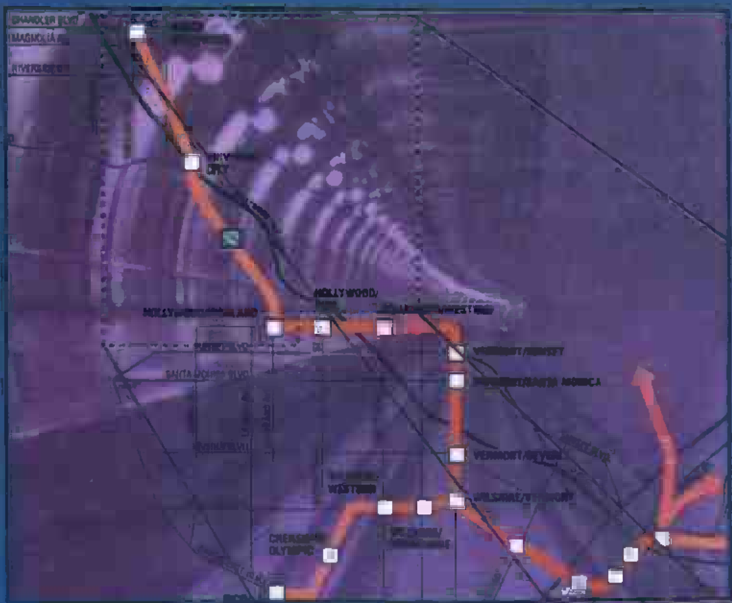
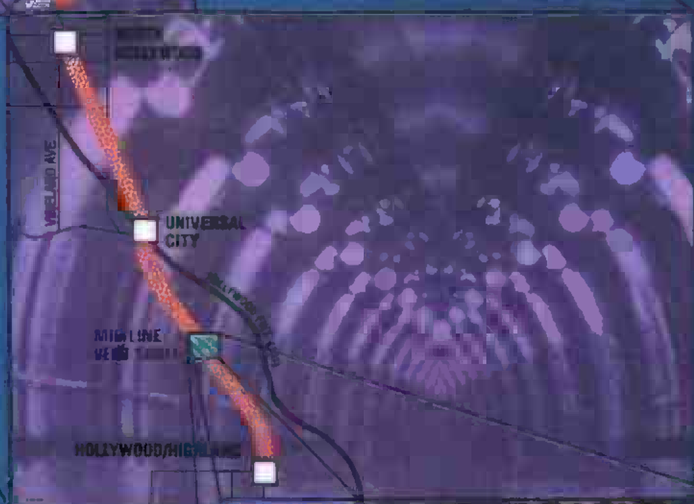
MID LINE VENT SHAFT (C0311) GROUNDWATER DISCHARGE ALTERNATIVES STUDY METRO RED LINE SEGMENT 3 (R 82) FINAL REPORT





Prepared for:

LACMTA/RCC

JUNE 17, 1994

Prepared by

ENGINEERING-SCIENCE INC.

Contract EN025
Metro Red Line Segment 3 (R 82)
Mid Line Vent Shaft (C0311)
Groundwater Discharge
Alternatives Study
Contract Work Order - 024

ES ENGINEERING-SCIENCE

THE PREPARATION OF THIS DOCUMENT HAS BEEN FINANCED IN PART THROUGH A GRANT FROM THE U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL TRANSIT ADMINISTRATION (FTA), UNDER THE FEDERAL TRANSIT ACT OF 1964, AS AMENDED, AND FUNDS FROM THE STATE OF CALIFORNIA

SEGMENT 3 METRO RED LINE (R82)

GROUNDWATER DISCHARGE ALTERNATIVES STUDY

MID-LINE VENTILATION SHAFT (C0311)

Submitted To:

The Rail Construction Corporation

Los Angeles County Metropolitan Transportation Authority

Submitted By:

Engineering-Science, Inc.

JULY 1994

FINAL
REPORT

SECTION 3

HYDROGEOLOGICAL DESCRIPTION

Detailed geotechnical and geological studies of the entire North Hollywood alignment have been conducted by various consultants and have been previously reported. For the purpose of summarizing the hydrogeology of the site, the following were reviewed: geotechnical investigation reports by The Earth Technology Corporation (TETC) [Ref. 2 and 3], and Segment 3 (R82) groundwater analysis report by Engineering-Science, Inc. (ES) [Ref. 4]. In addition to the report review, the Los Angeles County Flood Control District, the City of Los Angeles - Bureau of Sanitation and Department of Water and Power, and Engineering Management Consultants (EMC) were contacted by telephone and in person for review of files pertaining to the site. The reviews provided a knowledge of the hydrogeology of the shaft site, including the projection of quantity and duration of the dewatering flows, topography of the discharge location, accessibility from the site to the discharge points, and groundwater quality.

The shaft will be located in the eastern portion of the Santa Monica Mountains between the Hollywood Fault on the south and the Benedict Canyon Fault on the north. Near the shaft, the mountains are approximately three miles wide and consist of sedimentary, metamorphic, and igneous rocks ranging in age from Cretaceous to Upper Miocene. The rocks are discontinuous and comprise several formations including the Plutonic, Chico, Simi, Las Virgenes, and Upper, Middle and Lower Topanga Formations. These rocks were grouped by TETC according to lithology and geologic age. Figure 2 presents a geological profile along the tunnel alignment and the Mid-Line Ventilation Shaft, as adopted from the TETC report. At its current site, the shaft will be surrounded by Chico Formation and plutonic rock.

The Chico Formation extends from the surface to 400 feet in depth and consists of gravel and cobble conglomerates, thin claystone/shale layers, and interbedded sandstone. The rock is unaltered at tunnel depth and weathered near the surface. It is slightly to moderately well cemented, and jointed. The joints are closely spaced, tight, or filled with clay.

FINAL

TABLE OF CONTENTS

FINAL

FIGURES

TABLES

APPENDIX A

FINAL

SECTION 1

EXECUTIVE SUMMARY

Construction of the Mid-Line Vent Shaft (C0311) in the Santa Monica Mountains along the North Hollywood alignment (R82) of the Metro Red Line Segment 3 will require dewatering of the groundwater. The dewatering flows were projected by the Engineering Management Consultants (EMC) as 500 gallons per minute (gpm) at steady-state operation, following an initial flow of 1,500 gpm during startup (2 to 4 weeks). The purpose of this study was to evaluate the options for discharge of the water and recommend to the Los Angeles County Metropolitan Transportation Authority (MTA) the most suitable alternative(s). The topography of the shaft site and discharge locations, costs, implementation constraints and project schedule were considered in the evaluation of the alternatives. Sanitary sewer and storm drain discharge options, and potential for recharge (spreading) and reuse for landscape irrigation were the primary focus of the study. The location of the site, being in the mountains, limits the flexibility in exercising the options for effective management of the dewatering flows.

The hydrogeology of the site dictates that as the shaft excavation proceeds through the different geological formations, namely Chico and Plutonic, it is likely to encounter water of varying mineral quality. The concentration levels of the mineral constituents are expected to decrease over depth. The hydrogeological boundaries of the shaft site also indicate that the groundwater to be dewatered is not within the jurisdiction of the Upper Los Angeles River Area (ULARA) Watermaster, and hence no water rights issues are involved. Limited water quality analyses were obtained by sampling groundwater from two existing monitoring wells, previously installed by The Earth Technology Corporation (TETC). The sample results indicated that suspended solids (SS) and biological oxygen demand (BOD) may be higher than the NPDES Permit discharge standards. It is therefore recommended that MTA/RCC plan for the installation of a settling tank to handle dewatering flows of up 1,500 gpm at the shaft site. Considerations for space and location of the dewatering pumps and the settling tank must be addressed as part of the contract specifications for the Mid-Line Vent Shaft construction.

There is very limited scope for reusing the dewatering flows, either by recharge or through irrigation. Both recharge by spreading and reinjection do not appear to be feasible,

FINAL

due to prohibitive costs. While spreading may require up to 271 acres of land, reinjection will require extensive pumping and permitting. Reuse of the water for irrigation of natural vegetation within the vicinity of the Runyon Canyon Park is not recommended because the Department of Parks and Recreation prohibits this practice due to fire hazards. The only possible location is the Wattles Garden Park adjacent to Curson Avenue; however, only 2% (approximately 10 gpm) of the project dewatering flows will be needed for landscaping at this location. Such low demand does not justify pursuing this option due to expensive costs and time involved in the permitting and monitoring processes. Presence of trace radionuclides and slightly high BOD and SS levels also further discourages the recommendation of this option.

Discharge to the sanitary sewer or storm drain is possible although they are remotely located in the mountains. The sanitary sewer on Solar Drive will be the closest discharge point, however, such high discharge flows may not be allowed by the City of Los Angeles. Also, the existing 8-inch sewer line may not be adequate to carry the additional flow from the dewatering operation. The sanitary sewer discharge will also be costly in terms of sewer usage fees, which will be approximately $500,000 (0.5 Million dollars).

Discharge to a storm drain that is connected to the Los Angeles River is possible, only if a tunnel route exists from the shaft to Universal City. The execution of this option will be justified only if an existing pipeline within the tunnel can be used, since pumping, construction of a new pipeline (9,000 feet) and installation of wells for this purpose can cost up to $250,000. Use of an existing pipeline will bring the costs down to $100,000. For the present construction schedule this option may not be possible, however it is a recommended option if a change occurs in the construction schedule such as to implement this alternative. Discharge of the dewatering flows via the Universal City outfall can be covered by the MTA's Project-wide NPDES Permit through an amendment.

The two nearest storm drains are located on Curson Avenue and Larmar Avenue both within 3,000 feet from the shaft site. Both the storm drains discharge to the Ballona Creek. Costs for construction of the discharge system will be higher for the Larmar Avenue discharge because of pumping needs, whereas discharge at Curson Avenue will be by gravity flow. Combined permitting and construction costs for the Curson Avenue discharge will be $100,000 whereas for the Larmar Avenue discharge the total costs will be $135,000.

FINAL

Discharge at Curson Avenue is recommended over Larmar Avenue discharge, not only because of the lower costs but also due to the logistics and implementation considerations. It may also be argued that potential for landscape irrigation reuse at Wattles Garden Park near Curson Avenue, would strengthen the selection of the Curson Avenue discharge alternative. However, for reasons outlined above (costs for permitting and excessive monitoring), this reuse option is not recommended. Discharge at <u>either of the storm drains</u> will require a NPDES Permit from the RWQCB. Either a General NPDES Permit can be obtained for this purpose, or the Project-wide NPDES Permit can be amended to include the dewatering flows from the shaft site. The General Permit requires less time (one month) for processing and approval compared to six to nine months required for the amendment. Additional time for the City or County permits must be considered.

In addition to the NPDES Permit, discharge to the storm drain on Curson Avenue will require a connection permit from the Los Angeles County Flood Control District (LACFCD) and construction related permits from the City of Los Angeles. LACFCD also requires design drawings of the connection, and a hydraulic analysis to demonstrate that the project dewatering flows will not overload the existing storm drain system on Curson Avenue. On the other hand, discharge at the Larmar Avenue storm drain is expected to require minimal permitting from the City of Los Angeles.

The scope of the study was limited to the selection of a discharge alternative with respect to the present shaft location only; however, for different locations of the vertical shaft, or for a horizontal shaft at the same site, the information presented in this report can still be used on a limited scale. For instance, the logistics of the discharge system such as the need for a settling tank and permitting requirements and fees associated with them are applicable for most discharge options.

FINAL

SECTION 2

PROJECT DESCRIPTION

2.1 LOCATION

The North Hollywood segment (R82) of Metro Red Line Segment 3 will extend from the terminus of Segment 2 at the Hollywood/Highland Station through the Santa Monica Mountains to the North Hollywood Station at Lankershim/Chandler, a total distance of 6.3 miles. The alignment will include a Mid-Line Ventilation Shaft, between Universal City Station and the La Brea Shaft. Construction of the ventilation shaft will require excavation of an 800 feet vertical ventilation sink in the Santa Monica mountains. Since the groundwater table is present above the proposed tunnel alignment through the mountains, the construction of the shaft will require dewatering of the groundwater to facilitate the excavation. Groundwater that will be encountered during the excavation of the Mid-Line Vent Shaft at its present location is not within the jurisdiction of the Upper Los Angeles River Area (ULARA) Watermaster, and hence no water rights issues are involved [Ref. 1]. Figure 1 presents a layout of the Metro Red Line, Segments 1, 2 and 3.

