WESTCAPS

OUR WEST VALLEY COALITION

Regional Pipeline Transmission

Final Report

February 2010

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ACRONYMS

'	feet
ac.	Acre
AC-FT/ac-ft	acre-feet
AC	asphaltic concrete
ADWR	Arizona Department of Water Resources
AFWS	Agua Fria water system
AMA	active management area
AWC	Arizona Water Company
BPS	booster pumping station
CAGRD	Central Arizona Groundwater Replenishment District
CAWCD	Central Arizona Water Conservation District
CAP	Central Arizona Project
COG	City of Goodyear storage facility
CPI	consumer price index
cfs	cubic feet per second
Cls	class (pipe)
cy, cu yd	cubic yards
ea.	each
Elev.	elevation
ft.	feet
gal.	gallon
gpd	gallons per day
gpm	gallons per minute
GWTP	ground water treatment plant
hr.	hour
H-W	Hazen-Williams (friction factor)
Hp, hp	horsepower
in.	inch, inches
Kw	Kilowatt
L.F., Lin. Ft.	linear feet
LLC	limited liability corporation
Ln	lane
LPSCO	Litchfield Park Service Company (Litchfield water company)
M	million
MAG	Maricopa Association of Governments
MG, mg	million gallons
mg/l	milligrams per liter
MGD, mgd	million gallons per day
MWD	Maricopa Water District
MPA	municipal planning area
mi	miles
O&M	Operations and Maintenance
PMP	Pipeline Modeling Program

Ppb	parts per billion
PWR	potable water requirement
psi	pounds per square inch
RID	Roosevelt Irrigation District
Rte	route
S.C.A.D.A.	Supervisory Control and Data Acquisition
sec.	seconds
Sta.	station
SRP	Salt River Project
TDS	total dissolved solids
UA, ua	urban area
Vel.	velocity
WESTCAPS	West Salt River Valley Central Arizona Project Subcontractors
WPA	Water Provider Area
WTP	water treatment plant
yr.	year
x	times
x-ing	crossing
yr.	year

EXECUTIVE SUMMARY

WESTCAPS is an acronym for West Salt River Valley Central Arizona Project Subcontractors. The requirement to be a member of WESTCAPS is to have an allocation of Central Arizona Project (CAP) water which is delivered through the CAP system. These entities who make up WESTCAPS are: Arizona - American Water Company; City of Avondale; City of El Mirage; City of Goodyear; City of Peoria; City of Surprise; Global Water Resources, formerly West Maricopa Combine; and the Town of Buckeye. They have entered into a multiparty agreement and have pledge that they will work together to best use the scarce water resources available to them.

The transmission pipeline which is the subject of this report has been the focus of the WESTCAPS planning since the mid to late 90's. The goals of WESTCAPS has been to share the expenses associated with transporting CAP water the long distance from the CAP canal to the treatment facility and then to the WESTCAPS service area.

This regional transmission line still looks remarkably similar to the vision expressed in the, "WESTCAPS Strategic Plan for using Central Arizona Project Water in the West Salt River Valley 2000 to 2025," published May 14, 2001. All of WESTCAPS allocation of CAP water will be delivered through this pipeline and will come from the White Tanks Water Treatment Plant (WTWTP). Construction of this treatment plant began in 2007 and is near completion as of this writing with an initial capacity of 13.5 Million Gallons per Day (MGD) and with a projected full capacity of 80 MGD in 2025. The water delivered to and from the WTWTP is anticipated to be exclusively CAP water. Water demand had been determined by the WESTCAPS members based on their subcontract from the Central Arizona Water Conservation District (CAWCD) and delivered through the CAP system.

The pipeline consists of transmission piping with booster stations, turnouts for subcontractors, and all of the necessary equipment to deliver CAP water from the WTWTP to the local entity service area.

Determining the location of the proposed transmission pipeline has been a process of working with the WESTCAPS membership in determining their needs, the best and most direct access to the services areas, and cost efficiencies. In order to accommodate the desires of the membership, consensus was reached on the transmission pipeline alignment. The membership provided their information and data to calculate the necessary pipe size and dimensions to fully utilize each member's allocation for this report.

The total future cost of the regional transmission system is from Table 6-22 and is $190,110,000 with yearly operations and maintenance costs at approximately $36,000,000. Each member will be responsible for their portion of the costs based on their commitment to the system and their CAP subcontract allocation.

This report details most of the information necessary to begin the planning of a regional distribution system within the WESTCAPS service area.

CHAPTER I – INTRODUCTION

The details contained within this report are at the heart of WESTCAPS planning since the mid to late 1990's. Specifically, the details are the idea and concept of taking delivery of Central Arizona Project Water and having some idea of knowing what the cost of such an endeavor would be. An understanding that the costs of such an endeavor would be quite high is one of the reasons that led the cities in the southwest valley to form WESTCAPS. The goal was the ability to share in the expense of transporting CAP water long distances.

Although the strategic plan in 2001 was able to outline the costs of a shared transmission line, the details of a regional transmission line were not made available due to budgetary and time constraints. In the early years, the strategic plan formulation was an attempt by the coalition to formulate various strategies along with estimates of what the strategies would cost. This report is the first to use a hydraulic model to determine what is physically needed for a share regional transmission pipeline. Integrated into the model, and provided in the appendices, is a cost derivation program which automatically calculates the cost for pipeline materials and installation, the earthwork needed for constructing a pipeline, the pumping locations necessary and the cost of the pumping facilities, land easement expenses, and the energy costs needed to pump water to desired locations. What follows in the next chapters is a detailed look at what can be used of the existing infrastructure in the west valley to transport water closer to the water providers in order to minimize the expense of CAP water delivery, and how much water is either needed by the water providers or how much water could they realistically take delivery of based on their allocation.

Today's vision of the regional transmission line still looks remarkably similar to the vision expressed in the strategic plan in 2001. One of the options for taking delivery of CAP water in 2001 was to transport CAP water via the Beardsley Canal to a turnout at Cactus Road and the Beardsley with a water treatment plant located at that intersection. Today, the Maricopa Water District and Arizona American Water Company share in a joint venture to complete the White Tank Water Treatment Plant in 2010 at Cactus and Beardsley Road. Although the plant is intended to serve Arizona American's needs, the site allows for further expansion to treat and deliver CAP water to others. The five WESTCAPS entities who share an interest in wanting to explore having their CAP water allocation delivered to the White Tank plant and then taking delivery through a shared pipeline are Arizona Water Company, The City of Avondale, The City of Buckeye, Global Water Company, and The City of Goodyear. In Chapter 3, the report begins to look at the quantities of CAP water that each water provider above would desire to have delivered to them, and for some of the entities, specific locations for turnouts. Although there is an understanding that current restrictions exist on the volume of each stakeholder's CAP allocation, each stakeholder was able to decide whether to select their current CAP allocation, or predict a future CAP allocation anticipated may be available to them (the only restriction being that the total hookup to the White Tank WTP could not account for more than a 42 mgd delivery for all 5 participants).

In Chapter 4, the report looks back at some of the reports provided to date that dealt with transporting CAP water, the benefits to the region and each individual stakeholder for a new transmission system, and more details concerning the White Tank WTP.

Chapter 5 is a presentation of the regional transmission system with figures showing the pipeline alignment and turnout locations. Also provided are sizes and costs for the main trunk line, the total cost of the regional transmission system, and the cost to each individual participant.

Although the costs in Chapter 5 are relevant to today's costs, the system isn't constructed during one time period and thus the intent is to construct the system over a 25 year time frame. Chapter 6 presents the costs relevant to constructing the system in a staggered fashion over time and into the future.

The hope is that this report serves as a guide for WESTCAPS cities and water providers to be able to better anticipate when water demands are forthcoming, the extent of the system that is needed, and to what physical level and cost WESTCAPS entities will need to be anticipating. The report provides a total of 7 chapters in reference to a future WESTCAPS regional transmission pipeline with layouts, turnouts, present cost, and future cost. A summary of those chapters is provided below.

Chapter I	Introduction
Chapter II	The West Valley Water Transmission Pipeline – The Present Infrastructure
Chapter III	The Water Demands by Location
Chapter IV	The West Valley Water Transmission Pipeline – The Infrastructure of the Future
Chapter V	Hydraulic Analysis and Specific Regional Construction Costs
Chapter VI	Future Cost of the Regional Transmission System
Chapter VII	Conclusions and Observations

CHAPTER II - THE WEST VALLEY WATER TRANSMISSION PIPELINE - THE PRESENT INFRASTRUCTURE

The Agua Fria Water System is owned and operated by the Arizona American Water Company (Arizona-American). Currently the transmission main delivers pumped groundwater from the northern portion of its system to four turnouts – two turnouts located in the northern portion of its transmission main, and two in the southern portion of its transmission system. The transmission system is located in the far west Phoenix metro area and delivers water to areas east and northeast of the White Tank Mountains (see the CC&N map provided, Figure 1, for more detail on the location).

As a point of clarification, the Agua Fria Water System is owned by Arizona American whereas the White Tanks Water Treatment Plant is a collaborative effort between Arizona American and the Maricopa Water District.

Existing Alignments and Booster Pumping Stations

Nine groundwater pumping plants service customers within the Agua Fria Service Area. More than one ground water well serves most of the plants for the Agua Fria system. With future increases in deliveries in mind, the trunk line expands to 30 inches at the intersection with Cactus Road to Camelback (the main trunk line detours toward the west along Northern Avenue before paralleling south along Perryville Road to Camelback).

A service system map of the existing infrastructure is provided on Figure 2-1. On the map, the portion of the distribution system which is in red denotes the existing infrastructure, which is the infrastructure currently in operation. The purple line designates a future pipeline where the designs are complete and a developer will have the pipeline installed, but no set schedule is in place for the timing of the installation. The furthest southern purple line suggests a pipeline designated for Goodyear. The green line designates a pipeline not yet installed where the design has not begun and no set schedule is in place for the timing of the installation.

Pipeline Capacities

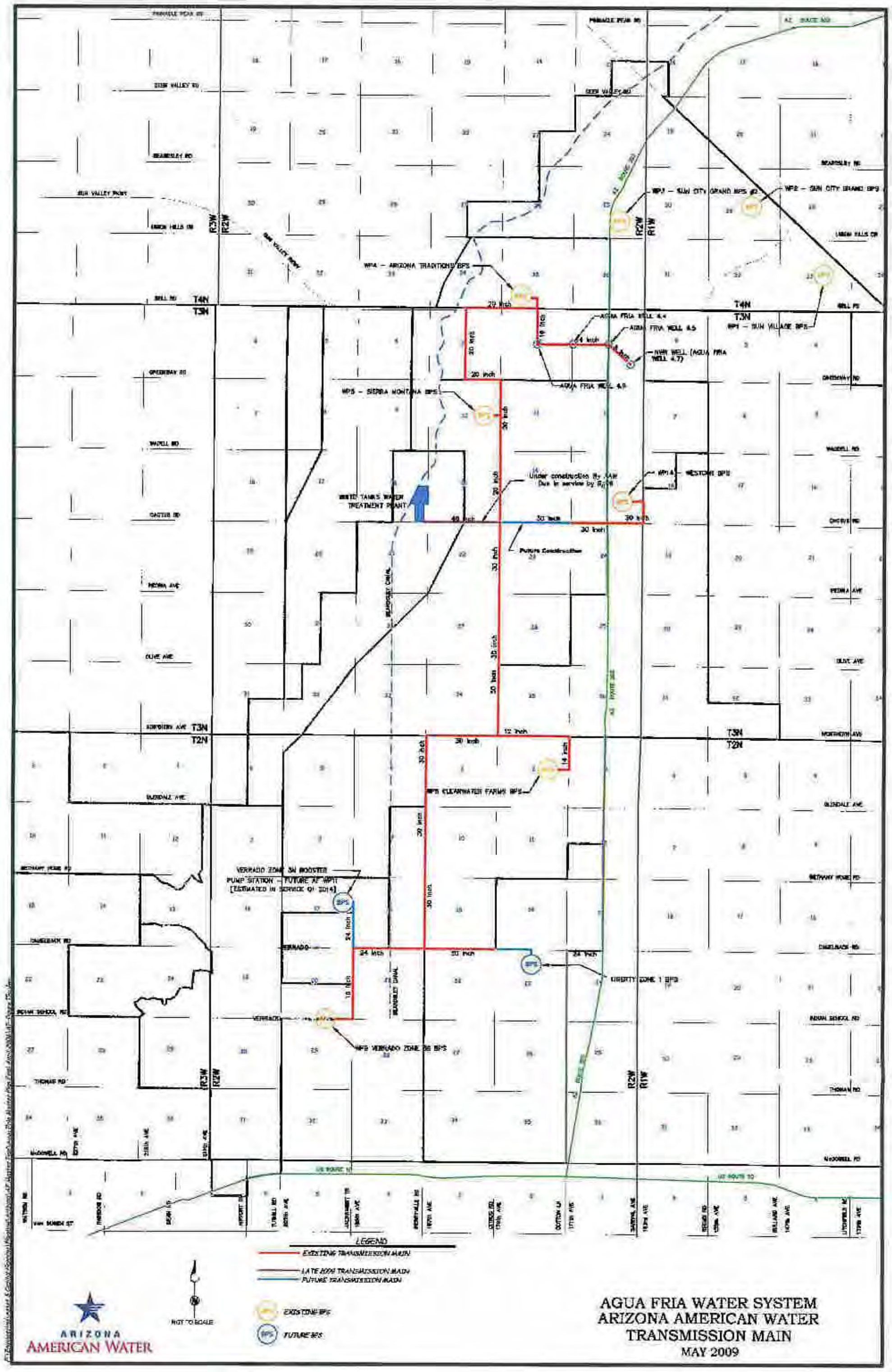
The capacities of the various trunk lines in cubic feet per second (cfs) and in mgd are provided below in Table 2.1. The capacities in cfs are instantaneous capacities based on a maximum allowable velocity of 6 feet per second in the transmission system from Arizona-American Water's Development Guide (2003). The capacities in mgd are based on volumes occurring over the course of a day of pumping. The analysis provides for the maximum capacities of the current system which can be used as a comparison against existing demands.

Table 2-1 Flow and Volume Capacities for Select Portions of the Main West Valley Water Transmission System in Cubic Feet per Second and Million Gallons per Day.

Alignment	Pipe Size* (inches)	Max Flow (cfs)	~ Max Vol. (mgd)
NWR Well (Agua Fria Well 4.7) – to well 4.5	8	2.09	1.35
Rte. 303 to Cotton Lane – well 4.5 to 4.4	14	6.41	4.14
Cotton Ln toward Citrus Rd – well 4.4 to 4.6	16	6.98	5.42
Paradise Ln. to Bell Rd – well 4.6 to AZ Traditions BPS	16	8.38	5.42
Union Hills Dr. to Bell Rd. – wells 4.1, 4.2, 4.3 to AZ Traditions BPS	N/A	unknown	unknown
AZ Traditions BPS to Cactus Rd.	20	13.09	8.46
Cactus Rd. to Camelback Rd.	30	29.45	19.03
Citrus Rd. to Cotton Ln.	12	4.71	3.04
Northern to Clearwater Farms BPS	14	6.41	4.14
Perryville Rd. to Verrado Zone 3N BPS	24	18.85	12.18
Camelback Rd. to Verrado Zone 3S BPS	16	8.38	5.42
Perryville Rd. to Citrus Rd.	20	13.09	8.46

* - Assumption is the inside diameter of the pipe for flow calculations

Figure 2-1 Agua Fria Water System, Arizona American Water Transmission Main



Planned Capacity

Some of the existing Arizona-American system has been developed to meet the needs of Arizona-American customers through sometime between the years 2020 and 2025. Those customers currently include developments such as Sedella LLC, and the Verrado Development, where Arizona-American has an existing agreement that the system will reserve the spare capacity in the pipeline system for these developments needs. The opportunity currently exists for an outside entity to wheel water through the Agua Fria system, though the timeline below shows the constraint on the ability to do so over time, based on expected growth.

Table 2-2 Expected Timing of Water Delivery Reductions/Restrictions in Planned Capacity from the Agua Fria Water System in millions of gallons per day.

	2009	2010	2011	2012	2013	2014	2015	2016	2017
AFWS	6.5	6.5	6.5	6.5	6.5	6.5	5.0	4.0	3.0

After 2017 the spare capacity in the Agua Fria system continues to decline as the aforementioned developments build out until no spare capacity remains. The reductions shown in Table 2.2 are with respect to a natural progression of water use anticipated by Arizona-American for its own needs which naturally reduces the capacity in the Agua Fria system.

Although the current Agua Fria transmission system is physically constrained with respect to available capacity over time, Arizona-American welcomes dialogue with potential customers interested in using Arizona-American's current spare pipeline capacity should customers be interested in treating water at the White Tanks WTP.

As Arizona-American's customer base grows, their water demands will increase with time. To meet these growing needs, Arizona-American's intent is to begin direct utilization of the Agua Fria district's CAP allocation. This will require additional treatment compared to the treatment needed for groundwater. That additional treatment will occur at the White Tanks Water Treatment Plant which will be operational in 2009. Currently all of Agua Fria's portion of their CAP water is being recharged.

White Tanks Water Treatment Plant

The concept behind the White Tanks WTP began in 2001 with the publication of the WESTCAPS Strategic Plan. The vision in 2001 for the west valley was for the full utilization of its renewable CAP supply and the construction of a water treatment plant to deliver treated water at the intersection of Cactus Road and the Beardsley Canal (then called the Agua Fria Regional Water Treatment Plant). The plant was perceived as coming on-line in 2005, and by 2025 the plant would be at full capacity, treating 79 MGD. The location of the plant was chosen because it appeared to be optimally located not only to be able to take CAP water off of the Beardsley, but due to its elevation, the need for booster pumping would be minimized. Another factor that may have played some significance for the location of the treatment plant at Cactus Road is that deliveries through the Beardsley Canal of up to 80 MGD are possible at that location, but likely not possible further downstream (Note: A wheeling fee is required by MWD for utilizing the

Beardsley Canal, and some financial consideration needs to be given for treatment costs at the White Tanks WTP).

The new water treatment plant has the potential to provide potable water to Goodyear, portions of Avondale, Buckeye, and Surprise, and to numerous other water companies and land developers. The water treated at the White Tanks plant could be used by entities to blend CAP water with groundwater in order to reduce salt levels, and potentially arsenic or nitrate levels. Beginning in late 2009, the Agua Fria system will be supplied from a blend of groundwater and treated surface water (the surface water is to be supplied from the Beardsley Canal via the CAP aqueduct).

Planned Capacity

Construction of the 13.5 MGD White Tanks plant began in November of 2007 (see Figure 2-2 for an aerial layout of the progress during the early summer of 2008). The elevation of the plant is approximately 1,420 feet, and is configured in order to take water from the canal in the northern portion of the property, and as treatment progresses, water is delivered toward the southern portion of the property. Plans call for the construction of a 48-inch pipe from the treatment plant to take the treated water east along Cactus road toward Citrus Road where a tee is located and where water can be distributed either north along a 20-inch line, or south along a 30-inch line, or further east along a planned 30-inch line which will be constructed in the future as demands require.

Potential Expansion Capability

Sufficient land has been purchased by Arizona-American beside the Beardsley Canal in order to expand the White Tanks Treatment Plant to 80 MGD. Although Arizona-American's entitlement to CAP water is less than 80 MGD, the treatment plant can nonetheless be expanded to receive CAP water for others to then treat and have ready for delivery for other water providers.

The treatment capacity available for expansion purposes at the plant reflects an opportunity for the west valley cities and water providers to have access to a CAP turnout closer to their community. If a water provider can access a surface water right and wheel it through the CAP and Beardsley Canals, the advantages for providing one's community with a renewable water supply are the following.

1. The use of surface water can relieve the continued use of ground water which in many places in the west valley is linked to subsidence. Surface water can also be blended with existing supplies in order to improve overall water quality.

2. Additional supplies provides confidence for community leaders that sufficient water exists for the approval of either large master planned communities or businesses and industries looking to purchase building permits or expand operations.

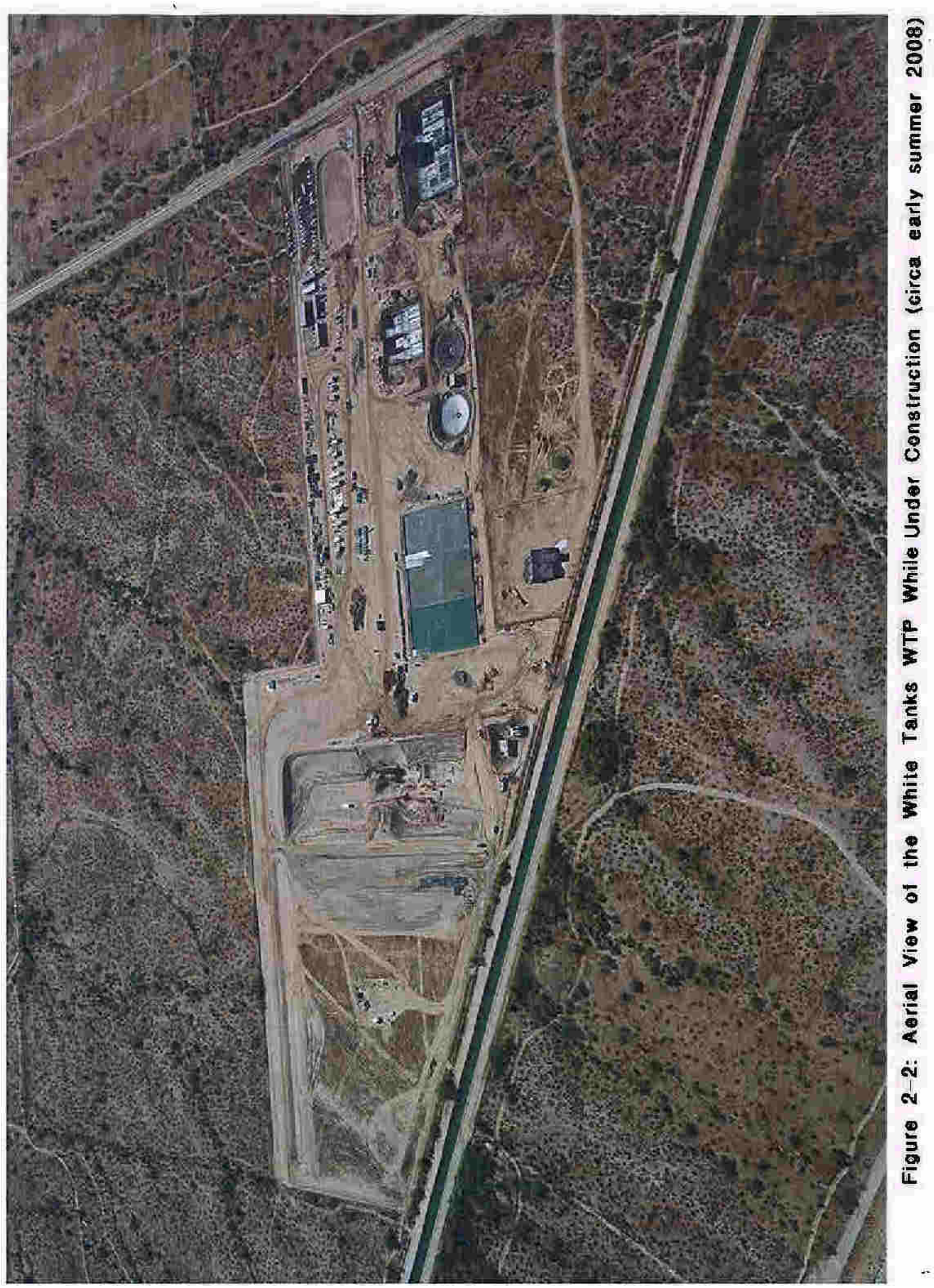
3. Additional water supplies and improved water quality add to the quality of life that builds confidence for developers and home buyers knowing that sufficient water exists into the future, and that the quality of water meets primary and secondary standards.

4. The use of surface water can reduce replenishment obligations and CAGRD replenishment fees related to groundwater pumping.

The Beardsley Canal is operated on the premise that if less than 40 cfs is ordered, that flows in the canal are halted due to larger evaporation losses from the canal than what can be provided to users. During this shutdown, MWD uses the opportunity if needed to perform canal maintenance.

The future of the White Tanks could be characterized by future water demands that are increasingly difficult to meet with the current infrastructure. In the following chapter, those demands are assessed by provider. Although the Agua Fria Transmission System may be built out by 2020 or 2025, the system was perceived to be able to operate at 80 MGD. Regardless of which cities and/or water providers are able to take their CAP water by using either or both the Agua Fria Transmission System or the White Tanks WTP will no doubt prove to be of great benefit in the years to come.

Figure 2-2 Aerial view of the White Tanks WTP While Under Construction (circa early summer 2008)



CHAPTER III - THE WATER DEMANDS BY LOCATION

The common thread among any and all water delivery systems is that a design for the capacity of the system begins at the point of use. The point of use is the demand for the product desired. Chapter 3 is intended to understand not only the water demands for each region in the west valley in general, but attempt to understand more specific areas needing the water.

Not to be overlooked is the importance of where the water is coming from and the source of water. The current intent is to divert CAP water off of the Beardsley Canal for points of use south of the White Tanks WTP location at Cactus Road. The expansion of the existing White Tanks WTP (for this report) will be based solely on expansion plans due to the delivery and treatment of CAP water, and therefore the amount of CAP water available to WESTCAPS entities is important to acknowledge. By late 2009 Arizona-American will have the ability to treat CAP water at the White Tanks plant. The goal of this chapter is determining the demand and timing of these deliveries, and the second goal is the use of this data to determine the cost of constructing a water delivery system to meet the demands.

CAP Water Allocations and the Current Use of CAP Water

The CAP water allocations for each participating WESTCAPS member is provided below in Table 3-1. The table does not include potential contracts, and only includes the allocations assigned to member entities.

Table 3-1 CAP Allocations for some WESTCAPS Members in Acre-Feet per Year of Water and the Amount of CAP Water Expected to be Used/Stored in 2009.

City/Entity	CAP Allocation	CAP ('09)
Arizona-American Water[1]	11,093	11,093
Avondale[2]	5,936	5,000
Goodyear	3,531	0
Arizona Water Company[3]	968	0
Buckeye	378	0
Global Water[4]	107	28
Total	**21,635**	**5,028**

[1] Arizona American's CAP allocation is comprised of 11,093 ac-ft/yr for the Agua Fria regional area. Currently Arizona American recharges its allocation through Maricopa Water District, Tonopah Desert Recharge Facility and the Verrado recharge facility.

[2] Avondale recharges its CAP allocation through a wheeling agreement with SRP at its Crystal Gardens facility and is able to recover the water for later use. The site is permitted for up to 10,000 acre-feet per year. Avondale's CAP allocation is 5,114 ac-ft/yr, with an additional 822 ac-ft/yr of water lease from the Apache Nation where as of printing time all participants have signed the legislation, and only the legislation has been introduced.

[3] AWC/White Tanks

[4] Global Water's CAP allocation is comprised of 43 ac-ft/yr for the Water Utility of Greater Buckeye, and 64 ac-ft/yr for the Water Utility of Greater Tonopah. The amount used in 2008 is an estimate as the Global Water recharge basin is permitted for 28 acre-feet per year.

Although not noted in the above table, as a WESTCAPS member, Surprise is currently planning on the creation of the technical and financial aspects of eventually using their CAP water. The eventual use of CAP water by the town of Surprise is feasible since the town has annexed to create new town limits up to the canal in recent years in the vicinity of Grand Avenue and the CAP canal. For purposes of this study, it is infeasible for Surprise to divert and treat its CAP water at the White Tanks WTP to then have it pumped uphill to its service area.

Buckeye is noted in the above table although it does not currently use its CAP allocation. Buckeye has elected to be a part of this study, but would also like to see its allocation increase from its small and diminishing volume. Buckeye's current allocation is 378 acre-feet per year which eventually reduces to 25 acre-feet per year by 2034. Buckeye is currently engaged in CAWCD's ADD water process, and eventually will be engaged in the reallocation of approximately 96,000 acre-feet of non-Indian water (classified as agricultural priority water) through the Southern Arizona Water Rights Settlement Act (SAWRSA). The ADD water process has been an ongoing study led by CAWCD to fairly distribute between 300,000 and 700,000 acre-feet per year of water among entities willing to purchase additional water. The process is contingent on a fairly large block of water being available to purchase by another entity willing to sell it. The language in the SAWRSA reallocation states that 96,000 acre-feet of water will be reallocated after 197,500 acre-feet of water is allocated among Indian tribes, and that neither will be allocated prior to January 1, 2010.

Peoria is using nearly half of its CAP allocation mostly through treatment and direct delivery from the Pyramid Peak WTP. Peoria also uses CAP water to irrigate common areas within a development, and to deliver CAP water to another developer. Peoria plans to increase the use of CAP water over time through the construction of the Twin Buttes WTP. Peoria additionally has the option of wheeling 7,240 acre-feet per year through the SRP and CAP interconnect which would bring CAP water into Peoria through SRP's canal. Originally this study was to include the planning of the Twin Buttes Water Treatment Plant which was to include a partnership between Peoria and Surprise. Although a potential partnership is possible between the two cities, discussions are not far enough along to be included with this report in order to begin to predict delivery of water volumes, locations of turnouts, and a cost assessment.

The City of Phoenix has determined that the service area planned with respect to this new transmission line is not in relative proximity to their own service area in order for there to be any benefit. Although there may be mentions of Phoenix in this report, it is not reflective of the City of Phoenix (unless stated), and may be more a parlance of using the word 'Phoenix' when denoting the regional area.

Goodyear's greatest challenge to using CAP water is the distance the city is located from the canal. The approximate distance from the CAP canal to Goodyear's service area is 20 miles making Goodyear one of the subcontractors located the furthest from the CAP canal who also have one of the biggest allocations of water. The emphasis for this report is determining how Goodyear can benefit from the use of its CAP allocation now that a delivery mechanism (the Beardsley Canal) and treatment infrastructure (White Tanks WTP) is being constructed within 10 miles from Goodyear's border.

The town of Avondale is fully utilizing its CAP allocation, but does not directly use its delivery. Avondale is taking delivery of its CAP water through a wheeling arrangement with SRP and discharging it at it Crystal Lakes wetlands/recharge facility and is thus receiving CAP water for 'incentive water' pricing. This usage is reflected in Table 3-1 above. The town is beginning to favor a direct CAP delivery option (receive, treat, and deliver through a distribution system) at some point in the future, and thus, this study fits in well with their planning, and in understanding future options.

Global Water is currently purchasing incentive recharge water from CAP and recharging it at the Hassayampa Recharge Facility owned and operated by Hassayampa Ventures LLC. The recharge credits are being offered on the market to other entities within the Phoenix AMA so they can meet their recharge obligations. Although they currently only possess a small volume, Global Water will work to increase its CAP allocation and continue to procure surplus supply. Ultimately, they will take delivery of their water for direct use or utilize the credits to pump elsewhere to meet is delivery needs within the Phoenix AMA.

Arizona-American Water Company, Agua Fria District, delivers groundwater to customers throughout Sun City Grand, to a large portion of Surprise, a sizeable portion of El Mirage, a small portion of Peoria, plus deliveries to unincorporated Maricopa county and Buckeye. Although the service area is fed by groundwater wells much of the pumping is recovered CAP water. Arizona-American is taking delivery of its CAP water at Maricopa Water District and Tonopah Desert Recharge Project in order to receive credits through underground storage. In 2010, Arizona-American's Agua Fria transmission system will begin direct delivery of CAP water once the White Tanks WTP comes on-line.

Arizona-Water Company's service area in the west valley is located at the tail end of the Beardsley Canal where it is located just far enough from the CAP canal that their relatively small allocation would be an expensive option to have delivered to them. However, considering their location, and their proximity to the Beardsley Canal and the White Tanks WTP, Arizona-Water has become aware that a regional plan could incorporate their service area rather easily. For purposes of this study, Arizona-Water has provided service area information, including other data, statistics, supply information, and projected population growth and water demands about their area in order to be included into this study.

Current CAP Demands by Location

Peoria's growth towards its northern boundary fits well with the CAP which is also located in the northern half of the city. Peoria's arrangement with Glendale is that Peoria can treat 9,120 acre-feet per year from Glendale's Pyramid Peak WTP for Peoria's use. The Pyramid Peak plant is located where the 63rd Avenue alignment meets the CAP aqueduct (north of Jomax). Deliveries for Peoria's service area from the WTP are toward the south and west as Peoria's eastern service area boundary is located at 67th Avenue. Avondale recharges its CAP allocation into its Crystal Gardens wetlands/recharge facility which is permitted for up to 10,000 acre-feet per year. The Crystal Gardens facility allows Avondale to recharge, treat, and recover the recharged CAP water for later use. The Crystal Gardens recharge facility is located north of McDowell Road and east and adjacent to the Agua Fria River. Although 5,416 acre-feet per year of CAP water is recharged into the facility, Avondale recharges 10,000 acre-feet per year in the facility which is made up of CAP water, brackish groundwater, and recycled water. Avondale's wells recover 90% of the total volume recharged for use throughout Avondale's distribution system.

Global Water has constructed a recharge facility south of the CAP canal aqueduct in the Hassayampa River in order to bank and/or sell recharge credits. Global Water has two 25,000 acre feet per year water storage permits, but only one of the facilities is currently constructed and the actual amount being recharged is between 20,000 and 25,000 acre-feet per year.

Arizona American takes delivery of their CAP water through Maricopa Water District's recharge facility, the Tonopah Desert Recharge Facility and the Verrado recharge facility. In all, Arizona American utilizes their 11,093 acre-foot per year allocation by recharging renewable water in receiving storage credits by the state of Arizona.

