Volume II I

Three Valleys Municipal Water District

TABLE OF CONTENTS

Page

TABLES

FIGURES

1.0 INTRODUCTION

1.1 Overview

The Chino Groundwater Basin (Basin) Dry-Year Yield (DYY) Program Expansion (Program Expansion) is a comprehensive water resources management program to maximize conjunctive-use opportunities in the Basin. Program Expansion details are provided in a two-volume Project Development Report (PDR). Volume I traces the development of the original DYY Program, describes the Program Expansion, and presents the technical, financial, and institutional framework within which individual projects will move forward. Volume II consists of 10 lettered sub-volumes (A-J) defining facilities to be developed by the Program Expansion's ten participating appropriators. This Volume II-I describes proposed facilities for Three Valleys Municipal Water District (TVMWD). A subsequent individual chapter provides conceptual development of the agency interconnection facilities required for TVMWD to participate in the Program Expansion. An Opinion of Probable Cost is also presented. This Introduction Chapter provides background information on the DYY Program, the Program Expansion, and the TVMWD system.

1.2 Evolution of DYY Program and Program Expansion

The Program Expansion is being developed by the Chino Basin Watermaster (Watermaster) in association with the TVMWD, Inland Empire Utilities Agency (IEUA), Metropolitan Water District of Southern California (Metropolitan), and Western Municipal Water District (WMWD). Table 1-1 summarizes the history and evolution of the Program Expansion, which could provide an additional 17,000 acre-feet (acre-ft) of groundwater for dry-year use.

Table 1-1
Evolution of Chino Basin DYY Program Expansion*

Item	Description	Comments
Chino Basin Optimum Basin Management Program (OBMP)	Developed in response to a 1998 court ruling governing water use in the Basin (Chino Judgment). The Judgment was a continuation of a 1978 ruling providing a legal definition for the Basin and establishing a court-appointed Watermaster.	OBMP objectives are to enhance Basin water supplies, protect and enhance water quality, enhance Basin management, and provide equitable financing. Of the OBMP's nine Program Elements, three are applicable to the Expansion Program: Salt Management (7), Groundwater Storage Management (8), and Conjunctive-use (9).
DYY Program	Conjunctive-use program initiated in 2002 among Metropolitan, IEUA, Watermaster, and participating Basin appropriators. IEUA, which manages the distribution of imported water to Basin appropriators, acts as liaison between Watermaster and Metropolitan.	The Program provides for 100,000 acre-ft of water through in-lieu exchange and direct recharge of surplus Metropolitan imported supplies. Water can be "put" into and "taken" out of the Basin at a maximum rate of 25,000 acre-feet per year (afy) and 33,000 afy, respectively.
DYY Program Expansion	Expansion of 2002 DYY Program to produce up to 17,000 afy of additional groundwater for dry-year use, in-lieu of imported water.	Each of the participating appropriators will contribute a portion of the 17,000 acre-ft of additional dry-year yield or necessary "puts" into the Basin.

* Additional details are provided in PDR Volume I.

1.3 Documentation

IEUA assembled the consultant team for both the DYY Program and the Program Expansion. Both Programs have been accomplished through a series of cooperative activities working extensively with Watermaster and the Basin appropriators. From this collaboration, several reports, technical memoranda (TMs), and computer models were produced, which served as the framework of this PDR.

The PDR is organized into four volumes. Volumes I and II, prepared by Black & Veatch (B&V), provide general information on the DYY Program Expansion. Volume I presents background information on the Basin and Program operation, while Volume II presents design criteria specific to each participating agency. Volume III, the Preliminary Modeling Report prepared by Wildermuth Environmental, Inc. (WEI), presents results of a groundwater model used to evaluate the water resources impacts of the DYY Program on the Basin. Volume IV presents the California Environmental Quality Act (CEQA) documentation conducted for this project and was prepared by Tom Dodson & Associates (TDA).

1.4 Summary of Program Participants

Volume II describes the specific site requirements and design criteria for the proposed facilities required to provide the 17,000 acre-ft of additional dry-year yield. Table 1-2 lists the appropriators and the corresponding PDR volume which identifies their project-specific facilities. Construction of these facilities is required for full Program implementation.

Table 1-2
Summary of Program Participants and Facility Requirements

Agency/PDR Volume	Facility Requirements
Chino (II A)	▸ Regenerable Ion Exchange (IX) treatment at existing well Nos. 3 and 12 ▸ Aquifer Storage Recovery (ASR) Site at Well No. 14: Regenerable IX treatment at existing well no. 14 and replacement of existing Chino agriculture well for injection
Chino Hills (II B)	▸ Convert existing well No. 19 to ASR
Cucamonga Valley Water District (II C)	▸ Four new ASR wells
Jurupa Community Services District (II D)	▸ New well No. 27 ("Galleano Well") ▸ New well No. 28 ("Oda Well") ▸ New well No. 29 ("IDI Well")
Monte Vista Water District (II E)	▸ New ASR well and regenerable IX treatment ▸ Rehabilitate existing well No. 2 and regenerable IX treatment ▸ Regenerable IX treatment at existing ASR well No. 4 and well No. 27 ▸ Conveyance facilities to deliver water from Monte Vista Water District (MVWD) via Chino Hills to Walnut Valley Water District Service Area
Ontario (II F)	▸ Conveyance facilities to establish interconnection with Cucamonga Valley Water District (CVWD)
Pomona (II G)	▸ Regenerable IX treatment at existing Reservoir No. 5 site
Upland (II H)	▸ New well in Six Basins
Three Valleys Municipal Water District (II I)	▸ Treated water pipeline from Water Facilities Authority (WFA) water treatment plant (WTP) to Miramar WTP ▸ Turnout along Azusa-Devil Canyon Pipeline
Western Municipal Water District (II J)	▸ Conveyance facilities to establish interconnection between planned Riverside-Corona (RC) Feeder and Jurupa Community Services District (JCSD) service area ▸ Conveyance pipeline to establish interconnection between WMWD service area and Arlington Desalter Pipeline

1.5 Conceptual Design Assumptions

Facilities described in Volume II were designed based upon information available and using the following general design assumptions:

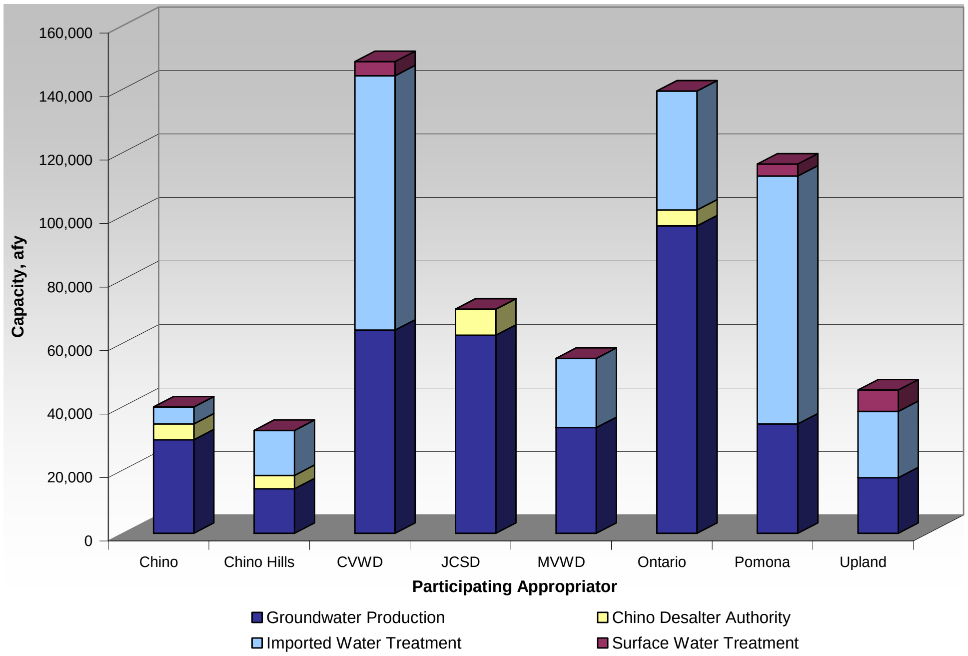
- Elevations were based upon United States Geological Survey (USGS) maps and maps obtained online from Google® Earth and are estimated to be accurate to within 10 percent of the actual elevation. Topographical surveys would be performed as part of the final design.
- Typical engineering calculations and assumptions were used to develop preliminary sizing for equipment and IX facilities. The final designs may vary slightly dependent upon results of the Title 22 water quality testing as well as detailed discussions with IX resin manufacturers.
- Conceptual designs assumed to not have significant permitting restrictions. Investigations of potential permit requirements for each project would be carried out during final design.

