NAVAJO GALLUP WATER SUPPLY PROJECT

APPRAISAL LEVEL DESIGNS AND COST ESTIMATES

APPENDIX F

CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES, REVISED JANUARY, 2002, BY DEPAULI ENGINEERING AND SURVEYING COMPANY

Preliminary Design and Report For

The Navajo-Gallup Water Supply Project

CITY OF GALLUP
TRANSMISSION AND STORAGE FACILITIES
(REVISED)
Northwest New Mexico Council of Governments
USDA Rural Business Enterprise Grant

Date: January, 2002

Prepared by:
DePauli Engineering and Surveying Co.
Gallup, New Mexico

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Registered Professional Engineer
1-10-02

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January 11, 2002

Rege Leach
Bureau of Reclamation
Upper Colorado Region
825 E. 2nd Avenue, Suite 300
Durango, CO 81302-5475

Ref: Preliminary Design and Report for The Navajo-Gallup Water Supply Project

Dear Rege

Enclosed please find one (1) copy of CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES (REVISED) in connection with subject project. The revisions contained in the report are noted in the Preface.

Please call if you have questions or wish to discuss.

Sincerely,

Marc DePauli

Marc DePauli PE\PS
DS\lvb

Enclosures

Preliminary Design and Report For

The Navajo-Gallup Water Supply Project

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INDEX CONT'D

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- PREFACE -

This is a revision of an earlier report entitled, Preliminary Design and Report for the Navajo - Gallup Water Supply Project, CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES dated December, 2000.

The purpose of the revision is to revise and correct estimated project pipe lengths and associated costs contained in the original report. The left-most digit of certain pipe lengths was omitted when tabulated and printed. Hydraulic calculations and other data did, however, remain intact.

Estimates for the relative amounts of Business verses Residential water use are also presented as requested by Northwest New Mexico Council of Governments. The estimates (Business verses Residential) are contained in Appendix J of this report.

NAVAJO-GALLUP WATER SUPPLY PROJECT

CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES

LIST OF ABBREVIATIONS

AF	Acre Feet
AF/YR	Acre Feet Per Year
BOR	United States Department of the Interior, Bureau of Reclamation
Gal/Day	Gallons per Day
GPCD	Gallons per Capita (Person) per Day
GPM	Gallons per Minute
MG	Million Gallons
MGD	Million Gallons per Day
NGWSP	Navajo Gallup Water Supply Project
NNDWR	Navajo Nation Department of Water Resources
NTUA	Navajo Tribal Utility Authority
NWNMCOG	Northwest New Mexico Council of Governments
RBEG	Rural Business Enterprise Grant
USDA	United States Department of Agriculture
YR	Year or Annual

THE NAVAJO - GALLUP WATER SUPPLY PROJECT

CITY OF GALLUP
TRANSMISSION AND STORAGE FACILITIES

1. Background: Planning and preliminary design work continues on the Navajo - Gallup Water Supply Project (NGWSP). Technical and planning data is being presented and exchanged by the Navajo Nation Department of Water Resources (NNDWR), the City of Gallup, the Northwest New Mexico Council of Governments (NWNMCOG) and the U.S. Bureau of Reclamation (BOR).

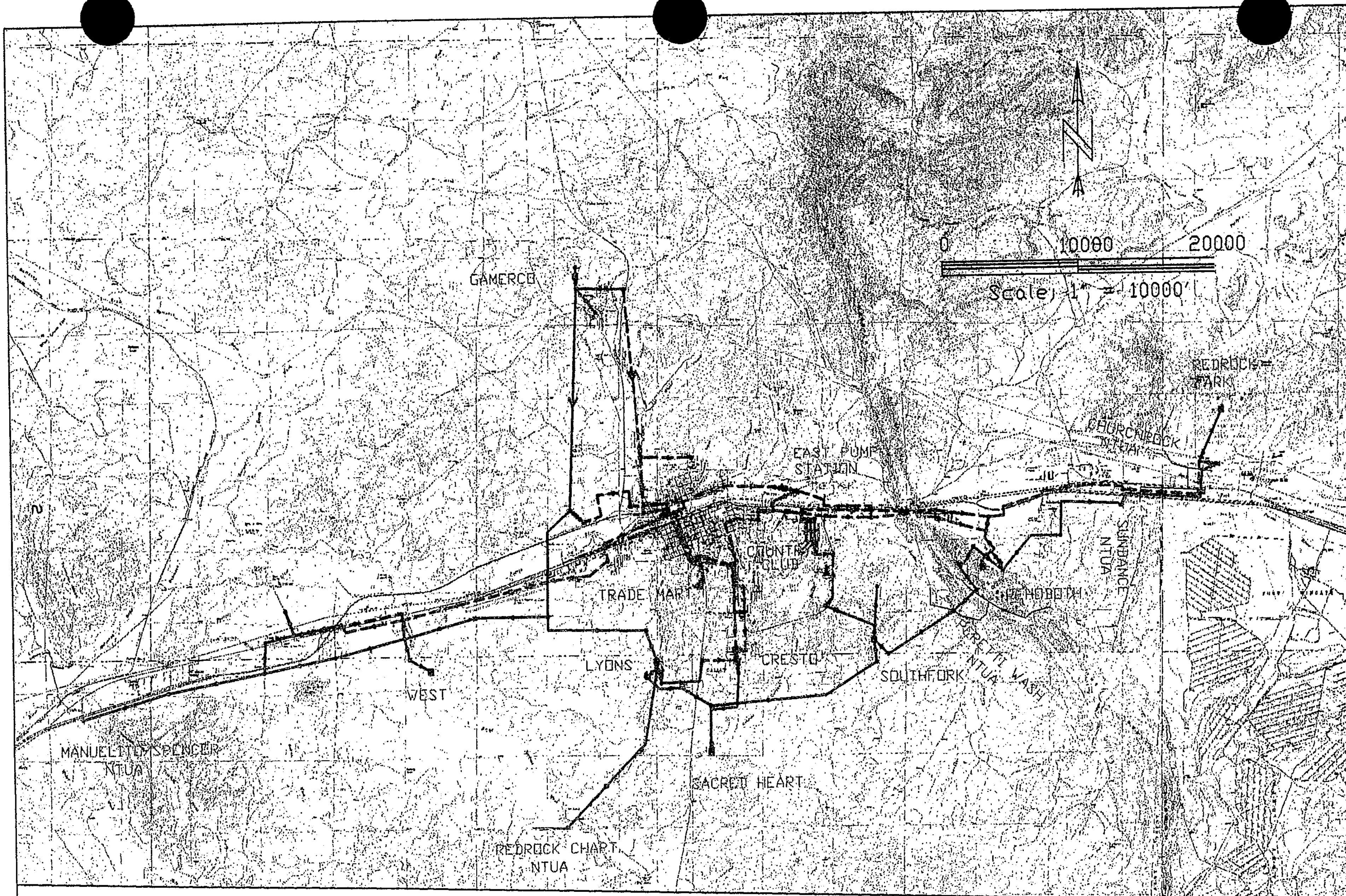
A transmission pipeline from the San Juan River will deliver a portion of NGWSP potable water to the City of Gallup and surrounding Navajo Communities. The pipeline should be sized with a 1.3 peaking factor per request.

It has become evident that a substantial amount of additional transmission and storage facilities will be required to deliver and distribute treated water from the NGWSP project to areas of the City of Gallup and adjacent Navajo communities. NWNMCOG has secured a USDA Rural Business Enterprise Grant to develop Preliminary Engineering Design and a Report for such facilities, which is contained herein.

This report will accompany the ongoing work of the NNDWR and the BOR in their preliminary design of the entire project.

2. Scope: The transmission and storage facilities are sized and designed to permit delivery of adequate quantities of water to areas of the City and adjacent Indian communities that have experienced supply problems in the past as well as areas deemed suitable from future growth. The system designed for this project begins immediately northwest of the Gamerco Townsite, at the Gallup receiving station, which is approximately two (2) miles north of present City limits. The project extends to the east to Redrock Park, to the south to Redrock Chapter and to the west to Spencer Valley, (See Fig. 1, Foldout A and Appendix G for geographical locations). The facilities are designed to fully utilize City of Gallup and Indian allocations of water from the Navajo - Gallup Water Supply Project with demands as projected to the year 2040. The storage set forth in this report for the City system is for down time on the transmission line from the San Juan as well as down time on local facilities and fire flows. Storage requirements and storage facilities for NTUA Systems are to be considered by others and are not included in this report. Storage facilities to utilize full allocations of water in the years prior to 2040 are not provided. There has been discussion in regard to utilizing aquifer recharge and recovery wells for storage of allocated water during initial years of lower demand and periods of lower seasonal demand. Analysis of technical and legal feasibility for such storage is beyond the scope of this report.

Possible adverse effects on water quality parameters, such as taste, odor, appearance and



DEPAULI ENGINEERING & SURVEYING CO. GALLUP, NEW MEXICO 601 W. AZTEC AVE. 505-863-5440	NORTHWEST NEW MEXICO COUNCIL OF GOVERNMENTS USDA RURAL BUSINESS ENTERPRISE GRANT CITY OF GALLUP & ADJACENT COMMUNITIES WATER SUPPLY DISTIBUTION SYSTEM	WATER TRANSMISSION AND DISTRIBUTION SYSTEM	DATE: DEC. 2000 FIGURE 1

corrosion due to blending waters from different sources, are not addressed. Additional studies would be required to determine if such blending should be a cause for concern. Remedies for resultant effects may include various degrees of filtration, settlement, disinfection and/or other "polishing" treatment methods. The Gallup receiving station for the NGWSP water is the location for such a polishing facility and is as specified in Appendix G. This location is higher than the highwater elevation of the Gamerco Tank T-1, which would permit gravity flow to the tank after treatment and metering. This report contains analysis and cost estimates for facilities downstream of the delivery point and downstream of a "polishing" treatment facility (if required).

This report deals with transmission mains and appurtenances for delivery of water in general to areas of significant demand. Detailed needs of distribution system piping within NTUA facilities or City facilities are not addressed. Pump Stations and Storage Facilities that may be required at delivery points or within NTUA Systems are not addressed.

Preliminary cost estimates for the total project as defined above are contained herein. Proportioned costs between the City and Navajo Nation are not provided. Factors that may be considered in such proportioning are listed in Section 5-(B), Cost Estimates.

3. Design Considerations:

(A) NGWSP Water Supply - Potable water delivered at 1.3 (seasonal peaking factor) times the project average annual allocation (supply) shall be available for the City of Gallup and adjacent Navajo communities. The peak amount of potable water delivered to the Gallup receiving station is 9,994 GPM (14.4 MGD) as shown below:

Community	NGWSP Annual Allocation (AF)	Peak Flow Delivered GPM	Peak Flow Delivered MGD
City of Gallup	7,500	6,042	8.7
Churchrock Chapter	1,900	1,544	2.2
Redrock Chapter	2,400	1,930	2.8
Manuelito Chapter	600	478	0.7
Totals	12,400	9,994	14.4

(B) City Demands - Average Day (based on annual use) demands for the City are estimated in the City's Well Production Planning Report (Fig. 3, Ref. 1) (See Appendix A). The graphical projection extends to the year 2030 with an approximate demand of 6.4 MGD (Million Gallons Per Day). Extension of the projection would yield the following:

Year 2040 City Average Day Demand = 7.4 MGD

The last water production figures considered in the report above were for 1997. City records for average daily water productions since that time show a "leveling off" of water use with an actual decrease in use for 1999. The "leveling off" may show to some extent, the effects of rate structures and an increased awareness of the need for water conservation. The decrease in use during 1999 probably had something to do with the prolonged rains of late summer. The average influent flow rates at the City Wastewater Plant did however, show an increase from 1997 to 1999. Shomaker (Ref. 2) predicted that the 152 GPCD water use would not rise significantly during the 40 year Planning Period addressed in his report. Presently, the City uses 160 GPCD in their planning efforts. If the figures of 7,400,000 Gal/Day and 160 GPCD are used for year 2040, the resultant population is 46,250. This compares favorably with the 46,736 figure in Table 5.1 of the Technical Memorandum by NNDWR (Ref. 3). This projection of water use demand from year 1997 as shown above is considered a reasonable estimate for the City.

The heaviest demand period for the City during previous years has occurred during the first half of July. Average daily production from July 1 through July 15 of 1997 was 5.10 MGD. Some daily figures had slightly higher values but these values were not sustained in subsequent days. The average daily production for the year of 1997 was 3.78 MGD.

$$\text{Summertime Peak Factor (July 1 - 15)} = \frac{5.10}{3.78} = 1.35$$

We feel that the use of this peak factor applied over several summer days plus fire flows best represent normal sustained maximum demand conditions. The sustained July 1 - 15 demand is referred to herein as <u>Summer Demand</u>. The effect of a one day demand referred to as <u>Peak Day Demand</u> with a peak factor of 1.8 will be examined in less detail. The Peak Day Factor is applied to a single day within the summer demand scenario. This is further described in Section 4(D).

Required Well Production for year 2040 Summer Demand:

Daily summertime use	= 1.35 x 7.4MGD= 9.99 MGD = 6,933 GPM
NGWSP City Allocation	= 7500 AF/YR (1.3 Peak Factor) = <u>8.70 MGD</u> = <u>6,042 GPM</u>
Required Well Production	= 1.29 MGD = 895 GPM

The proportions of Well Field Production are set as follows for year 2040:

FIGURE 2

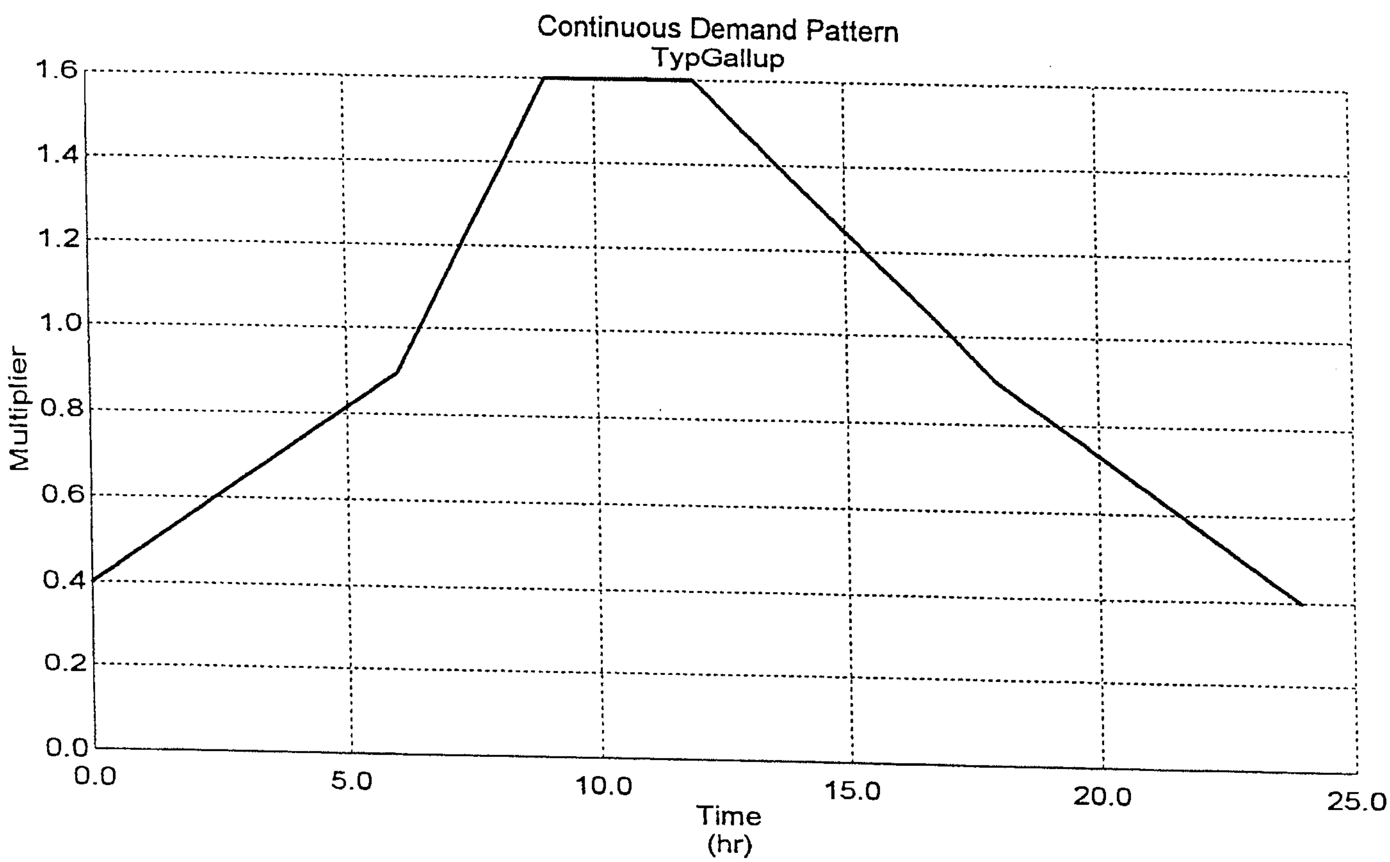
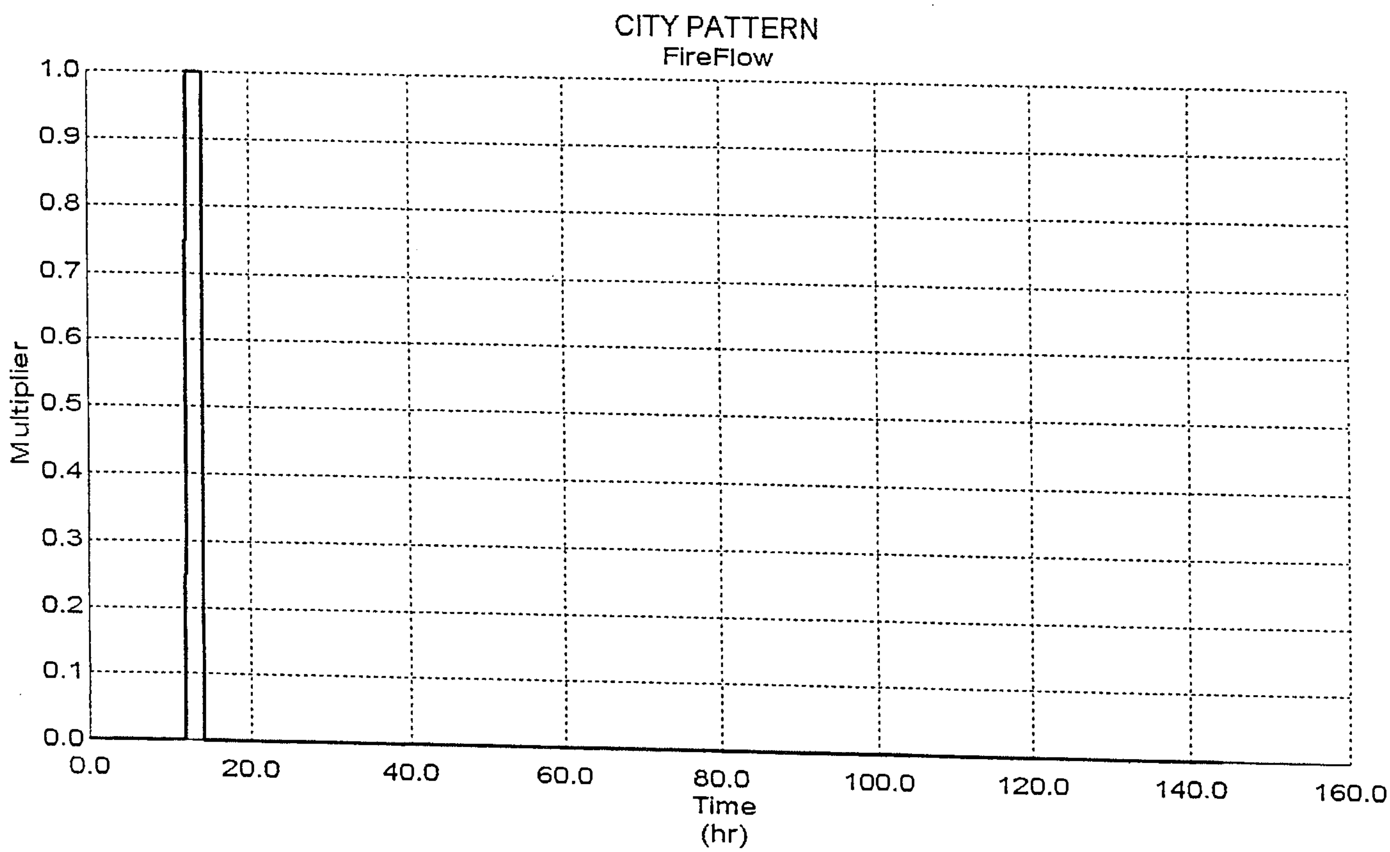
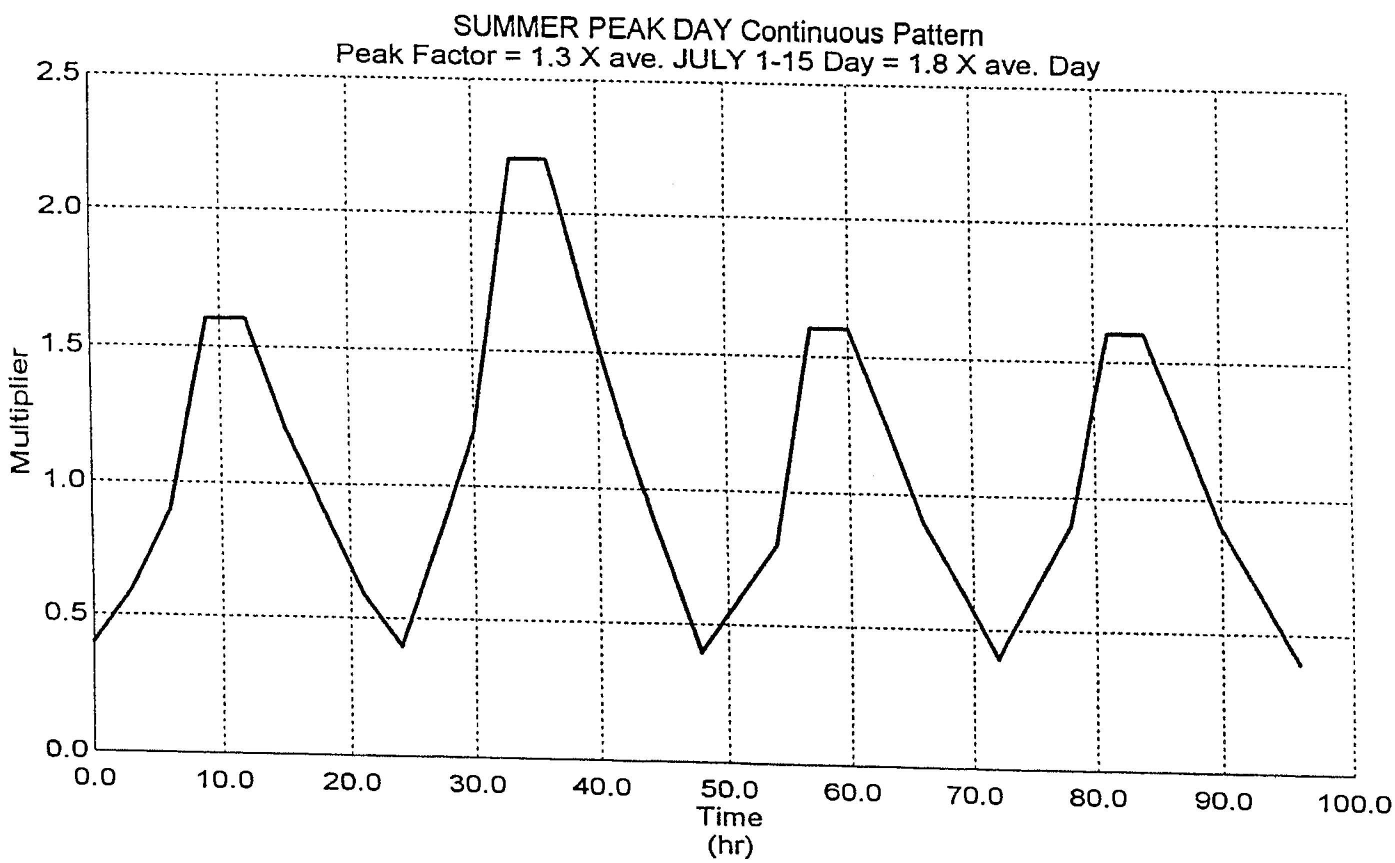

Continuous Demand Pattern
TypGallup
Multiplier
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
5.0
10.0
15.0
20.0
25.0
Time
(hr)

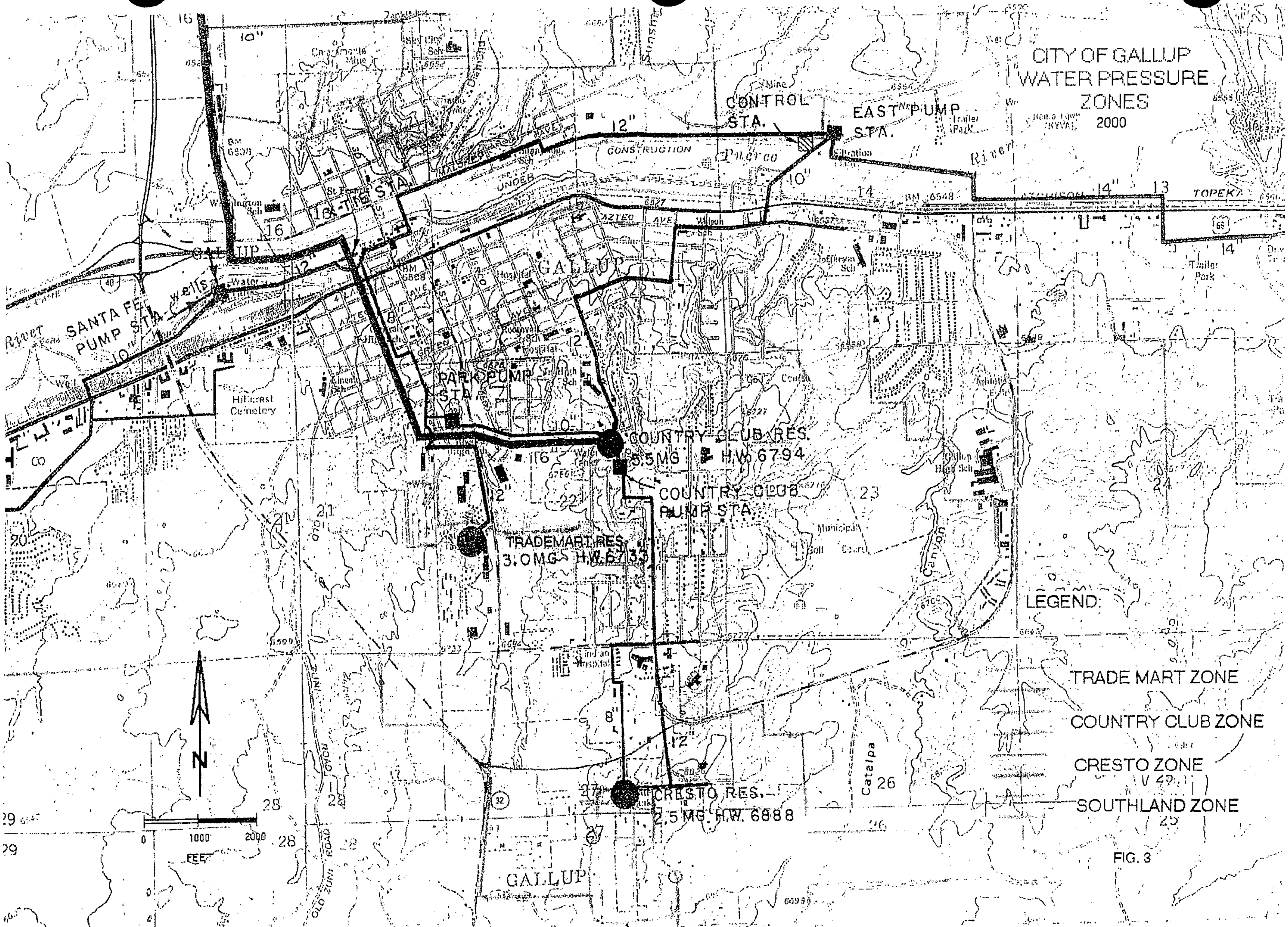
FIGURE 2A


CITY PATTERN
FireFlow
Multiplier
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)

6

FIGURE 2B


SUMMER PEAK DAY Continuous Pattern
Peak Factor = 1.3 X ave. JULY 1-15 Day = 1.8 X ave. Day
2.5
2.0
1.5
1.0
0.5
0.0
Multiplier
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Time
(hr)



CITY OF GALLUP
WATER PRESSURE
ZONES
2000
CONTROL STA.
EAST PUMP STA.
SANTA FE PUMP STA.
PARK PUMP STA.
COUNTRY CLUB RES.
5.5MG H.W. 6794
COUNTRY CLUB PUMP STA.
TRADEMART RES.
3.0MG H.W. 6733
CRESTO RES.
2.5MG H.W. 6888
LEGEND:
TRADE MART ZONE
COUNTRY CLUB ZONE
CRESTO ZONE
SOUTHLAND ZONE
GALLUP
0
1000
2000
FEET
N

FIG. 3

Yah-Ta-Hey Field	=1.03 MGD	= 715 GPM
Santa Fe Field	= .26 MGD	= 181 GPM
Total Well Supplement	= 1.29 MGD	= 895 GPM

The supplemental Yah-Ta-Hey flows will utilize existing Yah-Ta-Hey pump station and the 16" line that traverses from the Well field to the Country Club Tank (Reservoir) T-5. The supplemental Santa Fe flows will be pumped by existing Santa Fe pump station into the lower Trade Mart zone in Central Gallup. Both supplemental flows will utilize existing facilities presently in use.

