Parcel NW of I-35 Interchange: The entire project benefit is geared towards serving a future commercial lot, encouraging development and the associated economic benefit to the City. The project would include a simple grinder duplex lift station and small diameter force main, keeping costs down relative to the cost of a larger force main/lift station package. The disadvantage of the project is that upfront monies would be spent with no immediate impact/benefit to the City of Natalia.

Extend Sewer Service to T5M parcel SW of I-35 Interchange: The entire project benefit is geared towards serving a future commercial lot, encouraging development and the associated economic benefit to the City. The project would include a simple grinder duplex lift station and small diameter force main, keeping costs down relative to the cost of a larger force main/lift station package. The disadvantage of the project is that upfront monies would be spent with no immediate impact/benefit to the City of Natalia.

6.0 SELECTION OF PROJECTS

The project list discussed herein is focused primarily on maintenance related repairs and upgrades to the system, as opposed to system expansions, and wide scale replacements/upsizings. Projects listed were prioritized based on current condition of the infrastructure, criticality to the overall wastewater collection system, impacts to public health and environment resulting from failure, as well as cost. This list was prioritized at the same time a similar list was being prioritized for water system improvement projects. The City also set a limit for the amount of USDA money (combined for water and wastewater improvement projects) they wished to apply for.

Where applicable, a life cycle cost analysis was completed for each project and an associated project alternative (or option). Where projects focus primarily on maintenance of the system and/or replacement of aging infrastructure, parts of the 20-year cost analysis may not be applicable. Operation and maintenance costs as well as salvage value items are only presented for items that are considered additions to the existing system (i.e. not items/projects that simply replace or are repairs to existing infrastructure). These analyses have been provided as part of Appendix “E”.

Provided below in a tabular format is a cost and recommendation summary for the proposed project alternatives. Recommended projects are cost-effective and feasible improvements to the wastewater collection system that benefit the City as a whole.

City of Natalia Project Summary			
Project Number	Project Description	Estimated Total Capital Cost (not including Future Costs)	Recommended? Y or N
1	Redirect the Love’s Travel Center Lift Station Through New Pipeline to WWTP	\$374,000	Yes
2	Replace the Utility Crossing of Fort Ewell Creek	\$87,000	Yes
3	Reduction of Non-Wastewater Treatment at WWTP	\$399,000	Yes
4	Minor Repairs at the Ballfield Lift Station	\$12,000	Yes
5	Sewer Expansion Crossing East of I-35	\$389,000	No
6	Mustang Ridge Wastewater Collection System	\$412,000	No
7	Extend Sewer Service to Sepulveda Parcel NW of I-35 Interchange	\$79,000	No
8	Extend Sewer Service to T5M Parcel SW of I-35 Interchange	\$51,000	No

7.0 PROPOSED PROJECTS AND POSSIBLE ALTERNATIVES

7.1 Recommended Wastewater Collection System Improvement Projects

Construction of the wastewater system collection improvement projects summarized below is recommended for expansion and enhancement of the safety and reliability of the City’s wastewater collection system. A system map depicting each of the proposed projects has been included as Appendix “F”.

City of Natalia
Recommended Wastewater Collection System Improvement Projects
1. Redirect the Love’s Travel Center Lift Station Through a New Pipeline to the WWTP
2. Replace the Utility Crossing of Fort Ewell Creek
3. Reduction of Non-Wastewater Treatment at WWTP through Gravity Collection System Rehab
4. Minor Repairs (Replace Existing Pipe Rail Brackets) at the Ballfield Lift Station

7.2 Alternatives to the Recommended Projects

In addition to prioritizing each of the possible projects and developing the list above, a possible alternative to each of the four (4) selected projects was developed and discussed below.

Redirect the Love’s Travel Center Lift Station Through a New Pipeline to the WWTP: There is a cost effective option of upgrading the Ballpark Lift Station with larger pumps and upsizing the piping (both force main and gravity mains) from that Lift Station south to the WWTP. This option is a slightly shorter route and could actually present minor savings in capital costs. However, there are many other factors that contribute to the decision of building a new line in the southern portion of the City. First, having flows enter the station’s upstream lift station through separate conveyances will help alleviate some of the flow spikes the WWTP sees during major rain events. It is less likely that the two (2) lift stations (Love’s and Ballpark) will be operating simultaneously during these events meaning inflow rates into the WTTTP are better averaged out. Also, a pipeline to the south means the City has the flexibility of accepting future flows in these areas, should new development occur or existing homeowners decide to forego septic systems and connect.

Replace the Utility Crossing of Fort Ewell Creek: There is no cost-effective approach to resolving the condition of the current crossing other than replacement. However, it may be possible to cross the creek in a different location. Wastewater lines could be brought out to the highway and lines fastened to the bridge instead of crossing the creek in the current location. This would likely require an inverted siphon installation as the existing upstream and downstream inverts of the gravity sewer are set, not allowing for a longer run of pipe at a recommended minimum slope. Inverted siphons may require maintenance over and beyond a standard gravity sewer installation, leaving a replacement installation at the existing location as the preferred approach.