To date, the remaining WESTCAPS members are not utilizing their CAP allocation. Although the use of CAP by WESTCAPS members is limited in 2008, the commitment towards its use appears to be quite definitive. Many of the cities and water providers have published water resources plans to identify when and how their renewable supply will be put to use. From the WESTCAPS report entitled, Population and Water Demand Projections for WESTCAPS Member Lands, as a whole for the west valley the shortfall in renewable supplies doesn't occur until sometime between 2010 and 2015. As the shortfall grows over time, cities and water providers will feel more compelled to tap into their renewable supply and thus utilize the next supply in the water resources portfolio. The next section on projections of demands provides greater details of future projections.

Projections of Demands and their Locations

The cities and water providers who anticipate putting their CAP water to use in the near future are Avondale, Goodyear, the Arizona Water Company, Buckeye, Global Water Company, and Arizona-American Water Company. Of the six entities, Arizona-American is a stakeholder with most of their delivery infrastructure in place as they are not in need of partnering with the other entities for the development of a new pipeline system as a new water user. Of the remaining five water providers, preliminary work on where turnouts would be located within their current and future service area has been completed. Goodyear has additionally fulfilled a detailed future use analysis complete with a timeline on the timing of CAP turnouts. Because Goodyear's plans are for the delivery of a substantially large volume of water which has them delivering water further than the other CAP subcontractors, the most challenging analysis begins with Goodyear's analysis of projections of demands. The goal is therefore to tie other users to Goodyear's infrastructure.

It should be noted that water losses are fairly common when delivering water through an open channel system (such as the Beardsley canal), and again during a treatment process. Water losses will occur during open channel flow (canal losses and evaporation) and the water treatment process at the White Tanks plant. Typically these losses should be taken into account during the design process. However, a pipeline's size would also be reduced when taking these losses into account. Although there is recognition among water users that their wheeled water would be reduced due to losses, in the modeling portion of the work the losses are not taken into account. This allows the size of the pipeline to deliver the full allocation when constructed. A smaller pipeline cannot be utilized to deliver a full allocation when an additional water allocation has been obtained, or if conservation methods allow for full delivery. As such, the hydraulic modeling of CAP water for the coalition takes the full allocation into account which also winds up projecting an operating cost for user's full allocation.

The City of Goodyear

The City of Goodyear (Goodyear) has water supplied to it through two different water systems. The Litchfield Water Company (LPSCO) provides water generally north of Interstate 10. LPSCO's service area should experience moderate growth over time with 60 to 65% of this portion of Goodyear developed, and the area is of a nominal size at roughly 19 square miles. Water deliveries made south of Interstate 10 are provided by the City of Goodyear. A greater number of developments are anticipated south of Interstate 10 which is an area approximately 6 to 8 miles wide but stretches from Interstate 10 south to Mobile located along State Route 238, and is approximately 10% developed. The majority of the growth and the planning by the City is being conducted to Patterson Road which is located 5 miles south of Queen Creek Road. A smaller service area of approximately 3 square miles called Sonoran Highlands located south of Patterson Road is additionally part of Goodyear's planning outlook. The analysis and outlook in this report is for the City of Goodyear's service area (area of responsibility) located south of Interstate 10.

Goodyear's water system will eventually be taking shape in the coming years with respect to the development of infrastructure to accommodate the remaining 90% growth left to build-out. Some of Goodyear's renewable water supply is available from the Agua Fria water transmission system which has 6.5 MGD capacity in its system for Goodyear through the year 2014. The schedule Arizona-American has provided for the capacity reduction in the Agua Fria water system is the following.

Table 3-2 Timing of Water Delivery Reductions from the Agua Fria Water System (AFWS) to the City of Goodyear in millions of gallons per day.

	2009	2010	2011	2012	2013	2014	2015	2016	2017
AFWS	6.5	6.5	6.5	6.5	6.5	6.5	5.0	4.0	3.0

After 2017 the spare capacity in the Agua Fria system continues to decline until no spare capacity remains (although the details past 2017 are unknown). The reductions shown in Table 3-2 are with respect to a natural progression of water use anticipated by Arizona-American for its own needs which naturally reduces the capacity in the Agua Fria system. Goodyear's eventual desire is to have an additional 15 MGD of its CAP allocation delivered (for a total of 18 MGD) through the Beardsley Canal and either from Arizona-American's White Tanks WTP, or from a water treatment plant of their own.

Additional Goodyear Production Capacity

In order to meet its future demand obligation, Goodyear expects to eventually fully utilize its CAP allocation either through the existing Agua Fria system or the development of their own infrastructure. For purposes of this study, both Goodyear and WESTCAPS are interested in the analysis as it relates to Goodyear either tying into the Agua Fria water transmission system, or developing most or all of their own infrastructure in order to access their CAP allocation.

A summary of Goodyear's planned water production facilities or planned deliveries from outside areas follows. One delivery Goodyear is planning on is 10 MGD delivered to it through the Adaman Mutual Water Company WTP located at Sarival Road and Camelback Road. Goodyear plans to exercise the option of buying water and using the Adaman WTP to build a pipeline in order to deliver water to areas south of Interstate 10. The ability to provide peaking deliveries will not be possible and deliveries will be constrained to a maximum of 10 MGD from the Adaman Mutual Water Company.

Goodyear's current portfolio of water supplies includes a portion from LPSCO. Goodyear intends to continue to receive 3.0 MGD from the LPSCO connection at the intersection of Bullard and Sarival Roads. This volume of water is anticipated to be consistently available until Goodyear's build out which is estimated to be in 2045.

Waterman Wash which runs through the lower portion of Goodyear's planning area will factor significantly in the future with respect to Goodyear's water resources. Two groundwater treatment plants will eventually pump a combined 50 MGD for the new developments in southern Goodyear. And Goodyear also intends to expand their current well field located just south of Interstate 10 (on the west end of the City) to deliver an additional 2.3 MGD from the current 12.70 MGD. This is considered Goodyear's northern well field. For the eventual build out, the well field would be expanded to deliver an additional 3.3 MGD above the current 12.70 MGD.

Goodyear's plans include the development of the Gila River GWTP which will eventually be located in the south central portion of the planned northern well field (see paragraph above concerning the northern well field). The Gila River GWTP is scheduled to come on-line in 2012 with 5.0 MGD and eventually will be expanded in order to deliver 60.0 MGD by build-out.

Water Demand Analysis

Any data related to Goodyear's growth suggests that Goodyear's planning will be a constantly evolving affair. The demands for water to supply the growth are well understood by Goodyear in early 2008, and Goodyear's plans call for the development of five new water projects such as ground-water treatment plants or the development of renewable sources.

Although the total volume of Goodyear's CAP allocation is known, and Goodyear's water demands and supplies are projected, the timing of how each of their water sources are applied to various areas of the city must be analyzed. Goodyear is divided into five pressure zones, each zone requiring various demands with respect to time and water needs. Goodyear has projected their water demands by pressure zone for years 2007, 2012, 2017, and 2045. The years being reported for this publication are 2010, 2015, 2020, 2025, and 2035. Therefore, the years reported in the tables that follow are interpolated values from Goodyear's data. Because the pressure zone boundaries are defined by lines that are not straight, and zones which are split into more than one area, the task of describing the location of each zone would require many pages of text. Therefore, in order to reference the location of each zone, see Figure 3-1 from information supplied by Goodyear on the following page.

Table 3-3 Potable Water Requirements by Pressure Zones in MGD for Goodyear.

Zone	2010	2015	2020	2025	2035
Zone 1	3.84	6.86	9.17	10.61	13.49
Gila Zone	4.20	7.51	9.83	11.21	13.95
Zone 2	3.04	6.87	9.65	11.41	14.93
Zone 3	2.24	6.85	10.94	13.81	19.54
Zone 4	0.45	2.93	5.58	7.56	11.50
Total	13.77	31.02	45.17	54.60	73.41

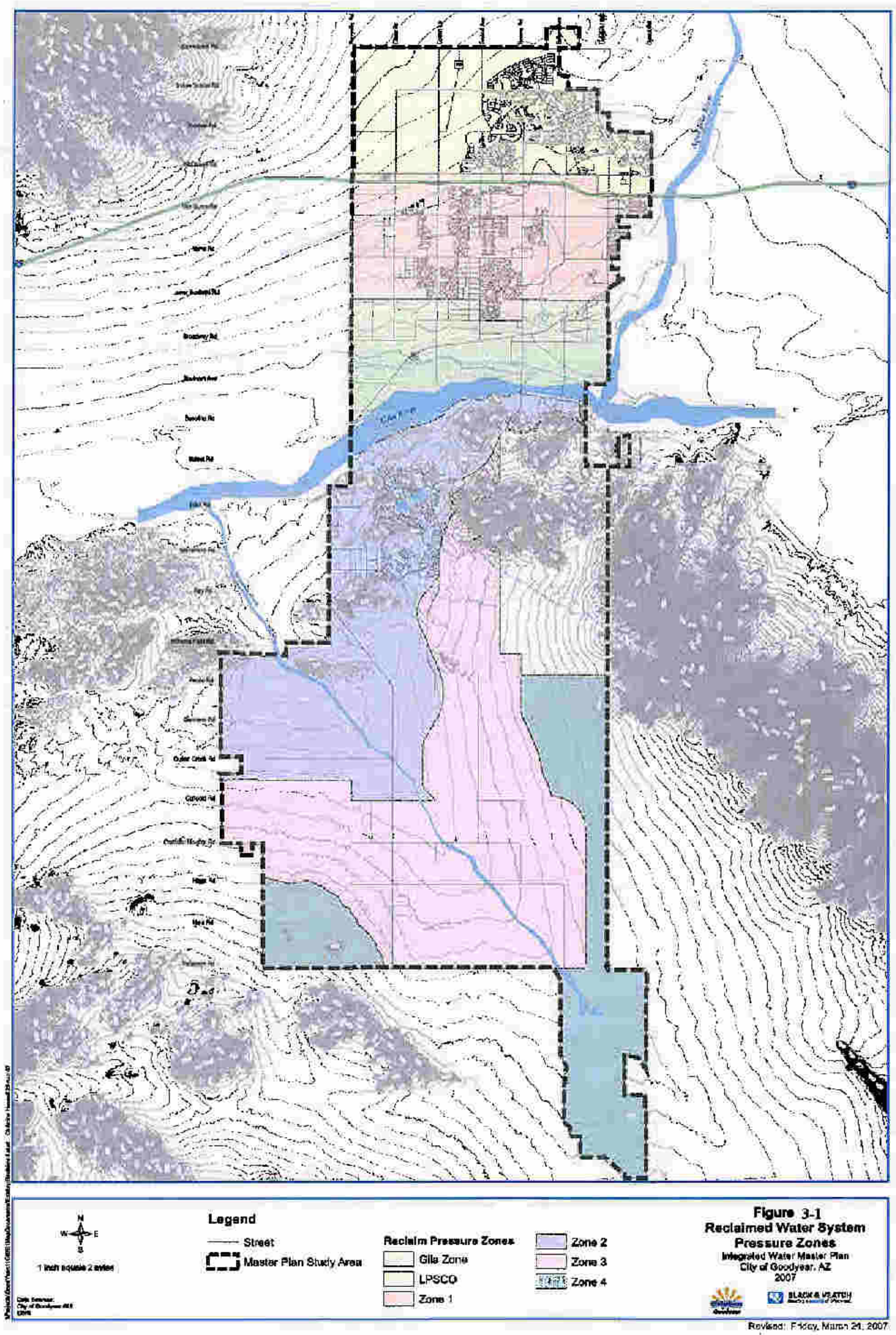
The above table is provided below with converted values in acre-feet per year.

Table 3-4 Potable Water Requirements by Pressure Zones in Acre-Feet per Year for Goodyear.

Zone	2010	2015	2020	2025	2035
Zone 1	4,301.4	7,684.2	10271.7	11,884.7	15,110.7
Gila Zone	4,704.6	8,412.3	11,011.0	12,556.8	15,626.0
Zone 2	3,405.2	7,695.4	10,809.4	12,780.8	16,723.7
Zone 3	2,509.1	7,673.0	12,254.4	15,469.2	21,887.6
Zone 4	504.1	3,282.0	6,250.4	8,468.3	12,881.7
Total	6,418.4	18,650.4	29,314.2	36,718.3	51,493.0

Within each zone, Goodyear either already has in place, or is planning to install, a water storage tank and booster station. The existing sites within Goodyear are COG #3, COG #7, COG #8, COG #10, COG #11, COG #12, COG #13, COG #18, COG #21, and COG #23. Goodyear does not consider these sites in their data for storage requirements through build-out (build-out is 2045). By build-out, Goodyear plans to consolidate storage facilities in order to achieve overall efficiency and simplicity of system operation.

Figure 3-1 Reclaimed Water System Pressure Zones



This means that all of the above existing storage facilities mentioned will have been retired and replaced with reservoirs of 2.0 to 7.0 MG each. However, from the analysis provided as part of this study, it appears that Goodyear can not afford to lose the storage capability and distribution from COG #7. So therefore in the tables below, COG #7 is included as a storage site meant to receive future water deliveries (COG's are changed to the word "site" in Goodyear's future outlook). For a location description of each storage facility, see Figure 3-2, entitled Water Transmission System.

Goodyear's data on storage facilities includes the volume required for each storage facility for all years from 2007 through 2017 and the year 2045, and the maximum daily demand expected from each facility in 2045. Goodyear's average maximum daily demand has historically been 1.67 times greater than the average daily demand. For design purposes, Goodyear uses the value 1.70 as the maximum daily demand divided by the average daily demand. By knowing the maximum daily demands at each storage site at build-out, the future storage volume at build-out, and the storage volumes from years 2007 through 2017 and 2045, a table can be created for each storage site which provides the average daily demand from years 2010 to 2035 in 5 year increments. The volumes of water for each site are added for each pressure zone and compared to the potable water requirements by pressure zone from Tables 3-3 and 3-4 in order to verify that the water developed will match the demands. Table 3-5 illustrates the results of the analysis for each storage and booster pumping station in Goodyear by pressure zone.

Table 3-5 Average Day Potable Water Delivery by Pressure Zone in MGD for Goodyear, Arizona from 2010 to 2035 and the Subsequent Potable Water Requirement (Demand) for Each Zone.

Zone	**2010**	**2015**	**2020**	**2025**	**2035**
Zone 1					
Site 21	3.34	3.34	3.52	3.82	4.41
Site 11	3.15	3.15	3.15	3.15	3.15
Site 18	1.41	1.41	1.56	1.81	2.31
Westpac	0	3.85	3.85	3.85	3.85
Site12-Zone1	1.74	1.74	1.99	2.41	3.24
Total: Zone 1	**9.64**	**13.49**	**14.07**	**15.04**	**16.97**
PWR: Zone1[1]	**3.84**	**6.86**	**9.17**	**10.61**	**13.49**
Gila River	**2010**	**2015**	**2020**	**2025**	**2035**
Site12-GRiver	1.57	1.57	1.79	2.17	2.92
Gila River	2.86	2.86	5.73	5.73	5.73
Site 7	1.06	1.06	1.06	1.06	1.06
Site 8	0.98	0.98	0.98	0.98	0.98
Kings Ranch	0	1.85	2.05	2.38	3.03
Total: GR	**6.47**	**8.32**	**11.61**	**12.32**	**13.72**
PWR: GR	**4.2**	**7.51**	**9.83**	**11.21**	**13.95**
Zone 2	**2010**	**2015**	**2020**	**2025**	**2035**
Site13 – Zone2	1.4	1.4	1.73	2.27	3.36
Rainbow Valley – Zone2	5.82	5.82	6.03	6.39	7.11
Waterman	0	2.68	2.97	3.44	4.40
Total: Zone 2	**7.22**	**9.90**	**10.73**	**12.11**	**14.86**
PWR: Zone 2	**3.04**	**6.87**	**9.65**	**11.41**	**14.93**
Zone 3	**2010**	**2015**	**2020**	**2025**	**2035**
Site13 – Zone3	0.94	0.94	1.15	1.15	2.19
Rainbow Valley – Zone3	1.88	1.88	1.93	2.02	2.20
Zone 3/4W – Zone3	0	0	0.53	1.41	3.18
Zone 3/4E – Zone3	0	0	0.81	2.16	4.86
Zone 3	0	8.05	8.05	8.05	8.05
Estrella – Zone3	0	3.15	3.15	3.15	3.15
Total: Zone 3	**2.82**	**14.02**	**15.62**	**18.29**	**23.64**
PWR: Zone 3	**2.24**	**6.85**	**10.94**	**13.81**	**19.54**
Zone 4	**2010**	**2015**	**2020**	**2025**	**2035**
Rainbow Valley – Zone4	0.76	0.76	0.78	0.81	0.88
Estrella – Zone4	0	1.84	1.84	1.84	1.84
Zone 3/4W – Zone4	0	0	0.21	0.55	1.25
Zone 3/4E – Zone4	0	0	0.36	0.95	2.14
Sonoran Highlands	0	0	0.49	1.31	2.94
Total: Zone 4	**0.76**	**2.60**	**3.68**	**5.47**	**9.05**
PWR: Zone 4	**0.45**	**2.93**	**5.58**	**7.56**	**11.5**

[1] - PWR is the potable water requirement for that pressure zone from Table 3-11.

The potable water requirement (PWR) is provided for each zone in the above table in order to compare the PWR with the water being developed. The totals for each pressure zone are the average flows planned for delivery, whereas the PWR values are the average daily flow requirement (from Table 3-3). When comparing the results from Table 3-5, the total flows planned (ie. Total: Zone 1, Total: GR, etc.), exceed, or greatly exceed the PWR value. The years and zones where the demand (PWR) is greater than the planned supply is in the Gila River zone for the year 2035, in Zone 2 for 2035, and in Zone 4 for 2015, 2020, 2025, and 2035. As such, for example, the flow values planned by Goodyear for Zone 4 do not meet what is planned beyond 2010. To correctly plan for future water deliveries, each storage facility and booster pumping station taking a water delivery will need to be adjusted to the PWR. For example, in Zone 4 in 2010, the water demand for the zone is 0.45 MGD, yet 0.76 MGD is planned to be delivered to the Rainbow Valley storage tank for Zone 4. Because no other storage facilities in Zone 4 are planning to come on-line in 2010, Rainbow Valley's delivery for Zone 4 is adjusted to 0.45 MGD (a distinction is made for Rainbow Valley in Zone 4 since the Rainbow Valley site also delivers water to Zones 2 and 3). Conversely, the water deliveries in Zone 4 in the year 2015 appear to be shy of what is needed as determined by the PWR. The planned delivery is 2.60 MGD, while the requirement PWR for delivery is 2.93 MGD. In order to meet the demand of 2.93 MGD in 2015, each site must have its water delivery readjusted equally in order to meet the demand. By adjusting the Rainbow Valley delivery from 0.76 to 0.86 MGD, and the Estrella – Zone 4 delivery from 1.84 to 2.07 MGD, the water demand of 2.93 MGD can be met. The following table, Table 3-6, provides adjusted values for Table 3-5 above in order to provide the corrected values of the flows needed to Meet the demands for each pressure zone within Goodyear. The values in table 3-6 can then be used to begin to correctly size the main trunk-line through Goodyear.

Figure 3-2 Water Transmission System CIP

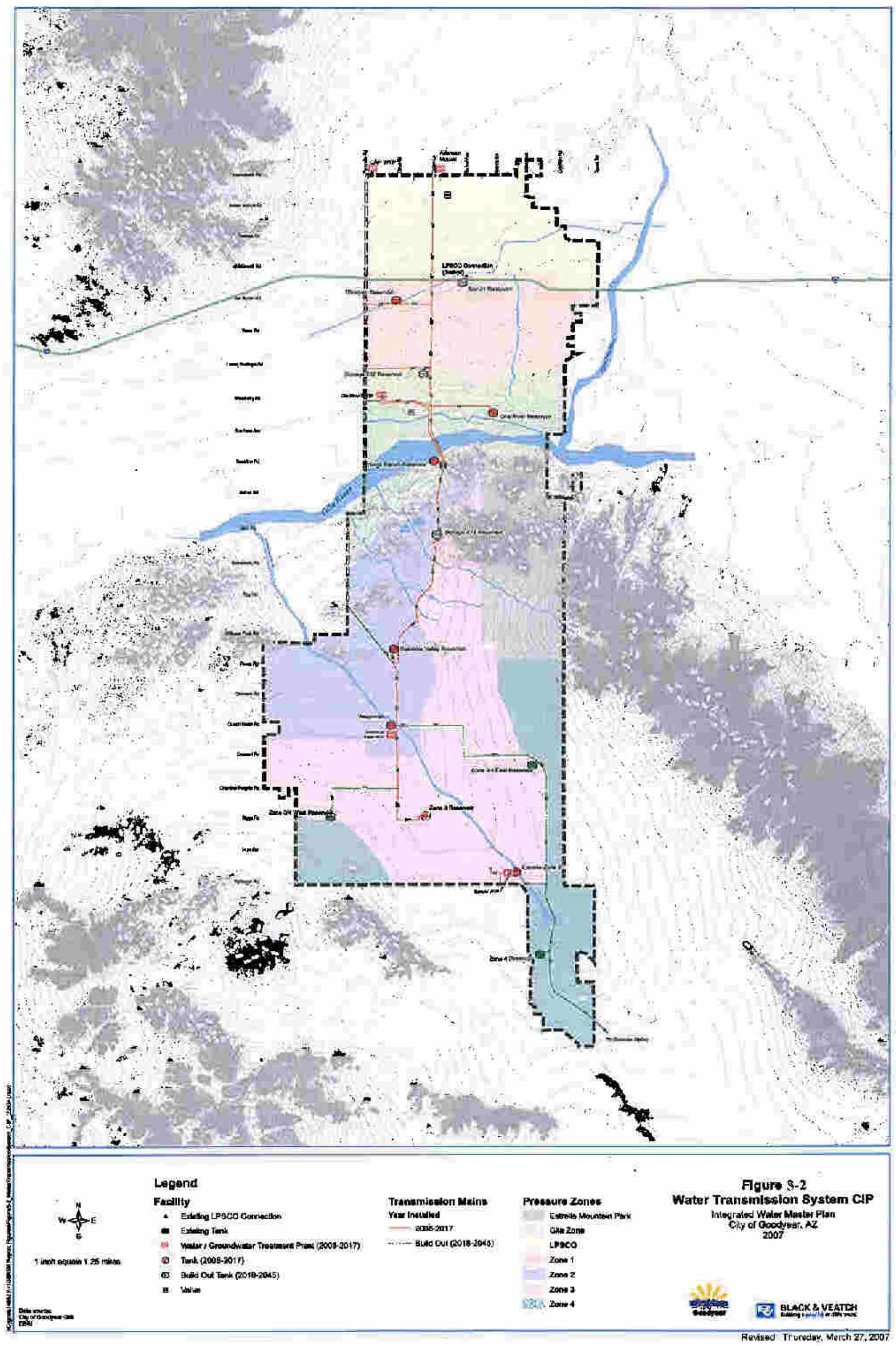


Table 3-6. Corrected Average Day Potable Water Delivery by Pressure Zone in MGD for Goodyear, Arizona from 2010 to 2035.

Zone	2010	2015	2020	2025	2035
Zone 1					
Site 21	1.33	1.70	2.29	2.69	3.51
Site 11	1.25	1.60	2.05	2.22	2.50
Site 18	0.56	0.72	1.02	1.28	1.84
Westpac	0	1.96	2.51	2.72	3.06
Site12-Zone1	0.69	0.88	1.30	1.70	2.58
Total: Zone 1	**3.84**	**6.86**	**9.17**	**10.61**	**13.49**
PWR: Zone1[1]	**3.84**	**6.86**	**9.17**	**10.61**	**13.49**
Gila River	**2010**	**2015**	**2020**	**2025**	**2035**
Site12-GRiver	1.02	1.42	1.52	1.98	2.97
Gila River	1.86	2.58	4.85	5.22	5.82
Site 7	0.69	0.96	0.90	0.96	1.08
Site 8	0.64	0.88	0.83	0.89	1.00
Kings Ranch	0	1.67	1.73	2.16	3.08
Total: GR	**4.2**	**7.51**	**9.83**	**11.21**	**13.95**
PWR: GR	**4.2**	**7.51**	**9.83**	**11.21**	**13.95**
Zone 2	**2010**	**2015**	**2020**	**2025**	**2035**
Site13 – Zone2	0.59	0.97	1.55	2.14	3.38
Rainbow Valley – Zone2	2.45	4.04	5.43	6.02	7.14
Waterman	0	1.86	2.67	3.24	4.42
Total: Zone 2	**3.04**	**6.87**	**9.65**	**11.41**	**14.93**
PWR: Zone 2	**3.04**	**6.87**	**9.65**	**11.41**	**14.93**
Zone 3	**2010**	**2015**	**2020**	**2025**	**2035**
Site13 – Zone3	0.75	0.46	0.80	1.13	1.81
Rainbow Valley – Zone3	1.49	0.92	1.35	1.53	1.82
Zone 3/4W – Zone3	0	0	0.37	1.07	2.63
Zone 3/4E – Zone3	0	0	0.57	1.63	4.02
Zone 3	0	3.93	5.64	6.08	6.65
Estrella – Zone3	0	1.54	2.21	2.38	2.60
Total: Zone 3	**2.24**	**6.85**	**10.94**	**13.81**	**19.54**
PWR: Zone 3	**2.24**	**6.85**	**10.94**	**13.81**	**19.54**
Zone 4	**2010**	**2015**	**2020**	**2025**	**2035**
Rainbow Valley – Zone4	0.45	0.86	1.18	1.13	1.12
Estrella – Zone4	0	2.07	2.79	2.54	2.34
Zone 3/4W – Zone4	0	0	0.32	0.77	1.58
Zone 3/4E – Zone4	0	0	0.54	1.32	2.72
Sonoran Highlands	0	0	0.74	1.81	3.74
Total: Zone 4	**0.45**	**2.93**	**5.58**	**7.56**	**11.50**
PWR: Zone 4	**0.45**	**2.93**	**5.58**	**7.56**	**11.50**

[1] - PWR is the potable water requirement for that pressure zone from Table 3-11.

The Timing of Goodyear's Production Capacity

As demands have been calculated into the future, so too must the production capacity be understood with respect to time. Goodyear has developed a "recommended phasing-in of production" for each of its water supply sources. Goodyear's data is provided yearly from 2007 through 2017 and build-out (2045). The following table provides that data from 2010 to 2035 in 5 year increments and thus interpolated values are used for years 2020, 2025, and 2035.

Table 3-7 Production Sources for Goodyear and the Recommended Phasing-In of Production in MGD from 2010 to 2035.

Production Source	2010	2015	2020	2025	2035
WPA2 Wells	15.0	15.0	15.11	15.29	15.64
Gila River GWTP	0	10.0	15.36	24.29	42.14
LPSCO	3.0	3.0	3.0	3.0	3.0
Adaman Mutual	4.0	10.0	10.0	10.0	10.0
CAP WTP	0	15.0	15.32	15.86	16.93
Waterman Basin GWTP	3.75	10.0	16.61	19.29	24.64
Estrella GWTP	0	0	6.61	9.29	14.64
Total Production	**25.75**	**63.00**	**82.00**	**97.00**	**127.00**

Table 3-8 compares the production with the demand, and naturally production should be at least equal to, or greater than, the demand.

Table 3-8 Recommended Production versus Peak Demand for Goodyear in MGD from 2010 to 2035.

	2010	2015	2020	2025	2035
Recommend Production	25.75	63.00	82.00	97.00	127.00
Peak Demand[2]	23.41	52.73	76.79	92.82	124.80

Deliveries from the main trunk line to Goodyear's storage facilities incorporate a factor of 1.5 for peak delivery, whereas a factor of 1.7 is used from storage facilities to the distribution system. The various storage reservoirs provide a buffer between what is needed in the distribution system (the 1.7 multiplier above average demand), and what the main trunk line can deliver (which is less than the 1.7 multiplier above average demand). However, the main trunk line should be designed to closely meet the peak demand delivery in the distribution system, and thus a multiplier of 1.5 is used as the design for the main line.

Goodyear intends to meet some of its demands with reclaimed water, however, this is already taken into account in Table 3-8 as the production of raw water shown in Table 3-8, and the demand for water, shown in various other tables, is separate from reclaimed water production and demands.

[2] Demands from Table 3-14 are multiplied by 1.7 for peak demands.

The recommended production in Table 3-8 exceeds the peak distribution demands on average by 9%. The sizing of the main trunk line to account for a peaking factor of 1.5 versus 1.7 will mean that the recommended production of water will exceed the peak demands by greater than 9%, and thus, a correction will eventually be noticed in the water production facilities which will be translated into the design for the main trunk line.

Because a significant amount of water produced by the WPA2 wells will be pumped across the Gila River to southern areas, the data on a balance of what can be produced by the WPA2 wells, what is used by the immediate region, and what is left over to be pumped across the Gila River, is needed. The following table provides this information for out years. All years shown in Table 3-9 are interpolated values as Goodyear's original data is for years 2007, 2017, and 2045.

Table 3-9 WPA2 Well Production (Total Capacity), WPA2 Site Demands (Demand), and the Unused Capacity Which Can be Pumped Across the Gila River to Goodyear's Southern Area, Flows are in MGD.

	2010	2015	2020	2025	2035	2045
Total Capacity	42.18	42.18	42.18	42.18	42.18	42.18
Demand	8.24	8.98	12.52	17.92	28.73	39.53
Avail. for Southern Area	33.94	33.20	29.66	24.26	13.45	2.65

The following analysis is an accounting of water production and water deliveries to Goodyear's main line. The data is arranged as water is produced and delivered from north to south. For example, the first water to be delivered into the main trunk line is from Adaman Mutual Water Company, then LPSCO, then a water delivery to Site 21, a

Table 3-10 Recommended Production Schedule and Estimated Deliveries for Goodyear, Arizona for 2010, 2015 and 2020 in MGD.

Note: Each Name Represents a Connection to the Main Trunk Line from North to South and Deliveries (Water Production) to the Main Trunk Line are Positive Numbers While Deliveries (to the Distribution System) from the Main Trunk Line are Negative Numbers. Values are with Respect to Peak Production (1.5 times average flow).

Main Line Trunk Connection	2010	Balance for 2010	2015	Balance for 2015	2020	Balance for2020
Adaman Mutual (+)	4.00	4.00	8.75	8.75	10.00	10.00
LPSCO (+)	3.00	7.00	3.00	11.75	3.00	13.00
Site 21 (-)	-2.00	5.00	-2.55	9.2	-3.44	9.56
Site 18 (-)	-0.84	4.16	-1.08	8.12	-1.53	8.03
CAP (+)	0.00	4.16	0.00	8.12	0.00	8.03
Site 11 (-)	-1.88	2.28	-2.40	5.72	-3.08	4.95
Westpac Reservoir (-)	0.00	2.28	-2.94	2.78	-3.77	1.18
WPA2 Wells	14.80	17.08	14.80	17.58	16.64	17.82
Site 12 (-)	-2.57	14.51	-3.45	14.13	-4.23	13.59
Site 7 (-)	-1.04	13.47	-1.44	12.69	-1.35	12.24
Site 8 (-)	-0.96	12.51	-1.32	11.37	-1.25	10.99
Gila River GWTP (+)	3.75	16.26	10.00	21.37	15.36	26.35
Gila River Reservoir -	-4.29	11.97	-3.87	17.50	-7.28	19.07
Kings Ranch Reserv.	0.00	11.97	-2.51	14.99	-2.60	16.47
Site 13 (-)	-3.51	8.46	-2.15	12.84	-3.53	12.94
Rainbow Valley Res.	-8.46	0.00	-8.73	4.11	-11.94	1.0
Waterman Basin GWT	0.00	0.00	10.00	14.11	16.61	17.61
Waterman Reservoir -	0.00	0.00	-2.79	11.32	-4.00	13.61
Zone 3/4W Reservoir	0.00	0.00	0.00	11.32	-1.04	12.57
Zone 3 Reservoir (-)	0.00	0.00	-5.90	5.42	-8.46	4.11
Zone 3/4E Reservoir -	0.00	0.00	0.00	5.42	-1.67	2.44
Estrella GWTP (+)	0.00	0.00	0.00	5.42	6.17	8.61
Estrella Reservoir (-)	0.00	0.00	-5.42	0.00	-7.50	1.11
Sonoran Highlands Res.	0.00	0.00	0.00	0.00	-1.11	0.00

The demands from the specific sites (water reservoirs feeding the distribution system) in the above table for 2010 are met for the most part by bringing water production facilities on-line as recommended in Table 3-7. The only exception was with the Gila River GWTP and the Waterman Basin GWTP. The recommendation in Table 3-7 to bring the Waterman Basin GWTP on-line in 2010 is substituted by constructing the Gila River GWTP instead. This substitution eliminates the need to construct over 2 miles of the trunk line from the Rainbow Valley Reservoir to the Waterman Basin GWTP. This is more desirable because in 2010 the Waterman Basin GWTP does not serve any reservoirs south of its location, and thus 3.75 MGD would be pumped north to the Rainbow Valley Reservoir. The construction of the Gila River GWTP provides supply which can be delivered south with the terminus of the main trunk line being the Rainbow Valley

Reservoir. The only other minor exception are the WPA2 wells, which according to Table 3-7 should phase-in at 15.00 MGD, but are needed at a delivery rate of 14.80 MGD instead.

The demands for 2015 can be met without bringing all of the recommended facilities on-line per the recommendations in Table 3-7. Adaman Mutual's full 10.0 MGD of production capability is needed at an 8.75 MGD level of production until 2020, and CAP water which was scheduled at 15.0 MGD is also not necessary due to the existing capacity of local production. Per the recommendation to bring a new facility on-line in 2015, the Gila River Ground-water Treatment Plant would begin operating with 10.0 MGD. Special attention was given to the expense of bringing both CAP water and the Gila River GWTP on-line at about the same time. Because the Gila River GWTP eventually provides greater water production at less of an expense to an area that it serves close-by, economically it makes more sense to bring the Gila River GWTP on-line and even expand the plant in 2020 and plan to pump and treat ahead of CAP which is shown in Table 3-7 for 2015. Lastly, Waterman Basin Ground-water treatment plant's production is increased per the recommendation from 3.75 to 10 MGD.