Summary of City Supply Inflows for Year 2040:

NGWSP @Gallup Receiving Station (J-63)
7500AF/yr (1.3). = 8.7 MGD = 6042 GPM
Yah-Ta-Hey Well Supplement (J-14)
@ Existing 16" Line
= 1.03 MGD = 715 GPM
Santa Fe Well Supplement (J-64)
In Central Gallup
= .26 MGD = 181 GPM

Total City Supply = 9.99 MGD = 6938 GPM

(C) Navajo Tribal Utility Authority (NTUA) System Demands -

NNDWR, through its planning efforts, has requested that the following demands for Indian communities be incorporated in this preliminary design:

Churchrock Chapter System	1544 GPM
Redrock Chapter System (J-91)	1930 GPM
Manuelito/Spencer Valley (J-54)	478 GPM
Total NTUA Demand	3952 GPM

The NNDWR values listed above contain a 1.3 peaking factor by request. Because of the routing of the proposed transmission system, additional tie-ins to the Churchrock system are shown with the resulting arbitrary proportions of the 1544 GPM figure.

Churchrock Chapter (J-51)	770 GPM
Sundance (J-52)	387 GPM
Peretti Wash (J-34)	387 GPM
Churchrock Demand	1544 GPM

(D) Combined City and NTUA Design Demands and Supply

NGWSP supply and City Well supplements are shown below:

NGWSP @ Gallup Receiving Station (J-63)

City of Gallup	6042 GPM
NTUA	3952 GPM
NGWSP Total Supply	9994 GPM

Yah-Ta-Hey Well Supplement (J-14)

City of Gallup	715GPM

Santa Fe Well Supplement (J-64)

City of Gallup	181 GPM
Total Peak Supply	10890 GPM

(E) Local City Demands -

Local City Demands were assigned to various areas of the City. The magnitude of the demands were based on existing flow or pumping records where available with allowances for growth to year 2040. Density and type of existing and future development were considered. City Water Department personnel was consulted to determine location of problem areas of low pressure and where difficulties in maintaining reservoir levels during heavy demands are encountered. Demand values were adjusted by trial and error until their sum equaled the projected Peak Supply Value of year 2040. Fire Flows were assigned to the East and West extremities of the system since heavy flows are most affected by long stretches of transmission lines.

Fire flows of 2000 GPM for duration of 2 hours were set for evaluating this project. These fire flow values are the minimum as recommended in Table A-III-A-I of the 1997 Uniform Fire Code for structures of various fire areas and construction types, many of which can be found in the City. The present City Ordinance which deals with fire codes is limited to recommending a minimum flow of 500 GPM for single and two family dwellings, with general recommendations for sprinkler systems in various structures.

(F) Demand Patterns -

(1) City of Gallup - The normal daily demand pattern for the City is shown on Figure 2. The demand pattern for Fire Flows is shown on Figure 2A. The demand pattern for Peak Day Flow (1.8) within a four (4) day pattern is shown on Figure 2B.

(2) NTUA Systems - Inflow patterns to NTUA systems which flow through the City system at the rates listed, are fixed (constant) and are the same as stated in Section 3(C).

(G) Routing -

Route locations for proposed transmission lines were chosen based on the following criteria.

(1) Ease of construction - Highly developed areas with pavement, utilities, traffic and congestion as well as rugged terrain were avoided to the extent possible for the sake of construction economy.

(2) Proximity to existing system elements - Routes were chosen so that tie-ins to existing zones and other lines to accomplish "looping" are within reasonable limits.

(3) Proximity to land suitable for future growth - Routes were chosen across land with reasonable terrain and land status that may permit development in the future.

(4) Proximity to NTUA Systems - Routes were chosen that provided reasonable proximity to NTUA systems to facilitate tie-ins.

(H) Zones -

The City of Gallup presently delivers water through five (5) different pressure zones as listed below in ascending elevation and partially shown on Figure 3.

		High Water Elevation
(1)	West Zone (Not shown on Figure) - West Tank (T-4)	6650
(2)	Trade Mart Zone (Southwest) - Trade Mart Tank (T-9)	6733
(3)	Country Club Zone - Rehoboth and Country Club Tanks (T-7 and &-5)	6794
(4)	Cresto Zone - Cresto Tank (T-6)	6888
(5)	Southland Zone (Sacred Heart) - Presently Pump Pressured System	7028

With the exception of Gamerco Tank (T-1), high water elevation 6905, the proposed new tanks (reservoirs) were set at elevations with high water elevations that matched existing tanks. This permits sharing of storage and limits distribution system overlapping and associated complexity.

Label	Tank Name	Zone	Volume MG
T-2	Lyons	Country Club	3.0
T-3	Sacred Heart	Southland	1.5
T-8	RR Park	Country Club	2.0
T-10	Southfork	Cresto	2.0

The Gamerco Tank (T-1) high water elevation was set 17 ft. higher than that of the Cresto Zone to ensure transmission capacity to Lyons Tank (T-2). An altitude valve is planned at a location on the line between T-1 and T-2 that would close when T-2 is full. Additionally, a surge control station is anticipated for this line. The Gamerco Tank elevation will be suitable for serving most of the Gamerco Townsite at some time in the future. The City of Gallup presently serves Gamerco and is legally obligated to do so until the year 2003. Service may continue after that time subject to negotiations. The West Tank will be fed by the Gamerco Tank through PRV's (PRV-5 & PRV-11) in a manner similar to the existing system. An altitude valve is planned for Redrock Park Tank (T-8) for separation from Cresto Zone.

There are several long stretches of transmission line in the proposed facilities that will operate at pressures considered too high for residential and commercial service. These lines are strictly transmission lines for transporting water to bolster areas of deficient supply. These lines would, of course, be suitable for providing water to various areas if pressure reducing valves and connecting lines are installed.

(I) Storage -

The total storage volume provided by proposed facilities consisting of existing and new tanks is 29.0 MG, as shown on Table 1. If daily demands total 6938 GPM (9.99 MGD), there would be enough storage to withstand 2.9 days of outage for City demand only. Management of pumping and valving operations would be required to insure that the supply provided by storage would be evenly distributed throughout the system during an extended outage. Storage for the NTUA system is not included. Storage for NTUA systems is to be included in these systems at some point near or past the point of delivery by the City. Preliminary storage and associated costs for NTUA systems are set forth by NNDWR in Ref. 3.

(J) Pump Stations -

Distribution system pumping facilities consist of upgrading existing system pump stations and installation of proposed Lyons pump station as shown on Table 2. Lyons pump station is planned to contain a separate pump arrangement to boost (PMP-1) water supply in the immediate area served by Cresto Tank (Reservoir) and to pump (PMP-6) water to the Southfork tank, Sacred Heart tank and areas to the east.

Existing Yah-Ta-Hey and Santa Fe stations boost well water supplement only to the system. No upgrade or expansion is planned or needed for these stations.

(K) Pressure Reducing Stations -

Pressure reducing stations are planned throughout the system. The stations utilize pressure reducing valves to ensure adequate flow of water from upper to lower zones and to separate zones. Existing and proposed pressure reducing stations are shown on Table 3. Existing PRVs 4 in. and smaller located within the system are not included in the system model. The contribution of these PRVs is small and localized to immediate area down stream.

(L) Flow Metering Stations

NGWSP treated water delivered to the Gallup Receiving Station and flow to the NTUA connections from the system shall be metered. Proposed flow meter stations are contained in Table 4. The maximum flow and meter sizes are shown.

(M) Materials of Construction -

The materials shown in this report for pipeline and storage facilities are not intended to preclude the use of different materials upon detailed design. Some portions of the facility may be better suited for other materials and systems with better resultant economy.

TABLE 1

NAVAJO-GALLUP WATER SUPPLY PROJECT
CITY OF GALLUP

TRANSMISSION AND STORAGE FACILITIES
PROPOSED AND EXISTING STORAGE TANKS (RESERVOIRS)

NAME	MODEL LABEL	ZONE	ELEVATION HIGH WATER	VOLUME (MG)	COMMENT
Gamerco	T-1	Gamerco	6,905	5.5	Proposed
Lyons	T-2	Country Club	6,794	3.0	Proposed
Sacred Heart	T-3	Sacred Heart	7,028	1.5	Proposed
West Tank	T-4	West	6,650	2.0	Existing
Country Club	T-5	Country Club	6,794	5.5	Existing
Cresto	T-6	Cresto	6,888	2.5	Existing
Rehoboth	T-7	Country Club	6,794	2.0	Existing
Redrock Park	T-8	Country Club	6,794	2.0	Proposed
Trade Mart	T-9	Trade Mart	6,733	3.0	Existing
South Fork	T-10	Cresto	6,888	2.0	Proposed

Summary:

Existing Storage Volume = 15.0 MG
Proposed Storage Volume = 14.0 MG

Total Storage = 29.0 MG

1

TABLE 2

NAVAJO-GALLUP WATER SUPPLY PROJECT
CITY OF GALLUP

TRANSMISSION AND STORAGE FACILITIES
PROPOSED AND EXISTING PUMP STATIONS

NAME	MODEL LABEL	DISCHARGE ZONE	DESIGN CRITERIA DISCHARGE (GPM)	HEAD (FT.)	COMMENT
Lyons	PMP-1	Cresto	1000	165	Proposed
Lyons	PMP-6	Cresto	3500	185	Proposed
Country Club	PMP-3	Cresto	600	140	Upgrade
East	PMP-4	Country Club	1300	180	Upgrade
Cresto	PMP-5	Sacred Heart	800	160	Upgrade
Yah-Ta-Hey	J-14	Country Club	Existing Well Field Pump		
Santa Fe	J-64	Trade Mart	Existing Well Field Pump		

1

TABLE 3

NAVAJO-GALLUP WATER SUPPLY PROJECT
CITY OF GALLUP

TRANSMISSION AND STORAGE FACILITIES
PROPOSED AND EXISTING PRESSURE REDUCING STATIONS

MODEL LABEL	UPPER ZONE	LOWER ZONE	SIZE (IN.)	COMMENT
PRV-3	Country Club	Trade Mart	8	Existing
PRV-4	Gamerco	Trade Mart	8	Proposed
PRV-5	Trade Mart	West	8	Existing
PRV-8	Cresto	Country Club	10	Proposed
PRV-10	Cresto	Country Club	10	Proposed
PRV-11	Gamerco	West	12	Proposed
PRV-12	Cresto	Country Club	10	Proposed
PRV-13	Country Club	Trade Mart	5	Proposed

TABLE 4

NAVAJO-GALLUP WATER SUPPLY PROJECT
CITY OF GALLUP

TRANSMISSION AND STORAGE FACILITIES
PROPOSED FLOW METERING STATIONS

NAME (NODE)	SERVICE	MAXIMUM FLOW (GPM)	SIZE (IN.)
GALLUP RECEIVING (J-63)	City of Gallup and NTUA	9994	24
PERETTI WASH (J-34)	NTUA	387	4
SUNDANCE (J-52)	NTUA	387	4
CHURCHROCK (J-51)	NTUA	770	6
REDROCK CHAPTER (J-9)	NTUA	1930	10
MANUELITO/SPENCER VALLEY (J-54)	NTUA	478	4

See Appendix G for Tabular Geographic Coordinated Locations and Elevations

4. Model Results:

(A) General -

Computer software, utilizing iteration methods was used to simulate dynamic conditions in the proposed facilities. Extended Period Simulation was used to examine behavior of the system over several days during the peak summer time use (Summer Demand Scenario) period. Tanks, pump and valve configurations as used in the model can be seen in Appendices B, C, and D of this report. Nodal and pipeline information is contained in Appendices E and F. Hour 0.00 represents 12:00 midnight in the time varying illustrations that follow.

The behavior of reservoir levels during this heavy use period was considered one of the most important indicators of system performance. Other important indicators are nodal pressure and pipeline velocities. These indicators were also observed in specific areas when fire flow scenarios were introduced during summer time flows. Summer Fire J-77 scenario represents a 2 hr. 2000 GPM fire at Redrock Park. Summer Fire J-78 scenario represents a 2 hr. 2000 GPM fire at County Road No. 1 and US 66.

A Peak Day Demand scenario occurring during the Summer Demand scenario was also investigated. The peak factor of 1.8 would be typically encountered according to DAVIS' HANDBOOK OF APPLIED HYDRAULICS - Table 7 (Ref. No. 5), although recent City production records would not indicate such.

(B) Reservoir Levels -

(1) Summer Demand Scenario

Fluctuations in reservoir levels can be seen in Figures 4 through 13. The scenario was begun with reservoir levels down from 2 to 4 ft. (below high water level). Most of the tanks (reservoirs) show that they are filled before or shortly after the first daily cycle. Southfork Tank (T-10) shows a steady trend toward filling after starting at a 92% level. The valve PRV-13 was set to limit the filling of the Trade Mart Tank (T-9) which seemed to be thieving water from the Country Club Tank (T-5) in preliminary runs. Tank T-9 otherwise has no problem filling.

Actual demands for a system will, of course, be more random and less predictable. The model does indicate however, that such a system can achieve reasonable distribution of the water to the City and adjacent communities. Adjustment of pump controls, PRV's and altitude valves can also be used to fine tune water flow in an actual system

FIGURE 4

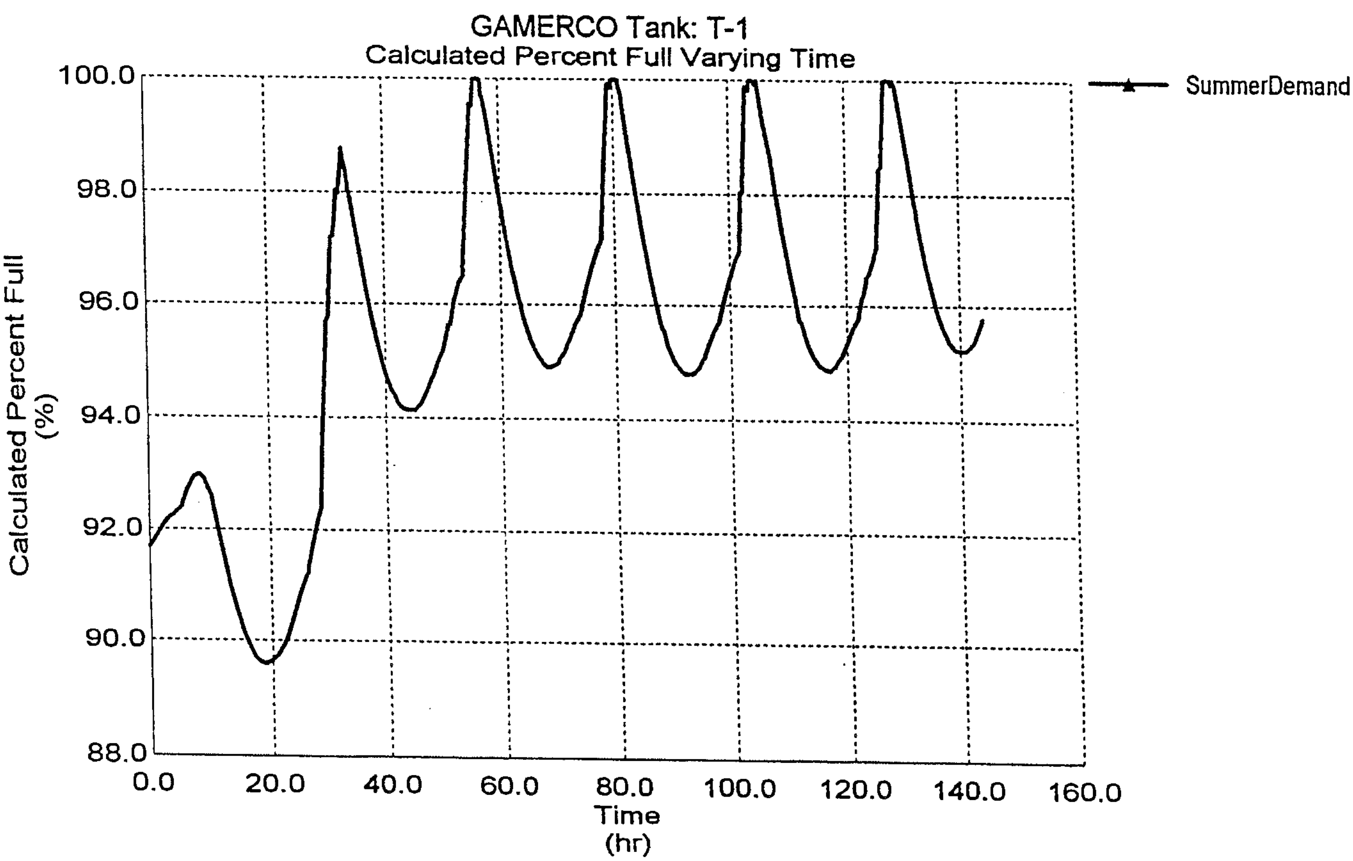

GAMERCO Tank: T-1
Calculated Percent Full Varying Time
SummerDemand
Calculated Percent Full
(%)
100.0
98.0
96.0
94.0
92.0
90.0
88.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)

FIGURE 5

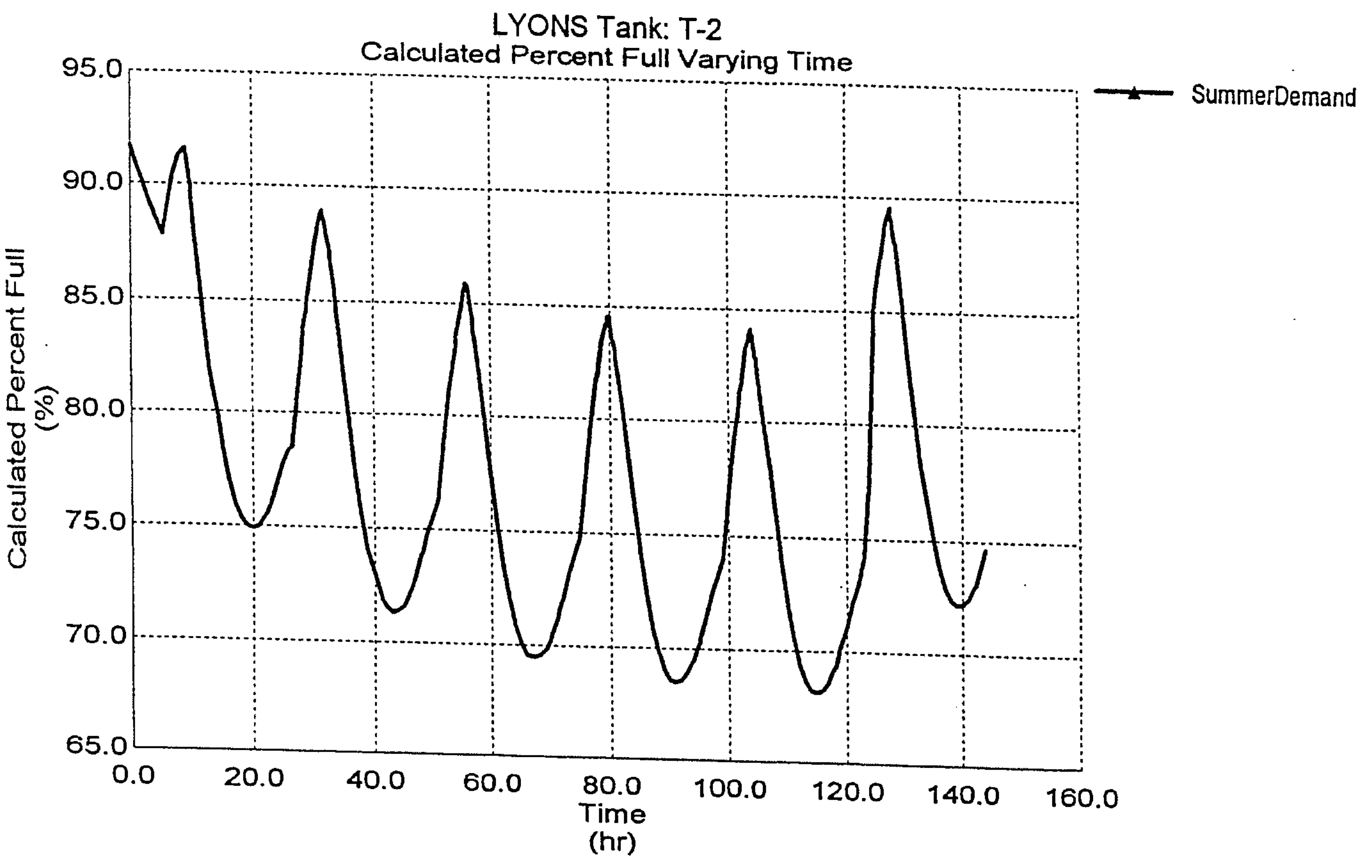

LYONS Tank: T-2
Calculated Percent Full Varying Time
95.0
90.0
85.0
80.0
75.0
70.0
65.0
Calculated Percent Full
(%)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)
SummerDemand

FIGURE 6

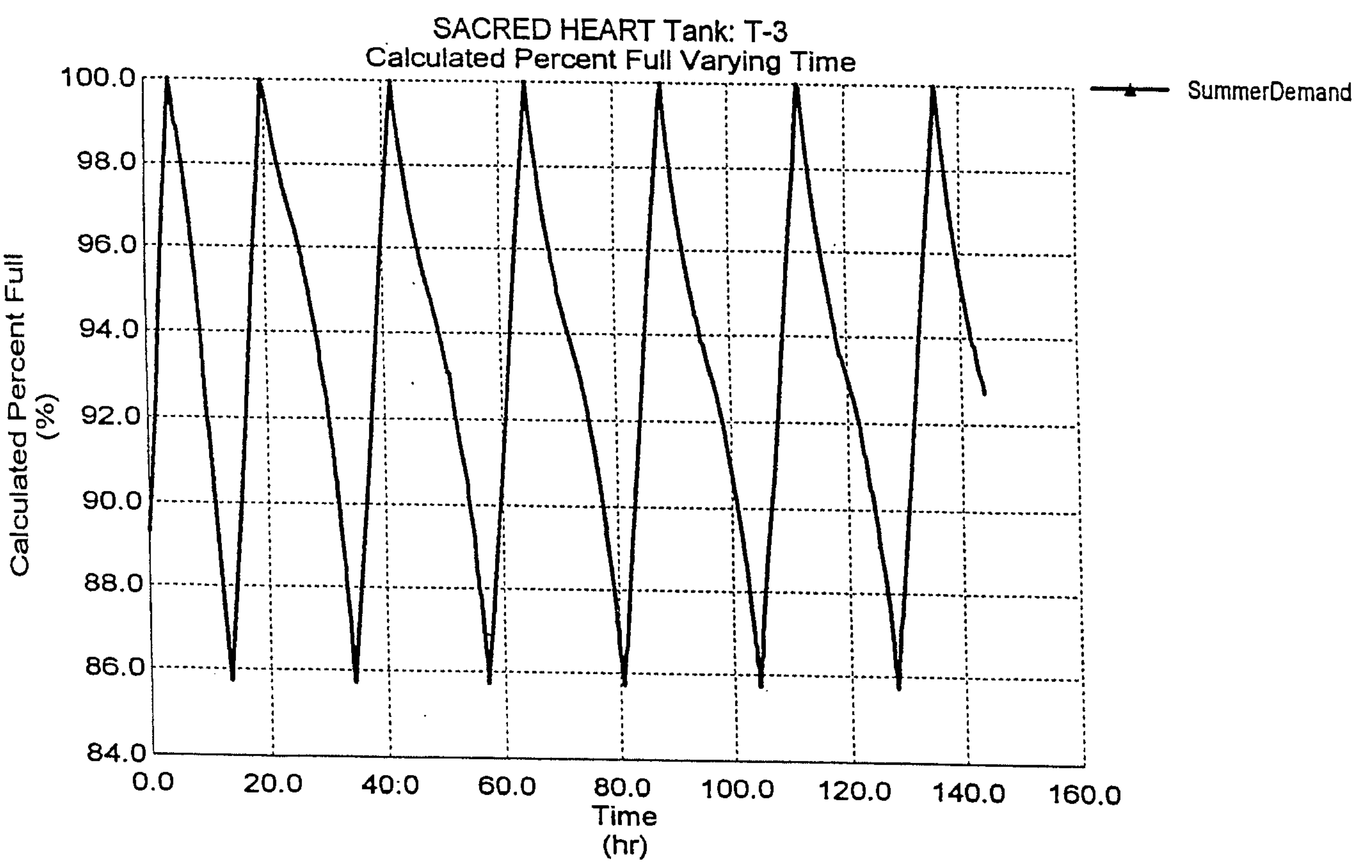

SACRED HEART Tank: T-3
Calculated Percent Full Varying Time
SummerDemand
Calculated Percent Full
(%)
100.0
98.0
96.0
94.0
92.0
90.0
88.0
86.0
84.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)

