MWD
THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

ORANGE COUNTY CROSS FEEDER
PRELIMINARY DESIGN REPORT
(12/20/2005)

ORANGE COUNTY CROSS FEEDER
APPROPRIATION NO. _______

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ORANGE COUNTY CROSS FEEDER (OCCF)
PRELIMINARY DESIGN REPORT

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EXECUTIVE SUMMARY

This Preliminary Design Report describes the design work to be done on the project, Orange Country Cross Feeder (OCCF). The proposed OCCF is a 2.36-mile, 84-inch diameter welded steel pipe (mortar-lined and coated) that would connect Second Lower Feeder to East Orange County Feeder No. 2. The feeder will be located in Miraloma Avenue, from approximately 700 feet east of Red Gum Street, to Richfield Road (Figure 1), in the cities of Anaheim and Placentia. This is the alignment recommended in the Feasibility Study prepared by Kennedy/Jenks Consultants in December 2004. This alignment is also recommended under Option A in Section 4.4, Construction Cost Estimate, of this Report.

Orange County Cross Feeder was planned to increase MWD's system flexibility for serving Orange County. The feeder will allow more State Project water to be moved into southern Orange County. The pipeline will also increase system reliability as it will allow water to be moved into the Diemer specific service area during planned or unplanned outages of the Diemer Plant.

This Report includes the preliminary design of Orange Country Cross Feeder with the following facilities located along the pipeline alignment: pressure control structure (Dwg. Sht. C-3) which will house the 84" west-end sectionalizing valve and a blow-off valve/piping assembly; one valve vault structure to house the east-end 84" sectionalizing valve; pump wells; air release and vacuum valves; access manholes; and Electrolysis Test Stations.

In order to meet the March 2007 Diemer/East Orange County No. 2 Shutdown and the October 2007 Jensen/2nd Lower Feeder Shutdown, the final design will be broken down into three separate design phases which are discussed in Section 1.4 "Project Description".

1.0 INTRODUCTION

1.1 General

The purpose of this report is to document the preliminary design of Orange County Cross Feeder (OCCF). This information will serve as the basis for the final design of OCCF. The preliminary design started in April 2005 and completed in December 2005.

1.2 Purpose

Orange County Cross Feeder was planned to increase MWD system flexibility for serving Orange County by constructing a connection pipeline from the Second Lower Feeder to the East Orange County Feeder No. 2. This connection will allow more State Project water to be moved into southern Orange County. This pipeline will also increase system reliability as it will allow water to be moved into the Diemer specific service area during planned or unplanned outages of the Diemer Plant.

1.3 Project Background

The south Orange County area of Metropolitan's distribution system receives potable water from Metropolitan's Diemer Plant, located in the city of Yorba Linda. The water filtered through this plant flows from both Metropolitan's 242-mile Colorado River Aqueduct and the SWP's 444-mile California Aqueduct. Treated water is delivered through Metropolitan's Orange County Feeder, EOCF2, and the Allen-McColloch Pipeline.

Metropolitan has been working with the Municipal Water District of Orange County (MWDOC) to address the need to increase the reliability of deliveries to the Diemer Plant service area, given planned maintenance and rehabilitation activities often requiring scheduled shutdowns. Over the next few years, major construction work planned under the Diemer Improvements Program and the Oxidation Retrofit Program (ORP) is expected to require a series of 3- to 7-day plant shutdowns. Because the Diemer Plant is the primary source of treated water for south Orange County, shutdowns of any substantial duration may affect Metropolitan's ability to meet MWDOC demands. In addition, in order to meet resource management and water quality objectives, Metropolitan needs greater system flexibility to deliver higher blends of SPW supplies to the Diemer Plant service area prior to the scheduled completion of the Diemer Plant ORP in 2010. Implementation of the proposed Project would help address these needs.

1.4 Project Description

The Metropolitan Water District of Southern California (Metropolitan) proposes the Orange County Cross Feeder Project (OCCF) in the cities of Anaheim and Placentia, in Orange County, California.

OCCF would involve the construction of a 2.36-mile, 84-inch diameter welded steel pipe (WSP) that would connect Metropolitan's Second Lower Feeder to Metropolitan's East Orange County Feeder No. 2 (EOCF2). OCCF would be located within and adjacent to the public right-of-way of Miraloma Avenue, from approximately 700 feet east of Red Gum Street, to the intersection of Miraloma Avenue and Richfield Road **(Figure 1)**. At the Carbon Canyon Diversion Channel, the proposed alignment may veer off of the right-of-way to one side of the channel to avoid impacts to an existing bridge support structure. The majority of the proposed Project alignment would be located within the city of Anaheim, except for the most easterly segment, which would be located in the city of Placentia.

Metropolitan would construct the proposed project in 3 contracts, as follows:

Contract 1 – Pipe Fabrication including all fittings and yard pipings at PCS.
Contract 2 – Construction of valve vault structure including pipe construction from vault structure to east tie-in.
Contract 3 – PCS construction and construction of the remainder of the pipeline.

Each of these contracts will have a separate final design work. The project phasing is planned to meet the March '07 Diemer/EOCF #2 Shutdown and the October '07 Jensen/2nd Lower Feeder Shutdown.

Pipeline Construction – The OCCF would be installed using two methods of construction: open trench and tunneling. Open trench construction would occur along the majority of the proposed alignment, except at the Orange County Transportation Authority (OCTA) Metrolink railroad tracks, where tunneling would be required. Tunneling may also occur under the Carbon Canyon Diversion Channel and the two signalized intersections at Kraemer Boulevard and Tustin Avenue.

Open trench construction would involve the following: (1) fabrication of 84-inch diameter WSP; (2) installation of shoring; (3) excavation of trench and laying of bedding sand in the excavated trench; (4) installation of pipe material within trench; (5) backfill with imported sand and previously excavated soil; and (6) removal and relocation of shoring system.

Tunneling operations would involve the following: (1) fabrication of 84-inch diameter WSP and 108-inch diameter steel casing or liner plate; (2) installation of shoring; (3) excavation of jacking and receiving pits; (4) tunneling with a 108-inch diameter steel casing or liner plate; (5) installation of pipe material within the casing; (6) backfill and grouting of the annuals between the 84-inch pipe and the 108-inch diameter tunnel; and (7) backfill with imported sand and previously excavated soil within the jacking and receiving pits.

The proposed Project would include the construction of pressure control structure and various appurtenant facilities located along the pipeline alignment, as discussed in Section 4.2.1.7.

1.5 Scope of Work

The scope of work for this report is to perform the preliminary design for OCCF. The preliminary design report will serve as a basis for final design of OCCF. The scope of work includes the following tasks:

- Prepare project schedule, budget, and preliminary construction cost estimate.
- Substructure investigations.
- Aerial mapping and field survey of the pipeline alignment.
- Potholes of existing utilities.
- Geotechnical investigations.
- Prepare preliminary plan and profile.
- Identification and procurement of all right-of-way needs for OCCF.
- Prepare Environmental Report (Negative Declaration).
- Identify permanent easements and temporary easements required for pipeline construction.
- Prepare hydraulic and surge analysis.
- Prepare water system operations.
- Prepare report for geotechnical investigations.
- Prepare preliminary layout of the valves, pipe, and fittings for Pressure Control Structure (PCS) and valve vault.
- Prepare electrical diagrams and preliminary electrical drawings for PCS, valve vault, and cathodic protection system.
- Prepare Process Flow Diagram and Piping/Instrumentation Diagram.
- Prepare Design Criteria for all disciplines.

1.6 Schedule and Budget

1.6.1 Schedule

The project schedule is listed below. Contracts 1, 2 and 3 are discussed in Section 1.4 "Project Description."

Description	Start *	Finish *
Study	March 2005	May 2005
Board Action No. 1	July 2005	
Preliminary Design	July 2005	December 2005
Advertise Valves	October 2005	December 2005
Board Action No. 2	January 2006	
Final Design	January 2006	November 2006
Advertise Contract 1 (Piping)	May 2006	July 2006
Advertise Contract 2 (EOC#2 Tie-in)	May 2006	July 2006
Board Action No. 3	August 2006	
Construction Phase 1	October 2006	May 2007
Advertise Contract 3 (Remaining Pipe)	September 2006	November 2006
Board Action No. 4	December 2006	
Construction Phase 2	February 2007	April 2008
Diemer/East Orange County No. 2 Shutdown (EOC #2 tie-in)	March 2007	

2nd Lower Shutdown (2nd lower tie-in)	October 2007	
As-Built	April 2008	June 2008

*End of month

1.6.2 Budget

The estimated budget cost for the project is as follows:

1. Owners Cost Estimate...................................$800,000*
2. Study/Preliminary Design Cost Estimate.......$237,000
3. Final Design Cost Estimate.........................$1,573,000
4. Right-of-way..$5,500,000*
5. 84" Butterfly Valves $1,350,000
6. Construction Management Cost Estimate $2,581,499*
7. Construction Cost Estimate.....................$33,868,694* (see Section 4.4 for details)
8. Contingency Cost Estimate.........................$6,886,529
9. Total Project Cost Estimate $52,796,722*

* Projected/Estimated Cost

2.0 PROJECT STUDIES

2.1 Alternative Alignment Studies – See Section 4.4

2.2 Hydraulic and Surge Analysis

The Orange County Cross Feeder (OCCF) can distribute water in two directions; from West to East and from East to West. For operational information and the purpose of flowing water from West to East or West to East, see the Waster System Operations section of this report.

The OCCF will connect the East Orange County Feeder No. 2 (EOCF #2) and the Second Lower Feeder (2LF). Since the EOCF#2 is designed for a hydrostatic grade of 810-feet, and the 2LF is designed for a hydrostatic grade of 660-feet, pressure relief valves are needed to prevent the 2LF from inadvertently being over pressurized.

2.2.1 Flow for West to East

Flowing water from West to East requires a Pressure Control Structure (PCS) to control water flows and break head into the lower pressure section of the 2LF. The EOCF #2 is designed for a maximum hydrostatic grade of 810-feet. The 2LF at the location where the OCCF is connecting is designed for a maximum hydrostatic grade of 660-feet. Therefore, during a normal operation of flowing water from the EOCF # 2 (with either Diemer of future CPA as the water source) across the OCCF to the 2LF, a PCS is required to reduce the pressure and control flow. This PCS will be able to control the flow rate to a desired amount and ensure the pressure in the 2LF will not exceed a hydraulic grade of 660-feet during normal operation. Currently the Carbon Creek Pressure Control Structure on the 2LF performs this function, but with the addition of the OCCF, a second PCS is required for this additional source of water to the 2LF.

2.2.1.1 Diemer Finished Water Reservoir as Source (See Figure 2.1.1)
A steady state hydraulic analysis was performed for flow operation with Diemer Finished Water Reservoir (FWR) as the water source and flow terminating at the Palos Verdes Reservoir. The maximum flow rate based on normal operation will be 305 cfs. This steady state analysis assumes the future OCCF PCS consists of 3-36-inch sleeve valves and the Diemer FWR water surface elevation (WSE) is at a low of 794-feet. Also, hydraulic conditions, assumptions and demands are assumed to match the 2LF hydraulic profile, B-25278 and B-25279.

2.2.1.2 Future Central Pool Augmentation Project (CPA) as the Source (See Figure 2.2.2)
A steady state hydraulic analysis was performed for flow operation with CPA as the water source and terminating at the Palos Verdes Reservoir. The maximum flow rate based on normal operation will be 198 cfs. Again, this steady state analysis assumes the future OCCF PCS consists of 3-36-inch sleeve valves and the CPA connection to the Allen McColloch Pipeline (AMP) would have a PCS throttling to 810-feet Hydraulic Grade Elevation. This analysis assumes a low-level connection to the Palos Verdes Reservoir and no demands on the 2LF.

2.2.2 Flow from East to West
If Diemer Treatment Plant is unavailable as a source, water from Jensen Treatment Plant in Granada Hills can be utilized to distribute flow to South Orange County via the MWD Central Pool system and across the OCCF to the EOCF#2. The source of water in this case would be the Jensen Treatment Plant and flow would go from East to West on the OCCF. Water in the EOCF#2 would then be distributed south toward South Orange County. Under the best scenario **(see Appendix A)** approximately 97 cfs will be flowing from the 2LF to the EOCF#2. Please see attached appendix for operational assumptions and various flow rates for various demand conditions. For flow from East to West, it is assumed the 84-inch butterfly valves at the West and East end of the OCCF will be 100% open.

2.2.3 Relief Capacity Calculations
Since the EOCF#2 is designed for a hydrostatic grade of 810-feet, and the 2LF is designed for a hydrostatic grade of 660-feet, pressure relief valves are needed to prevent the 2LF from inadvertently being over pressurized.

Currently the existing Carbon Creek PCS has pressure relief valves connected to the upstream and downstream side of the structure. Field investigation revealed several relief valves on the downstream side were missing. For these calculations it is assumed these valves will be replaced, and it is recommended that these valves be replaced immediately. For the analysis these downstream pressure relief valves were assumed to open at 660-feet. Also, any additional relief valves were assumed to be located at the Carbon Creek

PCS structure, but locating additional relief valves at the OCCF PCS would provide similar relief capacity.

To calculate the relief capacity needed with the OCCF connected, 6 critical operational scenarios were analyzed. In each case the critical event triggering a relief event would be the full closing of a sectionalizing valve on the 2LF while either all OCCF 84-inch sectionalizing valves are open, or both Carbon Creek PCS 36-inch bypass lines are full open and no system demands.

The pressure relief valves would also prevent over pressurization should the either or both OCCF PCS/84-inch sectionalizing valve and Carbon Creek PCS are fully opened. However this case would require less relief capacity than closing a sectionalizing valve on the 2LF because some flow could still continue down the 2LF.

The first step in calculation of relief capacity is to determine the flow that can be developed by the system. The flow rate the system can be determined by taking into account the head potential at the relief and the pipeline resistance. Then the required resistance for the pressure relief system can be calculated using the relief flow rate + 20% relief flow rate and the head difference at the relief discharge. The current resistance K-factor for the Carbon Creek PCS downstream relief valves is 1919.03 x 10-6. For each analysis case, flow rate generated from the system is calculated and required resistance K-factor for the pressure relief system is determined based on an additional 20% flow.

The 6 critical cases analyzed are (see **attached figures 2.2.3 through 2.2.8** for details):

Case 1:

This case analyzes flow from Diemer FWR to the 2LF via the EOCF#2 and the OCCF. Both 84-inch sectionalizing valves on the OCCF would be fully opened; Carbon Creek PCS would be fully closed. Then the sectionalizing valve on the 2LF at Station 558+30 would have to be manually closed. Flow would then relieve out the downstream pressure relief valves at a rate of 444 cfs.

The required resistance K-factor for the relief system was calculated to be 1546.91 x 10-6. Since the required resistance K-factor for the relief is less than the existing K-factor, additional relief capacity is needed for this case. Two additional 16-inch relief valves would satisfy the needed capacity, making the total resistance K-factor 1100.00 x 10-6.

Case 2:

This case analyzes flow for flow from the Diemer FWR to the 2LF via the 2LF. This is basically the existing conditions case. This assumes the Carbon Creek PCS has both 36-inch bypass lines fully opened and water is flowing down the 2LF with the future OCCF PCS and OCCF 84-inch sectionalizing valve closed. Then the sectionalizing valve on the 2LF at Station 558+30 would have to be manually closed. Flow would then relieve out the downstream pressure relief valves at a rate of 436 cfs.

The required resistance K-factor for the relief system was calculated to be 1635.82 x 10-6. Since the required resistance K-factor for the relief is less than the existing K-factor, additional relief capacity is needed for this case. Two additional 16-inch relief valves would satisfy the needed capacity, making the total resistance K-factor 1100.00 x 10-6.

Case 3:

This case analyzes flow for flow from the CPA to the 2LF via the AMP, the future CPA extension pipeline (from AMP to EOCF#2) and the OCCF. Both 84-inch sectionalizing valves on the OCCF would be fully opened; Carbon Creek PCS would be fully closed. Then the sectionalizing valve on the 2LF at Station 558+30 would have to be manually closed. Flow would then relieve out the downstream pressure relief valves at a rate of 160 cfs.

The required resistance K-factor for the relief system was calculated to be 12,162 x 10-6. Since the required resistance K-factor for the relief is greater than the existing K-factor, no additional relief capacity is needed for this case.

Case 4:

This case analyzes flow from Diemer FWR to the 2LF via the AMP, future CPA extension pipeline (from AMP to EOCF#2) and the OCCF. Both 84-inch sectionalizing valves on the OCCF would be fully opened; Carbon Creek PCS would be fully closed. Then the sectionalizing valve on the 2LF at Station 558+30 would have to be manually closed. Flow would then relieve out the downstream pressure relief valves at a rate of 343cfs.

The required resistance K-factor for the relief system was calculated to be 2606.42 x 10-6. Since the required resistance K-factor for the relief is greater than the existing K-factor, no additional relief capacity is needed for this case.

Case 5:

This case analyzes flow from Diemer FWR to the 2LF via the EOCF#2 and the OCCF and the 2LF. Both 84-inch sectionalizing valves on the OCCF would be fully opened; Carbon Creek PCS would be fully opened utilizing the two 36-inch bypass lines. Then the sectionalizing valve on the 2LF at Station 558+30 would have to be manually closed. Flow would then relieve out the downstream pressure relief valves at a rate of 866 cfs.

The required resistance K-factor for the relief system was calculated to be 407.58 x 10-6. Since the required resistance K-factor for the relief is less than the existing K-factor, additional relief capacity is needed for this case. Eight additional 16-inch relief valves would satisfy the needed capacity, making the total resistance K-factor 397.76 x 10-6.

After a meeting with the Water Systems Operations staff, it was determined that this case was not operationally feasible, due to the fact that both the OCCF PCS and Carbon Creek PCS would not be fully opened at the same time, and if they were accidentally, the sectionalizing valve on the 2LF would have to be manually closed. This scenario was determined not to be feasible.

Case 6:

This case analyzes flow from Diemer FWR to the 2LF via the EOCF#2 and the OCCF and the 2LF. Both 84-inch sectionalizing valves on the OCCF would be fully opened; Carbon Creek PCS would be fully opened utilizing the two 36-inch bypass lines. Santiago Creek PCS (on the EOCF#2) would be fully closed. Then the sectionalizing valve on the 2LF at Station 558+30 would have to be manually closed. Flow would then relieve out the downstream pressure relief valves at a rate of 898 cfs.

The required resistance K-factor for the relief system was calculated to be 377.90 x 10-6. Since the required resistance K-factor for the relief is less than the existing K-factor, additional relief capacity is needed for this case. Ten additional 16-inch relief valves would satisfy the needed capacity, making the total resistance K-factor 320.95 x 10-6.

After a meeting with the Water Systems Operations staff, it was determined that this case was not operationally feasible, due to the fact that both the OCCF PCS and Carbon Creek PCS would not be fully opened at the same time the Santiago Pressure Control Structure be fully closed, and the sectionalizing valve on the 2LF would have to be manually closed. This scenario was determined not to be feasible.

2.2.4 Hydraulic Conditions Summary – Minimum and Maximum Values

The following chart represents the maximum and minimum hydraulic conditions for all the scenarios analyzed:

Table 2.2.1 – Maximum and Minimum Hydraulic Conditions

	Location			
	Upstream of East OCCF 84-inch Isolation Valve	Downstream of East OCCF 84-inch Isolation Valve	Upstream of West OCCF 84-inch Isolation Valve	Downstream of West OCCF 84-inch Isolation Valve
Max Flow - relief case (cfs)	450	450	450	450
Max Flow - normal operation (cfs)	305	305	305	305
Max. Hydraulic Grade Elevation (feet)	810	810	810	695
Min. Hydraulic Grade Elevation (feet)	330*	330*	330*	330*

* Assumes future low-level connection upstream of Palos Verdes Reservoir

2.2.5 Pressure Surge Analysis

During final design, a pressure surge analysis should be performed to determine the closing speed of the valves on the OCCF PCS and the sectionalizing valves on the OCCF. Determining the correct closing speed of the valves based on the pressure surge analysis will prevent any distribution pipelines from becoming over pressurized due to surges generated by valve closures.

2.2.6 Air Release and Air Vacuum Valve Sizing and Location

Based on the dewatering and filling criteria established in the Water Systems Operations Section of this document, the Air Release valves shall be sized at 1-inch with a 7/32-inch orifice and the Air and Vacuum Valves shall be sized at 8-inches. This sizing is based on a controlled draining operation at a rate of 36.6 cfs and a filling rate of no greater than 38 cfs. The Air Vacuum Valves shall be located at all high points and at intervals of 0.25 to 0.5 miles along ascending or descending sections of the pipeline, and at all locations where an abrupt decrease in upslope or an increase in down slope occurs (see AWWA manual M51).

2.3 Value Engineering

Value Engineering will be performed after the 30% final design submittal.

3.0 PROJECT REQUIREMENTS

3.1 Water System Operations

There are two main operational scenarios for the Orange County Cross Feeder (OCCF):

1.) Distribute easterly flows from the Second Lower Feeder (2LF) across the OCCF to the East Orange County Feeder #2 (EOCF # 2).

2.) Distribute westerly flows across the OCCF to the 2LF.

Operationally, the filling and dewatering of the OCCF need to be accomplished in less than 8 hours. Structures such as blow off valves, pumpwell valves, air vacuum and air release valves, and bypass valves should be provided and sized to provide full filling and dewatering capabilities for the OCCF. Also relief settings on the current relief valves at the Carbon Creek Pressure Control Structure (PCS) and any new relief valves should provide protection from over pressurization in the system.

3.1.1 Operations for East to West Flows

Flows from East to West on the OCCF allow water from the Jensen Treatment Plant to supply South Orange County via the EOCF#2. This flow distribution could be only be utilized if the Diemer Treatment Plant is out of service or unavailable. If the Diemer Plant were in service, easterly flows on the OCCF would not be possible, unless the applicable piece of the distribution system were isolated from the Diemer Plant.

Flow from East to West would involve either shutdown of the Diemer Filtration Plant or isolation of the 2LF and EOCF#2 pipelines. Both 84-inch isolation valves on the OCCF would need to be fully opened and the Carbon Creek PCS would need to be fully closed. Also if the Diemer FWR is not empty then the EOCF #2 would need to be isolated with the 48-inch isolation valve near the Diemer Plant.

3.1.2 Operations for West to East Flows

Flows from West to East on the OCCF allow water from the Diemer Filtration Plant to supply the central pool area via the EOCF#2 across the OCCF to the 2LF. The purpose of this operational configuration would be to isolate the 2LF above Carbon Creek PCS for maintenance or emergency purposes. This configuration would require the Carbon Creek PCS to be fully closed, the 84-inch isolation valve at the West end of the OCCF to be fully closed, and the 84-inch isolation valve at the East end of the OCCF to be fully opened. The future OCCF PCS (at the West end of the OCCF) would be used to regulate pressures and/or flows into the 2LF from the OCCF.

Also in the future, if a Central Pool Augmentation (CPA) extension pipeline is built from the Allen McColloch Pipeline (AMP) to the EOCF #2 and the CPA project is implemented to connect and supply the AMP, water could flow from West to East on the OCCF with the CPA as a source. Again, this configuration would require the Carbon Creek PCS to be fully closed, the 84-inch isolation valve at the West end of the OCCF to be fully closed, and the 84-inch isolation valve at the East end of the OCCF to be fully opened. The future OCCF PCS (at the West end of the OCCF) would be used to regulate pressures and/or flows into the 2LF from the OCCF. Additionally, the EOCF#2 would need to the isolated at the Diemer Treatment Plant using the 48-inch sectionalizing valve.

3.1.3 Operational Considerations

There are two main operational considerations when operating the OCCF that should be noted.

The West OCCF 84-inch isolation valve should not be opened when flowing water from West to East. This will bypass the OCCF PCS and cause a loss of flow control due to the fact that the 84-inch isolation valve is not designed to throttle flow.

The Carbon Creek PCS and the OCCF PCS should not be opened at the same time. Flow should come from either the OCCF or the 2LF only, but not at the same time. If the Carbon Creek PCS is opened, then the OCCF should be fully closed, and visa versa, this will prevent introduction of too much flow to the 2LF and this operation will not be necessary to introduce flows into the 2LF.

3.1.3 Filling and Dewatering

To accomplish dewatering operations in less than 8 hours, flow calculations indicate that a 16-inch Blowoff should be located on the West end of the OCCF. The maximum flow rate at this Blowoff was calculated to be 36.6 cfs. The total volume of the pipeline to be dewatered is approximately 9.3 acre-feet. Also, an average dewatering rate of 14.9 cfs is assumed because of dropping heads during the draining process.

Filling will be accomplished using a bypass pipeline and valves around the West 84-inch isolation valve and around the East OCCF PCS. Please see Mechanical Section for specifics of the bypass pipelines and valves. The bypass line on the West end will consist of a 16-inch plug valve used for throttling the flow. The maximum flow rate through this valve should be limited to 34.8 cfs, which will allow filling of the OCCF in approximately 3 hours. If filling from the West side of the OCCF, a 12-inch valve will be used to throttle filling flows to 19.6 cfs. This will allow the OCCF to be filled in approximately 6 hours.

3.1.4 Pressure Relief Valve Settings

The pressure relief valve settings shall be set to ensure the maximum hydrostatic grade of the pipelines is not exceeded. Currently the MWD Pipeline Design Team is evaluating the maximum allowable pressure for the 2LF. When this is determined, the pressure relief valve opening settings should be staggered to allow incremental (about 2 psi) valve openings up to the maximum hydrostatic grade.

The smallest size relief valves shall open first, and then intermediate sizes opening next, up to the largest size valves opening last. Any existing pressure relief valves that are missing shall be replaced with the appropriate size and type valve.

3.2 Permits – See Section 4.2.1.2

3.3 Right of Way – See Section 4.2.1.4

3.4 Environmental – See Reference No. 7.2

3.5 Recommended Facilities – See Section 4.2.1.7

4.0 PRELIMINARY DESIGN

4.1 Purpose

The purpose of this section is to define the design criteria for OCCF. These criteria are the basis for the final design of OCCF and were developed by Engineering Services Section of Corporate Resources Group.

4.2 Design Criteria

4.2.1 Civil Design

4.2.1.1 General

Civil Design will adhere to the standards set forth in the Civil Design Manual, ESD No. 102 prepared by Metropolitan.

When outside of Metropolitan's right-of-way, design manuals and specifications of local agencies such as Cities of Anaheim and Placentia will be used, including the design criteria from Southern California Regional Rail Authority (SCRRA) and County of Orange. The Civil Design criteria are summarized in Section 4.3.1.3 to Section 4.3.1.12.

4.2.1.2 Required Construction Permits

Several permits will be required during the construction phase of OCCF. The following is a list of the permits that must be obtained for the project.

- Right-of-way construction permit from the City of Anaheim and a public right-of-way encroachment permit from the City of Placentia.
- Right-of-way encroachment permit from SCRRA (for railroad crossing).
- Flood encroachment permit from County of Orange (for channel crossing).*
- Tunnel classification permit from CAL OSHA.
- NPDES permit from the California State Water Resources Control Board.
- Excavation permit from CAL OSHA.
- A De Minimus NPDES permit from the Santa Ana Regional Water Quality Control Board for discharges of water from hydrostatic testing of the new pipeline.

*The blow-off discharge to Carbon Canyon Diversion Channel has already been coordinated by Hydraulic Team with the County of Orange Resources and Development

Management Department (OCRDMD). The maximum blow-off discharge rate of 27.5 CFS to Carbon Canyon Diversion Channel (w/Q=2,275 CFS capacity) is acceptable to OCRDMD.

4.2.1.3 Pipeline Plan and Profile

- All physical features along the pipe alignment including surface and overhead facilities and underground utilities will be identified and shown on the plans.
- Permanent and temporary construction easements will be tied to horizontal controls and shown on the plans.

4.2.1.4 Right-of-Way Requirements

- The pipeline will be constructed within public street right-of-way (of Miraloma Avenue) and a permanent easement at the site of Pressure Control Structure (PCS).
- Final construction footprint, including limits of work areas, will be specific to:
  - Construction staging areas
  - Temporary and Permanent easements
  - Contractor work and storage areas
  - Site access and service roads
- The construction limits, including limits of work areas, will be shown on the pipeline plan and profile drawings.

4.2.1.5 Hydrotesting

- The pipeline will be hydro-tested upon completion of the pipeline construction. The disposed volume of water is about 0.48 million cubic feet, or 3.60 million gallons.
- Pipeline will be dewatered through the Blow-off Structures and Pumping Wellls.
- Draining of the pipe will be controlled by opening the blow-off valves and releasing the water into existing storm drainage facilities or local drainage courses.
- The rate of the release will be regulated to avoid flooding, erosion, or damage to downstream properties and sensitive habitat areas.
- Draining will be performed pursuant to Regional Board discharge permit requirements.

4.2.1.6 Utility Relocations

- For some areas, temporary relocation of the existing utility lines will be required to accommodate pipeline trench excavation. These utility lines will be temporarily relocated within the construction limits, and after pipeline installation will be relocated back to their original location.

4.2.1.7 Appurtenances

The proposed Project would include the construction of various facilities located along the pipeline alignment, including pressure control structure to be located west of Carbon Canyon Diversion Channel which will house the 84" west-end sectionalizing valve and a blow-off valve/piping assembly; two pump well and air release/vacuum valve combined structures; five air release/vacuum valves; two air release valves; six access manholes; one valve vault structure to house the east-end 84" sectionalizing valve; and Electrolysis Test Stations (ETS) to be installed at 1,000-foot intervals along the outside pipeline alignment. Each of the air release valves would be located along the sidewalk in above-ground enclosures measuring approximately three feet wide by four feet long by four feet high.

4.2.1.8 Construction and Staging Areas and Traffic Control and Detouring
The proposed pipeline alignment would be approximately 40 feet wide by 12,500 feet long and would contain both construction and staging areas. Additional staging areas will be required along or adjacent to Miraloma Avenue to support the construction effort (Figure 3).

