Madison Water Utility	Alternative Evaluation	Project Manager:	Dennis M. Cawley P.E.
		Project Information:	Pressure Zone 4 Water Supply Augmentation
		1st Draft:	
Alder Dist:	Section: Engineering	Refd by Water Board:	
Alder:		Approved:	

Alternative Evaluation

Pressure Zone 4
Water Supply Augmentation

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1. Project Description

A description of the project, including a map showing existing facilities, approximate location of proposed facilities, documented contaminated sites, the extent of the Eau Claire shale (if applicable) and the location of floodplain areas.

The 2006 Water Utility Master Plan identified fire flow deficiencies throughout significant portions of Pressure Zone 4 (PZ4). PZ4 is supplied by a single source, which makes it vulnerable and the water supply less reliable. PZ4 is also expanding rapidly to the southeast making Unit Well 9 hydraulically remote from the far reaches of the zone and therefore difficult to move water efficiently and effectively to where it is needed.

The Madison Water Utility proposes to construct a new Unit Well in the southeast corner of the City in Pressure Zone 4. At this time the only identified potential location for the well is 5802 Femrite Drive. A location map of this site and system facilities map are attached as Exhibit A.

A standard Madison unit well consists of a deep well capable of producing 3 MGD, an approximately 400,000 gallon reservoir, and a booster station. This booster station is expected to have multiple sets of booster pumps, as it will be designed to serve both pressure district 6(PZ6) and pressure district 4 (PZ4).

If the Femrite Dr. site is chosen this well will serve PZ4 by connecting to the existing water main immediately in front of the site. In order to provide service to PZ6 an additional 7000 feet of 12 or 16 inch water main will be need to be installed. If a different site is chosen then additional water main and/or an independant pump station to serve PZ 6 will be needed.

2. Purpose

The purpose and necessity of the project, with supporting data including recent and anticipated water consumption data and hydraulic model summarizations.

The two primary reasons for needing another unit well in this area are fire protection and supply redundancy.

During the preparation of the 2006 Water Master Plan, PZ4 was analyzed for fire flow capability and the fire flow analysis of our current system shows significant areas of deficiency in this zone. The criteria established to determine fire flow requirements and maps showing areas of fire flow deficiency are included in Exhibit B.

The system facilities map shows that PZ4 is presently served only by Unit Well 9. When Well 9 is out of service valves must be opened so that service can be maintained from PZ6. All points of connection between the pressure districts are at the northern end of PZ4. When Well 9 is down the system has difficulty maintaining adequate flow and pressure in the rapidly expanding southeast portion of this pressure zone.

Once constructed PZ4 will have excess supply capacity when both wells are in service. The proposed dual pump station and transmission main will allow water to be pumped from PZ4 to PZ6 to supplement supply in PZ6. This function will serve to delay future well projects within PZ6 and will improve supply reliability.

3. Alternative Evaluation	*A description of alternative projects or programs considered (This does not include specific site comparisons during early phases of the project).*

Alt 1. Maintain the status quo. (Do nothing)

a. **Discussion:** Given the fire flow deficiencies noted in the Water Master Plan and in the subsequent water distribution system modeling results and the lack of supply redundancy and reliability, this "do nothing" alternative does not meet minimum system standards. Madison Water Utility has the obligation to provide adequate water service, including adequate fire flow capacity to all portions of its service area. Doing nothing and not providing redundancy would continue to expose the residents and businesses of Pressure Zone 4 to an unacceptable risk of losing their water supply.

b. **Estimated Cost:** Capital Cost $0; Operational cost $0; Social Cost: There would be an increased risk of water service interruptions under this Alternative. There would be an expectation of higher property insurance costs due to fire flow deficiencies in the area and this could also reduce development potential in the area.

c. **Engineering Cost:** Not Applicable

d. **Operating Cost:** Not Applicable

e. **Property Cost:** Not Applicable

f. **Schedule:** Not Applicable

g. **Recommendation**: This Alternative does not address the existing deficiencies, does not meet minimum Utility level of service, would not be acceptable to area residents and therefore will not be considered further.

Alt 2. Transfer water from Pressure Zone 6

a. Discussion

The only adjoining pressure district is PZ6. This is how the Water Utility currently provides water to PZ4 when Unit Well 9 is taken out of service.

