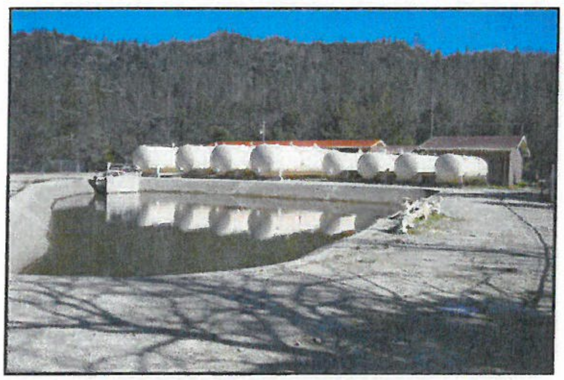
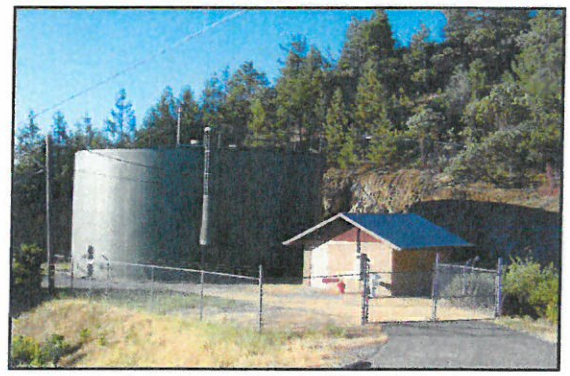
CENTERVILLE

C.S.D.

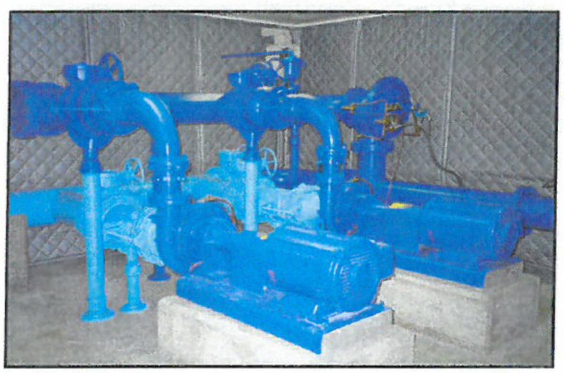
2004 MASTER WATER PLAN



WATER TREATMENT PLANT



ZONE A RESERVOIR/ZONE A-1 PS



ZONE C PUMP STATION

ZONE C RESERVOIR

July 2004

BY:

PACE CIVIL, INC.

PACE
CIVIL, INC.

July 13, 2004

214.70

Board of Directors
Centerville Community Services District
P.O. Box 990431
Redding, CA 96099-0431

Board Members:

We are pleased to present our engineering report entitled:

CENTERVILLE COMMUNITY SERVICES DISTRICT
2004 MASTER WATER PLAN

This report contains the results of our investigation of the District's water system including supply, treatment, storage, distribution, and internal pumping facilities. It includes conceptual plans, staging, and cost estimates for the major capital improvements that will be necessary as the District grows to reach its currently planned ultimate development. Emphasis has been placed on the planning and staging of near-term improvements necessary to allow continued growth over the next 10 to 20 years.

A summary of the report, including our recommendations, follows the Table of Contents.

PACE Civil, Inc., is very pleased to have participated in this project. We thank your staff for their able assistance in its preparation. We will be happy to meet with you at your convenience to discuss this Master Plan in detail.

Sincerely,

Samuel L. Smith
Managing Engineer

REGISTERED PROFESSIONAL ENGINEER
SAMUEL L. SMITH
No. 22640
EXP 12/3/05
CIVIL
STATE OF CALIFORNIA

SLS/dwa
enclosures
M:\Jobs\0214\0214.70\Ltr 2004 Master Water Plan.doc

1730 SOUTH STREET • REDDING, CA 96001-1811 • (530) 244-0202 • FAX (530) 244-1978

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

TABLES

TABLE OF CONTENTS (cont'd)

TABLES (cont'd.)

TABLE OF CONTENTS (cont'd)

TABLES (cont'd.)

FIGURES — FOLLOWING TEXT

PLATES

EXECUTIVE SUMMARY

Review of the Centerville Community Services District (District) water system consisted of a separate engineering analysis of each of its major components including storage reservoirs, booster pumping stations, pressure reducing stations, fire hydrants, and distribution piping. Analysis of the distribution piping was accomplished using the $H_2$0NET computer program.

Water Supply: The District is supplied water from the Muletown Conduit which is connected to Whiskeytown Reservoir. The District's current total allotment of water from the Muletown Conduit is 3,800 acre-feet annually. Previous pump testing of the Silver King Mine has indicated that it cannot be developed into a potential water source as once anticipated. Therefore, the District will have to increase its water allocation from the U.S. Bureau of Reclamation and/or acquire independent water rights from other entities to meet its estimated future ultimate demands of 6,140 acre-feet per year. For the purpose of this report it has been assumed that all water will be conveyed to the District via the Muletown Conduit.

Water Treatment: Clear Creek Community Services District owns and operates a water treatment facility at the base of Whiskeytown Dam. Centerville CSD has entered into an agreement with Clear Creek CSD for a 25 percent share in the existing 24 million gallon per day (MGD) water treatment plant that was completed in 1997.

Water Storage: Centerville CSD currently has a total of 2.205 million gallons (MG) of reservoir storage which exceeds the current estimated storage requirement by about 0.52 MG.

Water Distribution System: The existing water distribution system is generally in good condition, but improvements are needed for the following reasons:

(1) To allow for continued growth and still maintain sufficient water pressure to existing users.

(2) To provide adequate pipeline flow capacities for fire protection.

Fire Flows and System Analysis: Considerable attention was given to the determination of the entire water distribution system's adequacy to meet estimated fire flow requirements. Water demands for potential fires were based on fire flow criteria established by Shasta County, the City of Redding, and the Insurance Services Office (ISO), formerly the National Board of Fire Underwriters. ISO is the organization responsible for rating community water systems and fire protection facilities. This rating, in turn, establishes the fire insurance rates paid within the community. Centerville CSD currently holds a Class 6 rating. The distribution system is able to provide only a portion of these required fire flows in some areas. This is due to localized excessive headloss caused by certain undersized pipelines.

Based upon our hydraulic analyses, fire flow deficiencies exist at the following locations:

1. Silver King Road
2. Trail Drive

The computer model was valuable in determining weaknesses in the system. Using the computer analyses and 10-year and ultimate growth projections, the location and extent of the deficiencies were determined. Additional analyses were made incorporating improvements necessary to provide adequate supplies and pressures both now and in the future 2014 and ultimate development. Based on these analyses, a staged Master Plan of development can be estimated, but the system pressures and growth trends will have to be monitored with time in order to determine if an interim booster pump station will be required in the Placer Road Main.

Future Water Demands: In order to determine the required future improvements, it was necessary to project the current water usage. Based on pending developments within the City of Redding and County service areas; and the historical water use trend, it is expected that the annual growth rate in water demands will vary between 3 and 4 percent over the next ten years. The staging of improvements shown herein can be planned at a slower or faster growth rate by shifting them in time.

Considerable time was spent in making projections of future water use within small water service areas (113 in all). Existing water consumption and proposed land use (under the current County General Plan and proposed City zoning) were used in making future flow predictions for 2014 and for ultimate development within each of these service areas. Plate 1 at the end of the text indicates the boundaries of the overall water service area, which includes primarily the existing District boundary and four potential annexations. Based on this Study, the following total maximum daily demand (MDD) figures were determined:

	2002	2014	Ultimate
Maximum Daily Demand, MGD	3.5	5.5	12.6
Total Annual Demand, (ac-ft)	1,700	2,680	6,140

The ultimate flow was based on a saturation population of the entire District water service area as depicted in Plate 1. It appears that the District's ultimate maximum daily water usage will be about 3.6 times the current demand, which is about 3.5 MGD.

RECOMMENDATIONS

General: The proposed major capital improvements necessary to correct existing deficiencies and to meet future increasing water demands are shown on Plate 1 at the end of this report. Cost estimates of these improvements have been developed and are shown in detail in Tables I and II, also at the end of this report. Tables I and II are listings of major improvements needed primarily to provide for future growth based on using either the Alternative No. 1 Zone B Reservoir Site or the Alternative No. 2 Zone B Reservoir Site, respectively. If the District's goal is to have future connections pay for the improvements needed to accommodate growth, then it will be necessary to systematically increase the capital improvement fees to keep pace with inflation and the need for additional improvements. Tables III and IV outline schedules of improvements and cash flow scenarios for Zone Reservoir B Site Alternative No.'s 1 and 2, respectively. Tables I and III or Tables II and IV together with Plate 1 do, in effect, constitute the Master Plan of Improvements.

Water Supply: The District is currently using approximately 45 percent of its annual water allotment of 3,800 acre-feet and the projected 2014 demand is 2,680 acre-feet. Therefore, the District is in pretty good shape with regard to its water allotment from the Muletown Conduit.

Water Distribution System: The Master Plan is based on the eventual paralleling of the existing Placer Road main from the Muletown Conduit to the Zone C Booster Pump Station at Towerview Circle, in order to meet the ultimate demands of the system and provide adequate pressures.

Other major improvements to the water system include construction of new or additional storage reservoirs and new booster pump stations to serve the A2, A3, C1 and Muletown pressure zones. It will also eventually be necessary to upgrade the Zone A and C Booster Pump Stations and construct new booster pump stations at the Muletown Turnout and to serve Zone C2.

Numerous general improvements have been proposed for construction on Plate 1. Although a few of these improvements are needed for fire flows, most are needed for anticipated growth. Plate 1 also indicates additional improvements shown in red that will be required as development occurs in currently undeveloped areas.

Estimates of Cost: A summary of the estimated cost of future improvements as shown on Tables I and II are presented below:

TIME PERIOD	ALTERNATIVE NO. 1 ZONE B RESERVOIR SITE	ALTERNATIVE NO. 2 ZONE B RESERVOIR SITE
2004 to 2015	$ 4,712,000	$ 5,504,000
2015 to Ultimate	$ 5,480,000	$ 4,719,000
TOTAL	$ 10,192,000	$ 10,223,000

These figures do not include an allowance for inflation, over-sizing, or undefined improvements. As one can see the near term cost associated with using the Alternative No. 1 Site for the Zone B

Reservoir is lower than that for the Alternative No.2 Site, but the long term cost is about the same.

If the District constructs the water mains with its own forces, it is estimated that the project costs for those facilities will be about 15 percent lower than shown on Tables I and II. As shown in Table III, if the District's plant capacity fees are increased by $400 plus adjusted for inflation in 2004, then the 2004 plant capacity fee for a ¾-inch meter will be $5,329. If the incremental fee increase is systematically increased by $20 each year (i.e., $420 in 2005, $440 in 2006, etc.) and the adjustments for inflation are continued, then the plant capacity fund revenue will theoretically be adequate to construct the necessary improvements for the Alternative No. 1 scenario. Similarly, Table IV indicates that an incremental fee of $80 per year (i.e., to $480 in 2005, $560 in 2006, etc.) plus an annual adjustment for inflation will theoretically generate sufficient revenues to construct the improvements associated with the Alternative No. 2 Zone B Reservoir Site. However, there are many variables, such as the ability of the District to install large diameter water main at the pace required, the actual rate of growth in connections, and the ever increasing water use per service that can impact anticipated schedules of improvements. Thus, it is recommended that the plant capacity fees be reviewed annually and the potential impacts of large developments be evaluated carefully.

In order to keep pace with the inflation of construction costs, it is recommended that the plant capacity fees be adjusted annually in proportion to the increase of the Engineering News Record (20-City average) Construction Cost Index (ENR CCI) for the previous twelve months. The ENR (20-City Average) CCI for June 2004 was 7109 and monthly updates are available on the inter-net at www.enr.com.

INTRODUCTION

HISTORY

The Centerville Community Services District (CSD) was formed in 1959 for the purpose of providing a domestic water supply to approximately 8,000 acres of unincorporated land immediately west of the City of Redding. The initial water system improvements were financed through a Davis Grunsky loan from the State Department of Water Resources. Additional supply mains, storage, and booster pumping facilities were constructed by the District in 1982 and 1983 utilizing Farmers Home Administration combination grant and loan funding. Through the years the distribution system has also been expanded by private development, particularly the Olney Park, Ranchland and Montgomery Ranch, Monte De Las Flores, Westside Estates, and Placer Pine subdivisions.

In 1996 the District added a permanent Zone C Booster Pump Station and a 1.0 million gallon Zone C Reservoir to stabilize the summertime supply and pressures in Zone C. The District also participated in expansion of the water treatment plant at the base of Whiskeytown Dam to provide for year-round filtration of the water supply. All of these improvements were funded by a Safe Drinking Water Bond Law loan from the California Department of Water Resources.

In 2002 the District extended water mains easterly on Texas Springs Road and to Honeybee Road and Clear Creek Road. The majority of these mains were funded by Rural Development, except for the main in Clear Creek Road which were funded by the property owners being served.

Fire protection for the areas within the City of Redding is provided by the City of Redding. Fire protection for the remainder of the District is provided through the Shasta County Fire Department and the Centerville Volunteer Fire Company.

PREVIOUS STUDIES

In 1978, W. A. Gelonek and Affiliates made a study for the Centerville Community Services District entitled, "A Domestic Water Service Planning Study."

In 1980, PACE analyzed the needs of the water system and prepared an Engineering report entitled "Proposed Water System Improvements" which outlined the need for numerous supply main and storage improvements. Most of the critically needed improvements were constructed in 1982 and 1983. The District has also installed some additional mainline interconnections and fire hydrants that were recommended throughout the area.

In 1989, PACE re-analyzed the water system and prepared the 1989 Master Water Plan. Shortly after this master plan was finished, the City of Redding annexed a large section of land in the southeast area of the District's sphere of influence. The City staff also indicated that the City should provide water service to this area. Since this area was not in the District's service boundary at that time there was little that could be done to counteract the City's action. As a result, the major improvement scheme shown in the 1989 Master Water Plan to provide water service to the easterly portion of the District became infeasible.

In 1991 the District also began exploring numerous alternatives for complying with the pending State and Federal Surface Water Treatment Rule. At that time, the District's water supply was only filtered in the wintertime and the new regulations would require year-round treatment of surface water supplies. Alternatives that were analyzed included participation with Clear Creek Community Service District in expansion of the existing treatment plant, construction of a separate treatment plant near the District's Muletown Conduit turnout, purchase of treated water from the City of Redding from their new Buckeye Water Treatment plant, or from their Foothill Water Treatment Plant.

Following a detailed study of the particle removal efficiency of Whiskeytown Lake and the existing filtration system, it was determined that the most cost-effective solution was to participate in the improvement and expansion of the existing treatment plant at the base of Whiskeytown Dam. Construction of the improvements needed for a capacity of 24 MGD began in 1996 and was completed in 1997. The District's share of the expanded treatment plant capacity is 6 MGD.

In 1992, the District authorized PACE to prepare an abbreviated update to the 1989 Master Water Plan to outline the changes needed because of the loss of the large section of potential service area in the southeast corner of the District. However, due to the uncertainties associated with where the future treated water supply would come from, the work was suspended until 1997 when the District authorized a complete update to the 1989 Master Water Plan.

SCOPE OF WORK FOR CURRENT STUDY

In 2002, the District authorized PACE to convert the District's hydraulic model from the Kentucky Pipe program to the AutoCAD based $H_2$0NET program. Then in 2003 PACE was directed to update the Master Water Plan. This study reviews the current water system and recommend improvements required for ultimate development of the District's service area as currently envisioned with special emphasis on those improvements needed in the next twenty years. The resultant plan of improvements includes supply, treatment, storage, and distribution needs to meet existing and anticipated water demands.

RATINGS BY INSURANCE SERVICES OFFICE (ISO)

In 1989 the ISO rated the fire protection facilities provided by the District. This organization is responsible for rating fire protection facilities (including water systems), for all communities in the United States, and the assigned rating is used by fire underwriters to determine insurance rates. The lowest rating is a ten with the highest corresponding premium rate, and the highest and best rating is a one. The District received an overall Class rating of 6 in 1990, which is one point better than the 1979 rating. Although the ISO reviewed the District's water system in October 2003, the updated rating is not anticipated until early in 2005.

In 1980 the ISO began using a different rating system which does not penalize a community for not having fire flow capacity in excess of 3,500 gallons per minute (GPM). In effect this new rating system, which is described in the ISO Fire Suppression Rating Schedule, June 1980, puts the burden of fire demands in excess of 3,500 GPM on the property owner. No longer will cities and districts be penalized in ISO's rating system for not having capabilities to fight fires in excess of 3,500 GPM. The trend is to force property owners of large buildings to sprinkler their building and thus reduce their fire demand below the 3,500 GPM value. This is accomplished either by County or City Ordinance, or by the result of higher insurance premiums if the building is not sprinklered.