2.2 PROJECT BACKGROUND

Groundwater at the proposed shaft location occurs approximately 130 feet below ground surface, or 700 feet above the tunnel crown, thereby requiring dewatering during the construction phase. When no reuse alternatives are available, the extracted groundwater is normally discharged to a storm drain or sanitary sewer system. Discharge to the storm drain will require a National Pollutant Discharge Elimination System (NPDES) Permit administered by the Regional Water Quality Control Board (RWQCB), while sanitary sewer discharge is regulated by the local city or county. The location of the Mid-Line Vent Shaft is within the Santa Monica Mountains where storm drainage system conveyances are remotely located relative to the construction site, and the projected dewatering flows may be too high to discharge to the nearby sanitary sewer.

2.3 SCOPE

The purpose of this report is to present different alternatives for the discharge/reuse of groundwater dewatering flows generated from the construction of the shaft. Section 3 describes the hydrogeology of the site, summarized from previous studies of the alignment. Section 4 presents the groundwater quality likely to be encountered during actual dewatering. The groundwater quality as reported in previous studies, and present conditions as found from fresh groundwater samples are summarized in this section. The various discharge alternatives ranging from discharge to the storm drain or sanitary sewer to recharge by spreading, are presented in Section 5. The permitting requirements, feasibility and logistics for the implementation of each alternative, suitable locations for discharge or recharge and costs associated with each discharge alternative are also discussed in Section 5. Section 6 concludes the report by identifying the best available solution, implementation requirements, and recommendations.

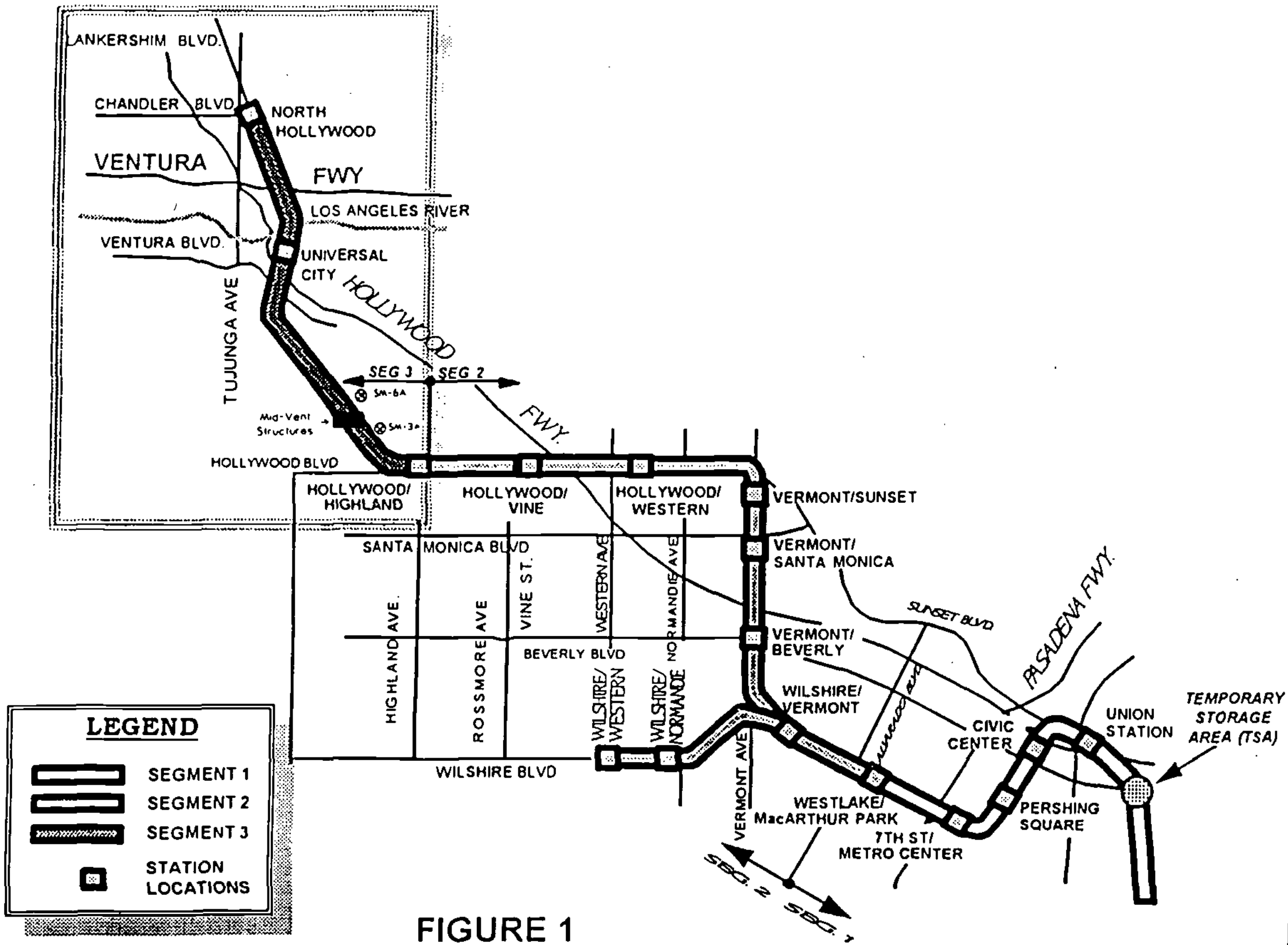

LANKERSHIM BLVD.
CHANDLER BLVD.
NORTH HOLLYWOOD
VENTURA FWY
LOS ANGELES RIVER
VENTURA BLVD.
UNIVERSAL CITY
HOLLYWOOD FWY.
TUJUNGA AVE
SEG 3
SEG 2
SM-6A
SM-3A
Mid-Vent Structures
HOLLYWOOD BLVD
HOLLYWOOD/ HIGHLAND
HOLLYWOOD/ VINE
HOLLYWOOD/ WESTERN
VERMONT/SUNSET
VERMONT/ SANTA MONICA
SANTA MONICA BLVD
HIGHLAND AVE.
ROSSMORE AVE
VINE ST.
WESTERN AVE
NORMANDIE AVE
VERMONT/ BEVERLY
BEVERLY BLVD
SUNSET BLVD
PASADENA FWY.
WILSHIRE/ WESTERN
WILSHIRE/ NORMANDIE
WILSHIRE/ VERMONT
VERMONT AVE
WILSHIRE BLVD
WESTLAKE/ MacARTHUR PARK
7TH ST/ METRO CENTER
CIVIC CENTER
PERSHING SQUARE
UNION STATION
TEMPORARY STORAGE AREA (TSA)
SEG. 2
SEG. 1
LEGEND
SEGMENT 1
SEGMENT 2
SEGMENT 3
STATION LOCATIONS

FIGURE 1

SECTION 3

HYDROGEOLOGICAL DESCRIPTION

Detailed geotechnical and geological studies of the entire North Hollywood alignment have been conducted by various consultants and have been previously reported. For the purpose of summarizing the hydrogeology of the site, the following were reviewed: geotechnical investigation reports by The Earth Technology Corporation (TETC) [Ref. 2 and 3], and Segment 3 (R82) groundwater analysis report by Engineering-Science, Inc. (ES) [Ref. 4]. In addition to the report review, the Los Angeles County Flood Control District, the City of Los Angeles - Bureau of Sanitation and Department of Water and Power, and Engineering Management Consultants (EMC) were contacted by telephone and in person for review of files pertaining to the site. The reviews provided a knowledge of the hydrogeology of the shaft site, including the projection of quantity and duration of the dewatering flows, topography of the discharge location, accessibility from the site to the discharge points, and groundwater quality.

The shaft will be located in the eastern portion of the Santa Monica Mountains between the Hollywood Fault on the south and the Benedict Canyon Fault on the north. Near the shaft, the mountains are approximately three miles wide and consist of sedimentary, metamorphic, and igneous rocks ranging in age from Cretaceous to Upper Miocene. The rocks are discontinuous and comprise several formations including the Plutonic, Chico, Simi, Las Virgenes, and Upper, Middle and Lower Topanga Formations. These rocks were grouped by TETC according to lithology and geologic age. Figure 2 presents a geological profile along the tunnel alignment and the Mid-Line Ventilation Shaft, as adopted from the TETC report. At its current site, the shaft will be surrounded by Chico Formation and plutonic rock.

The Chico Formation extends from the surface to 400 feet in depth and consists of gravel and cobble conglomerates, thin claystone/shale layers, and interbedded sandstone. The rock is unaltered at tunnel depth and weathered near the surface. It is slightly to moderately well cemented, and jointed. The joints are closely spaced, tight, or filled with clay.

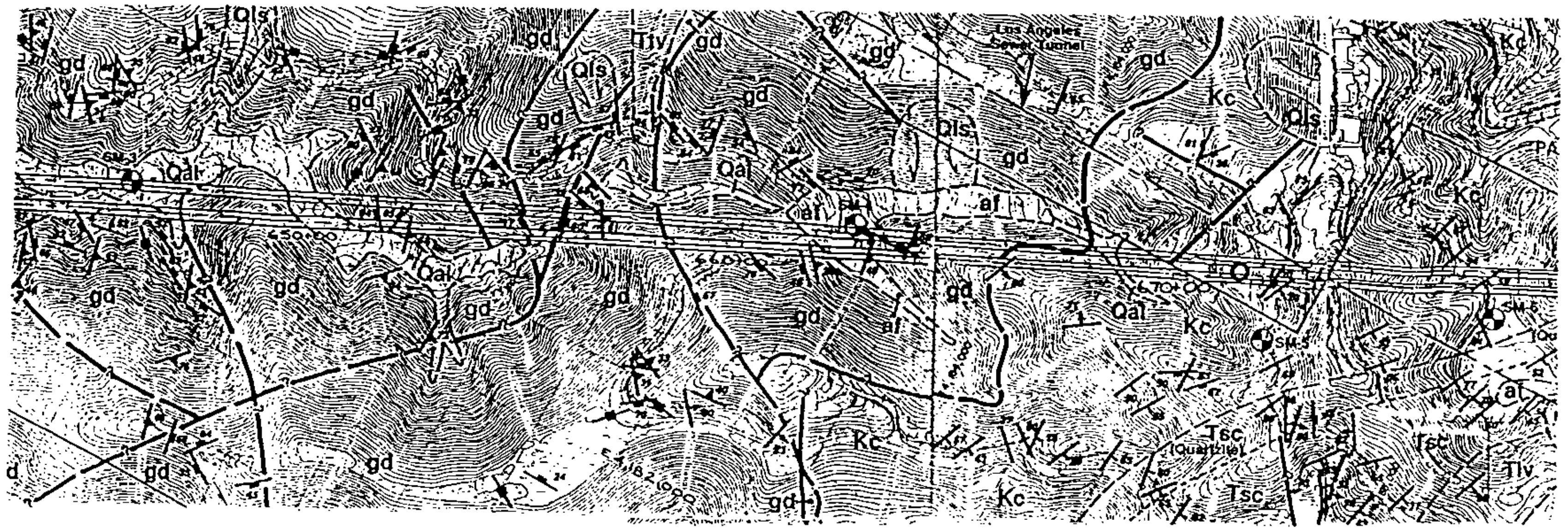
FINAL

The Chico is truncated by a sheared zone forming an unnamed fault. The fault is approximately 15 feet wide and contains brecciated/sheared rock, siltstone clasts, and other conglomeritic fragments. Weathering and shearing are anticipated on the upper and lower fault surface.

Underlying the fault, are plutonic rocks comprising undifferentiated granodiorite, quartz diorite, and quartz monzonite. These rocks are generally massive and irregularly jointed and fractured. The joint spacings range from 2 to 8 inches, but may be less in the shaft alignment. The fracture spacings are from a few inches to tens of feet and form weathered and brecciated zones within the rock.

