Slope for the pipeline was based upon the known beginning and ending invert elevations of the pipe, and the approximate length determined from the alignment study. Roughness values for the different pipe materials were obtained from various pipe manufacturers. Three pipe materials to be considered are vitrified clay pipe (VCP), reinforced concrete pipe (RCP), and polymer concrete pipe (PCP). Flow was taken as the peak wet weather flow generation from Table III-2. Depth to diameter ratio was not to exceed 75%. A summary of the parameters used for calculating the pipe diameter is shown in Table III-3.

Table III-3
PIPE SIZING PARAMETERS

VITRIFIED CLAY PIPE/REINFORCED CONCRETE PIPE	
Manning's Roughness Coefficient (n)	0.013
Slope	0.0086
Max Depth to Diameter Ratio (d/D)	75%
Discharge	12.46 MGD

Based upon a peak wet weather flow of 12.46 MGD (8,652 gpm), the gravity sewer pipeline should be 27-inches in diameter using vitrified clay pipe. Reinforced concrete pipe has the same roughness coefficient (n = 0.013) as vitrified clay pipe, so the gravity sewer pipeline would need to be 27-inches in diameter. The depth to diameter ratio for the 27-inch pipe would be 60.0%.

Polymer concrete pipe has a roughness coefficient of 0.009, lower than clay and concrete pipe. Using polymer concrete pipe would reduce the gravity sewer pipeline to 24-inches in diameter, and have a depth to diameter ratio of 58.0%.

A summary of velocities and depth to diameter ratios is shown in Table III-4.

Table III-4
PIPE VELOCITIES AND DEPTH TO DIAMETER RATIOS

Pipe	Velocity (ft/s)			Depth to Diameter Ratio (%)		
	Average Dry Flow	Peak Dry Flow	Peak Wet Flow	Average Dry Flow	Peak Dry Flow	Peak Wet Flow
27" VCP n = 0.013	6.48	7.72	7.73	39.7	59.7	60.0
27" RCP n = 0.013	6.48	7.72	7.73	39.7	59.7	60.0
24" PCP n = 0.009	8.53	10.18	10.20	38.6	57.6	58.0

3.5 EXPANDED SERVICE AREA ALTERNATIVE

The District is currently considering serving areas that are outside of the Orange County border, but within the natural tributary area of the proposed project. These areas include portions of unincorporated Los Angles County and an area within the City of Chino Hills (San Bernadino County).

A large portion of the Aera Master Planned Community is located in Los Angeles County. The portion within LA County is a 2,614-acre site that sits east and west of the Orange (57) Freeway. Proposed land use for the area is estate, with 2,700 dwelling units to be built in the Los Angeles County portion. A smaller portion of the site (321 acres) lies within Orange County.

Also within Los Angeles County is Firestone Boy Scout Camp, a 981-acre site zoned as open space.

The City of Chino Hills has an 80-acre site known as Sleepy Hollow that is located adjacent to the San Bernardino/Orange County border. Currently, the Sleepy Hollow area uses a septic sewer system. The area is within the natural tributary boundaries of the Carbon Canyon sewer shed.

A summary of the effect that the additional areas would have on projected wastewater generation is shown in Table III-5.

Table III-5
EXPANDED SERVICE AREA PROJECTED WASTEWATER GENERATION

Development Name	Land Use (P) = Proposed	Area (ac)	Wastewater Generation Factor [1] (gpd/ac)	Average Flow (MGD)	Peak Dry-Weather Flow [2] (MGD)	Peak Wet-Weather Flow [3] (MGD)
Orange County Totals		*8,591*		*6.17*	*12.34*	*12.46*
Chino Hills - Sleepy Hollow	Estate	80	727	0.06	0.12	0.12
Aera Master Planned Community in LA County [10]	Estate (P)	2,614	727	1.90	3.80	3.84
Firestone Boyscout Camp [3]	Open Space	981	129	0.13	0.25	0.26
Totals		**12,266**		**8.25**	**16.51**	***16.67***

[1] Per Table 3-6 of 1999 OCSD Strategic Plan (Vol. 3)
[2] peaking factor = 2.0
[3] I&I Factor of 1% per OCSD Strategic Plan Section 5.4.3.1

Peak wet-weather flow for the expanded service area would increase to 16.67 MGD (11,575 gpm), compared to 12.46 MGD for areas within Orange County.