Reduction of Non-Wastewater Treatment at WWTP through Gravity Collection System Rehab: Alternatives to reducing non-wastewater treatment at the City’s WWTP by reduction of I/I would increasing the capacity of the WWTP and repermitting the allowable discharge to handle the peak flows entering the system during major rain events. This solution is very cost prohibitive both in

terms of up front capital costs and in long term power. Furthermore, allowing I/I levels to increase as old pipes and manholes continue to degrade results in weak, or diluted inflows into the WWTP. These flows can cause the efficiency of the plants biological processes to suffer.

Minor Repairs (Replacing Existing Pipe Rail Brackets) at the Ballfield Lift Station

There is no feasible alternative to replacing the existing pipe rail supports. If the supports fail, the cost to replace the existing pump rails will far exceed the cost for the minor repair.

7.3 Recommended Projects Cost Estimates

Construction and installation cost estimates for the recommended projects, and their respective project alternatives, are summarized and provided for review in a tabular format within Appendix “E”.

The opinions of probable costs for wastewater system improvements are preliminary and were developed from industry unit costs that reflect typical bid pricing for similar construction projects in areas surrounding the City of Natalia. Costs for engineering and contingency are generally estimated as percentages of the overall construction estimate.

Note: Costs can vary somewhat depending upon a number of variables. Some of the main factors affecting costs are described as follows:

- Quality—Prices for materials and workmanship should represent sound construction work.
- Overtime—Labor costs should be adjusted accordingly if the schedule is accelerated to require effort beyond normal working hours.
- Size of Project—Economies of scale can reduce costs for large projects and, conversely, unit costs can often run higher for small projects.
- Location—Within dense neighborhoods, traffic (especially school-related traffic) and site storage limitations may increase costs.
- Season of the year / weather conditions
- Contractor management
- Building code requirements
- Availability of skilled labor and building materials
- Owner’s special requirements and/or restrictions
- Safety requirements
- Environmental considerations
- Traffic control

7.4 Project Schedule

A proposed Project Schedule for funding and administration of the recommended wastewater collection system improvements is provided for review within Appendix “G”.

Due to the standalone nature of each project, it is anticipated that, “construction packages,” consisting of construction plans, specifications, and contract documents will be developed for each of the three projects.

7.5 Annual Operating Budget

For information related to annual operating budgets prepared by the City of Natalia, the following documents are provided for review within Appendix “C”:

- Utility fixed asset list
- 2014/2015 budget vs. actual
- 2015/2016 budget
- Current financial audit (completed for the 2013/2014 fiscal year)

8.0 CONCLUSIONS AND RECOMMENDATIONS

To determine projects for recommendation, staff at M&S Engineering worked with City staff to determine the deficiencies and needs present in the wastewater collection system. Deficiencies included issues relating to system redundancy and reliability, TCEQ compliance, potential for wastewater overflows, as well as issues facing the maintenance staff day-to-day. These system deficiencies were then used to develop a suggested list of capital improvements that would be of benefit to the City of Natalia and its water customers. With City input, this list was prioritized based on the criticality of the need being served, how many of the City’s customers are potentially impacted, and the benefit to the City’s staff in terms of improving their abilities to provide reliable collection services. Costs estimates were then performed for the prioritized projects and projects selected based on the City’s desire to pursue approximately \$1,500,000 in USDA funding.

Through the efforts described above, it has been concluded that the most critical need for the City at this time are making critical repairs and also helping to alleviate flow spikes at the WWTP during major rain events. The poor condition of a gravity crossing of Fort Ewell Creek presents a critical environmental hazard should a failure occur. The Ballfield LS currently collects almost the entire wastewater collection system, a situation that causes overloading during periods of

highest flows. Also, City staff reports that flow spikes are extreme during major rain events, a situation that is normally a clear indicator of I/I intrusion into the collection system. To help alleviate these concerns, proposed projects include replacement of the gravity crossing of the Fort Ewell creek and offloading of the flow loadings into the Ballfield lift station by rerouting the Love's lift station through a new conveyance.

A significant portion of the City of Natalia's wastewater collection system is made up of old clay pipes, and is due for replacement or refurbishment. The aged system results in leaky pipes, which in turn result in:

- Groundwater intrusion and associated flow spikes at the WWTP
- Possible service interruptions in instances where pipe leaks create a collapsed pipe
- Wastewater leaked into the surrounding soils

Replacement of all lines in the system is something that the City has considered, but it is not justifiable at this time due to the high cost and their desire to limit the amount of funding requested. Instead, the portion of the system determined to be the oldest (and with the most frequent leaks/breaks) has been prioritized for replacement with new PVC mains. The recommendation to replace the oldest section ensures that the greatest benefit will be realized by the City in correlation with the USDA funding dollars spent. PVC mains have a long, established useful life. Placement of mains will take into account locations where the mains will be unlikely to suffer damage from miscellaneous excavations.