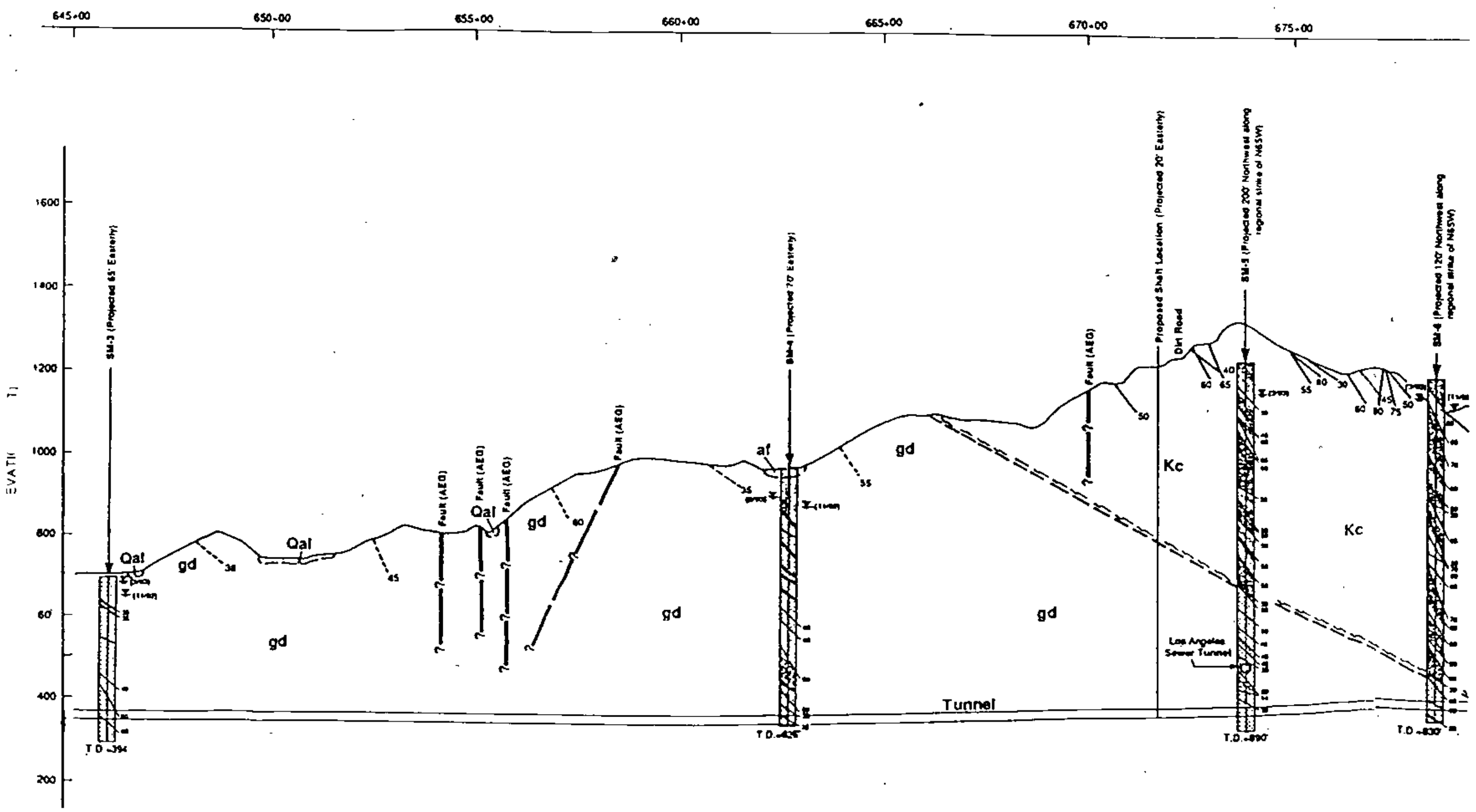
Groundwater occurs approximately 130 feet below ground surface, or 700 feet above the tunnel crown, and flows south in response to the topography and the degree of fracturing within each rock type. During construction of the Los Angeles Sewer tunnel, 70 and 850 gallons per minute (gpm) of groundwater flowed from the sedimentary (including conglomeritic) and plutonic rocks, respectively. These flows correspond to 100,000 gpd and 1,221,000 gpd, respectively.

In May 1994, EMC provided estimates of flow rates for the dewatering operation to construct the proposed Mid-Line Vent Shaft. Their estimate indicated that during the initial 2 to 4 weeks of construction, the flow rate will be high at 1,500 gpm; after this initial period, a steady-state flow of 400-600 gpm is expected [Ref. 5]. For the purpose of the discharge alternatives study in this report, a flow rate of 500 gpm from dewatering operations was considered.



Geologic Plan and Profile

Scale: 1" = 400' (Horizontal and Vertical)



EXPLANATION

Lithologic Symbols (Used in Borings)

- Plutonic Rocks
- Sandstone
- Conglomerate
- Conglomeratic Sandstone
- Shale/Siltstone
- Basalt
- Brecciated Basalt
- Alluvium or other surficial deposit
- Basalt Dike
- Shear Zone

Geologic Symbols

- Geologic Contact, dashed where approximately located, queried where uncertain
- Fault, dashed where approximately located, queried where uncertain, dotted where buried, arrow indicates dip direction and amount, D, downthrown side, U, upthrown side, parallel arrows indicate relative direction of movement
- Anticline, dashed where approximately located
- Syncline, dashed where approximately located
- 52 Bedding, strike and dip
- 50 Approximate Bedding, strike and dip
- Vertical Bedding, strike
- 35 Foliation, strike and dip
- 60 Joint, strike and dip
- Vertical Joint, strike
- 55 Shear, strike
- 60 Apparent inclination of typical bedding with respect to geologic profile from measurements made during geologic mapping
- 60 Apparent inclination of typical foliation with respect to geologic profile from measurements made during geologic mapping
- Sheer Zone
- Basaltic Dike

Explanation

Geologic Units

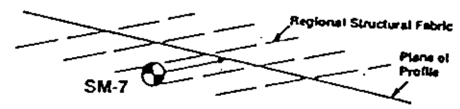
Quaternary	af	Artificial Fill
Quaternary	Qal	Alluvium
Quaternary	Qls	Landslide Debris
Tertiary – Miocene	Ttu (ss+sh)	Upper Topanga Formation, interbedded sandstone and shale
Tertiary – Miocene	Ttu (ss+Cgl)	Upper Topanga Formation, sandstone with conglomerate interbedded
Tertiary – Miocene	Tts	Middle Topanga Formation, sandstone
Tertiary – Miocene	Ttv	Middle Topanga Formation, basalt and basalt breccia
Tertiary – Miocene	Ttl	Lower Topanga Formation, sandstone with conglomerate interbedded
Tertiary – Paleocene	Tlv	Las Virgenes Sandstone, sandstone with shale in upper part
Tertiary – Paleocene	Tsc	Simi Conglomerate, conglomerate with sandstone interbedded bottom half consists predominantly of quartzite clasts
Cretaceous	Kc	Chico Formation- Conglomerate with sandstone interbedded
Cretaceous	gd	Plutonic Rocks- granodiorite, quartz diorite and quartz monzonite

Other Symbols

- SM- Boring by The Earth Technology Corporation, this investigation
- R- Boring by The Earth Technology Corporation, completed in 1989
- CEG-33- Boring by Converse and others, (1981,1984c)
- Mid Line Vent Shaft Location
- Boring, illustrating the maximum inclination of bedding in sedimentary rock or foliation in plutonic rock measured in the core samples, orientation is estimated based on geologic trends in the vicinity
- Location of Groundwater observed and date measured
- T D +206 T.D - Total Depth of Boring
- Potentiometric Groundwater Surface
- Runyon Canyon Park Boundary
- Existing Tunnel Alignment

Notes:

1. Geologic profile constructed along centerline of AR track.
2. Geologic structures (contacts and faults) have been projected to the locations where they are anticipated to be encountered in the tunnel. The projections are based on geologic mapping at the surface combined with subsurface data obtained from widely spaced borings and L.A. City Sewer Tunnel as-built geologic logs, and should be considered as approximate only.
3. Exploratory borings that are not located on the alignment are projected to the geologic profile along the strike of the regional structural fabric as shown below.



4. Boring SM-5 has been projected onto the profile parallel to the regional structure so that it appears to intersect the Los Angeles Sewer Tunnel. Boring SM-5 is actually located approximately 200 feet east of the sewer tunnel alignment as shown on the plan view.

The Earth Technology Corporation	Project No. 92-2050 Geotechnical Investigation Santa Monica Mountains Segment 3, Metro Red Line

Geologic Plan and Profile

Figure 2

6-93 Plate 2

SECTION 4

GROUNDWATER QUALITY

4.1 TETC STUDY

Groundwater quality for the Santa Monica mountains was assessed from data collected by The Earth Technology Corporation [Ref. 2], which indicated varying groundwater quality according to rock type. The groundwater in the undifferentiated granite/granodiorite appears to contain mineral constituents in low levels. Groundwater in the Chico, Middle Topanga, and Upper Topanga formations contains high total dissolves solids (TDS) and sulfate. Two monitoring wells installed by the TETC, were identified to be close to the shaft site: SM-3A and SM-6A, located in the tunnel right-of-way within the vicinity of the site. Results of sampling from these wells by TETC indicate that concentrations of volatile organic compounds, semi-volatile organic compounds, total recoverable petroleum hydrocarbons, and oil and grease were detected sporadically at low levels. The report suggests that low concentrations of chloroform, bis (2-ethylhexyl) phthalate, and oil and grease may have resulted from drilling/sampling methods. The basis for this conclusion was limited quality control sample analyses of laboratory and trip blanks. The results also indicate the presence of relatively high TDS and sulfate concentrations in SM-6A. TETC groundwater analytical results are summarized in Table 1.

4.2 SAMPLING BY ES

To obtain the present groundwater quality near the shaft site and as a cross reference to the TETC study, samples from monitoring wells SM-3A and SM-6A were obtained on May 17, 1994 by Engineering-Science (ES) personnel. The sample parameters including radionuclides were selected based on recommendation by the RWQCB staff. The well locations and sampling procedures are summarized below. The analytical results are summarized in Table 1.

4.2.1 Well Locations

Well SM-3A is located in Hollywood on Fuller Avenue inside the Runyon Canyon Park Gate, and well SM-6A is located in the Runyon Canyon Park off Mulholland Drive at the terminus of Desmond Estates Road. Figure 1 shows the locations of the wells. Figure

FINAL

pump was then run for approximately five minutes while fully submersed. All equipment was rinsed thoroughly prior to subsequent use.

4.2.5 Transport of Purged Water

Fluids produced from the well purging and decontamination activities were placed in drums and transported to the MTA Temporary Storage Area, located at 840 Commercial Street in Los Angeles. Based on analysis of the groundwater from these wells, the groundwater is considered "clean" by all definitions of federal, state and local laws and regulations.

4.2.6 Sample Analytical Results

Samples were analyzed by B C Analytical, a State certified laboratory. The results indicated that no semi volatile and volatile constituents were present in the water, except phthalates. The presence of phthalates can be attributed to possible sampling or laboratory cross contamination. Gross Alpha was detected in SM-6A at 11 ± 6.6 pCi/L. At the lower end of the concentration (i.e. 4.4 pCi/L), the Gross Alpha particle activity is within the California Maximum Contaminant Level (MCL) for drinking water. Asbestos fibers were also detected in trace levels at SM-6A . TDS and sulfate concentrations ranged from 410 and 63 mg/L in SM-3A to 1,100 and 500 mg/L in SM-6A, respectively. Suspended solids and BOD_5 were detected at levels exceeding regulatory limits for discharge in samples from SM-6A and SM-3A, respectively.

4.3 SUMMARY

SM-6A is installed in the Chico formation and SM-3A in the plutonic rock formation. Sample results from TETC and ES indicate that water quality parameters, specifically TDS and sulfate, are at low concentrations in the undifferentiated plutonic rock formation and high in the Chico Formation. Since shaft excavation will penetrate through both rock formations, it is possible that the quality of the dewatering fluids will change in terms of TDS and sulfate (i.e. decreasing TDS and sulfate from top to bottom). The high TDS and sulfate concentrations are not expected to impact storm drain or sewer discharge alternatives under study.