- Brine discharge to the non-reclaimable waste (NRW) system was assumed to not have a significant impact on NRW system capacity. The available capacity of the NRW System would be evaluated during final design.
- Groundwater levels and flows, anticipated drawdown from well operation and location, and concentration of contaminants was based upon available data provided by WEI based upon their recent modeling efforts.
- Facilities to be constructed on agency or City property were assumed to not require additional land purchase. In addition, pipelines constructed in City or County streets were assumed to be within the right-of-way limits.
- The opinion of probable cost is intended to provide a budgetary estimate of the capital and operational costs. Detailed quantity and unit cost figures for the facilities would depend on specific manufacturer equipment and prices.

1.6 Facility Requirements

An investigation ("Asset Inventory") consisting of several meetings and site visits was conducted to determine the condition of existing facilities and production capacities of each participating appropriator. The Asset Inventory presents a comprehensive list of the facilities available for each appropriator and identifies each participating appropriator's groundwater production capabilities and imported water treatment capacity. The results of the Asset Inventory are discussed in Volume I, Appendix A. Figure 1-1 summarizes Asset Inventory results.

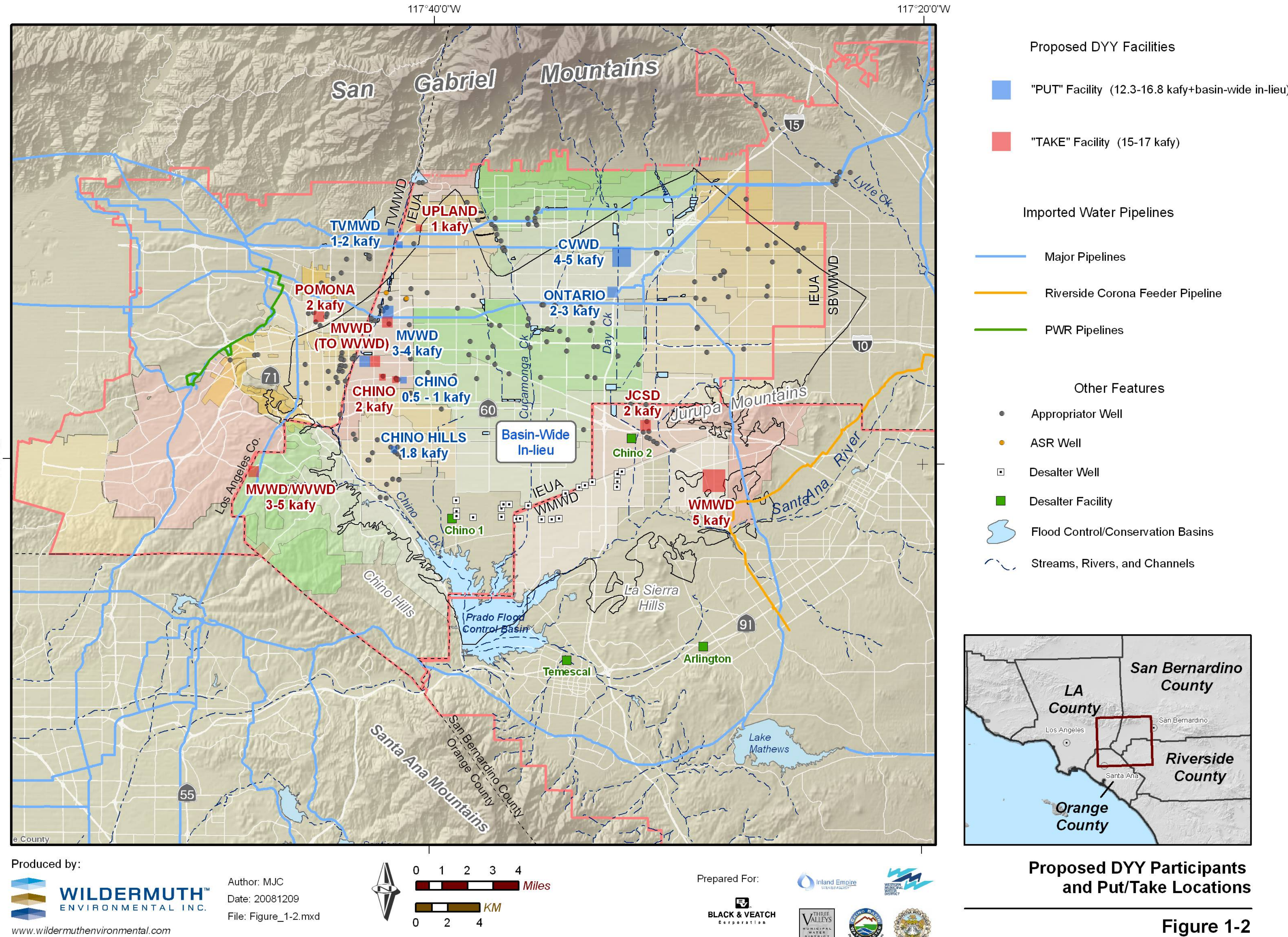
Figure 1-1
Water Resource Capacities for Participating Appropriators(1)(2)



Notes:
(1) Participating Appropriators include current Basin appropriators interested in participating in the DYY Program Expansion. This does not include agencies outside the Basin, such as TVMWD and WMWD.
(2) Does not include recycled water deliveries provided by IEUA.

Table 1-3 lists potential Program participants and each agency's potential "put" and/or "take" contribution. The combined "take" capacity of these agencies ranges from 15,000 to 17,000 afy. The combined "put" capacity of these agencies is approximately 12,300 to 16,800 afy of direct capacity plus Basin-wide in-lieu deliveries and surface spreading contributions.

Figure 1-2 shows the locations of each agency's proposed facilities and/or locations where potential "puts" and "takes" could occur within the Basin. As the figure demonstrates, the "puts" and "takes" may be balanced on the east and west sides of the Basin. Through groundwater modeling, Program operations were evaluated to determine the potential for material physical injury to a party of the Chino Judgment or to the Chino Basin as required by the Peace Agreement, (refer to Volume III, Program Modeling Report).



