Eng Copy

WATER DISTRIBUTION SYSTEM
BASIS OF DESIGN REPORT
FOR
REATA RANCH

Case # 3902-12

FILE COPY

FILE COPY

Prepared For:

Land Development Services
7525 East Camelback Road
Suite 104
Scottsdale, AZ 85251

Accepted for

City of Scottsdale
Water Resources Administration
9379 E. San Salvador
Scottsdale, AZ 85258

Prepared By:

Doug Mann
9.19.2012

SKG ENTERPRISES, INC.
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Registered Professional Engineer (Civil)
CERTIFICATE NO.
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SHAKIR K.
GUSHGARI
Date Signed 8-24-12
ARIZONA, U.S.A.
Expires 3-31-13

Job # 30-11.2
Prepared: July 2012
Revised: August 2012

9-DR-2014
3/26/2014

3902-12

Drainage Report

WATER DISTRIBUTION SYSTEM
BASIS OF DESIGN REPORT
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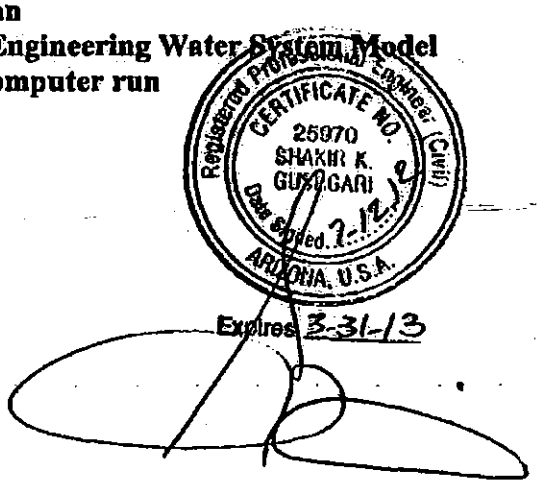
EXHIBITS

EXHIBIT	DESCRIPTION
1	Site Location Map
2	Conceptual Site Plan
3	Exerts from GTA Engineering Water System Model
4	Hydraulic model computer run



1.0 INTRODUCTION

Reata Ranch is a proposed master planned community located in Section 36 of Township 5 North, Range 5 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. This site is located within the City of Scottsdale's Upper Desert Landform of the Environmentally Sensitive Lands Ordinance (E.S.L.O.) area. Reata Ranch consists of three separate parcels that are combined into one development totaling 220-acres in size. A site location map is included as Exhibit 1 in this report.

The land generally slopes from northwest to southeast at an average rate of 5 percent and is traversed by several well-defined washes. The site is currently platted as single family residential development with various lot sizes and will undergo a re-platting process as a planned community consisting of various residential parcels, ranch resort, and open space. The name and address of the developer's agent is:

Land Development Services, L.L.C.
7525 East Camelback Road, Suite 104
Scottsdale, AZ 85251
480-946-5020

2.0 EXISTING WATER DISTRIBUTION SYSTEM

At present, no domestic water system exists within the immediate project area. According to the City of Scottsdale water quarter section maps 50-57 through 50-60, an existing 20" Ductile Iron Pipe (DIP) City water line terminates at 122nd Street along Rio Verde Drive (Dynamite Boulevard), as shown on quarter section map number 50-57. However, there had been several previous projects that provided water line extension designs connecting into the existing 20"-line and extending it to 136th Street. These plans have previously been City approved but never constructed and have now expired.

One of the referenced expired water extension design plans were prepared by SKV Engineering, which proposed to construct a 16" water line from 122nd Street to 128th Street and continues with a 12" water line from 128th Street to 132nd Street along the Rio Verde Drive (Ref. 1). The other project was prepared by Evolution Engineering, which proposed to construct a 12" water line from 132nd to 136th Street along the Rio Verde Drive (Ref. 2).

This project will need to utilize the aforementioned City approved water extension design plans (Ref. 1 and 2) as its main water source. As the referenced water extension design plans have expired, this project should consider resurrecting the expired plans for re-approval and constructing the proposed water line from 122nd Street to 136th Street, as specified on the referenced expired design plans. Per the City of Scottsdale Design Standards and Procedures Manual (DS&PM), Section 6-1.103 the Developer intends to file for "Payback Agreements" for the proposed extension. As payback agreements are based upon construction cost, a completed package containing all required materials will be submitted with the final improvement plans with supplemental documentation provided by contractors bid documents and receipts.

3.0 PRESSURE ZONES

The ground elevation range of Reata Ranch is 2,455 to 2,565 in elevation, which is classified as pressure zone 11E (City of Scottsdale). City of Scottsdale Design Standard and Policies Manual for Potable Water System Design (Ref. 2) requires the maximum allowable pressure not exceed 120 pounds per square inch (psi) and the minimum residual pressure of 50 psi be maintained under all non-fire flow conditions at the highest finished floor elevation.

Table 1 Pressure Zone Service Elevations

Pressure Zone	Minimum Elevation	Maximum Elevation
11E	2,440	2,570

4.0 PROPOSED WATER DISTRIBUTION SYSTEM

The proposed water infrastructure for Reata Ranch shall be composed of eight (8) and twelve (12) inch diameter Ductile Iron (poly-wrapped) pipes. The 8-inch diameter pipes will be along the interior roadways within the development and the 12-inch diameter pipes will be along 128th, 132nd, and 136th Streets. A conceptual site plan depicting major infrastructure layout is presented on Exhibit 2 of this report. The on-site water distribution system will follow the roadway system shown in Exhibit 2.

There will be four points of connections into the 12" water main along Rio Verde Drive to serve the Reata Ranch development and they are:

1. At 128th Street
2. At Rio Verde Drive at the main development entrance, midway between 128th and 132nd Streets
3. At 132nd Street
4. At 136th Street

According to the offsite water line plans along Rio Verde (Ref. 1), there will be a Pressure Reducing Valve (PRV) directly to the west of 128th Street. This PRV is located at the water pressure zone 12E / 11E line. The offsite water distribution system, along Rio Verde Drive, shall follow the City approved plans prepared by SVK Engineering (Ref. 1) and Evolution Engineering (Ref. 2). The proposed 12" water line along 128th, 132nd, and 136th Street together with the interior onsite water distribution system shall be designed in accordance with Chapter 4 of the City of Scottsdale Water Distribution System design guidelines (Ref. 3), the Arizona Administrative Code R18-4-502, and Engineering Bulletin no. 10 (Ref. 4).

- **Demand**

The design parameters for the proposed water distribution system for Reata Ranch is presented in the table below

Table 3 Design Criteria

Criteria	Parameter
Average Daily Water Demand (gallon/day/unit)	485.6
Maximum Unit Count	330
Peaking Factor / Maximum day peaking factor	3.5 times average day demand
Peaking Factor / Maximum hour peaking factor	1.7 times peak day
[1]Fire Demand (gallon per minute)	1,000 gpm Residential, 2,500 gpm Commercial
Minimum pressure in the system during fire flow	40 psi
Water velocity range (foot per second) during fire flow	0 to 8

[1]Commercial Fire Flow values assumed from 2006 International Fire Code, Appendix B "Fire-Flow Requirements for Buildings", Section B105 and Table B105.1 (Ref. 6).

The table below outlines the projected water demand for the proposed Reata Ranch development. It describes the water demand in terms of average daily demand, Peak demand, and peak demand with fire flow.

Table 3 Water demand calculation by development category

Type	Acres	DU/Ac	Units	Demand per unit	Ave. daily demand (GPD)	Peak daily demand (GPD)	Max Hourly demand (GPM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Resort			75	485.6	36,420	127,470	150
Parcel A	5.7	3.5	20	485.6	9,712	33,992	40
Parcel B	5.9	3.5	21	485.6	10,198	35,692	42
Parcel C	8.3	3.5	29	485.6	14,082	49,288	58
Parcel D	9.6	3.5	34	485.6	16,510	57,786	68
Parcel E	5.9	3.5	21	485.6	10,198	35,692	42
Parcel F	8.4	3.5	30	485.6	14,568	50,988	60
Parcel G	10.1	3.5	35	485.6	16,996	59,486	70
Parcel H	8.1	3.5	26	485.6	12,626	44,190	52
Parcel I	10.4	3.5	36	485.6	17,482	61,186	72
TOTAL	-	-	330	-	158,791	555,769	656

Notes:
(6) = (4) x (5)
(7) = (6) x 3.5
(8) = {(7) x 1.7}/1,440 minutes/day

5.0 HYDRAULIC ANALYSIS

The City of Scottsdale has approved the proposed water distribution system along Rio Verde Drive consisting of 16" and 12" mains (Ref. 1 and 2). This approved water system will be the main domestic and fire flow water sources for the proposed development of Reata Ranch. A hydraulic water model for this water system was also previously prepared and City approved on May 7, 2001 (Ref. 5). Exerts from this water model report is included in Exhibit 3 of this report. According to the enclosed exert, the available water flow and pressure are as described in the table below.