FINAL

Table 1
Summary of Analyses of Groundwater Samples from SM-6A and SM-3A

Parameter	ES- Results		TETC- Results	
	05/17/94	05/17/94	07/93	07/93
	SM-6A	**SM-3A**	**SM-6A**	**SM-3A**
Arsenic, mg/L	< 0.002	< 0.002	ND	ND
Antimony, mg/L	< 0.1	< 0.1	ND	ND
Barium, mg/L	0.026	0.028	0.013	0.05
Beryllium, mg/L	< 0.001	< 0.001	ND	ND
Cadmium, mg/L	< 0.005	< 0.005	ND	ND
Chromium, mg/L	< 0.01	< 0.01	ND	ND
Cobalt, mg/L	< 0.04	< 0.04	ND	ND
Copper, mg/L	< 0.02	< 0.02	ND	ND
Lead, mg/L	< 0.05	< 0.05	ND	ND
Mercury, mg/L	< 0.0002	< 0.0002	ND	ND
Molybdenum, mg/L	< 0.01	< 0.01	ND	ND
Nickel, mg/L	< 0.04	< 0.04	ND	ND
Selenium, mg/L	< 0.004	< 0.004	ND	ND
Silver, mg/L	< 0.01	< 0.01	ND	ND
Thallium, mg/L	< 0.07	< 0.07	ND	ND
Vanadium, mg/L	< 0.04	< 0.04	ND	ND
Zinc, mg/L	0.022	< 0.01	0.04	0.025
Total Fibers, MFL	18	ND	-	-
Asbestos Fibers, Fibers > 10 um in length, MFL	4.4	ND	-	-
Asbestos Fibers, Fibers > 5 um in length, MFL	8.8	ND	-	-
Survival Undiluted Waste, Percent	100	100	-	-
Cyanide, mg/L	< 0.02	< 0.02	-	-
Nitrate + Nitrite (as NO_3), mg/L	< 0.2	2.1	ND	ND
Nitrate + Nitrite (as N), mg/L	< 0.05	0.47	ND	62
Oil and Grease, mg/L	0.29	< 0.2	ND	0.06
BOD_5, mg/L	< 7	56	4.2	2.2
Sulfate, mg/L	500	63	470	78
Turbidity, NTU	38	4.5	320	190
Sulfide, mg/L	< 0.1	< 0.1	ND	ND
Dissolved Solids, mg/L	1100	410	1020	590
Settleable Solids, mL/L	< 0.1	< 0.1	1.5	0.6
Suspended Solids, TSS, mg/L	58	< 5	870	500
Chloride, mg/L	49	37	46	32
Boron, mg/L	0.082	0.0760	-	-
Radioactivity- Gross Alpha, pCi/L	11 ± 6.6	7.4 ± 5.6	-	-
Radioactivity- Gross Beta, pCi/L	11 ± 2.8	13 ± 4.0	-	-
1,2,4-Trichlorobenzene, ug/L	< 5	< 5	-	-
1,2-Dichlorobenzene, ug/L	< 6	< 6	ND	ND
1,2-Diphenylhydrazine, ug/L	< 5	< 5	-	-

ND - None Detected at Laboratory Detection Limits
\- Not Analyzed

Table 1 (continued)
Summary of Analyses of Groundwater Samples from SM-6A and SM-3A

Hexachlorocyclopentadiene, ug/L	< 5	< 5	ND	ND
Hexachloroethane, ug/L	< 5	< 5	ND	ND
Indeno(1,2,3-c,d)pyrene, ug/L	< 7	< 7	ND	ND
Isophorone, ug/L	< 5	< 5	ND	ND
N-Nitrosodimethylamine, ug/L	< 6	< 6	ND	ND
N-Nitrosodiphenylamine, ug/L	< 5	< 5	ND	ND
N-Nitrosodi-n-propylamine, ug/L	< 6	< 6	ND	ND
Nitrobenzene, ug/L	< 5	< 5	ND	ND
Naphthalene, ug/L	< 5	< 5	ND	ND
Phenanthrene, ug/L	< 5	< 5	ND	ND
Phenol, ug/L	< 5	< 5	ND	ND
Pentachlorophenol, ug/L	< 5	< 5	ND	ND
Pyrene, ug/L	< 5	< 5	ND	ND
Pyridine, ug/L	< 10	< 10	ND	ND
Bis(2-chloroethoxy)methane, ug/L	< 5	< 5	ND	ND
Bis(2-chloroethyl)ether, ug/L	< 5	< 5	ND	ND
Bis(2-chloroisopropyl)ether, ug/L	< 6	< 6	ND	ND
Bis(2-ethylhexyl)phthalate, ug/L	10	11	ND	ND
1,1,1-Trichloroethane, ug/L	< 1	< 1	ND	ND
1,1,2-Trichlor-1,2,3-trifluoroethane, ug/L	-	-	ND	ND
1,1,2,2-Tetrachloroethane, ug/L	< 1	< 1	ND	ND
1,1,2-Trichloroethane, ug/L	< 1	< 1	ND	ND
1,1-Dichloroethane , ug/L	< 1	< 1	ND	ND
1,1-Dichloroethene, ug/L	< 1	< 1	ND	ND
1,2-Dichloroethane, ug/L	< 1	< 1	ND	ND
1,2-Dichlorobenzene, ug/L	< 1	< 1	-	-
1,2-Dichloropropane, ug/L	< 1	< 1	ND	ND
1,3-Dichlorobenzene, ug/L	< 1	< 1	-	-
1,4-Dichlorobenzene, ug/L	< 1	< 1	-	-
2-Chloroethylvinylether, ug/L	< 1	< 1	-	-
2-Hexanone, ug/L	< 5	< 5	ND	ND
Acetone, ug/L	< 20	< 20	ND	ND
Acrolein, ug/L	< 50	< 50	-	-
Acrylonitrile, ug/L	< 50	< 50	-	-
Bromodichloromethane, ug/L	< 1	< 1	ND	ND
Bromomethane, ug/L	< 1	< 1	ND	ND
Benzene, ug/L	< 1	< 1	ND	ND
Bromoform, ug/L	< 1	< 1	ND	ND
Chlorobenzene, ug/L	< 1	< 1	ND	ND
Carbon Tetrachloride, ug/L	< 1	< 1	ND	ND
Chloroethane, ug/L	< 1	< 1	ND	ND
Chloroform, ug/L	< 1	< 1	ND	ND
Chloromethane, ug/L	< 1	< 1	ND	ND
Carbon Disulfide, ug/L	< 2	< 2	ND	ND
Dibromochloromethane, ug/L	< 1	< 1	-	-
Ethylbenzene, ug/L	< 1	< 1	ND	ND
Freon 113, ug/L	< 2	< 2	-	-
Methyl ethyl ketone, ug/L	< 5	< 5	-	-

ND - None Detected at Laboratory Detection Limits
\- Not Analyzed

SECTION 5

ALTERNATIVES STUDY

Several alternatives are evaluated and presented in this report, for management of groundwater generated from the shaft, including discharging the groundwater to sanitary or storm sewers and recharging by spreading or irrigation. In general, the criteria used in this evaluation include relative effectiveness, cost, permitting requirements, and scheduling needs of each option. The alternatives are summarized in Table 3. Each alternative is considered for a projected steady-state dewatering flow rate of 500 gpm, as estimated by the EMC.

To compare the different alternatives in terms of costs, a preliminary cost estimate was prepared. The scope of the cost estimate was based on construction and operation of a conveyance system initiating from the proposed settling tank at the dewatering site to the various discharge locations. Costs associated with pumping the dewatered flows from the shaft sink to the proposed settling tank, and labor costs for the operation and maintenance of the discharge system are not included in the estimate. The cost estimate worksheets and the assumptions used in the calculations are included in Appendix A.

5.1 DISCHARGE TO SANITARY SEWER

The Mid-Line Vent Shaft site is approximately 300 feet away from an existing manhole and sanitary sewer system, located on Solar Drive. The sanitary sewer system is maintained by the City of Los Angeles, Department of Public Works. To discharge to the sewer manhole which is at a higher elevation than the shaft site, the dewatered flows will require pumping. A below-grade pipeline could be placed along a LADWP access road for this purpose. The below-grade pipeline is suggested so as not to interfere with construction machinery and traffic. The existing 8" vitrified clay pipe (VCP) sewer line along Solar Drive conveys sanitary waste to the Hyperion Treatment Plant located in Playa Del Rey.

Discharge to the sanitary sewer is discouraged by the RWQCB and the City of Los Angeles (City). Discharge under this alternative will require permit approval from the City Bureau of Engineering and Bureau of Sanitation Industrial Waste Division. The following is a list of the permits and fees associated with this discharge alternative:

FINAL

Project is not classified as a SIU and is on an exempt status. Therefore, this fee will not be applicable.

A limited construction cost estimate was prepared for the piping, trenching, backfilling, street resurfacing and pumping needs. This estimate amounts to approximately $85,000 for the three year dewatering period. The estimate does not include any labor cost associated with the operation and maintenance of the system along the LADWP access road. Figure 3 presents a plan view of the shaft site and the connection to the existing sewer manhole, and Figure 4 presents a schematic of the discharge route.

Combining the construction costs and permitting fees, implementation of this discharge alternative will cost approximately $532,000. The costs can be reduced in half if after one year of discharge to the sanitary sewer, the flow is transported through the excavated tunnel section and discharged to the Los Angeles River near University City. The costs for this combination of discharges are estimated to be approximately $250,000.

5.2 DISCHARGE TO STORM DRAIN (BALLONA CREEK)

The Mid-Line Vent Shaft site is within the Santa Monica Mountains where storm drainage system conveyances are remotely located relative to the excavation site. However, there are two locations where the flow can be discharged to the existing storm drain system; Larmar Avenue and Curson Avenue. Both storm drains ultimately discharge to the Ballona Creek.

Discharge of extracted groundwater to the storm drain system requires a NPDES permit administered by the Regional Water Quality Control Board (RWQCB). In the case of discharge at Larmar Avenue or Curson Avenue, a General NPDES permit from the RWQCB, Los Angeles Region, will be required. The General NPDES Permit will cost $1,000 and may take up to 2 months for processing by the RWQCB. General Permit requirements and key discharge limitations are summarized in Table 2. Receiving water criteria with respect to TDS, chloride and sulfate concentrations do not apply to Ballona Creek. It is also possible to discharge the dewatering flows under the project-wide NPDES Permit through an amendment. However, the amendment will require six to nine months for processing and approval by the RWQCB.

FINAL

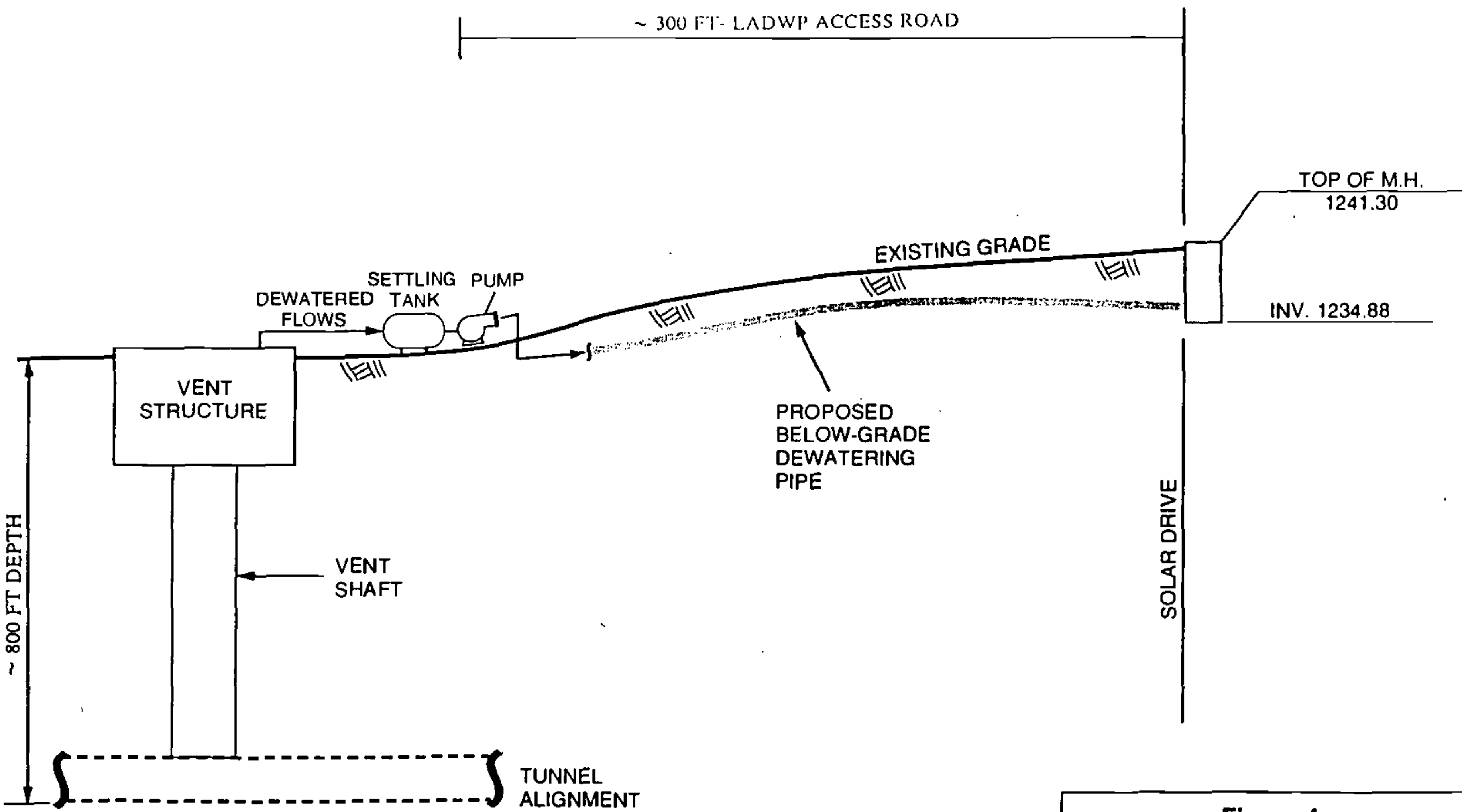


Figure 4
Mid-line Vent Shaft-Schematic
Discharge to Sanitary Sewer
Solar Drive

Date: June 1994   Not to Scale

ES ENGINEERING-SCIENCE

R889-2611/YO-FX

A settling tank must be provided if high levels of suspended solids and settleable matter are encountered. Based on the groundwater sampling data from monitoring wells SM-3A and SM-6A (refer Table 1), treatment of dewatered flows for other constituents is not required.