All parameters for sizing the pipe remain the same except for the flowrate. The size of pipe required to accommodate the expanded service area is also 27-inches for vitrified clay pipe and reinforced concrete pipe, and 24-inches for polymer concrete pipe. Although the discharges increase, the depth to diameter (d/D) ratios still remains below 75%. So the proposed pipe can handle the expanded service area without upsizing the pipe. A summary of pipe velocities and depth to diameter ratios for the expanded service area is shown in Table III-6.

Table III-6
PIPE VELOCITIES AND DEPTH TO DIAMETER RATIOS

Pipe	Velocity (ft/s)			Depth to Diameter Ratio (%)		
	Average Dry Flow	Peak Dry Flow	Peak Wet Flow	Average Dry Flow	Peak Dry Flow	Peak Wet Flow
27" VCP n = 0.013	7.00	8.18	8.16	46.7	73.5	74.1
27" RCP n = 0.013	7.00	8.18	8.16	46.7	73.5	74.1
24" PCP n = 0.009	9.22	10.79	10.81	45.3	70.5	71.0

3.6 FLOW MONITORING

Flow monitoring is currently being conducted in the 24-inch City of Brea gravity pipeline immediately upstream of the pump station to verify assumed flows entering the proposed pipeline. A monitor was set up to record depth, flow, and velocity, at 15-minute intervals for a period of two weeks. It should be noted that during the two-week period, there were several days of sustained rainfall, so the values are not indicative of dry weather flows. Table III-7 lists the average daily and peak measured values for the data available at the time of this report.

The complete flow monitoring program will be used to verify the hydraulic assumptions of this report when they are complete.

Table III-7

FLOW MONITORING DATA

		Average Daily Flow				Peak Flow				
Date	Day	Depth (in)	Flow (MGD)	Velocity (ft/sec)	d/D (%)	Time (hr)	Depth (in)	Flow (MGD)	Velocity (ft/sec)	d/D (%)
October 11, 2004	Mon.	4.78	0.32	1.09	19.9%	20:15	5.32	0.44	1.32	22.2%
October 12, 2004	Tues.	4.41	0.26	0.98	18.4%	7:45	5.33	0.41	1.21	22.2%
October 13, 2004	Wed.	4.46	0.27	1.02	18.6%	7:45	5.33	0.47	1.39	22.2%
October 14, 2004	Thur.	4.45	0.27	1.00	18.5%	7:30	5.31	0.46	1.38	22.1%
October 15, 2004	Fri.	4.51	0.26	0.96	18.8%	7:30	5.29	0.41	1.23	22.0%
October 16, 2004	Sat.	4.50	0.27	0.99	18.8%	10:00	5.44	0.45	1.31	22.7%
October 17, 2004	Sun.	4.80	0.32	1.09	20.0%	9:30	5.88	0.55	1.41	24.5%
October 18, 2004	Mon.	4.40	0.24	0.91	18.3%	7:30	5.46	0.44	1.27	22.8%
October 19, 2004	Tues.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 20, 2004	Wed.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 21, 2004	Thur.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 22, 2004	Fri.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 23, 2004	Sat.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 24, 2004	Sun.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 25, 2004	Mon.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Note: Data was available from 11:30 am on Oct. 11 thru 11:15 am on Oct. 18

Currently, flow traveling through the 24-inch gravity main where the flow monitor is installed is generated by the Olinda Heights Development, Olinda Village and Hollydale Mobile Home Park, and Carbon Canyon Regional Park. A comparison of the projected flows listed in Table III-2 for the existing sewer shed shows a calculated average daily flow of 0.53 MGD and a calculated peak dry weather flow of 1.07 MGD. A comparison of these values to the preliminary measured values indicate the projections are approximately double that of the actual. Further analysis will be conducted at the completion of the flow monitoring. It should be noted that the flow monitoring figures listed above are the raw data, further refinement of the values may adjust the values by +/- 10%.

IV. UTILITY RESEARCH AND AGENCY CONTACTS

4.1 GENERAL

Utility research was conducted by first obtaining a list of agencies with utilities in the vicinity of the proposed project from the Underground Service Alert website. In addition, all the companies listed in the scope of work were contacted as well. Letters were sent out to the various companies requesting plans and information on their utilities within the project area.