ABBREVIATIONS AND TERMS

Certain terms and abbreviations have been used in this report for convenience. Definitions are as follows:

AAD	Average Annual Demand
AC-FT	Acre-Feet
ADD	Average Day Demand. This is the average rate of water usage per day within a year. It can be expressed on an individual basis such as gallons per capita per day (GPCD) or on a community basis in million gallons per day (MGD).
CFS	Cubic Feet Per Second
CSD	Community Services District
GPCD	Gallons Per Capita Per Day
GPHED	Gallons per Household Equivalent Per Day
GPM	Gallons Per Minute
HE	Household Equivalent
HGL	Hydraulic Grade Line
HP	Horsepower
ISO	Insurance Services Office
KWH	Kilowatt Hours
MDD	Maximum Daily Demand, same units as ADD

MG	Million Gallons
MGD	Million Gallons Per Day. Note: 1 MGD = 694 GPM
MHD	Maximum Hourly Demand, same units as ADD
MMD	Maximum Month Demand
PRV	Pressure Reducing Valve
PSI	Pounds per Square Inch
TDH	Total Dynamic Head

EXISTING WATER SYSTEM

The existing Centerville CSD system will be described under nine major categories:

1. Supply
2. Treatment
3. Demand
4. Pressure Zones
5. Storage
6. Booster Pumping Station
7. Distribution System
8. Fire Flow and System Analysis
9. Control System

A plan of the system is shown on Plate 1. Figures and Plates are located at the back of this report.

SUPPLY

The District is supplied water from the Muletown Conduit, which is a "project facility" of the Federal Central Valley Projects' Whiskeytown Reservoir. The Muletown Conduit transmits water along Clear Creek to both the Centerville and Clear Creek Community Services Districts. The Centerville CSD diversion, located west of the intersection of Muletown Road and Placer Road, consists of a 12-inch turnout with 6-inch and 10-inch turbo-meters in parallel. The Muletown Conduit continues from the Centerville CSD turnout to a terminal reservoir in Clear Creek CSD.

With the annexation of the Muletown Road area in 1988, Centerville CSD also had about 12 individual service meters that were connected to the Muletown Conduit upstream of their main turnout. Since that time the District has consolidated the service connections so that the eighteen Muletown Zone customers in 2004 are served off of three master meters and one individual meter connected to the conduit.

Clear Creek CSD contracts directly with the U.S. Bureau of Reclamation, for both Municipal and Industrial (M&I) and Agricultural water. Clear Creek CSD is responsible for maintenance of the Muletown Conduit. In addition, Clear Creek CSD operates the water filtration and chlorination facility near the base of Whiskeytown Dam. Centerville CSD has paid for a 25 percent share of the original and expanded treatment facilities. Based on a filtration rate of 5 gallons per minute per square foot, Centerville CSD's share of the treatment facilities has an effective nominal capacity of 6 million gallons per day (MGD) or 9.3 cubic feet per second (CFS).

In October of 1994, the District entered into a "Water Treatment Plant Dedicated Capacity Contract" with Clear Creek CSD. The contract provides that Clear Creek CSD agrees to sell and Centerville CSD agrees to purchase dedicated capacity in the treatment plant, such that Centerville CSD shall be entitled to the availability of 25 percent of the plant capacity. The contract also states that "Centerville shall pay a portion of Clear Creek's total on-going direct costs for water treatment, transmission and conduit, maintenance and repair of the plant, and the Muletown Conduit facilities to Centerville's main turn out point equal to Centerville's percentage use of the total quantity of water treated by the plant."

In April of 2001, Centerville CSD completed negotiations with the U.S. Bureau of Reclamation and the Shasta County Water Agency and executed an Assignment Contract, which assigned all right, title, and interest of 2,900 acre-feet of Central Valley Project Water to Centerville CSD from the Shasta County Water Agency. In addition, in August of 2000, Centerville CSD entered into a Water Exchange Contract with the U.S. Bureau of Reclamation. This contract provides that the U.S. Bureau of Reclamation will substitute 900 acre-feet of project water for the District's pre 1914 appropriative right on Clear Creek and provide that water annually to the District at Wiskeytown Dam. This water is owned by the District and is senior water to any project water due to its pre 1914 status. Therefore, Centerville CSD's current total water entitlement under contract with the U.S. Bureau of Reclamation is 3,800 acre-feet per year.

TREATMENT

The water filtration and chlorination facilities are located near the base of the Whiskeytown Dam on the Muletown Conduit. The initial facilities were installed to provide year round chlorination, but to only provide filtered water during the winter months. Even with the additional improvements that were added in 1983, it was not possible to filter the entire summer flow rates.

The State Department of Health Services Surface Water Treatment Rule requires that all surface waters be filtered all year. The 1996 plant expansion combined the three existing 8-foot diameter by 40-foot filters with one more 8-foot diameter by 40-foot filter and four 10-foot diameter by 50-foot filters to create six separate treatment trains. The six filter trains all operate under pressure from the Whiskeytown Reservoir, and all by gravity. Cells are backwashed one at a time to the new backwash ponds. The captured lake turbidity and coagulant chemicals forms a sludge that settles in the ponds. The ponds overflow back to Clear Creek. The sludge will be dried in one of the ponds each year and taken to a landfill for disposal. Rinse water, following each backwash, is directed to a pond next to the filters. This water is quite clear and is all recycled back to the beginning of the filters.

Each filter train has a capacity up to about 5 MGD at 7 GPM/FT^2 for a total of 30 MGD. But because the plant operates better at lower filter rates, because of limited downstream clear well capacity, and to allow for equipment outages, the plant has a nominal rating of about 24 MGD. The treatment facilities are owned by Clear Creek CSD and Centerville CSD is currently entitled to 25 percent of its capacity.

With future expansions it is projected that the treatment plant capacity can be increased to about 44 MGD which is close to the hydraulic capacity of the Muletown Conduit.

DEMAND

Centerville CSD water consumption demand for 1996 was approximately 407 MG or 1,249 acre-feet. Table 1, Annual Water Consumption and Production, was compiled using the Districts records of metered sales (consumption) and metered flows at the Muletown Conduit turnout (production). The metered annual production for the last 10 years ranges from about one to eight percent higher than annual consumption. This is typical for water distribution systems where water is used for flushing lines, fires, etc. Some water is also lost through minor pipeline leaks and water meter measurement inaccuracy. The gross unaccounted for water in the last two years has been about 3.7 to 5 percent. After taking into account the estimated unmetered uses, such as fire training, system flushing, etc., the 2002 net unaccounted for water was about 2.3 percent, which is very good. As a basis for comparison, the City of Shasta Lake's gross unaccounted for water from 1995 through 1997 averaged 18 percent and the City of Anderson's gross unaccounted for water from 1998 through 2000 averaged 6.0 percent.

Figure 1 is a graphical presentation of the total annual water production, average annual production in gallons per day per service, and maximum month water production in gallons per day per service from 1970 to 2003. As can be seen from this graph the water production per service has increased fairly steadily from the 1977-78 drought to the 1991-93 drought and then continued to rise again. In fact, the maximum month water production per service increased about 27 percent in the ten-year period from 1986 to 1996 and another 12 percent from 1996 to 2003. This increase in consumption is due to the continued residential development of the area with more extensive landscape irrigation demands.

Figure 2 is a graphical presentation of the monthly production for 2002 and 2003, based on the monthly meter readings at the turnout. As expected, July tends to be the maximum production month at about twice the average monthly production.

The average consumption per household equivalent (HE) was determined by subtracting the water use of the 27 largest users from the total water use and then averaging the remaining water use over the remaining connections. The water use of the major users could then be expressed in HE's. An HE is the water usage of an average residential water user. For example:

TABLE 1
CENTERVILLE COMMUNITY SERVICES DISTRICT
ANNUAL WATER CONSUMPTION AND PRODUCTION

CALENDER YEAR	TOTAL ACTIVE METERED SERVICES (1)	UNUSED SERVICES (4)	AVERAGE NUMBER OF ACTIVE SERVICES FOR THE YEAR	METERED CONSUMPTION (MG/YR)	(GPSD)	METERED PRODUCTION (MG/YR)	(GPSD)	UNACCOUNTED FOR WATER (MG/YR)	(%)	ANNUAL GROWTH IN SERVICES
========	============	========	============	=======	=======	=========	==========	=========	========	========
1970	132		-	NA	NA	27.6	NA	#N/A	#N/A	
1971	139		136	NA	NA	27.5 (2)	556.0	#N/A	#N/A	5.3%
1972	149		144	NA	NA	30.9 (2)	587.9	#N/A	#N/A	7.2%
1973	167		158	NA	NA	37.2	645.0	#N/A	#N/A	12.1%
1974	188		178	NA	NA	49.9	770.2	#N/A	#N/A	12.6%
1975	213		201	47.6 (2)	650.4	49.6	677.8	2.0	4.0	13.3%
1976	236		225	59.9	731.0	64.9	792.0	5.0	7.7	10.8%
1977	349		293	53.3	499.2	53.5 (3)	501.1	0.2	0.4	47.9%
1978	441		395	66.8	463.3	75.0 (3)	520.2	8.2	10.9	26.4%
1979	499		470	88.9	518.2	95.7 (3)	557.9	6.8	7.1	13.2%
1980	558		529	109.5	567.6	113.2 (3)	586.8	3.7	3.3	11.8%
1981	569		564	142.0	690.4	151.2	735.1	9.2	6.1	2.0%
1982	580		575	NA	NA	152.9	729.0	#N/A	#N/A	1.9%
1983	607		594	NA	NA	165.5	764.0	#N/A	#N/A	4.7%
1984	629		618	NA	NA	201.3	892.3	#N/A	#N/A	3.6%
1985	642		636	184.1	793.7	193.8	835.5	9.7	5.0	2.1%
1986	650		646	198.0	839.9	218.0	924.5	19.9	9.2	1.2%
1987	675		663	251.0	1038.0	253.9	1050.1	2.9	1.2	3.8%
1988	700		688	250.3	997.5	258.7	1031.0	8.4	3.3	3.7%
1989	738		719	250.3	953.8	254.3	969.0	4.0	1.6	5.4%
1990	793		766	270.4	967.8	293.3	1049.7	22.9	7.8	7.5%
1991	826		810	247.4	837.3	265.6 (3)	898.9	18.2	6.9	4.2%
1992	887		857	297.0	950.0	311.2 (3)	995.4	14.2	4.6	7.4%
1993	909	(+31 unused)	898	304.8	929.9	318.9 (3)	972.9	14.1	4.4	2.5%
1994	926	(+31 unused)	918	366.0	1092.9	388.1	1158.9	22.1	5.7	1.9%
1995	944	(+31 unused)	935	352.7	1033.5	380.1	1113.8	27.4	7.2	1.9%
1996	953	(+31 unused)	949	380.8	1099.9	406.9	1175.3	26.1	6.4	1.0%
1997	970	(+30 unused)	962	400.0	1139.2	434.8	1238.3	34.8	8.0	1.8%
1998	987	(+25 unused)	979	336.2	940.8	377.7	1057.1	41.6	11.0	1.8%
1999	1012	(+23 unused)	1000	423.3	1159.7	478.8	1311.8	55.5	11.6	2.5%
2000	1027		1020	431.0	1157.7	477.1	1281.5	46.1	9.7	1.5%
2001	1061		1044	493.8	1296.0	525.5	1379.1	31.7	6.0	3.3%
2002	1111		1086	535.3	1320.0	556.1	1402.9	20.8	3.7	4.7%
2003	1140	(+19 unused)	1126	503.6	1210.3	530.3	1290.3	26.7	5.0	2.6%

NOTES: (1) End of calender year figures, excluding Muletown Rd. service area from 1970 to 1988. (3) Drought year conditions.

214.70/Spread/CNTBL3

Grant School is equivalent to about 27 HE's and the larger residential users range from about 4 to 11 HE's. As indicated in Table 2, in mid-2002 the District had a total of 1,086 active services which were equivalent to about 1,247 HE's.

Table 3, Ratio of Maximum Month Production Rates to Average Annual Production Rates, was developed to demonstrate the relative change in water consumption rates throughout the year. Historical maximum day and maximum hour demands are not available from the data due to limitations in the system measurement equipment and records. Design ratio value of 2.0 for maximum month demand to average annual demand, derived from an average of the last three years, agrees with industry standards and values used in master water plans for neighboring communities.

PRESSURE ZONES

The District now has six separate pressure zones as shown on Plate I. Zones B and D are supplied by gravity from the Muletown Conduit and Zones A and A1 are supplied by booster pump stations. Zone C is supplied by gravity most of the year, but the supply needs to be booster pumped during the summertime because of increasing headloss in the Placer Road water main. The Muletown Zone is supplied by gravity directly from the Muletown Conduit.

ZONE A1 is located in the higher elevations west of Mountain Shadows Drive and north of Secluded Valley Drive. The booster pump station at the Zone A Reservoir supplies water to the Zone A1 Reservoir which controls the pressure to the existing service area. In the future, the southerly portion of this zone will be supplied from the future Zone A2 Reservoir via a pressure-reducing valve.

Zone A is located primarily in the upper reaches of the Ranchland Subdivision including portions of both the Secluded Valley Drive, Knobhill Circle, and Mountain Shadows Drive areas. The booster pump station at the Zone B Reservoir supplies water to the Zone A Reservoir on Mountain Shadows Drive which controls the pressure to this area.

TABLE 2
CENTERVILLE COMMUNITY SERVICES DISTRICT
HE's DETERMINATION

NO.	NAME OR ACCOUNT No.	CONSUMPTION JULY[1] (cf)	CONSUMPTION JULY (gpd)	HE'S
1	016	273,570	66,010	27
2	444	105,270	25,401	11
3	440	97,350	23,490	10
4	464	95,150	22,959	10
5	503	85,470	20,623	9
6	050	75,790	18,287	8
7	105	69,740	16,828	7
8	107	69,190	16,695	7
9	133	64,350	15,527	6
10	441	63,690	15,368	6
11	375	57,310	13,828	6
12	062	55,220	13,324	6
13	477	53,900	13,006	5
14	895	53,790	12,979	5
15	494	53,680	12,952	5
16	1100	53,460	12,899	5
17	545	52,470	12,661	5
18	063	51,810	12,501	5
19	502	50,050	12,077	5
20	244	49,940	12,050	5
21	413	49,720	11,997	5
22	235	49,610	11,970	5
23	508	48,400	11,678	5
24	573	41,470	10,006	4
25	542	40,040	9,661	4
26	071	39,050	9,422	4
27	561	71,940	17,358	7
	TOTALS	1,871,430	451,558	188

AVERAGE NO. OF 2002 SERVICES = 1,086

TOTAL MAX MONTH CONSUMPTION[1] = 93.05 MG

LESS 27 LARGEST USERS = 14.00 MG

CONSUMPTION FOR REMAINDER OF DISTRICT = 79.05 MG

MAX MONTH CONSUMPTION / HOUSEHOLD EQUIVALENT = 2408 GPD

TOTAL AVERAGE NO. OF 2002 HE'S = 1,059 + 188 = 1,247

[1] 10% added to monthly total to account for early meter readings, i.e. meters were read 3 days early.

TABLE 3
CENTERVILLE COMMUNITY SERVICES DISTRICT RATIO OF MAXIMUM MONTH PRODUCTION RATES TO AVERAGE ANNUAL PRODUCTION RATES

CALENDER YEAR	AVERAGE No. OF ACTIVE SERVICES	AVERAGE ANNUAL DEMAND (AAD) (MGD)	MAX MONTHLY DEMAND (MMD) (MGD)	RATIOS MMD/AAD
1971	139	#N/A	0.180	#N/A
1972	149	#N/A	0.201	#N/A
1973	167	0.109	0.234	2.15
1974	188	0.137	0.302	2.20
1975	213	0.136	0.282	2.07
1976	236	0.178	0.373	2.10
1977	349	0.151	0.363	2.40 *
1978	441	0.205	0.595	2.90 *
1979	499	0.263	0.550	2.09 *
1980	558	0.310	0.659	2.13 *
1981	569	0.414	0.877	2.12
1982	580	0.419	0.902	2.15
1983	607	0.453	0.982	2.17
1984	629	0.551	1.205	2.19
1985	642	0.531	1.094	2.06
1986	650	0.597	1.274	2.13
1987	675	0.696	1.241	1.78
1988	700	0.709	1.505	2.12
1989	738	0.697	1.500	2.15
1990	793	0.804	1.500	1.87
1991	826	0.728	1.418	1.95 *
1992	887	0.853	1.829	2.14 *
1993	909	0.874	1.790	2.05 *
1994	926	1.063	2.173	2.04
1995	944	1.041	2.116	2.03
1996	953	1.115	2.320	2.08
1997	962	1.194	2.318	1.94
1998	979	0.925	2.514	2.72
1999	1000	1.312	2.753	2.10
2000	1020	1.307	2.609	2.00
2001	1044	1.440	2.733	1.90
2002	1086	1.523	3.019	1.98
2003	1126	1.453	3.082	2.12
	3 YEAR AVE. =			2.00
	RATIO DESIGN VALUES =			2.00

* Denotes drought conditions.

Zone B is located generally along Placer Road from the Muletown Conduit turnout to about Towerview Circle. The pressure in this zone is regulated by the water level in the Zone B Reservoir which is maintained via the supervisory valve at the turnout.

Zone C serves the area along both sides of Placer Road from about Towerview Circle to the City of Redding system at Record Lane. Pressure regulation is provided by the Zone C Reservoir which is fed via a supervisory valve and booster pump station near the intersection of Placer Road and Towerview Circle.

