American River Basin: Downtown Combined Sewer Upsizing Project

Attachment 3: Work Plan

Att3_SWF_SAC_Workplan_2of2 includes the following supporting documentation:

- Downtown Large Sewers Rehabilitation and Improvement, Phases 1 through 3
- P Street Sewer 60% Design
- California Sportfishing Protection Alliance Petition

Downtown Large Sewers Rehabilitation and Improvement, Phases 1 through 3

PRE-DESIGN REPORT

CITY OF SACRAMENTO

APRIL 2001

Downtown Large Sewers Rehabilitation and Replacement Project

Phases 1 through 3

CITY OF SACRAMENTO DEPARTMENT OF UTILITIES

BROWN AND CALDWELL

CITY OF SACRAMENTO

DOWNTOWN LARGE SEWERS REHABILITATION AND REPLACEMENT PROJECT

PHASES 1 THROUGH 3

PRE-DESIGN REPORT

April 30, 2001

CITY OF SACRAMENTO DEPARTMENT OF UTILITIES

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BACKGROUND

Due to the rapid development of the City of Sacramento (City) in the late 1850s following the gold rush, a combined sewer system (CSS) was constructed in the City's older, central area instead of separate sanitary sewers and storm drains. A CSS conveys both sanitary sewage and storm water runoff in the same pipelines. Due to the flat terrain of Sacramento and the small diameters and deteriorated condition of many of the old CSS pipelines, wastewater now backs up in the system during significant storms. During these storms, local street flooding and some flooding of basements occurs in several locations. As a result, the City's Department of Utilities has embarked on a long-term program to improve and rehabilitate the CSS. The program consists of (1) increasing pumping capacity at the two major drainage pump stations (a.k.a. "sumps"), (2) construction of regional underground detention basins for temporary storage of wastewater during storms, (3) replacement of old, small sewers with larger pipelines, (4) reinforcement of some trunk sewers with parallel pipelines, and (5) working with developers of new construction projects to incorporate on-site detention.

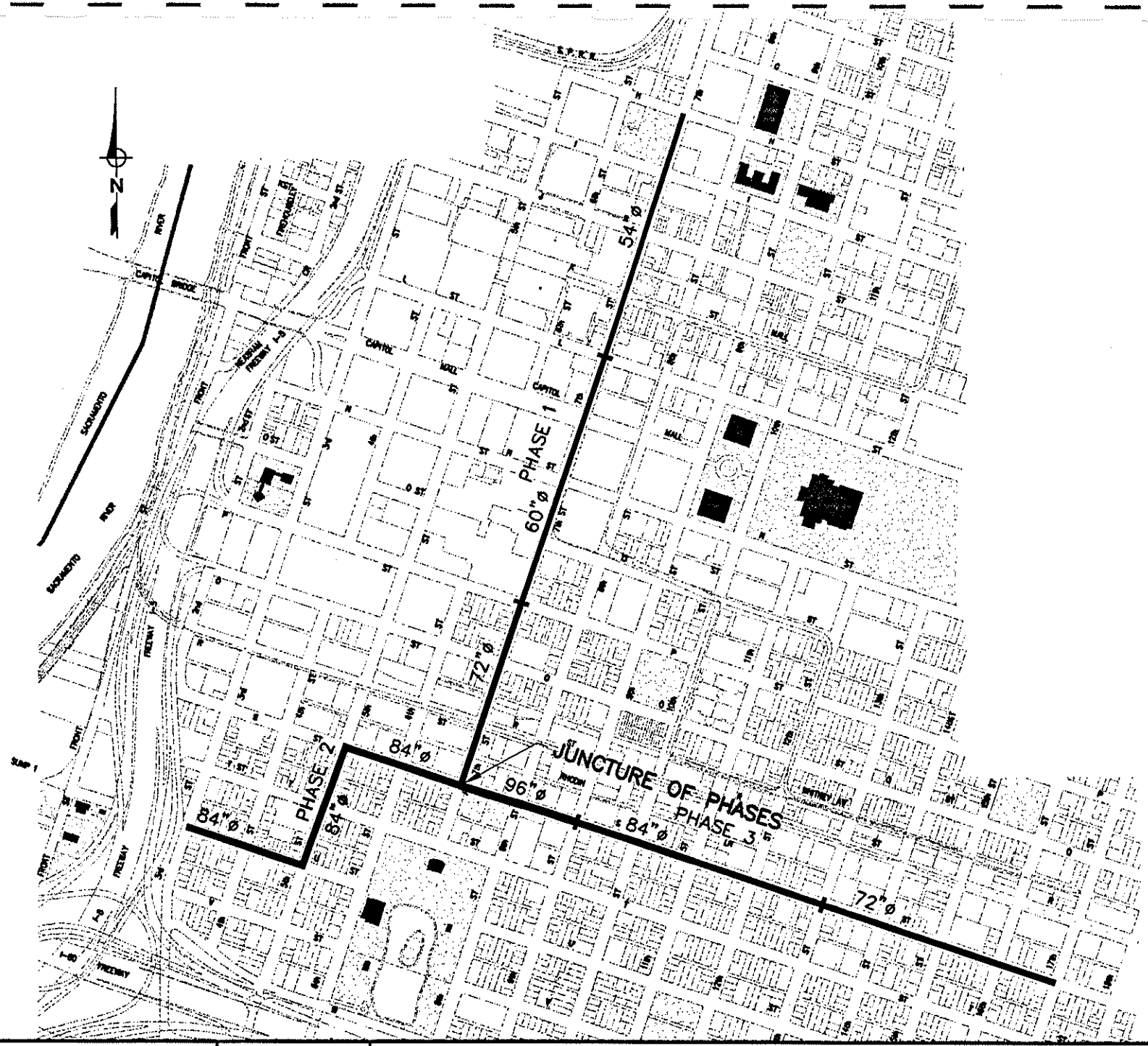
Some of the oldest sewers are in the downtown area. Some are made of brick and are over 100 years old. Due to the deteriorated condition of these sewers, they need to be removed and replaced or abandoned in-place following construction parallel replacement sewers. The City's Department of Utilities Engineering Division staff developed a plan to rehabilitate and replace major sewers in the downtown area with an emphasis on replacement of badly deteriorated sewers. This project is entitled the "Downtown Large Sewers Replacement and Rehabilitation Project", hereinafter referred to as "the Project".

In 1998, the staff prepared a draft pre-design report, which was completed to approximately 60 percent of a complete pre-design report, that developed a plan for the Project using large diameter reinforced concrete pipe (RCP) to provide in-line detention storage as well as conveyance capability. Due to annual budget constraints, the report established a six-phase program for making the improvements over several years. In 1999, the Department of Utilities engaged Brown and Caldwell and their subconsultants to prepare a complete pre-design report for Phases 1 through 3 of the Project. These three phases, as originally conceived, are shown on Figure 1 and consist of the following:

Phase 1 along 7th Street from H Street to S Street with replacement of the old brick and RCP combined sewers on the west side of 7th Street. 7th Street is very busy and has extensive underground utilities between H and L streets.

Phase 2 from 7th and S streets west to 5th and S streets, south to 5th and U streets, and west to 3rd and U street where the sewer will connect to a future 84-inch sewer extending under Interstate 5 to Sump 1A.

Phase 3 along S Street from 17th Street to the connection with Phases 1 and 2 at 7th Street.



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Original Phases 1, 2, and 3

Figure 1

The key features of the original Phases 1 through 3 are presented in Table 1.

Table 1. Key Features of Original Phase 1 through 3 Combined Sewers

Diameter,-inches	Length, feet	Min trench depth, feet	Max trench depth, feet	Storage volume, million gallons
Phase 1	-	-	-	-
72	1257	14	16	0.27
60	1708	14	16	0.25
54	1715	14	22	0.20
Phase 1 Total	4680	-	-	0.72
Phase 2	-	-	-	-
84	2433	14	16	0.70
Phase 3	-	-	-	-
96	817	15	15	0.31
84	1586	12	15	0.46
72	1492	11	13	0.32
Phase 3 Total	3895	-	-	1.09

PURPOSE OF THE PROJECT

The purpose of the Project is twofold: (1) to replace old deteriorated sewers and (2) to reduce flooding in the downtown area. Most of the older combined sewers in the downtown area have reached the end of their useful lives and need to be replaced to avoid failure or even catastrophic collapse in the future, which might result in sinkholes along the streets.

The City recently completed increasing the capacities of Sump 2, Sump 1/1A, and Pioneer Reservoir to accommodate considerably more CSS flow. The existing pipelines along Phase 2 range in diameter from 60 to 84 inches, and they are not as old as most of the downtown system and are in good condition. However, these pipelines are undersized for matching the new capacities of Sump 1/1A and Pioneer Reservoir, and their diameters must be increased. Phases 1 and 3 are large pipeline (54 to 96 inches in diameter) designed to replace a series of old sewers (24 to 48 inches in diameter) that are in poor condition and undersized for supplying adequate conveyance to the improved sumps and Pioneer Reservoir. These new large replacement sewers have been designed to provide both increased conveyance and in-line storage to achieve maximum flood reduction.

Flood reduction can be achieved by providing detention storage to temporarily hold the sudden, large volumes of combined wastewater that occur during significant storms until flows in the

downstream wastewater conveyance, treatment, and disposal facilities subside so these facilities can accommodate the detained wastewater. Pipes with diameters greater than required to convey peak wet weather flows can be installed in the public right-of-way to provide detention storage.

The Project offers the opportunity to both replace old sewers and provide detention storage in Sacramento's downtown area. Sewers ranging from 54 to 96 inches in diameter were considered for the Project. Usually, the larger the pipe, the better the storage volume-to-cost ratio since the volume is proportional to the square of the diameter while the cost increases incrementally with diameter.

The Department of Utilities uses the Sacramento Storm Water Management Model (SWMM), a customized version of the United States Environmental Protection Agency's computer-based SWMM, to analyze proposed modifications to the CSS and determine future benefits in flood reduction. One of the key features of the Sacramento SWMM is the ability to model the surface flow in the gutters. When the sewers are filled to capacity, wastewater flows up out of the drop inlets and into the gutters along the sides of the streets. This wastewater re-enters the sewers later on through downstream drop inlets. Results of the Sacramento SWMM runs for the Project are documented in Appendix A.

OBJECTIVES OF THIS REPORT

The objectives of this pre-design report are:

1. Identify any fatal flaws that would prevent construction of the new sewers as envisioned in the City's 60-percent pre-design report.

2. Develop alternatives for overcoming any fatal flaws.

3. Identify and locate the main interferences (mainly underground utilities) that will impede construction or require special design features.

4. Prepare preliminary capital cost estimates.

5. Prepare preliminary plans and profiles of the proposed improvements in sufficient detail to enable the Department of Utilities to proceed with detailed design and construction.

DEVELOPMENT OF PLANS AND PROFILES

This section of the report describes the activities undertaken to produce the preliminary plans and profiles of the replacement sewers for the Project.

Surveying

Development of the plans and profiles began with a survey of the existing sewers along the streets where construction of the three phases is proposed. Aerial photographs were taken in August 1999 (except for the 5th Street Alternative) to provide the up-to-date background for the plan views. The ground surface along the alignments of the existing sewers is shown on the profiles. Survey crews measured the depths to all pipes in every manhole along the existing sewers. The invert elevations of the pipes at the existing manholes are shown on the pipelines emanating from each manhole on the plans in Appendix D. Other utility features that are visible at street level, such as valve covers, vaults, and drop inlets, are shown on the plans.

Agency Coordination

Copies of Department of Utilities standard Letter "A", with a small map of the Project, were mailed to all the utility and communications companies that are likely to have underground pipelines or cables installed along or crossing the streets where the replacement sewers are proposed. Letter "A" informs the companies about the proposed Project and requests information about any installations that may interfere with the proposed Project. After about two weeks, phone calls were made to any company that did not respond to follow up on the request for information.

Field Checking

Using the information gathered in the surveying and agency coordination steps, the location of existing utilities and communication installations were visually checked in the field with Mr. Farrell Crawford, the Field Services Division Waste Water Superintendent. Information provided by the superintendent was valuable because he remembered underground conditions in several locations based on previous excavation projects he had witnessed. The identification and location of existing utilities and communication installations were assembled into an overlay to the plan views on the plan-and-profile sheets. Following completion of the field checking, lists of potential interferences with the construction of the new sewers were prepared; these lists are presented in Appendix B.

Potholing

Potholing was performed to determine the depth of more critical utilities and communication installations. With the Department of Utilities providing traffic control, the budget allowed for 60 potholes. A meeting was held with Department of Utilities staff to discuss where the potholes should be located. The Underground Service Alert (USA) system was used to get utility and communications companies to mark their facilities and installations on the pavement.

Potholing was performed using the vacuum method whereby the 12-inch square section of pavement is removed, and a vacuum tube is used to suck the soil up into a can. A mirror and natural sunlight were used to view the utilities in the hole. Logs of the potholing are included in

Appendix C. After the depth to the utilities was determined, the excavated soil was returned to the hole and compacted. Asphaltic concrete was placed in the top of the holes to restore the street surface.

Plan and Profile Preparation

The plans and profiles for the rehabilitation and replacement of the Phases 1 through 3 downtown sewers were prepared in AutoCAD Version 14. Copies are included in Appendix D. Selection of the alignment of the proposed replacement sewers is discussed in the section entitled "Interferences" below. The sewers must be deep enough that sewer laterals from basements can drain into them with gravity flow. However, the sewers must also drain into the downstream sewers to which they are connected with gravity flow, so they cannot be too deep. The profiles in the City's 60-percent pre-design report met these criteria and were retained in this pre-design report.

The plan views show the approximate faces of the trenches as heavy dashed lines. The faces of the trenches were selected, rather than the sewer pipe itself, to show the maximum extent of the underground area impacted by the construction. For the micro-tunneling portion of Phase 1 along 7th Street (refer to "Alternatives" below), the heavy dashed lines on the plans show the approximate diameter of the tunnel into which the sewer pipe will be installed.

INTERFERENCES

Pipelines for potable water, sewage, storm water, natural gas, steam, and chilled water historically have been installed under city streets. More recently, electrical power, telephone, television, and E-mail/Internet cables and terminal boxes have also been installed beneath city streets to avoid unsightly pole-mounted lines. These pipelines and cables create interferences when trenches are excavated to install sewers. Since the force of gravity makes wastewater flow down into sewers from buildings along the street (as opposed to being pumped), sewers tend to be deeper than pressure pipelines and cables, which can be installed with nominal cover.

When the pressure pipelines and cables cross the trench, the construction contractor can locate them by potholing and dig around and under them when excavating the trench. If the trench is wide, due to the large diameter of the sewer, some crossing pipelines and most cables must be temporarily supported with steel beams or timbers until the sewer is installed and the trench can be backfilled. . The construction contractors must be careful not to remove pressure pipeline thrust-block supports; existing thrust-blocks should be located by potholing.

If a crossing pressure pipeline is at the same depth as the sewer under construction, it can often be re-routed up and over the sewer to get it out of the way since it is a pressurized pipeline. Other gravity-flow sewers and storm drains, which tend to be deep and cannot be easily re-routed, can create significant interferences that are difficult to overcome.

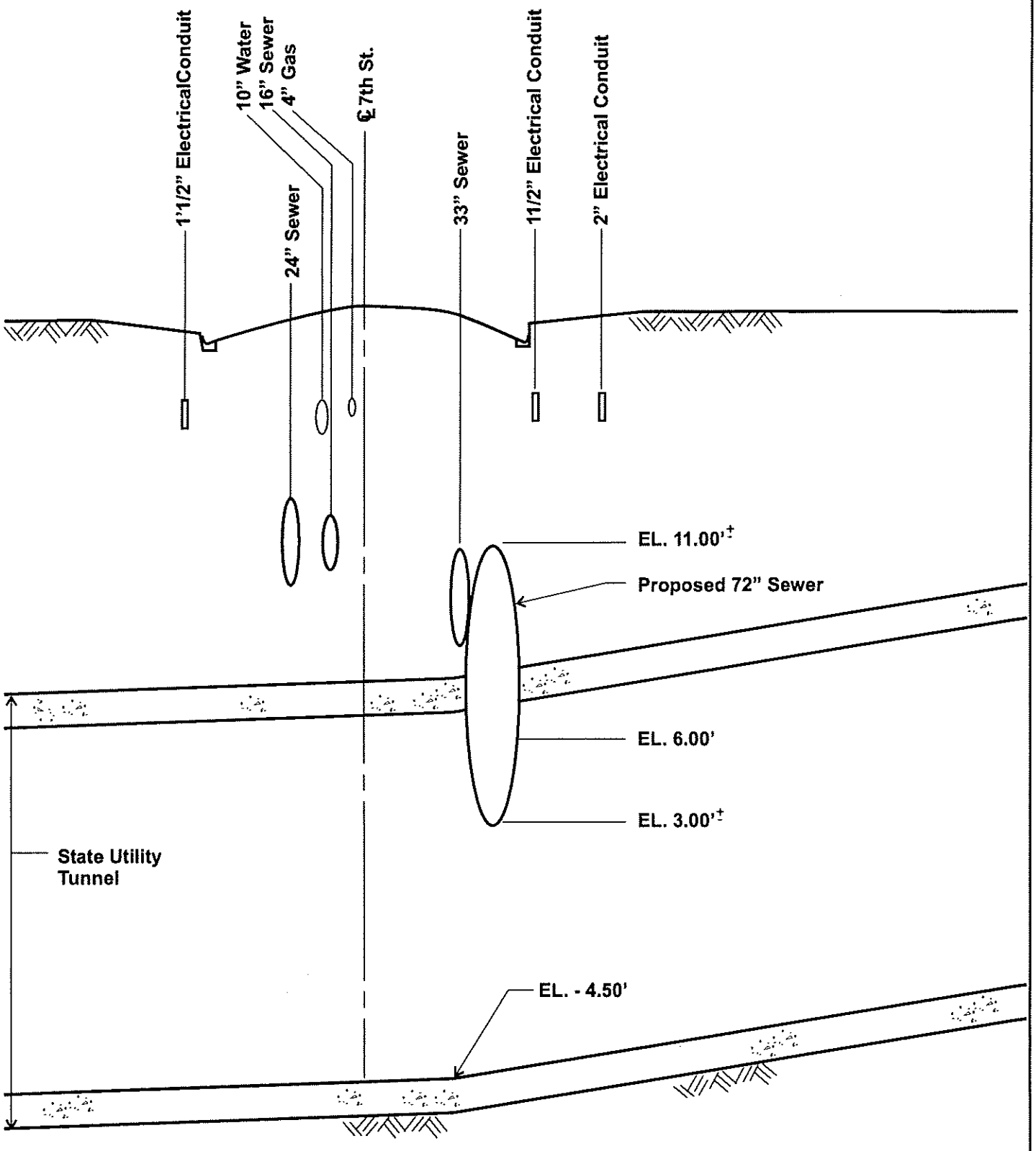
Existing utilities installed parallel to open trenches that are within or close to the sides of the trenches are more of a problem than utilities that cross the trench. If the pressure pipeline or cable runs longitudinally along the trench, it usually must be relocated before the trench is excavated. For existing parallel utilities close to the sides of open trenches, cement grout may have to be injected into the soil to support the old trenches in which the utilities were installed.

A review of the interference tables in Appendix B reveal that there are numerous interferences that will impact the Project. These tables also indicate whether or not the interferences were located by potholing for this pre-design report; only the most critical interferences were potholed. The most interferences occur along 7th Street between H and L streets where many underground pipelines and conduits exist in the busy downtown district in front of the State Capitol. There are lots of underground utilities along this portion, particularly at the crossing intersections. Besides the crossing utilities, there are several that extend north and south along 7th Street. The utilities include combined sewers, separate storm drains, connecting pipes from drop inlets along the curbs, water mains and services, gas mains and services, electrical power conduits, and fiber-optic and wire communication conduits. In addition, the light-rail transit tracks extend along the east side of 7th Street from K to O streets.

One very large interference was discovered that severely impacted the alignment along 7th Street in the Department of Utilities' 60 percent pre-design report. The State of California recently constructed a steam and chilled water generating plant on the west side of 7th Street between P and Q streets to serve the high-rise State office buildings in the blocks to the east. A large tunnel was constructed on the south side of the intersection at 7th and P streets to enclose pipelines extending east from the generating plant. A cross section of this tunnel in relation to the 72-inch sewer proposed for Phase 1 is shown Figure 2. The tunnel is shown in plan view on the Sheets 5 and 6 of the Phase 1 plan and profiles in Appendix D.

The size and elevation of the State's tunnel are such that it would intersect the lower portion of the proposed replacement sewer and interfere with the sewer flow line. Since this tunnel is lined with pipelines and also serves as a passage for personnel, it would be impossible to break through the top of the tunnel to allow installation or the new sewer. This interference proved to be a fatal flaw in the original alignment for the Phase 1 replacement sewer along 7th Street. The alternative alignment for circumventing this interference is described in the section entitled "Alternatives" below.

The number of interfering underground utilities are much less for Phases 2 and 3 than for Phase 1. No fatal flaws were discovered for Phases 2 and 3. On S Street, however, the originally proposed combined sewers are very shallow, and the cover was less than four feet for much of the length of the sewers. Even though there are not many crossing utilities now, installing new large sewers at such shallow depths would effectively create barriers to construction of other utilities extending from north to south across S Street in the future. At a constructibiliy meeting in February 2001, we decided to reduce the diameters of the sewers along S Street to provide a minimum cover of four feet above the outside top of the pipe. The diameters had to be reduced rather than lowering the larger sewers in order to maintain the original invert profile so that the combined sewers would properly drain to Pump Station 1/1A. Table 2 identifies the portions of Phases 2 and 3 pipeline that require reduced diameters along S Street.



Scale: 1" = 20' H
1" = 4' V

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BROWN AND CALDWELL		State Utility Tunnel at 7th and P Streets	Figure 2

Table 2. Pipe Diameters Required to Provide 4 feet of Cover Along S Street

Station		Original	Original	New	New
From	To	Diameter,- inches	Minimum Cover, feet	Diameter,- inches	Minimum Cover, feet
Phase 2					
17+51	25+33	84	3.5	78	4.0
Phase 3					
0+00	8+17	96	3.4	90	4.0
14+50[a]	16+20	84	3.7	78	4.2
16+20	20+22	84	2.7	66	4.3
20+22	25+03	84	1.8	60	4.0
25+03	37+09	72	1.9	48	4.1
37+09	41+11	72	2.3	54	4.0

[a] Requires additional manhole at this station.

The reduced diameters reduced the amount of storage provided by the proposed combined sewers. Sacramento SWMM runs were made to determine the impact of the reduction in storage, and the results are presented in Table 3. We decided that the reduction in storage was acceptable and could be compensated for in other downtown combined sewer system projects.

Table 3. Flood Volume Reductions with Smaller Diameter Pipes Along S Street

Phases	Flood Volume with Smaller Pipes, cu ft	Flood Volume with Larger Pipes, cu ft	Increased Flood Volume, cu ft
1,2&3	3,645,553	3,598,606	46,947
1,2,3&5	3,483,109	3,450,867	32,242
1,2,3,5&6	3,420,699	3,342,948	77,751

ALTERNATIVES

Alternatives to bypass major interferences were developed and are described in this section.