4.2 AGENCIES WITH JURISDICTION

Agencies with jurisdiction within the proposed project area and expanded service area alternative are:

- County of Orange
- County of Los Angeles
- County of San Bernardino
- City of Brea
- City of Chino Hills
- U.S. Army Corps of Engineers
- Orange County Harbors, Beaches, and Parks
- Aera Energy LLC
- Breitburn Energy LLC

4.3 UTILITIY AGENCIES

Several utility agencies were contacted to determine the location of any utilities near the proposed project area. Utility companies with utilities located near or within the project area are:

- Mobile Oil
- Texaco Oil
- Metropolitan Water District of Southern California

- Southern California Gas Company
- Airtouch Cellular/Verizon
- Southern California Edison
- Aera Energy
- Breitburn Energy
- City of Brea

4.4 COORDINATION

A log has been kept of all contact with jurisdictional agencies and utilities regarding the project. Contacts at each agency have been established for coordination during the design and construction of the project. An on-site investigation shall be conducted to search for surface features, which may verify known utilities or identify unknown utilities. Potholing is not anticipated during the design phase of this project. Some potholing may be required by the contractor prior to construction.

V. CONSTRUCTION METHODS

5.1 GENERAL

This section will discuss the methods for construction of the proposed pipeline. It is anticipated that portions of the pipeline will be constructed by means of standard trenching, and portions will require "trenchless" methods. This section will discuss the various methods of "trenchless" construction and make a recommendation for this project. Feasibility of traditional open cut trenching will also be addressed.

5.2 TRENCHLESS CONSTRUCTION METHODS

Construction of the sewer by using conventional open cut methods is impractical in certain areas due to the proposed depth of the sewer, which may reach up to 100 feet. Therefore, a trenchless construction method must be considered. Two trenchless methods considered for this project are microtunneling and horizontal directional drilling.

5.2.1 Horizontal Directional Drilling

Horizontal directional drilling (HDD) is the technology of creating and directing a borehole to follow a predetermined path to a specified target. It involves the use of mechanical or hydraulic deviation equipment to change the drilling course and the use of instrumentation to monitor the location and orientation of the drilling-head assembly. HDD was developed for utility crossings of roads, rivers and streams and therefore falls into the crossing category of installation. Although it can install single drives of more than a mile in length and can be monitored and steered, it is a system that normally drills an arc profile. Because of this feature HDD is limited in its ability to be installed to close tolerances to hold a predetermined slope such as in a sewer design. Flat slopes and tolerances within 1% to 2% deviation are not obtainable with this technology. It is better suited for short distances and slopes greater than 2%.

5.2.2 Microtunneling

Microtunneling is a term given to describe tunneling using a small tunnel boring machine (TBM) for installing pipes with an inside diameter of less than 36 inches to a predetermined line and grade by remotely controlling the cutting head. The main application for microtunneling is the installation of sewer lines in congested or environmentally sensitive areas at depths in excess of 12 feet. The tunneling shield is articulated to enable steering of the system. Line and grade are controlled by a laser beam transmitted from the drive shaft along the centerline of the pipe to a target mounted in the shield. The position of the laser on the target is transmitted back to the operator by closed circuit TV. Thus, microtunneling is capable of maintaining grade to within +/- 1" and line to within +/- 1.5" over the total distance between the jacking and reception shaft.

Unlike HDD, which uses high-density polyethylene pipe, microtunneling requires specially constructed materials. Apart from meeting its in-service performance requirements, the pipe has to be designed with an external joint and with a structural wall section to meet the forces imposed when it is jacked into position. The most commonly used pipe used for microtunneling a sewer line is vitrified clay pipe (VCP). The clay pipe industry has developed a proven design for VCP that includes a special stainless steel joint sleeve configuration that provides a smooth single dimension outside diameter. VCP microtunneling pipe must conform to ASTM C-1208.

Both of these construction methods require a thorough knowledge of the soils and ground water conditions of the alignments. Equally as important would be to predetermine the location of potential pockets trapped with hydrocarbons or other hazardous materials.

5.3 RECOMMENDATION

Horizontal directional drilling is not practical for this project.

Construct the pipeline using microtunneling methods. The recommended alignment is optimum because depths are kept as small as possible. Approximately 1200 feet would require microtunneling, depending on the exact location of the jacking and receiving pits. The microtunneling can be done in a single bore, because there are no bends for that length of the pipe. The jacking and receiving pits will be at the shallowest locations and can be converted to manholes.

5.4 FEASIBILITY OF OPEN CUT TRENCHING

Leighton Consulting, Inc. conducted a geotechnical investigation and evaluated the feasibility of open cut trenching. In areas where trenchless construction is unnecessary, open cut trenching is feasible provided that certain guidelines are adhered to.