Zone D covers the remaining area in the southern and eastern portions of the study area and along Clear Creek. Pressures to this area are controlled by three pressure-reducing valves located on Powerline Road, Chaparral Drive, and Texas Springs Road.

Muletown Zone serves the area along Muletown Road north of Clear Creek Knolls Drive. Since the Muletown Conduit was designed primarily as a transmission main to Clear Creek CSD there was no intent to maintain adequate domestic supply pressures in the Muletown area. Consequently, the pressures at existing dwellings in the Muletown Zone currently fluctuate from about 26 to 36 pounds per square inch (PSI) during the summer and could fluctuate from about 10 to 20 PSI in the future as the conduit flows approach its design capacity of about 68 CFS.

Table 4 is a listing of the present and future estimated pressure limits in each pressure zone.

STORAGE

Adequate water storage facilities in a water system are important for a number of reasons. It may be necessary to replace a pumped supply with stored water in the case of a power outage or broken pipeline. Also, it is usually more economical to rely on water from storage rather than pumped water to furnish fire flows and peak demand flows in excess of the average flow used on

TABLE 4
CENTERVILLE COMMUNITY SERVICES DISTRICT
PRESSURE ZONE LIMITS

ZONE	EL. @ PUMP HD (ft)	EXIST. PRESSURE RANGE @ PUMP (psi)	FUTURE PRESSURE RANGE @ PUMP (psi)	HGL (1) EXIST	HGL (1) EXIST	HIGHEST SERVICE POINT			LOWEST SERVICE POINT		
						ELEV (ft)	STATIC PRESSURE (psi) EXIST	STATIC PRESSURE (psi) FUTURE	ELEV (ft)	STATIC PRESSURE (psi) EXIST	STATIC PRESSURE (psi) FUTURE
A-2	1480	#N/A - #N/A	106 - 110	#N/A - #N/A	1725 - 1735	1620	#N/A - #N/A	45 - 50	1390	#N/A - #N/A	145 - 149
A-1	(2)	#N/A - #N/A	97 - 102	1485 - 1495	1485 - 1495	1390	41 - 45	41 - 45	1160	141 - 145	141 - 145
A	(2)	85 - 89	85 - 89	1278 - 1288	1278 - 1288	1160	51 - 55	51 - 55	950	142 - 146	142 - 146
B	(2)	#N/A - #N/A	#N/A - #N/A	1095 - 1105	1095 - 1105	980	50 - 54	50 - 54	750	149 - 154	149 - 154
C	(2)	#N/A - #N/A	#N/A - #N/A	1065 - 1075	1065 - 1075	950	50 - 54	50 - 54	750	136 - 141	136 - 141
C1	(2)	#N/A - #N/A	#N/A - #N/A	#N/A - #N/A	1275 - 1285	1170	#N/A - #N/A	45 - 50	960	#N/A - #N/A	136 - 141
D	(2)	#N/A - #N/A	#N/A - #N/A	#N/A - #N/A	890 - 900	800	#N/A - #N/A	39 - 43	580	#N/A - #N/A	134 - 139
MULETOWN ROAD AREA	(2)	#N/A - #N/A	#N/A - #N/A	1130 - 1160	1225 - 1235	1130	0 - 13	41 - 45	890	104 - 117	145 - 149

(1) HGL IS HYDRAULIC GRADIENT ELEVATION UNDER STATIC CONDITIONS. THIS IS USUALLY THE ELEVATION OF THE MAXIMUM WATER SURFACE AND ESTIMATED MAXIMUM HOUR WATER SURFACE IN A RESERVOIR CONTROLLING THE PRESSURE IN THE ZONE. OTHERWISE, IT IS SET BY PRESSURE RANGE AT A BOOSTER PUMP OR A HYDROPNEUMATIC TANK.

(2) PRESSURES CONTROLLED BY GRAVITY RESERVOIR.

(NA) MEANS NOT APPLICABLE.

the day of maximum daily demand. The amount of storage in a water system also affects the rating by ISO for fire protection facilities.

There are five existing reservoirs in the Centerville CSD water system. Reservoir data is shown in Table 5. The 0.685-million-gallon Zone B Reservoir was constructed as part of the 1982 Water Project. The 0.15-MG Zone C Reservoir was installed when the system was initially constructed in 1967 and was recoated inside and out in 1985. The Zone A and Zone A1 Reservoirs were constructed in 1992 as part of the Ranchland Acres development. The second Zone C Reservoir was constructed in 1996. It is recommended that these reservoirs be drained, cleaned, and internally inspected every five years.

BOOSTER PUMP STATION

ZONE A BOOSTER PUMP STATION: The Zone A Booster Pump Station is located adjacent to the Zone B Reservoir. This station initially consisted of two 20-HP horizontal centrifugal pumps with a normal capacity of 310 GPM per pump and a fire flow capacity of approximately 700 GPM with both pumps running. A 3,200-gallon hydropneumatic tank and associated pressure switch control system maintained the Zone A pressure between 73 PSI and 90 PSI at the pump station. In 1992 with the addition of the Zone A Reservoir, the pump control system was changed from operation off of a hydropneumatic tank pressure switch to operation off of the Zone A Reservoir level transducer. In addition, the two 20-HP pumps were replaced with two 75-HP pumps. In order to conserve power, the new pumps were installed with 8-inch diameter impellers that will only put out about 540 GPM and draw approximately 45 HP. As the demands increase, 8.7-inch diameter impellers can be installed in the same pumps and their capacity will increase to about 750 GPM which should satisfy the ultimate demand conditions. Thus with each pump being capable of meeting the maximum daily demand, the pump station has 100 percent redundancy.

DATE: 5/14/04

TABLE 5
CENTERVILLE COMMUNITY SERVICES DISTRICT
EXISTING RESERVOIR DATA

EXIST. RESERVOIR NAME	YEAR CONSTRUCTED	TYPE	VOLUME (gals)	MAXIMUM WATER SURFACE ELEVATION (ft)	BASE ELEVATION (ft)
ZONE A	1992	WELDED STEEL	280,000	1288.8	1266.5
ZONE A1	1992	WELDED STEEL	90,000	1495.4	1480.0
ZONE B (PROSPECT DRIVE)	1982	WELDED STEEL	685,000	1104.8	1080.1
ZONE C	1967	WELDED STEEL	150,000	1074.9	1040.7
ZONE C	1996	WELDED STEEL	1,000,000	1074.9	1044.0

ZONE A1 BOOSTER PUMP STATION: In 1992 the Zone A1 Booster Pump Station was constructed adjacent to the new Zone A Reservoir. This pump station consists of two 30-horsepower pumps, each capable of pumping 300 GPM to the Zone A1 Reservoir. Therefore, the effective capacity of this pump station is 300 GPM which meets the projected ultimate demands of Zone A1, A2, and A3. Although, additional booster pump stations will be needed to lift the water into Zones A2 and A3.

ZONE C BOOSTER PUMP STATION: As the system demands increased each summer, the hydraulic gradient available to gravity water from the Zone B Reservoir to the Zone C Reservoir has decreased. During the summer of 1994, the Zone C Reservoir was repeatedly drawn down approximately 20 feet during peak demand periods resulting in some low pressure complaints in the higher reaches of Zone C. In 1995 the District installed an interim booster pump at the easterly intersection of Towerview Circle and Placer Road. This booster pump kept the Zone C Reservoir full during the summer of 1995 and during the summer of 1996 while the permanent Zone C Booster Pump Station was under construction at the westerly intersection of Towerview Circle and Placer Road.

The permanent Zone C Booster Pump Station contains a new 10-inch supervisory valve and two 40-HP variable speed pumps. The supervisory valve opens and closes based on the Zone C Reservoir level. The booster pumps are also controlled by reservoir level as well as the available suction pressure from the Zone B supply main. Once a booster pump is called for, the pump will ramp up to the point that the suction pressure is reduced to 95 PSI. The pump will continue to run at various speeds needed to maintain the 95 PSI suction pressure until the reservoir water level rises to the pump OFF position. The pump control system also includes a low suction pressure shut down and a high discharge pressure shut down. A low pump output shut down feature is also included to save power during periods when less than 200 GPM of flow is available from the Zone B supply main.

Initially, the Zone C Booster Pump Station has an effective capacity of about 1,080 GPM at a minimum suction pressure of 95 PSI and a full Zone C Reservoir. As the Zone B and D demands west of the pump station increase, it is expected that this capacity will decrease unless the 10-inch main in Placer Road is paralleled.

In July 2002, the MMD was estimated at 400 GPM based on the Zone C propeller meter readings. This equates to an estimated maximum daily flow of about 460 GPM. Based on a three to four percent growth rate in the Zone C and northeasterly portion of Zone D, the existing pumps will be at their effective capacity by the year 2010. By installing a second pump and a 12-inch main to Richison Ranch Road, it will be possible to expand the pump station's effective capacity to about 1,800 GPM with one pump out of service. Of course the future capacity will be dependent upon paralleling the 10-inch main in Placer Road to the west.

In order to reach the estimated ultimate demands in Zone C and the northeasterly portion of Zone D it may be necessary to increase the pump impeller sizes and motor horsepowers. However, this ultimate demand (if it does materialize) will probably be many, many years into the future. Once the separate Zone D supply main is installed along Trail Drive it may even be more desirable to install a small supplemental booster pump down on Chapparel Drive to make up any Zone C shortfall during the maximum demand conditions.

DISTRIBUTION SYSTEM

The distribution system consists of a network of piping from 4 to 24 inch diameter. Pipe material is asbestos cement (AC), ductile iron, ASTM Class 200 polyvinyl chloride (PVC) and AWWA C-900 PVC Class 150. The District has standardized on AWWA C-900 ratings on all new PVC pipe.

A combination of 10- and 16-inch mains in Placer Road is the backbone of the distribution system with laterals branching out on both sides. Due to the level of development, many of the lines are dead end, but the system is looped where practical.

FIRE FLOW AND SYSTEM ANALYSIS

Considerable attention was given to determining the entire water distribution system's adequacy to meet estimated existing MHD and fire flow requirements at ADD conditions. Water demands for potential fires were based on fire flow requirements established by Shasta County Fire Protection Water Standards and the City of Redding.

A computer model consisting of pipes representing the existing supply and distribution system was used to simulate various water demands. Numerous computer analyses were made of the existing water system, including the MHD condition and different fire flows coincident with AAD conditions. In general, no extraordinary friction losses occurred in any pipes during the MHD simulation.

Potential fire flows were located at strategic, typically worst-case locations, such as dead ends or small size pipes. In general, Shasta County fire flow requirements were attained or nearly attained in most cases. This illustrates that the existing system is capable of achieving substantial fire flow; however, improvements are necessary to bring the entire District up to desirable standards.

Fire flows were estimated at the locations shown on Table 6 by setting the hydrant residual pressure at 20 PSI and letting the computer analysis determine the available fire flow:

TABLE 6
ESTIMATE FIRE FLOWS

FIRE LOCATION	ESTIMATED FIRE FLOW
Westside Estates	With the addition of the 12-inch main down Placer Road, easterly of Irish Creek Road, the available District fire flow has increased from 950 GPM to over 1,500 GPM with a 30 PSI residual on the Bond Ridge main.
Placer Pines	Estimated fire flow of 1,500 GPM at the highest fire hydrant with a 30 PSI residual on the Bond Ridge main.
End of Silver King Road	Maximum fire flow of 300 GPM at residual pressure of 20 PSI.
Intersection of Simmons Road and Trail Drive	Estimated fire flow of 300 GPM at residual pressure 20 PSI.
At intersection of Swasey Drive and Middletown Park Drive near Grant School	Estimated fire flow of 2,300 GPM at residual pressure of 20 PSI.
Clear Creek Road Industrial Area	Estimated fire flow of 2,000 GPM at residual pressure of 20 PSI.

FUTURE WATER DEMANDS

SERVICE AREA

To determine the future needs of the water system, it was first necessary to establish the physical and political boundaries of the service area and to estimate the water demands for that area at various times in the future.

The LAFCO sphere of influence water service area for Centerville CSD, shown on Plate 1, extends northwesterly to include a large area of BLM land; southerly to Clear Creek; and southeasterly beyond the existing District boundary. However, the District Board of Directors decided to limit the ultimate service area of this Master Plan to the District's existing boundary, plus the potential annexations listed below and shown on Plate 1.

TABLE 7
POTENTIAL ANNEXATION AREA

POTENTIAL ANNEXATION	Area (acres)	Estimated Ultimate Water Demand (acre-feet)
Foxwood – North of the Zone C Reservoir	±368 acres	114
Sargents Property – Near the center of the District	±372 acres	200
Miscellaneous – Southeast edge of District	±32 acres	18
Extension of West Ridge – Northeast edge of District	±30 acres	16
Total	±802	348

GROWTH PROJECTION

The District had 1,111 active services at the end of 2002 and an average of about 1,086 active services during the calendar year 2002. For the purpose of this report, we have chosen to project future growth in terms of the number of services and the potential increased water demand rather than population. All services in the District are metered. The number of services and past water consumption and production values are shown in Table 1.

Future growth is very difficult to predict. However, the Redding area is currently in a fairly high growth trend and the following developments are being constructed or proposed in the District's sphere of influence:

TABLE 8

PENDING DEVELOPMENTS

PROPOSED DEVELOPMENTS	NO. OF PARCELS	EQUIVALENT ¾" METERS
Placer Pines on Placer Road – (within City of Redding)	44	30
West Ridge – East of Placer Road and South of Camp Calle (within City of Redding)	279	187
Foxwood – North of the Zone C Reservoir	100	100
Morgan Development – Near Intersection of Placer Road and Swasey Drive	16	16
Jaxon Enterprises – Off Texas Springs Road	49	49
TOTAL	488	382

In addition, there is a city park proposed as part of the West Ridge Development and a number of smaller developments possible throughout the District. While it is not certain that all of these developments will be completed and built out by 2014, it is a possibility. Therefore, the flow projections in this Master Plan have been based on a 3 to 4 percent annual increase in equivalent ¾-inch meters.

It must be remembered that City lots may purchase a 5/8-inch meter, which is equivalent to 0.67 times a ¾-inch meter, and meters larger than ¾-inch in size can be equal to a number of ¾-inch equivalents. Thus, the number of lots connected will not correspond to the number of ¾-inch meter equivalents connected.

PROJECTED WATER DEMANDS

Water consumption rates in various areas of the District were analyzed to verify the applicability of the water consumption values for various land uses that were used in the 1997 Master Plan. Only parcels where landscaping features had probably been established were included in the analysis. As shown on Table 9, the estimated 1996 and 2002 maximum daily consumption in the various sample service areas were fairly close to the 1989 design values for consumption based on zoning, except for the Mt. Shadows Drive and Secluded Valley areas. Based on these results the consumption design values by land use were modified slightly as shown in Table 7 to allow for lower consumption values in the 0.33 units/acre land use areas that have relatively steep terrain. The consumption design values for 0.75 and 3.0 units per acre were also increased slightly based on the data on the Olney Park and Westside Estates areas. Projected ultimate water demands were determined by using the values shown in Table 10; and the County and City General Plan land use designations.

As indicated previously, the MMD per service increased by about 12 percent from 1996 to 2002. This also indicates that the MDD per service is also still increasing.

An analysis was also made of the summertime water use for various water use categories ranging from 0 to 10,000 cubic feet up to greater than 100,000 cubic feet. Table 11 is a summary of the water usage in each category from June through October 2003. (Grant School is included in this analysis, but their main irrigation was curtailed during this time period due to construction activities.) Figure 3 is a graphical presentation of the percentage of services and water usage for July 2003 consumption, when the average consumption was about 10,500 cubic feet per customer. As can be seen, about 11 percent of the services consumed more than 20,000 cubic feet and those services used about 35 percent of all the water sold. Similarly, about five percent of the services consumed greater than 30,000 cubic feet and those services used about 19 percent of the water sold. One customer used approximately 140,600 cubic feet in July 2003. Table 11 indicates the approximate consumption that was greater than 20,000 cubic feet per service and 30,000 cubic feet per service, from June through October which totaled 5,565,000 and 2,310,000 cubic feet, respectively.

TABLE 9

CENTERVILLE CSD
ANALYSIS OF WATER CONSUMPTION BY LAND USE

SAMPLE SERVICE AREAS	DEVELOPMENT DENSITY UNITS/ACRE		DESIGN VALUES FOR MDD (gal/ac/day)			
	ALLOWABLE PER ZONING	ACTUAL	1989 DESIGN VALUES FOR CONSUMPTION BASED ON ZONING	ESTIMATED 1996 MDD CONSUMPTION VALUES	ESTIMATED 2002 MDD CONSUMPTION VALUES	VALUES USED IN 2004 MASTER PLAN
SECLUDED VALLEY (Steep Terrain)	0.33	0.25	1150	799	690	**700**
LEDGEWOOD (Steep Terrain)	0.33	0.20	1150	N/A	470	**700**
MT. SHADOW	0.33	0.22	1150	540	950	**1150**
MONTGOMERY RANCH	0.33	0.20	1150	863	1,000	**1150**
RANCHLAND	0.33	0.25	1150	1,093	1,170	**1150**
MIDDLETOWN	0.33	0.26	1150	1,171	1,210	**1150**
OLNEY PARK	0.75	0.66	2050	1,860	2,070	**2100**
WESTSIDE ESTATES	3.00	2.43	5000	4,652	4,980	**5500**

TABLE 10

CONSUMPTION DESIGN VALUES BY LAND USE

Density Units/Acre or Land Use Designation	Design Values (Gal/Ac/Day)*	
	MDD	MHD
0.1	500	1000
.02	700	1,400
0.25	900	1,800
0.33 (steep terrain)	700	1,400
0.33 (gentle rolling terrain)	1,150	2,300
0.50	1,600	3,200
0.75	2,100	4,200
1.0	2,500	5,000
2.0	4,500	9,000
3.0	5,500	11,000
Industrial	2,000	4,000
Bureau of Land Management (BLM)	Same as adjacent private lands	

*Gross area, includes streets

NOTE: Above design values are only applicable to forecasting of District-wide flow rates, not individual property flow rates.