FIGURE 7

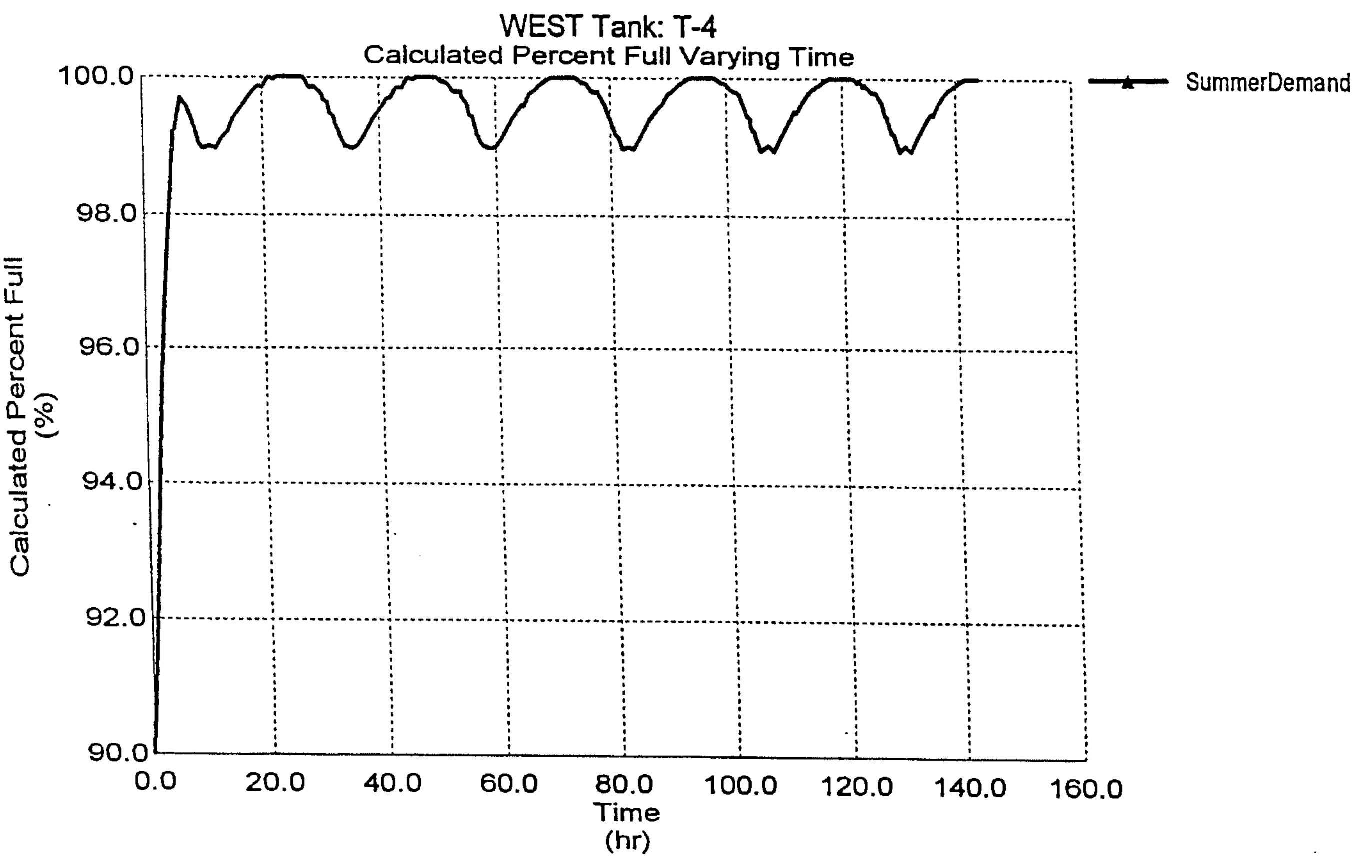

WEST Tank: T-4
Calculated Percent Full Varying Time
SummerDemand
Calculated Percent Full
(%)
100.0
98.0
96.0
94.0
92.0
90.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)

FIGURE 8

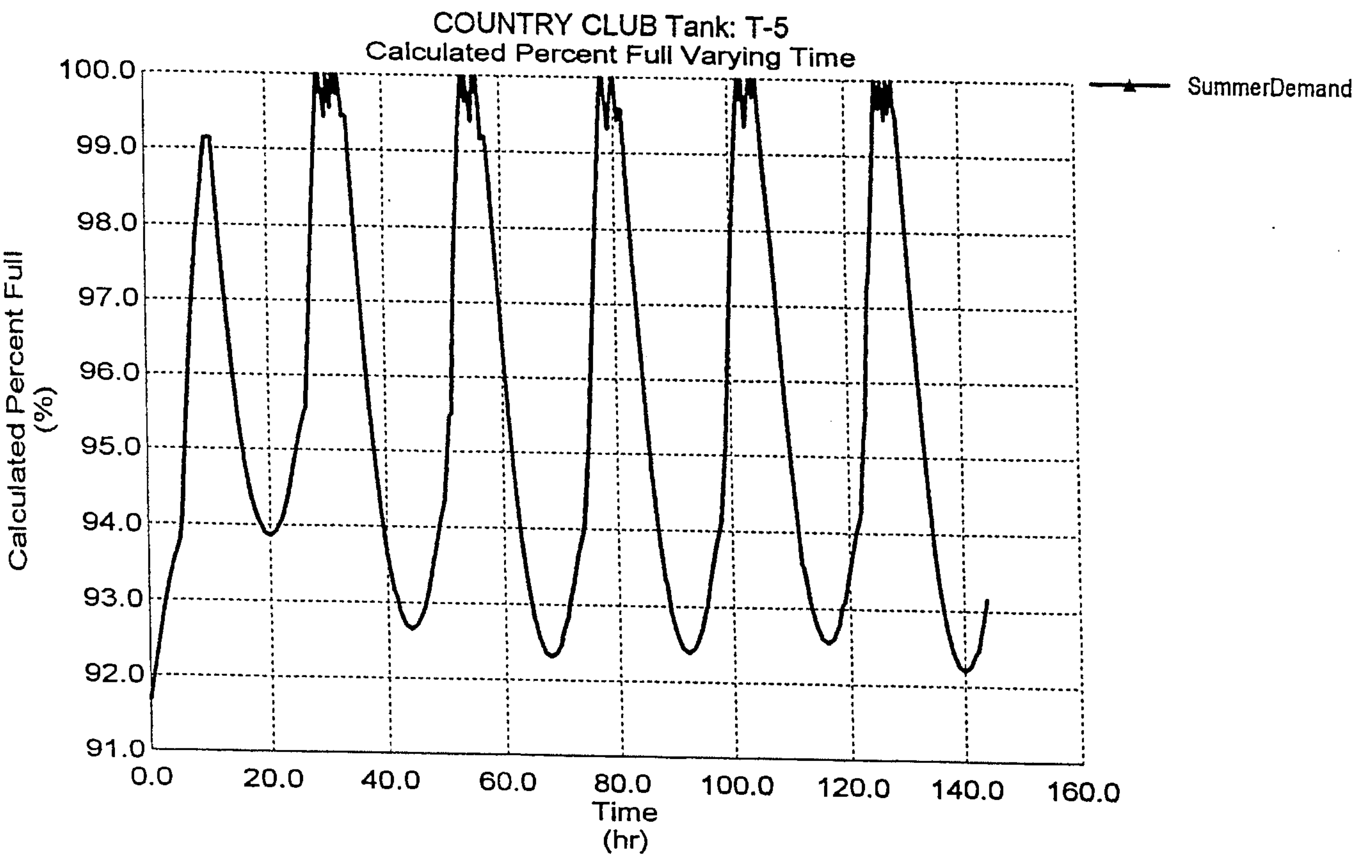
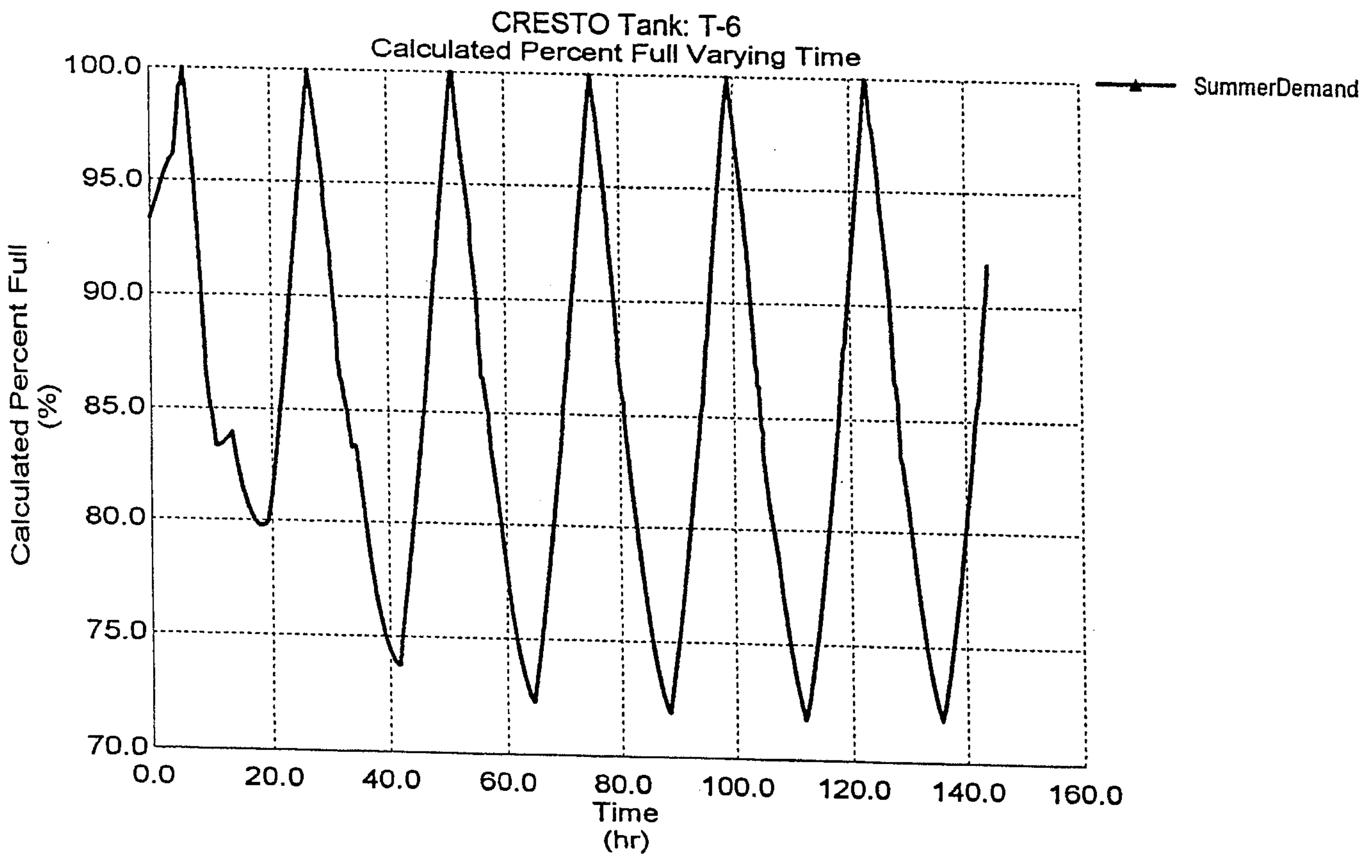

COUNTRY CLUB Tank: T-5
Calculated Percent Full Varying Time
SummerDemand
Calculated Percent Full
(%)
100.0
99.0
98.0
97.0
96.0
95.0
94.0
93.0
92.0
91.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)

FIGURE 9



CRESTO Tank: T-6
Calculated Percent Full Varying Time
100.0
95.0
90.0
85.0
80.0
75.0
70.0
Calculated Percent Full
(%)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)
SummerDemand

FIGURE 10

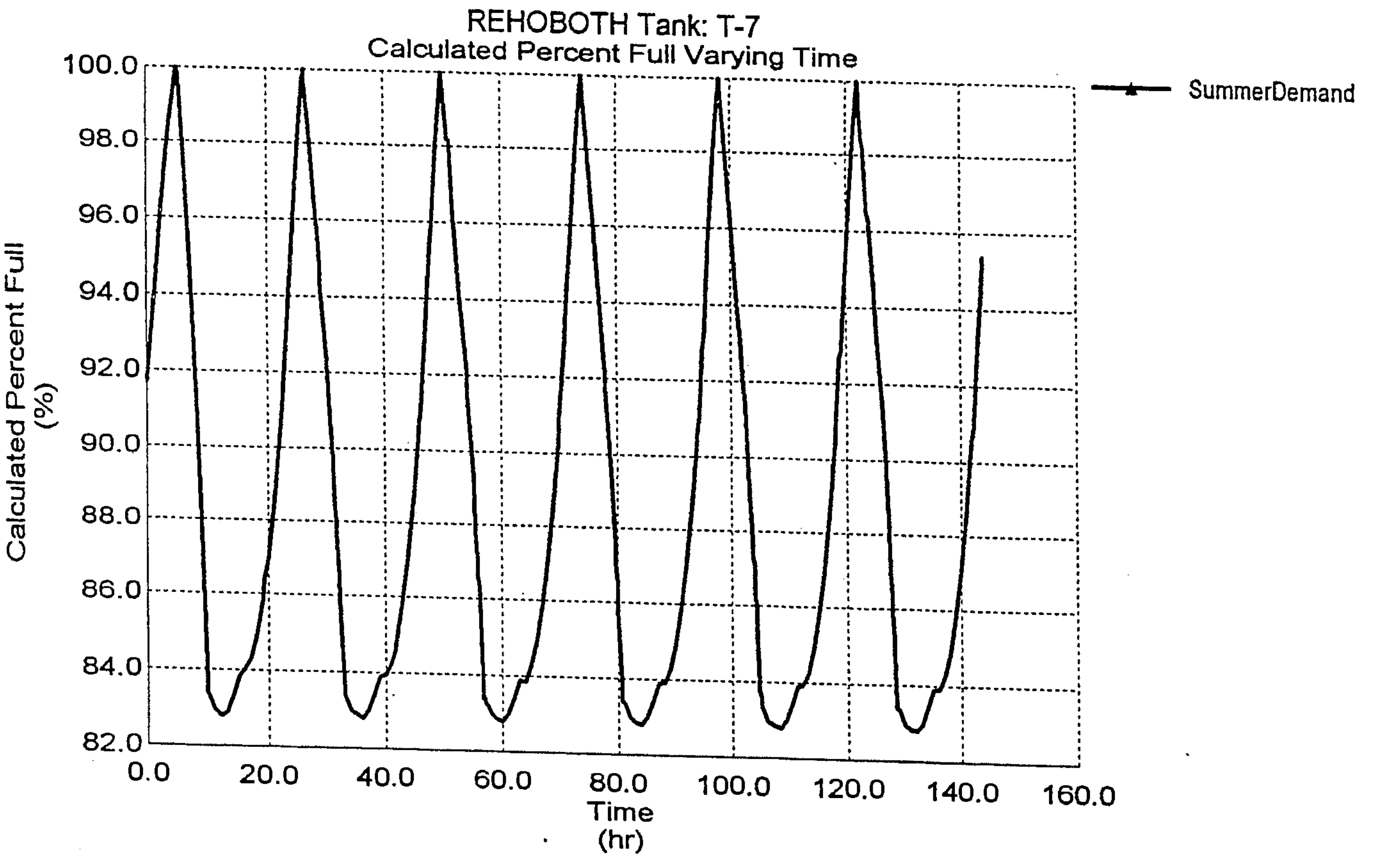
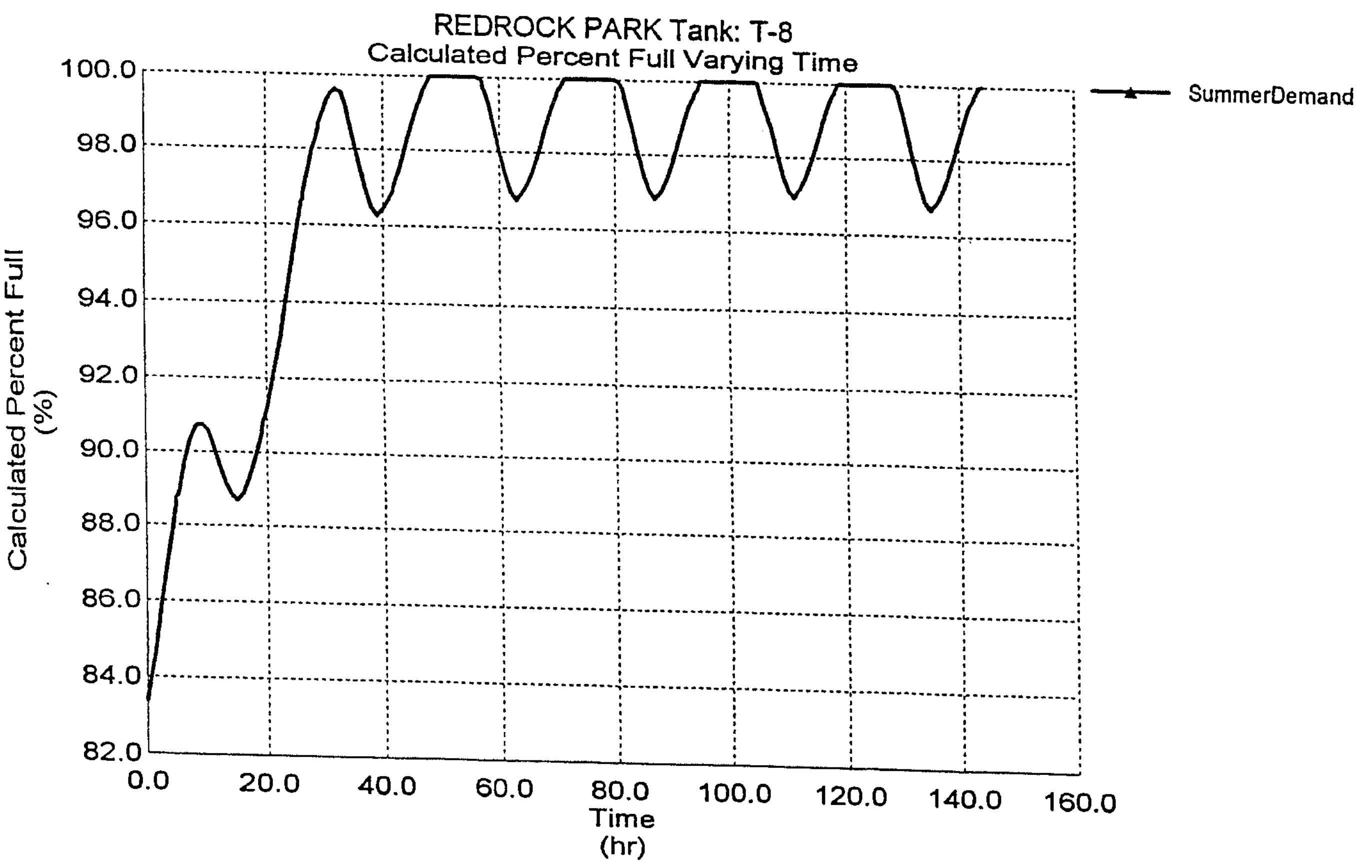
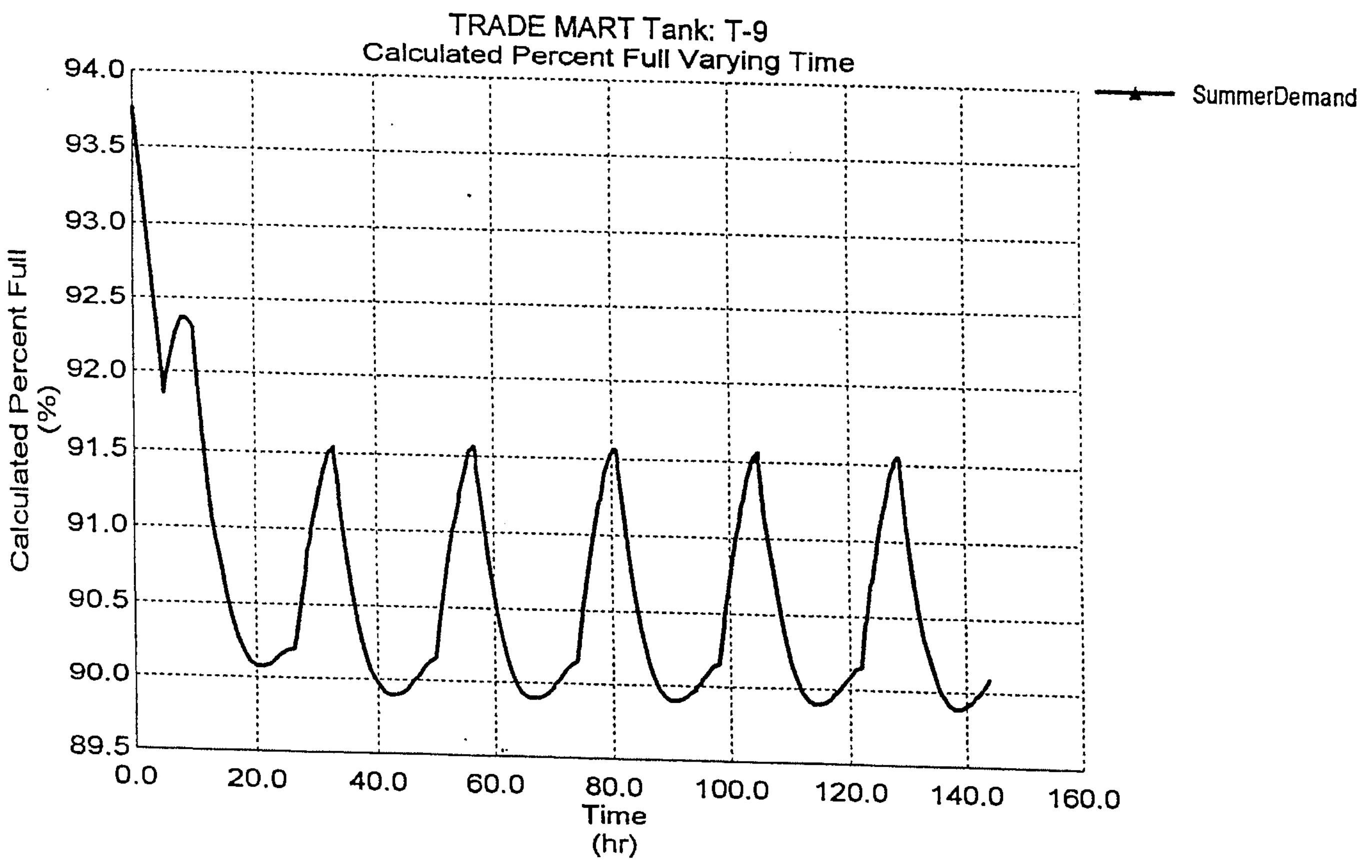

REHOBOTH Tank: T-7
Calculated Percent Full Varying Time
SummerDemand
Calculated Percent Full
(%)
100.0
98.0
96.0
94.0
92.0
90.0
88.0
86.0
84.0
82.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)

FIGURE 11



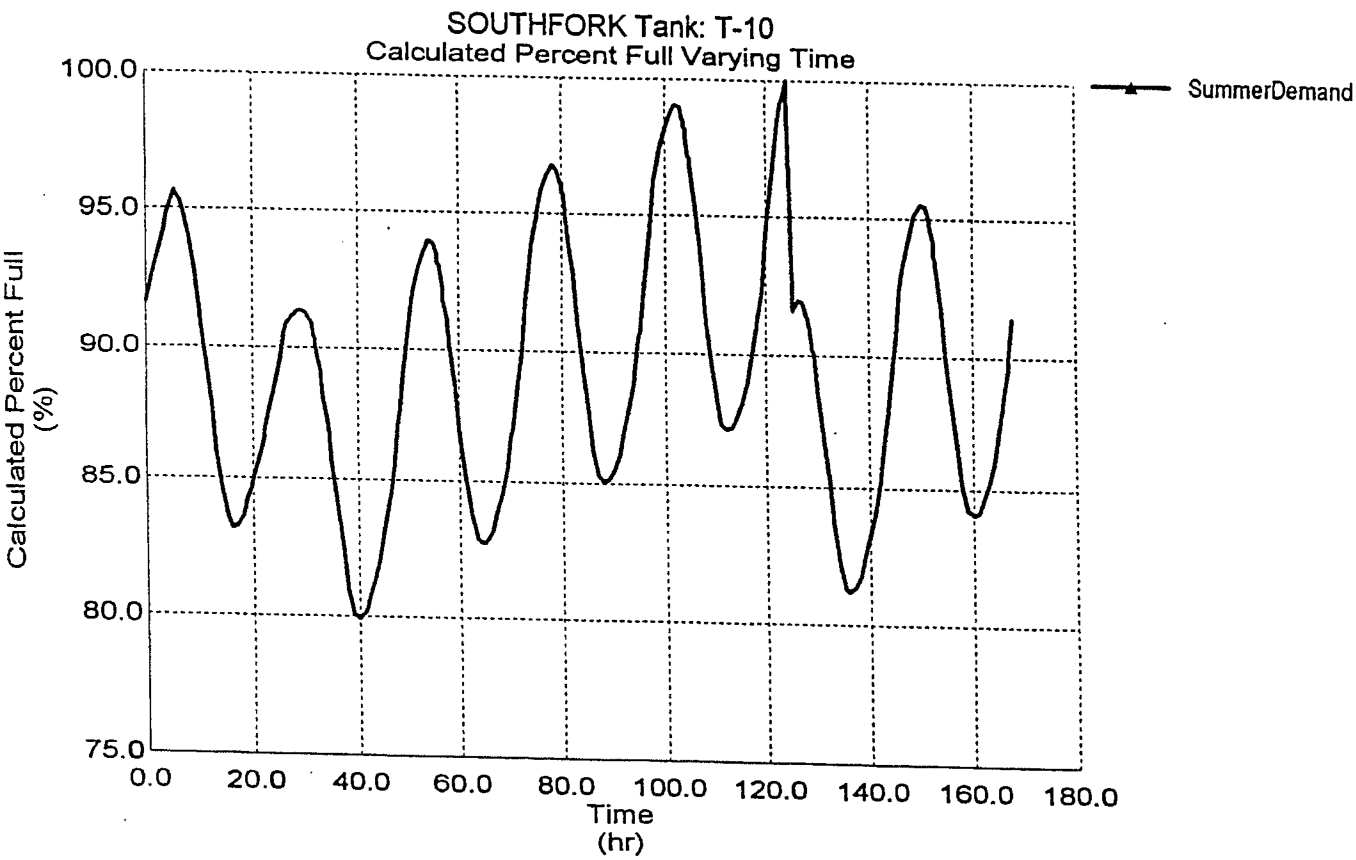
REDROCK PARK Tank: T-8
Calculated Percent Full Varying Time
100.0
98.0
96.0
94.0
92.0
90.0
88.0
86.0
84.0
82.0
Calculated Percent Full
(%)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)
SummerDemand

FIGURE 12



TRADE MART Tank: T-9
Calculated Percent Full Varying Time
SummerDemand
Calculated Percent Full (%)
94.0
93.5
93.0
92.5
92.0
91.5
91.0
90.5
90.0
89.5
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time (hr)

FIGURE 13


SOUTHFORK Tank: T-10
Calculated Percent Full Varying Time
100.0
95.0
90.0
85.0
80.0
75.0
Calculated Percent Full
(%)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
Time
(hr)
SummerDemand

(2) Summer Fire J-77 Scenario

The fire flow at node J-77 represents a fire in the Redrock Park which is at the extreme east end of the Gallup City limits. Figure 14 shows that the water level in Tank T-8 (Redrock Park) drops to 79% immediately after the fire flow and begins steady recovery afterward.

(3) Summer Fire J-78 Scenario

The fire flow at node J-78 represents a fire in the truck stops area in western Gallup near County Road No. 1. Figure 14A shows a slight dip in Tank T-4 (West) levels with quick recovery afterward.