1. No surcharge loads should be permitted within a horizontal distance equal to the height of the cut or 5 feet; whichever is greater from the top of the slope, unless the cut is shore appropriately.
2. Excavations may slope down at a 1:1 ratio without being shored. Any cut steeper than 1:1 must be shored.
3. Design of any shoring or retaining walls must be in accordance with geotechnical report conducted by Leighton Consulting, Inc.
4. Onsite material may be used as backfill, provided it is free of debris or oversized material. Prior to backfilling, pipes should be bedded in and covered with a granular material that has a sand equivalent of 30 or greater.

VI. DRAFT ODOR ASSESSMENT AND ODOR CONTROL PLAN

6.1 GENERAL

The purpose of this Section is to summarize the data collection and analysis and assessment of the odor potential during the construction and odor mitigation measures for the Orange County Sanitation District (OCSD) Carbon Canyon Sewer and Pump Station Abandonment Project.

The only potential for odors above current levels could occur during the following activities:

- Construction of the tie in to the sewer manhole at Rose Drive and Vesuvius Drive
- Construction of the tie in to the sewer manhole just upstream of the existing CCPS to make the diversion into the new gravity sewer
- Clean-out of the existing CCPS wet well and abandonment of the pump station.

6.2 POTENTIAL ODOR RELEASING ACTIVITIES

In anticipation of the construction, data on wastewater sulfides, sewer (manhole) hydrogen sulfide concentration, and ambient outside air hydrogen sulfide concentration was measured. Two locations were recommended for field data collection.

- Existing Carbon Canyon Pump Station
- Proposed connection to OCSD trunk sewer at Rose Dr. and Vesuvius Dr.

The existing CCPS is located in Carbon Canyon Regional Park near the park entrance and visitor parking lots.

As part of the data collection samples of the wastewater were collected by RBF and analyzed for total and dissolved sulfides and pH by Del Mar Analytical Laboratory. In addition OCSD's Odalog®, Gas Data Logger was installed in a manhole upstream of the CCPS for continuous recording of hydrogen sulfide

concentrations in the sewer headspace. To measure ambient hydrogen sulfide concentrations in area surrounding the CCPS, OCSD's Odalog® Low Range Hydrogen Sulfide Gas Logger was installed in a tree about 200 ft from the CCPS.

A summary of the results of the liquid wastewater sampling and analysis is presented in Table VI-1. The liquid samples were grab samples.

Table VI-1

Wastewater Sampling 10/11/2004

Time	Dissolved Sulfide, mg/L (Note 1)	Total Sulfide, mg/L (Note 1)	pH	Manhole Gas Phase Odalog® Concentration ppmv (Note 2)
10:00 am	ND	ND	7.42	1 - 2
1:00 pm	ND	ND	7.52	2 - 3
3:30 pm	ND	0.14	7.57	8 - 9

1. Reporting limit = 0.10 mg/L as $S^{=}$
2. Gas concentrations presented to illustrate relationship between dissolved sulfide and gas phase concentrations; ppmv is parts per million by volume

At the time of the sampling the temperature, as measured by the Odalog® was 78ºF.

In wastewater collection systems, hydrogen sulfide is generated in the anaerobic portion of the slime layer in the submerged section of the pipe walls. The hydrogen sulfide dissolves in the wastewater, some of it being present as hydrogen sulfide (H_2S)aqueous; the remainder is either HS^- ion or $S^{=}$ ion as shown in the following equation:

$$H_2S_{aq} \rightleftharpoons HS^- + H^+ \qquad (1)$$

$$HS^- \rightleftharpoons S^{=} + H^+ \qquad (2)$$

The partitioning of the hydrogen sulfide into these components depends primarily on the temperature and the pH of the water, although ionic strength, as

represented by dissolved solids or electrical conductivity, also affects the partitioning. The amount of aqueous hydrogen sulfide is a function of the pH as illustrated by equation (1). At lower pH values more of the dissolved sulfides are in the aqueous form.

The summation of the (H_2S)aqueous, HS^- ion and $S^=$ ion represent the total dissolved sulfides and are reported as such in the analysis. (To simplify the reporting all of the three species are reported as "Sulfur, S.") The HS^- ion and $S^=$ ion produce no odors. Note that there are also some insoluble sulfides also present in the wastewater. These are principally precipitates and are not of a major concern in the odor potential. Equation (2), above, occurs only at pH values above 8 and $S^=$ is only significant above pH equal to 9.5 or so.

