

CITY OF JETMORE

Water System

Preliminary Engineering Report,

Project Number 12-48

August 28, 2014



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Salina, Kansas

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PRELIMINARY ENGINEERING REPORT
WATER SYSTEM IMPROVEMENTS
JETMORE, KANSAS

1. GENERAL

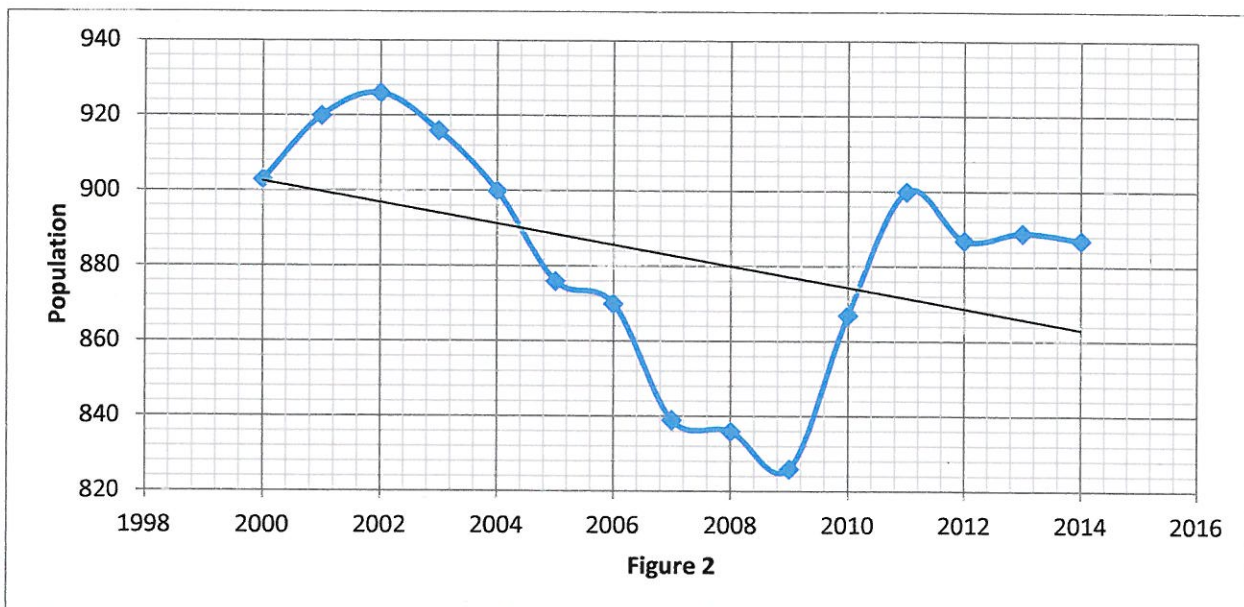
The purpose of this report, prepared for the City of Jetmore, Kansas, is to examine the water system and to investigate and recommend improvements necessary to restore the distribution system to original design capacity, increase pressure, remove dead end lines, reduce breaks and maintenance costs, provide dependable water service and fire protection for Jetmore presently and in the near future. This report also includes a summary of financing sources available for construction of recommended improvements.

2. SERVICE AREA

The City of Jetmore is located in central Hodgeman County at the intersection of State Highway 156 and US Highway 283. The service area encompasses the entire community as shown on Figure 1.

3. POPULATION TREND

The historical population for Jetmore shown on Figure 2 shows the population trend has been in general decline, however it is anticipated that with continued infrastructure improvements this trend will stabilize and potentially rebound.



4. EXISTING FACILITIES

4.1 Water Supply

The water supply for Jetmore is obtained from four wells of varying depths scattered about the community. Three wells (No's 11, 12 & 14) are rated as primary wells and well No 13 is rated as a secondary water source. The maximum dependable production of the three primary wells combined is 790 gallons per minute (gpm) for a capacity of 1.138 million gallons per day (mgd). Individual pump rates and detailed well information is included in Appendix B.

Annual average water usage for 2012 was 0.214 mgd pumped with 0.180 mgd of that being sold and metered. Of the total water pumped 0.034 mgd (16%) is not being accounted for, water loss from leaking pipes and / or inaccurate readings from worn out water meters.