(4) Peak Day Demand Scenario

The Peak Day Demand scenario as defined herein should be considered a somewhat unusual situation based on City production records. The scenario was, however, investigated to determine how the system would react. The two tanks that showed substantial effects were the Lyons Tank (T-2) and Southfork (T-10). Figures 14B and 14C show reservoir levels of the two tanks with supplemental well flows of 896 GPM, the same as were required to meet total demands under the Summer Demand scenario. Tank T-2 shows a drastic drop to the 45% level at hour 65 with a slow recovery trend thereafter. Tank T-10 shows a substantial drop to the 55% level at hour 43 with a slow recovery trend thereafter.

Figures 14D and 14E show reservoir levels of the two tanks with supplemental well flows of 3208 GPM (4.6 MGD)which would be required to make the daily system inflow (supply) equal to demand. This flow is higher than present average daily flow. The initial drop in reservoir levels is less severe and subsequent recovery trends more rapid than the situation above. In summary, the Peak Day Demand, should it occur, would have as dramatic effect on certain reservoir levels, but recovery is possible especially with increased supplemental flows from City wells.

(C) Nodal Pressures

(1) Summer Demand Scenario

General variations can be seen in color coded nodal pressures in Figures 15 and 16. More precise values are listed in Tables 1 and 2 of Appendix E. The values shown for both illustrations are for the randomly selected hours of 11.0 and 21.0.

FIGURE 14

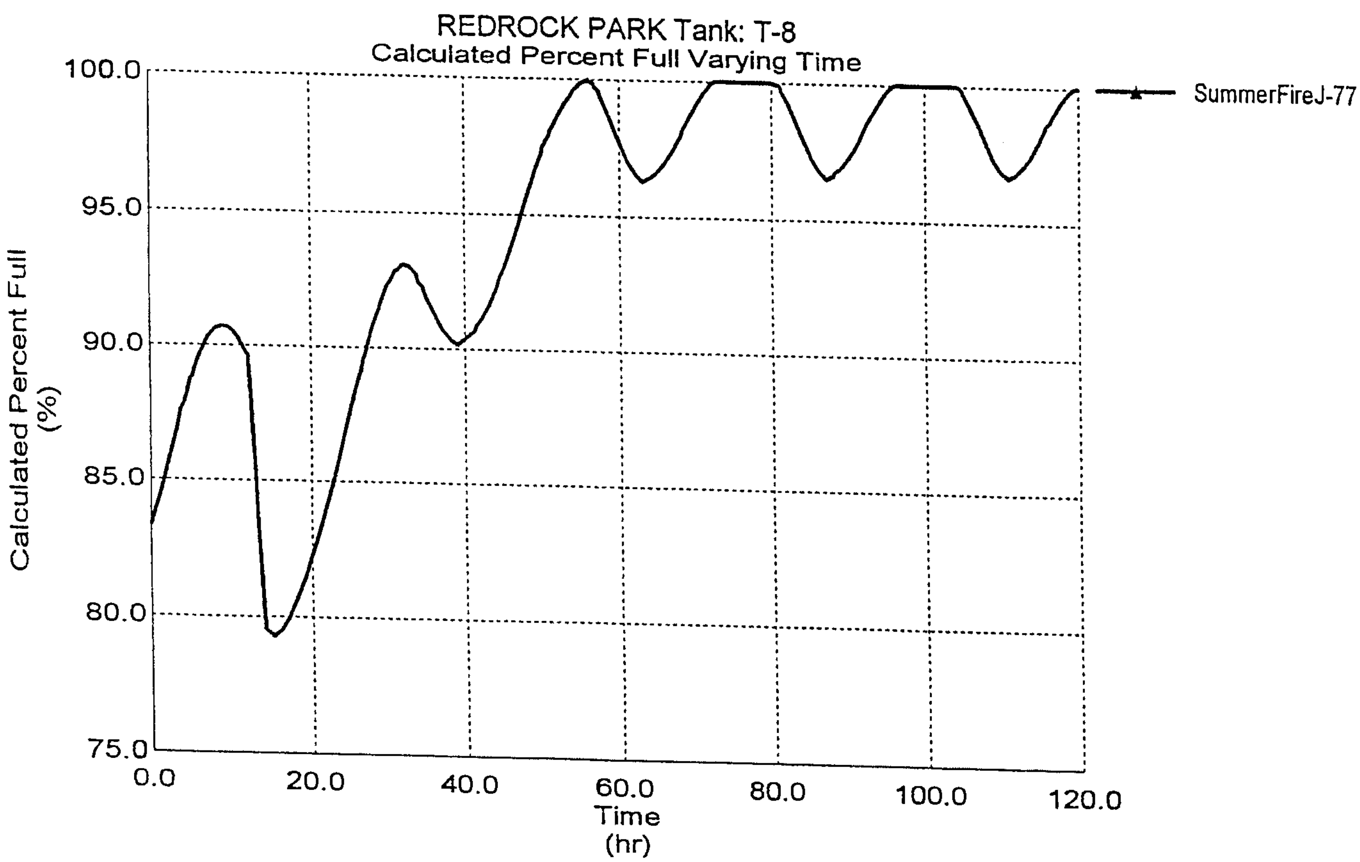

REDROCK PARK Tank: T-8
Calculated Percent Full Varying Time
100.0
95.0
90.0
85.0
80.0
75.0
Calculated Percent Full
(%)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
Time
(hr)
SummerFireJ-77

FIGURE 14A

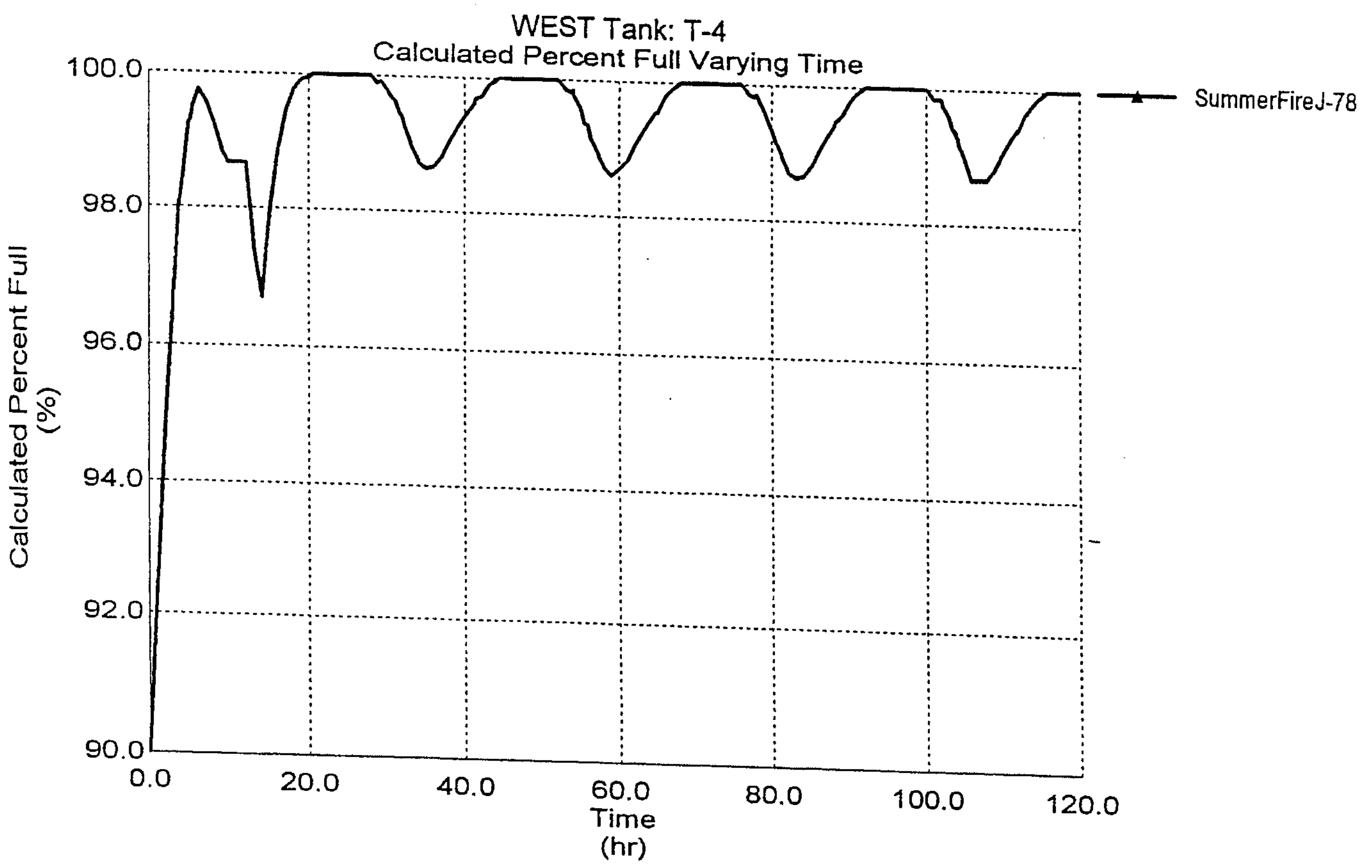

WEST Tank: T-4
Calculated Percent Full Varying Time
100.0
98.0
96.0
94.0
92.0
90.0
Calculated Percent Full
(%)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
Time
(hr)
SummerFireJ-78

FIGURE 14 B

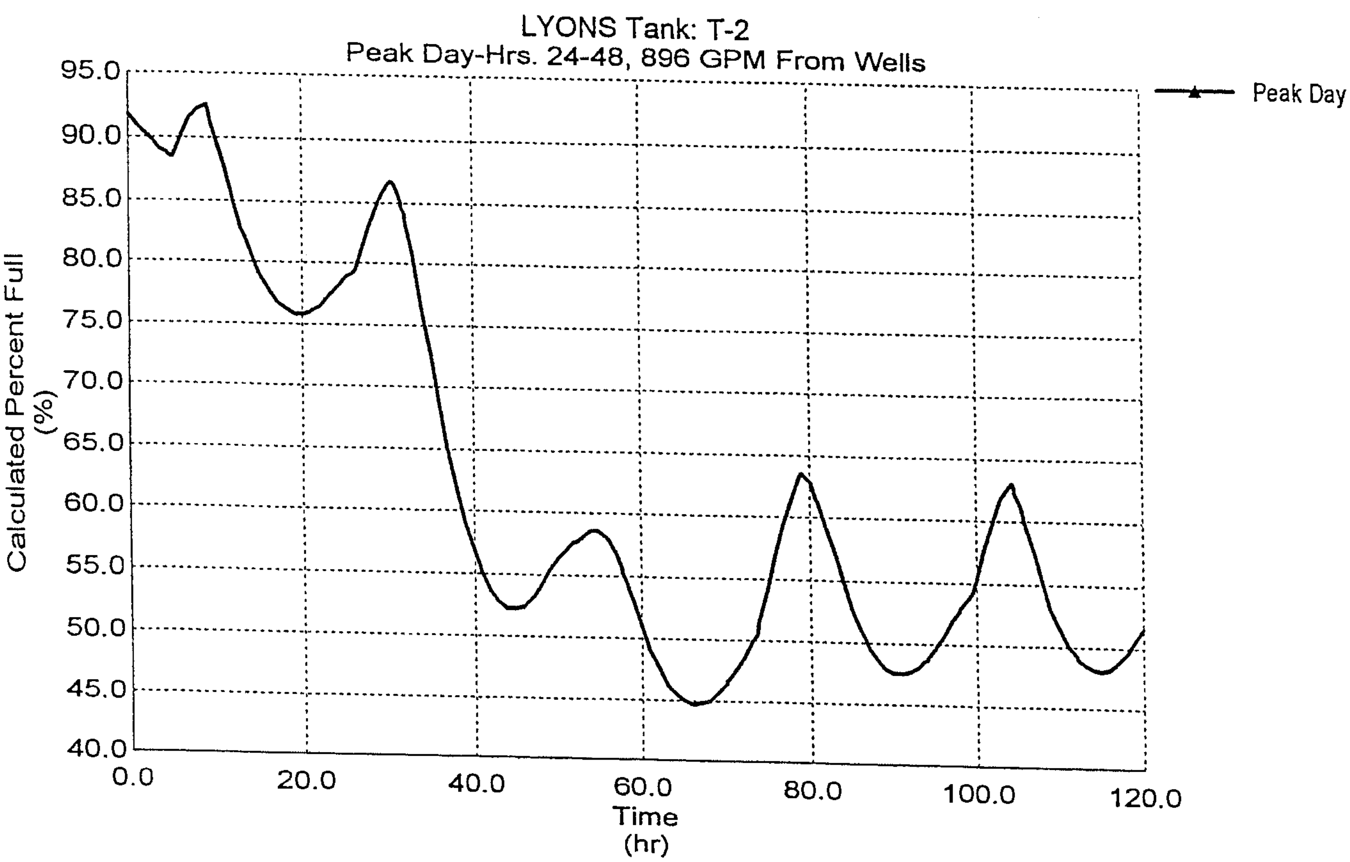

LYONS Tank: T-2
Peak Day-Hrs. 24-48, 896 GPM From Wells
Calculated Percent Full
(%)
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
Time
(hr)
Peak Day

FIGURE 14C

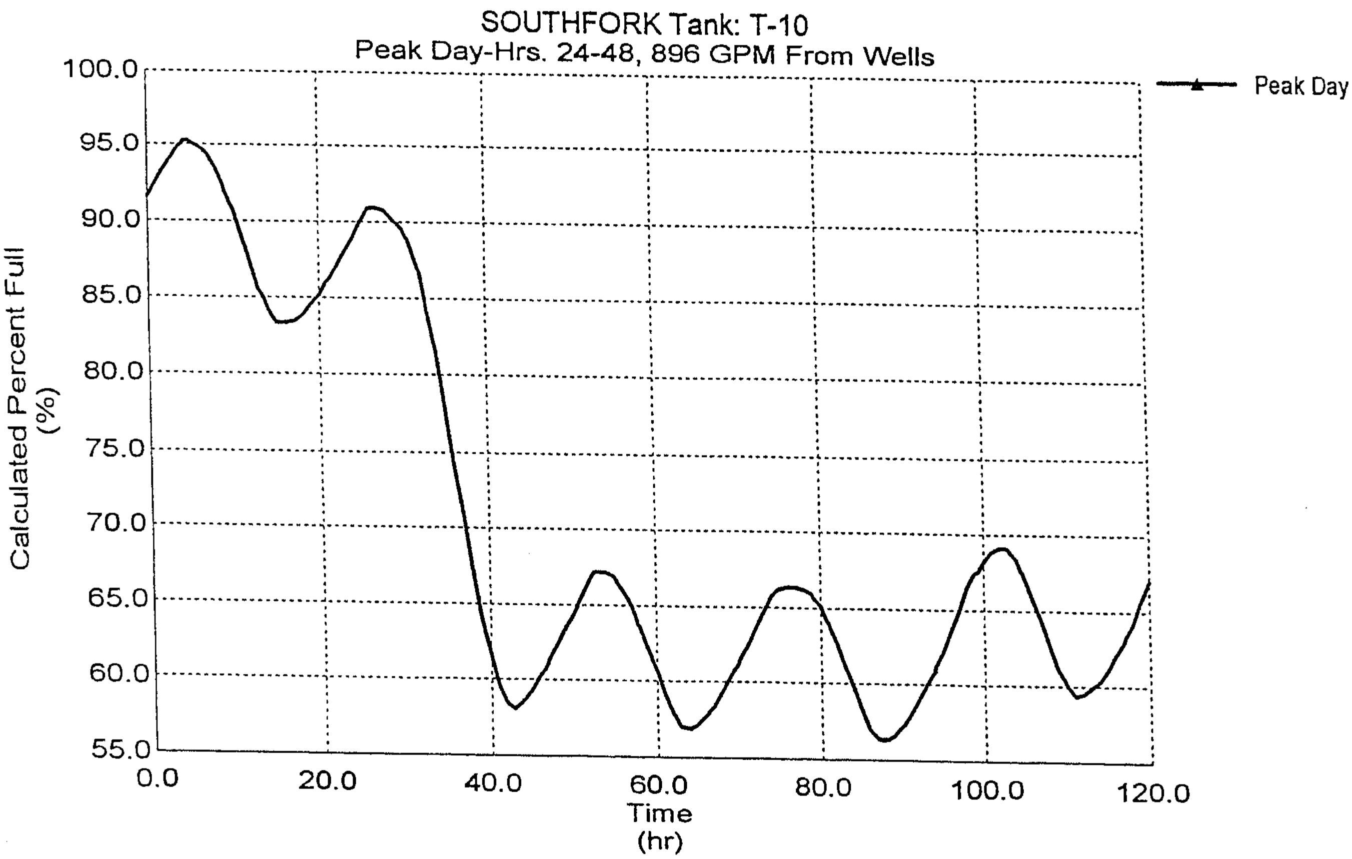

SOUTHFORK Tank: T-10
Peak Day-Hrs. 24-48, 896 GPM From Wells
Peak Day
Calculated Percent Full
(%)
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
Time
(hr)

FIGURE 14 D

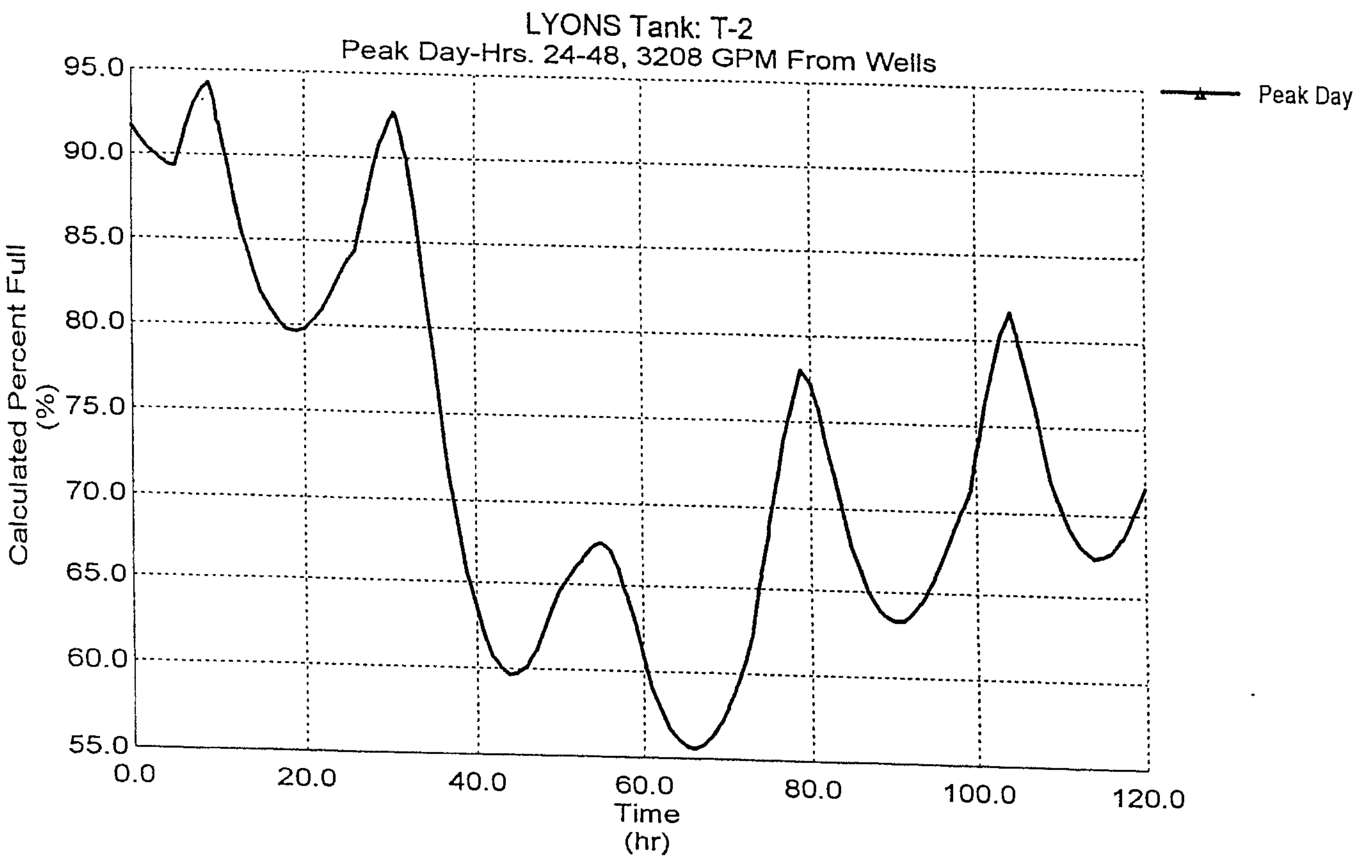
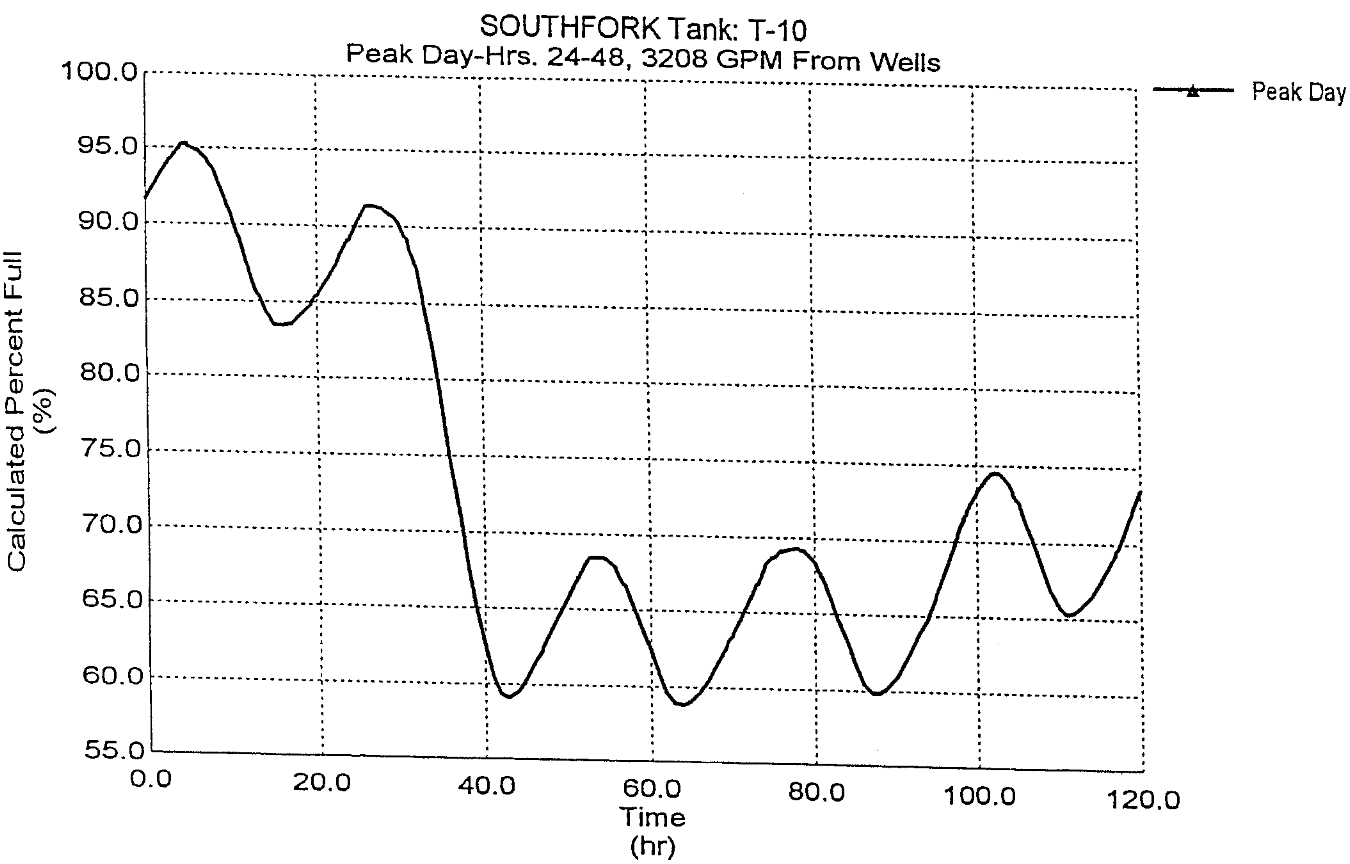
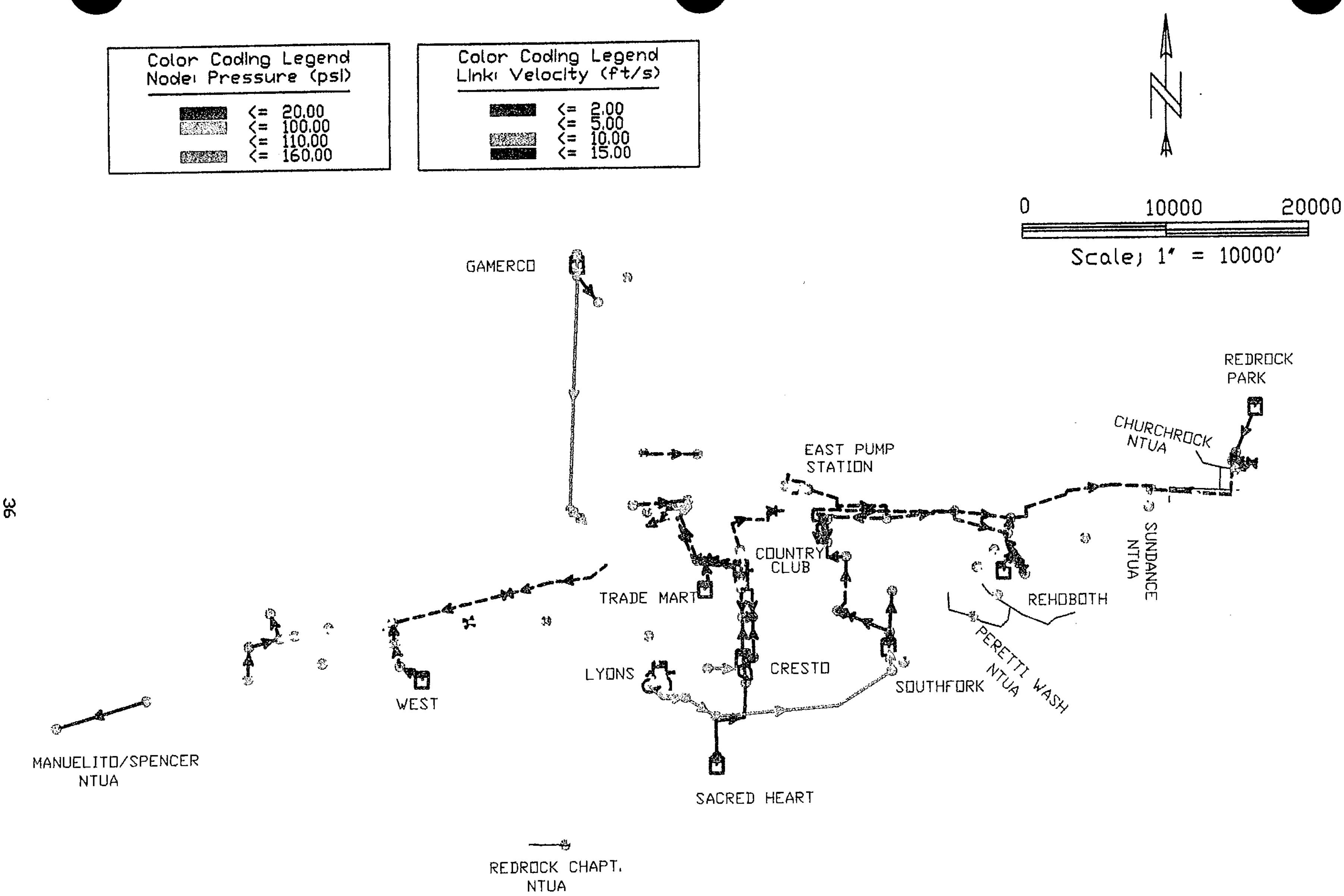
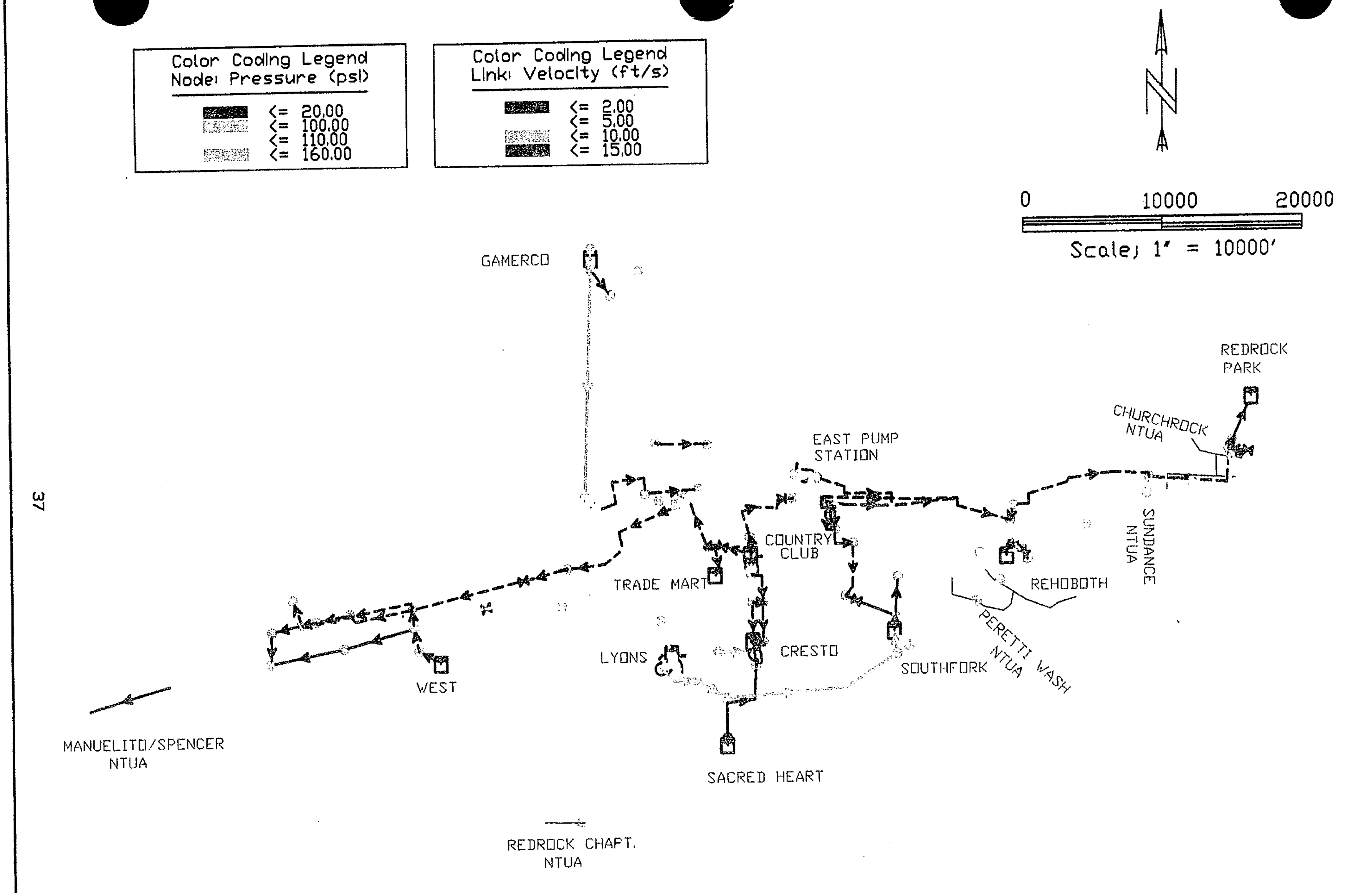

