CITY OF ROCHESTER HILLS, MICHIGAN

Water Storage Feasibility Study

December 2009

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SECTION 1 - EXECUTIVE SUMMARY

The City of Rochester Hills is considering adding water storage to its water distribution system to provide emergency supply, meet peak demands when pressures are low and to realize a reduction in water rates from its supplier, the Detroit Water and Sewerage Department (DWSD).

In July 2009, the City signed a new water service agreement with DWSD, which provides for service to Rochester Hills for the next 30 years. The agreement establishes peak use rates (maximum day and maximum hour) that the City cannot exceed without penalty, establishes minimum operating pressures that DWSD must provide at each master meter and outlines the preferred allocation of supply rates at each of the four master meters. Currently, the City's water commodity charge is based in part on the maximum day and maximum hour rates established in the contract. Potential reductions in future water rates are dependent on renegotiating a new maximum hour rate based on system performance with the new storage facilities.

The previous studies recommended a total of 5 million gallons (MG) of storage divided between two areas within the City. The City of Rochester Hills determined the most feasible locations for storage reservoirs based on available land in these locations.

A site was selected in the northwest portion of the City within Nowicki Park, east of Adams Road and south of Tienken Road. A second site was selected in the East Central

portion of the City, located on the east side of John R Road between Bloomer Road and Avon Road.

Utilizing the City's previously calibrated WaterGEMs model, an extended period analysis was completed to determine the recommended size of each reservoir, the additional infrastructure improvements required for their effective use, and the hydraulic benefit to the distribution system in reducing peak flows.

Reservoirs were set to pump water to the system whenever the water use from the closest DWSD master meter rose above the maximum day value. This control logic is simpler than the actual system control strategy that will be necessary to keep the daily peaks below the maximum day value, however the resultant output showed that the goal of becoming a "Maximum Day Customer" can be reached with a total storage of 6 million gallons. A Maximum Day Customer is a classification for DWSD customers who control their water demand so that their peak hour water demand is equal to their maximum day water demand.

To determine the potential savings in future water rates, the DWSD Rate Section was consulted. DWSD provided estimated revenue requirements for Rochester Hills for various projected maximum hour demands. The estimated annual water savings presented were calculated with the assumption that the contracted Maximum Day would not be adjusted.

The projected capital costs ($11,050,000), the operation costs ($66,577), and low interest debt service fees (assumed loan rate of 4.375%) were compared to the projected annual savings. The projected annual savings of $4,100,000 assume Rochester Hills will operate as a Maximum Day Customer, where the negotiated peak hour rate is set at their maximum day value of 25.81 MGD. The payback period under these projected conditions is 2.98 years.

The most influential factor in the return on investment calculations was the negotiated peak hour rate. A change in the assumptions from a rate of 25.81 MGD to 30.0 MGD would increase the assumed payback period from 2.98 years to 3.67 years. A further increase in the assumed peak hour to 35 MGD would increase the assumed return to 4.94 years, and a 35.16 MGD peak hour rate would produce a five-year payback period.

Therefore, with a projected return on investment of less than 5 years for negotiated rates less than 35 MGD, and a potential payback period of less than 3 years, we recommend the City of Rochester Hills proceed with the construction of storage. This recommendation is based on assumed savings within the DWSD rate calculation shown in Table 10 and that DWSD is in agreement with the assumptions made herein.

SECTION 2 – BACKGROUND AND BASE CONDITIONS

The City of Rochester Hills is considering adding water storage to its water distribution system to provide emergency supply, meet peak demands when pressures are low and to realize a reduction in water rates from its supplier, the Detroit Water and Sewerage Department (DWSD).

In July 2009, the City signed a new water service agreement with DWSD, which provides for service to Rochester Hills for the next 30 years. The agreement establishes peak use rates (maximum day and maximum hour) that the City cannot exceed without penalty, establishes minimum operating pressures that DWSD must provide at each master meter and outlines the preferred allocation of supply rates at each of the four master meters. Currently the City's water commodity charge is based, in part, on the maximum day and maximum hour rates established in the contract. Potential reductions in future water rates are dependent on renegotiating a new maximum hour rate based on system performance with the new storage facilities. The new contract provides a six-hour period for replenishment of storage, which is not subject to the maximum hour use restrictions.

The City of Rochester Hills has a current population of about 70,000. The City is mostly built-out with little expected growth in population or water use. Potential growth from Oakland University is not expected to significantly increase water use in the area. For the purposes of this study, marginal growth in water demands (1-2%) over the next 20 years was assumed.

Rochester Hills' current contract with DWSD provides for a maximum daily usage rate of 25.81 million gallons per day (MGD) and a maximum hour rate of 51.91 MGD. DWSD provides water to Rochester Hills through four separate master meters. The meter stations are identified below:

Table 1
DWSD Master Meter Locations

Meter	Location
RC-1	South Boulevard and Livernois Road
RC-2	Walton Boulevard and the City Border
RC-3	South Boulevard and Adams Road
RC-4	Dequindre Road and 24 Mile Road

Water is distributed from the four master meters to eight pressure districts that are separated and controlled through the use of 52 pressure relief valves (PRVs). Districts have been established based on the topography of the area. The elevation of Rochester Hills generally rises from about 700 feet (USGS datum) in the southeast to about 990 feet in the northwest. The terrain is hilly, which increases the need for pressure regulation throughout the City. The Clinton River flows from the southwest to the City of Rochester, exiting Rochester and Rochester Hills near RC-4. The elevations near the Clinton River are lower than the surrounding area, creating a zone where high pressures are a concern.

The City's water distribution system has been modeled with the use of WaterGEMs, Version 8i. The model of the distribution system was approved by the City. It was developed during previous system analyses in 2003 and 2005, and has been recently updated and calibrated by others.

In the model, water demands are assigned to each of the 35 Plat Sections and then distributed evenly within each Section. Water pressure provided at each of the master meters is set based on the current DWSD contract amounts as shown in Table 2.

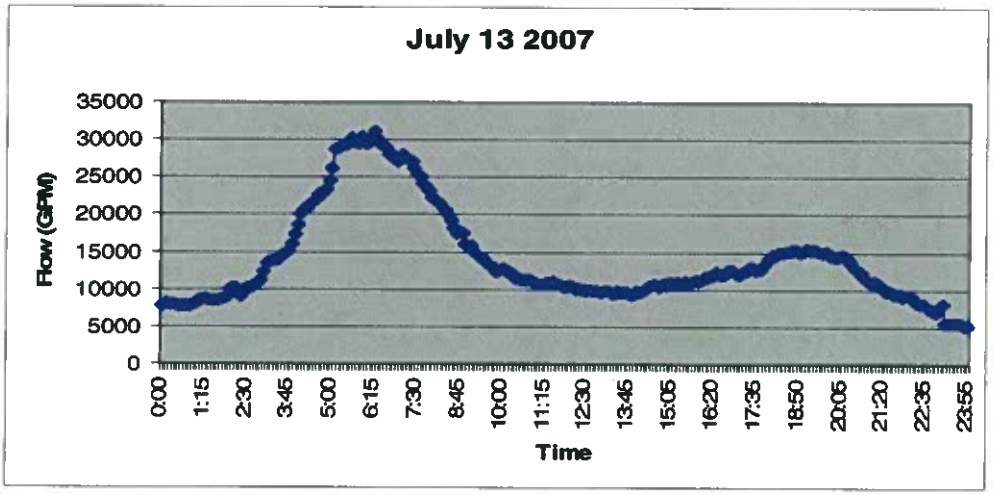
Table 2
Feed Pressures from DWSD

Meter	Location	Pressure*	HGL	Variation**
RC-1	South Blvd. and Livernois Road	90 psi	1001'	Fixed
RC-2	Walton Blvd. and the City Border	100 psi	1165'	Fixed
RC-3	South Blvd. and Adams Road	125.1 psi	1149'	Fixed
RC-4	Dequindre Road and 26-Mile Road	Varies	Min = 928' Max= 1079'	Min = 70psi Max=135 psi