During construction, two 12-foot lanes of Miraloma Avenue with a roadway width of 64 feet (curb to curb) would be left open at all times for traffic flow (one lane in each direction) throughout most of the proposed alignment. In those locations where Miraloma Avenue narrows insufficiently to allow two lanes of traffic to remain open, all or part of the traffic flow would be redirected around that portion of the construction area. The required large turning radius of big trucks at the driveways of industrial buildings is being coordinated with the City of Anaheim. Metropolitan would utilize a combination of barricades, signs and flagmen, as needed, to minimize traffic disruption. All traffic diversions would be coordinated with the cities of Anaheim and Placentia prior to construction. Prior to commencement of construction activities, a Right-of-Way Construction Permit from the City of Anaheim and a Public Right-of-Way Encroachment Permit from the City of Placentia would be obtained. In addition, Metropolitan would coordinate with the Orange County Transportation Authority Detour Hotline Group prior to construction. The Hotline group is set up to specifically determine the rerouting of buses prior to construction.

4.2.2 Structural Design Criteria

4.2.2.1 General
This section presents the design criteria for the Structural Engineering discipline. Also presented are listings of the codes and standards that govern design, as well as the references used during the design.

4.2.2.2 Codes and Standards
The following codes, specifications and standards shall apply to the related structural design. Unless specifically stated otherwise, the latest edition of all codes shall apply.

- American Concrete Institute (ACI), ACI 318, Building Code Requirements and Commentary for Reinforced Concrete.
- ACI 350, Environmental Engineering Concrete Structures.
- California Building Code.
- American Society for Testing and Materials Standards (ASTM).

- American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code.
- American Association of State Highway and Transportation Officials (AASHTO).

4.2.2.3 Structural Design References

The following references and applicable provisions of industry standards and publications are used in the design. Unless specifically stated otherwise, the latest edition of all codes shall apply.

- Concrete Reinforcing Steel Institute (CRSI) Handbook.
- American Institute of Steel Construction (AISC), 9th Edition.
- American National Standards Institute (ANSI).
- American Water Works Association (AWWA).
- American Petroleum Institute (API).
- National Association of Corrosion Engineers (NACE).
- ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels.
- ANSI / AWS D1.1, Structural Welding Code, American Welding Society (AWS).
- Moments and Reactions for Rectangular Plates, Engineering Nomograph No. 27, Bureau of Reclamation - U.S. Department of the Interior.

4.2.2.4 Detailed Structural Design Criteria

Structural designs are prepared in accordance with recognized engineering principles and accepted practices established by building codes and the codes published by various professional institutions.

Loading

***Dead Loads**:*

Dead loads shall be comprised of the weight of all permanent construction, including walls, floors, roofs, ceilings, stairways, fixed mechanical equipment and bases, HVAC ducting and piping and soil overburden. In estimating dead loads for purposes of design, the actual weights of materials and construction shall be used. In the absence of definite information, values satisfactory to Metropolitan shall be used.

- Weight of structure, including the weight of contained water.
- Weight of pipe and valves, including the weight of contents.
- Weight of mechanical and electrical equipment.

Live Loads:

Live loads are those loads produced by the use and occupancy of the building or other structure and do not include environmental loads such as wind load, snow load, rain load, earthquake load, or dead load. Live loads on a roof are those produced (1) during maintenance by workers, equipment, and materials, and (2) during the life of the structure by people and by movable objects such as planters.

The live loads assumed in the design of the building and other structures shall be the maximum loads likely to be produced by the intended use of occupancy but shall in no case be less than the minimum uniformly distributed unit loads required by CBC Tables 16-A, 16-B, and 16-C.

Unless otherwise indicated, the following live loads shall be used:

- Roof loads per CBC.
- Mechanical and operating forces and reactions.
- Crane, hoist, and jacking loads: Include an additional minimum vertical impact load factor of 25% times the rated hoist capacity plus the crane trolley or hoist. The lateral force shall be at least 20% of the rated capacity plus the crane trolley applied normal to the rails. The longitudinal force shall be at least 10% of the maximum wheel load of the crane. The lateral and longitudinal forces shall be applied at the top or bottom of the rail in such a manner that it produces the largest overall member stresses or deflections. The loads shall be distributed with due regard to the lateral stiffness of the structure supporting the rails.
- Reactions due to hydraulic thrusts.
- Internal water pressure.
- External water pressure.
    - Heavy equipment floors: 300 psf or actual equipment weight
    - Electrical control floors: 300 psf or actual equipment weight
- All other floors: 100 psf
- Walkways, platforms, and stairs: 100 psf
- Concentrated gravity load of 2,000 pounds minimum on any floor span supporting a tributary area greater than 200 square ft.

Vehicle Loads:

All new structures subject to traffic loading shall be designed to withstand standard H20 vehicle loading as defined in Section 1.3.3 of the AASHTO Standard Specifications for Highway Bridges. Distribution of the wheel loads across the tire area should be considered if the standard AASHTO H20 loading leads to an overly conservative design.

Construction vehicle loading that exceeds the standard AASHTO H20 loading shall be considered individually for each case.

Impact loading should be calculated as outlined by AASHTO Standard Specifications for Highway Bridges. For pipelines, valve structures, meter structures, etc., the impact factor shall be 50% and shall not vary with depth of cover. For pipelines over 12 feet deep, impact does not need to be considered.

Wind Loads:

Basic wind speed of 80 mph, exposure "C" per CBC. Occupancy category shall be "1-Essential Facilities".

Seismic Loads:

Seismic loads shall be based on the results of the site-specific Probabilistic Seismic Hazards Analysis (PSHA) for a 10 percent exceedance in 100 years or an average return period (ARP) of 950 years. Since the PSHA for Diemer yielded greater ground motions than those obtained from the CBC, the results of the PSHA ARP of 950 years will be used for design. The seismic forces shall be determined using the CBC with the following site specific factors:

- Occupancy Category — 1 – Essential Facilities
- Seismic Zone — 4
- Soil Profile Type — S_C
- Seismic Source Type — B, ≤ 2 km
- Seismic Coefficient C_a — 0.95
- Seismic Coefficient C_v — 1.50

Soil Design Parameters

Geotechnical design criteria, including allowable soil bearing pressures, lateral static and seismic soil pressures, and minimum footing depth and width requirements, shall be as specified in the geotechnical reports referenced in Section 6 of this report.

A stability safety factor of 1.5 shall be used to resist overturning and sliding. A safety factor of 1.1 shall be used to resist uplift. All safety factors are against unfactored soil loadings.

Equipment Anchorage

Anchorage of equipment shall be based on the more stringent of the following criteria:

1. CBC criteria using the site specific seismic factors specified in this report plus vertical forces equal to two thirds of the calculated horizontal force acting in either direction.
2. Metropolitan established minimum standard acceleration of 0.50g applied horizontally with 0.33g vertically in either direction applied at the center of gravity of the equipment. The forces determined by the minimum standard accelerations shall not be reduced by any modification factors.

Both the horizontal and vertical forces shall be applied concurrently.

Anchorage of equipment installed with vibration isolators shall be designed to resist concurrent seismic forces equal to 2.5 times the accelerations in item 1 and 2 above.

Expansion anchors shall not be used to resist seismic forces. Cast-in-concrete anchor bolts shall be used whenever possible. No cinch anchor, expansion anchor, or chemical anchor shall be used on rotating equipment greater than 2.0 horsepower.

For all equipment weighing 400 pounds (181 kilograms) or more, the minimum anchor bolt (including chemical anchor bolt) diameter shall be 5/8-inch. The minimum anchor bolt diameter for all other equipment shall be 3/8-inch.

Combination of Loads

The most severe distribution, concentration, and combination of design loads and forces shall be determined and then used in the design. The referenced codes permit stress increases for some combinations but not for others. The design shall meet code and satisfy all combinations regardless of allowable stresses. For reductions in live loads, the design engineer shall comply with the CBC requirements.

Structural Materials

Concrete:

- f'c = 4,000 psi – all structural applications.
- f'c = 3,000 psi – curb and gutter and drainage structures.
- f'c = 2,000 psi – reinforced thrust blocks, unreinforced pipe encasements, and concrete fill for structural foundations.
- f'c = 5,000 psi – Precast concrete.
- f'c = 1,500 psi – Electrical ductbank.

Reinforcement:

- Reinforcing steel bars are ASTM A615 Grade 60 with Fy = 60 ksi
- Welded wire fabric are ASTM A185 with Fy = 70 ksi

Masonry:

ASTM C90-N concrete masonry units (CMU) grouted solid; combined prism compressive strength, f_m	=	1,500 psi
Grout, ASTM C476, f'c	=	2,000 psi
Mortar, ASTM C270, type S, f'c	=	1,800 psi

Structural Steel:

Structural Steel shall conform to the following:

"W" Shapes	ASTM A992 with a specified yield strength of 50 kips per square inch (ksi)
Other Shapes, Bars & Plates	ASTM A36 with a specified yield strength of 36 kips per square inch (ksi)
Pipe	ASTM A53, Grade B with a specified yield strength of 35 ksi
Tubing	ASTM A500, Grade B with a specified yield strength of 42 ksi

***Structural Bolts**:*

Structural bolts conform to ASTM A325 Type 3 bolts with threads included in the shear plane.

Anchor bolts in normally dry environments shall be ASTM A307 and shall be designed in accordance with ACI 318-02 Appendix D "Anchoring to Concrete". Anchor bolts immersed in water, intermittently or continuously, or in a moist environment shall be stainless steel type 316.

Adhesive for anchorage and doweling into hardened concrete shall be 2-component, insensitive to moisture. Adhesive anchors immersed in water, intermittently or continuously, or in a moist environment shall be stainless steel type 316. The following adhesive products may be used:

Anchor System Type	Conditions at Time of Installation	Manufacturer	Product	ICBO Report
Cartridge Adhesive	Dry or damp surface conditions	Hilti, Inc.	HIT C-100 Doweling Anchor System	4419
Cartridge Adhesive	Dry or damp surface conditions	ITW Ramset/Redhead Epcon System	Ceramic 6	4285
		Simpson Strong-Tie	S.E.T. Anchor Adhesive	5279

Anchor System Type	Conditions at Time of Installation	Manufacturer	Product	ICBO Report
Capsule Adhesive	Dry or damp surface conditions	ITW Ramset/Redhead Epcon System	Maxima 7	5560
Cartridge Adhesive	Dry surface Conditions only	Hilti, Inc.	HIT HY-150 Injection Anchors	5193
		Covert Operations, Inc.	Injection Adhesive Anchors	4846
		Adhesive Technology, Inc.	Anchor-It Fastening Systems Solid Bond HS-200 Adhesive	4398
Capsule Adhesive	Dry surface Conditions only	Hilti, Inc. HVA Adhesive System	HVU Capsule	5369

Expansion anchors shall be used for the installation of light metal accessories. Expansion anchors in normally dry environments shall be hot dip galvanized, or stainless steel. Expansion anchors immersed in water, intermittently or continuously, or in a moist environment shall be stainless steel. All components of expansion anchors shall be stainless steel type 304 or 316. Expansion anchors shall not be use in applications that will be subjected to vibrations or impact loads. Drop-in anchors shall not be used in applications to resist seismic or wind loading. The following expansion anchors may be used:

Anchor System Type	Manufacturer	Product	ICBO Report
Drop-In	Hilti, Inc.	HDI	2895
	Gunnebo Fastening Corp.	Drop-In	3219

Anchor System Type	Manufacturer	Product	ICBO Report
Mechanical-Stud	Hilti, Inc.	Kwik-Bolt II	4627
		HSL Metric Heavy Duty Expansion Anchor	3987
	Gunnebo Fastening Corp.	Sup-R-Stud Concrete Anchors	3219
	Drillco Devices Limited	Maxi-Bolt	4133

Welding:

Welding is in conformance with AWS A5.1 or A5.5 E70XX Electrodes.

Aluminum:

Aluminum conforms to ASTM B308, Alloy 6061-T6.

Stainless Steel:

- Type 304 or 316.
- Type 304L or 316L where welding is required.
- Type 316 or 316L used in water or moist environments.

Pipeline Steel:

- Steel plates for the steel pipe and appurtenances and for fabricated fittings, except as otherwise specified, shall be in accordance with the following requirements:
  (1) Type I steel plate material shall be in accordance with ASTM A36.
  (2) Type II steel plate material shall be in accordance with ASTM A572, Grade 42 or ASTM A36 with a F_y = 42 ksi.
- Steel plates for crotch plates and flanges and all plates over 1-1/2 inches in thickness shall be in accordance with ASTM A516, Grade 65 or Grade 70 and shall be heat-treated for grain refinement.

- Coil steel for fabricating spiral-seam pipe shall be as follows:
  (1) Type I steel coil material: For thicknesses 0.330 inch and greater, the steel shall be in accordance with ASTM A1018, Grade 36.
  (2) Type II steel coil material: For thicknesses 0.330 inch and greater, the steel shall be in accordance with ASTM A1018, Grade 45, Class 1 or 2. The Contractor shall use 42 ksi yield as basis for the design.

4.2.2.5 Structural Design Methods and Assumptions

Reinforced Concrete Design:

- Non-hydraulic/Water Bearing Structures: Strength design method in accordance with CBC Chapter 19 and ACI 318.
- Below grade structures: Strength design method in accordance with ACI 350.

Structural Steel Design:

All designs shall be in accordance with AISC Manual of Steel Construction, 9th Edition, Allowable Stress Design (ASD) and Supplement No. 1, except where modified by CBC. Seismic design shall be in accordance with the CBC.

Welding shall be performed using E70XX low-hydrogen electrodes, and shall be in conformance with AWS A5.1 or A5.5

All bolted connections for structural framing shall be made with ¾" min ASTM A325 Type 3 bolts, the threads shall be assumed to be in the shear plane. Other steel connections such as framing anchorage to foundations or equipment anchorage where a ductile failure mechanism is desired will be ASTM A307 bolts.

All steel framing for platforms, stairways, hatches, or steel exposed to earth or weather will be hot dipped galvanized in accordance with ASTM A123.

Grating Design:

Weight of grating or plate segment will be limited to 80 pounds maximum.

Steel bar grating shall be welded, type W-19, designed for a uniform distributed live load of 100 pounds per square foot (psf) or the actual applied loads, whichever are greater, and a deflection of 1/240 of the span or ¼ inch maximum. All grating shall be galvanized in accordance with ASTM A123.

Steel Plate Design:

Steel floor plates shall conform to ASTM A36 steel and shall be designed for a uniform live load of 100 psf or the actual applied loads, whichever are greater, and a deflection of 1/240 of the span or ¼ inch maximum. Steel floor plate shall have a raised pattern in accordance with ASTM A786 Pattern No. 4 or No. 5. Floor plates shall be galvanized in accordance with ASTM A123. Plates immersed in water, intermittently or continuously, or in a moist environment shall be stainless steel type 316.

Steel Decking Design:

Steel decks shall be galvanized steel. The gauge and type required shall be determined for load and span conditions, 20-gauge minimum. Steel deck shall be manufactured and installed in accordance with The Steel Deck Institute Specifications. Steel deck shall be designed in accordance with the American Iron and Steel Institute's (AISI) Cold-Formed Steel Design Manual. Steel deck shall be anchored to support the actual loads; dead loads, live loads, and wind loads (uplift). Spacing of connections shall be as required to develop the diaphragm shear required by the design forces. Additional metal reinforcement and closure pieces shall be used as required.

Pipeline Design:

Pipe shall be designed to withstand internal hydrostatic pressure, external dead and live loads, and the combination of internal and external loads.

Steel pipe design shall be in accordance with AWWA Manual M-11 and MWD standards. Deflection of the empty pipe under full vertical dead and live loads shall be limited to 3 percent of the vertical pipe diameter. Any structural benefit derived from mortar lining and coating shall be neglected in the stress and deflection analysis of the pipe. A minimum 3/8-inch plate thickness shall be used for pipe over 24 inches in diameter.

4.2.3 MECHANICAL DESIGN CRITERIA

4.2.3.1 Recommended Facilities

4.2.3.2 General

The OCCF connects the 2nd Lower Feeder with the EOCF#2 and is designed for bi-directional flow. Refer to the Hydraulics Section for the various operational cases that define the flows and heads used to size and select mechanical equipment.

For this project, it was assumed flow from East to West shall occur only in the future when the CPA project is complete. However, the OCCF project does include a pressure control structure designed such that future pressure reducing sleeve valves can be installed for the future case of water flowing East to West in the feeder. The specification and supply of the sleeve valves in the OCCF PCS would become a part of a future CPA project.

4.2.3.3 SITE No. 1 - SECTIONALIZING VALVE AT STA. 114+40

The mechanical equipment for the proposed isolation valve structure shall consist of a vault that contains a mainline isolation valve, bypass line, air–vacuum valves, ventilation equipment, sump pump, and other miscellaneous equipment.

4.2.3.4 Main Isolation Valve: The main line isolation valve shall be Metropolitans special purpose rubber seated butterfly valve designed for a 50 plus year life. Valve shall be the same size of the main line (84"). The maximum static head the valve can be subjected to is 585 feet. The pressure rating shall be 275 psig. The valve shall consist of an internally rubber coated carbon steel flanged valve body and rubber coated disc. Shafting shall be stainless steel supported by bronze self lubricated radial and axial bearings. The valve actuator shall be Metropolitans "Class D" type, sized and designed to close the valve with a complete line break on east side of valve with maximum reservoir elevation at Diemer Plant Reservoir. Valve operating time shall be 30 minutes.

The valve shall be open or close, with local and remote open and close control. Valve position shall be monitored remotely. Emergency power shall be available for closing the valve if normal power is lost.

4.2.3.5 Bypass Line: A bypass line shall be provided around the main isolation valve to fill the pipeline after it has been dewatered. The bypass line shall include a throttling valve between two isolation valves (three valves total). The bypass line shall be 316 stainless steel and sized so velocities do not exceed 30-35 feet per second.

Isolation valves shall be of the manually actuated high performance butterfly valve type with 316 stainless steel body and disc. Isolation valves shall be of the same size as the bypass line (24"). The throttling valve shall be a 16" inverted plug valve. The bypass line and related equipment shall be sized to fill the pipeline in less than 12 hours.

4.2.3.6 Air Vacuum And Air Release Valve: An air vacuum and release station shall be provided with piping connections on both sides of the main line isolation valve to allow air to enter and exit the main pipeline during operation and when the pipeline is being filled or drained to prevent excessive negative pressure that might collapse the pipeline. To avoid cross-connection issues, the air vacuum and release station shall be located above grade at the side of the road. The vacuum valve and air release valve line shall have an isolation valves and a surge check valve located in the sectionalizing valve vault. The air vacuum valve, surge check valve and air release valves shall be ductile iron and per latest Metropolitan standards. The isolation valves shall be of the manually actuated high performance butterfly valve type with 316 stainless steel body and disc. Metropolitan's Hydraulic Branch shall perform air release and vacuum valve sizing.

4.2.3.7 Vault Ventilation: The isolation valve structure shall have electrical fans to provide 6 air changes per hour. Inlet and exhaust location shall be place to avoid any dead area of un-circulated air.

4.2.3.8 Sump Pump: Vaults with electrical equipment shall have a self-actuated electrical sump pump to remove wash down water or water from minor leaks. Pump shall be sized for 50 gpm. A flood alarm with remote alarm signal shall also be provided if water reaches a depth 3" above the lowest floor level.

4.2.3.9 Electrical Insulation Joints: Electrical insulation joints shall be provided at location where dissimilar metals are in contact i.e. stainless steel bypass line with carbon steel main pipeline.

4.2.3.10 Pipe: Pipe 24" and smaller shall be carbon steel 'A' pipe or stainless steel 'E' pipe as indicated on P&ID's. Pipe 30" and larger shall be 'K' pipe or 'A' pipe.

4.2.3.11 Miscellaneous Connections: One 84" and one 24" sleeve coupling shall be provided for isolation valve and bypass valves installation and removal. A thrust harness per AWWA M11 shall be provided for each sleeve coupling. The main pipe shall have a 4" valved drain on both sides of the main line isolation valve. Connections on the main pipeline for instrumentation and other uses shall be 1" with a 1" ball valve.

4.3 SITE No. 2 – PRESSURE CONTROL STRUCTURE AT STA. 27+70

The structure would contain the sleeve valves, pressure discharge vessels, inlet and outlet block valves, and a control room for the sleeve and block valves. The control room includes a, and battery room (**Figures 8-35**).

The structure will contain a main line isolation valve, pressure relief lines, blow-off line, water quality sweep line, bypass line, air-vacuum lines, ventilation equipment, sump pump, and miscellaneous connections and equipment.

The structure will be below grade with a control room above grade. The roof of the structure would have removable hatches to allow crane access to valves and their actuators.

The PCS layout shall include header and branch piping to accommodate the future installation of three 54" by 36" horizontal sleeve valves designed to break head when flows are east to west. Each sleeve valve shall have an upstream and downstream isolation valve. Two 84" tees located on the main line, one east and one west of the structure, shall feed two 84" headers. Three 54" inlet and three 54" outlet stub lines shall run from the headers into the structure, terminating with 54" flanges and blinds. Refer to drawing yyyy for preliminary PCS layout.

Electrical and control equipment shall be located in the control room. Room size shall accommodate electrical and control equipment for 84" butterfly valve, future 54" butterfly valves, and future 54" sleeve valves, including the motor control center, control panels, remote terminal unit, and emergency battery power back-up for closing the 84" butterfly valve and three 54" butterfly valves. Motor size will be approximately 7 hp for the 84" valve actuator and 5 hp for the 54" valve actuator. Refer to drawing yyyy for preliminary control room layout.

4.3.1 Main Isolation Valve: The main line isolation valve shall be Metropolitans special purpose rubber seated butterfly valve designed for a 50 plus year life. Valve shall be the same size of the main line (84"). The maximum static head the valve can be subjected to is 585 feet. The pressure rating shall be 275 psig. The valve shall consist of an internally rubber coated carbon steel flanged valve body and rubber coated disc. Shafting shall be stainless steel supported by bronze self lubricated radial and axial bearings. The valve actuator shall be Metropolitan's "Class D" type, sized and designed to close the valve with a complete line break downstream of the valve with maximum reservoir elevation at Diemer Plant Reservoir. Valve operating time shall be 30 minutes.

The valve shall be open or close, with local and remote open and close control. Valve position shall be monitored remotely. Emergency power shall be available for closing the valve if normal power is lost.

4.3.2 Pressure Relief Lines: Pressure relief is required to protect the 2nd Lower Feeder, with a HGL of 660' from the EOCF#2 HGL of 810'. Refer to the Hydraulics section of this PDR for determination of pressure relief design capacity. Pressure relief capacity at the OCCF PCS is capacity in addition to existing pressure relief capacity at the Carbon Creek PCS on the 2nd Lower Feeder.

The OCCF PCS pressure relief shall consist of a 30" stub-out connection and line from the 84" downstream header into the PCS. Two 16" pilot operated, bottom guided stem globe valves (Ross type or equal) shall run in parallel from the 30" inlet header to a 30" common discharge header. The two parallel branch piping shall be stainless steel. An isolation plug valve shall be located upstream of each globe valve. The 30" discharge header shall exit the structure, terminating in the Carbon Creek Diversion Channel. Pressure indication instrumentation connections shall be on upstream of globe valves.

4.3.3 Blow-Off Line: Based on a 16" line, maximum blow-off flow is 37 cfs, with dewatering time 8 hours. A blow-off line with manual 16" inverted plug valve shall connect from Eastside header to 30" pressure relief header that leads to Carbon Creek Diversion Channel. An isolation valve consisting of a manually actuated high performance butterfly valve with 316 stainless steel body and disc, shall be located upstream of the plug valve. The isolation valve shall be a minimum 20" in size. A separate pump well structure is required to pump out water low section of pipe passing under the Carbon Creek. Diversion Channel.

4.3.4 Bypass & Water Quality Sweep Line: A bypass line shall be provided around the main isolation valve to help fill the OCCF after it has been dewatered. The line shall also be used as a water quality sweep line allowing 3 to 5 cfs to sweep through the OCCF when the feeder is not in use. The line shall include a manual 12" inverted plug valve between upstream and downstream isolation valves. The bypass line shall be 316 stainless steel. A strap on accusonic flow meter will be used to manually adjust the plug valve to obtain the sweep flow.

The line shall include a manually actuated high performance butterfly valves with 316 stainless steel body and disc. This isolation valve shall be a minimum 20" in size.

4.3.5 Air Vacuum and Air Release Valves: Just down stream of the main isolation valve an air vacuum and release station shall be provided to allow air to enter and exit the main pipeline during operation and when the pipeline is being filled or drained to prevent excessive negative pressure that might collapse the pipeline. To avoid cross-connection issues, the air vacuum and release station shall be located above grade at the side of the road. The vacuum valve and air release valve line shall have an isolation valve and surge check valve located in the sectionalizing valve vault. Vacuum and air release piping shall come off the top of the main pipeline. The air vacuum valve, surge check valve and air release valves shall be ductile iron and per latest Metropolitan standards. The isolation valves shall be of the manually actuated high performance butterfly valve type with 316 stainless steel body and disc. Metropolitan's Hydraulic Branch shall perform air release and vacuum valve sizing.

4.3.6 Structure Ventilation: The PCS shall have electrical fans to provide 6 air changes per hour. Inlet and exhaust location shall be place to avoid any dead area of un-circulated air. The battery room will have separated dedicated ventilation providing an air exchange of 1 cfm per square foot.

4.3.7 Sump Pump: Vaults with electrical equipment shall have a self-actuated electrical sump pump to remove wash down water or water from minor leaks. Pump shall be sized for 50 gpm. A flood alarm shall also be provided.

4.3.8 Electrical Insulation Joints: Electrical insulation joints shall be provided at location where dissimilar metals are in contact i.e. stainless steel bypass line with carbon steel pipeline.

4.3.9 Pipe: Pipe 24" and smaller shall be carbon steel 'A' pipe or stainless steel 'E' pipe as indicated on P&ID's. Pipe 30" and larger shall be 'K' pipe or 'A' pipe.

4.3.10 Miscellaneous Connections: Sleeve couplings with thrust harnesses per AWWA M11 shall be provided for main pipe line, pressure relief lines, bypass line, and blow-off line for installation and removal of valves. The main pipe shall have 4" valved drain line connections, and pressure instrument tap connections, on either side of the isolation valve. Connections on the main pipeline for instrumentation and other uses shall be 1" with a 1" ball valve. Manway access shall be included on west side of main isolation valve. A nozzle for wire connection of a future internal accusonic flow meter shall be included on main pipe west of main isolation valve.

4.2.4 ELECTRICAL DESIGN CRITERIA

4.2.4.1 General Electrical Design

1. Two new valve structures, one each at the following locations:

A. Pressure Control Structure (PCS)

B. East-End Sectionalizing Valve Structure

2. OC PCS will require the following:

   A. Lighting and lights are manually switched

   B. 120 volt power receptacles

   C. Valve position status, intrusion Alarm and etc (signal to RTU)

   D. RTU cabinet for PCS alarm and instrument signals. RTU signals transmitted via frame relay.

   E. Sump pump with level switch and manual motor starter

   F. 120/240 volt feeder from Southern Cal. Edison (SCE) to a Electrical Service Cabinet

   G. Emergency power to be a diesel generator power or an UPS with 1 hour of battery backup.

      1) Sized to only handle the current design electrical loads and will NOT handle the future bypass valves and sleeve valves.

      2) 25 % interior lighting and all exit signs are connected to emergency power

      3) Critical instruments and control panels are connected to emergency power

   H. 240 volt, single-phase power to Mov's. This voltage may need to go to 480 volt 3 phase, if MOV exceeds 1 horsepower

   I. 120/240-volt panel board to power all electrical devices inside PCS.

   J. Forced ventilation system.

3. East-End Sectionalizing Valve structure will require the following

   A. Lighting and lights are manually switched

   B. 120 volt power receptacles

   C. Valve position status, intrusion Alarm and etc (signal to RTU)

   D. RTU cabinet for Valve structure alarm and instrument signals. RTU signals transmitted via frame relay.

   E. Sump pump with level switch and manual motor starter

   F. 120/240 volt feeder from Southern Cal. Edison (SCE) to a Electrical Service Cabinet.

   G. 240 volt, single-phase power to Mov's. This voltage may need to go to 480 volt 3 phase, if MOV exceeds 1 horsepower

   H. 120/240-volt panel board to power all electrical devices inside structure alarm.

   I. Forced ventilation system.

J. Both valves will require remote open/close and valve position status via RTU

4. Cathodic Protection System for Corrosion Control

   A. Cathodic Protection System should be impressed current type and 120/240 volt, single phase power is required at the rectifiers.

   B. Power will came from SCE and therefore will require service drop from SCE.

   C.

5. Level indicator transmitter (LIT) will be located inside valve structure at Yorba Linda Pressure Control Structure and transmitter signal will go to RTU.

4.2.4.2 Codes and Standards Governing Electrical Design

The following codes are used in the design:

- National Electrical Code (NEC), latest edition.

- California Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA), California Code of Regulations (CCR), Title 8; Electrical Safety Orders, latest edition.

4.2.4.3 Electrical Design References

The following references are used in the design:

- American National Standards Institute (ANSI) / Institute for Electrical and Electronics Engineering (IEEE):

  ANSI/IEEE 141, Recommended Practice for Electrical Power Distribution for Industrial Plants
  ANSI/IEEE 142, Recommended Practice for Grounding of Industrial and Commercial Power Systems.
  ANSI/IEEE 242, Recommended Practice for Protection and Coordination of Industrial Plants.

- Institute for Electrical and Electronics Engineering:

  IEEE 399, Recommended Practice for Industrial and Commercial Power System Analysis

- Illuminating Engineering Society (IES):

  IES, Lighting Handbook for Lighting Levels.

4.2.4.4 General Electrical Design Criteria

Good Reliability. Design the electrical equipment and systems to minimize outages and failures..

Cost Effective. Specify plant electrical equipment and systems to minimize the capital and operating costs without compromising quality.

Improved Efficiency. Use proven state-of-the-art technology in designing and specifying efficient equipment and systems. This includes using, premium efficiency motors, and efficient lighting systems.