LYONS Tank: T-2
Peak Day-Hrs. 24-48, 3208 GPM From Wells
Peak Day
Calculated Percent Full
(%)
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
Time
(hr)

FIGURE 14E


SOUTHFORK Tank: T-10
Peak Day-Hrs. 24-48, 3208 GPM From Wells
Peak Day
Calculated Percent Full
(%)
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
Time
(hr)



DEPAULI ENGINEERING & SURVEYING CO. GALLUP, NEW MEXICO 601 W. AZTEC AVE. 505-863-5440	NORTHWEST NEW MEXICO COUNCIL OF GOVERNMENTS USDA RURAL BUSINESS ENTERPRISE GRANT CITY OF GALLUP & ADJACENT COMMUNITIES WATER SUPPLY DISTIBUTION SYSTEM	SUMMER DEMAND PIPELINE VELOCITIES & NODAL PRESSURES HOUR 11.0	DATE: Dec. 2000 FIGURE 15



DEPAULI ENGINEERING & SURVEYING CO. GALLUP, NEW MEXICO 601 W. AZTEC AVE. 505-863-5440	NORTHWEST NEW MEXICO COUNCIL OF GOVERNMENTS USDA RURAL BUSINESS ENTERPRISE GRANT CITY OF GALLUP & ADJACENT COMMUNITIES WATER SUPPLY DISTIBUTION SYSTEM	SUMMER DEMAND PIPELINE VELOCITIES & NODAL PRESSURES HOUR 21.0	DATE: Dec. 2000 FIGURE 16

High pressures in excess of 110 PSI can be seen on lines on the immediate discharge side of the East Pump Station (PMP-4). Pressure at the northside of the Mossman area (J-21) are shown at 112 PSI for hour 21.0 which is a period when East Pump Station pumps are running. Static pressure (no demands and no pumping) is calculated at 108 PSI. The pressure resulting from East Pump Station pumping is the limiting factor for pump sizing at the station. Pump capacity is in return, the limiting factor in delivering water to the eastern extremities of the City. The addition of lines proposed this project is intended to alleviate this situation.

The existing 16" line which carries water from the Yah-Ta-Hey field, the proposed 24" line from the Gamerco Tank and the 10" line to Spencer Valley also show nodes with pressures in excess of 110 PSI (See nodes J-16, J-3 and J-49 respectively). These pressure points are located in the lower reaches of the Rio Puerco Valley, and are on lines primarily used for transmission .

Nodes indicating low pressure (less than 20 PSI) are not evident except on the suction side of the Lyons Pump Station (See J-8) where it connects to Lyons Tank. Detailed design may dictate the type of pump used or the setting elevation of the pump station. The elevation and pressure at node J-69, which is located at the proposed pipeline bore in the Hogback, had a significant effect on the sizing of the upstream pipeline and location of the Hogback crossing. It is desirable to maintain a positive pressure at this location during high flows. The actual elevation of the proposed bore to be set during final design will be governed by such resulting pressures.

(2) Summer Fire J-77 Scenario

System pressures in the vicinities of fire flows are, of course, important. Figure 17 shows a residual system pressure of 55 PSI ± at nearby node J-27 during Fire Flow at Redrock Park.

(3) Summer Fire J-78 Scenario

Figure 18 shows a residual system pressure of 32.0 PSI ± at nearby node J-56 during Fire Flow in the truck stop area of western Gallup.

FIGURE 17

FIRE @ REDROCK PARK (East Gallup)

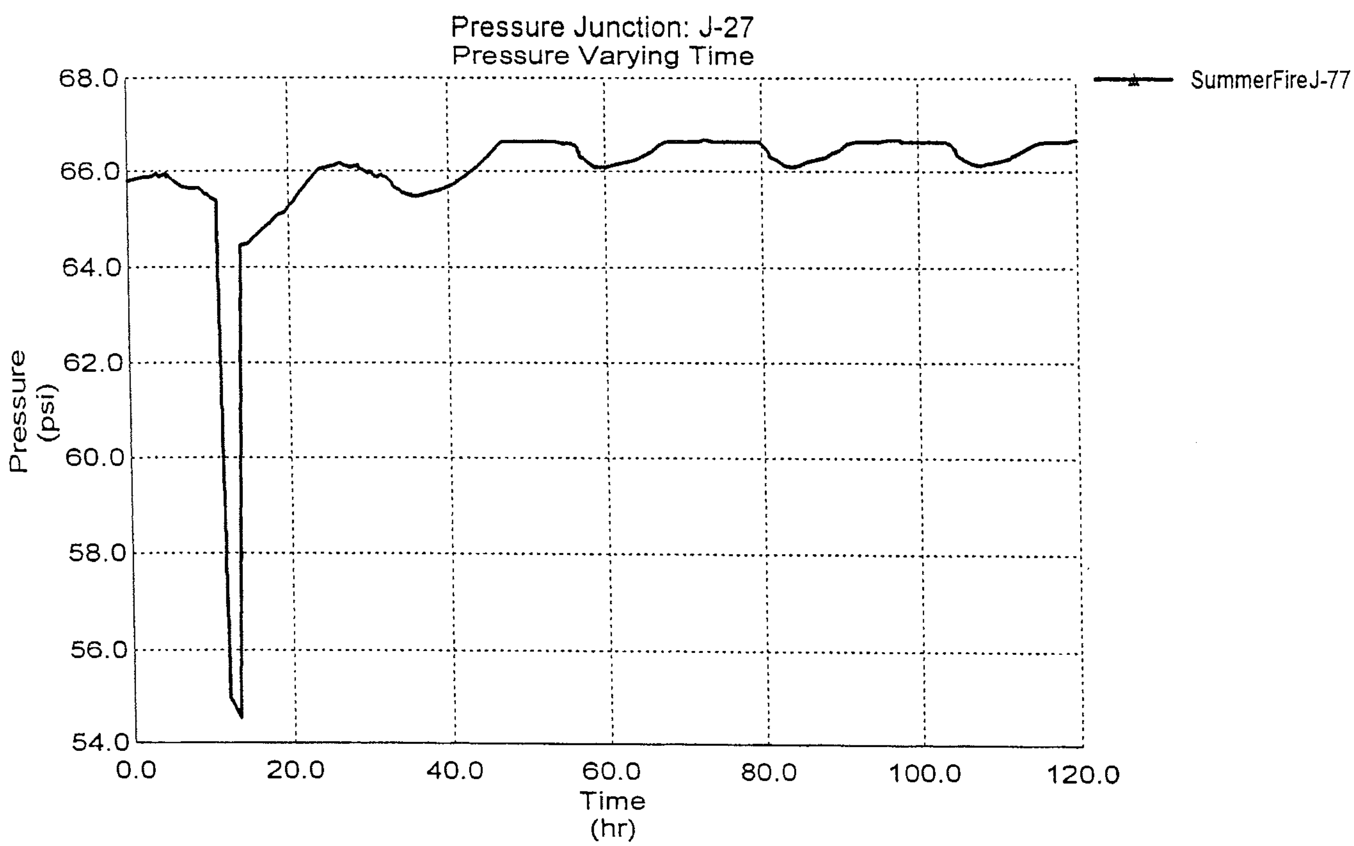
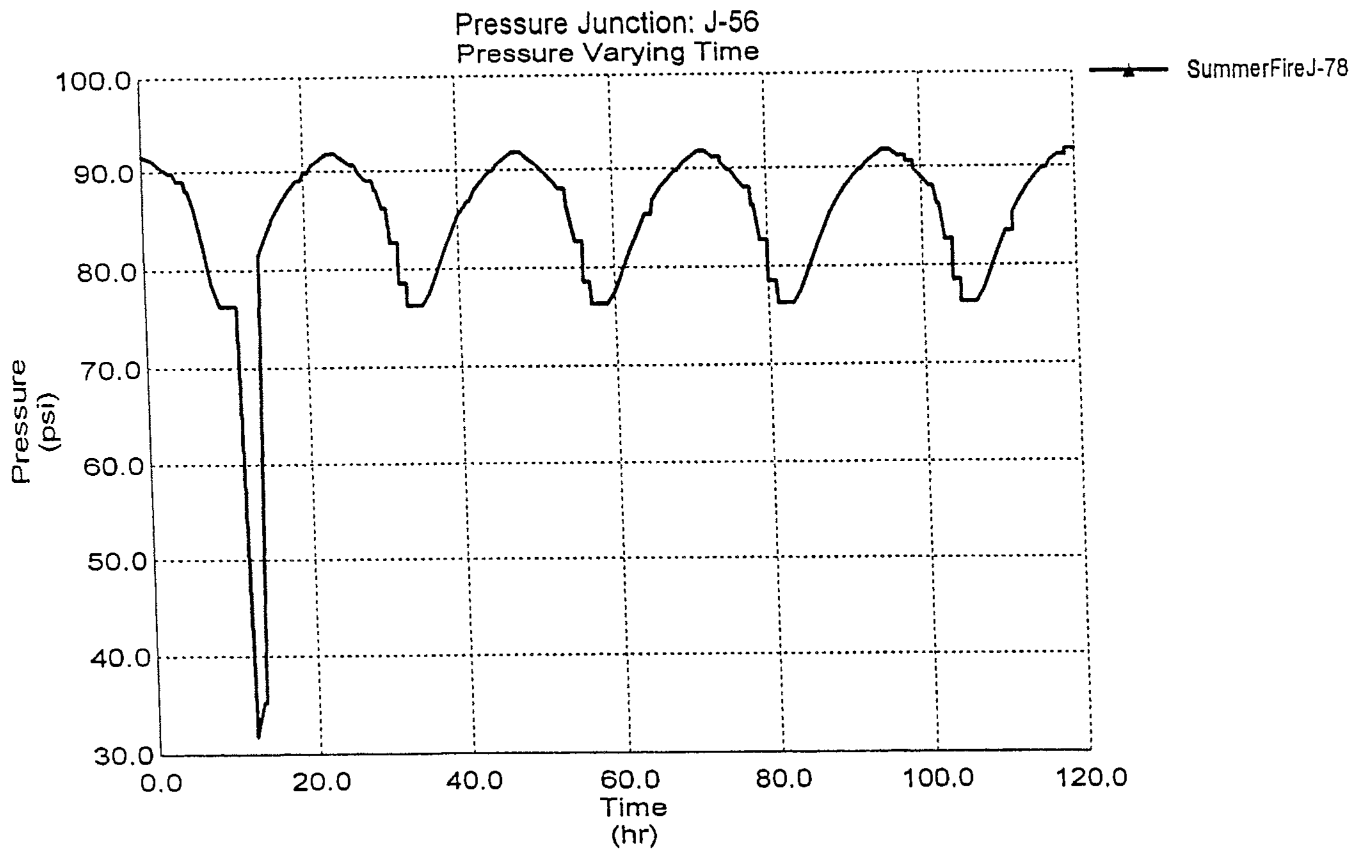


FIGURE 18

FIRE IN WEST GALLUP



(D) Pipeline Velocities -

(1) Summer Demand Scenario

General velocity variations can also be seen in Figures 15 and 16 with more precise values listed in Tables of Appendix F. Pipeline velocities are important for considerations of water quality, head loss and system surges. Most of the velocities noted on computer results for proposed transmission facilities during a 24 hr. cycle vary from 2 FPS to 6 FPS. Velocities through piping at the existing PRV - 3 station in central Gallup (P-64 and P-65) are in excess of 13 FPS. Many of the low velocities that occur during the day are within existing pipelines in the City. This is most noted on lines on the discharge side of the East Pump Station (PMP-4). Increases in pump discharge rates to increase velocities (to improve transmission rates) would create unacceptable pressures in the area.

(2) Summer Fire J-77 Scenario

Figure 19 shows a velocity of 4.9 FPS ± in P-152 during Fire Flow at Redrock Park. This line is the Tank (Reservoir) feed line and is affected the most, from a velocity standpoint, of all of the pipelines in the vicinity during such an event. Low velocities during more normal days are noted.

(3) Summer Fire J-78 Scenario

Figure 20 shows a velocity of 8.2 FPS ± in P-137 during Fire Flow in the truck stop area of West Gallup. This line, although some distance from the event, is the most affected.

(E) Conditions at NTUA Delivery Points

(1) General

See Appendix G for tabular geographic coordinate locations and elevations.

(2) Figures 21 through 25 show pressure variations at NTUA delivery points during the Summer Demand scenario.
Pressure variations are summarized and static pressures listed below:

Churchrock Chapter:

Churchrock - Pressures vary from 66 PSI to 81 PSI at a 770 GPM flow
Static pressure = 107 PSI

FIGURE 19

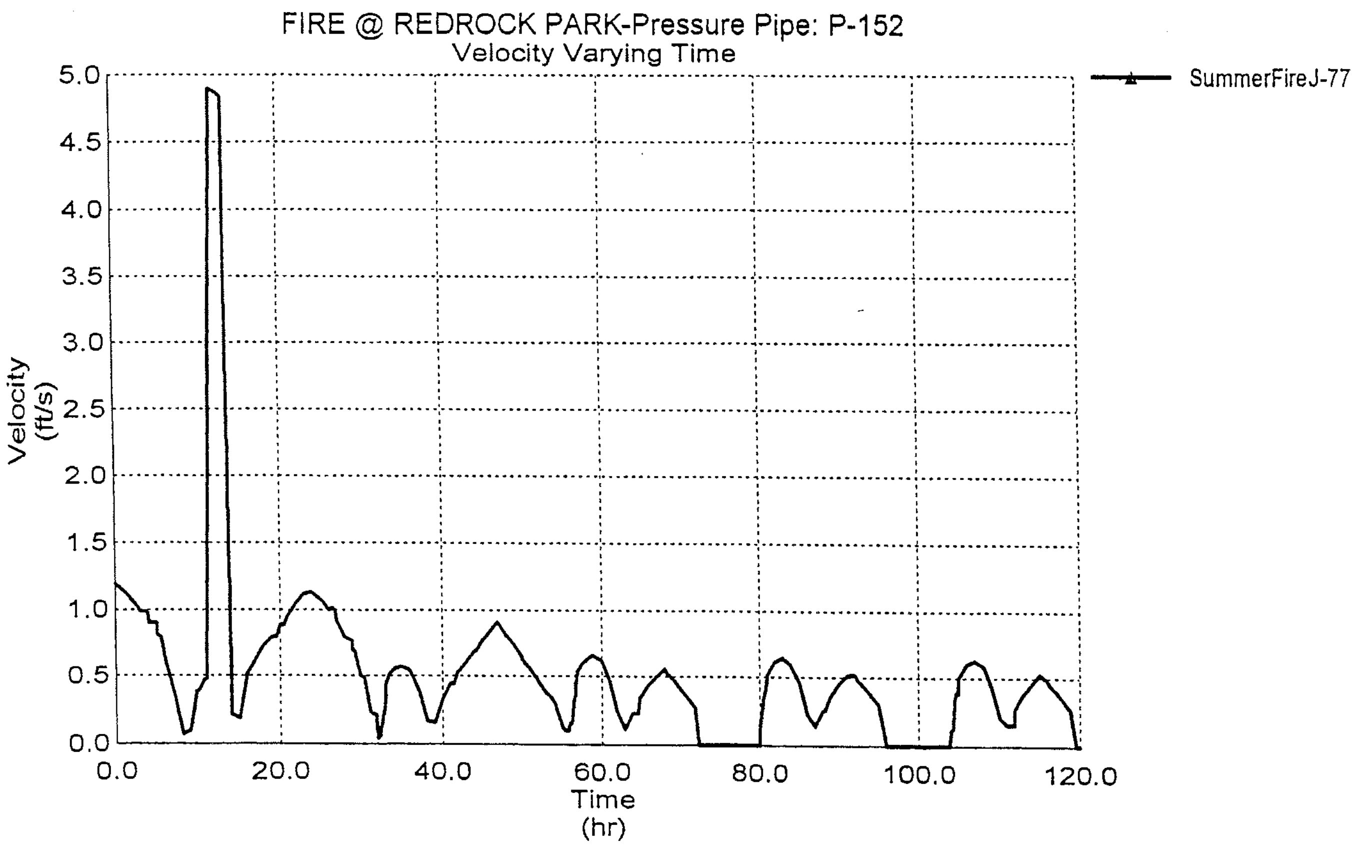
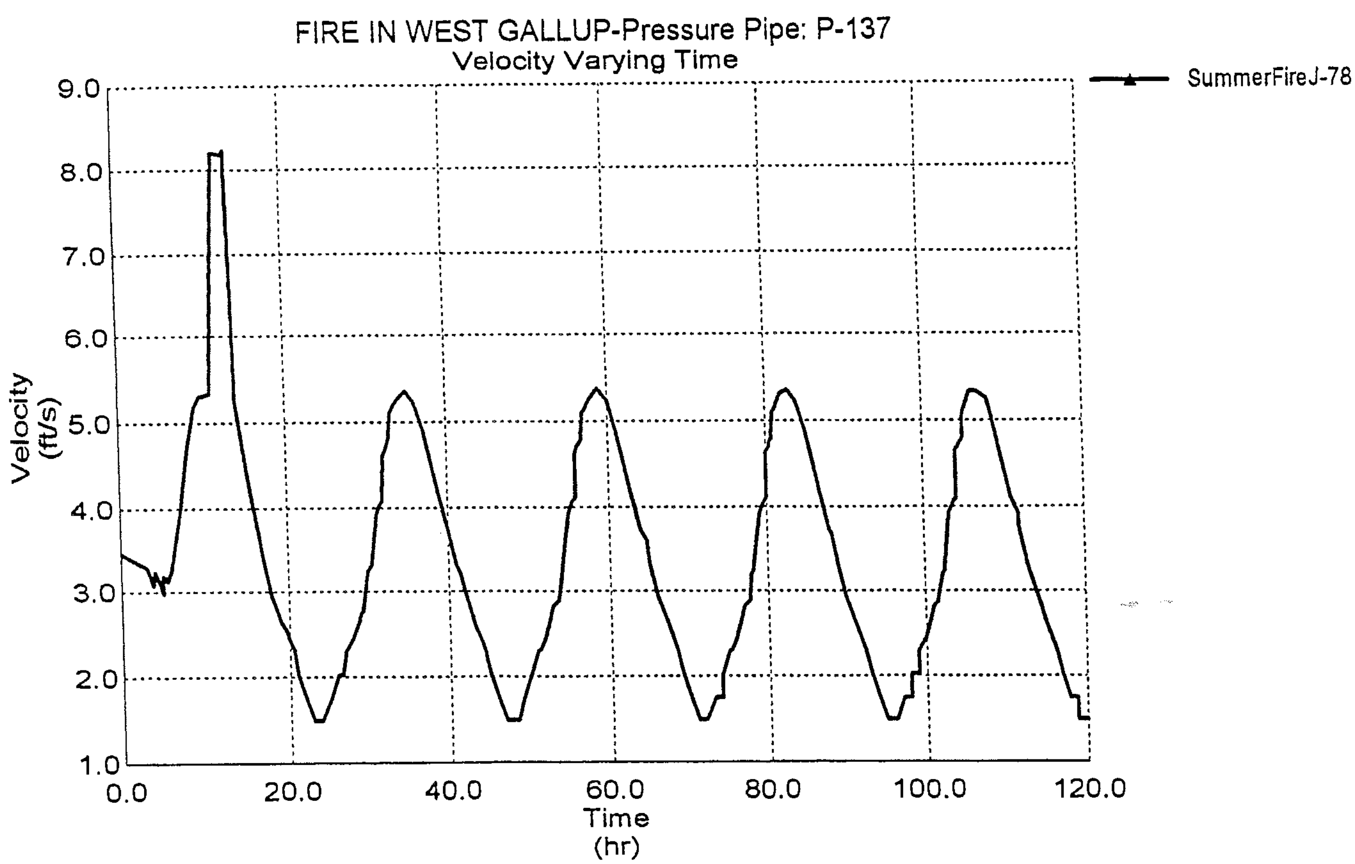

FIRE @ REDROCK PARK-Pressure Pipe: P-152
Velocity Varying Time
SummerFireJ-77
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Velocity
(ft/s)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
Time
(hr)

FIGURE 20



FIRE IN WEST GALLUP-Pressure Pipe: P-137
Velocity Varying Time
SummerFireJ-78
Velocity (ft/s)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
Time (hr)

FIGURE 21

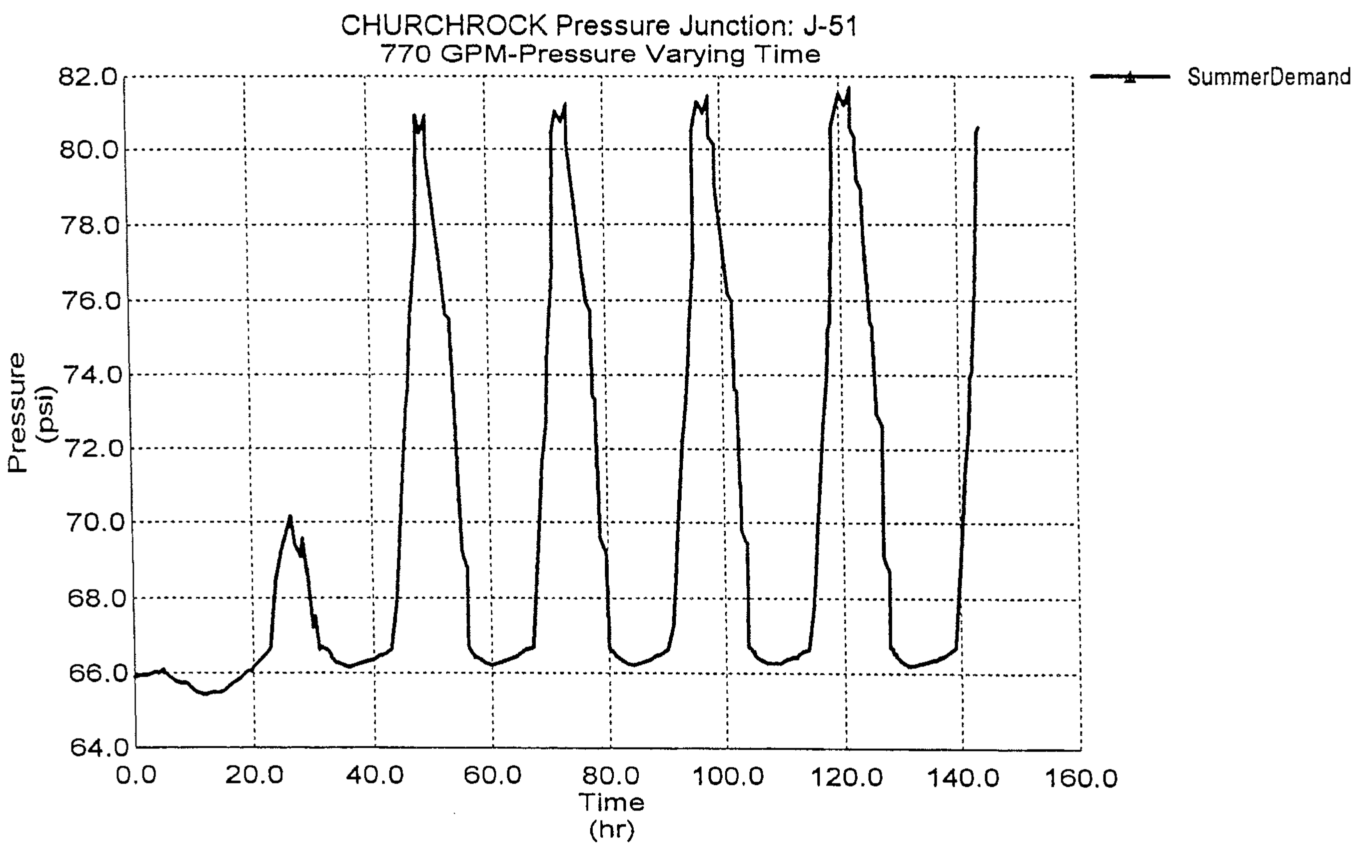

CHURCHROCK Pressure Junction: J-51
770 GPM-Pressure Varying Time
SummerDemand
Pressure (psi)
82.0
80.0
78.0
76.0
74.0
72.0
70.0
68.0
66.0
64.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time (hr)