Node	Near	Flow (GPM)	(1) Pressure (psi)
210	128th Street	299.56	55.00
212	East of 128nd Street	299.56	63.46
220	West of 132nd Street	299.56	80.45
224	136th Street	299.56	91.11

(1) Based upon Average Day Demand

A hydraulic model has been developed connecting into the water system along Rio Verde Drive with the flows and pressures provided in the table above. The purpose of this hydraulic model is to present the water demand for Reata Ranch development and for the single family residential parcels to the south of Reata Ranch relative to flow and pressure. The model is presented in Exhibit 4 of this report. The hydraulic model employed the following parameters:

- ✓ The water source (PRV at Rio Verde Road, east of 128th Street) is modeled at fixed grade node with a constant pressure head of 55 psig;
- ✓ The Hazen-Williams "C" for ductile iron pipe is 120;
- ✓ Ignore minor losses

The results of the computer runs are included in Exhibit 4 and are summarized below.

- ✓ The overall head-loss through the piping networks is low at peak day demand and also at maximum day + fire demands. The maximum and minimum pressures at each junction nodes are within the pressure zone range.
- ✓ The proposed piping network for this subdivision is adequate for peak and maximum day + fire flow demands.
- ✓ Fire flow is modeled at Node J14 to coincide with the Resort parcel and a fire flow demand of 2,500 gpm. Results, as shown prove the sustainability of the proposed system under modeled conditions.

6.0 RECOMMENDATIONS

- ✓ Construct the offsite water line from 122nd Street to 136th Street per City approved plans, project number 3357-04-4 and project number 3357-04-1 upon plans re-approval.
- ✓ Construct the onsite piping network consisting of 8-inch diameter pipe following the backbone roadway alignment s as shown in Exhibit 2 for the Reata Ranch development.

7.0 CONCLUSIONS

- ✓ The project is located in City of Scottsdale pressure zones 11E (El. 2,440-2,570).
- ✓ Fire hydrants shall be placed per requirements of City of Scottsdale Fire Department.
- ✓ A "Water Quality Sampling Station" shall be placed in Reata Ranch development. The water quality sampling station shall be constructed according the City of Scottsdale Standard Detail 2349.
- ✓ The proposed offsite piping improvement shall comply with the approved Water Distributions System Master Plan. (Ref. 1, 2, and 5).
- ✓ When the water line alignments cross natural washes they shall be protected from scouring by the use of a downstream cutoff wall in the flow area.

8.0 REFERENCES

1. SVK Engineering, Inc., ***"Rio Verde Estates offsite Water, Rio Verde / Dynamite Boulevard – Water Main Plans Phase 2"***, April 10, 2008, Plan number 23-PP-2004, 3357-04-4 (Approved by the City of Scottsdale on May 20, 2008).

2. Evolution Engineering, LLC, ***"Desert Estates Offsite, Rio Verde Drive Water Main Plans"***, September 26, 2007, Plan number 5-PP-03, 73-NP-2001, 1346-03-4 (Approved by the City of Scottsdale on May 20, 2008).

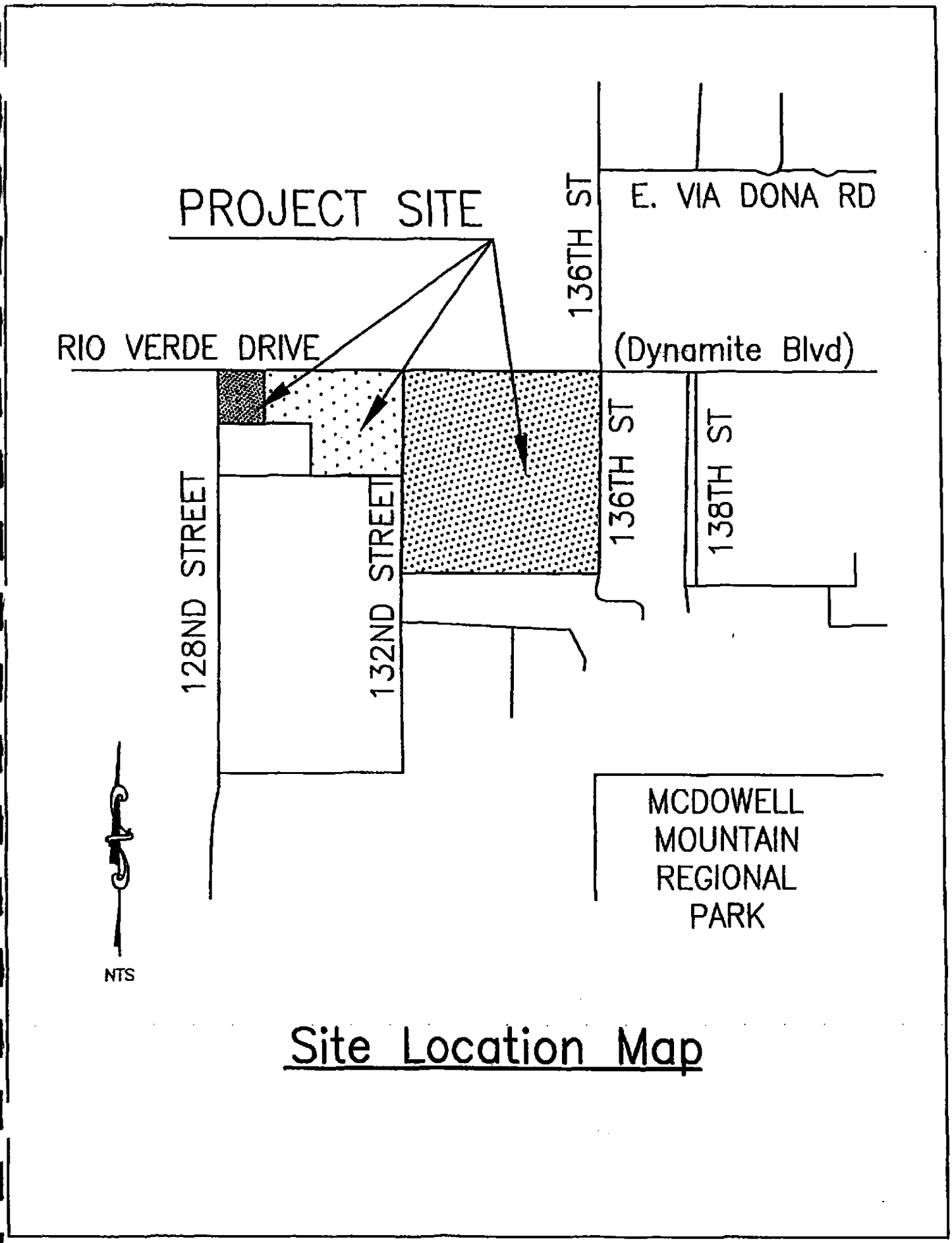
3. City of Scottsdale, ***"Chapter 6 Potable Water System Design, Design Standards and Policies Manual", Dated August 2008***.

4. Arizona Department of Environmental Quality, ***"engineering bulletin no. 10 Guidelines for the Construction of Water, Minimum Requirements for Design, Submission of Plans and Specifications of Sewage Works"***. May, 1978.

5. GTA Engineering, Inc., ***Scottsdale National Water Supply System, Scottsdale, Arizona***. April 25, 2001. Project number GTA00145 ((Approved by the City of Scottsdale on May 07, 2001).