Flexibility. Specify readily available equipment to facilitate easy acquisition of spare parts.

Space Requirements. Utilize the available space as efficiently as possible while providing adequate clearances for ease of maintenance and new equipment installations. Classify work areas in accordance with the NEC and other applicable standards and select suitable NEMA rated enclosures for all electrical equipment.

4.2.4.5 Detailed Electrical Design Criteria

Voltage Drop:	Normal operation - feeders 2% or less. Feeders and branch circuits combined 5% or less. Contingency operation - feeders 5 % or less. Feeders and branch circuits combined 8% or less.
Conductor Ampacity:	125% or more of connected load with additional oversizing for energy efficiency based on actual load demands.
Demand Factor:	80%
System Grounding:	Separate ground wells at each valve structure and meter structure.
Cables:	Low voltage power - stranded copper conductors, THHW, THW, or THWN insulation on feeders, branch circuits, and building wiring. RHW-2 insulation on 125VDC cables. 90 degrees C temperature rise on all insulation. Low voltage control - multiconductor, PVC jacketed, color coded 600V THWN insulation. Low voltage instrumentation - multi twisted pair, individual/overall mylar shielded, PVC jacketed, black/white 600V THWN insulation.

Raceways:	Exposed conduits - rigid galvanized steel. Exposed conduits in corrosive areas - PVC coated rigid steel. Concrete embedded conduits - PVC Schedule 40 or PVC coated rigid steel. Cable tray - aluminum ladder type Conduits in reinforced duct bank - Type E-B plastic
Lighting System:	Indoor areas - incandescent type

4.2.4.6 Electrical Design Documents

The electrical system design shall be documented with the following drawings:

- Symbols and general notes
- One-line diagrams
- Control schematics
- Equipment location plans (Show new equipment connecting to SCE power , source , and RTU cabinet)
- Equipment and Conduit Plans, Sections and Details
- Grounding Plans and Details
- Fixture Schedules
- Lighting Panel Schedules

4.2.4.7 Design References

The following references are considered necessary for the implementation of the electrical design:

- MWD Electrical Design Manual

4.2.5 CONTROL SYSTEM DESIGN CRITERIA

4.2.5.1 Governing Codes and Standards

The following codes, standards, and specifications shall be considered as part of this criteria. All documents shall be the latest edition in force on the date of issuance of the purchase order. Whenever a difference exists between documents issued and any referenced publications, the more stringent requirement shall govern.

- Instrument Society of America

- S5.1 Instrument Symbols and Identification
- S5.4 Instrument Loop Diagrams

- Occupational Safety and Health Standard
  - Code of Federal Regulations Title 27 Dept. of Labor
- National Electrical Manufacturers Association (NEMA)

4.2.5.2 Design References

The following references are considered necessary for the implementation of the control system design:

- MWD Instrumentation Design Manual
- MWD Electrical Design Manual

4.2.5.3 Design Criteria

General. The typical Local/Remote control capability will be provided for major component --- 84" motor operated butterfly valves. A local control panel in each structure shall be provided for mounting control switches, digital meters, status lights and alarm lights. A remote terminal unit (RTU) will be provided in each structure to relay the control signals and status signals from/to MWD control system network. A Frame-Relay Interface device will be required to connect this RTU to MWD network.

The pressure transmitters will be needed on both side of the MOV. A bi-directional flow meter will be used to monitor the water filling rate on bypass line.

1. Signals to RTU:
   - MOV "open" position
   - MOV "closed" position
   - MOV "open percentage" (0 – 100%)
   - MOV "Available" signal (remote position of local/remote selector)
   - MOV actuator hand-wheel interlock "Unlocked" (for remote operation)
   - MOV open side "Over-torque" alarm
   - MOV closed side "Over-torque" alarm
   - Upstream pressure signal (analog)
   - Upstream high pressure alarm
   - Downstream pressure signal (analog)
   - Downstream high pressure alarm

- Bypass flow rate

2. Signals From RTU:
   - MOV "open" command
   - MOV "close" command

3. Control of 84" Motor Operated Butterfly Valve

   There are 3 different ways to open or close 84" butterfly valve:
   - With Open/Close signal generated from RTU to control the electric actuator. The electric actuator works along with the gears to open or close the valve in about 30 minutes. This RTU control can be either an APC automatic control or an operator manual from Eagle Rock Control Center (or Diemer Plant Control Room).
   - From Open/Close push-button mounted on local control panel to control the electric actuator. The electric actuator works along with the gears to open or close the valve in about 30 minutes. This is local-manual operation
   - Using integral mounted hand-wheel to crank open or close the valve by hand. This is an emergency operation method. For safety reason, an interlock device is provided to enable the operation of the hand wheel and to prevent accidental operating of the electric actuator.

   A local/remote selector switch is needed to select the operation mode --- remotely from RTU or locally from local control panel.

4.3 GEOTECHNICAL CONSIDERATIONS

4.3.1 Overview

The proposed Orange County Cross Feeder is an 84-inch diameter, approximately 2½-mile long welded steel pipeline that will connect the existing 85-inch diameter Second Lower Feeder and the 79-inch diameter East Orange County Feeder No. 2. The pipeline alignment will be located along Miraloma Avenue in the cities of Anaheim and Placentia. With the exception of the crossing of the Carbon Canyon Diversion Channel, the pipeline will be constructed within the paved limits of Miraloma Avenue. The pipeline invert depth along the alignment is approximately 15 feet below the existing grade.

The pipeline will include the construction of a pressure control structure adjacent to the Carbon Canyon Diversion Channel and a valve vault structure near the inter-tie with the East Orange County Feeder No. 2 will be constructed along the alignment. The base of the pressure control structure will be about 25 feet below the existing ground surface. The base of the vault structure will be about 20 feet below grade.

Generalized geotechnical conditions and construction considerations are discussed in this section. Specific geotechnical design and construction recommendations will be presented in a project-specific geotechnical report currently in preparation.

4.3.2 Geotechnical Conditions

Subsurface Exploration and Encountered Conditions

Geotechnical exploration for the Orange County Cross Feeder is currently in progress and will consist of a total of 18 to 20 exploratory borings drilled along the proposed pipeline alignment and at the pressure control facility site. Exploratory boring depths will be about 30 to 40 feet below the existing grade.

Holocene floodplain and stream terrace deposits, derived mainly from the Santa Ana River and its tributary drainages, underlie the pipeline alignment. These alluvial deposits consist primarily of medium dense to dense poorly graded to well-graded sand and silty sand with occasional medium stiff to stiff sandy silt. Fill soils consisting of silty sand and poorly graded sand were encountered in parts of the eastern portion of the alignment. Gravels and some cobbles were present in the fill soils and in the alluvium. Groundwater has not been encountered in any of the borings drilled to date for the project.

Groundwater

Recent groundwater well data available from the Orange County Water District (OCWD) and California Department of Water Resources (CDWR) in the vicinity of the project pipeline alignment between 2000 and 2005 indicate that the highest groundwater levels recorded during this period ranged from a depth of about 11 feet to 46 feet below the ground surface. The lowest recorded groundwater levels during this period ranged from a depth of about 27 feet to 86 feet. The shallowest groundwater levels were recorded adjacent to the Anaheim Lake deep groundwater-recharging basin operated by OCWD.

Historic high ground water levels for the general project area are reported in the California Division of Mines and Geology (CDMG) Seismic Hazard Zone Report for the Orange 7.5 Minute Quadrangle, Orange County, California (1997, revised 2001). The CDMG data indicates that the pipeline alignment is located between the 10 and 20-foot depth to ground water contours measured from the existing ground surface. The CDMG data does not provide dates for the historic groundwater levels.

Groundwater levels along the project alignment will be affected by the proximity to, and the operation of, the OCWD groundwater recharge basins, particularly the Anaheim Lake spreading basin and Miller retarding basin, as well as seasonal precipitation conditions. Since groundwater has not been encountered in any of the exploratory borings drilled to date, including those drilled near Anaheim Lake and the Miller spreading basin, an assessment of the operational stage of spreading basins relative to the timing of the drilling of the nearby exploratory borings is currently in progress. Pending the results of this evaluation, it is currently expected that only minor groundwater will be encountered along the pipeline alignment, consisting of perched groundwater conditions in the vicinity of the Carbon Creek Diversion Channel where the deepest construction excavations will be required. This preliminary conclusion is based upon the relatively shallow depth of the pipeline project.

Geologic Hazards

The pipeline alignment does not cross any mapped or zoned active or potentially active fault zones. As a result, the potential for damage due to fault rupture is non-existent.

Strong-ground shaking should be expected for structures along the pipeline alignment, as is expected for most of southern California. The seismic design criteria for the pressure control structure and the valve vault will be determined using site-specific probabilistic site hazard assessment methods for a 10 percent chance of exceedance in a 100-year design life (annual average return period of 950-years).

The project alignment is located within a CDMG designated liquefaction hazard zone as shown on the Seismic Hazards Zones for the Orange Quadrangle. This publication provides an initial screening to identify project areas where site-specific liquefaction analyses may be needed. As a result, the field exploration data collected to date is being reviewed to assess the need for detailed liquefaction analyses for the pipeline alignment.

4.3.3 Construction Considerations

The majority of the pipeline will be constructed by conventional cut-and-cover trenching methods within the paved limits of Miraloma Avenue, except at the crossings of Kramer Boulevard, Carbon Canyon Diversion Channel, Tustin Avenue and OCTA Metrolink Rail Road, where the pipeline will be constructed using pipe jacking/tunneling methods.

The primary consideration for the cut-and-cover construction portions of the alignment will involve the excavation and shoring for pipeline installation along Miraloma Avenue. Since the pipeline will be constructed within a busy roadway, where significant existing utilities are present, fully shored and supported excavation will be required; sloped excavations are not expected to be feasible. Conventional shoring consisting of soldier piles and lagging may be used. Alternatively, "moving shield" shoring may be used. For the pressure control structure and the valve vault structure excavations, cantilever shoring with internal bracing may be adequate. The primary consideration for the use of shoring for construction will be the need to control and monitor deflections of shoring near existing utilities and structures. The soils along the alignment can be excavated using conventional equipment.

The primary consideration for the pipe jacking/tunneling operations at the four identified critical undercrossing areas is the presence of sandy soils. The caving potential of these materials will need to be considered in the determination of initial support systems and the selection of mining methods.

Groundwater was not encountered in our borings, although historical data indicates that the groundwater levels may be as shallow as 10 feet below the existing grade. Since the depth of pipeline construction is relatively shallow, it is currently expected that groundwater will only be encountered in the deepest excavations needed for the project in the vicinity of the Carbon Creek Diversion Channel. Therefore, only minor dewatering is expected to be required during construction.

4.3.4 Geotechnical Design Parameters and Construction Recommendations

Site-specific geotechnical design parameters and recommendations for construction will be contained in the project-specific geotechnical report being prepared for the project.

4.4 Construction Cost Estimate

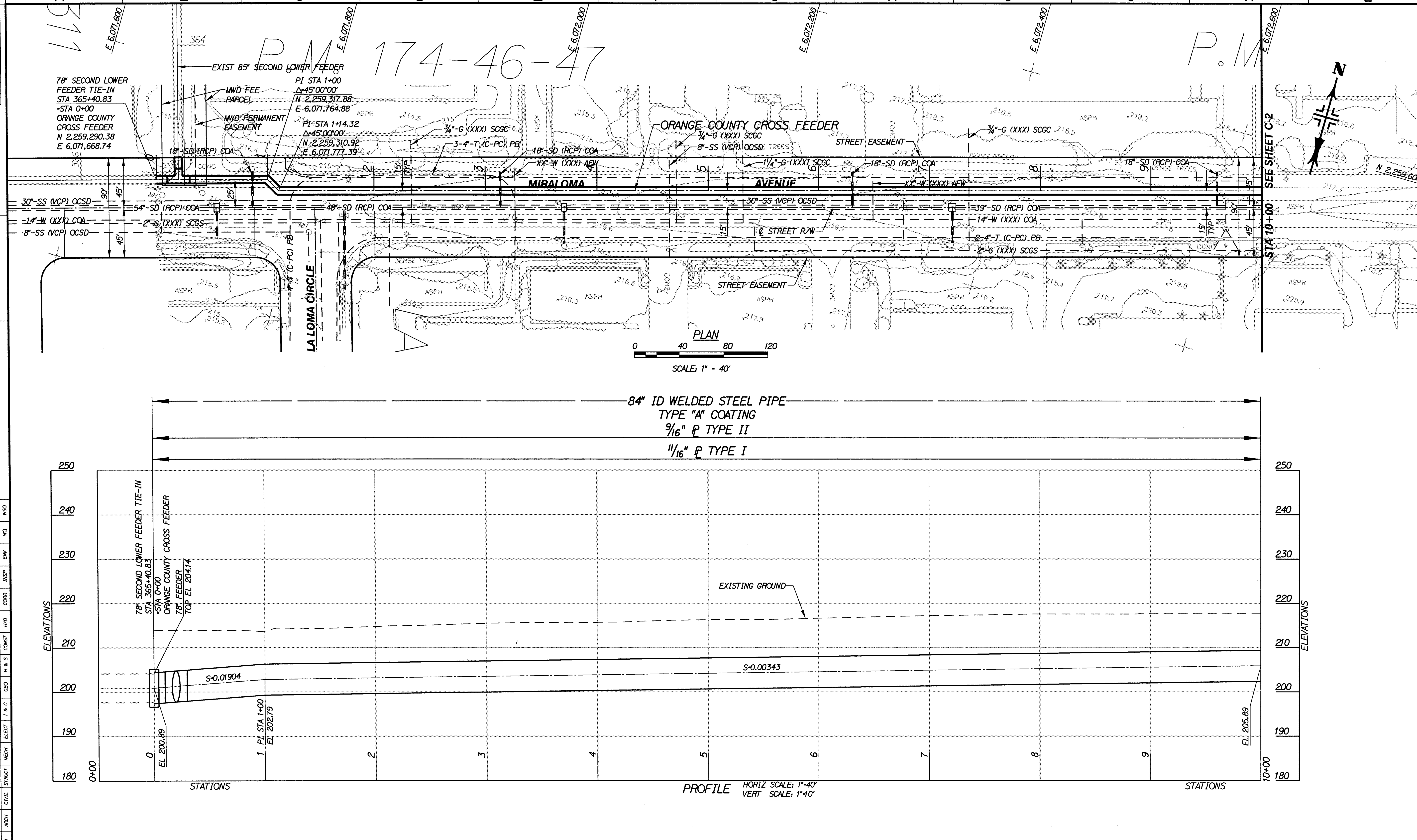
As part of the preliminary design investigation, two preliminary construction estimates where put together.

The first estimate (Option A) is for an OC Cross Feeder alignment that runs East-West along Miraloma Avenue. The cross feeder would tie-in on the east end to the East Orange County No. 2 Feeder at Miraloma & Richfield. On the west end, the feeder would tie in to the second lower feeder approximately 700 feet east of Red Gum Street. This requires approximately 2,500 feet of pipe and the construction of a new pressure control structure.

The second estimate (Option B) is for an OC Cross Feeder alignment that primarily runs east-west, turns north at Kraemer and Miraloma and ties in to the second Lower Feeder on Orangethorpe Avenue. This alignment is longer than option A but eliminates the need for a new pressure control structure. In addition, this alignment will require a third sectionalizing valve on the 2nd Lower Feeder and a 12-inch line for water quality purposes that connects downstream of the existing Carbon Creek PCS.

Option A is selected due to several advantages to the project.

			Option A		Option B	
		Unit Price	**Quantity**	**Total Price**	**Quantity**	**Total Price**
Excavation	CY	$4	75,000	$ 300,000	96,144	$ 384,575
Shoring	SF	$8	336,000	$ 2,688,000	430,724	$ 3,445,792
Backfill	CY	$5	58,000	$ 290,000	74,351	$ 371,756
Spoil (assumed dump within 5 miles)	CY	$10	17,000	$ 170,000	21,793	$ 217,926
Pipe Installation (84")	LF	$1,150	12,478	$ 14,349,700	15,383	$ 17,690,450
Microtunnel 24"Casing w/12" Pipe	LF	$800			360	$ 288,000
Tunnel w/96" casing (6 locations)	LF	$1,500	300	$ 450,000	600	$ 900,000
Jacking & receiving pits (6 locations)	EA	$50,000	6	$ 300,000	12	$ 600,000
PCS/Valve Vault	*EA*	*$7,000,000*	*1*	*$ 7,000,000*		
Carbon Creek Modification?	*EA*	*$3,000,000*				*$ 3,000,000*
Valve Vault	EA	$300,000	1	$ 300,000	3	$ 900,000
Traffic Control	LS	$200,000	1	$ 200,000	1	$ 200,000
Misc Items Allowance	LS	$20,000	1	$ 20,000	1	$ 20,000
				$ 26,067,700		$ 28,018,499
Tax on Materials (assume 1/3 of job)		7.75%		$ 673,416		$ 723,811
				$ 26,741,116		$ 28,742,310
General Conditions (mob, jobsite expenses, etc.)		10%		$ 2,674,112		$ 2,874,231
				$ 29,415,228		$ 31,616,541
Overhead and Profit		14%		$ 4,118,132		$ 4,426,316
				$ 33,533,360		$ 36,042,857
Bond		1.0%		$ 335,334		$ 360,429
			Total Unescalated	**$ 33,868,694**		**$ 36,403,286**



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DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
STA 0+00 TO STA 10+00

PLAN AND PROFILE

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET C-1
DWG | REV

METROPOLITAN WATER DISTRICT

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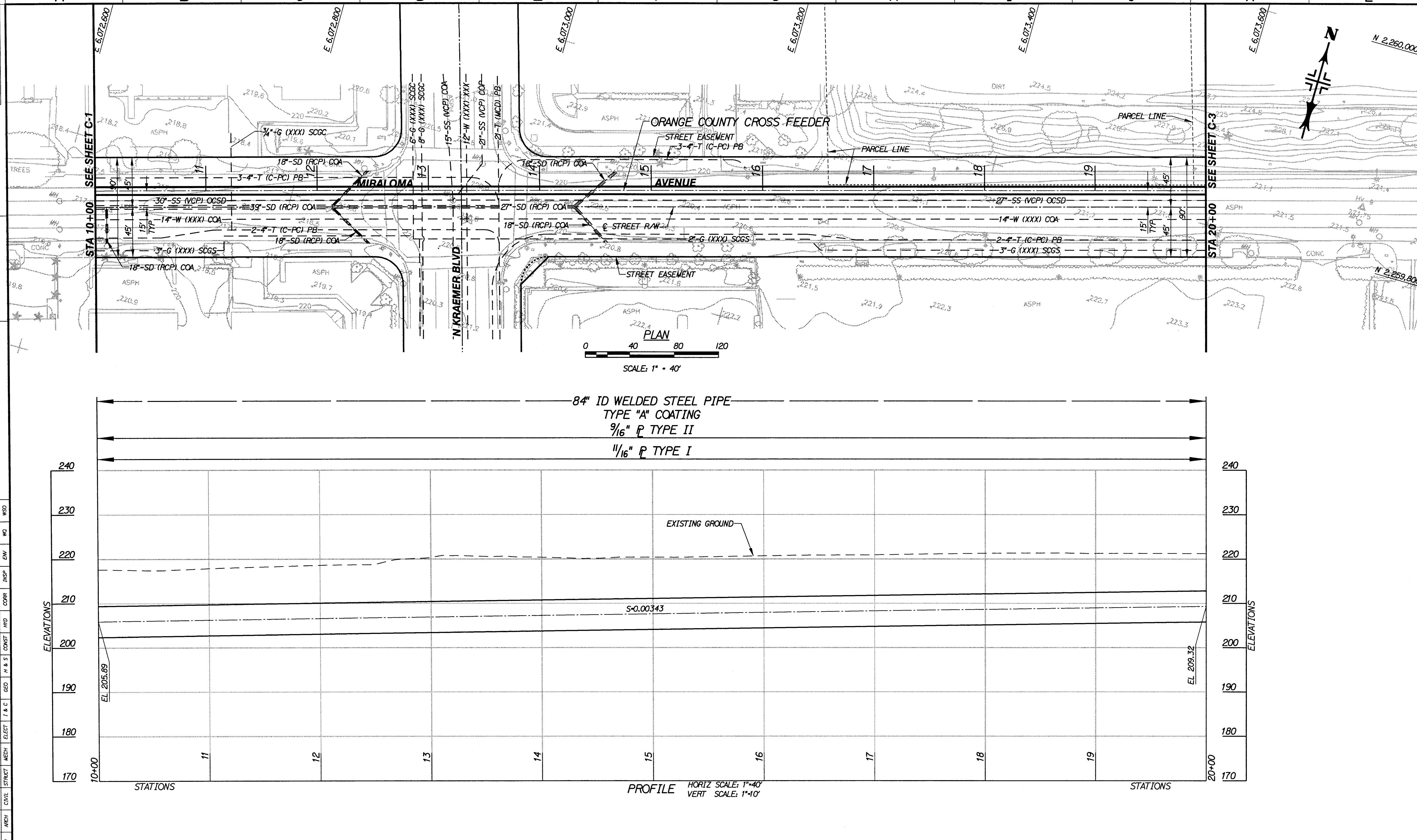

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PLAN AND PROFILE

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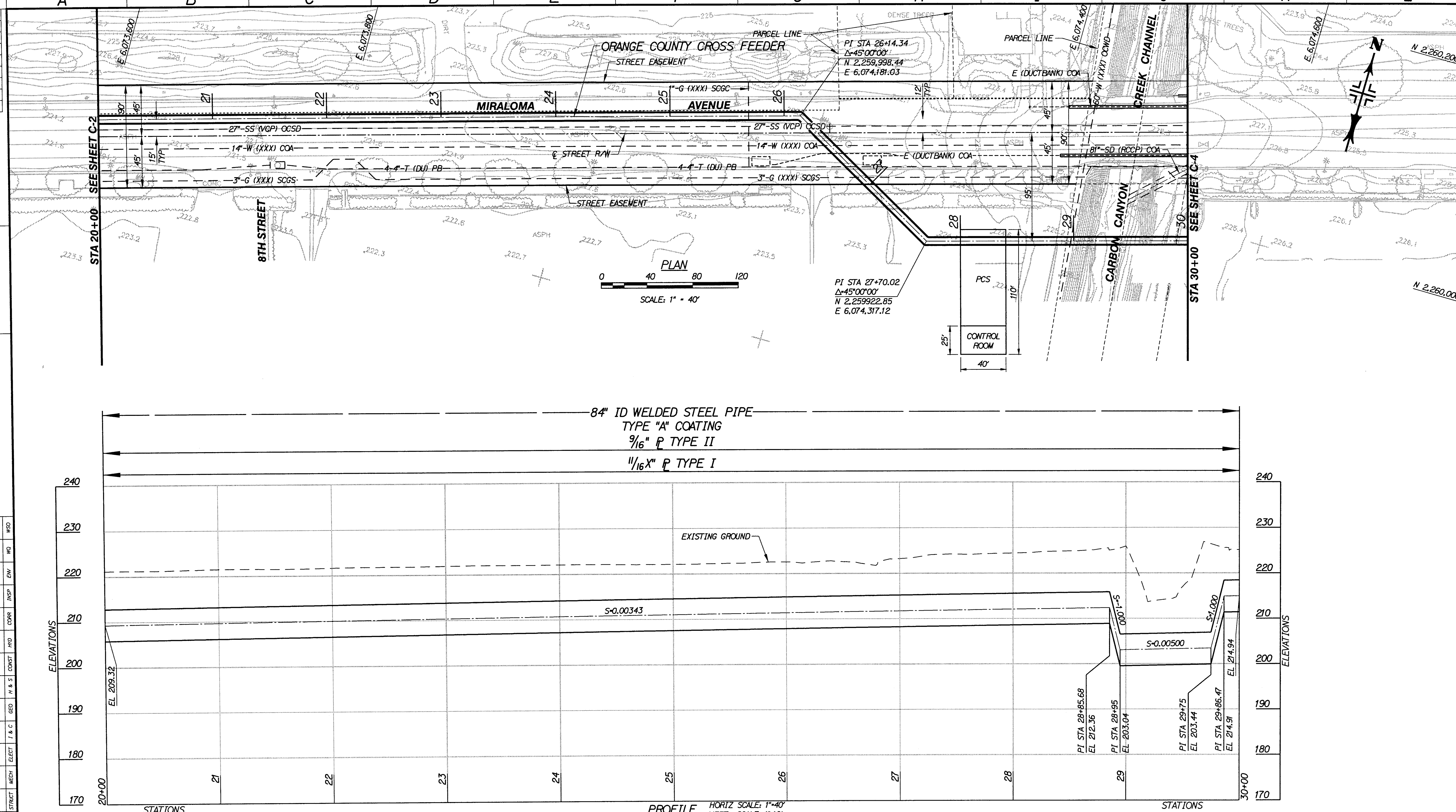

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DISTRIBUTION SYSTEM
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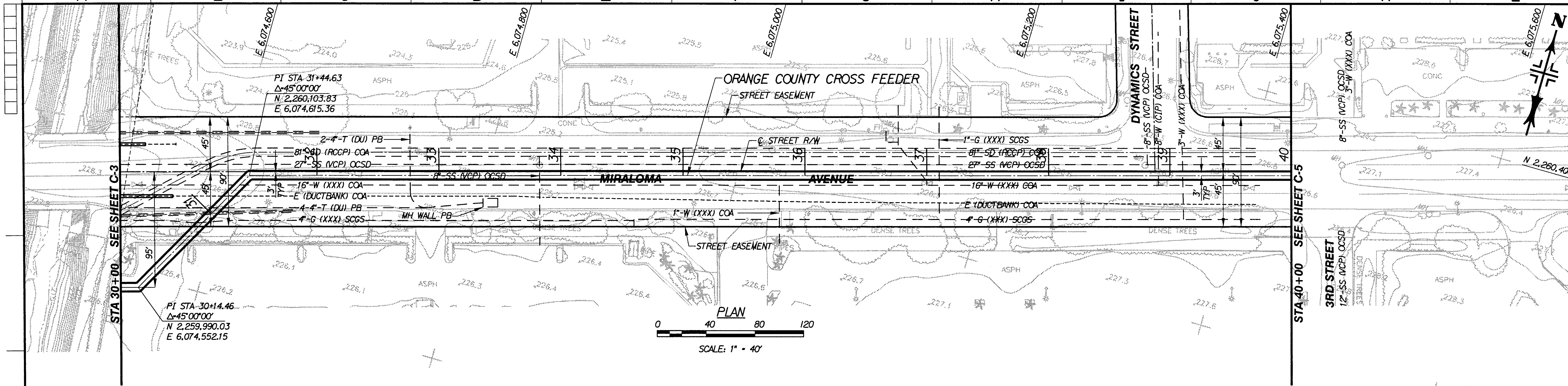

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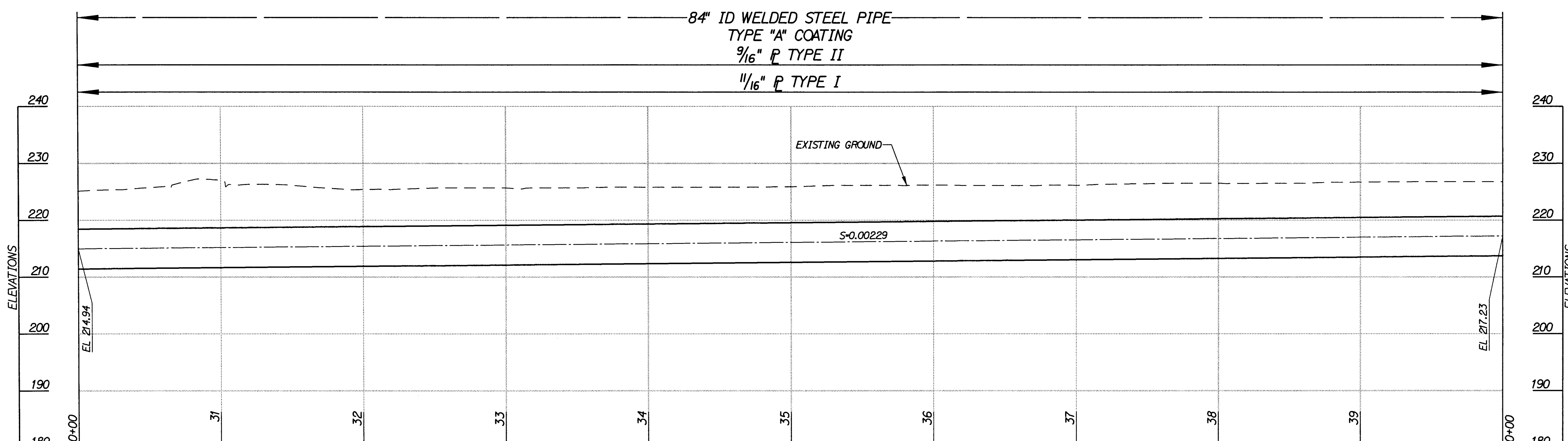