The supply system condition varies greatly. Well No. 11 is the oldest of the current supply wells, constructed in 1980. Well No. 12 was originally constructed in 1987 and completely reconditioned in 2011 reusing the pump and column pipe. A variable frequency drive was added at that time. Well No. 13 currently is used to fill the golf course irrigation pond. Well No. 14 is the newest domestic municipal well constructed in 2005. Additional wells owned and operated by the City are the Motorplex, City Lake, and Air Port Hangar.

Pumps are activated using pressure switches located at the base of the elevated water tank turning the wells off and on using a rotator to change pumping order after each pumping cycle. The system was initially installed around 1980 and uses phone lines to send signals from the tank site to the wells. The majorities of the well pump operating problems are due to phone line issues.

Water is treated with chlorine at the individual well sites prior to entering the distribution system. The chemical analysis of the existing wells is included in Appendix C along with the maximum contaminant levels permitted by the National Primary Drinking Water Standards and recommended by the Federal Secondary Drinking Water Standards. The primary standards are regulations which limit the concentration of those constituents which affect the health of consumers. The secondary standards deal with the esthetic and palatable qualities of the drinking water and were established by the Environmental Protection Agency as guidelines for the States.

The overall quality of the water from the existing wells appears to be of marginal acceptable quality based upon the KDH&E samples tested. Overall constituents tested except iron, manganese, sulfate and total dissolved solids which are fairly typical of the water supplies in the geographical area, are within the limits of the Primary and Secondary Drinking Water Standards.

The presence of radionuclide's as a primary standard can be a serious issue addressed by blending sources, treatment, and/or replacement of water sources. Treatment is the least desirable due to issues of disposing of the waste stream.

4.2 Storage System

Jetmore's water storage system consists of a 50,000 gallon elevated steel storage tank located in the center of the community at Roughton and Highway. The storage tank was constructed in the early 1910's. An analysis of the structural condition of tank is beyond the scope of this report.

The City maintains a maintenance service contract on the elevated tank to provide inspection and periodic touchup painting as required. Detailed inspection reports for the tank are included in Appendix D. Recent inspection resulted in having the tank cleaned and repainted early this year. During the cleaning and painting process several deficiencies were encountered and repaired. This included patching a previously installed internal repair plate for a failed bowl bottom.

Storage requirements are based on the need to supplement the capacity of the water supply. Supplemental fire storage is not required if the water supply capacity can provide fire flow while meeting maximum daily demand. The maximum fire flow need determined by Insurance Services Office (ISO) for Jetmore is 3,000 gallons per minute (gpm) resulting in the calculations below. The Jetmore ISO Hydrant Flow Data Summary is included in Appendix E.

Fire storage required is expressed by ***SSR = NFF + MDC – PC – ES – SS – FDS**.

SSR=storage supply required, **NFF**=needed fire flow, **MDC**=maximum daily consumption, **PC**=production capacity, **ES**=emergency supply, **SS**=suction supply, **FDS**=fire department supply.

SSR = (3,000 gpm X 3 hours X 60 min/hour) + (556,320 gal/day) – ((80 gpm + 330 gpm + 380 gpm) X (60 min/hour X 24 hour/day)) X 0.85** – 0 – 0 – 0.

SSR = 129,360 gallons.

* Water Distribution Systems Handbook, Chapter 10 – Hydraulic Design of Water Distribution Storage Tanks, McGraw-Hill

** =15% reduction for elevated tank

The current 50,000 gallon storage system is not adequate based upon the need for a minimum amount of storage for high consumption periods and fire flows.

4.3 Distribution System

A map of the water distribution system for the City of Jetmore (Figure 3) is included in Appendix A.

The majority of the mains were installed in the early 1900's of cast iron pipe with newer lines being constructed of PVC (Polyvinyl Chloride) pipe. Additional lines have been constructed as needed.

Following are approximate existing system quantities.