For 2020, the most important water portfolio additions are the addition of 6.61 MGD to the Waterman Basin GWTP (from 10.0 to 16.61 MGD), the addition of 1.25 MGD to the Adaman Mutual Water Company from 8.75 to 10.0 MGD, and the addition of 5.36 MGD to the Gila River GWTP from 10.0 to 15.36 MGD. Additionally, the production of water from WPA2 wells requires an increase from 14.80 to 17.58 MGD which is a greater volume than the recommended phase-in production schedule (although it is greater than the 2035 production schedule, 17.58 MGD does not exceed the delivery capability of WPA2 wells). The recommendation to bring the Estrella GWTP into operation at 6.61 MGD is not totally necessary as a yearly operation of 6.17 MGD sufficiently provides for the demands at the Estrella Reservoir and Sonoran Highlands Reservoir.

The analysis below is a continuation of the accounting for water production and water deliveries for the years 2025 and 2035 similar to the information provided in Table 3-10.

Table 3-11 Recommended Production Schedule and Estimated Deliveries for Goodyear, Arizona for 2025 and 2035 in MGD.

Note: Each Name Represents a Connection to the Main Trunk Line from North to South and Deliveries (Water Production) to the Main Trunk Line are Positive Numbers While Deliveries (to the Distribution System) from the Main Trunk Line are Negative Numbers. Values are with Respect to Peak Production (1.5 times average flow).

Main Line Trunk Connection	2025	Balance for 2025	2035	Balance for 2035
Adaman Mutual (+)	10.00	10.00	10.00	10.00
LPSCO (+)	3.00	13.00	3.00	13.00
Site 21 (-)	-4.04	8.96	-5.27	7.73
Site 18 (-)	-1.92	7.04	-2.76	4.97
CAP (+)	12.98	20.02	18.00	22.97
Site 11 (-)	-3.33	16.69	-3.75	19.22
Westpac Reservoir (-)	-4.08	12.61	-4.59	14.63
WPA2 Wells	13.01	25.62	12.28	26.91
Site 12 (-)	-5.52	20.10	-8.33	18.58
Site 7 (-)	-1.44	18.66	-1.62	16.96
Site 8 (-)	-1.34	17.32	-1.50	15.46
Gila River GWTP (+)	15.36	32.68	30.24	45.70
Gila River Reservoir -	-7.83	24.85	-8.73	36.97
Kings Ranch Reserv.	-3.24	21.61	-4.62	32.35
Site 13 (-)	-4.91	16.70	-7.79	24.56
Rainbow Valley Res.	-11.33	5.37	-15.12	9.44
Waterman Basin GWT	16.61	21.98	23.60	33.04
Waterman Reservoir -	-4.86	17.12	-6.63	26.41
Zone 3/4W Reservoir	-2.76	14.36	-6.32	20.09
Zone 3 Reservoir (-)	-9.12	5.24	-9.98	10.11
Zone 3/4E Reservoir -	-4.43	0.81	-10.11	0.00
Estrella GWTP (+)	9.29	10.10	13.02	13.02
Estrella Reservoir (-)	-7.38	2.72	-7.41	5.61
Sonoran Highlands Res.	-2.72	0.00	-5.61	0.00

For 2025, the most important water portfolio additions are the addition of 3.12 MGD to the existing 6.17 MGD for the Estrella GWTP and the addition of 12.98 MGD of CAP water. The 3.12 MGD brought into production with the Estrella plant could be postponed and covered by expanding other ground-water treatment plants. However, increasing groundwater production at the Estrella treatment plant allows Goodyear the ability to maximize the spreading out of ground-water pumping at a time when demands are growing rapidly which prevents over drafting in any one region. CAP water should be brought on-line in 2025 to make up for the loss of water which can be delivered by WPA2 wells to other sites (see Table 3-9 for the schedule on the loss of capacity from WPA2 wells), and to slow down ground water pumping. In addition, CAP water should not be brought on-line all at once (Google search: disastrous delivery of CAP water in the early 1990’s(Tucson)), and in preparation for the eventual use of CAP water.

By 2035, Goodyear has had all of its ground-water production facilities in operation for a minimum of 10 years. The WPA2 site operates at 80% of its eventual capacity, the Gila River GWTP operates at 70% of its capacity, Waterman Basin GWTP operates at 95% of its capacity, and Estrella GWTP is operates at 90% of its capacity. By 2035 CAP water is being fully utilized which is ahead of its full utilization schedule in preparation for the almost complete loss of water for the southern area from the WPA2 wells by build-out (2045).

The production capability for Goodyear in 2035 is 127.0 MGD of water, and the demands with a 1.5 peaking factor is 110.1 MGD. With the additional 16.9 MGD (25.35 MGD design flow with the peaking factor), the main trunk line can be modeled to deliver water toward the southern boundary for Goodyear near the unincorporated area of Mobile, Arizona.

Although Tables 3-10 and 3-11 do not take into account the overall water loss of 14.05% within the Beardsley Canal and the White Tanks WTP, the approximate 2.5 MGD loss was not reduced for Goodyear because of the greater possibility of purchasing the lost water, or through other potential sources.

Within Goodyear, water is planned to be delivered in two parallel pipelines along Perryville Road and along Cotton Lane south to the Rainbow Valley Reservoir which is located between Williams Field Road and Pecos Road. From Rainbow Valley Reservoir toward the south, the delivery system becomes one pipeline to Waterman Reservoir where the pipeline splits. One side of the split feeds Zone 3/4 West Reservoir, and Zone 3 Reservoir, and the other split feeds Zone 3/4 East Reservoir and other reservoirs towards Mobile.

The City of Avondale

The recognition exists within Avondale that with its location of being within the fringe of Phoenix’s general metropolitan development, that Avondale will inevitably continue to experience substantial growth. Avondale’s current population is just under 80,000, and the population is expected to double to160,000 by 2035 according to the Population and Water Demand Projections published by WESTCAPS in 2006.

Avondale is fortuitous in that it possesses both SRP and CAP water. Avondale currently makes use of its SRP water not through direct delivery, but through recharge and recovery, but does not take delivery of its CAP water. Avondale does use CAP incentive water which allows it to bank CAP water for a fee which allows an equal amount of withdrawal within its service area. However, the CAP water being banked is not within Avondale's service area.

In the future Avondale envisions taking direct delivery of its CAP water which fits in well with this study. Avondale would like to have a better understanding of its portion of the overall cost of a west valley water transmission system without the actual commitment of doing so which this study affords. Avondale's allocation of 5,936 acre-feet would be delivered via a turnout from the main line along Broadway Road east of the Agua Fria River, and west of Dysart Road, and Avondale expects that only one turnout for its allocation would be needed.

The timing of such a delivery will require that it coincide with the timing of the overall construction planned (see Goodyear's section above).

Arizona Water Company

Arizona water has a fair amount of interest in the regional water transmission study, as their White Tank Service Area is located along the alignment of the expected path of the main transmission line. Arizona-Water's service area surrounds the terminus of the Beardsley Canal. The service area is roughly bounded by Camelback Road in the north, Tuthill Road to the west, Citrus Road to the east, and Yuma Road to the south (see Figure 3-3 for Arizona-Water's service area). Within this service area, Arizona-Water has 1,850 customers with an expected build-out of approximately 5,000 customers, and a CAP allocation of 968 acre-feet per year.

An assumption of the customer growth of Arizona-Water is provided in Table 3-12 beginning with 2010 and ending with 2035 where it would be assumed that by 2035 Arizona-Water is receiving all of its CAP allocation. Build-out is not assumed to occur until 2045. The growth is then translated into water delivery for the service area. Growth projections for Arizona-Water in Table 3-12 are similar in trend to those which have been projected for other west valley cities noted in the WESTCAPS publication "Population and Water Demand Projections for WESTCAPS Member Lands," May 2006.

Table 3-12 Customer Growth Projection for Arizona-Water Company's White Tank Service Area Where the Number of Customers in 2009 Number 1,850.

	2010	2015	2020	2025	2030	2035
Customers	1,850	1,940	2,120	2,820	3,580	4,080

Due to the recession of 2008-2009, no growth is expected among Arizona-Water customers in 2009 to 2010. For the table below, a customer is translated into water usage assuming that Arizona-Water's full allocation is desired by 2035. For the year 2030 and all prior years, Table 3-13 below shows the converted water usage based on population.

Table 3-13 Customer Growth Projections for Arizona-Water's White Tank Service Area and the Translated Water Needs Assuming Arizona-Water Company's Full Allocation is Needed in 2035.

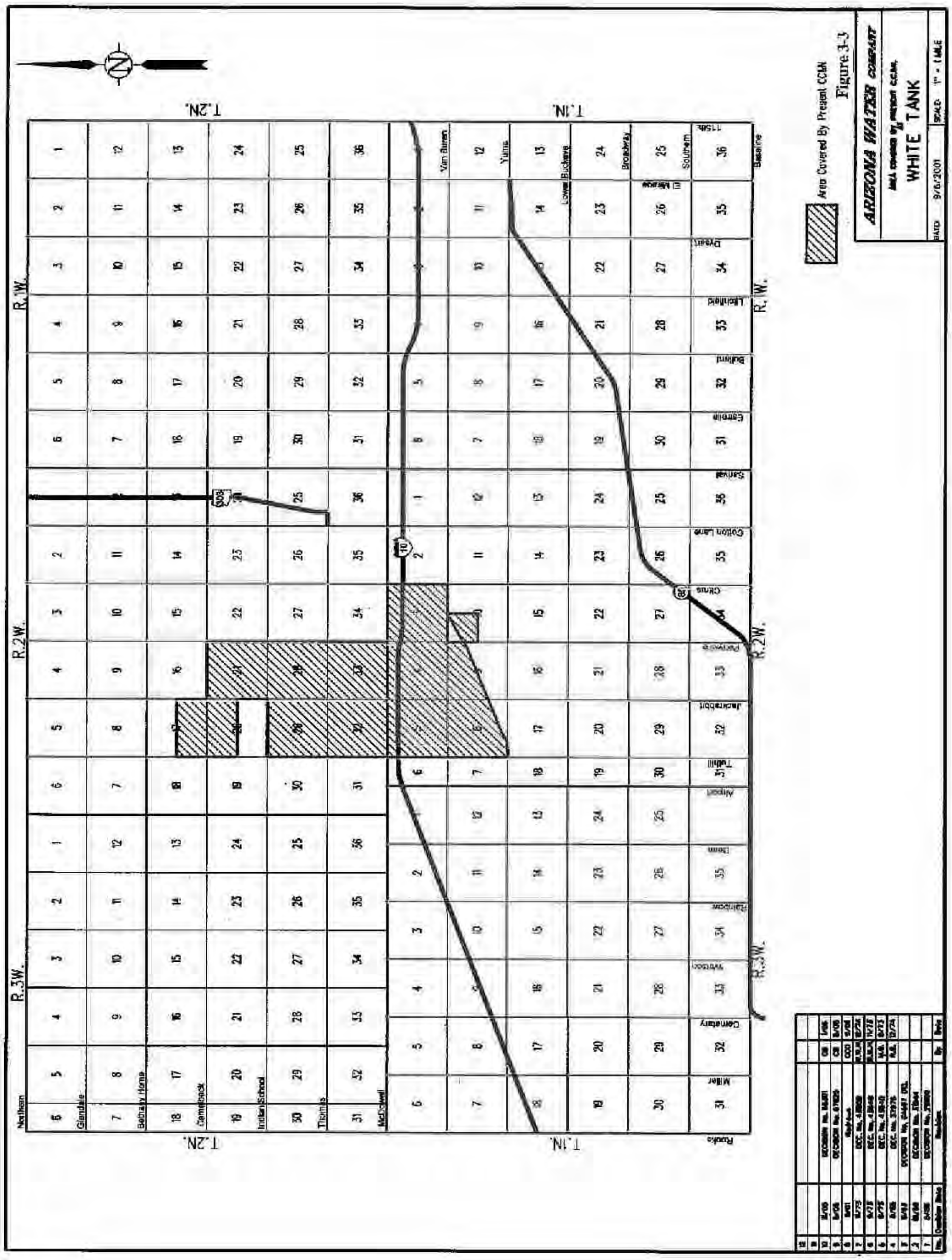
	2010	2015	2020	2025	2035
Customers	1,850	1,940	2,120	2,820	4,080
Flow (ac-ft/yr)	440	460	500	670	968
Flow (gpm)	273	285	310	415	600

Arizona-Water's long term goals appear to be in-line with Goodyear's goals of water delivery considering the location of the pipeline and the timing of the growth for justifying the construction of a pipeline for CAP water delivery. Arizona-Water's service area is not only within the proximity of Goodyear's service area, but also Goodyear's future plans include taking delivery of their CAP water via a pipeline which parallels the Beardsley Canal. A future pipeline that would parallel the Beardsley Canal would be constructed through Arizona-Water's service area making a turnout ideal for Arizona-Water.

At build-out, the bulk of the flow in the regional transmission line will belong to the City of Goodyear at 18 mgd, and according to the outlook, CAP water would not be diverted to Goodyear until 2025. Goodyear plans on a CAP delivery in 2025 amounting to 13 mgd. At 13 mgd of CAP delivery, Arizona-Water could potentially receive their full allocation scheduled for 2035. This is because 968 ac-ft per year amounts to 0.86 mgd, or 1/15th of Goodyear's 13 mgd allocation. As Goodyear takes a greater percentage of their allocation, deliveries for Arizona-Water become a smaller percentage of the bulk volume of water being delivered. This adds to the possibility of Arizona-Water someday realizing their CAP water delivery since Arizona-Water is a willing customer, the regional pipeline is planned to be located within their service area, and their service area is smaller relative to other water providers.

From Figure 3-3, the main transmission line is planned through the middle of quadrants 21, 28, 33, etc. From a hydraulic standpoint, a turnout located near the top of quadrant 21 makes the most sense, and the model will be expressed this way.
Another possibility exists for Arizona-Water to begin receiving their CAP allocation sooner than 2025. Arizona-Water has expressed an interest in trading their CAP allocation for a like amount of groundwater which Arizona-American pumps out of

Figure 3-3 Planned Transmission Lines



Arizona-Water's service area. This would allow Arizona-American to divert Arizona-Water's CAP allocation to the White Tanks WTP to then treat and deliver to their own customers. Arizona-Water would benefit due to the proximity of the groundwater already pumped in its area.

The results of the infrastructure and cost for Arizona-Water are identified in Chapter 5 under "Cost Summary by Specific Region."

The Town of Buckeye

Buckeye's greatest challenge to the proposal of connecting to the White Tanks WTP is the expense of constructing a water transmission line, either in tandem with other water providers, or, on its own when it currently has very little CAP allocation. Buckeye's current allocation is 378 acre-feet per year which eventually reduces to 25 acre-feet per year by 2034. Buckeye has an interest in obtaining additional CAP water and having a portion of it wheeled through the west valley water transmission system. A summary list of the advantages and disadvantages of a west valley transmission pipeline with respect to Buckeye's views are provided below.

The advantages of a west valley water transmission pipeline for Buckeye.

- Developments requiring a supply in the eastern portion of the municipality could construct a relatively small pipeline versus the 42-inch trunkline which was determined to be required in the Pipeline to the Future report for the Buckeye area (the report from 2004 modeled the system requirements in order to deliver water from the Hassayampa river to the far eastern edges of Buckeye). A smaller system could be constructed faster, with less disruption to existing neighbors, and be less expensive to construct, operate, and maintain.
- There is a relative proximity (~ 2 miles) from the Regional Transmission System which is planned to the edges of eastern Buckeye. A relative cost savings could benefit the town with respect to a connection with this pipeline versus developing water supplies independently in the eastern portion of Buckeye.

The disadvantages of a west valley water transmission pipeline for Buckeye.

- Buckeye's benefit from a west valley water transmission line is contingent upon Buckeye receiving a long-term CAP allocation large enough to justify the cost of constructing a pipeline into southeastern Buckeye. The allocation must be large enough to allow some of it to be directly delivered to developments in northwest Buckeye bordering the CAP canal, and some of it to southeast Buckeye via the West Valley Water Transmission Pipeline.
- The town may not have the ability to wait for the west valley water transmission trunk line to be extended to its southeastern border. Although growth may be slower for the next few years, a high rate of growth is somewhat expected by 2012, and Buckeye's southeastern border may need a water supply by then. The expense of extending the Agua-Fria trunk line from approximately Jackrabbit Trail and Indian School is economically unfeasible for Buckeye, in addition to

the fact that Agua Fria's excess capacity in their Agua Fria system is mostly non-existent by 2020.

- Buckeye does not anticipate the need to construct a pipeline to deliver water from the eastern edge of Buckeye into the central and western portions of Buckeye. In addition, this is probably economically unfeasible for at least the next decade. The cost in 2004 dollars to deliver 11,000 acre-feet to the central portion of Buckeye, and 14,000 acre-feet to eastern and far eastern portions of Buckeye from the Hassayampa River was calculated at roughly $90 million (in 2004 dollars).

Having weighed the alternatives, and the fact that the eastern edge of Buckeye's town limits are within 2 miles of the west valley water transmission line, Buckeye is interested in knowing its share of the cost of the infrastructure in order to bring water inside of its borders. Buckeye is predicting that southeastern areas will need 5,000 acre-feet of water delivered from the west valley water transmission line, and that an ideal turnout would be located near the intersection of Jackrabbit and Yuma Roads.

Global Water Company

Within the Town of Buckeye's MPA, the largest water holding is the Valencia Water Company – Town Division. The service area is roughly 3 miles by 4 miles and is bounded primarily in the north by Interstate 10 and in the south by the Town of Buckeye's Historic District. Well production yields TDS values between 400 mg/l and 1,500 mg/l TDS, with an average blend of about 900 mg/l TDS. Raw water arsenic concentrations in the source wells vary from 12 ppb to 30 ppb. A challenge for Valencia Water Company – Town Division is that the northern half of the service area is incapable of producing any water due to shallow bedrock as confirmed from test wells drilled in the past, and additional groundwater drawdown in the southern half of the service area due to future growth could potentially further impact water quality.

The estimated population for all of Global Water's assets in the west valley is 98,300 by 2035, data based on WESTCAPS data from the Population and Water Demand Projections. Currently, Global Water is only considering this opportunity for its Valencia Water Company divisions. The estimated build out for this Utility is 33,000 connections, with an estimated annual demand totaling approximately 16,500 acre-feet. The transmission line would allow Global Water to blend with local sources to meet this demand.

CHAPTER IV - THE WEST VALLEY WATER TRANSMISSION PIPELINE - THE INFRASTRUCTURE OF THE FUTURE

The West Valley Water Transmission Pipeline is also referred to by some as the Agua Fria Water System, but more commonly referred to as the North-South pipeline. However, the three names have been formed over time to describe an area generally east of the White Tank Mountains that stretches from the northern to the southern metropolitan boundary of the west valley - the intent being the delivery of a renewable water supply to west valley cities. The distinction between the three systems is related to timing with respect to planning, designing and construction, and expansion of the system. During the early years of WESTCAPS, the North-South pipeline was meant to describe a delivery system to transport water from the northern portion of the west valley at the CAP to what was then central Goodyear. A water treatment plant was envisioned at the CAP and Sarival Road, and another plant was expected to be needed at Cactus Road and the Beardsley Canal. The Agua Fria Water System is meant to describe the existing Arizona-American water transmission system. The West Valley Water Transmission Pipeline is in reference to a future system which doesn't yet exist, but as envisioned, could be an expansion of the existing Agua Fria Water System. The likelihood is that the West Valley Regional Water Transmission System will be a separately constructed system which ties into the White Tanks WTP to deliver CAP water to several WESTCAPS entities. The future West Valley Water System would include various additions such as future water treatment plants - the White Tanks Water Treatment Plant, and the Twin Buttes Water Treatment Plant. The Twin Buttes Plant is planned for construction sometime after 2011. In order to better understand the infrastructure of the future and how it might operate, a summary is provided for the planning concepts and cost estimates published about this topic in the past.

Summary of Previous Studies

2001 Strategic Plan

The idea of a North-South pipeline was envisioned during the years 2000 and 2001 during the planning work for the 2001 WESTCAPS Strategic Plan. The goal was to create a concept of how the west valley's infrastructure would evolve in order to begin using CAP water. The Strategic Plan was ultimately published in April of 2001. The plan had four main points with respect to the infrastructure needed to begin using CAP water.

- The use of nearly 4 million gallons per day (MGD) of available capacity in the planned Phoenix Lake Pleasant Water Treatment Plant (WTP).
- Expansion of Glendale's Pyramid Peak WTP
- Two new WTPs with capacities of approximately 58 and 79 MGD

- Use of approximately 16 MGD of capacity in West Maricopa Combine's (WMC) recharge and recovery project

The Lake Pleasant WTP concept would deliver water south and west, and the main water transmission lines from the Lake Pleasant WTP were planned to stay within Peoria's boundaries. Although transmission lines from the Lake Pleasant WTP would not deliver water outside of the Peoria service area, a connection was envisioned to the water transmission main being fed from the North Beardsley Regional WTP (noted as the North Regional WTP on the 9/15/00 strategy) whose transmission lines parallel Sarival Road. The connection with this north-south alignment is made possible because of a lateral line coming off of the main trunk line into Peoria which would connect with the line from Lake Pleasant. The connection between the Sarival road main transmission line and the Lake Pleasant WTP would occur just north of the phantom alignment of the 303 – North Estrella Parkway, and El Mirage Road.

The Glendale/Peoria Pyramid Peak WTP was envisioned delivering water toward the southwest from its location at the CAP canal and North Pyramid Peak Parkway (63rd Avenue alignment), and was not envisioned being connected to the rest of the infrastructure. The City of Glendale initially built the Pyramid Peak WTP in 1986. In 1998, Glendale joined with the City of Peoria to expand the water treatment plant capacity from 10 MGD to 26 MGD. Peoria purchased 6 MGD of the plant capacity for delivery to their service area using a pipe junction at 67th Avenue and Jomax Road. The expansion envisioned of Glendale's Pyramid Peak WTP in the 2001 Strategic Plan involved adding treatment for an additional 29 MGD, expanding the plant to 56 MGD capacity.

One of the four main points envisioned in 2001 was the addition of two new water treatment plants with capacities of 58 and 79 MGD. The 58 MGD plant was simply titled the North Beardsley Regional WTP and the 79 MGD plant was named the South Beardsley Regional WTP. Both WTP's were meant to delivery water into the North-South Pipeline alignment which parallels Sarival Road. The North Beardsley plant was the northern most point of the North-South Pipeline alignment and was located at the CAP and Sarival Road. The South Beardsley plant was planned to be located at Cactus Road and the Beardsley canal. In 2001 it was envisioned that the southern plant would be needed by 2005, whereas the northern plant would not be necessary until 2015, and both plants would be fully utilized to design capacity by the year 2025.

The final piece of the strategy in 2001 was the planned recharge and recovery of between 25,000 and 37,000 acre-feet per year from the Hassayampa River by West Maricopa Combine (today West Maricopa Combine is Global Water Resources). The intent would be to recharge CAP water in the Hassayampa and recover the water downstream, thus eliminating multiple miles of pipeline and/or canal in order to delivery water predominantly for the town of Buckeye and the City of Goodyear. The recharge and recovery anticipated serving a population of up to 210,000 people if ADWR allowed WESTCAPS members to use the recharged water. The cost of implementing this project in 2001 (recharge and recovery only) was initially estimated as $13.00 per acre-foot versus the CAGRD fee of $188 per ac-ft. No estimate is readily available today of the cost per acre-foot to WESTCAPS (Global Water), but the 2008/09 CAGRD fee for the Phoenix AMA is $281 per ac-ft, with an estimate by 2013/14 of $353 per ac-ft. It was also recognized that a recharge and recovery option was of little use unless the water could be delivered to population centers within the west valley. With little analysis of what would determine the cost, the expected price tag of such a system was given as a round figure of $358 per acre-foot of water. The portion of the project that was the water delivery system was coined "Pipeline to the Future" for its importance and need someday in the future for the west valley. Of the four main points of the 2001 Strategic Plan, the least amount of time was spent defining the Global Water strategy.

A summary map of the planned infrastructure is provided as Figure 4-1 on page 40 and is regarded as the 9/15 strategy for its adoption by WESTCAPS on September 15, 2000.

WESTCAPS – West Salt River Valley Ground-Water Supply Study

This study was accomplished in parallel with the 2001 Strategic Plan and likewise was published in April 2001. The goal of the Ground Water Supply Study was to determine groundwater levels in the future based on five solutions which could stem the decline of groundwater. The solutions in general involved using CAP water instead of groundwater, recharging, or a combination of using CAP water and recharging. Groundwater levels were modeled for the years 2025 and 2100.

A base case scenario was also developed which assumed that groundwater pumping would be continuing at present rates.

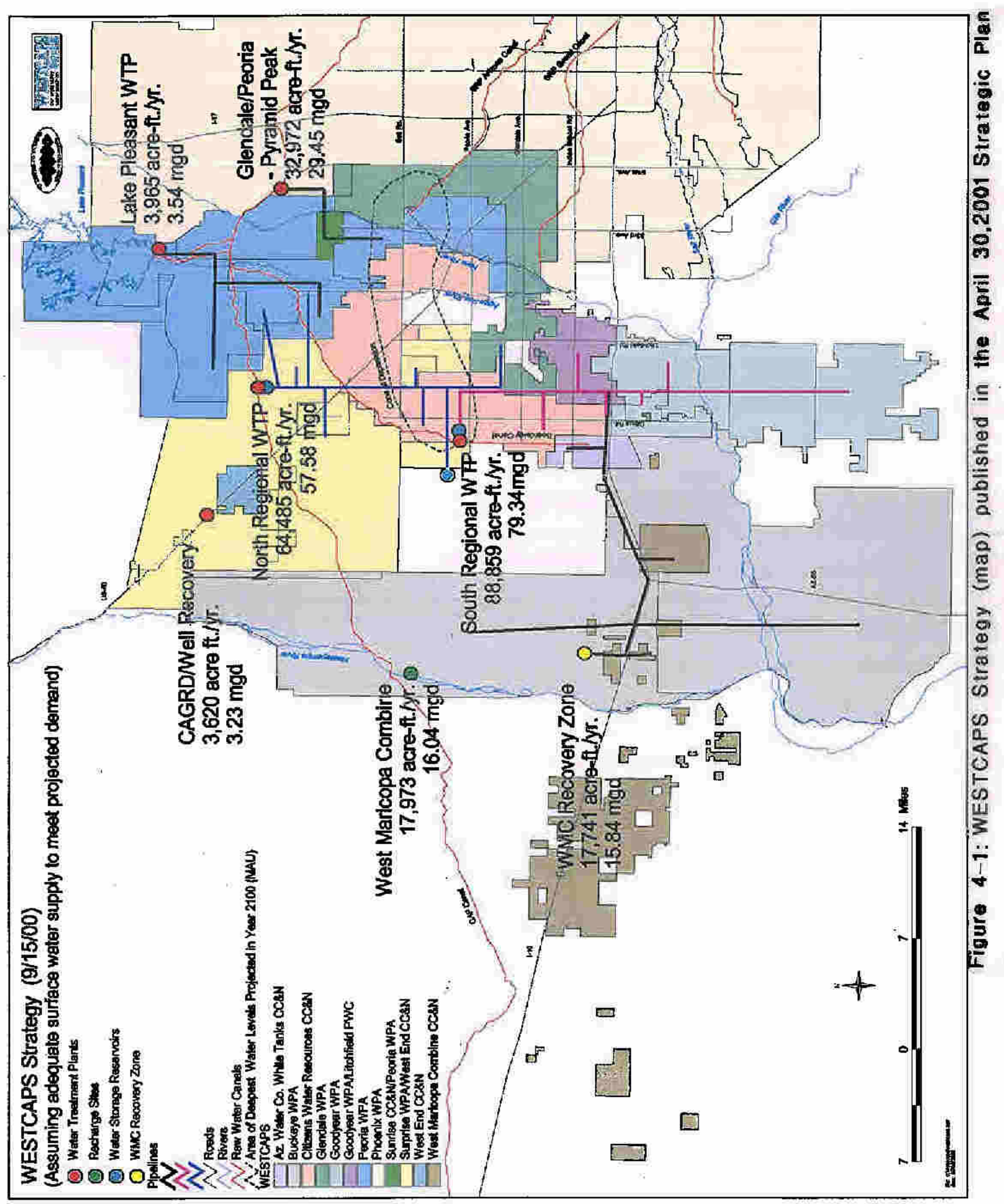
The results of the study showed that for the base case scenario, for the year 2100, groundwater levels varied from 0 feet along the Gila River to over 1,000 feet below the ground surface at 83rd Avenue and Bell Road. In contrast, the solutions had depths-to-groundwater of between 200 and 500 feet in 2025, and depths to groundwater of between 200 and 500 feet in the central, most impacted portions of the basin. By 2100, the solutions had water levels rising above the 2025 levels as recharge outpaces pumping. One could deduce that this is possible since CAP water would substantially reduce pumping, and both effluent originally derived from the CAP and groundwater could be recharged.

The most startling results were those associated with the base case scenario. The results are provided below for six locations in the west valley for years 2025 and 2100.

Year 2025:

Bell Road and 83rd Avenue: Depth-to-groundwater is over 550 feet.
CAP canal and U.S. 60: Depth-to-groundwater is 450 feet
AZ-85 five miles south of I-10: Depth-to-groundwater less than 50 feet
Citrus Road and Peoria Avenue: Depth-to-groundwater 550 feet
I-17 and Indian School Road: Depth-to-groundwater over 200 feet
Beardsley Road and Grand Avenue: Depth-to-groundwater over 450 feet

Figure 4-1 WESTCAPS Strategy (map) Published in the April 30, 2001 Strategic Plan



Year 2100:

Bell Road and 83rd Avenue: Depth-to-groundwater is over 1,000 feet.
CAP canal and U.S. 60: Depth-to-groundwater is over 600 feet
AZ-85 five miles south of I-10: Depth-to-groundwater less than 50 feet
Citrus Road and Peoria Avenue: Depth-to-groundwater 850 feet
I-17 and Indian School Road: Depth-to-groundwater over 350 feet
Beardsley Road and Grand Avenue: Depth-to-groundwater 750 feet

WESTCAPS Strategic Plan – Refinement of West Maricopa Combine Pipeline Study

Although the 2001 Strategic Plan had identified the Pipeline to the Future as delivering water from the Hassayampa River east to the North-South Pipeline at Sarival Road, nothing else about the system and its operations were known. In 2002 WESTCAPS set out to determine the most ideal pipeline alignment, its cost, and how it would operate. The results of the refinement effort were published in August of 2002. The goals of the study were the following.

- To find the least expensive alignment for the pipeline from the vicinity of the Hassayampa River near Interstate 10 to Sarival Road. At Sarival Road the Pipeline to the Future would connect with the North-South Pipeline. The connection would allow flows from the Pipeline to the Future to be delivered to the North-South Pipeline, or vice-versa. The goal would be to be able to deliver 25,000 acre-feet per year to three distinct population centers within Buckeye (see the second goal below for a description of the population centers), with the ability for the system to deliver up to 37,000 acre-feet per year under peak conditions.

- To determine the yearly average water demand by population centers in Buckeye. The population centers were projected to be along Miller Road (the area bounded by Turner Road and Rainbow Road, and from Interstate 10 to Baseline Road), along Tuthill Road (from Rainbow Road to Jackrabbit Trail, and from Interstate 10 to Lower Buckeye Road), and along Cotton Lane (from Citrus Road to Sarival Road, and from just south of Lower Buckeye Road to Interstate 10).

- To develop an understanding of the operations of the Pipeline to the Future, particularly with respect to time as the population centers grow.

A total of five alignments were conceived under the plan and the evaluation of each consisted of variables such as construction costs, land acquisition costs, and annual operations and maintenance costs. The pipeline would be evaluated beginning at a storage tank/pump station located on Sun Valley Parkway located ¾ of a mile north of Interstate 10. One of the goals was to find the least cost alignment that could deliver water to the three main population centers and be able to connect with the North-South Pipeline at Sarival Road. The pipeline which would cost the least to construct and operate was a pipeline which traversed along the north side of Interstate 10, would be constructed under Interstate 10 at Yuma Road, and then parallel Yuma Road to Sarival Road. Figure 4-2 on page 43 is a map of the alignments which were evaluated, with the preferred alignment being the route shown by parallel blue lines.