For the storm drain discharge, MTA/RCC will be required to implement and conduct a river monitoring program to verify that project discharges do not exceed applicable NPDES Permit limits.

5.2.1 Larmar Avenue

The nearest accessible storm drain inlet is located approximately 1,400 feet east of the Mid-Line Vent Shaft site on Larmar Avenue, and drains to the Ballona Creek. This storm drain system is maintained and managed by the City of Los Angeles.

The location of the shaft in the mountains and the topography require that the dewatering flow be conveyed in three piping segments. The first segment will consist of a below-grade pipe from the shaft site to a ridge 450 feet east of the site. Since the ridge is at a higher elevation, pumping will be required. Below-grade piping is recommended because of the LADWP access road interference. The second segment will be a pipe from the ridge to the edge of the cul-de-sac at Larmar Avenue. This piping segment will be above-grade, except at Runyon Canyon Drive crossing. This crossing is a paved 12-foot wide private street, and hence the proposed pipe will be placed below-grade. The second segment is approximately 450 feet long. The third segment will be a temporary below-grade pipe from the cul-de-sac to the nearest catch basin on Larmar Avenue, which will be approximately 500 feet. Again, below-grade piping is recommended because of the residential properties along Larmar Avenue. The overall length of the pipe will be approximately 1,400 feet from the shaft site to the discharge location.

Figures 5 and 6 present a plan view and a schematic, respectively, of the dewatering flow conveyance from the shaft site to the storm drain system at Larmar Avenue.

FINAL

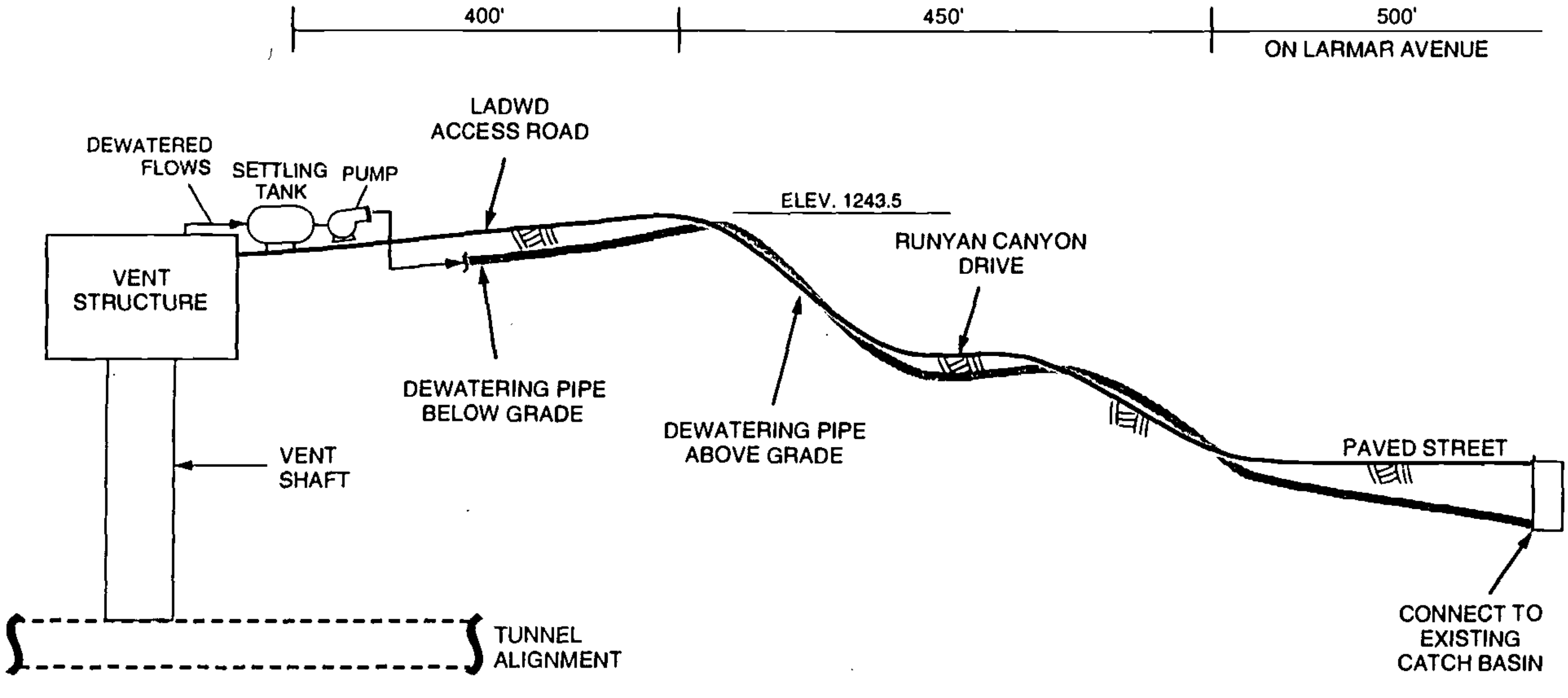


Figure 6
Mid-line Vent Shaft-Schematic Discharge to Storm Drain on Larmar Avenue

Date: June 1994 Not to Scale

R889-2612/YO-FX

ES ENGINEERING-SCIENCE

shaft site. Figure 7 presents a plan view of the Curson Avenue discharge location with respect to the shaft site. An advantage of this alternative is that the flow will be by gravity, and hence will not require pumping. The storm drain system on Curson Avenue is maintained and managed by the County of Los Angeles Flood Control District (LACFCD).

The proposed discharge route will be through Curson Canyon which stretches approximately 2,200 feet down-hill from the shaft site to the edge of Curson Avenue/Wattles Drive. A drain pipe shall be placed above-grade along the canyon with an exception where the pipe crosses a 12-foot wide paved trail path. The pipe shall be placed below grade at the trail path crossing. From the edge of Curson Avenue to the nearest catch basin approximately 800 feet away, a temporary below-grade pipe needs to be constructed. Presented in Figure 8 is a schematic of the proposed discharge route from the site to the Curson Avenue storm drain.

In addition to the NPDES Permit, the Curson Avenue discharge alternative requires the following:

- Storm drain connection application/permit from the L.A. County Flood Control District: The fee for the storm drain connection permit will be approximately $400 ($100 plan check fee and a $300 inspection fee). From the time of submittal, approximately 45 days will be required for approval. With the application package, the LACFCD may also require a hydraulic analysis using the County WSPG program to demonstrate that project dewatering flows will not overburden the storm drain system. A structural design detail showing the proposed connection to the catch basin is required. Additional plans as outlined in the LACFCD guidelines may be required.

- Revocable Permit to Occupy, Resurfacing "A Permit" and Bonded Contract requirements by the City: As described in the requirements for the Larmar Avenue discharge alternative, Section 5.2.1.

A limited cost estimate for piping, trenching, backfilling and street resurfacing indicated approximately $81,000 cost expenditure for construction.