- | | |
|------------------------|--------------------|
| • 8-inch water mains - | 2,071 lineal feet |
| • 6-inch water mains - | 22,321 lineal feet |
| • 4-inch water mains - | 38,373 lineal feet |

- 2-inch water mains - 2,558 lineal feet
- 1 ½-inch water mains - 475 lineal feet
- 10 dead end points
- 121 valves; 2 inoperable & 75% reported not fully functional
- 554 meters, varies

The 4-inch and smaller cast iron water mains no longer provide the desired water flow for normal residential uses and fire protection of the business and residential areas. The pipes are old and due to the small size lose a lot of pressure through friction loss. Additionally, several lines are not looped, thereby allowing for additional pressure loss due to the lack of dual flow. The older lines are constantly breaking especially along North Bowlus and North Atkins requiring numerous repairs.

Hydrant flow tests were performed on the Jetmore system by City staff and are included in Appendix E. Each hydrant test utilizes two adjacent fire hydrants within the system. Measurements of the pressure were taken at the fire hydrants with and without water flowing from the hydrant. Static pressures ranged from 38 psi to 70 psi and flow pressures ranged from 10 psi to 61psi. Ideally the static pressures would be 60 to 70 psi and the flow pressures would be 45psi to 55 psi. Large variances in static pressure versus flow pressure, at specific locations, indicate there is a problem in the distribution system. If you have adequate static pressure with low flow pressure indicates; closed valve(s), undersized or damages lines, and/or blockage. Low static and flow pressures indicate the well pumps and storage tank are inadequate. Adequate flow pressure equate to adequate flows. Low pressures equals low flows.

The hydrant test results indicated the water delivery capacity decreases as the distance from the water tower increases and the hydrant elevation increases. The variance may be attributed to the size of the water lines, the roughness of the interior walls of the lines and the number of looped lines within the system. Fire hydrant flow tests provide an important indication of the ability of the system to provide adequate fire protection. According to the Guide for Determination of Needed Fire Flow published by ISO, the minimum hydrant flow available must be 250 gpm for two hour duration plus the maximum anticipated consumption usage during the period. A 20 psi, residual pressure must be maintained in the mains to prevent line collapse during fire fighting.

5. CURRENT OPERATING PROBLEMS

The City is currently experiencing operating problems with the systems pressures in the NW corner of Jetmore, deteriorated piping in the older portions of town, and inoperable valves, undersized storage system and water quality issues.

The City crew repairs several leaks in the distribution system each year. The majority of older water lines are located in the streets where the repair work disrupts traffic and requires additional work to maintain the street surfaces in a usable condition. Most recent repairs have been found in the 4-inch lines on Bowlus and Atkins between Wash and Best. Staff has also experienced

difficulty in expediently repairing leaks due to non-functional shut-off valves. This causes major areas of the system to be shut down to make repairs to the system.

There is a variance in reported water pumped and water sold. As meters age, they record lower amounts than actual values. Numerous older meters need tested and repaired or replaced.

The fire hydrants at Clay and Wash, and Roughton and Tucker are in need of replacement.

Well chemical feed houses need exhaust fan updates to remove chlorine fumes.

Additional operation items addressed are the result of KDHE, Public Water Supply – Sanitary Survey Inspection included in Appendix F.

6. RECOMMENDED SYSTEM IMPROVEMENTS

The recommended improvements to the system include construction of an 150,000 gallon elevated storage tank, main distribution system improvements replacing non-fully functional valves, all smaller lines and those existing lines known to be severely deteriorated. These improvements will allow shutting down specific portions of the community to make repairs or improvements and increase the water flow capacities and line pressure in general and within the western portion of Jetmore. Detailed descriptions of recommended improvements are summarized as follows:

- Replace approximately 90 shut off valves. Operate/exercise all shut-off valves regularly to identify those in need of repair or replacement.
- Replacement of deteriorated water lines shown on Figure 3.
- Add 150,000 gallon elevated water storage tank.
- Replace existing known fire hydrants that are in deteriorated condition.
- Exercise fire hydrants semi-annually. Repair existing fire hydrants where applicable.
- Establish meter testing, repair/replacement program. Replace older meters using meters with AMR capabilities.
- Upgrade Disinfection System; replace chlorine buildings, feed equipment and safety equipment.
- Upgrade Pump Control System (telemetry) with wireless system.

Due to the amount of work the improvements need to be prioritized and a capital improvements program needs to be established. A partial priority list is included in Appendix G.