M:\Jobs\0214\0214.70\Word Documents\Report.doc

TABLE 11
CENTERVILLE CSD
2003 SUMMER CONSUMPTION COMPARISON

USE CATEGORIES (1,000 cf)	CATEGORY USAGE IN CF					
	JUNE	JULY	AUGUST	SEPT	OCTOBER	TOTAL
0 - 10	3,878,000	3,412,100	3,536,900	3,696,200	3,825,900	18,349,100
10 - 20	3,331,900	4,322,700	3,911,000	3,462,700	2,910,800	17,939,100
20 - 30	1,129,000	1,841,300	1,818,400	1,367,000	1,197,300	7,353,000
30 - 40	485,400	977,400	1,199,300	562,000	540,200	3,764,300
40 - 50	181,300	457,900	86,600	318,500	218,800	1,263,100
50 - 60	261,400	428,400	325,800	219,600	222,400	1,457,600
60 - 70	196,200	128,100	194,500	132,600	132,800	784,200
70 - 80	71,500	73,500	222,300	0	78,400	445,700
80 - 90		0	0	82,000		82,000
90 - 100		101,000	93,400			194,400
> 100*		140,600				140,600
TOTALS	**9,534,700**	**11,883,000**	**11,388,200**	**9,840,600**	**9,126,600**	**51,773,100**
TOTAL GREATER THAN 20,000 cf PER SERVICE	**844,800**	**1,548,200**	**1,420,300**	**921,700**	**829,900**	**5,564,900**
	8.9%	13.0%	12.5%	9.4%	9.1%	10.7%
TOTAL GREATER THAN 30,000 cf PER SERVICE	**385,800**	**565,300**	**621,900**	**384,700**	**352,600**	**2,310,300**
	4.0%	4.8%	5.5%	3.9%	3.9%	4.5%

* DOES NOT INCLUDE GRANT SCHOOL MAIN IRRIGATION CONSUMPTION.

The MDD flows are significant because they are the primary design criteria used in design of the water treatment and storage facilities. As long as there is sufficient storage to handle the peak demand periods during the 24-hour MDD, then the treatment facility will be sufficient if it is designed to produce the required amount of water at a constant rate. If the MDD increases beyond the projected design value because of abnormally high consumption, then the capacity of the treatment plant would have to be increased beyond the values estimated in this Master Plan.

Typically, the amount of storage needed is determined by evaluating the need for equalizing storage (usually 20 percent of the MDD), emergency storage (usually 25 percent of the MDD), and fire storage ranging from 500 GPM for two hours (60,000 gallons) in the County rural residential areas; up to 3,500 GPM for three hours (630,000 gallons) in industrial areas. The storage requirement for each pressure zone is usually determined by using the equalizing storage plus the larger quantity of either the fire storage or the emergency storage.

The fire flow storage is usually larger than the ultimate emergency storage in the small pressure zones such as A1 and Muletown. However, in the other zones, the ultimate emergency storage is larger than the fire storage. Thus, the total storage requirement in the larger pressure zones is based on the equalizing plus the emergency storage, which are both functions of the MDD. Thus, if the MDD increases due to abnormally high consumption, then the ability of the storage reservoirs to equalize the flow would be impacted and could cause the need for additional storage.

The water distribution system is typically sized to handle both the MHD condition and the MDD plus the fire flow condition. Typically, the water main sizes in rural areas will be controlled by the fire flow condition until the number of houses served exceeds about 500; then the MHD condition will become the overriding factor. With this in mind, the size of the main distribution line down Placer Road from Muletown Road to the Zone C Pump Station is probably more a function of consumptive use during peak demand than a function of the fire flow conditions. **Thus, if the MDD and MHD continue to increase due to abnormally high consumption,the headloss in the Placer Road water main will increase above the design values. This could result in lower than normal pressures and/or a reduction in the ability to refill the reservoirs at nighttime during peak demand periods.**

Table 9 indicates the estimated ultimate water consumption based on current County General Plan and the City of Redding's 2000 -2020 General Plan within the existing District boundary; along with the potential annexations shown on Plate 1. These projections were made by estimating full development at a practical level of development considering the constraints imposed by health standards for sewage disposal in the County areas, topography, existing zoning in the County, proposed zoning in the City, and recently proposed subdivisions.

As shown in Table 10, it is estimated that the MDD will increase to approximately 12.6 MGD at ultimate buildout of the service area. Table 10 also indicates that with ultimate development there will be approximately 3,624 services on about 10,290 acres for an overall average parcel size of about 2.8 acres (gross). If the ultimate development should become more dense than now planned, such as could occur if sewers are extended beyond the current City planning areas and zoning were changed; then the plan shown herein would require further modification and strengthening.

In 1989 the study area included approximately 3,700 acres of Federal land managed by the Bureau of Land Management (BLM). In recent years BLM has sold or traded many of these lands to private ownership. Therefore, this current Master Plan provides for service to all BLM lands within the current District boundaries, except for those along the northerly and westerly boundaries which are not likely to be sold by BLM.

TABLE 12
CENTERVILLE CSD
SUMMARY OF ESTIMATED ULTIMATE CONSUMPTION

PRESSURE ZONE	MAXIMUM NUMBER OF SERVICES	PRACTICAL NUMBER OF SERVICES	AREA (acres)	MDD USAGE (MGD)	TOTAL ANNUAL USAGE (ac-ft/yr)
A,A1,A2,A3	300	270	1,510	1.13	552
B	1,290	1,097	4,200	4.42	2,155
C & C1	1,160	1,067	1,640	2.87	1,398
LOWER D	540	432	1,920	2.14	1,042
UPPER D	850	723	660	1.86	904
MULETOWN	36	36	360	0.18	88
TOTAL	4,176	3,624	10,290	12.60	6,138

Table 10, Summary of Design Values Used in Water System Analysis, is a summary of design parameters used for 2002, 2014, and ultimate system analysis. Values for 2014 were based upon a projection of 2002 values plus the increased demand associated with anticipated future growth. Ultimately, the District could reach an ADD of about 5.48 MGD which represents a 360 percent increase in the current 1.52 MGD average daily demand. The ultimate system will also have approximately 3,620 services which is 3.3 times the 1,086 average active services in 2002.

Using the projected water demands, the average day, maximum day, and maximum hour demands were plotted on Figure 4 to illustrate how supply requirements could increase over time with development approaching ultimate build-out by about year 2050.

The growth rate in a given area will usually form an "S" curve with a higher rate of growth occurring during the middle years than occurs at either the beginning of development or when development is approaching saturation. The "S" curve estimate assumes that zoning, general plan designations, and land use will remain unchanged in the future. Of course future growth is also dependent upon the local economy and the ability of Centerville CSD to secure the needed water from the Muletown Conduit. This report projects growth at between 3 and 4 percent per year for the next 30 years and then leveling off for the following 16 years until ultimate build-out

TABLE 13
CENTERVILLE CSD
SUMMARY OF DESIGN VALUES USED IN WATER SYSTEM ANALYSIS

ANNUAL AVERAGE DAILY PRODUCTION DEMAND (GAL/HE/DAY)		1200
RATIO	MMD:AAD	2.0
RATIO	MDD:AAD	2.3
RATIO	MHD:AAD	4.6

YEAR	2002	2014	ULTIMATE
AVERAGE NUMBER OF METERED SERVICES	1086	1700	3620
HOUSEHOLD EQUIVALENTS (1)	1267	1990	4570
AVERAGE DAILY DEMAND (MGD)	1.52	2.39	5.48
MAXIMUM DAILY DEMAND (MGD)	3.50	5.49	12.61
MAXIMUM HOUR DEMAND (MGD)	6.99	10.98	25.23
ADD/EQUIVALENT HOUSE SERVICE(GPM)	0.83	0.83	0.83
MDD/EQUIVALENT HOUSE SERVICE(GPM)	1.92	1.92	1.92
MHD/EQUIVALENT HOUSE SERVICE(GPM)	3.83	3.83	3.83

(1) Household equivalents are based on the District's current average usage, even for future projections

in year 2050. Approximately 90 percent of the ultimate development is projected to occur by the year 2035.

DISTRIBUTION SYSTEM DEMANDS

In the hydraulic analysis of a distribution system, it is necessary to use both the MHD and MDD and to properly distribute these flows within the distribution system. In this study the distribution of these flows was done on the basis of subservice areas. The service area boundary was divided into approximately 112 subservice areas. Then using the existing County General Plan and existing City zoning in the northeast corner of the District, the ultimate MDD was estimated for each subservice area based on its area, its land use designation, and the design values shown in Table 8. The 2002 MDD per subservice area was determined based on the maximum month water meter readings for that subservice area times the factor of 1.15 to adjust from the MMD to MDD. The 2014 conditions were based on the future units being added to those subservice areas that were expected to be all or partly developed by 2014. The estimated 1.99 MGD increase in MDD from 2002 to 2014 was spread as follows:

- 0.05 MGD in Zone A1
- 0.13 MG in Zone A
- 0.54 in Zone B and the southerly portion of Zone D
- 0.94 MGD in Zone C and the northeasterly portion of Zone D
- 0.30 MGD in Zone C1
- 0.03 MGD in the Muletown pressure zone

This flow information was concentrated to demands at various points in the system; and then head losses, pressures, and pipeline flow were determined by the computer model. By running the computer model under various conditions, one can determine the weaknesses of the distribution system and simulate the system operation with the proposed improvements to verify that the desired result will be attained.

A table of the area of each subservice area and its land use designation, together with a map showing the boundaries of the subservice areas has been prepared for future reference. It was not included in this report, as it will seldom be used.

ANALYSIS AND RECOMMENDED IMPROVEMENTS

GENERAL

The first step in analysis of the water system was to compare the capacity of existing facilities with desired capacities based on recognized engineering design criteria. Next, the facilities were analyzed under future conditions based on projected growth and corresponding system demands. Deficiencies were noted and solutions examined. Finally, the improvements appearing to have the least cost and provide the required capacity were listed in order of priority in a timetable. This list of improvements constitutes the Master Plan of Improvements. The improvements are shown in tabular form in Table I and shown graphically on Plate 1 at the end of the text. The analysis and specific recommendations for these improvements will be discussed under the following headings:

1. Supply
2. Treatment
3. Pressure Zones
4. Storage Reservoirs
5. Booster Pumping
6. Pressure Reducing and Automatic Valves
7. Distribution System
8. Fire Hydrants
9. Monitoring, Alarm, and Control System
10. Interconnection with Other Agencies

SUPPLY

Supply systems are normally designed to provide a capacity equal to or greater than the average flow during the MDD. As discussed hereinbefore, the District's only existing source of water supply is from the Muletown Conduit, which is owned by the Bureau of Reclamation and maintained by Clear Creek CSD. The groundwater aquifer under the District service area has a very limited capacity. In 1989, the District pump tested the 310-foot deep Silver King Mine in an attempt to develop a groundwater source. Unfortunately there was very little effective yield and the water quality was poor. Therefore, groundwater wells within the District are no longer considered to be a viable water source for the District.

For the purposes of this report, it has been assumed that the Muletown Conduit will continue to be the primary source of water for the District. Table 14 is a summary of the District's projected water supply needs. Based on these projections, the District's current water entitlement of 3,800 acre-feet annually should be adequate for at least the next 10 and possibly up to 20 years. It is of interest to note that under ultimate conditions the District's MDD of almost 20 CFS will be about 30 percent of the existing conduit's estimated capacity of 68 CFS. Depending upon Clear Creek CSD's ultimate demands, a parallel conduit may someday be necessary.

Although the inerties with the City of Redding (near the intersection of Placer Road and Record Lane and on the east boundary of the Westside Estates Subdivision) provide an alternate source of water to either agency in the event of an emergency; it is not envisioned that these inerties will be used as a normal source of supply for either agency.

The Record Lane manually-operated pump station can be used to pump City water to the District's Zone C Reservoir. The piping in the Zone C Booster Pump Station was designed such that the pumps can also be used to pump water from the Zone C Reservoir to the Zone B Reservoir in a manual operation mode. Therefore, under emergency conditions the City of Redding water could reach all of the District's customers on a very limited basis, except for the Muletown Road customers. This system was used during the winter of 2003-2004 when the Muletown Conduit was shut down for maintenance.

TABLE 14

SUMMARY OF WATER SUPPLY NEEDS

DEMAND CONDITION	YEAR			
	1996	2002	2014	ULTIMATE
Average Daily Demand, MGD	1.115	1.52	2.39	5.48
Total Annual Demand, ac-ft	1,250	1,700	2,680	6,140
Maximum Daily Demand				
In MGD	2.90	3.5	5.49	12.61
In cfs	4.50	5.46	8.56	19.67

In the future, it may be desirable to develop an emergency intertie with Shasta CSD as well. A water main over the pass on Swasey Drive would be at a hydraulic gradient sufficient to supply water to the Centerville CSD Zone B Reservoir under a minimal demand condition. This intertie could provide an emergency source of water for both Districts. However, the normal Shasta CSD hydraulic gradient is too high for water to flow by gravity from Centerville CSD's system. Thus, a booster pump would be needed to supply water from Centerville CSD to Shasta CSD.

TREATMENT

As indicated in the Section EXISTING WATER SYSTEM the existing treatment plant is rated at a hydraulic capacity of 30 MGD and a nominal treatment capacity of 24 MGD. Based on a 25 percent share in the treatment facility the District's current nominal treatment capacity is 6 MGD. It is estimated that the average cost of adding a 10'x50' filter at the treatment plant will be about $1,100,000 in 2004 dollars. If one assumes that the District purchases 25 percent or 1-MGD of each additional filter's 4.0 MGD nominal capacity, then the cost per MGD would be about $275,000. The total estimated cost of 6.6 MGD in additional treatment plant capacity is about $1,815,000 in 2004 dollars.

At this point in time, it is not possible to project the future accurately enough to predict whether both Centerville CSD and Clear Creek CSD can satisfy their ultimate demands for water without paralleling the Muletown Conduit.

PRESSURE ZONES

Pressure zone boundaries and upper elevation limits are shown on Plate 1. The boundaries and the pressure limits maintained in the various pressure zones all seem to be acceptable. Normally, pressures of about 50 to 125 PSI should be maintained in a distribution system. However, as a matter of practicality, these limits are often stretched to about 40 to 150 PSI. Pressures below 20 PSI do not meet State Health Department standards unless the user is informed of the limits of pressure and is in agreement with such limitations. In general, pressures in the Centerville system are maintained within the 45 to 140 PSI range. Only under conditions of very high demand or in a few special cases are pressures found to be outside this range. Refer to Table 5 in the Section EXISTING WATER SYSTEM for a list of current and future pressure extremes. Areas in Zones A1, A2, A3, B, C, and C1 that may require individual booster pumping are shown on Plate 1.

STORAGE RESERVOIRS

It is usually more economical and reliable to provide stored water for supply needed during: (1) fire demands; (2) peak demands in excess of MDD; and (3) in the event of an emergency short-term loss of the usual source of supply such as power outage. The required storage in a typical water system is a function of three quantities as follows:

1. Equalizing storage is the amount of water needed over and above the MDD rate to satisfy peak demands of the day. This is often found to be between 15 and 20 percent of the MDD and has been assumed to be 20 percent for design purposes herein.

2. Fire storage is usually based on the theoretical amount that could be used to combat a major fire in the high value districts. Insurance Services Office recommends fire storage be a function of computed fire demands. Shasta County fire standards recommended fire flows varying from 500 GPM for single-family residential lots larger than 1 acre in size to a maximum of 2,500 GPM for multi-family residential, commercial, or industrial.

The City of Redding requires fire flows of 1,500 GPM for singe-family residential lots, with the exception that if the homes are equipped with a fire sprinkler system, then the fire flow requirement can be reduced to 1,000 GPM.

ISO recommendations range from 500 GPM for single-family residential on large parcels (1,000 GPM if the dwellings have wood shake roofs) to a maximum of 3,500 GPM. Buildings requiring higher flows would not be counted against the community water system if ISO were to rate the system. It seems impractical to design the entire water system to meet every possible fire demand, which can change with building reconstruction, sprinkler installation, or building demolition.

