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JOSHUA BASIN WATER DISTRICT

Recharge Basin Supply Pipeline Preliminary Design Report

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EXP. 06-30-2010
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STATE OF CALIFORNIA

Prepared for:
Joshua Basin Water District
Joshua Tree, California

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10/22/09

Project No. 6079-15

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Recharge Basin Supply Pipeline Preliminary Design Report

Joshua Basin Water District
Joshua Tree, California

1.0 INTRODUCTION

This Preliminary Design Report (PDR) provides a basis of design for the construction of an extension of the Mojave Water Agency's (MWA) Morongo Pipeline. The proposed pipeline will convey the Joshua Basin Water District's (District) allotted State Water Project water supply to serve a proposed Water Recharge Facility (WRF) for the District.

Included in this report is an analysis of proposed alignments, a review of potential conflicts with existing utilities, a hydraulic analysis of the proposed pipeline, and a preliminary cost estimate for the project. Further design will be authorized to create contract documents for bidding purposes. The schedule for the design and public bidding of this project will be finalized during the final design phase of the project. This document addresses the preliminary design of the recharge pipeline only.

An EIR for the entire Water Recharge Project (recharge basin and supply pipeline) was prepared by ESA and adopted by the District Board of Directors in September 2009.

1.1 Recharge Pipeline Background

The District was formed as a public agency in 1963, when the District purchased and combined several smaller existing water systems. Since that time, the District has grown to serve more than 5,500 connections within its 96-square mile service area.

Situated above the Copper Mountain and Joshua Tree groundwater basins, the District's sole source of water is the groundwater that is pumped from these basins. Currently in a state of overdraft, the observed water level within these basins has been lowered by approximately 35 feet over the last 45 years. In 2004, the United States Geological Survey (USGS) completed a study concluding that approximately 1,600 acre-feet per year (afy) is being pumped from the basins which have an in-flow of approximately 1,200 afy.

In January 1995, the MWA completed construction of a 71-mile pipeline to deliver State Water Project (SWP) water to the communities served by the Hi-Desert Water District, Bighorn-Desert View Water Agency, San Bernardino County Service Area 70, and Joshua Basin Water District. That construction project included an agreement between the District and MWA, which entitled the District to an annual volume of 1,959 afy of SWP water and provided a stub-out at the District boundary for future extension of the MWA pipeline.

1.2 Project Description

As part of its long term groundwater management plan, the District will construct a Water Recharge Facility, consisting of a 16-inch water delivery pipeline and 30-acre recharge basin site. The water supply pipeline will provide the District access to its allotted SWP water and will relieve current overdraft conditions in the Joshua Tree groundwater basin.

The proposed recharge pipeline project connects to the existing Morongo Basin Pipeline, located along the District boundary in the vicinity of Yucca Mesa Road and Barron Drive. The pipeline will be constructed within public rights-of-way approximately 4.4 miles to the WRF to be constructed on a 30-acre parcel located one-quarter mile east of the intersection of Sunburst Street and Verbena Road.

2.0 DESIGN CRITERIA

Design criteria considered for this preliminary design report include pipeline alignment alternatives, utility conflicts, constructability, pipeline hydraulics, verification of available SWP supply, public impacts, and cost considerations.

2.1 Existing Public Rights-of-Way

When available, it is considered preferable to construct public utility infrastructure project within existing public rights-of-way or public utility easements (PUEs). Such construction avoids the requirement for negotiating acquisition of easements with private land owners and potential damage to private property. As such, existing public rights-of-way and easements are identified in the vicinity of the pipeline alignment to include:

- San Bernardino County Roadways
- Southern California Edison (SCE) overhead electrical easements
- Southern California Gas Company (Gas Company) easements
- California Department of Transportation (Caltrans) highway right-of-way

Each of these alignment options were considered for potential use. Existing County rights-of-way occur sporadically along the project alignment and require significant acquisition of additional easement or right-of-way for construction. Initial discussions with SCE and Gas Company staff indicate that conjunctive use of these easements is available.

Construction of public utilities transversing Caltrans rights-of-way requires preparation of an encroachment permit application, with subsequent review and approval by the local Caltrans District office. Longitudinal encroachments are not allowed within controlled access freeway rights-of-way. Based on our discussions with the local Caltrans office, State Highway 62 (SR62) is an unrestricted right-of-way and longitudinal encroachment is permitted. Caltrans requires that transverse encroachments be constructed using trenchless methods, while longitudinal encroachments may be constructed with conventional cut and cover techniques.

Based on our investigations, the recharge pipeline will be constructed within existing public rights-of-way throughout its length, with two required transverse crossings of SR62. A longitudinal encroachment

will be used to facilitate construction within the SR62 right-of-way from Yucca Mesa Road to Sunset Road.

2.2 Utility Conflicts

Utility purveyors have been contacted for record documents and locations of existing utilities within the project alignment, including Southern California Edison, Southern California Gas Company, Time Warner Cable, and Verizon. Existing District facilities were identified based on previous record information. In general, no fatal flaw utility conflicts were identified. Potentially significant utility conflicts along the pipeline alignment include overhead electric and high-pressure gas (HPG) along the northerly shoulder of SR62 and underground low-pressure gas (LPG), cable television, and telephone lines within arterial streets in the downtown Joshua Tree area.

In evaluating potential pipeline alignments, conjunctive use of the existing easement along the northerly boundary of SR62 was considered. While construction in close proximity to the existing HPG pipeline is possible, that alignment represented significant risk to the District for initial construction and long-term operation and maintenance. The northerly alignment also represented additional cost relative to acquiring easements through private property and potential coordination considerations relative to the overhead power utilities along the north side of the right-of-way.

Alternatively, the southerly boundary of SR62 was determined to have few existing utilities. In addition, the pipeline could be constructed outside the paved roadway for a large portion of the pipeline length, significantly lowering projected pipeline cost to the District.

Based on analysis of the existing utility locations, it was determined that the pipeline will be constructed along the southerly boundary of SR62 from Yucca Mesa Road to Sunset Road.

2.3 Hydraulic Analysis

Existing hydraulic information for the Morongo Basin Pipeline was provided by the MWA. Hydraulic information provided by the MWA indicates various operational scenarios for the Morongo Basin Pipeline. Based on upstream hydraulic conditions, the Joshua Basin recharge pipeline will operate under the following hydraulic scenarios:

1. MWA Base Case 1: Gravity flow condition with Hi-Desert Water District taking its full water allotment concurrent with JBWD. Projected JBWD boundary condition is 4.71 cfs (2,114 gpm) at a residual pressure of 120 psi.

2. MWA Base Case 2: Gravity flow condition with Hi-Desert Water District taking no water from the pipeline. Projected JBWD boundary condition is 7.06 cfs (3,169 gpm) at a residual pressure of 165 psi.

3. MWA Max Flow Case 1: Pumped flow condition with booster pump engaged and Hi-Desert Water District taking its full water allotment concurrent with JBWD. Projected JBWD boundary condition is 11.2 cfs (5,027 gpm) at a residual pressure of 173 psi.

4. MWA Max Flow Case 2: Pumped flow condition with booster pump engaged and Hi-Desert Water District taking no water from the pipeline. Projected BWD boundary condition is 13.9 cfs (6,239 gpm) at a residual pressure of 156 psi.

The District's SWP water allotment is 1,959 afy. The WRF will be design to accept water deliveries at higher flow rates to accommodate future changes in water availability throughout the year. The design capacity of the pipeline is, therefore, defined to accommodate delivery of the total District water allotment over one-half of the year, which is a rate of 4,000 afy based on the District's current allotment. As the District water allotment increases, the pipeline will be required to convey greater flowrates. Based on current projections, the maximum capacity of the recharge pipeline will be approximately 8,000 afy. Based on the available information, the proposed pipeline will have sufficient head to deliver water at these rates to the District recharge basin site. The MWA system has more than sufficient head to convey water to the JBWD recharge site. As such, analysis is necessary to confirm that the proposed pipeline is protected against over pressurization.