Produced by:

WILDERMUTH ENVIRONMENTAL INC.

www.wildermuthenvironmental.com

Author: MJC
Date: 20081209
File: Figure_1-2.mxd

Prepared For:

BLACK & VEATCH Corporation

Proposed DYY Participants and Put/Take Locations

Figure 1-2

Table 1-3
Summary of Initial and Expanded DYY Program Participants and Proposed Put/Take Capacities

Agency	Initial DYY Program (1)		DYY Program Expansion (2)	
	Put Capacity (afy)	Take Capacity (afy)	Put Capacity (afy) (4)	Take Capacity (afy) (6)
City of Chino	(3)	1,159	500-1,000	2,000
City of Chino Hills[5]		1,448	1,800	0
Cucamonga Valley Water District		11,353	4,000-5,000	0
Jurupa Community Services District		2,000	0	2,000
Monte Vista Water District		3,963	3,000-4,000	3,000-5,000
City of Ontario		8,076	2,000-3,000	0
City of Pomona		2,000	0	2,000
City of Upland		3,001	0	1,000
Three Valleys Municipal Water District		0	1,000-2,000	0
Western Municipal Water District		0	0	5,000
Total	25,000	33,000	12,300 – 16,800	15,000 – 17,000

Notes:
(1) Initial 100,000 acre-ft DYY Program includes maximum 25,000 afy "put" over a four-year period of surplus water and a maximum 33,000 afy "take" over a three-year dry period.
(2) DYY Program Expansion includes increases in total storage, "put" capacity, and "take" capacity.
(3) "Puts" for the initial DYY Program are accomplished by a combination of direct recharge and in-lieu deliveries.
(4) Does not include basin-wide in-lieu deliveries and direct recharge.
(5) MVWD assumed Chino Hills' shift obligation of 1,448 afy per an amendment to the agreement between the agencies dated March 5, 2007.
(6) Post modeling, adjusted take capacities. See Volume III for details.

Therefore, while the Basin has adequate storage capacity, any increases in groundwater production during dry years would likely require additional production capacity and/or groundwater treatment. Groundwater treatment during dry years will contribute to the long term sustainable use of the Basin. A further discussion of the Basin Operations Plan is provided in Volume I.

1.6.1 Water Resources, Historical Water Use, and Shift Obligation for TVMWD

TVMWD serves the Southeast region of Los Angeles County with water from Metropolitan via the Department of Water Resource's State Water Project. TVMWD provides wholesale water to the cities of La Verne, Covina, Pomona, Glendora, and Rowland and Walnut Valley Water Districts. Water is also served to customers in Azusa, La Puente, Claremont, Diamond Bar, San Dimas, Walnut, Industry, West Covina, as well as California State Polytechnic University, Pomona, Mount San Antonio College, and the Firestone Reservation. TVMWD currently supplies approximately 68,000 acre-ft of water annually to its customers. The water is comprised of both treated and untreated water in the service area from various sources.

In addition to importing water from Metropolitan's Weymouth WTP, TVMWD owns and operates the 25 million gallons per day (mgd) Miramar WTP, which treats surface water imported via Metropolitan's Rialto Pipeline. TVMWD is also a member agency of the Six Basins Watermaster which, similar to the Chino Basin Watermaster, monitors the health of Six Basins including the Canyon, Upper and Lower Claremont Heights, Pomona, Live Oak and Ganesha Basins.

Figure 1-3 presents TVMWD's historical imported water purchases. Based on historical imports and on future growth projections, as summarized in Table 1-3, TVMWD has elected to participate in the "put" side of the Program Expansion by contributing between 1,000 to 2,000 afy. To achieve this potential contribution, TVMWD has proposed two new conveyance facilities as discussed in Section 1.5.2. TVMWD would also be involved with any in-lieu shifts conducted by their retail agencies, Walnut Valley Water District (refer to MVWD Volume II E), and the City of Pomona (refer to Volume II G).

Figure 1-3
TVMWD Historical Imported Water Usage

Notes:
(1) Proposed maximum potential shift based upon the total shifts of TVMWD's retail agencies, Walnut Valley Water District and City of Pomona.

1.6.2 Program Expansion Facility Requirements

Two interconnection facilities to achieve TVMWD's put contribution are being considered including: 1) the WFA – Miramar WTP Interconnection, a conveyance pipeline to convey treated water from WFA's Agua de Lejos WTP to TVMWD's Miramar WTP; and 2) Azusa Devil Canyon (ADC) Pipeline Turnout, a new turnout that would provide a supply to the San Antonio Channel for eventual groundwater recharge in the Chino Basin.

1.6.2.1 WFA - Miramar WTP Interconnection

The interconnection facilities would consist of a new 36-inch diameter pipeline and booster pump station to convey flow west, beginning at the WFA Agua de Lejos WTP treated water effluent to the Miramar WTP treated water reservoirs.

The interconnection would be an in-lieu "put" for the Expansion Program. Due to service area demands, the TVMWD Miramar WTP frequently operates at capacity, while the nearby WFA WTP has difficulty maintaining the minimum flow requirement during periods of low demand. The interconnection would increase the availability of treated imported water to TVMWD, allowing its retail agency, City of Pomona, to reduce groundwater pumping in exchange for additional imported deliveries. A booster pump station would be required to convey water to the Miramar WTP, which is located at a higher elevation than the WFA WTP.

1.6.2.2 Azusa Devil Canyon Pipeline Turnout

The second proposed project to achieve TVMWD's shift is construction of a turnout structure from the ADC pipeline. The facility would involve a new pipe, a meter vault, and a pressure reducing valve to connect the ADC Pipeline to the San Antonio Channel. Water would then be conveyed to several Chino Basin recharge facilities via the San Antonio Channel as an alternative to the Rialto Feeder/OC-59 "put" into the Basin.

1.7 Abbreviations and Acronyms

The following abbreviations/acronyms are used in this report:

acre-ft	acre-feet
afy	acre-feet per year
ADC	Azusa Devil Canyon
ASR	aquifer storage and recovery
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
B&V	Black & Veatch
Basin	Chino Basin
Cal-OSHA	California Operational Safety and Health Administration
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CVWD	Cucamonga Valley Water District
d/t	diameter/thickness

DYY	Dry-Year Yield
DYY Program	initial Chino Basin Dry-Year Yield Program
DYY Program Expansion	Chino Basin Dry-Year Yield Program Expansion
fps	feet per second
HDPE	high-density polyethylene
HGL	hydraulic grade line
IEUA	Inland Empire Utilities Agency
IX	ion exchange
JCSD	Jurupa Community Services District
Judgment	Chino Basin Municipal Water District vs. the City of Chino et al. (1978)
lbs/ft^3	pounds per cubic foot
Metropolitan	Metropolitan Water District of Southern California
mgd	million gallons per day
MVWD	Monte Vista Water District
OBMP	Optimum Basin Management Program
OD	outside diameter
PDR	Project Development Report
Program	DYY Program, DYY Program Expansion
Program Expansion	Chino Basin Dry-Year Yield Program Expansion
psi	pounds per square inch
PVC	polyvinyl chloride
RC	Riverside-Corona
ROW	right of way
SGVMWD	San Gabriel Valley Municipal Water District
TBD	to be determined
TDA	Tom Dodson & Associates
TDH	total dynamic head
TM	technical memorandum
TVMWD	Three Valleys Municipal Water District
USGS	U.S. Geographic Survey
Watermaster	Chino Basin Watermaster
WEI	Wildermuth Environmental, Inc.
WFA	Water Facilities Authority
WTP	water treatment plant
WMWD	Western Municipal Water District

1.8 References

General references are listed in Volume I, Section 1.9. Agency-specific references for the facilities listed in this Volume II E are shown below.

[WFA/IEUA/TVMWD, 2007] *Preliminary Engineering Report for the SGVMWD Devil Canyon-Azusa Pipeline Emergency Interconnection*, prepared for the Water Facilities Authority, Three Valleys Municipal Water District, and Inland Empire Utilities Agency, TKE Engineering, Inc., April 2007.

2.0 AGENCY INTERCONNECTION FACILITIES

2.1 Overview

This chapter describes the TVMWD interconnection facilities required to participate in the Program Expansion. Two projects have been identified to provide capacity on the "put" side for the Program. Coordination among WFA, TVMWD, and the City of Pomona would be required to arrange the in-lieu shifts.

