

MISSOURI AMERICAN WATER
PLATTE COUNTY SYSTEM

DRAFT

Project <u>A-1</u>			
Riverside Fire Flow Modeling			
Design and Permitting:	___ months	Project Cost:	\$ _____
Construction:	___ months		

Need for Project:

Missouri American Water (MAW) retained HDR Engineering, Inc. (HDR) to evaluate the capabilities of the system within the City of Riverside to meet required fire flows and to provide recommendations for improvements. Based on hydraulic modeling of the system, the City of Riverside may have problems meeting required fire flows at adequate pressures in select areas.

Background:

The Platte County water supply system provides service to the cities of Parkville, Riverside, and parts of unincorporated Platte County. Raw water is obtained from wells along the Missouri River and the water is treated at the water treatment facility in downtown Parkville. In addition, there are four interconnects with Kansas City, Missouri that provide water to the system during periods of high demand. The water distribution system has two pressure zones, Main and High. The City of Riverside is located within the Main pressure zone. Two of the existing interconnects with Kansas City, Houston Lake (NW 56th Street) and Vivion Road, are located within the City of Riverside.

The intent of this project is to identify the areas within the City of Riverside that do not meet the required fire flow. These areas will be prioritized according to the available fire flow and the extent of the area that cannot meet the required fire flow. The existing hydraulic model will be used to identify and evaluate recommended improvements.

Recommended Solution:

The existing steady-state hydraulic model was used for the analysis of available fire flows within the City of Riverside. The model was created in June, 2006 using WaterCAD and includes demand scenarios for average day, maximum day, peak hour, and minimum hour conditions. The model was calibrated to a series of hydrant flow tests. The 2006 peak hour scenario for existing distribution system conditions was used for this analysis. The fire flow simulator within WaterCAD was used to determine which areas in the City of Riverside could not meet a fire flow of 1,000 gallons per minute (gpm) while maintaining a residual pressure of 20 pounds per square inch (psi) at any node in the Main pressure zone. The fire flow simulator within WaterCAD allows many nodes to be tested for the fire flow within one simulation. The fire flow demand is added to the baseline demand and the allowable fire flow at each node is calculated based on the minimum residual pressure.

Appendix A contains a summary of the model nodes that did not meet the required fire flow and gives the available fire flow at each node. The simulation identified six general areas that did not meet the required fire flow (Figure 1). Many of the areas that cannot meet the required fire flow at adequate pressures are served by 4-inch water mains. The Missouri Department of Natural Resources Design Guide for Community Water Systems (August, 2003) requires that water mains that provide fire protection be a minimum of 6-inches in diameter. The 4-inch water main at NW 50th Road and High Drive does not have any fire hydrants connected to it; it appears the one hydrant on this road is served by the adjacent 8-inch line. Since this water main is not used for fire protection, it will not be considered further in this report. Table 2 describes and prioritizes the problem areas.

Table 1
Areas Deficient for Fire Flow Analysis

Problem Area	Min Available Fire Flow (gpm)	Max Available Fire Flow (gpm)	Pipe Size (in.)	Priority
Houston Lake	160	905	4	1
NW Gateway	640	780	6/8	2
Woodland Road	330	995	4/6	3
Homestead Road	315	430	4	4
Cerrito Lane	610	610	4/6	5