The elevation of the recharge pipeline connection to the Morongo Basin Pipeline is approximately 2,990 feet. The elevation of the proposed recharge basin site is approximately 2,685 feet. Therefore, the differential static head is approximately 305 feet or 132 psi for the proposed pipeline. Based on this information, pipeline can be design using C905 PVC pipe with a pressure rating of 165 psi. However, it may be more prudent to design the pipeline using 235 psi rated PVC pipe materials.

The MWA system provides additional pressure head under the various operational scenarios, as well as additional static head that must be considered. As stated previously, the residual pressure at the pipeline connection point ranges between 275 and 400 feet of head under the various operational scenarios. In addition, the static head condition on the MWA system is computed based on the high water elevation of the MWA supply reservoir, which is approximately at an elevation of 3,560 feet. Therefore, the static pressure at the connection point could be as high as 570 feet (250 psi). It is noted that the Morongo Basin Pipeline may not experience these high pressures. However, if the pipeline were to be filled, this static head would be realized. Thus, the District pipeline would add an additional 305 feet of head, totaling approximately 875 feet or 375 psi.

It would be costly to construct the District's recharge pipeline to handle such high pressures. As such, a pressure reducing station is proposed at the connection point. This facility will allow construction of the recharge pipeline using standard PVC pipe materials. The pressure reducing station will need to be designed to reduce pressure to approximately atmospheric pressure, as the District's pipeline will have sufficient fall to convey water to the site by gravity. Additionally, air vacuum valves will be require to at the connection point to facilitate gravity flow conditions, as well as any depressions in the pipeline along the alignment. It is projected that the pressure reducing valve will be design to fail closed to avoid potential over pressurization of the District's pipeline. In addition, the recharge basin site will incorporate pressure relief valves to protect the pipeline by discharging water to the recharge basins in emergency situations. Final design of the pipeline and recharge basin will define the details of these required facilities.

2.4 Public Impacts

Identified public impacts anticipated during construction were determined to include traffic congestion and existing business or home access. Construction related traffic will cause a temporary reduction in the capacity of arterial and connector streets within the project area resulting from increased activity of construction-related equipment and lane closures associated with anticipated open-trench construction. During design, alternative construction periods will be investigated to minimize traffic impacts. Traffic control will be employed to maintain safe flow of traffic through the construction areas. Trench plating will be used to maintain access to local businesses and residents in the vicinity of the construction.

The majority of the proposed pipeline alignment provides sufficient space to accommodate traffic and avoid significant impact to businesses and residents. However, the downtown Joshua Tree area includes

a variety of commercial enterprises. It was determined that construction within the downtown Joshua Tree area would constitute an unacceptable level of disruption. As such, the pipeline alignment will diverge from the SR62 at Sunset Road to avoid the downtown area.

2.5 Recommended Design

Based on review and analysis of available alignment considerations, the following pipeline alignment is identified as the preferred alignment for the water recharge pipeline:

The recharge pipeline will commence at the connection point to the existing Morongo Basin Pipeline (Yucca Mesa Road near Barron Drive). Cut and cover construction will continue south along Yucca Mesa Drive to its intersection with SR62. At this point, the pipeline will be constructed (through trenchless construction techniques) across SR62 to the southerly boundary of the right-of-way. From that point, the pipeline will be constructed with cut and cover methods along the southerly boundary of the SR62 right-of-way within the unpaved shoulder for as long as feasible. Avoiding impact to the downtown commercial area, the pipeline will be constructed north across SR62 (again through trenchless methods) at the intersection with Sunset Road, and continue north along Sunset Road to the intersection of Chollita Road. The pipeline alignment will continue east in Chollita Road using cut and cover methods to its intersection with Sunburst Street. The pipeline will continue north in Sunburst Street to Verbena Road, and continue easterly in Verbena Road to the WRF recharge site. At this point, the pipeline will transition to the recharge site and connect to the on-site facilities.

The final design scope will be based on preparation of plans and specifications for construction of the pipeline as described above.

3.0 ALIGNMENT SURVEY

Aerial surveying has been completed for the identified alignment, and the preliminary pipeline alignment identified. The preliminary pipeline alignment is provided in Appendix A. Surveyors set the ground control and provided alignment control along the alignment corridor. Following the ground control and alignment phase, the alignment was flown and digital topographic mapping was prepared. This effort produced 1-foot contour intervals for a 200-foot wide area along the proposed alignment. The field and topographic survey efforts were combined to produce the project basemap used as the basis of the alignment evaluation and preliminary design, shown in Appendix A. The developed survey information will be used during final design. At the time of the completion of the aerial survey, information supplied to Dudek by the MWA indicated that the Morongo Basin Pipeline stub-out was located at the intersection of Yucca Mesa Road and Barron Drive. Further research performed by Dudek during the preparation of this report determined that the actual Joshua Basin extension is located approximately 400' north of Barron Drive near the northerly boundary of a low water crossing of Yucca Mesa Road (and associated San Bernardino County Flood Control District ROW.) Topographic information will need to be acquired for this stretch of alignment and additional surface and subsurface information may be required for final design completion.

4.0 CALTRANS ENCROACHMENT

Construction of the proposed pipeline improvements will require issuance of a Caltrans encroachment permit for work within SR62. Permit issuance will require careful review and consideration of the provisions and requirements provided in the Manual for Encroachment Permits on California State Highways, prepared by Caltrans.

District staff has discussed the preliminary alignment with Caltrans District 8, Office of Encroachments staff. Preliminary discussions have determined that issuance of the longitudinal encroachment is feasible and that the required design provisions in the Encroachment Permit Manual are achievable. Key considerations of these provisions include trenchless construction methods for transverse crossings and Caltrans requirements for longitudinal encroachments, as follows:

Construction within rural areas (listed in order of preference) shall be located:

1) As close to the right-of-way line as possible
2) Under unimproved shoulder
3) Under paved shoulder, or
4) Under the outermost lane of a multi-lane highway

An overview of the encroachment permit process and a sample encroachment permit are included in Appendix B.

5.0 PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

The following information addresses the cost analysis of the recharge pipeline only. Unit costs for major items of work were obtained from vendors and other local public bidding results for similar projects.

Table 1 - Estimated Recharge Pipeline Design and Construction Costs

Item	Unit	Quantity	Unit Cost	Total Cost
Mobilization/Demob, Insurance, Bonds	LS	1	$250,000	$250,000
Pothole to Locate existing utilities	EA	200	$500	$100,000
Furnish and Install 16" PVC Pipe, Fittings, Excavation, Thrust Blocks, Backfill & Compaction, Repaving	LF	23,150	$150	$3,472,500
Trenchless Crossings of Hwy 62	EA	2	$60,000	$120,000
Air Vac Assembly	EA	12	$6,000	$72,000
BO Assembly	EA	12	$5,000	$60,000
16" In-Line Valve	EA	9	$6,500	$58,500
Connect to Exist SWP pipeline (PRV)	LS	1	$50,000	$50,000
Traffic Control	LS	1	$150,000	$150,000
Testing and Disinfection	LF	23,150	$1.50	$34,725
Clean Up and Disposal	LS	1	$50,000	$50,000
Total Construction Costs				***$4,417,725***

It is noted that the cost information included herein is based on preliminary design efforts and may be subject to change following final design.