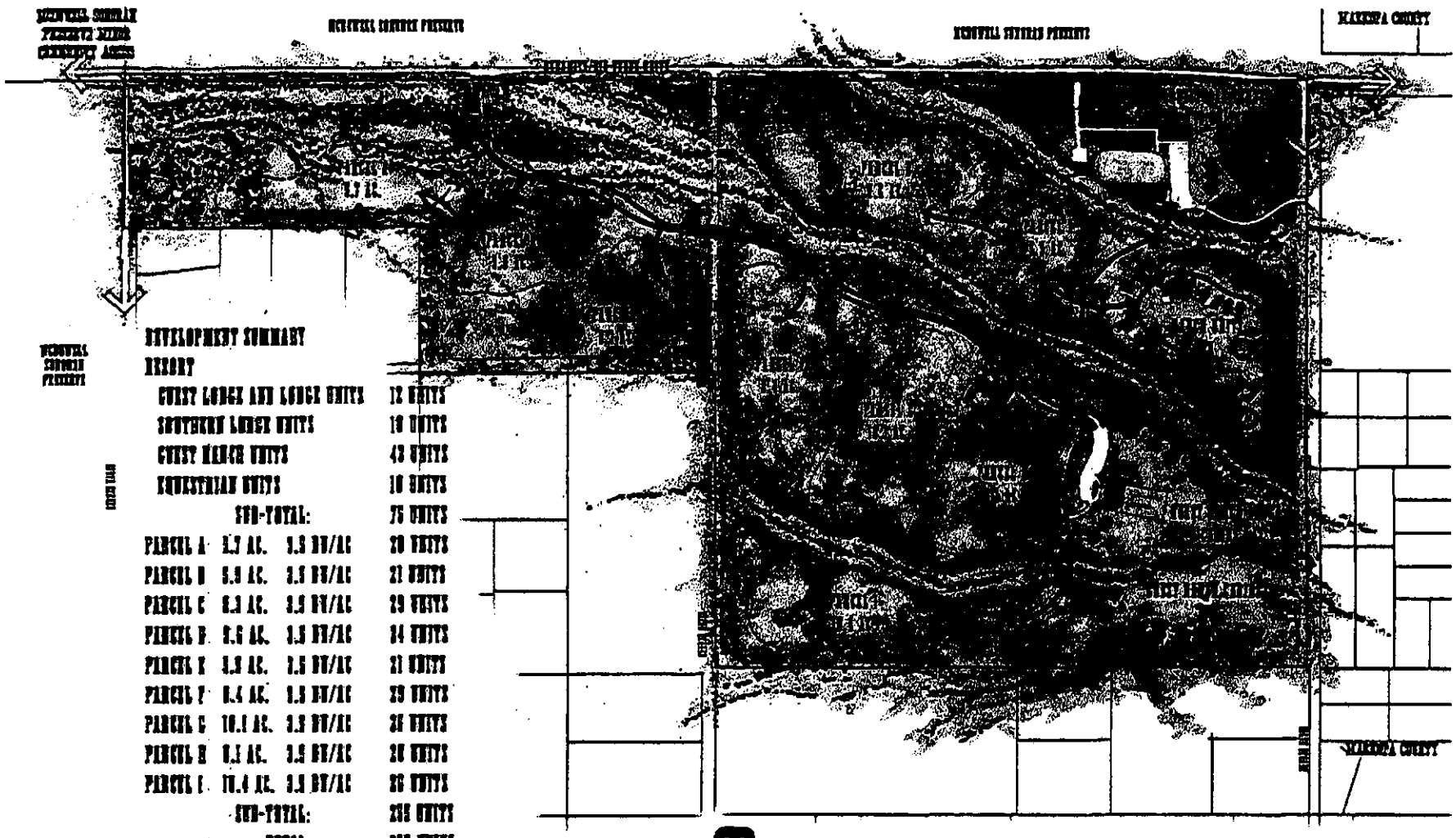
6. **2006 International Fire Code**, International Code Council, dated 2006

EXHIBIT 1



Site Location Map

EXHIBIT 2



DEVELOPMENT SUMMARY

RESORT

GUEST LODGE AND LODGE UNITS			12 UNITS
SOUTHERN LODGE UNITS			18 UNITS
GUEST RANCH UNITS			43 UNITS
EQUESTRIAN UNITS			18 UNITS
SUB-TOTAL:			75 UNITS
PARCEL A	2.7 AC.	1.5 DU/AC	20 UNITS
PARCEL B	5.9 AC.	1.5 DU/AC	21 UNITS
PARCEL C	8.3 AC.	1.5 DU/AC	29 UNITS
PARCEL D	2.6 AC.	1.5 DU/AC	14 UNITS
PARCEL E	3.3 AC.	1.5 DU/AC	21 UNITS
PARCEL F	8.4 AC.	1.5 DU/AC	29 UNITS
PARCEL G	10.1 AC.	1.5 DU/AC	24 UNITS
PARCEL H	8.3 AC.	1.5 DU/AC	20 UNITS
PARCEL I	10.4 AC.	1.5 DU/AC	29 UNITS
SUB-TOTAL:			235 UNITS
TOTAL:			310 UNITS

REATA RANCH

EXHIBIT 3

Scottsdale National
Water Supply System
Scottsdale, Arizona

Water Master Plan

prepared for:
Hunn & Associates, Inc.

Accepted w/ Comments:

CITY OF SCOTTSDALE
WATER RESOURCES DEPT
9388 E SAN SALVADOR DR.
SCOTTSDALE, AZ 85258

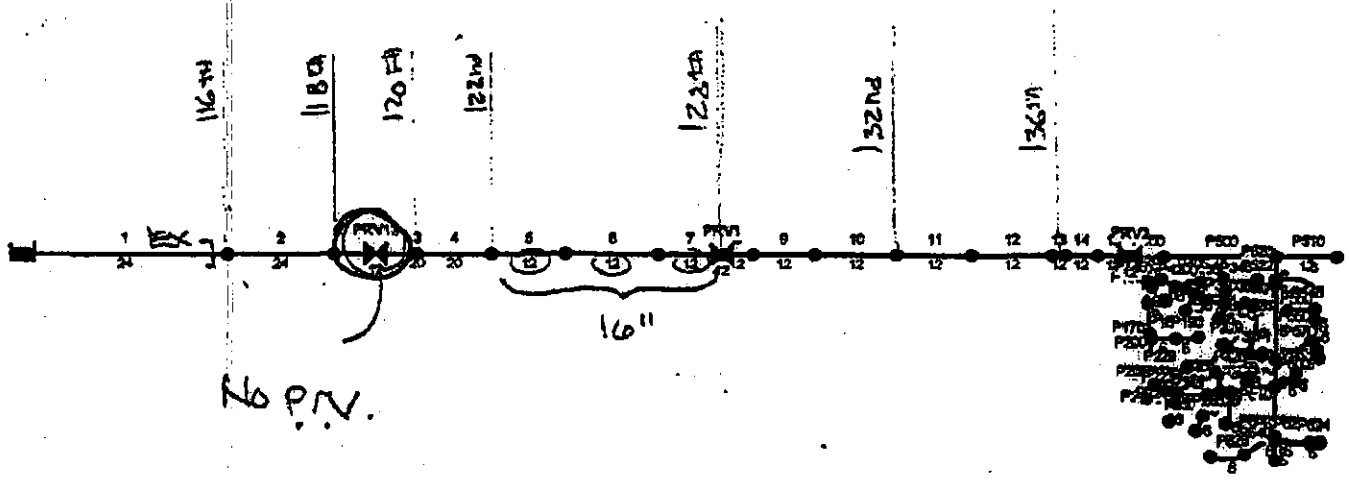
by DougMann
5-7-2001

prepared by

GTA ENGINEERING, INC.
Consulting Engineers
1990 W. Camelback Rd., Suite 401
Phoenix, Arizona 85015
TEL (602) 246-7759 FAX (602) 246-7645
e-mail: gta@goldmantoy.com

Revised April, 2001

Scottsdale National Links Map



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*****************************************************************
*                                                               *
*                          E P A N E T                          *
*                  Hydraulic and Water Quality                  *
*                  Analysis for Pipe Networks                   *
*                          Version 2.0                          *
*                                                               *
*****************************************************************

Input File: SN3ADF.inp

Scottsdale National (w/o Map)
AVERAGE DAILY FLOW RUN
Map displays entire network w/o backdrop. To see partial network w/
backdrop, open:  SNmap.net