Fire storage requirements are based on being capable of providing the recommended fire flow for a period of at least 2 hours for fire flows equal to or less than 2,500 GPM and 3 hours for fire flows above 2,500 GPM. Therefore, it would require 0.06 MG and 0.30 MG of storage to meet the 500 GPM and 2,500 GPM fire flow requirements, respectively.

The Shasta County fire storage requirements have been used herein as the design value for areas within the County's jurisdiction. Fire flows of 500 GPM have been used in residential areas. Due to the limited capacity of the existing distribution system, fire flows to the industrial area along Clear Creek Road are limited to about 1,500 to 2,000 GPM. Thus, fire sprinklers may be required for industrial buildings in that area.

The City of Redding residential fire flow requirement of 1,500 GPM has been used as the design value for areas in the City of Redding.

3. Emergency storage is the amount of water necessary to continue service in the event of power failure or some other failure of the supply system. This is usually assumed to be the MDD rate times some interval of time such as might occur during a power outage. Six hours is normally used. However, where supply system failures are uncommon, it seems unreasonable to imagine a major fire coincident with both a supply failure and with a period of water consumption equal to the MDD. For this reason, the recommended Centerville CSD storage will be the equalizing storage plus the larger quantity of either fire storage or emergency storage.

Table 15 summarizes the District's 2002, proposed 2014, and Ultimate storage requirements for each zone.

The District currently has 2.2 MG of storage capacity which is 0.52 MG above the current recommended total storage capacity. However, the next near-term need for additional storage will be in Zone B, which is a need that cannot be met by the excess capacity in the Zone C Reservoirs.

Fortunately, the District also has excess capacity available in the water treatment plant so this excess maximum day supply can be used to supply some of the difference between the MDD and the MHD. It is estimated that the combination of using 50 percent of the existing storage for equalizing and the treatment plant capacity of 6.0 MGD will reasonably satisfy the maximum hourly demands associated with a MDD of about 5.5 MGD. Based upon a MDD use of 3,400 gallons per day per service, the new Zone B Reservoir will be needed when the number of active services reaches about 1,600.

Two potential sites for the future Zone B Reservoir are shown on Plate 1. Alternative No. 1 is located on BLM land north of the intersection of Swasey Drive and Delano Drive, while Alternative No. 2 is located in the proposed Foxwood Development north of the existing Zone C

DATE: 5/14/04

TABLE 15
CENTERVILLE COMMUNITY SERVICES DISTRICT
STORAGE REQUIREMENTS

YEAR	MDD (MGD)	EQUAL. STORAGE (MG)	EMERG. STORAGE (MG)	SHA. CO. FIRE STORAGE (MG)	CITY OF REDDING FIRE STORAGE (MG)	DESIRABLE STORAGE (MG)	
===========	========	========	========	========	========	========	
		.20*MDD	.25*MDD				
ZONE A3							
2002	0.000	0.000	0.000	0.000	N/A	0.000	
2014	0.000	0.000	0.000	0.000	N/A	0.000	
ULT.	0.077	0.015	0.019	0.060	N/A	0.075	Add 0.09 MG
ZONE A2							
2002	0.000	0.000	0.000	0.000	N/A	0.000	
2014	0.000	0.000	0.000	0.060	N/A	0.060	
ULT.	0.118	0.024	0.030	0.060	N/A	0.084	Add 0.15 MG
ZONE A1							
2002	0.050	0.010	0.013	0.060	N/A	0.070	Exist. 0.09
2014	0.100	0.020	0.025	0.060	N/A	0.080	
ULT.	0.196	0.039	0.049	0.060	N/A	0.099	
ZONE A							
2002	0.470	0.094	0.118	0.060	N/A	0.212	Exist 0.280 MG
2014	0.600	0.120	0.150	0.060	N/A	0.270	
ULT.	0.742	0.148	0.186	0.060	N/A	0.334	
ZONE B & A PORTION OF ZONE D							
2002	2.260	0.452	0.565	0.180 (1)	0.180 (2)	1.017	Exist 0.685 MG
2014	2.800	0.560	0.700	0.180 (1)	0.180 (2)	1.260	Add 2.5 MG
ULT.	6.561	1.312	1.640	0.180 (1)	0.180 (2)	2.952	
ZONE C & A PORTION OF ZONE D							
2002	0.660	0.132	0.165	0.060	0.180 (2)	0.312	Exist 1.15 MG
2014	1.600	0.320	0.400	0.060	0.180 (2)	0.720	
ULT.	4.260	0.852	1.065	0.060	0.180 (2)	1.917	Add 1.0 MG
ZONE C1							
2002	0.000	0.000	0.000	0.060	N/A	0.000	
2014	0.300	0.060	0.075	0.060	N/A	0.135	Add 0.21 MG
ULT.	0.466	0.093	0.117	0.060	N/A	0.210	
MULETOWN ZONE							
2002	0.060	0.012	0.015	0.060	N/A	0.072	
2014	0.090	0.018	0.023	0.060	N/A	0.078	
ULT.	0.180	0.036	0.045	0.060	N/A	0.096	Add 0.1 MG
TOTAL							
2002	3.500					1.68	Exist 2.205
2014	5.490					2.53	4.915
ULT.	12.600					5.65	6.255

NOTES:
1. Fire flow based on industrial development along Clear Creek Road with sprinklered buildings.
2. Fire flow based on residential development only within the City of Redding.

Reservoir. If the Alternative No. 1 Site is used, then it would require construction of about 7,500 feet of 20-inch water main from Point 6 near the intersection of Placer Road and Swasey Drive to the new tank and about 8,000 feet of 14-inch parallel main from the intersection of Placer Road and Swasey Drive to the Zone C Pump Station.

If the Alternative No. 2 Site is utilized, then the 20-inch main up Swasey Drive would not be needed and the parallel main in Placer Road from Point 6 to Zone C Pump Station would be increased from 14-inch and 20-inch main to a 24-inch main. A 20-inch main would then be run from Placer Road at Point 15 to the new Zone B Reservoir.

No matter which alternative is selected, it will be necessary to modify operation of the Muletown Turnout Supervisory Valve and Booster Pump Station once the new Zone B Reservoir is added. Control of the Muletown Turnout Facilities would be tied to the water level of the new reservoir and an altitude valve would be added at the inlet of the existing Zone B Reservoir to keep it from overflowing while refilling the new Zone B Reservoir. In addition, it would be necessary to add a pressure transducer upstream of the altitude valve on the existing Zone B Reservoir to control the output of the Muletown Turnout Pump Station and keep it from over-pressurizing the piping on Texas Springs Road while refilling the new Zone B Reservoir.

Since Zone D is fragmented into a number of relatively separate pockets of potential demand, it has been decided that these various areas can be better served with storage in either the Zone B or Zone C Reservoirs, than by constructing a separate Zone D Reservoir. Thus the concept of a separate Zone D Reservoir has been abandoned and the various Zone D service areas will be served via pressure reducing stations being fed from the higher zones. Since Zone B is up gradient of Zone C, it would also be possible to store some of the Zone C emergency water requirement in the Zone B Reservoirs. However, because the ultimate Zone C and Upper Zone D demands will require equalizing storage of about 75 percent of the existing reservoir capacity, it is recommended that a 1.0 million gallon Zone C Reservoir be added in the future.

Pressure Zones A2, A3, and C1 are future zones that will be required when development continues to higher elevation on Mule Mountain and to the north of the Zone C Reservoir. Each zone will require a booster pump station and the Zone A2, A3, and C1 Reservoirs will need to be constructed on an "as-developed" basis in order to provide the sufficient storage in the event of a power outage. Based on the preliminary information on the proposed Foxwood Development, the District should consider oversizing the Zone C1 Reservoir, so it can serve a larger area to the west and east in the future.

Pressures in the Muletown Zone are marginal now and will get worse as flows in the Muletown Conduit increase. Ultimately a booster pump station and 0.10 MG reservoir should be constructed to enhance service in this zone. Because of the small number of users in the area it will probably be less expensive in the near future for those customers to install private individual booster pumps on an as-needed basis. It is difficult to project the timing of the Muletown Reservoir but it is estimated that it will be constructed by the year 2020.

BOOSTER PUMPING

Currently booster pumping is required to lift the water from Zone B to Zone A, from Zone A to Zone A1, and during the summertime from Zone B to Zone C. As higher elevation pressure zones are developed and the demands throughout the system continue to increase, the need for additional booster pumping will also increase.

As shown on Plate 1 water supplied to Zones A, A1, A2, and A3 is taken from the Zone B Reservoir and lifted in series to the next higher zone via a booster pump station. Consequently the Zone A Booster Pump Station must be capable of supplying the MDD of all three zones, and the Zone A1 Booster Pump Station must have a capacity equal to the MDD of Zones A1 and A2, etc. As discussed previously in the Section EXISTING WATER SYSTEM, the existing Zone A Booster Pump Station has an effective capacity of about 540 GPM and can be easily modified to an effective capacity of about 740 GPM.

The Zone A1 Booster Pump Station consists of two pumps with each one capable of providing its design ultimate effective capacity of 300 GPM. The pumps are controlled by the water level in the Zone A1 storage reservoir.

As the demands have continued to increase in Zones B and C, the hydraulic gradient of the 10-inch main in Placer Road has dropped to the point that it is no longer possible to maintain the required water level in the Zone C Storage Reservoir by gravity during high demand periods. The Zone C Booster Pump Station was constructed in 1996 with an effective capacity of about 1,080 GPM and is expandable to about 1,800 GPM by adding a third pump and a 12-inch main to Richison Ranch Road provided that the 10-inch main in Placer Road is paralleled in order to provide sufficient suction pressure. It should be pointed out that if the new Zone B Reservoir is constructed at the Alternative No. 2 Site, then the Zone C Pump Station will probably only be needed under maximum hour demands, if at all. This is because there would be very little headloss from the new Zone B Reservoir to the Zone C Supervisory Valve.

Figure 5 indicates the estimated hydraulic grade line on the Muletown Conduit under 28 MGD and 44 MGD flow conditions. The theoretical capacity of the Muletown Conduit is estimated at 44 MGD or 68 CFS. As the District's water demands increase and the Muletown Conduit's hydraulic gradient (pressure) decreases, it will be necessary to booster pump the entire District supply from the Muletown Conduit. This pump station should ultimately have a pumping capacity of about 9,000 GPM. Although the pumps will operate very little in the early years, they will need to operate more often and for longer periods as the hydraulic grade line of the Muletown Conduit continues to decrease, especially during the summer months.

An analysis of the existing Muletown Conduit turnout facilities indicates that whenever the Zone B Reservoir level controls signal for the supervisory valve to open, the turnout facility opens wide open and provides water at a rate of about 3.9 MGD. Thus the hydraulic capacity of the existing facility is about 3.9 MGD. By modifying the turnout to include a bypass with a motor-operated butterfly valve and a venturi tube type flow meter; and by allowing for some additional drawdown in the Zone B Reservoir, the turnout capacity can probably be increased to about 4.2 MGD. As District flow approaches 4.0 to 4.2 MGD it will probably be necessary to booster pump from the Muletown Conduit into the District's distribution system.

Figure 6 shows a number of hydraulic system curves that depict the hydraulic gradeline on the Muletown Conduit at the District's Turnout as well as the District's distribution system under current and future conditions. The Muletown Conduit system's curve is based on a conduit flow equal to four times the District withdrawal rate from the conduit. This is consistent with the District being entitled to 25 percent of the water treatment plant's flow. The point where the Muletown Conduit's system curve crosses the District's system curve is the estimated hydraulic capacity of the system. For any given flow rate if the District's system curve is above the Muletown Conduit's system curve it will be necessary to pump into the District's system. Therefore, the existing District's distribution system from the Muletown Conduit to the Zone B Reservoir has a theoretical gravity flow capacity of 3.9 MGD. Once the parallel 18-inch and 24-inch mains are installed in Placer Road and the parallel 14-inch main is installed in Prospect Drive, the theoretical gravity flow capacity will increase to about 6.5 MGD.

From a practical standpoint it will probably be necessary to construct the initial 6.0 MGD Muletown Turnout Pump Station when the MDD flows reach about 4.0 MGD and gradually install the parallel Placer Road main over time to limit the headloss and resultant power costs. As shown on Figure 6, the theoretical pumping head at 6.0 MGD is about 85 feet based on the District's existing 10-inch and 16-inch mains in Placer Road (i.e., the difference in elevation between the District's existing systems curve and the Muletown Conduit's system curve at 6.0 MGD. Similarly the theoretical pumping head at 13.2 MGD is about 95 feet assuming that the parallel Placer Road mains are installed. It should be noted that the maximum hydraulic gradient on the discharge side of the booster pump station should be limited to about elevation 1,210 in order to prevent over pressuring the southeastern reaches of the Zone B distribution system.

PRESSURE REDUCING AND AUTOMATIC VALVES

Pressure reducing valves will be needed at a number of locations in future development of the water distribution system. Pressure reducing valves are shown between Zones A, A1, and A2 to the north of Secluded Valley Road. These valves will be needed to serve that portion of Zone A1 from the Zone A2 Reservoir and provide additional fire flow capability to the west side of Zone A. In addition, a number of pressure reducing valves will be needed between Zone C and Zone D and between Zone B and Zone D to provide redundancy and supplemental fire flow to Zone D.

An altitude valve will be needed on the existing Zone B Reservoir to allow filling of the proposed new Zone B Reservoirs off Swasey Drive or in the proposed Foxwood development.

DISTRIBUTION SYSTEM

The computer analysis of the distribution system was discussed in the Section EXISTING WATER SYSTEM. In addition to analyzing the existing system, the computer model was used to analyze future flows at the estimated 2014 and Ultimate levels of development.

The pipeline improvements shown on Plate 1 are in two categories:

1. Pipelines needed to correct existing deficiencies (such as meeting fire demands) or to keep pace with projected growth, but are of a general nature not related to a particular development. These improvements are shown in Table I in the Master Plan.
2. Pipelines needed to serve new development (and possibly at the same time provide for future growth) are shown as "As Developed." Oftentimes these pipelines are in excess of the size needed to serve that particular development. "As Developed" indicates there is no existing significant development along this line and installation of the line probably can await development.

As shown on Plate 1 it will eventually be necessary to essentially parallel the entire length of the 10-inch main in Placer Road in order to meet the Ultimate demands of the system. Although it may be possible to use smaller parallel mains in Placer Road, the trade off will be higher pumping costs and the addition of more pressure reducing stations to reduce the pressures on Texas Springs Road and in other low lying areas of Zone B. Because of the very long length of the Placer Road main, it will not be possible to construct the parallel pipelines in such a manner as to maintain adequate system pressures as continued growth occurs. Therefore, it will be necessary to construct a booster pump station at the Muletown Conduit to assist in meeting demands during the summer months.

Also as shown on Plate 1 and discussed in the Reservoir section of this chapter, the size of the parallel water main from Point 6 near the intersection of Placer Road and Swasey Drive to the Zone C Reservoir, will vary depending upon which future Zone B Site is utilized.
Not all pipelines that will be needed in the future are shown on the Master Plan. Some pipelines will be needed to serve new developments, and some will be needed to account for growth generally beyond a 10-year period.

The District should consider participating in the oversizing costs of "As Developed" pipelines that are in excess of the size needed to serve a particular development even though the full capacity of the line may not be needed for many years. Oversizing normally applies to pipelines of 10-inch diameter and larger that are in excess of the size needed to serve a particular development. Many agencies contribute the incremental cost of the pipe material plus an allowance of 15 percent of that amount which is intended to cover the extra labor required to install the larger size pipe.

It should be noted that many of the lines shown "As Developed" are very nebulous at this point; this is especially true where they are providing supplies to undeveloped perimeter areas. In these cases, the extent of future development is not well known.

FIRE HYDRANTS

The current Fire Protection Water Standards for Shasta County require a maximum hydrant spacing and a maximum driving distance from the nearest hydrant to the structure of 750 feet for single-family residential lots larger than 1 acre in size and 300 feet hydrant spacing in industrial areas. The District's existing standard of 750 feet maximum hydrant spacing and 600 feet maximum driving distance from the nearest hydrant to the building site is more consistent with the ISO recommendations and is still a reasonable requirement for development within the County on large lots. Pursuant to an agreement between Centerville CSD and the City of Redding, development constructed within the City limits will have to be designed and constructed in accordance with the City's standards. These higher density developments will probably be required to install fire hydrants spaced 500 feet apart in residential areas and 300 feet apart in commercial areas.

MONITORING, ALARM, AND CONTROL SYSTEM

The District recently completed installation of a new radio telemetry system. The following future additions are envisioned as new facilities are added:

1. Include telemetry, level recording, and high/low level alarm for the new Zones A2, A3, B, C1, and Muletown Reservoirs.

2. When Zones A2, A3, C1, and Muletown Booster Pump Stations are added, include local flow measurement.

All reservoir level recorders and the central alarm annunciator panel should continue to be located at the District Office.

INTERCONNECTIONS WITH OTHER AGENCIES

Interconnections with other agencies are very desirable from a mutual aid standpoint during emergencies. The District currently has completed an interconnection with the City of Redding at the east boundary of the Westside Estates development and a manually-operated emergency booster pump station at the intersection of Record Lane and Conard Street. Both of these interconnections have flow meters that measure the flow in either direction.