APPENDIX A

(TOPO SURVEY AND PRELIM PLAN)

PRELIMINARY DESIGN
FOR
RECHARGE BASIN PIPELINE

JOSHUA BASIN WATER DISTRICT
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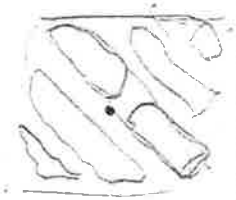

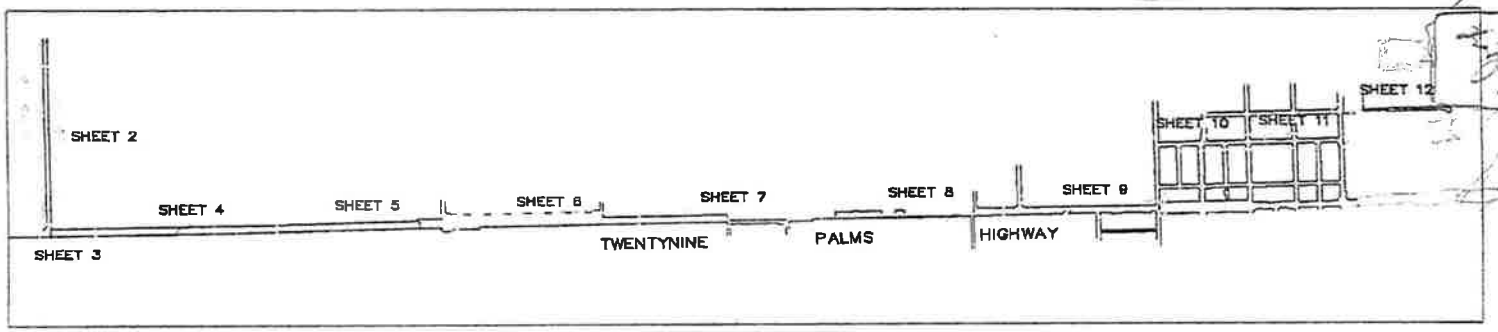

SITE MAP

SCALE: 1" = 800'

LEGEND

- EXISTING WATER MAIN
- RIGHT OF WAY
- CENTERLINE
- OVERHEAD ELECTRIC LINE (OHE)
- GAS MAIN (G)
- TELEPHONE LINE (OVERHEAD & CONDUIT) (T)
- EXISTING EDGE OF PAVEMENT

GRAPHIC SCALE
-800 -400 0 400 800 1600
(IN FEET)
1 INCH = 800 FT

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REVISIONS

NO.	BY	DATE	REMARKS

ENGINEER OF WORK
CHARLES H. GRIDLEY DATE
R.C.E. EXPIR. DATE: 06/30/10
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PRELIMINARY DESIGN
FOR
RECHARGE BASIN PIPELINE

SHEET NO 1 OF 12 SHEETS
DATE: SEPTEMBER 2009
W.O. 80278

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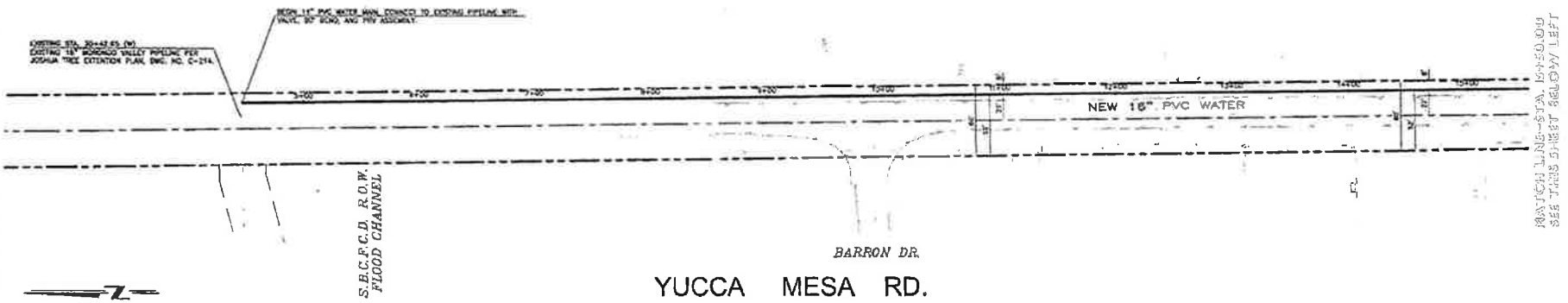
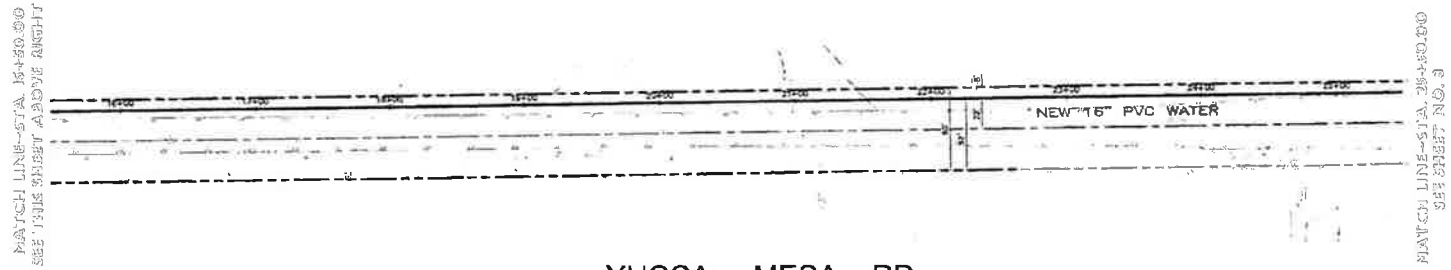
SUPPLEMENTAL TOPO REQUIRED FOR FINAL DESIGN





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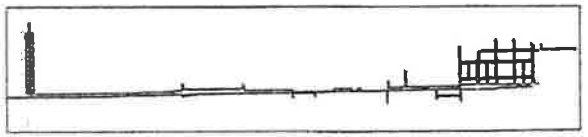

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PRELIMINARY DESIGN
FOR
RECHARGE BASIN PIPELINE

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DATE SEPTEMBER, 2009
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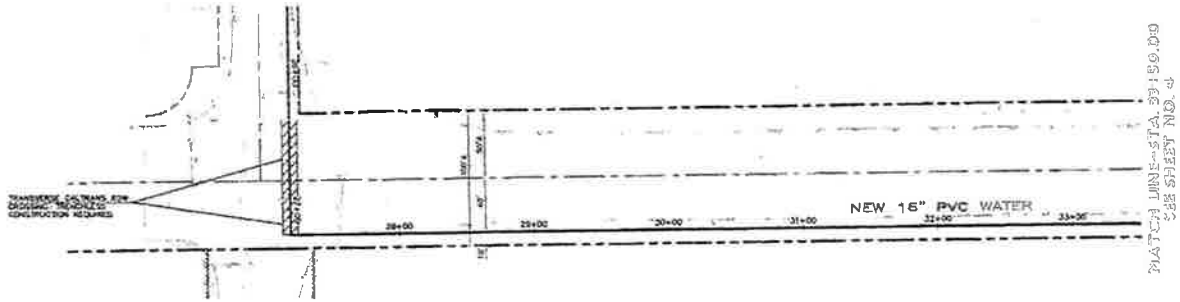

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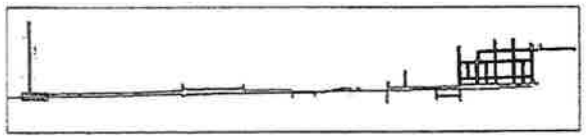
TWENTYNINE PALMS HWY.