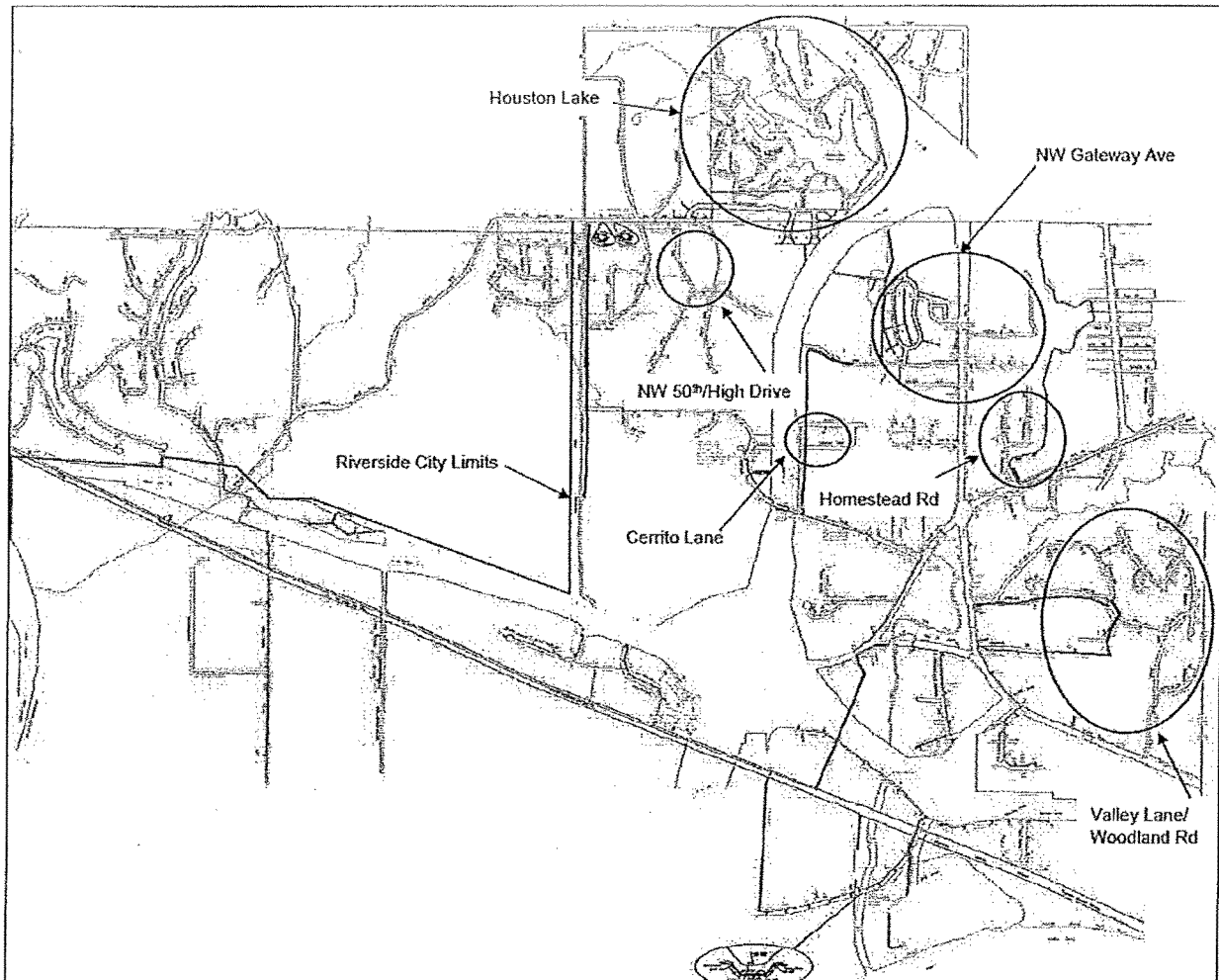


Figure 1: Areas That Do Not Meet the Required Fire Flow

The areas are prioritized according to the severity and extent of the area that could not meet the required fire flow. Houston Lake, for example, was given first priority because the 4-inch water mains cannot deliver the required fire flow at any point throughout the residential area. This area also had very low available fire flow (approximately 160 gpm) at the end of the branch. The Cerrito Lane area is prioritized last; although the available fire flow in this area is relatively low, it is also a much smaller area and does not affect as many properties as higher priority areas.

It is anticipated that many areas will require upsizing of the lines or looping in branched systems. Several improvement scenarios were evaluated and are discussed in the Options section of this report.

Output and Benefits:

If the recommended improvements are made, all areas within the City of Riverside will meet the required fire flow of 1,000 gpm.

Options:

The hydraulic model was used to identify possible improvements that would allow the system within the City of Riverside to meet the required fire flow of 1,000 gpm. These improvements were modeled and evaluated for meeting the required fire flow.