The Westside Estates interconnection opens automatically in the event of low pressure caused by a high fire demand in the Westside Estates area. The Record Lane intertie has been used to supply water to the City of Redding a number of times and was used last winter to supply water to the District while the Muletown Conduit was down for maintenance.

The City of Redding has recently inquired about the possibility of an additional intertie on Clear Creek Road. Although Centerville CSD can easily gravity flow water to the City of Redding at this location, it would take at least two booster pump stations to move water from the City of Redding to the District's Zone B Reservoir.

At some future date it may also be possible to interconnect with the Shasta CSD on Swasey Drive. It would not be necessary to pump from the Shasta CSD system.

ESTIMATES OF COST AND FINANCIAL CONSIDERATIONS

BASIS

Pipeline and other facility costs were determined on the basis of previous projects competitively bid in this area. It should be noted that these estimates are based, in many instances, on extremely preliminary information. One example of this is the cost of proposed mains to supply areas that are as yet undeveloped. The lengths of these mains may vary considerably from those shown. Even in the developed areas, at the report stage, it is often difficult to determine whether a new main will require pavement replacement or how much utility interference will be encountered. These costs cannot be properly evaluated until final design. Consequently, the estimates in this report may vary considerably from the actual cost for a particular project.

In order to obtain total project costs, construction contingencies and indirect costs were added to the construction costs. Construction contingencies are usually assumed to be 10 percent of the construction costs. Indirect costs include engineering, administration, and legal costs. All of these combined usually amount to about 15 percent. The total of the above was taken at 25 percent. This figure may vary considerably depending on the complexity of the work. Where bonding or other loans are involved, costs for interest during construction and other finance costs (such as bond discounts, legal and bond counsel fees, and reserve funds) should be added in preparing the financial plan.

IMPROVEMENT COSTS

Order of magnitude cost estimates for each of the proposed improvements based on the Alternative No. 1 Zone B Reservoir Site and the Alternative No. 2 Zone B Reservoir Site are shown in Table I and Table II respectively, at the end of the text. Since almost all of the proposed improvements are for future growth, the implementation schedule is a function of the actual growth rate.

Project costs listed in Tables I and II are based on June 2004 dollars. An allowance for construction cost increases must be added by the District to keep revenues adjusted for inflation. During the last eight years, construction costs have increased at an average rate of about 3 percent per year. During the first 5 months of 2004, construction costs have increased at an annual rate of about 6 percent. A simple and efficient means by which the District can keep its plant capacity fees adjusted for the current inflation trend is by annually updating plant capacity fees based upon the Engineering News Record Construction Cost Index (ENR CCI). The 20 Cities Average CCI for June 2004 was 7109. This value is published monthly in the ENR magazine and essentially takes into account the costs for constructing major public works type projects. Several entities have adopted this method of updating their charges for inflation because it provides an accurate and relatively small annual increase that is readily determined and easily justified.

FINANCIAL CONSIDERATIONS

In order to have new development pay for their share of new facilities, it is becoming common in preparation of master plans to determine the cost of future improvements attributed to growth, and then divide those costs by the number of future users that those facilities can support. This yields a cost per connection, usually expressed in a cost per standard household equivalent (HE), which for the District is a house served by a ¾-inch meter. This amount is often used to determine the revenue portion of a plant capacity fee (excluding any service line or meter construction costs). The District's current plant capacity fee is $4,785 for a ¾-inch meter. In addition, any parcel that has not already been assessed for their share of the 1995 Water Project are required to pay a contingent assessment. The contingent assessment amount was initially set a $1,832 and has been increased at the rate of 5 percent per year. The contingent assessments collected are allocated to paying off the Department of Water Resources Loan.

If one divides the total estimated cost of the future improvements of $10,192,000 based on the Alternative No. 1 Zone B Reservoir Site by the estimated potential increase in connections at ultimate build-out (which is about 2,480 connections), the average cost per future connection is about $4,100. Similarly, the estimated average cost per future connection is about $4,100 for the Alternative No. 2 Zone B Reservoir Site. Unfortunately, this approach does not provide the cash flow needed to construct the improvements when they are needed in order to meet the future demands.

As shown in Table III, if the District's plant capacity fees are increased by $400 plus adjusted for inflation in 2004, then the 2004 plant capacity fee for a ¾-inch meter will be $5,329. If the incremental fee increase is systematically increased by $20 each year (i.e., $420 in 2005, $440 in 2006, etc.) and the adjustments for inflation are continued, then the plant capacity fund revenue will theoretically be adequate to construct the necessary improvements for the Alternative No. 1 scenario. Similarly, Table IV indicates that an incremental fee of $80 per year (i.e., to $480 in 2005, $560 in 2006, etc.) plus an annual adjustment for inflation will theoretically generate sufficient revenues to construct the improvements associated with the Alternative No. 2 Zone B Reservoir Site. However, there are many variables, such as the ability of the District to install large diameter water mains at the pace required, the actual rate of growth in connections, and the ever increasing water use per service that can impact anticipated schedules of improvements. Thus, it is recommended that the plant capacity fees be reviewed annually and the potential impacts of large developments be evaluated carefully.

In order to keep pace with the inflation of construction costs, it is recommended that the plant capacity fees be adjusted annually in proportion to the increase of the Engineering News Record 20 City average Construction Cost Index (ENR CCI) for the previous twelve months. The ENR (20 City Average) CCI for June 2004 was 7109 and monthly updates are available on the internet at www.enr.com.

Table V is a comparison of Centerville improvement fee options and the City of Redding fees. As noted, the Centerville options include 3 percent per year for inflation, but do not include the contingent assessments. The results of a capital improvement fee survey of other neighboring water purveyors is presented in Table VI.

TABLE I

PRELIMINARY PROJECT COST ESTIMATES
2004 MASTER WATER PLAN OF IMPROVEMENTS
WITH ALTERNATIVE NO. 1 ZONE B RESERVOIR SITE
JUNE 2004 COSTS (ENR Index: 7109)

Item No.	Description	Ident. Points	Length Feet	June 2004 Unit price	June 2004 Project Cost
ZONE B IMPROVEMENTS					
1	18" Parallel Main In Placer Rd. (Turnout to Secluded Valley Rd)	1-2	9000	$120	$1,080,000
2	24" Parallel Main In Placer Rd. (Secluded Valley Dr. to Arbor Vitae Dr)	2-3	1500	$130	$195,000
3	24" Parallel Main In Placer Rd. (Texas Sps Rd. to Montgomery Ranch Rd.)	4-4A	700	$160	$112,000
4	24" Parallel Main In Placer Rd. (Montgomery Ranch Rd. to Prospect Dr.)	4A-5	2200	$160	$352,000
5	24" Parallel Main In Placer Rd. (Prospect Dr. to Point 6)	5-6	3500	$160	$560,000
6	20" Parallel Main in Placer Rd. (Point 6 to Swasey Dr.)	6-7	1100	$155	$170,500
7	20" Main in Swasey Dr. (Point 7 to Zone B Tank)	7-8	7800	$130	$1,014,000
8	14" Parallel Main in Prospect Dr. (Zone B Tank to Placer Rd.)	5-12	3600	$85	$306,000
9	14" Parallel Main in Placer Rd (Swasey Dr. to Plateau Circle)	7-14	3400	$95	$323,000
10	14" Parallel Main in Placer Rd (Plateau Circle to Zone C Pump Station)	14-15	4600	$95	$437,000
11	6" Intertie (Gold Run Rd. to Graystone Ct.)	11-13	1200	45	$54,000
12	Increase Capacity of Muletown Conduit Turnout	1	--	--	$151,000
13	Add 6.0 MGD Booster Pump Station at Muletown Turnout	1	--	--	$550,000
14	Increase the Muletown Conduit Booster Pump Station to 8.5 MGD	1	--	--	$91,000
15	Increase the Muletown Conduit Booster Pump Station to 12.6 MGD	1	--	--	$150,000
16	2.5 MG Zone B Reservoir with supervisory valve & telemetry	8	--	--	$1,240,000
17	8" Intertie (Texas Springs Road to Sol Semsete Trail)	21-22	1600	55	$88,000

			Subtotal		**$6,873,500**
ZONE C IMPROVEMENTS					
1	Expand Zone C Pump Station	15	--	--	$50,000
2	12" Main in Towerview Circle	15-16	500	$85	$42,500
3	6" Intertie (Chaparral D. to Silver King Rd.)	17-18	1500	$45	$67,500
4	1.0 MG Zone B Reservoir	13	--	--	$660,000

			Subtotal		**$820,000**
MULETOWN PRESSURE ZONE IMPROVEMENTS					
1	8-inch PVC Main (Class A1 & A4)	--	1000	$60	$60,000
2	8-inch PVC Main (Class C)	--	1000	$50	$50,000
3	6-inch PVC Main (Class C)	--	3000	$45	$135,000
4	100,000 gal Reservoir	--	--	--	$165,000
5	Reservoir access road and fencing	--	--	--	$35,000
6	Booster Pump Station	--	--	--	$100,000
7	Fire Hydrants	--	4	$3,300	$13,200

			Subtotal		**$558,200**
TREATMENT PLANT EXPANSIONS					**$1,940,000**
	GRAND TOTAL				**$10,191,700**

NOTE: ESTIMATED COSTS BASED ON BIDDING ALL CONSTRUCTION WORK AND INCLUDE A 25 PERCENT ALLOWANCE FOR INDIRECT, ENGINEERING AND CONTINGENCIES BUT NO ALLOWANCE FOR RIGHT-OF-WAY, LAND, OR FINANCING.

TABLE II

PRELIMINARY PROJECT COST ESTIMATES
2004 MASTER WATER PLAN OF IMPROVEMENTS
WITH ALTERNATIVE NO. 2 ZONE B RESERVOIR SITE
JUNE 2004 COSTS (ENR Index: 7109)

Item No.	Description	Ident. Points	Length Feet	June 2004 Unit price	June 2004 Project Cost
ZONE B IMPROVEMENTS					
1	18" Parallel Main In Placer Rd. (Turnout to Secluded Valley Rd)	1-2	9000	$120	$1,080,000
2	24" Parallel Main In Placer Rd. (Secluded Valley Dr. to Arbor Vitae Dr)	2-3	1500	$130	$195,000
3	24" Parallel Main In Placer Rd. (Texas Sps Rd. to Montgomery Ranch Rd.)	4-4A	700	$160	$112,000
4	24" Parallel Main In Placer Rd. (Montgomery Ranch Rd. to Prospect Dr.)	4A-5	2200	$160	$352,000
5	24" Parallel Main In Placer Rd. (Prospect Dr. to Point 6)	5-6	3500	$160	$560,000
6	24" Parallel Main in Placer Rd. (Point 6 to Swasey Dr.)	6-7	1100	$160	$176,000
7	14" Parallel Main in Prospect Dr. (Zone B Tank to Placer Rd.)	5-12	3600	$85	$306,000
8	24" Parallel Main in Placer Rd (Swasey Dr. to Plateau Circle)	7-14	3400	$160	$544,000
9	24" Parallel Main in Placer Rd (Plateau Circle to Zone C Pump Station)	14-15	4600	$160	$736,000
10	20" Main in Foxwood Development (Point 15 to Zone B Tank)	15-20	4000	$130	$520,000
11	6" Intertie (Gold Run Rd. to Graystone Ct.)	11-13	1200	$45	$54,000
12	Increase Capacity of Muletown Conduit Turnout	1	--	--	$151,000
13	Add 6.0 MGD Booster Pump Station at Muletown Turnout	1	--	--	$550,000
14	Increase the Muletown Conduit Booster Pump Station to 8.5 MGD	1	--	--	$91,000
15	Increase the Muletown Conduit Booster Pump Station to 12.6 MGD	1	--	--	$150,000
16	2.5 MG Zone B Reservoir with supervisory valve & telemetry	20	--	--	$1,240,000
17	8" Intertie (Texas Springs Road to Sol Semente Trail)	21-22	1600	$55	$88,000
			Subtotal		**$6,905,000**
ZONE C IMPROVEMENTS					
1	Expand Zone C Pump Station	15	--	--	$50,000
2	12" Main in Towerview Circle	15-16	500	$85	$42,500
3	6" Intertie (Chaparral D. to Silver King Rd.)	17-18	1500	$45	$67,500
4	1.0 MG Zone B Reservoir	13	--	--	$660,000
			Subtotal		**$820,000**
MULETOWN PRESSURE ZONE IMPROVEMENTS					
1	8-inch PVC Main (Class A1 & A4)	--	1000	$60	$60,000
2	8-inch PVC Main (Class C)	--	1000	$50	$50,000
3	6-inch PVC Main (Class C)	--	3000	$45	$135,000
4	100,000 gal Reservoir	--	--	--	$165,000
5	Reservoir access road and fencing	--	--	--	$35,000
6	Booster Pump Station	--	--	--	$100,000
7	Fire Hydrants	--	4	$3,300	$13,200
			Subtotal		**$558,200**
TREATMENT PLANT EXPANSIONS					**$1,940,000**
		GRAND TOTAL			**$10,223,200**

NOTE: ESTIMATED COSTS BASED ON BIDDING ALL CONSTRUCTION WORK AND INCLUDE A 25 PERCENT ALLOWANCE FOR INDIRECT, ENGINEERING AND CONTINGENCIES BUT NO ALLOWANCE FOR RIGHT-OF-WAY, LAND, OR FINANCING.

TABLE III

REVISED July 12,2004

CENTERVILLE CSD
WATER SYSTEM IMPROVEMENT PROGRAM SCHEDULE WITH ALTERNATIVE NO. 1 ZONE B RESERVOIR SITE
PRELIMINARY CASH FLOW PROJECTION
(BASED ON A 3 PERCENT GROWTH RATE AND THE DISTRICT PERFORMING THE PIPELINE CONSTRUCTION WORK)

YEAR	PROJECT COSTS (JUNE 2004 Dollars)	DESCRIPTION OF GENERAL MAJOR IMPROVEMENTS	YEAR "n"	INFLATION FACTOR 1.03
2004	$165,000	Portion of 24" main from Secluded Valley to Arbor Vitae Dr.		1.00
2005	$95,000	24" main from Texas Springs Rd. to Montgomery Ranch Rd.	1	1.03
	$151,000	Increase Capacity of Muletown Turnout to about 4.2 MGD		1.03
2006	$150,000	Portion of 24" main from Montgomery Ranch Rd. to Prospect Dr.	2	1.06
2007	$150,000	Portion of 24" main from Montgomery Ranch Rd. to Prospect Dr.	3	1.09
	$550,000	Add 6.0 MGD Pump Station near Muletown Conduit Turnout		1.09
2008	$159,000	Portion of 24" main from Prospect to Point 5	4	1.13
2009	$159,000	Portion of 24" main from Prospect to Point 5	5	1.16
2010	$159,000	Portion of 24" main from Prospect to Point 5	6	1.19
	$50,000	Expand Zone C Pump Station	6	1.19
	$36,000	12" main in Towerview Circle	6	1.19
2011	$145,000	20" main from Point 5 to Swasey Dr.	7	1.23
2012	$288,000	Portion of 20' main in Swasey Dr. to new Zone B Reservoir	8	1.27
2013	$288,000	Portion of 20' main in Swasey Dr. to new Zone B Reservoir	9	1.30
2014	$288,000	Portion of 20' main in Swasey Dr. to new Zone B Reservoir	10	1.34
2015	$1,240,000	2.6 MG Zone B Reservoir	11	1.38
2016			12	1.43
2017	$275,000	1.0 MGD of Treatment Plant Capacity (Could be $1,100,000	13	1.47
2018		if Clear Creek CSD does not participate.)	14	1.51

	$4,348,000			

NOTES: 1. Pipeline project costs have been reduced 15 percent from TABLE I values based on the District performing the construction.

PRELIMINARY CASH FLOW ANALYSIS

(BASED ON INFLATION AT 3% PER YEAR)

1. CONSTRUCTION COSTS AND PLANT CAPACITY FEES HAVE BEEN INCREASED AT 3 PERCENT PER YEAR FOR INFLATION
2. CASH FLOW FOR PROJECT IMPROVEMENTS ONLY. NO DEVELOPER REIMBURSEMENT FOR OVERSIZING, ETC.
3. CASH FLOW REVENUE DOES NOT INCLUDE ANY ALLOWANCE FOR FUTURE ANNEXATION FEES.