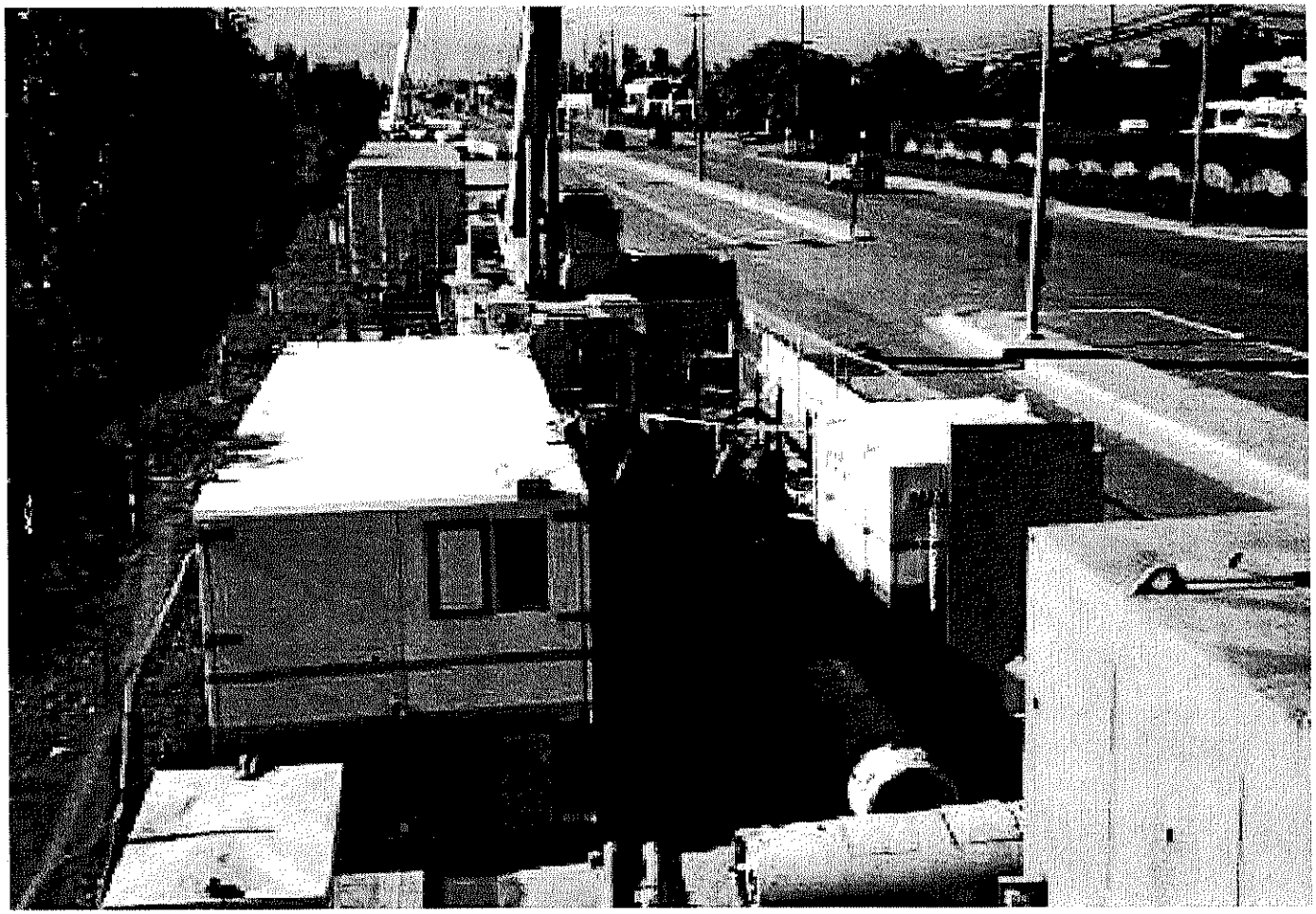
7th Street Between H and L Streets

Using open-trench construction along 7th Street between H and L streets would be disruptive to traffic and businesses in this busy downtown district and would require special attention to ensure that some of the many interfering pipelines and conduits are not accidentally cut. Special shoring techniques would be necessary to provide lateral trench support while allowing clearance for the crossing utilities. One option to overcome these problems is to use micro-tunneling along this portion of 7th Street.

Micro-tunneling would be much less disruptive than open-trench construction because only three pits need to be excavated. A 13-foot wide by 25-foot long tunneling pit for the tunneling equipment would be excavated approximately 140 feet south of J Street. This pit would be located within a 25 foot wide by 150-foot long contractor's working area. This location is relatively free of underground interferences. The tunnels would be extended both north and south from this pit to two receiving pits, one located on the south side of L Street, and the other located on approximately 180 feet north of I Street. The tunnel would first be drilled in one direction, and then the machine would be turned around so the tunnel could be drilled in the other direction. A typical micro-tunneling work site with the necessary equipment and trailers is shown in the photograph on Figure 3 (note that the photograph was taken from on top of the slurry machine, which is one of the large pieces of equipment used in micro-tunneling).

The micro-tunneled portion will be constructed below the existing combined sewer. After the micro-tunneled portion is complete, the existing service laterals will have to be transferred from the old combined sewer to the new combined sewer. These transfers will require excavation of pits, similar to potholing pits, at each service lateral. For each service lateral, new lateral piping will be required, and a cored-in fitting will be installed in the wall of new sewer for connecting the lateral. During detailed design, consideration should be given to abandoning the old brick sewer prior to micro-tunneling by diverting flow and relocating the service laterals to the existing 24-inch-diameter sewer.

We also prepared an open trench alternative for 7th Street between H and L streets, which snakes around some of the longitudinal (i.e., north and south) underground interferences. Cost estimates were prepared for both the micro-tunneling and the open trench alternatives, as discussed in the "Cost Estimates" section of this report. Although the base construction cost of the micro-tunneling alternative along the original alignment is more expensive by $ 540,000, or 8 percent, than the open trench alternative, micro-tunneling will much less disruptive during construction and deserves serious consideration.



BROWN AND CALDWELL	DATE 9-5-00 PROJECT 18292-400	Typical Micro-Tunneling Work Site	Figure 3

Chilled Water Tunnel at P Street

The State's chilled water tunnel under 7th Street on the south side of P Street is a fatal flaw in the Phase 1 alignment of the replacement sewer extending south from that intersection. As shown on Figure 2, the depth of the tunnel is such that the proposed profile of the sewer goes right through the upper half of the tunnel. There are two options available for avoiding this obstacle. One option is to alter the alignment of the proposed sewer to another nearby parallel street. The other is to construct an inverted siphon so the sewer passes underneath the tunnel.

We discussed the option of an alternate alignment with City staff. It appears that the most favorable alternative would be to install the new combined sewer west along P Street from 7th Street to 5th Street and then south along 5th Street until it joins the Phase 2 sewer at 5th and S streets. We have named this new proposed alignment the "5th Street Alternative". Since the city blocks are rectangular in this part of town, the total length of sewer from 7th and P streets to 5th and S streets would be the same whether the sewer is installed along its original alignment or along the 5th Street Alternative alignment. However, the 5th Street Alternative adds two 90-degree bends to the alignment, which will increase the head loss in this portion of the sewer.

The invert elevation of the proposed manhole at 5th and S streets is low enough that a 72-inch sewer can be installed along the 5th Street Alternative alignment and drain correctly. However, there will be solids deposition during summertime low flow period regardless of which alignment is chosen, as discussed in the "Low Flow Analysis" section of this report.

The service laterals along 7th Street south of P Street can be transferred from the old 24-inch brick sewer to the newer 33-inch RCP sewer on the east side of 7th Street. This will allow the old brick sewer to be filled with sand and abandoned.

We developed the 5th Street Alternative to the same level of detail as the original Phase 1 alignment. The check of potential interferences along the 5th Street Alternative alignment revealed that the number and significance of the utilities is approximately the same as along the original alignment, with two notable exceptions. At the intersection of 5th and Q streets, the proposed combined sewer crosses and interferes with a 30-inch diameter storm drain that drains to the west. The storm drain is shown in plan view on the Sheet 2 of the 5th Street Alternative plan and profiles in Appendix D. An inverted siphon in the storm drain must be constructed to clear this interference. Since a storm drain only operates during rainy weather, an inverted siphon does not produce as many operation and maintenance problems as an inverted siphon in a combined sewer, which conveys raw sewage all year long. With installation of manholes, the inverted siphon can be drained and cleaned between storms.

At the intersection of 5th and S streets, there are two 30-inch diameter chilled water pipelines, owned and operated by the State of California, that will have to be relocated up and over the proposed combined sewer.

The option of using an inverted siphon in the proposed combined sewer to pass under the chilled water tunnel at 7th and P streets was considered, but it is clearly not as attractive as the 5th Street

Alternative. An inverted siphon in a sewer that will convey only sanitary sewage during the dry summer months would cause maintenance problems. A multiple-barrel siphon, with one barrel having a diameter small enough to ensure low flow velocities sufficient to convey solids, would have to be installed to ensure that solids do not settle to the bottom on the siphon. Small diameter barrels could become plugged with sticks or other foreign objects. These features could require inordinate amounts of labor to keep the siphon clean and operating. Therefore, the option of an inverted siphon will not be considered further. Since the proposed profile of the sewer passes through the upper portion of the tunnel, the installation of multiple small diameter straight sewer pipes passing under the tunnel is infeasible.

CONSTRUCTIBILITY

Installing large diameter pipe in busy downtown urban areas is difficult and expensive because these areas are usually built up and leave little space to move around and work. There is little space for construction crews to remove excavated soil and deliver pipe. In addition, downtown areas are usually congested with both vehicular and pedestrian traffic.

Construction Sequencing

Excavating wide, deep trenches along streets in the busy downtown area will be disruptive to traffic flow and parking. The inherent noise (even if pile driving is prohibited) and dust and dirt will also be bothersome to residents, office workers, and pedestrians. We estimate that an average of only three 24-foot long pieces of combined sewer could be installed during a 7 AM to 6 PM work day. Thus, only about 100 feet of trench should be open at any time. This short length will limit the extent of community disruption and traffic congestion. Trenching across intersections should be done at night or on weekends. Interfering utilities should be relocated before the replacement sewer construction begins along any stretch of street to reduce the time it takes to install the new sewer.

To reduce excessive community disruption during construction, work hours should be limited to 7 AM to 6 PM, Monday through Friday. The preliminary capital cost estimates in this report are based on a 7 AM to 6 PM work day. The Department of Utilities specifications for sewer construction usually require the contractor to work shorter hours. It would take about twice as long to complete each construction project if work hours were limited to 9AM to 3 PM because it takes about one hour to set up and get started in the morning and one hour to clean up at the end of each day. If the work hours are reduced to 9 AM to 3 PM, the construction cost would increase by approximately 65 percent from the estimates presented in this report.

To complete the construction in a reasonable time, consideration should be given to permitting work at night in areas dominated by office buildings as opposed to residences. Nighttime work would greatly reduce disruption of traffic and parking during the business hours. However, there will be complaints about noise from residents living within ¼ mile of the construction site. Lights, illuminated signs, and electrical power generators would be necessary for nighttime work. The costs

of these items would be approximately $10,000 per week, which would increase the construction cost by about two percent above the estimates in this report. Labor pay differential for nighttime work would increase construction cost by approximately 0.5 percent above the estimates in this report.

Flow Maintenance

The new sewers for Phases 1 through 3 will replace existing sewers. For most of the alignments, the existing sewers will be demolished when the trenches for the new sewers are excavated because the existing sewers are close to the alignments of the new sewers. Since the existing sewers are currently conveying wastewater, the flow must be maintained during construction. To minimize this effort, construction should take place during the dry summer months to avoid the high flows caused by winter storms.

On some projects, sewage is simply allowed to flow along the bottom of the open trench. However, this practice is now considered an illegal discharge by the Regional Water Quality Control Board, so we do not recommend it. Flows in the existing sewers can be temporarily diverted around an open trench by placing sandbags in an upstream manhole and installing a portable trash pump and fire hoses to transport the wastewater to a manhole downstream of the open trench. Since the downtown CSS is so complex, with sewers installed along parallel streets and crisscrossing one another at intersections, it may be possible to divert flow from upstream of the trench excavation around the work area via temporary interconnections. If feasible, this practice could eliminate the need for pumping.

Flow in the laterals from the buildings adjacent to the open trench must be accommodated. This can be done by cutting the laterals a foot or so inside the trench walls and installing temporary plastic pipe with tee or wye fittings to collect the flows from the laterals and convey it to a sump equipped with a portable trash pump temporarily installed at the downstream end of the open trench. The wastewater would be pumped from the sump to a downstream manhole in the old sewer. The plastic pipe could be suspended by straps from the trench shoring.

Utility Relocation

The City has the authority to order a private utility company to relocate its pipes or conduits to make way for a new City sewer at no cost to the City, although the City does not like to do that unless it is necessary to do so. The number of underground utilities that will interfere with the installation of the Phase 1 through 3 replacement sewers is not extensive in several portions of the phases. However, installing shoring and lowering the sewer pipes between the existing utilities during installation along 7th Street between H and L streets will be difficult. Therefore, we recommend micro-tunneling this portion of Phase 1 because it be less disruptive to traffic and parking and there will be less chance of accidentally severing an existing utility than if this portion were constructed with open trenching.

Usually, small diameter pressure pipelines for potable water, natural gas, steam, and chilled water can be relocated up and over a replacement gravity sewer because the pressure pipelines always flow full (assuming proper air/vacuum valves are installed at high points on liquid pipelines). Pressurized pipelines are not dependent on the slopes of the pipelines to generate flow. Water pipelines eight inches and less in diameter and gas pipelines four inches and less in diameter are considered small and candidates for relocation. With gas pipelines, the pressure makes a difference; the higher the pressure, the more difficult it is to relocate. The pressure is usually higher in transmission pipelines than in distribution pipelines. A 24-inch water main along 7th Street from L Street (Station 29 + 70 ±) to just north of the K Street Mall (Station 35 + 00 ±) will need special attention during detailed design.

Combined sewers, sanitary sewers, and storm drains, which are owned by the City, rely on their slopes to generate gravity flow. Thus, they cannot be easily relocated. The same is true of large diameter pressure pipelines (especially with high internal pressures) and structures such as electrical vaults and utility tunnels. In these cases, decisions must be made as to whether the replacement sewer should remain on the selected alignment with a change in profile or be relocated to avoid the interference. Inverted siphons should not be installed in the replacement sewer (or any other sanitary or combined sewers), because the sewage solids may settle in the siphon during low flow periods and become septic if the siphon is not promptly cleaned. Inverted siphons can be installed in storm drains to avoid interferences because storm drains do not convey sanitary sewage.

Electrical power and communication cables (hard-wire or fiber-optics) also create interference problems and are expensive to relocate, particularly if large duct banks or vaults are involved. Again, the City has authority to require the private company to relocate the cables.

Table 2 presents a summary of the key conflicts required utility relocation for the recommended phased projects.

Table 4. Conflict Summary

Phase 1 from 5th and S Streets to 7th and H Streets

Sheet	Station	Utility	Conflict Description	Recommended Solution
2	8+70	30-inch storm drain (SD)	Crossing near flowline	Install inverted siphon in 30-inch SD
2	8+87	Drop Inlet (DI) Lead	Crossing near soffit	Notch top of Combined Sewer (CS)
2	8+92	12-inch water (W)	Crossing near soffit	Raise 12-inch W
3	8+50 to 12+90	City communications	Parallel in trench	Relocate City communications
3	12+80	SD Service	Crossing near soffit	Notch top of CS
4	13+04	6-inch W	Crossing near soffit	Raise 6-inch W

Sheet	Station	Utility	Conflict Description	Recommended Solution
4	16+72	24-inch W	Crossing near soffit	Reduce CS to 54-inch from Sta. 16+60 to 16+90
4	16+83	SD Service	Crossing near soffit	Reduce CS to 54-inch from Sta. 16+60 to 16+90
5	20+65	18-inch SD	Crossing near soffit	Reduce to 42-inch from Sta. 20+50 to 20+80
7	16+83	12-inch SD	Crossing near soffit	Notch top of CS
8	21+03	36-inch SD	Crossing near soffit	Install inverted siphon in SD
9	23+73	DI Lead	Crossing near soffit	Notch top of CS
10	29+70	24-inch W	Crossing near soffit	Relocate 24-inch W from Sta. 29+70 to 35+00
10	32-33+00	24-inch W	Crossing near soffit	Relocate 24-inch W from Sta. 29+70 to 35+00

Phase 2 from 3rd and U Streets to 7th and S Streets

Sheet	Station	Utility	Conflict Description	Recommended Solution
4	17+28	DI Lead	Crossing near soffit	Reduce CS to 72-inch from Sta. 17+10 to 17+50
4	17+45	DI Lead	Crossing near soffit	Reduce CS to 72-inch from Sta. 17+10 to 17+50
5	21+63	24-inch W	Crossing in top of pipe	Lower 24-inch W

Phase 3 from S Street from 7th Street to 17th Street

Sheet	Station	Utility	Conflict Description	Recommended Solution
1	4+42	DI Lead	Crossing near soffit	Tap DI Lead into CS
5	19+98	12-inch W	Crossing in top of pipe	Lower 12-inch W
8	29+89	14-inch W	Crossing in top of pipe	Lower 14-inch W
8	33+35	DI Lead	Crossing near soffit	Tap DI Lead into CS
9	36+83	12-inch W	Crossing near soffit	Lower 12-inch W

Notes:

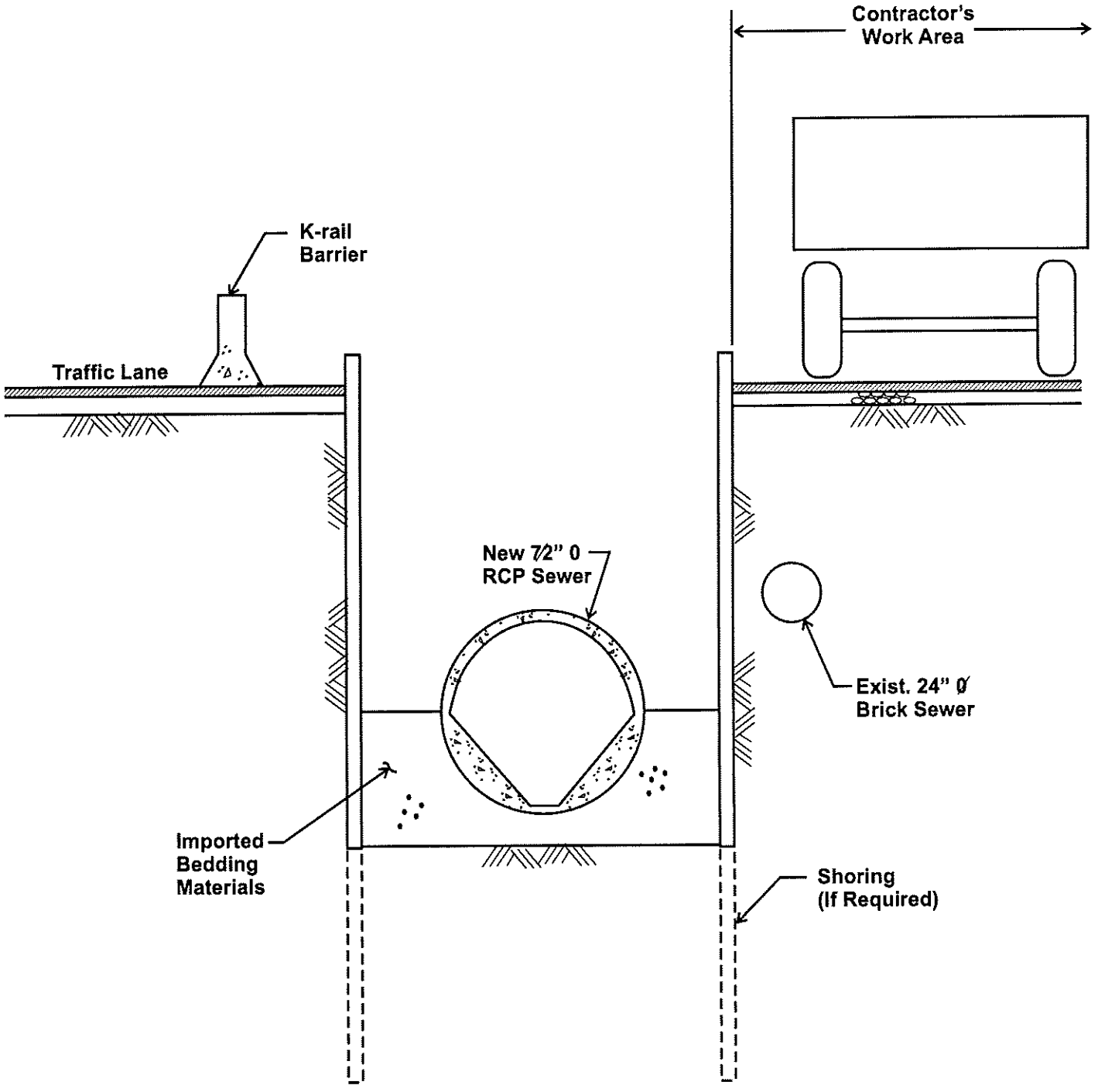
1. Only known conflicts with City utilities are included in Table 2. Other utilities will be relocated by their owners to avoid conflicts.
2. City street lighting, fire alarm, traffic signal and communication facilities are generally not included in Table 2, but will have to be relocated as part of this project.
3. Transferring DI leads to a CS are not included because they are assumed to be replaced whether rerouted or not.

Access

During construction, access must be provided to both the contractors, so they can do the work, and the public, so they can conduct business while moving about the downtown area. For the most part, the new combined sewers will be installed near the centerline of the streets, thus allowing one half of the street to be devoted to the contractor's operations, while the other half is devoted to public access. This concept is depicted in the cross-section on Figure 4 and the plan on Figure 5. Only one access lane will be available to the contractor, and only one traffic lane will be available to the public. Street parking will have to be prohibited during construction hours. The contractor will have to move his trucks used for spoil removal, pipe delivery, pipe installation, and delivery of backfill material in tandem on one side of the trench rather than having the privilege of access to both sides on the trench. One-way, controlled traffic will be necessary for the side of the street devoted to public travel. The contractor and/or the City will have to provide traffic control consisting of early warning signs, detour marker signs, flashing traffic control and direction signals, traffic cones, and flag-persons.

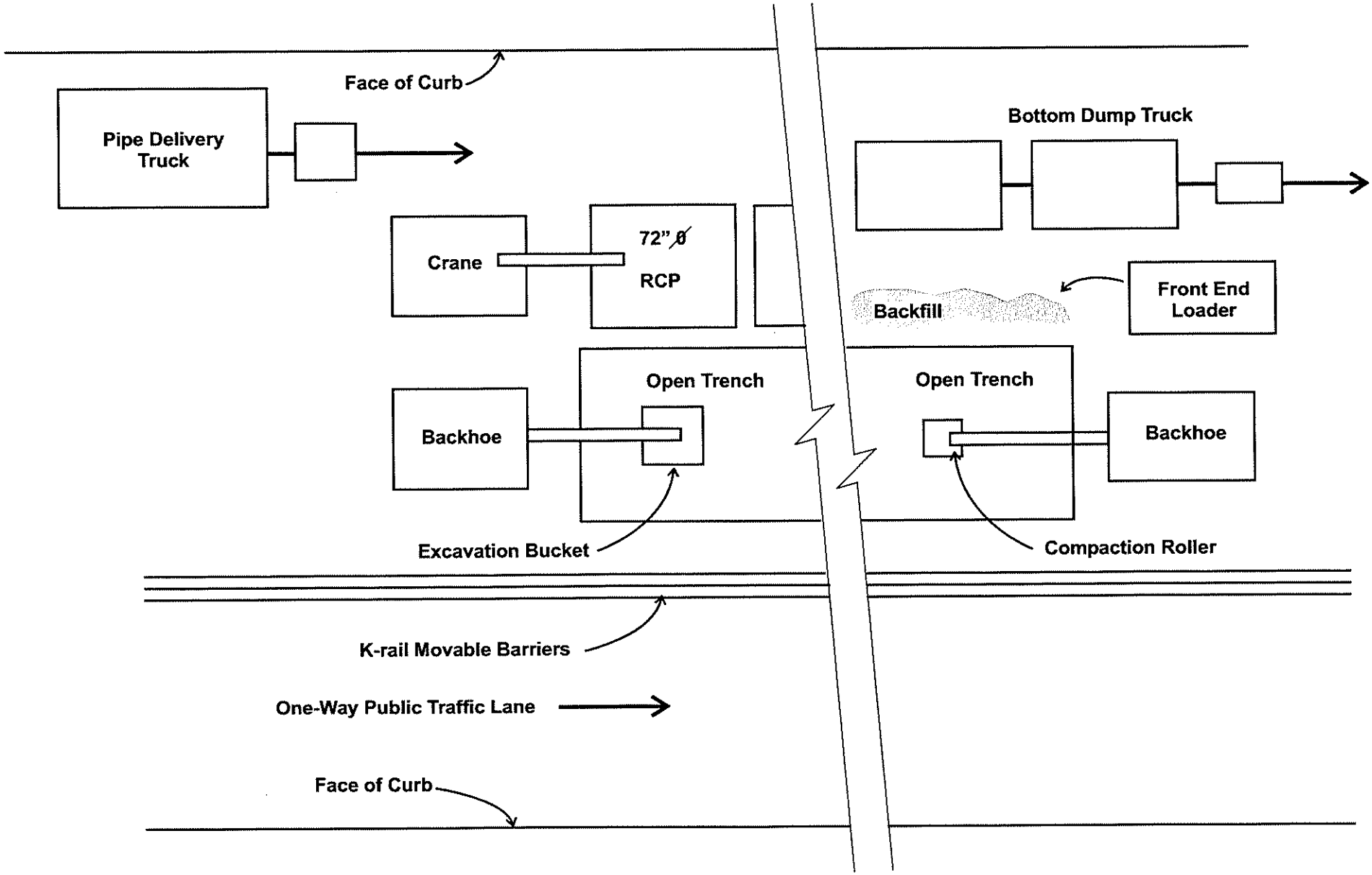
Shoring

The trench design will require the use of vertical walls to minimize disruption. The construction contractors will have the authority to select the trench shoring systems they choose to use so long as the systems are not prohibited by the project specifications, and the systems comply with the project specifications and Cal OSHA requirements. Most likely, the contractor will elect to use the steel



Scale: 1" = 5'

DATE	PROJECT		
9-5-00	18292-400		
BROWN AND CALDWELL		7th Street Trench Section	Figure 4



BROWN AND CALDWELL	DATE 9-5-00 PROJECT 18292-400	Conceptual Installation Plan Along 7th Street	Figure 5

plate slide-rail system, movable aluminum hydraulic trench jacks, a trench shield that can be moved along the trench with the installation of pipe, or a traditional plywood sheet and screw-jack system. The contractor will probably not elect to use drilled soldier pile and wood lagging (as was dictated for the 42nd Street storage facility) because this system is too expensive, although this system could be dictated in the specifications for certain sensitive locations. Driven or vibrated steel sheet piling should be prohibited because of the noise generated during installation and withdrawal.