Link - Node Table:
-----------------------------------------------------------------
Link         Start        End          Length     Diameter
ID           Node         Node             ft           in
-----------------------------------------------------------------
1            R100         105            1300           24
2            105          110            1700           24
3            111          113            1300           20
4            112          114            1200           20
5            113          115            1200           16
6            116          118            1500           12
7            119          120            1000           16
8            121          310             500           12
9            210          212            1000           12
10           212          214            1300           12
11           214          220            1300           12
12           220          224            1300           12
13           224          226             200           12
14           228          230             500           12
15           230          232             500           12
P100         233          J100          551.79           12
P500         J500         J500         1789.21           12
P510         J500         J510          950.00           12
P120         J100         J120          420.01            8
P140         J120         J140          187.89            8
P160         J140         J160          372.89            8
P170         J160         FH170         489.42            8
P180         FH170        J180           83.32            8
P200         J180         J200          745.19            8
P210         J200         FH210         192.30            8
P220         FH210        J220          192.43            8
P240         J220         J240          474.89            8
P260         J240         J260          817.32            8
P280         J260         J280          161.15            8
P290         J280         FH290          32.26            8
P300         FH290        J300          307.32            8
P310         J300         J600          465.63            8
P520         J500         J520          611.75            8
P522         J520         FH522          66.51            8
```

16" Revised to 16" on 9.19.01 OK w/ Maryanne After discussion.

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length ft	Diameter in
P524	FH522	FH524	705.52	8
P526	FH524	FH526	849.87	8
P528	FH526	J600	60.79	8
P610	J600	FH610	772.03	8
P620	FH610	J620	69.46	8
P626	J620	FH626	535.35	8
P640	J620	J640	109.40	8
P145	J140	J145	121.59	6
P165	J160	J165	262.24	6
P185	J180	FH185	196.87	6
P190	FH185	J190	169.92	6
P205	J200	J205	254.73	6
P223	J220	FH223	130.86	6
P226	FH223	J226	313.79	6
P229	J220	J229	472.71	6
P245	J240	FH245	131.57	6
P250	FH245	J250	263.17	6
P265	J260	J265	124.30	6
P285	J280	J285	476.27	6
P305	J300	FH305	82.83	6
P320	FH305	J320	353.12	6
P323	J320	J323	303.66	6
P326	J320	FH326	379.38	6
P329	FH326	J329	70.13	6
P340	J320	J340	769.79	6
P343	J340	FH343	339.53	6
P346	FH343	J346	131.87	6
P350	J340	FH350	111.93	6
P360	FH350	J360	348.78	6
P363	J360	FH363	211.31	6
P366	FH363	J366	190.78	6
P369	J360	J369	258.68	6
P370	J360	FH370	299.99	6
P380	FH370	J380	306.82	6
P385	J380	J385	297.69	6
P400	J380	J400	157.31	6
P405	J400	J405	315.39	6
P410	J400	FH410	263.58	6
P420	FH410	G120	222.19	6
P540	J520	J540	963.88	6
P545	J540	J545	434.39	6
P550	J540	FH550	174.49	6
P560	FH550	J560	355.24	6
P563	J560	FH563	189.48	6
P566	FH563	J566	125.01	6
P570	J660	FH570	612.60	6
P580	FH570	J580	139.43	6

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length ft	Diameter in	
P600	J580	J600	309.74	6	
P622	J620	PH622	575.20	6	
P624	PH621	J624	135.33	6	
P626	PH626	J626	544.80	6	
PRV1	120	121	#N/A	12	Valve
PRV2	232	233	#N/A	12	Valve
PRV11	110	111	#N/A	12	Valve

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality	
105	0.00	2814.60	51.89	0.00	
110	572.00	2814.39	49.57	0.00	
111	0.00	2814.39	49.57	0.00	
112	0.00	2814.29	60.36	0.00	
114	0.00	2814.20	71.15	0.00	
116	0.00	2813.06	81.49	0.00	
118	0.00	2811.68	98.21	0.00	
120	235.00	2810.76	108.65	0.00	
121	0.00	2686.93	55.00	0.00	
210	0.00	2686.78	59.26	0.00	
212	0.00	2686.46	63.45	0.00	
214	0.00	2686.05	69.78	0.00	
220	0.00	2685.67	80.45	0.00	
224	0.00	2685.26	91.11	0.00	
228	0.00	2685.20	91.08	0.00	
230	251.00	2685.04	101.84	0.00	
232	0.00	2685.04	101.84	0.00	
233	0.00	2576.93	55.00	0.00	
J100	0.00	2576.93	67.47	0.00	
J120	0.00	2576.92	85.86	0.00	
J140	0.00	2576.91	84.93	0.00	
J145	1.01	2576.91	82.86	0.00	
J160	0.67	2576.91	67.39	0.00	
J165	1.01	2576.91	59.84	0.00	
PH170	0.00	2576.91	59.32	0.00	
J180	2.02	2576.91	57.50	0.00	
PH185	0.00	2576.91	76.65	0.00	
J190	2.36	2576.91	66.25	0.00	
J200	1.35	2576.90	60.62	0.00	
J205	1.35	2576.90	63.65	0.00	
PH210	0.00	2576.90	62.15	0.00	
J220	2.02	2576.90	64.52	0.00	
PH223	0.00	2576.90	63.65	0.00	
J226	1.35	2576.90	67.55	0.00	

* 128th St./Rio Verde

Node Results: (continued)

Node ID	Demand GPM	Head ft	Pressure psi	Quality
J329	1.35	2576.90	64.74	0.00
J240	0.34	2576.90	71.76	0.00
