City of Rochester Hills, MI
Water Distribution Model Evaluations

Meeting with Community Development
January 22, 2004

AGENDA

- Scope of Initial Project
  - Identify improvements to increase pressure to NW portion of the City
  - Identify means to level out peak demand periods

- System Modeling

- Results and Conclusions
  - Some areas of low pressure under maximum day/peak hour demand
  - Some areas of low pressure under fire flow conditions
  - Improved pressure conditions through addition of water storage facilities
  - Significant reduction in peak demand through addition of storage facilities

- Benefits of Water Storage
  - Increase water pressure
  - Fire flow
  - Lower peak usage rate

- DWSD Rate Structure
  - Factors
    - Maximum day factor
    - Peak hour factor
    - Distance from supply
    - Difference in elevation from supply
  - Impact of Elimination of Peak Hour Factor

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- Scope of Current Project
  - Coordination Meetings
  - Collection of additional flow/pressure data
  - Computer model runs
    - Draw more water from RC-4
    - More precise sizing/location of storage facilities
  - Updated cost estimates
  - Coordination with DWSD

Section 6 – Storage Options

Considering the pressure deficiencies resulting from decreased DWSD supply pressures during the peak demand periods and the expected rate increases for purchasing water from DWSD, potential storage options were evaluated. Storage facilities could consist of either elevated storage tanks fed from a booster pumping station, or ground level reservoirs using booster pumps to feed the distribution system.

Rate calculations prepared by DWSD for each community it serves take into account a historical base flow. On top of this, peaking factors are applied for both a maximum day and a peak hour usage. Currently, the peaking factors applied to Rochester Hills are 2.4 times the average daily demand for the maximum day, and 3.4 times the average daily demand for the peak hour. The calculation also takes into account the distance from the DWSD facilities and an elevation factor. Unit costs applied to each of these factors determine the allocated cost of providing water service to the City of Rochester Hills. For FY 2003, the water service rate charged by DWSD to the City of Rochester Hills is $14.14 per 1000 cubic feet, as shown on **Table 11**. This represents an increase of nearly 13% over FY 2002 rates, and is expected to continue to increase in the future. Although many of these factors are fixed (base demand, distance, elevation), changes in the peaking factor for peak hour demands, that could be accomplished by addition of storage facilities, would have an impact on the overall cost of water service.

Table 11
DWSD Rate Calculation
2002/2003 Rates

Service Category	Peaking Factor	Units of Service	Applied Units	Unit Cost	Allocated Costs
Base (Mcf/Day)		1232.9	1349.3	$686.98	$926,942
Max. Day	2.4	2958.96	1726.06	$370.51	$639,522
Peak Hour	3.4	4191.86	1232.9	$92.27	$113,760
Base Distance		27.7	37375.61	$13.90	$519,521
Max Day Distance			47811.86	$10.36	$495,331
Peak Hour Distance			34151.33	$10.36	$353,808
Base Distance/Elevation		51.6	69623.88	$7.69	$535,408
Max. Day Distance/Elevation			89064.69	$16.86	$1,501,631
Peak Hour Distance/Elevation			63617.64	$16.86	$1,072,593
Customer A (Commercial)		96		$10.27	$986
Customer B (Meters)		3480		$20.12	$70,018
Total FY Revenue Requirement					$6,229,519
Less 2 Mo. @ Prev. FY Rates		450000*	0.17*	$12.34	$925,500
Total to Recover with 10 Mo.					$5,304,019
10 Mo. Of FY Volume		450000*	0.83		375000 Mcf
FY Rate					$14.14 /Mcf

To simulate the operation of water storage facilities used to limit the peak hour demand of purchasing water from DWSD, flow control valves were added to the model at each of the four metering stations. These flow control valves would limit the amount of water obtained from the DWSD system to the maximum day demand of 12,780 gpm (18.4 MGD). During portions of the day when demand exceeds the maximum day rate, such as during peak hour or fire flow conditions, the distribution system would utilize water from the storage facilities, rather than from the DWSD supply. During periods when the

demand for water recedes, the storage facilities would be replenished. In this way the peak hour demand from DWSD would be equivalent to the maximum day demand, resulting in a reduction in the peaking factor used in the DWSD rate calculation from 3.4 to 2.4.