If micro-tunneling is not used along 7th Street between H and L streets where there are so many interferences with existing underground utilities, the contractor may have to install a system of soldier piles separated at specific distances to allow the steel or plywood sheets to be slipped between the soldier piles while missing most of the existing underground utilities and providing the necessary shoring. The soldier pile separation distances would be dictated by the locations of the utilities.

Dewatering

Groundwater could flow into the trench and adversely affect construction. The presence of groundwater will depend on the season and the proximity of the trench to the Sacramento and American Rivers. Therefore, summertime construction is recommended when the groundwater level is lower. Should trench dewatering be required, portable trash pumps placed in earthen sumps dug into the lower corners of the trenches should suffice. The need to install well-point dewatering systems alongside the trenches is not anticipated.

Spoil Transport and Disposal

Since the construction contractor will only have access to one side of the trench, he will not be able to temporarily stockpile excavated dirt alongside the trench for use later as backfill. Thus, excavated dirt will have to be hauled away by dump trucks and stored temporarily at another site obtained by the contractor. Contractors usually obtain temporary storage sites by renting an empty space such as a portion of a parking lot or landscaped lawn area. Such sites will be difficult to find in the built-up downtown area. The contractor for the UCD Medical Center regional storage facility was successful in doing this, however. Since the volume of excavated material will be more than the volume that can be placed back in the trench as backfill, some dirt will have to be disposed of at another construction site where clean fill material is needed or in a Class III landfill, assuming the spoil is clean. Soil contamination, particularly from old underground storage tanks for fuel at service stations, is a potential problem.

By limiting the length of trench that can be open at any time, the volume of spoil requiring off-hauling each day will be reduced. Restrictions on truck haul routes to reduce traffic congestion should be defined in the specifications. Care should be taken to ensure that dirt does not spill from the trucks during hauling, and that dust is controlled. This may require the use of tarpaulin covers on dump trucks and the use dust-control watering trucks.

LOW FLOW ANALYSIS

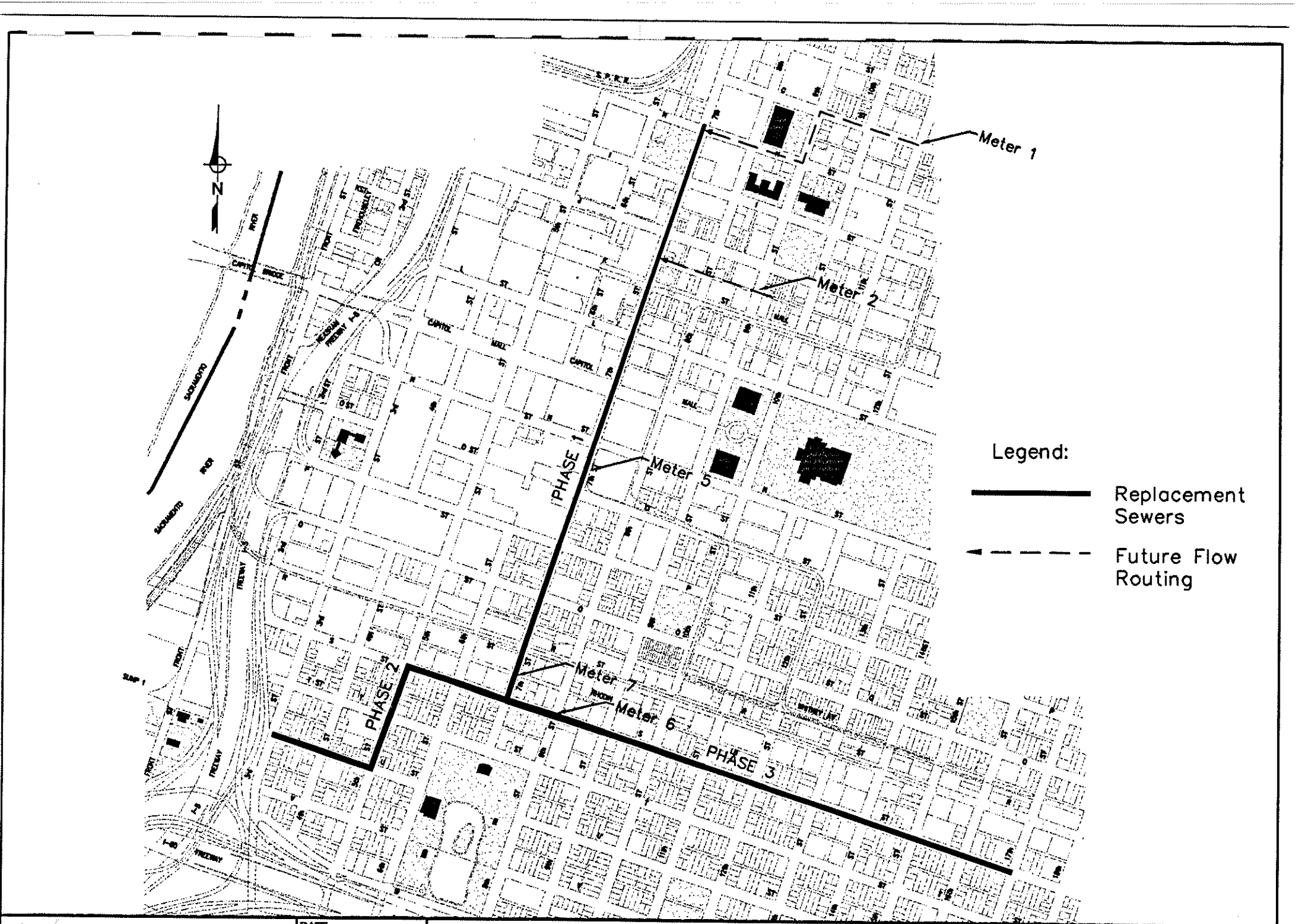
Since the purpose of the proposed replacement sewers is to provide in-line storage as well as wastewater conveyance, the sewers are large diameter pipelines. As a result, flow velocities during dry weather, when no storm runoff is entering the sewers, will be very low. For sewers greater than 36 inches in diameter, the Sacramento County Sanitation District 1 (CSD-1) design their sewers to have a minimum velocity of three feet per second (fps) at peak dry weather flow (PDWF) conditions to prevent solids from settling to the bottom (i.e., invert) of the sewers. Settling of solids and longer residence times allows an increase in sulfide formation which can cause the generation of odors and corrosion of the crowns of the pipes.

Flows and Velocities

The City has installed several flow meters at strategic locations in the downtown area to gather flow data for use in evaluating the sewage flows related to the Downtown Large Sewers Rehabilitation and Replacement Project. The locations of some of these meters are shown on Figure 6. We used dry weather flow data from these meters to estimate the low flows and velocities for the new replacement sewers proposed for Phases 1 through 3. We calculated PDWF rates to compare them with the CSD-1 design standard. Our conclusions are summarized below.

Phase 1. According to Department of Utilities staff, Meter No. 7, located north of 7th and S streets, did not produce reliable data and should not by used for our analysis. The current flow for the northern portion of the Phase 1 sewer is measured by Meter No.5 located on 7th Street between N and O streets. The Phase 1 sewer will eventually receive flow measured by Meter No.1 located at G and 11th streets. Flow measured at Meter No. 1 will flow west on G Street, south on 9th Street, and west on H Street to 7th Street. Additional flow, measured by Meter No.2 located on 9th Street between J and K streets, will merge into Phase 1 by flowing west along Merchant Street.

We determined the PDWF for Phase 1 using flow data from Meters No.1, No.2, and No.5. The PDWF at Meter No.5 averages 0.95 million gallons per day (mgd) between 3:00 PM and 4:30 PM. The additional flow contribution during those times measured by Meter No.1 is 0.17 mgd. The flow contribution measured by Meter No.2 between 3:00 PM and 4:30 PM is negligible. Therefore, we estimate the PDWF for Phase 1 will be approximately 1.12 mgd. Although this approach does not involve flow routing, the distances between the meter locations are short enough to make our approach reasonably accurate for our purposes.



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Flow Meter Locations

Figure 6

Phase 2. There is no meter monitoring flow data for the Phase 2 sewer. However, Phase 1 and Phase 3 both flow into Phase 2. Phase 3 monitoring data is described below. We determined PDWF for Phase 2 by using the PDWF from Phase 3 and the flow contributions from Phase 1 during the Phase 3 PDWF period. The PDWF for Phase 3 is 1.75 mgd between 11:00 AM and 2:00 PM. The flow contribution from Phase 1 during this period is 1.19 mgd. Therefore, we estimate the PDWF for Phase 2 will be approximately 2.94 mgd.

Phase 3. The current flow for the Phase 3 sewer is measured by Meter No.6 located at S and 8th streets. The PDWF for Meter No.6 averages at 1.80 mgd between 11:00 AM and 2:00 PM. In the future, the flow measured at Meter No.2 will be entering Phase 1 instead of its current destination, which is into Phase 3. Therefore, the PDWF at Meter No.6 is decreased by the flow contribution from Meter No.2, which is 0.05 mgd for the 11:00 AM to 2:00 PM period. Thus, we estimate the future PDWF for Phase 3 will be approximately 1.75 mgd.

The resulting velocities in circular pipe for these PDWF rates are presented in Table 3. In no case does the PDWF velocity exceed the three fps standard used by CSD-1. These results are significant because extensive, costly maintenance will be required to prevent excessive corrosion and control odors. In San Jose, maintenance crews have to dose one large sewer monthly with caustic soda for odor control.

Table 5. Peak Dry Weather Flow and Velocities

Phase and Diameter, inches	Peak Dry Weather Flow, mgd	Slope, feet per foot	Peak Dry Weather Velocity, fps[a]
Phase 1			
72	1.12	0.00135	1.5
60	1.12	0.00137	1.7
54	1.12	0.00137	1.8
Phase 2			
84	2.94	0.00048[b]	1.6
Phase 3			
96	1.75	0.00120	1.8
84	1.75	0.00120	1.9
72	1.75	0.00100	1.8

[a] Assumed Manning's n = 0.013 due to grease buildup.
[b] Flattest portion of Phase 2.

Options

We considered several options to accommodate high flows during wet weather and to reduce solids deposition and odor generation due to low flows during dry weather. The first three options aim to reduce dry weather solids deposition by increasing dry weather velocities to above two fps. The last two options can apply to conventional circular pipe installations. These options are discussed below.

Odd-Shaped Pipes. Odd-shaped pipes create higher velocities for low flows by decreasing the cross-sectional area at the bottom of the pipe. Two types of odd-shaped pipes, considered for this option and shown on Figure 7, are egg-shaped and kite-shaped pipe. The pipe is made in multiple cross-section sizes and in lengths of eight to ten feet. Currently, odd-shaped pipe is mostly manufactured in Europe, and importing the pipe may not make use of these types of pipe cost-effective.

To replace a standard 72-inch diameter circular pipe, a cross-sectional area of approximately 28 square feet is required. The width and height of an egg-shaped pipe would have to be 74 inches and 110 inches, respectively, to provide an equivalent cross-sectional area. For a 72-inch diameter kite-shaped pipe, the effective cross-sectional flow area of 25 square feet is approximately 89 percent of the area of the conventional circular pipe. The effective area percentage for kite-shaped pipe would be more for larger diameters and less for smaller diameters. The narrow invert of these cross-sections creates a good low-flow channel without significant reduction in cross-sectional area. However, the current PDWF for the Phase 1 through 3 sewers are so low that velocities in odd-shaped pipe remain below two fps in most cases. Therefore, use of odd-shaped pipe is not considered further for Phases 1 through 3.

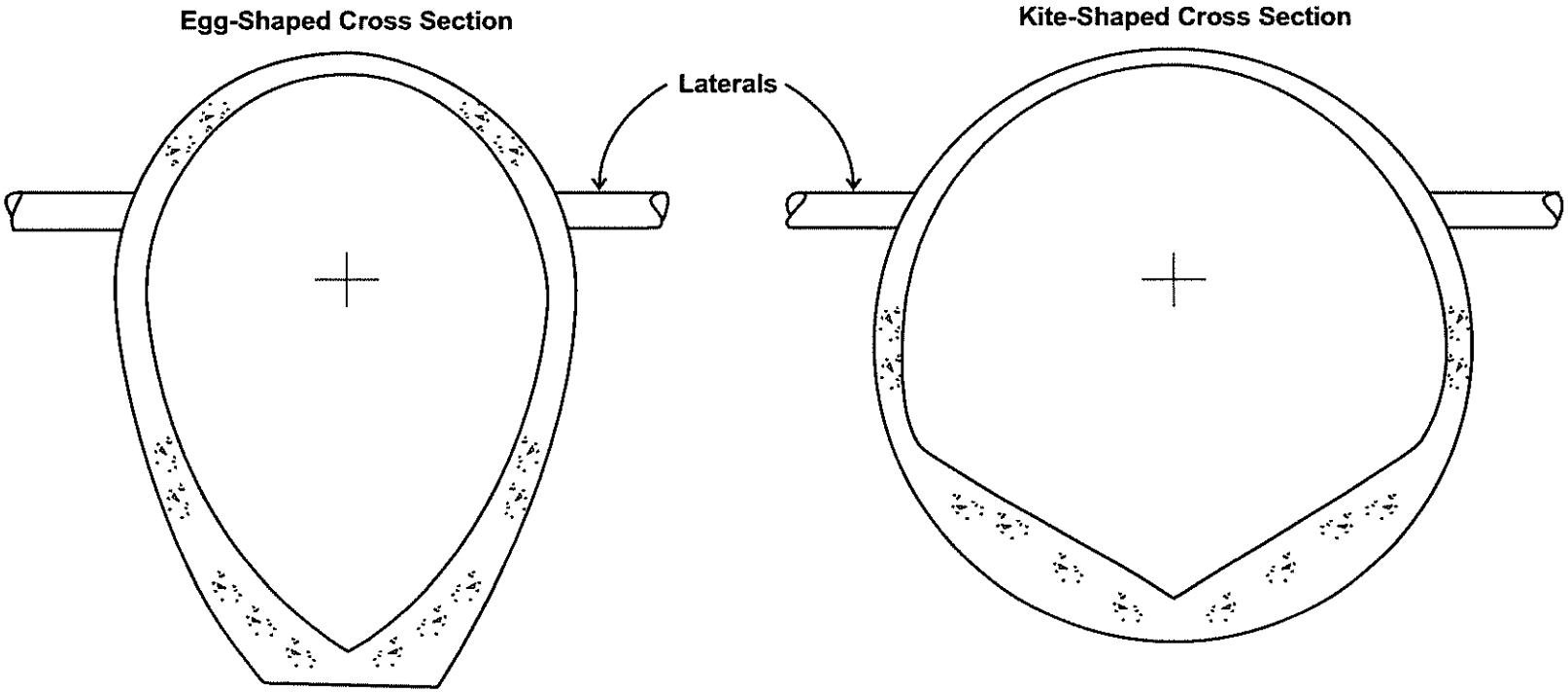
Side Sewers. This concept consists of installing a small-diameter sanitary sewer on each side of a large-diameter combined sewer. This concept is shown on Figure 8. The small sewers are sized to accommodate the PDWF from the laterals they serve, thereby providing sufficient velocities to prevent solids settling during dry weather. Drop inlets for storm runoff collection would be connected to the large combined sewer rather than the small sanitary sewers. When the flows increase in the sanitary sewers during wet weather due to infiltration and inflow, overflow weirs installed in manholes will allow the sewage to spill into the large combined sewer.

The following aspects of the side sewer concept require consideration:

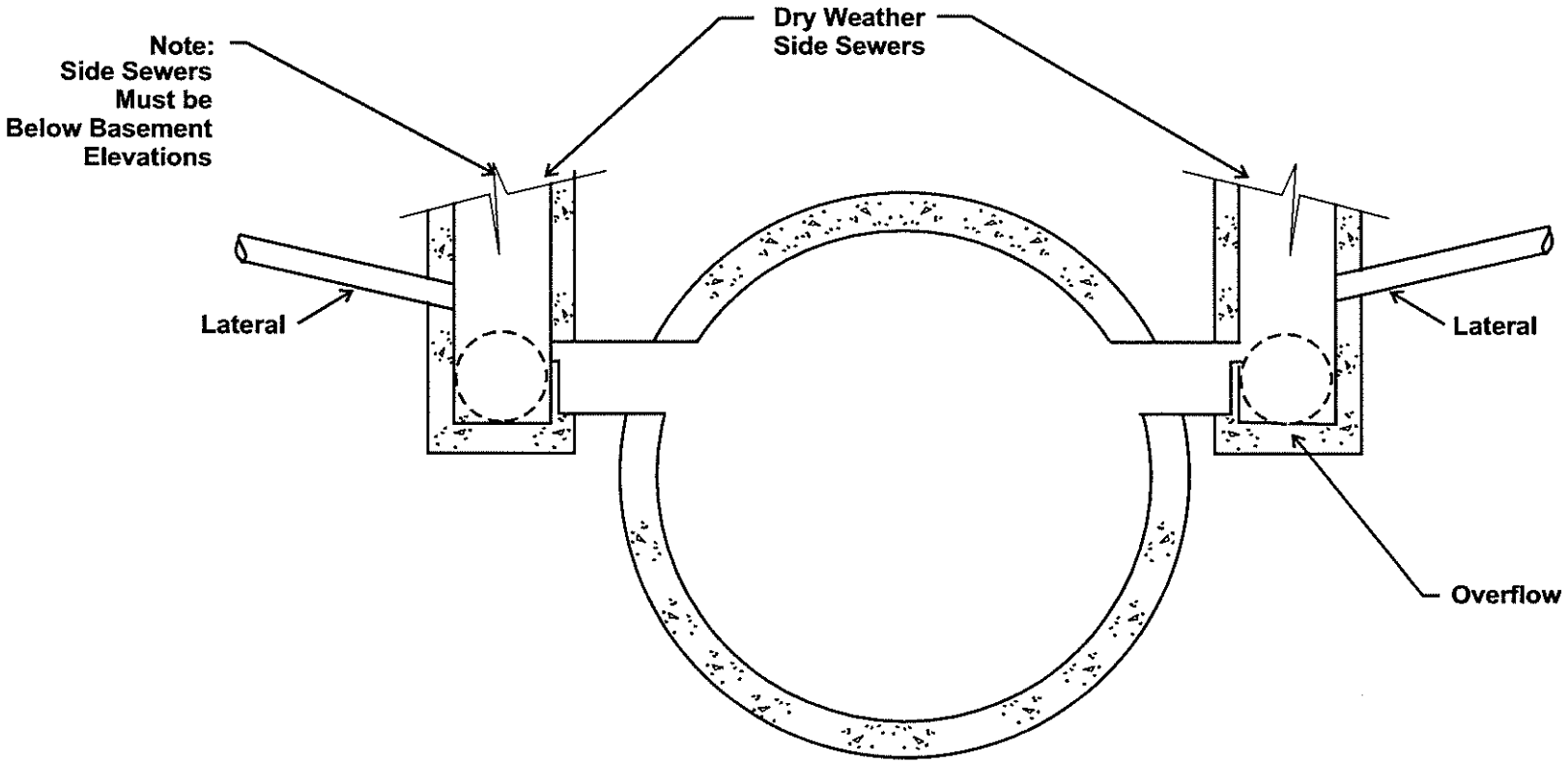
- The side sewers must be at elevations below any adjacent basement that have floor drains to prevent back flow and flooding of the basements.

- The slopes of the side sewers must be steeper than the slope of the large sewer to account for hydraulic friction loss associated with the smaller diameter pipes.

- The large combined sewer must be installed at a lower elevation than the side sewers to allow wet weather flows to overflow into the large sewer.



BROWN AND CALDWELL	DATE 9-5-00 PROJECT 18292-400	Odd-Shaped Pipes	Figure 7



BROWN AND CALDWELL	DATE 9-5-00 PROJECT 18292-400	Side Sewer Installation	Figure 8

As a result of these aspects, the large combined sewer would have to be installed at a lower elevation than would be required with the conventional single replacement sewer concept. The installation of three sewers instead of one and the requirement for deeper installations would significantly increase the construction costs. Therefore, the concept of side sewers is not considered further for Phases 1 through 3.

Box Sewers. The box sewer is similar in concept to the installation of side sewers. A box sewer is shown on Figure 9 and consists of concrete boxes formed with small-diameter channels on each side of a large central channel. The smaller channels would provide small cross-sectional areas to provide sufficient velocities for dry weather flow. When flows increase during wet weather, the sewage flow over the weirs and spills into the large central channel. The large channel in the middle provides the capacity needed for wet weather flows and detention storage. These boxes could be constructed as a cast-in-place conduits using movable forms, or they could also be constructed with pre-cast units that are fabricated at an off-site plant and trucked to the Project site and joined with a mastic joint sealer. The pre-cast boxes would be similar to those installed at the UCD Medical Center Storage Facility. Box sewers were used for the combined sewer along the Great Highway on the west side of San Francisco.

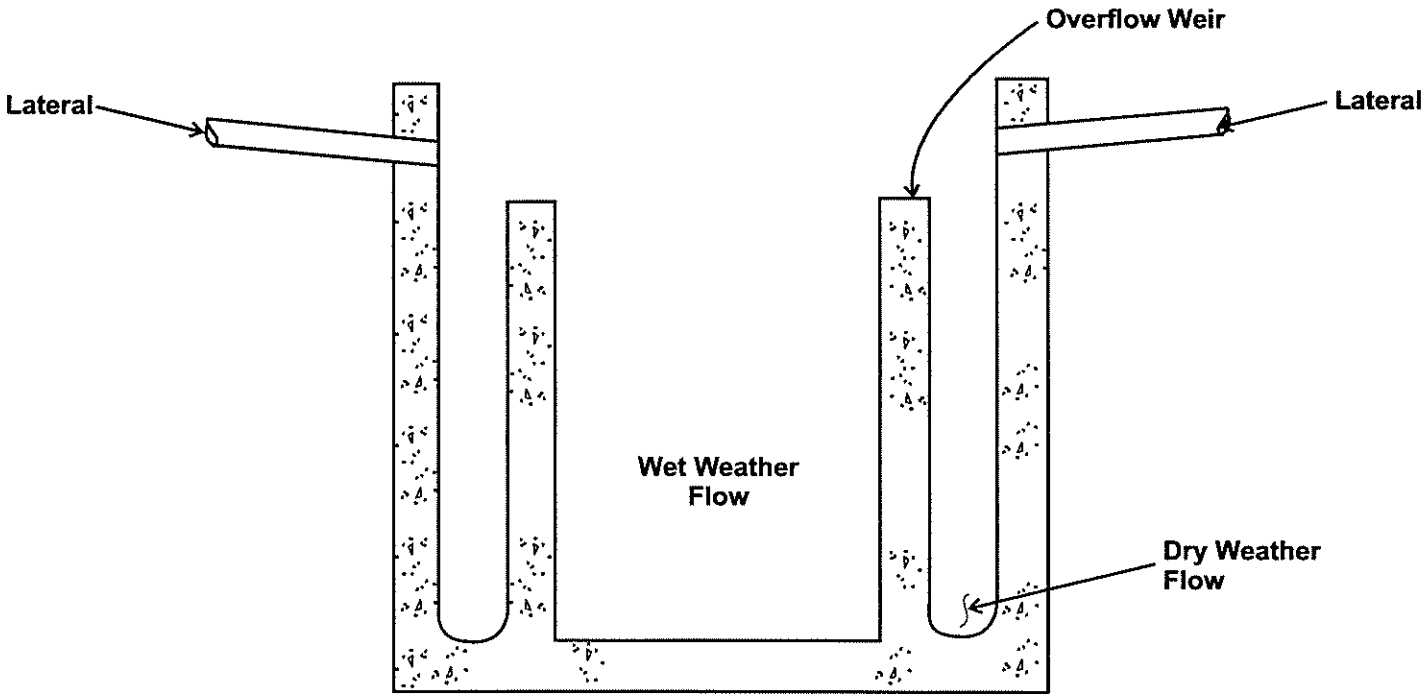
Use of box sewers would create the same concerns regarding slopes and depths as the side-sewer concept. In addition, construction of cast-in-place box conduits would be more expensive than installation of conventional RCP, while pre-cast box units would have the same joint problems as the box units at the UCD Medical Center Storage Facility. Therefore, box sewers are not considered further for Phases 1 through 3.