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DISTRIBUTION SYSTEM
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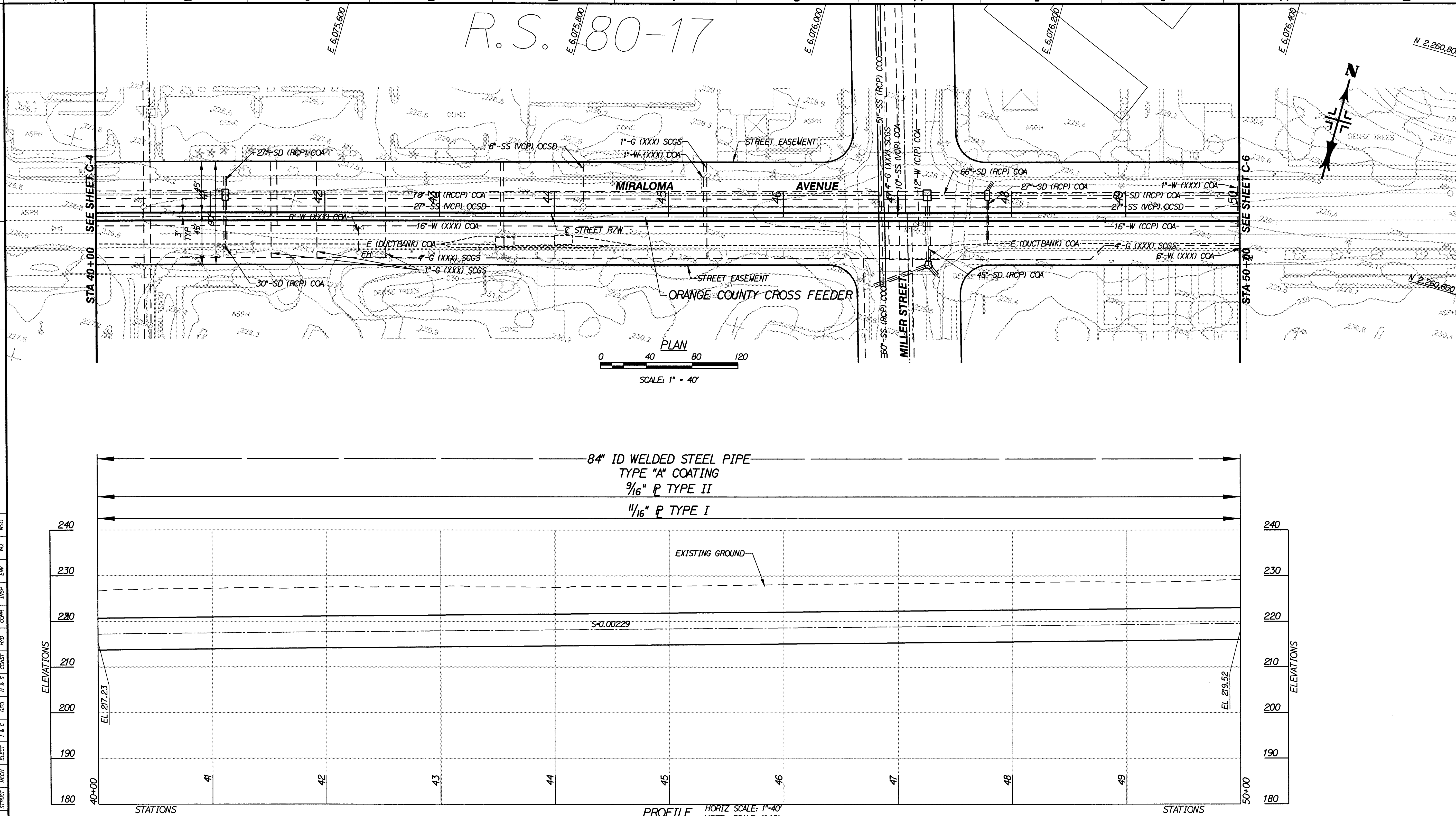

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METROPOLITAN WATER DISTRICT

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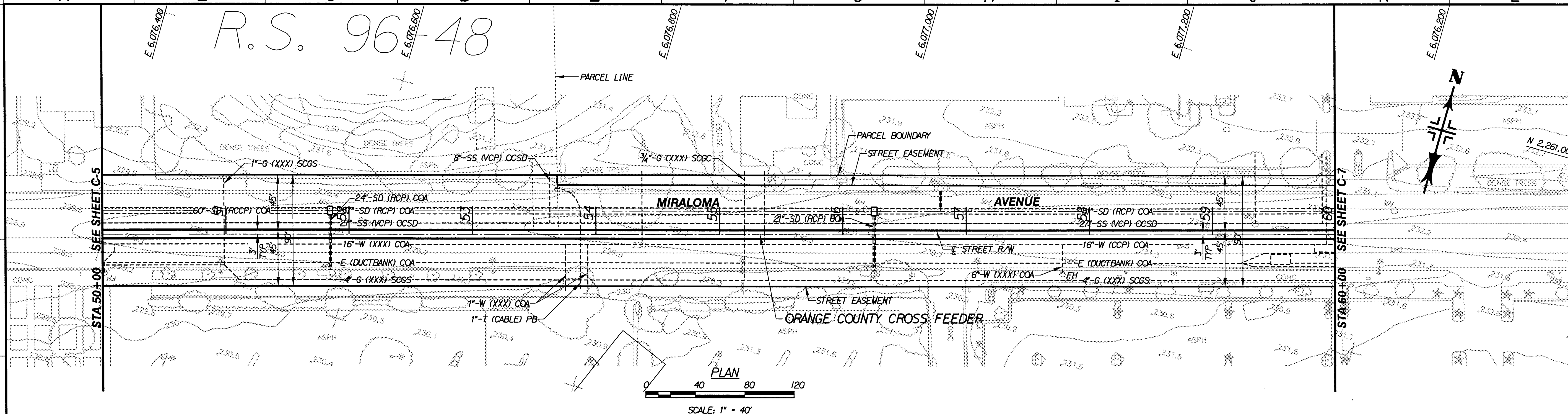

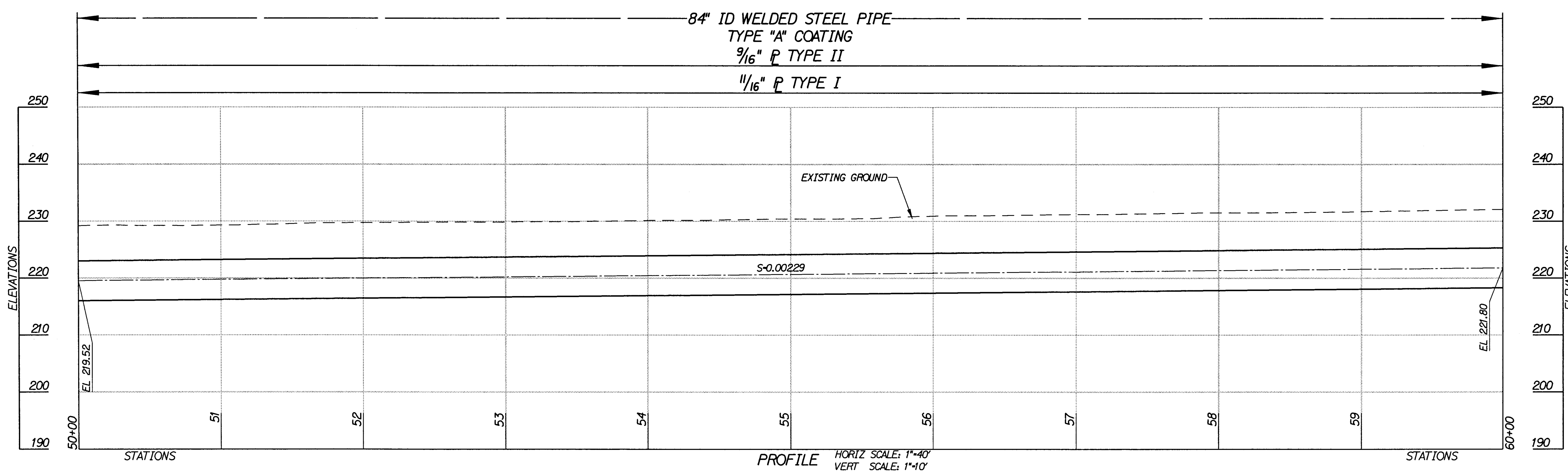

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DISTRIBUTION SYSTEM
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METROPOLITAN WATER DISTRICT

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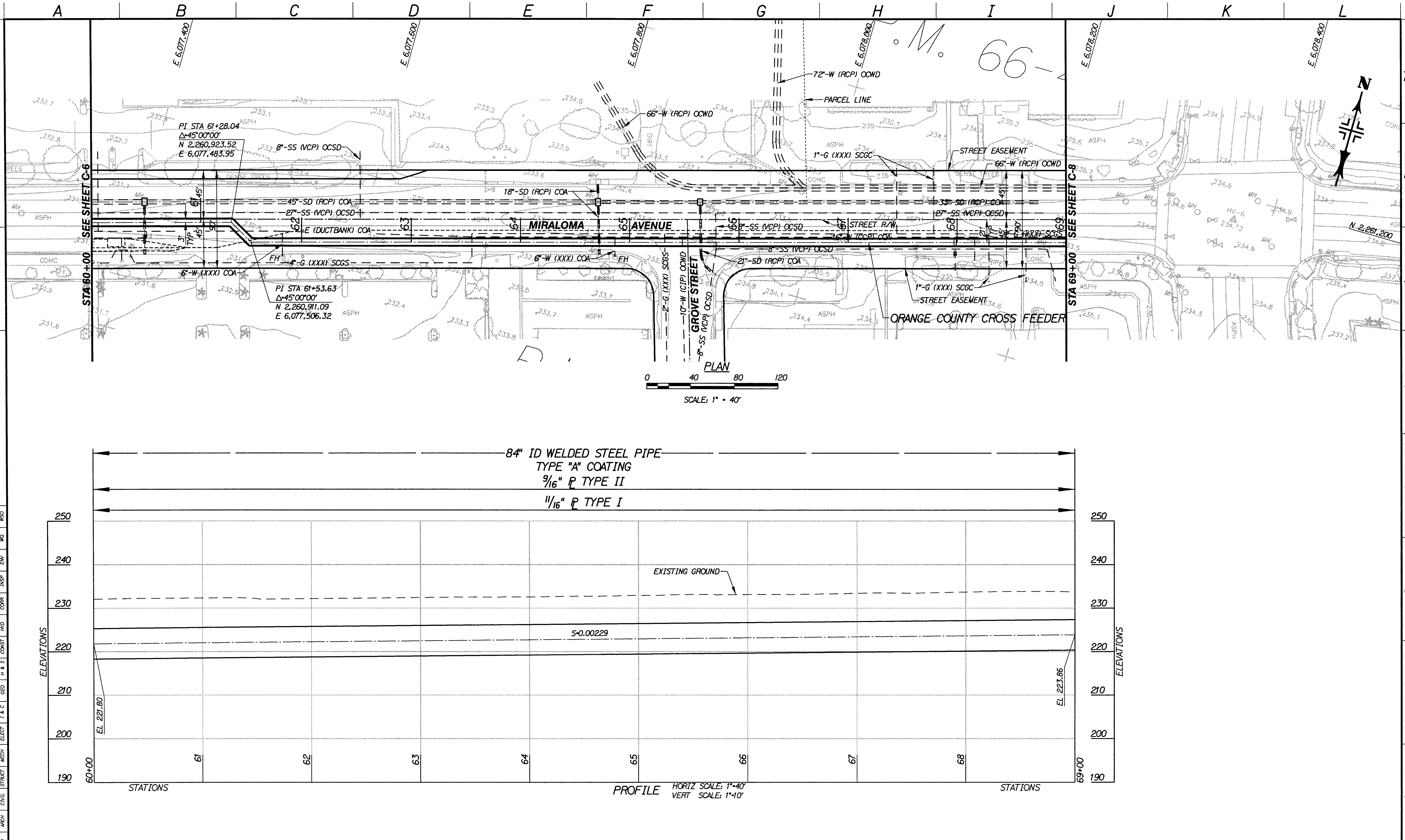

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METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
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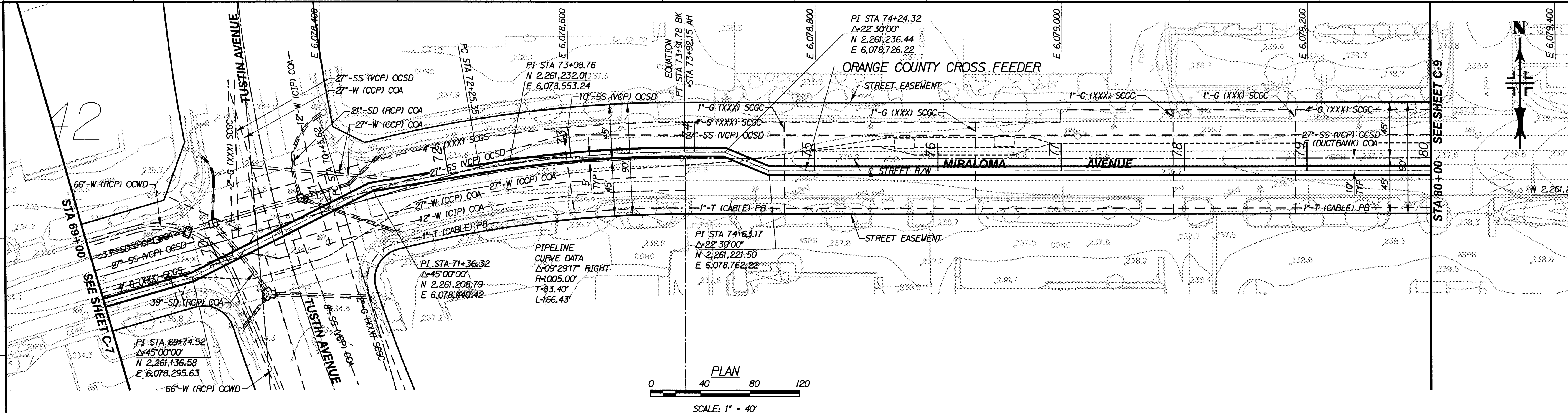

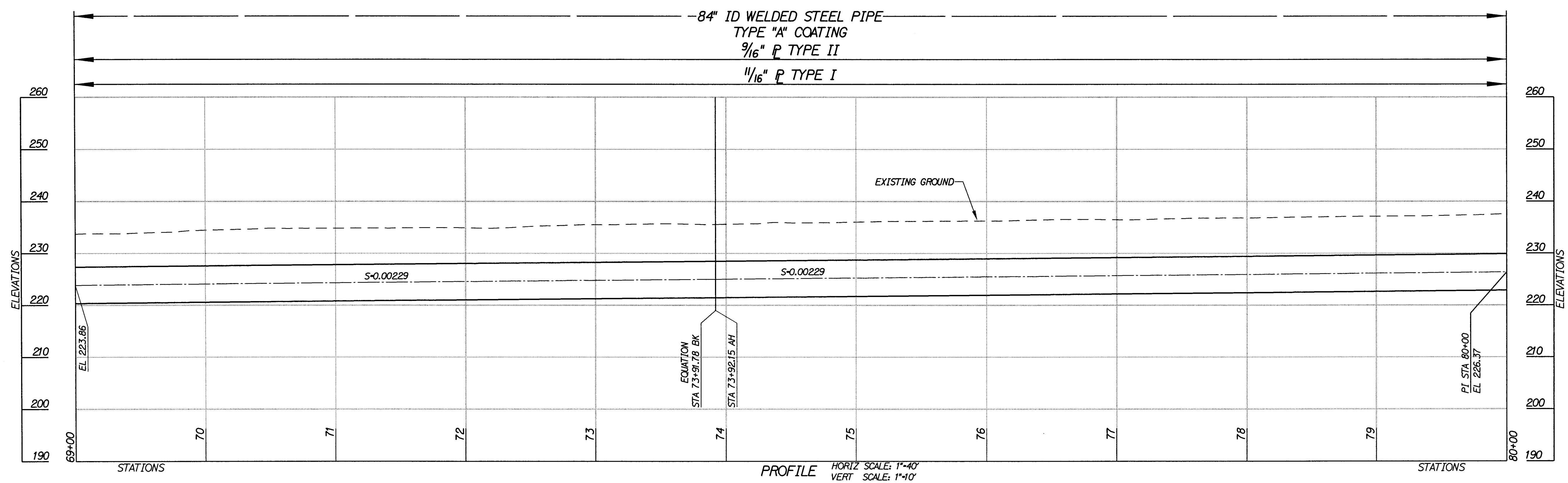

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MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
STA 70+00 TO STA 80+00

PLAN AND PROFILE

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET C-8
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METROPOLITAN WATER DISTRICT

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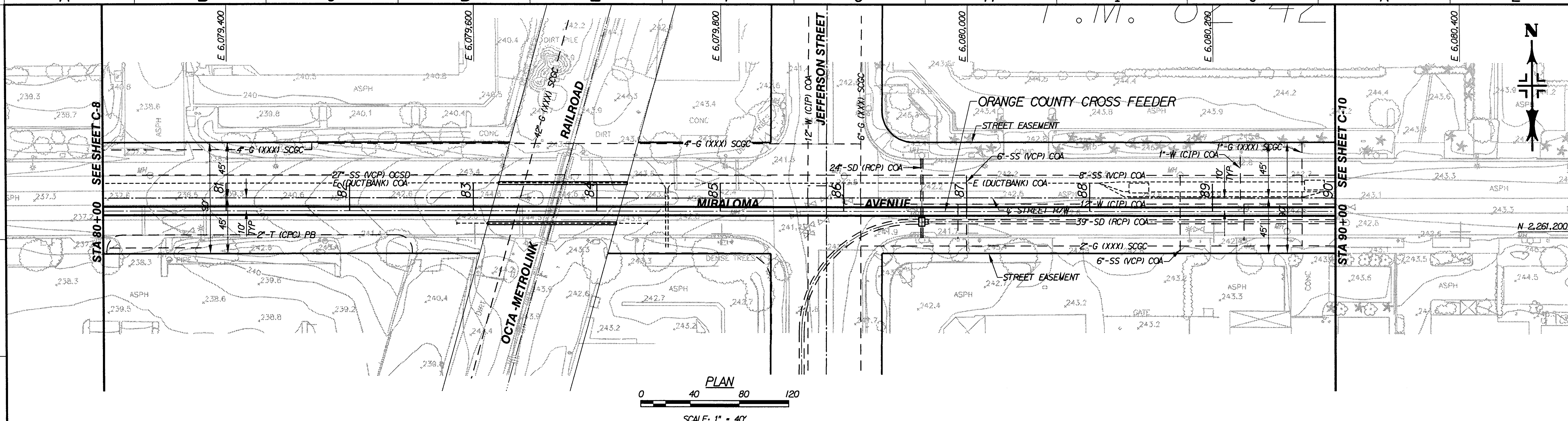

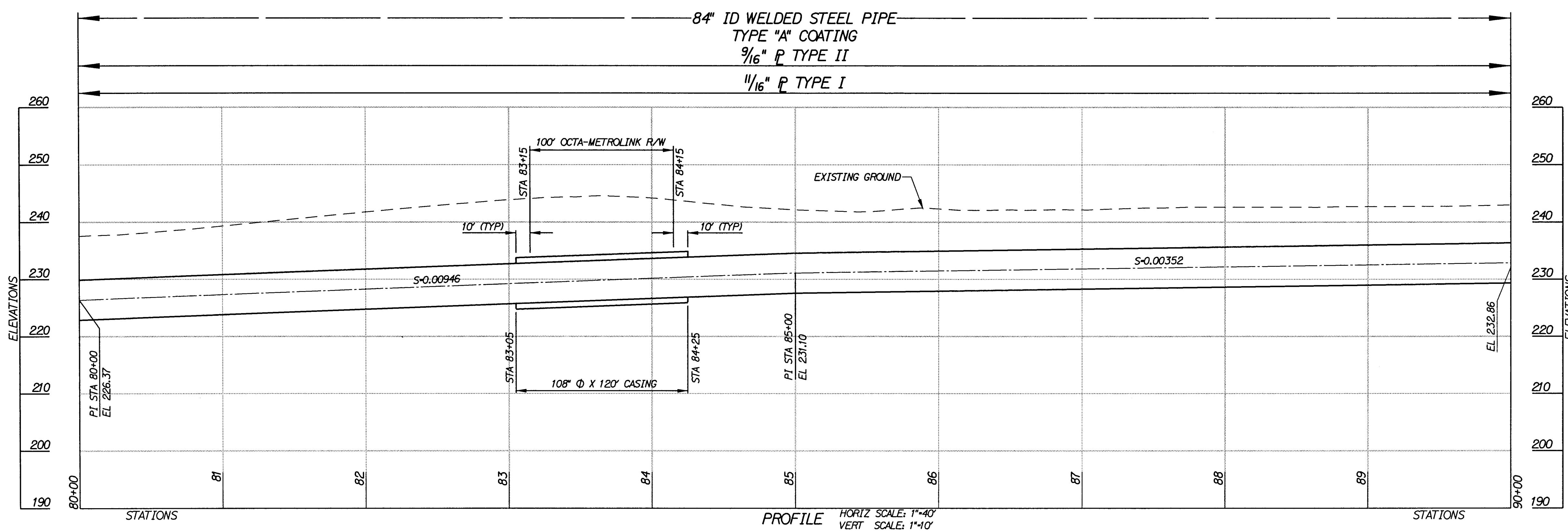

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METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
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STA 80+00 TO STA 90+00

PLAN AND PROFILE

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METROPOLITAN WATER DISTRICT

COORDINATION CHECK: WSO, WQ, EN, INSP, COPR, HYD, CONST, H & S, GEO, I & C, ELECT, MECH, STRUCT, CIVIL, ARCH, OM, PM, DATE, ORIGINAL RELEASE REV

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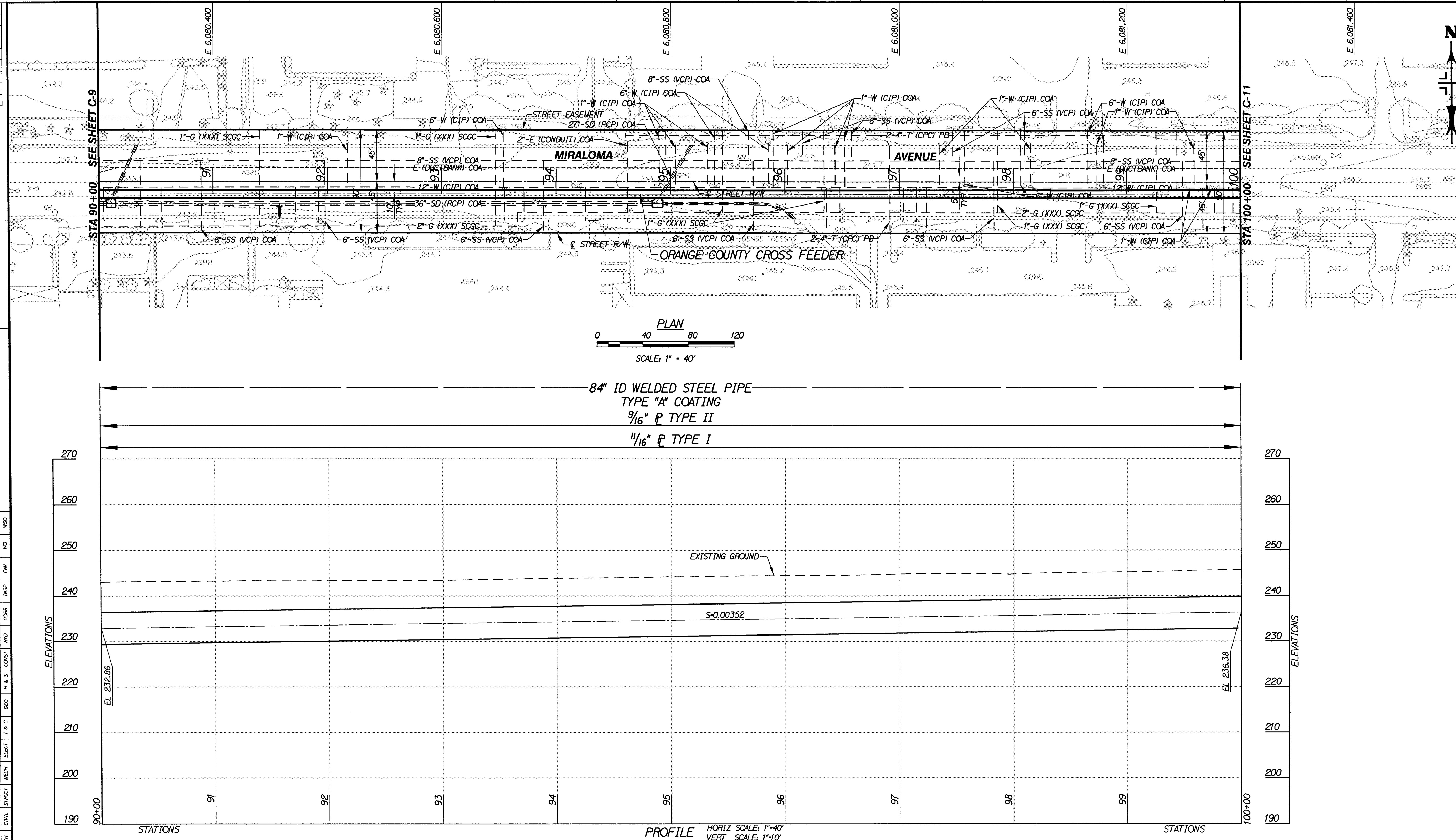

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METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
STA 90+00 TO STA 100+00

PLAN AND PROFILE

SPECIFICATIONS 0000
PROJECT NUMBER 103584
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DWG
REV

METROPOLITAN WATER DISTRICT

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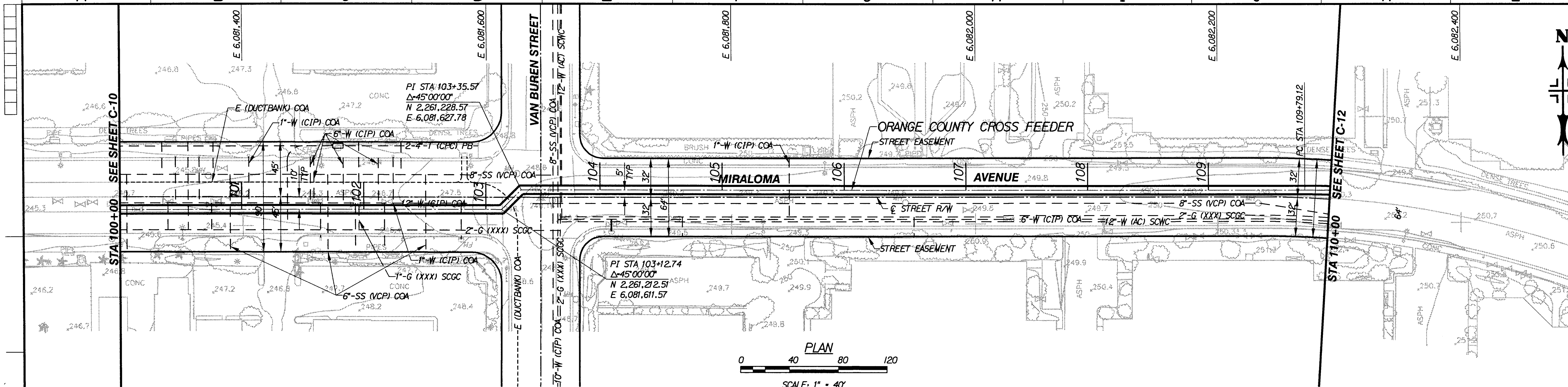

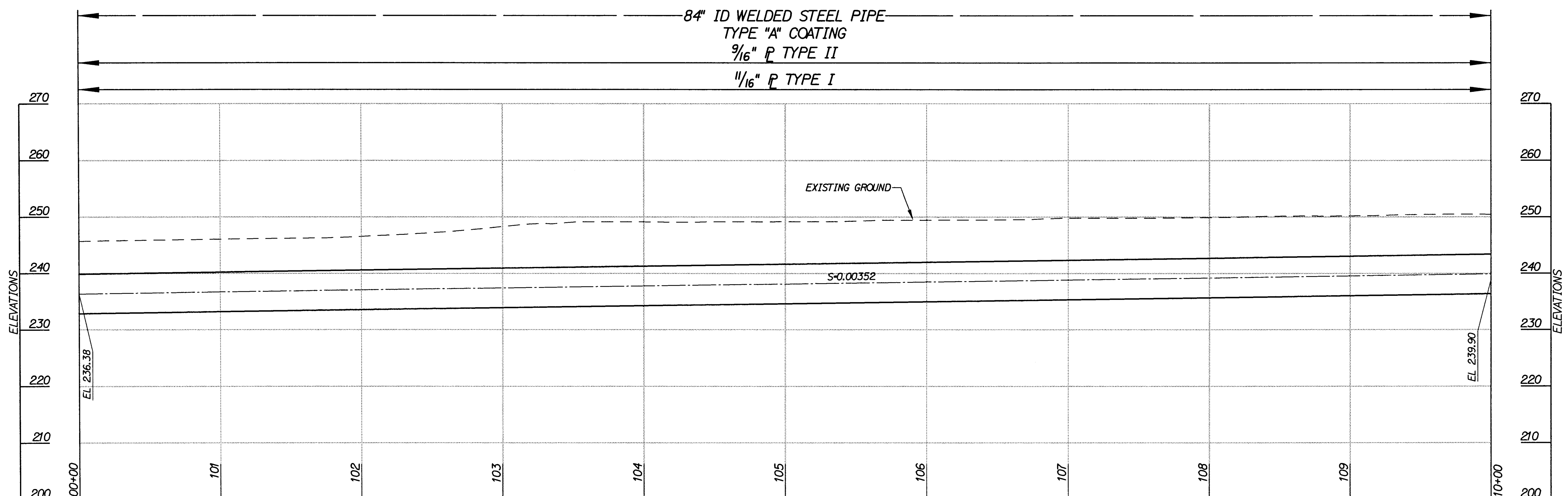

PROFILE HORIZ SCALE: 1"=40' VERT SCALE: 1"=10'

PEN TABLE: MWDHBW.TBL

REV	REVISION	DATE	DWN	CHK	REC	UNIT APP	ESS APP

MWD METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
STA 100+00 TO STA 110+00

PLAN AND PROFILE

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET C-11
DWG REV

METROPOLITAN WATER DISTRICT

COORDINATION CHECK: ORIGINAL RELEASE, REV, DATE, PM, DM, ARCH, CIVIL, STRUCT, MECH, ELECT, I & C, GEO, H & S, CONST, HYD, CORR, INSP, EM, WQ, WSO