YEAR	INFLATED PROJECT COST (See Note 1)	NO. OF CONNECTIONS AT THE END OF THE YEAR	ESTIMATED NO. OF 3/4" EQUIVALENT CONNECTIONS @ 3% GROWTH	ANNUAL INCREMENTAL FEE INCREASE	PLANT CAPACITY FEE FOR 3/4-INCH SERVICE	ESTIMATED TOTAL PLANT CAPACITY FEE REVENUE	IMPROVEMENT FUND BALANCE
2003		1140			$4,785	$0	$469,000
2004	$165,000	1174	34	$400	$5,329	$181,171	$485,171
2005	$253,380	1209	35	$420	$5,908	$206,794	$438,585
2006	$163,909	1245	36	$440	$6,526	$234,924	$509,600
2007	$764,909	1282	37	$460	$7,181	$265,713	$10,404
2008	$178,956	1320	38	$480	$7,877	$299,321	$130,769
2009	$184,325	1360	40	$500	$8,613	$344,527	$290,971
2010	$292,543	1401	41	$520	$9,392	$385,054	$383,483
2011	$178,332	1443	42	$540	$10,213	$428,959	$634,111
2012	$364,830	1486	43	$560	$11,080	$476,428	$745,709
2013	$375,775	1531	45	$580	$11,992	$539,645	$909,579
2014	$387,048	1577	46	$600	$12,952	$595,786	$1,118,317
2015	$1,716,450	1624	47	$620	$13,960	$656,140	$58,008
2016	$0	1673	49	$640	$15,019	$735,943	$793,951
2017	$403,847	1723	50	$660	$16,130	$806,491	$1,196,595
2018	$0	1775	52	$680	$17,294	$899,273	$2,095,868
2019	$0	1828	53	$700	$18,513	$981,164	$3,077,032
	-----------		-----------			-----------	
TOTAL	$5,429,302		688			$8,037,334	
	TOTAL FROM 2004 THRU 2015		484			$3,958,323	

214.70\spreadSht\ConnectFee1

REVISED July 12,2004

TABLE IV

CENTERVILLE CSD
WATER SYSTEM IMPROVEMENT PROGRAM SCHEDULE WITH ALTERNATIVE NO. 2 ZONE B RESERVOIR SITE
PRELIMINARY CASH FLOW PROJECTION
(BASED ON A 3 PERCENT GROWTH RATE AND THE DISTRICT PERFORMING THE PIPELINE CONSTRUCTION WORK)

YEAR	PROJECT COSTS (JUNE 2004 Dollars)	DESCRIPTION OF GENERAL MAJOR IMPROVEMENTS	YEAR "n"	INFLATION FACTOR 1.03
2004	$165,000	Portion of 24" main from Secluded Valley to Arbor Vitae Dr.		1.00
2005	$95,000	24" main from Texas Springs Rd. to Montgomery Ranch Rd.	1	1.03
	$151,000	Increase Capacity of Muletown Turnout to about 4.2 MGD		
2006	$150,000	Portion of 24" main from Montgomery Ranch Rd. to Prospect Dr.	2	1.06
2007	$150,000	Portion of 24" main from Montgomery Ranch Rd. to Prospect Dr.	3	1.09
	$550,000	Add 6.0 MGD Pump Station near Muletown Conduit Turnout		
2008	$159,000	Portion of 24" main from Prospect to Point 6	4	1.13
2009	$159,000	Portion of 24" main from Prospect to Point 6	5	1.16
2010	$159,000	Portion of 24" main from Prospect to Point 6	6	1.19
	$50,000	Expand Zone C Pump Station	6	1.19
	$36,000	12" main in Towerview Circle	6	1.19
2011	$150,000	20" main from Point 6 to Swasey Dr.	7	1.23
2012	$462,000	24" main in Placer Rd. from Swasey Dr. to Plateau Circle	8	1.27
2013	$534,000	20" & 24" main from Plateau Circle to new Zone B Reservoir	9	1.30
2014	$534,000	20" & 24" main from Plateau Circle to new Zone B Reservoir	10	1.34
2015	$1,240,000	2.5 MG Zone B Reservoir	11	1.38
2016			12	1.43
2017	$275,000	1.0 MGD of Treatment Plant Capacity (Could be $1,100,000	13	1.47
2018		if Clear Creek CSD does not participate.)	14	1.51
	-----------		15	1.56
	$5,019,000			

NOTES: 1. Pipeline project costs have been reduced 15 percent from TABLE II values based on the District performing the construction.

PRELIMINARY CASH FLOW ANALYSIS

(BASED ON INFLATION AT 3% PER YEAR)

1. CONSTRUCTION COSTS AND PLANT CAPACITY FEES HAVE BEEN INCREASED AT 3 PERCENT PER YEAR FOR INFLATION
2. CASH FLOW FOR PROJECT IMPROVEMENTS ONLY. NO DEVELOPER REIMBURSEMENT FOR OVERSIZING, ETC.
3. CASH FLOW REVENUE DOES NOT INCLUDE ANY ALLOWANCE FOR FUTURE ANNEXATION FEES.

YEAR	INFLATED PROJECT COST (See Note 1)	NO. OF CONNECTIONS AT THE END OF THE YEAR	ESTIMATED NO. OF 3/4" EQUIVALENT CONNECTIONS @ 3% GROWTH	ANNUAL INCREMENTAL FEE INCREASE	PLANT CAPACITY FEE FOR 3/4-INCH SERVICE	ESTIMATED TOTAL PLANT CAPACITY FEE REVENUE	IMPROVEMENT FUND BALANCE
2003		1140			$4,785	$0	$469,000
2004	$165,000	1174	34	$400	$5,329	$181,171	$485,171
2005	$253,380	1209	35	$480	$5,968	$208,894	$440,685
2006	$163,909	1245	36	$560	$6,707	$241,469	$518,244
2007	$764,909	1282	37	$640	$7,549	$279,301	$32,637
2008	$178,956	1320	38	$720	$8,495	$322,815	$176,496
2009	$184,325	1360	40	$800	$9,550	$382,000	$374,172
2010	$292,543	1401	41	$880	$10,716	$439,376	$521,005
2011	$184,481	1443	42	$960	$11,998	$503,916	$840,440
2012	$585,248	1486	43	$1,040	$13,398	$576,111	$831,303
2013	$696,749	1531	45	$1,120	$14,920	$671,394	$805,948
2014	$717,651	1577	46	$1,200	$16,567	$762,103	$850,400
2015	$1,716,450	1624	47	$1,280	$18,344	$862,191	($3,859)
2016	$0	1673	49	$1,360	$20,255	$992,486	$988,628
2017	$403,847	1723	50	$1,440	$22,302	$1,115,123	$1,699,904
2018	$0	1775	52	$1,520	$24,492	$1,273,560	$2,973,465
2019	$0	1828	53	$1,600	$26,826	$1,421,793	$4,395,258
	-----------		-----------			-----------	$4,395,258
TOTAL	$6,307,447		688			$10,233,705	
TOTAL FROM 2004 THRU 2015			484			$5,430,742	

REVISED July 12, 2004

TABLE V

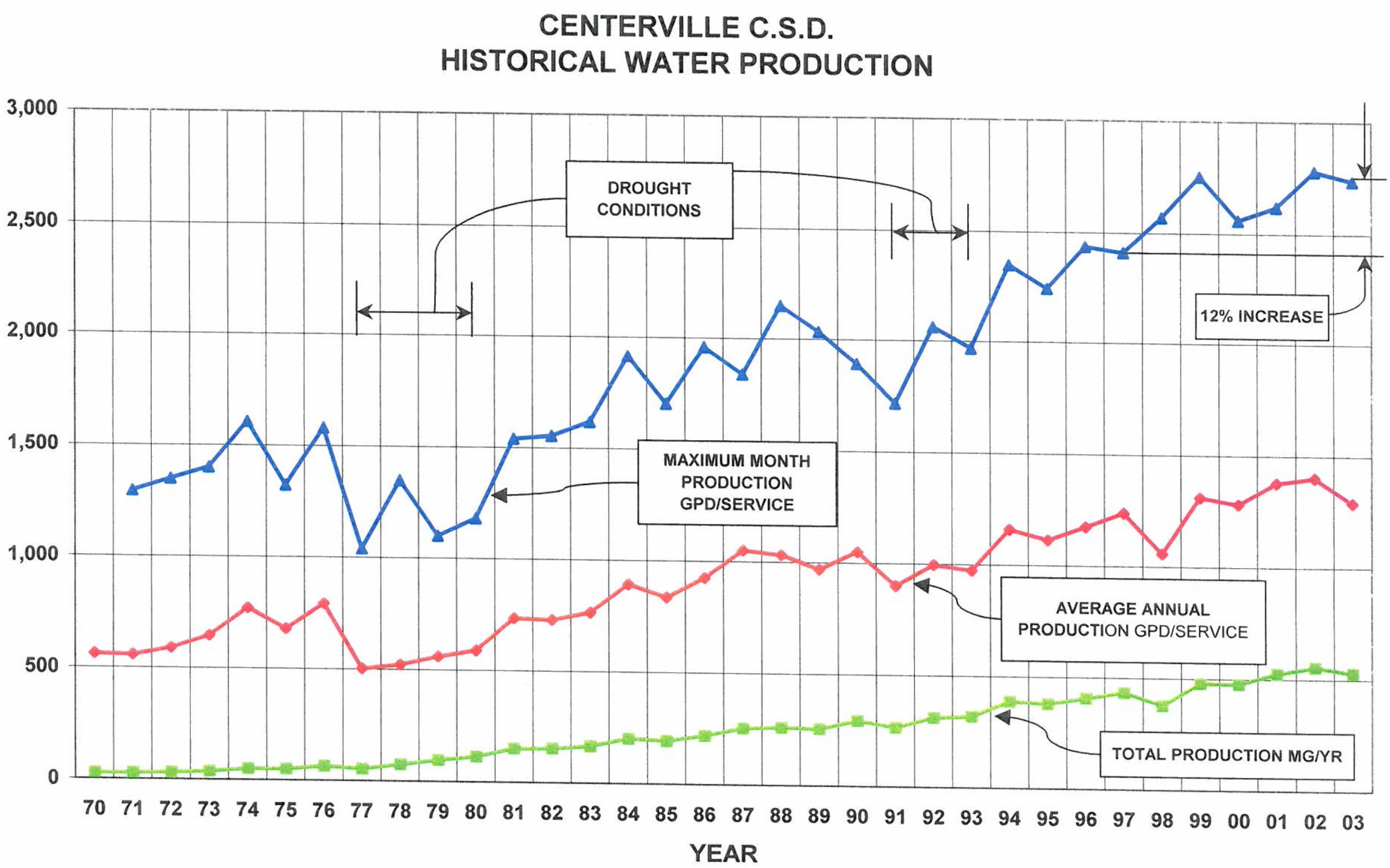
CENTERVILLE CSD
PLANT CAPACITY FEE OPTIONS

YEAR	CENTERVILLE CSD				City of Redding Fee Schedule	
	ALTERNATIVE NO. 1 "B' RESERVOIR SITE INFLATION PLUS AN ANNUAL INCREASE STARTING AT $400/YR AND INCREASING INCREMENTALLY AT $20 PER YEAR BEGINNING IN 2005		ALTERNATIVE NO. 1 "B' RESERVOIR SITE INFLATION PLUS AN ANNUAL INCREASE STARTING AT $400/YR AND INCREASING INCREMENTALLY AT $80 PER YEAR BEGINNING IN 2005			
	5/8" Meter	3/4" Meter	5/8" Meter	3/4" Meter	5/8" Meter	3/4" Meter
2003	$3,192	$4,785	$3,192	$4,785	$3,977	$5,966
2004	$3,554	$5,329	$3,554	$5,329	$4,931	$7,397
2005	$3,941	$5,908	$3,981	$5,968	$6,115	$9,173
2006	$4,353	$6,526	$4,474	$6,707	$6,298	$9,447
2007	$4,790	$7,181	$5,035	$7,549		
2008	$5,254	$7,877	$5,666	$8,495		
2009	$5,745	$8,613	$6,370	$9,550		
2010	$6,264	$9,392	$7,148	$10,716		
2011	$6,812	$10,213	$8,003	$11,998		
2012	$7,390	$11,080	$8,936	$13,398		
2013	$7,999	$11,992	$9,952	$14,920		
2014	$8,639	$12,952	$11,050	$16,567		
2015	$9,311	$13,960	$12,235	$18,344		

TABLE VI
COMPARISON OF CAPACITY CHARGES FOR NEIGHBORING WATER PURVEYORS WITH SURFACE WATER TREATMENT

	Effective Date	5/8" Service	3/4" Service	1" Service	1 1/2" Service	2" Service	3" Service	4" Service	6" Service
Centerville CSD	2003	$3,190	$4,785	$7,975	$15,950	$25,520	$47,850	$79,750	$159,500
		+ $2400assess.	+ $2400assess.	+ $2400assess.	+ $2400assess.	+ $2400assess.	+ $2400assess.	+ $2400assess.	+ $2400assess.
	TOTAL	$5,590	$7,185	$10,375	$18,350	$27,920	$50,250	$82,150	$161,900
Clear Creek CSD (M&I)	2003	N/A	$4,058	$5,719	$7,981				
Bella Vista WD (M&I)	2003	N/A	$2,726	$4,167	$6,564	$8,756	$16,502		
Mountain Gate CSD	2002	$3,000	$4,500						
City of Redding	2002	$2,884	$4,326	$7,210	$14,420	$23,072	$43,260	$72,100	$144,200
	2003	$3,194	$4,791	$7,985	$15,970	$25,552	$47,910	$79,850	$159,700
	2004	$3,977	$5,966	$9,943	$19,885	$31,816	$59,655	$99,425	$198,850
	2005	$4,931	$7,397	$12,328	$24,655	$39,448	$73,965	$123,275	$246,550
	2006	$6,115	$9,173	$15,288	$30,575	$48,920	$91,725	$152,875	$305,750
	2007	$6,298	$9,447	$15,745	$31,490	$50,384	$94,470	$157,450	$314,900
Shasta CSD	2003	$3,948							
	Proposed	$5,890	$8,835	$14,725	$29,450	$47,120	$88,350	$147,250	$294,500
City of Shasta Lake	1992	$1,300 per household equivalent							
PROPOSED	2004	$3,450	$5,175	$8,625	$17,250	$27,600	$51,750	$86,250	$172,500
PROPOSED	2005**	$3,800	$5,700	$9,500	$19,000	$30,400	$57,000	$95,000	$190,000
PROPOSED	2006**	$4,180	$6,270	$10,450	$20,900	$33,440	$62,700	$104,500	$209,000

** Subject to additional annual ENR Construction Cost Index adjustment of approximately 3 percent per year.



CENTERVILLE C.S.D.
HISTORICAL WATER PRODUCTION
3,000
2,500
2,000
1,500
1,000
500
0
DROUGHT CONDITIONS
12% INCREASE
MAXIMUM MONTH PRODUCTION GPD/SERVICE
AVERAGE ANNUAL PRODUCTION GPD/SERVICE
TOTAL PRODUCTION MG/YR
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03
YEAR