Chemical Addition. The addition of chemicals to wastewater flow can be used to reduce generation of aqueous sulfur compounds, such as hydrogen sulfide (H_2S). An oxidizing agent, such as sodium hypochlorite (NaOCl), can be added to the CSS to reduce generation of odors downstream during dry weather. Although velocities in the sewers will still be less than two fps, the H_2S odors would be reduced due to the action of the chemical additive.

A chemical injection facility, consisting of a chemical storage tank, a pair of feed pumps, a motor control center, and process control instrumentation, all housed in a small building, would be required to add NaOCl to the collection system. This alternative requires the acquisition of small sites for construction of the facilities.

The advantage of chemical addition is low capital costs relative to the structural options described above. The disadvantages of chemical addition include high operating costs and the need to replace the NaOCl at various downtown locations on the routine basis.

Cleaning. Flushing sewers periodically will remove settled solids and reduce corrosion and odor generation. Normally, the sewers will be flushed each winter by Mother Nature when high wet weather flows and velocities occur during storms. Cleaning during dry weather should be done on a routine basis to prevent solids buildup and odor complaints.



BROWN AND CALDWELL	DATE 9-5-00 PROJECT 18292-400	Box Sewer	Figure 9

Flushing would be done by the Field Services Division of the Department of Utilities, which would increase their work load. Flushing could be done with water from a nearby fire hydrant using a hose with a nozzle to concentrate the force of the water. Flushing would require confined-space entry by maintenance personnel. The advantage of cleaning is low capital cost. The disadvantage is high labor-intensive maintenance costs, the need for confined-space entry by maintenance personnel, and possible complaints should odors occur between cleanings.

Conclusions To limit capital costs, we recommend that the new replacement sewers be inspected each spring to ensure that wet weather flows have cleaned out settled solids from the inverts of the pipes. Settled solids should be removed by flushing during the summer as the need arises. If flushing proves too labor-intensive, chemical addition should be considered.

COST ESTIMATES

Pre-design-level capital cost estimates were prepared for the original alignments for Phases 1 through 3. Estimates were prepared for both the micro-tunneling and an open trench alternative for the portion of Phase 1 along 7th Street between H and L streets. Estimates were prepared for the 5th Street Alternative for Phase 1 as well as matching alternatives for Phases 2 and 3. In addition, the Department of Utilities staff requested that cost estimates be prepared for other alternatives to allow comparison with the initial alignments proposed for Phases 1 through 3; these other alternatives include the following:

1. A single 96-inch sewer in lieu of parallel 84-inch sewers (one new and one existing) for Phase 2 along U Street between 3rd and 5th streets.

2. An alternative for Phase 2 that wraps around Southside Park from 7th and S streets to 5th and U streets.

Each cost estimate is for the entire length of a phase. The cost estimates are based on working from 7 AM to 6 PM, Monday through Friday. In addition to the main features of sewer installations (excavation, bedding, pipe installation, manhole construction, backfilling, etc.) the estimates include costs for the following:

1. Removal of existing sewers from the trenches for the new sewers.

2. Filling sewers abandoned in place with sand.

3. Temporary sewers along the sides of the trenches to convey sewage from the service laterals.

4. Reconnecting the service laterals to the new sewers.

5. Connecting pipes from drop inlets to the new sewers.

6. Asphaltic concrete repaving over the width of the trenches.

The estimates do not include costs for repaving the entire width of the streets or replacing curbs, gutters, or sidewalks.

Methodology

The construction costs, which form the basis for the capital cost estimates, were estimated using Brown and Caldwell's proprietary software program, BACPAC. BACPAC contains a database of 17,000 items, including labor-hour requirements, wage rates, and unit material prices, which are kept current by our cost estimators. Quantity take-off data are put into the BACPAC program, which, in turn, prints out the construction cost estimate. The computer printouts for the BACPAC estimates for the recommended alternatives for Phases 1 through 3 are included in Appendix B. Allowances are added to the construction cost estimates prepared using BACPAC to develop capital cost estimates. The following allowances have been added:

- Nineteen percent for professional services including soils investigation, surveying, design, construction management, environmental impact documentation, legal and administrative expenses.

- Twenty percent for design and construction contingencies. Changes made during the design phase may result from decisions by City staff directing changes to the project or discovery of interferences not located for this predesign report. Changes during construction are usually for unforeseen site conditions or *force majeur* events such as labor strikes or excessive rainy work days; these changes result in contractor change orders.

A summary of the cost estimates for the alternatives recommended for implementation in this report is presented in Table 4. Each estimate is for the entire length of the phase.

Table 6.

Recommended Alternative Cost Estimate Summary (dollars)

Item	Phase 1[a]	Phase 2[b]	Phase 3[c]
Construction			
Indirect Contractor Costs	380,000	258,000	549,000
Utility Protection/Relocation	200,000	50,000	200,000
Shoring	1,789,000	776,000	2,246,000
Existing Sewer and MH Removal	193,000	105,000	274,000

Item	Phase 1[a]	Phase 2[b]	Phase 3[c]
54 inch Sewer Installation[d]	283,000	-	-
60 inch Sewer Installation[d]	834,000	-	-
72 inch Sewer Installation[d]	1,014,000	-	827,000
84 inch Sewer Installation[d]	-	1,030,000	948,000
96 inch Sewer Installation[d]	-	-	1,043,000
54 inch Micro-tunneling	1,770,000	-	-
Maintenance Hole Construction	81,000	25,000	71,000
Temporary Service Connection	334,000	103,000	297,000
Service Reconnections	140,000	86,000	230,000
Sales Tax, Bond and Profit	779,000	325,000	860,000
Construction Cost	7,797,000	2,758,000	7,545,000
Professional Services Allowance @ 19 percent	1,481,000	524,000	1,434,000
Subtotal	9,278,000	3,282,000	8,979,000
Contingency @ 20 percent	1,856,000	656,000	1,796,000
Capital Cost	11,134,000	3,938,000	10,775,000
Cost per linear foot	2892	2302	2352

[a] 5th Street Alternative and micro-tunneling along 7th Street from H to L streets.
[b] Matches 5th Street Alternative with twin 84-inch sewers along U Street.
[c] Matches 5th Street Alternative.
[d] Open-trench construction.

A summary of the cost estimates for the alternatives that are not recommended for implementation is presented in Table 5. Each estimate is for the entire length of the phase.

Benefit/Cost Ratios

The reduction in street flooding for each phase was determined by running the Sacramento Storm Water Management Model (SSWMM) for a storm with a ten-year recurrence interval (i.e., a storm with a ten percent probability of occurring every year) and a six-hour duration. The results are presented in Appendix A. By dividing the flood reduction in cubic feet for each phase the capital cost for the phase in Table 3, we can derive a benefit/cost ratio for the recommended alternative for each phase; the results are presented in Table 5.

Table 7. Non-recommended Alternative Cost Estimate Summary (dollars)

Item	Phase 1A[a]	Phase 1B[b]	Phase 2A[c]	Phase 2B[d]	Phase 2C[e]	Phase 2D[f]	Phase 3A[g]
Construction Cost	6,390,000	5,850,000	2,830,000	2,920,000	3,190,000	2,490,000	5,200,000
Professional Services Allowance @ 19 percent	1,210,000	1,110,000	540,000	550,000	610,000	470,000	990,000
Subtotal	7,600,000	6,960,000	3,370,000	3,470,000	3,800,000	2,960,000	6,190,000
Contingency @ 20 percent	1,520,000	1,390,000	670,000	690,000	760,000	590,000	1,240,000
Capital Cost	9,120,000	8,350,000	4,040,000	4,160,000	4,560,000	3,550,000	7,430,000
Cost per linear foot	1950	1785	1661	1710	1874	2075	1799

[a] Original alignment (not the 5th Street Alternative) with micro-tunneling along 7th Street from H to L streets.
[b] Original alignment (not the 5th Street Alternative) with trenching along 7th Street from H to L streets.
[c] Original alignment with twin 84-inch sewers along U Street.
[d] Original alignment with 96-inch sewer along U Street.
[e] Southside Park Alternative with twin 84-inch sewers along U Street.
[f] Matches 5th Street Alternative with 96-inch sewer along U Street.
[g] Original alignment.

Table 8. Benefit/Cost Ratios

Item	Phase 1	Phase 2	Phase 3	All three phases
Flood reduction, cubic feet	108,672	154,185	198,737	451,719
Capital cost, $million	11.134	3.938	10.775	25.847
Benefit/cost ratio, cubic feet/$ million	9,800	39,200	18,400	17,500

The benefit/cost ratios vary significantly, but the values are deceiving because not all the phases of the overall Downtown Large Sewers Rehabilitation and Replacement Project are addressed in this pre-design report. For example, the flood reduction for Phase 1 plus the future phases will be approximately 700,000 cubic feet when all phases have been constructed.

RECOMMENDATIONS

We recommend the City take the following course of action regarding Phases 1 through 3 of the Downtown Large Sewers Replacement and Rehabilitation Project:

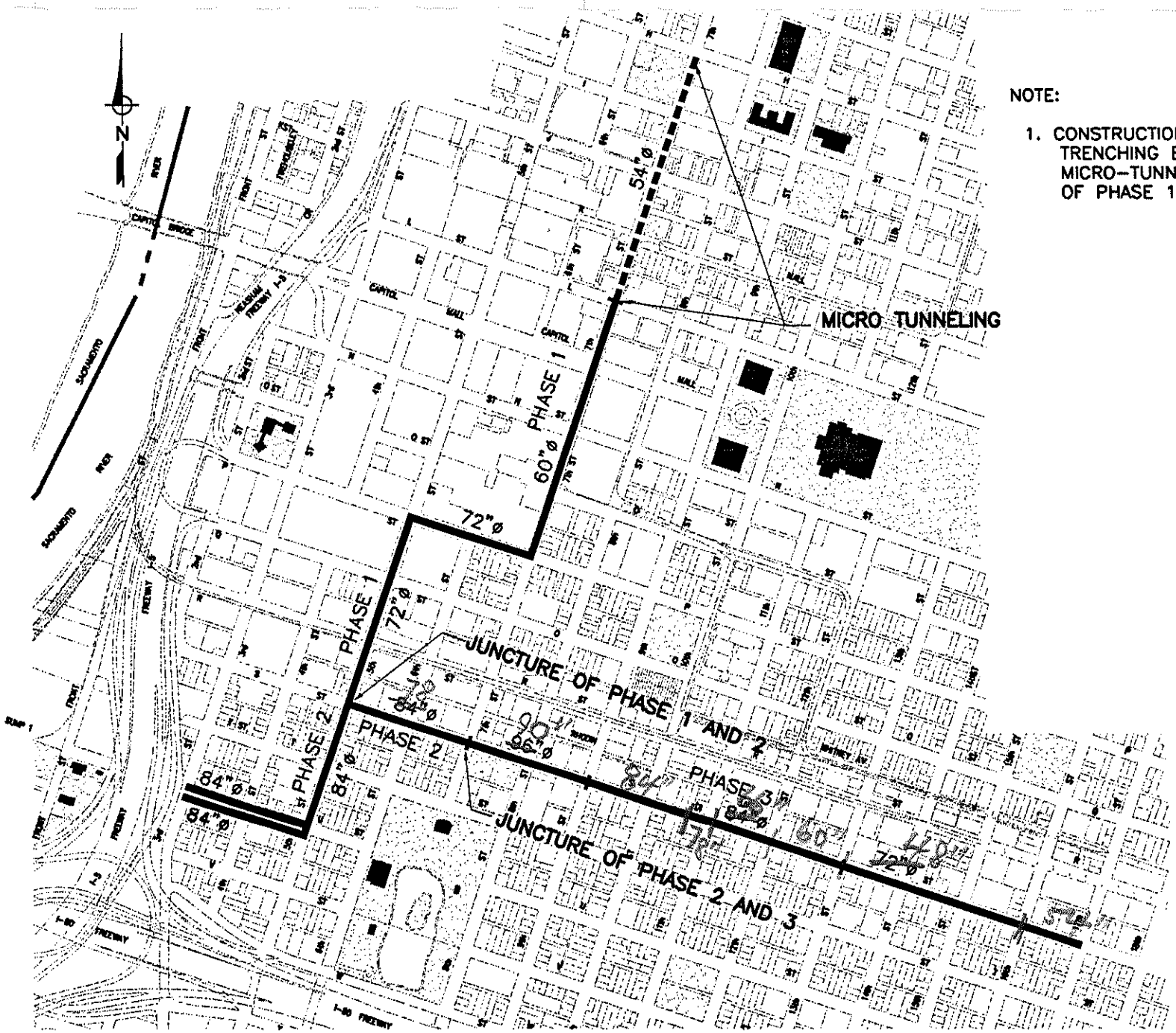
1. Review the cost estimates presented in this pre-design report against available and projected funds to pay for the design and construction of Phases 1 through 3. Decide in what fiscal year each phase or portion of a phase should be constructed. Construction projects should be manageable in size and cost, and should allow good opportunities for participation by a number of local, qualified contractors.

2. Based on the decisions in Step 1 above, proceed with detailed design and construction of Phases 1 through 3. These phases are shown on Figure 10. Phase 1 should include micro-tunneling along 7th Street between H and L streets to reduce disruption in this busy area. The 5th Street Alternative should be constructed to avoid the interference of the State's chilled water tunnel at 7th and P streets. Phase 3 should consist of two parallel 84-inch sewers along U Street; since one of the sewers already exists, construction of the parallel 84-inch sewer is less expensive than construction of a 96-inch sewer, and the storage volume of a pair of 84-inch sewers is more than a single 96-inch sewer. The pre-design report assumes the new sewers will be reinforced concrete pipe, which is the City's standard. During detailed design, consideration should be given to using high-density polyethylene (HDPE) or Vylon polyvinyl chloride (PVC) pipe.

3. The design engineer should engage a potholing company to locate any potential interferences not located for this pre-design report and to conform the locations of utilities that are close to the replacement sewer. Pothole pits should be excavated using a backhoe to provide enough room for proper measurement. Interferences will be particularly troublesome to the micro-tunneling portion of Phase 1.

4. The design engineer should meet early with the City Traffic Department to review the proposed alignments of the new sewers and determine requirements for (1) the length of trench that can be open at any one time, (2) allowable working hours, (3) when and how intersections should be crossed, (4) any additional parking and shuttle service, and (5) traffic control patterns and necessary traffic control equipment and personnel. The design engineer should review these plans with the fire and police departments to hear their concerns and get their approval regarding emergency vehicular movement and access.

5. A complete new survey must be done during detailed design to accurately determine the elevations and stationing along the alignments of the replacement sewers. The survey for this pre-design report will not suffice for detailed design because these survey lines and elevations do not exactly follow the recommended alignments of the replacement sewers.



NOTE:

1. CONSTRUCTION SHOULD USE TRENCHING EXCEPT FOR MICRO-TUNNELING PORTION OF PHASE 1.

BROWN AND CALDWELL	DATE 5-11-01 PROJECT 18292-400	Recommended Projects for Phases 1, 2, and 3	Figure 10

6. The detailed design plans should show (1) existing pipelines that are 16-inch and larger as double lines, (2) both rails of light-rail transit tracks, not just the centerline, and (3) existing overhead utilities as well as underground utilities so bidders will know the clearances for cranes and other equipment.

7. The design engineer must specify criteria for the contractor to use to design the trench support system along 7th Street between K and O streets. This trench support system must withstand the lateral live loads created by the passage of light-rail transit cars on the east side of the street.

8. The construction manager and/or contractor must notify the fire department if fire hydrants are going to be temporarily removed from service.

9. The new replacement sewers should be inspected each spring to ensure that wet weather flows have cleaned out settled solids from the inverts of the pipes. Diverting dry-weather flows to the new large-diameter sewers to improve flushing by increasing diurnal peak flows should be evaluated. Settled solids should be removed by flushing with water during the summer as the need arises. If flushing proves too labor-intensive, chemical addition should be considered.

10. With appropriate lead time, the Department of Utilities should initiate an aggressive public outreach campaign to inform residents, business owners, and commuters of the need for and benefits of the projects, the schedules and working hours, and the traffic and parking control plans. The public should be asked for their questions and comments, cooperation, and patience. Questions should be answered honestly.

11. In March 2001, the Department of Public Works was contacted by the Regional Transit Authority. The Authority operates the light-rail system along 7th Street, and they are planning to extend the rail line north from K Street (where it now turns east off 7th Street) to beyond H Street where Phase 1 of the Downtown Large Sewers Replacement and Rehabilitation Project terminates. This situation provides an opportunity for both projects to be constructed at the same time to reduce extended disruption of the downtown area. It also may make open trench construction of the combined sewer between L and H streets more attractive than micro-tunneling if extensive utility relocation will be necessary to accommodate the new light-rail tracks. The Department of Public Works should coordinate with the Regional Transit Authority to explore every possibility for designing and constructing both projects in concert with each other to reduce overall cost and disruption to the public.

APPENDIX A

CITY OF SACRAMENTO SWMM RUNS

FLOODING BEFORE IMPLEMENTATION OF PHASES 1, 2 AND 3

* MONTGOMERY WATSON - STORMWATER MANAGEMENT MODEL (MW-SWMM)
*** EXTENDED TRANSPORT PROGRAM (EXTRAN BLOCK) ***

<< CSS,10YR 6HR STORM,Mh lowered 2',Overflow off,& Adjusted Runoff>>
:< FILENAME: newmaster.DAT & master10.gut: does not use 1 cfs capitol area plan