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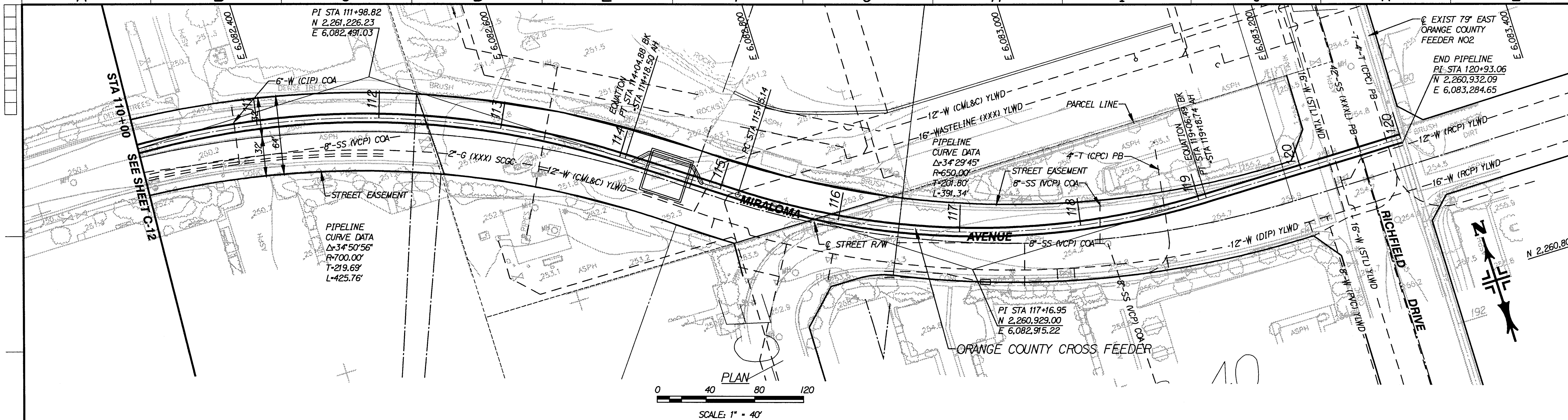

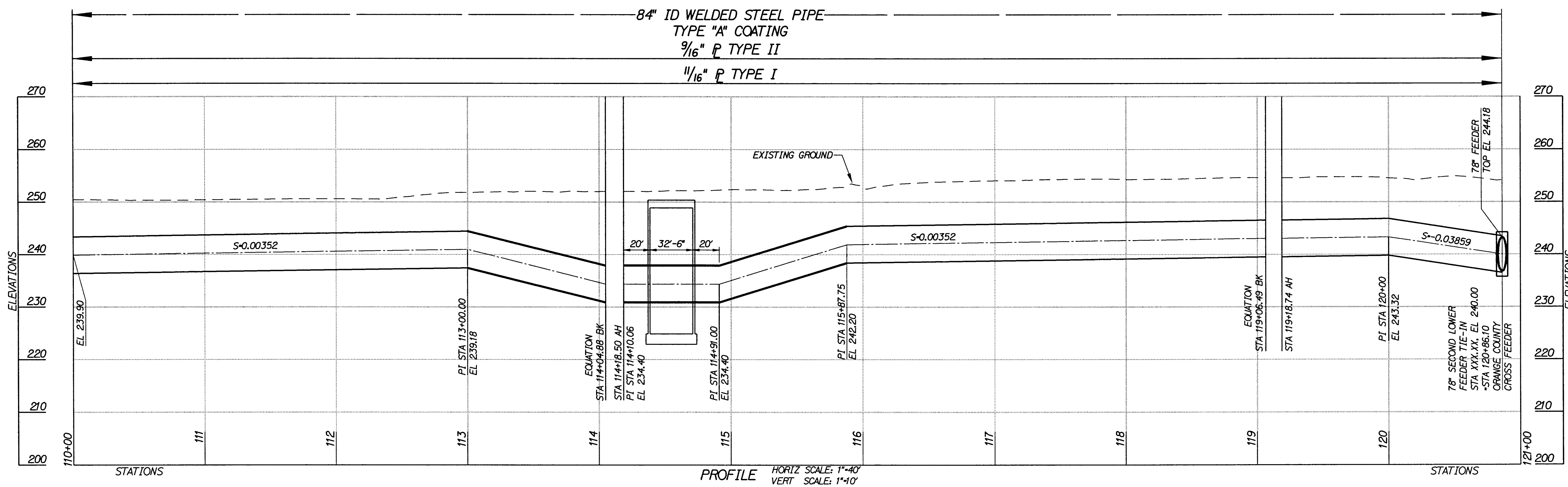

PEN TABLE: MWDHBM.TBL

REV	DATE	PM	DM	ARCH	CIVIL	STRUCT	MECH	ELECT	I & C	GEO	H & S	CONST	HYD	CORR	INSP	ENV	WQ	WSO
ORIGINAL RELEASE																		

COORDINATION CHECK

PRELIMINARY

REV	REVISION	DATE	DWN	CHK	REC	UNIT APP	ESS APP

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
STA 110+00 TO STA 118+64.29

PLAN AND PROFILE

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET C-12
DWG
REV

METROPOLITAN WATER DISTRICT

PLOT TIME: 23-NOV-2005 12:42
USERID: u08016
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OCCF ELECTRCIAL EQUIPMENT LIST

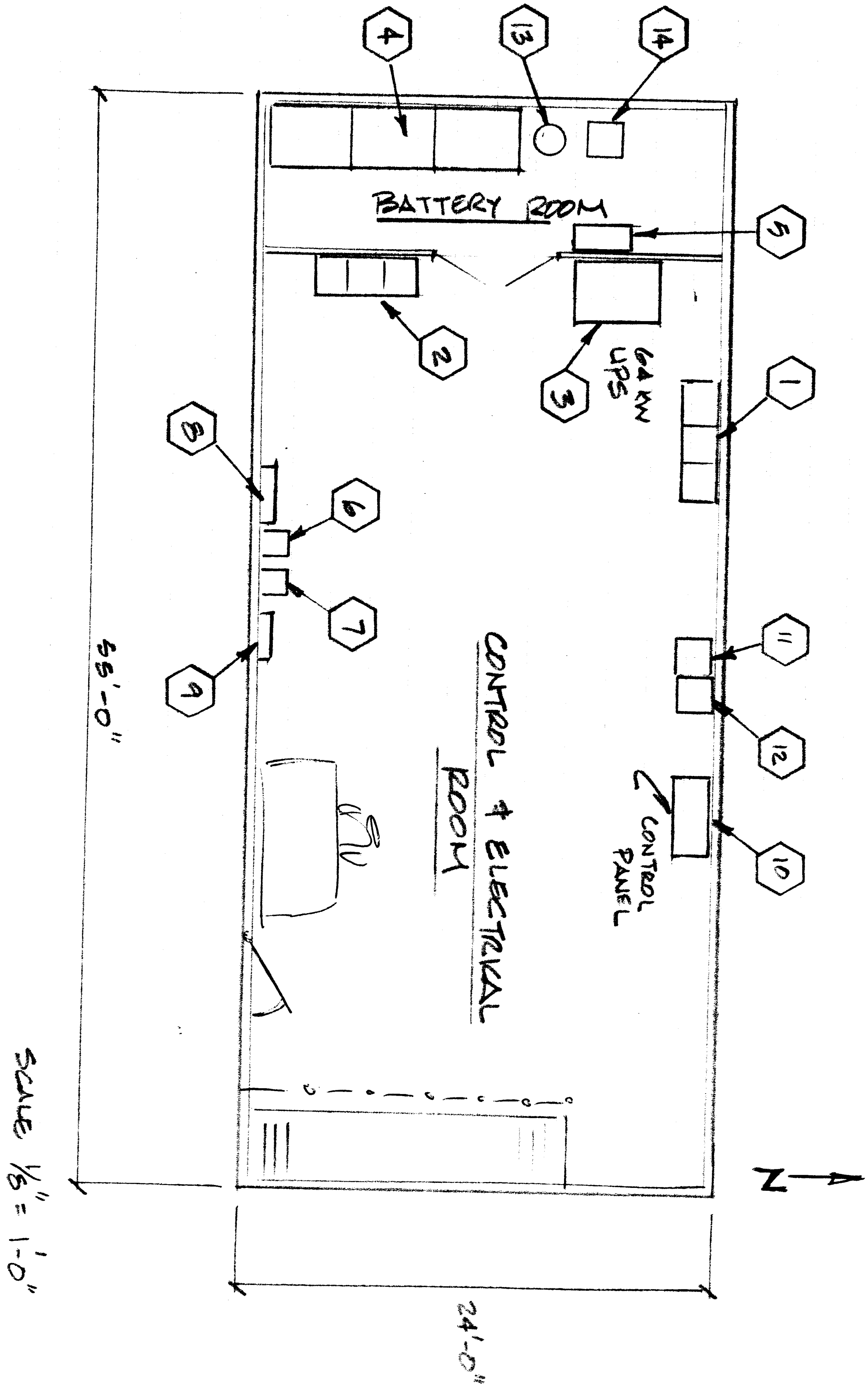
1/11/2006

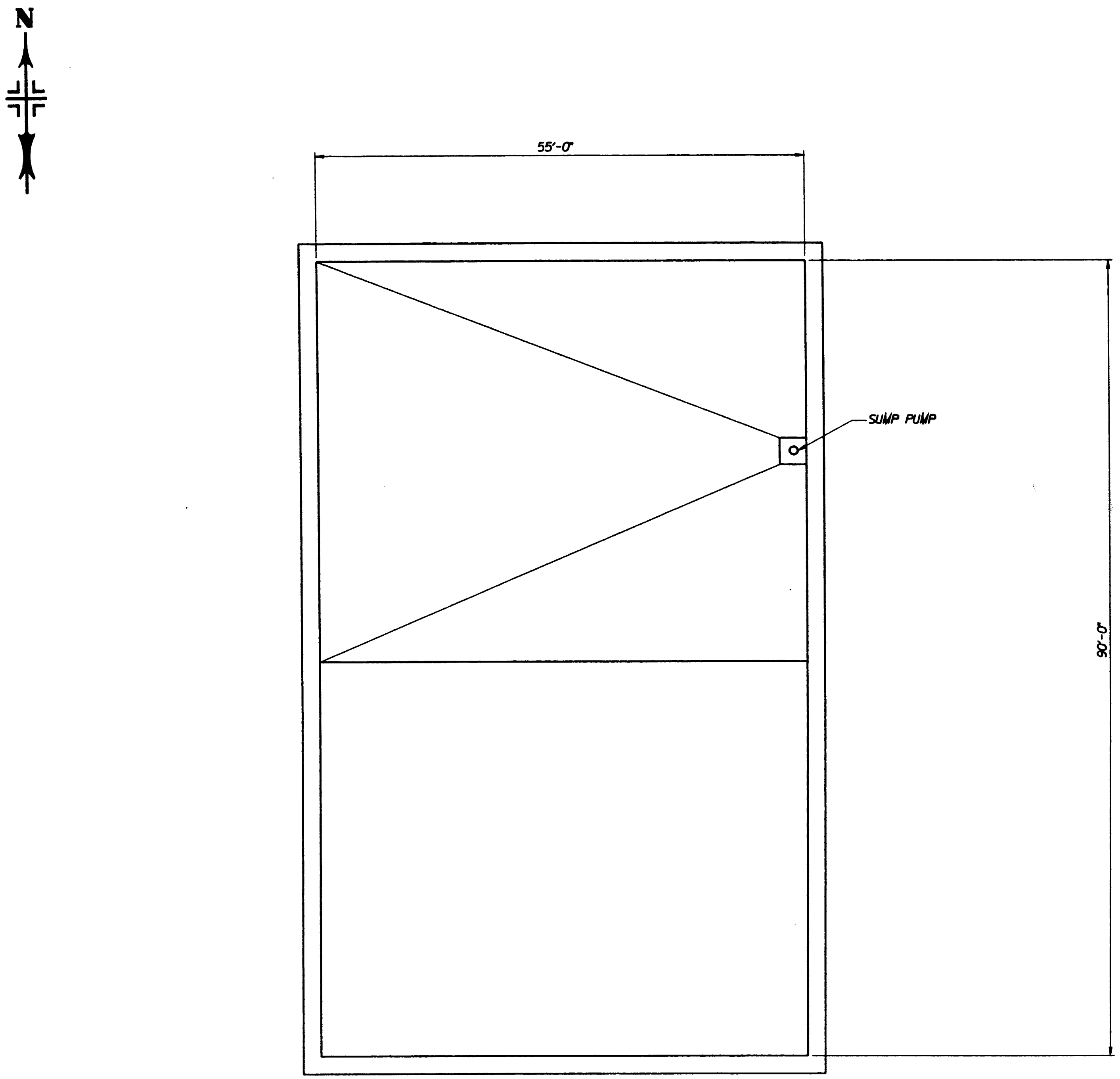
EQUIP. ID NO.	EQUIPMENT DESCRIPTION	EQUIPMENT DIMENSIONS (W x D x H)
1	480 volt 600 Amp Switchboard with Utility Meter (Normal Power)	60"x 20"x 90"
2	480 volt 600 Amp MCC (Emergency Power)	60"x 20"x 90"
3	64 kW/ 80kVA UPS	40" x 36" x 72"
4	UPS Battery System mounted on Racks	Three Racks at 25" x 36" x 72" each
5	400 Amp Battery Disconnect	30" x 18" x 30"
6	25 kVA Lighting Transformer	24" x 18" x 18"
7	15 kVA Lighting Transformer	24" x 18" x 18"
8	42 Circuit Panelboard	24" x 12" x 48"
9	24 Circuit Panelboard	24" x 12" x 30"
10	Control Panel	48"x 20"x 90"
11	RTU Cabinet	24" x 24" x 90"
12	RTU Termination Cabinet	24" x 24" x 90"
13	Portable Eye Wash	18" x 18" x 42"
14	Portable Shower	18" x 18" x 72"

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

CALCULATION SHEET

Title	OCCF PCS CONTROL ROOM LAYOUT	Sheet No.	2 of 2
		Calc. by	J. Wong
		Checked by	
Work Order Number	P/N 103584	Date	1/11/06





PLAN

1/8" = 1'-0" 0 8 16 24 FEET

REV	REVISION	DATE	DWN	CHK	REC	UNIT APP	ESS APP

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
MECHANICAL
PRESSURE CONTROL STRUCTURE
BOTTOM PLAN

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET M-1
DWG B-000000 REV

METROPOLITAN WATER DISTRICT

PEN TABLE: MWDHBW.TBL

WSO | WQ | EM | INSP | CORR | HYD | CONST | H & S | GEO | I & C | ELECT | MECH | STRUCT | CIVIL | ARCH | OM | PM | DATE | REV | ORIGINAL RELEASE

COORDINATION CHECK

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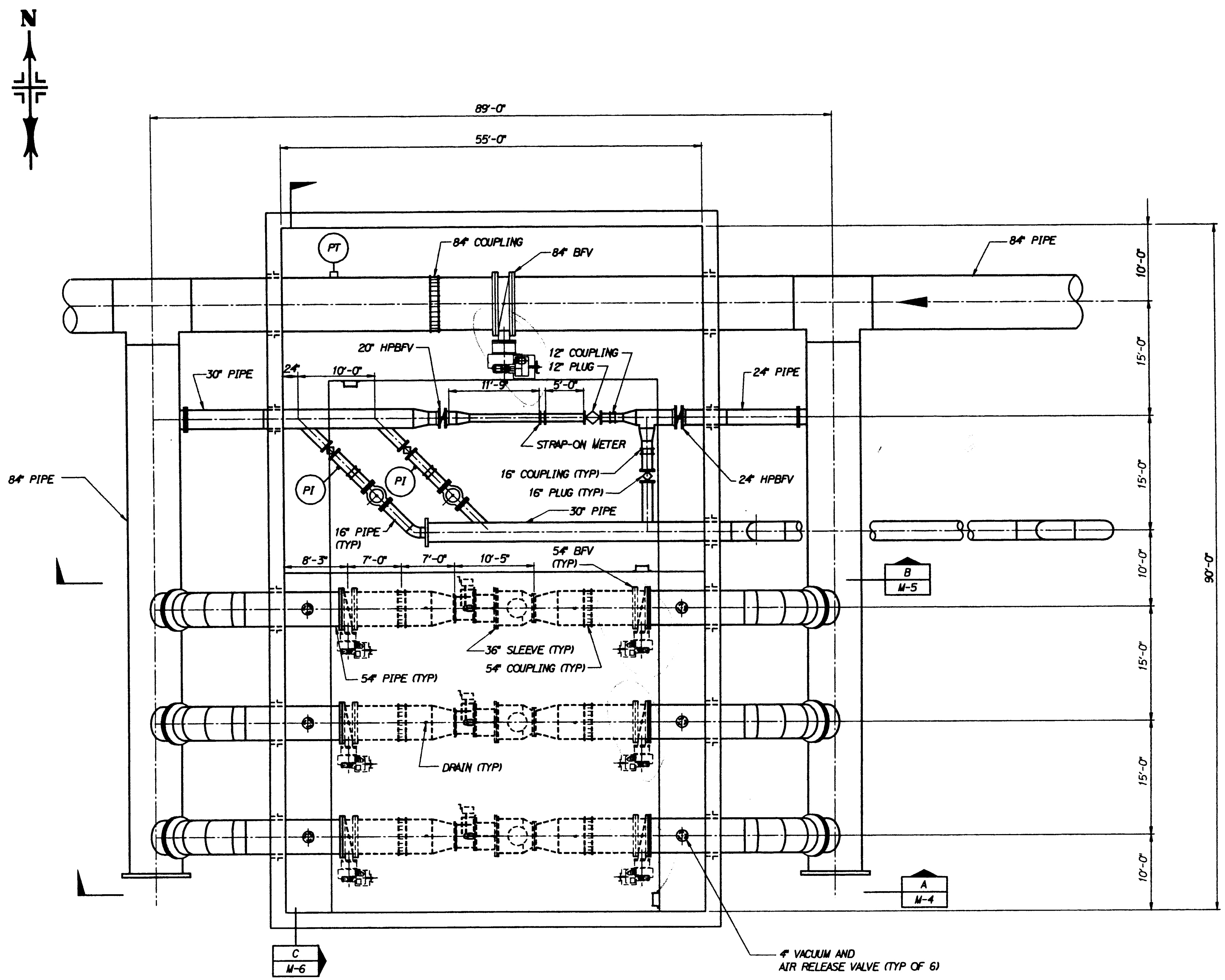

PLAN

1/8" = 1'-0" 0 8 16 24 FEET

A B C D E F G H I J K L

1 2 3 4 5 6 7 8

PEN TABLE: MWDHBW.TBL

REV	REVISION	DATE	DWN	CHK	REC	UNIT APP	ESS APP

MWD METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
MECHANICAL
PRESSURE CONTROL STRUCTURE
GENERAL ARRANGEMENT - PLAN

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET M-2
DWG B-000000 REV

METROPOLITAN WATER DISTRICT

COORDINATION CHECK: WSD, WQ, ENV, INSP, CORR, HYD, CONST, H & S, GEO, I & C, ELECT, MECH, STRUCT, CIVIL, ARCH, OM, PM, DATE, ORIGINAL RELEASE REV

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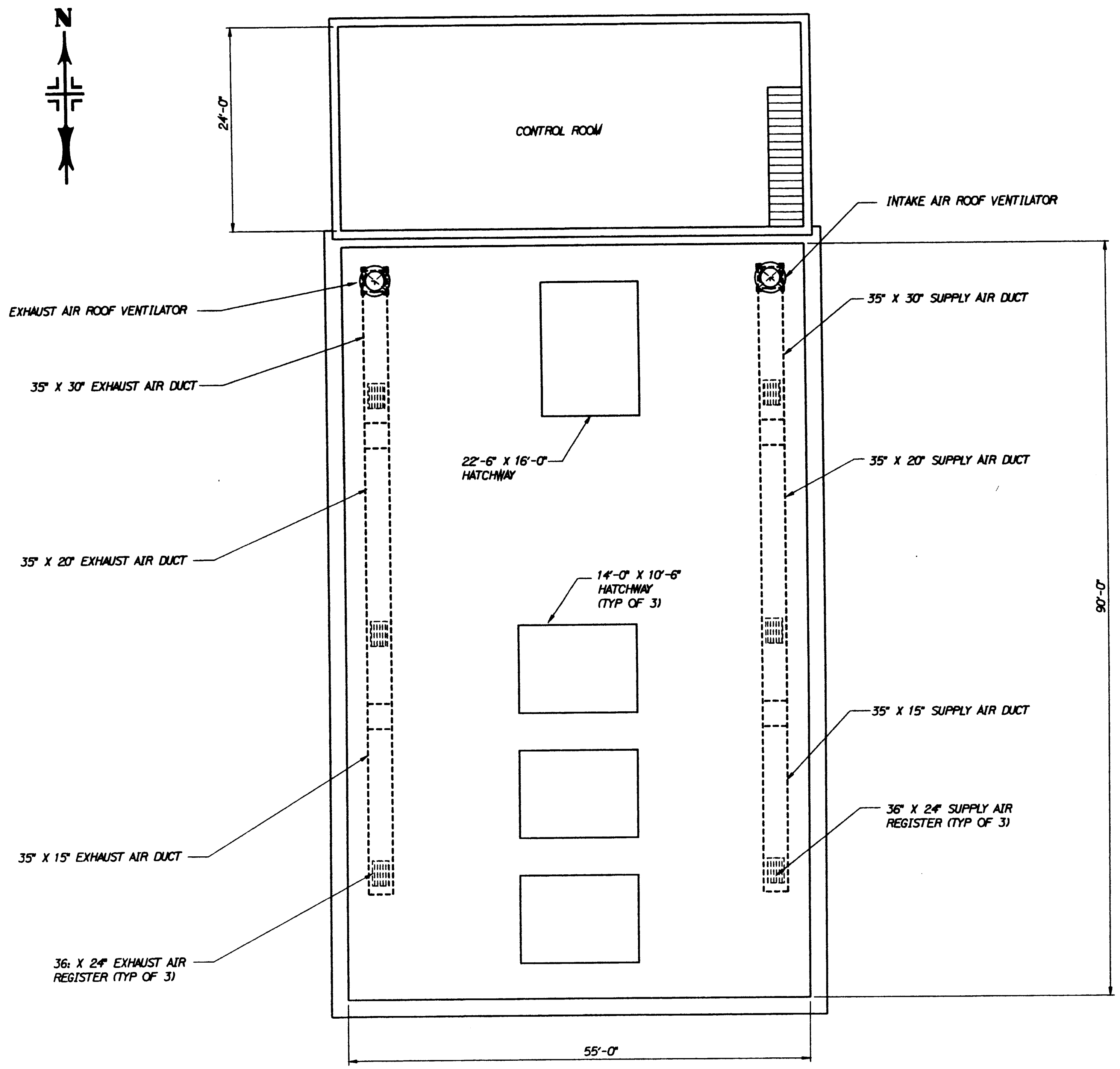

PLAN

1/8" = 1'-0" 0 8 16 24 FEET

PEN TABLE: MWDHBW.TBL

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE	MONTH YEAR
DRAWN	UNIT APPROVED		
CHECKED	ENGINEERING SERVICES SECTION APPROVED		

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
MECHANICAL
PRESSURE CONTROL STRUCTURE
TOP PLAN

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET M-3
DWG B-000000 REV

REV | REVISION | DATE | DWN | CHK | REC | UNIT APP | ESS APP

COORDINATION CHECK: ORIGINAL RELEASE, REV, DATE, PM, DM, ARCH, CIVIL, STRUCT, MECH, ELECT, I & C, GEO, H & S, CONST, HYD, CORR, INSP, EM, WQ, WSO

METROPOLITAN WATER DISTRICT

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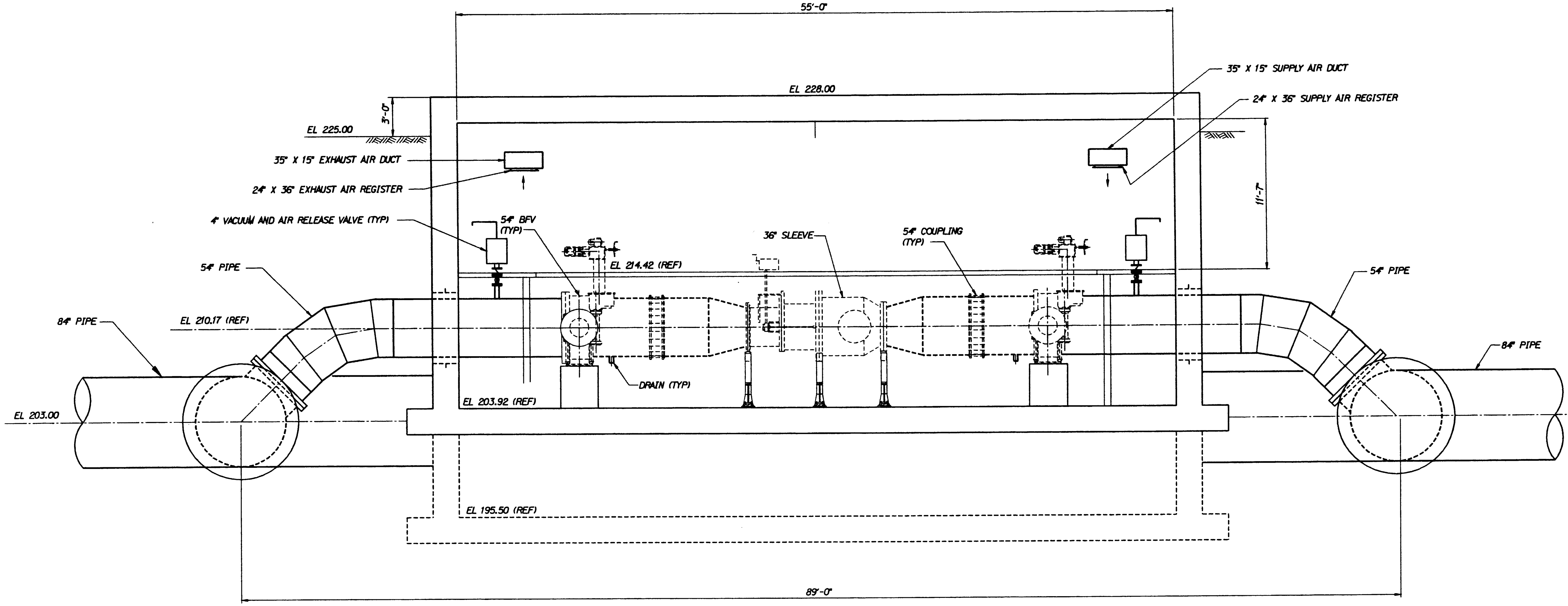

SECTION A / M-2

1/4" = 1'-0" 0 4 8 12 FEET

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
MECHANICAL
PRESSURE CONTROL STRUCTURE
SECTION

SPECIFICATIONS	0000
PROJECT NUMBER	103584
SHEET	M-4
DWG	B-000000
REV	

DESIGNED | RECOMMENDED | DATE MONTH YEAR
DRAWN | UNIT APPROVED
CHECKED | ENGINEERING SERVICES SECTION APPROVED

REV | REVISION | DATE | DWN | CHK | REC | UNIT APP | ESS APP

PEN TABLE: MWDHBW.TBL

COORDINATION CHECK: WSO, WQ, EW, INSP, CORR, HYD, CONST, H & S, GEO, I & C, ELECT, MECH, STRUCT, CIVIL, ARCH, DM, PM, DATE, ORIGINAL RELEASE REV

METROPOLITAN WATER DISTRICT

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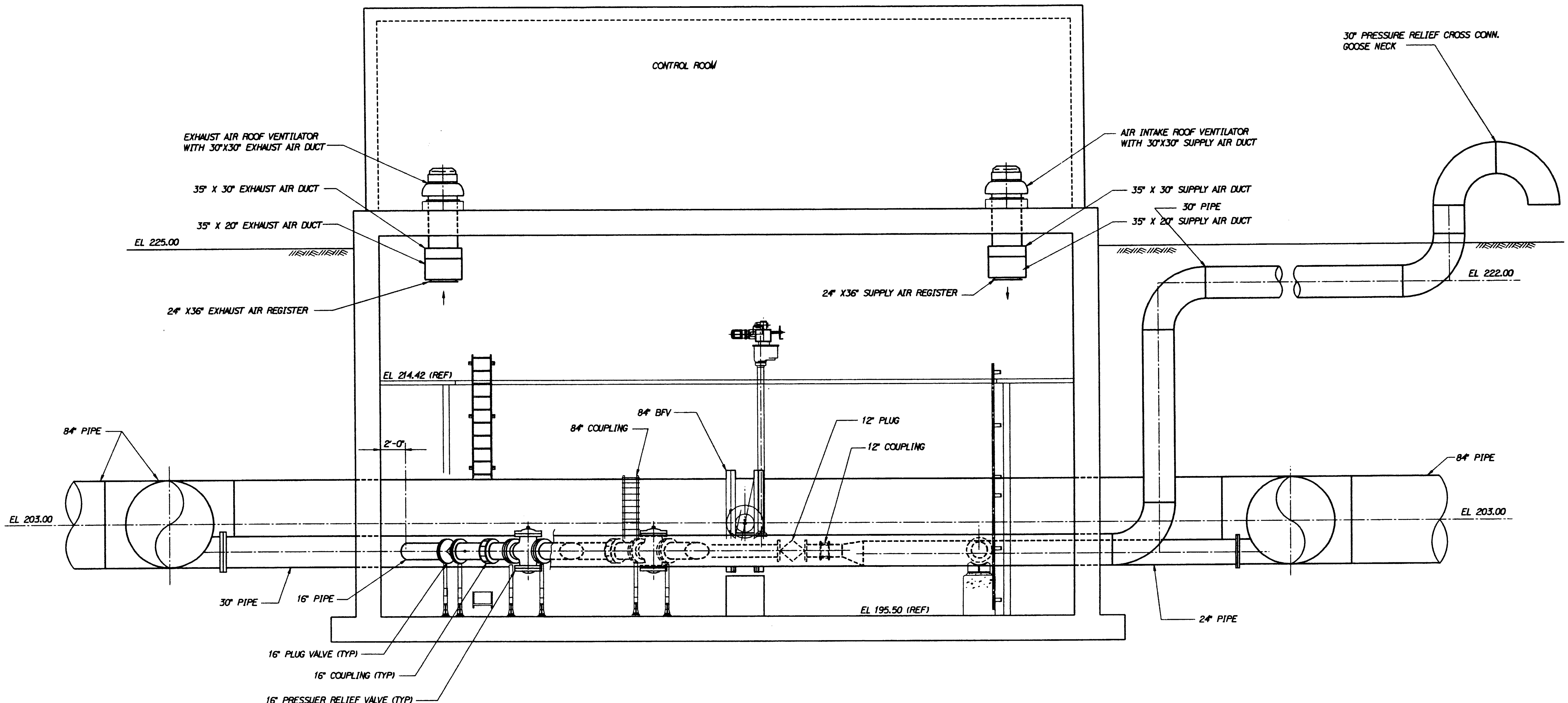