* Pressure shown matches the DWSD contracted minimum pressure at each location, except for RC-4 which varies as noted below.
**The water model varies the pressure at RC-4 between the minimum contract level and the maximum contract level to represent the need for additional pressure from DWSD during peak hours to serve the northeast section of the Rochester Hills.

The daily demand variations throughout the day are summarized in a daily demand curve within the model. The demand curve can be applied to any daily average flow, but was used in this study to simulate hourly variations during a projected annual maximum day demand. The demand curve's peak flow occurs at about 6:30 a.m. with a second lower peak at about 9:30 p.m. Historical records from the most recent high demand days in 2007 verified the shape of this curve and are shown below in Figure 1.

Figure 1
July 13, 2007 Daily Demand (Sum of DWSD meters)



The peak demand for the day based on the Daily Demand Curve is approximately 27,200 gpm (38.9 MGD) while the average for the maximum day is approximately 15,000 gpm (21.6 MGD). While these values are 15-20 percent less than the current contract values, they are assumed to be more representative of actual maximum daily and peak hour flows based on historical water use as seen in Table 3 below.

Table 3
Historic Water Use – Rochester Hills Metered Usage from DWSD

Year	Ave Day MGD	Max Day MGD	Peak Hour Coincidental*	Peak Hour Non-Coincidental*
2003	8.25	20.65	24.40	37.82
2004	8.86	17.82	26.25	33.29
2005	8.86	19.19	26.00	36.87
2006	9.35	22.19	40.20	40.20
2007	9.10	22.37	44.99	44.99
2008	9.08	16.71	30.27	30.92
2009	8.12	17.14	24.14	26.58
Average	**8.80**	**19.44**	**30.89**	**35.81**

*Per DWSD contract the peak hour equates to the peak hour usage by Rochester Hills during DWSD's peak hour. Coincidental Peak hour refers to this rate. Non-Coincidental is Rochester Hill's peak hour regardless of time.

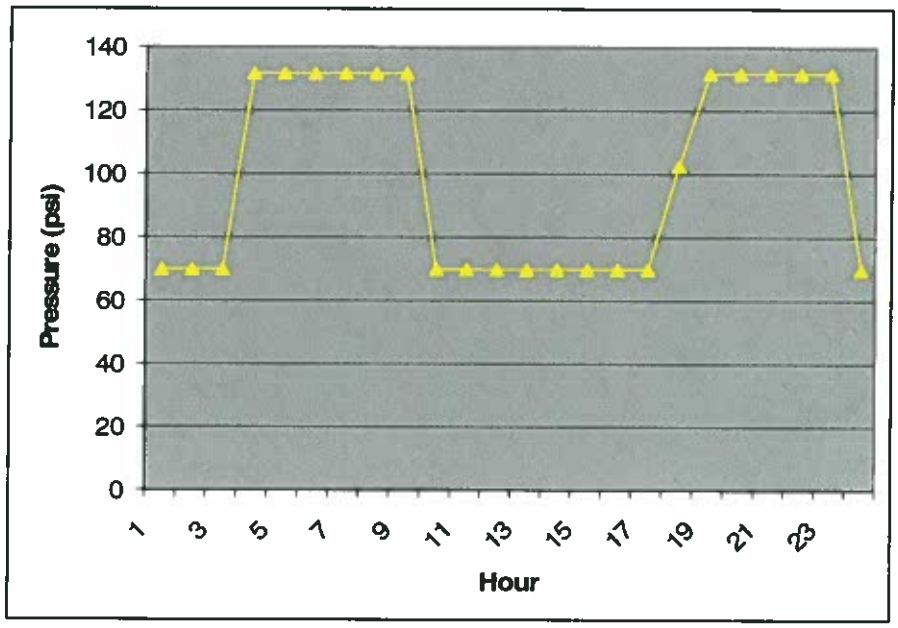
Distribution of water supply from the four DWSD master meters varies throughout the year. During an average day the distribution resembles the flow splits described in Exhibit B of the DWSD Water Service Contract shown below in Table 4.

Table 4
Flow Split Assumptions in DWSD Water Service Agreement

Meter	Assumed Flow Split (2009-2010)
RC-1	32%
RC-2	45%
RC-3	18%
RC-4	5%

During peak flow periods, more flow may be taken from RC-4 to feed the northeast sections as well as the southeast pressure district. For the water to reach the northern sections of the City, the pressure provided at RC-4 needs to be higher then the minimum contract value of 70 psi. Within the water distribution model, the pressure provided by RC-4 is assumed to be providing maximum pressure during the City's peak demand hours. This is represented in the water model by the pressure variation in Figure 2. The ability of DWSD to meet the assumed pressure variation during peak demand periods at RC-4 should be confirmed with DWSD.

Figure 2
Assumed RC-4 Pressure Variation



The increase in water supply during higher water demands was verified by historical data from 2007. During the summer peaks, a higher distribution percentage was observed from RC-4 than is assumed in the DWSD Water Service Agreement. Statistics from July 13, 2007 are provided below for reference.

Table 5
Historic Water Supply Distribution – July 13, 2007

Meter	Daily Flow (MGD)	%	Peak Hr. 6-7am (MGD)	%
RC-1	5.06	24.4	10.79	25.99
RC-2	7.08	34.2	11.93	28.73
RC-3	3.01	14.5	7.54	18.15
RC-4	5.55	26.8	11.26	27.13
Total	**20.7**		**41.5**	

For this study, the WaterGEMs model was used to perform extended period analysis of the current conditions. The results provided the base conditions for analysis of water storage scenarios. Maps showing the expected minimum pressures during the peak demand, and the maximum expected pressures are provided in the following section.

SECTION 3 – EXTENDED PERIOD ANALYSIS – STORAGE OPTIONS

Previous studies to determine the benefits and feasibility of constructing water storage reservoirs recommended a total of 5 million gallons of storage divided between two reservoirs. The reservoirs were to be located in the Northwest and East Central areas of the City. The City of Rochester Hills determined the most feasible locations based on available land in these locations.

A site was selected in the northwest portion of the City within Nowicki Park, east of Adams Road and south of Tienken Road. A second site was selected in the East Central portion of the City, located on the east side of John R Road between Bloomer Road and Avon Road.

Reservoirs are to be above ground or partially buried. It was determined by the City that elevated tanks would not be acceptable and thus they were not considered in the feasibility analysis.