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PRELIMINARY DESIGN
ON
RECHARGE BASIN PIPELINE

SHEET NO. 3
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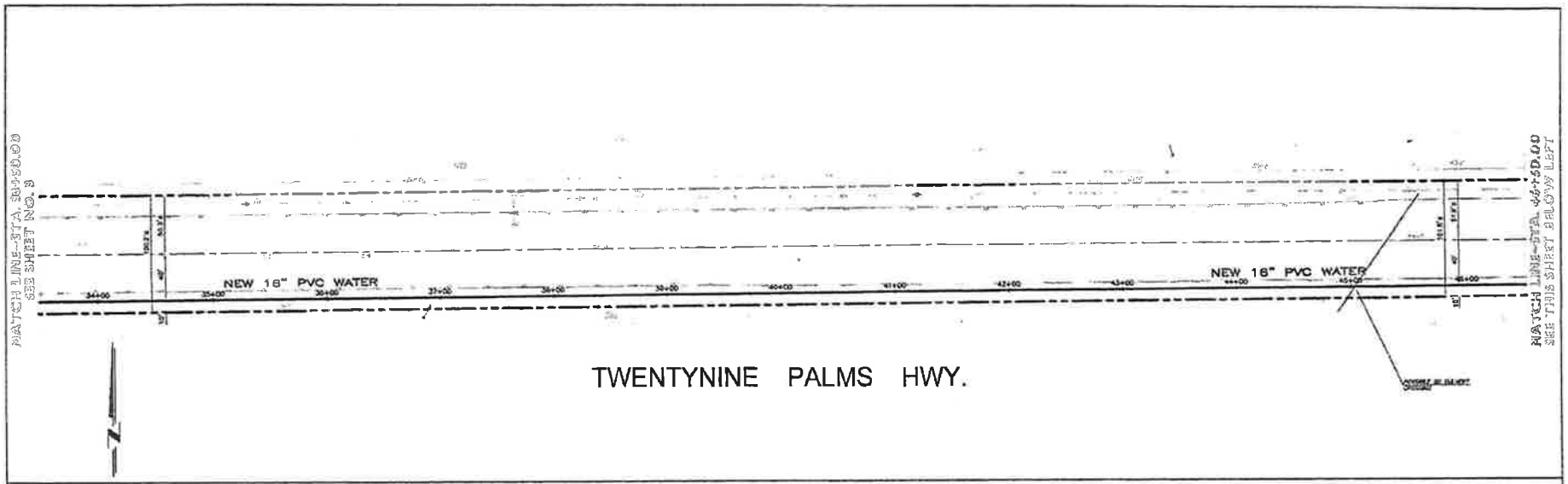

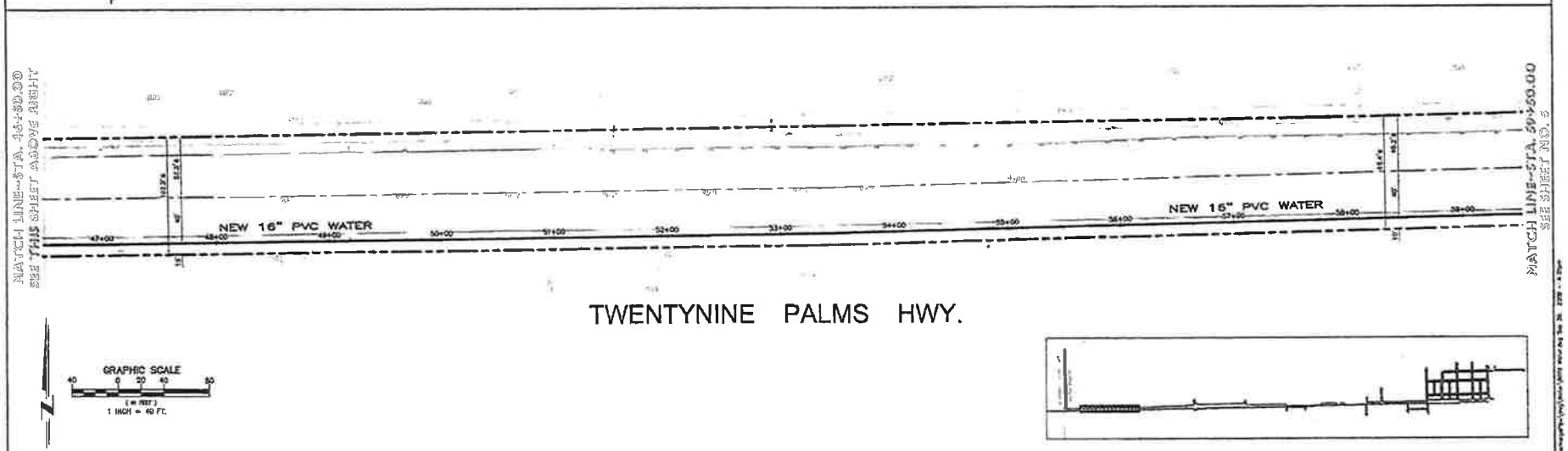

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PRELIMINARY DESIGN
FOR
RECHARGE BASIN PIPELINE

SHEET NO. 4
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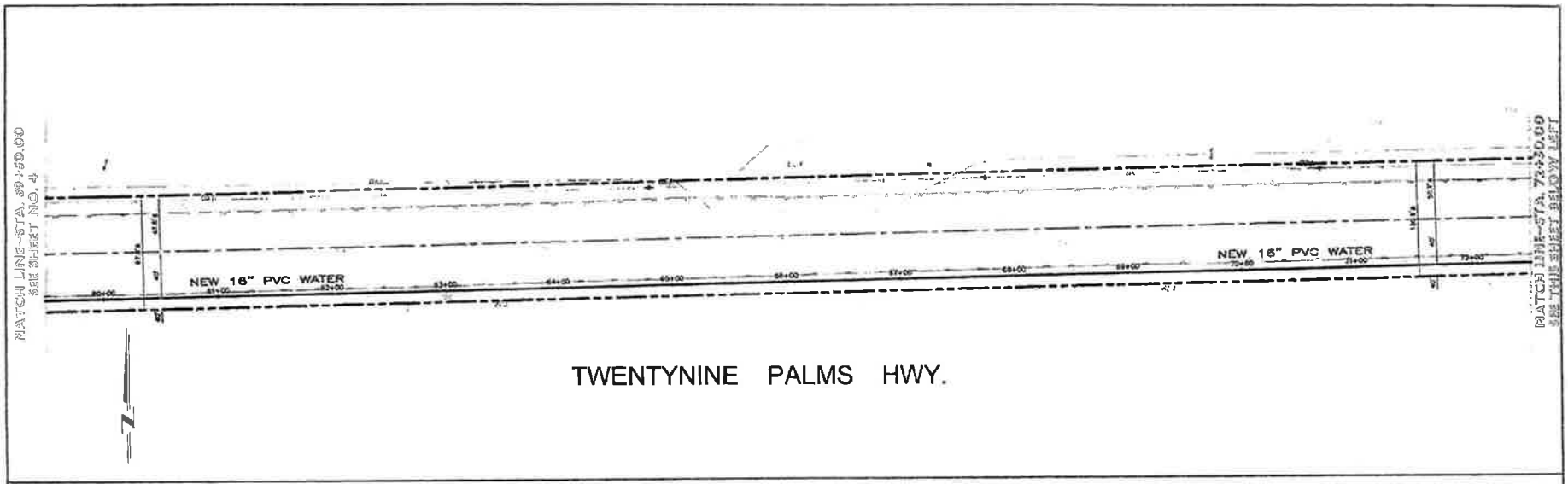