FH245	0.00	2576.90	72.32	0.00
J250	1.69	2576.90	71.45	0.00
J260	0.34	2576.90	74.49	0.00
J265	1.01	2576.90	67.55	0.00
J280	0.67	2576.90	76.44	0.00
J285	1.35	2576.90	75.57	0.00
FH290	0.00	2576.90	76.65	0.00
J300	1.01	2576.90	72.78	0.00
FH305	0.00	2576.90	74.49	0.00
J320	1.01	2576.90	73.62	0.00
J323	1.69	2576.90	75.78	0.00
FH326	0.00	2576.90	76.15	0.00
J329	1.69	2576.90	67.99	0.00
J340	1.69	2576.90	71.45	0.00
FH343	0.00	2576.90	72.32	0.00
J346	1.69	2576.90	70.58	0.00
FH350	0.00	2576.90	68.72	0.00
J360	1.35	2576.90	66.69	0.00
FH363	0.00	2576.90	65.82	0.00
J366	1.35	2576.90	65.60	0.00
J369	0.67	2576.90	69.07	0.00
FH370	0.00	2576.91	63.65	0.00
J380	0.00	2576.91	61.92	0.00
J385	1.35	2576.91	62.79	0.00
J400	0.34	2576.91	60.19	0.00
J405	1.01	2576.91	62.36	0.00
FH410	0.00	2576.91	57.37	0.00
J500	0.00	2576.92	74.58	0.00
J510	0.00	2576.92	84.03	0.00
J520	1.35	2576.92	74.27	0.00
FH522	0.00	2576.91	73.62	0.00
FH524	0.00	2576.91	78.89	0.00
FH526	0.00	2576.90	78.39	0.00
J540	1.69	2576.91	81.85	0.00
J545	1.35	2576.91	77.52	0.00
FH550	0.00	2576.91	83.15	0.00
J560	1.01	2576.90	82.07	0.00
FH563	0.00	2576.90	83.15	0.00
J566	1.01	2576.90	85.75	0.00
FH570	0.00	2576.90	83.15	0.00
J580	2.02	2576.90	84.45	0.00
J600	0.67	2576.90	78.39	0.00
FH610	0.00	2576.90	78.73	0.00
J620	1.69	2576.90	77.52	0.00
FH622	0.00	2576.90	83.15	0.00

Node Results: (continued)

Node ID	Demand GPM	Head ft	Pressure psi	Quality	
J624	2.02	2576.90	83.80	0.00	
FH626	0.00	2576.90	72.32	0.00	
J628	1.01	2576.90	71.45	0.00	
J648	0.00	2576.90	75.08	0.00	
R100	-1106.57	2815.00	8.00	0.00	Reservoir
VolCurve	0.00	2400.00	0.00	0.00	Reservoir

Will Establish Now @ 2830 w/ 2 12 Reservoir

Link Results:

Link ID	Flow GPM	Velocity fps	Headloss ft/Kft	Status
1	1106.57	0.78	0.12	Open
2	1106.57	0.78	0.12	Open
3	534.57	0.85	0.08	Open
4	534.57	0.85	0.08	Open
5	534.57	1.52	0.25	Open
6	534.57	1.52	0.23	Open
7	534.57	1.52	0.22	Open
8	299.56	0.85	0.32	Open
9	299.56	0.85	0.32	Open
10	299.56	0.85	0.32	Open
11	299.56	0.85	0.32	Open
12	299.56	0.85	0.32	Open
13	299.56	0.85	0.11	Open
14	299.56	0.85	0.32	Open
15	48.56	0.14	0.01	Open
P100	48.57	0.14	0.01	Open
P500	21.70	0.06	0.00	Open
P510	0.00	0.00	0.00	Open
P120	26.86	0.17	0.03	Open
P140	17.04	0.11	0.01	Open
P160	16.03	0.10	0.01	Open
P170	14.34	0.09	0.01	Open
P180	14.34	0.89	0.61	Open
P200	9.96	0.06	0.00	Open
P210	7.26	0.05	0.00	Open
P220	7.26	0.05	0.00	Open
P240	2.54	0.02	0.00	Open
P260	0.51	0.00	0.00	Open
P280	-0.83	0.01	0.00	Open
P290	-2.86	0.02	0.00	Open
P300	-2.86	0.02	0.00	Open
P310	-7.87	0.05	0.00	Open
P520	21.70	0.14	0.02	Open
P522	13.10	0.08	0.01	Open
P524	13.10	0.08	0.01	Open

Link Results: (continued)

Link ID	Flow GPM	Velocity fps	Headloss ft/Kft	Status
P526	13.10	0.08	0.01	Open
P528	13.10	0.08	0.01	Open
P610	4.72	0.03	0.00	Open
P620	4.72	0.03	0.00	Open
P626	1.01	0.01	0.00	Open
P640	0.00	0.00	0.00	Open
P145	1.01	0.01	0.00	Open
P165	1.01	0.01	0.00	Open
P185	2.36	0.03	0.00	Open
P190	2.36	0.03	0.00	Open
P205	1.35	0.02	0.00	Open
P223	1.35	0.02	0.00	Open
P226	1.35	0.02	0.00	Open
P229	1.35	0.02	0.00	Open
P245	1.69	0.02	0.00	Open
P250	1.69	0.02	0.00	Open
P265	1.01	0.01	0.00	Open
P285	1.35	0.02	0.00	Open
P105	4.00	0.05	0.00	Open
P120	4.00	0.05	0.00	Open
P123	1.69	0.02	0.00	Open
P126	1.69	0.02	0.00	Open
P129	1.69	0.02	0.00	Open
P140	-0.38	0.00	0.00	Open
P143	1.69	0.02	0.00	Open
P146	1.69	0.02	0.00	Open
P150	-3.75	0.04	0.00	Open
P160	-3.75	0.04	0.00	Open
P161	1.35	0.02	0.00	Open
P166	1.35	0.02	0.00	Open
P169	0.67	0.01	0.00	Open
P170	-7.13	0.08	0.01	Open
P180	-7.13	0.08	0.01	Open
P185	1.35	0.02	0.00	Open
P400	-8.47	0.10	0.01	Open
P405	1.01	0.01	0.00	Open
P410	-9.83	0.11	0.02	Open
P420	-9.82	0.11	0.02	Open
P540	7.35	0.08	0.01	Open
P545	1.35	0.02	0.00	Open
P550	4.21	0.05	0.00	Open
P560	4.21	0.05	0.00	Open
P563	1.01	0.01	0.00	Open
P566	1.01	0.01	0.00	Open
P570	2.19	0.02	0.00	Open
P580	2.19	0.02	0.00	Open
P600	0.17	0.00	0.00	Open

Link Results: (continued)

Link ID	Flow GPM	Velocity fps	Headloss ft/Kft	Status
P622	2.02	0.02	0.00	Open
P624	2.02	0.02	0.00	Open
P628	1.01	0.01	0.00	Open
PRV1	299.57	0.85	123.82	Active Valve
PRV2	48.56	0.14	108.10	Active Valve
PRV12	334.57	1.51	0.00	Open Valve

EXHIBIT 4

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101
GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102
DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

SECTION B103
MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the fire code official is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code*.

SECTION B104
FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the exterior walls, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by fire walls without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105
FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings. The [redacted] fire-flow requirements for one- and two-family dwellings having a fire-flow calculation area which does not exceed [redacted] square feet (344.5 m^2) shall be [redacted] gallons per minute (3785.4 L/min). Fire-flow and flow duration for dwellings having a fire-flow calculation area in excess of 3,600 square feet (344.5 m^2) shall not be less than that specified in Table B105.1.