Houston Lake

The residential area surrounding Houston Lake is mostly 4-inch water mains that are fed off an 8-inch main. The area is a branched system and ends on the east side of Houston Lake. Nearly every node in this area did not meet the required fire flow; the nodes on the end of the line were the most severe with only approximately 160 gpm of fire flow available. It should also be noted that on NW 56th Street east of NW Venetian Drive there is an interconnect with Kansas City, Missouri. Five improvement scenarios were tested for this area; Table 2 summarizes the effectiveness of each scenario at meeting the fire flow and the resulting flow obtained from the interconnect.

Table 2
Improvement Scenarios at Houston Lake

Scenario	Description	# Problem Nodes	Q at Interconnect (gpm)
1	Existing Conditions	13	166
2	Loop in with 4" line	13	200
3	Loop in and upsize east side to 6"	6	475
4	Loop in and upsize west side to 6"	5	511
5	Increase 4" to 6" (no loop)	2	444
6	Loop in and upsize all lines to 6"	0	581

The scenario that fully allows the area to meet the required fire flow is to loop the area in and upsize all the lines to 6 inches. This scenario also results in a substantial increase in flow from the interconnect with Kansas City. This scenario requires approximately 7,700 feet of 6-inch water main. Figure 2 shows the proposed improvements.

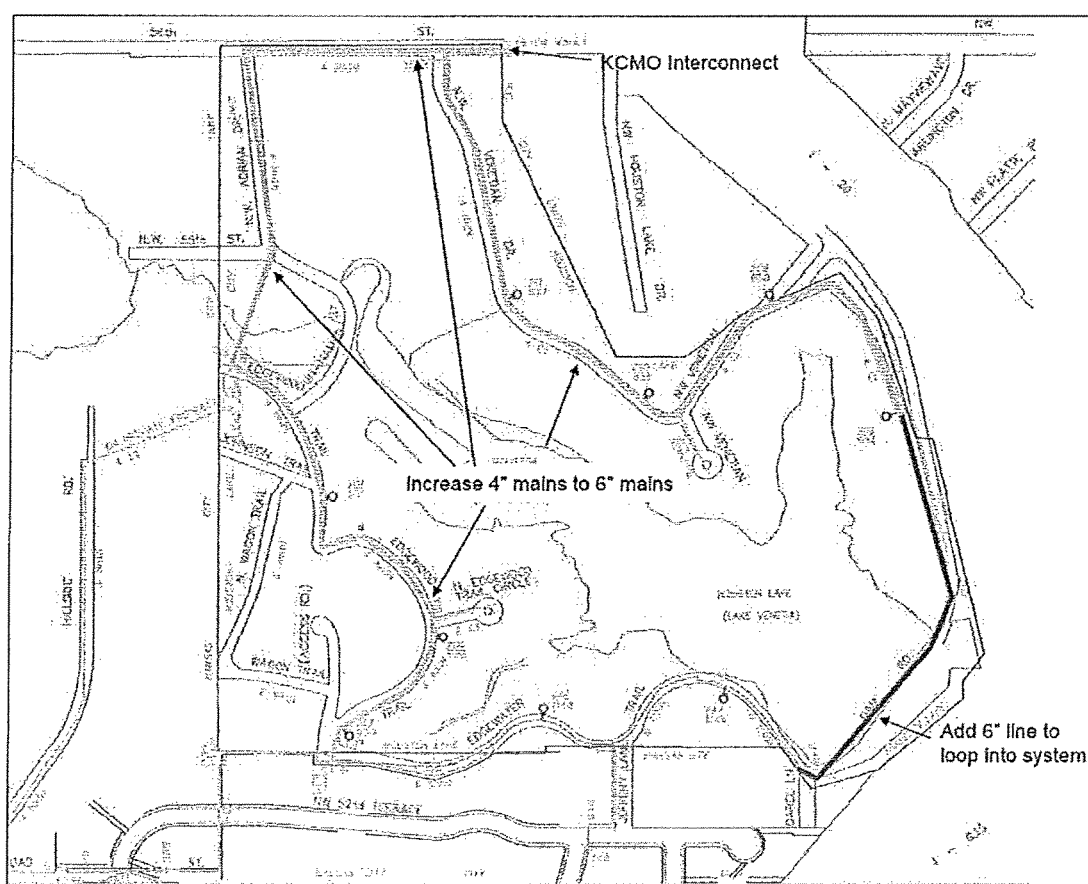