Some of the (H_2S)aqueous, which is in the wastewater, will escape into the sewer atmosphere. The amount that escapes is a function of Henry's law as shown in equation (3).

$$Xg = K_H * Pg \qquad (3)$$

Xg = mol gas/mol of gas and water
Pg = Partial pressure of the gas, atm, = ppmv/1,000,000
K_H = Henry's constant, atm

Henry's Law represents an equilibrium condition, i.e., a worst case or maximum concentration in the gas phase. It is not common for sewers to reach an equilibrium condition unless it is poorly ventilated.

Review of the data from the grab sampling indicates low levels of dissolved sulfides, i.e., below the reporting limit. Correlating that with the manhole gas monitoring, shows relatively low hydrogen sulfide gas concentrations. An independent analysis, using the temperature and pH data determined that the equilibrium concentrations, (using Henry's Law), are around 6 to 7 ppmv. Thus the hydrogen sulfide concentrations in the manhole as recorded by the Odalog®

are near equilibrium concentrations. As such, the hydrogen sulfide concentrations would not be expected to be much greater than the values indicated.

Table IV-2 presents a summary of the Odalog measurements for hydrogen sulfide in the sewer atmosphere in a manhole upstream of CCPS.

Table IV-2
Summary of Hydrogen Sulfide Gas Monitoring in Sewer Upstream of CCPS
10/11/2004 to 10/18/2004

Location	Instrument	Summary of Data
In Manhole on 24-in gravity sewer, adjacent to Regional Park Visitor Center	Odalog® as manufactured by App-Tek Range 0 to 200 ppmv Log Interval: 300 seconds Accuracy: ± 1 ppm	Minimum: 1 ppmv (10/11/04 @ installation) Maximum: 9 ppmv (10/11/04 @ 15:20) Average: 3 ppmv Temperature: Minimum 75.2 (10/17/04) Maximum: 79.5 (10/11/04 @ installation)

In reviewing the output from the Odalog® unit, the hydrogen sulfide concentrations varied throughout the day, with lower values in the early morning hours. The peaks on Monday (10/11) through Thursday (10/14) were higher than the peaks on Friday through the following Monday (10/18). The peaks were trending downward during the period Monday through Thursday. When the Odalog® was removed from the manhole on Monday 10/18/2004, it was observed that it was wet, possibly indicating that it may have been submerged. If so it is now known what impact this might have had on the measurements. There was significant rainfall on Saturday (10/16, late night) and on Sunday (10/17). It is now known what impact this might have had on the flows. In summary the hydrogen sulfide concentrations in the sewer system are not significant

Data from the low range Odalog® mounted in a tree about 6 feet above ground, midway between the Regional Park Visitor Center and the CCPS was collected in a series of 5 "sessions." Sessions started about 8 am and ended in the afternoon about 3 to 5 pm. The low range Odalog® has a range of 0.01 to 2.00 ppmv. The accuracy is ± 10 percent of the reading. The logging interval was 1800 seconds (30 minutes). All readings were zero.

The downstream end of the project is at intersection of Rose Dr. and Vesuvius Dr., just downstream from Carbon Canyon Dam. The existing CCPS has two force mains which discharge into a manhole adjacent to the top of Carbon Canyon Dam. From there it flows by gravity, down a significant slope to a manhole about 50 ft northeasterly of manhole in the middle of the intersection of Rose Dr. and Vesuvius Drive. The east side of Rose Dr. is undeveloped. There are residences within 100 feet of the intersection of Rose Dr. and Vesuvius Dr. (southeast corner).

No data on hydrogen sulfide were collected at this location. Due to the force main discharge from the existing CCPS, the sulfide data collected upstream of the pump station are probably not representative of what is occurring in this location. Odor measurements will be done during the design phase.

6.3 ODOR ASSESSMENT AND CONTROL PLAN FOR CONSTRUCTION

Based on the data collected to date and the location and duration of the construction activities which would allow odors to escape, the odor impact is minimal. In the case of the work at Carbon Canyon Regional Park, the hydrogen sulfide concentration in the collection system is low. However, it is possible, depending on the time of year the connection to the existing sewer manhole is made, odors could be noticed by visitors to the park. The reason for this is the relatively sheltered area (away from winds) that the existing pump station is located. There might be some short term odors associated with the clean out of the existing wet well, prior to abandonment of the Pump Station.

At the downstream end of the project, the major concern will be to minimize odors to the residences to the south and east of the intersection of Rose Dr. and Vesuvius Dr. Again the duration of work is expected to be short.