FINAL

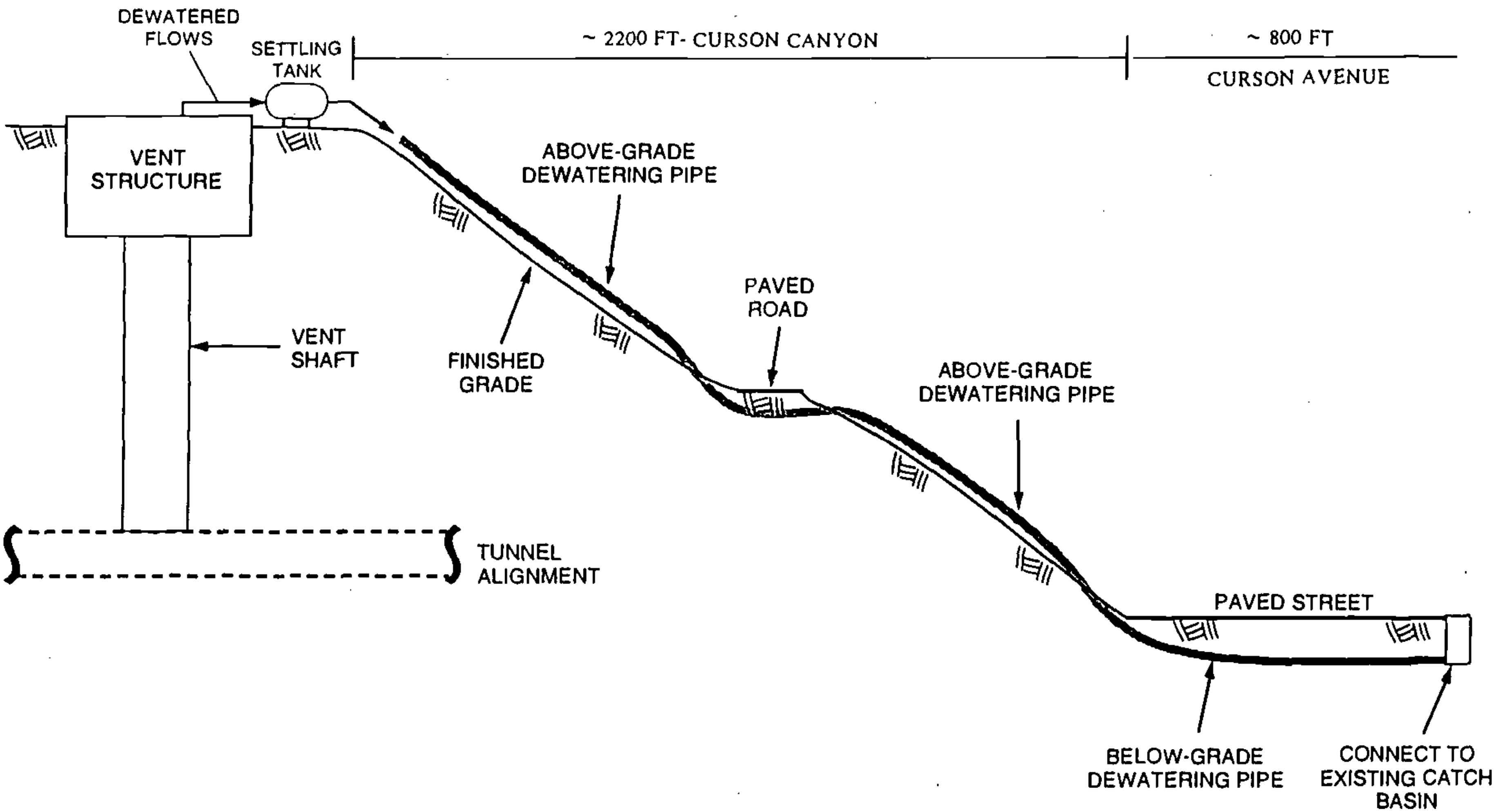


Figure 8
Mid-line Vent Shaft-Schematic Discharge to Storm Drain in Curson Avenue

Date: June 1994 Not to Scale

ES ENGINEERING-SCIENCE

R889-2610/YO-JED

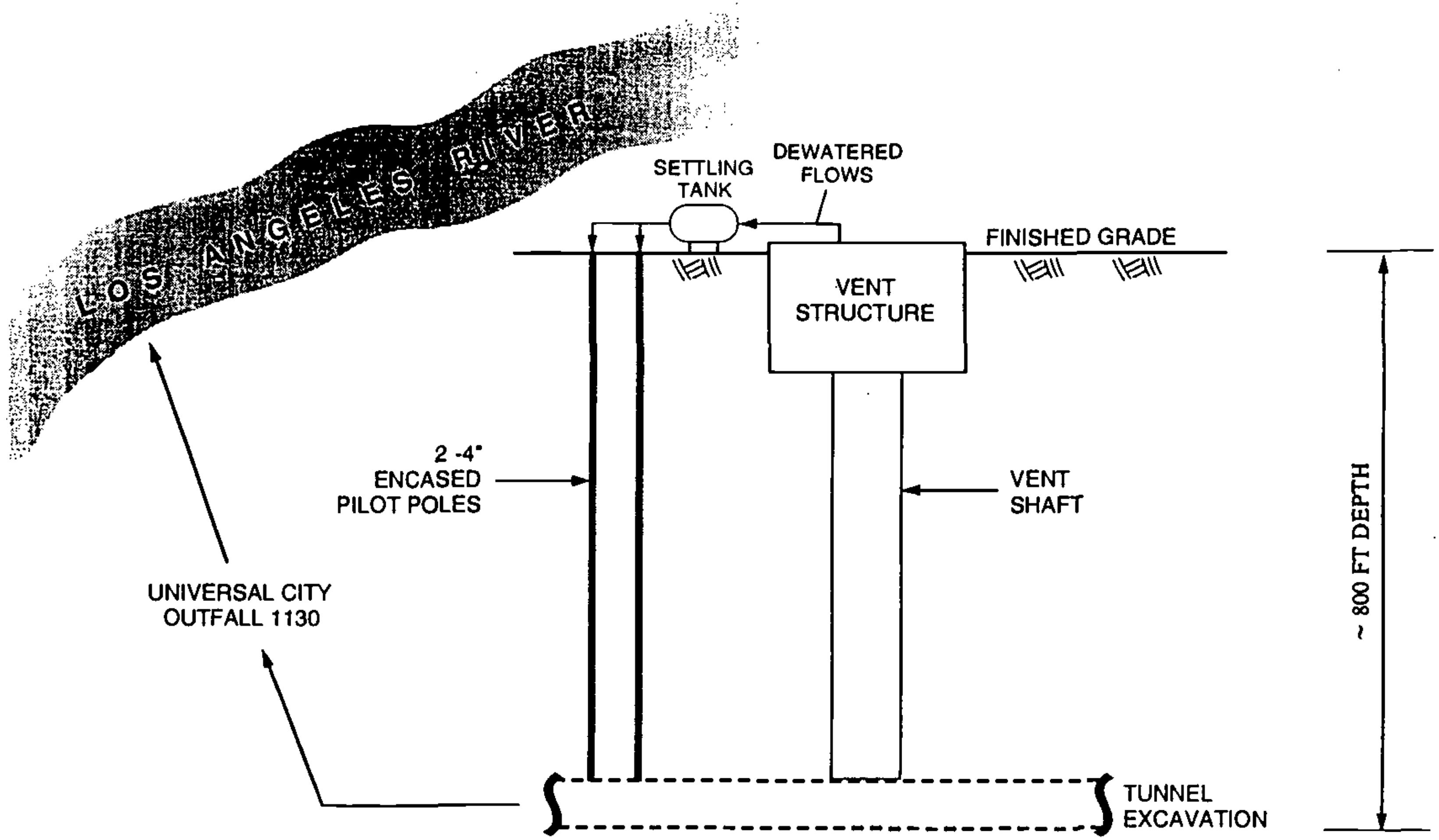


Figure 9
Mid-line Vent Shaft-Schematic Discharge to L.A. River

Date: June 1994 Not to Scale

ES ENGINEERING-SCIENCE

R889-2613/YO-FX

Packard Tests was to assess potential groundwater seepage into the proposed tunnel alignment 800 feet bgs.

At either location, the potential for groundwater to flow through fractures and re-enter the shaft or tunnels, creating added costs through construction delays and the need for additional dewatering, can not be entirely ruled out. The history of construction of the nearby Metropolitan Water District (MWD) tunnel reveals that increased groundwater flows were encountered during storm events [Ref. 2].

For the purpose of this study, a potential spreading basin ranging from 14 to 271 acres could not be located or identified in the vicinity of the site. Costs associated with acquisition of land are generally based on location and acreage. Due to the several unknown variables associated with this alternative, construction costs were not evaluated.

5.5 REUSE FOR LANDSCAPE IRRIGATION

Runyon Canyon Park consists mainly of natural vegetation with a very limited landscaped area. It was found that the Department of Parks and Recreation does not irrigate natural vegetation to minimize potential fire hazards and maintenance by the Department. Therefore, Runyon Canyon Park can not be considered as a potential user of dewatered flows.

Wattles Garden Park which is located south of the shaft site near Curson Avenue contains approximately 3 acres of landscaping and ornamental plants. The Department of Parks and Recreation estimated that park irrigation would need an average of one inch of rainfall per week. This estimate is equivalent to 10 gpm or 14,000 gpd.

Because the Wattles Garden Park is located adjacent to Curson Avenue which has a discharge location (see Section 5.2.2), 10 gpm of the dewatering flows could be diverted to the Park for landscape irrigation. A storage tank will need to be installed by the MTA at the park for this purpose. It may be possible to sell this water to the Department of Parks and Recreation for a fee (say, at half the price of MWD water). This option will allow approximately 2 percent of the dewatered flows to be used for irrigation. The bulk of the dewatered flows, however, would be discharged to the storm drain system on Curson

FINAL

SECTION 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

- A projected steady-state dewatering flow of 500 gpm (720,000 gpd) is expected from the construction of Mid-Line Vent Shaft in the Santa Monica mountains. The start-up flow rate may be as high as 1,500 gpm.

- The shaft site is located in the Santa Monica mountains outside the boundaries of the ULARA Watermaster's jurisdiction, and hence the dewatering operation will not require approval from the Watermaster.

- The hydrogeology of the shaft site indicates that the groundwater quality may change in terms of mineral content, as the excavation progresses from the top (Chico formation) to the bottom (Plutonic formation). A decreasing concentration of the mineral constituents is expected.

- Dewatering flows may be high in suspended solids and slightly above discharge limits for BOD. A settling tank will need to be installed to handle flows of up to 1,500 gpm for suspended solids treatment. Site topography and space limitations will need to be considered in placement of the dewatering pumps and the settling tank.

- The potential for spreading is limited because of the requirements for a large land area, uncertainties regarding surface permeability and possible "recirculation" of the dewatering flows. Depending on the permeability of the chosen area, land area as large as 241 acres may be required, the cost for which would be prohibitively expensive.

- Irrigation reuse for non-landscaping areas is discouraged by the Department of Parks and Recreation because of the potential for increased vegetation that would demand increased vigilance due to fire hazards.

FINAL

City. In this case, costs for pumping and construction of pilot holes will be approximately $100,000. If a dedicated pipeline is constructed within the tunnel, the cost will increase by $250,000.

6.2 RECOMMENDATIONS

- The critical constraints in the recharge of dewatered flows by spreading is the availability of adequate spreading grounds and ensuring that there is no "re-entry" of the spread water into the shaft site. Both these factors need further investigation, and based on the limited scope of this study, this option is not recommended. It may be costly to purchase the land needed for spreading. Also, extensive treatment may be required to meet permitting requirements for spreading since groundwater sampling results indicated that radionuclides and certain minerals including Boron exceeded the maximum contaminant levels for groundwater recharge.

- Use of the dewatered flows for irrigation of natural vegetation within the vicinity of the Runyon Canyon Park is not feasible because the Department of Parks and Recreation prohibits this practice due to fire hazards. The only possible location is the Wattles Garden Park, however, only 2% (approximately 10 gpm) of the project dewatering flows would be needed for the landscaping.

- Discharging to the sanitary sewer is expensive because of the costly sewer facility charge ($518,000) assessed by the City of Los Angeles. The City would also discourage this discharge due to high flows which may burden its existing 8 inch sewer main along Solar Drive. Although the discharge location is the closest, this alternative is not recommended because of permitting constraints and cost.

- Discharge to a storm drain that is connected to the Los Angeles River is possible, only if a tunnel route exists to transport the water from the shaft to the Universal City outfall location. The prudence of executing this option is justified only if an existing pipeline within the tunnel can be used, since construction of a new pipeline for this purpose (9000 feet) can be prohibitively expensive. Discharge of the dewatering flows via the Universal City outfall must be covered by the MTA's Project-wide NPDES Permit through an amendment. Based on the present construction schedule however, the AL

Table 3
Mid-Line Ventilation Shaft - Segment 3
Discharge Alternatives for Dewatered Flows

Discharge Alternatives	Agencies Involved	Constraints	Approximate Construction Costs and Fees	Permits Required	Comments
1. Discharge to City of L.A. Sanitary Sewer on Solar Drive	City of L.A. Bureau of Engineering & Bureau of Sanitation, LADWP, L.A. Dept. of Parks & Rec. (LADPR) and Street Maintenance Division.	1. Existing sewer main on Solar Dr. may not be capable of accepting additional flow. 2. Pumping of dewatered flows is required.	Sewer facility charge, annual inspection fee, surcharge fee, and construction costs: $532,000	Sewer Facility Permit, Resurfacing "A Permit", Approval from City of L.A. Bureau of Sanitation, DWP, LADPR.	1. Negotiation with Bureau of Sanitation in order to discharge flows into sanitary sewer system. 2. Negotiation with LADWP and LADPR regarding the construction of temporary pipe along access road.
2. Discharge to City of L.A. Storm Drain System (Ballona Creek) on Larmar Ave.	RWQCB, City of L.A. Bureau of Engineering & Bureau of Sanitation, LADWP, LADPR, Street Maintenance Division, State DHS.	1. Pumping of dewatered flows is required. 2. Construction of approximately 1200 feet of pipeline.	Associated fees and construction & pumping costs: $135,000	NPDES Permit, Storm Drain Connection Permit, Resurfacing "A Permit", approval from Bureau of Sanitation, LADWP, LADPR, and State DHS.	1. Negotiation with the RWQCB regarding NPDES permit. 2. Negotiation with LADWP and LADPR regarding the construction of temporary pipe along access road and park property.
3. Discharge to LACFCD Storm Drain System (Ballona Creek) on Curson Ave.	RWQCB, City of L.A. Bureau of Engineering, LACFCD, LADPR, Street Maintenance Division, State DHS.	1. Construction of approximately 3000 feet of pipeline.	Associated fees and construction costs: $100,000	NPDES Permit, LACFCD Connection Permit, Resurfacing "A Permit", approval from Bureau of Engineering, LADPR, and County DHS (for landscape irrigation).	1. Negotiation with the RWQCB regarding NPDES permit. 2. Negotiation with LADPR regarding the construction of temporary pipe in park property. 3. Negotiation with LACFCD in order to discharge dewatered flows into storm drain system.

SECTION 7

REFERENCES

1. Watermaster Service in the Upper Los Angeles River Area-Los Angeles County, October 1, 1991- September 30, 1992, Upper Los Angeles River Area Watermaster, May 1993.

2. Geotechnical Investigation Report, Santa Monica Mountains, Segment 3 Metro Red Line, Volumes 1 and 2, The Earth Technology Corporation, 1993.

3. Geotechnical Design Summary Report Contract C0311, Parsons Brinckerhoff Quade & Douglas, Inc. and The Earth Technology Corporation, May 1994.

4. Groundwater Analysis of Segment 3, Engineering-Science, Inc., September 21, 1993.

5. Telephone conversation with Mr. Bomi Ghadiali (EMC), May 4, 1994.

FINAL

APPENDIX A

LIMITED COST ESTIMATE
FOR
VARIOUS DISCHARGE ALTERNATIVES

FINAL

<u>Alternative 5:</u> Discharge flows into tunnel alignment below shaft site.