Figure 2: Proposed Improvements - Houston Lake

NW Gateway Avenue

The area near NW Gateway Avenue is a mixed-use area with commercial, multi-family residential, and church/cemetery. The area is served by 6-inch and 8-inch water lines. A bottleneck exists on NW Gateway Avenue where an 8-inch line decreases to a 6-inch line for approximately 1,350 feet and then increases back to an 8-inch line. Increasing the 6-inch bottleneck to 8 inches allows most of the area to meet the required fire flow. Figure 3 shows the proposed improvements.

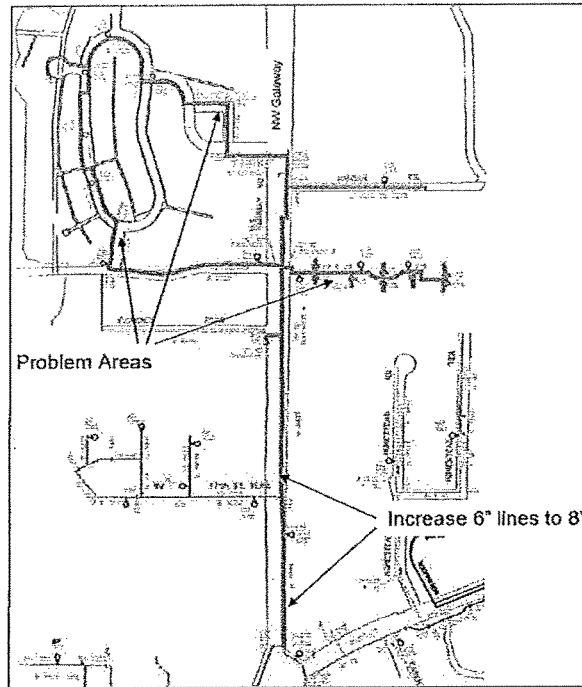


Figure 3: Proposed Improvements - NW Gateway Avenue

The 6-inch line that extends east at 50th Street does not meet fire flow with the proposed improvements. This water main is cast iron and was modeled with a C factor of 79 to reflect the age and condition of the pipe during model calibration. If the C factor is increased to a design value of 100, the end of the line is just short of meeting the required fire flow. As long as the line is in reasonable condition, this line should meet the fire flow requirements.

Valley Lane/Woodland Road

The area near Valley Lane and Woodland Road is mostly single family residential. The area is served by a network of 4-inch, 6-inch, and 8-inch lines. The areas that do not meet fire flow are on the 4-inch and 6-inch lines, as shown in Figure 4.