Figure 4-2 Pipeline to the Future Alternatives Published on 2002

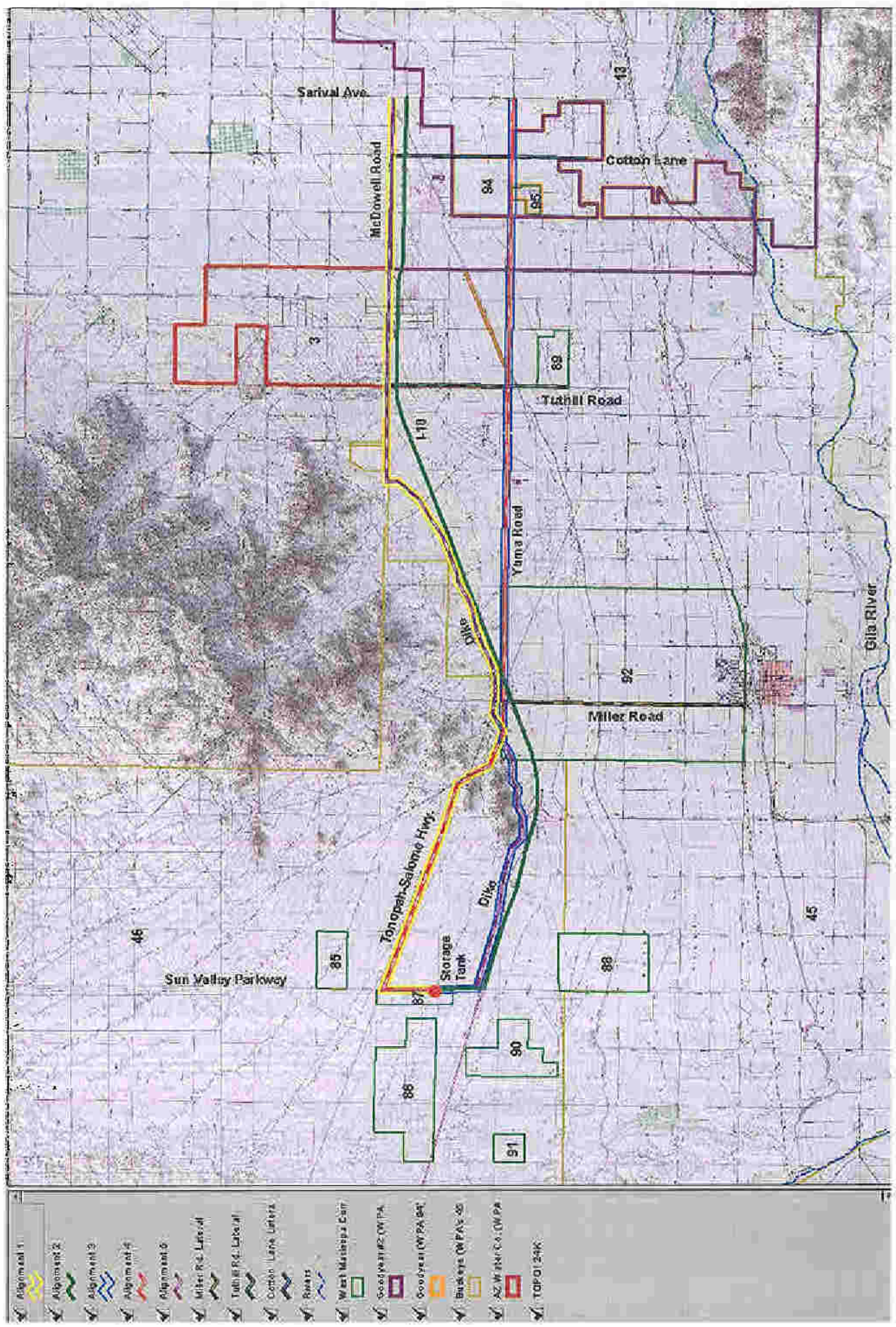


Figure 4-2:Pipeline to the Future Alternatives published in 2002

A summary of the costs to construct and operate the pipeline are provided in Table 4-1 below.

Table 4-1 Cost Summary for the Preferred "Pipeline to the Future" Alignment Shown as Figure 4-2 on Page 51.

Note: The Pipeline is 42-inch Outside Diameter Reinforced Concrete Pipe Delivering 25,000 acre-feet per year, with a Peak Delivery Capability of 37,000 acre-feet per year for 16.4 miles (2002 Costs).

Item	Cost
Capital Cost (Construction Cost)	$34,164,409 ($23,246,007)
20 Years Amortized Cost	$2,858,855
Annual Operations and Maint. Cost	$871,733
Total Annual Cost	$3,730,588
Cost per Acre-Feet	$149
Cost per 1,000 Gallons	$0.46

Expected housing developments factored into the location of lateral delivery lines from the main trunk line along Yuma Road. The expected developments would be mainly clustered around Miller Road, Tuthill Road, and Cotton Lane. From the expected population centers, yearly water demands could be determined. The breakdown of these water demands could be determined for each later. The following table provides the expected demands for each lateral over time.

Table 4-2 Expected Water Demands Over Time in Acre-Feet per Year for the Miller Road, Tuthill Road, and Cotton Lane Laterals from the Year 2000 to 2025.

	Year					
Lateral	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
Miller Rd	2,177	2,714	3,407	6,247	11,570	16,896
Tuthill Rd	498	679	915	1,236	1,703	2,303
Cotton Ln	8,587	17,807	26,540	37,173	50,969	64,798
Total	11,262	21,200	30,862*	44,656	64,242	83,997

* - Note that the total yearly water demand exceeds the available supply from 2010 and beyond if the water available to recover from the Hassayampa River is 25,000 ac-ft/yr.

The supply from the Hassayampa River is greater than the demand in 2000 and 2005, but the supply is insufficient to meet demands from 2010 to 2025. The following table provides the analysis for what can be delivered from the Pipeline to the Future to the North-South Pipeline, or vice versa.

Table 4-3 The Deliveries and Supplies from the Pipeline to the Future with the North-South Pipeline in Acre-Feet per Year.

Supplies to N-S		Deliveries from N-S			
2000	**2005**	**2010**	**2015**	**2020**	**2025**

Supplies to N-S		**Deliveries from N-S**			
13,738	3,800	5,862	19,656	39,242	58,997

The operation of the system is such that water could expect to be recovered from the Hassayampa River and delivered for Buckeye and Goodyear with water to spare in the years 2000 and 2005. Beginning in the 2010 time frame, water would need to be delivered from the North-South Pipeline toward Goodyear and Buckeye as the Pipeline to the Future would have insufficient capability of delivering what Buckeye and Goodyear are expected to demand.

A final tabulation of costs was prepared toward the end of the report which is provided and explained below.

Table 4-4 Summary of All Anticipated Costs Associated with the Pipeline to the Future in Dollars per Acre-Feet.

Description of Cost	**$/Acre-Foot**	**$/1000 Gallons**
Pipeline System and Facilities: Capital and O&M costs	$149	$0.46
Recharge Facility	$13	$0.04
Cost to Recover from Recharge Facility and Deliver to Storage	$169	$0.52
SUBTOTAL	$331	$1.02
10% Profit and 33% Income Tax	$57	$0.18
SUBTOTAL	$388	$1.20
Cost of CAP Water	$150	$0.46
TOTAL – Forward Flow	$538	$1.66
Facilities for Reverse Flow, Capital and O&M Cost	$34	$0.10
10% Profit and 33% Income Tax	$6	$0.02
TOTAL – Reverse Flow	$40	$0.12
TOTAL COST – FORWARD AND REVERSE FLOW	$578	$1.78

The $149 per acre-foot of Capital and O&M costs was derived from Table 4-1, and the $13 per acre-foot cost of the recharge facility was calculated from the 2001 Strategic Plan. The cost of recovering water from the Hassayampa and delivering it to the storage tank ¾ of a mile north of Interstate 10 on Sun Valley Parkway would require somewhere between 12 and 20 wells near the banks of the Hassayampa and a pipeline collection to deliver water at least 3 ½ miles toward the east. This recovery and delivery system is associated with the $169 per acre-foot cost in the table above. The $57 cost per acre-foot associated with profit and tax is the cost associated with the profit by the contractor of constructing the pipeline, and the tax imposed on the business of water delivery after start-up. The cost to purchase CAP water is the cost associated with $150 per acre-foot for a total of $538 per acre-foot, or $1.66 per 1,000 gallons, to deliver water along the laterals and toward Sarival Road. The cost associated with the entire infrastructure necessary to deliver water from the North-South Pipeline toward Buckeye in the Pipeline to the Future was calculated as $578 per acre-foot, or $1.78 per 1,000 gallons, in 2002.

Pipeline to the Future – Construction, Operations, and Maintenance Cost Comparison of Alignments

Work began less than one year later, in 2003, on a subsequent Pipeline to the Future Study. A final report was published in January 2004. Concerns had mounted that the housing development which had occurred along Yuma Road might make a future west to east pipeline project unfeasible due to the disruptions which would occur due to the new developments and the extra expense of digging up new roads and the subsequent subdivision's utilities. In addition, WESTCAPS (specifically West Maricopa Combine) had discovered that the potential existed to be granted access to the Roosevelt Irrigation District's right of way which cut a path through the same area as Yuma Road. The goal of the study was to compare the two alignments with respect to construction costs, operations and maintenance costs, and to develop a more detailed cost associated with the recovery and delivery of water from the Hassayampa well field as opposed to an analysis that began approximately 4 miles east of the Hassayampa River.

The same Yuma Road alignment from the 2002 study report was compared with the cost of a Roosevelt Irrigation District (RID) alignment. However, the refined Yuma Road alignment would incorporate the cost of constructing 16 wells along the Hassayampa River (as would the RID alignment). As opposed to the Yuma Road alignment, the RID alignment would traverse east along Yuma Road from just east of the Hassayampa River for 2 miles, then south along Johnson road for just under 2 miles until it would intersect with the north side of the RID canal right-of-way. From the intersection of Johnson Road and the canal right-of-way, the alignment parallels the RID for 13.6 miles toward the east, intersecting Yuma Road. From the intersection of Yuma Road and the canal, the pipeline traverses eastward along Yuma Road for 4.8 miles, terminating at Sarival Road. For a map description of the alignments, Figures 4-3 and 4-4 are provided which are the Yuma Road and RID Canal alignments.

Both alignments were seen as having advantages and disadvantages at the time. The list for both alignments is provided below.

Figure 4-3 The Yuma Road Alignment with Booster Pumps (2004)

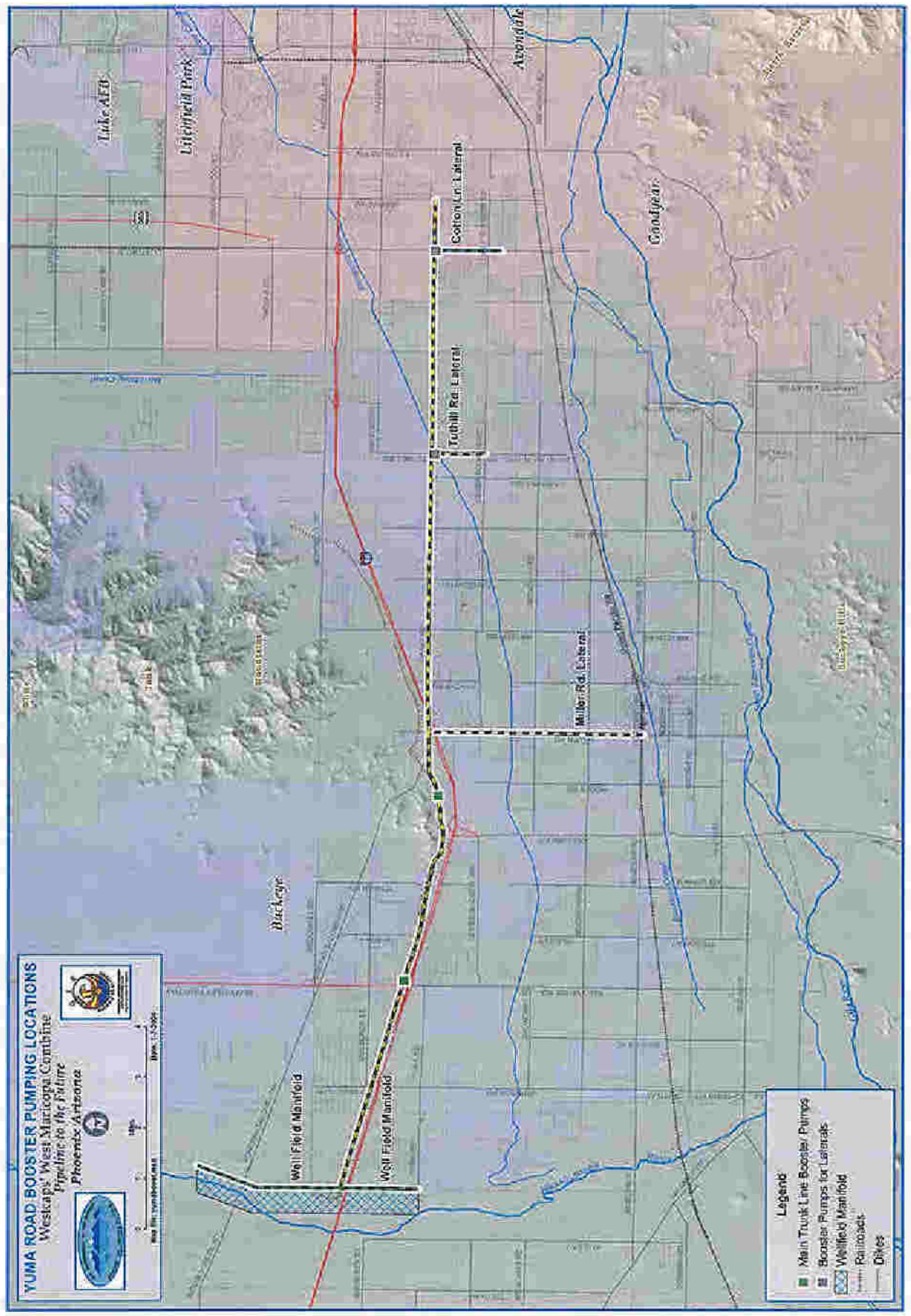
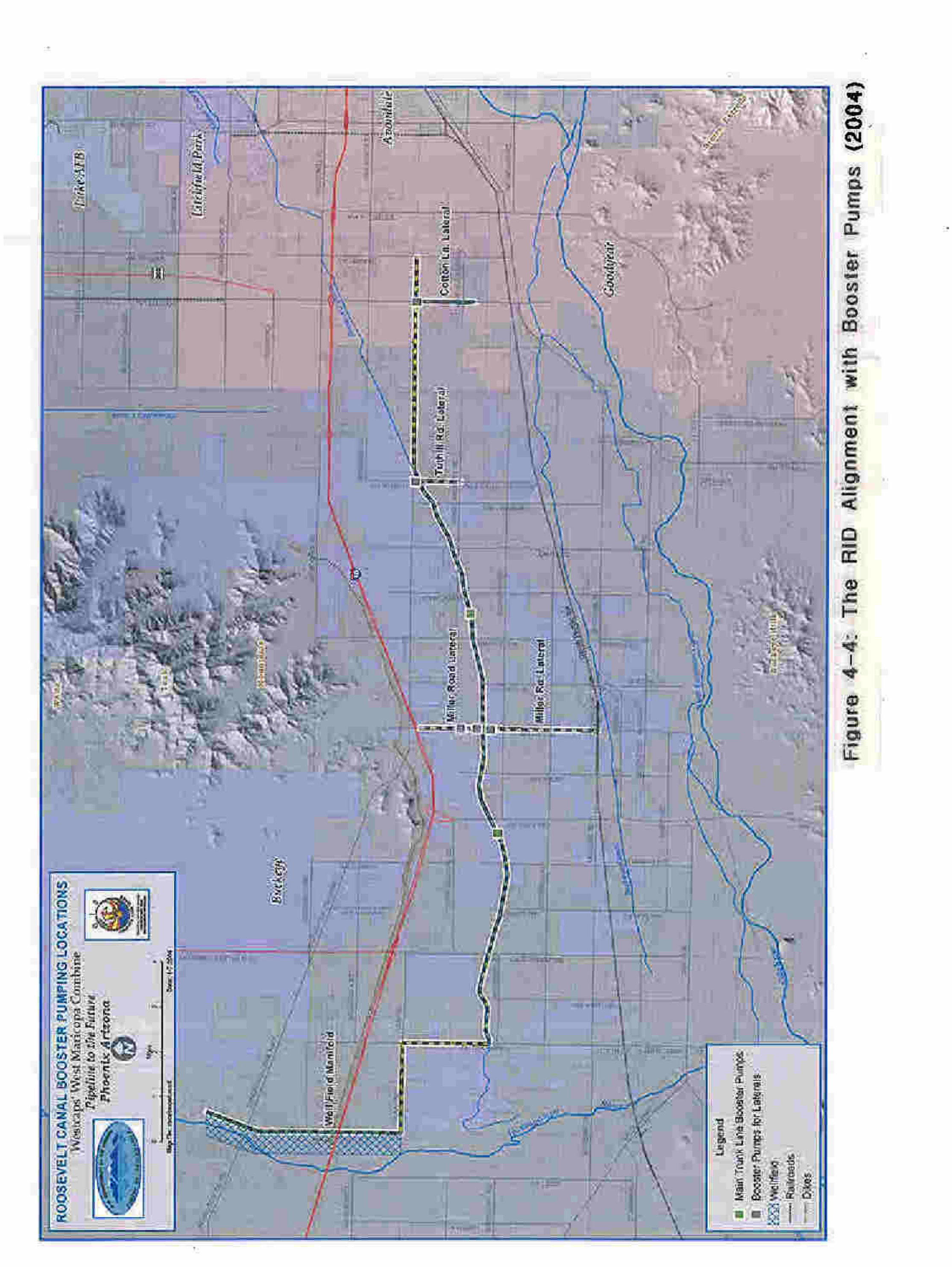


Figure 4-3: The Yuma Road Alignment with Booster Pumps (2004)

Figure 4-4 The RID Alignment with Booster Pumps (2004)



Yuma Road Advantages:

- The alignment is shorter by 3 miles when compared to the RID alignment, and therefore is less expensive with respect to material costs. The cost to replace the infrastructure would be advantageous when compared to the RID trunk line.

- Deliveries into north Buckeye could be made more easily from an alignment already partially located north of Interstate 10. Pump energy costs for deliveries to the north are minimized using this alignment versus the RID alignment. This scenario is not apparent in this study since the laterals are all sited south of the Yuma Road trunk line.

- The trunk line paralleling the interstate dike would be relatively easy to install and is straight for 5 miles. The Yuma Road portion would require constructing through paved roads and development, but it also is a straight stretch for approximately 15 miles.

Yuma Road Disadvantages:

- The main trunk line would encounter new development along Yuma Road between Interstate 10 and Sarival Road. In addition to the expense of ripping out new construction, residents in the area might view the construction negatively and wonder why a water line couldn't have been installed prior to their arrival. In addition to crossing through this new development, the construction of the pipeline would also have to make special construction provisions for crossing Interstate 10 and the interstate dike twice. The dike and interstate would need to be crossed at the well field (the well field manifold), and again where the main trunk line transitions away from the interstate dike toward Yuma Road just east of Miller Road.

- Although the interstate dike alignment is relatively free of utilities, the transition on to Yuma Road is not. Particularly the first three miles of the Yuma Road alignment where numerous utilities are known to cross the road. Fiber optic cable traverses along the north side of Yuma Road from the interstate east to Jackrabbit Road, and then along the south side of Yuma Road east to an unknown point. A gas pipeline is located on the north side of Yuma Road from Jackrabbit to Perryville Road.

- Pipeline and related infrastructure replacement costs would likely increase due to planned development along Yuma Road.

The following are the perceived advantages and disadvantages of the RID Canal alignment.

RID Canal Advantages:

- The new Sundance development located on Yuma Road beginning just east of the interstate is avoided. The expense of ripping out paved roads, utilities, and replacing the removed infrastructure is avoided.
- A negative public relations with the Sundance community is avoided.
- By using the RID right-of-way, construction across the interstate and interstate dike occurs only once.
- Easement fees appear to be less expensive using the RID canal right-of-way versus county or city right-of-way.
- The construction avoids very much traffic control by constructing less of the pipeline along Yuma Road.
- Future activities to replace pipeline and infrastructure costs less since less of the pipeline is constructed along a high traffic roadway.

RID Canal Disadvantages:

- The main trunk line is three miles longer than the main trunk line for the Yuma Road alignment. A longer alignment reflects a higher materials cost.

- The canal right-of-way could represent a narrower strip of land when constructing the pipeline, which could cause logistical construction challenges.

The final cost for both systems was comparable, with the Yuma Road alignment being slightly less expensive with respect to construction and operations costs. A cost summary of each system is provided in the following table.

Table 4-5 The Cost of Delivering Water With Respect to All Fees Including Income Tax in Order to Earn a 10% Profit.

SUMMARY OF TOTAL PER UNIT COSTS				
	Yuma Road Alignment		**RID Canal Alignment**	
Description of Cost	$/Acre-Foot	$/1,000 gallons	$/Acre-Foot	$/1,000 gallons
Amortized Capital Cost - Pipeline	$341	$1.05	348	1.07
Recharge Facility Use Fee[1]	13	0.04	13	0.04
Cost of Recovery to Storage Reservoir[2]	169	0.52	169	0.52
SUBTOTAL	523	1.61	530	1.63
10% Profit and 33% Income Tax[3]	90	0.28	91	0.28
SUBTOTAL	613	1.89	621	1.91

[1] Cost of recharge is from West Maricopa Combine data provided to WESTCAPS during the 2002 report process.
[2] Recovery costs were calculated on 6/11/02. The original work did not include verifying the cost of recharge or recovery for the 2002 report.
[3] Allowable for private utilities.

SUMMARY OF TOTAL PER UNIT COSTS				
CAP Water Cost[4]	150	0.46	150	0.46
TOTAL COST FOR FORWARD FLOW	**763**	**2.35**	**771**	**2.37**
Additional Facilities for Reverse Flow[5]	34	0.10	n/a	n/a
10% Profit and 33% Income Tax[6]	6	0.02	n/a	n/a
SUBTOTAL	40	0.12	n/a	n/a
TOTAL COST FOR FORWARD AND REVERSE FLOW	**803**	**2.47**	n/a	n/a

For a description of the costs above, see the breakdown provided at the end of the WESTCAPS Strategic Plan – Refinement of West Maricopa Combine Pipeline Study section.

Refinement of the North-South Pipeline Study (unpublished)

In late spring of 2004 WESTCAPS began to explore the possibility of conducting a similar type of study for a pipeline from the north side of the west valley to the south much like the pipeline described as the North-South pipeline in the Strategic Plan. The alignment termination desired by 2004 was not in central Goodyear (north of the Gila River as per the 2001 Strategic Plan), but what was then the far southern end of the Estrella Mountain Estates (south of the Gila River), and near the currently existing Estrella Foothills High School (in the fall of 2004, the Estrella Foothills High School did not exist, though groundbreaking had occurred). Likewise, the beginning of the pipeline was not as the 2001 Strategic Plan had envisioned at the CAP and Sarival Road, but was rather at the intersection of El Mirage Road and the CAP. The new water treatment plant at this location was named Twin Buttes WTP for its proximity to the landmark bearing the same name.

The existing Arizona-American infrastructure, along with what was planned by Peoria was beginning to dictate where it made the most sense to route the rest of the North-South alignment. For example, Peoria's plans were to construct the Twin Buttes plant and generally have four delivery points located southwest from the plant. Two alignments were mapped in order to begin to determine the more favorable alternative. In both cases, the modeling for each alignment was left incomplete. The first alignment was named the Jomax Road Alignment because of its alignment along Jomax Road between El Mirage Road and Citrus Road. This alignment serves turnouts 2 and 4. Turnouts 1 and 3 must be served by an extension off of the main trunk line along Jomax

[4] Cost of CAP Water was an amount determined as part of the 9/15 plan.
[5] Cost was not calculated for this study for the RID Canal alignment. The cost provided was calculated during the 2002 report process and re-published for this report to give a true cost of water for at least one alignment for the forward and reverse flow options.
[6] Allowable for private utilities.

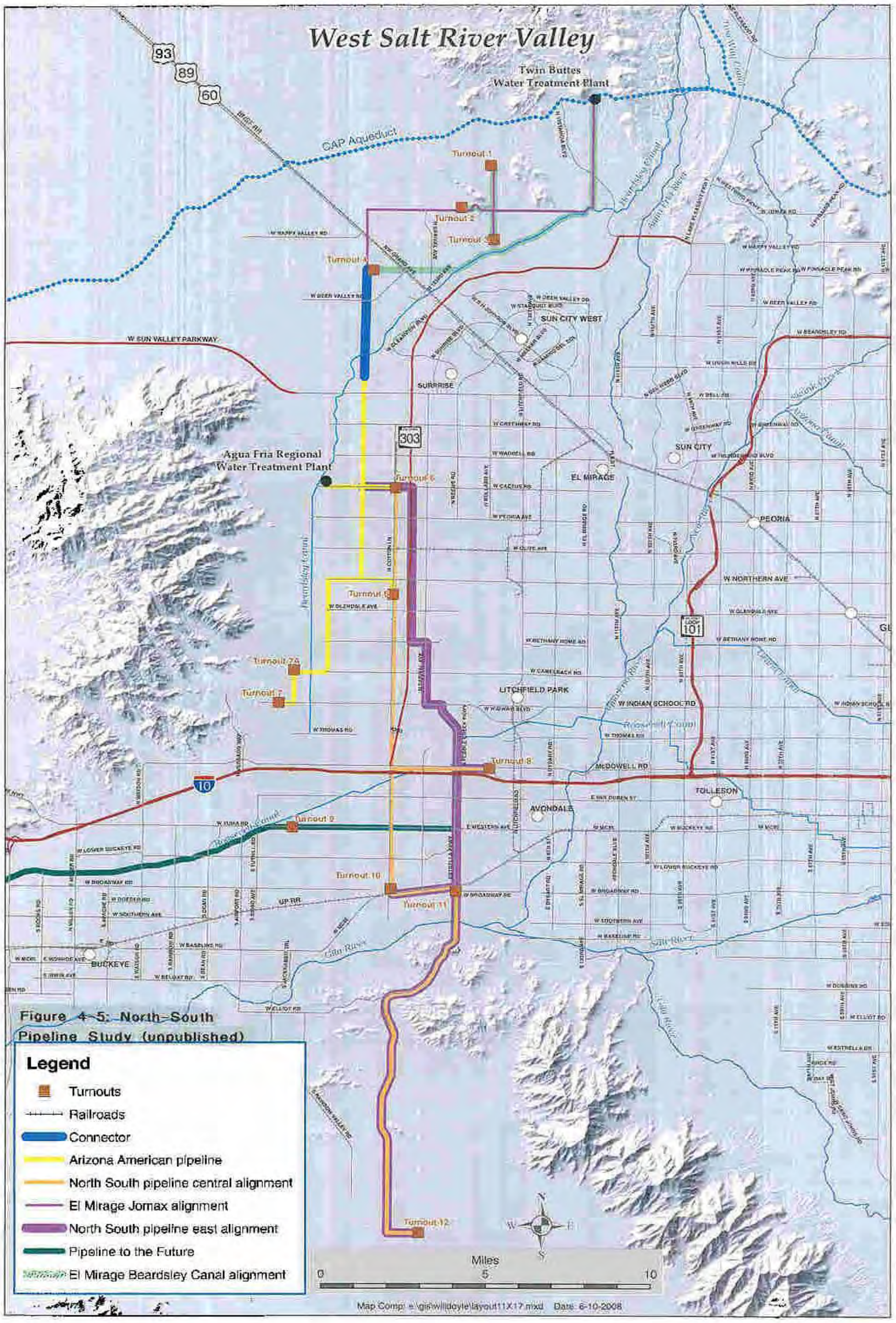
Road at Bullard Road. Jomax Road is denoted by the horizontal purple line just south of the CAP aqueduct in Figure 4-5 on the following page. The second alignment, named the Beardsley Canal Alignment, would deliver water down El Mirage Road and follows the Beardsley Canal right-of-way from about the intersection of El Mirage and Jomax Road to about the intersection of Reems Road and Pinnacle Peak Road. Although this represents most of the alignment, it does not represent the bulk of the water delivery. Using this alignment, a great portion of the water must be delivered uphill to turnouts 1, 2, and 3. The delivery uphill to turnout 3 is less than 4/10 of a mile, and the delivery uphill to the tee at Jomax Road is nearly 1-mile, and neither of these sections require booster pumping. A booster pump is needed between the tee at Jomax Road north to turnout 1, and from the tee west to turnout 2.

A rough cost estimate was developed for each alignment and the Jomax Road Alignment was the least expensive option with respect to construction. And although operations costs were determined, maintenance costs were never completed. During the development of the construction costs, there was a limited supply of water that was recognized as a realistic renewable supply that was available. An unlimited renewable supply that was not allocated to the region was also estimated with respect to cost because it was recognized that this unlimited supply would ultimately be the demand for the region. The limited supply of water was described by the 20 MGD that the Twin Buttes WTP was planned to treat. Under this plan the Jomax Road Alignment (in 2004 dollars) would cost $14.5 million whereas the Beardsley Canal Alignment would have cost $16.5 million. The Jomax Road Alignment would cost $93,000 to operate yearly, while the Beardsley Canal Alignment was slated to run $132,500 yearly to operate. Under the unlimited supply of water scenario, the Twin Buttes WTP would plan to treat approximately 60 MGD. The Jomax Road Alignment under the unlimited supply option would cost $26.5 million whereas the Beardsley Canal Alignment would have cost $29.75 million. Yearly operations costs for the Jomax Road Alignment would be $170,000, and for the Beardsley Alignment it would be $216,500.

Through interviews and meetings conducted, Peoria's plans were to construct the Twin Buttes plant to deliver 20 MGD, and no further information is available as to whether all 20 MGD would be used for Peoria's customers, or if some capacity was available for other customers (ie. in the Arizona-American system).

The lack of details because the report went unpublished makes it difficult to determine what of the Arizona-American infrastructure existed at the time. The Arizona-American system at the time was described by the lines in yellow. What is unsure is whether the infrastructure was in the ground, or was planned, as it was assumed for modeling purposes that it would exist at some point (some of the modeling was completed for this study). By late 2004, Arizona-American had already planned on the White Tanks WTP (referred to as the Agua Fria Regional WTP at the time) at Cactus Road and the

Figure 4-5 North-South Pipeline Study (unpublished)



Beardsley Canal with a pipeline which would take finished water from the water treatment plant to the pipeline at Citrus and Cactus Road. The plant at the time was expected to be built to provide 80 MGD of which 50 MGD was planned for Arizona-American customers, and 30 MGD was for others. The plant would have the ability to be expanded to 100 MGD if desired.

The extra capacity being planned by Arizona-American for the White Tanks WTP (30 MGD) was seen as fulfilling a demand coming from within the Goodyear area. A total of 5 turnouts were planned to deliver the additional 30 MGD to locations such as McDowell Road and Bullard Avenue, Yuma Road and Jackrabbit Trail, Cotton Lane and West Buckeye Road – S.R. 85, Reems Road and West Buckeye Road – S.R. 85, and South Estrella Parkway approximately one and two-thirds miles east of South Estrella Parkway. The turnout located at Yuma Road and Jackrabbit Trail was a turnout associated with the Pipeline to the Future and this study was poised to determine the cost of providing water south along the North-South pipeline until it was sent west via the Pipeline to the Future toward the Yuma Road/Jackrabbit Trail turnout.

In order to reach the four planned turnouts in the Goodyear area, two different alignments were mapped and were compared for construction costs and operations and maintenance costs. These are denoted as the orange and purple lines on Figure 4-5. From Citrus and Cactus Roads, both alignments were to head east along Cactus Road. The more centralized alignment then traversed south from Cactus along Cotton Lane to West Buckeye Road – S.R. 85 where it traversed east along West Buckeye Road - S.R. 85 until it reached the intersection with South Estrella Parkway. The more eastern alignment would traverse south from Cactus Road along the 303 until intersecting with Sarival Road. From Sarival Road the pipeline heads south along Sarival Road, then east along Indian School Road, and finally south along South Estreally Parkway. In each case, both alignments bisect three of the four turnout locations. In ultimately choosing either alignment, a lateral would have been needed to one of the turnouts from the main trunkline. The longest lateral would have been required of the more centralized alignment in order to reach the turnout located at McDowell Road and Bullard Avenue. This lateral would have necessitated over 3 miles of pipeline to reach the turnout. The eastern most alignment necessitated a lateral toward the west to reach the turnout at West Buckeye Road – S.R. 85 and Cotton Lane from West Buckeye Road – S.R. 85 and South Estrella Parkway. This lateral would have necessitated about 2 miles of pipeline to reach the turnout.

The cost estimate associated with the Arizona-American portion of the system was begun, but not completed. The estimate associated with extending the system for the five turnouts in Goodyear was not started, and therefore not even a rough idea of the cost of such a system is available today. The costs associated with the limited and unlimited supply option for the Arizona-American system, turnouts 5 through 7A, are so rough in their completion, that there is no merit to their value. For example, in the limited and unlimited option, pipe costs were developed, but pipeline appurtenance costs and the additional cost associated with constructing a pipeline in an urban area were not determined.

Some other asides related to the system in general were the following. A thought was raised over whether Peoria could save on pipeline installation by also having a Beardsley canal WTP versus a CAP located WTP. Though this idea was thought to have some potential, the mapping of a potential location and the costs associated with this idea were not begun. The other aside was that Peoria's pipeline system was planned to terminate at Citrus Road and Pinnacle Peak Road. If a connection was going to be made with Arizona-American's system, then it was unclear which entity, or what arrangement would be made between entities, in order to pay for the approximate 3.6 miles of pipeline needed to make the connection near Bell Road and Citrus Road. This stretch of pipeline is represented as the blue line on the map.

Population and Water Demand Projections for WESTCAPS Member Lands

Published in 2006, the report was deemed important not only from the standpoint that city and water providers wanted to know what their population outlooks were, but also how well renewable water supplies would hold out in the west valley. The final report was published in May of 2006. This report is important to this study as the results have already been used to determine the Demand by Locations section, and the Projections of Demands and their Locations section in Chapter 3.

Some of the more impressive anticipated population increases by 2035 (based on the anticipated population in 2010) are provided in Table 4-6.

Table 4-6 Anticipated Population Increases for the West Valley from 2010 to 2035.

City/Water Provider	2010	2035	% Increase
Global Water	13,896	98,303	700
Buckeye	100,000	670,350	675
Goodyear	58,839	389,500	650
Arizona-American Water	102,547	339,150	325
Arizona Water Company	9,983	31,133	300
Surprise	124,537	365,780	300

The results of the report showed a shortfall in renewable supplies by 2015 based on WESTCAPS' outlook (not MAG's outlook) of 20,000 acre-feet per year, and by 2035 the shortfall is projected to be 175,000 acre-feet per year. The projected total water deficit (in renewable supply) from 2010 to 2035 for WESTCAPS members is 2,000,095 acre-feet.

Although each report identified above has provided pertinent information related to planning, costs of potential projects, projected supplies and demands, and future outlooks; as a whole the reports published by WESTCAPS tell an incredible story of the growth anticipated in the west valley and the demands which will drive the creation of infrastructure based on the water supplies needed. It is this work already accomplished which has been an eye opener in order to allow city leaders and managers to begin planning the next generation of infrastructure.