SECTION B / M-2

1/4" = 1' -0"   0   4   8   12 FEET

PEN TABLE: MWDHBW.TBL

COORDINATION CHECK
WSO
WO
ENV
INSP
CORR
HYD
CONST
H & S
GEO
I & C
ELECT
MECH
STRUCT
CIVIL
ARCH
DM
PM
DATE
ORIGINAL RELEASE REV

REV	REVISION	DATE	DWN	CHK	REC	UNIT APP	ESS APP

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
MECHANICAL
PRESSURE CONTROL STRUCTURE
SECTION

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET M-5
DWG B-000000
REV

METROPOLITAN WATER DISTRICT

PLOT TIME: 09-JAN-2006 07:30
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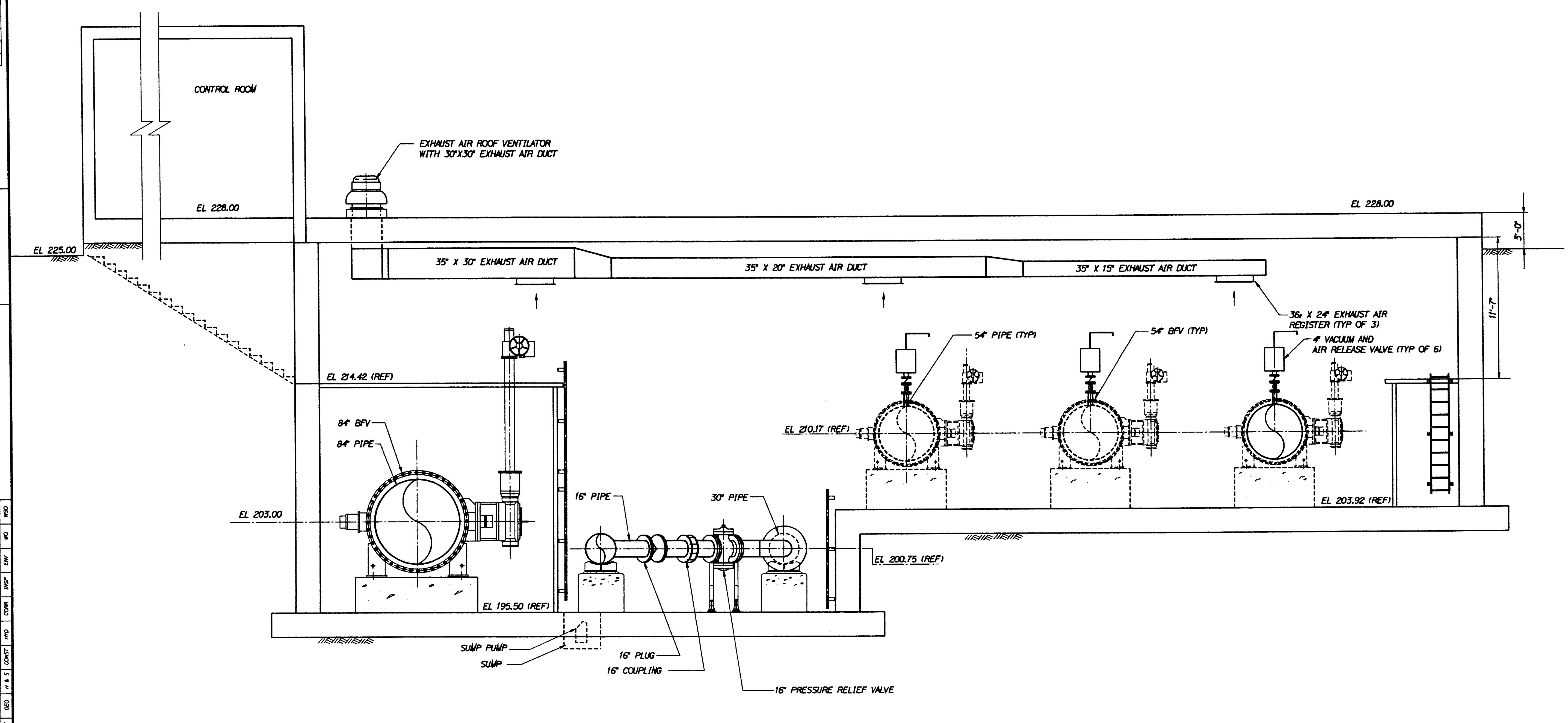

SECTION C / M-2

1/4" = 1' -0"   0 4 8 12 FEET

REV	REVISION	DATE	DWN	CHK	REC	UNIT APP	ESS APP

MWD METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29
MECHANICAL
PRESSURE CONTROL STRUCTURE
SECTION

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET M-6
DWG B-000000 REV

METROPOLITAN WATER DISTRICT

PEN TABLE: MWDHBW.TBL

COORDINATION CHECK: WSO, WQ, EMV, INSP, CONR, HYD, CONST, H & S, GEO, I & C, ELECT, MECH, STRUCT, CIVIL, ARCH, DM, PM, DATE, ORIGINAL RELEASE REV

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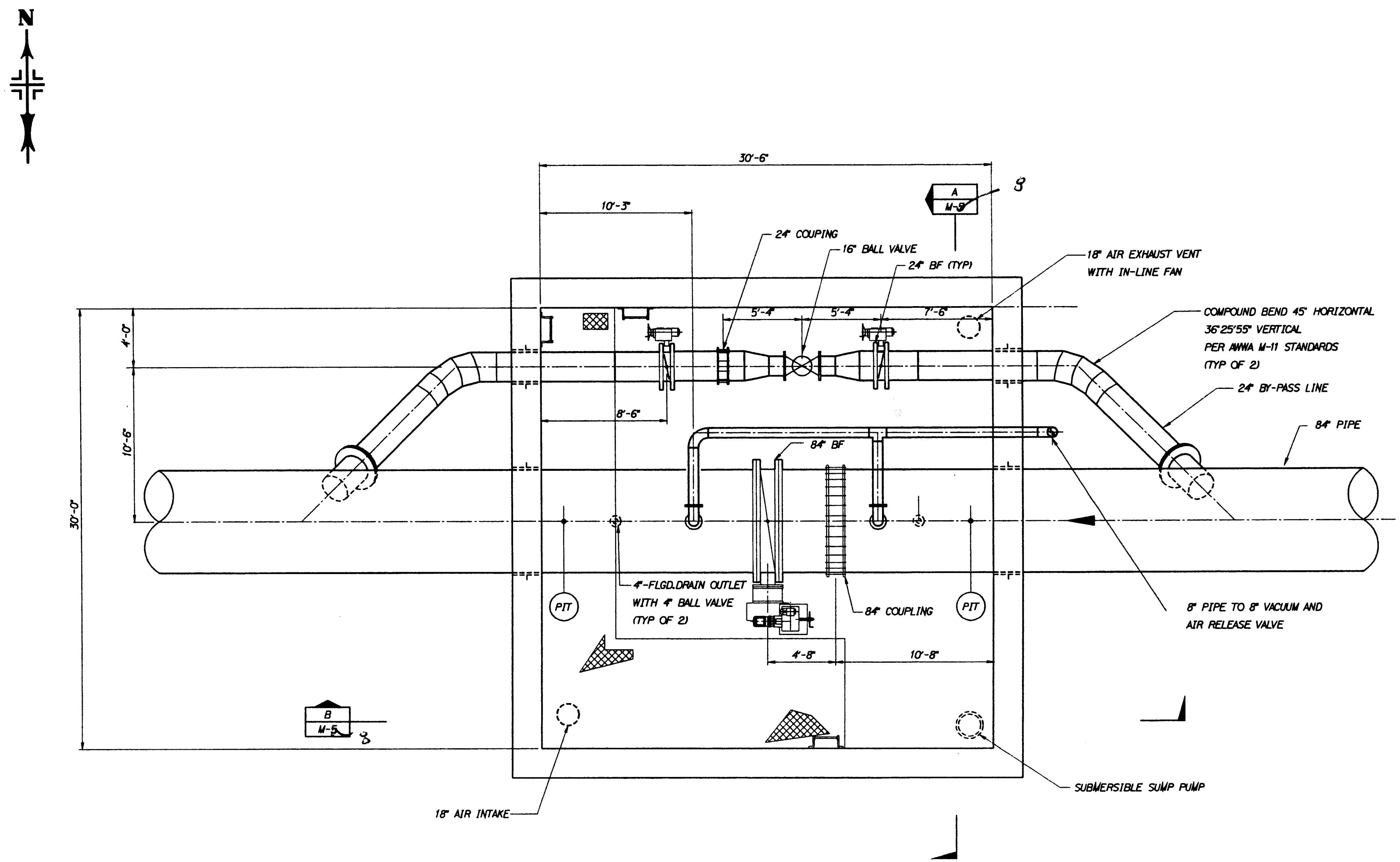

PLAN 1

1/4" = 1' -0" 0 4 8 12 FEET

REV	REVISION	DATE	DWN	CHK	REC	UNIT APP	ESS APP

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29

MECHANICAL
ORANGE COUNTY CROSS FEEDER
EAST VALVE VAULT PLAN

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET M-7
DWG B-000000 REV

METROPOLITAN WATER DISTRICT

PEN TABLE: MWDHBW.TBL

COORDINATION CHECK: ORIGINAL RELEASE, REV, DATE, PM, DM, ARCH, CIVIL, STRUCT, MECH, ELECT, I & C, GEO, H & S, CONST, HYD, CORR, INSP, ENV, WQ, WSO

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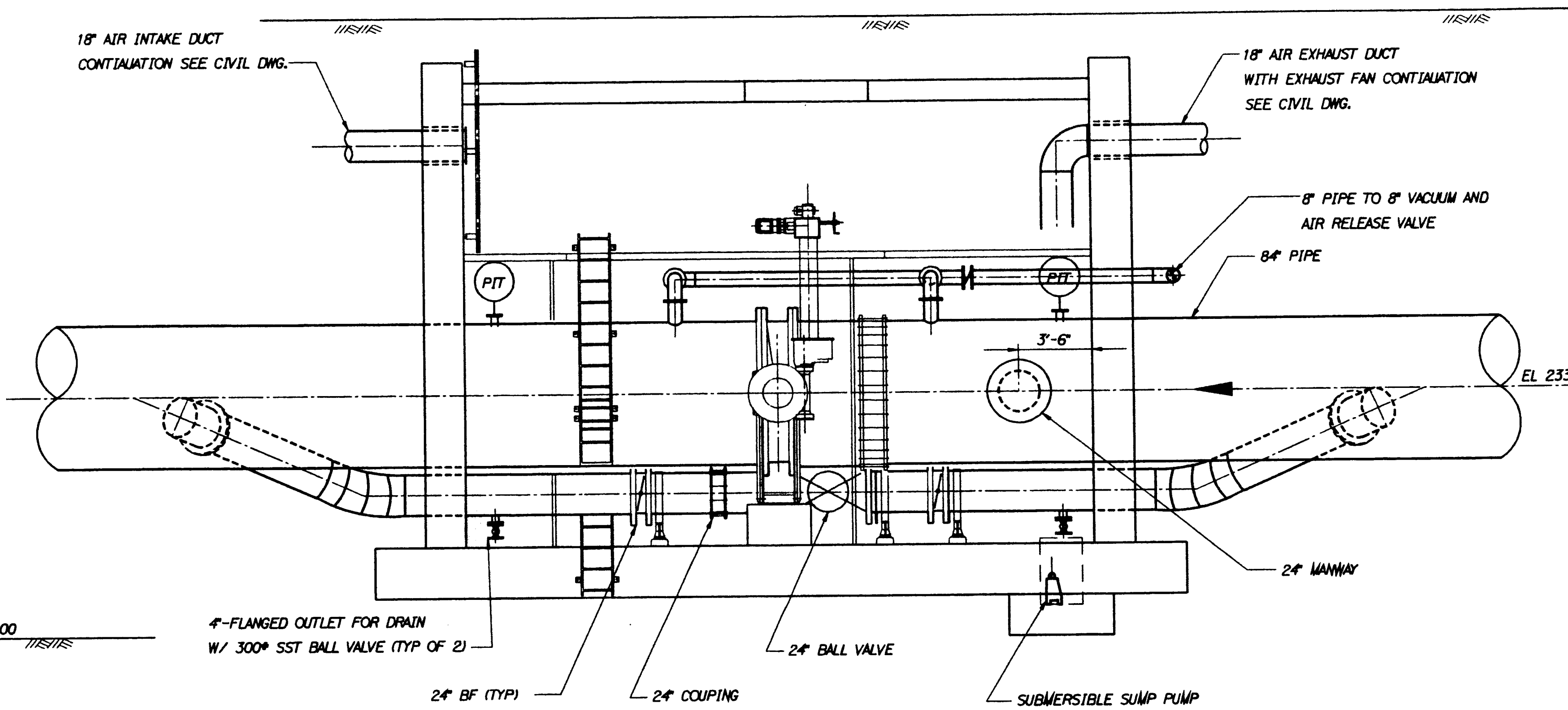
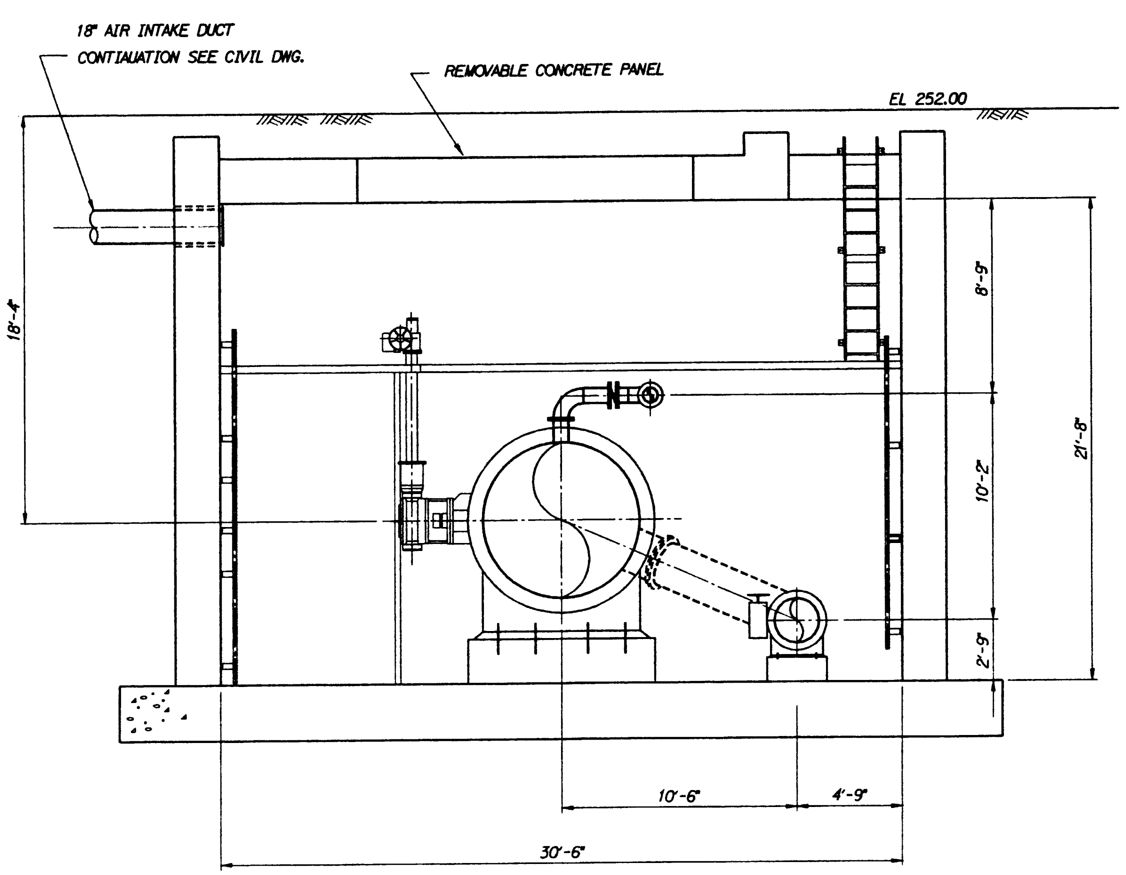


SECTION B / M-4



SECTION A / M-4

$\frac{1}{4}$" = 1' -0"   0   4   8   12   FEET

REV	REVISION	DATE	DWN	CHK	REC	UNIT APP	ESS APP

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED	RECOMMENDED	DATE MONTH YEAR
DRAWN	UNIT APPROVED	
CHECKED	ENGINEERING SERVICES SECTION APPROVED	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
STA 0+00 TO STA 118+64.29

MECHANICAL
ORANGE COUNTY CROSS FEEDER
EAST VALVE VAULT SECTIONS

SPECIFICATIONS 0000
PROJECT NUMBER 103584
SHEET M-8
DWG B-000000 REV

METROPOLITAN WATER DISTRICT

PEN TABLE: MWDHBW.TBL

COORDINATION CHECK: WSD, WQ, ENV, INSP, CORR, HYD, CONST, H & S, GEO, I & C, ELECT, MECH, STRUCT, CIVIL, ARCH, DM, PM, DATE, ORIGINAL RELEASE, REV

PLOT TIME: 09-JAN-2006 13:41
USERID: u30669
FILE NAME: I:\N03584\mech\N03584_M008.dgn

LEGEND AND SYMBOLS

- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- DIAPHRAGM VALVE
- GATE VALVE
- GLOBE VALVE
- PLUG VALVE
- NEEDLE VALVE
- ANGLE VALVE
- BACK FLOW PREVENTER
- THREE WAY VALVE
- FOUR WAY VALVE
- SLIDING GATE
- MULTI-JET SLIDING GATE
- DROP GATE
- RADIAL GATE
- MOTOR OPERATED ACTUATOR
- SOLENOID OPERATOR
- PNEUMATIC OR HYDRAULIC OPERATED ACTUATOR
- CYLINDER ACTUATOR
- HOSE CONNECTION
- FLEXIBLE CONNECTION
- DRAIN
- DRAIN WITH DRAINAGE I.D.
  X - CONNECTOR NO.
  XX - DRAIN TYPE
- RUPTURE DISC PRESSURE
- RUPTURE DISC VACUUM
- VACUUM & PRESSURE SAFETY RELIEF VALVE
- AIR RELEASE / AIR AND VACUUM VALVE
- PRESSURE SAFETY RELIEF VALVE
- VACUUM SAFETY RELIEF VALVE
- SELF CONTAINED BACK PRESSURE VALVE
- SELF CONTAINED PRESSURE REDUCING VALVE
- Y STRAINER
- BASKET STRAINER
- FILTER
- DIAPHRAGM SEAL
- EJECTOR OR EDUCTOR
- STATIC MIXER
- LIGHT/BEACON

- SAFETY SHOWER & EYE WASH
- LINE NO. CHANGE
- PIPING MATERIAL CLASSIFICATION CHANGE
  X & Y = MATERIAL CLASS
- REDUCER / PIPE DIAMETER CHANGE
- INSULATION BREAK
- INSULATION
- FIRE HYDRANT
- LIMIT OF CONTRACT
- PULSATION DAMPENER / HAMMER ARRESTOR OR EXPANSION TANK
- DENSITY ANALYZER
- ULTRASONIC FLOWMETER
- MAGNETIC FLOWMETER
- PADDLE WHEEL
- PROPELLER FLOWMETER
- ROTAMETER
- ORIFICE PLATE
- VENTURI OR FLOW TUBE
- CALIBRATION TUBE
- FLOAT ACTUATED DEVICE
- PROBE ACTUATED DEVICE
- STEAM TRAP
- SILENCER
- CENTRIFUGAL PUMP
- SUBMERSIBLE PUMP
- PROGRESSIVE CAVITY PUMP

- CHEMICAL PUMP
- VERTICAL TURBINE PUMP
- DIAPHRAGM PUMP - SIMPLEX/DUPLEX
- GEAR PUMP
- BLOWER
- VENTILATOR / FAN
- DEMISTER
- HORN
- MIXER
- OFF PAGE PROCESS/INSTRUMENT CONNECTION (X | B- / XXX)
  X - CONTINUATION ARROW NO.
  B- - CONTINUATION P & ID DWG NO./SHT NO.
  XXX - LINE DESCRIPTION OR TO LOCATION
- ON PAGE PROCESS/INSTRUMENT CONNECTION (X | B- / XXX)
  X - CONTINUATION ARROW NO.
  B- - CONTINUATION P & ID DWG NO./SHT NO.
  XXX - LINE DESCRIPTION OR TO LOCATION
- OFF PAGE UTILITY CONNECTION (X | B- / XXX)
  X - CONNECTOR ID NUMBER
  B- - CONTINUATION P & ID DWG NO./SHT NO.
  XXX - UTILITY DESCRIPTION OR FROM LOCATION
- MAIN PROCESS LINE STYLE
- SECONDARY PROCESS LINE STYLE
- EXISTING LINE STYLE
- FUTURE
- WATER SURFACE ELEVATION

SAMPLE LINE NUMBER (SEE NOTE 2)

1200-3"-OZ-D

- MATERIAL SPECIFICATION CODE
- FLUID CODE (SEE FLUID CODE LIST)
- LINE SIZE
- LINE SEQUENCE NUMBER

NOTES:

1. FOR DEFINITION OF V- DESIGNATED VALVES AND MATERIAL SPECIFICATION CODE SEE MECHANICAL SPECIFICATIONS.
2. USE OF LINE SEQUENCE NUMBER OR FLUID CODE IS OPTIONAL.

FLUID CODE LIST

A	AIR	NG	NATURAL GAS
AA	AQUEOUS AMMONIA	OF	OVERFLOW
AL	ALUM	OG	OFF-GAS
AV	AIR VENT	OW	OZONATED WATER
BP	BYPASS	OX	OXYGEN (GAS)
BW	BACKWASH WATER	OZ	OZONE
C	CONDENSATE	PA	PLANT AIR
CD	CHEMICAL DRAIN	PW	POTABLE WATER
CLG	CHLORINE GAS	RW	RAW WATER
CLL	CHLORINE LIQUID	RWW	RECLAIMED WASHWATER
CLS	CHLORINE SOLUTION	SD	SANITARY DRAIN
COA	COAGULANT	SF	SLUDGE FILTRATE
CS	CAUSTIC SODA	SFA	SULFURIC ACID
CWR	COOLING WATER RETURN	SFW	SOFT WATER
CWS	COOLING WATER SUPPLY	SP	SPARE
D	DRAIN	SS	SANITARY SEWER
DIW	DEIONIZED WATER	SU	STRUCTURE UNDERDRAIN
DMW	DEMINERALIZED WATER	SUBD	SUBDRAIN
DN	DECANT	SPD	SUMP PUMP DISCHARGE
DPOL	DRY POLYMER SOLUTION	SW	SETTLED WATER
FC	FERRIC CHLORIDE	TS	THICKENED SLUDGE
FOR	FUEL OIL RETURN	TSN	THICKENER SUPERNATANT
FOS	FUEL OIL SUPPLY	UWW	USED WASHWATER
FPW	FIRE PROTECTION WATER		
FSW	FILTER SURFACE WASHWATER		
FW	FILTERED WATER		
HP	HYDROGEN PEROXIDE		
HW	POTABLE HOT WATER		
IA	INSTRUMENT AIR		
IRW	IRRIGATION WATER		
IW	INDUSTRIAL WATER (NON-POTABLE)		
LO	LUBE OIL		
LOX	LIQUID OXYGEN		
LPOL	LIQUID POLYMER		

EQUIPMENT ABBREVIATIONS

ACP	AIR COMPRESSOR	LF	LINE FILTER (STRAINER)
AD	AIR DRYER	MX	MIXER
AF	AIR FILTER	OG	OZONE GENERATOR
AFC	AFTER COOLER	OBC	OXYGEN BOOSTER COMPRESSOR
B	BLOWER	P	PUMP
BFP	BACKFLOW PREVENTER	PBC	PRESSURE BUILDING COIL
BPV	BACK PRESSURE VALVE	PD	PULSATION DAMPENER
CD	CATALYTIC DESTRUCT	PRV	PRESSURE REDUCING VALVE
CL	CHLORINATOR	PSV	PRESSURE SAFETY VALVE
EF	ELECTRIC FAN	RD	RUPTURE DISC
EJ	EJECTOR	S	SEPARATOR
EPG	EMERGENCY POWER GENERATOR	SBR	SCRUBBER
EV	EVAPORATOR	SS	SAFETY SHOWER
EW	EYE WASH	SV	SOLENOID VALVE
F	FLOCCULATORS	TK	TANK
FC	FLEXIBLE CONNECTION	TRB	TRAVELING BRIDGE
FTR	FILTER	V	VALVE
FV	FLOW VALVE	VAP	VAPORIZER
G	SLIDE GATE/SLUICE GATE	TG	TURBINE GENERATOR
H	HEATER	TGA	TURBINE GENERATOR AUXILIARY
HE	HEAT EXCHANGER		

METROPOLITAN FORCE CONSTRUCTION

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PIPING AND INSTRUMENTATION DIAGRAM

LEGEND AND SYMBOLS
SHEET 2 OF 2

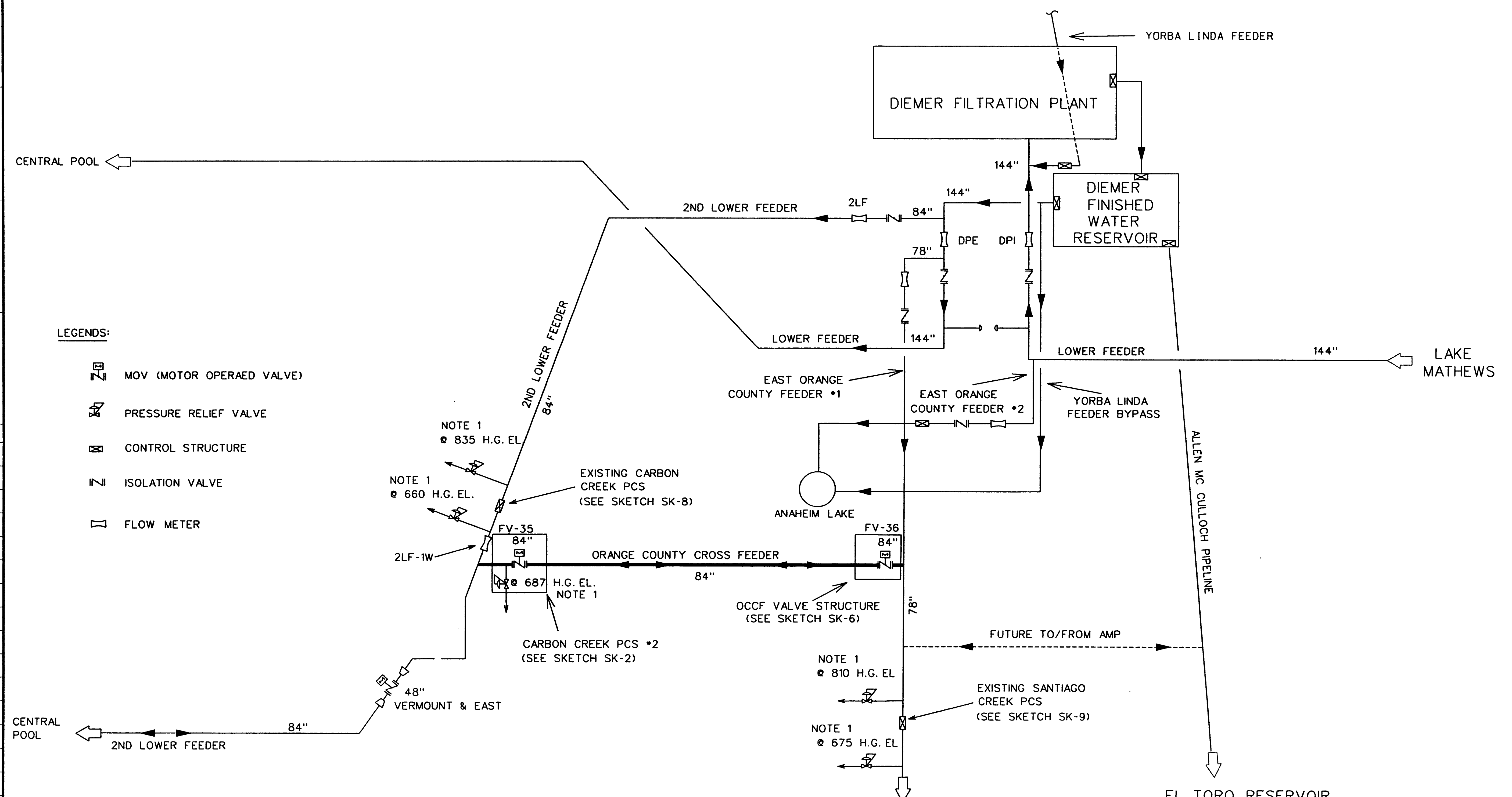
DESIGNED	SCC
DRAWN	SCC
CHECKED	XXXX
RECOMMENDED	XXXX
PROJECT APPROVED	XXXX
DIVISION APPROVED	XXXX
DATE	DEC 2004
SPECIFICATIONS	
WORK ORDER	103584
SHEET	B2
DWG	B-104908
rev	

REV | REVISION: XXX | DATE | DWN | CHK | REC | PRJ APP | DIV APP

METROPOLITAN WATER DISTRICT

INTERGRAPH FILE NAME: D:\Documents and Settings\u04725\My Documents\03584 Orange County Cross Feeder
USERID: u04725
PLOT TIME: 06-DEC-2005 11:08
PEN TABLE: MWDHBW.TBL

COORDINATION CHECK
MICROFILM DATE



NOTES:

1. FIRST OPENNING SETTING, (MULTIPLE RELIEF VALVES WITH STAGGERED SETTINGS).

NOT TO SCALE

PRELIMINARY

MWD — METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED SCC | RECOMMENDED XXXX | DATE DEC 2004
DRAWN SCC | PROJECT APPROVED XXXX
CHECKED XXXX | DIVISION APPROVED XXXX

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PROCESS FLOW DIAGRAM
OPTION "A"

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-1

REV | XXX REVISION | DATE | DWN | CHK | REC | PRJ APP | DIV APP

INTERGRAPH FILE NAME: D:\Documents and Settings\u04725\My Documents\103584_Orange County Cross Feeder\OCCF
USERID: u04725
PLOT TIME: 21-DEC-2005 09:25
PEN TABLE: MWDHBW.TBL

COORDINATION CHECK

GENERAL INSTRUMENT OR FUNCTION SYMBOLS

	PRIMARY LOCATION NORMALLY ACCESSIBLE *** TO OPERATOR	FIELD MOUNTED	AUXILIARY LOCATION NORMALLY ACCESSIBLE ***TO OPERATOR
DISCRETE INSTRUMENTS	IP1 **		
SHARED DISPLAY, SHARED CONTROL (DCS FUNCTIONS)	*		
COMPUTER FUNCTION (CCS FUNCTIONS)			
PROGRAMMABLE LOGIC CONTROL			

* RTU NUMBER

** ABBREVIATIONS SUCH AS IP1 (INSTRUMENT PANEL #1), IC2 (INSTRUMENT CONSOLE #2), CC3 (COMPUTER CONSOLE #3), ETC., ARE USED WHEN NECESSARY TO SPECIFY INSTRUMENT OR FUNCTION LOCATION

*** NORMALLY INACCESSIBLE OR BEHIND-THE-PANEL DEVICES OR FUNCTIONS ARE DEPICTED BY USING THE SAME SYMBOLS BUT WITH DASHED HORIZONTAL BARS, I.E.