Utilizing the City's WaterGEMs model, an extended period analysis was completed to determine the recommended size of each reservoir, the additional infrastructure improvements required for their effective use, and the hydraulic benefit to the distribution system in reducing peak flows.

For both locations, it was determined that the reservoir size required would be 3 million gallons based on the amplitude of the peak within the daily demand curve and the desire

to include volume for emergency fire demands. The fire flow volumes were conservatively estimated as 0.63 MG (3,500 gpm fire demand over 3 hours) at each reservoir. The additional 2.37 MG would be available for reducing the peak hour flow.

Depending on the location of the reservoir, the size of the water mains near the proposed reservoir, and the location of the reservoir in relation to the DWSD feed points, some water main improvements may be necessary to allow the reservoir to fully fill during the night-time hours. For the filling analysis, it was assumed that each reservoir was empty at the start of the filling cycle, the reservoir should be full when the system demands increase, and the replenishment could not cause localized pressure distribution problems.

For the East Central site, the water main on Avon Road west of Pressure Reducing Valve 52 (PRV-52) to John R. and the water main on John R. from Avon to the reservoir needed to be increased to 20-inches in diameter. The piping improvements total approximately 3,000 linear feet and included modifying the set point of PRV-52 to allow for the increase in feed rate through the new main. In the Northwestern site, no additional system watermain improvements were found to be necessary.

For the purposes of the model analysis, the height of the reservoirs were assumed to be 25 feet above the local ground elevation. The ground elevation at the Adams Road site was assumed to be 984 feet, while the ground elevation of the reservoir at the John R. site was assumed to be 752 feet. The height of the reservoirs at the Adams Road and John R sites could be increased to 30 feet if locally acceptable. The increased height would slightly reduce operating costs by preserving more of the available pressure from DWSD.

Based on the reservoir elevations and the surrounding elevations, pressure sustaining valves were included as part of the reservoirs for all sites to maintain the system pressures above minimum values during filling of the reservoirs. In addition, the low ground elevation of the reservoir site on John R. Road required an additional discharge watermain from the reservoir to Avon Road and then west for approximately one-half mile to Thames Road.

During the daily peaks, the reservoirs were set to pump water to the system whenever the water use from the closest DWSD master meter rose above the maximum day value. Thus, water was used from the reservoir and limited the water coming from the master meter. When demand from the nearest master meter dropped below the maximum day value, no water was pumped to the system from the reservoir.

Pumping rates to the distribution system from the reservoirs was simulated by composite pump curves within the model. The pressure requirements from each composite pump curve were determined based on the pressure (i.e. hydraulic gradient) needed to keep inflow at the nearest DWSD master meter below its daily average (Max Day) value. The rated pumping capacity at each site is listed below.

Table 6
Modeled Pumping Requirements for Proposed Reservoirs

Site	Feet of Hydraulic Head	Pumping Rate
Adams Road	140 TDH	6,500 gpm
John R. Road	235 TDH	7,000 gpm

For each site, pressures were compared to the base condition during reservoir filling (4 a.m.) and at peak demand (6:30 a.m.). These times represent the periods when the system is under the most stress and could result in minimum pressures. In each case, no localized or system-wide pressure problems were observed. (See Figures 3, 4, and 5).

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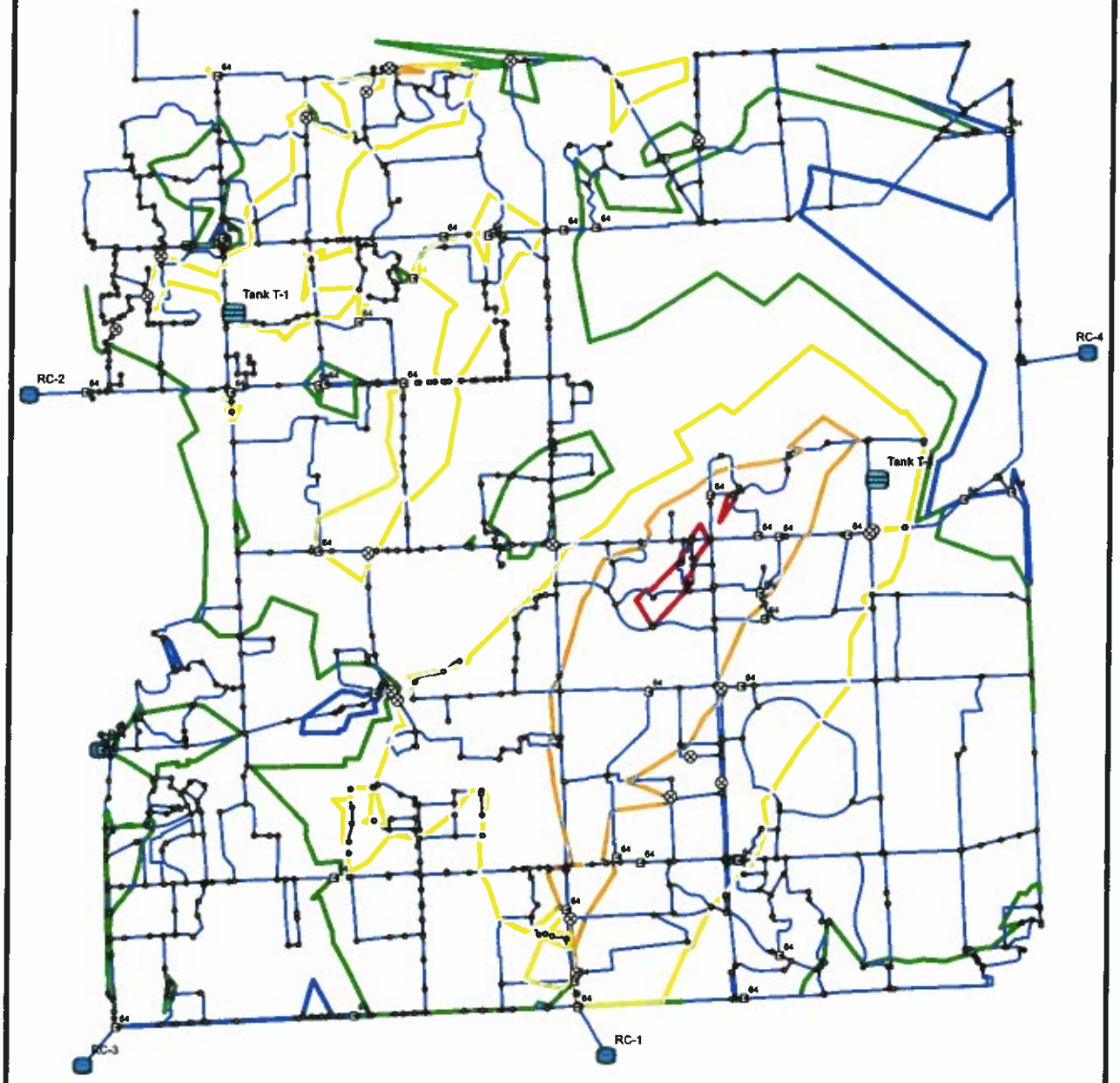

TETRA TECH

DESIGNED V. NOVAES | DATE 11/23/09

Legend

Pressure (psi)

