SECTION 8

HYDRAULIC MODEL

8-1 General

A computer model of the City's water system was utilized to aid in the evaluation of the adequacy of the existing facilities under present and future demand conditions.

Hydraulic analyses were performed using the Innovyze (formerly MWHSoft) InfoWater program, which is a commercially available hydraulic software package that is designed to simulate steady state and extended period operations of water systems.

The City's existing hydraulic model, developed for the 2006 Water and Recycled Water Master Plan, was used as the basis for the model. For this study, pipelines and facilities that had been constructed since mid-2004 and not included in the original model were added per the City's Water GIS and as-built construction plans.

The model primarily includes the domestic water pipelines that are owned by the City. Water service laterals are not included. Modeling information associated with each pipe includes size, length, and roughness. Other information included in the model database are pipe diameter, year of installation, zone, and pipe material. Modeling information associated with each node includes elevation, water demand, and diurnal pattern of demand. Node and facility elevations were obtained from the City's 2-foot contour information, provided in GIS shapefile format. The elevations are based on the National American Vertical Datum (NAVD) of 1988.

8-2 Demand Distribution

<u>Existing Demands</u>

The water demand distribution for the existing system was based upon water meter data provided for calendar year 2008. Geocoded meter data was provided by the City. It was found that the geocoding was not precise in the sense that each meter was not placed exactly inside or in front of the parcel it was associated with. The meters were determined to be located close enough to the correct locations that the data was still used to distribute the demands in the model.

Theissen polygons were created around each model node or cluster of model nodes. The demands were then aggregated and assigned to the appropriate modeling node. They were then universally increased to match the existing water use, depending on which scenario is being modeled (average day, maximum day, etc.). This method of distributing demands inherently accounted for any high water users within the existing service area.

The water demands are assigned to the following database fields:

- Demand Type 1: Commercial and Industrial Users
- Demand Type 2: Irrigation Users
- Demand Type 3: Residential Users
- Demand Type 10: Large Users

Ultimate Demands

The ultimate demands, described in Subsection 4-7.2 of this report, were distributed in the ultimate system model as follows:

1. Existing development areas in OMC - Demands remained the same in OMC, as long as the area is currently developed and future land use changes are not planned.
2. Vacant areas in OMC – Theissen polygons were used to apply ultimate demands to appropriate model nodes in each vacant area.
3. Densification areas in OMC – Existing demands were removed. Theissen polygons were used to apply ultimate demands to appropriate model nodes in each densification area.
4. Future development areas in NMC – Ultimate demands were calculated based on TAZ land use information and applied to model node selected to represent service to each TAZ area.
5. Mixed use areas in OMC and NMC – Ultimate demands were divided by the number of model nodes in each mixed use area and then applied to each node.

The water demands are assigned to the following database fields:

- Demand Type 1: Existing Commercial and Industrial Users in OMC and
  Future Commercial and Industrial Areas in NMC
- Demand Type 2: Existing Irrigation Users in OMC
- Demand Type 3: Existing Residential Users in OMC and
  Future Residential Areas in NMC
- Demand Type 4: Schools in NMC
- Demand Type 5: Vacant Land in OMC
- Demand Type 6: Mixed Use Commercial Areas in OMC and NMC
- Demand Type 7: Mixed Use Residential Areas in OMC and NMC
- Demand Type 8: Commercial Densification Areas in OMC
- Demand Type 9: Residential Densification Areas in OMC
- Demand Type 10: Existing Large Users in OMC

8-3 Diurnal Curves

The developed diurnal curves discussed in Section 4-6 were specified at each node.

8-4 Pump Controls

Booster pump and well pump controls were provided by City staff and are listed in Table 8-1 and Table 8-2, respectively. These pump controls were implemented by the system in September 2010.