The Benefits to the Region

The City of Goodyear

Originally begun as a farming area, Goodyear's start was predominantly as cotton growing fields. In 1917, Goodyear Tire and Rubber Company purchased 16,000 acres of cotton growing farmland by the then junior executive of the company, Paul Litchfield. The first of the "boom years" for Goodyear came during World War II when the Litchfield Naval Air Facility and the Goodyear Aircraft Corporation employed 7,500 people. The town later was incorporated in 1946 which at the time totaled 151 homes, 250 apartments, and several businesses. In 1968 the Navy sold the airfield to the City of Phoenix which became the Phoenix-Litchfield Airport, and later was turned into the Phoenix-Goodyear Airport.

Throughout Goodyear's history, having an ample water supply has been on the forefront of all of the major businesses and development which have occurred. The difference between the past and the future is that a sustainable water supply is necessary for the permanent residents of Goodyear.

The benefit of Goodyear having a CAP allocation will allow it not only the ability to count on a sustainable supply, but will also allow it to expand further south, and will allow it to provide for commercial development or industrial ventures which require blocks of water. And because CAP water does not posses arsenic, and has salt loads which are generally lower than typical ground-water along the Salt and Gila Rivers, Goodyear can additionally benefit from water blending in order to meet EPA/ADEQ primary and secondary standards.

The City of Surprise

In the west valley, after the City of Peoria and Arizona-American Water, Surprise has the largest share of CAP water among WESTCAPS entities at 7,373 acre-feet per year. The growth for Surprise has been provided on the back of ground water and some water recycling projects. Though growth in Surprise has been astounding in a very short time (ie.: 2000 census of 30,000, 2007 census of 90,700), the continued growth projections are no less mind boggling. The 2010 projections are for 124,500, and by 2035 growth projections are expected to be a population of 366,000. One has to assume that CAP water would come into play in order to successfully sustain future demands without overburdening ground water. The real benefit to Surprise is a confidence in knowing that the expected growth will not be an unrealistic demand on water supplies. The added benefit is in knowing that with a sufficient water supply, that the town will flourish as not only a bedroom community to Phoenix, but also as a place where commercial development provides local jobs which adds to the taxable revenue for the region.

The City of Peoria

Much like the City of Surprise, the City of Peoria expects steady growth along with the continued and expanded use of CAP water. Unlike other water providers, Peoria has begun to prove that they can take and use their CAP water, and their mandate is a continuation of what has been done in the past until Peoria reaches full utilization of CAP water. Peoria's strategy has been to utilize the CAP water that it has needed with respect to the time frame they're in (a progression of use has occurred within Peoria since the CAP crosses Peoria's city limits).

From the formative years for WESTCAPS, Peoria has been at the forefront of renewable water supply planning (see this Chapter and the section on Summary of Previous Studies). In addition, Peoria's successful partnerships using CAP water have allowed the City to realize the cost savings and efficiencies that could be implemented on a larger scale with respect to the regional transmission pipeline. An add-on study to this one for both Surprise and Peoria would make up the northern portion of CAP use for the regional transmission pipeline concern. As such, the timing of Surprise and Peoria's discussions will take the issue into the future beyond the conclusion of the publication of this report.

The Town of Buckeye

Buckeye's future as a livable destination appears promising with lots of flat land (some of which is already graded flat due to agriculture), mountain vistas, and promising transportation corridors allowing residents suitable access into Phoenix. These benefits place Buckeye in a region of future growth and as an interested party for desiring to purchase water and having it delivered from either the CAP running through northern Buckeye, or from the proposed regional transmission pipeline at the White Tanks WTP.

Town planners view Buckeye as a municipality split in two. The northern half, predominantly north of Interstate 10, typically has groundwater of better quality. The southern half, predominantly south of Interstate 10, typically has groundwater of poorer quality which requires treatment for arsenic or has higher TDS concentrations. With respect to the southern half, the portion of Buckeye which rests south of Interstate 10, the town is at a crossroads to decide on the best course of action for the development of the next water supply within the next 3 years, and also the decision on how the expansion of that system takes place over time as Buckeye continues to grow and develop. As housing is constructed around the original town limits, logistics dictate that developers tap into Buckeye's existing water supply system. As development occurs farther from the existing system and north of Interstate 10, the less expensive option for developers is to construct an on-site groundwater based supply (this is possible because lower TDS and arsenic concentrations are typically the norm in the groundwater north of I-10 versus south of I-10).

Town officials are planning for the next water supply assuming that a high rate of growth may resume by 2012. Buckeye planners are thinking that central and western reaches of the city may benefit from a desalination facility and that eastern edges of the city could benefit from a west valley water transmission pipeline, particularly since past

WESTCAPS planning proposed a north-south transmission main paralleling Sarival Road which is about 3 miles east of Buckeye's southeastern town limits.

The benefits Buckeye would receive from having CAP water delivered to it amounts to not only an added water supply, but a supply that would allow greater usage of the existing groundwater supply through blending. Like Goodyear, much of Buckeye's groundwater contains moderate to high amounts of salt. Another benefit is that as Buckeye continues to grow, a CAP supply would relieve groundwater pumping and thus reduce the chances of subsidence, and preserve more of the high quality water for the future. In short, Buckeye has far more to gain with respect to water resources management in the long run by implementing a CAP solution. The expected population growth could make complete reliance on groundwater a challenge which could be alleviated somewhat by improved methods of water conservation and/or reuse. The modeling results in Chapter 5 highlight Buckeye's renewable supply option which is modeled as a treat and deliver option in southeastern Buckeye via the White Tanks WTP. Another option available to Buckeye is through the CAP canal which runs through the northern portion of the newer annexed portion of the city.

The City of Avondale

The recognition exists within Avondale that with its location of being within the fringe of Phoenix's general metropolitan development, that Avondale will inevitably continue to experience substantial growth. Avondale's current population estimate is just under 80,000, and the population is expected to double to160,000 by 2035 according to the Population and Water Demand Projections published by WESTCAPS.

Avondale is fortuitous in that it possesses both SRP and CAP water. Avondale currently makes use of its SRP water not through direct delivery, but through recharge and recovery, but does not take delivery of its CAP water. Avondale does use CAP incentive water which allows it to bank CAP water for a fee which allows an equal amount of withdrawal within its service area. However, the CAP water being banked is not within Avondale's service area.

In the future Avondale envisions taking direct delivery of its CAP water which fits in well with this study. Avondale would like to have a better understanding of its portion of the overall cost of a west valley water transmission system without the actual commitment of doing so which this study affords. Avondale's allocation of 5,416 acre-feet per year (~ 4.84 MGD) is approximately one-fourth of Goodyear's planned CAP delivery of water routed through the MWD canal and treated at the White Tanks plant, and the point of delivery would be at one location which is as-yet undetermined.

The City of Phoenix

As of publication time, Phoenix does not envision being a stakeholder in the west valley water distribution process. No relative proximity exists from the White Tanks area to the western boundary of Phoenix, and thus the issue for Phoenix is therefore not only the relatively long distance for water delivery, but also that Phoenix has other treatment and delivery options underway or complete such as the Lake Pleasant WTP and water delivery and treatment planning by way of the SRP canal in the southwestern portion of the city.

Arizona-American Water Company

The Arizona-American water company located in Phoenix is a subsidiary of American Water. The company was originally founded in 1886 as American Water Works & Guarantee Company and today continues to be the parent company of a nineteen state subsidiary. Today, Arizona-American is a water provider to thousands of customers in the Phoenix west valley, to Scottsdale and Paradise Valley customers, and in Lake Havasu City, Bullhead City, and Tubac, Arizona. Arizona-American has also undertaken various water-use-it-wisely campaigns and is a staunch promoter of water conservation among its service areas.

Within its customer service area in the Phoenix west valley, Arizona-American's belief is that if the Agua Fria water transmission system is of benefit to their service community, then the entire system should serve to benefit other service providers as well. Relying on that theory, Arizona-American has proceeded to construct a regional treatment plant capable of being expanded which could ultimately be capable of delivering 80 MGD of potable water. The broader points of the planning that should be taken into account when considering expansion of the existing system are the following.

1. Through financial agreements, Arizona-American foresees their infrastructure as being available for others to hook up to if necessary so that new water providers can expand water deliveries. This option however does not provide water, and thusly, a provider must have an existing water allocation or have acquired water and have entered into an agreement with the Maricopa Water District to wheel water through the MWD canal. Deliveries using MWD's Beardsley Canal would require a wait until 2010 which is the time-frame for the planned completion of Arizona-American's White Tanks WTP.
2. Arizona-American's current pipeline system is planned to be at full capacity at approximately the year 2020. Any additional pipeline hook-ups to the existing Arizona-American pipeline system will lose the ability to have water delivered to them in 2020. This time-frame is associated with Arizona-American's expectation that their customers will have built-out their developments and will be requesting the entire output of the existing Agua Fria system.
3. The regional water treatment plant (White Tanks WTP) will have the capability of expanding by another 42 MGD after going into operation in 2009. The limitation on new deliveries is constrained by the cost and the time necessary to expand the future plant.
4. Arizona-American and MWD are open to any and all discussions regarding potential financing or cost-sharing of new infrastructure for the purpose of water wheeling through the Beardsley Canal and through Arizona-American's transmission system, and the necessary treatment to bring water to potable standards from the White Tanks WTP. A fee for treatment costs would need to be negotiated with MWD.

The potential benefit of the existing and future combined Arizona-American and Maricopa Water District infrastructure is what makes this study and the possibility of using a substantial amount of the west valley's renewable water resource possible. The question is not 'if' this infrastructure will be used some day in the future, but rather the fact that since the potential is in place, 'when' will the west valley begin to tap into such a significant resource. By scouring through various providers' data and incorporating growth estimates, a relative idea of when infrastructure development occurs is possible. A hint of the relative estimates of infrastructure development are provided in Chapter 3, and the layout and costs of this development are provided later in this chapter under the heading, "Capacity of Future Alignments."

Global Water Company

Global Water Resources is the owner of two water provider subsidiaries in the west valley. Global Water owns the Valencia Water Company-Town and Greater Buckeye Divisions, and the Water Utility of Greater Tonopah. Of the two water utilities, the Valencia Water Company shows the highest potential for growth in the near term. With growth come higher demands for water which are not of immediate concern as groundwater appears to be readily available in the service area. Although water reserves are not of immediate concern, the outlook for water quality within the service area is uncertain. Arsenic values are high and treatment for this constituent is costly. The unknown is whether water quality, specifically TDS values, will increase with time as more water is demanded from local aquifers.

As the Valencia Water Company – Town Division is located in the heart of the Town of Buckeye, a joint effort with the Town of Buckeye for the eventual installation of the needed infrastructure to allow CAP water to be used in the far west valley could be prudent. In addition to the surface water recharge currently being performed by Global Water at their Hassayampa Recharge Facility and the planned use of recycled water west of the Hassayampa River by Global Water utilities, the possibility of bringing in CAP water to the west valley area could be beneficial to assist Global Water with its anticipated demands as well as for all the neighboring municipalities. Global Water continues to explore several opportunities for such a partnership, and believes the White Tanks WTP and associated North South supply line could be one potential component of its long-term regional plan.

Arizona-Water Company

Arizona Water stands to benefit from their location, customers in the area should benefit from improved water quality, and the delivery of CAP water to the area means that savings to groundwater could be in order which overall may aid the quality of groundwater.

The mixed news is that Goodyear's plan for the completion of a CAP transmission main is not scheduled until 2025. Prior to that time frame, a possibility exists for Arizona-Water to begin receiving their CAP allocation sooner than 2025. Arizona-Water has expressed an interest in trading their CAP allocation for a like amount of groundwater which Arizona-American pumps out of Arizona-Water's service area. This would allow Arizona-American to deliver Arizona-Water's allocation to the White Tanks WTP to then treat and deliver to their own customers. This arrangement could be contingent on a time frame until CAP water deliveries begin to pass through the area. In this manner, Arizona-Water would benefit due to the proximity of the groundwater already pumped in its area.

The White Tanks Water Treatment Plant

The concept behind the White Tanks WTP began in 2001 with the publication of the WESTCAPS Strategic Plan. The vision in 2001 for the west valley was for the full utilization of its renewable CAP supply and the construction of a water treatment plant to deliver treated water at the intersection of Cactus Road and the Beardsley Canal (then called the Agua Fria Regional Water Treatment Plant). The concept was that the plant was perceived as coming on-line in 2005, and by 2025 the plant would be at full capacity, treating 79 MGD. The location of the plant was chosen because it appeared to be optimally located not only to be able to take CAP water off of the Beardsley, but due to its elevation, the need for booster pumping would be minimized. Another factor that may have played some significance for the location of the treatment plant at Cactus Road is that deliveries of up to 80 MGD are possible at that location, but an 80 MGD flow on the Beardsley was likely not possible further downstream.

The new water treatment plant has the potential to provide potable water to Goodyear, portions of Avondale, Buckeye, and Surprise, and numerous other water companies and land developers. The water treated at the White Tanks plant could be used by entities to blend CAP water with groundwater in order to reduce salt levels, and potentially arsenic or nitrate levels (Note: A wheeling fee is required by MWD for utilizing the Beardsley Canal). Beginning in late 2009, the Agua Fria system will be supplied from a blend of groundwater and treated surface water (the surface water to be supplied from the Beardsley Canal via the CAP aqueduct).

Planned Capacity

Construction of the 13.5 MGD White Tanks plant began in November of 2007 (see Figure 2.1 for an aerial layout of the progress during the early summer of 2008). The elevation of the plant is approximately 1,420 feet, and is configured in order to take water from the canal in the northern portion of the property, and as treatment progresses, water is delivered toward the southern portion of the property. Plans call for the construction of a 48-inch pipe from the treatment plant to take the treated water east along Cactus road toward Citrus Road where a tee is located and where water can be distributed either north along a 20-inch line or south along a 30-inch line, or further east along a planned 30-inch line which will be constructed in the future as demands require.

Potential Expansion Capability

Sufficient land has been purchased by Arizona-American beside the Beardsley Canal in order to expand the White Tanks Treatment Plant to 80 MGD. Although Arizona-

American does not have the entitlement to take this amount of water from the CAP canal and route it through the Beardsley, the option exists for others to hook up to the White Tanks plant.

The daily volume of water which is available for expansion purposes at the plant reflects an opportunity for the west valley cities and water providers to access a CAP turnout within reach of their community. If a water provider can gain a surface water allocation and wheel it through the CAP and Beardsley Canals, the advantages for providing one's community with a renewable water supply are the following.

1. The use of surface water can relieve the continued use of ground water which in many places in the west valley is linked to subsidence. Surface water can also be blended with existing supplies in order to improve overall water quality.

2. Additional supplies provides confidence for community leaders that sufficient water exists for the approval of either large master planned communities or businesses and industries looking to purchase building permits or expand operations.

3. Additional water supplies and improved water quality add to the quality of life that builds confidence for developers and home buyers knowing that sufficient water exists into the future, and that the quality of water meets primary and secondary standards.

4. The use of surface water can reduce replenishment obligations and CAGRD replenishment fees related to groundwater pumping.

The Beardsley Canal is operated on the premise that if less than 40 cfs is expected to be flowing through the canal, that flows in the canal are to cease due to larger evaporation losses from the canal than what can be provided to users. During this shutdown, MWD will use the opportunity if needed to perform maintenance on the canal.

As the White Tanks plant comes on line, the future of its expansion depends on future demands from surrounding providers. In the following chapter, those demands are assessed by provider. Although the pipeline portion of the existing Agua Fria Transmission System may be at full capacity by 2020, the system was thought out so that expansion could occur for a total of 80 MGD. The relative proximity for several cities and water providers to be able to take their CAP water in the vicinity of the Agua Fria Transmission System versus the existing location of the CAP canal will no doubt prove to be of great benefit in the years to come.

The Timing of Future Connections

The timing of the construction can be associated with many factors, not the least of which is the current economic condition across most regions in the United States which have affected the financial outlook of most industries (U.S. recession of 2008, 2009) . The timing of a project is also associated with its projected use, its current benefit, and long term benefit, and many other factors which could fill this publication. But not to be overlooked as a timing factor is also location.

As the largest expected user of CAP water, and thus the biggest financial contributor to its outcome, Goodyear is expected to control the timing of a pipeline in order to use CAP water. The remaining financial contributors of a pipeline, Avondale, Buckeye, Global Water, and Arizona-Water, are in effect located "on the way to Goodyear" as the pipeline is constructed from the White Tanks WTP to Goodyear. Goodyear winds up as the largest user of CAP water, the largest financial contributor to a pipeline, which also happens to be the furthest from the point of water treatment.

The most detailed analysis of water development and use in this report is for the City of Goodyear (see Chapter 3, Projections of Demands and Their Locations), and the analysis illustrates that CAP water can be postponed until 2025 when Goodyear's populations have grown enough to begin to demand more water than groundwater well fields should realistically provide. Though some of the other WESTCAPS entities may be ready sooner than 2025 for CAP water delivery, they may have to develop other alternatives first, or seek temporary alternatives until CAP water can be delivered through their service areas. It should also be kept in mind that there isn't anything concrete about Goodyear's CAP water delivery in 2025, and should growth accelerate, or a pipeline from the White Tanks WTP to Goodyear become a less expensive alternative in the near future, construction of a transmission line and delivery of CAP water could occur sooner than 2025.

CHAPTER V - HYDRAULIC ANALYSIS AND SPECIFIC REGIONAL CONSTRUCTION COSTS

Background

Reclamation's Pipeline Modeling Program (PMP) was developed in order to hydraulically asses a desired reach of pipeline and as an aid to determine construction, operation and maintenance costs. Overall costs can be divided into smaller costs for each of the study participants which include the City of Goodyear, the City of Avondale, Arizona Water Company, Global Water Company, and the Town of Buckeye. Ultimately the goal is to provide each participant with an understanding of the various costs associated with CAP water delivery which includes the cost of infrastructure development, maintenance, water wheeling, and water treatment. The PMP provides other planning information such as the expected volume of earthwork and the right-of-way needed depending on the pipe size, and the majority of the appurtenances needed in order to complete a pipeline installation.

Bonding Cost for Pipeline Development

Bonding rates for municipal water systems are traditionally calculated using a 20-year time horizon. The cost of building, operating, and maintaining the system over 20 years in a present worth dollar figure is reported in terms of dollars per acre-foot, and dollars per thousand gallons. Present worth dollar amounts are also reported as an estimated future amount since a portion of the pipeline system isn't planned for many years. The bonding rate used for the development of infrastructure is 4.5% which is slightly higher than current bonding rates, but the rate assumes inflation will increase slightly over time. Pipeline construction costs still set to occur someday in the future will be based on an estimate of the consumer price index (CPI). The CPI has historically averaged 3.0% for the last 20 years.[*] Future worth amounts therefore will be set at 3.0% so that construction costs in 2010, 2015, etc. are reflective of future worth.

Design Parameters

The following parameters are the basis for calculating the pipeline infrastructure needed.

- Flow velocities in pipes are modeled to stay at and within 5 feet per second. For pipes of 42-inches in diameter or larger, a 10% increase in velocity above 5 feet per second is allowed. This design parameter is important over time as it reduces pipe friction cost which helps to keep energy costs down, and lengthens the life of the pipe by reducing internal scouring due to high velocities.
- The Hazen-Williams (H-W) Friction Factor of 130 is used. Ductile-iron pipe is selected for the pipeline material due to its success in many areas including the existing Agua-Fria transmission system and because it has been priced as a less expensive alternative compared to most pipe sizes. Ductile-iron pipe is rated with an H-W friction factor of 140, but with time the factor will tend to decrease as the

[*] - source: www.swivel.com/data_sets/spreadsheet/100084

pipe material becomes rougher internally. The value of 130 is chosen over time as an average value of what the H-W friction factor will become.

- The model operates assuming a day's flow can be delivered in 18 hours to account for peak demands. Therefore in the spreadsheet tables one will note that the correlation between million gallons per day and cubic feet per second is a factor of 1.33. Each cubic foot per second is multiplied by 1.33 versus its value in gallons per day.
- Five feet of earth cover is assumed for all buried pipe. According to WESTCAPS advisors, this is a Maricopa County construction requirement. The overall trenching dimensions are the width of the pipe plus 19-inches, and the width of the pipe plus five feet of earth cover.
- Pipeline pressures below zero were not allowed due to the potential for cavitation and pipeline implosions considering positive pressures assist in offsetting earth loads.
- Contingencies for the system are calculated in the following way. The general contingency, applied to the value of construction, is calculated at 5% mobilization, 20% of the cost of constructing the pipeline, reservoirs, pipeline appurtenances, and the mobilization cost. The engineering and administration expense is calculated at 20% of the cost of constructing the pipeline, the reservoirs, and unlisted items. See Table 5-5, Cost Analysis Sheet.
- The value used for amortizing the annual interest rate and duration are 4.5 percent and 20 years.
- Overall motor and pump efficiency is assumed as 68 percent.
- The electrical power cost is 145 mills ($0.145) per kilowatt-hour.
- Land easement fees in various areas are often calculated by the taxing district for that area, and are based on an unwieldy formula which is difficult to ascertain. In order to ease the calculation process for land easement fees, yet provide a good estimate of the expense of an easement, easements are calculated at $1,000 per acre for the Mobile area and most of the Rainbow Valley area, $3,500 per acre in the Estrella Mountain Park area, $2,500 per acre between Estrella Mountain Park and I-10, and $3,500 per acre north of Interstate 10.
- Earthwork is calculated as $8.33 per cubic yard for trenching, $2.21 per cubic yard to backfill, $3.18 per cubic yard to compact backfill, and $7.77 per cubic yard to remove spoil assuming the haul distance is 2 miles or less.
- The cost of the facility to house pumping infrastructure is a formula based on the expense of the pump. For pumps valued under $20,000 the facility cost is estimated as four times the cost of the pump. For pumps valued at between $20,000 and $40,000, the facility cost to house the pump is calculated at 15 times the value of the pump. For pumps costing upwards of $40,000, the facility is expected to cost approximately 24 times the cost of the pump. The reason for the increase in the cost for the more expensive pumps is related to a more secure and larger structure necessary to house more expensive equipment and partly related to the electronic monitoring and switching equipment (SCADA) necessary to operate the larger pumps.

- Urban areas are considered more expensive to build through than undeveloped areas. The additional costs to consider besides the earthwork activities needed for construction through undeveloped areas include the reconstruction of asphaltic concrete pavement, pipe bedding for pipe support due to traffic in urban areas, traffic control, and the replacement of any utilities. The areas considered for this additional cost were along surface streets in urban areas which are paved. The cost of asphaltic concrete is $10.80 per square yard, and the cost to bypass or replace utilities is a rough calculation of 75% of the total cost of jacking and boring under other utilities since smaller utilities are known to exist, but are unknown in terms of magnitude. The cost of pipe bedding is $26 per linear foot, and the cost for traffic control is $25 per linear foot of pipe installed.

Hydraulic Analysis

The hydraulic analysis was conducted by using the PMP developed by several engineers in the early 1990's at the Phoenix Area Office of the Bureau of Reclamation. In 1995 the modeling program underwent improvement refinements. Unlike purchased software which cannot be improved or refined by the user, this model allows the user, if familiar with Lotus 1-2-3, with hydraulic and fluid mechanics engineering principles, and pipeline construction, to make improvements and adjustments to the model. The most notable improvements made to the model in 2003 included adding an estimate for the cost of spoil removal based on the trenching material minus the backfill replacement. An additional column was added to calculate the amount of land needed with respect to the cost of land easements. The pressure transferred to a lateral (tee) from the main line was additionally added to the PMP. And if pipe sizes changed along a line, the PMP was adjusted to read the upstream line pressure and elevation.

The PMP calculates the hydraulic data on the pipeline between two points selected by the user. The hydraulic profile for the pipeline includes the elevation, friction losses, the pumping head added (if any), the pressure head out of one section, and the pressure head back into the next section, and the velocity in feet per second. The user selects the distance between two points, and in essence, how often the hydraulic updating should occur along the pipeline route. The shorter the distance, the more accurate the analysis, but the more tedious to profile shorter distances, particularly if the pipe length is miles long. The longer the distance selected between points, the less accurate a picture the designer has in correctly determining the class of pipe needed based on hydraulics due to error.

For this study, a distance of 500-feet was selected as the distance between two points for the pipeline model. At point "zero feet" the only hydraulics occurring are the addition of pressure added by the pump and the volume of water being pushed by the pump which the PMP associates with a pressure value at the inlet of the pipe in terms of feet and psi. At point "5.0", 500-feet later, the PMP calculates the new pressure in the pipe based on friction losses, elevation differences, if a booster pump added any more pressure, or if a pressure reducing valve dropped the pressure. The next section is then adjusted accordingly, and so on. The first column in the PMP is labeled "Sta." and is the actual station length for each notch shown on the hydraulic modeling map. The next column is labeled "Map Sta." which is the station value shown on the map. The results of the modeling are available in the appendix.

As an added safety factor, the average pressure in any one section of pipe is increased by 40% to account for incidences of water hammer. Based on the pressures calculated in any one section of 500-feet of pipe, the PMP reads a second lotus sheet to determine what class of pipe is appropriate, and the cost per foot for that class pipe is subsequently shown. The earthwork needed is additionally calculated in subsequent columns based on the size of pipe selected by the user, and the length of pipe needed, and earth cover required. The equations in the PMP used to calculate earthwork are a function of the user's equation to calculate the size of trench needed based on the size of pipe selected.

Overall Results of the Modeling Run

The results of the WESTCAPS Strategic Plan in 2001 highlighted a water treatment plant located at the Beardsley canal and Cactus Road. The advantage of such a site was the water delivery capability using the Beardsley Canal, and the elevation which would act as a gravity feed from that location to water delivery points anywhere south up to the Salt River.

The results of the modeling for water deliveries from the White Tanks Water Treatment Plant and from Adaman Mutual Water Company in the direction of the Salt River highlight what was learned in 2001. The drops in elevation overcome the losses in internal pumping pressure, and thus additional booster pumping is not necessary. For deliveries which cross the Salt River for the southern portion of Goodyear, the subsequent rise in elevation requires a booster pumping station at Reservoir Site 13 in the Estrella Mountain Community.

Water Deliveries

Water demands will vary over time for Goodyear as noted in Chapter 3 as groundwater treatment plants come on-line at various times, while main line deliveries are planned to come on-line in 2025 for the rest of the WESTCAPS water providers. This occurs because the connection at the White Tanks WTP is planned so that deliveries can begin in 2025.

As demands rise over time, an understanding of the maximum water demands at each turnout is needed so that the pipeline can be constructed to be able to deliver the maximum volume of water demanded. A difference in deliveries exist from first water delivery (which occurs mostly in 2010 and 2015), and the maximum water delivery (which occurs mostly in 2035). The pipeline is sized and modeled for the maximum water delivery occurring predominantly in 2035.

The following table highlights water deliveries to various points and provides the time frame for when maximum deliveries are expected to occur.

Table 5-1 Accounting of Production and Deliveries to Assist in Determining Maximum Pipeline Sizes for Years 2015, 2020, 2025, and 2035.

Note: Years in Parenthesis Indicate the Year Construction is needed, while Year of Occurrence Indicates the Year the Volume Reaches a Maximum in the Main Line.

Main Line Trunk Connections	Max Flow for Reach (MGD)	Year of Occurrence
White Tanks WTP & Reservoir to Arizona Water (2025)	42	2035
Arizona Water Turnout to Westpac Reservoir (2025)	41.136	2035
Westpac Reservoir to Connection w/Main Line (2015)	36.546	2035
Combined Adaman, LPSCO, Site 21 & 18 to the interconnect w/the White Tanks/CAP Main Line (2010)	8.12	2015
From the CAP Main Line Junction to the Turnout for Buckeye, Global Water and Site 11 (2010)	41.516	2035
From the turnout to Buckeye, Global, and Site 11 to the WPA2 wells and Site 12 Reservoir (2010)	19.932	2035
From theWPA2 Wells/Site 12 to the Turnout for Site 7, 8, the Avondale Facility and Gila River Reservoir. (2010)	25.399	2025
From the Gila River Res., Site 7, 8, and the Avondale Water Facility to Kings Ranch Reservoir (2010)	36.973	2035
Kings Ranch Reservoir to Site 13 Reservoir (2010)	32.353	2035
Site 13 to Rainbow Valley Reservoir (2010)	24.563	2035
Rainbow Valley Reservoir to Waterman Facilities (2015)	9.443	2035
From Waterman Facilities to the Turnout for Zone 3 and Zone ¾ West Reservoir (2015)	26.413	2035
From Zone 3 and ¾ West Reservoir, to Zone 3/4 East Reservoir (2015)	10.113	2035
From Zone ¾ East Reservoir to Estrella GWTP and Estrella Reservoir (2015)	5.42	2015
From the Estrella Facilities to Sonoran Highlands (2020)	5.613	2035
From Sonoran Highlands to Mobile (2035)	0.003	2035

The values in Table 5-1 are derived by determining when maximum demands occur. Maximum demands are determined by comparing a similar table for years 2015, 2020, 2025, and 2035.

The value in Table 5-1 presented for water flowing past Sonoran Highlands is essentially zero and is based on accounting of water produced and delivered. Goodyear's water resource plan showed the last delivery to Sonoran Highlands Reservoir, and the report did not present Mobile as a planning area requiring deliveries. However, from Table 3-8, the recommended production is capable of producing 2.2 mgd more than peak production demands. If 2.2 mgd can be produced from Goodyear's system than is required from peak production in 2035, then the additional production would be delivered to the Mobile area when it is assumed that all other demands can be met. Therefore, the modeling results show the mobile area receiving 2.2 mgd. As an added benefit, the report provides an estimate of deliveries and costs to develop a smaller pipeline from the Mobile area to the Booth Hills area. The delivery is modeled for 200,000 gallons per day.

Pipeline Requirements for the Main Trunk Line

Various sizes of pipe are necessary for the trunk line from the White Tanks WTP to Mobile due to the various production and deliveries of water along the pipeline route. The material planned for the route is ductile iron. Velocities in the main line range from 3.4 to 5.4 feet per second, and pressures vary from 25.97 to 72.99 psi. The size of pipe ranges from 30-inches, to 54-inches in diameter which is the equivalent of $74.30 to $245.76 per lineal foot.

Like Table 5-1, the main line connections are provided below along with the pipe sizes needed for the various stretches of the pipeline route and the cost per lineal foot of the various sizes needed.

Table 5-2 Pipeline Sizes and Pipe Cost Associated with the Main Trunk Line.

Main Line Trunk Connections	Pipe Size Diameter (inches)	Pipe Cost ($/Lin. Ft)
White Tanks WTP & Reservoir to Arizona Water (2025)	54	245.76
Arizona Water Turnout to Westpac Reservoir (2025)	54	245.76
Westpac Reservoir to Connection w/Main Line (2015)	54	245.76
Combined Adaman, LPSCO, Site 21 & 18 to the interconnect w/the White Tanks/CAP Main Line (2010)	30	74.30
From the CAP Main Line Junction to the Turnout for Buckeye, Global Water and Site 11 (2010)	54	245.76
From the turnout to Buckeye, Global, and Site 11 to the WPA2 wells and Site 12 Reservoir (2010)	42	133.31
From theWPA2 Wells/Site 12 to the Turnout for Site 7, 8, the Avondale Facility and Gila River Reservoir. (2010)	42	133.31
From the Gila River Res., Site 7, 8, and the Avondale Water Facility to Kings Ranch Reservoir (2010)	54	245.76
Kings Ranch Reservoir to Site 13 Reservoir (2010)	48	212.45
Site 13 to Rainbow Valley Reservoir (2010)	48	212.45
Rainbow Valley Reservoir to Waterman Facilities (2015)	30	74.30
From Waterman Facilities to the Turnout for Zone 3 and Zone ¾ West Reservoir (2015)	48	212.45
From Zone 3 and ¾ West Reservoir, to Zone 3/4 East Reservoir (2015)	30	74.30
From Zone ¾ East Reservoir to Estrella GWTP and Estrella Reservoir (2015)	24	56.69
From the Estrella Facilities to Sonoran Highlands (2020)	24	56.69
From Sonoran Highlands to Mobile (2035)	18	$39.29

Modeling the System

The model was assembled in the order that construction would occur. The model begins with the Adaman Mutual Facility and each successive model run was added as the flow was delivered south, with additional runs for turnout deliveries provided as they occurred. The one deviation was the assembly of the turnout for Buckeye and Global Water (a shared turnout) due to the unknown locations for each of their facilities as the model was being assembled. Their model run occurs after the model run for Booth Hills Reservoir, but prior to the assembly of the model for the White Tanks WTP (see Table A-30 and Table A-31). Since the White Tanks connection and construction along the Beardsley would occur later in time than the Goodyear system would start to be constructed, the main trunk line from Adaman Mutual to Mobile was modeled first. The model is reflective of this from Table A-1 through Table A-31. At Table A-32 the model begins to assess the hydraulic requirements from the White Tanks WTP to the Arizona Water Turnout, and to the Westpac Reservoir.

The pipeline appurtenances needed include 10 air chambers, 27 Air/Vacuum Valves, 115 gate valves, a S.C.A.D.A. system, 10 elbows, and 19 tees. The S.C.A.D.A. system is applied to the Goodyear system only due to the complexity of routing water in Goodyear. An assumption of $2,500,000 is made for a S.C.A.D.A. system, though price quotes were not obtained.

The installation of the pipeline includes other costs such as trenching, backfilling, compacting the backfill, and removing excess earth spoil. The spoil cost assumes that a haul distance is less than 2 miles from the installation of the pipeline which in rural conditions is reasonable. What is unknown is how rural these areas will be in the future when portions of the pipeline are not scheduled for construction until between 2020 and 2035. Another factor not accounted for is the cost of environmental mitigation simply because it is such an unknown factor. Whereas a trenching activity may not upset anything in the environment, removing spoil to an area close by could disrupt flora or fauna.