Construction (dedicated pipeline for ~9,000 feet) and pumping costs = $242,760

However, the cost estimate should be based on the assumption that the contractor is responsible for discharging the flows once they are transferred to the excavated tunnel alignment. Therefore, only select items are evaluated:

Drilling of Pilot Holes	=	$40,000
Encase Pilot Holes	=	$15,760
Total of Direct Costs	=	$55,760
Indirect Costs (14% of Direct)	=	$7,806
Total (Direct and Indirect Costs)	=	$63,566
Pumping for 3 years	=	$26,500

Based on a three year dewatering period and the above assumptions, the adjusted approximate cost is $100,000.

c:\en025\cwo024\cost2.doc

PDCD

CHANGE ESTIMATE WORK SHEET

PROJECT: C 311 LA CBL to N. Hollywood Sta 6?? to Universal City [illegible]

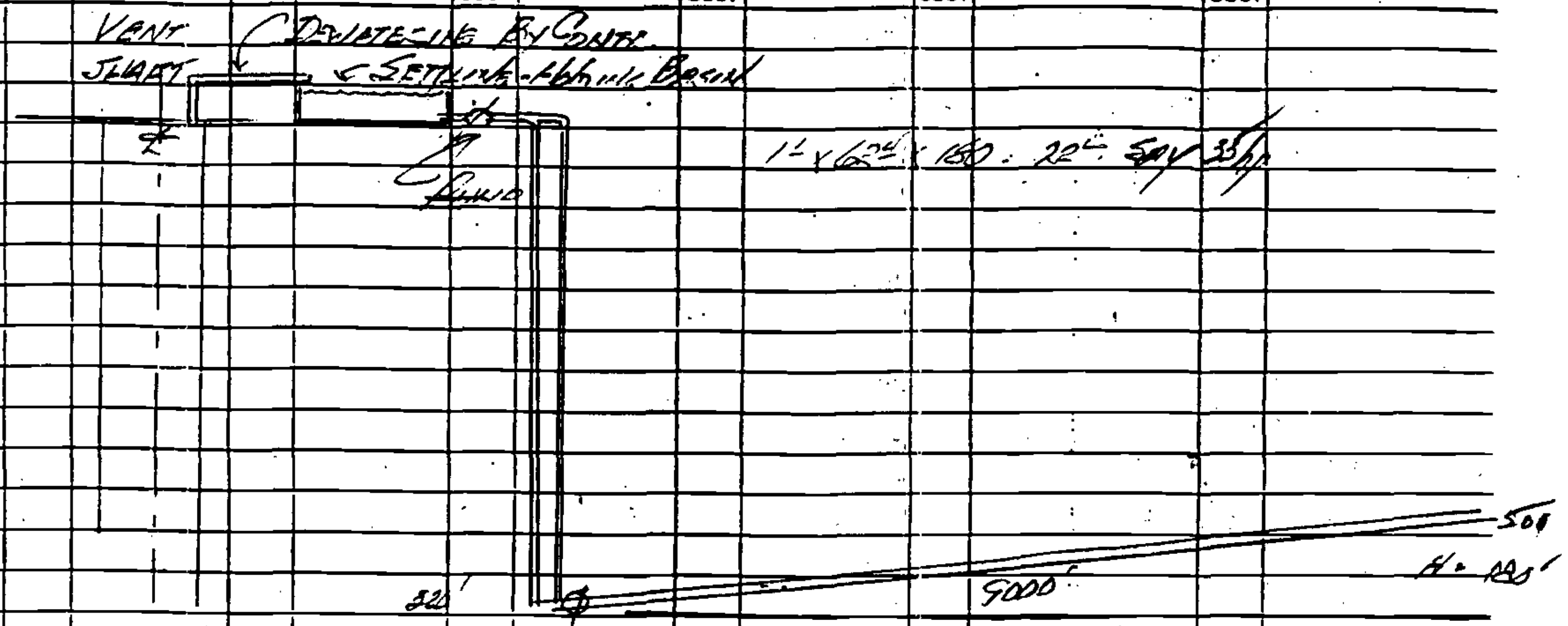
PREPARED BY: GKE DATE: 5-17-9?

DESCRIPTION CR – Midline Vent Shaft – Dewatering Discharge Facility

RESIDENT ENGR. APPROVAL:

Alternative 5: Discharge flows into tunnel alignment below shaft site.

- Assume flow is 720,000 gpd, equivalent to 1.11 cfs.
- Assume the construction of 2-4" PVC encased pilot holes to transfer water from shaft surface to excavated tunnel alignment below. Proposed pilot holes are 800 feet in depth.
- Assume the construction of an above-grade 6" PVC along tunnel alignment to the discharge point at Universal City Station. Approximate length is 9000 feet. Assume pipe is flowing full.
- O&M cost estimates are needed for this alternative.



DESCRIPTION	QUANTITY	UNIT	QUANTITY	UNIT	LABOR UNIT COST	LABOR TOTAL	EQUIPMENT UNIT COST	EQUIPMENT TOTAL	SMALL TOOLS AND SUPPLIES UNIT COST	SMALL TOOLS AND SUPPLIES TOTAL	PERMANENT MATERIALS UNIT COST	PERMANENT MATERIALS TOTAL	SUBCONTRACT UNIT COST	SUBCONTRACT TOTAL	ITEM UNIT COST	TOTAL	ITEM UNIT COST	TOTAL
1. Drill Pilot Holes [illegible]	[illegible]		1600	LF									25	40000		40000		
2. Encase 2-4" PVC	1600	LF	160	hrs	35	5600	10	1600		560	5.00	8000				15760		
3. Set Pump	35	hr	X			400		50		50		3500				4000		
4. Stage Above 6" PVC	9000	LF	400	hrs	35	14000	10	4000		1400	8	72000				91400		
						20000		5650		2010		83500		40000		151,161		
Pumping																		
48 WKS x 7 x 24 = 8064 hr	282,240	KW	8064	hr			5	40320	0.0?	22221						62540		
Total Direct Cost						20000		45970		24230		83500		40000		215,705		
MU						4000		6900		3630		12530		2000		29063		
Total Price						24000		52870		27860		96030		42000		242760		242760

PDCD Form 304 (9/88)

PDCD

CHANGE ESTIMATE WORK SHEET

PROJECT: 311 [illegible] | PREPARED BY: [illegible] | DATE: 5-17-9[illegible]

DESCRIPTION CR - Midline Vent Shaft - Dewatering Discharge Facility | RESIDENT ENGR. APPROVAL:

Alternative 1: Discharge to existing sanitary sewer.

- Assume flow is 2,200,000 gpd, equivalent to 3.34 cfs. This is the estimated flow for the first four weeks of pumping. After the initial period, the flow is expected to stabilize at 720,000 gpd or 1.11 cfs.
- Use 8" PVC to connect to existing manhole 300 feet away. The pipe will be placed four feet below-grade along the unpaved LADWP access road. The pipe is to connect to a an existing manhole on Solar Drive, therefore approximately 20 feet of paved road will be trenched and resurfaced. Assume pipe is flowing full.
- Assume 12 feet of head for pumping requirements. The existing manhole is on a higher elevation than the proposed shaft.
- O&M cost estimates are needed for this alternative.

Vent Shaft — Dewatering Ex Settling Basin — 8" PVC Buried — 300' — Manhole — H = 12'

Excav 2x4 = 8 x 300 = Say 100 cy Backfill Say 100 cy Comp.

Pump 3 [illegible] x 12 = 2546 [illegible] = 4[illegible] x 1[illegible] Say 7 hp
1[illegible] [illegible] = 824 [illegible] 1[illegible] x 1[illegible] Say 2 hp

DESCRIPTION	QUANTITY	UNIT	QUANTITY	UNIT	LABOR UNIT COST	LABOR TOTAL	EQUIPMENT UNIT COST	EQUIPMENT TOTAL	SMALL TOOLS AND SUPPLIES UNIT COST	SMALL TOOLS AND SUPPLIES TOTAL	PERMANENT MATERIALS UNIT COST	PERMANENT MATERIALS TOTAL	SUBCONTRACT UNIT COST	SUBCONTRACT TOTAL	ITEM UNIT COST	TOTAL	ITEM UNIT COST	TOTAL
1. Furn & Set Pump	7	hp	8	[illegible]		400		50		50	100	700				1200		
2 Excav Trench	300 CY	[illegible]	12	[illegible]	3	400	2	300		20					2.50/LF	750		
3 Lay Pipe	300 LF	[illegible]	16	[illegible]	3	560	10	160		60	10	3000			12.60	3780		
4 Backfill Trench			300	[illegible]	2.00	600	1.00	300	0.20	60	2.80	840			6.00	1800		
5 Resurface Street 20x2 = 5SY			2	Ton									100	200		200		
Subtotal Total Dir.			[illegible]		[illegible]	1980	2.75	810	[illegible]	220	15[illegible]	4540	[illegible]	200	[illegible]	7730		
Pumping							2.00	1.20										
4wks x 7 x 24 = 672 hr.	4704 [illegible]		672	hr	[illegible]	~~2016~~	[illegible]	~~[illegible]~~	0.10	471						1810		
48 wks x 7 x 24 = 8064 hr [illegible]	20160	[illegible]	8064	hr	3[illegible]	~~[illegible]~~	15	~~[illegible]~~	0.10	2020						18150		
						~~[illegible]~~	17[illegible]	~~[illegible]~~		2490						19960		
Total [illegible]						1980		18280		2690		4540		200		27690		
[illegible]						400		2740		400		680		10		4230		
Total [illegible]						2380		21020		3090		5220		210		31920		= 31920

PDCO Form 304 (9/88)

PDCD

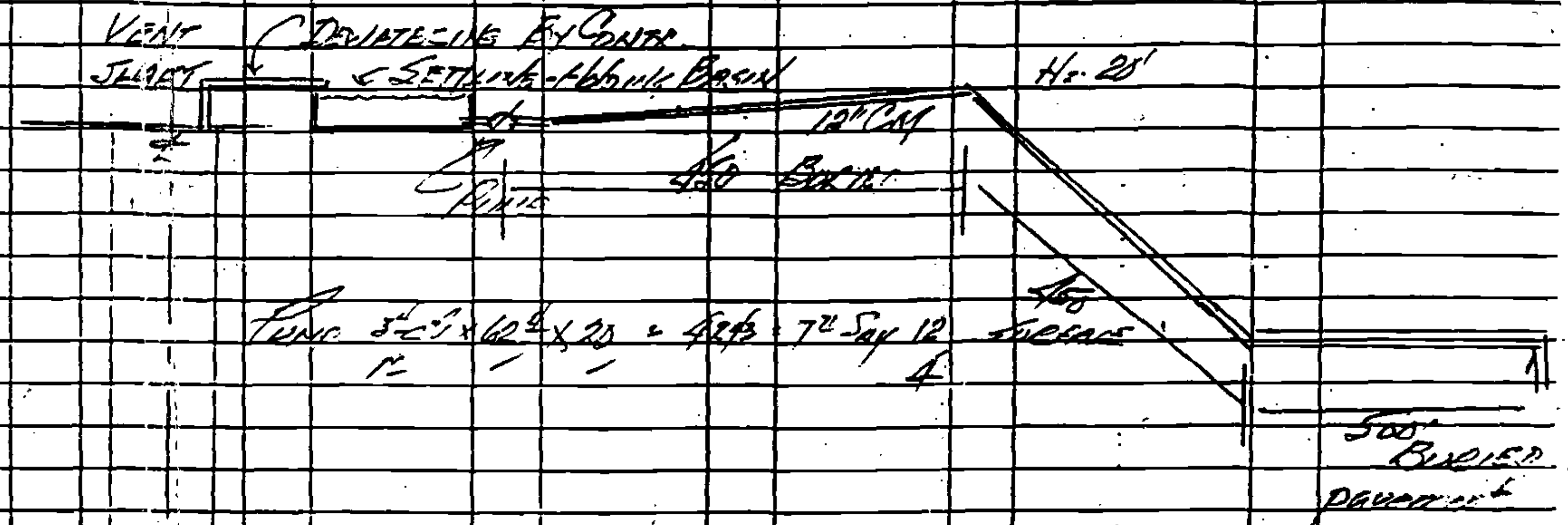
CHANGE ESTIMATE WORK SHEET

PROJECT C-311 LA CBL to N. Hollywood Sta 6? + [illegible] | PREPARED BY GKE | DATE 5-17-9?

DESCRIPTION CR – Midline Vent Shaft – Dewatering Discharge Facilities | RESIDENT ENGR. APPROVAL

Alternative 2: Discharge to existing storm drain on Larmar Ave.

- Assume flow is 2,200,000 gpd, equivalent to 3.34 cfs. This is the estimated flow for the first four weeks of pumping. After the initial period, the flow is expected to stabilize at 720,000 gpd or 1.11 cfs.
- Use a 12" Corrugated Metal Pipe (CMP) to connect to the existing catch basin 1400 feet away on Larmar Ave. In the first segment (450 feet), the pipe will be placed four feet below-grade along the unpaved LADWP. In the second segment (450 feet), the pipe (CMP) will be placed above grade on a steep downhill-slope. Also in the second segment the pipe will cross a 12 foot wide paved road. For that 12 foot stretch, the pipe will be placed below grade. In the final segment (500 feet), the pipe will be placed four feet below-grade along Larmar Ave. (paved street) to the connection point at an existing catch basin.
- For this alternative, assume 20 feet of head for pumping requirements from the shaft site to the ridge 450 feet east of the site. From the ridge to the point of discharge (950 feet), assume gravitational flow. Assume pipe is flowing full.
- O&M cost estimates are needed for this alternative.