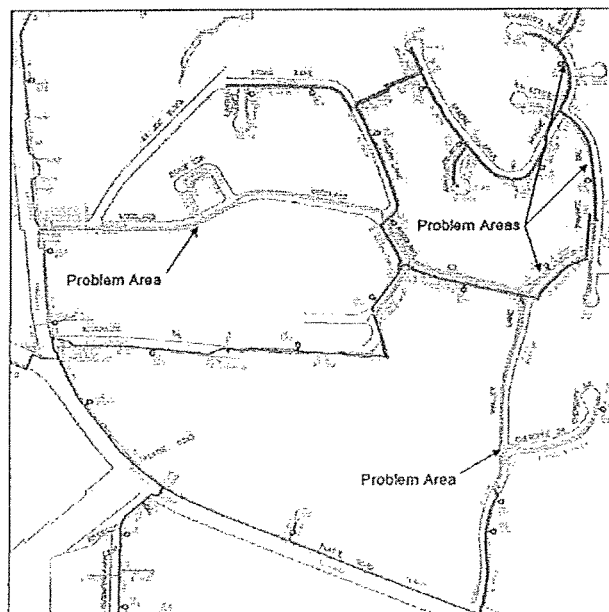


Figure 4: Problem Areas at Valley Lane/Woodland Road

Several scenarios were modeled for this area to determine their effect on meeting the required fire flow. The scenarios can be broken down into two alternatives. The scenarios for Alternative 1 are described in Table 3. A bottleneck exists on NW Gateway Avenue where an 8-inch line decreases to a 6-inch line for approximately 775 feet and then increases back to an 8-inch line. Eliminating this bottleneck by increasing the 6-inch line to an 8-inch line brings more flow into the area and increases the fire flow at each node. However, this improvement doesn't resolve the problems on Apache Road/NW 45th Terrace; resolving these nodes requires looping in the nodes that are currently at the end of the branch.

Table 3
Alternative 1 Improvements – Valley Lane/Woodland Road

Scenario	Description	# Problem Nodes
1	Existing Conditions	15
2	Upsize 6" on NW Gateway to 8"	9
3	Scenario 2 + loop in	6
4	Scenario 3 + upsize 4" on Valley Lane	5

If the improvements described in Scenarios 2 and 3 are made, the remaining nodes that do not meet the required fire flow are on the 4-inch line on Valley Lane and Woodland Road. There is one hydrant on a 4-inch line that serves a cul-de-sac off of Valley Lane. The 4-inch main on Valley Road and the 4-inch main on Cherokee Drive should be increased to 6-inches to serve this hydrant. Per the water distribution maps, there is one fire hydrant on the 4-inch line that is located on the north side of Woodland Road. It is recommended that service to this hydrant be relocated to the 8-inch main that is on the south side of Woodland Road. If this hydrant is moved to the 8-inch line, the 4-inch line would not be providing fire protection and would not need to meet the required fire flow. The proposed improvements for Alternative 1 are shown in Figure 5. This alternative requires approximately 1,550 feet of 6-inch water main and 800 feet of 8-inch water main.