FIGURE 1

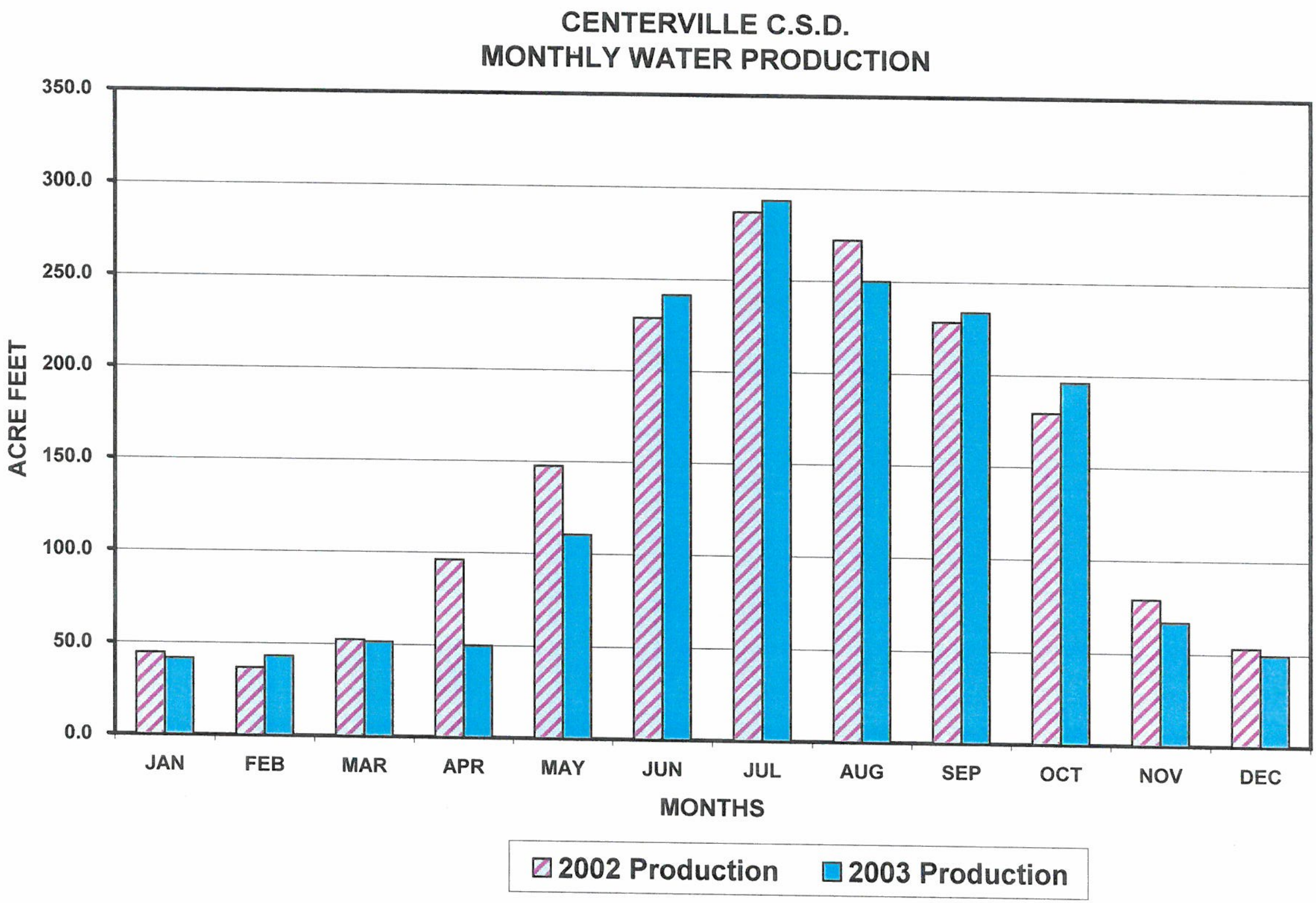
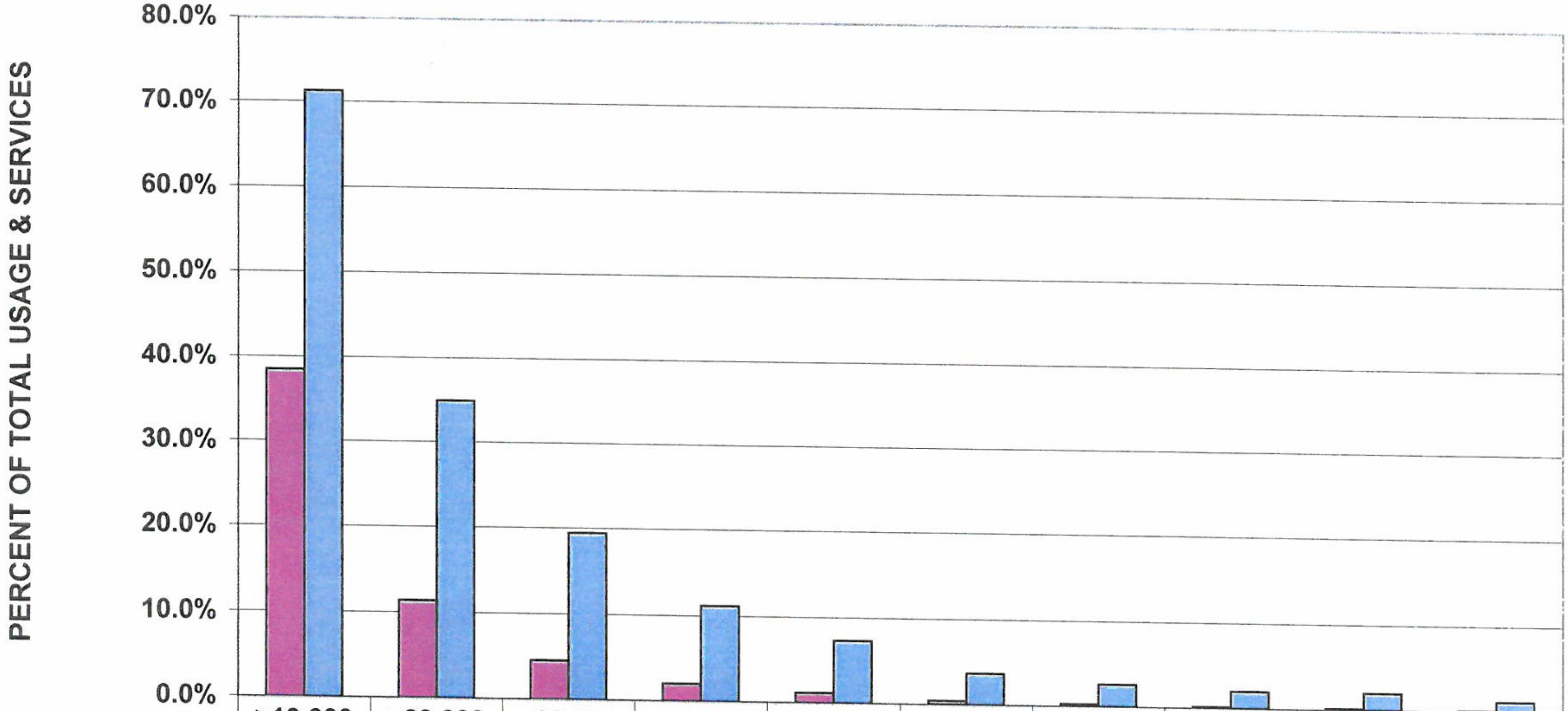

CENTERVILLE C.S.D.
MONTHLY WATER PRODUCTION
ACRE FEET
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
MONTHS
2002 Production
2003 Production

FIGURE 2

CENTERVILLE C.S.D.
JULY 2003 CONSUMPTION BY GREATER THAN 10,000 CF USAGE CUSTOMERS



	>10,000	>20,000	>30,000	>40,000	>50,000	>60,000	>70,000	>80,000	>90,000	>100,000
% Services	38.4%	11.4%	4.6%	2.0%	1.1%	0.4%	0.3%	0.2%	0.2%	0.1%
% of usage	71.3%	34.9%	19.4%	11.2%	7.3%	3.7%	2.7%	2.0%	2.0%	1.2%

USAGE CATEGORIES

FIGURE 3

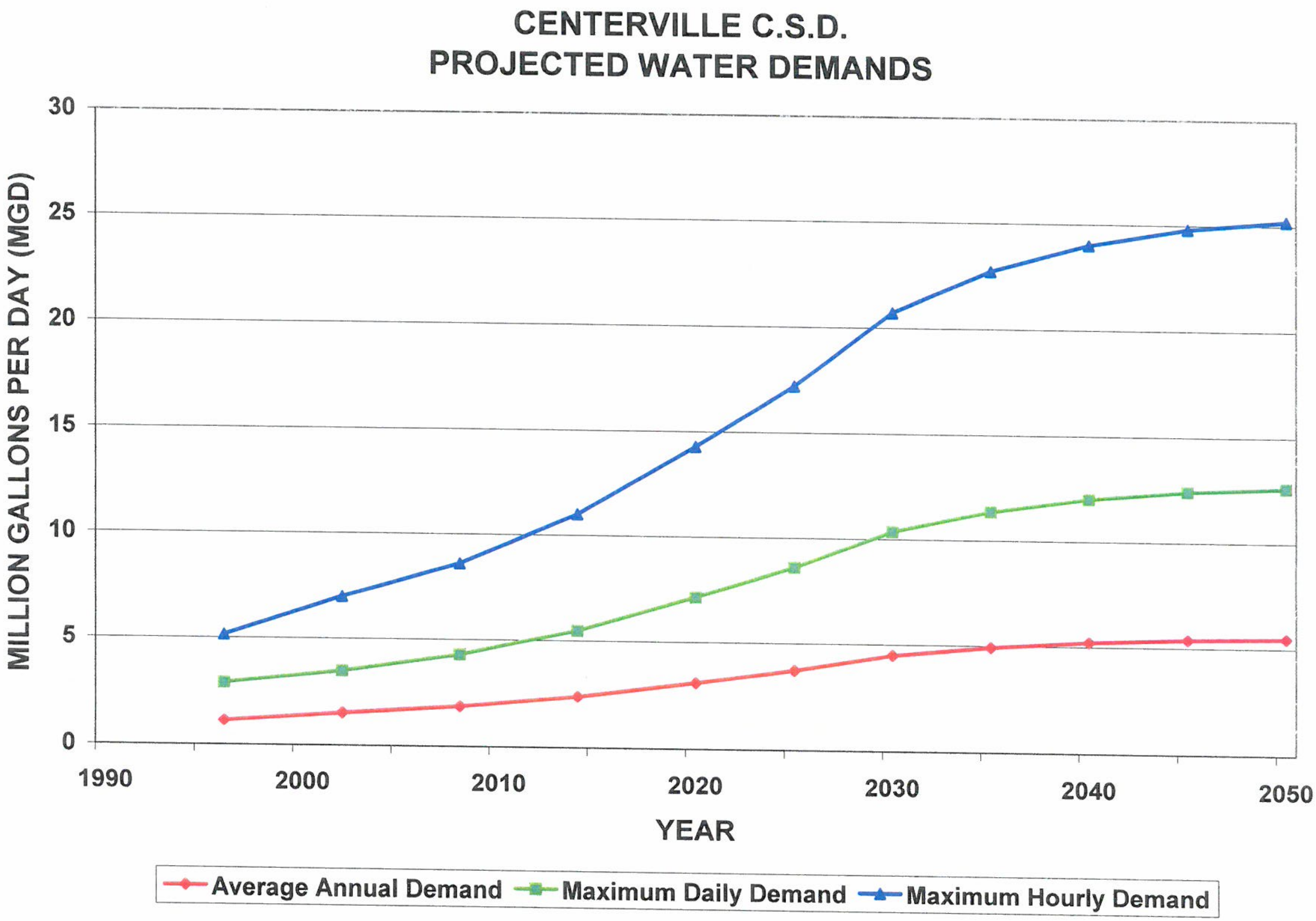
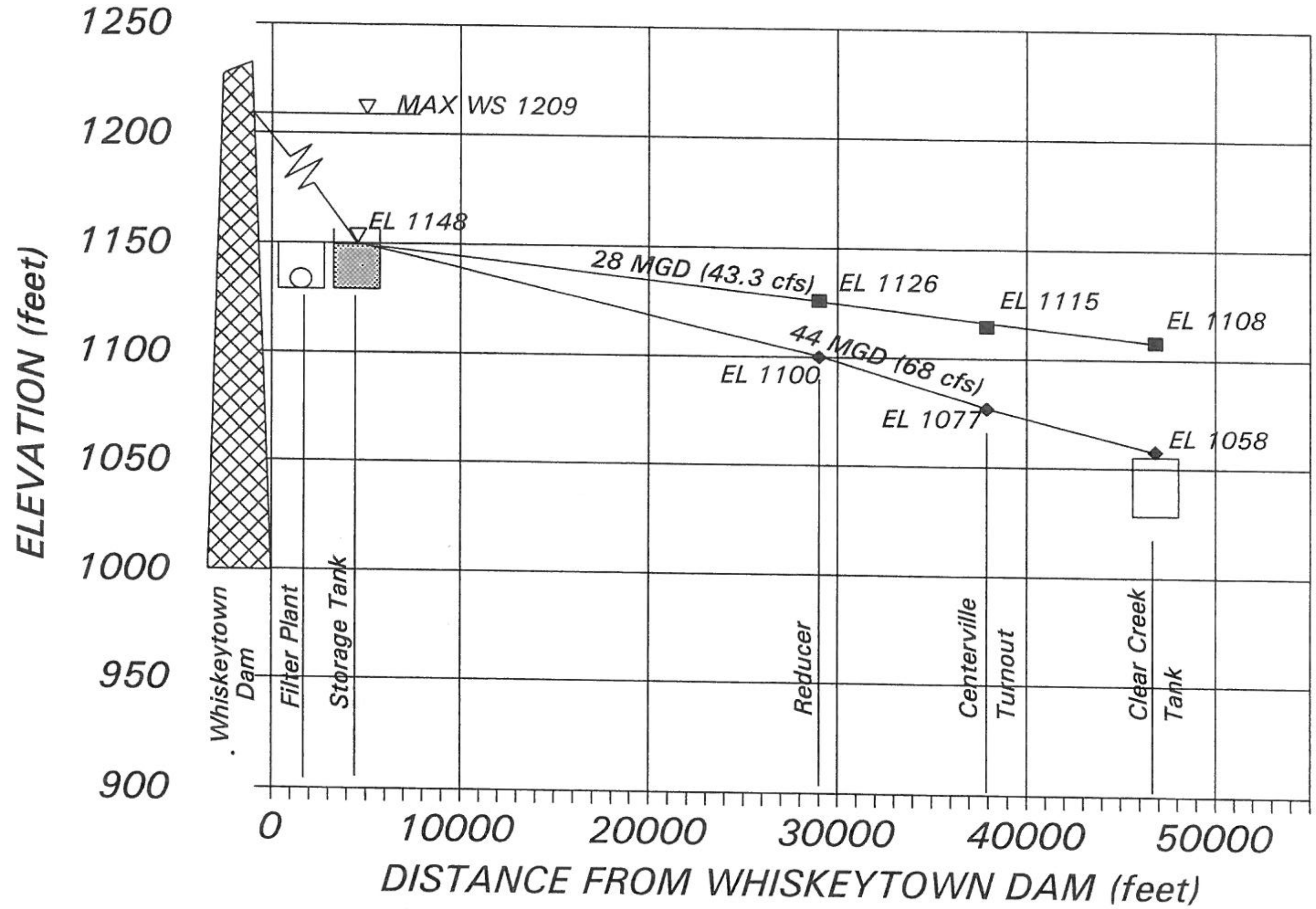

CENTERVILLE C.S.D.
PROJECTED WATER DEMANDS
MILLION GALLONS PER DAY (MGD)
30
25
20
15
10
5
0
1990
2000
2010
2020
2030
2040
2050
YEAR
Average Annual Demand
Maximum Daily Demand
Maximum Hourly Demand

FIGURE 4

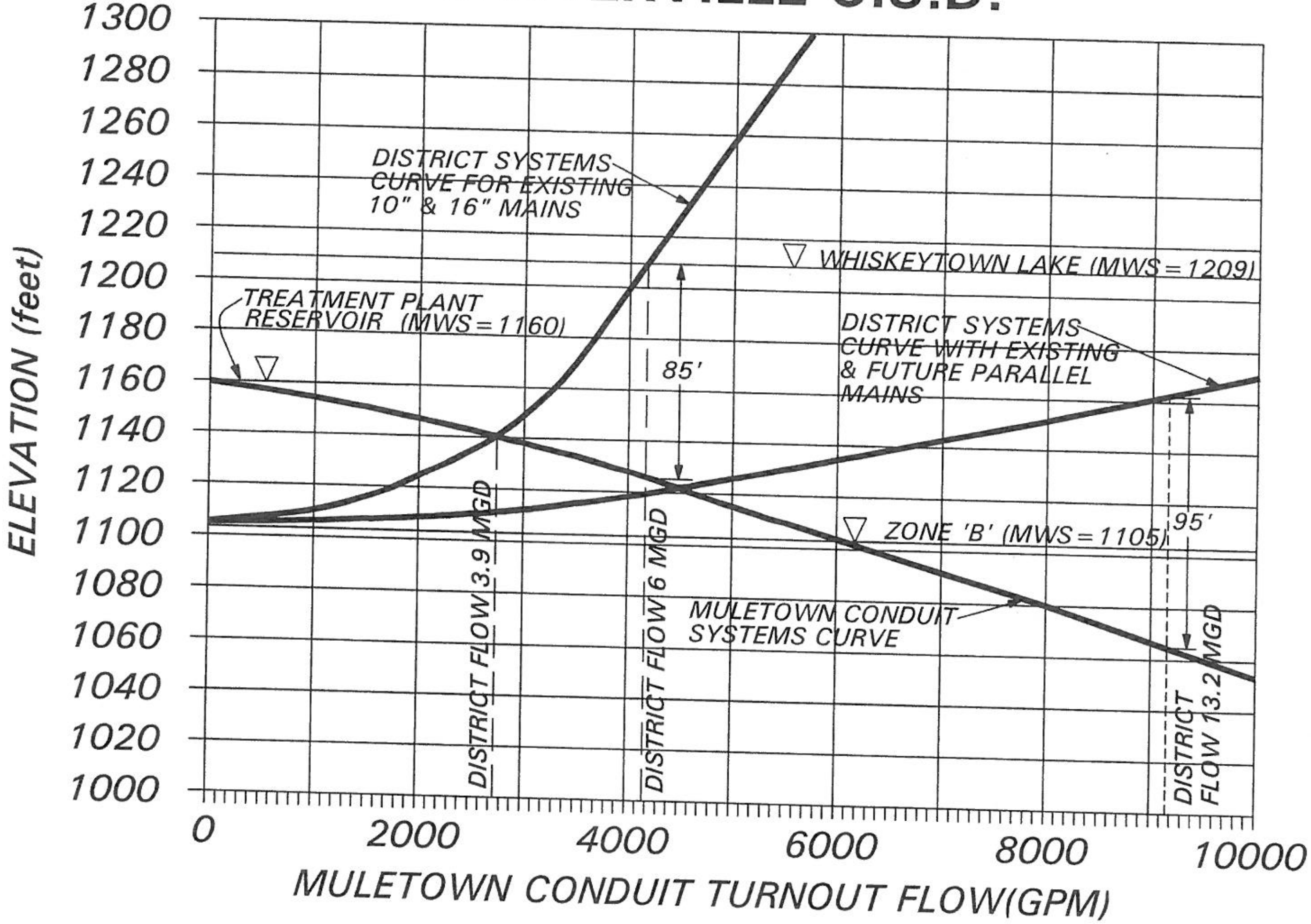
CENTERVILLE C.S.D.



HYDRAULIC GRADE LINE FOR MULETOWN CONDUIT

FIGURE 5

CENTERVILLE C.S.D.



NOTE:
(MULETOWN CONDUIT FLOW ASSUMED
TO BE FOUR TIMES CENTERVILLE C.S.D. FLOW)

MULETOWN TURNOUT HYDRAULICS

FIGURE 6