INSTRUMENTS SHARING COMMON HOUSING OR OTHER COMPONENT HAVING MULTIPLE FUNCTIONS.

EXISTING INSTRUMENT

METROPOLITAN FURNISHED EQUIPMENT (MFE)

XXX — DESIGNATIONS OF CONTROL FUNCTIONS OR ANALYSIS VARIABLE ASSOCIATED WITH INSTRUMENTS OR OTHER COMPONENTS.

A/M	— AUTO/MANUAL	O/O/C	— OPEN/OFF/CLOSE
H/O/A	— HAND/OFF/AUTO	O/I/C	— OPEN/INTERMEDIATE/CLOSED
L/R	— LOCAL/REMOTE	O/R/C	— OPEN/REMOTE/CLOSE
L/G/R	— LOCAL/GALLERY/REMOTE	B/F/C/S	— BACKWASH/FILTERING/CLOSED/STOPPED
R	— REMOTE	B/F/C	— BACKWASH/FILTERING/CLOSED
D/L/R	— DECK/LOCAL/REMOTE	TU	— TURBIDITY
O/A/C	— OPEN/AUTO/CLOSE	PH	— HYDROGEN ION CONCENTRATION
O/C	— OPEN/CLOSE	CON	— CONDUCTIVITY
O/S/C	— OPEN/STOP/CLOSE	DO2	— DISSOLVED OXYGEN
R/S/L	— RAISE/STOP/LOWER	AM	— AMMONIA
R/L	— RAISE/LOWER	CL	— CHLORINE
R/S	— RUN/STOP	O3	— OZONE
LOS	— LOCKOUT STOP	O2	— OXYGEN
SD	— SHUTDOWN	HC	— HYDROCARBON
SEL	— SELECT	LEL	— LOWER EXPLOSIVE LIMIT
DEV	— DEVIATION	L/R/E	— LOCAL/REMOTE/EMERGENCY
FB	— FEED BACK	EO	— EMERGENCY OVERRIDE

FY * — INSTRUMENT PANEL MOUNTED WITH COMPUTING OR CONVERTING FUNCTION

* COMPUTING FUNCTIONS:

Σ SUMMING	÷ DIVIDING	AVERAGING	> HIGH SELECTING	∫ INTEGRAL
- SUBTRACTING	ROOT EXTRACTION	RATIO	< LOW SELECTING	LINEARIZER
X MULTIPLYING	K PROPORTIONAL	DERIVATIVE	Δ DIFFERENCE	X^n EXPONENTIAL

EXAMPLE: Σ THE OUTPUT SIGNAL EQUALS THE SUM OF THE INPUTS. THE INPUTS MAY BE LABELED WITH POSITIVE OR NEGATIVE SIGNS.

E/I CONVERTING FUNCTIONS:

E — VOLTAGE	O — ELECTROMAGNETIC,SONIC	P — PNEUMATIC
I — CURRENT	A — ANALOG, ACTUAL	H — HYDRAULIC
R — RESISTANCE (ELECT.)	D — DIGITAL	S — STANDARD

EXAMPLE: I/P IS THE CONVERTING FUNCTION THAT CHANGES A CURRENT INPUT SIGNAL TO A PNEUMATIC OUTPUT SIGNAL.

I B-XXXXX — HARDWIRED INTERLOCK LOGIC. SEE ELECTRICAL DRAWING B-XXXXX FOR DETAILS.

I XXX — SOFTWARE OR LOGIC RESIDENT IN DISTRIBUTED CONTROL SYSTEM AT REMOTE TERMINAL UNIT XXX OR IN A DEDICATED MICROPROCESSOR CONTROLLER (E.G. PROGRAMMABLE LOGIC CONTROLLER) USED FOR PROCESS OR EQUIPMENT CONTROL. IF INCLUDED AS PART OF AN EQUIPMENT PACKAGE, THEN "EQUIP" WILL BE SHOWN IN THE XXX FIELD.

MCC-# / M — IDENTIFICATION OF MOTOR CONTROL CENTER (MCC #) OR POWER PANEL (PP #) ASSOCIATED WITH MOTOR DRIVER.

ASD-XX — ADJUSTABLE SPEED DRIVE

SCR-XX — SILICON CONTROLLED RECTIFIER

INSTRUMENT IDENTIFICATION SYMBOLS

SAMPLE INSTRUMENT IDENTIFICATION OR TAG NUMBER

SWITCH SETTING
HH — HIGH HIGH
H — HIGH
L — LOW
LL — LOW LOW
(10FIC 103A) XX — CONTROL FUNCTION OR ANALYSIS VARIABLE; YY — DEVICE/FUNCTION LOCATION

ALARM SETTING
HH — HIGH HIGH
H — HIGH
L — LOW
LL — LOW LOW
(10FIC 103A) XX — CONTROL FUNCTION OR ANALYSIS VARIABLE; YY — DEVICE/FUNCTION LOCATION

TYPICAL INSTRUMENT TAG NUMBER

10 FIC 103 A

AREA NUMBER (OPTIONAL) — 10
FUNCTIONAL IDENTIFICATION — FIC
F - FIRST LETTER
IC - SUCCEEDING LETTERS
(SEE TABLE BELOW)
LOOP NO — 103
SUFFIX (OPTIONAL) — A

INSTRUMENT IDENTIFICATION LETTERS

	FIRST-LETTER		SUCCEEDING-LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		AVAILABILITY
B	BURNER, COMBUSTION				
C				CONTROL	CLOSE(D)
D		DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G			GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		INTERMEDIATE
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT(STATUS)		LOW
M		MOMENTARY			MIDDLE
N	TORQUE				
O			ORIFICE, RESTRICTION		OPEN
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT		WELL		
X					
Y	EVENT, STATE OR PRESENCE			RELAY, COMPUTE, CONVERT	
Z	POSITION			DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

GENERAL ABBREVIATIONS

ATM — ATMOSPHERE
CCS — CENTRAL COMPUTER SYSTEM (SEE ISA S5.3 FOR EXPANDED DEFINITION)
DCS — DISTRIBUTED CONTROL SYSTEM (SEE ISA S5.3 FOR EXPANDED DEFINITION)
EQUIP — DEVICE FURNISHED AS PART OF THE EQUIPMENT PACKAGE
FBSP — FILTER BACKWASH SEQUENCING PROGRAM
LCP — LOCAL CONTROL PANEL
MCC — MOTOR CONTROL CENTER
NC — NORMALLY CLOSED
NIC — NOT IN CONTRACT
NO — NORMALLY OPEN
PLC — PROGRAMMABLE LOGIC CONTROLLER
RTU — REMOTE TERMINAL UNIT
RIO — PLC REMOTE INPUT/OUTPUT

INSTRUMENT LINE SYMBOLS

INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
PNEUMATIC SYMBOL **
ELECTRIC SYMBOL *
HYDRAULIC SYMBOL
CAPILLARY TUBE
ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED) ***
ELECTROMAGNETIC OR SONIC SIGNAL (NOT GUIDED) ***
INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
MECHANICAL LINK

* THE FOLLOWING ABBREVIATIONS ARE USED TO DENOTE THE TYPES OF ELECTRICAL SIGNALS. NUMBER PREFIXES MAY BE USED TO DESIGNATE QUANTITIES OF I/O SIGNALS IF NOT SHOWN ELSEWHERE.

CC — DRY CONTACT CLOSURE (ON/OFF SIGNAL)
4-20 — 4-20 MILLIAMPERE DC SIGNAL
POT — POTENTIOMETER (RESISTANCE) SIGNAL
DI — DIGITAL INPUT
DO — DIGITAL OUTPUT
AI — ANALOG INPUT (4-20 MA)
AO — ANALOG OUTPUT
SI — SLIDE WIRE (POT) INPUT
PI — PULSE INPUT

** THE PNEUMATIC SIGNAL SYMBOL APPLIES TO A PROCESS SIGNAL, NOT A SUPPLY SOURCE, USING ANY GAS AS A MEDIUM. IF A GAS OTHER THAN AIR IS USED, THE GAS IS IDENTIFIED BY A NOTE ON THE SIGNAL.

*** ELECTROMAGNETIC PHENOMENA INCLUDE HEAT, RADIO WAVES, NUCLEAR RADIATION, AND LIGHT.

THE FOLLOWING ABBREVIATIONS ARE USED TO DENOTE THE TYPES OF POWER SUPPLY. THEY MAY ALSO APPLY TO PURGE FLUID SUPPLY:

AS — AIR SUPPLY	HS — HYDRAULIC SUPPLY
IA — INSTRUMENT AIR	NS — NITROGEN SUPPLY
PA — PLANT AIR	SS — STEAM SUPPLY
ES — ELECTRIC SUPPLY	WS — WATER SUPPLY
GS — GAS SUPPLY	

NOTES

1. INSTRUMENTATION SYMBOLOGY AND NOMENCLATURE ARE BASED ON INSTRUMENT SOCIETY OF AMERICA (ISA) STANDARDS S5.1 AND S5.3.
2. SEE ELECTRICAL AND MECHANICAL DRAWINGS FOR ADDITIONAL INSTALLATION DETAILS.
3. SEE RELATED ELECTRICAL DRAWINGS FOR HARDWIRED CONTROL.
4. SEE RELATED LOGIC DIAGRAMS FOR CONTROL BY PROGRAMMABLE LOGIC CONTROLLER.

METROPOLITAN FORCE CONSTRUCTION

PRELIMINARY

MWD METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED SCC; RECOMMENDED XXXX; DATE DEC 2004
DRAWN SCC; PROJECT APPROVED XXXX
CHECKED XXXX; DIVISION APPROVED XXXX

REV / REVISION XXX / DATE / DWN / CHK / REC / PRJ APP / DIV APP

COLORADO RIVER AQUEDUCT / DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PIPING AND INSTRUMENTATION DIAGRAM

LEGEND AND SYMBOLS
SHEET 1 OF 2

SPECIFICATIONS
WORK ORDER 103584
SHEET B1
DWG B-104907
REV

METROPOLITAN WATER DISTRICT

COORDINATION CHECK ESP-1030 (09/01/94)

MICROFILM DATE

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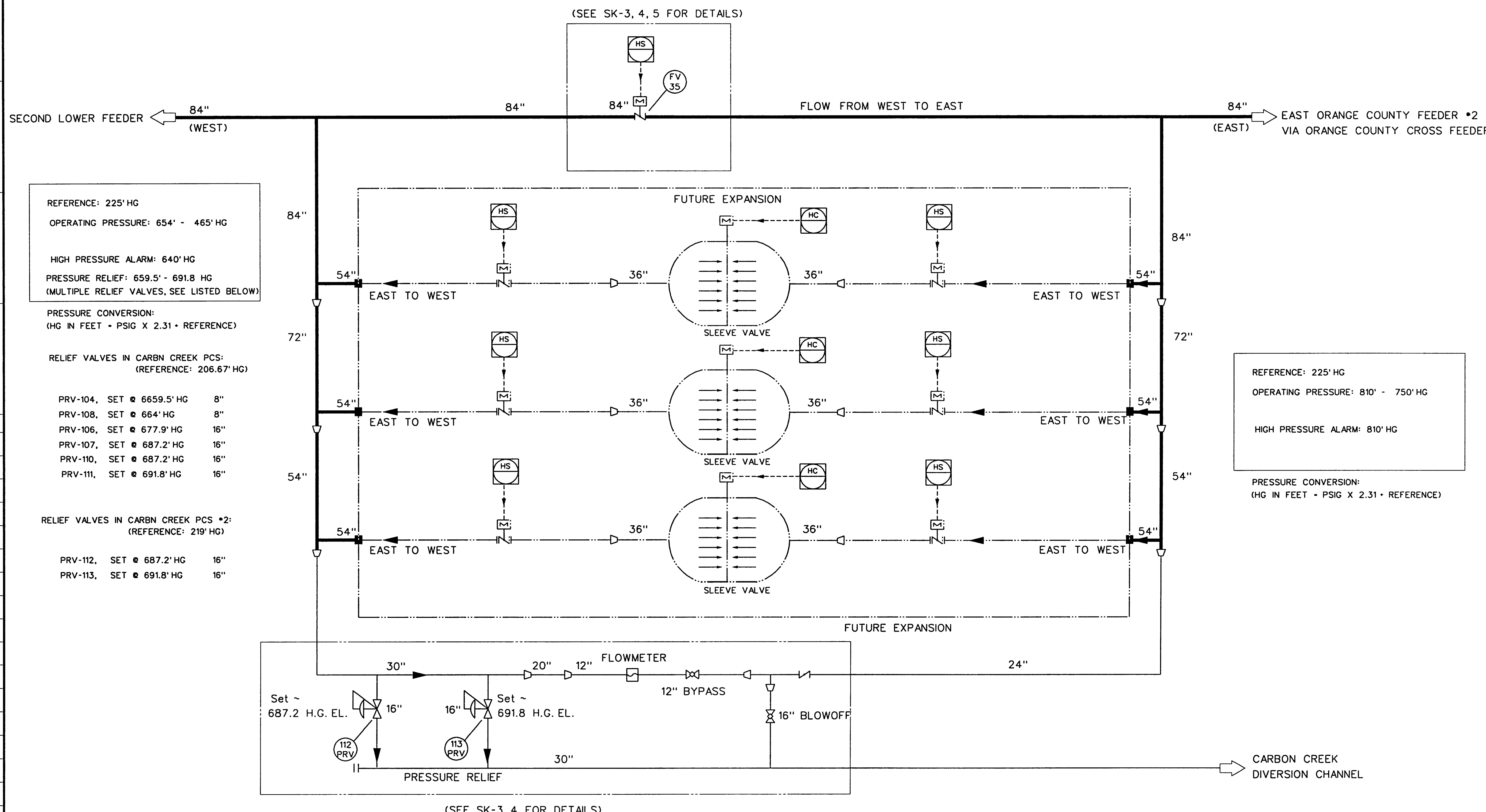


NOT TO SCALE

PRELIMINARY

REV	REVISION XXX	DATE	DWN	CHK	REC	PRJ APP	DIV APP	

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

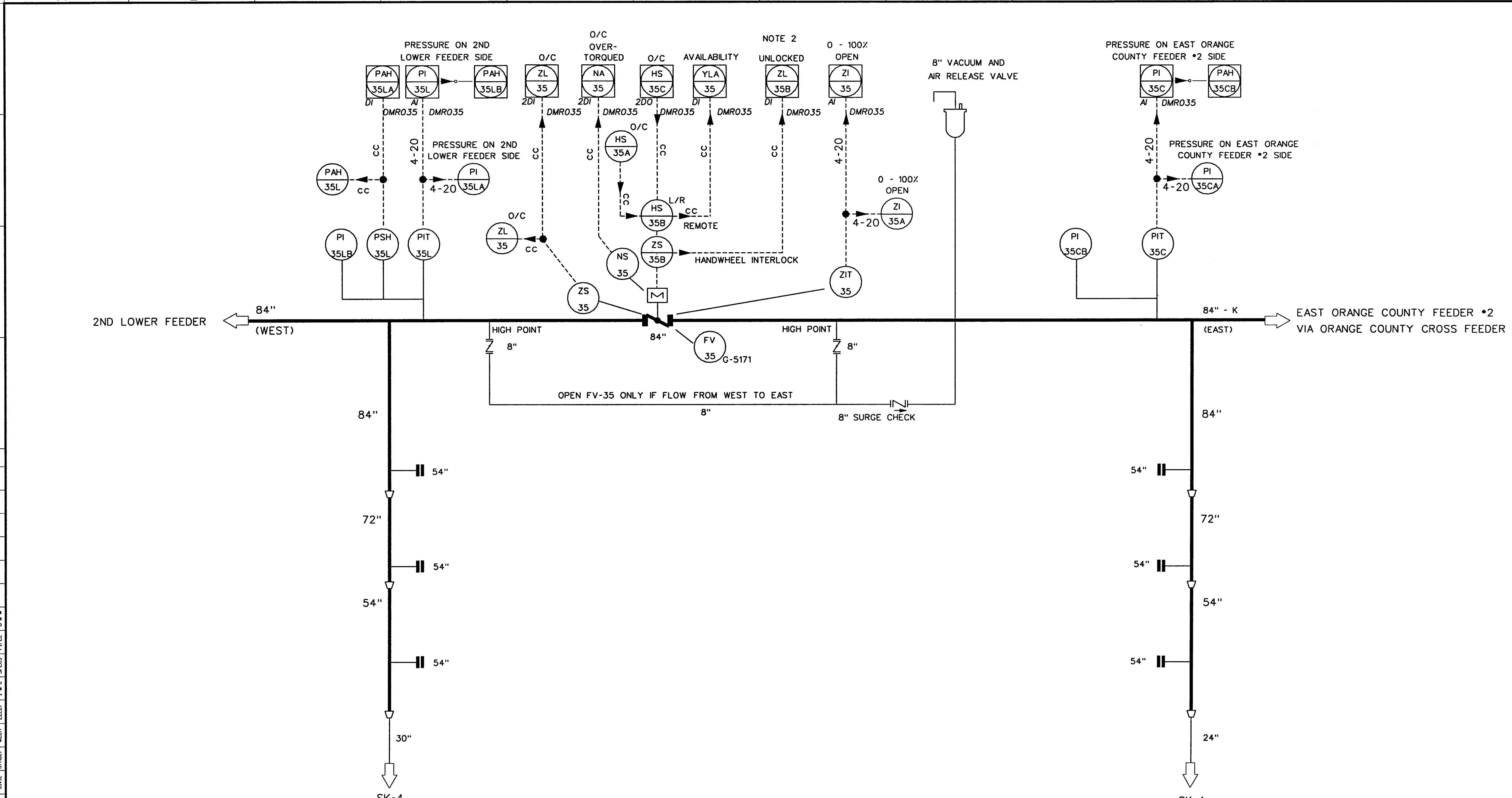
DESIGNED SCC	RECOMMENDED XXXX	DATE DEC 2004
DRAWN SCC	PROJECT APPROVED XXXX	
CHECKED XXXX	DIVISION APPROVED XXXX	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PROCESS FLOW DIAGRAM
CARBON CREEK PCS No.2

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-2
DWG
rev

METROPOLITAN WATER DISTRICT

COORDINATION CHECK ESD-1700 (09/01/94)
ORIGINAL RELEASE REV | MON/YR DATE | XX PRJ E | XX ARCH | XX CIVIL | XX STRUCT | XX MECH | XX ELECT | XX I & C | XX SPECS | XX PIPEL | XX O & M
MICROFILM DATE



A B C D E F G H I J K L

1 2 3 4 5 6 7 8

NOTES:

1. A WALL-MOUNTED RTU (DMR035) WILL BE USED TO INTERFACE WITH MWD'S FRAME-RELAY WIDE AREA NETWORK THROUGH PHONE COMPANY'S CIRCUIT.
2. AN ELECTRO-MECHANICAL INTERLOCK IS REQUIRED FOR HANDWHEEL OPERATION.

PRELIMINARY

REV	REVISION	DATE	DWN	CHK	REC	PRJ APP	DIV APP
	XXX						

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED SCC	RECOMMENDED XXXX	DATE DEC 2004
DRAWN SCC	PROJECT APPROVED XXXX	
CHECKED XXXX	DIVISION APPROVED XXXX	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PIPING AND INSTRUMENTATION DIAGRAM
CARBON CREEK PCS No. 2
84 INCH ISOLATION VALVE

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-3
DWG
rev

METROPOLITAN WATER DISTRICT

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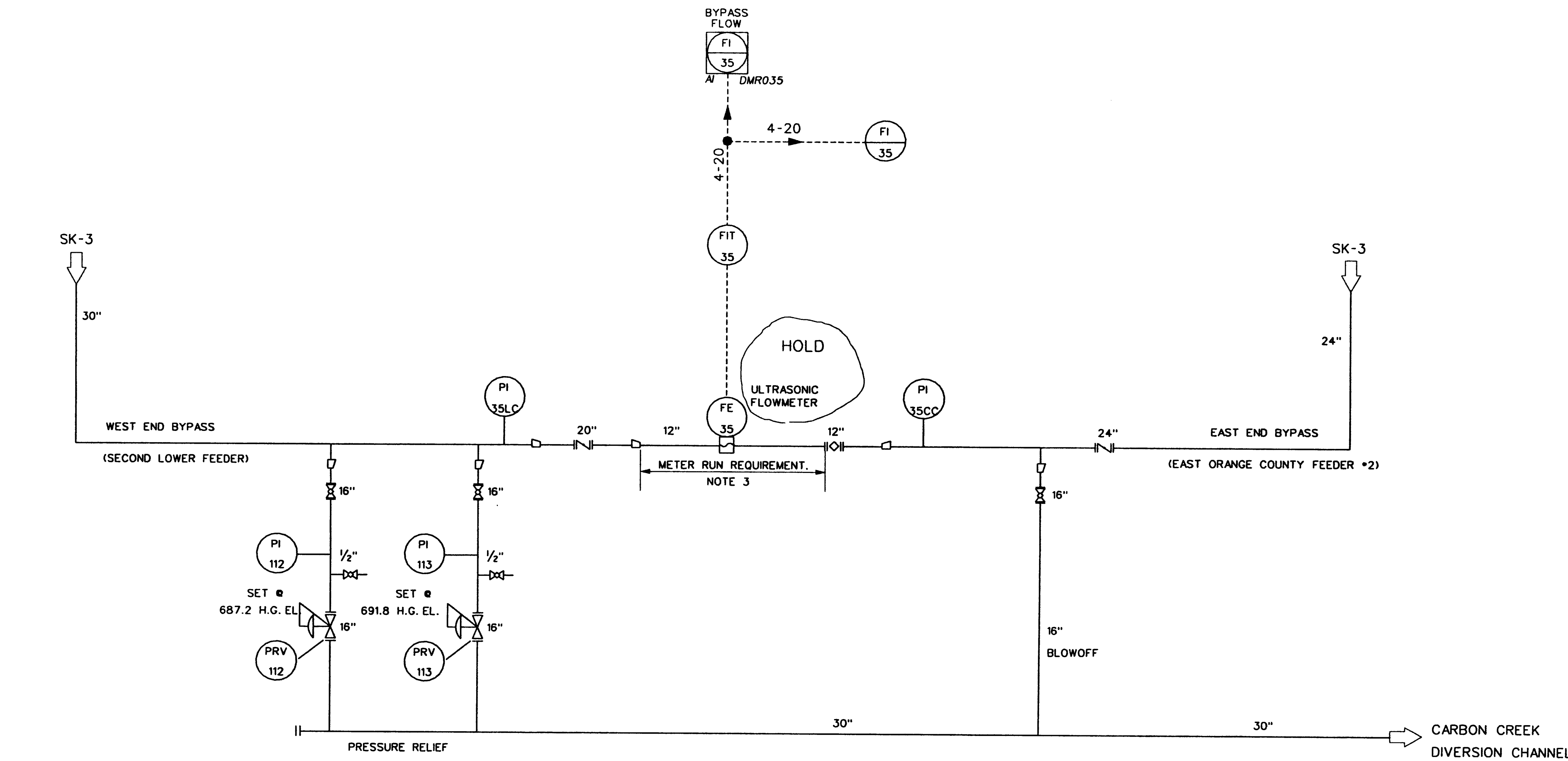
COORDINATION CHECK ESD-1730 (03/01/94)
ORIGINAL RELEASE
REV DATE
MON/YR
PRJ E ARCH CIVIL STRUCT MECH ELECT I & C SPECS PIPEL O & M
XX XX XX XX XX XX XX XX XX XX
MICROFILM DATE



NOTES:

1. A WALL-MOUNTED RTU IS NEEDED TO INTERFACE WITH MWD'S FRAME-RELAY WIDE AREA NETWORK THROUGH PHONE COMPANY'S CIRCUIT.
2. USE ECCENTRIC REDUCER IF POSSIBLE.
3. KEEP 5 DIAMETER METER RUN ON BOTH DIRECTION IF POSSIBLE. (10 DIA. DESIRED)

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PRELIMINARY

REV	REVISION	DATE	DWN	CHK	REC	PRJ APP	DIV APP
	XXX						

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED SCC	RECOMMENDED XXXX	DATE DEC 2004	
DRAWN SCC	PROJECT APPROVED XXXX		
CHECKED XXXX	DIVISION APPROVED XXXX		

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PIPING AND INSTRUMENTATION DIAGRAM
CARBON CREEK PCS No. 2
WATER QUALITY BYPASS

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-4
DWG
rev

METROPOLITAN WATER DISTRICT

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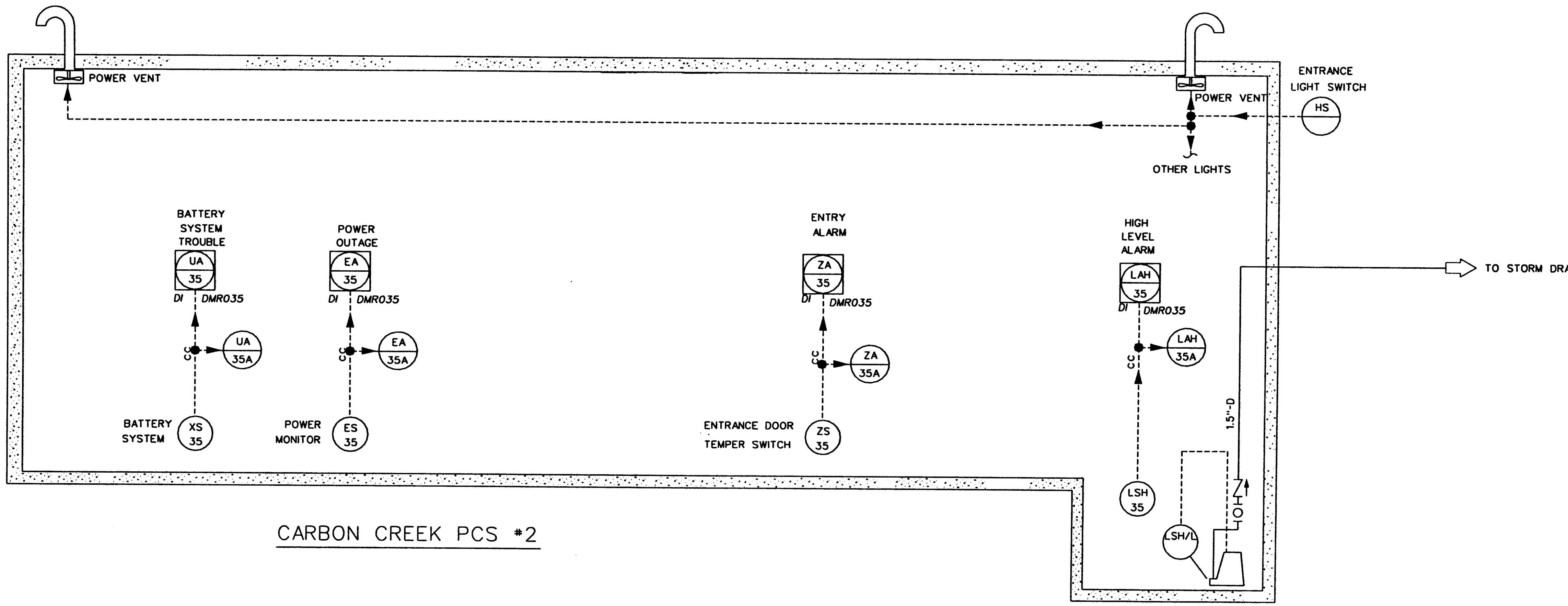

CARBON CREEK PCS #2

CARBON CREEK PCS #2 SUMP PUMP

SELF START/STOP SUMP PUMP
WITH BUILT-IN FLOAT SWITCH
1/2HP, 120VAC, 1 PH, 60HZ

NOTES:

1. A WALL-MOUNTED RTU IS NEEDED TO INTERFACE WITH MWD'S FRAME-RELAY WIDE AREA NETWORK THROUGH PHONE COMPANY'S CIRCUIT.
2. PRE-FIX OF THE TAG NUMBERS WILL BE DECIDED LATER.