Exception: A [redacted] in required fire flow of [redacted], as approved, is allowed when the building is provided with an approved automatic sprinkler system.

B105.2 Buildings other than one- and two-family dwellings. The minimum fire-flow and flow duration for buildings other than one- and two-family dwellings shall be as specified in Table B105.1.

Exception: A reduction in required fire-flow of up to 75 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. The resulting fire-flow shall not be less than 1,500 gallons per minute (5678 L/min) for the prescribed duration as specified in Table B105.1.

SECTION B106
REFERENCED STANDARDS

ICC	IBC	International Building Code	B104.2, Table B105.1
ICC	IWUIC	International Wildland-Urban Interface Code	B103.3
NFPA	1142	Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3

typical WOOD FRAME

TABLE B105.1
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS[a]

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[c]	FLOW DURATION (hours)
Type IA and IB[b]	Type IIA and IIA[b]	Type IV and V-A[b]	Type IIB and IIB[b]	Type V-B[b]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	3600 max is BASIS OF 900 gpm
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	2
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.
a. The minimum required fire flow shall be allowed to be reduced by 25 percent for Group R.
b. Types of construction are based on the *International Building Code*.
c. Measured at 20 psi.

Disregard per FD – Armstrong

THE CODE CONNECTION

Hosted by Terry Welker AIA

Construction Types

All buildings are classified according to their construction type. Type I is least combustible and Type V is most combustible. The more combustible a building is and the more hazardous the use is, the more the maximum allowable area is limited (in table 503). All construction types and use groups are allowed to have increased areas by using sprinklers.

Type I

I-A or I-B

Typically these are concrete frame buildings made of noncombustible materials. All of the building elements (structural frame, bearing walls, floors and roofs) are fire resistance rated according to Tables 601 and 602.

Type II

II-A or II-B

These buildings are constructed of noncombustible materials. Typically these are masonry bearing walls structures with steel studs for walls and steel bar joists for floor and roof structures. IIA has fire rated building elements (structural frame, bearing walls, floors and roofs). IIB is the most common construction type for commercial buildings because the building elements are not required to be fire resistance rated but still must be non-combustible.

Types I and II. (602.2)
Types I and II construction are those types of construction in which the building elements listed in Table 601 are of noncombustible materials.

Type III

III-A or III-B

Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by the code (combustible or non-combustible). This is typical of buildings with masonry bearing walls and wood roofs or floors.

Type III. (602.3)
Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant-treated wood framing complying with Section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating or less.

Type IV

IV-A or IV-B

This is Heavy Timber construction which is not common in Ohio except perhaps in some worship facilities.

Type IV. (602.4)
Type IV construction (Heavy Timber, HT) is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid or laminated wood without concealed spaces. The details of Type IV construction shall comply with the provisions of this section. Fire-retardant-treated wood framing complying with Section 2303.2 shall be permitted within exterior wall assemblies with a 2-hour rating or less.

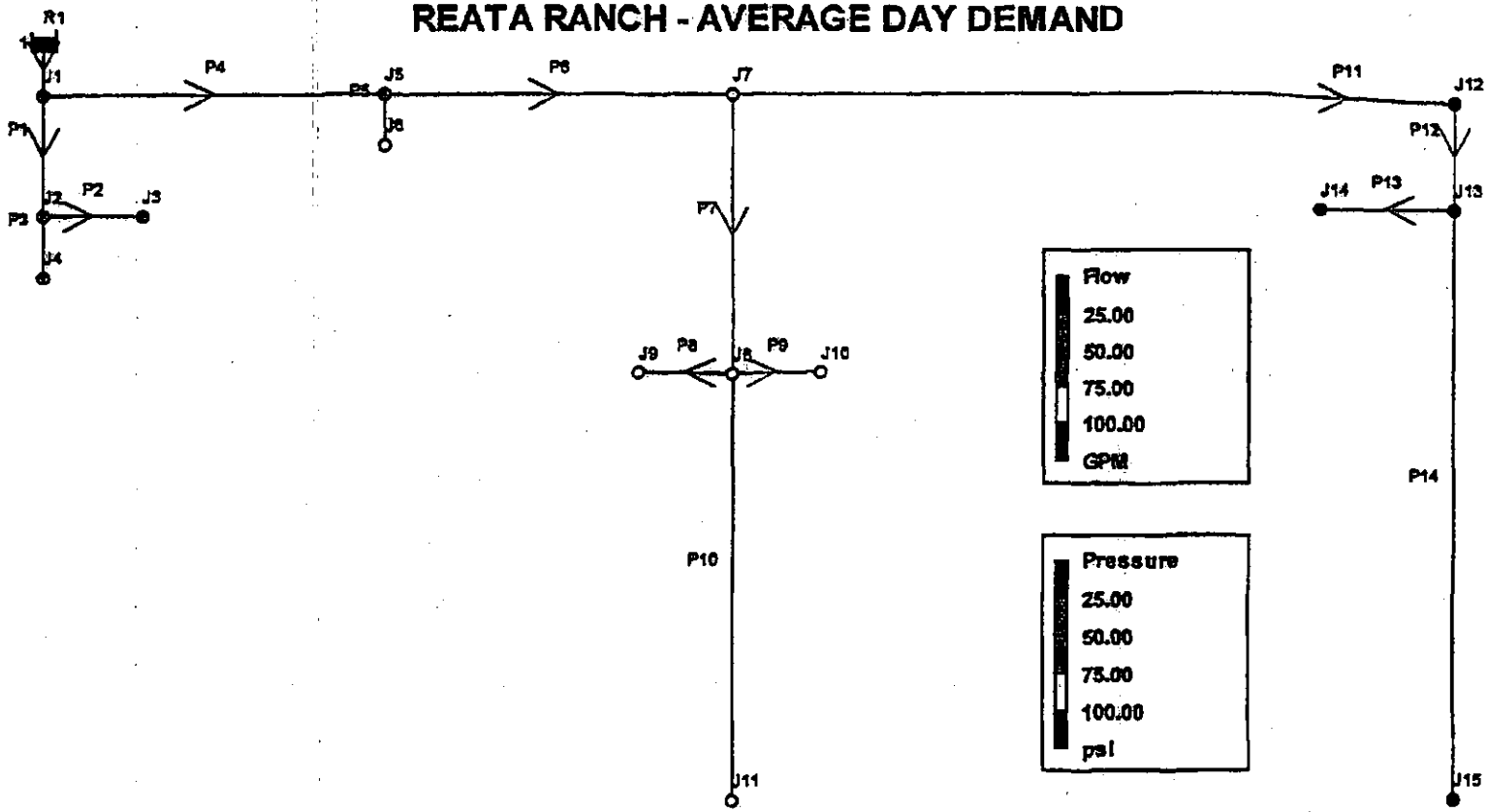
Type V

V-A or V-B

Type V construction is typically wood frame construction. V-A requires fire rated assemblies for all building elements (structural frame, bearing walls, floors and roofs); this is often seen in older construction that predates sprinklers but still not commonly used. V-B is very common because it does not require any fire rating.

Type V. (602.5)
Type V construction is that type of construction in which the structural elements, exterior walls and interior walls are of

REATA RANCH - AVERAGE DAY DEMAND



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**************************************************************************
*                          E P A N E T                                   *
*                  Hydraulic and Water Quality                           *
*                  Analysis for Pipe Networks                            *
*                        Version 2.0                                     *
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Input File: Reata Ranch Water System (AVG DAY)_7-11-2012.net

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
P1	J1	J2	455.3	12
P12	J12	J13	404	12
P11	J7	J12	2693	12
P10	J11	J8	1610	12
P2	J2	J3	19	8
P3	J2	J4	232.9	12
P6	J5	J7	1299	12
P5	J5	J6	50	8
P7	J8	J7	1053	12
P8	J9	J8	100	8