CONTINUITY BALANCE IN CU-FT AT END OF RUN

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
11	0.	0.	0.	0.	0.	0.	0.	2919701.
12	0.	0.	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	7782285.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	6024818.	0.	0.	0.
25	0.	0.	0.	0.	952150.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	6084195.	0.	0.	0.
10	406439.	0.	0.	406439.	4.	0.	0.	0.
20	385751.	0.	0.	385751.	3.	0.	0.	0.
101	0.	0.	0.	0.	0.	0.	0.	0.
102	0.	0.	0.	0.	0.	0.	0.	0.
103	39825.	0.	0.	39825.	0.	0.	0.	0.
104	0.	0.	0.	0.	0.	0.	0.	0.
105	49389.	0.	0.	49389.	0.	0.	0.	0.
106	185135.	0.	44.	185091.	1.	44.	0.	0.
107	141133.	0.	0.	141133.	1.	0.	0.	0.
108	147246.	0.	0.	147246.	1.	0.	0.	0.
109	0.	0.	0.	0.	0.	0.	0.	0.
110	114562.	0.	0.	114562.	1.	0.	0.	0.
120	0.	0.	0.	0.	0.	0.	0.	0.
121	28141.	0.	4.	28136.	0.	4.	0.	0.
124	78378.	0.	12971.	65408.	1.	12971.	0.	0.
130	103035.	0.	29633.	73402.	3.	41419.	11786.	0.
132	54316.	0.	240.	54076.	0.	604.	363.	0.
133	163057.	0.	616.	162441.	1.	852.	236.	0.
134	0.	0.	0.	0.	0.	251.	251.	0.
135	0.	0.	0.	0.	0.	4030.	4030.	0.
136	30216.	0.	3941.	26276.	0.	3941.	0.	0.
140	65329.	0.	0.	65329.	0.	0.	0.	0.
142	153806.	0.	0.	153806.	1.	0.	0.	0.
143	30022.	0.	0.	30022.	0.	0.	0.	0.
144	84835.	0.	0.	84835.	0.	0.	0.	0.
145	142434.	0.	0.	142434.	3.	0.	0.	0.
146	0.	0.	0.	0.	0.	47.	47.	0.
148	65215.	0.	7369.	57846.	1.	7369.	0.	0.
150	75202.	0.	0.	75202.	1.	0.	0.	0.
151	110698.	0.	55431.	55267.	0.	55431.	0.	0.
152	101746.	0.	24100.	77647.	0.	24100.	0.	0.
153	24089.	0.	133.	23955.	0.	142.	8.	0.
154	0.	0.	0.	0.	0.	0.	0.	0.
155	129617.	0.	0.	129617.	0.	0.	0.	0.
156	132756.	0.	9.	132747.	1.	9.	0.	0.
158	44278.	0.	0.	44278.	0.	0.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
159	81329.	0.	44.	81285.	0.	44.	0.	0.
1159	0.	0.	0.	0.	0.	0.	0.	0.
1590	10800.	0.	7.	10793.	0.	11.	4.	0.
1591	0.	0.	0.	0.	0.	1.	1.	0.
160	135132.	0.	35232.	99901.	1.	35232.	0.	0.
1621	0.	0.	0.	0.	0.	0.	0.	0.
163	177323.	0.	0.	177323.	0.	0.	0.	0.
1162	0.	0.	0.	0.	0.	0.	0.	0.
2183	0.	0.	0.	0.	0.	0.	0.	0.
2712	0.	0.	0.	0.	0.	0.	0.	0.
2718	0.	0.	0.	0.	0.	0.	0.	0.
8712	0.	0.	0.	0.	0.	0.	0.	300299.
164	98877.	0.	4.	98873.	0.	4.	0.	0.
165	113715.	0.	55690.	58022.	1.	57417.	1727.	0.
166	101587.	0.	35762.	65825.	0.	35762.	0.	0.
170	0.	0.	0.	0.	0.	0.	0.	0.
171	0.	0.	0.	0.	0.	0.	0.	0.
172	115499.	0.	0.	115499.	1.	0.	0.	0.
173	83692.	0.	7167.	76525.	1.	7167.	0.	0.
1730	0.	0.	0.	0.	0.	0.	0.	0.
174	53040.	0.	3865.	49175.	0.	3875.	9.	0.
175	36690.	0.	0.	36690.	0.	0.	0.	0.
176	0.	0.	0.	0.	0.	0.	0.	0.
177	62034.	0.	11705.	50330.	0.	11705.	0.	0.
178	42448.	0.	28043.	14404.	0.	56322.	28279.	0.
179	85896.	0.	2431.	83465.	0.	2431.	0.	0.
181	0.	0.	0.	0.	0.	0.	0.	0.
182	53774.	0.	12464.	41310.	0.	12469.	5.	0.
183	168397.	0.	0.	168397.	0.	0.	0.	0.
184	0.	0.	0.	0.	0.	0.	0.	0.
185	0.	0.	0.	0.	0.	0.	0.	0.
186	184943.	0.	48012.	136931.	0.	48012.	0.	0.
187	28900.	0.	20061.	8838.	0.	83534.	63473.	0.
188	36433.	0.	337.	36096.	0.	337.	0.	0.
189	22609.	0.	126.	22483.	0.	126.	0.	0.
190	0.	0.	0.	0.	0.	0.	0.	0.
191	96414.	0.	62695.	33726.	1.	65337.	2642.	0.
192	132924.	0.	0.	132924.	1.	0.	0.	0.
193	190747.	0.	0.	190747.	3.	0.	0.	0.
1930	0.	0.	0.	0.	0.	0.	0.	0.
194	26132.	0.	0.	26132.	0.	0.	0.	0.
1940	2880.	0.	0.	2880.	0.	0.	0.	0.
1941	2880.	0.	0.	2880.	0.	0.	0.	0.
195	85624.	0.	0.	85624.	1.	0.	0.	0.
292	0.	0.	0.	0.	0.	0.	0.	0.
301	22113.	0.	0.	22113.	0.	0.	0.	0.
302	51556.	0.	0.	51556.	0.	0.	0.	0.
303	57605.	0.	2.	57603.	0.	2.	0.	0.
304	168580.	0.	0.	168580.	1.	0.	0.	0.
305	0.	0.	0.	0.	0.	0.	0.	0.
306	0.	0.	0.	0.	0.	0.	0.	0.
307	23167.	0.	6216.	16951.	0.	6279.	63.	0.
308	63464.	0.	18668.	44796.	0.	18668.	0.	0.
309	56657.	0.	25740.	30920.	0.	25740.	0.	0.
311	0.	0.	0.	0.	0.	0.	0.	0.
312	122080.	0.	0.	122080.	0.	0.	0.	0.
4314	0.	0.	0.	0.	0.	0.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
315	45978.	0.	0.	45978.	0.	0.	0.	0.
316	41213.	0.	18105.	23103.	0.	31004.	12900.	0.
319	29163.	0.	0.	29163.	0.	0.	0.	0.
320	112088.	0.	6052.	106036.	0.	6052.	0.	0.
322	0.	0.	0.	0.	0.	41.	41.	0.
323	179714.	0.	58458.	121261.	1.	58458.	0.	0.
324	67580.	0.	0.	67580.	0.	0.	0.	0.
325	8641.	0.	420.	8220.	0.	10973.	10552.	0.
327	0.	0.	0.	0.	0.	0.	0.	0.
328	47677.	0.	11085.	36592.	0.	11085.	0.	0.
329	37473.	0.	8786.	28683.	0.	8801.	15.	0.
331	123724.	0.	0.	123724.	0.	0.	0.	0.
332	88183.	0.	28597.	59585.	1.	28597.	0.	0.
333	98470.	0.	55129.	43342.	0.	64789.	9661.	0.
334	108598.	0.	0.	108598.	1.	0.	0.	0.
335	95688.	0.	0.	95688.	0.	0.	0.	0.
336	147862.	0.	91410.	56451.	1.	111016.	19605.	0.
337	59902.	0.	30427.	29477.	0.	43801.	13374.	0.
341	108588.	0.	0.	108588.	0.	0.	0.	0.
3241	0.	0.	0.	0.	0.	428.	428.	0.
3240	0.	0.	0.	0.	0.	153.	153.	0.
3421	0.	0.	0.	0.	0.	3854.	3854.	0.
3420	188378.	0.	79876.	108506.	1.	80830.	954.	0.
342	71624.	0.	57.	71567.	0.	219.	162.	0.
343	154725.	0.	60814.	93903.	0.	84226.	23412.	0.
344	0.	0.	0.	0.	0.	407.	407.	0.
345	104946.	0.	388.	104557.	1.	4602.	4214.	0.
346	89904.	0.	107.	89797.	0.	283.	177.	0.
348	0.	0.	0.	0.	0.	0.	0.	0.
349	169229.	0.	41258.	127979.	0.	41335.	77.	0.
350	128300.	0.	18588.	109712.	0.	18588.	0.	0.
351	81504.	0.	0.	81504.	0.	0.	0.	0.
352	0.	0.	0.	0.	0.	0.	0.	0.
353	76540.	0.	31577.	44964.	0.	31588.	11.	0.
354	5033.	0.	2598.	2435.	0.	43432.	40834.	0.
355	55506.	0.	0.	55506.	0.	0.	0.	0.
356	125977.	0.	2344.	123633.	1.	2344.	0.	0.
357	18026.	0.	6719.	11307.	0.	13415.	6696.	0.
358	157834.	0.	33357.	124466.	1.	33357.	0.	0.
361	245567.	0.	67017.	178550.	3.	67017.	0.	0.
362	79400.	0.	2834.	76568.	0.	2834.	0.	0.
363	0.	0.	0.	0.	0.	0.	0.	0.
364	10080.	0.	90.	9990.	0.	610.	521.	0.
365	62613.	0.	15168.	47445.	0.	15168.	0.	0.
3660	58309.	0.	249.	58059.	1.	249.	0.	0.
3661	61924.	0.	35127.	26795.	0.	49859.	14732.	0.
3662	41763.	0.	0.	41763.	0.	0.	0.	0.
398	95413.	0.	34459.	60953.	1.	35075.	616.	0.
399	112284.	0.	235.	112049.	0.	476.	240.	0.
501	3543.	0.	0.	3543.	0.	0.	0.	0.
502	53192.	0.	0.	53192.	0.	0.	0.	0.
503	40503.	0.	0.	40503.	0.	0.	0.	0.
504	62359.	0.	0.	62359.	0.	0.	0.	0.
506	77169.	0.	0.	77169.	1.	0.	0.	0.
508	62020.	0.	0.	62020.	0.	0.	0.	0.
509	118472.	0.	0.	118472.	1.	0.	0.	0.
510	55329.	0.	0.	55329.	0.	0.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
511	85684.	0.	31182.	54501.	0.	185061.	153878.	0.
512	132590.	0.	0.	132590.	0.	0.	0.	0.
514	0.	0.	0.	0.	0.	0.	0.	0.
515	153576.	0.	0.	153576.	3.	0.	0.	0.
516	0.	0.	0.	0.	0.	0.	0.	0.
518	85535.	0.	0.	85535.	0.	0.	0.	0.
520	26560.	0.	0.	26560.	0.	0.	0.	0.
521	34113.	0.	0.	34113.	0.	0.	0.	0.
522	69464.	0.	0.	69464.	0.	0.	0.	0.
524	0.	0.	0.	0.	0.	0.	0.	0.
525	46457.	0.	0.	46457.	0.	0.	0.	0.
526	0.	0.	0.	0.	0.	0.	0.	0.
528	15080.	0.	0.	15080.	0.	0.	0.	0.
529	12983.	0.	0.	12983.	0.	0.	0.	0.
530	41804.	0.	0.	41804.	0.	0.	0.	0.
532	154125.	0.	0.	154125.	0.	0.	0.	0.
534	512767.	0.	2668.	510099.	3.	2668.	0.	0.
536	0.	0.	0.	0.	0.	0.	0.	0.
537	130711.	0.	2339.	128372.	0.	3800.	1461.	0.
538	212422.	0.	282.	212140.	1.	282.	0.	0.
539	73534.	0.	585.	72949.	1.	1924.	1339.	0.
540	194533.	0.	0.	194533.	4.	0.	0.	0.
541	0.	0.	0.	0.	0.	0.	0.	0.
542	160933.	0.	0.	160933.	0.	0.	0.	0.
543	0.	0.	0.	0.	0.	0.	0.	0.
544	0.	0.	0.	0.	0.	0.	0.	0.
545	66587.	0.	0.	66587.	1.	0.	0.	0.
546	224456.	0.	0.	224456.	1.	0.	0.	0.
547	20759.	0.	0.	20759.	0.	0.	0.	0.
548	219175.	0.	55618.	163557.	1.	55618.	0.	0.
549	60042.	0.	12875.	47167.	1.	12990.	115.	0.
550	88219.	0.	48147.	40072.	0.	73175.	25028.	0.
552	0.	0.	0.	0.	0.	0.	0.	0.
553	0.	0.	0.	0.	0.	0.	0.	0.
554	0.	0.	0.	0.	0.	0.	0.	0.
555	0.	0.	0.	0.	0.	0.	0.	0.
556	139460.	0.	0.	139460.	3.	0.	0.	0.
557	60962.	0.	28387.	32573.	0.	40853.	12466.	0.
5580	31682.	0.	5513.	26168.	0.	46431.	40917.	0.
559	167136.	0.	97253.	69892.	1.	146795.	49542.	0.
5590	0.	0.	0.	0.	0.	0.	0.	0.
560	247165.	0.	0.	247165.	1.	0.	0.	0.
558	33329.	0.	3488.	29839.	0.	3488.	0.	0.
562	20160.	0.	0.	20160.	0.	0.	0.	0.
563	43224.	0.	0.	43224.	0.	0.	0.	0.
564	71644.	0.	0.	71644.	0.	0.	0.	0.
565	0.	0.	0.	0.	0.	0.	0.	0.
566	14968.	0.	0.	14968.	0.	0.	0.	0.
567	123455.	0.	28.	123427.	1.	28.	0.	0.
568	118341.	0.	56001.	62341.	1.	56002.	0.	0.
569	90236.	0.	14714.	75522.	0.	14714.	0.	0.
5690	0.	0.	0.	0.	0.	0.	0.	0.
5621	0.	0.	0.	0.	0.	0.	0.	0.
5703	0.	0.	0.	0.	0.	0.	0.	0.
5830	0.	0.	0.	0.	0.	0.	0.	0.
570	26638.	0.	0.	26638.	0.	0.	0.	0.
5702	0.	0.	0.	0.	0.	0.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
571	54891.	0.	0.	54891.	1.	0.	0.	0.
572	24552.	0.	0.	24552.	1.	0.	0.	0.
573	0.	0.	0.	0.	0.	0.	0.	0.
574	164482.	0.	0.	164482.	3.	0.	0.	0.
575	53139.	0.	0.	53139.	0.	0.	0.	0.
576	0.	0.	0.	0.	0.	73.	73.	0.
577	28082.	0.	0.	28082.	0.	0.	0.	0.
578	18719.	0.	0.	18719.	0.	0.	0.	0.
579	23761.	0.	0.	23761.	0.	0.	0.	0.
580	0.	0.	0.	0.	0.	0.	0.	0.
582	114428.	0.	4286.	110142.	0.	4286.	0.	0.
583	79586.	0.	5839.	73747.	1.	5839.	0.	0.
584	80152.	0.	439.	79713.	0.	439.	0.	0.
585	86361.	0.	31232.	55107.	0.	31232.	0.	0.
586	53708.	0.	8341.	45367.	0.	8341.	0.	0.
587	30821.	0.	5913.	24908.	0.	5913.	0.	0.
588	44837.	0.	2070.	42767.	0.	2070.	0.	0.
589	0.	0.	0.	0.	0.	4341.	4341.	0.
590	53229.	0.	0.	53229.	1.	0.	0.	0.
591	0.	0.	0.	0.	0.	0.	0.	0.
592	78738.	0.	0.	78738.	0.	0.	0.	0.
593	150249.	0.	60292.	89956.	0.	116238.	55946.	0.
594	219576.	0.	0.	219576.	0.	0.	0.	0.
596	41393.	0.	13862.	27530.	0.	13880.	18.	0.
597	0.	0.	0.	0.	0.	26.	26.	0.
598	85296.	0.	38540.	46756.	1.	38540.	0.	0.
599	112016.	0.	34616.	77400.	1.	36977.	2360.	0.
7460	0.	0.	0.	0.	0.	0.	0.	294.
7461	0.	0.	0.	0.	0.	0.	0.	320435.
7400	241044.	0.	5585.	235459.	0.	5585.	0.	195.
7401	0.	0.	0.	0.	0.	0.	0.	0.
701	2765.	0.	0.	2765.	0.	0.	0.	0.
702	0.	0.	0.	0.	0.	0.	0.	0.
703	0.	0.	0.	0.	0.	0.	0.	0.
704	6119.	0.	0.	6119.	0.	0.	0.	0.
705	113986.	0.	0.	113986.	1.	0.	0.	0.
706	0.	0.	0.	0.	0.	0.	0.	0.
708	0.	0.	0.	0.	0.	0.	0.	0.
709	0.	0.	0.	0.	0.	0.	0.	0.
710	41005.	0.	0.	41005.	0.	0.	0.	0.
711	76761.	0.	0.	76761.	1.	0.	0.	0.
712	161765.	0.	0.	161765.	1.	0.	0.	0.
713	50555.	0.	0.	50555.	0.	0.	0.	0.
714	16728.	0.	0.	16728.	0.	0.	0.	0.
715	115412.	0.	0.	115412.	0.	0.	0.	0.
716	115981.	0.	0.	115981.	1.	0.	0.	0.
718	69394.	0.	0.	69394.	0.	0.	0.	0.
719	88705.	0.	0.	88705.	1.	0.	0.	0.
720	47586.	0.	0.	47586.	0.	0.	0.	0.
721	80236.	0.	0.	80236.	1.	0.	0.	0.
722	94461.	0.	46456.	48004.	0.	241522.	195066.	0.
723	76907.	0.	0.	76907.	1.	0.	0.	0.
724	252231.	0.	0.	252231.	1.	0.	0.	0.
725	0.	0.	0.	0.	0.	0.	0.	0.
726	0.	0.	0.	0.	0.	0.	0.	0.
728	0.	0.	0.	0.	0.	174.	174.	0.
729	33729.	0.	0.	33729.	0.	0.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
730	0.	0.	0.	0.	0.	0.	0.	0.
731	0.	0.	0.	0.	0.	0.	0.	0.
732	71187.	0.	0.	71187.	1.	0.	0.	0.
733	72116.	0.	0.	72116.	1.	0.	0.	0.
734	20198.	0.	0.	20198.	0.	0.	0.	0.
735	46223.	0.	0.	46223.	0.	0.	0.	0.
736	132402.	0.	0.	132402.	1.	0.	0.	0.
737	120708.	0.	0.	120708.	1.	0.	0.	0.
738	149196.	0.	0.	149196.	1.	0.	0.	0.
739	0.	0.	0.	0.	0.	3985.	3985.	0.
740	64471.	0.	27394.	37077.	1.	27394.	0.	0.
741	103524.	0.	0.	103524.	0.	0.	0.	0.
742	96389.	0.	0.	96389.	1.	0.	0.	0.
743	313728.	0.	0.	313728.	1.	0.	0.	0.
744	255374.	0.	114.	255260.	1.	114.	0.	0.
745	37390.	0.	0.	37390.	0.	0.	0.	0.
746	50323.	0.	0.	50323.	0.	0.	0.	0.
747	0.	0.	0.	0.	0.	0.	0.	0.
748	177476.	0.	0.	177476.	1.	0.	0.	0.
749	202004.	0.	0.	202004.	1.	0.	0.	0.
750	0.	0.	0.	0.	0.	0.	0.	0.
751	0.	0.	0.	0.	0.	0.	0.	0.
752	16503.	0.	0.	16503.	0.	0.	0.	0.
753	0.	0.	0.	0.	0.	0.	0.	0.
754	77040.	0.	0.	77040.	0.	0.	0.	0.
755	0.	0.	0.	0.	0.	0.	0.	0.
756	34562.	0.	0.	34562.	0.	0.	0.	0.
757	0.	0.	0.	0.	0.	0.	0.	0.
758	68400.	0.	0.	68400.	0.	0.	0.	0.
760	58472.	0.	0.	58472.	0.	0.	0.	0.
7600	0.	0.	0.	0.	0.	0.	0.	115111.
7601	0.	0.	0.	0.	0.	19.	19.	0.
7603	0.	0.	0.	0.	0.	0.	0.	0.
7612	0.	0.	0.	0.	0.	0.	290867.	0.
761	10800.	0.	0.	10800.	0.	0.	0.	0.
762	126153.	0.	0.	126153.	3.	4.	0.	0.
763	0.	0.	0.	0.	0.	0.	0.	0.
764	11520.	0.	0.	11520.	0.	0.	0.	0.
765	24482.	0.	0.	24482.	0.	0.	0.	0.
766	0.	0.	0.	0.	0.	0.	0.	0.
768	80641.	0.	0.	80641.	0.	0.	0.	0.
769	9359.	0.	0.	9359.	0.	0.	0.	0.
770	18719.	0.	0.	18719.	0.	0.	0.	0.
771	31682.	0.	0.	31682.	0.	0.	0.	0.
773	0.	0.	0.	0.	0.	0.	0.	0.
774	13681.	0.	0.	13681.	0.	0.	0.	0.
775	28082.	0.	0.	28082.	0.	0.	0.	0.
776	12241.	0.	0.	12241.	0.	0.	0.	0.
777	23039.	0.	0.	23039.	0.	0.	0.	0.
778	70877.	0.	11373.	59499.	0.	11373.	0.	0.
779	82193.	0.	27598.	54599.	0.	27598.	0.	0.
780	57554.	0.	40610.	16941.	0.	91740.	51130.	0.
781	116556.	0.	30091.	86465.	0.	30091.	0.	0.
782	114400.	0.	0.	114400.	0.	0.	0.	0.
783	83598.	0.	4462.	79136.	0.	4462.	0.	0.
784	0.	0.	0.	0.	0.	1173.	1173.	0.
785	85379.	0.	0.	85379.	0.	0.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
786	80209.	0.	0.	80209.	0.	0.	0.	30.
787	145909.	0.	0.	145909.	1.	0.	0.	0.
790	169080.	0.	0.	169080.	1.	0.	0.	0.
791	245988.	0.	0.	245988.	1.	0.	0.	0.
792	22870.	0.	0.	22870.	0.	0.	0.	0.
793	40508.	0.	0.	40508.	0.	0.	0.	0.
794	89033.	0.	0.	89033.	1.	0.	0.	0.
795	145714.	0.	0.	145714.	1.	0.	0.	0.
796	140455.	0.	0.	140455.	1.	0.	0.	0.
797	221055.	0.	0.	221055.	0.	0.	0.	0.
798	0.	0.	0.	0.	0.	0.	0.	0.
799	125271.	0.	0.	125271.	0.	0.	0.	0.
7901	0.	0.	0.	0.	0.	0.	0.	0.
7902	0.	0.	0.	0.	0.	0.	0.	0.
7921	0.	0.	0.	0.	0.	0.	0.	0.
7903	0.	0.	0.	0.	0.	11116.	11116.	0.
7911	0.	0.	0.	0.	0.	0.	0.	0.
902	84914.	0.	0.	84914.	0.	0.	0.	0.
903	52409.	0.	0.	52409.	0.	0.	0.	0.
904	0.	0.	0.	0.	0.	0.	0.	0.
905	159661.	0.	0.	159661.	1.	0.	0.	0.
906	105445.	0.	0.	105445.	0.	0.	0.	0.
907	69168.	0.	0.	69168.	1.	0.	0.	0.
908	22221.	0.	0.	22221.	0.	0.	0.	0.
909	0.	0.	0.	0.	0.	54.	54.	0.
910	77645.	0.	0.	77645.	0.	0.	0.	0.
912	0.	0.	0.	0.	0.	0.	0.	0.
913	107362.	0.	417.	106944.	1.	417.	0.	0.
915	189536.	0.	0.	189536.	1.	0.	0.	0.
916	0.	0.	0.	0.	0.	0.	0.	0.
918	77394.	0.	84.	77310.	0.	84.	0.	0.
919	45180.	0.	0.	45180.	0.	0.	0.	0.
920	61429.	0.	0.	61429.	0.	0.	0.	0.
921	57706.	0.	0.	57706.	0.	0.	0.	0.
922	50556.	0.	0.	50556.	0.	0.	0.	0.
923	0.	0.	0.	0.	0.	415.	415.	0.
924	21754.	0.	105.	21649.	0.	810.	705.	0.
925	80011.	0.	209.	79802.	0.	298.	89.	0.
926	0.	0.	0.	0.	0.	0.	0.	0.
927	0.	0.	0.	0.	0.	0.	0.	0.
928	126048.	0.	0.	126048.	1.	0.	0.	0.
929	90448.	0.	0.	90448.	0.	0.	0.	0.
930	14400.	0.	723.	13677.	0.	5503.	4780.	0.
931	20160.	0.	923.	19237.	0.	3090.	2167.	0.
932	0.	0.	0.	0.	0.	0.	0.	0.
933	3600.	0.	0.	3600.	0.	0.	0.	0.
934	52564.	0.	0.	52564.	0.	0.	0.	0.
936	86219.	0.	179.	86039.	0.	182.	2.	0.
937	145223.	0.	50198.	95028.	1.	50198.	0.	0.
938	155254.	0.	35449.	119806.	0.	35449.	0.	0.
939	125645.	0.	11.	125634.	0.	11.	0.	0.
940	65074.	0.	40213.	24862.	0.	51270.	11057.	0.
941	152267.	0.	66046.	86230.	1.	66045.	0.	0.
942	0.	0.	0.	0.	0.	11908.	11908.	0.
944	0.	0.	0.	0.	0.	333.	333.	0.
945	155613.	0.	0.	155613.	1.	0.	0.	0.
946	0.	0.	0.	0.	0.	8.	8.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
947	61984.	0.	26458.	35526.	0.	26458.	0.	0.
948	42714.	0.	11184.	31534.	0.	11184.	0.	0.
949	82469.	0.	40323.	42146.	0.	40324.	2.	0.
950	108184.	0.	58714.	49471.	1.	60589.	1875.	0.
955	71238.	0.	26039.	45194.	0.	146690.	120651.	0.
956	0.	0.	0.	0.	0.	96395.	96395.	0.
958	33838.	0.	0.	33838.	0.	0.	0.	0.
959	14400.	0.	0.	14400.	0.	0.	0.	0.
960	0.	0.	0.	0.	0.	0.	0.	0.
961	14400.	0.	0.	14400.	0.	0.	0.	0.
962	9359.	0.	0.	9359.	0.	0.	0.	0.
963	13681.	0.	0.	13681.	0.	0.	0.	0.
964	29518.	0.	0.	29518.	0.	0.	0.	0.
965	0.	0.	0.	0.	0.	0.	0.	0.
966	30238.	0.	0.	30238.	0.	0.	0.	0.
967	0.	0.	0.	0.	0.	0.	0.	0.
968	0.	0.	0.	0.	0.	0.	0.	0.
970	145445.	0.	29955.	115489.	1.	29955.	0.	0.
971	87386.	0.	35997.	51387.	0.	35997.	0.	0.
972	73375.	0.	0.	73375.	0.	0.	0.	0.
973	100125.	0.	36952.	63173.	0.	36952.	0.	0.
974	157070.	0.	63431.	93638.	0.	63442.	11.	0.
88143	0.	0.	0.	0.	0.	0.	0.	0.
88316	0.	0.	0.	0.	0.	0.	0.	0.
88356	0.	0.	0.	0.	0.	0.	0.	0.
88522	0.	0.	0.	0.	0.	0.	0.	0.
88526	0.	0.	0.	0.	0.	0.	0.	0.
88188	0.	0.	0.	0.	0.	0.	0.	0.
88302	0.	0.	0.	0.	0.	0.	0.	0.
88153	0.	0.	0.	0.	0.	0.	0.	0.
88142	0.	0.	0.	0.	0.	0.	0.	0.
88908	0.	0.	0.	0.	0.	0.	0.	0.
88747	0.	0.	0.	0.	0.	0.	0.	0.
88351	0.	0.	0.	0.	0.	0.	0.	0.
88765	0.	0.	0.	0.	0.	0.	0.	0.
88938	0.	0.	0.	0.	0.	0.	0.	0.
88739	0.	0.	0.	0.	0.	0.	0.	0.
88964	0.	0.	0.	0.	0.	0.	0.	0.
88681	0.	0.	0.	0.	0.	0.	0.	0.
88428	0.	0.	0.	0.	0.	0.	0.	0.
88257	0.	0.	0.	0.	0.	0.	0.	0.
88451	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL	25369540.	0.	2531898.	22837630.	20843640.	3669090.	1428053.	3656063.