Due to the pressure district isolation of the north and south portions of the City, two separate storage reservoirs were evaluated, one located in the northwest portion of the City, and one in the east central portion of the City, near the areas where low pressure conditions were indicated through the modeling. The purpose of these reservoirs would be to fill to a predetermined level based on system pressure, during low demand (night time) hours. During peak hours and emergency situations, when system demands increase, water would be pumped from the tank to supplement these high demands.

Storage volumes were estimated by calculating the difference between peak hour demand (18,800 gpm) and maximum day demand (13,270 gpm), or 5,530 gpm. Peak hour demands were estimated to occur three times each day (morning, midday and evening) for a total of 1.0 MGD. Proportioning this volume between the north and south storage facilities was based on the average daily demand associated with each area (62% north of the north-south isolation boundary, 38% south of the isolation boundary). In addition to providing the volume necessary to meet the peak demand periods, the required storage volume also considered providing for a 3,500 gpm fire flow for a three hour period, or 0.63 MG. Therefore, the north area storage facility would require approximately 0.62 MG to satisfy the peak hour demands, plus 0.63 MG for fire flow for a total minimum storage volume of 1.25 MG. The south area facility would require a total minimum storage volume of 1.01 MG to satisfy the peak demand (0.38 MG) and fire flow (0.63 MG). To account for variability in the maximum day and peak hour demands, since continuous flow and pressure data is not yet available, we would recommend that each storage facility be sized for a capacity of 2.0 MG.

The impact on water rates of providing storage within the system is shown in **Table 12.** Providing an additional 5,530 gpm to the system under peak hour conditions reduces the peaking factor from 3.4 to 2.4. When factored into the rate calculations, a reduction of approximately $1,500,000 per year in the revenue requirement is realized.

Table 12
DWSD Rate Calculation
2002/2003 Rates With Storage Tanks To Satisfy Peak Hour Demand

Service Category	Peaking Factor	Units of Service	Applied Units	Unit Cost	Allocated Costs
Base (Mcf/Day)		1232.9	1349.3	$686.98	$926,942
Max. Day	2.4	2958.96	1726.06	$370.51	$639,522
Peak Hour	2.4	3612.397	0	$92.27	$0
Base Distance		27.7	37375.61	$13.90	$519,521
Max Day Distance			47811.86	$10.36	$495,331
Peak Hour Distance			0	$10.36	$0
Base Distance/Elevation		51.6	69623.88	$7.69	$535,408
Max. Day Distance/Elevation			89064.69	$16.86	$1,501,631
Peak Hour Distance/Elevation			0	$16.86	$0
Customer A (Commercial)		96		$10.27	$986
Customer B (Meters)		3480		$20.12	$70,018
Total FY Revenue Requirement					$4,689,358
Less 2 Mo. @ Prev. FY Rates		450000*	0.17*	$12.34	$925,500
Total to Recover with 10 Mo.					$3,763,858
10 Mo. Of FY Volume		450000*	0.83		375000 Mcf
FY Rate					$10.04 /Mcf

Scope of Services

In order to accomplish the above, FPS offers the following scope of services:

1. Coordination Meetings

    a. Meet with Rochester Hills officials to reconfirm the City's desire regarding improvement options and public meetings.
    b. Meet with City officials to review findings of the additional study.
    c. Presentations to City Council to review the final revised conclusions of the study.

2. Data Collection

    a. Updated pressure and flow data from the DWSD SCADA system will be important to consider, since this data was not available at the time the initial modeling was performed. FPS will meet with the DPS staff and download the pressure and flow data from the four DWSD feed points. If this data is for some reason not available at the City's workstation, DWSD will be contacted to obtain the data. From the usable data, adjustments will be made to the existing model, if required.

3. Computer Model Runs

    a. Perform computer model runs that will result in drawing more water through DWSD meter station RC-4. This will require booster pumping, possibly with storage, that will deliver water to the north pressure zone. Revising the model inputs and performing new maximum day, maximum day plus fire protection and peak hour runs to assess the impacts of bringing water from the east feed point will be included.
    b. More precise sizing and locating of storage tank(s) elsewhere in the system, plus a confirmation of the best means of storage (ground versus elevated) and operational procedures will be completed. Care must be taken to recognize the importance of maintaining adequate residual chlorine levels and in general, avoiding stagnant water conditions.

4. Report Supplement

    a. Develop a report supplement that will explain the scope and nature of the reconfirmed system improvements.
    b. Provide revised estimates of costs (construction costs and engineering fees) of the recommended improvements.