20 40 60 80 100

Storage Tanks

Reservoir

Water Main

Rochester Hills Water Distribution System
Storage Tank Feasibility Study

Pressure Contour
Peak Hour - Base

FIGURE
3

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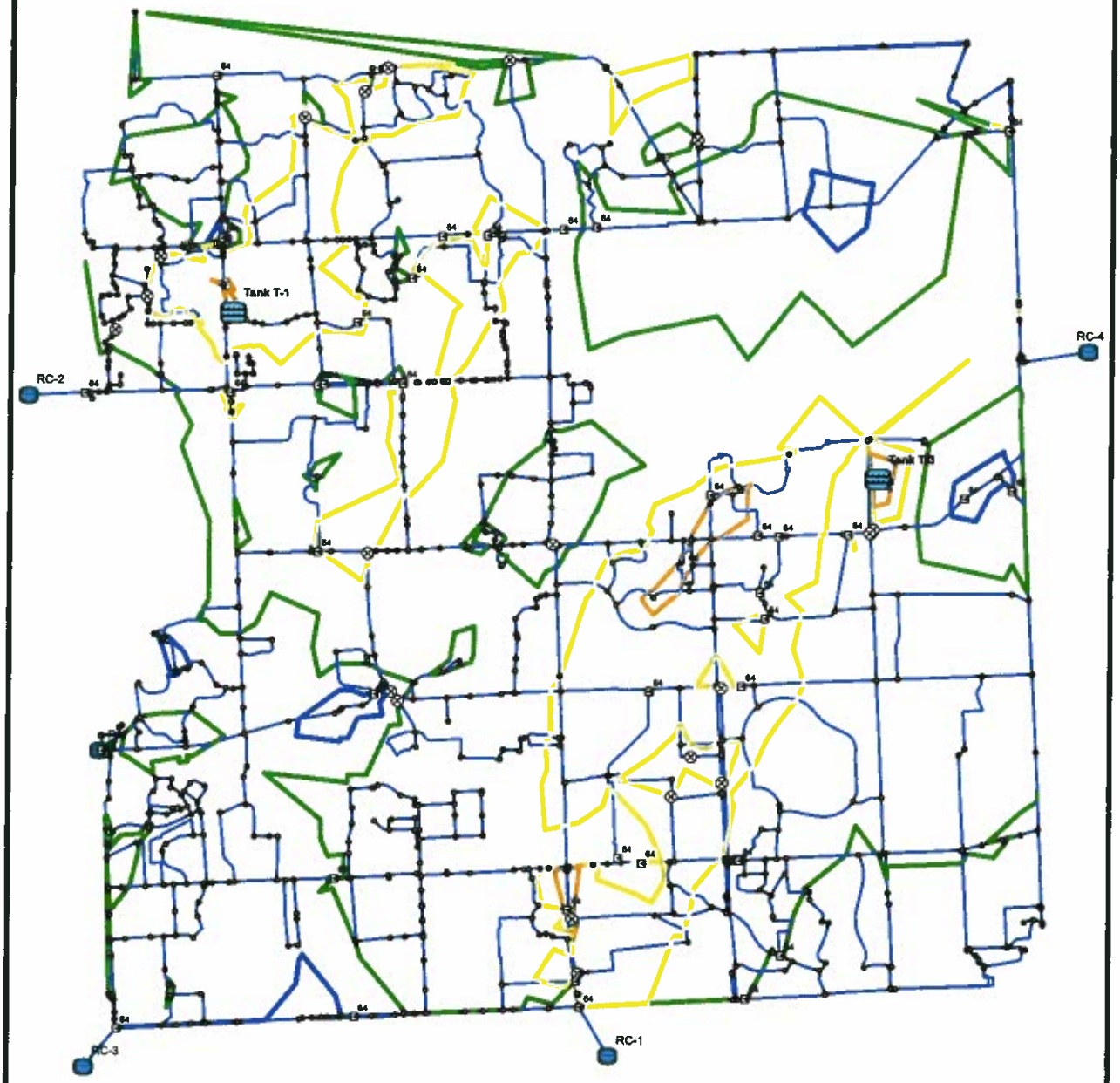

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DESIGNED: V. NOVAES | DATE: 11/23/09

Legend

Pressure (psi)

20 40 60 80 100

Storage Tanks

Reservoir

Water Main

Rochester Hills Water Distribution System
Storage Tank Feasibility Study

Pressure Contour
Recommended Plan
Peak Filling

FIGURE 4

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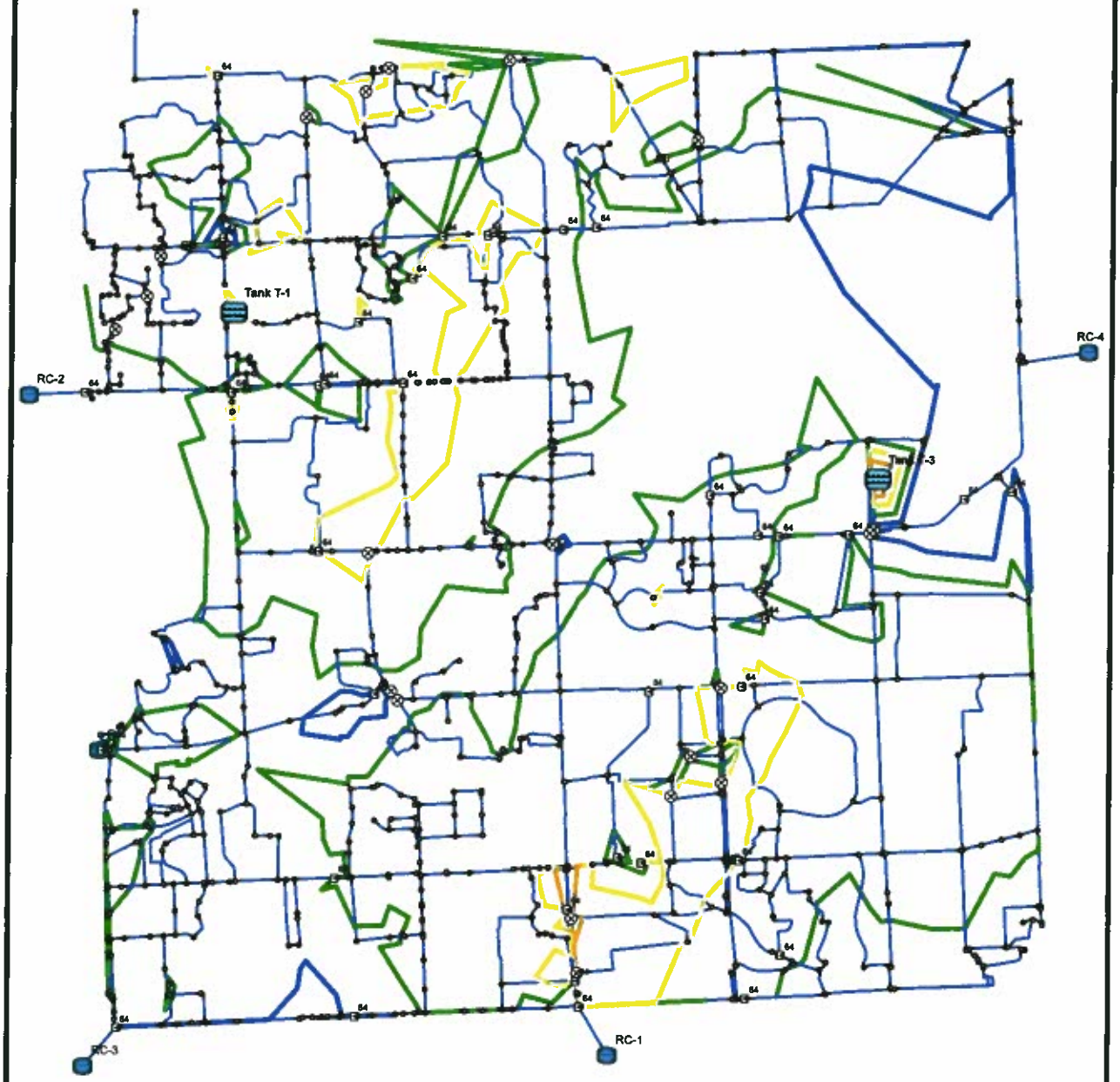