The odor assessment and control plan for construction will include the following assessment methods when work is occurring in the manhole immediately upstream of the CCPS wet well, the CCPS wet well is being cleaned out, the force mains are being purged and flushed out prior to being abandoned, and when the connection is made at the downstream end of the project:

- Continually monitor and record the hydrogen sulfide concentration at the bottom of the manhole immediately upstream of the CCPS wet well or the manhole at the point of connection in Rose Dr. and Vesuvius Dr.
- Monitor and record the ambient air in the vicinity of the CCPS near the visitor parking lot/visitor center and near the closest residence at the intersection of Rose Dr. and Vesuvius Dr.
- The specifications will require the contractor to use an Odalog gas monitor for manhole hydrogen sulfide monitoring and a low range Odalog™ for the ambient air monitoring. The ambient air monitor will be installed in a tree at "nose" level.

If the hydrogen sulfide concentration indicates possible odor problems, the contractor may take one or more of the following actions to prevent and odor problem:

- Stop work until concentrations decrease or wind conditions change
- Stop work for the remainder of the day and request the injection of sodium hydroxide into an upstream manhole
- Install facilities to feed ferrous chloride into the wastewater system upstream of CCPS to reduce odors at the CCPS and the discharge end of the force mains and operate the facilities as needed. Ferrous chloride will require containment and security.

- Install facilities to feed Bioxide into the CCPS wet well to reduce sulfide buildup in the force mains thereby reducing odor at the point of connection in Rose Dr. and Vesuvius Dr. and operate the facilities as needed. Bioxide™ is a relatively innocuous chemical (calcium nitrate -- a good grade of fertilizer) and is easier to handle than ferrous chloride.
- Enclose the work area in a temporary structure and exhaust and treat the air with granular activated carbon. This system will require South Coast Air Quality Management District permit. The contractor will be required to secure such a permit. If such a system is used by the contractor, it is important the contractor be prohibited from using caustic impregnated granular activated carbon as this type of carbon is subject to bed fires due to its low ignition temperature.

The "action limits" will be tentatively set at those indicated below. If there are odor complaints, or if the inspectors can detect odor in the Regional Park or at the sidewalk adjacent to the residences at the intersection of Rose Dr. and Vesuvius Dr., the "action limits" will be adjusted downward as needed to mitigate the odors.

The proposed action limits are:

- Hydrogen sulfide concentrations at the manhole bases above 25 ppmv
- Hydrogen sulfide concentration at the sidewalk near the residences or in the Regional Park within 50 ft of the construction area above 10 ppbv. This is well above the reported detection threshold of 0.5 ppbv (someone detects some odor) and about twice the recognition threshold (the individual recognizes that is the odor of rotten eggs) of about 4.7 ppbv[1]. The 10 ppbv action level is reasonable.

[1] Water Environment Federation, Design of Municipal Wastewater Treatment Plants, 4th ed.

VII. IMPLEMENTATION PLAN

7.1 GENERAL

This section will identify the construction constraints and begin to develop a sequencing of the actual work and tie-ins. This section will also identify constructability issues that may arise during the project.

7.2 CONSTRUCTION CONSTRAINTS

Potential construction constraints for this project are:

- Truck and equipment access to sites within the Park and Aera property.
- Retention of water behind the dam may encroach upon the construction area.
- Must keep the existing Pump Station and force main in service during the entire construction process.
- Microtunneling may be difficult if impenetrable material is encountered.
- Protection of native plant and animal species (especially during nesting seasons).
- Portions of the work will take place in or near oil fields.

7.3 SEQUENCING OF WORK

The sequencing of the work must be such that the existing Pump Station and force mains remain in service until the gravity pipeline is complete and ready to convey flow. In addition, the existing Carbon Canyon Interceptor must remain in service throughout the project. For discussion purposes, the proposed pipeline will be broken into 3 reaches: Reach 1 begins at the existing Pump Station and ends at the first microtunnel pit; Reach 2 is the microtunneled section of pipe; Reach 3 runs between the second microtunnel pit and the end of the pipeline at Rose and Vesuvius. A general sequencing of the construction activities is as follows:

1. Construct Reach 1 – do not make connection between Reach 1 and the existing gravity pipeline at the Pump Station.
2. Construct Reach 2 – do not connect Reach 1 and Reach 2
3. Perform testing and cleaning procedures on Reach 2.
4. Connect Reach 1 and Reach 2.
5. Construct Reach 3 – do not make connection between Reach 3 and existing Carbon Canyon Interceptor.
6. Perform testing on Reaches 1 – 3.
7. Make connection between Reach 3 and Carbon Canyon Interceptor.
8. Divert flow around existing manhole at upstream of Pump Station and make connection between Reach 1 and existing manhole.
9. Divert all flow through new gravity sewer pipeline.
10. Pump out existing wet well, salvage pumps and valves to OCSD and abandon Pump Station and force mains.