Jack and bore construction to bypass freeways and canals is also needed at multiple sites. The pipeline transmission system must pass under Interstate 10 twice, and also pass under the RID Canal twice. In addition, the main trunk line must pass under the Buckeye Canal. For areas south of the Gila River, State Route 238 can likely be trenched with traffic control used to close one lane at a time. However, parallel to S.R. 238 is Southern Pacific Railroad’s tracks which will necessitate a jack and bore in order to reach Booth Hills Reservoir from Mobile Reservoir. The breakdown of jack and bore construction is $240,000 for 30-inch pipe for 290 feet of construction, and $430,000 for 54-inch pipe for 290-feet of construction which includes 100-feet of pipe on either side of the infrastructure crossing for large obstructions, and 50-feet of pipe for smaller obstructions such as small canals. For smaller obstructions the cost is half of the cost mentioned above. The regional transmission system required the crossing of 3 smaller canals in the vicinity of the Beardsley Canal.

The activity for replacing or bypassing smaller utilities is a best guess since at this level of cost estimating, the replacement and bypassing of utilities is unknown. This activity is an estimate of the utilities which could be encountered along the pipeline route and is estimated at 75% of the cost to jack and bore.

Results of the Modeling Run for General Areas

Geographically the system appears as a “y” on a map. The left handle of the “y” is the portion of the main line which begins at the White Tanks plant and joins the main trunk line at Van Buren Road and Cotton Lane 1-mile east of the expected location of the Westpac Reservoir. The right hand of the “y” begins at Adaman Mutual Water Company and joins the main trunk line at Van Buren and Cotton Lane. Each handle of the “y” begins with pumped water deliveries from a storage tank. The details of these pumps and additional booster pumps needed for the system are shown below.

Table 5-3 Location, Cost of Pumps, Horsepower Output, and Total Yearly Power Needed Based on Pumping Requirements for the WESTCAPS Regional Transmission Pipeline.

Location	Pressure Head (ft)	Required Power Output (hp)	Purchase Cost ($)	Yearly Operations Cost
White Tanks WTP	30	300	$58,600	$404,000
Adaman Mutual WTP	60	140	$31,100	$192,300
Gila River GWTP	60	425	$98,100	$581,500
Site 13 Reservoir	40	230	$47,700	$315,000
Rainbow Valley Reservoir	40	230	$47,700	$315,000
Concord Rd & S. Estrella Pkwy.	60	230	$47,700	$313,000
Zone 3 Reservoir	60	90	$21,350	$121,500
½-mile west of S. Estrella Pkwy & Queen Creek Road, Sta. 150+50	105	250	$49,400	$340,500
½-mile south of Concord Rd. between Bullard & Litchfield Rd., Sta. 173+00	20	30	$9,700	$35,000
Estrella WTP	50	65	$16,850	$40,000
1-mile south of Patterson between Bullard & Litchfield Rd., Sta. 198+00	40	50	$15,150	$72,000
Sonoran Highlands Reservoir	120	60	$16,850	$84,300
Gas Pipeline Rd. between Schrader Ln. & Parker Wash Rd., Sta. 232+50	110	55	$15,150	$78,000
Mobile Reservoir, Sta. 256+00	230	11	$5,500	$15,000
Total			**$480,850**	**$2,907,100**

Note in the above table that other than the White Tanks, Adaman Mutual WTP, Gila River GWTP, and the Estrella WTP that all other deliveries are booster pumps which are needed south of the Gila River. Overall construction costs for the system are provided below.

Table 5-4 Itemization of Costs for Construction Activities Associated with the Construction of the Regional Transmission Pipeline.

Activity	Pipeline Costs ($)
Pipe Costs (including installation, but not appurtenances)	$65,014,947
Pipeline Appurtenances	$4,805,750
Booster Pumps	$480,850
Pumping Facilities (Housing)	$6,309,250
Pipeline Trenching and General Excavating	$4,995,599
Backfilling Operation	$847,165
Compacting Backfill	$1,218,992
Removing Spoil (less than 2 mile haul)	$1,681,273
Urban Area Costs (AC pavement, bedding, traffic control)	$10,625,020
Jack and Bore (mobilizing, two I-10 x-ings, two RID x-ings, etc.)	$3,016,188
Combination of Replacing or Bypassing Smaller Utilities	$1,967,079
Total of Activities	**$100,962,093**

The price and installation for the pipeline can be determined by adding the costs for all of the reaches shown from Table A-1 to Table A-34. In these tables, the unit cost for pipe does not match the price of the entire pipe reach when the unit cost is multiplied by 500-feet. The reach of pipe includes a factor for the installation which varies depending on the size of pipe and ranges from $5.28 per foot for 4-inch pipe to $60.90 per foot for 64-inch pipe.

A phenomenon encountered during the modeling was that lower sized pipes encountered higher friction losses than larger sized pipes. For example, a 16-inch pipe flowing at 3.3 feet per second creates a 1.18 foot per 500-foot friction loss versus a 30-inch pipe flowing at 4.3 feet per second which creates a 0.39 foot per 500-foot loss. Higher friction losses add to the expense of purchasing booster equipment and add to operating expenses through higher energy costs. Where friction losses were noticeably high, two model runs were attempted in order to determine the less expensive option for water delivery. In some cases, when a larger sized pipe was modeled, the extra expense of the pipe offset the expense of purchasing booster pumping equipment and the additional operating expenses (generally the offset was paid back within 3 to 9 years). Most of the smaller pipe was needed toward the far southern end of the system in Rainbow Valley and the Mobile area.

Except for operating pressures at the start of each “y” for the transmission line, booster pumps were unnecessary in areas north of the Gila River. For areas south of the Gila River, booster pumping was necessary to deliver water toward Rainbow Valley and Mobile since the ground naturally slopes upward as it moves away from the Gila River. Mobile’s elevation is 416-feet higher than the elevation at the south bank of the Gila River at the site of the expected King’s Ranch Reservoir. The cost of the pumps and the facilities needed for the pumps in order to provide water south of the Gila River are $352,000 and $4,370,000 respectively. These costs equate to roughly three-quarters of the total cost needed for pumping water, yet eventually the area accounts for slightly more than half of the total water delivery.

The most detailed estimate of the price of the west valley regional transmission system is provided in Table 5-5 which provides the cost for specific components. The total price for construction is $154,308,000 which does not include the cost of reservoirs, the cost of wheeling water in the Beardsley, or the cost of treatment at the White Tanks WTP. The yearly operating costs which include energy and maintenance costs are $4,254,000.

Cost Summary by Water Provider

The costs presented are itemized for each water provider. The differences in costs are due to the quantity of water the provider is taking delivery of, and also of note is the fact that Arizona-Water Company, Avondale, Buckeye, and Global Water Company are taking delivery of CAP water only, while Goodyear is melding their groundwater system with the delivery of CAP water. It is in fact Goodyear's planning of large volumes of water delivery which has dictated many of the pipeline alignments presented thus far. The layout presented would eventually lead to a modification in costs for the Buckeye/Global Water Turnout at Yuma Road. The costs provided initially are for the layout as presented in Figures 5-1 and 5-2, with an explanation of the correction which follows in their section.

In order to calculate the cost for each provider in terms of dollars per acre-foot, other operations costs are needed in order to make this determination. These costs include the wheeling fee for transporting water in the Beardsley Canal, the cost to provide treatment at the White Tank facility, the cost of purchasing CAP water, and the cost of energy to pump the water from the White Tank facility.

The costs for each of these items are the following. The wheeling fee for water delivery in the Beardsley Canal is $30 per acre-foot. Maricopa Water District's fee is based on the length of delivery which includes taking a smaller delivery at the turnout due to evaporation and other losses.

The cost for providing treatment at the White Tank plant is $400 per acre-foot. This is the equivalent of 1/10 of 1 cent per gallon for treatment.

The cost of purchasing municipal and industrial water from the Central Arizona Project (CAP) in 2009 is $108 per acre-foot. This rate is based on a fee schedule adopted by the CAP Board on June 19, 2008, and amended on June 4, 2009. The fee schedule is entitled Final 2009/2010 Rate Schedule.

Energy costs are $0.145 per kilowatt hour. 1-watt is the equivalent of 0.7375 foot-pounds per second. The formula for calculating foot-pounds per second when displacing water involves a formula which multiplies the volume of water pumped times the density of water times the lift necessary (or pressure) to move the water, divided by the efficiency of the pump since the pump cannot convert all of the energy given to it for displacing water.

The following are the individual cost summaries for the stakeholder water providers or cities.

Figure 5-1 WESTCAPS Regional Transmission Pipeline Infrastructure Map – Proposed Schedule

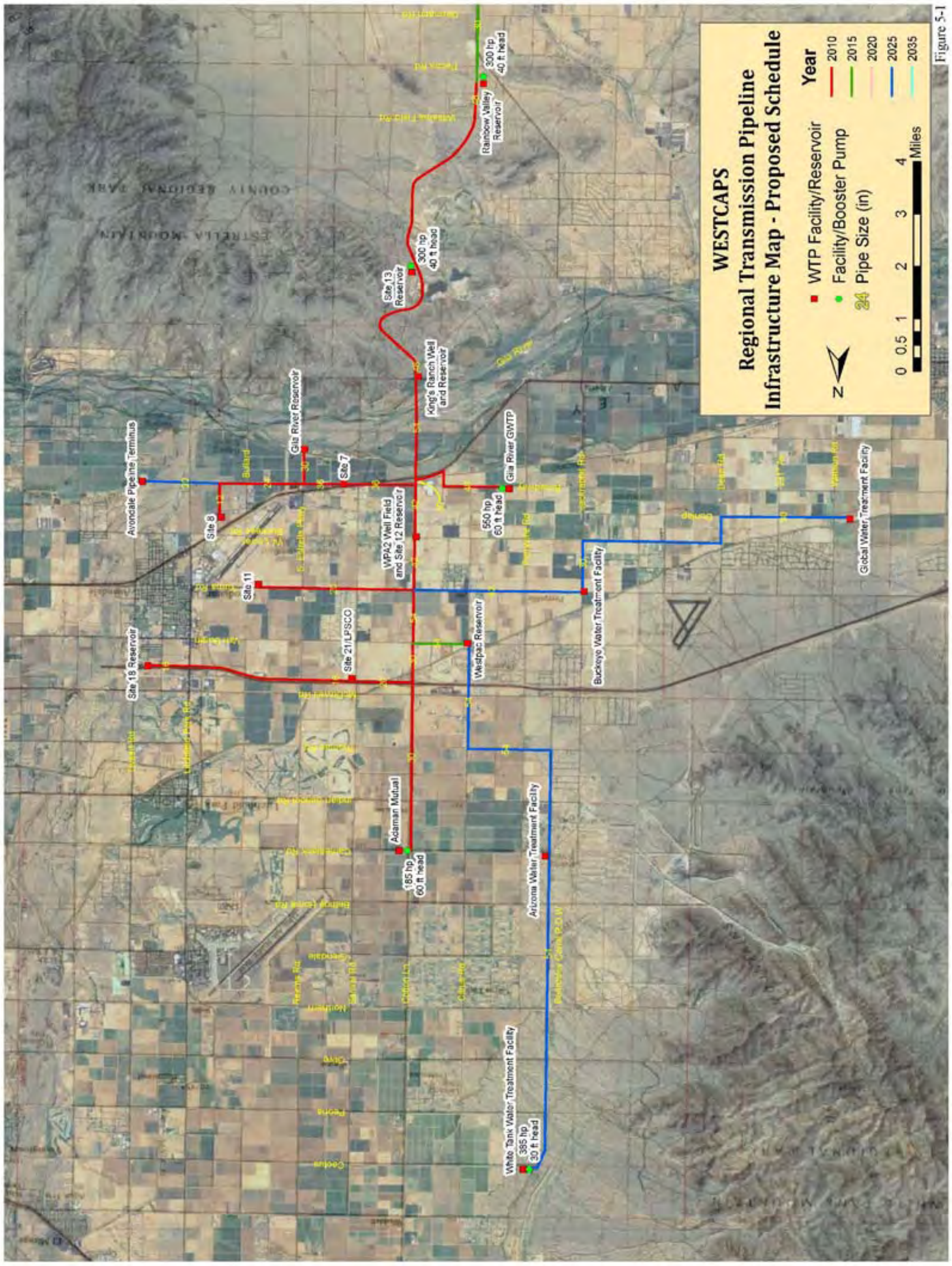
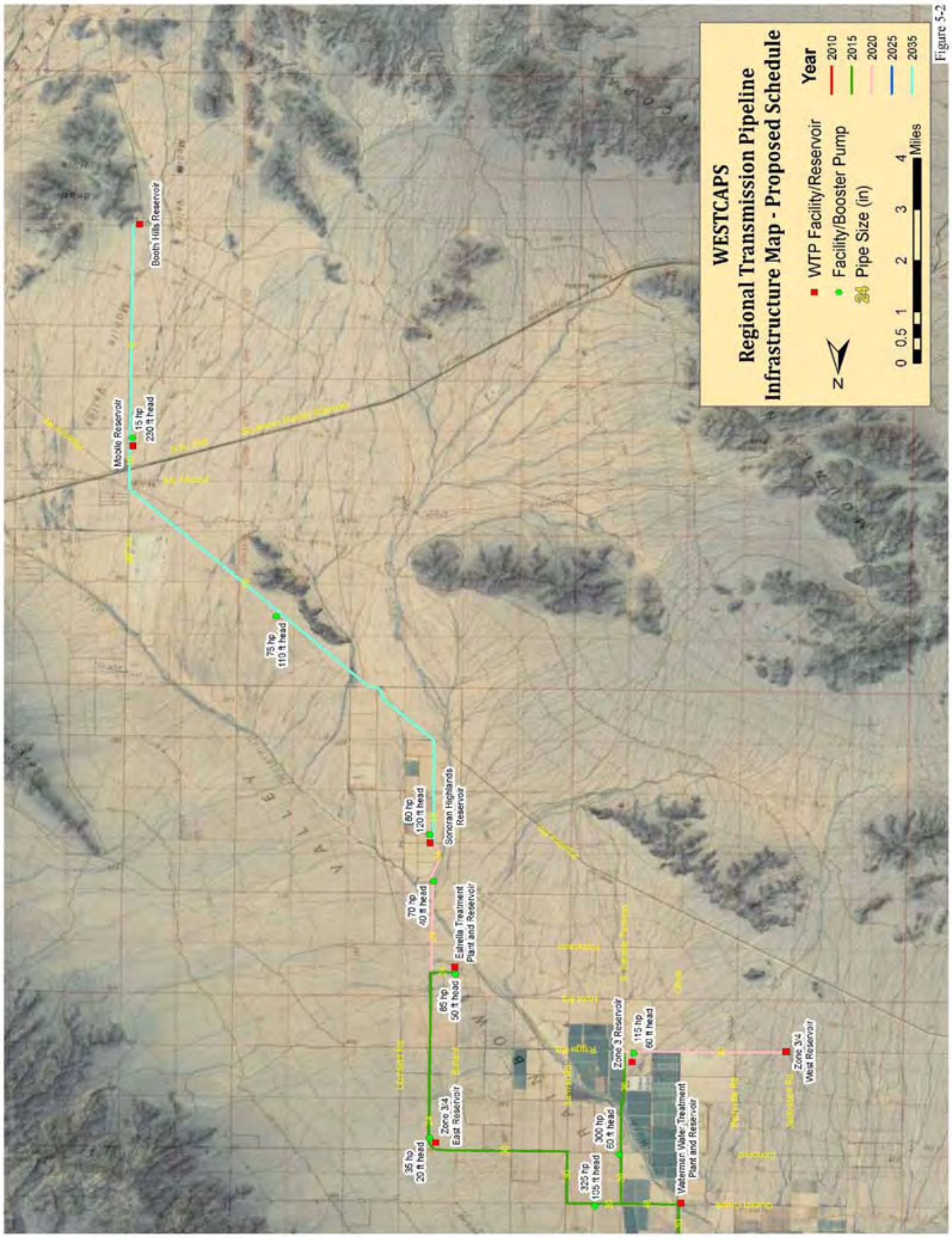


Figure 5-2 WESTCAPS Regional Transmission Pipeline Infrastructure Map – Proposed Schedule



Cost Summary for Arizona-Water Company

Arizona-Water's CAP delivery was modeled to reflect a delivery of 968 acre-feet per year. The cost to deliver CAP water to Arizona-Water is reflected as a portion of the costs shown in Table A-32. The table does not include wheeling costs by MWD, or treatment costs at the White Tanks WTP (see Table 5-7 for these costs). The total delivery for the modeling run in Table A-32 is 42 mgd, and Arizona-Water's delivery is 0.864 mgd which represents 2.057% of the total water delivery.

The following table reflects the costs to Arizona-Water for taking delivery of CAP water.

Table 5-5 Construction, Operations and Maintenance, and Delivery Costs for Arizona-Water Company in order to Receive 968 Acre-Feet per Year of Central Arizona Project Water.

Note: 2009 Costs, Reference Table A-32.

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Installation/Facilities		
Pipeline	$197,469	$2,567
Pumps	$1,205	$8,324
Pump Housing Facilities	$18,082	$235
Electronic Controls for Facilities	$452	$6
Earthwork	$21,065	$274
Urban Area Costs	0	0
Jack and Bore	$5,086	N/A
Small Utilities	$3,317	N/A
Subtotal	**$246,676**	**$11,406**
Pipeline Appurtenances		
Air Chamber	$1,029	$13
Air/Vacuum Valve	$43	$1
Gate Valves	$3,816	$79
Pressure Reducing Valves	0	0
S.C.A.D.A.	0	0
Elbows (2 needed)	$453	N/A
Tees	0	N/A
Subtotal	**$5,341**	**$93**
General Expenses		
Mobilization	$12,601	
Contingencies	$52,924	
Engineering and Administration	$63,508	
Land (Easement)	$959	
Facilities Building	$50,000	$4,000

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Subtotal	**$179,992**	**$4,000**
Total Capital Costs	**$432,009**	**$15,499**
Beardsley Canal Transportation	$29,040	
Treatment Costs @ White Tanks WTP	$387,200	
CAP Water Expense ('09 rate)	$104,544	
Yearly Operations Costs (right column)	$15,499	
Yearly Operations & Maint. Costs	**$536,283**	

Arizona-Water benefits not only from regional cooperation, but in addition the alignment of the left "y" of the main trunk line is located within Arizona-Water's service area.

The following table summarizes Arizona-Water's cost in terms of cost per ac-ft and cost per 1,000 gallons.

Table 5-6 Amortized Capital Costs – 20 Years – with a Municipal Capital Recovery Factor Equal to 0.0769.

Note: Based on 4.5% Bonding Rate and 20 Year Financing for Arizona-Water Company's Share of the West Valley Regional Transmission Pipeline.

Table(s)	Annualized Capital[1]	O&M[2]	Total Annual Cost*	Cost/ac-ft**	Cost/1,000 gallons
A-32	$33,222	536,283	$569,505	$588	$1.81

*** -** Total Annual Cost is the annualized capital plus the O&M Cost.

**** -** The cost is based on the overall delivery of 968 acre-feet per year.

Cost Summary for the City of Avondale

Avondale's CAP delivery was modeled to reflect a delivery of 5,936 acre-feet per year. The cost to deliver CAP water to Avondale is reflected as a portion of the costs shown in Tables A-5, 7, 8, 9, 10, 12, 14, 32, 33, and 34. When tracking the flow, the tables in order of flow are Tables A-32, 33, 34, 5, 7, 8, 9 10, 12, and 14. Avondale would pay a fraction of the total cost represented in each table except for Table A-14 which is a dedicated line for Avondale (see Table 5-7 for the fraction that Avondale would pay for each pipeline section). Avondale's share of the cost of each table is represented in the table below since their share varies with the delivery of section of pipeline.

Table 5-7 Total Flows Versus Avondale's Flow and the Representative Share of the Cost for Avondale for Individual Sections of Pipeline.

Reference Table	Total Flow (MGD)	Avondale's Flow (MGD)	Fractional Share Paid by Avondale
A-5	41.516	5.299	12.764%

[1]Annualized Capital is the total capital costs from Table 5-6 multiplied by the capital recovery factor.
[2] The O&M value is derived from Table 5-6 as the yearly operations and maintenance costs.

Reference Table	Total Flow (MGD)	Avondale's Flow (MGD)	Fractional Share Paid by Avondale
A-7	19.932	5.299	26.585%
A-8	25.399	5.299	20.863%
A-9	17.149	5.299	30.900%
A-10	15.529	5.299	34.123%
A-12	6.799	5.299	77.938%
A-14	5.299	5.299	100%
A-32	42.0	5.299	12.617%
A-33	41.136	5.299	12.882%
A-34	36.546	5.299	14.50%

In general, as the flow moves from Table 32 to Table 14, it makes sense that a larger share of the flow dedicated in the line belongs to Avondale. It is expected that the final segments of pipeline would be nearly, or completely, owned by Avondale. This is the case for Tables A-12 and A-14.

The following table summarizes the costs for each reference table so that total costs can be more easily accounted for.

Table 5-8 Summary of Cost Components by Reference Table for the City of Avondale for Installation/Facilities Items.

Ref. Table	Pipeline	Pumps	Pump Facility	Elec. Controls	Earth-work	UA Costs	Jack/ Bore	Small Utils.
A-5	$194,154	0	0	0	$20,711	0	0	0
A-7	$273,408	0	0	0	$36,697	0	0	0
A-8	$169,103	0	0	0	$82,651	$59,954	0	0
A-9	$302,452	0	0	0	$61,874	$19,096	0	0
A-10	$178,928	0	0	0	$25,307	0	0	0
A-12	$563,962	0	0	0	$89,880	0	0	0
A-14	$369,736	0	0	0	$65,233	0	0	0
A-32	$1,211,131	$7,394	$110,903	$2,773	$129,195	0	$31,196	$20,345
A-33	$1,103,400	0	0	0	$229,158	$111,455	$211,110	$137,512
A-34	$207,712	0	0	0	$22,157	0	0	0
Totals	**$4,573,986**	**$7,394**	**$110,903**	**$2,773**	**$762,863**	**$190,505**	**$242,306**	**$157,857**

In addition to the installation and facility items, the share of the costs of pipeline appurtenances is needed. The specific items and those costs to Avondale are provided in the table below.

Table 5-9 Summary of Cost Components by Reference Table for the City of Avondale for Regional Transmission Pipeline Appurtenance Items.

Note: **Includes Land Easement Expense.**

Ref. Table	Air Chamber	Air/Vacuum Valve	Gate Valves	Elbows	Tees	Land Easement
A-5	0	0	$3,382	0	0	$943
A-7	0	0	$5,051	0	0	$2,250
A-8	0	0	$3,964	0	0	$1,392
A-9	0	$108	$4,635	0	$4,635	$3,104
A-10	0	$119	0	0	0	$1,836
A-12	0	$273	$6,040	0	0	$9,617
A-14	0	$350	$4,750	0	$15,000	$8,107
A-32	$6,309	$265	$23,405	$2,776	0	$5,883
A-33	0	$180	$20,482	$2,834	0	$5,360
A-34	0	0	0	$1,595	$2,175	$1,009
Totals	**$6,309**	**$1,295**	**$71,709**	**$7,205**	**$21,810**	**$39,501**

The following table reflects the costs to Avondale for taking delivery of CAP water.

Table 5-10 Construction, Operations and Maintenance, and Delivery Costs for the City of Avondale in order to Receive 5,936 Acre-Feet per Year of Central Arizona Project Water.

Note: 2009 Costs, Reference Tables A-5, 7, 8, 9, 10, 12, 14, 32, 33, 34.

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Installation/Facilities		
Pipeline	$4,573,986	$59,462
Pumps	$7,394	$51,644
Pump Housing Facilities	$110,903	$1,442
Electronic Controls for Facilities	$2,773	$36
Earthwork	$762,863	$9,917
Urban Area Costs	$190,505	$2,477
Jack and Bore	$242,306	N/A
Small Utilities	$157,857	N/A
Subtotal	**$6,048,587**	**$124,978**
Pipeline Appurtenances		
Air Chamber	$6,309	$82
Air/Vacuum Valve	$1,295	$17
Gate Valves	$71,709	$932
Pressure Reducing Valves	0	0
S.C.A.D.A.	0	0

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Elbows (5 needed)	$7,205	N/A
Tees (3 needed)	$21,810	N/A
Subtotal	**$108,328**	**$1,031**
General Expenses		
Mobilization	$307,846	
Contingencies	$1,292,952	
Engineering and Administration	$1,551,543	
Land (Easement)	$39,501	
Facilities Building	$100,000	$8,000
Subtotal	**$3,291,842**	**$8,000**
Total Capital Costs/O&M Costs	**$9,448,757**	**$134,009**
Beardsley Canal Transportation	$178,080	
Treatment Costs @ White Tanks WTP	$2,374,400	
CAP Water Expense ('09 rate)	$641,088	
Yearly Operations Costs (right column)	$134,009	
Yearly Operations & Maint. Costs	**$3,327,577**	

The cost of a pressure reducing valve is omitted from Table 5-10 because only 1 pressure reducing valve is needed for the system which is located in the Goodyear service area.

The following table summarizes Avondale's costs in terms of cost per ac-ft and cost per 1,000 gallons.

Table 5-11 Amortized Capital Costs – 20 Years – with a Municipal Capital Recovery Factor Equal to 0.0769.

Note: Based on 4.5% Bonding Rate and 20 Year Financing for the City of Avondale's Share of the West Valley Regional Transmission Pipeline.

Table(s)[3]	Annualized Capital[4]	O&M[5]	Total Annual Cost*	Cost/ac-ft**	Cost/1,000 gallons
see foot note	$726,609	$3,327,577	$4,054,186	$683	$2.10

***** - Total Annual Cost is the annualized capital plus the O&M Cost.

****** - The cost is based on the overall delivery of 5,936 acre-feet per year.

[3] The tables to reference are Tables A-5, 7, 8, 9, 10, 12, 14, 32, 33, and 34.
[4] Annualized Capital is the total capital costs from Table 5-11 multiplied by the capital recovery factor.
[5] The O&M value is derived from Table 5-11 as the yearly operations and maintenance costs.

The additional cost to Avondale is based on the additional distance of having to deliver water. The expense of having larger volumes of water delivered are not much greater than delivering lesser volumes of water, and the larger volume of water can offset the per gallon expense. In this case it does not as the distance is greater than the volume of water which could help to offset costs.

Cost Summary for the City of Buckeye

Buckeye's portion of their water (CAP) delivery is shown in Table 5-12 which is equivalent to 7,476 acre-feet per year. The cost to deliver CAP water to Buckeye is reflected as a portion of the costs shown in Tables A-5, 30, 32, 33, and 34 in the appendix. The tables in the order that water flows from the White Tanks plant south are Tables A-32, 33, 34, 5, and 30. Buckeye would pay the representative fraction of the total cost of each table. Buckeye's share of the cost is represented in the table below since their share varies with the overall delivery of specific sections of pipeline.

Table 5-12 Total Flows Versus Buckeye's Flow and the Representative Share of the Cost for Buckeye for Individual Sections of Pipeline.

Reference Table	Total Flow (MGD)	Buckeye's Flow (MGD)	Fractional Share Paid by Buckeye
A-5	41.516	6.674	16.075%
A-30	17.833	6.674	37.425%
A-32	42.0	6.674	15.890%
A-33	41.136	6.674	16.224%
A-34	36.546	6.674	18.262%

Buckeye does not have any portion of a pipeline segment dedicated to them since they are an in-line delivery and not a final turnout. The pipeline associated with Table A-30 is the largest fractional ownership for Buckeye because the line is dedicated only to Buckeye and Global Water Company.

The following table summarizes the costs for each reference table so that total costs can be more easily calculated.

Table 5-13 Summary of Cost Components by Reference Table for the City of Buckeye for Installation/Facilities Items.

Ref. Table	Pipeline	Pumps	Pump Facility	Elec. Controls	Earth-work	UA Costs	Jack/ Bore	Small Utils.
A-5	$244,517	0	0	0	$26,083	0	0	0
A-30	$1,027,460	0	0	0	$137,908	0	0	0
A-32	$1,525,313	$9,312	$139,673	$3,492	$162,710	0	$39,288	$25,623
A-33	$1,389,657	0	0	0	$288,609	$140,370	$265,554	$173,187
A-34	$261,602	0	0	0	$27,906	0	0	0
Totals	**$4,448,549**	**$9,312**	**$139,673**	**$3,492**	**$643,216**	**$140,370**	**$304,842**	**$198,810**

In addition to the installation and facility items, the share of the costs of pipeline appurtenances is needed. The specific items and those costs to Buckeye are provided in the table below.

Table 5-14 Summary of Cost Components by Reference Table for the City of Buckeye for Regional Transmission Pipeline Appurtenance Items (Includes Land Easement Expense).

Ref. Table	Air Chamber	Air/Vacuum Valve	Gate Valves	Elbows	Tees	Land Easement
A-5	0	0	$4,260	0	$5,614	$1,188
A-30	0	$786	$21,332	$4,117	0	$8,457
A-32	$7,945	$334	$29,476	$3,496	0	$7,410
A-33	0	$227	$25,796	$3,569	0	$6,751
A-34	0	0	0	$2,009	$2,739	$1,271
Totals	**$7,945**	**$1,347**	**$80,864**	**$13,191**	**$8,353**	**$25,077**

The above costs are determined based on the share of water being delivered for Buckeye in relation to the overall volume of water being delivered. The cost of the tee for Table A-5 ($5,614) is not based on the 16% percent listed in Table 5-12 since the tee is only in place because Buckeye and Global Water require a lateral turnout. The true cost is the actual cost of the tee which is shared with Global Water Company.

The detailed costs determined above allows for the calculation of overall construction, operations, and maintenance costs which is shown in Table 5-15 below.

Table 5-15 Construction, Operations and Maintenance, and Delivery Costs for the City of Buckeye in order to Receive 7,476 Acre-Feet per Year of Central Arizona Project Water .

Note: 2009 Costs, Reference Tables A-5, 30, 32, 33, 34.

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Installation/Facilities		
Pipeline	$4,448,549	$57,831
Pumps	$9,312	$64,294
Pump Housing Facilities	$139,673	$1,816
Electronic Controls for Facilities	$3,492	$45
Earthwork	$643,216	$8,362
Urban Area Costs	$140,370	$1,825
Jack and Bore	$304,842	N/A
Small Utilities	$198,810	N/A
Subtotal	**$5,888,264**	**$134,173**
Pipeline Appurtenances		
Air Chamber	$7,945	$103
Air/Vacuum Valve	$1,347	$18
Gate Valves	$80,864	$1,051
Pressure Reducing Valves	0	0
S.C.A.D.A.	0	0
Elbows (6 needed)	$13,191	N/A
Tees (2 needed)	$8,353	N/A
Subtotal	**$111,700**	**$1,172**
General Expenses		
Mobilization	$299,998	
Contingencies	$1,259,992	
Engineering and Administration	$1,511,990	
Land (Easement)	$25,077	
Facilities Building	$100,000	$8,000
Subtotal	**$3,197,057**	**$8,000**
Total Capital Costs/O&M Costs	**$9,197,021**	**$143,345**
Beardsley Canal Transportation	$224,280	
Treatment Costs @ White Tanks WTP	$2,990,400	
CAP Water Expense ('09 rate)	$807,408	
Yearly Operations Costs (right column)	$143,345	
Yearly Operations & Maint. Costs	**$4,165,433**	

The following table summarizes Buckeye's costs in terms of cost per ac-ft and cost per 1,000 gallons.

Table 5-16 Amortized Capital Costs – 20 Years – with a Municipal Capital Recovery Factor Equal to 0.0769.

Note: Based on 4.5% Bonding Rate and 20 Year Financing for the City of Buckeye's Share of the West Valley Regional Transmission Pipeline.

Table(s)[6]	Annualized Capital[7]	O&M[8]	Total Annual Cost*	Cost/ac-ft**	Cost/1,000 gallons
see foot note	$707,251	$4,165,433	$4,872,684	$652	$2.00

***** - Total Annual Cost is the annualized capital plus the O&M Cost.

****** - The cost is based on the overall delivery of 7,476 acre-feet per year.

The costs relative to other water providers are only slightly more expensive overall, but because Buckeye is having more water delivered to it, the cost per acre foot is slightly more economical.

It appears that Buckeye's overall costs could be reduced by a more direct pipeline route to Buckeye's facility than the current plan being shown. From Thomas Road and the Beardsley Canal, the transmission pipeline alignment shown is constructed toward the east. For Buckeye the preferred alignment from this intersection would be to have the pipeline directed south. The easterly alignment currently shown takes an 8 mile loop before it reaches Buckeye. A more direct path would only be a 3 mile course. As shown, Buckeye pays for an additional 5 miles of pipeline that isn't needed. The benefit Buckeye receives from the longer loop is that 5 of the 8 miles of pipeline are cost shared with other water providers. Should Buckeye opt for the more direct route of only 3 miles, Buckeye (and Global Water) would find themselves paying for the more expensive I-10 and Roosevelt Irrigation District Canal crossings on their own.

Taking into account overall costs, it appears intuitive that there is a cost benefit of taking the more direct route even by having to cross infrastructure and pay it on their own. If the pipeline from the main trunk line to Buckeye's water treatment facility was rotated from the treatment facility and pointed northward, the route would nearly intersect the main trunk line at the Beardsley Canal. It appears that an additional half-mile would be required to extend the pipeline to reach the main trunk line near the Beardsley Canal if the line were directed northward. A rough recalculation of the costs therefore becomes relatively easy and is approximated below.