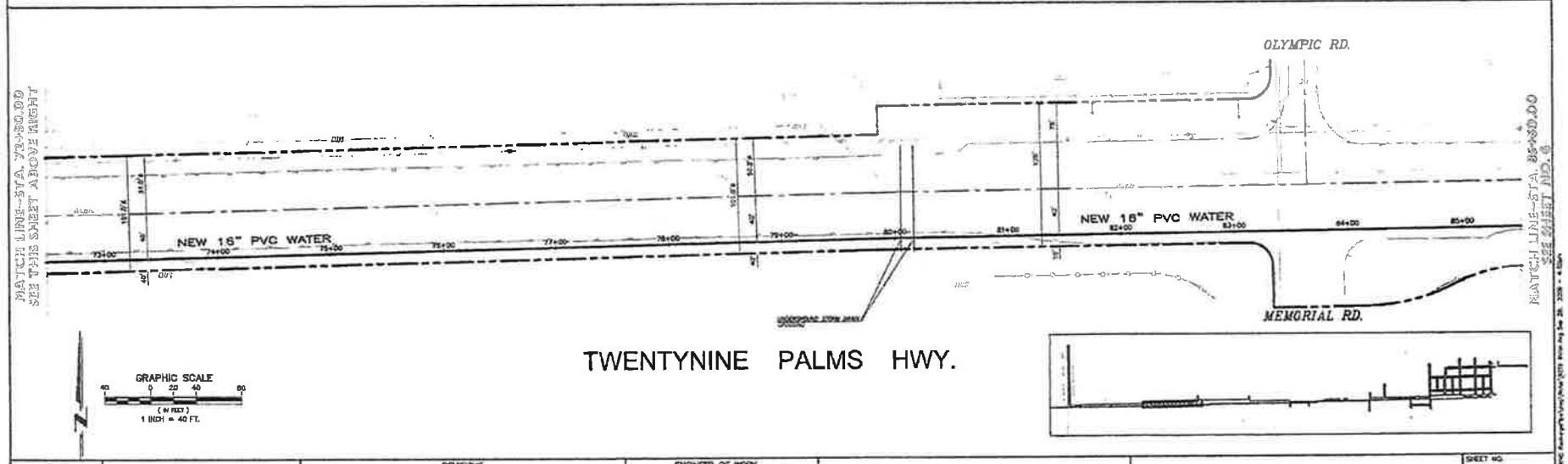

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ENGINEER OF WORK
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PRELIMINARY DESIGN
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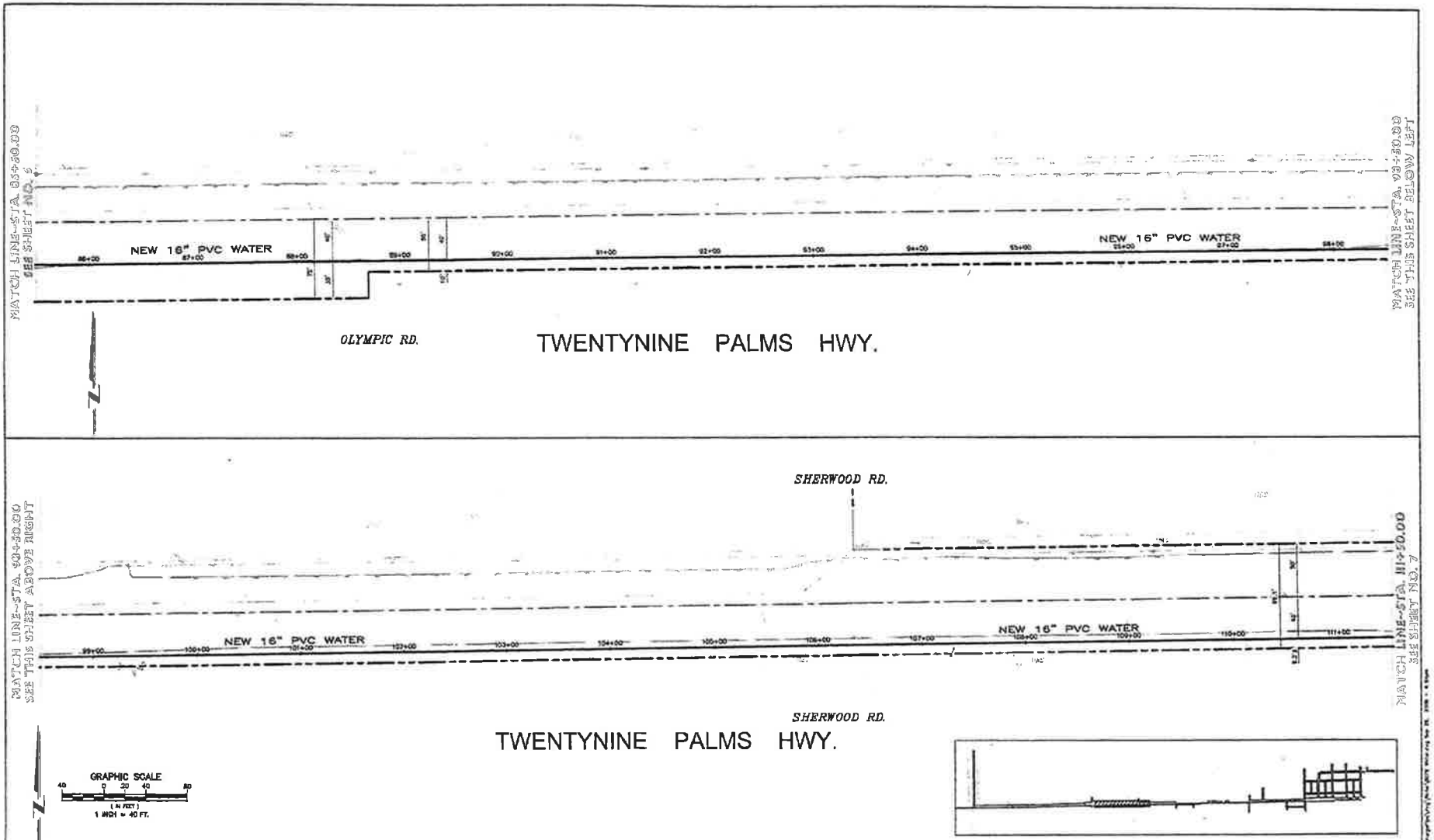

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PRELIMINARY DESIGN
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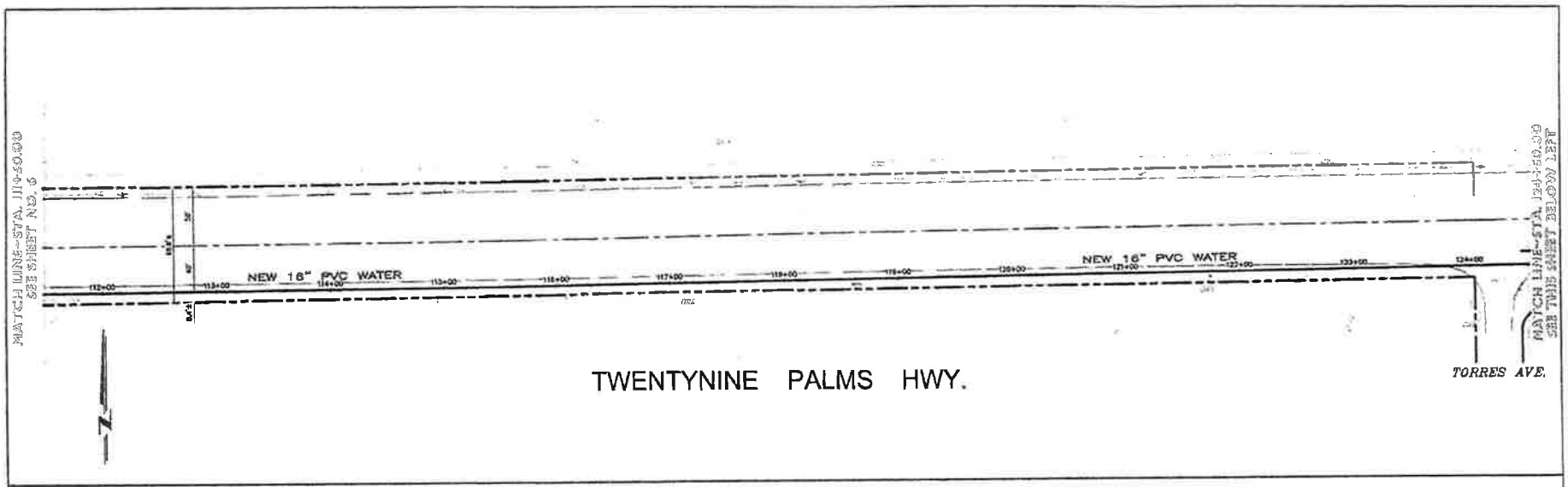