VIII. PRELIMINARY DRAWINGS

8.1 GENERAL

Preliminary drawings have been prepared to show the proposed alignment of the pipeline and topographical characteristics. The drawings are attached at the end of this report.

PRELIMINARY GEOTECHNICAL INVESTIGATION, PROPOSED CARBON CANYON DAM SEWER AND PUMP STATION REPLACEMENT PROJECT FOR ORANGE COUNTY SANITATION DISTRICT, NEAR CARBON CANYON ROAD AND ROSE DRIVE, CITY OF BREA AND UNINCORPORATED ORANGE COUNTY, CALIFORNIA

Prepared for:

RBF CONSULTING
14725 Alton Parkway
Irvine, California 92618-2027

Project No. 600034-001

June 30, 2003

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

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June 30, 2003

Project No. 600034-001

To: RBF Consulting
14725 Alton Parkway
Irvine, California 92618-2027

Attention: Mr. Kevin Gustorf

Subject: Preliminary Geotechnical Investigation, Proposed Carbon Canyon Dam Sewer and Pump Station Replacement Project for Orange County Sanitation District, Near Carbon Canyon Road and Rose Drive, City of Brea and Unincorporated Orange County, California

Introduction

In response to your request, Leighton Consulting, Inc. has conducted a geotechnical investigation for proposed Carbon Canyon Dam Sewer and Pump Station Replacement Project for the Orange County Sanitation District. The project area is between Carbon Canyon Road and Rose Drive in the City of Brea and portions of the Unincorporated Orange County, California (see Figure 1, Site Location Map). The purpose of our investigation was to evaluate the soil characteristics at the site and to provide geotechnical recommendations for design and construction of the proposed improvements. This investigation is based on our discussions with you and the 350-scale, Orange County Sanitation District (OCSD), Carbon Canyon Sewer, Exhibit 2, prepared by RBF Consulting, dated April 24, 2003. This map has been used as the base for our Boring Location Map, Figure 2.

Based upon our investigation, the proposed improvements are feasible from a geotechnical viewpoint, provided our recommendations are incorporated into the design and construction of the project.

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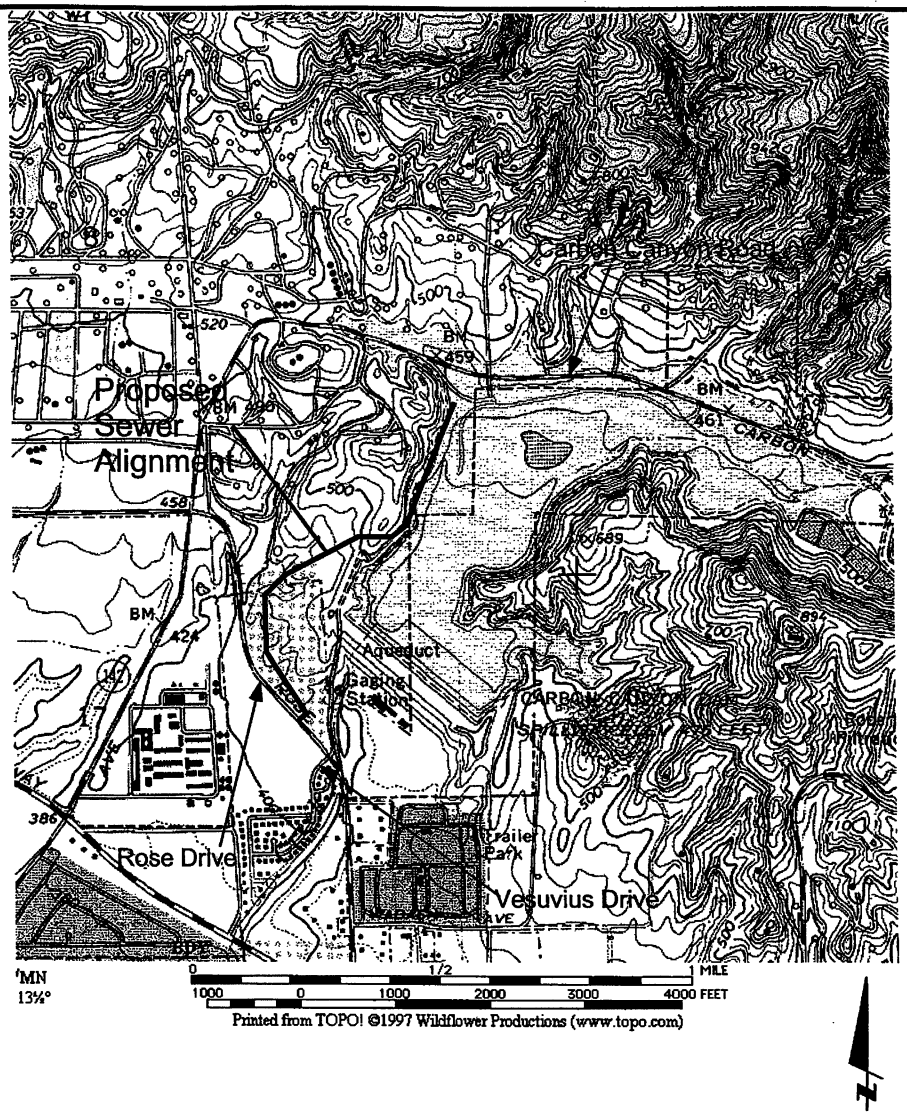