VOLUME LEFT IN PIPE = 4668967. CU FT
VOLUME LEFT IN STREET = 290861. CU FT
VOLUME LEFT IN STORAGE = 3156945. CU FT

ERROR IN CONTINUITY, PERCENT =-13.55
(INFLOW-OUTFLOW-VOLUME LEFT)/INFLOW

FLOODING AFTER IMPLEMENTATION OF PHASES 1, 2 AND 3

* MONTGOMERY WATSON - STORMWATER MANAGEMENT MODEL (MW-SWMM)
*** EXTENDED TRANSPORT PROGRAM (EXTRAN BLOCK) ***

<< CSS,10YR 6HR STORM,Mh lowered 2',Overflow off,& Adjusted Runoff>>
< FILENAME: newmaster.DAT & master10.gut: does not use 1 cfs capitol area plan

CONTINUITY BALANCE IN CU-FT AT END OF RUN

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
11	0.	0.	0.	0.	0.	0.	0.	2921960.
12	0.	0.	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	7892128.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	6023534.	0.	0.	0.
25	0.	0.	0.	0.	934871.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	5965550.	0.	0.	0.
10	406439.	0.	0.	406439.	4.	0.	0.	0.
20	385751.	0.	0.	385751.	3.	0.	0.	0.
101	0.	0.	0.	0.	0.	0.	0.	0.
102	0.	0.	0.	0.	0.	0.	0.	0.
103	39825.	0.	0.	39825.	0.	0.	0.	0.
104	0.	0.	0.	0.	0.	0.	0.	0.
105	49389.	0.	0.	49389.	0.	0.	0.	0.
106	185135.	0.	0.	185135.	1.	0.	0.	0.
107	141133.	0.	0.	141133.	1.	0.	0.	0.
108	147246.	0.	0.	147246.	1.	0.	0.	0.
109	0.	0.	0.	0.	0.	0.	0.	0.
110	114562.	0.	0.	114562.	1.	0.	0.	0.
120	0.	0.	0.	0.	0.	0.	0.	0.
121	28141.	0.	5.	28136.	0.	5.	0.	0.
124	78378.	0.	12976.	65402.	1.	12976.	0.	0.
130	103035.	0.	29694.	73341.	3.	40208.	10514.	0.
132	54316.	0.	223.	54093.	0.	409.	186.	0.
133	163057.	0.	436.	162621.	1.	516.	80.	0.
134	0.	0.	0.	0.	0.	70.	70.	0.
135	0.	0.	0.	0.	0.	529.	529.	0.
136	30216.	0.	1880.	28336.	0.	1880.	0.	0.
140	65329.	0.	0.	65329.	0.	0.	0.	0.
142	153806.	0.	0.	153806.	1.	0.	0.	0.
143	30022.	0.	0.	30022.	0.	0.	0.	0.
144	84835.	0.	0.	84835.	0.	0.	0.	0.
145	142434.	0.	0.	142434.	3.	0.	0.	0.
146	0.	0.	0.	0.	0.	44.	44.	0.
148	65215.	0.	7431.	57784.	1.	7431.	0.	0.
150	75202.	0.	0.	75202.	1.	0.	0.	0.
151	110698.	0.	55345.	55353.	0.	55346.	1.	0.
152	101746.	0.	23889.	77857.	0.	23889.	0.	0.
153	24089.	0.	147.	23942.	0.	150.	3.	0.
154	0.	0.	0.	0.	0.	0.	0.	0.
155	129617.	0.	0.	129617.	0.	0.	0.	0.
156	132756.	0.	0.	132756.	1.	0.	0.	0.
158	44278.	0.	0.	44278.	0.	0.	0.	0.

* MONTGOMERY WATSON - STORMWATER MANAGEMENT MODEL (MW-SWMM)
*** EXTENDED TRANSPORT PROGRAM (EXTRAN BLOCK) ***

<< CSS,10YR 6HR STORM,Mh lowered 2',Overflow off,& Adjusted Runoff>>
<< FILENAME: newmaster.DAT & master10.gut: does not use 1 cfs capitol area plan

CONTINUITY BALANCE IN CU-FT AT END OF RUN

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
11	0.	0.	0.	0.	0.	0.	0.	2921960.
12	0.	0.	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	7892128.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	6023534.	0.	0.	0.
25	0.	0.	0.	0.	934871.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	5965550.	0.	0.	0.
10	406439.	0.	0.	406439.	4.	0.	0.	0.
20	385751.	0.	0.	385751.	3.	0.	0.	0.
101	0.	0.	0.	0.	0.	0.	0.	0.
102	0.	0.	0.	0.	0.	0.	0.	0.
103	39825.	0.	0.	39825.	0.	0.	0.	0.
104	0.	0.	0.	0.	0.	0.	0.	0.
105	49389.	0.	0.	49389.	0.	0.	0.	0.
106	185135.	0.	0.	185135.	1.	0.	0.	0.
107	141133.	0.	0.	141133.	1.	0.	0.	0.
108	147246.	0.	0.	147246.	1.	0.	0.	0.
109	0.	0.	0.	0.	0.	0.	0.	0.
110	114562.	0.	0.	114562.	1.	0.	0.	0.
120	0.	0.	0.	0.	0.	0.	0.	0.
121	28141.	0.	5.	28136.	0.	5.	0.	0.
124	78378.	0.	12976.	65402.	1.	12976.	0.	0.
130	103035.	0.	29694.	73341.	3.	40208.	10514.	0.
132	54316.	0.	223.	54093.	0.	409.	186.	0.
133	163057.	0.	436.	162621.	1.	516.	80.	0.
134	0.	0.	0.	0.	0.	70.	70.	0.
135	0.	0.	0.	0.	0.	529.	529.	0.
136	30216.	0.	1880.	28336.	0.	1880.	0.	0.
140	65329.	0.	0.	65329.	0.	0.	0.	0.
142	153806.	0.	0.	153806.	1.	0.	0.	0.
143	30022.	0.	0.	30022.	0.	0.	0.	0.
144	84835.	0.	0.	84835.	0.	0.	0.	0.
145	142434.	0.	0.	142434.	3.	0.	0.	0.
146	0.	0.	0.	0.	0.	44.	44.	0.
148	65215.	0.	7431.	57784.	1.	7431.	0.	0.
150	75202.	0.	0.	75202.	1.	0.	0.	0.
151	110698.	0.	55345.	55353.	0.	55346.	1.	0.
152	101746.	0.	23889.	77857.	0.	23889.	0.	0.
153	24089.	0.	147.	23942.	0.	150.	3.	0.
154	0.	0.	0.	0.	0.	0.	0.	0.
155	129617.	0.	0.	129617.	0.	0.	0.	0.
156	132756.	0.	0.	132756.	1.	0.	0.	0.
158	44278.	0.	0.	44278.	0.	0.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
159	81329.	0.	39.	81290.	0.	39.	0.	0.
1159	0.	0.	0.	0.	0.	0.	0.	0.
1590	10800.	0.	9.	10791.	0.	15.	6.	0.
1591	0.	0.	0.	0.	0.	0.	0.	0.
160	135132.	0.	31332.	103801.	1.	31336.	5.	0.
1621	0.	0.	0.	0.	0.	0.	0.	0.
163	177323.	0.	0.	177323.	0.	0.	0.	0.
1162	0.	0.	0.	0.	0.	0.	0.	0.
2183	0.	0.	0.	0.	0.	0.	0.	0.
2712	0.	0.	0.	0.	0.	0.	0.	0.
2718	0.	0.	0.	0.	0.	0.	0.	0.
8712	0.	0.	0.	0.	0.	0.	0.	300236.
164	98877.	0.	1.	98876.	0.	1.	0.	0.
165	113715.	0.	57067.	56645.	1.	58595.	1528.	0.
166	101587.	0.	35879.	65709.	0.	35879.	0.	0.
170	0.	0.	0.	0.	0.	0.	0.	0.
171	0.	0.	0.	0.	0.	0.	0.	0.
172	115499.	0.	0.	115499.	1.	0.	0.	0.
173	83692.	0.	9519.	74173.	1.	9519.	0.	0.
1730	0.	0.	0.	0.	0.	6.	6.	0.
174	53040.	0.	4218.	48822.	0.	4227.	9.	0.
175	36690.	0.	0.	36690.	0.	0.	0.	0.
176	0.	0.	0.	0.	0.	0.	0.	0.
177	62034.	0.	11740.	50295.	0.	11740.	0.	0.
178	42448.	0.	28084.	14363.	0.	56332.	28248.	0.
179	85896.	0.	2420.	83477.	0.	2420.	0.	0.
181	0.	0.	0.	0.	0.	0.	0.	0.
182	53774.	0.	12501.	41272.	0.	12503.	2.	0.
183	168397.	0.	0.	168397.	0.	0.	0.	0.
184	0.	0.	0.	0.	0.	0.	0.	0.
185	0.	0.	0.	0.	0.	0.	0.	0.
186	184943.	0.	46666.	138276.	0.	46666.	0.	0.
187	28900.	0.	19981.	8917.	0.	83193.	63212.	0.
188	36433.	0.	336.	36098.	0.	336.	0.	0.
189	22609.	0.	119.	22489.	0.	119.	0.	0.
190	0.	0.	0.	0.	0.	0.	0.	0.
191	96414.	0.	62637.	33783.	1.	65255.	2618.	0.
192	132924.	0.	0.	132924.	1.	0.	0.	0.
193	190747.	0.	0.	190747.	3.	0.	0.	0.
1930	0.	0.	0.	0.	0.	0.	0.	0.
194	26132.	0.	0.	26132.	0.	0.	0.	0.
1940	2880.	0.	0.	2880.	0.	0.	0.	0.
1941	2880.	0.	0.	2880.	0.	0.	0.	0.
195	85624.	0.	0.	85624.	1.	0.	0.	0.
292	0.	0.	0.	0.	0.	0.	0.	0.
301	22113.	0.	0.	22113.	0.	0.	0.	0.
302	51556.	0.	0.	51556.	0.	0.	0.	0.
303	57605.	0.	0.	57605.	0.	0.	0.	0.
304	168580.	0.	0.	168580.	1.	0.	0.	0.
305	0.	0.	0.	0.	0.	0.	0.	0.
306	0.	0.	0.	0.	0.	0.	0.	0.
307	23167.	0.	4984.	18183.	0.	4984.	0.	0.
308	63464.	0.	14866.	48598.	0.	14866.	0.	0.
309	56657.	0.	25116.	31544.	0.	25116.	0.	0.
311	0.	0.	0.	0.	0.	0.	0.	0.
312	122080.	0.	0.	122080.	0.	0.	0.	0.
4311	0.	0.	0.	0.	0.	0.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
4314	0.	0.	0.	0.	0.	0.	0.	0.
315	45978.	0.	0.	45978.	0.	0.	0.	0.
316	41213.	0.	0.	41213.	0.	0.	0.	0.
319	29163.	0.	0.	29163.	0.	0.	0.	0.
320	112088.	0.	0.	112088.	0.	0.	0.	0.
322	0.	0.	0.	0.	0.	1.	1.	0.
323	179714.	0.	50463.	129256.	1.	50463.	0.	0.
324	67580.	0.	0.	67580.	0.	0.	0.	0.
325	0.	0.	0.	0.	0.	6598.	6598.	0.
327	0.	0.	0.	0.	0.	0.	0.	0.
328	47677.	0.	9765.	37911.	0.	9765.	0.	0.
329	37473.	0.	8584.	28885.	0.	8584.	0.	0.
331	123724.	0.	0.	123724.	0.	0.	0.	0.
332	88183.	0.	15883.	72300.	1.	15883.	0.	0.
333	98470.	0.	47718.	50752.	0.	56154.	8437.	0.
334	108598.	0.	48.	108549.	1.	48.	0.	0.
335	95688.	0.	0.	95688.	0.	0.	0.	0.
336	147862.	0.	90654.	57208.	1.	110226.	19573.	0.
337	59902.	0.	29884.	30021.	0.	43139.	13255.	0.
341	108588.	0.	0.	108588.	0.	0.	0.	0.
4401	0.	0.	0.	0.	0.	0.	0.	0.
3241	0.	0.	0.	0.	0.	0.	0.	0.
3240	0.	0.	0.	0.	0.	0.	0.	0.
3421	0.	0.	0.	0.	0.	0.	0.	0.
3420	188378.	0.	5112.	183265.	1.	5112.	0.	0.
342	71624.	0.	0.	71624.	0.	0.	0.	0.
343	154725.	0.	0.	154725.	0.	0.	0.	0.
4441	0.	0.	0.	0.	0.	0.	0.	0.
344	0.	0.	0.	0.	0.	0.	0.	0.
345	104946.	0.	0.	104946.	1.	0.	0.	0.
346	75503.	0.	0.	75503.	0.	0.	0.	0.
348	0.	0.	0.	0.	0.	0.	0.	0.
349	169229.	0.	27376.	141854.	0.	27454.	79.	0.
350	128300.	0.	20861.	107439.	0.	20861.	0.	0.
351	81504.	0.	0.	81504.	0.	0.	0.	0.
352	0.	0.	0.	0.	0.	0.	0.	0.
353	76540.	0.	31477.	45063.	0.	31490.	13.	0.
354	5033.	0.	2069.	2964.	0.	19342.	17274.	0.
355	55506.	0.	0.	55506.	0.	0.	0.	0.
356	125977.	0.	0.	125977.	1.	0.	0.	0.
357	18026.	0.	4539.	13486.	0.	4792.	252.	0.
358	157834.	0.	17014.	140820.	1.	17014.	0.	0.
361	245567.	0.	62561.	183006.	3.	62561.	0.	0.
362	79400.	0.	2831.	76572.	0.	2831.	0.	0.
363	0.	0.	0.	0.	0.	0.	0.	0.
364	10080.	0.	86.	9994.	0.	588.	501.	0.
365	62613.	0.	14710.	47903.	0.	14710.	0.	0.
3660	58309.	0.	232.	58077.	1.	232.	0.	0.
3661	61924.	0.	34740.	27182.	0.	49134.	14394.	0.
3662	41763.	0.	0.	41763.	0.	0.	0.	0.
398	95413.	0.	33618.	61795.	1.	34156.	538.	0.
399	112284.	0.	302.	111982.	0.	613.	311.	0.
501	3543.	0.	0.	3543.	0.	0.	0.	0.
502	53192.	0.	0.	53192.	0.	0.	0.	0.
503	40503.	0.	0.	40503.	0.	0.	0.	0.
504	62359.	0.	0.	62359.	0.	0.	0.	0.
506	77169.	0.	0.	77169.	1.	0.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
508	62020.	0.	0.	62020.	0.	0.	0.	0.
509	118472.	0.	0.	118472.	1.	0.	0.	0.
510	55329.	0.	0.	55329.	0.	0.	0.	0.
511	85684.	0.	28997.	56686.	0.	158601.	129604.	0.
512	132590.	0.	0.	132590.	0.	0.	0.	0.
514	0.	0.	0.	0.	0.	0.	0.	0.
515	153576.	0.	0.	153576.	3.	0.	0.	0.
516	0.	0.	0.	0.	0.	0.	0.	0.
518	85535.	0.	0.	85535.	0.	0.	0.	0.
520	26560.	0.	0.	26560.	0.	0.	0.	0.
521	34113.	0.	0.	34113.	0.	0.	0.	0.
522	69464.	0.	0.	69464.	0.	0.	0.	0.
524	0.	0.	0.	0.	0.	0.	0.	0.
525	46457.	0.	0.	46457.	0.	0.	0.	0.
526	0.	0.	0.	0.	0.	0.	0.	0.
528	15080.	0.	0.	15080.	0.	0.	0.	0.
529	12983.	0.	0.	12983.	0.	0.	0.	0.
530	41804.	0.	0.	41804.	0.	0.	0.	0.
532	154125.	0.	0.	154125.	0.	0.	0.	0.
534	512767.	0.	1416.	511351.	3.	1416.	0.	0.
536	0.	0.	0.	0.	0.	0.	0.	0.
537	130711.	0.	1929.	128782.	0.	2939.	1010.	0.
538	212422.	0.	151.	212271.	1.	151.	0.	0.
539	73534.	0.	507.	73027.	1.	1686.	1179.	0.
540	194533.	0.	0.	194533.	4.	0.	0.	0.
541	0.	0.	0.	0.	0.	0.	0.	0.
542	160933.	0.	0.	160933.	0.	0.	0.	0.
543	0.	0.	0.	0.	0.	0.	0.	0.
544	0.	0.	0.	0.	0.	0.	0.	0.
545	66587.	0.	0.	66587.	1.	0.	0.	0.
546	224456.	0.	0.	224456.	1.	0.	0.	0.
547	20759.	0.	0.	20759.	0.	0.	0.	0.
548	219175.	0.	54182.	164993.	1.	54181.	0.	0.
549	60042.	0.	10765.	49278.	1.	10765.	0.	0.
550	88219.	0.	47320.	40900.	0.	70724.	23404.	0.
552	0.	0.	0.	0.	0.	0.	0.	0.
553	0.	0.	0.	0.	0.	0.	0.	0.
554	0.	0.	0.	0.	0.	0.	0.	0.
555	0.	0.	0.	0.	0.	0.	0.	0.
556	139460.	0.	0.	139460.	3.	0.	0.	0.
557	60962.	0.	26606.	34354.	0.	36289.	9683.	0.
5580	31682.	0.	5192.	26490.	0.	44274.	39082.	0.
559	167136.	0.	96486.	70660.	1.	144811.	48326.	0.
5590	0.	0.	0.	0.	0.	34.	33.	0.
560	247165.	0.	0.	247165.	1.	0.	0.	0.
558	33329.	0.	2106.	31221.	0.	2106.	0.	0.
562	20160.	0.	0.	20160.	0.	0.	0.	0.
563	43224.	0.	141.	43082.	0.	499.	358.	0.
564	71644.	0.	0.	71644.	0.	0.	0.	0.
565	0.	0.	0.	0.	0.	0.	0.	0.
566	14968.	0.	0.	14968.	0.	0.	0.	0.
567	123455.	0.	0.	123455.	1.	0.	0.	0.
568	118341.	0.	55647.	62696.	1.	55647.	0.	0.
569	90236.	0.	14496.	75739.	0.	14496.	0.	0.
5690	0.	0.	0.	0.	0.	131.	131.	0.
5621	0.	0.	0.	0.	0.	0.	0.	0.
5703	0.	0.	0.	0.	0.	0.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
5830	0.	0.	0.	0.	0.	0.	0.	0.
570	26638.	0.	0.	26638.	0.	0.	0.	0.
5702	0.	0.	0.	0.	0.	0.	0.	0.
571	54891.	0.	0.	54891.	1.	0.	0.	0.
572	24552.	0.	0.	24552.	1.	0.	0.	0.
573	0.	0.	0.	0.	0.	0.	0.	0.
574	164482.	0.	0.	164482.	3.	0.	0.	0.
575	53139.	0.	0.	53139.	0.	0.	0.	0.
576	0.	0.	0.	0.	0.	0.	0.	0.
577	28082.	0.	4.	28078.	0.	5.	1.	0.
578	18719.	0.	3.	18716.	0.	12.	10.	0.
579	23761.	0.	0.	23761.	0.	0.	0.	0.
580	0.	0.	0.	0.	0.	0.	0.	0.
582	114428.	0.	3394.	111034.	0.	3394.	0.	0.
583	79586.	0.	4369.	75217.	1.	4369.	0.	0.
584	80152.	0.	153.	79999.	0.	153.	0.	0.
585	86341.	0.	31237.	55103.	0.	31237.	0.	0.
586	53708.	0.	8070.	45638.	0.	8082.	12.	0.
587	30821.	0.	5524.	25297.	0.	5524.	0.	0.
588	44837.	0.	1709.	43128.	0.	1709.	0.	0.
589	0.	0.	0.	0.	0.	4179.	4179.	0.
590	53229.	0.	39.	53190.	1.	39.	0.	0.
591	0.	0.	0.	0.	0.	0.	0.	0.
592	78738.	0.	22.	78715.	0.	22.	0.	0.
593	150249.	0.	57963.	92286.	0.	109786.	51823.	0.
594	219576.	0.	0.	219576.	0.	0.	0.	0.
596	41393.	0.	14054.	27338.	0.	14084.	30.	0.
597	0.	0.	0.	0.	0.	60.	60.	0.
598	85296.	0.	38504.	46792.	1.	38504.	0.	0.
599	112016.	0.	34122.	77893.	1.	35681.	1558.	0.
7460	0.	0.	0.	0.	0.	0.	0.	353.
7461	0.	0.	0.	0.	0.	0.	0.	320150.
7400	225221.	0.	91.	225129.	0.	91.	0.	0.
7431	0.	0.	0.	0.	0.	0.	0.	0.
7401	0.	0.	0.	0.	0.	0.	0.	68.
7402	0.	0.	0.	0.	0.	0.	0.	0.
7403	0.	0.	0.	0.	0.	0.	0.	0.
701	2765.	0.	0.	2765.	0.	0.	0.	0.
702	0.	0.	0.	0.	0.	0.	0.	0.
703	0.	0.	0.	0.	0.	0.	0.	0.
704	6119.	0.	0.	6119.	0.	0.	0.	0.
705	113986.	0.	0.	113986.	1.	0.	0.	0.
706	0.	0.	0.	0.	0.	0.	0.	0.
708	0.	0.	0.	0.	0.	0.	0.	0.
709	0.	0.	0.	0.	0.	0.	0.	0.
710	41005.	0.	0.	41005.	0.	0.	0.	0.
711	76761.	0.	0.	76761.	1.	0.	0.	0.
712	161765.	0.	0.	161765.	1.	0.	0.	0.
713	50555.	0.	0.	50555.	0.	0.	0.	0.
714	16728.	0.	0.	16728.	0.	0.	0.	0.
715	115412.	0.	0.	115412.	0.	0.	0.	0.
716	115981.	0.	0.	115981.	1.	0.	0.	0.
718	69394.	0.	0.	69394.	0.	0.	0.	0.
719	88705.	0.	0.	88705.	1.	0.	0.	0.
720	47586.	0.	0.	47586.	0.	0.	0.	0.
721	80236.	0.	0.	80236.	1.	0.	0.	0.
722	94461.	0.	46795.	47666.	0.	247904.	201109.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
723	76907.	0.	0.	76907.	1.	0.	0.	0.
724	252231.	0.	0.	252231.	1.	0.	0.	0.
725	0.	0.	0.	0.	0.	0.	0.	0.
726	0.	0.	0.	0.	0.	13.	13.	0.
728	0.	0.	0.	0.	0.	0.	0.	0.
729	33729.	0.	0.	33729.	0.	0.	0.	0.
730	0.	0.	0.	0.	0.	0.	0.	0.
731	0.	0.	0.	0.	0.	0.	0.	0.
732	71187.	0.	0.	71187.	1.	0.	0.	0.
733	72116.	0.	0.	72116.	1.	0.	0.	0.
734	20198.	0.	0.	20198.	0.	0.	0.	0.
735	46223.	0.	0.	46223.	0.	0.	0.	0.
736	132402.	0.	0.	132402.	1.	0.	0.	0.
737	120708.	0.	0.	120708.	1.	0.	0.	0.
738	149196.	0.	0.	149196.	1.	0.	0.	0.
739	0.	0.	0.	0.	0.	6725.	6725.	0.
740	64471.	0.	27085.	37386.	1.	27085.	0.	0.
741	103524.	0.	0.	103524.	0.	0.	0.	0.
742	96389.	0.	0.	96389.	1.	0.	0.	0.
743	313728.	0.	0.	313728.	1.	0.	0.	0.
744	255374.	0.	229.	255145.	1.	229.	0.	0.
745	37390.	0.	0.	37390.	0.	0.	0.	0.
746	134554.	0.	0.	134554.	0.	0.	0.	0.
747	0.	0.	0.	0.	0.	0.	0.	0.
748	177476.	0.	0.	177476.	1.	0.	0.	0.
749	202004.	0.	0.	202004.	1.	0.	0.	0.
750	0.	0.	0.	0.	0.	0.	0.	0.
751	0.	0.	0.	0.	0.	0.	0.	0.
752	16503.	0.	0.	16503.	0.	0.	0.	0.
753	0.	0.	0.	0.	0.	0.	0.	0.
754	77040.	0.	0.	77040.	0.	0.	0.	0.
755	0.	0.	0.	0.	0.	0.	0.	0.
756	34562.	0.	0.	34562.	0.	0.	0.	0.
757	0.	0.	0.	0.	0.	0.	0.	0.
758	68400.	0.	0.	68400.	0.	0.	0.	0.
760	58472.	0.	0.	58472.	0.	0.	0.	0.
7600	0.	0.	0.	0.	0.	0.	0.	115111.
7601	0.	0.	0.	0.	0.	32.	32.	0.
7603	0.	0.	0.	0.	0.	0.	0.	0.
7612	0.	0.	0.	0.	0.	0.	290866.	0.
761	10800.	0.	0.	10800.	0.	0.	0.	0.
762	126153.	0.	0.	126153.	3.	4.	0.	0.
763	0.	0.	0.	0.	0.	0.	0.	0.
764	11520.	0.	0.	11520.	0.	0.	0.	0.
765	24482.	0.	0.	24482.	0.	0.	0.	0.
766	0.	0.	0.	0.	0.	0.	0.	0.
768	80641.	0.	0.	80641.	0.	0.	0.	0.
769	9359.	0.	0.	9359.	0.	0.	0.	0.
770	18719.	0.	0.	18719.	0.	0.	0.	0.
771	31682.	0.	0.	31682.	0.	0.	0.	0.
773	0.	0.	0.	0.	0.	0.	0.	0.
774	13681.	0.	0.	13681.	0.	0.	0.	0.
775	28082.	0.	0.	28082.	0.	0.	0.	0.
776	12241.	0.	0.	12241.	0.	0.	0.	0.
777	23039.	0.	0.	23039.	0.	0.	0.	0.
778	70877.	0.	11384.	59488.	0.	11384.	0.	0.
779	82193.	0.	27644.	54553.	0.	27644.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
780	57554.	0.	40575.	16976.	0.	91644.	51069.	0.
781	116556.	0.	29232.	87324.	0.	29232.	0.	0.
782	114400.	0.	0.	114400.	0.	0.	0.	0.
783	83598.	0.	4550.	79048.	0.	4550.	0.	0.
784	0.	0.	0.	0.	0.	1214.	1214.	0.
785	85379.	0.	0.	85379.	0.	0.	0.	0.
786	80209.	0.	0.	80209.	0.	0.	0.	30.
787	145909.	0.	0.	145909.	1.	0.	0.	0.
790	169080.	0.	0.	169080.	1.	0.	0.	0.
791	245988.	0.	0.	245988.	1.	0.	0.	0.
792	22870.	0.	0.	22870.	0.	0.	0.	0.
793	40508.	0.	0.	40508.	0.	0.	0.	0.
794	89033.	0.	0.	89033.	1.	0.	0.	0.
795	145714.	0.	0.	145714.	1.	0.	0.	0.
796	140455.	0.	0.	140455.	1.	0.	0.	0.
797	221055.	0.	0.	221055.	0.	0.	0.	0.
798	0.	0.	0.	0.	0.	0.	0.	0.
799	125271.	0.	0.	125271.	0.	0.	0.	0.
7901	0.	0.	0.	0.	0.	0.	0.	0.
7902	0.	0.	0.	0.	0.	0.	0.	0.
7921	0.	0.	0.	0.	0.	0.	0.	0.
7903	0.	0.	0.	0.	0.	13141.	13141.	0.
7911	0.	0.	0.	0.	0.	0.	0.	0.
902	84914.	0.	0.	84914.	0.	0.	0.	0.
903	52409.	0.	0.	52409.	0.	0.	0.	0.
904	0.	0.	0.	0.	0.	0.	0.	0.
905	159661.	0.	0.	159661.	1.	0.	0.	0.
906	105445.	0.	0.	105445.	0.	0.	0.	0.
907	69168.	0.	0.	69168.	1.	0.	0.	0.
908	22221.	0.	0.	22221.	0.	0.	0.	0.
909	0.	0.	0.	0.	0.	364.	364.	0.
910	77645.	0.	0.	77645.	0.	0.	0.	0.
912	0.	0.	0.	0.	0.	69.	69.	0.
913	107362.	0.	388.	106974.	1.	388.	0.	0.
915	189536.	0.	0.	189536.	1.	0.	0.	0.
916	0.	0.	0.	0.	0.	0.	0.	0.
918	77394.	0.	0.	77394.	0.	0.	0.	0.
919	45180.	0.	78.	45103.	0.	118.	41.	0.
920	61429.	0.	0.	61429.	0.	0.	0.	0.
921	57706.	0.	0.	57706.	0.	0.	0.	0.
922	50556.	0.	0.	50556.	0.	0.	0.	0.
923	0.	0.	0.	0.	0.	6.	6.	0.
924	21754.	0.	136.	21618.	0.	837.	701.	0.
925	80011.	0.	340.	79671.	0.	607.	267.	0.
926	0.	0.	0.	0.	0.	0.	0.	0.
927	0.	0.	0.	0.	0.	0.	0.	0.
928	126048.	0.	0.	126048.	1.	0.	0.	0.
929	90448.	0.	0.	90448.	0.	0.	0.	0.
930	14400.	0.	723.	13677.	0.	5443.	4720.	0.
931	20160.	0.	912.	19248.	0.	3058.	2146.	0.
932	0.	0.	0.	0.	0.	0.	0.	0.
933	3600.	0.	0.	3600.	0.	0.	0.	0.
934	52564.	0.	0.	52564.	0.	0.	0.	0.
936	86219.	0.	178.	86040.	0.	180.	2.	0.
937	145223.	0.	50044.	95182.	1.	50044.	0.	0.
938	155254.	0.	34687.	120568.	0.	34687.	0.	0.
939	125645.	0.	12.	125633.	0.	12.	0.	0.