PRELIMINARY

REV	REVISION	DATE	DWN	CHK	REC	PRJ APP	DIV APP
	XXX						

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED SCC	RECOMMENDED XXXX	DATE DEC 2004
DRAWN SCC	PROJECT APPROVED XXXX	
CHECKED XXXX	DIVISION APPROVED XXXX	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PIPING AND INSTRUMENTATION DIAGRAM

CARBON CREEK PCS No.2
MISCELLANEOUS EQUIPMENT

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-5
DWG
rev

COORDINATION CHECK ESD-1730 (09/01/94)
MICROFILM DATE

METROPOLITAN WATER DISTRICT

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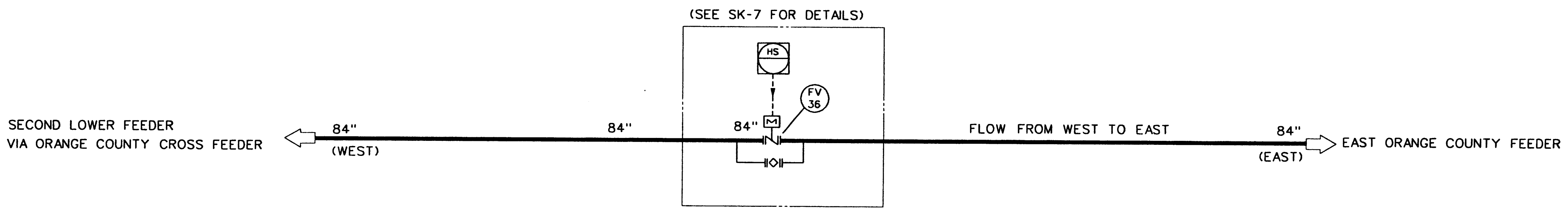
REFERENCE: 240' HG
OPERATING PRESSURE: 810' - 750' HG
HIGH PRESSURE ALARM: 810' HG

PRESSURE CONVERSION:
(HG IN FEET = PSIG X 2.31 + REFERENCE)

REFERENCE: 240' HG
OPERATING PRESSURE: 810' - 750' HG
HIGH PRESSURE ALARM: 810' HG

PRESSURE CONVERSION:
(HG IN FEET = PSIG X 2.31 + REFERENCE)



NOT TO SCALE

PRELIMINARY

REV	XXX
REVISION	

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED SCC	RECOMMENDED XXXX	DATE DEC 2004
DRAWN SCC	PROJECT APPROVED XXXX	
CHECKED XXXX	DIVISION APPROVED XXXX	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PROCESS FLOW DIAGRAM
OCCF VALVE STRUCTURE

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-6
DWG
rev

METROPOLITAN WATER DISTRICT

COORDINATION CHECK
ESD-1700 (09/01/94)
MICROFILM DATE

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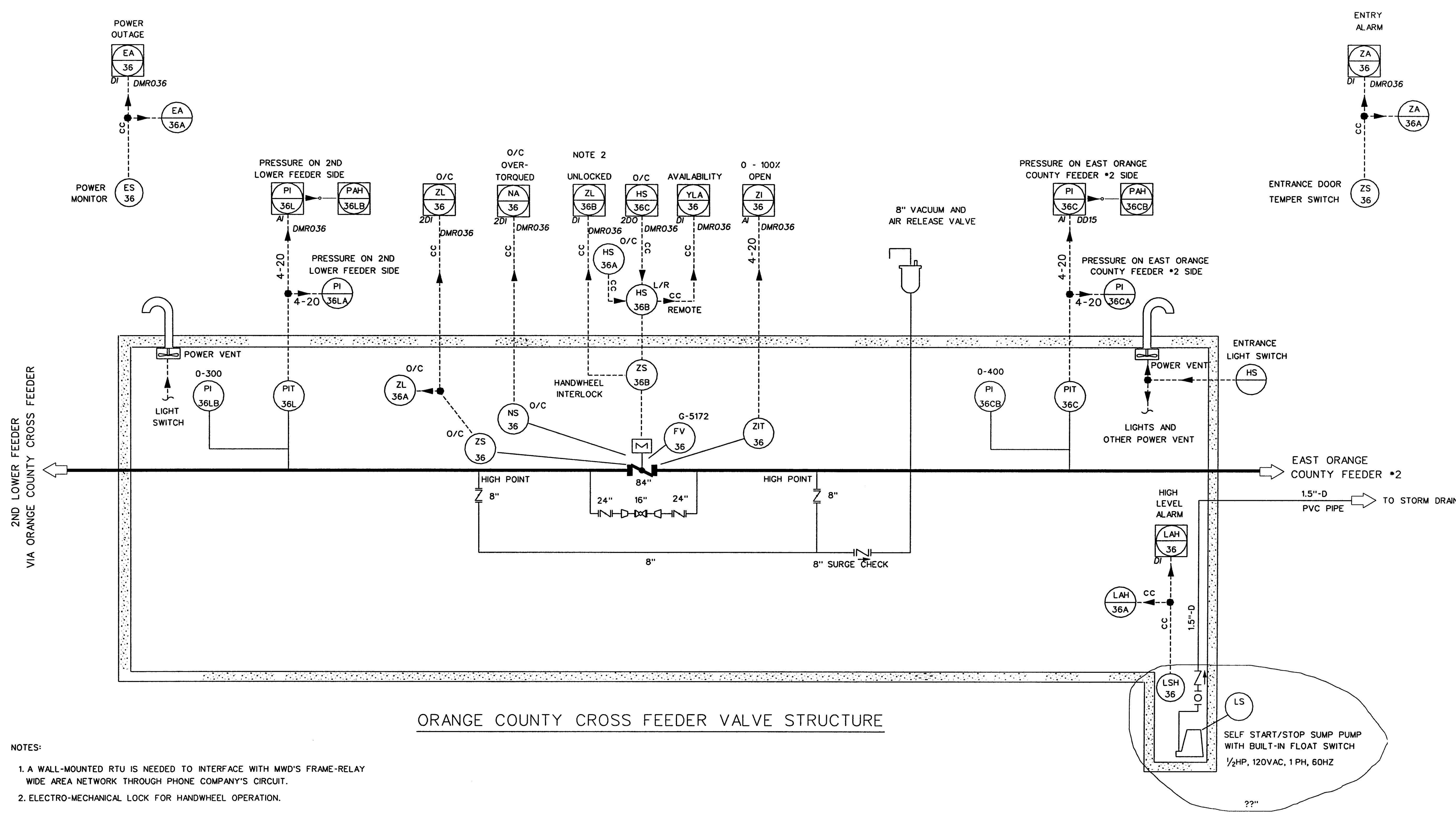


NOTES:

1. A WALL-MOUNTED RTU IS NEEDED TO INTERFACE WITH MWD'S FRAME-RELAY WIDE AREA NETWORK THROUGH PHONE COMPANY'S CIRCUIT.
2. ELECTRO-MECHANICAL LOCK FOR HANDWHEEL OPERATION.

PRELIMINARY

COORDINATION CHECK ESD-1700 (09/01/94)

REV	REVISION	DATE	DWN	CHK	REC	PRJ APP	DIV APP
	XXX						

MWD METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

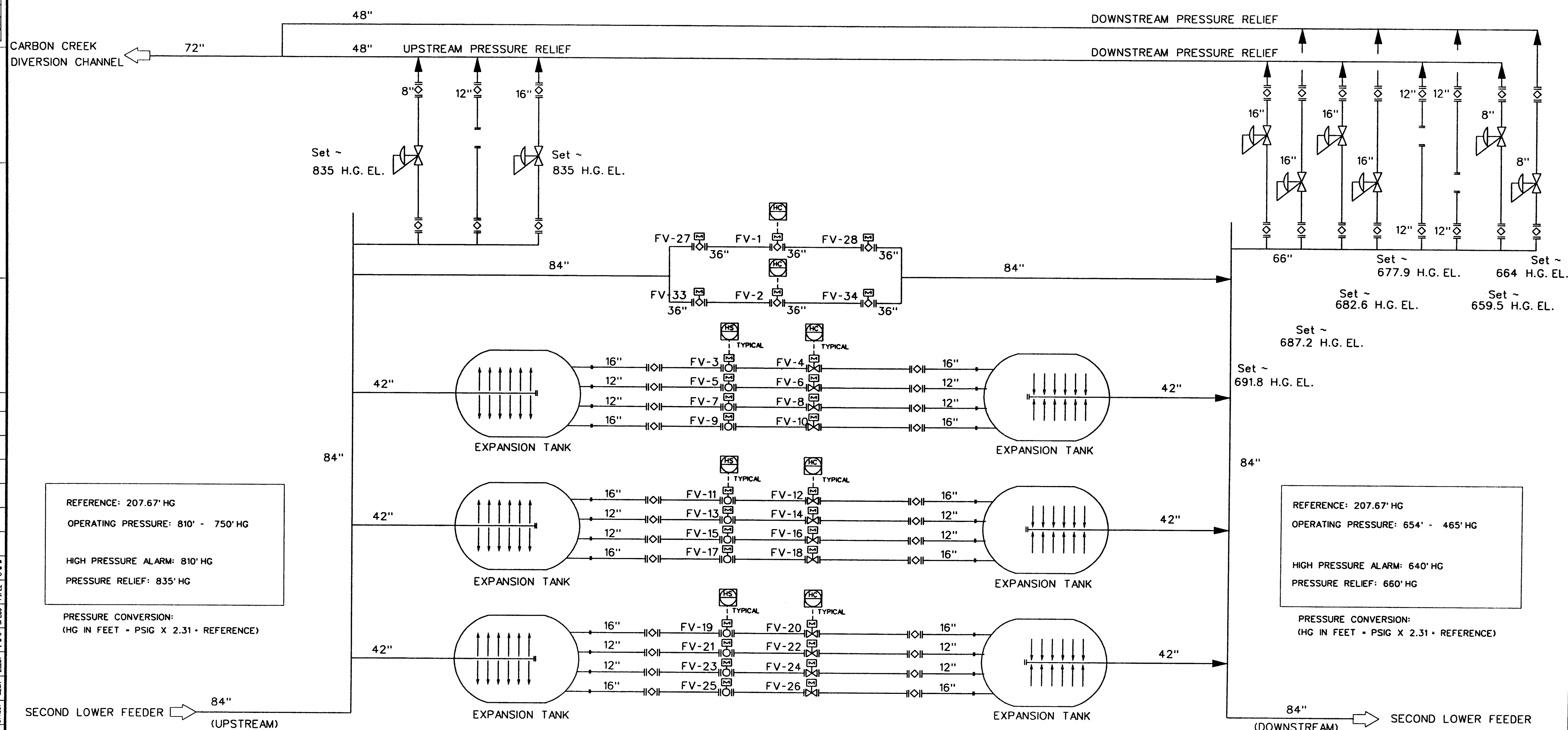
DESIGNED SCC | RECOMMENDED XXXX | DATE DEC 2004
DRAWN SCC | PROJECT APPROVED XXXX
CHECKED XXXX | DIVISION APPROVED XXXX

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PIPING AND INSTRUMENTATION DIAGRAM

ORANGE COUNTY CROSS FEEDER VALVE STRUCTURE

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-7
DWG
rev

METROPOLITAN WATER DISTRICT



NOTES:

1. RTU NUMBER IS "DMR015

2. ⊖ CAPABLE CONTROLLE FROM RTU

NOT TO SCALE

REFERENCE ONLY

REV	REVISION	DATE	DWN	CHK	REC	PRJ APP	DIV APP
	XXX						

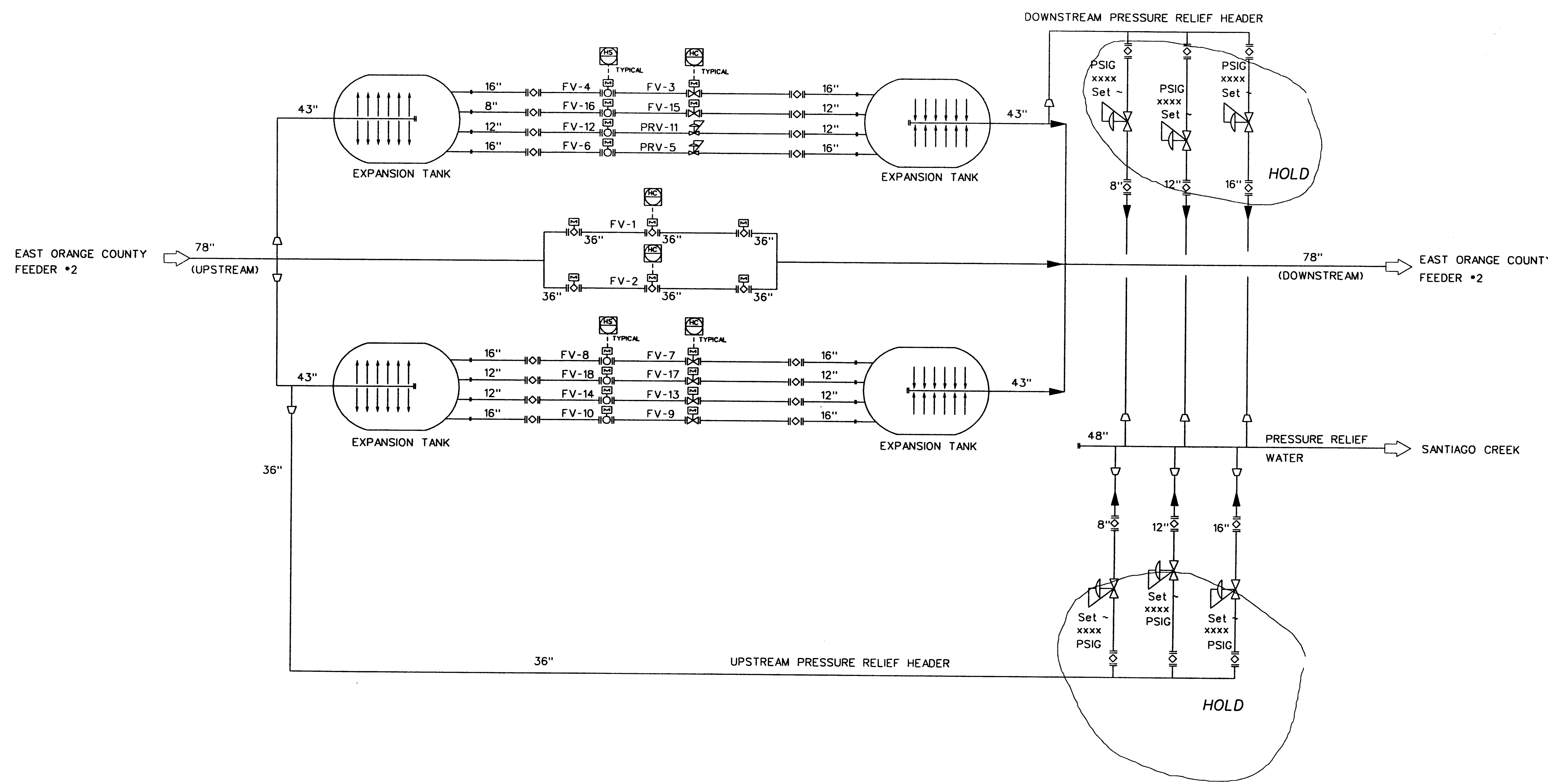
MWD METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED SCC — RECOMMENDED XXXX — DATE DEC 2004
DRAWN SCC — PROJECT APPROVED XXXX
CHECKED XXXX — DIVISION APPROVED XXXX

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PROCESS FLOW DIAGRAM
EXISTING CARBON CREEK PCS

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-8
DWG rev

METROPOLITAN WATER DISTRICT



NOTES:

1. RTU NUMBER IS "DMR015

2. ⊖ CAPABLE CONTROLLE FROM RTU

NOT TO SCALE

REFERENCE ONLY

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED SCC	RECOMMENDED XXXX	DATE DEC 2004	
DRAWN SCC	PROJECT APPROVED XXXX		
CHECKED XXXX	DIVISION APPROVED XXXX		

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PROCESS FLOW DIAGRAM
EXISTING SANTIAGO CREEK PCS

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-9
DWG
rev

REV | XXX REVISION | DATE | DWN | CHK | REC | PRJ APP | DIV APP

COORDINATION CHECK
MICROFILM DATE

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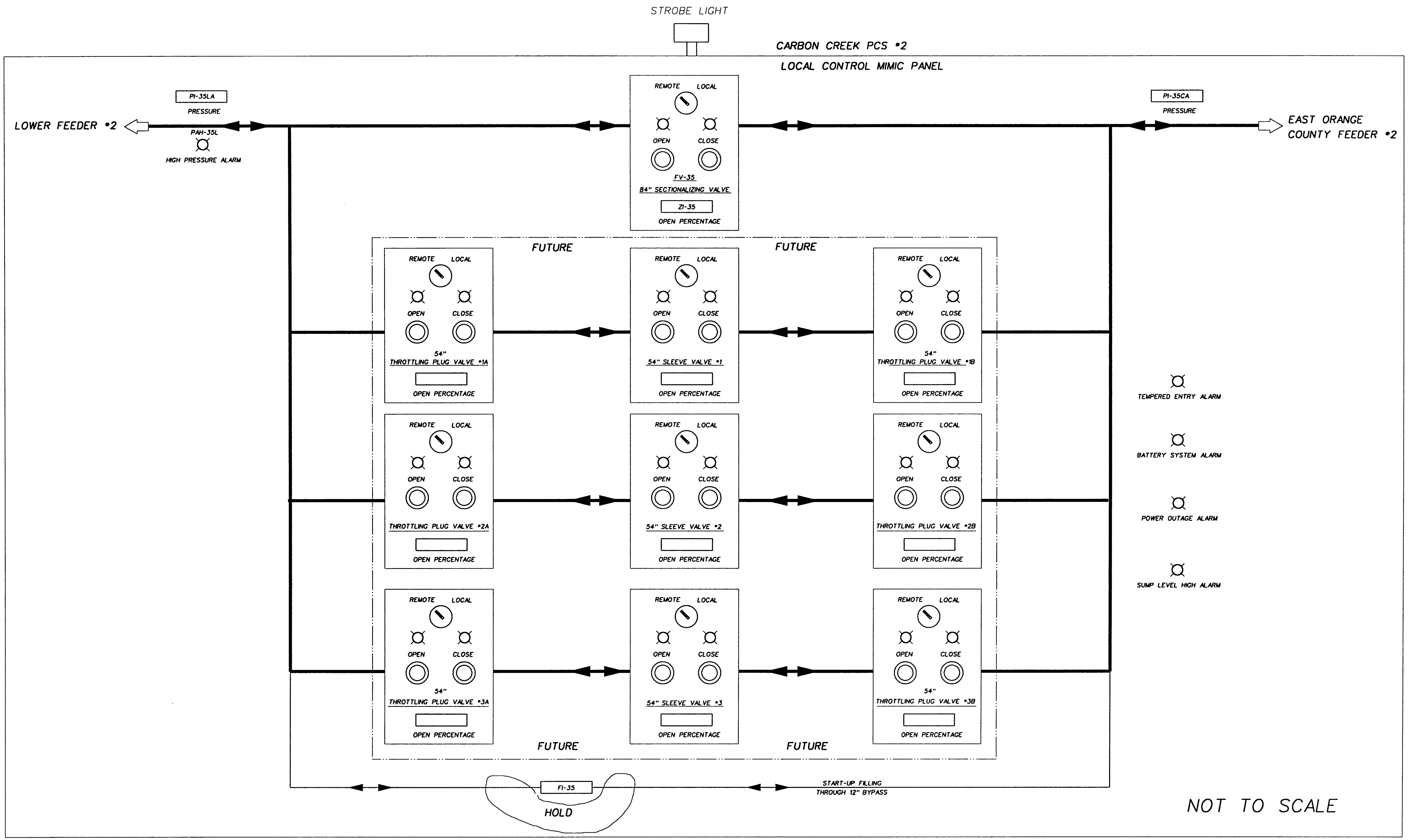

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COORDINATION CHECK ESD-17010 (03/01/94)

MICROFILM DATE

REFERENCE ONLY

REV	REVISION	DATE	DWN	CHK	REC	PRJ APP	DIV APP
	XXX						

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

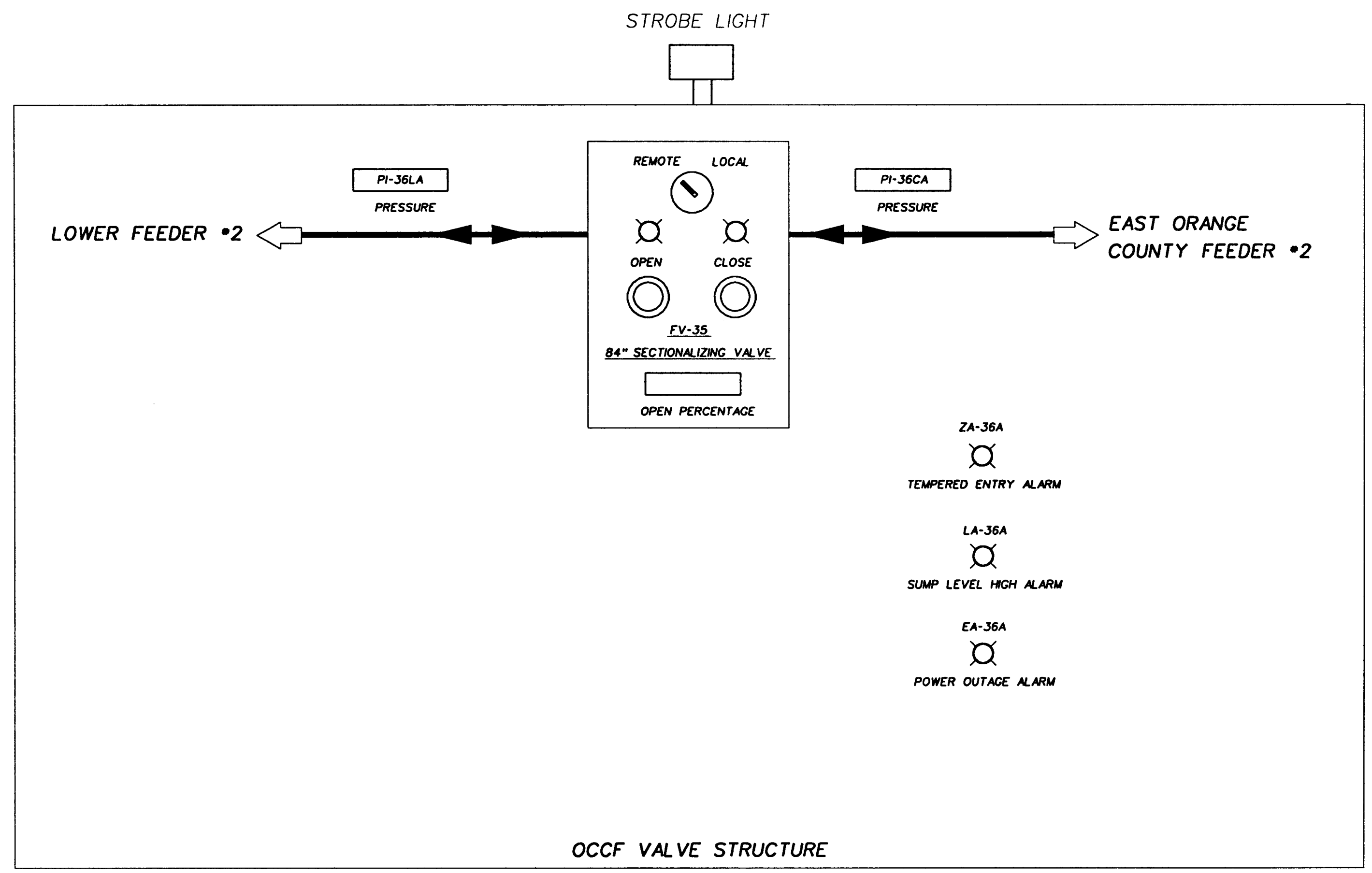
DESIGNED SCC	RECOMMENDED XXXX	DATE DEC 2004
DRAWN SCC	PROJECT APPROVED XXXX	
CHECKED XXXX	DIVISION APPROVED XXXX	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PIPING AND INSTRUMENTATION DIAGRAM

CARBON CREEK PCS •2
LOCAL CONTROL PANEL

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-10
DWG
rev

METROPOLITAN WATER DISTRICT



LOCAL CONTROL MIMIC PANEL

NOT TO SCALE

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USERID: u04725
PLOT TIME: 11-JAN-2006 15:22
PEN TABLE: MWDHBW.TBL

REFERENCE ONLY

REV	REVISION	DATE	DWN	CHK	REC	PRJ APP	DIV APP
	XXX						

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

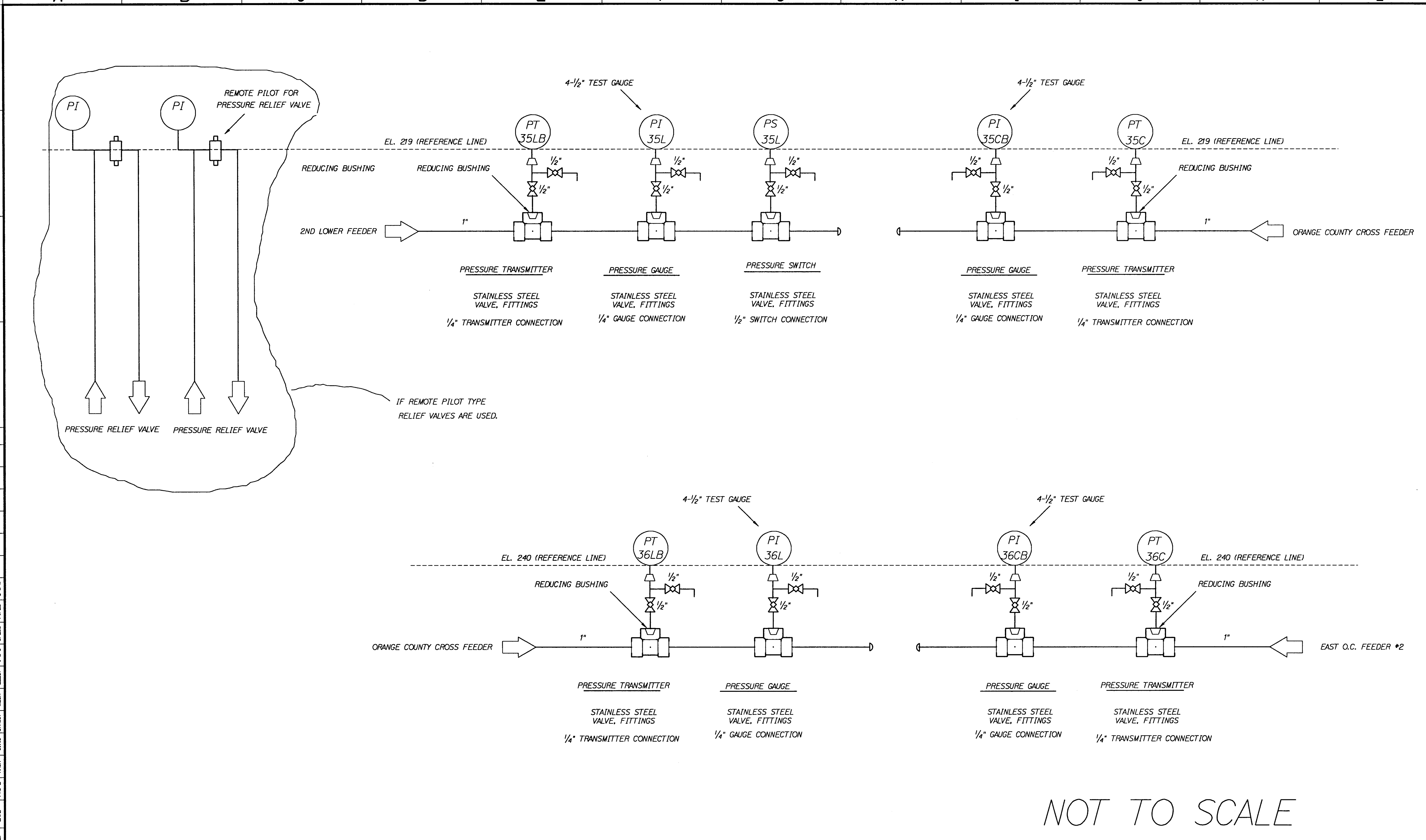
DESIGNED SCC	RECOMMENDED XXXX	DATE DEC 2004
DRAWN SCC	PROJECT APPROVED XXXX	
CHECKED XXXX	DIVISION APPROVED XXXX	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PIPING AND INSTRUMENTATION DIAGRAM

ORANGE COUNTY CROSS FEEDER
VALVE STRUCTURE
LOCAL CONTROL PANEL

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-11
DWG
rev

COORDINATION CHECK
ESD-1(120 (09/17/94)
MICROFILM DATE
METROPOLITAN WATER DISTRICT



NOT TO SCALE

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PLOT TIME: 11-JAN-2006 15:15
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COORDINATION CHECK ESD-1700 (09/01/94)

ORIGINAL RELEASE	PRJ E	ARCH	CIVIL	STRUCT	MECH	ELECT	I & C	SPECS	PIPEL	O & M
MON/YR	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX

MICROFILM DATE

REV	REVISION	DATE	DWN	CHK	REC	PRJ APP	DIV APP
	XXX						

MWD METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

DESIGNED SCC	RECOMMENDED XXXX	DATE DEC 2004
DRAWN SCC	PROJECT APPROVED XXXX	
CHECKED XXXX	DIVISION APPROVED XXXX	

DISTRIBUTION SYSTEM
ORANGE COUNTY CROSS FEEDER
PIPING AND INSTRUMENTATION DIAGRAM

PRESSURE INSTRUMENT ENGINEERING DETAILS

SPECIFICATIONS
WORK ORDER 103584
SHEET SK-12
DWG
rev

METROPOLITAN WATER DISTRICT