2.2 Water Supply

2.2.1 WFA – Miramar WTP Interconnection

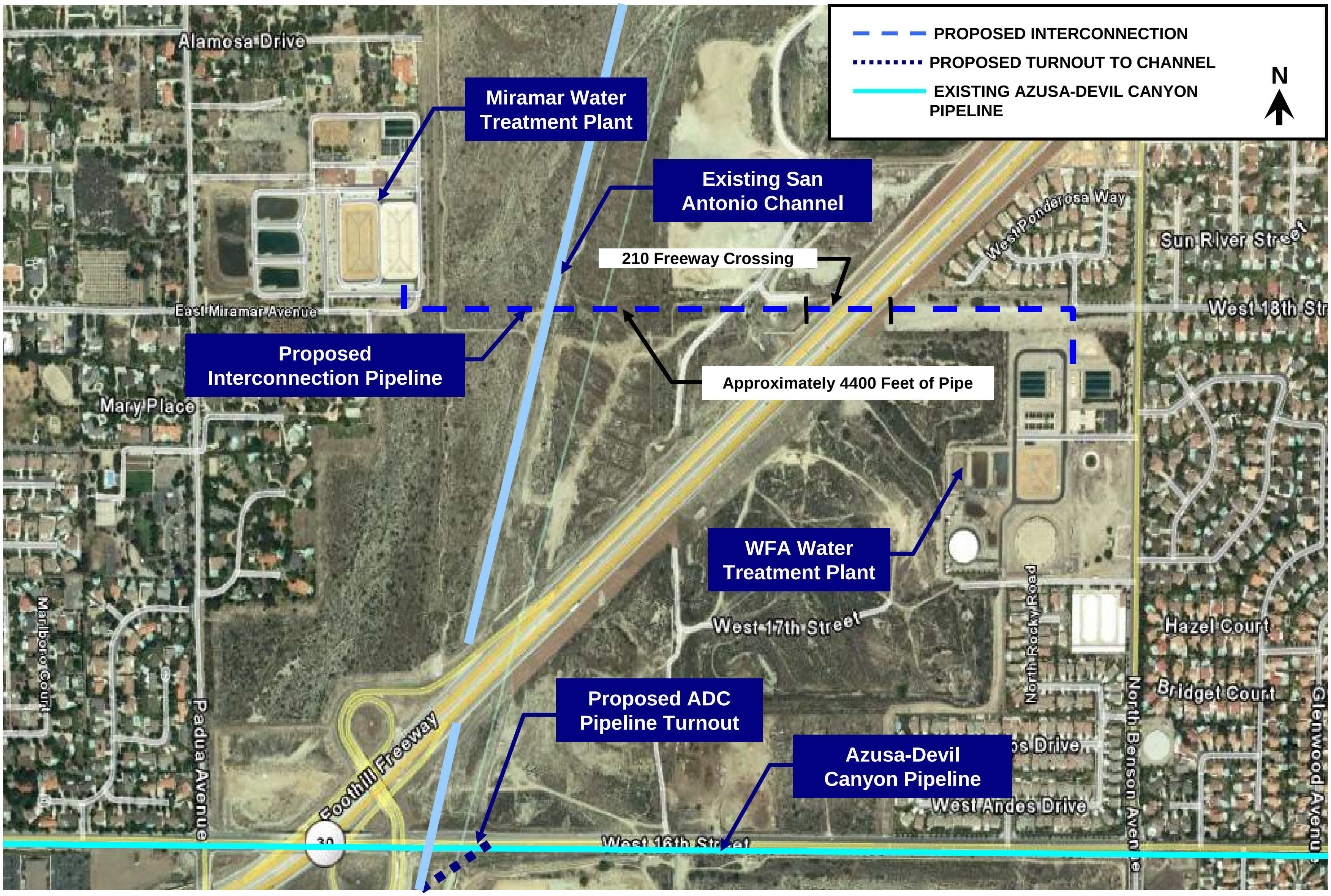
The first in-lieu shift with TVMWD would be provided using existing WTP facilities and a new conveyance pipeline. Treated water would be conveyed west from the WFA Agua de Lejos WTP through a new 36-inch line to the Miramar WTP treated water reservoir, to be used in-lieu of groundwater pumping by TVMWD's retail agency, City of Pomona.

2.2.2 ADC Pipeline Turnout to San Antonio Channel

The second TVMWD "put" contribution would be accomplished by a turnout constructed on the ADC pipeline. Water from San Gabriel Valley Municipal Water District (SGVMWD) would be diverted to the San Antonio Channel through a turnout and metering structure and flow south to several Chino Basin recharge facilities. However, there are limitations on this supply due to hydroelectric facilities downstream of the proposed turnout location. Power generation units operate under a specific amount of influent pressure. Any new facilities causing a decrease in pressure would be operated to ensure continued function of the existing facilities, thereby, limiting the frequency of operation or flow available. A vicinity map for these two concepts is shown on Figure 2-1.

2.3 Pipeline Conceptual Design

Design parameters discussed in this chapter include general design criteria, applicable codes and standards, hydraulic design, steel pipe design, pipe diameter, pipe material, pipe sections, load criteria, pipeline wall thickness, pipe deflection, joints and fittings, trench design, lining and coatings, corrosion control, and construction requirements (e.g., pipeline appurtenances, couplings, isolation valves, air release/vacuum relief, blowoff facilities, access manway, and utility research). At this stage of project development, it was assumed that steel pipe would be the selected pipe material for the purposes of developing an opinion of probable cost. Alternative pipe materials, such as ductile iron, high-density polyethylene (HDPE), and polyvinyl chloride (PVC), may also be appropriate and should be investigated during the design phase in order to provide a competitive bidding scenario. A summary of the design criteria for the pipelines is presented in Table 2-1.



BLACK & VEATCH building a world of difference™

ENERGY WATER INFORMATION GOVERNMENT

Chino Basin Dry Year Yield Program Expansion Project

Three Valleys Municipal Water District – WFA – Miramar Interconnection and ADC Turnout

Figure 2-1

Table 2-1
Summary of Pipeline Design Criteria

	WTP Interconnection	Azusa Devil Canyon Pipeline Turnout
Pipe		
Pipe Diameter, inches	36	36
Pipe Length, feet	4,400	800
Design Flows		
Maximum, cfs (1)	55	55
Average (2)	28	28
Velocities		
Maximum, feet per second (fps) (1)	7.7	7.7
Average (2)	4.0	4.0
Design Pressure		
Start Hydraulic Gradient, feet	1,604	1,686
End Hydraulic Gradient, feet	1,632	1,500
Pipe Wall Design		
Diameter/Thickness (d/t) Ratio	165	165
Minimum Thickness, inches	0.25 (Min. steel thickness)	0.25 (Min. steel thickness)
Pipe and Fittings Materials	Cement Mortar Lined and Coated Welded Steel	Cement Mortar Lined and Coated Welded Steel
Pipe	Steel AWWA C200	Steel AWWA C200
Lining	Plant applied cement mortar, AWWA C205	Plant applied cement mortar, AWWA C205
Coating	Cement mortar, AWWA C205	Cement mortar, AWWA C205
Minimum Cover, feet	6	6
Allowable Nominal Deflection, Percent of Nominal Diameter	2	2
Modulus of Soil, pounds per square inch (psi) (assumed)	1,400	1,400
Pipe Joints	Single or double welded, or butt strap, as required by District	Single or double welded, or butt strap, as required by District

Notes:
(1) Based on maximum pipeline capacity equivalent to maximum flow from SGVMWD's ADC pipeline.
(2) Based on average 10,000 acre-foot per year (afy) delivery over a six month period.

2.3.1 Pipeline Alignment

2.3.1.1 WFA – Miramar WTP Interconnection

The new pipeline would start at the WFA Agua de Lejos WTP conveying treated water west beneath the 210 freeway and across the San Antonio Channel, terminating at the treated water reservoir of the Miramar WTP. The section of pipe would be approximately 4,400 feet long and 36 inches in diameter.

2.3.1.2 Azusa Devil Canyon Pipeline Turnout

A new pipeline would be constructed connecting the ADC pipeline on West 16th Street to the San Antonio Channel. The pipeline would be approximately 800 feet long and 36 inches in diameter and would also include a metering, flow control and air gap facility at the connection to the San Antonio Channel.