JUNCTION	WATERSHED INFLOW	INFLOW STORAGE	HYDROGRAPH EXCESS	SYSTEM INFLOW	SYSTEM OUTFLOW	INFLOW FROM FLOODING	SURCHARGE TO STREET	MAX NODE STORAGE
940	65074.	0.	40155.	24919.	0.	51181.	11025.	0.
941	152267.	0.	66113.	86163.	1.	66155.	42.	0.
942	0.	0.	0.	0.	0.	10394.	10394.	0.
944	0.	0.	0.	0.	0.	257.	257.	0.
945	155613.	0.	0.	155613.	1.	0.	0.	0.
946	0.	0.	0.	0.	0.	9.	9.	0.
947	61984.	0.	26445.	35540.	0.	26445.	0.	0.
948	42714.	0.	11182.	31536.	0.	11182.	0.	0.
949	82469.	0.	40289.	42180.	0.	40290.	2.	0.
950	108184.	0.	58455.	49729.	1.	60276.	1821.	0.
955	71238.	0.	25698.	45535.	0.	144197.	118499.	0.
956	0.	0.	0.	0.	0.	91759.	91759.	0.
958	33838.	0.	0.	33838.	0.	0.	0.	0.
959	14400.	0.	0.	14400.	0.	0.	0.	0.
960	0.	0.	0.	0.	0.	0.	0.	0.
961	14400.	0.	0.	14400.	0.	0.	0.	0.
962	9359.	0.	0.	9359.	0.	0.	0.	0.
963	13681.	0.	0.	13681.	0.	0.	0.	0.
964	29518.	0.	0.	29518.	0.	0.	0.	0.
965	0.	0.	0.	0.	0.	0.	0.	0.
966	30238.	0.	0.	30238.	0.	0.	0.	0.
967	0.	0.	0.	0.	0.	0.	0.	0.
968	0.	0.	0.	0.	0.	0.	0.	0.
970	145445.	0.	31227.	114217.	1.	31264.	37.	0.
971	87386.	0.	35812.	51572.	0.	35812.	0.	0.
972	73375.	0.	0.	73375.	0.	0.	0.	0.
973	100125.	0.	36677.	63448.	0.	36677.	0.	0.
974	157070.	0.	63836.	93233.	0.	63854.	18.	0.
88143	0.	0.	0.	0.	0.	0.	0.	0.
88316	0.	0.	0.	0.	0.	0.	0.	0.
88356	0.	0.	0.	0.	0.	0.	0.	0.
88522	0.	0.	0.	0.	0.	0.	0.	0.
88526	0.	0.	0.	0.	0.	0.	0.	0.
88188	0.	0.	0.	0.	0.	0.	0.	0.
88302	0.	0.	0.	0.	0.	0.	0.	0.
88153	0.	0.	0.	0.	0.	0.	0.	0.
88142	0.	0.	0.	0.	0.	0.	0.	0.
88908	0.	0.	0.	0.	0.	0.	0.	0.
88747	0.	0.	0.	0.	0.	0.	0.	0.
88351	0.	0.	0.	0.	0.	0.	0.	0.
88765	0.	0.	0.	0.	0.	0.	0.	0.
88938	0.	0.	0.	0.	0.	0.	0.	0.
88739	0.	0.	0.	0.	0.	0.	0.	0.
88964	0.	0.	0.	0.	0.	0.	0.	0.
88681	0.	0.	0.	0.	0.	0.	0.	0.
88428	0.	0.	0.	0.	0.	0.	0.	0.
88257	0.	0.	0.	0.	0.	0.	0.	0.
88451	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL	25414900.	0.	2266144.	23148770.	20816270.	3280400.	1305119.	3657908.

VOLUME LEFT IN PIPE = 4663266. CU FT
VOLUME LEFT IN STREET = 290863. CU FT
VOLUME LEFT IN STORAGE = 3158970. CU FT

ERROR IN CONTINUITY, PERCENT =-13.30
(INFLOW-OUTFLOW-VOLUME LEFT)/INFLOW

APPENDIX B

INTERFERENCE TABLES

CITY OF SACRAMENTO

DOWNTOWN LARGE SEWERS REPLACEMENT AND REHABILITATION PROJECT

INTERFERENCE TABLE

(Revised March 14, 2000)

Notes:

1. Interfering utilities are listed in order of increasing station number along new sewer.
2. Depths of all sewers and storm drains will be determined from manhole invert elevations furnished by Psomas.
3. "Defer" means to defer potholing until the detailed design stage of the project.
4. Total number of potholes = 43.

Location	Interfering Utility	Action
Phase I: 7th Street from S Street to H Street		
Alley btwn S & R	Cable TV (fiberoptic)	Defer
	Cable TV (fiberoptic)	Defer
	2-4" electrical	Defer
	6" water	Defer
R Street	3" gas	Defer
	10" gas in 14" casing pipe	Pothole
	8-6" electrical	Measure depth in vault to west of intersection
	6" gas	Defer
	3-6" electrical	Defer
Alley btwn R & Q	10 " water	Defer
	6-4" electrical	Pothole
Q Street	6" gas	Defer
	24" water	Pothole
Alley btwn Q & P	? water (blowoff valve in manhole)	Defer
	Electrical	Measure depth in vault on east side of street
	? water (to fire hydrant ?)	Defer
P Street	8-4" electrical	Pothole
	6" gas	Defer
	MCI telephone	Defer

Alley btwn P & O	5" electrical	Defer
	Cable TV	Defer
	6" water	Defer
O Street	8" gas (N-S direction)	Pothole
N Street	MCI telephone (N-S direction)	Pothole
North of alley btwn N & Capitol Mall	8" water	Defer
Capitol Mall	12" water	Defer
Alley btwn Capitol Mall & L	Abandoned electrical	None
	6" water	Defer
L Street	Cable TV	Defer
	6" gas (N-S direction)	Defer
	Abandoned electrical	None
	EL telephone	Pothole
	8-5"electrical	Pothole
	Cable TV	Defer
	MCI telephone	Pothole
	8" water	Defer
	ICG telephone	Defer
	6" gas	Defer
	24" water	Pothole
	12-4" telephone	Pothole
	8" gas	Pothole
	ICG telephone	Defer
Alley btwn L & K	Electrical (8-5"?)	Measure depth in vault behind east curb
	24" water (N-S direction)	Pothole
	Telephone	Defer
	8" water	Defer
	Abandoned electrical	None
	6" gas (N-S direction)	Defer
	QWT telephone (N-S direction)	Defer
	ICG telephone (N-S direction)	Defer

K Street	Abandoned electrical	None
	Abandoned electrical	None
	4-5" electrical	Measure depth in manhole on west side of street
	6-5" electrical	Measure depth in same manhole as above
	24" water (N-S direction)	Measure depth in manhole
	2-3" electrical	Measure depth in vault on east side of street
Alley btwn K & J	Cable TV	Defer
	Cable TV	Defer
	8" water	Defer
	Electrical	Measure depths in manholes on both sides of street
Halfway btwn alley & J	Electrical	Measure depth in manhole on west side of street
	4" water	Defer
	Cable TV	Defer
	Water (to meter)	Defer
J Street	2-3" electrical	Measure depth in vault on west side of intersection
	Electrical	Measure depth in same vault as above
	Telephone (MCI,QWT & ICG)	Pothole
	9-4" electrical	Pothole
	ICG telephone	Defer
	2-3" electrical	Measure depth in vault on east side of intersection
	EL telephone	Defer
	4" gas	Defer
	4" water	Defer
Halfway btwn alley & J	Electrical	Measure depth in manhole on west side of street
Alley btwn J & I	22-4" telephone	Pothole
	6" gas	Defer
	6" water	Defer
	4-4" electrical	Measure depths in vaults on both sides of street

I Street	Cable TV	Defer
	Electrical	Measure depth in manhole on west side of street
	Telephone	Defer
	10" gas	Pothole
	ICG telephone	Pothole
	12" gas	Defer
	8 " gas	Defer
	20" water	Pothole
	BFC telephone	Pothole
Btwn I & H	6-4" electric	Pothole
	Water to fire hydrant	Defer
	8" water	Defer
	8" water	Defer
	2-4" telephone (N-S direction)	Defer
	Telephone	Defer
	8" water	Defer
	Water to fire hydrant	Defer
H Street	Cable TV	Defer
	12" gas (N-S direction)	Pothole

Phase II: 3rd Street & U Street to 7th Street & S Street

U Street & 3rd Street	24" gas	Pothole
U Street & 4th Street	10" water	Defer
Alley btwn U & T on 5th	6" water	Defer
5th Street & T Street	8" gas	Pothole
	8" gas	Defer
Alley btwn T & S on 5th	6" water	Defer
5th Street & S Street	2" gas	Defer
	Telephone	Pothole
	2" (?) gas	Defer
	6" gas	Defer
	30" water	Pothole
	4" gas	Defer

S Street & 6th Street	8" gas	Pothole
	24" water	Pothole
	10" gas	Pothole
	4" gas	Defer

Phase III: S Street from 7th Street to 15th Street

Btwn 7th & 8th	Telephone	Defer
	Telephone	Pothole
8th Street	Telephone	Measure depth in manhole
	2" gas	Defer
	3- 4"electrical	Pothole
9th Street	8" water	Defer
	4" gas	Defer
10th Street	Telephone	Measure depth in manhole on south side of street
	4" gas	Defer
	8" water	Defer
	4" gas	Defer
11th Street	3" gas	Defer
Btwn 11th & 12th	4" gas	Defer
	16" gas	Pothole
12th Street	12" water	Pothole
	16" gas	Pothole
13th Street	EL telephone	Pothole
	6" gas	Pothole
	4" gas	Defer
14th Street	18-4" telephone	Pothole
	4" gas	Pothole
15th Street	4" gas	Defer
	14" water	Pothole
	Telephone	Pothole
	3" gas	Defer
16th Street	6" gas	Pothole
	4" gas	Defer
	6" gas	Pothole
	12" water	Pothole

CITY OF SACRAMENTO

DOWNTOWN LARGE SEWERS REPLACEMENT AND REHABILITATION PROJECT

INTERFERENCE TABLE 2

July 14, 2000

Notes:

1. Interfering utilities are listed in order of increasing station number along new sewer.
2. Sewer, storm drains, and connecting pipes from drop inlets are not listed. Depths of all sewers, storm drains, and connecting pipes will be estimated from manhole invert elevations furnished by MRPE or future surveys during detailed design.
3. "Defer" means to defer potholing until the detailed design stage of the project.
4. Total number of potholes = 14. However, more than one interfering utility may be located with a single pothole when the utilities are close together.

Location	Interfering Utility	Action
5th Street from S Street to P Street		
S Street	Dual 30" water	Defer
Alley btwn S & R	18-4" telephone	Pothole
	6" water	Defer
	Electrical	Pothole
R Street	Cable TV	Defer
	4" gas	Defer
	3-6" electrical	Pothole
Alley btwn R & Q	Cable TV	Pothole
	6 " water	Defer
	1-4" City commo (N-S direction)	Defer (will be protected, replaced, or relocated)
Q Street	6" gas	Pothole
	5-2" City commo (N-S direction)	Defer (will be protected, replaced, or relocated)
	12" water	Pothole
	8" gas	Pothole
	IMI	Defer
Midway btwn Q & P	2" gas	Defer

P Street	6" gas	Pothole
	Electrical	Pothole

P Street from 5th Street to 7th Street

5th Street	Cable TV	Defer
	3-6" electrical	Pothole
	6"water	Defer
Btwn 5th and 6th	Cable TV	Defer
6th Street	8" gas	Pothole
	Cable TV	Defer
	24" water	Pothole
	Electrical	Pothole
	Electrical	Pothole
	Telephone	Pothole
7th Street	Cable TV	Defer
	10" water	Defer
	4" gas	Defer
	MCI telephone	Defer

APPENNDIX C

POTHOLING LOGS

May 3, 2000

CITY OF SACRAMENTO

DOWNTOWN LARGE SEWERS REPLACEMENT AND REHABILITATION PROJECT

POTHOLE SUMMARY – I

Notes:

1. Potholes were generally conducted from north to south for Phase I, east to west for phase II, and west to east for Phase III. Potholes are listed in the order they were performed.

2. Total potholes conducted to date=35. Total remaining for this project=25.

3. Due to limitations from the size of the hole findings should be considered approximate. For more information see field notes from MRPE & Cruz Bros.

4. T= Pac Bell Telephone, E= Electrical, W= Water, CTV= Cable TV, G=gas, AC=Asphalt, ELI=Electric Lightwave

Phase I: 7th Street from S to H Street

#	Location	Utility	Findings
1	I Street	2-4" T	2.8' to top of pipe, 8" AC, sandy backfill material
2	I Street	6-4" E	5' to bottom of encasement, 12" AC over 2' of ballast rock
3	I Street	20"W, 12"G	Not found. Couldn't dig through slurry backfill around gas main angle point, 12" AC
4	I Street	20"W, 12"G	Not found. Couldn't dig through concrete under 12" AC. (maybe E cap?)
5	I Street	20"W, 12"G	3' to top of W, 6.2' to bottom of slurry around gas, 12"AC
6	I Street	10"G, 6-4"T	Not found. Found 2-4"? Running northwest –3.7' to top, 8"AC
7	I/J Alley	22-4" T	Not found. Assumed to go underneath sewer based on discussion w/Pac Bell rep.
8	J Street	18-4" T, & 9-4" E	2.6' to bottom of T conduits, 6.8' to bottom of E encasement, 12" AC, sandy backfill material
9	J Street	18-4" T	1.8' to top of concrete cap, estimated 5' to bottom of conduits (at 3 wide x 6 high)
10	K/L Alley	24" W, & 10-4" T	~7' to top of W (probed, not seen, assumed to go under sewer), 3' to top of T
11	L Street	12-4" T	Not found. Hit AC spoil backfill material and couldn't dig through
12	L Street	12-4" T	Not found. Couldn't dig through concrete under

			AC (7"AC over 4"concrete+/-)
13	L Street	12-4" T	Not found. Hit concrete cap at ~2' deep & couldn't dig around
14	L Street	12-4" T	~7' to bottom of trench (found native under crushed rock, conduit not seen because of concrete cap), 7" AC, sandy clay and rock
15	L Street	24"W, 8"G	Found 2"? running east to west (2' to bottom), 7.4' to top of W, 3.5' to top of G
16	L Street	6-5" E, MCI	E not found (assumed to be under sewer), 2' to bottom of MCI, 8" AC
17	O Street	8" G	Not found. Couldn't dig through slurry around gas main, 6" AC
18	O Street	8" G	3.3' to top, 12" AC
19	P Street	6-5" E	2.6' to top, 4.6' to bottom, 9"AC
20	Q Street	24" W	Found 2"? running north-south (2.9' to top), 3.4' to top of W, 10" AC
21	R Street	10"G	4.6' to top of pipe, 10" AC, sandy material
22	R Street	8-6" E	5' to bottom of encasement

Phase II, 7th & S, to 3rd & U Streets

#	Location	Utility	Findings
23	6th & S	10"G, 24"W	G not found (assumed to go under sewer), 4.7' to top of W, 8"AC, sandy material with chunks of wood and brick found
24	6th & S	8" G	3.5' to top of pipe, 6" AC
25	5th & S	6" G, & 2-4" T	4.3' to top of G, 2.9' to top of T, 12" AC
26	5th & T	8" G	4.1' to top of pipe, 8" AC over 6" rock over stiff clay native found
27	3rd & U	24" G	4.9' to top of pipe, 9" AC, sand backfill

Phase III, S Street, 7th to 17th Streets

#	Location	Utility	Findings
28	8th Street	3-4" T	3.7' to bottom of conduits, 10" AC
29	12th Street	12" W	4.7' to top of pipe, 12" AC, stiff clay native
30	12th Street	16" G	4' to top of pipe, 11" AC, clay native
31	Bet 11th/12th	16" G	3.9' to top of pipe, 8" AC, sand backfill
32	13th Street	ELI	2.1' to bottom of conduits, 9" AC, sandy clay
33	13th Street	6" G	4' to top of pipe, 9" AC, sandy clay
34	14th Street	18-4" T	4.7' to bottom of sand trench, 9" AC, sand backfill
35	14th Street	4" G	3.5' to top of pipe, 9" AC, sand backfill

August 16, 2000 MRPE:99010

CITY OF SACRAMENTO

DOWNTOWN LARGE SEWERS REPLACEMENT AND REHABILITATION PROJECT

POTHOLE SUMMARY – II

Notes:

1. Potholes were generally conducted from south to north for the revised Phase I, north to the south for the original Phase I, and east to west for phase III. Potholes are listed in the order they were performed.

2. Total potholes conducted to date=60. Total remaining for this project=0.

3. Due to limitations from the size of the hole findings should be considered approximate. For more information see field notes from MRPE & Cruz Bros.

4. T= Pac Bell Telephone, E= Electrical, W= Water, CTV= Cable TV, G=gas, AC=Asphalt, ELI=Electric Lightwave

#	Location	Utility	Findings
36	6th & P	8-4" T	3' to bottom of conduits, 12" AC & some cobble
37	6th & P	6-4" T	4.2' to bottom of trench, 8" AC
38	6th & P	(2) 4-4"E	2.3' to bottom of Easterly encasement, 3.5' to top of Westerly encasement, 8" AC, slurry backfill
39	6th & P	24" W & 4-4"E	4' to top of 24"W, 6' to bottom of E (westerly encasement from 38, above), 12" AC
40	6th & P	8" G	4.5' to top of pipe, 12" AC
41	5th & R/S Alley	18-4"T	Marked as 5, 2, & 8 ducts (S->N), 3.6' to bottom of 8 duct, 12" AC, brick and concrete debris in backfill
42	5th & R/S Alley	18-4" T	Started after not finding in 41, and then stopped when found in 41, above
43	5th & R/S Alley	E	E not found. Obstructed by drain lead (2.5' to top). Also found 12"SD? (3.5' to top of pipe), 13"AC
44	5th & R/S Alley	E	3.3' to top of 2" E conduit.
45	5th & R Streets	3-6"E	5.5' to top, and 7.1' to bottom of encasement, 6"AC
46	5th & Q/R Alley	CTV	1' to bottom of 2" CTV, 6" AC
47	5th & Q Streets	6" Gas	2.5' to top of pipe, 6" AC

48	5th & P Streets	6" Gas	Not found. Determined to be abandoned, or removed by PG&E representative. 6" AC
49	5th & P Streets	6" W	4.4' to top of pipe, 6" AC
50	5th & P Streets	E (n-s)	5.3' to bottom of slurry, 10" AC
51	5th & P Streets	E (e-w)	8.5' to top of E?, 10" AC
52	9th & S Streets	8" W	4.0' to top of pipe, 13" AC
53	8th & S Streets	E	3.9' to bottom of encasement, 11" AC
54	5th & Q Streets	8" Gas	5.1' to top of 8"G. Also found 12"VCP CITY? (3.5' to top), 9" AC, small cobbles in backfill
55	5th & Q Streets	12" W	5.1' to top of 12"W. Also found 12"VCP CITY? (3.5' to top), 9" AC, small cobbles in backfill
56	7th & I	10"G	5.5' to top of fitting, or repair clamp, 8" AC, some cobble in backfill
57	7th & K/L Alley	8-5"E	4.0' to bottom. One conduit high?
58	7th & L Streets	12-4"T	5.7' to bottom of trench, & 2.1' to top of concrete cap, 6" AC
59	7th & L Streets	8" Gas	4.5' to top of pipe, 10" AC, slurry backfill
60	7th & L Streets	MCI, CTV, & AT&T	1.7' to bottom of MCI (3-2" conduit high bank), 4.4' to top of 4" CTV, 5' to bottom of 6-2" AT&T (conduits randomly placed), 11"AC, some cobble in backfill