DESCRIPTION	QUANTITY	UNIT	QUANTITY	UNIT	LABOR UNIT COST	LABOR TOTAL	EQUIPMENT UNIT COST	EQUIPMENT TOTAL	SMALL TOOLS AND SUPPLIES UNIT COST	SMALL TOOLS AND SUPPLIES TOTAL	PERMANENT MATERIALS UNIT COST	PERMANENT MATERIALS TOTAL	SUBCONTRACT UNIT COST	SUBCONTRACT TOTAL	ITEM UNIT COST	TOTAL	ITEM UNIT COST	TOTAL
1. Furn & Set Pump	12	hr	8	hr		400		50		50		1200				1700		
2. Excav Trench 450+512	962	LF	40	hr	35	1400	25	1000	2.50	100			Rem	5000		7500		
3. Clear Trees [illegible]	450	LF	20	mhr	30	600	10	200	3.00	60						860		
4. String & Lay Pipe 950@0.05 + 450@5%			96	mhr	35	3360	10	960		340	10	14000				18660		
5. Backfill Trench			962	LF	2.00	1930	1.00	770	0.20	190	2.80	2700				5790		
6. Resurface [illegible] 512x12=1750			40	Ton									100	4000		4000		
Sub total Item Direct			1460			7690		3180		740		17900		9000	2.1	38510		
Pumping																		
4 wks x 7 x 24 = 672 hr [illegible]	8064	[illegible]	672	hr	~~35~~	~~23520~~	2.00 / 10	1340 / ~~6720~~	0.12	810						~~2150~~		
[illegible]	32256		8064	hr	~~34~~	~~241920~~	2.00 / 13	16130 / ~~[illegible]~~	0.10	3230						19360		
Pumping						~~266080~~	17470	~~[illegible]~~		4040						~~21510~~		
Total Direct						7690		21650		4780		17900		9000		60020		
[illegible]						1540		2100		720		2690		450		8500		
Total Alt 2						9230		23750		5500		20590		9450		68520		68520

PDCD Form 304 (9/88)

PDCD

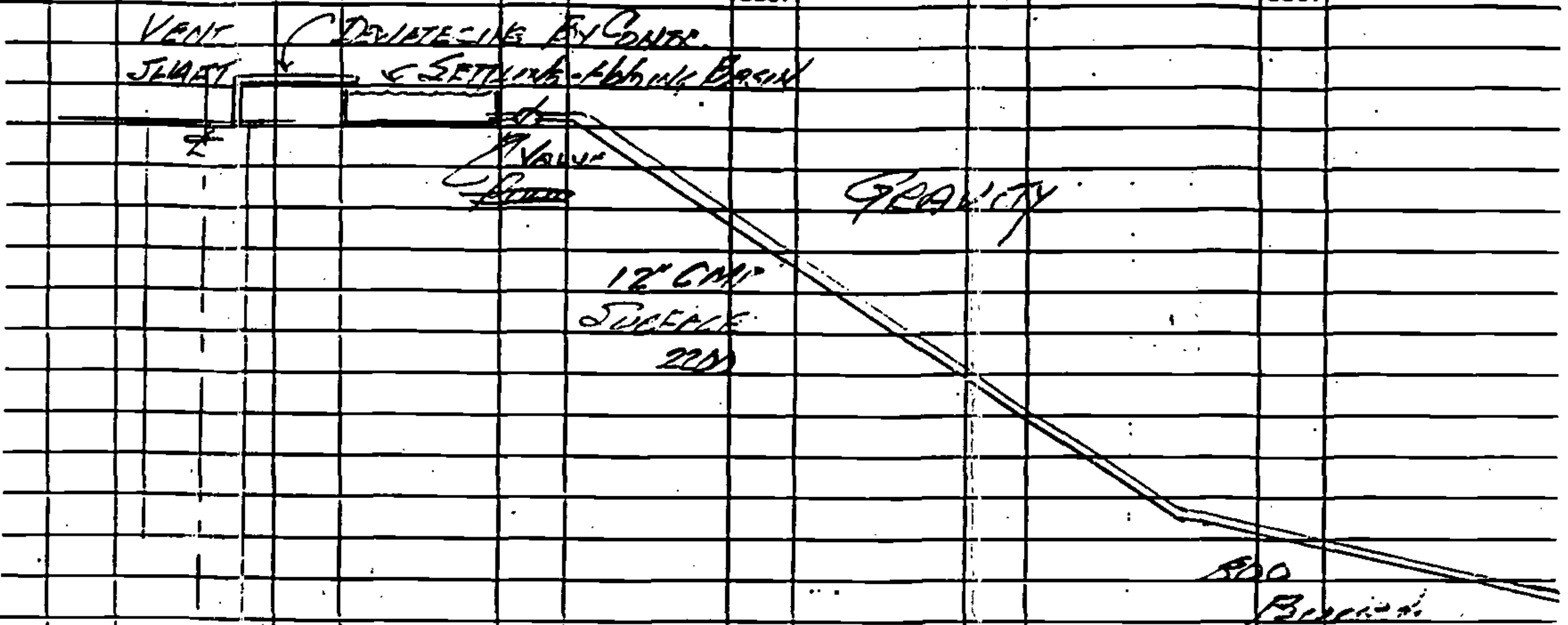
CHANGE ESTIMATE WORK SHEET

PROJECT C.S. 311 LACBL to N. Hollywood Ste 6? & Winkes, Inc.   PREPARED BY GKL   DATE 5-17-94

DESCRIPTION CR – Midline Vent Shaft – Dewatering Discharge Facilities   RESIDENT ENGR. APPROVAL

Alternative 3: Discharge to existing storm drain on Curson Ave.

- Assume flow is 2,200,000 gpd, equivalent to 3.34 cfs. This is the estimated flow for the first four weeks of pumping. After the initial period, the flow is expected to stabilize at 720,000 gpd or 1.11 cfs.
- Assume a 12" Corrugated Metal Pipe (CMP) throughout alignment. Assume pipe is flowing full.
- Assume gravitational flow for the entire 3000 alignment from the shaft site to the catch basin on Curson Ave. In the first segment (2200 feet), an above-grade CMP pipe will be placed from the shaft site to Curson Ave./Wattles Dr. In the second segment (800 feet), a below-grade pipe will be placed along Curson Ave. (paved street) to the connection point at an existing catch basin.
- O&M cost estimates are needed for this alternative.



DESCRIPTION	QUANTITY	UNIT	QUANTITY	UNIT	LABOR UNIT COST	LABOR TOTAL	EQUIPMENT UNIT COST	EQUIPMENT TOTAL	SMALL TOOLS AND SUPPLIES UNIT COST	SMALL TOOLS AND SUPPLIES TOTAL	PERMANENT MATERIALS UNIT COST	PERMANENT MATERIALS TOTAL	SUBCONTRACT UNIT COST	SUBCONTRACT TOTAL	ITEM UNIT COST	TOTAL	ITEM UNIT COST	TOTAL
1. Furn & Set Pump																0		
2. Excav Trench – [illegible]	800	LF	32	HC	35	1120	25	800	2.5	80						2000		
Pavement Removal	1600	SF	80											8000		8000		
3. Clear [illegible]	2200	LF	110	MH	30	3300	10	1100	2.5	25						4241		
4. Store Pipe [illegible] 2200 [illegible]			320	MH	35	11200	10	3200		1100	15	30000				45500		
5. Backfill Trench			800	LF	20	1600	10	800	0.2	160	2.80	2240				4800		
6. Resin [illegible]			6	[illegible]									100	6000		6000		
	3000	LF				17220		5900		1670		32240		14000	3%	71041		
Pumping	0		0													0		
Gravity Flow																		
Total [illegible]						17220		5900		1670		32240		14000		71043		
[illegible]						3444		850		250		4840		700		10120		
Total Alt – 3						20664		6800		1920		37080		14700		81161		Total

PDCD Form 304 (9/85)

PDCD

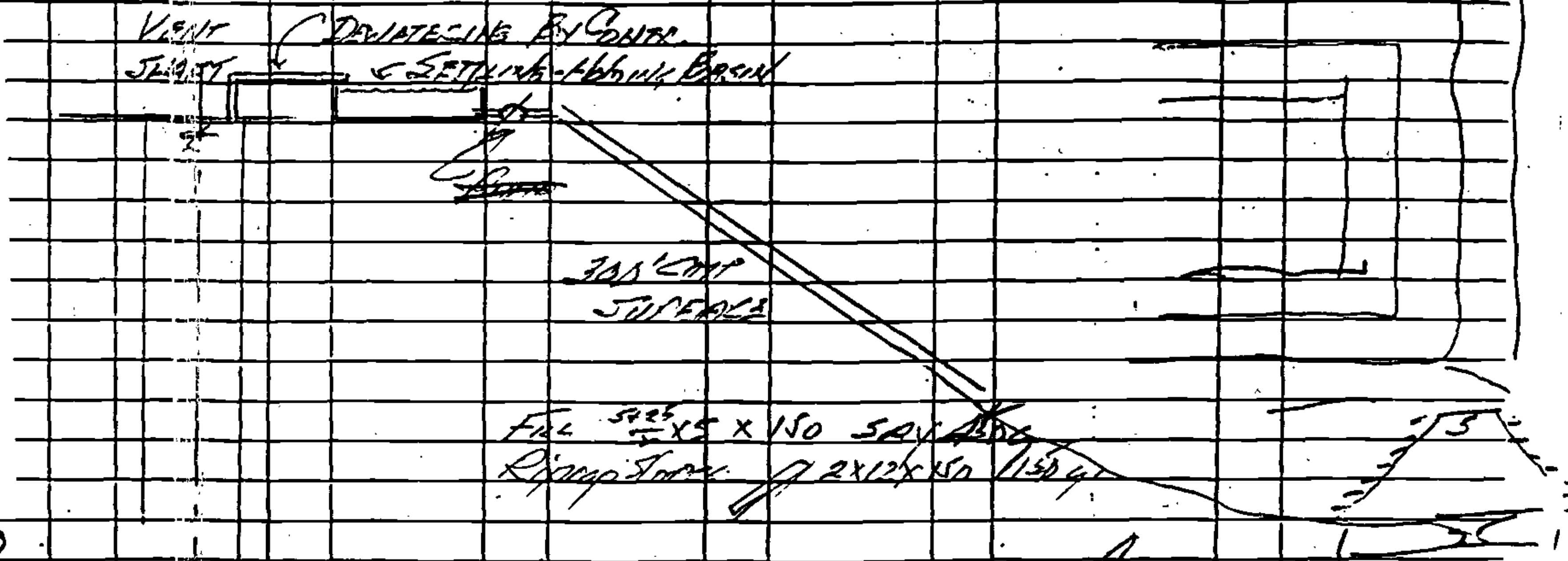
CHANGE ESTIMATE WORK SHEET

PROJECT: CO 311 LF CBL ... N. Hollywood Sta 6 ... [illegible] PREPARED BY: GKE DATE: 5-17-9[illegible]

DESCRIPTION CR – Midline Vent Shaft – Dewatering Discharge Facilities RESIDENT ENGR. APPROVAL: ______

Alternative 4: Discharge to proposed spreading basin.

- Assume flow is 2,200,000 gpd, equivalent to 3.34 cfs. This is the estimated flow for the first four weeks of pumping. After the initial period, the flow is expected to stabilize at 720,000 gpd or 1.11 cfs.
- Assume above-grade 12" Corrugated Metal Pipe (CMP) throughout the 300 feet alignment. Assume pipe is flowing full. Assume gravitational flow for the entire alignment from the shaft site to the proposed spreading basin below.
- Estimate cost for the construction of a five foot high compacted dirt berm to be erected surrounding proposed 50 ft x 30 ft spreading basin.
- O&M cost estimates are needed for this alternative.



DESCRIPTION	QUANTITY	UNIT	QUANTITY	UNIT	LABOR UNIT COST	LABOR TOTAL	EQUIPMENT UNIT COST	EQUIPMENT TOTAL	SMALL TOOLS AND SUPPLIES UNIT COST	SMALL TOOLS AND SUPPLIES TOTAL	PERMANENT MATERIALS UNIT COST	PERMANENT MATERIALS TOTAL	SUBCONTRACT UNIT COST	SUBCONTRACT TOTAL	ITEM UNIT COST	TOTAL	ITEM UNIT COST	TOTAL
1. Set Pump			0			0										0		
2 Clear Trail [illegible]	300	LF	30	[illegible]	30	900	10	300	3	90						1290		
3. Clear [illegible] Line	5000	[illegible]	40	[illegible]	60	2400	55	2200		120						4520		
4. Construct Dike	450	c.			20	9000	15	6750	5	2250					40	18000		
[illegible]	150	[illegible]			50	7500	30	4500	5	750	15	2250				15000		
5 Lay Pipe	300	[illegible]	32	[illegible]	35	1120	10	320		120	10	3000				4560		
6 Emergency [illegible] Blanket			5	[illegible]	300	1500	50	250	50	250	100	500				2300		
Total Direct						22420		14120		3580		5750				45870		
Pumping	0		0													0		
Total Direct						22420		14120		3580		5750				45870		
[illegible]						4480		2120		543		860				8000		
Total [illegible]						26900		16240		4123		$6610				53870		$53870

PDCD Form 304 (9/88)