There are two problems with this current scenario. The first is that because PZ6 operates at a higher hydraulic gradient than PZ4 the 3 million gallon reservoir at Unit Well 9 is taken out of service and thus while the static pressures are actually raised the fire protection in this zone is reduced during these periods. To overcome this a series of pressure reducing stations along with larger transmission mains would have to be installed along the border between the two districts. The second problem is that this alternative puts more pressure on the wells in the eastern portion of PZ6. PZ6 east does not have excess supply capacity, especially with the use of Unit Well 29 at 1100 gpm, and the loss of Unit Well 3.
Computerized modeling data shows that transfer of large volumes of water from Zone 6 to Zone 4 can not be done without creating large areas of deficient fire flow in Zone 6.

b. **Estimated Capital Cost:** $ 300,000 for pressure reducing stations.

c. **Engineering Cost:** $36,000

d. **Operating Cost:** Not Applicable

e. **Property Cost:** Not Applicable

f. **Schedule:** Not Applicable

g. **Recommendation:** Computer modeling data indicates this alternative will not solve the problem without creating additional problems in PZ6. The Black & Veatch Master Plan report recommending that a new well in PZ 4 also have the ability to transfer water to PZ6 supports this data. Therefore it is recommended that this alternative not be selected.

Alt. 3 Transfer water from adjacent municipalities

a. **Discussion**: The only adjoining municipalities are the City of Monona and the Village of McFarland. Purchasing water from Monona is not an option as they are having their own water supply problems. Monona has three existing wells and would like to add a fourth but they have been having difficulty finding an appropriate site. In fact they have approached the Madison Water Utility about a system interconnection that would allow them to purchase water from us during their high demand periods. McFarland also has three wells but they are smaller than the typical Madison well. This alternative was discussed with their Public Works Director but while he is comfortable with their current supply they do not have excess supply to share with Madison.

b. **Estimated Capital Cost:** Not Applicable

c. **Engineering Cost:** Not Applicable

d. **Operating Cost:** Not Applicable

e. **Property Cost:** Not Applicable

f. **Schedule:** Not Applicable

g. **Recommendation:** Not Applicable

Alt. 4 Construct a reservoir only, without a deep well

a. **Discussion:** We have identified that the problems we are trying to solve in Zone 4 are fire flow deficiency and water supply redundancy. Fires are typically short term (2-3 Hour) events that require high volumes of water, up to 3500 gallons per minute. A reservoir

certainly could be constructed to augment the existing water supply to solve the fire protection issue. To provide 3500 gpm for 3 hours a minimum 630,000 gallon reservoir would be needed. Either the reservoir would have to be constructed to the same elevation as the existing reservoir at Well 9 in order to stabilize the hydraulic gradient in this Zone, or a booster station would have to be constructed with the reservoir to boost the pressure to the correct gradient.

A reservoir alone however would not solve the problem of system redundancy. The average day demand in Zone 4 is 1.1 million gallons. The peak day demand is 1.9 million gallons. The largest reservoir in the Madison Water Utility system is 6 million gallons, thus the largest reservoir would not even have enough water for one week. The only way to supply a reservoir without also drilling a well is to transfer water from other wells. See alternative 2 for discussion of this alternative.

b. **Estimated Capital Cost:** $ 1.5 to 3.5 million depending on the size of the reservoir and the need for a booster station

c. **Engineering Cost:** $100,000 to $200,000 depending on the scope of the project.

d. **Operating Cost:** varies

e. **Property Cost:** $ 200,000

f. **Schedule:** 1.5 to 2 years for site acquisition, design and construction

g. **Recommendation:** This alternative does not solve both objectives of the project so it is recommended that it not be pursued any further.

Alt. 5 **Drill a new well**

a. Discussion: This alternative solves both the fire flow deficiency issue and the redundancy issue.

b. Estimated Capital Cost $3,000,000

c. Engineering Cost: $ 270,000

d. Operating Cost: $ 140,000

e. Property Cost: $ 200,000

f. Schedule: 3 to 5 years until a new well can be put on line.

g. <u>Recommendation:</u> This is the only alternative that solves both issues.	
4. Recommendation	*A summary of the recommendation of the preferred alternative.*
Alternative 5	