Costs for replacement of water distribution system mains, and 150,000 gallon elevated storage tank are included in Appendix H. The main replacement costs will vary due to project scale. The larger the total project there is a reduction in line item costs. Some of the smaller repair/replace tasks can be performed by City staff i.e. replace inoperable fire hydrants and shutoff valves, if adequate equipment is available and does not take away from other existing work.

7. ALTERNATIVE FINANCING

The City of Jetmore has several funding options available. Four sources of funds exist which may be used either individually or in combination to finance proposed improvements. The four sources are:

1. KDHE, Kansas Public Water Supply Loan Fund – July 2.60 %
2. Community Development Block Grant Program
3. USDA – 3.25 % median
4. Conventional Bond Financing

KDHE, Kansas Public Water Supply Loan Fund:

The KDHE revolving loan fund is a 20 year loan with a variable interest rate and service fee based on the current bond market. This loan is competitive with other communities and the qualifications are you have the means to repay the loan and make the priority list. The application for funding is multi month process and works well with CDBG.

Community Development Block Grant:

This grant is administered through the Kansas Department of Commerce. It is a competitive program with other communities applying from a pool of funds. A requirement of this program is the City of Jetmore meets the Low to Moderate Income requirement of 51% or greater. This is about a 3 month application process. Currently the block grants are limited to \$2,000 per person and not to exceed \$500,000. Hodgeman County is currently conducting a LMI survey.

Rural Development – USDA:

This funding is usually a loan and grant combination. The RD loan is a 40 year with a variable loan rate based on the bond market, and is competitive with other communities. Funds are made available from a federal pool of money available in October if funded. A pre-application must be submitted to Rural Development to be considered for funding. If CDBG funds are being applied for along with RD grant funding a RD loan is recommended.

Conventional Bond Financing:

Two types of bonding are available through the private sector and are similar to a loan. These are revenue bonds and general obligation bonds.

Revenue bonds are issued against the receipts of the utility. General obligation bonds are based on the taxing power of the municipality. Statutory limitations are placed on the amount of obligation bonds a city may issue. As a result they are usually issued at lower rate than revenue bonds. They require a minimum of 45 days to prepare an application and can be done anytime during the year.

8. RECOMMENDATIONS

Initiate the maintenance programs, finalize the priority list and establish a workable timeline to make system improvements. It is recommended the City submit an application to the Kansas Department of Health and Environment, Kansas Public Water Supply Loan Fund for funding to assist in financing the project or inquire with local lending institutes regarding local financing.

Jetmore, Kansas
Water System Improvements
8/26/2014

Estimated Project Cost	Estimated O & M Annual Costs	CDBG Grant	SRLF Loan	Annual Debt Payment *	Total System Annual Costs	Average Cost Per Household	Cost Per Month	Percent Share City/Total
150,000 Gallon Tank \$ 1,061,643.00								
Dedicated Main \$ 208,032.00								
Tank & Main \$ 1,269,675.00	\$ 198,066.00	\$ 500,000.00	\$ 769,675.00	\$ 49,567.07	\$ 247,633.07	\$ 515.90	\$ 42.99	60.6%
150,000 Gallon Tank \$ 1,061,643.00								
Dedicated Main \$ 208,032.00								
Minimal Distribution System Improvements \$ 256,652.00								
Tank, Main, & Min. Distribution Improvements \$ 1,526,327.00	\$ 198,066.00	\$ 500,000.00	\$ 1,026,327.00	\$ 66,095.46	\$ 264,161.46	\$ 550.34	\$ 45.86	67.2%
150,000 Gallon Tank \$ 1,061,643.00								
Dedicated Main \$ 208,032.00								
Non-Distribution System Improvements \$ 83,329.40								
Tank, Main, & Non-Dist. Improvements \$ 1,353,004.40	\$ 198,066.00							
Meter Upgrade \$ 340,000.00	\$ 2,165.00							
Tank, Main, Non-Dist. Improvements & Meters \$ 1,693,004.40	\$ 200,231.00	\$ 500,000.00	\$ 1,193,004.40	\$ 76,829.48	\$ 277,060.48	\$ 577.21	\$ 48.10	70.5%
150,000 Gallon Tank \$ 1,061,643.00								
Dedicated Main \$ 208,032.00								
Distribution System Improvements \$ 518,248.50								
Tank, Main, & Distribution Improvements \$ 1,787,923.50	\$ 198,066.00	\$ 500,000.00	\$ 1,287,923.50	\$ 82,942.27	\$ 281,008.27	\$ 585.43	\$ 48.79	72.0%
Remaining Distribution System Improvements \$ 4,203,047.50		\$ 500,000.00	\$ 3,703,047.50	\$ 238,476.26	\$ 238,476.26	\$ 496.83	\$ 41.40	88.1%
Remaining Distribution System Improvements - 3 Phases \$ 1,401,015.83	\$ 500,000.00		\$ 901,015.83	\$ 58,025.42	\$ 58,025.42	\$ 120.89	\$ 10.07	64.3%
\$ 1,471,066.63	\$ 500,000.00		\$ 971,066.63	\$ 62,536.69	\$ 62,536.69	\$ 130.28	\$ 10.86	66.0%
\$ 1,544,619.96	\$ 500,000.00		\$ 1,044,619.96	\$ 67,273.53	\$ 67,273.53	\$ 140.15	\$ 11.68	67.6%