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DESIGNED: V. NOVAES | DATE: 11/23/09

Legend

Pressure (psi)

20 40 60 80 100

Storage Tanks

Reservoir

Water Main

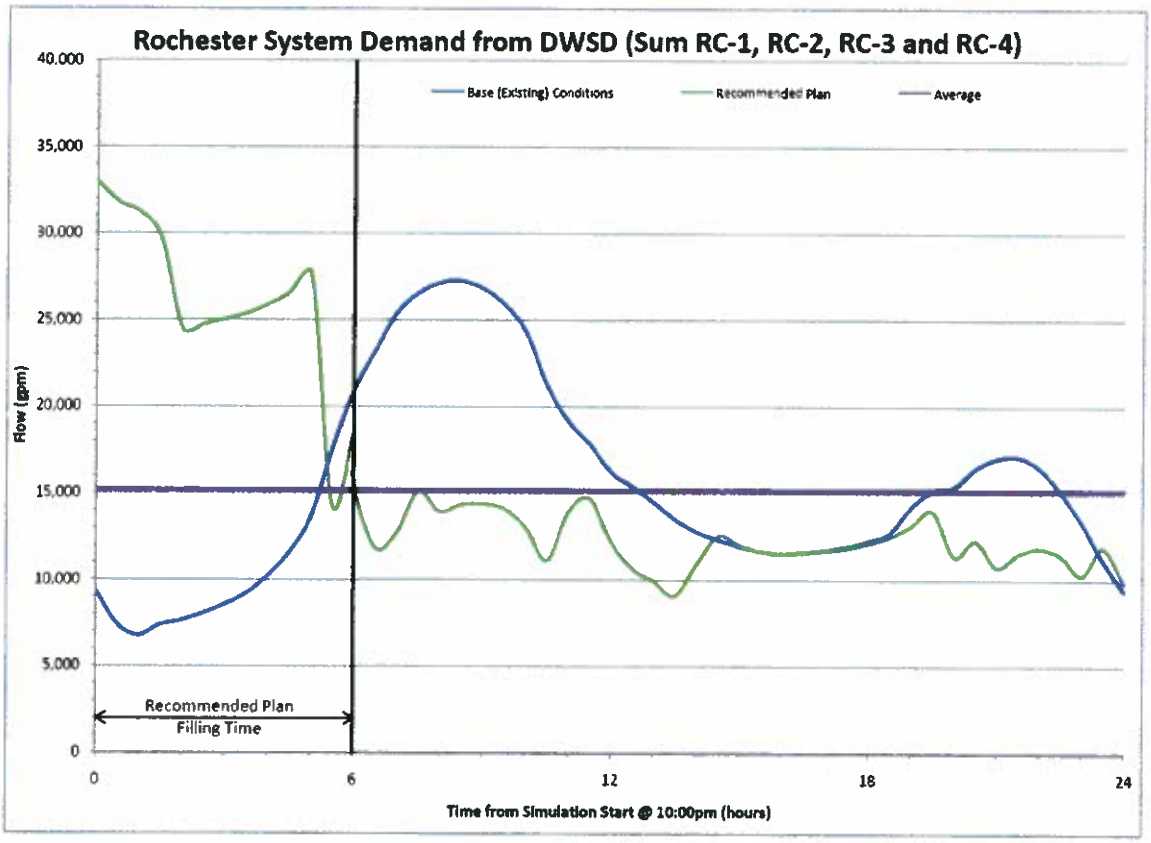
Rochester Hills Water Distribution System
Storage Tank Feasibility Study

Pressure Contour
Recommended Plan
Peak Hour

FIGURE 5

The resultant reduction of peak flow from the DWSD master meters throughout the day is shown below in Figure 6. The base condition is the system demand curve as included in the City's model, with no improvements. The curves show the combined water demand for all four master meters over time. Time (0 hour) starts at 10 p.m. the previous day. The peak hour for the day is approximately 6:30 a.m. and the reservoir filling time is set from 10 p.m. to 4 a.m.

Figure 6
Peak Flow Reduction



*Note: Simulation was set to start at 10pm. Filling of tanks occurs from 10pm to 4am.

Within the model, the reservoirs were set to pump water to the system whenever the water use from the closest DWSD master meter rose above the max day value. This control logic is simpler than the actual system control strategy that will be necessary to

keep the daily peaks below the maximum day value; however, the resultant output showed that the goal of becoming a "Maximum Day Customer" can be reached. A Maximum Day Customer is a classification for DWSD customers who control their water demand so that their peak hour water demand is equal to their maximum day water demand.

Operation of the tanks can vary depending on the final negotiated rates from DWSD. Currently, Rochester Hills does not monitor flow (only pressure) from the DWSD Master Meters. For implementation and operation of these reservoirs, monitoring of the flow from all four of the DWSD master meters will be necessary. Operator logic can be developed to keep the supply rate from DWSD during the peak demand below the negotiated peak hour rate.

The extended period analysis with the City's WaterGEMs model provided the basis for the conceptual layouts of improvements for each of the sites chosen by the City. The layout and conceptual costs of these improvements are provided in Appendix A.

The costs for the proposed reservoirs will vary depending on the City's preferences for site work, landscaping, and architectural enhancements to the reservoirs. A summary of the costs of construction for various options at each site is presented in Table 7.

Table 7
Opinion of Probable Construction Costs*

Site	Domed Roof	Flat Roof	Partially Buried	Improved Architecture	Additional Amenities
Adams Rd.	$4.0M	$4.4M	$4.6M	+50-100K	Public Restroom + $40,000**
John R. Rd.	$6.0M	$6.4M	$6.6M	+50-100K	

* Costs shown are further broken down within appendix A with variations based on different reservoir configurations.
**Public Restroom is included with the assumed project costs for the Adams Road site.

The costs presented above are based on prefabricated concrete reservoir tanks, a 24' by 36' split face block pumping station, and associated site work. The reservoirs are assumed to require a baffling or mixing system to reduce water age in the reservoir. No onsite chlorination is assumed to be required as long as the water age is managed through mixing and proper operation.

It is assumed that backup generators will be desired to ensure pumping operations during a power outage. Generators would not be a necessity for system performance; however, they will be a relatively inexpensive safeguard against losing power during peak demand and thus not being able to operate at a maximum day level.