CARBON CANYON DAM SEWER REPLACEMENT PROJECT, CITY OF BREA AND UNINCORPORATED ORANGE COUNTY, CALIFORNIA	**SITE LOCATION MAP**	PROJECT NO. 600034-001 DATE June, 2003 Figure No. 1

Project Description

The existing Carbon Canyon Pump Station was originally built in 1974 and modified in 1984. The existing alignment consists of two forced main and one gravity feed sewer lines. The forced main lines consist of a 4-inch and a 6-inch cast iron pipe. Both lines begin at the pump station in Carbon Canyon Regional Park and end at the top of Carbon Canyon Dam. The length of the forced main alignment is approximately 2,800 feet. South of Carbon Canyon Dam, the sewer is a gravity line. The diameter of the line varies from 12 to 27 inches and runs from a manhole atop the dam, across Aera Energy Property, and ends near the intersection of Rose and Vesuvius Drives. The gravity line is approximately 1,500 feet long.

OCSD plans to abandon the existing pump station and replace the forced mains with a 21-inch VCP gravity flow line. The new line will be constructed using both open trench and micro tunneling. The line will extend approximately 1,600 feet southerly from the existing pump station using conventional trenching methods. From that point, the sewer line will be extended in a westerly direction through the hillside using micro tunneling. The micro tunnel will extend roughly 1,200 feet. The approximate starting and end points (the proposed jacking pit locations) for the proposed microtunnel are shown on Figure 2. The sewer line will then continue approximately 1,800 feet to the south using conventional trenching methods. This portion of the alignment will roughly parallel and eventually connect with the existing 27-inch OCSD gravity sewer line located on Rose Drive. The proposed sewer line will connect with the existing Rose Drive, 27-inch sewer line approximately 650 feet north of the intersection of Rose and Vesuvius Drives.

Previous Geotechnical Investigations

Pacific Soils and Engineering Inc. conducted a geotechnical investigation within the Aera Energy Property of the site in 1999 (PSE, 1999). We reviewed appropriate portions of their data during our investigation of the sewer alignment.

Scope of Work

The scope of our work for this investigation included the following tasks:

- Review of published and unpublished geologic reports and aerial photographs pertinent to the site available from our in-house library. We also reviewed the Pacific Soils report for the Aera Energy site.

- Obtained utility clearance from Underground Service Alert and Aera Energy prior to our subsurface investigation.
- Attendance at a safety meeting (presented by Aera Energy representatives) by the onsite field staff of Leighton Consulting and our subcontracted drill rig.
- Drilled, logged and sampled eight small diameter borings (B-1 through B-8) within the proposed sewer alignment, and one large-diameter bucket auger boring (B-4A) within the proposed micro tunneling portion of the sewer alignment. The depth of the borings ranged from 21 from 76 feet below the existing ground surface.
- Laboratory testing of representative, relatively undisturbed and bulk soil samples obtained during the course of the field investigation.
- Laboratory testing for Coliform of samples collected in the vicinity of the existing sewer line alignment.
- Analysis of the field and laboratory data.
- Preparation of this report presenting our findings, conclusions, and geotechnical recommendations.