2.3.2 Applicable Codes and Standards

The following codes and standards are applicable to the design and construction of the pipeline:

- American Society for Testing Materials (ASTM)
- American Water Works Association (AWWA) Codes and Standards
- AWWA Manual M11 (Steel Pipe – A Guide for Design & Installation)
- AWWA Manual M51 (Air Release, Air/Vacuum, and Combination Air Valves)
- B&V Design Procedures
- California Code of Regulations
- State of California Construction Safety Orders (California-Occupational Safety and Health Administration) Cal-OSHA
- California Department of Public Health (CDPH)
- TVMWD, SGVMWD, WFA-Joint Powers Authority (JPA), U.S. Army Corps of Engineers Standards

2.3.3 Hydraulic Design

Pipeline hydraulic design and requirements are based on information obtained from TVMWD and WFA. Potential hydraulic losses within the pipelines were also determined and are summarized in Table 2-2.

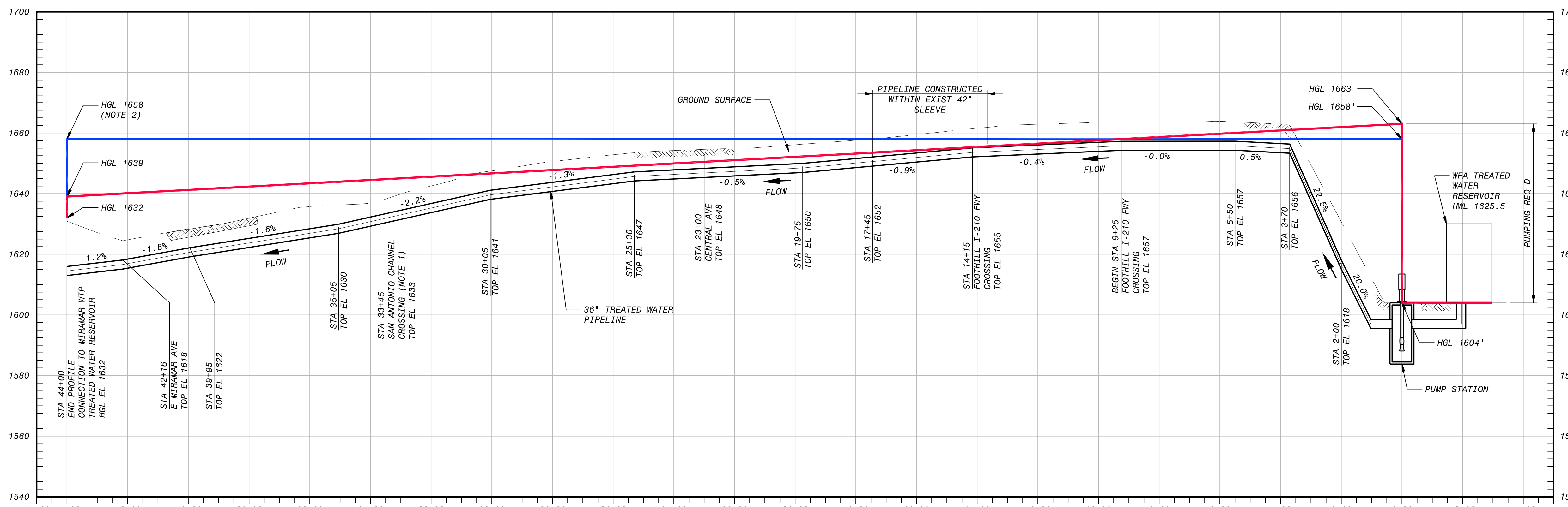
Table 2-2
Summary of Hydraulic Parameters

	Maximum Flow Rate, cfs	Hydraulic Loss, feet	Pump Station TDH, feet
WFA – Miramar WTP Interconnection	55	24.4	59 (1)
ADC Pipeline Turnout	55	4.4	N/A

Notes:
(1) TDH includes additional pumping required to maintain flow within the pipeline at high spots within the alignment.

Figures 2-2 and 2-3 provide preliminary hydraulic profiles for the two proposed projects.

PLAN STA 0+00 TO STA 44+00
HORIZ - 1" = 400'



HYDRAULIC PROFILE STA 0+00 TO STA 44+00
HORIZ - 1" = 400'
VERT - 1" = 40'

HYDRAULIC LEGEND

HGL	FLOW SCENARIO	FLOW RATE	NOTES
(red line)	DESIGN CAPACITY	55 CFS	BASED ON ADC PIPELINE CAPACITY
(blue line)	AVERAGE CAPACITY	28 CFS	BASED ON AVERAGE 10,000 AFY DELIVERY OVER A 6-MONTH PERIOD

NOTES:
1. PIPELINE DEPTH AT SAN ANTONIO CHANNEL TO BE CONFIRMED.
2. PIPELINE LOSSES ARE SMALL AND ASSUMED NEGLIGIBLE FOR THIS PROJECT PHASE.

CONCEPTUAL - NOT FOR CONSTRUCTION

CHINO BASIN DYY PROGRAM EXPANSION PROJECT
PROJECT DEVELOPMENT REPORT

THREE VALLEYS MUNICIPAL WATER DISTRICT
WFA - MIRAMAR WTP INTERCONNECTION
PLAN AND PROFILE

BLACK & VEATCH
Black & Veatch Corporation
Irvine, California

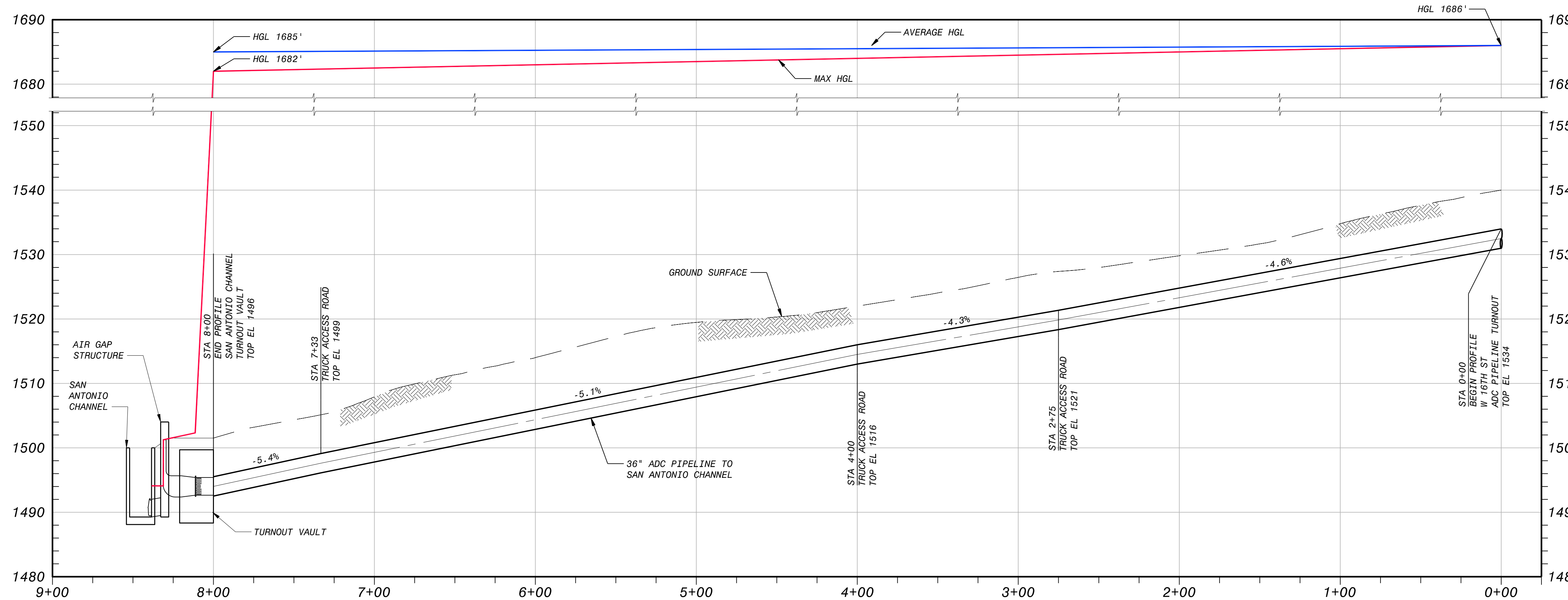
DESIGNED: MEM
DETAILED: JEG
CHECKED:
APPROVED:
DATE:

PROJECT NO.
160374

FIGURE 2-2

FD160374
D160374

PLAN STA 0+00 TO STA 8+00
HORIZ - 1" = 80'



HYDRAULIC PROFILE STA 0+00 TO STA 8+00
HORIZ - 1" = 80'
VERT - 1" = 20'

HYDRAULIC LEGEND

HGL	FLOW SCENARIO	FLOW RATE	NOTES
(red line)	DESIGN CAPACITY	55 CFS	BASED ON ADC PIPELINE CAPACITY
(blue line)	AVERAGE CAPACITY	28 CFS	BASED ON AVERAGE 10,000 AFY DELIVERY OVER A 6-MONTH PERIOD

NOTE:
1. ASSUMES 66 PSI OPERATING PRESSURE AT AZUSA DEVIL CANYON (ADC) PIPELINE.

CONCEPTUAL - NOT FOR CONSTRUCTION

FD160374
D160374

DATE | REVISIONS AND RECORD OF ISSUE | NO. | BY | CK | APP

CYGNET ID: 160374-2000-WTUP-C-N000147HV
WF: Figure 2-3.dwg
SAVED: GLA36511, 12/11/2008 9:08:04 AM
PLOTTED: GLA36511, 12/11/2008 9:08:06 AM
USER: GLA36511 | DWG VER: 1.4
XREF1: ADC Turnout Aerial.jpg
XREF2:
XREF3:
XREF4:
XREF5:

BLACK & VEATCH
Black & Veatch Corporation
Irvine, California

CHINO BASIN DYY PROGRAM EXPANSION PROJECT
PROJECT DEVELOPMENT REPORT

THREE VALLEYS MUNICIPAL WATER DISTRICT
ADC PIPELINE TURNOUT TO SAN ANTONIO CHANNEL
CONVEYANCE PLAN AND PROFILE

DESIGNED: MEM
DETAILED: JEG
CHECKED:
APPROVED:
DATE:

PROJECT NO.
160374

FIGURE 2-3

As shown on Figure 2-2, the 3.0 million gallon (MG) clearwell at the WFA WTP has a grade elevation of approximately 1604 feet and maintains a high water level of 1625.5 feet. The high water elevation in the Miramar WTP treated water reservoir is 1632 feet. The static head difference between these two reservoirs ranges from 0-28 feet and pumping would be required. A small amount of additional pumping would also be necessary to maintain backpressure within the pipeline throughout the high points of the alignment. The approximate total dynamic head (TDH) necessary to convey water between the WTPs is 59 feet, resulting in a power demand of approximately 472 horsepower at the maximum flow of 55 cfs.

2.3.4 Pipe Diameter

Both of the TVMWD proposed projects would consist of a 36-inch diameter pipeline to convey the maximum flow of 55 cfs.

2.3.5 Pipe Materials

Pipeline materials would be selected to meet ductility and joint design guidelines for superior seismic performance. Steel pipe was selected for the basis of this PDR; however, alternative pipe materials could be evaluated during final design. The pipeline would be cement mortar lined and coated steel pipe conforming to AWWA C200. The pressure class would be allowed to vary along the pipe. The required pipeline wall thickness would be determined for the pipeline and indicated on the plan and profile drawings.

2.3.6 Pipe Sections

Typical pipe sections are available in alternative lengths from 40 to 60 feet, depending on the pipe manufacturer’s mill capabilities. Table 2-3 provides the approximate number of pipe sections that would be necessary for each potential project.

Table 2-3
Summary of Pipe Sections

	60 ft sections	40 ft sections
WTP Interconnection	74	110
ADC Pipeline Turnout	14	20

2.3.7 Load Criteria

Internal and external loads must be considered to ensure appropriate pipeline design.

2.3.7.1 Internal Load

Design for internal loading would be based on the design HGL. Design pressures would be based on the considerations of normal operating conditions, transient surge conditions, hydrostatic test pressures, and other conditions if warranted.

2.3.7.2 External Load

Design of the pipe for external loading would consider the depth of earth cover, live loads, and construction loads. A maximum deflection of two percent nominal pipe diameter would be allowed. A maximum allowable design deflection of two percent for the 36-inch diameter pipe is 0.72 inches. Based on a modulus of elasticity of 1,400 pounds psi for soil, the minimum cover over the pipeline would be six feet and the maximum cover 22 feet. Concrete slurry would be required for deeper installation. In areas where utility crossings may occur, pipe cover would range from six to ten feet or be governed by the geotechnical engineer's recommendations.

2.3.8 Pipeline Wall Thickness

Minimum pipe wall thickness is an important consideration for handling and installation as well as for protection against collapse or buckling due to internal vacuum. Hydraulic requirements often dictate that the pipe wall thickness be increased for internal pressure. The minimum wall thickness and internal pressure were calculated to determine the governing criteria for wall thickness. For this pipeline, the minimum guidelines governed pipe wall thickness design.

The d/t ratio provides the minimum steel thickness for safe transport of the pipe. A d/t of 165 is recommended for this pipeline, which would result in a minimum wall thickness for a 36-inch pipeline of 0.22-inches; however, because the pipeline would be buried in streets with congested underground utilities and/or in areas where future construction may expose the pipe and added strength may be necessary, a minimum wall thickness of 0.25-inch is recommended.

The steel thickness necessary to withstand the internal pressure was also calculated to ensure the minimum thickness would be adequate. Based upon preliminary calculations, the internal pressure considered is negligible when utilizing a thickness of 0.25-inches. The pipe wall thickness would vary along the alignment based on the test HGL and the actual centerline of the installed pipe. These thicknesses would be determined during final design, although the recommended pipe wall thickness would not be less than the minimum 0.25-inches specified.

2.3.9 Pipe Deflection

Since steel pipe is a flexible conduit, the maximum cover depth is dependent on the allowable deflection caused by external loads. Maximum allowable deflection resulting from external loading conditions is limited to two percent of the pipe diameter for pipe with shop applied cement mortar coating. The maximum allowable design deflection of two percent for the 36-inch diameter pipe would be 0.72 inches.

Estimated deflections using the minimum pipe wall thicknesses were calculated assuming a soil unit weight of 120 pounds per cubic foot (lbs/ft^3) and assuming Class B bedding as summarized in Table 2-4.

Table 2-4
Estimated Pipe Deflection

	36-Inch Pipe Diameter
Deflection, inch	0.19
Max. Cover Depth, feet	22

Notes:
(1) Assumes w = 120 lbs/ft^3 and Class B bedding.

2.3.10 Joints and Fittings

Pipe installation would use rubber gasket joints or single or double welded joints to join pipe sections, depending upon TVMWD standards.

2.3.11 Trench Design

Excavation for pipe installation would be in accordance with the requirements established by Cal-OSHA and by the applicable agencies. Shoring may be required due to space constraints and possibly soil considerations. Shoring design would be specified to be the responsibility of the contractor. Trench depth should be generally selected based on minimum cover to protect the pipe safely from transient loads. Depth of trenching in city streets may be governed by existing utilities or other conditions. If the sides of the trench remain vertical after excavation, and if bedding and backfill were consolidated by hydraulic methods, the minimum trench width at the top of the pipe would then be pipe outside diameter (OD) plus 20 inches on each side of the pipe. If the pipe-zone bedding and backfill require densification by compaction, then the width of the trench at the bottom of the pipe should be determined by the space required for the proper and effective use of tamping equipment, but it should never be less than pipe OD plus 20 inches on each side. Flat bottom trenches should be excavated to a depth of a minimum of four inches below the established grade line of the outside bottom of the pipe. Specified building material should be used to fill the excess excavation. Loose subgrade material should be graded uniformly to the established grade line for the full length of the pipe.