P9	J8	J10	100	12
P14	J13	J15	2220	12
P13	J13	J14	35	12
1	R1	J1	75	36
P4	J1	J5	1280	12

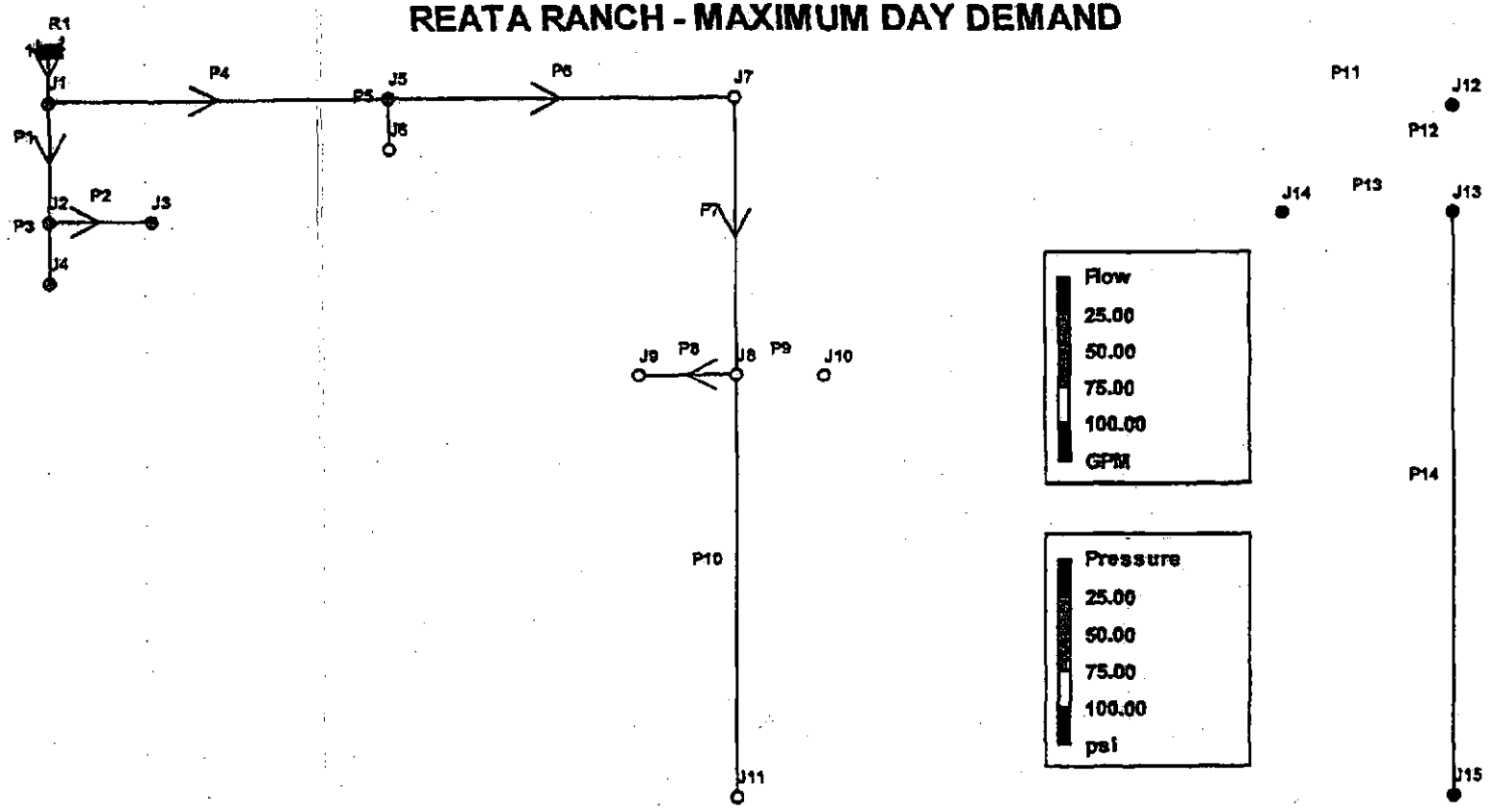
Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality	
J1	0.00	2706.77	59.26	0.00	128th / Rio Verde
J2	0.00	2706.77	58.83	0.00	
J12	0.00	2706.58	97.74	0.00	
J13	0.00	2706.57	104.67	0.00	
J7	0.00	2706.61	78.69	0.00	
J11	0.00	2706.59	81.71	0.00	
J8	0.00	2706.59	84.75	0.00	
J3	6.74	2706.77	59.70	0.00	
J4	0.00	2706.77	57.10	0.00	
J5	0.00	2706.69	70.06	0.00	
J6	0.00	2706.69	71.36	0.00	
J9	16.86	2706.58	83.88	0.00	
J10	43.16	2706.58	85.18	0.00	
J15	0.00	2706.57	106.84	0.00	
J14	43.84	2706.57	104.67	0.00	
R1	-110.61	2706.77	0.00	0.00	Reservoir

Link Results:

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
P1	6.74	0.02	0.00	Open
P12	43.84	0.12	0.01	Open
P11	43.84	0.12	0.01	Open
P10	0.00	0.00	0.00	Open
P2	6.74	0.04	0.00	Open
P3	0.00	0.00	0.00	Open
P6	103.86	0.29	0.06	Open
P5	0.00	0.00	0.00	Open
P7	-60.02	0.17	0.02	Open
P8	-16.86	0.11	0.01	Open
P9	43.16	0.12	0.01	Open
P14	0.00	0.00	0.00	Open
P13	43.84	0.12	0.01	Open
1	110.61	0.03	0.00	Open
P4	103.87	0.29	0.06	Open

REATA RANCH - MAXIMUM DAY DEMAND



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*                          E P A N E T                               *
*                   Hydraulic and Water Quality                      *
*                   Analysis for Pipe Networks                       *
*                         Version 2.0                                *
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Input File: Reata Ranch Water System (MAX DAY)_7-11-2012.NET

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
P1	J1	J2	455.3	12
P12	J12	J13	404	12
P11	J7	J12	2693	12
P10	J11	J8	1610	12
P2	J2	J3	19	8
P3	J2	J4	232.9	12
P6	J5	J7	1299	12
P5	J5	J6	50	8
P7	J8	J7	1053	12
P8	J9	J8	100	8
P9	J8	J10	100	12
P14	J13	J15	2220	12
P13	J13	J14	35	12
1	R1	J1	75	36
P4	J1	J5	1280	12

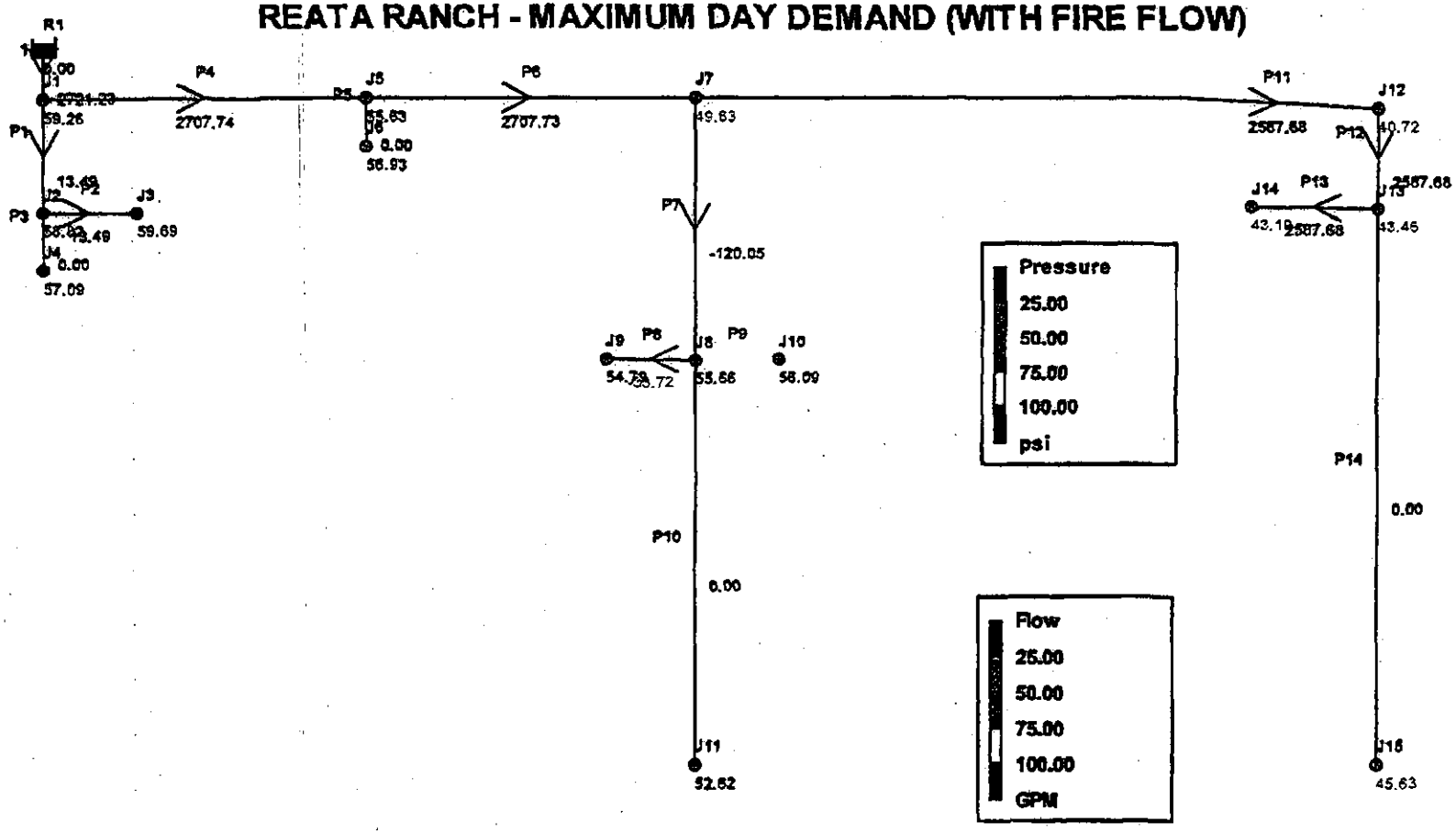
Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality	
J1	0.00	2706.77	59.26	0.00	128th/Rio Verde
J2	0.00	2706.77	58.83	0.00	
J12	0.00	2706.07	97.52	0.00	
J13	0.00	2706.05	104.45	0.00	
J7	0.00	2706.19	78.51	0.00	
J11	0.00	2706.11	81.51	0.00	
J8	0.00	2706.11	84.54	0.00	
J3	13.49	2706.77	59.70	0.00	
J4	0.00	2706.77	57.10	0.00	
J5	0.00	2706.48	69.97	0.00	
J6	0.00	2706.48	71.27	0.00	
J9	33.72	2706.10	83.67	0.00	
J10	86.33	2706.10	84.97	0.00	
J15	0.00	2706.05	106.61	0.00	
J14	87.68	2706.05	104.45	0.00	
R1	-221.23	2706.77	0.00	0.00	Reservoir

Link Results:

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
P1	13.49	0.04	0.00	Open
P12	87.68	0.25	0.05	Open
P11	87.68	0.25	0.05	Open
P10	0.00	0.00	0.00	Open
P2	13.49	0.09	0.01	Open
P3	0.00	0.00	0.00	Open
P6	207.73	0.59	0.22	Open
P5	0.00	0.00	0.00	Open
P7	-120.05	0.34	0.08	Open
P8	-33.72	0.22	0.06	Open
P9	86.33	0.24	0.04	Open
P14	0.00	0.00	0.00	Open
P13	87.68	0.25	0.04	Open
1	221.23	0.07	0.00	Open
P4	207.74	0.59	0.22	Open

REATA RANCH - MAXIMUM DAY DEMAND (WITH FIRE FLOW)



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*                          E P A N E T                               *
*                   Hydraulic and Water Quality                      *
*                   Analysis for Pipe Networks                       *
*                        Version 2.0                                 *
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Input File: Reata Ranch Water System (MAX DAY-W_FIRE)_7-11-2012.NET

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
P1	J1	J2	455.3	12
P12	J12	J13	404	12
P11	J7	J12	2693	12
P10	J11	J8	1610	12
P2	J2	J3	19	8
P3	J2	J4	232.9	12
P6	J5	J7	1299	12
P5	J5	J6	50	8
P7	J8	J7	1053	12
P8	J9	J8	100	8
P9	J8	J10	100	12
P14	J13	J15	2220	12
P13	J13	J14	35	12
1	R1	J1	75	36
P4	J1	J5	1280	12

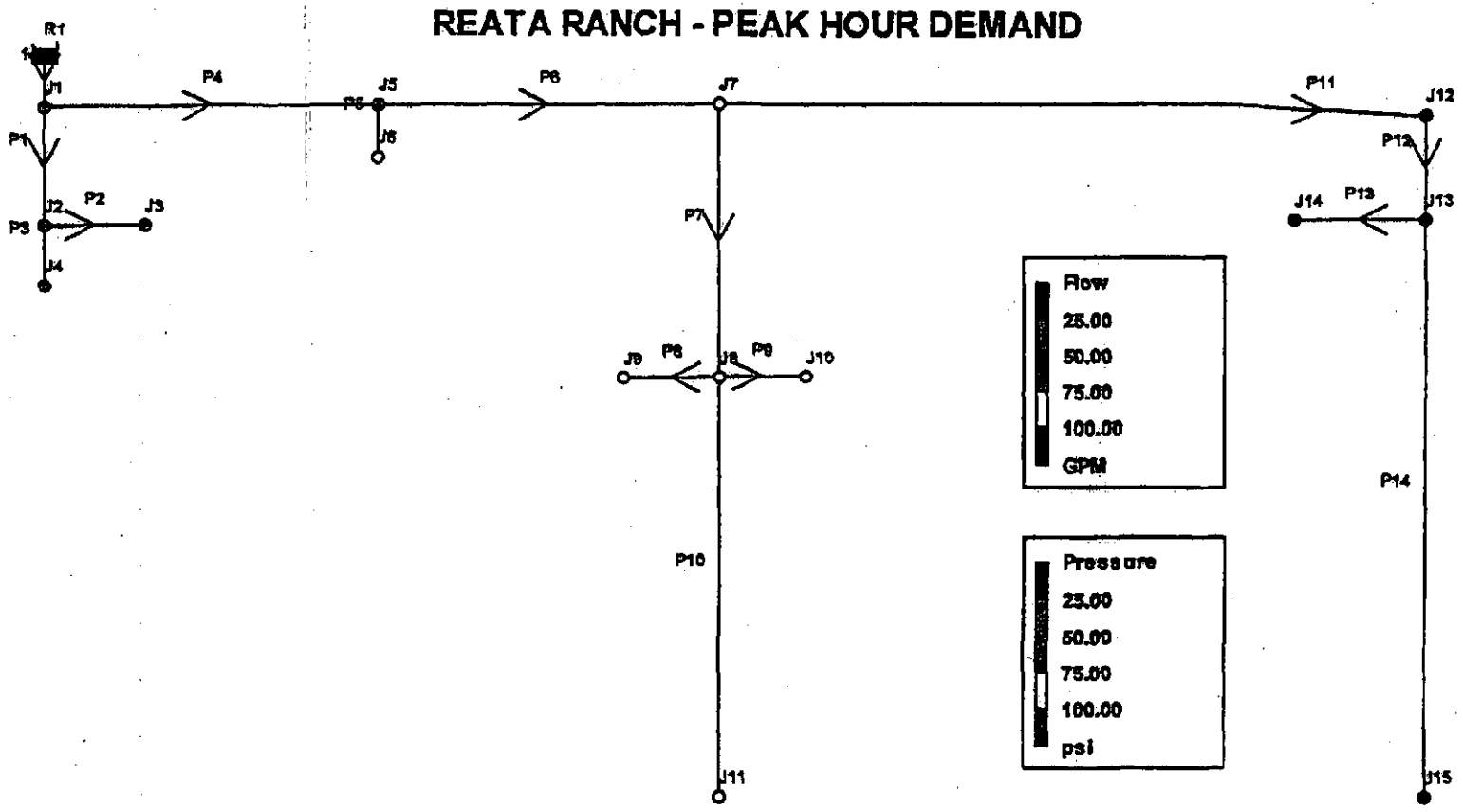
Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality	
J1	0.00	2706.76	59.26	0.00	128th / Rio Verde
J2	0.00	2706.76	58.82	0.00	
J12	0.00	2574.98	40.72	0.00	
J13	0.00	2565.30	43.46	0.00	
J7	0.00	2639.53	49.63	0.00	
J11	0.00	2639.44	52.62	0.00	
J8	0.00	2639.44	55.66	0.00	
J3	13.49	2706.76	59.69	0.00	
J4	0.00	2706.76	57.09	0.00	
J5	0.00	2673.39	55.63	0.00	
J6	0.00	2673.39	56.93	0.00	
J9	33.72	2639.44	54.79	0.00	
J10	86.33	2639.44	56.09	0.00	
J15	0.00	2565.30	45.63	0.00	
J14	2587.68	2564.46	43.10	0.00	
R1	-2721.23	2706.77	0.00	0.00	Reservoir

Link Results:

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
P1	13.49	0.04	0.00	Open
P12	2587.68	7.34	23.97	Open
P11	2587.68	7.34	23.97	Open
P10	0.00	0.00	0.00	Open
P2	13.49	0.09	0.01	Open
P3	0.00	0.00	0.00	Open
P6	2707.73	7.68	26.07	Open
P5	0.00	0.00	0.00	Open
P7	-120.05	0.34	0.08	Open
P8	-33.72	0.22	0.06	Open
P9	86.33	0.24	0.04	Open
P14	0.00	0.00	0.00	Open
P13	2587.68	7.34	23.97	Open
1	2721.23	0.86	0.12	Open
P4	2707.74	7.68	26.07	Open

REATA RANCH - PEAK HOUR DEMAND



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*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                           Version 2.0                                 *
*************************************************************************
```