Each site has been estimated with three levels of reservoir cost. The domed roof option is the most basic and least costly. A flat roof option is shown assuming the reservoir is constructed at grade with minimal excavation in the site layouts within Appendix A. The partially buried option assumes a flat roof and 50% of the reservoir buried through excavation, use of the surrounding topography and backfilling. Excavated soils have been assumed to be used on site for additional landscaping.

The "Improved Architecture" option include the additional anticipated costs for enhancing the exterior appearance of the precast reservoirs with a brick (or similar) appearance. The basic precast concrete architecture would include standard stamped designs with dyed concrete.

Additional amenities outside of the basic pump station structure, reservoir, access road, fencing, and water system improvements could include additional landscaping, public restrooms, fountains, or similar.

For both sites, there will be system upgrades that would be considered necessary for the project. These include upgrading the City's monitoring capabilities at each of the four DWSD master Meters to include flow as well as pressure. In addition, it is assumed there will be programming and instrumentation upgrades that will be necessary for the system as a whole. These costs were estimated and have been included as a lump sum to the estimated capital costs of the project in Table 8.

For the purposes of the rate analysis we have assumed the following:

Table 8
Base Rochester Hills Reservoir Construction Cost

Location	Reservoir Design	Cost
Northwest – Adams Rd.	Partially Buried Flat Roof with public restroom	$4,600,000
East Central – John R.	At Grade Flat Roof with no additional amenities	$6,350,000
System Upgrades	Monitoring of Flow at each DWSD Master Meter and upgrades to system instrumentation	100,000
Total		**$11,050,000**

For the rate analysis, there will also be an assumed cost of operation of each site, including facility maintenance and electricity costs for pump operation. An annual allocation of $5,000 has been assumed for maintenance costs at each pump station.

Electricity costs will be minor except for the cost of pumping. Pumping will occur during peak demand and during recirculation of the reservoir water. It is assumed that the reservoirs will need to recycle all stored water a minimum of two times per week. The recirculation pumping was added to the anticipated peak use pumping to develop the anticipated pumping hours. The estimated annual electrical costs are based on the pump hours, pumping rate, and head differential with the following equation.

$$\frac{\text{Flow (gpm)} \times \text{Head (TDH)} \times .7460 \times \text{Pump Hours}}{3960 \times (\text{pump eff.}) \times (\text{motor eff.})} \times \$0.08 \text{ per kWh} = \text{Elect. Cost}$$

Table 9
Pump Station Operation & Maintenance Costs

Site	Pump Hours	TDH	Flow (gpm)	Pump HP	Pump Costs
Adams Road	2970	140	2166	100	$17,847/year
John R. Road	2600	240	2335	200	$38,730/year
Annual Maintenance					$10,000/year
Annual Costs					**$66,577/year**

SECTION 4 – RATE ANALYSIS

The economic justification for adding storage facilities to the water system is dependent on anticipated savings in future water commodity rates from DWSD. For this reason an analysis of the potential impact of reduced peak hour usage rates on future water rates was conducted.

Rochester Hills water rates are based on a water service contract that became effective on July 1, 2009. It is a 30-year contract with optional 10-year renewals. It establishes Project Annual Volumes, Minimum Annual Volumes and Maximum Flow Rates (for Maximum Day and Maximum Hour) which are used in water rate calculations. It also establishes penalties for using less then the Minimum Annual Volume and for exceeding the Maximum Flow Rates.

The current contracted Maximum Day value is 25.81 MGD and the contracted Maximum Hour value is 51.91 MGD. There is no mechanism for adjusting these set flow rates based on the actual use as has been DWSD's practice in the past. The Maximum Flow Rates established in the Contract can only be adjusted after Years 2 and 5 of the Contract, and every 5 years thereafter, by negotiation between the parties. Establishment of storage (i.e. reservoirs) would constitute a changed condition that would allow for renegotiation outside the set intervals established in the contract.

Based on the results of the extended period analysis of the new reservoirs, it is expected that Rochester Hills can become close to a Maximum Day customer; where the water

supplied from all four DWSD master meters would not exceed the current contracted value of 25.81 MGD. It is important to note that while the model has shown that Rochester Hills can operate as a Maximum Day customer, proposed new contract maximum flow rates will need to be negotiated with DWSD to establish a new Contract Maximum Hour rate.

To determine the potential savings in future water rates, the DWSD Rate Section was consulted. Mr. Raphael Chirolla, Rate Section Supervisor, provided estimated revenue requirements for Rochester Hills for various projected maximum hour demands. These estimates are based on FY 2009-2010 rates (shown in Table 10). For these estimates, Rochester Hills was the only changed condition in their rate model. Peak use reductions by other communities would tend to diminish the anticipated annual savings for Rochester Hills; however no action by Rochester Hills while other communities reduce their peaks would tend to increase revenue requirements. The annual savings for each new rate is based on the projected annual volume within the Water Service Contract of 445,000 mcf.

Table 10
Rochester Hills Estimated Rates based on Contracted Peak Hour Flow

Peak Hour (MGD)	Est. Water Rate*	Revenue to DWSD	Annual Savings
51.91	$23.82/mcf	$10,600,000	0
40.00	$19.78/mcf	$8,800,000	$1,800,000
37.50	$18.88/mcf	$8,400,000	$2,200,000
35.00	$17.98/mcf	$8,000,000	$2,600,000
32.50	$17.08/mcf	$7,600,000	$3,000,000
30.00	$16.18/mcf	$7,200,000	$3,400,000
27.50	$15.28/mcf	$6,800,000	$3,800,000
25.81	$14.61/mcf	$6,500,000	$4,100,000

*Est. Water Rate based off of projected annual volume from Water Service Contract (445,000 mcf)

The estimated water rates presented were calculated with the assumption that the contracted Maximum Day would not be adjusted. The additional water storage will reduce the diurnal peak use rates during a maximum day, but it is not good design practice to utilize storage to provide a portion of the maximum day demand.

The current Maximum Day value in the contract was generated based on the City's historical peak in 2007 and was adjusted upward to reflect maximum demands during DWSD's recent historical peak in 1998. Based on the recent historical peaks and the limited anticipated growth in water demand, Rochester Hills may wish to discuss this value with DWSD in the future.

The next designated contract review date is July 2011, with discussions with Rochester Hills to begin in the Fall of 2010. DWSD has indicated that preliminary discussions of a new peak hour can begin at anytime based on the proposed design and construction schedule of the reservoirs. Once the reservoirs are anticipated to be in service, final negotiations could be scheduled. For the purposes of this Rate analysis, it has been

assumed that the DWSD will agree to allow Rochester to be close to a Maximum Day Costumer.

With the base construction costs of $11,050,000 from Table 8, the operation costs of $66,577, and the assumed annual savings of $4,100,000 from Table 10, the payback period is projected to be less than 3 years (2.98 years). These calculations assume a low interest loan rate of 4.375%. See calculations below.