Three applicable methods of trenching are described in the following subsections.

2.3.11.1 Open Trench with Flared Sidewalls

This method would require more construction area than any other method due to the type of equipment used. However, open trenching with flared sidewalls is the least expensive form of excavation for pipelines. This method would generally be used in open terrain. Limitations of available rights-of-way (ROW) would have to be investigated to utilize the open trench method.

2.3.11.2 Open Trench with Shoring

Open trench with shoring would be used for confined construction areas and restricted ROW. Pipe placement along the street would require this method because of space confinement. According to TVMWD staff, coordination is underway with Metropolitan to utilize its ROW within the area.

2.3.11.3 Jack and Bore Method

The jack and bore method may be utilized if conditions exist that would not allow sections of the street to be opened, such as a congested intersection, or the San Antonio Channel. The contractor would install a prefabricated pipe through the ground from a jacking pit to a receiving pit. The pipe would be propelled by jacks located in the jacking pit. As the pipe installation progresses, the spoils would be transported out of the pipe either manually or by mechanical methods. The casing pipe material would be steel pipe welded at each joint. The casing pipe would need to accommodate the carrier pipe plus the skids, or pipe spacers, to support the carrier pipe. For a 36-inch pipeline, the casing pipe would be 48-inches. The contractor would need space for the jacking pit (approximately 20 by 40 feet), equipment (e.g., excavator, crane, generator, small equipment, storage containers), materials, temporary spoils piles, and delivery equipment. The jacking and receiving pits would be supported in a manner similar to open trench excavation with shoring.

2.3.12 Lining and Coatings

All buried steel pipe would be coated and lined. The pipe coating and lining would be a cement mortar coating in accordance with AWWA C205. The lining and coating would be used to protect the pipeline from wear during installation and operation, as well as from corrosion.

2.3.13 Corrosion Control

The water to be conveyed is treated and not known to be corrosive. Cement mortar lining on the inside of the steel pipe would provide the primary corrosion protection for the steel shell.

If cathodic protection is desired to protect the external pipe surface, cathodic test stations would be included in the pipeline design. Installation of wire jumpers at joints, harness assemblies, and couplings would be provided for continuity along the pipeline. Insulating flanges would be provided to isolate pipeline segments. Where cement mortar coatings are not provided on the pipeline, the pipe would be coated with a high performance protective coating, coated with mastic, and wrapped with polyethylene sheeting.

2.3.14 Construction Requirements

The alignment would lie within the Metropolitan and public ROW. Encroachments through public streets would be handled by the City of Upland or San Bernardino County. The contractor would have to work within a restricted construction zone along the road, either on the shoulder or within an identified lane, where the trench would be located using a shored trench. A detailed evaluation of the construction zone requirements versus available width would be required during design.

2.3.14.1 Pipeline Appurtenances

Water conveyance facilities include appurtenant structures for operation and protection against damaging hydraulic transients, as well as facilities to permit periodic maintenance. Specific appurtenances would include couplings, isolation valves, air and vacuum relief, blow-off facilities, access manways, pipe draining and filling, and marker posts.

2.3.14.2 Couplings

Sleeve couplings provide tightness and strength with flexibility. Flexible sleeve couplings would be able to handle acceptable pipe axial movement. If greater displacement were needed, a harness assembly could be installed with each flexible coupling according to AWWA M11.

2.3.14.3 Isolation Valves

The pipeline would be designed to resist damage from earthquakes. In addition, valves may be provided to isolate portions of the pipeline should damage occur. Isolation valves would be the same size as the pipeline and would be manually operated. The location of these valves, if desired, would be determined after the completion of the geotechnical report during final design.

2.3.14.4 Air Release/Vacuum Relief

Air release/vacuum relief valves allow entrained air to vent out of the pipeline during fill, allow air back into the pipeline when it is being drained, and protect the pipeline from collapse due to negative pressures. The air release/vacuum relief valves would be installed at every summit along the pipeline; the valves would prevent accumulation of air pockets at high points, which might impair the pipe’s flow capacity. Air release/vacuum relief valves would be designed to meet all the criteria in AWWA M11 and M51.

2.3.14.5 Blowoff Facilities

Blowoff facilities would be located at the low points and upstream of line valves located on a slope of the pipeline. Blowoff facilities would be used to drain pipe sections and to allow for relief of pipe pressure for inspection and maintenance purposes. The blow off facilities would consist of a short length of pipe connected to the bottom of the main pipe and carried away from the main to a gate valve where the operating nut must be accessible from the surface. The blowoff facilities would be designed and set with the stem vertical and just beyond the side of the pipeline.

2.3.14.6 Access Manway

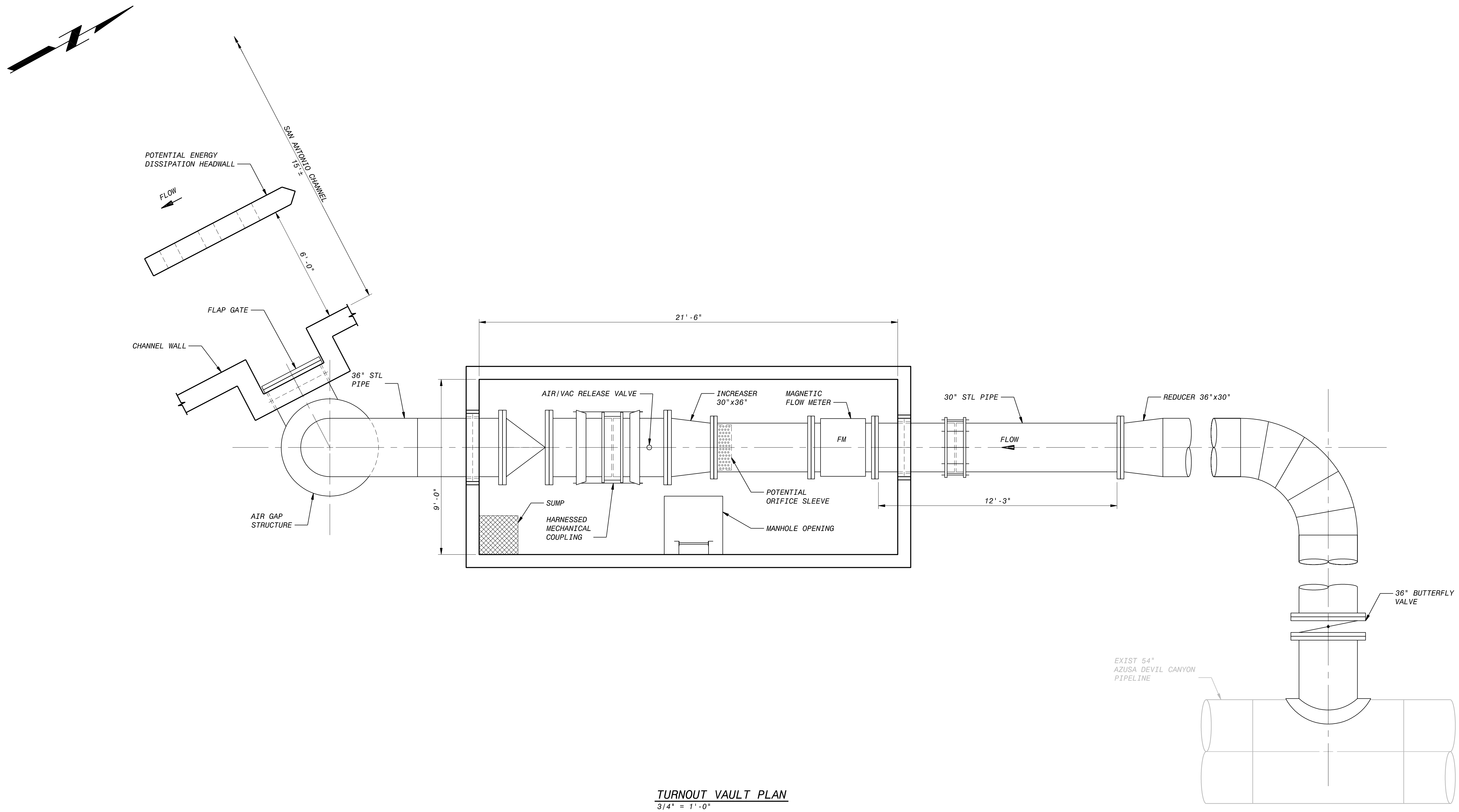
Access to the pipeline would be provided from the top of the pipe by a tee in the pipeline with a blind flange. The manholes would typically be 30-inch flanged tees, either buried or contained within a concrete structure and located at about 2,000 foot spacings along the alignment. Access manholes would be located close to valves and low points, as well as intermediate locations along the pipeline.

