ENGINEERING SERVICES INC.
1207 S. Old Missouri Rd. • P.O. Box 282 • Springdale, Arkansas 72765-0282 Ph: 479-751-8733 • Fax: 479-751-8746

May 5, 2014

Mr. Ivan Reynolds
Mt. Sherman Water Association
P.O. Box 323
Jasper, Arkansas72641

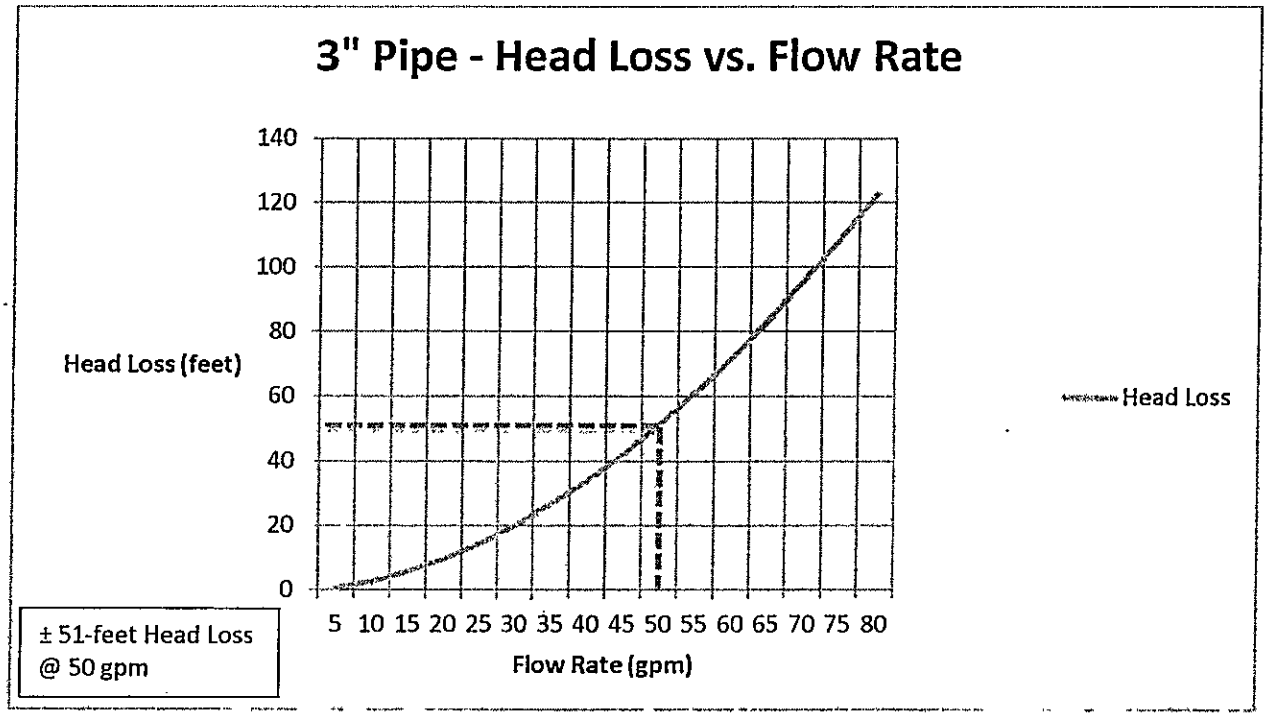
Re: 3-inch Water Main Capacity Concerns

Dear Mr. Reynolds:

At your request we have examined the capacity of the 3-inch water from your tank to the Low Gap area. Our findings are detailed in the following discussion.

The Low Gap area is served by a 3-inch water main connected to the Mount Sherman stand pipe. The 3-inch main is approximately 6000 feet long. There are a total of 129 customers with active meters and 21 customers with inactive meters supplied through this 3-inch main. 15 of these customers are located in Low Gap and Steel Creek area. The remainder of the customers are spread out between Low Gap and the Shiloh community.

The following graph depicts friction loss through this 3-inch PVC water main at various rates of flow:

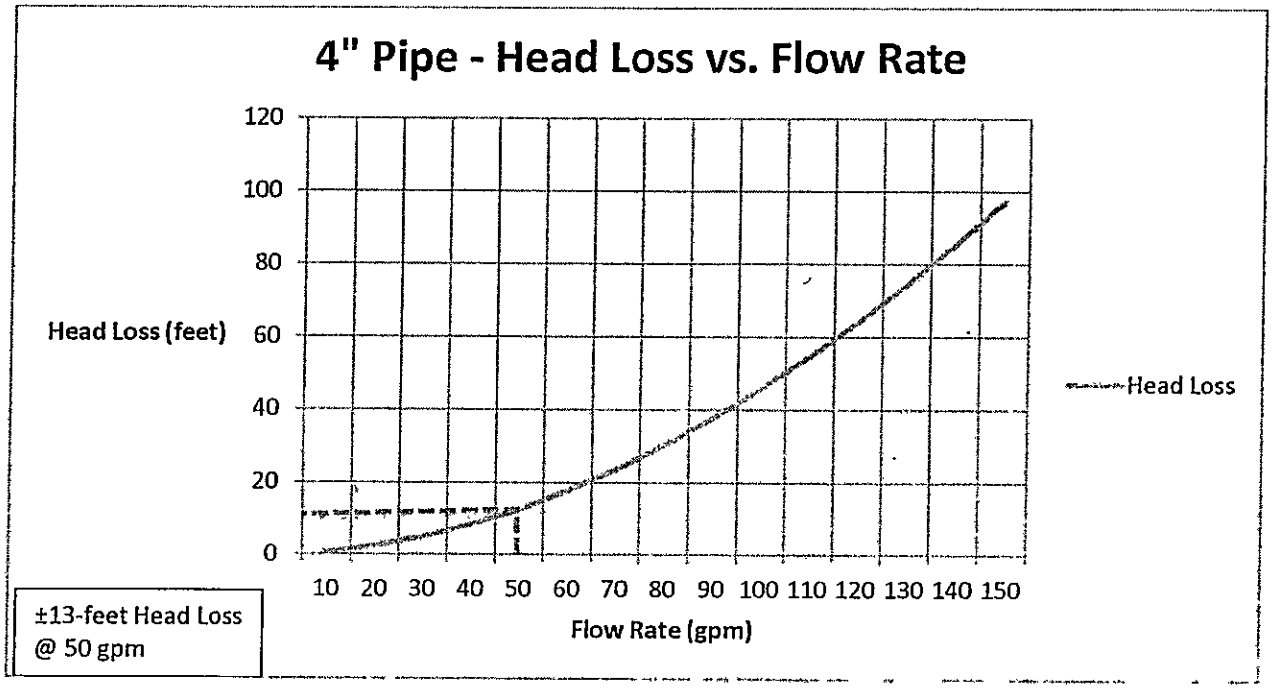


The Mt. Sherman Water Association customers appear to be frugal in their water use. Bearing this frugality in mind let it be assumed that the peak use by each customer to be low and the corresponding simultaneous total use by all customers is also low. Several possible low flow rates and corresponding head losses from the graph are summarized in the following:

Flow per Customer (gpm)	Total Flow (gpm)	Head Loss (feet)	Pressure Drop (psi)
0.25	37.5	30	13
0.33	49.5	51	22
0.5	75	109	47
0.6	90	153	66
0.75	112.5	231	99
1	150	393	169

Excessive friction loss occurs at relatively low flows.

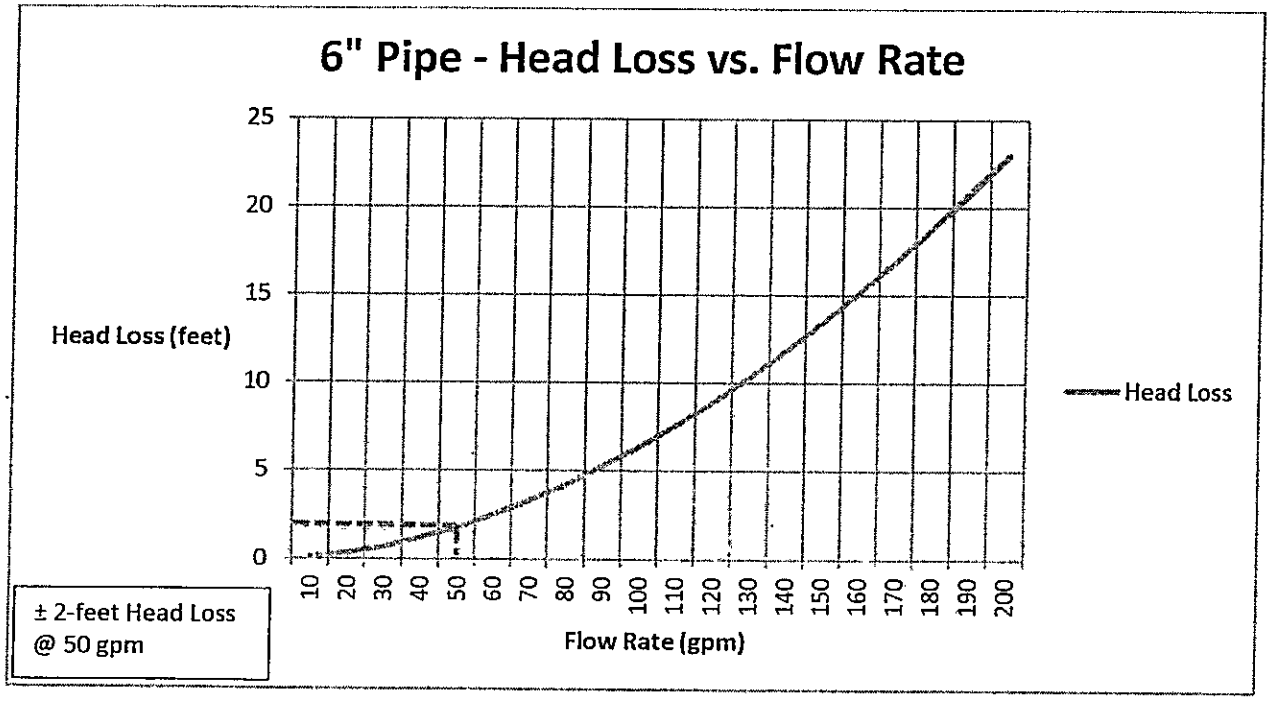
If the 3-inch were replaced with a 4-inch main the friction loss to flow rate graph becomes:



Looking at the same flow rates yields the following:

Flow per Customer (gpm)	Total Flow (gpm)	Head Loss (feet)	Pressure Drop (psi)
0.25	37.5	7	3
0.33	50	13	5
0.5	75	27	12
0.6	90	38	16
0.75	112.5	57	24
1	150	97	42

Replacement of the 3-inch pipe with a 4-inch will yield significantly better flow characteristics. A 4-inch main should be adequate for the current number of customers. Given the relatively low increase in cost from 4-inch to 6-inch pipe it is probably wise to consider replacement of the 3-inch with a 6-inch main instead of the 4-inch. If a 6-inch main is installed the friction loss to flow rate graph becomes:



For comparison the same flow rates as used above yield the following head losses:

Flow per Customer (gpm)	Total Flow (gpm)	Head Loss (feet)	Pressure Drop (psi)
0.25	37.5	1	0
0.33	49.5	2	1
0.5	75	4	2
0.6	90	5	2
0.75	112.5	8	3
1	150	13	6

A 6-inch main is more than adequate for the current number of customers and will provide capacity for future growth.

The probable cost estimate for a 4-inch water main is as follows:

Item	Unit	Quantity	Unit Price	Amount
4-inch PVC Water Main	LF	6000	$ 9.00	$ 54,000.00
Gravel Drive Crossing	LF	90	$ 10.00	$ 900.00
Jack & Bore Highway Crossing	LF	70	$ 250.00	$ 17,500.00
2-Way Fire Hydrant	EA	2	$ 2,900.00	$ 5,800.00
6" x 4" Tapping Sleeve & Valve	EA	1	$ 2,100.00	$ 2,100.00
4" Tapping Sleeve & Valve	EA	1	$ 1,800.00	$ 1,800.00
Water Service	EA	5	$ 435.00	$ 2,175.00
Ductile Iron Fittings	LB	400	$ 4.00	$ 1,600.00
			Total Construction	$ 85,875.00
			25% Engineering & Contingency	$ 21,468.75
			Total Project Cost	$ 107,343.75

The probable cost estimate for a 6-inch main extension is as follows:

Item	Unit	Quantity	Unit Price	Amount
6-inch PVC Water Main	LF	6000	$ 11.00	$ 66,000.00
Gravel Drive Crossing	LF	90	$ 10.00	$ 900.00
Jack & Bore Highway Crossing	LF	70	$ 250.00	$ 17,500.00
3-Way Fire Hydrant	EA	2	$ 3,100.00	$ 6,200.00
6" x 6" Tapping Sleeve & Valve	EA	1	$ 2,400.00	$ 2,400.00
4" Tapping Sleeve & Valve	EA	1	$ 1,800.00	$ 1,800.00
Water Service	EA	5	$ 435.00	$ 2,175.00
Ductile Iron Fittings	LB	600	$ 4.00	$ 2,400.00
			Total Construction	$ 99,375.00
			25% Engineering & Contingency	$ 24,843.75
			Total Project Cost	$ 124,218.75

There exists approximately 3000 feet from Low Gap a booster pump station on the 4-inch main that supplies the Shiloh area. This booster pump has a maximum capacity of about 50 gpm. This is the limiting component of this portion of the water system. The fact that this pump handles current system demand while supplying possibly more than 130 customers testifies to the frugality of the system's customer's water use. Should there be increase in customers or demand it may be necessary to upgrade the pumps.

If funding is sought it may be easier to perform the replacement of the 3-inch water line and pump station upgrade within the same project. If desired, Engineering Services will gladly assist your organization in obtaining financing for the pipeline replacement and/or the pump station upgrade through programs offered by the Arkansas Natural Resource Commission. Typically low interest loans are available for system upgrades such as described herein. Grants are not usually available for projects of this nature.

We thank you for the opportunity to serve you with this analysis. If we can be of further assistance please do not hesitate to contact us.

Respectfully submitted,

Mark C. Johnson, PE, PLS
Project Engineer

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May 5, 2014

Mr. Ivan Reynolds
Mt. Sherman Water Association
P.O. Box 323
Jasper, Arkansas 72719-0366

Re: Engineer's Statement

Dear Mr. Reynolds:

This statement is submitted for services rendered to date for the above referenced project.

Hydraulic Analysis of Existing 3-inch Water Main.....$550.00

Total Due and Payable $550.00

We thank you for the opportunity to be of service on this project.

Respectfully submitted,

Mark C. Johnson, PE, PLS
Project Engineer