Input File: Reata Ranch Water System (PEAK HOUR)_7-11-2012.NET

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
P1	J1	J2	455.3	12
P12	J12	J13	404	12
P11	J7	J12	2693	12
P10	J11	J8	1610	12
P2	J2	J3	19	8
P3	J2	J4	232.9	12
P6	J5	J7	1299	12
P5	J5	J6	50	8
P7	J8	J7	1053	12
P8	J9	J8	100	8
P9	J8	J10	100	12
P14	J13	J15	2220	12
P13	J13	J14	35	12
1	R1	J1	75	36
P4	J1	J5	1280	12

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality	
J1	0.00	2706.77	59.26	0.00	128th/Rio Verde
J2	0.00	2706.77	58.83	0.00	
J12	0.00	2704.79	96.97	0.00	
J13	0.00	2704.74	103.88	0.00	
J7	0.00	2705.14	78.05	0.00	
J11	0.00	2704.90	80.98	0.00	
J8	0.00	2704.90	84.02	0.00	
J3	23.61	2706.77	59.69	0.00	
J4	0.00	2706.77	57.09	0.00	
J5	0.00	2705.96	69.74	0.00	
J6	0.00	2705.96	71.04	0.00	
J9	59.01	2704.88	83.14	0.00	
J10	151.08	2704.88	84.44	0.00	
J15	0.00	2704.74	106.05	0.00	
J14	153.44	2704.74	103.88	0.00	
R1	-387.15	2706.77	0.00	0.00	Reservoir

Link Results:

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
P1	23.61	0.07	0.00	Open
P12	153.44	0.44	0.13	Open
P11	153.44	0.44	0.13	Open
P10	0.00	0.00	0.00	Open
P2	23.61	0.15	0.03	Open
P3	0.00	0.00	0.00	Open
P6	363.54	1.03	0.63	Open
P5	0.00	0.00	0.00	Open
P7	-210.09	0.60	0.23	Open
P8	-59.01	0.38	0.16	Open
P9	151.08	0.43	0.12	Open
P14	0.00	0.00	0.00	Open
P13	153.44	0.44	0.13	Open
1	387.15	0.12	0.00	Open
P4	363.54	1.03	0.63	Open

SKG Enterprises, Inc.

Junction Node Elevation and Demand — *Date:* 7/11/2012

Project: Reata Ranch (Scottsdale, Arizona) — *SKG Project No.* 30-9

Junction Number (node)	Elevation (feet)	Number of Units	Average Day Water Demand (gpm)	Maximum Day Water Demand (gpm)	Peak Hour Water Demand (gpm)	Notes
Res1	2706.77[4]	0	Units*485.6/1440	2*Avg. Day	3.5*Average Day	Base Parameters
J1[5]	2570.0 ft	0	0.00	0.00	0.00	
J2	2571.0 ft	0	0.00	0.00	0.00	
J3	2569.0 ft	20	6.74	13.49	23.61	Parcel A
4[1]	2575.0 ft	0	0.00	0.00	0.00	
J5	2545.0 ft	0	0.00	0.00	0.00	
J6	2542.0 ft	0	0.00	0.00	0.00	
J7	2525.0 ft	0	0.00	0.00	0.00	
J8	2511.0 ft	0	0.00	0.00	0.00	
J9	2513.0 ft	50	16.86	33.72	59.01	Parcel B and Parcel C
J10	2510.0 ft	128	43.16	86.33	151.08	Parcels F, G, H and I
11[1]	2518.0 ft	0	0.00	0.00	0.00	
J12	2481.0 ft	0	0.00	0.00	0.00	
J13	2465.0 ft	0	0.00	0.00	0.00	
J14[2][3]	2465.0 ft	130	43.84	87.68	153.44	Parcels D, E and Resort (Fire Flow)
J15[1]	2460.0 ft	0	0.00	0.00	0.00	
Total		328	110.61	221.22	387.13	Total

1 = Boundary node – Future system expansion estimated based on adjacent zoning opportunity

2 = Fire Flow Analysis (Use 2,500 gpm for Resort as Site Fire Flow control)

3 = A daily demand of 485.6/unit was applied to the Resort and Guest Ranch facilities as units more closely resemble Single Family housing.

4 = Elevation reflects required head + ground elevation.

5 = Node J1 (this report) = Node 210 (approved GTA Engineering, Inc. report for the Scottsdale national Water Supply System (dated 4/25/01).

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