2.3.14.7 Utility Research

An investigation of existing facilities should be performed to identify approximate locations of crossings or parallel utilities in relation to that of the pipeline. Potholing is also expected in some locations along the pipeline alignment during final design to determine unknown or verify as-built utility locations.

2.4 Turnout Conceptual Design

The turnout from the ADC Pipeline to the San Antonio Channel would include a vault and air gap structure at the point of connection to the channel. As shown in Figure 2-4, the turnout vault would contain a flowmeter (to get an accurate measure of TVMWD's put contribution), a fixed orifice sleeve to reduce pressure head, and a check valve to prevent backflow. The water would then enter an air gap structure to ensure stormwater from the channel would not enter into the turnout vault during high flow events and to maintain a constant discharge head from the turnout. From this structure, a connection to the San Antonio Channel would be made and a flap gate would be installed to further prevent backflow and to protect the conveyance facility from debris. Within the channel, energy dissipation head walls may be constructed instead of the fixed sleeve as a barrier from high velocity streams exiting the structure. Coordination with the Army Corps of Engineers would be necessary to ensure compliance with all codes and standards.



TURNOUT VAULT PLAN
3/4" = 1'-0"

NOTE:
1. REQUIREMENT FOR SLEEVE VALVE, OR OTHER PRESSURE REDUCING VALVE, TO BE DETERMINED UPON FURTHER DEVELOPMENT AND COORDINATION WITH SAN GABRIEL VALLEY MWD, U.S. ARMY CORPS OF ENGINEERS, AND TVMWD.

CONCEPTUAL - NOT FOR CONSTRUCTION

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK	APP

CYGNET ID: 160374-2000-WTUP-C-N000147HW XREF1:
WF: Figure 2-4.dwg XREF2:
SAVED: GLA36511, 12/10/2008 8:09:45 AM XREF3:
PLOTTED: GLA36511, 12/11/2008 9:11:46 AM XREF4:
USER: GLA36511 DWG VER:1.6 XREF5:

BLACK & VEATCH
Black & Veatch Corporation
Irvine, California

CHINO BASIN DYY PROGRAM EXPANSION PROJECT
PROJECT DEVELOPMENT REPORT

THREE VALLEYS MUNICIPAL WATER DISTRICT
ADC PIPELINE TURNOUT TO SAN ANTONIO CHANNEL
TURNOUT VAULT PLAN

DESIGNED: MEM
DETAILED: JEG
CHECKED:
APPROVED:
DATE:

PROJECT NO.
160374

FIGURE 2-4

FD160374
D160374

3.0 OPINION OF PROBABLE COST

3.1 Overview

This chapter presents the opinion of probable cost for the facilities described in this Volume II I of the PDR. General cost assumptions and the opinion of probable capital and annual operations and maintenance (O&M) costs are presented below.

The opinion of probable cost was based on conceptual-level unit cost criteria intended to provide a budgetary estimate of each facility's capital and annual O&M costs. Table 3-1 summarizes the estimated capital and annual O&M costs for the District's proposed facilities. As shown in the table, the total opinion of probable capital and annual O&M costs for the new facilities would be $6,410,000 and $398,000, respectively.

Table 3-1
Summary of Opinion of Probable Capital and Annual O&M Costs

Component	Cost
Capital Cost	
Construction Cost	$4,856,000
Contingency [(1)]	$971,000
Engineering/Administration/CM[(2)]	$583,000
Total Capital Cost	**$6,410,000**
Midpoint of Construction Cost [(3)]	$7,004,000
Annual Cost	
Annual O&M Cost	$398,000
Annualized Capital Cost [(4)]	$548,000
Total Annual Cost	**$946,000**

Notes:
(1) Based on 20 percent contingency.
(2) Based on 12 percent engineering/administration/construction management (CM).
(3) Assumes midpoint of construction in year 2012 at 3 percent escalation rate.
(4) Assumes amortization period of 25 years and discount rate of 6 percent.

3.2 General Cost Assumptions

The conceptual-level opinion of probable capital and O&M costs developed in this PDR were derived from quotes received from equipment manufacturers, a survey of bid pricing from participating agency facilities previously or currently under construction, and bid results or construction cost estimates from similar and recent B&V projects. Volume I, Chapter 9, presents a summary of the basis for the unit costs used in this PDR.

Volume I, Chapter 9, also presents the construction, annual O&M, general, and financing unit cost criteria used to develop the cost estimates provided in this chapter.

3.3 Capital Cost

Table 3-2 presents the opinion of probable capital cost for construction of the District's new facilities. As shown, the total estimated capital cost for the facilities would be $6,410,000. Midpoint of construction costs are also provided and indicate the constructions costs in year 2012 using a 3 percent escalation rate.

Table 3-2
Summary of Opinion of Probable Capital Cost

Component/Facility Detail	Cost
Conveyance Facilities	
Distribution Pipeline: 5,200 feet @ 36" Diameter	$2,808,000
Pump Station: 450 HP Booster Station	$1,125,000
Storm Channel Crossing (auger boring)	$150,000
Transmission Pipeline Turnout	$400,000
Connection to Storm Channel	$50,000
Misc. Valves and Flowmeters	$25,000
General Costs	
Mechanical (1)	$34,000
Electrical (1)	$113,000
Site Work (1)	$56,000
General Requirements (2)	$95,000
Total Construction Cost	$4,856,000
Contingency (3)	$971,000
Engineering/Administration/CM(4)	$583,000
Total Capital Cost	**$6,410,000**
Total Midpoint of Construction Cost (5)	$7,004,000

Notes:
(1) Includes general costs for all treatment and booster station facilities.
(2) Includes general requirements costs for all facilities (except land and SARI/NRWS).
(3) Based on 20 percent contingency.
(4) Based on 12 percent engineering/administration/CM.
(5) Assumes midpoint of construction in year 2012 at 3 percent escalation rate.

3.4 Annual O&M Cost

Table 3-3 presents the opinion of probable annual O&M cost for the District's new facilities. As shown, the total estimated annual O&M cost for the facilities would be $398,000.

Table 3-3
Summary of Opinion of Probable Annual O&M Cost

Component/Facility Detail	Cost
Conveyance Facilities	
General Pipeline Maintenance: Distribution	$4,000
Pump Station Power: 450 HP Booster Station	$371,000
Pump Station General Maintenance	$23,000
Total Annual O&M Cost	**$398,000**
Annualized Capital Cost (1)	$548,000
Total Annual Cost	$946,000

Notes:
(1) Assumes amortization period of 25 years and discount rate of 6 percent.