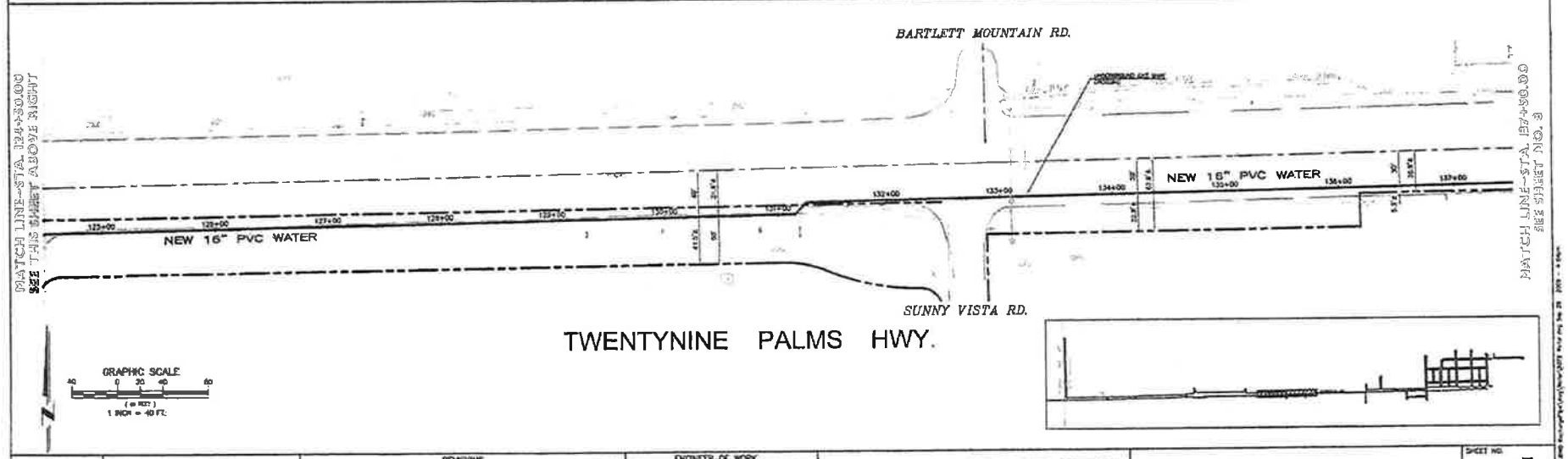

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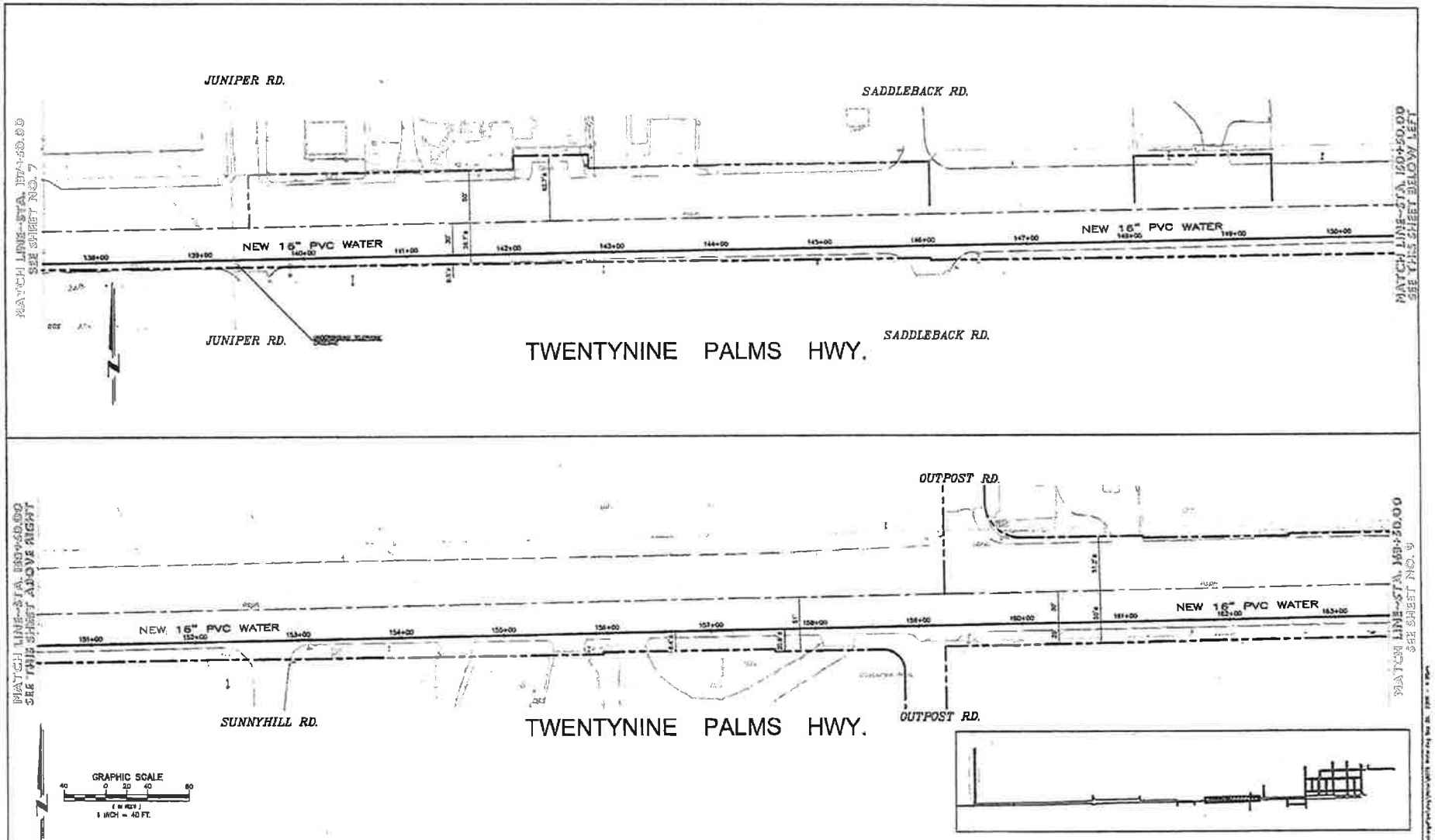