Interest on SRLF @ 2.6% - semi-annual payments
Total O&M Cost = \$136,320
No. of Meters = 480

150,000 Gallon Single Pedestal Elevated Tank

Opinion of Construction Costs

Jetmore, Kansas

5/22/2014

150,000 Gallon Tank			
150,000 Gallon Tank	1	LS	\$675,000
Telemetry System	1	LS	\$90,000
Tower Site	1	LS	\$5,000
Valve Pit, Yard Piping	1	LS	\$15,000
Subtotal			\$785,000
Administration & Environmental			\$78,500
Geotechnical			\$5,000
Surveying, Property			\$4,000
Engineering			\$61,230
Construction Admin. & Observation			\$31,400
Subtotal			\$180,130
Total 150,000 Tank			\$965,130
Dedicated Main			
8-Inch PVC Water Main	*		\$189,120
Tank & Main Construction Cost			
			\$1,154,250
Contingencies 10%			\$115,425
Total Construction Cost			
			\$1,269,675

150,000 Gallon Single Pedestal Elevated Tank

Opinion of Construction Costs

Jetmore, Kansas

8/26/2014

150,000 Gallon Tank			
150,000 Gallon Tank	1	LS	\$675,000
Telemetry System	1	LS	\$90,000
Tower Site	1	LS	\$5,000
Valve Pit, Yard Piping	1	LS	\$15,000
Subtotal			\$785,000
Administration & Environmental			\$78,500
Geotechnical			\$5,000
Surveying, Property			\$4,000
Engineering			\$61,230
Construction Admin. & Observation			\$31,400
Subtotal			\$180,130
Total 150,000 Tank			\$965,130
Upgrade Wells 13 & 14			
Add VFD's	1	LS	\$13,000
Chlorination Buildings			
2-Fiberglass Enclosures	1	LS	\$17,304
2-Electronic Scales	1	LS	\$4,200
Misc. / Site Work	1	LS	\$10,000
Subtotal			\$31,504
Dedicated Main			
8-Inch PVC Water Main	*		\$189,120
Bowlus St. Replacement (10-3) 1/2			
6-Inch PVC Water Main	*		\$43,944
Atkins St. Replacement (9-3) 1/3			
6-Inch PVC Water Main	*		\$43,254
Bramley St. Replacement (16-1) 1/3			
6-Inch PVC Water Main	*		\$37,000
West Park Replacement (20-1) 1/2			
6-Inch PVC Water Main	*		\$33,368
Fire Hydrant Assembly Replacement			
Fire Hydrant Assemblies	2	Ea	\$11,250
Tank Demolition			
Demo Existing Tank	1	LS	\$20,000
Tank & Main Construction Cost			
			\$1,387,569
Contingencies 10%			\$138,757
Total Construction Cost			\$1,526,326