Table 8-1
Booster Pump Controls

Booster Pump	Reference Reservoir	Action	If Reference Reservoir is	[1]Level (Off Peak)	[2]Level (Mid Peak)	[3]Level (Peak)
Galvin Booster 1A	1074-1A	open	above	18.5	18.5	18.5
		closed	below	17.0	17.0	17.0
Galvin Booster 1B	1074-1A	open	above	17.8	17.8	17.8
		closed	below	15.8	15.8	15.8
Galvin Booster 1C	1074-1A	open	above	18.2	18.2	18.2
		closed	below	16.8	16.8	16.8
Booster 2	1074-1A	open	above	18	18	18
		closed	below	16.5	16.5	16.5
Booster 3B	1348-1A	open	below	14.0	14.0	14.0
		closed	above	15.5	15.5	15.5
Booster 4B	1348-1A	open	below	13.5	13.5	13.5
		closed	above	15.0	15.0	15.0
Booster 9A	1348-1A	open	below	13.0	13.0	13.0
		closed	above	14.5	14.5	14.5
Booster 9B	1348-1A	open	below	15.0	15.0	15.0
		closed	above	17.0	17.0	17.0
Booster B	1348-1A	Inactive				
Ontario Booster Pump 1	925-2A	open	above	21	21	21
		closed	below	18	18	18
Ontario Booster Pump 2	925-2A	open	above	21.5	21.5	21.5
		closed	below	18.5	18.5	18.5
Ontario Booster Pump 3	925-2A	open	above	20.5	20.5	20.5
		closed	below	17.5	17.5	17.5

[1] Off Peak time is from 6 pm to 6 am
[2] Mid Peak time is from 6 am to 12:30 pm
[3] Peak time is from 12:30 pm to 6 pm

Table 8-2
Well Pump Controls

Well	Reference Reservoir	Action	If Reference Reservoir is	[1]Level (Off Peak)	[2]Level (Mid Peak)	[3]Level (Peak)
Well 17	1074-1A	Manually run when needed				
Well 20	1212-3	closed	above	18.7	15.2	14.8
		open	below	17.7	14.2	13.8
Well 24	1212-3	closed	above	19.5	16.0	15.5
		open	below	18.5	15.0	14.5
Well 25	1212-3	closed	above	19.8	18.0	15.8
		open	below	18.8	17.0	14.8
Well 26	1212-3	closed	above	19.0	15.5	14.8
		open	below	18.0	14.5	13.8
Well 27	1212-3	closed	above	19.3	15.5	14.8
		open	below	18.3	14.5	13.8
Well 29	1212-3	closed	above	20.0	18.3	16.0
		open	below	19.0	17.3	15.0
Well 30	1212-3	closed	above	20.8	19.0	16.8
		open	below	19.8	18.0	15.8
Well 31	1212-3	closed	above	21.0	19.3	19.3
		open	below	20.0	18.3	18.3
Well 34	1010-1A	closed	above	26.0	25.0	24.3
		open	below	24.0	23.0	22.3
Well 35	1074-1A	closed	above	15.5	15.5	14.5
		open	below	13.0	13.0	12.0
Well 36	1074-1A	closed	above	15.0	15.0	14.0
		open	below	12.5	12.5	11.5
Well 37	1212-3	closed	above	21.3	19.5	17.0
		open	below	20.3	18.5	16.0
Well 38	1212-3	closed	above	20.5	18.8	16.5
		open	below	19.5	17.8	15.5
Well 39	1010-2A	closed	above	23.0	23.0	23.0
		open	below	21.0	21.0	20.0
Well 40	1074-1A	closed	above	16	16	15
		open	below	13.5	13.5	12.5
Well 41	1212-3	closed	above	20.3	18.5	16.3
		open	below	19.3	17.5	15.3
Well 44	1074-1A	Only runs with Well 52 and Ion Exchange Plant				
Well 45	1074-1A	closed	above	16.5	16.5	15.5
		open	below	14	14	13
Well 46	1348-1A	closed	above	16.5	16.5	16.5
		open	below	14.5	14.5	14.5
Well 47	1212-3	closed	above	21.5	20.5	17.2
		open	below	20.5	19.5	16.2
Well 49	925-2A	closed	above	24.0	20.0	20.0
		open	below	21.5	17.0	17.0
Well 50	1010-1A	Inactive				
Well 52	1074-1A	Only runs with Well 52 and Ion Exchange Plant				

[1] *Off Peak time is from 6 pm to 6 am*
[2] *Mid Peak time is from 6 am to 12:30 pm*
[3] *Peak time is from 12:30 pm to 6 pm*

8-5 Friction Factors

The friction factors established in for the 2006 Water and Recycled Water Master Plan were utilized in the hydraulic model for this study as well. The friction factors used are shown in Table 8-3.

Table 8-3
C-factors used in Model

Diameter	AC Pipes	PVC Pipes	Mortar Lined Pipes	Steel/ Cast Iron Pipes (before 1950)	Steel/ Cast Iron Pipes (after 1950)
<= 4-inch	125	135	110	80	110
6-inch	125	135	110	80	110
8-10 inch	125	135	110	80	110
12-16 inch	130	140	115	90	115
16-20 inch	130	140	115	90	115
20-24 inch	130	140	115	90	115
24-30 inch	140	150	120	100	120
30-36 inch	140	150	120	100	120