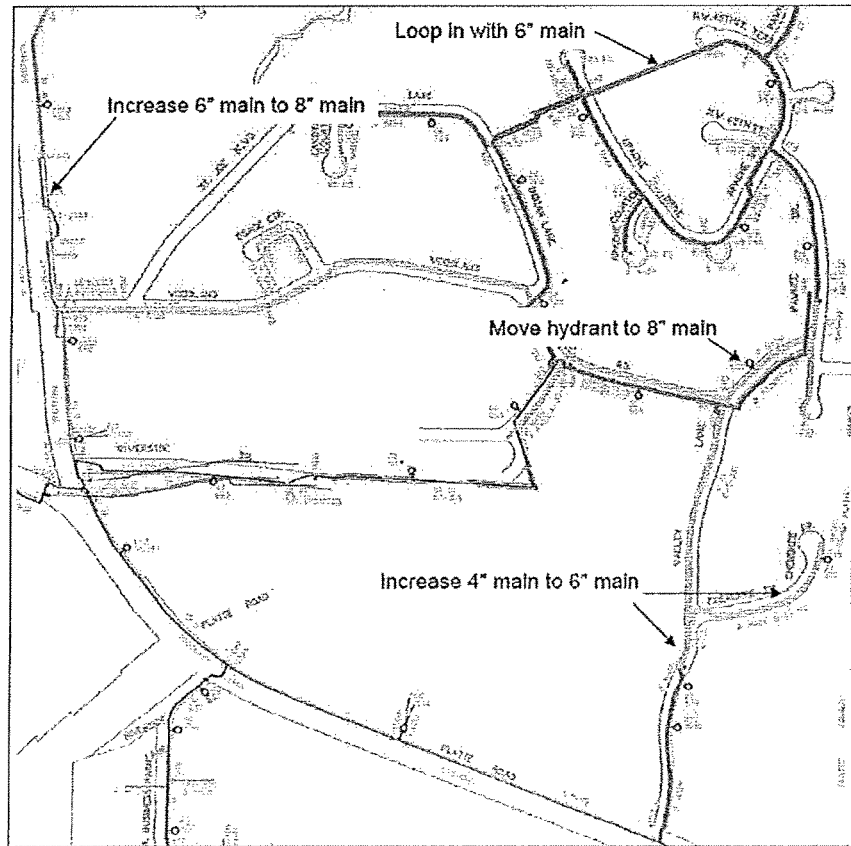


Figure 5: Alternative 1 Improvements – Valley Lane/Woodland Road

Alternative 2 considers increasing the size of the 4-inch water main on Valley Road to bring more water to the area. This alternative may be especially advantageous once the Phase IB water main and the Briarcliff interconnect are constructed. Additionally, similar to Alternative 1, Apache Road/NW 45th Terrace would have to be looped in to resolve the fire flow problems on the end of the branch. Figure 6 shows the improvements proposed for Alternative 2. This alternative requires approximately 3,020 feet of 6-inch water main.

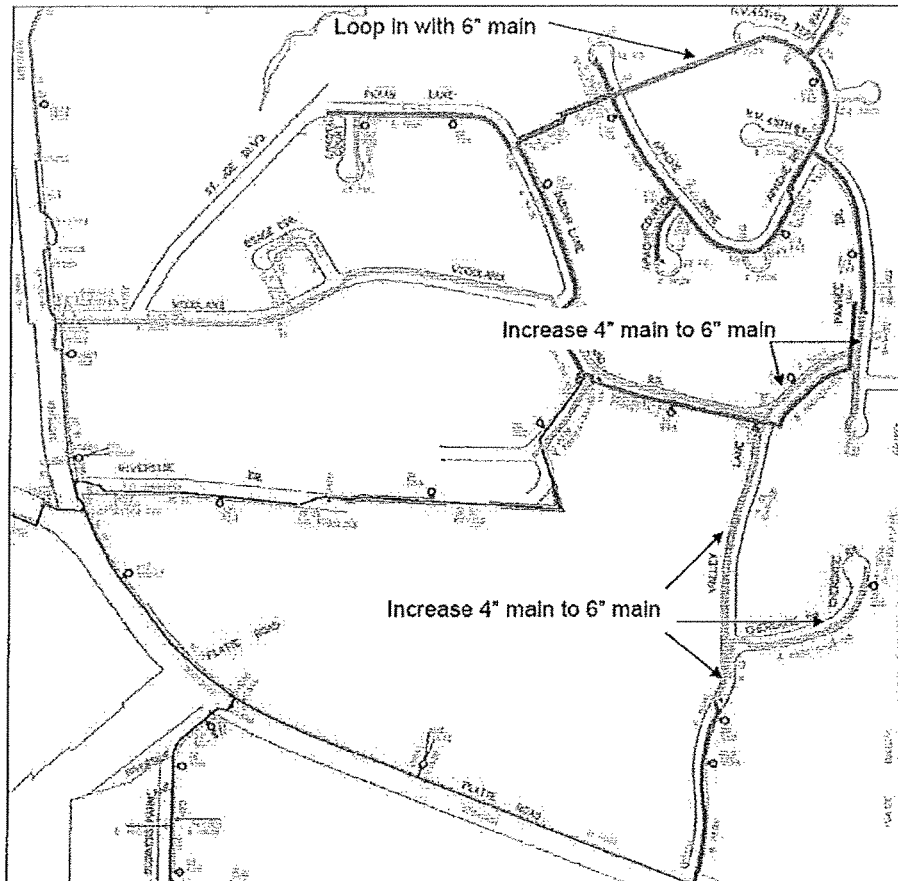


Figure 6: Alternative 2 Improvements – Valley Lane/Woodland Road

Homestead Road

The area on Homestead Road is a multi-family residential area that is served by 4-inch water mains. This area is in close proximity to the Vivion Road interconnect with Kansas City. The only improvement scenario evaluated was to upsize the 4-inch lines to 6-inches. Figure 7 shows the improvements that are necessary to meet the required fire flow. Improvements in this area require approximately 1,465 feet of 6-inch water main.