150,000 Gallon Single Pedestal Elevated Tank

Opinion of Construction Costs

Jetmore, Kansas

8/26/2014

150,000 Gallon Tank			
150,000 Gallon Tank	1	LS	\$675,000
Telemetry System	1	LS	\$90,000
Tower Site	1	LS	\$5,000
Valve Pit, Yard Piping	1	LS	\$15,000
Subtotal			\$785,000
Administration & Environmental			\$78,500
Geotechnical			\$5,000
Surveying, Property			\$4,000
Engineering			\$61,230
Construction Admin. & Observation			\$31,400
Subtotal			\$180,130
Total 150,000 Tank			\$965,130
Upgrade Wells 13 & 14			
Add VFD's	1	LS	\$13,000
Chlorination Buildings			
2-Fiberglass Enclosures	1	LS	\$17,304
2-Electronic Scales	1	LS	\$4,200
Misc. / Site Work	1	LS	\$10,000
Subtotal			\$31,504
Dedicated Main			
8-Inch PVC Water Main	*		\$189,120
Bowlus St. Replacement (10-3)			
6-Inch PVC Water Main	*		\$87,887
Atkins St. Replacement (9-3)			
6-Inch PVC Water Main	*		\$129,761
Bramley St. Replacement (16-1)			
6-Inch PVC Water Main	*		\$110,998
West Park Replacement (20-1)			
6-Inch PVC Water Main	*		\$66,735
Fire Hydrant Assembly Replacement			
Fire Hydrant Assemblies	2	Ea	\$11,250
Tank Demolition			
Demo Existing Tank	1	LS	\$20,000
Tank & Main Construction Cost			
			\$1,625,385
Contingencies 10%			\$162,538
Total Construction Cost			\$1,787,923

Total Water Line Replacement Work	
Segment No.	Estimated Cost
3-7	20,649.00
4-1	55,855.50
5-1	60,521.50
7-1	70,046.00
7-2	79,358.00
7-3	58,046.00
7-4	49,035.00
8-1	65,337.00
8-2	112,830.00
8-3	61,683.00
8-4	125,942.00
8-5	126,319.00
8-6	114,261.00
9-1	136,133.50
9-2	146,957.50
9-4	44,030.00
9-5	94,112.50
9-6	146,405.00
10-1	160,036.00
10-2	124,648.50
10-4	87,887.00
10-5	93,688.00
11-1	49,507.50
11-2	32,067.50
11-3	23,880.00
11-4	23,462.50
11-5	18,267.50
13-1	34,242.00
13-2	45,475.50
13-3	38,526.50
14-1	101,405.00
14-2	19,754.00
14-3	27,970.00
14-4	107,677.50
14-5	51,162.50
14-6	114,947.00
15-1	84,270.00
15-2	135,162.50
15-3	62,782.50
15-4	41,916.00
15-5	96,605.50
16-2	120,091.50
16-3	159,975.00
16-4	70,410.00
16-5	74,290.50
16-6	164,693.00
17-1	27,128.00
20-1	66,735.00
20-3	20,488.00
21-2	65,908.00
21-3	22,243.00
21-4	38,738.00
21-6	26,345.00
22-1	83,470.00
22-2	35,085.00
22-3	84,585.00

\$4,203,047.50

Jetmore, Kansas

Preliminary Priority List

1. Establish a Fire Hydrant Flushing Program – Recommend flushing semi-annual and monitoring flows and pressures bi-annually. Place inoperable hydrants on repair and/or replacement priority list.
2. Develop a Shutoff Valve Exercising Program to coordinate with the hydrant flushing. Place inoperable valves on repair and/or replacement priority list.
3. Establish a Water Meter Testing Program – Short term, is to repair and/or replace meters as needed. Long term, the system should be divided into zones where the entire distribution system is completely evaluated every 5 to 7 years. The capital fund will allow up grading all meters on a regular basis.
4. Replace known inoperable fire hydrants.
5. Replace known inoperable shutoff valves.
6. Upgrade Disinfection System, chlorine buildings and ancillary items to KDHE Guidelines.
7. Install new 150,000 gallon elevated water storage tank, dedicated main and upgrade pump&control system.
8. Replace deteriorated mains on Bowles and Atkins between Wash and Best, to include mains, valves, meters and service lines to meters.
9. Develop long term capital improvements program to upgrade water distribution system, replacing undersized deteriorating mains, service lines and loop dead end lines where practicable.
10. Establish long term capital fund for new water source development and/or treatment of existing water supplies caused by deteriorating water quality and increased water demands.