FIGURE 22

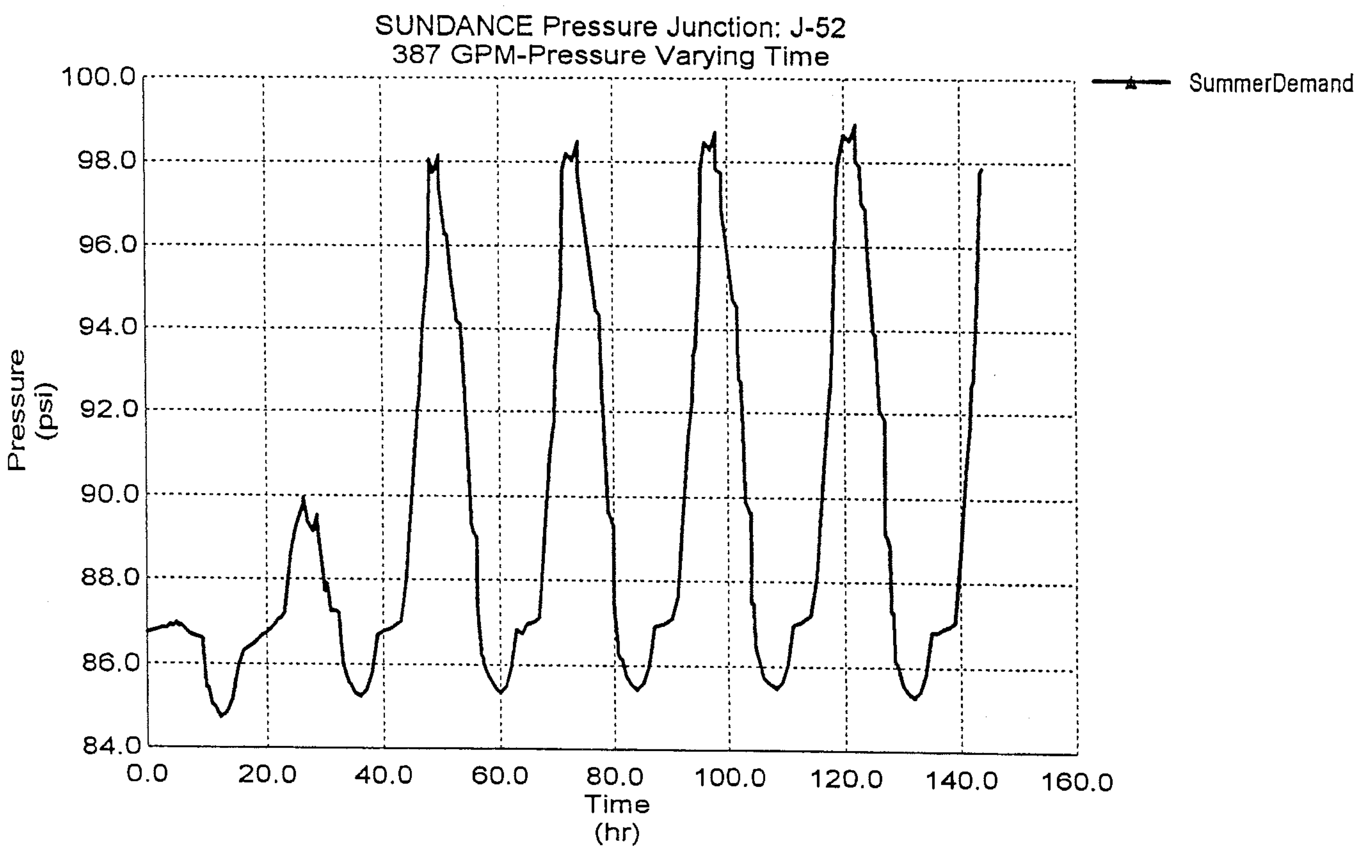

SUNDANCE Pressure Junction: J-52
387 GPM-Pressure Varying Time
SummerDemand
Pressure
(psi)
100.0
98.0
96.0
94.0
92.0
90.0
88.0
86.0
84.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)

FIGURE 23

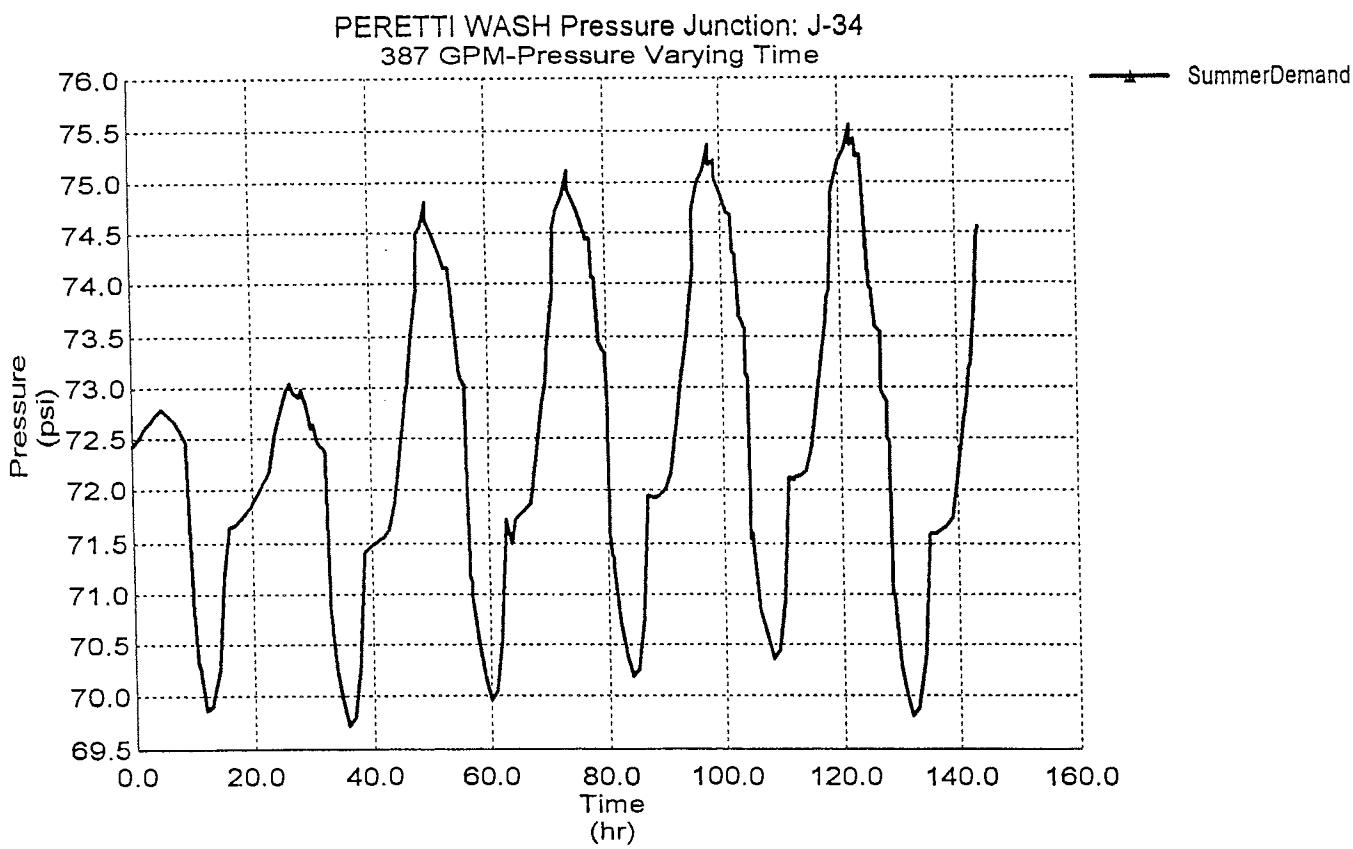
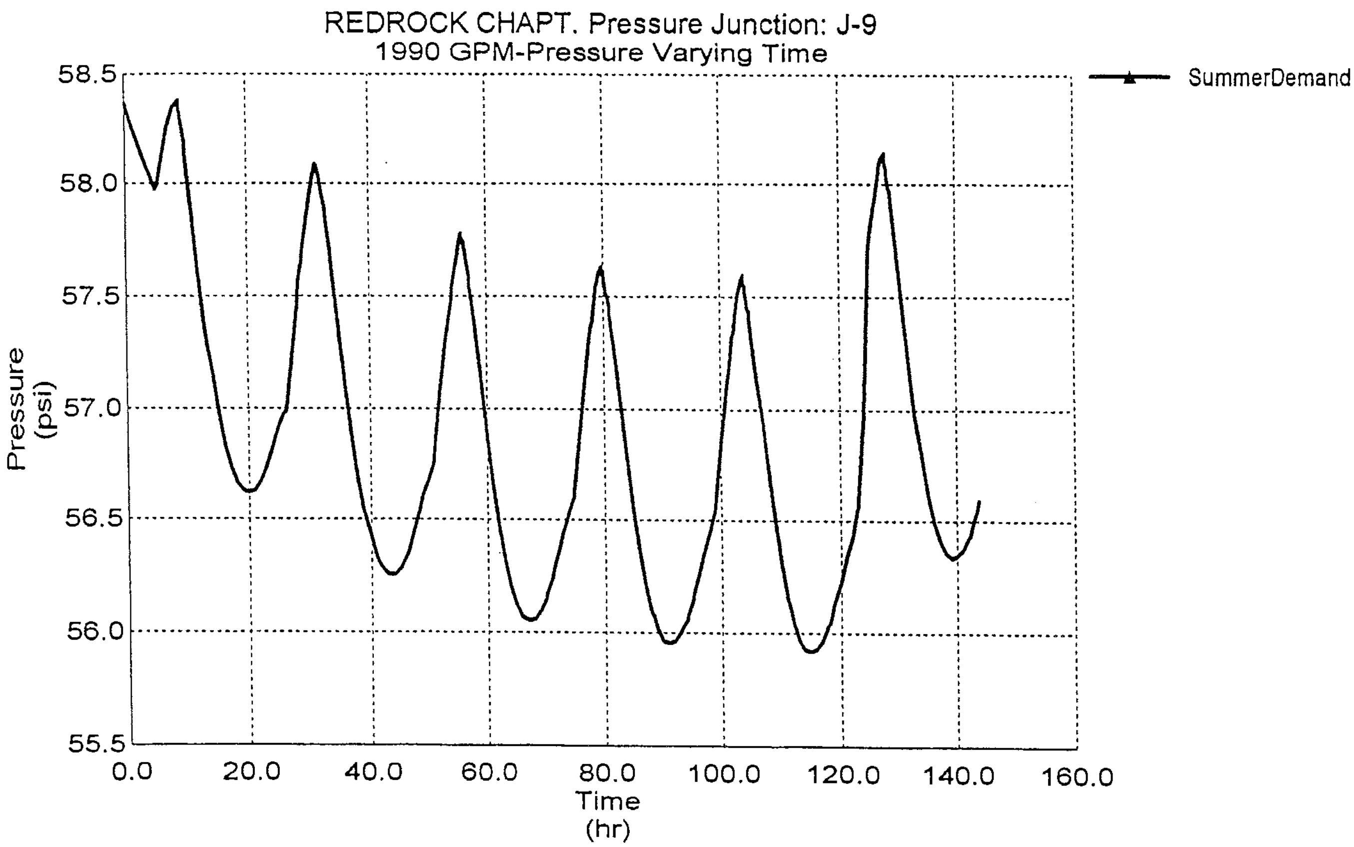
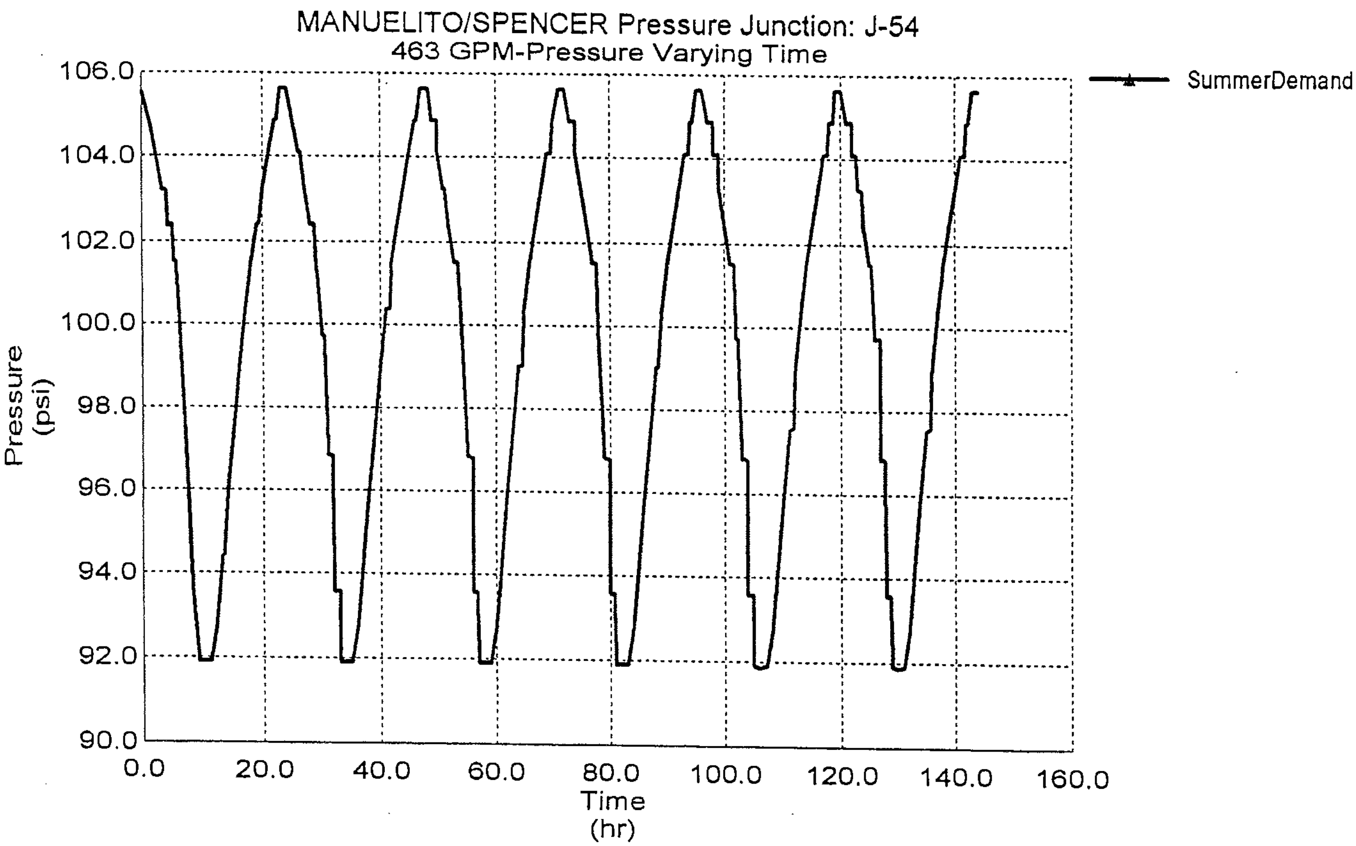

PERETTI WASH Pressure Junction: J-34
387 GPM-Pressure Varying Time
SummerDemand
76.0
75.5
75.0
74.5
74.0
73.5
73.0
72.5
72.0
71.5
71.0
70.5
70.0
69.5
Pressure
(psi)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)

FIGURE 24



REDROCK CHAPT. Pressure Junction: J-9
1990 GPM-Pressure Varying Time
SummerDemand
Pressure
(psi)
58.5
58.0
57.5
57.0
56.5
56.0
55.5
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)

FIGURE 25


MANUELITO/SPENCER Pressure Junction: J-54
463 GPM-Pressure Varying Time
SummerDemand
Pressure
(psi)
106.0
104.0
102.0
100.0
98.0
96.0
94.0
92.0
90.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Time
(hr)

Conditions @ NTUA Delivery Points (Continued)

Sundance - Pressures vary from 85 PSI to 99 PSI @ 387 GPM flow
Static pressure = 120 PSI

Peretti Wash - Pressures vary from 70 PSI to 76 PSI @ 387 GPM flow.
Static pressure = 81 PSI

Redrock Chapter - Pressures vary from 56 PSI to 58 PSI @ 1990 GPM flow.
Static pressure = 84 PSI

Manuelito/Spencer Valley - Pressures vary from 92 PSI to 106 PSI @ 463 GPM flow.
Static pressure = 119 PSI

5. Cost Estimates:

(A) General

A preliminary cost estimate summary for the project is shown in Table 5. More detailed costs estimates are listed in Appendix H. The basis for the Lump Sum and Unit Prices is year 2000.

The total estimated amount for Construction, Engineering, Contingencies and tax is $26,253,561.

2. Cost Proportioning Factors (Navajo Nation and City)

1. New storage tanks for the City as listed in this report should be considered as capital costs apportioned to the City.

2. The City of Gallup presently has facilities capable of delivering approximately 5.5 MGD to residents and businesses of the City, Gamerco Townsite and nearby government and tribal facilities. This fact should be considered as a credit to the City when proportioning project costs.

3. Capital costs for pipe, pumps and appurtenances may, in general, be proportioned relative to benefits (quantities of water) received by the City and Tribe. Costs for items that are clearly required for one entity, only may be assigned to that entity, however, an extremely detailed apportionment analysis is not recommended.

4. Operating, maintenance and repair (OM&R) expenses may, in general, be proportioned to the entities as to flow received from NGWSP. Some consideration may be given to the fact that the City has to maintain and repair aged City facilities. OM&R expenses for City wells, used in water production for the City should be borne by the City.

3. Operation, Maintenance and Repair (OM & R) Costs

Operation, maintenance and repair (O & R) costs for the NGWSP City of Gallup Transmission and Distribution System is proportioned directly to flow of the current City system as follows:

TABLE 5

NAVAJO - GALLUP WATER SUPPLY PROJECT
CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES

PRELIMINARY COST ESTIMATE SUMMARY
(YEAR 2000 COST BASIS)

ITEM	ESTIMATED COST
Pipelines	$10,112,445.00
Crossings & Bores	$725,000.00
Tanks (Reservoirs)	$4,500,000.00
Pump Stations	$710,000.00
Valve and Metering Stations	$575,000.00
Surge Control Station (T1-T2) (24")	$90,000.00
SCADA System	$2,000,000.00
TOTAL CONSTRUCTION	$18,712,445.00
Contingencies @ 15%	$2,806,867.00
SUBTOTAL	$21,519,312.00
Engineering @ 22%	$4,734,249.00
TOTAL:	**$26,253,561.00**

NOTES:
1. See Cost Breakdowns in Appendix H.
2. Engineering estimate is for design and construction supervision, monitoring quality control and inspection.
3. Costs above do not include NEPA, Cultural Resources or right-of-way aquisition.

Average Annual City Flow, Year 2040	=	7.4 MGD
Average Annual NTUA Flow, Year 2040	=	4.4 MGD
Total Average Annual Flow, Year 2040	=	11.8 MGD

1999/2000 City of Gallup Flow = 3.78 MGD

$$\text{Direct Flow Proportion (Ratio)} = \frac{11.8 \text{ MGD}}{3.78 \text{ MGD}} = 3.1217$$

Currently OM & R costs for the City's water department for the year 1999/2000 as determined by the City is contained in Appendix I. The expense costs shown are combined costs for the water distribution system and the well production system. The combined expenses are reduced to that of the water distribution system costs only using estimating factors described below.

1. Wages and Benefits - The City of Gallup estimates eight (8) employees for the distribution system versus thirteen (13) overall, resulting in a 8/13 ratio.

2. Operation and Maintenance - The City of Gallup estimates 40% for distribution system and 60% for well production.

3. Electrical - Electrical costs estimate 20% for distribution and 80% for well production.

4. Shared Services - These services are estimated the same as wages and benefits, eight (8) employees for distribution system versus thirteen (13) overall.

5. Bonds and Depreciation - The City of Gallup estimates 25% for distribution system and 75% for well production.

The total estimated annual OM & R cost for the project is $3,355,796.00. Table 6 summarizes the annual OM& R costs.

TABLE 6

NAVAJO-GALLUP WATER SUPPLY PROJECT
CITY OF GALLUP

TRANSMISSION AND STORAGE FACILITIES
PRELIMINARY OPERATIONS, MAINTENANCE AND REPAIR COST ESTIMATE

Wages and Benefits	8/13 (513,783)	$316,174.00
Operating and Maintenance	.40 (662,262)	$264,905.00
Electrical	.20 (812,809)	$162,562.00
Shared Services	8/13 (255,400)	$157,169.00
Bonds and Depreciation	.25 (696,720)	$174,180.00

Estimated Annual Expenses $1,074,990.00

OM & R Expense Proportioned directly as to flow would be as follows:

Ave. City Flow Year 2040	=7.4 MGD
Ave. NTUA Flow Year 2040	=4.4 MGD
Total Flow	= 11.8 MGD
Estimated Annual OM & R Expense	=11.8/3.78 (1,074,990) = $3,355,789

8. References:

(1) Sterling and Mataya, 1998, WELL PRODUCTION PLANNING REPORT for City of Gallup, New Mexico, Gallup, New Mexico

(2) John W. Shomaker, 1991, WATER-SUPPLY STUDIES AND FORTY-YEAR WATER SUPPLY MASTER PLAN, City of Gallup, New Mexico, John W. Shomaker Inc, Albuquerque, New Mexico

(3) The Navajo Nation Department of Water Resources, The City of Gallup, The Northwest New Mexico Council of Governments, The U.S. Bureau of Reclamation, 2000, TECHNICAL MEMORANDUM, THE NAVAJO-GALLUP WATER SUPPLY PROJECT, Fort Defiance, Arizona

(4) U.S. Bureau of Reclamation, 1984, GALLUP-NAVAJO INDIAN WATER SUPPLY PROJECT Planning Report and Draft Environmental Statement, Southwest Regional Office, Amarillo, Texas

(5) Zipparro, Hasen, (Editors), 1993, DAVIS' HANDBOOK OF APPLIED HYDRAULICS, Fourth Edition, McGraw Hill, Inc., New York, St. Louis, San Francisco

(6) DePauli Engineering & Surveying Co., 2002, BUSINESS AND RESIDENTIAL WATER USE, Report for Northwest New Mexico Council of Governments, Gallup, New Mexico

APPENDIX A

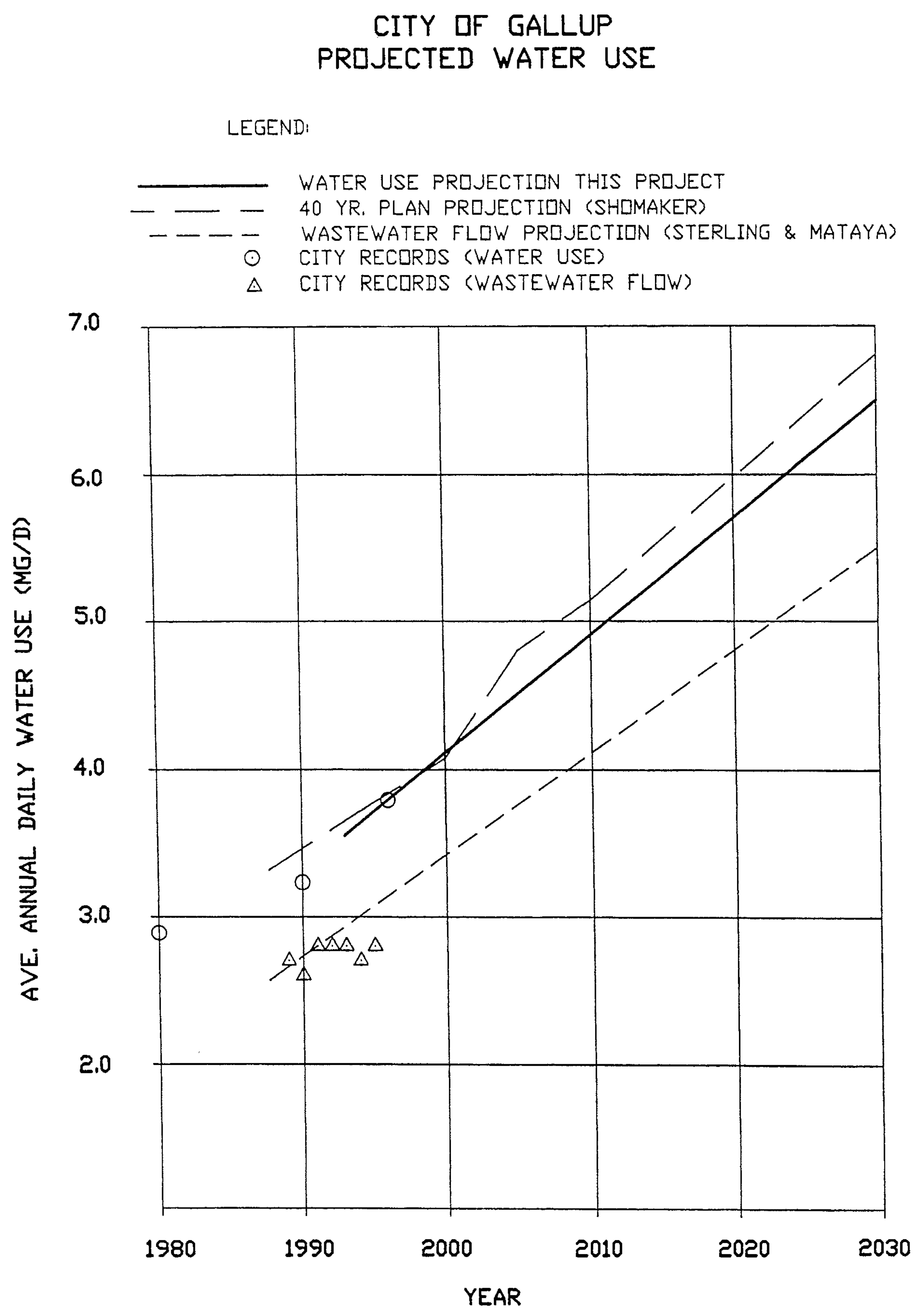


FIG. 4

STERLING & MATAYA
ENGINEERS – SURVEYORS
GALLUP, NEW MEXICO

APPENDIX B

Scenario: SummerDemand
Extended Period Analysis: 11.0 hr / 144.0 hr
Tank Report

Label	Base Elevation (ft)	Minimum Elevation (ft)	Initial HGL (ft)	Maximum Elevation (ft)	Tank Diameter (ft)	Inflow (gpm)	Current Status	Calculated Hydraulic Grade (ft)	Calculated Percent Full (%)	Total Volume (gal)
T-1	6,881.00	6,881.00	6,903.00	6,905.00	198.00	-491	Draining	6,903	92.1	5,528,000
T-2	6,770.00	6,770.00	6,792.00	6,794.00	148.00	-1,291	Draining	6,791	86.9	3,089,000
T-3	7,000.00	7,000.00	7,025.00	7,028.00	95.00	-457	Draining	7,025	89.8	1,485,000
T-4	6,610.00	6,610.00	6,646.00	6,650.00	93.00	-2	Draining	6,650	99.0	2,033,000
T-5	6,770.00	6,770.00	6,792.00	6,794.00	198.00	-931	Draining	6,794	98.8	5,528,000
T-6	6,858.00	6,858.00	6,886.00	6,888.00	118.00	49	Filling	6,883	83.4	2,454,000
T-7	6,770.00	6,770.00	6,792.00	6,794.00	120.00	-55	Draining	6,790	82.9	2,030,000
T-8	6,770.00	6,770.00	6,790.00	6,794.00	120.00	-170	Draining	6,792	90.1	2,030,000
T-9	6,701.00	6,701.00	6,731.00	6,733.00	127.00	-197	Draining	6,730	91.8	3,032,000
T-10	6,864.00	6,864.00	6,886.00	6,888.00	120.00	-579	Draining	6,885	89.4	2,030,000