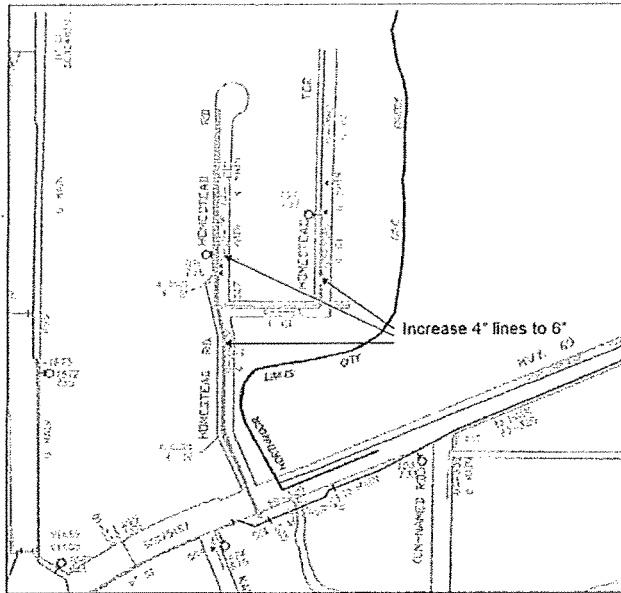


Figure 7: Proposed Improvements - Homestead Road

Cerrito Lane

The area on Cerrito Lane is a single-family residential area that is served by 4-inch and 6-inch water mains. The 4-inch line in this area was not modeled; however, the downstream end of the 6-inch line could not meet the fire flow due to low pressure in the area. This point and the line on Cerrito Lane appear to be a high point in the area. If this point cannot meet the required flow, the hydrant on the 4-inch line on Cerrito Lane will not meet the required fire flow as well. Two scenarios were evaluated for this area; 1) loop in Cerrito Lane with the existing 6-inch main, and 2) upsize the 6-inch line to an 8-inch line. For both scenarios it is recommended that the 4-inch line on Cerrito Lane be replaced with a 6-inch line. Scenario 1, looping in the branched system with a 6-inch line did not allow the nodes on Cerrito Lane to meet the fire flow. However, Scenario 2, increasing the 6-inch line to an 8-inch line did allow the fire flow to be met. Figure 8 shows the improvements that are necessary to meet the fire flow. Improvements in this area require approximately 675 feet of 6-inch water main and 1,200 feet of 8-inch water main.

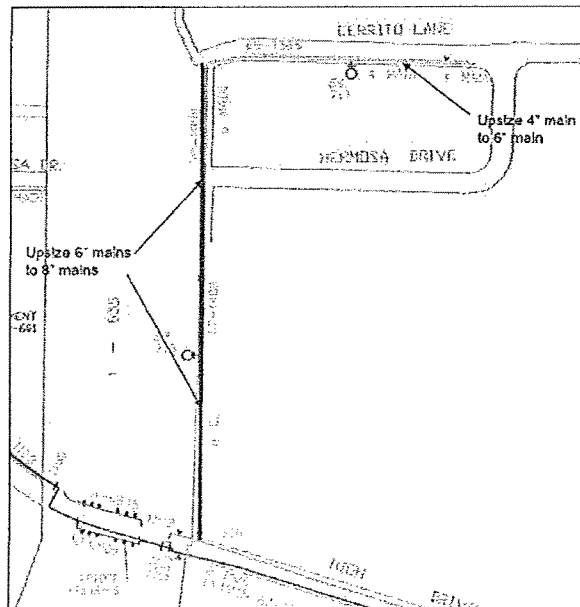


Figure 8: Proposed Improvements - Cerrito Lane

Effect of the Platte County System Improvements, Phases I and IV

Construction of water main improvements in late 2007 and 2008 may have a positive effect on the available fire flow within the City of Riverside. The Phase IA water main will be a 16-inch water main to replace the existing 10-inch water main on NW Platte Road at the Riverside Levee. The Phase IB water main will extend the system on NW Platte Road at Valley Lane and will include an interconnect with Kansas City, Missouri at Briarcliff Parkway. The Phase IV water main will be a 20-inch/24-inch water main between the water treatment facility in downtown Parkville and the City of Riverside.