Table 11
Present Worth Calculations for Reservoir Improvements

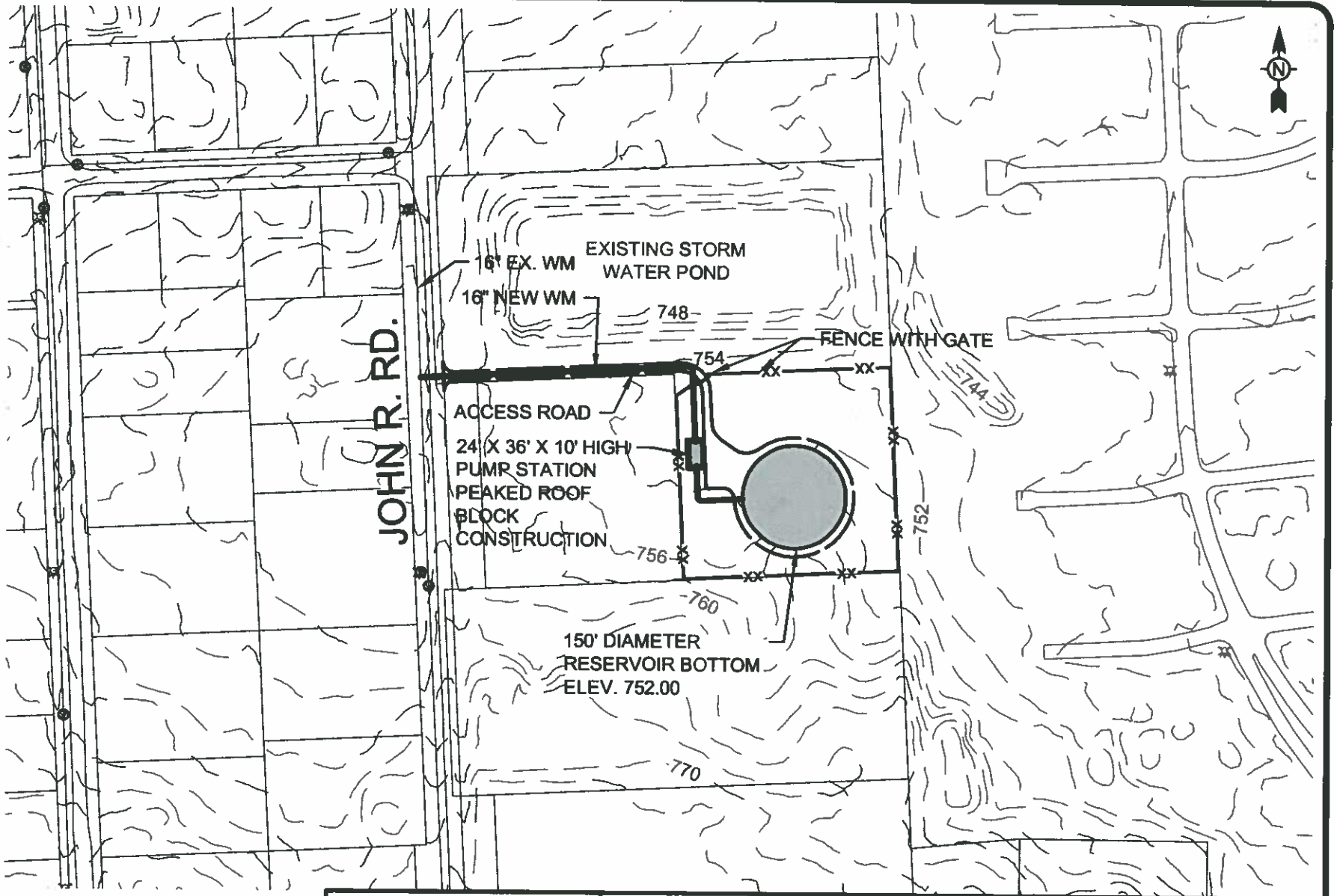
Year	Capital Costs	Loan Interest	O/M cost	Rate Utility Savings	Present Worth
0	$11,050,000				($11,050,000)
1		$483,438	$66,577	$4,100,000	($7,500,015)
2		$328,126	$66,577	$4,100,000	($3,794,717)
3		$166,019	$66,577	$4,100,000	$72,687
4					

There are several variables that will influence the total return on investment including the final site plan, the chosen reservoir design, and the final negotiated peak hour amount. The most influential factor in the return on investment calculations is the negotiated peak hour rate. A change in our assumptions from a Maximum Day customer rate of 25.81 MGD to 30.0 MGD would increase the payback period from 2.98 years to 3.67 years. A further increase in the assumed peak hour to 35 MGD would increase the assumed return to 4.94 years, and a 35.16 MGD peak hour rate would produce a five-year payback period.

Therefore, with an assumed return on investment of less than 5 years for negotiated rates less than 35 MGD, and a potential payback period of less than 3 years, we recommend

the City of Rochester Hills proceed with the construction of storage. This recommendation is based on anticipated savings within the DWSD rate calculation shown in Table 10 and assumes that DWSD is in agreement with the assumptions made herein.

Appendix A – Opinion of Probable Costs



TETRA TECH
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Detroit, MI 48226-3516
PHONE: (313) 964-0790 FAX: (313) 964-6857

ROCHESTER HILLS, MICHIGAN

ROCHESTER HILLS WATER STORAGE RESERVOIRS

JOHN R. ROAD SITE

Project No.:	200-46087-10001
Date:	12-9-2009
Designed By:	J. RYDQUIST

Supplemental

C-1

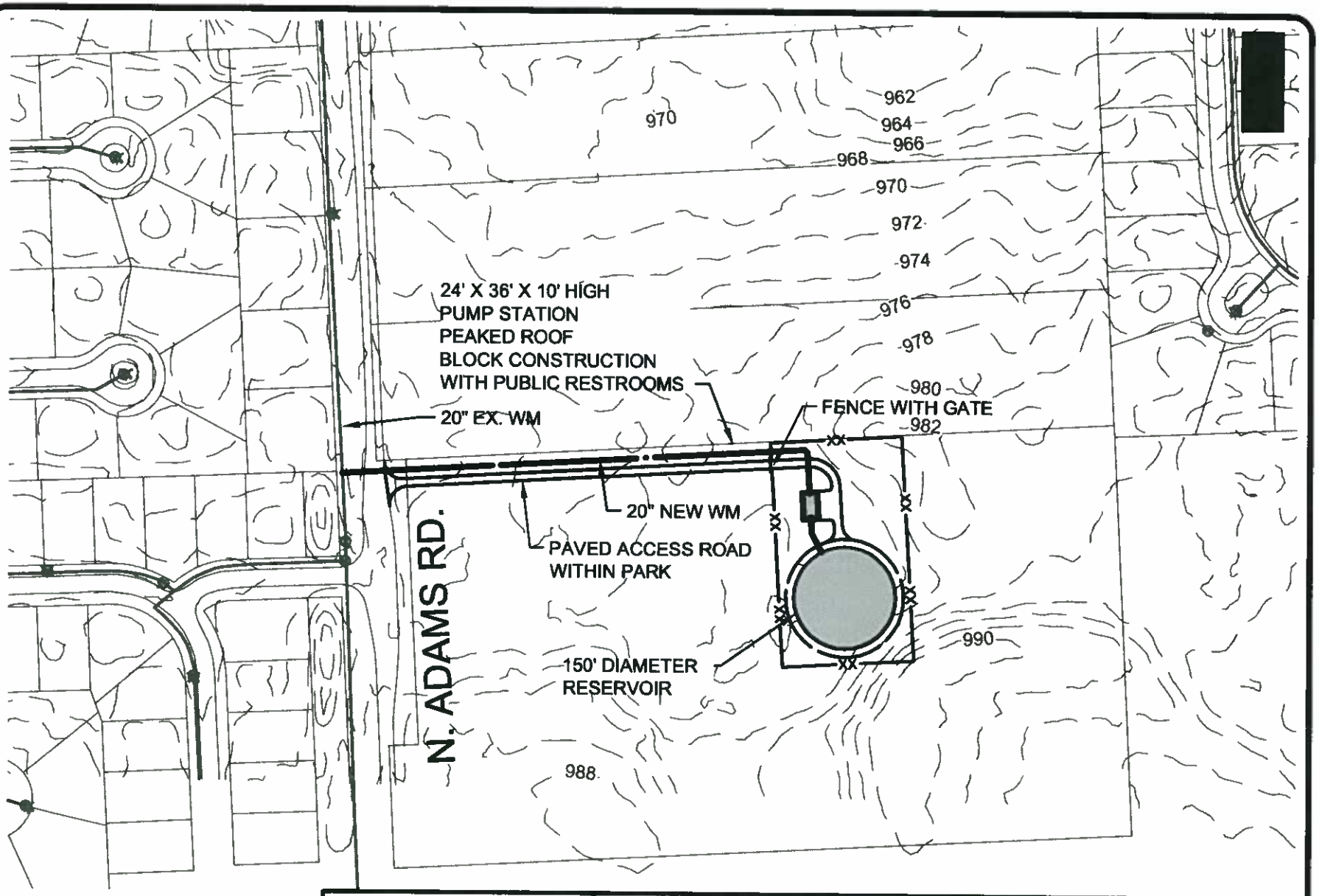
OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH

65 Cadillac Square, Detroit, Suite 3400 MI 48226

PROJECT:	Rochester Hills Water Storage Reservoirs	DATE:	12/9/2009
LOCATION:	Rochester Hills, Michigan	PROJECT NO.	
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	JVR
WORK:	John R. Road - Flat Top Reservoir at Grade	CHECKED BY:	TAA
		CURRENT ENR:	

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	General Conditions (5% of Base Costs)	1	LS	$281,040	$281,040
3	Site Clearing	1	LS	$15,000	$15,000
4	Excavation, Backfill and Grading	2,000	CY	$20	$40,000
5	Restoration, Topsoil Seed and Mulch	5,000	SY	$6	$30,000
6	Pavement Restoration (20' Wide)	10,000	SY	$45	$450,000
7	6-inch Asphalt Access Road (20' Wide)	1,350	SY	$45	$60,750
8	Chain Link Fencing	1,000	LF	$50	$50,000
9	Access Gate	1	EA	$2,000	$2,000
10	20-inch DIP Watermain and assocated fittings	3,600	LF	$200	$720,000
11	20-inch DIP High Pressure Discharge	3,600	LF	$200	$720,000
12	Cast-in-place Concrete / Slab foundation	88	CY	$350	$30,800
13	Exterior Wall Assembly (Split Face CMU, 2" Insulation)	1,680	SF	$20	$33,600
14	Roofing and Accessories	864	SF	$10	$8,640
15	Interior Doors, Windows and misc. Construction Pump Station	1	LS	$40,000	$40,000
16	Booster Pumps and Motors (200HP)	4	EA	$45,000	$180,000
17	Interior Piping, Control and Pressure Valving	1	LS	$200,000	$200,000
18	Emergency Generator, Exterior on Slab	1	LS	$200,000	$200,000
19	Pump Station Plumbing and HVAC	1	LS	$15,000	$15,000
20	Electrical Feed for Site	1	LS	$50,000	$50,000
21	Pump Station Lighting and Electrical	1	LS	$200,000	$200,000
22	VFD drives for Pumps	4	EA	$50,000	$200,000
23	Prefabricated Concrete Reservoir	1	LS	$2,000,000	$2,000,000
24	Reservoir Mixing - Water Age Control	1	LS	$300,000	$300,000
25	Instrumentation and Control Improvements Site	1	LS	$75,000	$75,000
26					
27					
28	Contingency	1	LS	$448,170	$448,170
29					
30					
31					
	TOTAL CONSTRUCTION COST				$6,350,000



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ROCHESTER HILLS, MICHIGAN

ROCHESTER HILLS WATER STORAGE RESERVOIRS

ADAMS ROAD SITE

Project No.:	200-46087-10001
Date:	12-9-2009
Designed By:	J. RYDQUIST

Supplemental

C-2

OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH

65 Cadillac Square, Detroit, Suite 3400 MI 48226

PROJECT:	Rochester Hills Water Storage Reservoirs	**DATE:**	12/9/2009
LOCATION:	Rochester Hills, Michigan	**PROJECT NO.**	
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	**ESTIMATOR:**	JVR
WORK:	Adams Road - Half Buried Reservoir with Flat Roof	**CHECKED BY:**	TAA
		CURRENT ENR:	

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	General Conditions (5% of Base Costs)	1	LS	$197,677	$197,677
3	Site Clearing	1	LS	$15,000	$15,000
4	Excavation, Backfill and Grading	10,000	CY	$20	$200,000
5	Restoration, Topsoil Seed and Mulch	5,000	SY	$6	$30,000
6	Pavement Restoration at Adams Road	100	SY	$45	$4,500
7	6-inch Asphalt Access Road (20' Wide)	1,800	SY	$45	$81,000
8	Cast Iron with Brick Security Fencing	700	LF	$200	$140,000
9	Access Gate	1	EA	$2,000	$2,000
10	20-inch DIP Watermain and assocated fittings	700	LF	$200	$140,000
11					
12	Cast-In-place Concrete / Slab foundation	88	CY	$350	$30,800
13	Exterior Wall Assembly (Split Face CMU, 2" Insulation)	1,680	SF	$20	$33,600
14	Roofing and Accessories	864	SF	$10	$8,640
15	Interior Doors, Windows and misc. Construction Pump Station	1	LS	$40,000	$40,000
16	Booster Pumps and Motors (100 HP)	4	EA	$32,000	$128,000
17	Interior Piping, Control and Pressure Valving	1	LS	$200,000	$200,000
18	Emergency Generator, Exterior on Slab	1	LS	$100,000	$100,000
19	Pump Station Plumbing and HVAC	1	LS	$15,000	$15,000
20	Electrical Feed for Site	1	LS	$50,000	$50,000
21	Pump Station Lighting and Electrical	1	LS	$200,000	$200,000
22	VFD drives for Pumps	4	EA	$40,000	$160,000
23	Prefabricated Concrete Reservoir	1	LS	$2,000,000	$2,000,000
24	Reservoir Mixing - Water Age Control	1	LS	$300,000	$300,000
25	Instrumentation and Control Improvements Site	1	LS	$75,000	$75,000
26					
27					
28	Contingency	1	LS	$408,783	$408,783
29	Public Bathroom	1	LS	$40,000	$40,000
30					
31					
	TOTAL CONSTRUCTION COST				**$4,600,000**