APPENDIX C

Scenario: SummerDemand
Extended Period Analysis: 11.0 hr / 144.0 hr
Pump Report

Label	Elevation (ft)	Design Head (ft)	Design Discharge (gpm)	Maximum Operating Head (ft)	Maximum Operating Discharge (gpm)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Discharge (gpm)	Pump Head (ft)	Calculated Water Power (Hp)
PMP-1	6,770.00	165	1,000	95	1,600	On	6,790	6,947	1,111	156	43.84
PMP-3	6,770.00	140	600	90	900	On	6,794	6,884	900	90	20.46
PMP-4	6,540.00	180	1,300	100	1,800	On	6,647	6,799	1,494	152	57.48
PMP-5	6,858.00	160	800	120	1,100	Off	6,883	7,022	0	0	0.00
PMP-6	6,770.00	185	3,500	120	4,200	On	6,790	7,017	2,662	227	152.60

APPENDIX D

Scenario: SummerDemand
Extended Period Analysis: 11.0 hr / 144.0 hr
Valve Report

Label	Elevation (ft)	Diameter (in)	Minor Loss Coefficient	Control Status	Discharge (gpm)	From HGL (ft)	To HGL (ft)	Headloss (ft)
PRV-3	6,490.00	8	0.00	Throttling	2,101	6,794	6,733	60
PRV-4	6,485.00	8	0.00	Throttling	825	6,825	6,733	92
PRV-5	6,465.00	8	0.00	Throttling	92	6,719	6,650	69
PRV-8	6,660.00	10	0.00	Throttling	387	6,881	6,794	87
PRV-10	6,640.00	10	0.00	Throttling	389	6,843	6,790	52
PRV-11	6,480.00	12	0.00	Throttling	2,286	6,776	6,650	126
PRV-12	6,640.00	10	0.00	Inactive	465	6,791	6,791	0
PRV-13	6,610.00	8	0.00	Throttling	84	6,794	6,730	63

APPENDIX E

Scenario: SummerDemand
Extended Period Analysis: 11.0 hr / 144.0 hr
Junction Report

Label	Elevation (ft)	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	6,800.00	Demand	0	TypGallup	0	6,897	42.13
J-2	6,480.00	Demand	0	TypGallup	0	6,833	152.77
J-3	6,477.00	Demand	95	TypGallup	152	6,806	142.27
J-4	6,700.00	Demand	95	TypGallup	152	6,794	40.73
J-6	7,000.00	Demand	48	TypGallup	76	7,025	10.73
J-7	6,820.00	Demand	143	TypGallup	228	6,977	67.98
J-8	6,770.00	Demand	0	TypGallup	0	6,791	8.92
J-9	6,600.00	Demand	1,930	Fixed	1,930	6,734	57.86
J-10	6,500.00	Demand	214	TypGallup	342	6,630	56.41
J-11	6,435.00	Demand	95	TypGallup	152	6,620	79.90
J-12	6,470.00	Demand	190	TypGallup	304	6,650	77.66
J-13	6,500.00	Demand	0	TypGallup	0	6,650	64.69
J-14	6,700.00	Inflow	715	Fixed	-715	6,887	80.77
J-15	6,530.00	Demand	0	TypGallup	0	6,825	127.55
J-16	6,500.00	Demand	0	TypGallup	0	6,806	132.16
J-17	6,490.00	Demand	0	TypGallup	0	6,797	132.84
J-18	6,560.00	Demand	280	TypGallup	447	6,791	99.98
J-19	6,540.00	Demand	0	TypGallup	0	6,799	111.86
J-20	6,540.00	Demand	0	TypGallup	0	6,794	109.87
J-21	6,545.00	Demand	285	TypGallup	457	6,791	106.29
J-22	6,555.00	Demand	357	TypGallup	571	6,787	100.49
J-23	6,660.00	Demand	143	TypGallup	228	6,791	56.84
J-24	6,570.00	Demand	285	TypGallup	457	6,790	95.07
J-25	6,560.00	Demand	200	TypGallup	320	6,790	99.53
J-26	6,610.00	Demand	190	TypGallup	304	6,786	76.11
J-27	6,640.00	Demand	285	TypGallup	457	6,791	65.40
J-28	6,820.00	Demand	238	TypGallup	381	6,882	26.95
J-29	6,802.00	Demand	418	TypGallup	669	6,882	34.50
J-30	6,770.00	Demand	381	TypGallup	609	6,883	48.97
J-31	6,620.00	Demand	0	TypGallup	0	6,843	96.50
J-32	6,760.00	Demand	0	TypGallup	0	6,881	52.19
J-33	6,660.00	Demand	0	TypGallup	0	6,827	72.13
J-34	6,700.00	Demand	387	Fixed	387	6,863	70.28
J-35	6,850.00	Demand	238	TypGallup	381	7,022	74.31
J-36	6,630.00	Demand	0	TypGallup	0	6,730	43.26
J-37	6,490.00	Demand	418	TypGallup	669	6,704	92.39
J-38	6,490.00	Demand	0	TypGallup	0	6,721	99.84
J-39	6,490.00	Demand	0	TypGallup	0	6,730	103.60
J-40	6,490.00	Demand	143	TypGallup	228	6,706	93.19
J-41	6,480.00	Demand	285	TypGallup	457	6,724	105.53
J-42	6,560.00	Demand	0	TypGallup	0	6,652	39.79
J-43	6,480.00	Demand	190	TypGallup	304	6,721	104.13
J-44	6,470.00	Demand	95	TypGallup	152	6,649	77.21
J-45	6,434.00	Demand	214	TypGallup	342	6,618	79.71
J-46	6,465.00	Demand	0	TypGallup	0	6,627	69.87
J-47	6,740.00	Demand	190	TypGallup	304	6,896	67.39
J-48	6,670.00	Demand	71	TypGallup	114	6,825	66.83
J-49	6,470.00	Demand	95	TypGallup	152	6,719	107.69
J-51	6,640.00	Demand	770	Fixed	770	6,791	65.45
J-52	6,610.00	Demand	387	Fixed	387	6,807	84.99
J-53	6,385.00	Demand	143	TypGallup	228	6,597	91.80

Scenario: SummerDemand
Extended Period Analysis: 11.0 hr / 144.0 hr
Junction Report

Label	Elevation (ft)	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-54	6,375.00	Demand	463	Fixed	463	6,587	91.88
J-55	6,426.00	Demand	0	TypGallup	0	6,620	83.78
J-57	6,775.00	Demand	190	TypGallup	304	6,913	59.59
J-58	6,770.00	Demand	0	TypGallup	0	6,946	76.03
J-59	6,780.00	Demand	0	TypGallup	0	6,857	33.39
J-60	6,780.00	Demand	0	TypGallup	0	6,884	45.14
J-61	6,720.00	Demand	143	TypGallup	228	6,884	70.88
J-62	6,660.00	Demand	143	TypGallup	228	6,793	57.60
J-63	6,850.00	Inflow	9,994	Fixed	-9,994	6,904	23.49
J-64	6,490.00	Inflow	181	Fixed	-181	6,728	103.12
J-65	6,560.00	Demand	0	TypGallup	0	6,790	99.58
J-66	6,580.00	Demand	190	TypGallup	304	6,790	90.72
J-67	6,600.00	Demand	0	TypGallup	0	6,791	82.62
J-68	6,810.00	Demand	0	TypGallup	0	6,896	37.07
J-69	6,800.00	Demand	0	TypGallup	0	6,852	22.31
J-72	6,640.00	Demand	0	TypGallup	0	6,843	87.66
J-73	6,640.00	Demand	0	TypGallup	0	6,790	64.82
J-74	6,640.00	Demand	0	TypGallup	0	6,790	64.87
J-75	6,840.00	Demand	0	Fixed	0	6,996	67.48
J-76	6,795.00	Demand	0	Fixed	0	6,882	37.84
J-77	6,640.00	Demand	0	TypGallup	0	6,791	65.42
J-56	6,434.00	Demand	249	TypGallup	398	6,620	80.31
J-78	6,434.00	Demand	0	Fixed	0	6,623	81.68
J-79	6,570.00	Demand	0	Fixed	0	6,790	95.08

Scenario: SummerDemand
Extended Period Analysis: 21.0 hr / 144.0 hr
Junction Report

Label	Elevation (ft)	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	6,800.00	Demand	0	TypGallup	0	6,898	42.17
J-2	6,480.00	Demand	0	TypGallup	0	6,839	155.24
J-3	6,477.00	Demand	95	TypGallup	58	6,812	144.77
J-4	6,700.00	Demand	95	TypGallup	58	6,793	40.40
J-6	7,000.00	Demand	48	TypGallup	29	7,028	11.94
J-7	6,820.00	Demand	143	TypGallup	87	6,980	69.11
J-8	6,770.00	Demand	0	TypGallup	0	6,788	7.69
J-9	6,600.00	Demand	1,930	Fixed	1,930	6,731	56.63
J-10	6,500.00	Demand	214	TypGallup	130	6,644	62.35
J-11	6,435.00	Demand	95	TypGallup	58	6,640	88.76
J-12	6,470.00	Demand	190	TypGallup	116	6,650	77.84
J-13	6,500.00	Demand	0	TypGallup	0	6,650	64.86
J-14	6,700.00	Inflow	715	Fixed	-715	6,888	81.19
J-15	6,530.00	Demand	0	TypGallup	0	6,830	129.65
J-16	6,500.00	Demand	0	TypGallup	0	6,811	134.44
J-17	6,490.00	Demand	0	TypGallup	0	6,803	135.20
J-18	6,560.00	Demand	280	TypGallup	170	6,805	105.96
J-19	6,540.00	Demand	0	TypGallup	0	6,813	117.88
J-20	6,540.00	Demand	0	TypGallup	0	6,808	115.98
J-21	6,545.00	Demand	285	TypGallup	174	6,805	112.46
J-22	6,555.00	Demand	357	TypGallup	217	6,791	102.26
J-23	6,660.00	Demand	143	TypGallup	87	6,792	57.15
J-24	6,570.00	Demand	285	TypGallup	174	6,791	95.70
J-25	6,560.00	Demand	200	TypGallup	122	6,801	104.30
J-26	6,610.00	Demand	190	TypGallup	116	6,791	78.38
J-27	6,640.00	Demand	285	TypGallup	174	6,793	66.23
J-28	6,820.00	Demand	238	TypGallup	145	6,883	27.30
J-29	6,802.00	Demand	418	TypGallup	254	6,884	35.26
J-30	6,770.00	Demand	381	TypGallup	231	6,888	51.16
J-31	6,620.00	Demand	0	TypGallup	0	6,852	100.26
J-32	6,760.00	Demand	0	TypGallup	0	6,881	52.24
J-33	6,660.00	Demand	0	TypGallup	0	6,834	75.11
J-34	6,700.00	Demand	387	Fixed	387	6,866	71.98
J-35	6,850.00	Demand	238	TypGallup	145	7,027	76.59
J-36	6,630.00	Demand	0	TypGallup	0	6,730	43.17
J-37	6,490.00	Demand	418	TypGallup	254	6,715	97.50
J-38	6,490.00	Demand	0	TypGallup	0	6,726	102.02
J-39	6,490.00	Demand	0	TypGallup	0	6,731	104.43
J-40	6,490.00	Demand	143	TypGallup	87	6,719	98.98
J-41	6,480.00	Demand	285	TypGallup	174	6,730	108.18
J-42	6,560.00	Demand	0	TypGallup	0	6,664	45.16
J-43	6,480.00	Demand	190	TypGallup	116	6,730	108.13
J-44	6,470.00	Demand	95	TypGallup	58	6,650	77.71
J-45	6,434.00	Demand	214	TypGallup	130	6,640	89.25
J-46	6,465.00	Demand	0	TypGallup	0	6,643	76.88
J-47	6,740.00	Demand	190	TypGallup	116	6,897	68.00
J-48	6,670.00	Demand	71	TypGallup	43	6,830	69.08
J-49	6,470.00	Demand	95	TypGallup	58	6,730	112.30
J-51	6,640.00	Demand	770	Fixed	770	6,793	66.31
J-52	6,610.00	Demand	387	Fixed	387	6,811	86.90
J-53	6,385.00	Demand	143	TypGallup	87	6,626	104.01

Scenario: SummerDemand
Extended Period Analysis: 21.0 hr / 144.0 hr
Junction Report

Label	Elevation (ft)	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-54	6,375.00	Demand	463	Fixed	463	6,616	104.10
J-55	6,426.00	Demand	0	TypGallup	0	6,640	92.73
J-57	6,775.00	Demand	190	TypGallup	116	6,921	63.04
J-58	6,770.00	Demand	0	TypGallup	0	6,950	77.64
J-59	6,780.00	Demand	0	TypGallup	0	6,862	35.66
J-60	6,780.00	Demand	0	TypGallup	0	6,885	45.21
J-61	6,720.00	Demand	143	TypGallup	87	6,884	71.12
J-62	6,660.00	Demand	143	TypGallup	87	6,802	61.46
J-63	6,850.00	Inflow	9,994	Fixed	-9,994	6,904	23.25
J-64	6,490.00	Inflow	181	Fixed	-181	6,731	104.42
J-65	6,560.00	Demand	0	TypGallup	0	6,804	105.57
J-66	6,580.00	Demand	190	TypGallup	116	6,803	96.54
J-67	6,600.00	Demand	0	TypGallup	0	6,803	87.71
J-68	6,810.00	Demand	0	TypGallup	0	6,895	36.86
J-69	6,800.00	Demand	0	TypGallup	0	6,858	25.17
J-72	6,640.00	Demand	0	TypGallup	0	6,852	91.47
J-73	6,640.00	Demand	0	TypGallup	0	6,791	65.41
J-74	6,640.00	Demand	0	TypGallup	0	6,791	65.41
J-75	6,840.00	Demand	0	Fixed	0	6,997	68.09
J-76	6,795.00	Demand	0	Fixed	0	6,884	38.55
J-77	6,640.00	Demand	0	TypGallup	0	6,793	66.15
J-56	6,434.00	Demand	249	TypGallup	151	6,641	89.35
J-78	6,434.00	Demand	0	Fixed	0	6,642	89.78
J-79	6,570.00	Demand	0	Fixed	0	6,791	95.70

APPENDIX F

Scenario: SummerDemand
Extended Period Analysis: 11.00 hr / 144.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)	Velocity (ft/s)
P-1	841	24	Ductile Iro	130.0	false	Open	10,485	6,903	6,897	6	6.74	7.44
P-2	16,338	24	Ductile Iro	130.0	false	Open	7,828	6,897	6,833	64	3.93	5.55
P-3	8,535	24	Ductile Iro	130.0	false	Open	7,003	6,833	6,806	27	3.20	4.97
P-4	8,149	24	Ductile Iro	130.0	false	Open	4,565	6,806	6,794	12	1.45	3.24
P-5	2,453	24	Ductile Iro	130.0	false	Open	4,413	6,794	6,791	3	1.36	3.13
P-7	100	24	Ductile Iro	130.0	false	Open	5,704	6,791	6,791	2.0e-1	2.19	4.05
P-8	13,982	14	Ductile Iro	130.0	false	Open	1,930	6,791	6,734	57	4.06	4.02
P-9	100	12	Ductile Iro	130.0	false	Open	1,111	6,791	6,790	3.0e-1	3.10	3.15
P-12	573	12	Ductile Iro	130.0	false	Open	-457	7,025	7,025	3.0e-1	0.60	1.30
P-14	5,206	12	Ductile Iro	130.0	false	Open	1,218	6,650	6,630	19	3.68	3.46
P-15	5,349	12	Ductile Iro	130.0	false	Open	876	6,630	6,620	11	2.00	2.48
P-16	1,610	14	Ductile Iro	130.0	false	Open	-2	6,650	6,650	0	0.00	3.29e-3
P-18	1,799	14	Ductile Iro	130.0	false	Open	-2	6,650	6,650	0	0.00	3.29e-3
P-22	12,367	16	Ductile Iro	130.0	false	Open	3,067	6,887	6,825	62	5.00	4.89
P-23	4,152	16	Ductile Iro	130.0	false	Open	2,953	6,825	6,806	19	4.66	4.71
P-24	1,806	16	Ductile Iro	130.0	false	Open	2,953	6,806	6,797	8	4.66	4.71
P-25	7,443	16	Ductile Iro	130.0	false	Open	852	6,797	6,794	3	0.47	1.36
P-28	6,900	14	Ductile Iro	130.0	false	Open	945	6,799	6,791	7	1.08	1.97
P-29	2,576	10	Asbestos	140.0	false	Open	550	6,799	6,794	5	1.79	2.25
P-30	2,091	10	PVC	150.0	true	Open	550	6,794	6,791	3	1.57	2.25
P-32	4,479	12	Ductile Iro	130.0	false	Open	-571	6,787	6,791	4	0.90	1.62
P-33	1,352	12	Ductile Iro	130.0	false	Open	-799	6,791	6,794	2	1.68	2.27
P-34	1,699	10	Ductile Iro	110.0	true	Closed	0	6,787	6,794	0	0.00	0.00
P-35	5,147	10	Asbestos	140.0	false	Open	-102	6,791	6,791	4.0e-1	0.08	0.42
P-36	4,765	14	Ductile Iro	130.0	false	Open	395	6,791	6,790	1	0.22	0.82
P-37	3,988	10	Asbestos	140.0	false	Open	100	6,790	6,790	3.0e-1	0.08	0.41
P-39	11,063	8	Asbestos	140.0	false	Open	126	6,790	6,786	4	0.35	0.81
P-40	7,941	8	Asbestos	140.0	false	Open	-178	6,786	6,791	5	0.66	1.14
P-43	100	14	Ductile Iro	130.0	false	Open	900	6,794	6,794	10.0e-2	0.99	1.88
P-45	742	12	PVC	150.0	false	Open	669	6,883	6,882	1	0.93	1.90
P-46	2,778	12	PVC	150.0	false	Open	288	6,882	6,882	1	0.20	0.82
P-47	100	10	Asbestos	140.0	false	Open	900	6,884	6,883	4.0e-1	4.44	3.68
P-49	2,695	8	Asbestos	140.0	false	Open	160	6,883	6,882	1	0.54	1.02
P-57	5,733	16	Ductile Iro	130.0	false	Open	2,398	6,881	6,863	18	3.17	3.83
P-61	2,681	12	Ductile Iro	130.0	false	Open	197	6,730	6,730	3.0e-1	0.13	0.56
P-62	3,603	8	Cast iron	110.0	false	Open	290	6,730	6,721	9	2.54	1.85
P-63	1,345	12	Cast iron	110.0	false	Open	2,024	6,721	6,704	17	12.80	5.74
P-64	50	8	Ductile Iro	130.0	false	Open	2,101	6,797	6,794	4	72.58	13.41
P-65	50	8	Ductile Iro	130.0	false	Open	2,101	6,733	6,730	4	72.59	13.41
P-66	1,233	12	Ductile Iro	130.0	false	Open	1,733	6,730	6,721	9	7.06	4.92
P-67	3,836	8	Ductile Iro	130.0	false	Open	140	6,706	6,704	2	0.48	0.89
P-68	6,406	8	Ductile Iro	130.0	false	Open	368	6,724	6,706	19	2.89	2.35
P-69	618	8	Ductile Iro	130.0	false	Open	825	6,833	6,825	8	12.87	5.26
P-70	713	8	Ductile Iro	130.0	false	Open	825	6,733	6,724	9	12.87	5.26
P-71	7,066	12	Cast iron	110.0	false	Open	1,494	6,704	6,652	52	7.31	4.24
P-72	704	12	Cast iron	110.0	false	Open	1,494	6,652	6,647	5	7.31	4.24
P-73	100	12	Ductile Iro	130.0	false	Open	1,494	6,799	6,799	1	5.37	4.24
P-76	8,232	8	Asbestos	140.0	false	Open	92	6,650	6,649	2	0.19	0.59
P-77	1,398	14	Ductile Iro	130.0	false	Open	768	6,650	6,649	1	0.74	1.60
P-79	4,855	8	Asbestos	140.0	false	Open	-505	6,627	6,649	22	4.53	3.22

Scenario: SummerDemand
Extended Period Analysis: 11.00 hr / 144.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)	Velocity (ft/s)
P-21	3,480	16	Ductile Iro	130.0	false	Open	2,352	6,897	6,887	11	3.06	3.75
P-81	2,323	10	Ductile Iro	130.0	false	Open	304	6,897	6,896	2	0.69	1.24
P-85	3,758	10	Ductile Iro	130.0	false	Open	114	6,825	6,825	4.0e-1	0.11	0.47
P-86	4,410	10	Asbestos	140.0	false	Open	244	6,721	6,719	2	0.40	1.00
P-87	3,306	10	Asbestos	140.0	false	Open	92	6,719	6,719	2.0e-1	0.07	0.38
P-92	7,180	10	Ductile Iro	130.0	false	Open	691	6,620	6,597	22	3.13	2.82
P-93	6,573	10	Ductile Iro	130.0	false	Open	463	6,597	6,587	10	1.49	1.89
P-94	1,852	10	Asbestos	140.0	false	Open	-342	6,618	6,620	1	0.74	1.40
P-96	2,241	10	Ductile Iro	130.0	false	Open	32	6,620	6,620	2.0e-2	0.01	0.13
P-97	2,219	10	Ductile Iro	130.0	false	Open	32	6,620	6,620	2.0e-2	0.01	0.13
P-98	3,141	8	PVC	150.0	false	Open	807	6,913	6,883	30	9.49	5.15
P-99	100	10	Ductile Iro	130.0	false	Open	1,111	6,947	6,946	1	7.54	4.54
P-101	6,959	12	Ductile Iro	130.0	false	Open	-381	7,022	7,025	3	0.43	1.08
P-104	100	10	Ductile Iro	130.0	false	Open	-5.0e-4	7,022	7,022	0	0.00	2.23e-6
P-105	100	12	Ductile Iro	130.0	false	Open	-6.0e-4	6,883	6,883	0	0.00	1.84e-6
P-106	2,316	16	Ductile Iro	130.0	false	Open	2,011	6,863	6,857	5	2.29	3.21
P-108	1,505	16	Ductile Iro	130.0	false	Open	2,398	6,885	6,881	5	3.17	3.83
P-109	1,036	12	Ductile Iro	130.0	false	Open	615	6,885	6,884	1	1.04	1.74
P-110	2,856	12	Ductile Iro	130.0	false	Open	228	6,884	6,884	5.0e-1	0.17	0.65
P-111	3,036	10	Ductile Iro	130.0	false	Open	387	6,884	6,881	3	1.07	1.58
P-112	857	10	Ductile Iro	130.0	false	Open	387	6,794	6,793	1	1.07	1.58
P-113	200	24	Ductile Iro	130.0	false	Open	-9,994	6,903	6,904	1	6.17	7.09
P-114	1,308	10	Asbestos	140.0	false	Open	368	6,730	6,728	1	0.85	1.50
P-115	4,311	10	Asbestos	140.0	false	Open	549	6,728	6,721	8	1.78	2.24
P-116	1,490	10	Ductile Iro	90.0	false	Open	146	6,791	6,790	1	0.35	0.60
P-118	2,374	8	Asbestos	140.0	false	Open	-158	6,790	6,791	1	0.53	1.01
P-119	1,858	6	Asbestos	140.0	false	Open	50	6,790	6,790	5.0e-1	0.26	0.57
P-120	2,692	6	Asbestos	140.0	false	Open	41	6,790	6,790	5.0e-1	0.18	0.47
P-121	4,047	8	Asbestos	140.0	false	Open	-158	6,791	6,793	2	0.53	1.01
P-122	13,052	14	Ductile Iro	130.0	false	Open	2,434	6,977	6,896	81	6.24	5.07
P-123	1,644	14	Ductile Iro	130.0	false	Open	2,434	6,896	6,885	10	6.24	5.07
P-124	4,380	10	Ductile Iro	130.0	false	Open	1,111	6,946	6,913	33	7.54	4.54
P-125	2,459	16	Ductile Iro	130.0	false	Open	2,011	6,857	6,852	6	2.29	3.21
P-126	1,924	14	Ductile Iro	130.0	false	Open	2,011	6,852	6,843	8	4.38	4.19
P-136	100	14	Ductile Iro	130.0	false	Open	2,011	6,843	6,843	4.0e-1	4.38	4.19
P-138	100	10	Ductile Iro	130.0	false	Open	389	6,843	6,843	1.0e-1	1.08	1.59
P-140	25	12	Ductile Iro	130.0	false	Open	-55	6,790	6,790	0	0.00	0.16
P-141	100	10	Ductile Iro	130.0	false	Open	404	6,790	6,790	1.0e-1	1.16	1.65
P-142	100	10	Ductile Iro	130.0	false	Open	404	6,790	6,790	1.0e-1	1.16	1.65
P-90	6,882	14	Ductile Iro	130.0	false	Open	1,622	6,827	6,807	20	2.95	3.38
P-129	5,404	14	Ductile Iro	130.0	false	Open	1,622	6,843	6,827	16	2.95	3.38
P-131	100	16	Ductile Iro	130.0	false	Open	2,662	6,791	6,790	4.0e-1	3.84	4.25
P-133	2,556	14	Ductile Iro	130.0	false	Open	2,662	6,996	6,977	19	7.37	5.55
P-134	2,880	14	Ductile Iro	130.0	false	Open	2,662	7,017	6,996	21	7.37	5.55
P-135	100	14	Ductile Iro	130.0	false	Open	2,290	6,650	6,650	1	5.58	4.77
P-137	5,440	14	Ductile Iro	130.0	false	Open	2,286	6,806	6,776	30	5.56	4.76
P-143	8,535	14	Ductile Iro	130.0	false	Open	1,235	6,807	6,791	15	1.78	2.57
P-144	100	12	Ductile Iro	130.0	false	Open	465	6,791	6,791	6.0e-2	0.62	1.32
P-145	100	12	Ductile Iro	130.0	false	Open	465	6,791	6,791	6.0e-2	0.62	1.32
P-146	2,098	10	Asbestos	140.0	false	Open	84	6,794	6,794	1.0e-1	0.06	0.34