The Phase IB water main and interconnect will likely have the most impact on the improvements; the interconnect with Kansas City has the potential to bring more water into the area and increase fire flows. The fire flow scenario was modeled with the Phase I and IV improvements to determine the impact on fire flows. The only area affected is the Valley Road/Woodland Road area. The new interconnect provides enough flow in this area to resolve the low fire flow nodes except on the 4-inch water main on Woodland Road. If the hydrant on this line is moved to the adjacent 8-inch line as recommended previously, this line will not be used for providing fire flows and would not need to meet the requirement. The relocation of hydrant service and implementation of the Phase I and IV improvements are considered as Alternative 3 for the Valley Road/Woodland Road improvements. Improvements for Alternative 3 are shown in Figure 9.

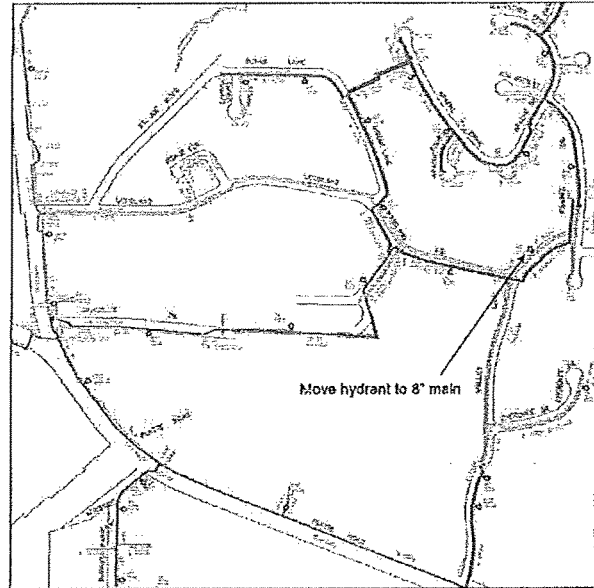


Figure 9: Alternative 3 Improvements – Valley Lane/Woodland Road

Budget Discussion:

A summary of the improvement options and estimated construction costs for each area is given in Table 4. Estimated construction costs include costs for general requirements, including mobilization and equipment rental, costs for pipe materials and fittings, hydrant and water service reconnections, connections to existing water lines, pavement removal and replacement, and contingencies. Pavement removal and replacement costs are based on the worst case of having to remove pavement along the length of the water line. Detailed cost information is provided in Appendix B.

Table 4
Summary of Improvements Options and Costs

Problem Area	Priority	Recommended Pipe Size (in.)	Pipe Length (ft)	Estimated Construction Cost
Houston Lake	1	6	7,700	\$1,066,000
NW Gateway	2	8	1,350	\$271,000
Woodland Road – Alt 1	3	6/8	2,325	\$409,000
Woodland Road – Alt 2	3	6	3,020	\$443,000
Woodland Road – Alt 3	3	-	-	\$6,500
Homestead Road	4	6	1,465	\$221,000
Cerrito Lane	5	6/8	1,875	\$258,700

The total estimated cost to complete all projects with Alternative 1 for Valley Lane/Woodland Road is \$2,225,700. The total estimated cost to complete all projects with Alternative 2 for Valley Lane/Woodland Road is \$2,259,700. The total estimated cost to complete all projects with Alternative 3 for Valley Lane/Woodland Road is \$1,823,200.

Risks:

As with any project, there are risks that can affect schedule, cost, or quality of the final product. Examples of risks for this project include:

- Location of the installation (open terrain vs. pavement) will affect project costs.
- Easements may be required that could affect project costs and schedule.
- Permits from various agencies could affect the project schedule.

Additionally, many areas impacted by the recommended improvements are mostly residential. Water service to customers in the area may need to be turned off for construction of the water line and to make connections to existing water lines and existing service meters.

Purpose Codes and Drivers:

Asset Type	Purpose	Code	%