In order to extend the pipeline to Buckeye by half a mile, the costs associated with that section of pipe would increase by 17%. In addition, 64% percent of the cost of the main trunk line from the Arizona-Water Company to the Westpac Reservoir can be eliminated. Tables 5-13 and 5-14 from above are adjusted for the increased cost of extending the

[6] The tables to reference are Tables A-5, 30, 32, 33, and 34.
[7] Annualized Capital is the total capital costs from Table 5-15 multiplied by the capital recovery factor.
[8] The O&M value is derived from Table 5-15 as the yearly operations and maintenance costs.

pipeline (reference Table A-30), and the costs associated with the loop to deliver water are eliminated (part of reference Tables A-33, and all of A-5 and 34). Buckeye and Global Water would assume the full cost of jacking and boring to reach their infrastructure.

These costs are estimated as $993,300 and $662,200 for the jack and bore and small utilities costs respectively. Buckeye's share is shown in Table 5-17 below.

Table 5-17 Adjusted Cost Summary of Cost Components by Reference Table for the City of Buckeye for Installation/Facilities Items for a Direct Pipeline Route.

Ref. Table	Pipeline	Pumps	Pump Facility	Elec. Controls	Earth-work	UA Costs	Jack/ Bore	Small Utils.
A-30	$1,199,853	0	0	0	$161,047	0	$371,743	$247,828
A-32	$1,525,313	$9,312	$139,673	$3,492	$162,710	0	$39,288	$25,623
A-33	$505,330	0	0	0	$104,949	$51,044	0	0
Totals	**$3,230,496**	**$9,312**	**$139,673**	**$3,492**	**$428,706**	**$51,044**	**$411,031**	**$273,451**

In addition to the installation and facility items, the share of the costs of pipeline appurtenances is needed. The specific items and those costs to Buckeye are provided in the table below.

Table 5-18 Adjusted Summary of Cost Components by Reference Table for the City of Buckeye for Regional Transmission Pipeline Appurtenance Items.

Note: Includes Land Easement Expense for a More Direct Route.

Ref. Table	Air Chamber	Air/Vacuum Valve	Gate Valves	Elbows	Tees	Land Easement
A-30	0	$918	$24,911	$4,808	$5,606	$9,876
A-32	$7,945	$334	$29,476	$3,496	0	$7,410
A-33	0	$227	$9,380	$1,298	0	$2,389
Totals	**$7,945**	**$1,479**	**$63,767**	**$9,602**	**$5,606**	**$19,675**

A cost summary is shown below for the adjustment of delivering water to Buckeye more directly from the most southerly point of the Beardsley Canal pipeline alignment.

Table 5-19 Adjustment in the Construction, Operations and Maintenance, and Delivery Costs for the City of Buckeye in order to Receive 7,476 Acre-Feet per Year of Central Arizona Project Water.

Note: (2009 Costs, Reference Tables A-30, 32, 33). The Adjustment is Related to Taking a Shorter Pipeline Route than the Route Shown in Figure 5-1 (see explanation in paragraphs above).

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Installation/Facilities		
Pipeline	$3,230,496	$41,996
Pumps	$9,312	$64,294
Pump Housing Facilities	$139,673	$1,816
Electronic Controls for Facilities	$3,492	$45
Earthwork	$428,706	$5,573
Urban Area Costs	$51,044	$664
Jack and Bore	$411,031	N/A
Small Utilities	$273,451	N/A
Subtotal	**$4,547,205**	**$114,388**
Pipeline Appurtenances		
Air Chamber	$7,945	$103
Air/Vacuum Valve	$1,479	$19
Gate Valves	$63,767	$829
Pressure Reducing Valves	0	0
S.C.A.D.A.	0	0
Elbows	$9,602	N/A
Tees	$5,606	N/A
Subtotal	**$88,399**	**$951**
General Expenses		
Mobilization	$231,780	
Contingencies	$973,477	
Engineering and Administration	$1,168,172	
Land (Easement)	$19,675	
Facilities Building	$100,000	$8,000
Subtotal	**$2,493,104**	**$8,000**
Total Capital Costs/O&M Costs	**$7,128,708**	**$123,339**
Beardsley Canal Transportation	$224,280	
Treatment Costs @ White Tanks WTP	$2,990,400	
CAP Water Expense ('09 rate)	$807,408	
Yearly Operations Costs (right column)	$123,339	
Yearly Operations & Maint. Costs	**$4,145,427**	

The above adjustments were not created through detailed calculation the way the previous analysis was conducted. Based on this rough adjustment, it appears that Buckeye could save about $2 million in overall costs by not cost sharing in the loop delivery, but by sharing costs with Global Water and taking the more direct delivery. A more thorough planning study with real alignments would need to be undertaken to have more confidence in the adjusted costs.

The following table summarizes Buckeye's adjusted costs for the new alignment in terms of cost per ac-ft and cost per 1,000 gallons.

Table 5-20 Adjusted Amortized Capital Costs – 20 Years – with a Municipal Capital Recovery Factor Equal to 0.0769.

Note: Based on 4.5% Bonding Rate and 20 Year Financing for the City of Buckeye's Share of the West Valley Regional Transmission Pipeline.
These Estimates are for the Shorter Alignment.

Table(s)[9]	Annualized Capital[10]	O&M[11]	Total Annual Cost*	Cost/ac-ft**	Cost/1,000 gallons
see foot note	$548,198	$4,145,427	$4,693,625	$628	$1.93

*** -** Total Annual Cost is the annualized capital plus the O&M Cost.
**** -** The cost is based on the overall delivery of 7,476 acre-feet per year.

Comparing the values for Buckeye in Table 5-20 versus costs for the longer pipeline in Table 5-16, Buckeye can save of over $2 million in construction costs and $24 per acre foot by opting for the shorter pipeline. Although some costs are higher for this option, most costs are lower when a pipeline is shortened. Undoubtedly Buckeye would choose some shorter pipeline route other than the current one portrayed in Figure 5-1. The costs provided in Table 5-19 and 5-20 are for the pipeline route explained on the previous pages.

Cost Summary for Global Water Company

Global Water's portion of their water (CAP) delivery is shown in Table 5-21 which is equivalent to 12,500 acre-feet per year. The cost to deliver CAP water to Global Water is reflected as a portion of the costs shown in Tables A-5, 30, 32, 33, and 34, and all of the costs associated with Table A-31 in the appendix. The tables in the order that water flows from the White Tanks plant south are Tables A-32, 33, 34, 5, 30, and 31. Global Water's share of the cost is represented in the table below since their share varies with the overall delivery of specific sections of pipeline.

[9] The tables to reference are Tables A-30, 32, and 33.
[10] Annualized Capital is the total capital costs from Table 5-15 multiplied by the capital recovery factor.
[11] The O&M value is derived from Table 5-15 as the yearly operations and maintenance costs.

Table 5-21 Total Flows Versus Global Water's Flow and the Representative Share of the Cost for Global Water for Individual Sections of Pipeline.

Reference Table	Total Flow (MGD)	Global's Flow (MGD)	Fractional Share Paid by Global
A-5	41.516	11.159	26.878%
A-30	17.833	11.159	62.575%
A-31	11.159	11.159	100%
A-32	42.0	11.159	26.569%
A-33	41.136	11.159	27.127%
A-34	36.546	11.159	30.534%

Table A-31 is a line dedicated entirely to delivering Global Water's allocation from the Buckeye facility along Jackrabbit and West Lower Buckeye Roads, and thus the reason for all of the costs associated with this line being allocated to Global.

The following table summarizes the costs for each reference table so that total costs can be more easily calculated.

Table 5-22 Summary of Cost Components by Reference Table for the Global Water Company for Installation/Facilities Items.

Ref. Table	Pipeline	Pumps	Pump Facility	Elec. Controls	Earth-work	UA Costs	Jack/ Bore	Small Utils.
A-5	$408,842	0	0	0	$43,613	0	0	0
A-30	$1,717,923	0	0	0	$230,584	0	0	0
A-31	$3,436,875	0	0	0	$534,559	0	0	0
A-32	$2,550,411	$15,569	$233,542	$5,839	$272,060	0	$65,692	$42,843
A-33	$2,323,547	0	0	0	$482,563	$234,703	$444,013	$289,574
A-34	$437,398	0	0	0	$46,659	0	0	0
Totals	**$10,874,996**	**$15,569**	**$233,542**	**$5,839**	**$1,610,038**	**$234,703**	**$509,705**	**$332,417**

In addition to the installation and facility items, the share of the costs of pipeline appurtenances is needed. The specific items and those costs to Global Water are provided in the table below.

Table 5-23 Summary of Cost Components by Reference Table for Global Water Company for Regional Transmission Pipeline Appurtenance Items.

Note: Includes Land Easement Expense.

Ref. Table	Air Chamber	Air/Vacuum Valve	Gate Valves	Elbows	Tees	Land Easement
A-5	0	0	$188	0	$4,032	$1,986
A-30	0	$1,314	$35,668	$6,883	$9,386	$14,141
A-31	0	$1,400	$78,750	$33,000	0	$46,631
A-32	$13,285	$558	$49,285	$5,845	0	$12,389
A-33	0	$380	$43,132	$5,968	0	$11,287
A-34	0	0	0	$3,359	$4,580	$2,125
Totals	**$13,285**	**$3,652**	**$207,023**	**$55,055**	**$17,998**	**$88,559**

A cost that appears to be higher for Global Water versus the other water providers is the land easement fee. This is most likely due to the longer length of pipeline that is dedicated strictly for Global. From Table 5-23, Reference Table A-31 is the dedicated line for Global and the land easement expense is more than half of the total easement cost.

The detailed costs determined in the above tables are tallied below for overall construction, operations, and maintenance costs which are shown in Table 5-24 below.

Table 5-24 Construction, Operations and Maintenance, and Delivery Costs for Global Water Company in order to Receive 12,500 Acre-Feet per Year of Central Arizona Project Water.

Note: 2009 Costs, Reference Tables A-5, 30, 31, 32, 33, 34.

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Installation/Facilities		
Pipeline	$10,874,996	$141,375
Pumps	$15,569	$107,503
Pump Housing Facilities	$233,542	$3,036
Electronic Controls for Facilities	$5,839	$76
Earthwork	$1,610,038	$20,930
Urban Area Costs	$234,703	$3,051
Jack and Bore	$509,705	N/A
Small Utilities	$332,417	N/A
Subtotal	**$13,816,809**	**$275,971**
Pipeline Appurtenances		
Air Chamber	$13,285	$173
Air/Vacuum Valve	$3,652	$47
Gate Valves	$207,023	$2,691
Pressure Reducing Valves	0	0
S.C.A.D.A.	0	0
Elbows (9 needed)	$55,055	N/A
Tees (3 needed)	$17,998	N/A
Subtotal	**$297,013**	**$2,911**
General Expenses		
Mobilization	$705,691	
Contingencies	$2,963,903	
Engineering and Administration	$3,556,683	
Land (Easement)	$88,559	
Facilities Building	$100,000	$8,000
Subtotal	**$7,414,836**	**$8,000**
Total Capital Costs/O&M Costs	**$21,528,658**	**$286,882**
Beardsley Canal Transportation	$375,000	
Treatment Costs @ White Tanks WTP	$5,000,000	
CAP Water Expense ('09 rate)	$1,350,000	
Yearly Operations Costs (right column)	$286,882	
Yearly Operations & Maint. Costs	**$7,011,882**	

The following table summarizes Global Water's costs in terms of cost per ac-ft and cost per 1,000 gallons.

Table 5-25 Amortized Capital Costs – 20 Years – with a Municipal Capital Recovery Factor Equal to 0.0769.

Note: Based on 4.5% Bonding Rate and 20 Year Financing for Global Water's Share of the West Valley Regional Transmission Pipeline.

Table(s)[12]	Annualized Capital[13]	O&M[14]	Total Annual Cost*	Cost/ac-ft**	Cost/1,000 gallons
see foot note	$1,655,554	$7,011,882	$8,667,436	$693	$2.13

***** - Total Annual Cost is the annualized capital plus the O&M Cost.

****** - The cost is based on the overall delivery of 12,500 acre-feet per year.

Global Water's cost of delivery to this point is similar to Buckeye's early costs which can be reduced by a more direct pipeline route to Global's facility than the current plan shown in Figure 5-1. From Thomas Road and the Beardsley Canal, the transmission pipeline alignment shown is planned to be constructed toward the east. For Global Water, the preferred alignment from this intersection would be to have the pipeline directed south. The easterly alignment currently shown takes an 8 mile loop before it reaches Buckeye's facility, and then ultimately Global's facility further west. A more direct path would be an approximate 3 mile course. Therefore, Global pays for an additional 5 miles of pipeline. The benefit Global receives from the longer loop is that 5 of the 8 miles of pipeline are cost shared with other water providers. Should Global (and Buckey) opt for the more direct route of only 3 miles, Global Water (and Buckeye) would find themselves paying for the more expensive I-10 and Roosevelt Irrigation District Canal crossings on their own. A rough recalculation of the costs is approximated below.

In order to extend the pipeline from the main line to Buckeye's facility, the costs associated with that section of pipe would increase by 17%. In addition, 64% percent of the cost of the main trunk line from the Arizona-Water Company to the Westpac Reservoir can be eliminated. Tables 5-22 and 5-23 from above are adjusted for the increased cost of extending the pipeline (reference Table A-30), and the costs associated with the loop to deliver water are eliminated (part of reference Tables A-33, and all of A-5 and 34). Buckeye and Global Water would assume the full cost of jacking and boring to reach their infrastructure. The costs are similar to the costs associated with Buckeye except that Global Water's share of the costs are larger because of the greater share of water they are taking delivery of, and a longer pipeline is needed to reach Global's turnout facility.

The estimated costs to jack and bore and for small utilities are $993,300 and $662,200 respectively. Globals's share is shown in Table 5-26 below.

[12] The tables to reference are Tables A-5, 30, 31, 32, 33, and 34.
[13] Annualized Capital is the total capital costs from Table 5-25 multiplied by the capital recovery factor.
[14] The O&M value is derived from Table 5-25 as the yearly operations and maintenance costs.

Table 5-26 Adjusted Cost Summary of Cost Components by Reference Table for the Global Water Company for Installation/Facilities Items for a Direct Pipeline Route.

Ref. Table	Pipeline	Pumps	Pump Facility	Elec. Controls	Earth-work	UA Costs	Jack/ Bore	Small Utils.
A-30	$2,006,166	0	0	0	$269,273	0	0	0
A-31	$3,436,875	0	0	0	$534,559	0	0	0
A-32	$2,550,411	$15,569	$233,542	$5,839	$272,060	0	$65,692	$42,843
A-33	$844,926	0	0	0	$175,478	$85,347	$621,557	$414,372
Totals	**$8,838,378**	**$15,569**	**$233,542**	**$5,839**	**$1,251,370**	**$85,347**	**$687,249**	**$457,215**

In addition to the installation and facility items, the share of the costs of pipeline appurtenances is needed. The specific items and those costs to Global Water are provided in the table below.

Table 5-27 Adjusted Cost Summary of Cost Components by Reference Table for Global Water Company for Regional Transmission Pipeline Appurtenance Items.

Note: Includes Land Easement Expense) for a Direct Pipeline Route.

Ref. Table	Air Chamber	Air/Vacuum Valve	Gate Valves	Elbows	Tees	Land Easement
A-30	0	$1,534	$41,653	$8,038	$10,961	$16,514
A-31	0	$1,400	$78,750	$33,000	0	$46,631
A-32	$13,285	$558	$49,285	$5,845	0	$12,389
A-33	0	$138	$15,684	$2,170	0	$4,104
Totals	**$13,285**	**$3,630**	**$185,372**	**$49,053**	**$10,961**	**$79,638**

The detailed costs determined in the above tables are tallied below for overall construction, operations, and maintenance costs which are shown in Table 5-28 below.

Table 5-28 Adjustment in the Construction, Operations and Maintenance, and Delivery Costs for Global Water Company in order to Receive 12,500 Acre-Feet per Year of Central Arizona Project Water.

Note: 2009 Costs, Reference Tables A-30, 31, 32, and 33).
The Adjustment is Related to Taking a Shorter Pipeline Route than the Route Shown in Figure 5-1 (see explanations in paragraphs above).

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Installation/Facilities		
Pipeline	$8,838,378	$114,890
Pumps	$15,569	$107,503
Pump Housing Facilities	$233,542	$3,036
Electronic Controls for Facilities	$5,839	$76
Earthwork	$1,251,370	$16,268
Urban Area Costs	$85,347	$1,110
Jack and Bore	$687,249	N/A
Small Utilities	$457,215	N/A
Subtotal	**$11,574,509**	**$242,883**
Pipeline Appurtenances		
Air Chamber	$13,285	$173
Air/Vacuum Valve	$3,630	$47
Gate Valves	$185,372	$2,410
Pressure Reducing Valves	0	0
S.C.A.D.A.	0	0
Elbows (8 needed)	$49,053	N/A
Tees (1 needed)	$10,961	N/A
Subtotal	**$262,301**	**$2,630**
General Expenses		
Mobilization	$591,841	
Contingencies	$2,485,730	
Engineering and Administration	$2,982,876	
Land (Easement)	$79,638	
Facilities Building	$100,000	$8,000
Subtotal	**$6,240,085**	**$8,000**
Total Capital Costs/O&M Costs	**$18,076,895**	**$253,513**
Beardsley Canal Transportation	$375,000	
Treatment Costs @ White Tanks WTP	$5,000,000	
CAP Water Expense ('09 rate)	$1,350,000	
Yearly Operations Costs (right column)	$253,513	
Yearly Operations & Maint. Costs	**$6,978,513**	

The following table summarizes Global Water's costs in terms of cost per ac-ft and cost per 1,000 gallons.

Table 5-29 Adjusted Amortized Capital Costs – 20 Years – with a Municipal Capital Recovery Factor Equal to 0.0769.

Note: (Based on 4.5% Bonding Rate and 20 Year Financing) for Global Water's Share of the West Valley Regional Transmission Pipeline.
These Estimates are for the Shorter Alignment.

Table(s)[15]	Annualized Capital[16]	O&M[17]	Total Annual Cost*	Cost/ac-ft**	Cost/1,000 gallons
see foot note	$1,390,113	$6,978,513	$8,368,626	$670	$2.05

*** -** Total Annual Cost is the annualized capital plus the O&M Cost.

**** -** The cost is based on the overall delivery of 12,500 acre-feet per year.

The costs associated with Global Water's delivery are in-line with the distance a pipeline must be constructed for Global's water delivery. Global Water can reduce their costs similar to Buckeye's modified cost structure by shortening the pipeline route. The more expensive route is shown in Figure 5-1. The shorter route is an alignment that continues to be directed south from the White Tank WTP toward the Buckeye facility. Global Water would spend nearly $3.5 million less or the equivalent of $23 less per acre foot by opting for the shorter pipeline route.

Cost Summary for the City of Goodyear

The breakdown of costs for Goodyear is similar to those for the water providers previously discussed in this chapter, but an additional component includes the delivery of groundwater. Goodyear has multiple points of water treatment and delivery and many points for the storage of the water being delivered. For a breakdown of costs, one can refer to the tables in the appendix to locate a specific pipe run, then take the table number and find these costs in tables 5-31 and 5-32 below.

Table 5-30 below is used to show the representative cost to Goodyear for each pipeline segment. The fractional share paid by Goodyear is with respect to the flow in each segment of pipeline allocated to Goodyear. The percentages are then used to calculate the representative cost to Goodyear for the construction of the pipeline. Those costs are shown in Tables 5-31 and 5-32. For example, Reference Table A-34 in Table 5-30 below shows Goodyear's share of the segment of pipeline from the Westpac Reservoir to the Main Trunk Line as 36.693%. In 2035, CAP water from the White Tank facility is delivered to the Westpac Reservoir. Goodyear's CAP delivery is 18 mgd and 4.59 mgd is delivered to the Westpac Reservoir leaving 13.41 mgd belonging to Goodyear which is pumped toward the main trunk line. The total daily volume of water being delivered from the Westpac Reservoir to the main trunk line in 2035 is 36.546 mgd. Of this

[15] The tables to reference are Tables A-5, 30, 31, 32, 33, and 34.
[16] Annualized Capital is the total capital costs from Table 5-25 multiplied by the capital recovery factor.
[17] The O&M value is derived from Table 5-25 as the yearly operations and maintenance costs.

volume, 5.299 mgd is for Avondale, 6.674 is for Buckeye, 11.159 is for Global Water, and 13.41 is for Goodyear. Goodyear's 13.41 mgd flow divided by 36.546 mgd is equal to 36.693%. Each representative cost in Table A-34 is then multiplied by 0.36693 and placed in Tables 5-31 and 5-32 below.

Prior to 2025, when Goodyear and the other entities are not taking delivery of CAP water, Goodyear plans to begin operating the Westpac Reservoir in 2015. The connection between the Westpac Reservoir and the Main trunk line would normally be constructed by Goodyear to eventually handle their future maximum capacity in that line which would be 13.41 mgd. Yet that segment of pipeline needs to be constructed for a future capacity of 36.546 mgd. The capacity needed in order to also serve Avondale, Buckeye, Global Water and Goodyear. The 10 year gap between what the pipeline should be constructed for and its ultimate use will be a challenging topic among members. On the one hand, Goodyear would not want to front the cost of a larger pipeline for which they would only ever use 36% of the capacity. On the other hand, the other water providers would not want to front the cost of a system for which they wouldn't use for another 10 years. It's possible that some financial instrument is available that would allow the entities the ability to ease into the costs, rather than pay for all of the construction 10 years sooner than needed. Municipal bonds might work to allow cities to sell, in essence, their mortgage on a system today to investors, with the cities obligation to pay back those investors over time with interest.

In the above example the total delivery in the pipeline is modeled for 41.516 mgd, yet the total for the four entities discussed above is 41.512 mgd. The 0.004 mgd difference is prevalent throughout the calculations (usually between 0.003 and 0.004 mgd) and is likely due to a rounding error when volumes were converted from acre-feet per year to million of gallons per day. Because the difference is not assigned to any one entity, the rounding error is evenly distributed among the participants in this study.

Table 5-30 Total Flows Versus the City of Goodyear's Flow and the Representative Share of the Cost for Goodyear for Individual Sections of Pipeline.

Reference Table	Total Flow (MGD)	Goodyear's Flow (MGD)	Fractional Share Paid by Goodyear
A-1	10	10	100%
A-2	5.03	5.03	100%
A-3	8.12	8.12	100%
A-4	2.76	2.76	100%
A-5	41.516	18.38	44.272%
A-6	3.75	3.75	100%
A-7	19.932	14.633	73.415%
A-8	25.399	20.1	79.137%
A-9	17.149	11.85	69.1%
A-10	15.529	10.23	65.877%
A-11	8.73	8.73	100%
A-12	6.799	1.5	22.062%
A-13	1.5	1.5	100%
A-15	8.25	8.25	100%
A-16	30.24	30.24	100%
A-17	36.973	36.973	100%
A-18	32.353	32.353	100%
A-19	24.563	24.563	100%
A-20	9.443	9.443	100%
A-21	26.413	26.413	100%
A-22	16.3	16.3	100%
A-23	6.32	6.32	100%
A-24	10.113	10.113	100%
A-25	5.42	5.42	100%
A-26	5.61	5.61	100%
A-27	5.613	5.613	100%
A-28	2.2	2.2	100%
A-29	0.2	0.2	100%
A-32	42.0	18.0	42.857%
A-33	41.136	18.0	43.757%
A-34	36.546	13.41	36.693%

The table above represents Goodyear's planning deliveries from the White Tank WTP to Booth Hill Reservoir south of Mobile. Many of the lines are dedicated entirely to Goodyear due to Goodyear's planning area reaching south across the Gila river and toward Mobile.

The following table summarizes the costs for each reference table so that total costs can be more easily accounted for.

Table 5-31 Summary of Cost Components by Reference Table for the City of Goodyear for Installation/Facilities Items.

Ref. Table	Pipeline	Pumps	Pump Facility	Elec. Controls	Earth-work	UA Costs	Jack/ Bore	Small Utils.
A-1	$1,834,763	$31,100	$466,500	$11,663	$1,357,602	$1,072,230	$361,643	$235,854
A-2	$392,640	0	0	0	$69,273	0	0	0
A-3	$423,000	0	0	0	$312,992	$247,200	$276,000	$180,000
A-4	$1,116,663	0	0	0	$203,855	0	0	0
A-5	$673,423	0	0	0	$71,836	0	0	0
A-6	$1,014,320	0	0	0	$178,957	0	0	0
A-7	$755,021	0	0	0	$101,341	0	0	0
A-8	$641,439	0	0	0	$313,512	$227,416	0	0
A-9	$676,358	0	0	0	$138,364	$42,704	0	0
A-10	$345,435	0	0	0	$48,856	0	0	0
A-11	$343,688	0	0	0	$53,456	0	0	0
A-12	$159,642	0	0	0	$25,443	0	0	0
A-13	$123,795	0	0	0	$28,717	0	0	0
A-15	$68,738	0	0	0	$10,691	0	0	0
A-16	$2,577,500	$98,100	$1,471,500	$36,788	$273,063	0	0	0
A-17	$3,056,976	0	0	0	$326,097	0	$494,500	$322,500
A-18	$4,252,875	0	0	0	$450,555	0	0	0
A-19	$5,451,413	$47,700	$715,500	$17,888	$577,529	0	0	0
A-20	$1,290,150	$47,700	$715,500	$17,888	$200,665	0	0	0
A-21	$1,328,701	0	0	0	$140,764	0	0	0
A-22	$2,167,365	$47,700	$715,500	$17,888	$306,541	0	0	0
A-23	$1,533,375	$21,350	$320,250	$8,006	$238,496	0	0	0
A-24	$2,484,596	$49,400	$741,000	$18,525	$386,445	0	0	0
A-25	$1,472,450	$59,700	$145,500	$3,638	$234,669	0	0	0
A-26	$168,280	$16,850	$33,700	$843	$26,819	0	0	0
A-27	$1,152,718	$15,150	$30,300	$758	$183,713	0	0	0

Ref. Table	Pipeline	Pumps	Pump Facility	Elec. Controls	Earth-work	UA Costs	Jack/ Bore	Small Utils.
A-28	$3,218,787	$32,000	$64,000	$1,600	$568,283	0	0	0
A-29	$383,674	$5,500	$11,000	$275	$137,492	0	0	0
A-32	$4,113,929	$25,114	$376,713	$9,418	$438,845	0	$105,964	$69,107
A-33	$3,747,980	0	0	0	$778,394	$378,586	$716,212	$467,095
A-34	$525,626	0	0	0	$56,070	0	0	0
Totals	**$47,495,320**	**$469,364**	**$5,806,963**	**$163,066**	**$8,239,335**	**$1,968,136**	**$1,954,319**	**$1,274,556**

In addition to the installation and facility items, the share of the costs of pipeline appurtenances is needed. The specific items and those costs to Avondale are provided in the table below.

Table 5-32 Summary of Cost Components by Reference Table for the City of Avondale for Regional Transmission Pipeline Appurtenance Items.

Note: Includes Land Easement Expense.

Ref. Table	Air Chamber	Air/Vacuum Valve	Gate Valves	Elbows	Tees	Land Easement
A-1	$20,000	0	$33,750	0	$15,000	$34,851
A-2	0	0	$4,750	0	$15,000	$12,052
A-3	0	0	$11,250	0	0	$5,739
A-4	0	$750	$10,500	0	0	$29,814
A-5	0	0	$11,732	0	0	$3,271
A-6	0	0	$14,250	0	$15,000	$22,239
A-7	0	0	$13,949	0	0	$6,215
A-8	0	0	$15,036	0	$11,871	$5,280
A-9	0	$242	$10,365	0	0	$6,940
A-10	0	$231	0	0	$9,882	$3,545
A-11	0	0	0	0	0	$4,663
A-12	0	$77	$1,710	0	0	$2,722
A-13	0	$250	0	0	$15,000	$5,022
A-15	0	0	0	0	$15,000	$933
A-16	$40,000	$1,400	$23,000	0	0	$14,348
A-17	0	$1,400	$53,000	0	0	$14,850
A-18	0	$2,100	$69,000	0	0	$23,674
A-19	$40,000	$700	$92,000	0	0	$30,346
A-20	$20,000	$350	$9,500	0	0	$17,505
A-21	0	$700	0	0	$15,000	$2,959
A-22	$23,150	$700	$45,000	0	0	$22,239
A-23	$20,000	$700	$33,750	0	0	$20,805
A-24	$20,000	$700	$45,000	$22,000	0	$33,711
A-25	$17,250	$350	$23,250	0	$15,000(1)	$25,109
A-26	$17,250	$350	0	0	0	$1,148
A-27	$17,250	$700	$23,250	$33,000	0	$7,863
A-28	$26,500	$1,750	$41,000	$55,000	0	$76,475
A-29	$1,500	$500	$5,000	0	0	$13,068
A-32	$21,429	$900	$79,500	$9,429	0	$19,985
A-33	0	$613	$69,574	$9,627	0	$18,207
A-34	0	0	0	0	$5,504	$2,553
Totals	**$284,329**	**$15,463**	**$715,866**	**$129,056**	**$132,257**	**$488,131**

The detailed costs determined in the above tables are tallied below for overall construction, operations, and maintenance costs which are shown in Table 5-33 below.

Table 5-33 Construction, Operations and Maintenance, and Delivery Costs for the City of Goodyear in order to Deliver and Receive 123,597 Acre-Feet per Year of Central Arizona Project Water and Groundwater

Note: 92.34 MGD of Groundwater, 18.0 MGD of CAP Water; 2009 Costs; Reference the Tables Used in Table 5-33.

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Installation/Facilities		
Pipeline	$47,495,320	$617,439
Pumps	$469,364	$2,731,646
Pump Housing Facilities	$5,806,963	$75,491
Electronic Controls for Facilities	$163,066	$2,120
Earthwork	$8,239,335	$107,111
Urban Area Costs	$1,968,136	$25,586
Jack and Bore	$1,954,319	N/A
Small Utilities	$1,274,556	N/A
Subtotal	**$67,371,059**	**$3,559,393**
Pipeline Appurtenances		
Air Chamber	$284,329	$3,692
Air/Vacuum Valves	$15,463	$201
Gate Valves	$715,866	$9,306
Pressure Reducing Valve (1 needed)	$11,000	$143
S.C.A.D.A.	$2,500,000	$32,500
Elbows (14 needed)	$129,056	N/A
Tees (8 needed)	$132,257	N/A
Subtotal	**$3,787,971**	**$45,842**
General Expenses		
Mobilization	$3,557,952	
Contingencies	$14,943,396	
Engineering and Administration	$17,932,076	
Land (Easement)	$488,131	
Facilities Building	$500,000	$25,000
Subtotal	**$37,421,555**	**$25,000**
Total Capital Costs/O&M Costs	**$108,580,585**	**$3,630,235**
Beardsley Canal Transportation[1]	$604,878	
Treatment Costs @ White Tanks WTP[2]	$8,065,200	
CAP Water Expense ('09 rate)	$2,177,604	

[1] Canal transportation is for 18.0 MGD of CAP water. Does not include groundwater transportation as groundwater is not planned to be transported through the Beardsley for Goodyear.
[2]Treatment costs for Goodyear's CAP water.

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Yearly Operations Costs (right column)	$3,630,235	
Yearly Operations & Maint. Costs	**$14,477,917**	

The following table summarizes Goodyear's costs in terms of cost per ac-ft and cost per 1,000 gallons.

Table 5-34 Capital Costs – 20 Years – with a Municipal Capital Recovery Factor Equal to 0.0769

Note: Based on 4.5% Bonding Rate and 20 Year Financing for Goodyear's Share of the West Valley Regional Transmission Pipeline.

Table(s)[3]	Annualized Capital[4]	O&M[5]	Total Annual Cost*	Cost/ac-ft**	Cost/1,000 gallons
see foot note	$8,349,847	$14,477,917	$22,827,764	$185	$0.57

*** -** Total Annual Cost is the annualized capital plus the O&M Cost.

**** -** The cost is based on the overall delivery of 123,597 acre-feet per year.

The cost of the overall system is impressive at over $100 million for the construction of the pipeline for Goodyear, and nearly $15 million per year in operations and maintenance costs. Yet considering the volume of water being delivered, the cost to delivery water in terms of dollars per acre-foot, or dollars per thousand gallons, the cost of the overall system is very reasonably priced. The cost relative to the other water providers already discussed is quite a bit less expensive in terms of dollars per volume delivered which is due to several factors which are discussed below.

A benefit that would be enjoyed by all members, if construction were to begin next year, is the low cost of financing due to the low interest rate environment the nation is currently experiencing. The financing assumed in all the tables similar to the one in Table 5-34 assume that interest rates will go up by somewhere between half a percent and one-percent by this time next year. Economists are predicting that the Federal Reserve will begin raising interest rates in early 2010.

While the other water providers' estimates have been in the $2 per 1,000 gallon range, Goodyear's estimate is almost 4 times less expensive. The benefit Goodyear experiences that others do not is the benefit of the system almost exclusively delivering groundwater. CAP water makes up only 15% of the total volume of water being delivered to Goodyear. The benefit of groundwater is that large volumes can be delivered to storage and treatment facilities which are fairly close by, thus reducing the length of transportation and thus helping to reduce costs relative to volumes being delivered.

[3] The tables to reference are shown in Table 5-32 and 5-33.
[4] Annualized Capital is the total capital costs from Table 5-34 multiplied by the capital recovery factor.
[5] The O&M value is derived from Table 5-34 as the yearly operations and maintenance costs.

Though difficult to quantify without spending additional time, Goodyear benefits from economies of scale. A larger pipeline is more cost effective at delivering water than a smaller one, and a larger system is more cost effective than a smaller system. Goodyear has both of these factors working in its favor with respect to unit pricing.

This concludes Chapter 5, and prior to the conclusion, Chapter 6 provides future costs for the system since the regional transmission system is not constructed all at once. For more details on future costs, see the next chapter entitled The Future Cost of the Regional Transmission System.

CHAPTER VI - FUTURE COST OF THE REGIONAL TRANSMISSION SYSTEM

Introduction and Analysis

The costs of the regional transmission system pipeline have thus far been presented as a present cost. The real cost of the system will be in tomorrow's dollars, meaning sometime between 2010 and 2035. The cost of tomorrow's dollars is difficult to estimate, but an analysis of longer term inflation was conducted and the results indicate that long term the U.S. is averaging 3.0% inflation per year (read the particulars on the results of the study in Chapter 5).