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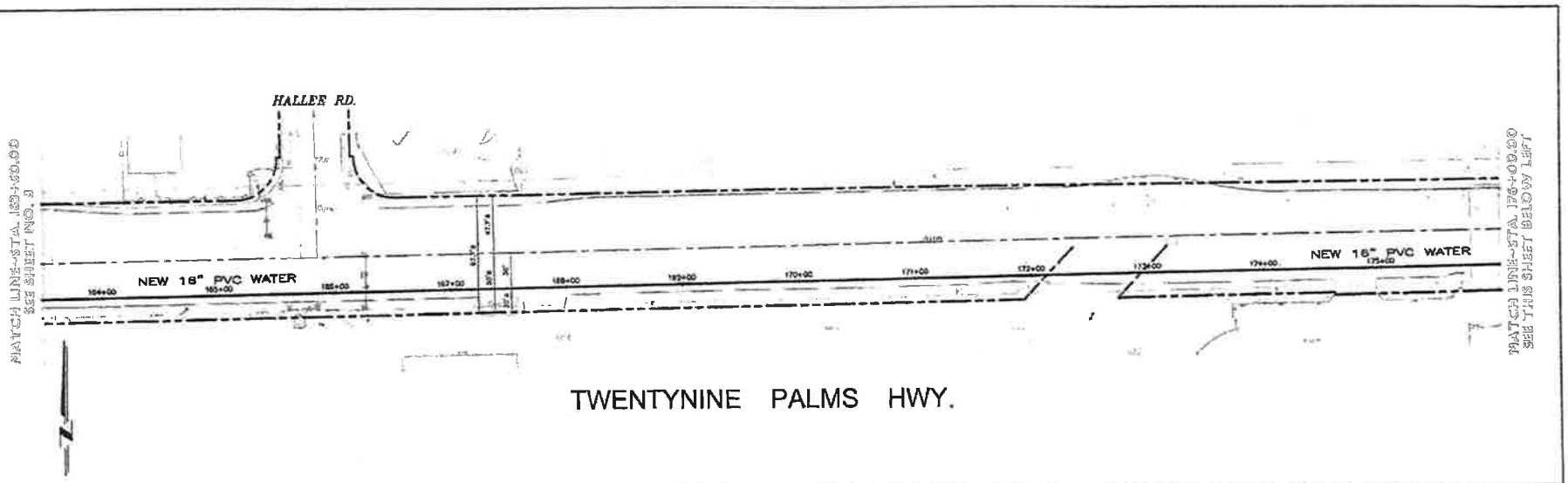
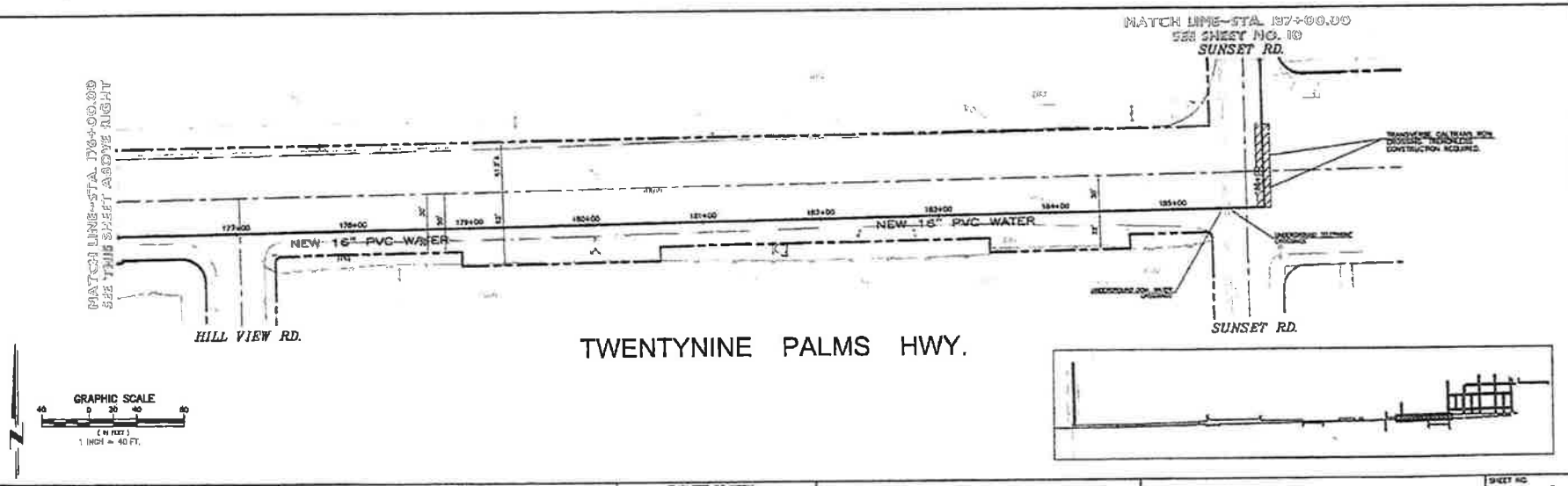
DATE: SEPTEMBER, 2009
W.O. 80078

•PRELIMINARY PLANS • NOT FOR CONSTRUCTION





DUDEK

REVISIONS

ENGINEER OF WORK

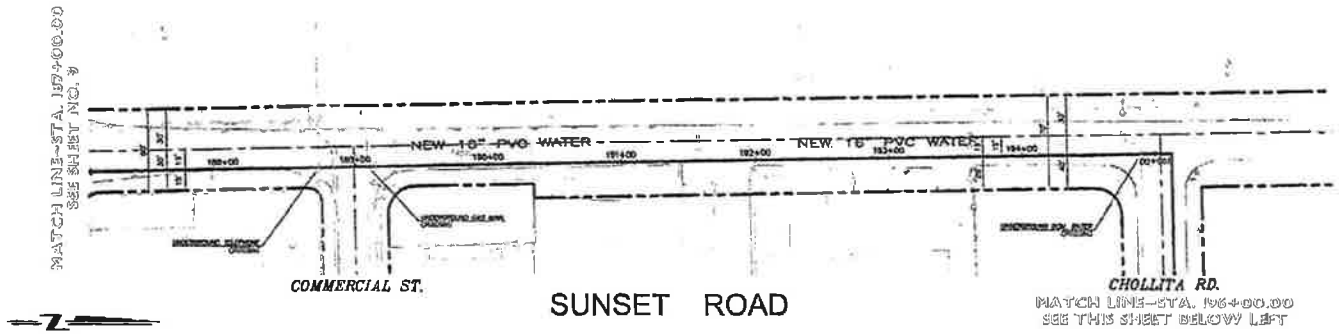
CHARLES H. GROLY
R.C.E. 59256, EXP. 06/30/10
DATE

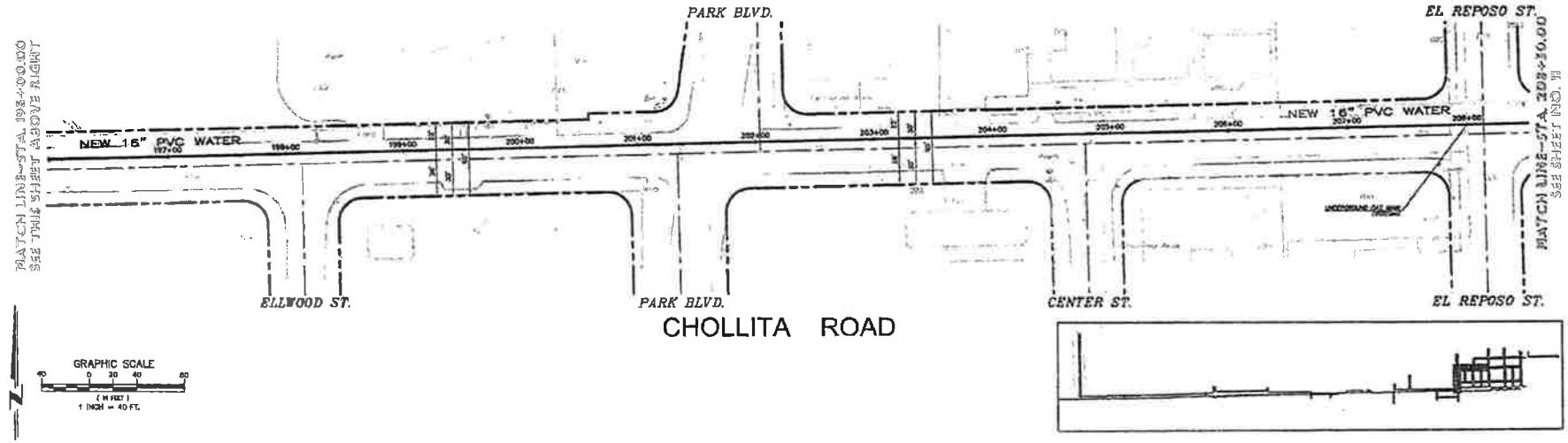
JOSHUA BASIN WATER DISTRICT
61-750 CHOLLITA ROAD
JOSHUA TREE, CA 92252-0675
TEL (760) 366-8438
FAX (760) 366-9528

PRELIMINARY DESIGN
FOR
RECHARGE BASIN PIPELINE

SHEET NO. 9
OF 12 SHEETS
DATE: SEPTEMBER, 2009
W.O. 9078

●PRELIMINARY PLANS ● NOT FOR CONSTRUCTION





DUDEK — Engineering, Planning, Environmental Sciences and Management Services

REVISIONS			
NO.	BY	DATE	REMARKS

ENGINEER OF WORK

CHARLES M. SPEED, R.C.E. 56304, EXP. 06/30/10 — DATE

DRAWN BY: P.V. / K.S.K.
DESIGN BY: K.S.K. / C.S.
CHECKED BY: D.M.K.