Scenario: SummerDemand
Extended Period Analysis: 11.00 hr / 144.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)	Velocity (ft/s)
P-147	1,122	10	Asbestos	140.0	false	Open	93	6,730	6,730	7.0e-2	0.07	0.38
P-148	1,998	8	Asbestos	140.0	false	Open	130	6,883	6,882	1	0.37	0.83
P-149	2,787	8	Asbestos	140.0	false	Open	-90	6,882	6,883	1	0.18	0.57
P-150	741	8	Asbestos	140.0	false	Open	-220	6,882	6,882	1	0.97	1.40
P-151	683	12	Ductile Iro	130.0	false	Open	-170	6,791	6,791	7.0e-2	0.10	0.48
P-152	3,513	12	Ductile Iro	130.0	false	Open	-170	6,791	6,792	3.0e-1	0.10	0.48
P-153	1,106	10	Asbestos	140.0	false	Open	-708	6,620	6,623	3	2.86	2.89
P-154	2,424	10	Asbestos	140.0	false	Open	-505	6,623	6,627	4	1.53	2.06
P-155	7,499	6	Asbestos	140.0	false	Open	204	6,649	6,623	26	3.42	2.31
P-156	10,097	8	Asbestos	140.0	false	Open	49	6,791	6,790	1	0.06	0.32
P-157	9	10	Ductile Iro	130.0	false	Open	-483	6,790	6,790	1.0e-2	1.63	1.97
P-158	16	10	Ductile Iro	130.0	false	Open	-459	6,790	6,790	2.0e-2	1.46	1.87
P-159	4,446	6	Asbestos	140.0	false	Open	24	6,790	6,790	3.0e-1	0.07	0.27
P-117	1,584	6	Asbestos	140.0	false	Open	55	6,790	6,790	5.0e-1	0.30	0.62

Scenario: SummerDemand
Extended Period Analysis: 21.00 hr / 144.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)	Velocity (ft/s)
P-1	841	24	Ductile Iro	130.0	false	Open	9,811	6,903	6,898	5	5.96	6.96
P-2	16,338	24	Ductile Iro	130.0	false	Open	7,449	6,898	6,839	59	3.58	5.28
P-3	8,535	24	Ductile Iro	130.0	false	Open	6,994	6,839	6,812	27	3.19	4.96
P-4	8,149	24	Ductile Iro	130.0	false	Open	5,798	6,812	6,793	18	2.25	4.11
P-5	2,453	24	Ductile Iro	130.0	false	Open	5,740	6,793	6,788	5	2.21	4.07
P-7	100	24	Ductile Iro	130.0	false	Open	5,532	6,788	6,788	2.0e-1	2.07	3.92
P-8	13,982	14	Ductile Iro	130.0	false	Open	1,930	6,788	6,731	57	4.06	4.02
P-9	100	12	Ductile Iro	130.0	false	Open	1,032	6,788	6,788	3.0e-1	2.71	2.93
P-12	573	12	Ductile Iro	130.0	false	Open	-174	7,028	7,028	6.0e-2	0.10	0.49
P-14	5,206	12	Ductile Iro	130.0	false	Open	640	6,650	6,644	6	1.12	1.82
P-15	5,349	12	Ductile Iro	130.0	false	Open	510	6,644	6,640	4	0.73	1.45
P-16	1,610	14	Ductile Iro	130.0	false	Open	-14	6,650	6,650	10.0e-4	6.07e-4	0.03
P-18	1,799	14	Ductile Iro	130.0	false	Open	-14	6,650	6,650	5.0e-4	2.71e-4	0.03
P-22	12,367	16	Ductile Iro	130.0	false	Open	2,962	6,888	6,830	58	4.68	4.73
P-23	4,152	16	Ductile Iro	130.0	false	Open	2,918	6,830	6,811	19	4.56	4.66
P-24	1,806	16	Ductile Iro	130.0	false	Open	2,918	6,811	6,803	8	4.56	4.66
P-25	7,443	16	Ductile Iro	130.0	false	Open	1,517	6,803	6,793	10	1.36	2.42
P-28	6,900	14	Ductile Iro	130.0	false	Open	950	6,813	6,805	8	1.09	1.98
P-29	2,576	10	Asbestos	140.0	false	Open	536	6,813	6,808	4	1.70	2.19
P-30	2,091	10	PVC	150.0	true	Open	536	6,808	6,805	3	1.50	2.19
P-32	4,479	12	Ductile Iro	130.0	false	Open	-217	6,791	6,792	1	0.15	0.62
P-33	1,352	12	Ductile Iro	130.0	false	Open	-304	6,792	6,793	4.0e-1	0.28	0.86
P-34	1,699	10	Ductile Iro	110.0	true	Closed	0	6,791	6,808	0	0.00	0.00
P-35	5,147	10	Asbestos	140.0	false	Open	26	6,805	6,805	3.0e-2	0.01	0.11
P-36	4,765	14	Ductile Iro	130.0	false	Open	806	6,805	6,801	4	0.81	1.68
P-37	3,988	10	Asbestos	140.0	false	Open	656	6,801	6,791	10	2.48	2.68
P-39	11,063	8	Asbestos	140.0	false	Open	13	6,791	6,791	5.0e-2	4.9e-3	0.08
P-40	7,941	8	Asbestos	140.0	false	Open	-103	6,791	6,793	2	0.24	0.66
P-43	100	14	Ductile Iro	130.0	false	Open	867	6,793	6,792	9.0e-2	0.92	1.81
P-45	742	12	PVC	150.0	false	Open	-105	6,883	6,883	2.0e-2	0.03	0.30
P-46	2,778	12	PVC	150.0	false	Open	-249	6,883	6,884	4.0e-1	0.15	0.71
P-47	100	10	Asbestos	140.0	false	Open	867	6,889	6,888	4.0e-1	4.15	3.54
P-49	2,695	8	Asbestos	140.0	false	Open	304	6,888	6,884	5	1.77	1.94
P-57	5,733	16	Ductile Iro	130.0	false	Open	2,112	6,881	6,866	14	2.51	3.37
P-61	2,681	12	Ductile Iro	130.0	false	Open	-7	6,730	6,730	5.0e-4	1.82e-4	0.02
P-62	3,603	8	Cast iron	110.0	false	Open	183	6,730	6,726	4	1.08	1.17
P-63	1,345	12	Cast iron	110.0	false	Open	1,545	6,726	6,715	10	7.77	4.38
P-64	50	8	Ductile Iro	130.0	false	Open	1,402	6,803	6,801	2	34.33	8.95
P-65	50	8	Ductile Iro	130.0	false	Open	1,401	6,733	6,731	2	34.32	8.95
P-66	1,233	12	Ductile Iro	130.0	false	Open	1,362	6,731	6,726	6	4.52	3.86
P-67	3,836	8	Ductile Iro	130.0	false	Open	195	6,719	6,715	3	0.89	1.24
P-68	6,406	8	Ductile Iro	130.0	false	Open	281	6,730	6,719	11	1.76	1.80
P-69	618	8	Ductile Iro	130.0	false	Open	455	6,839	6,836	3	4.28	2.90
P-70	713	8	Ductile Iro	130.0	false	Open	455	6,733	6,730	3	4.28	2.90
P-71	7,066	12	Cast iron	110.0	false	Open	1,485	6,715	6,664	51	7.22	4.21
P-72	704	12	Cast iron	110.0	false	Open	1,485	6,664	6,659	5	7.22	4.21
P-73	100	12	Ductile Iro	130.0	false	Open	1,485	6,813	6,813	1	5.30	4.21
P-76	8,232	8	Asbestos	140.0	false	Open	47	6,650	6,650	5.0e-1	0.06	0.30
P-77	1,398	14	Ductile Iro	130.0	false	Open	390	6,650	6,650	3.0e-1	0.21	0.81
P-79	4,855	8	Asbestos	140.0	false	Open	-270	6,643	6,650	7	1.43	1.73

Scenario: SummerDemand
Extended Period Analysis: 21.00 hr / 144.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)	Velocity (ft/s)
P-21	3,480	16	Ductile Iro	130.0	false	Open	2,247	6,898	6,888	10	2.81	3.58
P-81	2,323	10	Ductile Iro	130.0	false	Open	116	6,898	6,897	3.0e-1	0.11	0.47
P-85	3,758	10	Ductile Iro	130.0	false	Open	43	6,830	6,830	7.0e-2	0.02	0.18
P-86	4,410	10	Asbestos	140.0	false	Open	105	6,730	6,730	4.0e-1	0.08	0.43
P-87	3,306	10	Asbestos	140.0	false	Open	47	6,730	6,730	6.0e-2	0.02	0.19
P-92	7,180	10	Ductile Iro	130.0	false	Open	550	6,640	6,626	15	2.05	2.25
P-93	6,573	10	Ductile Iro	130.0	false	Open	463	6,626	6,616	10	1.49	1.89
P-94	1,852	10	Asbestos	140.0	false	Open	-130	6,640	6,641	2.0e-1	0.12	0.53
P-96	2,241	10	Ductile Iro	130.0	false	Open	-98	6,640	6,640	2.0e-1	0.08	0.40
P-97	2,219	10	Ductile Iro	130.0	false	Open	-98	6,640	6,641	2.0e-1	0.08	0.40
P-98	3,141	8	PVC	150.0	false	Open	916	6,921	6,883	38	11.99	5.85
P-99	100	10	Ductile Iro	130.0	false	Open	1,032	6,950	6,950	1	6.57	4.21
P-101	6,959	12	Ductile Iro	130.0	false	Open	-145	7,027	7,028	5.0e-1	0.07	0.41
P-104	100	10	Ductile Iro	130.0	false	Open	-7.0e-4	7,027	7,027	0	0.00	2.97e-6
P-105	100	12	Ductile Iro	130.0	false	Open	-6.0e-4	6,883	6,883	0	0.00	1.84e-6
P-106	2,316	16	Ductile Iro	130.0	false	Open	1,725	6,866	6,862	4	1.72	2.75
P-108	1,505	16	Ductile Iro	130.0	false	Open	2,112	6,885	6,881	4	2.51	3.37
P-109	1,036	12	Ductile Iro	130.0	false	Open	87	6,885	6,885	3.0e-2	0.03	0.25
P-110	2,856	12	Ductile Iro	130.0	false	Open	87	6,885	6,884	8.0e-2	0.03	0.25
P-111	3,036	10	Ductile Iro	130.0	false	Open	0	6,885	6,885	0	0.00	0.00
P-112	857	10	Ductile Iro	130.0	false	Open	0	6,802	6,802	0	0.00	0.00
P-113	200	24	Ductile Iro	130.0	false	Open	-9,994	6,903	6,904	1	6.17	7.09
P-114	1,308	10	Asbestos	140.0	false	Open	40	6,731	6,731	2.0e-2	0.01	0.16
P-115	4,311	10	Asbestos	140.0	false	Open	221	6,731	6,730	1	0.33	0.90
P-116	1,490	10	Ductile Iro	90.0	false	Open	203	6,805	6,804	1	0.64	0.83
P-118	2,374	8	Asbestos	140.0	false	Open	87	6,803	6,803	4.0e-1	0.17	0.55
P-119	1,858	6	Asbestos	140.0	false	Open	70	6,804	6,803	1	0.47	0.79
P-120	2,692	6	Asbestos	140.0	false	Open	57	6,804	6,803	1	0.32	0.65
P-121	4,047	8	Asbestos	140.0	false	Open	87	6,803	6,802	1	0.17	0.55
P-122	13,052	14	Ductile Iro	130.0	false	Open	2,483	6,980	6,895	85	6.48	5.18
P-123	1,644	14	Ductile Iro	130.0	false	Open	2,483	6,895	6,885	11	6.48	5.18
P-124	4,380	10	Ductile Iro	130.0	false	Open	1,032	6,950	6,921	29	6.57	4.21
P-125	2,459	16	Ductile Iro	130.0	false	Open	1,725	6,862	6,858	4	1.72	2.75
P-126	1,924	14	Ductile Iro	130.0	false	Open	1,725	6,858	6,852	6	3.30	3.60
P-136	100	14	Ductile Iro	130.0	false	Open	1,725	6,852	6,852	3.0e-1	3.30	3.60
P-138	100	10	Ductile Iro	130.0	false	Open	0	6,852	6,852	0	0.00	0.00
P-140	25	12	Ductile Iro	130.0	false	Open	631	6,791	6,791	3.0e-2	1.09	1.79
P-141	100	10	Ductile Iro	130.0	false	Open	0	6,791	6,791	0	0.00	0.00
P-142	100	10	Ductile Iro	130.0	false	Open	0	6,791	6,791	0	0.00	0.00
P-90	6,882	14	Ductile Iro	130.0	false	Open	1,725	6,834	6,811	23	3.30	3.60
P-129	5,404	14	Ductile Iro	130.0	false	Open	1,725	6,852	6,834	18	3.30	3.60
P-131	100	16	Ductile Iro	130.0	false	Open	2,570	6,788	6,787	4.0e-1	3.60	4.10
P-133	2,556	14	Ductile Iro	130.0	false	Open	2,570	6,997	6,980	18	6.90	5.36
P-134	2,880	14	Ductile Iro	130.0	false	Open	2,570	7,017	6,997	20	6.90	5.36
P-135	100	14	Ductile Iro	130.0	false	Open	1,133	6,650	6,650	2.0e-1	1.52	2.36
P-137	5,440	14	Ductile Iro	130.0	false	Open	1,138	6,812	6,803	8	1.53	2.37
P-143	8,535	14	Ductile Iro	130.0	false	Open	1,338	6,811	6,793	18	2.06	2.79
P-144	100	12	Ductile Iro	130.0	false	Open	568	6,793	6,793	9.0e-2	0.90	1.61
P-145	100	12	Ductile Iro	130.0	false	Open	568	6,793	6,793	9.0e-2	0.89	1.61
P-146	2,098	10	Asbestos	140.0	false	Open	190	6,793	6,792	1	0.25	0.78

Scenario: SummerDemand
Extended Period Analysis: 21.00 hr / 144.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)	Velocity (ft/s)
P-147	1,122	10	Asbestos	140.0	false	Open	190	6,730	6,730	3.0e-1	0.25	0.78
P-148	1,998	8	Asbestos	140.0	false	Open	332	6,888	6,884	4	2.08	2.12
P-149	2,787	8	Asbestos	140.0	false	Open	131	6,884	6,883	1	0.37	0.84
P-150	741	8	Asbestos	140.0	false	Open	-200	6,884	6,884	1	0.82	1.28
P-151	683	12	Ductile Iro	130.0	false	Open	291	6,793	6,793	2.0e-1	0.26	0.83
P-152	3,513	12	Ductile Iro	130.0	false	Open	291	6,793	6,792	1	0.26	0.83
P-153	1,106	10	Asbestos	140.0	false	Open	-379	6,641	6,642	1	0.90	1.55
P-154	2,424	10	Asbestos	140.0	false	Open	-270	6,642	6,643	1	0.48	1.10
P-155	7,499	6	Asbestos	140.0	false	Open	109	6,650	6,642	8	1.08	1.24
P-156	10,097	8	Asbestos	140.0	false	Open	133	6,805	6,801	4	0.38	0.85
P-157	9	10	Ductile Iro	130.0	false	Open	470	6,791	6,791	1.0e-2	1.52	1.92
P-158	16	10	Ductile Iro	130.0	false	Open	631	6,791	6,791	4.0e-2	2.62	2.58
P-159	4,446	6	Asbestos	140.0	false	Open	161	6,801	6,791	10	2.23	1.83
P-117	1,584	6	Asbestos	140.0	false	Open	76	6,804	6,803	1	0.55	0.86

APPENDIX G

LOCATIONS AND ELEVATIONS OF NTUA AND CITY DELIVERY POINTS

	City of Gallup Control System (NMSPCS, NAD83, Modified)		UTM (NAD 1927)		Approx. Ground (NVGD 1929)
	Feet		Meters		Feet
	N:	E:	N:	E:	
Churchrock Chapter					
Churchrock (J-51)	1,652,106	2,491,181	3,934.981	716,245	6640
Sundance (J-52)	1,649,639	2,485,112	3,934,171	714,421	6610
Peretti (J-34)	1,642,034	2,472,764	3,931,733	710,734	6700
Redrock Chapter (J-9)	1,626,532	2,444,164	3,926,732	702,175	6600
Manuelito/Spencer Valley (J-54)	1,635,141	2,408,582	3,929,006	691,254	6375
City of Gallup Receiving Station	1,667,695	2,445,014	3,939,278	702,031	6935

APPENDIX H

NAVAJO - GALLUP WATER SUPPLY PROJECT
CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES

PRELIMINARY COST ESTIMATE

PIPELINES

Label	Dia. Inches	Length (Feet)	Unit Cost	Extended Cost
P-1	24	841	88.00	74,008
P-2	24	16338	88.00	1,437,744
P_3	24	8535	88.00	751,080
P-4	24	8149	88.00	717,112
P_5	24	2453	88.00	215,864
P-7	24	100	88.00	8,800
P-8	14	13982	55.00	769,010
P-9	12	100	48.00	4,800
P-12	12	573	48.00	27,504
P_14	12	5206	48.00	249,888
P-15	12	5349	48.00	256,752
P-21	16	3480	62.00	215,760
P-57	16	5733	62.00	355,446
P-69	8	618	35.00	21,630
P-70	8	713	35.00	24,955
P-81	10	2323	41.00	95,243
P-90	14	6882	55.00	378,510
P-92	10	7180	41.00	294,380
P-93	10	6573	41.00	269,493
P-96	10	2241	41.00	91,881
P-97	10	2219	41.00	90,979
P-99	10	100	41.00	4,100
P-101	12	6959	48.00	334,032
P-104	10	100	41.00	4,100
P-105	12	100	48.00	4,800
P-106	16	2316	62.00	143,592
P-108	16	1505	62.00	93,310
P-109	12	1036	48.00	49,728
P-110	12	2856	48.00	137,088
P-111	10	3036	41.00	124,476
P-112	10	857	41.00	35,137
P-113	24	200	88.00	17,600
P-122	14	13052	55.00	717,860

PIPELINES (CONTINUED)

Label	Dia. Inches	Length (Feet)	Unit Cost	Extended Cost
P-123	14	1644	55.00	90,420
P-124	10	4380	41.00	179,580
P-125	16	2459	62.00	152,458
P-126	14	1924	55.00	105,820
P-129	14	5404	48.00	259,392
P-131	16	100	62.00	6,200
P-133	14	2556	55.00	140,580
P-134	14	2880	55.00	158,400
P-135	14	100	55.00	5,500
P-136	14	100	55.00	5,500
P-137	14	5440	55.00	299,200
P-138	10	100	41.00	4,100
P-141	10	100	41.00	4,100
P-142	10	100	41.00	4,100
P-143	14	8535	55.00	469,425
P-144	12	100	48.00	4,800
P-145	12	100	48.00	4,800
P-151	12	683	48.00	32,784
P-152	12	3513	48.00	168,624

TOTAL COST EST. $10,112,445

NOTE: Pipeline Unit Costs are Weighted for 15% Rock Excavation

NAVAJO - GALLUP WATER SUPPLY PROJECT

CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES

PRELIMINARY COST ESTIMATE
NEW TANKS (RESERVOIRS)

(CIRCULAR STEEL TANKS W/CONCRETE RINGWALLS)

Label	Name	Zone	Volume MG	Lump Sum Cost
T-1	Gamerco	Gamerco	5.5	$1,300,000.00
T-2	Lyons	Country Club	3.0	$1,000,000.00
T-3	Sacred Heart	Sacred Heart	1.5	$600,000.00
T-8	RR Park	Country Club	2.0	$800,000.00
T-10	Southfork	Cresto	2.0	$800,000.00
		TOTALS	14.0	$4,500,000.00

NOTE: Detailed design considerations of economy and topography will govern tank diameters and heights. Final tank heights are expected to vary from 24 ft. to 40 ft.

NAVAJO - GALLUP WATER SUPPLY PROJECT

CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES

PRELIMINARY COST ESTIMATE
PROPOSED PUMP STATION CONSTRUCTION AND UPGRADES

Label	Name	Discharge Zone	Estimated Operating Motor HP	Lump Sum Cost
PMP-1 and PMP-6	Lyons Pump Station	Cresto	300	$500,000.00
PMP-3	Country Club Upgrade	Cresto	40	$50,000.00
PMP-4	East Pump Station Upgrade	Country Club	90	$100,000.00
PMP-5	Cresto Pump Station Upgrade	Sacred Heart	50	$60,000.00
	TOTAL			**$710,000.00**

NAVAJO - GALLUP WATER SUPPLY PROJECT

CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES

PRELIMINARY COST ESTIMATE
PROPOSED VALVE AND METERING STATIONS

PRV VALVE STATION

Label	Location	Discharge Zone	Size (Inches)	Lump Sum Cost
PRV-4	Sec. 17, T15N, R18W	Trade Mart	8	$40,000.00
PRV-8	Sec. 23,24 or 25, T15N, R18W	Country Club	8	$40,000.00
PRV-10	Rehoboth	Country Club	10	$45,000.00
PRV-11	South of Airport	West Zone	12	$50,000.00
PRV-12	Redrock Park	Country Club	10	$45,000.00
PRV-13	Park Pump Sta. Upgrade	Trade Mart	8	$10,000.00
	TOTALS			$230,000.00

PROPOSED METERING STATIONS

Name	Location (See Appendix G for Coordinate Locations	Maximum Flow (GPM)	Size (Inches)	Lump Sum Cost
Peretti Wash (Churchrock Chapt.)	Sect. 19, T15N, R17W	387	4"	$25,000.00
Sundance (Churchrock Chapt.)	Sec. 16, T15N, R17W	387	4"	$25,000.00
Churchrock (Churchrock Chapt.)	Sec. 11, T15N, R17W	770	6"	$35,000.00
Spencer Valley	Sec. 31, T15N, R19W	478	4"	$25,000.00
Redrock Chapt.	Sec. 8, T14N, R18W	1930	10"	$45,000.00
Gamerco (Receiving Station)	Sec. 32, T16N, R18W	9994	24"	$75,000.00
	TOTALS			$230,000.00

NAVAJO - GALLUP WATER SUPPLY PROJECT
CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES

PRELIMINARY COST ESTIMATE
VALVE AND METERING STATIONS (CONTINUED)

ALTITUDE VALVE STATIONS

Tank to Control	Size (Inches)	Lump Sum Cost
Redrock Park, T-8	12'	$45,000.00
Lyons, T-2	24"	$70,000.00
TOTALS		$115,000.00

VALVE & METERING STATION COST SUMMARY

Item	Lump Sum Cost
PRV Valve Stations	$230,000.00
Metering Stations	$230,000.00
Alt. Valve Stations	$115,000.00
TOTALS	$575,000.00

SURGE CONTROL STATION

Location	Size (Inches)	Lump Sum Cost
24" Pipeline Between Gamerco Tank and Lyons Tank	24"	$90,000.00

NAVAJO - GALLUP WATER SUPPLY PROJECT
CITY OF GALLUP TRANSMISSION AND STORAGE FACILITIES

PRELIMINARY COST ESTIMATE

CROSSINGS AND BORES

Pipe Label	Location	Carrier Size (Inches)	Estimated Lump Sum
P-3	I-40, Sec. 17, T15N, R18W	24"	$90,000.00
P-3	Rio Puerco, Sec. 20, T15N, R18W	24"	$40,000.00
P-3	Burlington Northern RR Sec. 20, T15N, R18W	24"	$75,000.00
P-3	H/W 66, Sec. 20, T15N, R18W	24"	$50,000.00
P-135	Bread Springs Wash, Sec. 25, T15N, R19W	12"	$30,000.00
P-96	I-40, Secs. 27 & 28, T15N, R19W	10"	$40,000.00
P-96	H/W 66, Secs. 27 & 28, T15N, R19	10"	$25,000.00
Near J-53	I-40, Sec. 29, T15N, R19W	8"	$35,000.00
P-4	Nizhoni Ext., Sec. 29, T15N, R18	24"	$45,000.00
P-124	H/W 602, Sec. 27, T15N, R18W	10"	$30,000.00
P-133	H/W 602, Sec. 34, T15N, R18W	14"	$40,000.00
P-126 @J-69	Hogback, Sec. 19, T15N, R17W	14"	$75,000.00
P-143	I-40, Sec. 16, T15N, R17W	12"	$45,000.00
P-143	H/W 66, Sec. 16, T15N, R17W	12"	$35,000.00
P-143	Burlington Northern RR Sec. 14, T15N, R17W	12"	$40,000.00
P-143	Rio Puerco, Sec. 14, T15N, R17W	12"	$30,000.00
	TOTALS:		$725,000.00

APPENDIX I

CITY OF GALLUP

Water Production
Income and Expenses
June, 2000

Unaudited Figures

	Current Month June, 2000	Y.T.D. Ended 06/30/00	Prior Year June, 1999	Y.T.D. Ended 06/30/99	% of Increase (Decrease) over Prior year
INCOME					
Water Sales	$307,989.	$2,886,898.	$272,073.	$2,776,361.	3.98
Misc Water Revenue	11,826.	110,501.	14,047.	118,136.	(6.46)
Common Items	3,842.	23,723.	894.	25,422.	(6.68)
Total Income	323,657.	3,021,122.	287,014.	2,919,919.	3.47
EXPENSES:					
Wages & Benefits	61,052.	513,783.	33,679.	465,122.	10.46
Operating Expenses	40,655.	388,642.	25,233.	248,794.	56.21
Electrical Expense	74,758.	812,809.	75,629.	745,413.	9.04
Maintenance Expense	18,064.	273,620.	16,711.	246,698.	10.91
Shared Services	21,284.	255,400.	21,913.	262,098.	(2.56)
Transfer to Bond Fund	13,047.	156,564.	7,992.	95,904.	63.25
Depreciation	45,013.	540,156.	46,232.	554,784.	(2.64)
TOTAL OPERATING EXPENSES	273,873.	2,940,974.	227,390.	2,618,813.	12.30
NET INCOME:	$ 49,784.	$ 80,148.	$ 59,624.	$ 301,106.	(73.38)
Water Pumped (gallons)	142,754,100	1,303,877,600	127,018,791	1,313,320,566	(7.19)
Water Sold (gallons)	116,181,600	1,045,352,100	112,740,011	1,109,154,310.	(5.75)
Gallons Unmetered	26,572,500	258,525,500	14,278,780	264,166,256	(2.14)
% Of Water Unmetered	18.61%	19.83%	11.24%	19.24%	3.07
Cost to Pump (per 1,000 gallons)	1.9185	2.2556	1.7902	1.9069	18.29
Earnings (per 1,000 gallons)	.4285	.0767	.5289	.2715	(71.75)
CAPITAL EXPENDITURES	$ 8,723.	$ 142,697.	$ 30,703.	$ 123,359.	15.68

Prepared by Lynne Thompson

APPENDIX J

BUSINESS VERSES RESIDENTIAL WATER USE

Estimates have been made as to the relative amounts of Business verses Residential water use in the City of Gallup (See Ref. 6 of this report). The estimates are based on contributions to the sewer collection and transmission system as determined by field counts and estimates which were further refined by actual flow measurements. The percentages listed below are believed to represent relative amounts of winter water demand as well as sewage contributions.

Percent Business Demand (winter) = 36%
Percent Residential Demand (winter) = 64%

City water use records show a present average January demand of 3.23 MGD, The winter demand would therefore by proportioned as follows:

Business - .36 x 3.23 = 1.16 MGD
Residential - .64 x 3.23 = 2.07 MGD

The estimated percentage values for a yearly basis are revised to account for an increase of residential irrigation during the summer months.

Percent Business Demand (yearly basis) = 33%
Percent Residential Demand (yearly basis) = 67%

The relative amounts of each classification for an average daily production of 3.78 MGD (See Page 4 of this report) would be as follows:

1997 Yearly Water Use:

Business - .33x 3.78 = 1.25 MGD
Residential - .67 x 3.78 = 2.53 MGD

The relative amounts of each classification for a future average daily production of 7.4 MGD (See Page 4 of this report) would be as follows:

2040 Yearly Water Use Estimate:

Business - .33x 7.4 = 2.44 MGD
Residential - .67 x 7.4 = 4.96 MGD