The following table will assist in the development of future costs. If the present value of something is equal to1, the future worth of that same item is greater than 1 if inflation is accounted for. That number greater than 1 will be the constant the values from Chapter 5 will be multiplied by assuming 3.0% inflation. Table 6-1 provides the constants in order to calculate future worth.

Table 6-1 Future Worth Constants for Years 2010, 2015, 2020, 2025 and 2035 Assuming 3.0% Inflation per Year beginning 2009.

	2010	2015	2020	2025	2035
Future Worth Value (F/P)	1.03	1.1941	1.3842	1.6047	2.1566

The biggest change in inflation is from years 2025 to 2035 where those portions of the system would go from one in a half times the current cost to more than double the 2009 cost. All other years are separated by a 5 year difference, whereas 2025 and 2035 are separated by 10 years. The increase in cost over time appears to be an exponential growth curve. With these constants, the future worth of the pipeline system as it would be constructed can be calculated. The following sections are provided for each water provider in terms of future cost.

The Future Cost of CAP Water Delivery for Arizona-Water Company

Arizona Water's portion of the system is planned to come on-line in 2025, and therefore the constant from Table 6-1 of 1.6047 is used to gauge the cost to Arizona-Water in the year 2025.

Table 6-2 provides the cost to Arizona-Water for construction, and operations and maintenance costs.

Table 6-2 The Future Cost of the Regional Transmission Pipeline System in Dollars for Arizona-Water Company.

Item	2009 Costs	Multiplied by 2025 Future Worth Constant	2025 Cost
Capital Costs	$432,009	1.6047	$693,245
Yearly Operations & Maintenance	$536,283	1.6047	$860,573

Because Arizona Water Company's costs occur in the same year, and the water delivered to Arizona Water also occurs in the same year, the following table, Table 6-3 can be calculated. For the rest of the water providers this isn't possible because construction occurs in various years, with construction occurring, and no water flowing. In addition, amortized costs are beginning and ending at various time frames. The following table however would give Avondale, Buckeye, Global Water, and Goodyear a glimpse as to how the costs could be expected to increase over time. The following table summarizes Arizona-Water's cost in terms of cost per ac-ft and cost per 1,000 gallons in terms of 2025 costs. In addition, the bonding rate has been increased to 5.5% which reflects the norm for the past when financing pipeline systems over 20 years.

Table 6-3 Future Amortized Capital Costs – 20 Years – with a Municipal Capital Recovery Factor Equal to 0.0837

Note: Based on 5.5% Bonding Rate and 20 Year Financing for Arizona-Water Company's Share of the West Valley Regional Transmission Pipeline Assuming Financing Would Begin in 2025.

Table(s)	Annualized Capital[1]	O&M[2]	Total Annual Cost*	Cost/ac-ft**	Cost/1,000 gallons
A-32	$58,025	$860,573	$918,598	$949	$2.91

*** -** Total Annual Cost is the annualized capital plus the O&M Cost.

**** -** The cost is based on the overall delivery of 968 acre-feet per year.

The Future Cost of CAP Water Delivery for the City of Avondale

Avondale's future costs are dependent on portions of its system being constructed at various times, and therefore a table is created to show the future cost of each portion of the system. The tables that follow aid to organize future costs because Avondale's system are shared with other providers and constructed at various intervals. Tables 6-4, 6-5, and 6-6 help to illustrate how a future cost is derived for Avondale.

[1] Annualized Capital is the capital costs from Table 6-2 multiplied by the capital recovery factor.

[2] The O&M value is derived from Table 6-2 as the yearly operations and maintenance costs.

Table 6-4 Construction Schedule as it Pertains to the City of Avondale for Various Portions of the Regional Transmission Pipeline and the Subsequent Future Worth Constant for Each Year.

Reference Table	Planned Year for Construction	Future Worth Constant
A-5	2010	1.03
A-7	2010	1.03
A-8	2010	1.03
A-9	2010	1.03
A-10	2010	1.03
A-12	2010	1.03
A-14	2025	1.6047
A-32	2025	1.6047
A-33	2025	1.6047
A-34	2015	1.1941

The above years can be lumped together as 2010, 2015, and 2025 costs in order to modify the 2009 costs from Chapter 5. These costs are shown in Table 6-5 below.

Table 6-5 The Future Cost of Construction Concentrated into Years 2010, 2015 and 2025 for Various Construction Items Related to the Regional Transmission Pipeline for Avondale.

Note: Future Worth Constants from Table 6-4 are Employed.

Year	Pipeline	Pumps	Pump Facility	Elec. Control	Earth-work	UA Costs	Jack/ Bore	Small Utils.
2010	$1,732,467	0	0	0	$326,634	$81,422	0	0
2015	$248,029	0	0	0	$26,458	0	0	0
2025	$4,307,443	$11,865	$177,966	$4,450	$679,728	$178,852	$388,828	$253,313
Totals	**$6,287,939**	**$11,865**	**$177,966**	**$4,450**	**$1,032,820**	**$260,274**	**$388,828**	**$253,313**

The additional components for Avondale by year increment for the pipeline are provided in the table below.

Table 6-6 The Future Cost of Construction Concentrated into Years 2010, 2015, and 2025 for Pipeline Appurtenance Items.

Note: Includes Land Easement Expense for the City of Avondale.

Year	Air Chamber	Air/Vacuum Valve	Gate Valves	Elbows	Tees	Land Easement
2010	0	$515	$23,764	0	$4,774	$19,716
2015	0	0	0	$1,905	$2,597	$1,205
2025	$10,124	$1,276	$78,048	$9,002	$24,071	$31,051
Totals	**$10,124**	**$1,791**	**$101,812**	**$10,907**	**$31,442**	**$51,972**

The above costs are added and shown in Table 6-7. The total capital cost and the yearly O&M cost represent the expected cost to occur in the future which Avondale can expect to expend in order to receive CAP water through the regional transmission pipeline.

Table 6-7 The Future Cost of Construction, Operations and Maintenance, and Delivery Costs for the City of Avondale in order to Receive 5,936 Acre-Feet per Year of Central Arizona Project Water

Note: Costs Related to Construction Periods 2010, 2015, and 2025; Reference Tables A-5, 7, 8, 9, 10, 12, 14, 32, 33, 34.

ITEMS	**CONSTRUCTION COSTS**	**OPERATIONS COSTS**
Installation/Facilities		
Pipeline	$6,287,939	$81,743
Pumps	$11,865	$82,873
Pump Housing Facilities	$177,966	$2,314
Electronic Controls for Facilities	$4,450	$58
Earthwork	$1,032,820	$13,427
Urban Area Costs	$260,274	$3,384
Jack and Bore	$388,828	N/A
Small Utilities	$253,313	N/A
Subtotal	**$8,417,455**	**$183,799**
Pipeline Appurtenances		
Air Chamber	$10,124	$132
Air/Vacuum Valve	$1,791	$23
Gate Valves	$101,812	$1,324
Pressure Reducing Valves	0	0
S.C.A.D.A.	0	0
Elbows (5 needed)	$10,907	N/A
Tees (3 needed)	$31,442	N/A
Subtotal	**$156,076**	**$1,479**
General Expenses		
Mobilization	$428,676	
Contingencies	$1,800,442	
Engineering and Administration	$2,160,530	
Land (Easement)	$51,972	
Facilities Building	$160,470	$12,838
Subtotal	**$3,291,842**	**$12,838**
Total Capital Costs/O&M Costs	**$11,865,373**	**$198,116**
Beardsley Canal Transportation	$284,928	
Treatment Costs @ White Tanks WTP	$3,810,200	
CAP Water Expense ('09 rate)	$1,224,300	

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Yearly Operations Costs (right column)	$198,116	
Yearly Operations & Maint. Costs	**$5,517,544**	

Operation costs for the pump are calculated simply as the 2009 cost multiplied by the 2025 cost index (1.6047; the year that CAP water would begin delivery for Avondale). All other operations and maintenance costs are the construction costs multiplied by 1.3%.

The Facilities Building for Avondale is priced on the assumption that the building isn't needed until 2025 when the final leg of the pipeline is built for Avondale to receive CAP water in 2025. The $100,000 building assumed in 2009 is multiplied by the cost index to arrive at the future cost of the building in 2025. Likewise, the cost of the maintenance is also multiplied by the future cost index.

Beardsley Canal transportation costs are likewise assumed to increase with time. The $30 transportation fee in 2009 is estimated will cost $48 in 2025 when indexed to the assumed inflation rate.

Likewise, treatment costs at the White Tank plant will increase from $400 an acre-foot to an assumed $641.88 an acre-foot by 2025.

The cost of CAP water is being recommended by the Central Arizona Water Project to cost $149 per acre foot by 2014. Applying a 3% inflation rate to $149, from 2014 to 2025 the cost of CAP water would increase to $206.25. This $206.25 rate is what is applied to the cost of delivery for Avondale in Table 6-7.

The Future Cost of CAP Water Delivery for the City of Buckeye

In Chapter 5 two cost analyses were provided for the City of Buckeye. The first provided costs based on the pipeline run shown in Figure 5-1. The second analyses provided the cost for a more direct route which would cost Buckeye approximately $2 million less than the first run. Buckeye's future costs (shown below) are based on the second analyses since Buckeye (and Global Water) is more likely to construct a pipeline which is directed toward it, rather than the longer loop shown in Figure 5-1.

Buckeye's costs are based on portions of the system being constructed at various times, and thus the tables below are provided to show the future cost of each portion of the system. The tables that follow aid to organize future costs because Buckeye's system are shared with other providers and constructed at various intervals. Tables 6-8, 6-9, and 6-10 help to illustrate how a future cost is derived for Buckeye.

Table 6-8 Construction Schedule as it Pertains to the City of Buckeye for the Regional Transmission Pipeline and the Subsequent Future Worth Constant for Each Year.

Reference Table	Planned Year for Construction	Future Worth Constant
A-30, 32, 33	2025	1.6047

The above reference tables reflect construction occurring in 2025 for the City of Buckeye. The index for inflation is used in Tables 6-9 and 6-10 below in order to begin

Table 6-9 The Future Cost of Construction Concentrated into Year 2025 for Various Construction Items Related to the Regional Transmission Pipeline for Buckeye.

Note: The Future Worth Constant from Table 6-8 is Employed.

Year	Pipeline	Pumps	Pump Facility	Elec. Control	Earth-work	UA Costs	Jack/ Bore	Small Utils.
2025	$5,183,979	$14,943	$224,133	$5,604	$687,945	$81,910	$659,581	$438,807

The additional components for Buckeye by year increment for the pipeline are provided in the table below.

Table 6-10 The Future Cost of Construction Concentrated into Year 2025 for Pipeline Appurtenance Items.

Note: Includes Land Easement Expense for the City of Buckeye.

Year	Air Chamber	Air/Vacuum Valve	Gate Valves	Elbows	Tees	Land Easement
2025	$12,749	$2,373	$102,327	$15,408	$8,996	$31,572

Construction costs in the above 2 tables are added and shown in Table 6-11. The total capital cost and the yearly O&M cost represent the financial layout which would occur in 2025 which Buckeye can expect to occur in order to receive CAP water through the regional transmission pipeline.

Table 6-11 The Future Cost of Construction, Operations and Maintenance, and Delivery Costs for the City of Buckeye in order to Receive 7,476 Acre-Feet per Year of Central Arizona Project Water

Note: 2025 Costs, Reference Tables A-30, 32, 33).

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Installation/Facilities		
Pipeline	$5,183,979	$67,392
Pumps	$14,943	$103,173
Pump Housing Facilities	$224,133	$2,914
Electronic Controls for Facilities	$5,604	$73
Earthwork	$687,945	$8,943
Urban Area Costs	$81,910	$1,065
Jack and Bore	$659,581	N/A
Small Utilities	$438,809	N/A
Subtotal	**$7,296,904**	**$183,560**
Pipeline Appurtenances		
Air Chamber	$12,749	$166
Air/Vacuum Valve	$2,373	$31
Gate Valves	$102,327	$1,330
Pressure Reducing Valves	0	0
S.C.A.D.A.	0	0
Elbows	$15,408	N/A
Tees	$8,996	N/A
Subtotal	**$141,853**	**$1,527**
General Expenses		
Mobilization	$371,938	
Contingencies	$1,562,139	
Engineering and Administration	$1,874,567	
Land (Easement)	$31,572	
Facilities Building	$160,470	$12,838
Subtotal	**$4,000,686**	**$12,838**
Total Capital Costs/O&M Costs	**$11,439,443**	**$197,925**
Beardsley Canal Transportation	$358,848	
Treatment Costs @ White Tanks WTP	$4,798,695	
CAP Water Expense ('09 rate)	$1,541,925	
Yearly Operations Costs (right column)	$197,925	
Yearly Operations & Maint. Costs	**$6,897,393**	

Operation costs for the pump are calculated simply as the 2009 cost multiplied by the 2025 cost index (1.6047; the year that CAP water would begin delivery for Buckeye). All other operations and maintenance costs are the construction costs multiplied by 1.3%.

The Facilities Building for Buckeye is priced on the assumption that the building isn't needed until 2025 when the final leg of the pipeline is built for Avondale to receive CAP water in 2025. The $100,000 building assumed in 2009 is multiplied by the cost index to arrive at the future cost of the building in 2025. Likewise, the cost of the maintenance is also multiplied by the future cost index.

Beardsley Canal transportation costs are assumed will increase with time. The $30 transportation fee in 2009 is estimated will cost $48 in 2025 when indexed to the assumed inflation rate.

Treatment costs at the White Tank plant will increase from $400 an acre-foot to an assumed $641.88 an acre-foot by 2025.

The cost of CAP water is being recommended by the Central Arizona Water Project to cost $149 per acre foot by 2014. Applying a 3% inflation rate to $149, from 2014 to 2025 the cost of CAP water would increase to $206.25. This $206.25 rate is what is applied to the cost of delivery for Buckeye in Table 6-11.

Because all of the expenses occurred for the 2025 time period for Buckeye, a breakdown of the costs per acre-foot and dollars per thousand gallons can be provided. The following are such costs for Buckeye.

Table 6-12 Future Amortized Capital Costs – 20 Years – with a Municipal Capital Recovery Factor Equal to 0.0837.

Note: Based on 5.5% Bonding Rate and 20 Year Financing for the City of Buckeye's Share of the West Valley Regional Transmission Pipeline Assuming Financing Would Begin in 2025.

Table(s)	Annualized Capital[3]	O&M[4]	Total Annual Cost*	Cost/ac-ft**	Cost/1,000 gallons
A-30, 32, 33	$957,481	$6,897,393	$7,854,874	$1,051	$3.22

*** -** Total Annual Cost is the annualized capital plus the O&M Cost.

**** -** The cost is based on the overall delivery of 7,476 acre-feet per year.

The Future Cost of CAP Water Delivery for Global Water Company

Chapter 5 presented two scenarios for the delivery of CAP Water to Global Water Company. The second analysis is the analysis that will be used to index costs for inflation. The second analysis determined that a cost savings of $3.5 million could be realized by taking a more direct route to Buckeye's facility, and ultimately on to Global's

[3] Annualized Capital is the capital costs from Table 6-11 multiplied by the capital recovery factor.
[4] The O&M value is derived from Table 6-11 as the yearly operations and maintenance costs.

facility. Because all of Global's system would be constructed in 2025, the cost is calculated fairly easily as 2009 costs multiplied by the index factor of 1.6047.

Table 6-12 below provides the reference tables from the pipeline model that Global would require in order to construct the pipeline to Global's facility.

Table 6-13 Construction Schedule as it Pertains to Global Water Company for the Regional Transmission Pipeline and the Subsequent Future Worth Constant for Each Year.

Reference Table(s)	Planned Year for Construction	Future Worth Constant
Table A-30, 31, 32, 33	2025	1.6047

The index for inflation shown above is applied to construction items in Tables 6-13 and 6-14 below.

Table 6-14 The Future Cost of Construction Concentrated into Year 2025 for Various Construction Items Related to the Regional Transmission Pipeline for Global Water Company.

Note: The Future Worth Constant from Table 6-12 is Employed.

Year	Pipeline	Pumps	Pump Facility	Elec. Control	Earth-work	UA Costs	Jack/ Bore	Small Utils.
2025	$14,182,945	$24,984	$374,765	$9,370	$2,008,073	$136,956	$1,102,828	$733,693

The additional components for Global Water by year increment for the pipeline are provided in the table below.

Table 6-15 The Future Cost of Construction Concentrated into Year 2025 for Pipeline Appurtenance Items

Note: Includes Land Easement Expense for Global Water.

Year	Air Chamber	Air/Vacuum Valve	Gate Valves	Elbows	Tees	Land Easement
2025	$21,318	$5,825	$297,466	$78,715	$17,589	$127,795

The detailed costs from above are applied to the table below in order to determine overall costs including operations and maintenance costs.

Table 6-16 The Future Cost of Construction, Operations and Maintenance, and Delivery Costs for Global Water Company in order to Receive 12,500 Acre-Feet per Year of Central Arizona Project Water

Note: 2025 Costs, Reference Tables A-30, 31, 32, 33.

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Installation/Facilities		
Pipeline	$14,182,945	$184,378
Pumps	$24,984	$172,510
Pump Housing Facilities	$374,765	$4,872
Electronic Controls for Facilities	$9,370	$122
Earthwork	$2,008,073	$26,105
Urban Area Costs	$136,956	$1,819
Jack and Bore	$1,102,828	N/A
Small Utilities	$733,693	N/A
Subtotal	**$18,573,614**	**$389,806**
Pipeline Appurtenances		
Air Chamber	$21,318	$277
Air/Vacuum Valve	$5,825	$76
Gate Valves	$297,466	$3,867
Pressure Reducing Valves	0	0
S.C.A.D.A.	0	0
Elbows	$78,715	N/A
Tees	$17,589	N/A
Subtotal	**$420,913**	**$4,220**
General Expenses		
Mobilization	$949,726	
Contingencies	$3,988,851	
Engineering and Administration	$4,786,621	
Land (Easement)	$127,795	

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Facilities Building	$160,470	$12,838
Subtotal	**$10,013,463**	**$12,838**
Total Capital Costs/O&M Costs	**$29,007,990**	**$406,864**
Beardsley Canal Transportation	$600,000	
Treatment Costs @ White Tanks WTP	$8,023,500	
CAP Water Expense ('09 rate)	$2,578,125	
Yearly Operations Costs (right column)	$406,864	
Yearly Operations & Maint. Costs	**$11,608,489**	

Operation costs for the pump are calculated simply as the 2009 cost multiplied by the 2025 cost index (1.6047; the year that CAP water would begin delivery for Global Water). All other operations and maintenance costs are the construction costs multiplied by 1.3%.

The Facilities Building for Global Water is priced on the assumption that the building isn't needed until 2025 when the final leg of the pipeline is built for Avondale to receive CAP water in 2025. The $100,000 building assumed in 2009 is multiplied by the cost index to arrive at the future cost of the building in 2025. Likewise, the cost of the maintenance is also multiplied by the future cost index.

Beardsley Canal transportation costs are assumed to increase with time. The $30 transportation fee in 2009 is estimated will cost $48 in 2025 when indexed to the assumed inflation rate.

Treatment costs at the White Tank plant will increase from $400 an acre-foot to an assumed $641.88 an acre-foot by 2025 when applying the inflation index to the existing price.

The cost of CAP water is being recommended by the Central Arizona Water Project to cost $149 per acre foot by 2014. Applying a 3% inflation rate to $149, from 2014 to 2025 the cost of CAP water would increase to $206.25. This $206.25 rate is what is applied to the cost of delivery for Global Water in Table 6-16.

Because all of the expenses related to construction are planned in the same time period for Global Water, a breakdown of the costs per acre-foot and dollars per thousand gallons can be provided. The following are the expected future costs for the Global Water Company.

Table 6-17 Future Amortized Capital Costs – 20 Years – with a Municipal Capital Recovery Factor Equal to 0.0837.

Note: Based on 5.5% Bonding Rate and 20 Year Financing) for Global Water Company's Share of the West Valley Regional Transmission Pipeline Assuming Financing Would Begin in 2025.

Table(s)	Annualized Capital[5]	O&M[6]	Total Annual Cost*	Cost/ac-ft**	Cost/1,000 gallons
A-30, 31, 32, 33	$2,427,969	$11,608,489	$14,036,458	$1,123	$3.45

*** -** Total Annual Cost is the annualized capital plus the O&M Cost.

**** -** The cost is based on the overall delivery of 12,500 acre-feet per year.

The Future Cost of CAP and Groundwater Delivery for the City of Goodyear

Chapter 5 presents cost for Goodyear based on construction occurring in 2009. In reality, the costs for Goodyear are spread out among five time frames from 2010 to 2035. The table provided below highlights the years and the inflation factor associated with each reference table for Goodyear. With this information, the various construction components can begin to be indexed to inflation.

Table 6-18 Construction Schedule as it Pertains to the City of Avondale for Various Portions of the Regional Transmission Pipeline and the Subsequent Future Worth Constant for Each Year.

Reference Table	Planned Year for Construction	Future Worth Constant
A-1	2010	1.03
A-2	2010	1.03
A-3	2010	1.03
A-4	2010	1.03
A-5	2010	1.03
A-6	2010	1.03
A-7	2010	1.03
A-8	2010	1.03
A-9	2010	1.03
A-10	2010	1.03
A-11	2010	1.03
A-12	2010	1.03
A-13	2010	1.03
A-15	2010	1.03
A-16	2010	1.03
A-17	2010	1.03
A-18	2010	1.03
A-19	2010	1.03
A-20	2015	1.1941

[5]Annualized Capital is the capital costs from Table 6-16 multiplied by the capital recovery factor.

[6] The O&M value is derived from Table 6-16 as the yearly operations and maintenance costs.

Reference Table	Planned Year for Construction	Future Worth Constant
A-21	2015	1.1941
A-22	2015	1.1941
A-23	2020	1.3842
A-24	2015	1.1941
A-25	2015	1.1941
A-26	2015	1.1941
A-27	2020	1.3842
A-28	2035	2.1566
A-29	2035	2.1566
A-32	2025	1.6047
A-33	2025	1.6047
A-34	2015	1.1941

The years and reference tables from above can be consolidated to provide costs for only specific years for all of the construction items for Goodyear. This information is provided in the tables below.

The above years can be lumped together as 2010, 2015, and 2025 costs in order to modify the 2009 costs from Chapter 5. These costs are shown in Table 6-5 below.

Table 6-19 The Future Cost of Construction for Years 2010, 2015, 2020, 2025 and 2035 for Various Construction Items Related to the Regional Transmission Pipeline for Goodyear.

Note: Future Worth Constants from Table 6-18 are Employed.

Year	Pipeline	Pumps	Pump Facility	Elec. Control	Earth-work	UA Costs	Jack/ Bore	Small Utils.
2010	$24,624,920	$182,207	$2,733,105	$68,329	$4,678,403	$1,637,237	$1,166,107	$760,505
2015	$11,268,922	$264,314	$2,807,568	$58,782	$1,614,391	0	0	0
2020	$3,718,090	$50,523	$485,231	$12,131	$584,422	0	0	0
2025	$12,616,005	$60,176	$120,353	$15,113	$1,953,303	$607,517	$1,317,741	$860,443
2035	$7,769,067	$80,873	$161,745	$4,044	$1,522,074	0	0	0
Totals	**$59,997,004**	**$638,093**	**$6,308,002**	**$158,399**	**$10,352,593**	**$2,244,754**	**$2,483,848**	**$1,620,948**

The additional pipeline components for Goodyear by year increment for the pipeline are provided in the table below.

Table 6-20 The Future Cost of Construction for Years 2010, 2015, and 2020, 2025 and 2035 for Pipeline Appurtenance Items.

Note: Includes Land Easement Expense for the City of Goodyear.

Year	Air Chamber	Air/Vacuum Valve	Gate Valves	Elbows	Tees	Land Easement
2010	$103,000	$7,365	$375,221	0	$99,656	$233,299
2015	$116,604	$3,761	$146,576	$26,270	$42,395	$105,224
2020	$51,561	$1,938	$78,899	$45,679	0	$3,968
2025	$34,387	$2,428	$111,645	$30,579	0	$61,287
2035	$60,385	$4,852	$321,493	$41,096	0	$38,192
Totals	**$365,937**	**$20,344**	**$1,033,834**	**$143,624**	**$142,051**	**$441,970**

The detailed costs from above are applied to the table below in order to determine overall costs including operations and maintenance costs for the City of Goodyear.

Table 6-21 The Future Cost of Construction, Operations and Maintenance, and Delivery Costs for the City of Goodyear in order to Deliver and Receive 123,597 Acre-Feet per Year of Central Arizona Project Water and Groundwater.

Note: 92.34 MGD of Groundwater, 18.0 MGD of CAP Water (20,162.59 ac-ft/yr); See Table 6-18 for the Various Tables Which Apply at Various Time Frames).

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
Installation/Facilities		
Pipeline	$59,997,004	$779,961
Pumps	$638,093	$3,780,994
Pump Housing Facilities	$6,308,002	$82,004
Electronic Controls for Facilities	$158,399	$2,059
Earthwork	$10,352,593	$134,584
Urban Area Costs	$2,244,754	$29,182
Jack and Bore	$2,483,848	N/A
Small Utilities	$1,620,948	N/A
Subtotal	**$83,803,641**	**$4,808,784**
Pipeline Appurtenances		
Air Chamber	$365,937	$4,757
Air/Vacuum Valve	$20,344	$264
Gate Valves	$1,033,834	$13,440
Pressure Reducing Valves	$17,652	$229
S.C.A.D.A.	$3,460,500	$44,987
Elbows	$143,624	N/A
Tees	$142,051	N/A
Subtotal	**$5,183,942**	**$63,677**

ITEMS	CONSTRUCTION COSTS	OPERATIONS COSTS
General Expenses		
Mobilization	$4,449,379	
Contingencies	$18,687,392	
Engineering and Administration	$22,424,871	
Land (Easement)	$441,970	
Facilities Building	$802,350	$40,118
Subtotal	**$46,805,962**	**$40,118**
Total Capital Costs/O&M Costs	**$135,793,545**	**$4,912,579**
Beardsley Canal Transportation	$967,804	
Treatment Costs @ White Tanks WTP	$1,294,196	
CAP Water Expense ('09 rate)	$4,158,534	
Yearly Operations Costs (right column)	$4,912,579	
Yearly Operations & Maint. Costs	**$11,333,113**	

There are two items in Table 6-21 which were not calculated using Tables 6-19 and 6-20. The pressure reducing valve for Goodyear was needed in 2025, and the S.C.A.D.A. system was assumed also would be needed in 2025. The future worth factor of 1.6047 was applied to both of these items. Therefore, the 2009 cost for the pressure reducing valve and the S.C.A.D.A. system were multiplied by 1.6047 and is shown in Table 6-21 above.

The other costs are similar to the ones used for the other water providers. Beardsley Canal transportation is indexed to inflation and will cost $48 per acre foot. Treatment costs at the White Tanks are expected to cost $641.88 by 2025. And CAP water will cost $206.25 an acre-foot. These costs only apply to the CAP volume of water piped which is 20,162.59 acre-feet per year and represents 15% of the total volume of water pumped and delivered to various Goodyear storage facilities.

The future cost of the entire system for all water providers is the following shown in Table 6-22.

Table 6-22 The Future Cost of Construction, Operations and Maintenance, and Delivery Costs for the Regional Transmission Pipeline from the White Tank Water Treatment Plant and Adaman Mutual to Booth Hills Reservoir South of Mobile.

Note: Includes the Water Providers Arizona-Water Company, The City of Avondale, The City of Buckeye, Global Water Company and The City of Goodyear.

ITEMS	**CONSTRUCTION COSTS**	**OPERATIONS COSTS**
Installation/Facilities		
Pipeline	$85,968,746	$1,117,593
Pumps	$691,819	$4,152,908
Pump Housing Facilities	$7,113,882	$92,481
Electronic Controls for Facilities	$178,548	$2,322
Earthwork	$14,115,234	$183,499
Urban Area Costs	$2,723,894	$35,450
Jack and Bore	$4,643,247	N/A
Small Utilities	$3,052,086	N/A
Subtotal	**$118,487,456**	**$5,584,253**
Pipeline Appurtenances		
Air Chamber	$411,779	$5,353
Air/Vacuum Valve	$30,402	$396
Gate Valves	$1,541,563	$20,088
Pressure Reducing Valves	$17,652	$229
S.C.A.D.A.	$3,460,500	$44,987
Elbows	$249,381	N/A
Tees	$200,078	N/A
Subtotal	**$5,911,355**	**$71,053**
General Expenses		
Mobilization	$6,219,940	
Contingencies	$26,123,751	
Engineering and Administration	$31,348,500	
Land (Easement)	$654,848	
Facilities Building	$1,363,995	$85,051
Subtotal	**$65,711,034**	**$85,051**
Total Capital Costs/O&M Costs	**$190,109,845**	**$5,740,357**
Beardsley Canal Transportation	$2,258,180	
Treatment Costs @ White Tanks WTP	$18,547,931	
CAP Water Expense ('09 rate)	$9,670,646	
Yearly Operations Costs (right column)	$5,740,357	
Yearly Operations & Maint. Costs	**$36,217,114**	

The total future cost of the regional transmission system from Table 6-22 is $190,110,000 and yearly operations and maintenance costs will be approximately $36 million. One important line item to highlight is the cost of pumps and the yearly operations costs of pumps. The operations costs are higher on a percentage basis for pumps than for the other line items because the line item for pumps includes the energy cost to operate the pumps.

This concludes the future cost section for the five water providers.

CHAPTER VII - CONCLUSIONS AND OBSERVATIONS

In the late 1990's WESTCAPS embarked on a mission to organize as a group and to work toward obtaining and reclaiming water supplies. In 2001, WESTCAPS published the WESTCAPS Strategic Plan which specified several strategies for providing more water to the cities and water providers participating in the WESTCAPS planning process. In 2001, the greatest emphasis of the work was the time spent developing the nuances of the pipeline alignment, volumes of water needed, sharing strategies, and financial needs of attempting to import CAP water through a share regional system.

In late 2009, this report is being published more than 8 years after the initial work of the Strategic Plan. This report emphasizes more the pipeline alignments, the volumes of water which could be delivered in a shared transmission system, and the share of the cost for each participant. The costs are more detailed than those provided in 2001, and estimates are provided for construction, yearly operations and maintenance costs, and the energy costs needed to operate the system on a yearly basis. This was accomplished by first creating the hydraulic model of the system, and then providing a cost evaluation.

The many observations made during the reading and/or perusing of this report are what will be referred to as "notables." One of the notables is that it appears present day 2009 costs are a little low. This phenomenon is related to the savings that the WESTCAPS members make us of by cost sharing a pipeline distribution system. Individual costs should be higher if only one entity were the focus of the costs in this report. In some of the pipeline sections, the costs are being shared by all five of the water providers participating in this study.

The other notable is that appears future costs are a little high. A future cost is nice to know, but, it is an unknown value unless one can also understand how the prices of other goods, services, and wages will also rise. In the early to mid-1970's, gasoline sold for between 35 and 50 cents a gallon. No one in the 70's would have guessed that it could reach $4 by 2007. During the same 1970's time frame a typical home in the western United States might have sold new for $20,000. Back then, it would be difficult to understand how a home could sell for between our typical $200,000 and $400,000 prices of today, let alone some of the million dollar prices some homes now sell for. Therefore, one shouldn't place too much emphasis on future costs as prices tend to rise and the future cost of something becomes the norm. Remember that it is also difficult for us to understand how a typical home could have sold for $20,000 in what seems like the not too distant past.

One thing to keep in mind is that this system does not deliver CAP water solely. CAP water is delivered from the White Tank WTP south toward the Arizona Water Treatment Facility and the Westpac Reservoir. The Adaman Mutual facility pumps and delivers ground water south, and where the two lines intersect at Van Buren and Cotton Lane is the point at which both CAP and groundwater begin to mix for other deliveries south of this intersection. The entities receiving this mix of CAP and groundwater include

Buckeye, Global Water, Avondale, and Goodyear. Only Arizona-Water would receive strictly CAP water. This report did not delve into the water quality ramifications of the mixing effect and the subsequent considerations to keep in mind for treatment prior to delivery.

Another notable is that portions of the pipeline are constructed at various times. Some portions necessitate construction next year, while the remainder of the system may not be scheduled to come on-line for another 16 years. It would be challenging for the communities and water providers like Buckeye, Global Water, and Avondale to begin sponsoring their share of the cost of a pipeline in 2010 when their share of CAP water doesn't come on-line until 2025. The schedule for the system was created in 2007 which was at the end of the real estate expansion. It was probably thought that if growth would continue at the 2004 to 2007 rate, that the system schedule the way it is portrayed in this report was plausible. Most of the system prescribed for next year will not occur in 2010. Therefore the concern in the earlier part of this paragraph about a 15 year gap between the earliest funding and final construction is unlikely, and more than likely the gap would be half of the 16 year time frame or less.

As of the printing of this report, The City of Avondale has not decided on the final turnout for delivery of their CAP water. The location modeled and shown on Figure 5-1 is a point at which Avondale would like to see their water delivered to, but as of yet the City is unsure about the final location for the turnout. Figure 5-1 identifies Avondale's pipeline endpoint as "Avondale Pipeline Terminus" which is an endpoint for Avondale with a turnout for Avondale as yet unknown.

This report is the culmination of 18 months of work which began with an outline in March of 2008. William A. Doyle is the principal author of this report with the final chapter is being written within a few days of his departure from Reclamation to work with the US Army Corps of Engineers in Sacramento, California. Should you wish to contact him, please e- mail him at william.a.doyle@usace.army.mil .

APPENDIX – PIPELINE MODEL

ALIGNMENT MAPS