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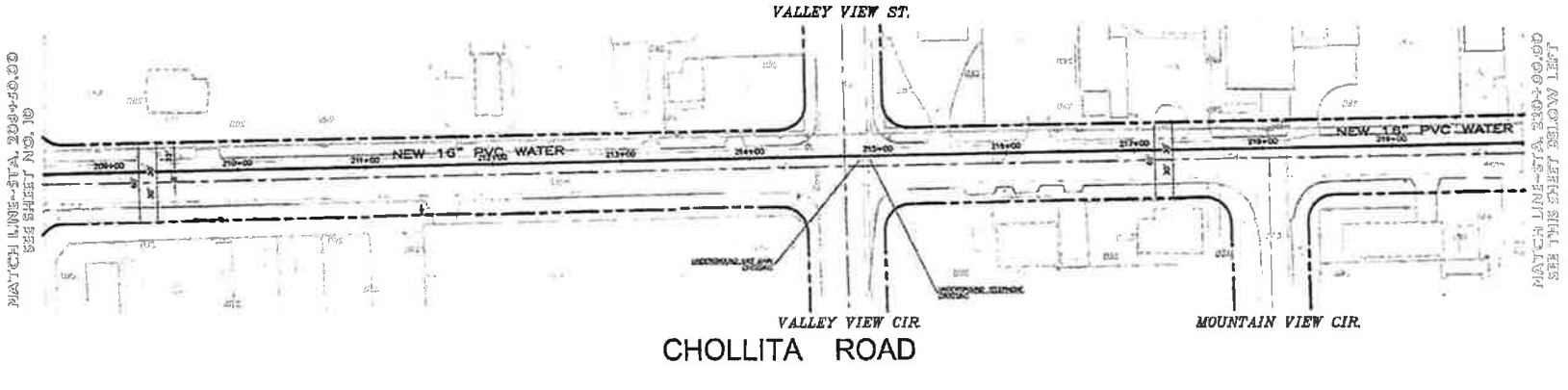
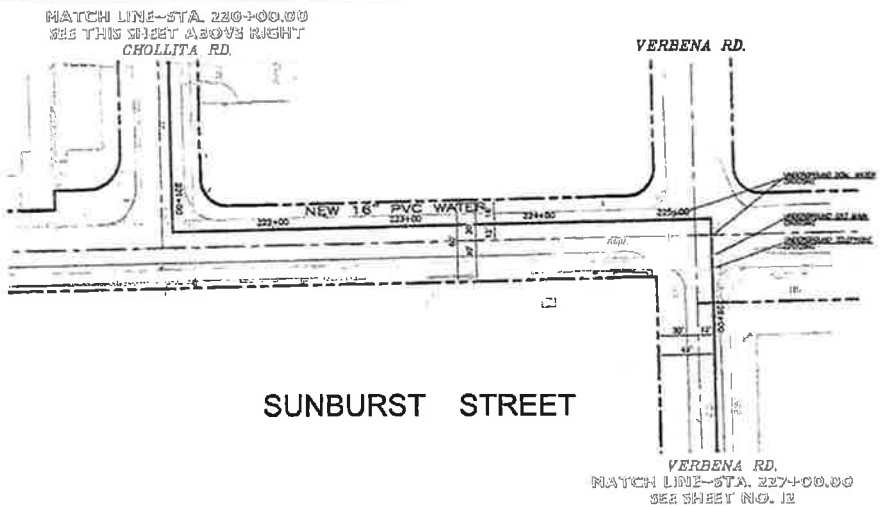
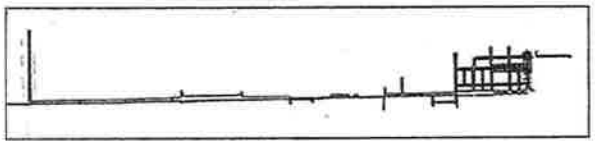
PRELIMINARY DESIGN
FOR
RECHARGE BASIN PIPELINE

SHEET NO. 10 OF 12 SHEETS
DATE: SEPTEMBER, 2008
W.O. 8078

•PRELIMINARY PLANS • NOT FOR CONSTRUCTION







GRAPHIC SCALE
40 0 20 40 80
(IN FEET)
1 INCH = 40 FT.

DUDEK
Engineering, Planning, Environmental Sciences and Management Services

REVISIONS			
NO.	BY	DATE	REMARKS

ENGINEER OF WORK
CHARLES N. GRESLY R.C.E. 49954, EXP. 06/30/10 DATE
DRAWN BY: P.K. / K.E.A.
DESIGN BY: K.E.A. / C.G.
CHECKED BY: C.N.G.

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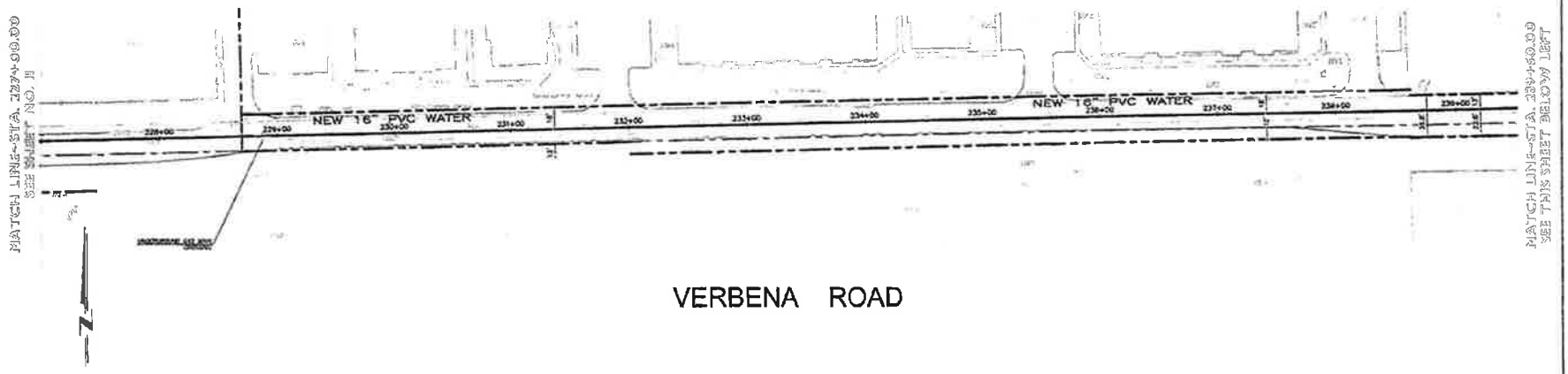
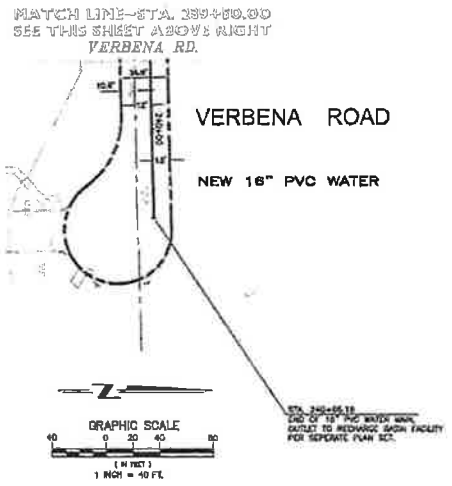
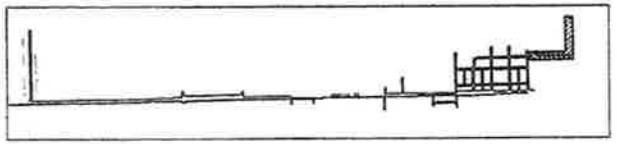
PRELIMINARY DESIGN
FOR
RECHARGE BASIN PIPELINE

SHEET NO. 11
OF 12 SHEETS
DATE: SEPTEMBER, 2009
W.O. 8079

•PRELIMINARY PLANS • NOT FOR CONSTRUCTION







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REVISIONS			
NO.	BY	DATE	REMARKS

ENGINEER OF WORK

CHARLES H. GREELY R.C.E. 56304, EXP. 06/30/10 — DATE

DRAWN BY: F.V. / K.S.B.
DESIGN BY: K.S.A. / C.S.
CHECKED BY: C.H.G.

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PRELIMINARY DESIGN
FOR
RECHARGE BASIN PIPELINE

SHEET NO. 12 OF 12 SHEETS
DATE: SEPTEMBER, 2009
W.O. 6072

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