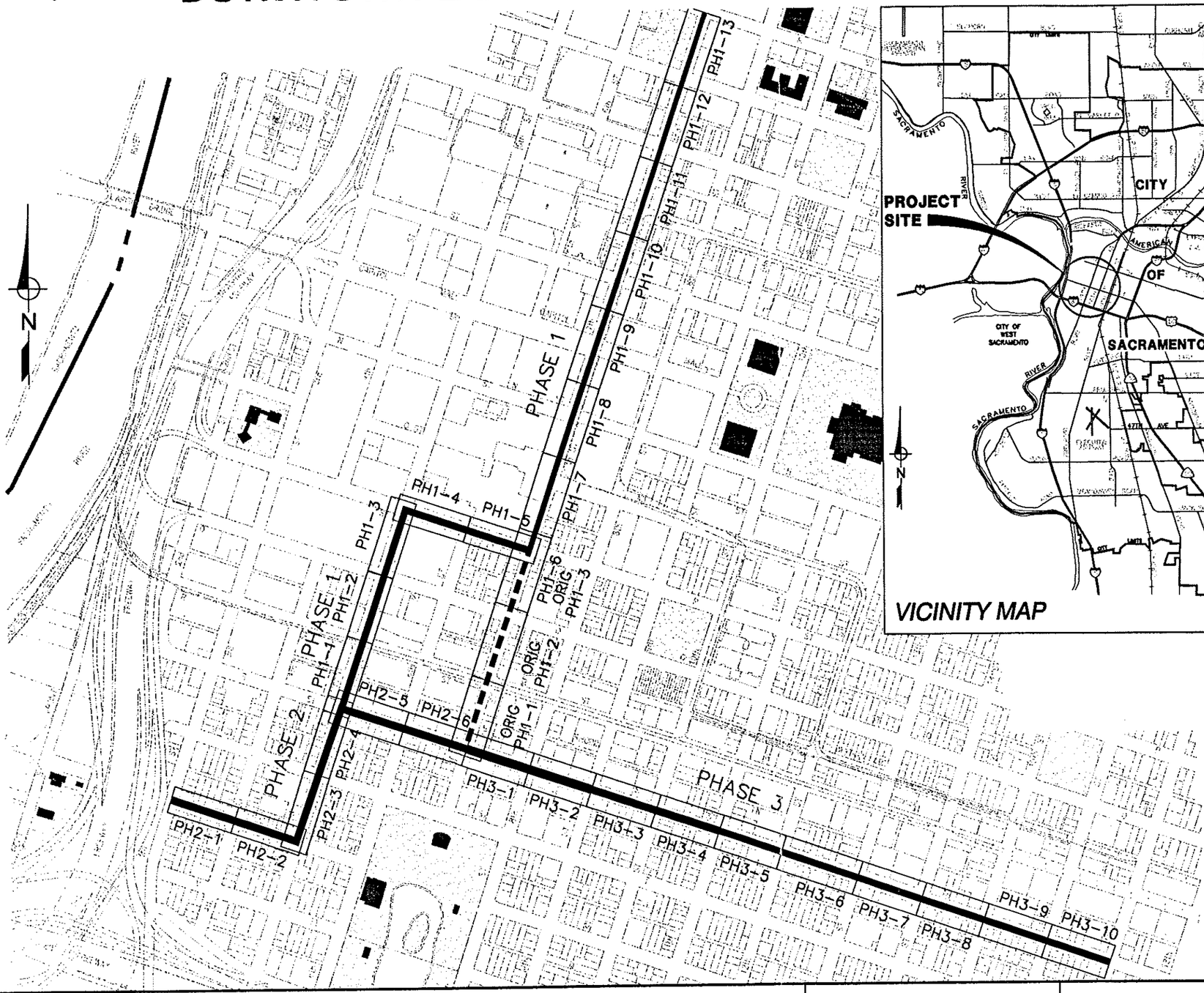
APPENDIX D

PLANS AND PROFILES

CITY OF SACRAMENTO

DEPARTMENT OF UTILITIES

DOWNTOWN LARGE SEWERS REHABILITATION AND REPLACEMENT PROJECT



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CITY OF SACRAMENTO

DEPARTMENT OF UTILITIES

DOWNTOWN LARGE SEWERS REHABILITATION AND REPLACEMENT PROJECT

PLAN LEGEND

- EXISTING ELECTRICAL AND COMMUNICATION LINE
- EXISTING GAS PIPELINE
- EXISTING SEWER, STORM DRAIN OR DROP INLET LEAD
- EXISTING WATER PIPELINE
- EXISTING COMBINED SEWER TO BE REMOVED OR ABANDONED
- NEW SEWER
- SIDES OF TRENCH

PROFILE LEGEND

- EXISTING UTILITY
- STREET SURFACE
- EXISTING SEWER TO BE REMOVED OR ABANDONED
- EXISTING SEWER TO REMAIN
- NEW SEWER

NOTES

1. MANHOLE HOLE NUMBERS ARE TAKEN FROM CITY SEWER MAPS.
2. NUMBERS ON PIPELINES NEAR MANHOLES ARE INVERT ELEVATIONS.
3. STATIONING AND STREET SURFACE PROFILE ARE ALONG EXISTING SEWERS, NOT NEW SEWERS.

ABBREVIATIONS

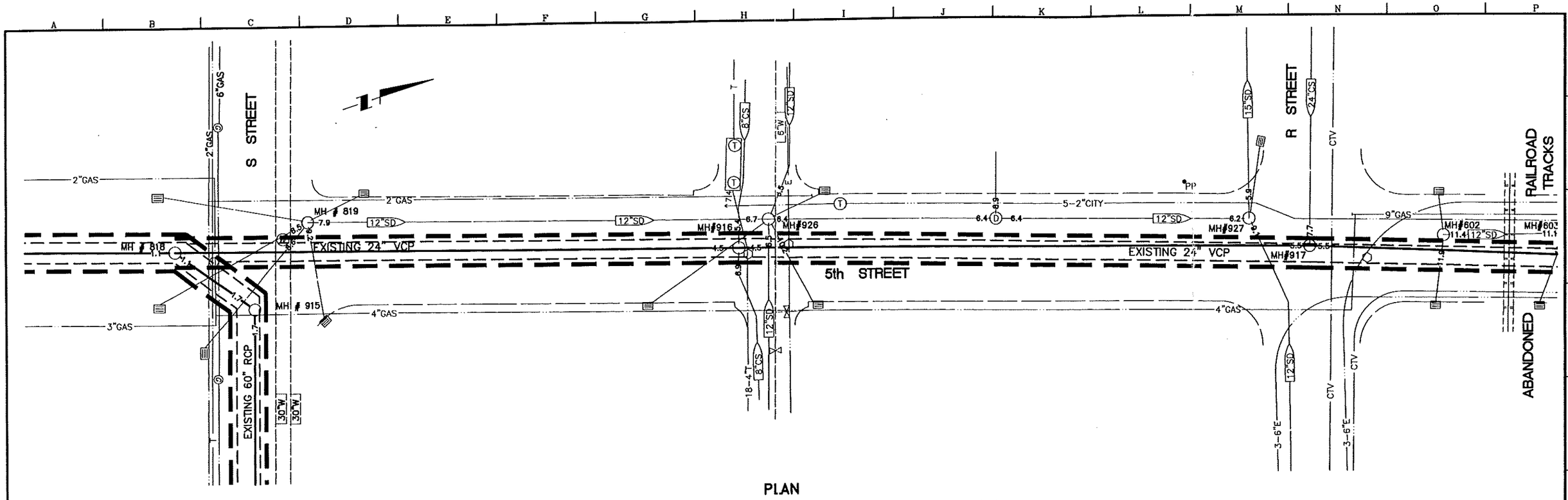
A:	ABANDONED
CS:	COMBINED SEWER
CTV:	CABLE TELEVISION
D:	DRAIN (STORM DRAIN)
E:	ELECTRICAL
F:	FIBER OPTIC
G:	GAS
MH:	MANHOLE
PP:	POWER POLE
RCP:	REINFORCED CONCRETE PIPE
RT:	REGIONAL TRANSIT
S:	SLOPE OR SEWER
SD:	STORM DRAIN
T:	TELECOMMUNICATIONS
TR:	TRANSFORMER
UKN:	UNKNOWN
VCP:	VITRIFIED CLAY PIPE
W:	WATER

BENCHMARKS

BENCHMARK NAME	PUBLISHED VALUE	PROJECT VALUE	DESCRIPTION
BM 297-C3D	29.377	29.377	BRONZE MONUMENT STAMPED "USGS BM-147-M-29-1933" SW CORNER OF POST OFFICE AT WEST ENTRANCE; THIS IS A DATUM-CONTROLING MONUMENT.
BM 297-C5C	15.950	15.958	HILTI NAIL, TRAFFIC LIGHT BASE, NE CORNER, 10th AND S STREET.
BM 297-D5C	16.422	16.469	HILTI NAIL, TRAFFIC LIGHT BASE, NE CORNER, 16th AND S STREET.
BM 297-D5D	16.278	16.317	HILTI NAIL, TRAFFIC LIGHT BASE, NE CORNER, 16th AND T STREET.
BM 297-C5B	15.179	15.131	HILTI NAIL, TOP OF CURB, NW CORNER, ALLEY BETWEEN R AND S STREETS, ON 12th STREET.
BM 297-B5B	13.979	13.995	HILTI NAIL, LIGHT BASE, NE CORNER, 5th AND W STREET.

NOTE: PROJECT VALUES ARE BASED ON AN ADJUSTED CLOSED DIFFERENTIAL LEVEL LOOP BY PSOMAS.

SCALE: NO SCALE DRAWN BY: HK DATE: 03/28/01	CITY OF SACRAMENTO DEPARTMENT OF UTILITIES	BROWN AND CALDWELL	DOWNTOWN LARGE SEWERS PROJECT LEGENDS, NOTES, ABBREVIATIONS AND BENCHMARKS	LEGEND SHEET

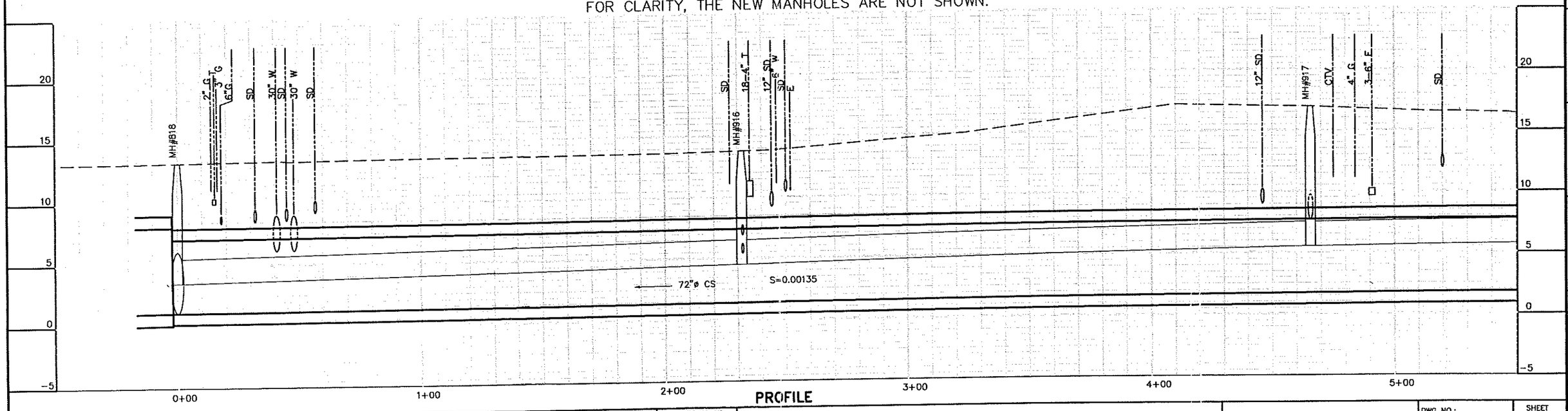


PLAN

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

VERTICAL SCALE: (FEET) 0 2 4 6 8

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. ____ DATE: ____
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

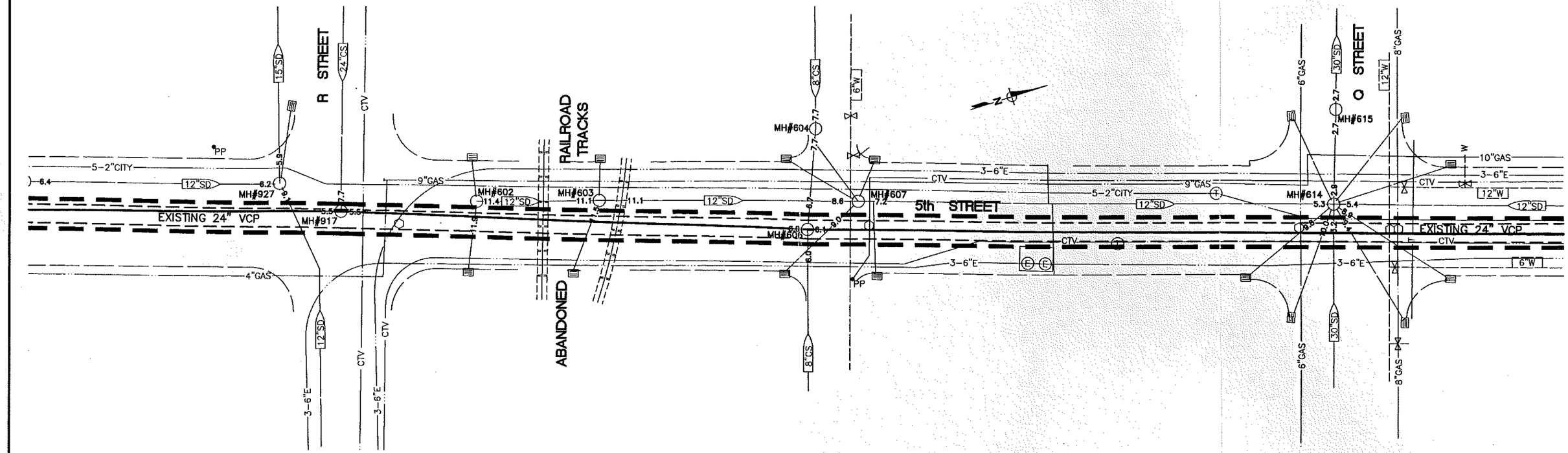
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 0+00 TO 5+50

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 1 OF 13



PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

HORIZONTAL SCALE: (FEET) 0 10 20 30 40

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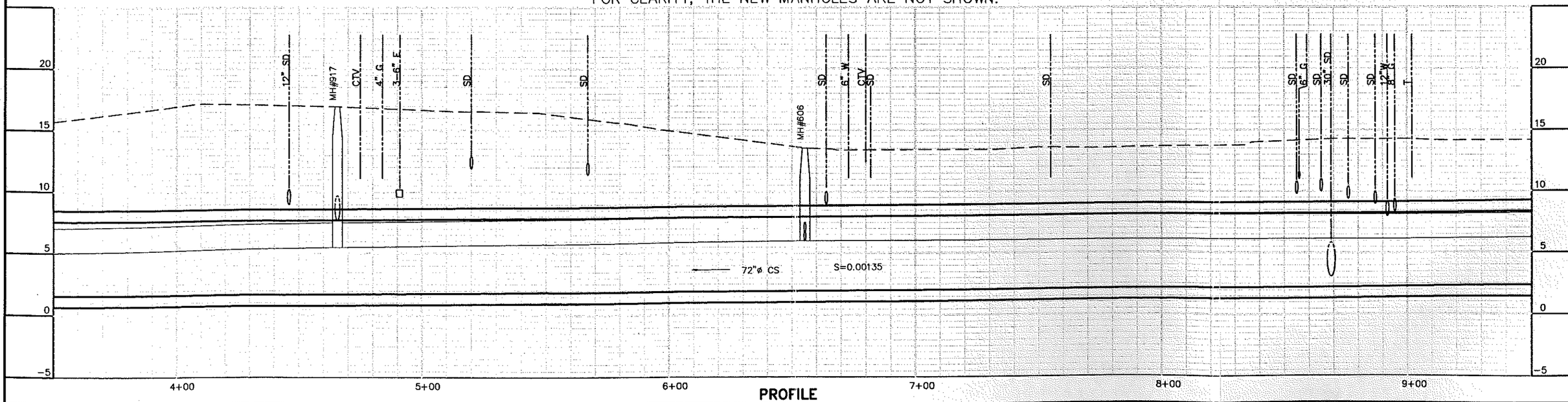


PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01 | DESIGNED BY: N/A P.E. NO. ____ DATE: ____ | CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

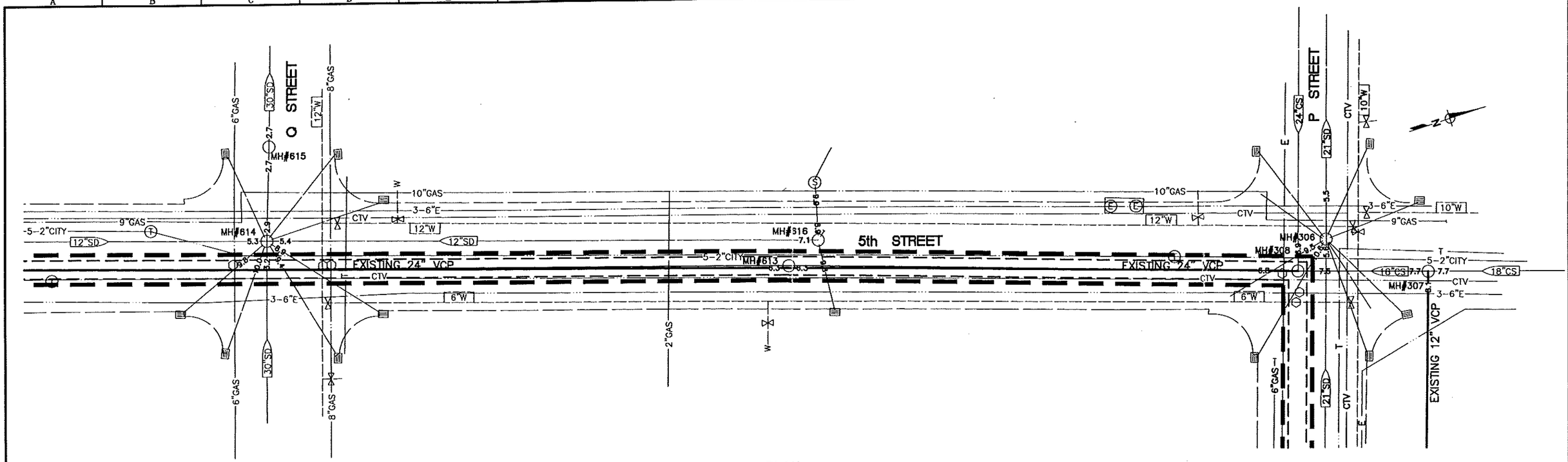
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 3+50 TO 9+50

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 2 OF 13



PLAN

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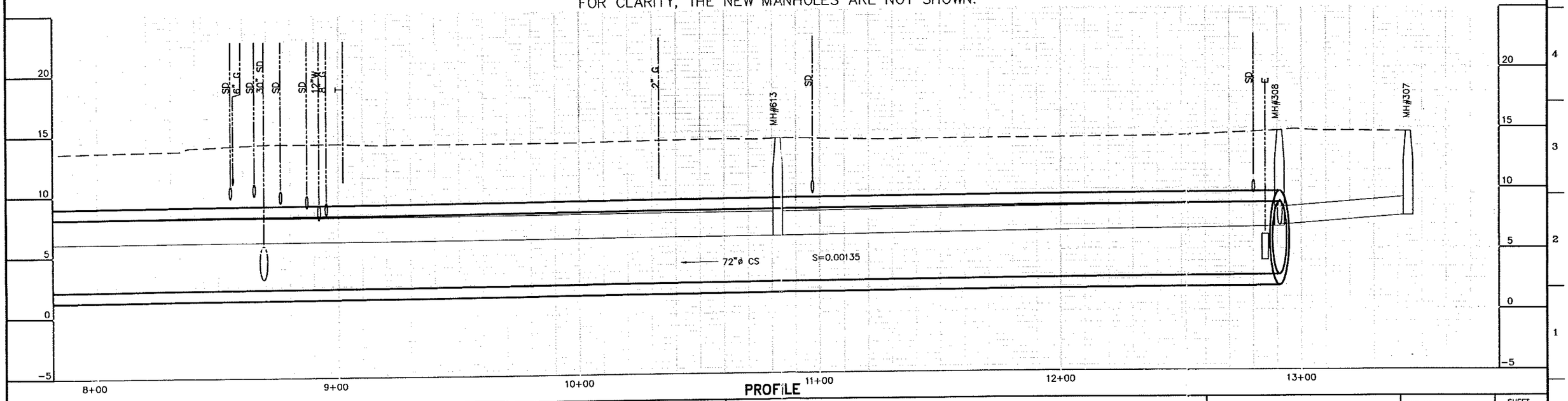
VERTICAL SCALE: (FEET) 0 2 4 6 8

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

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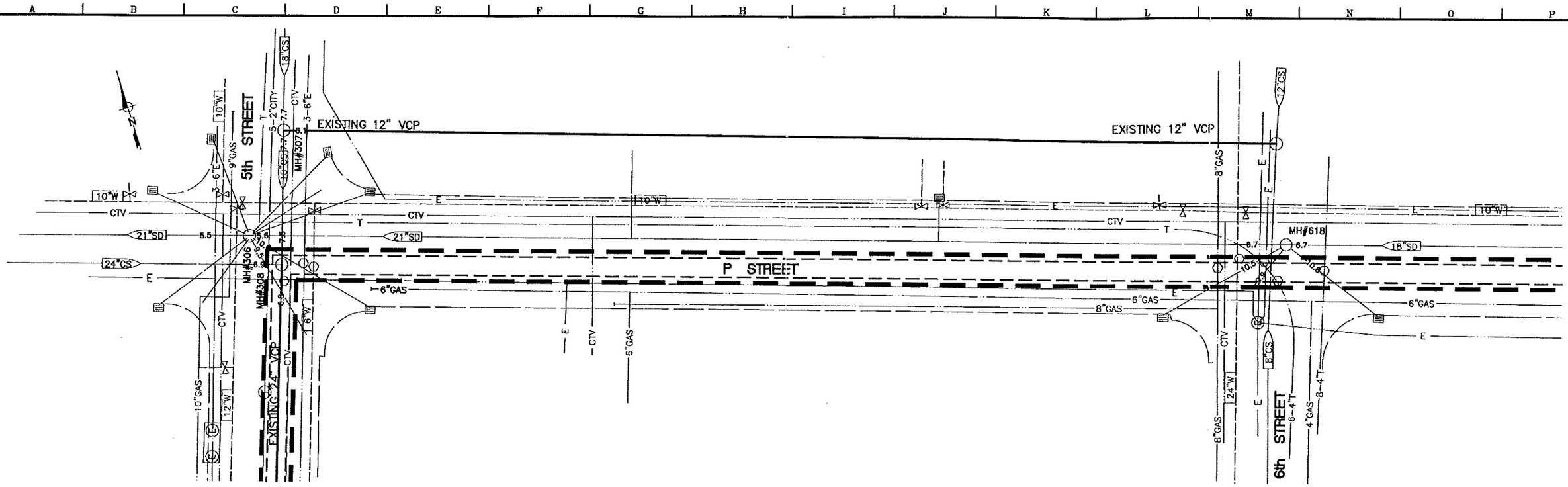
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 7+80 TO 13+80

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 3 OF 13



PLAN

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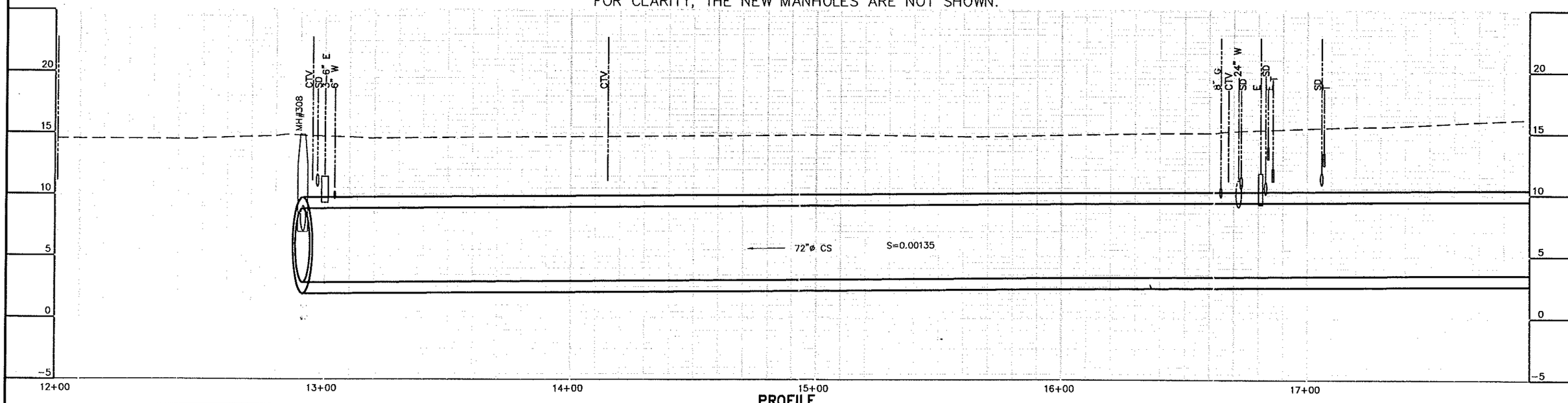
HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

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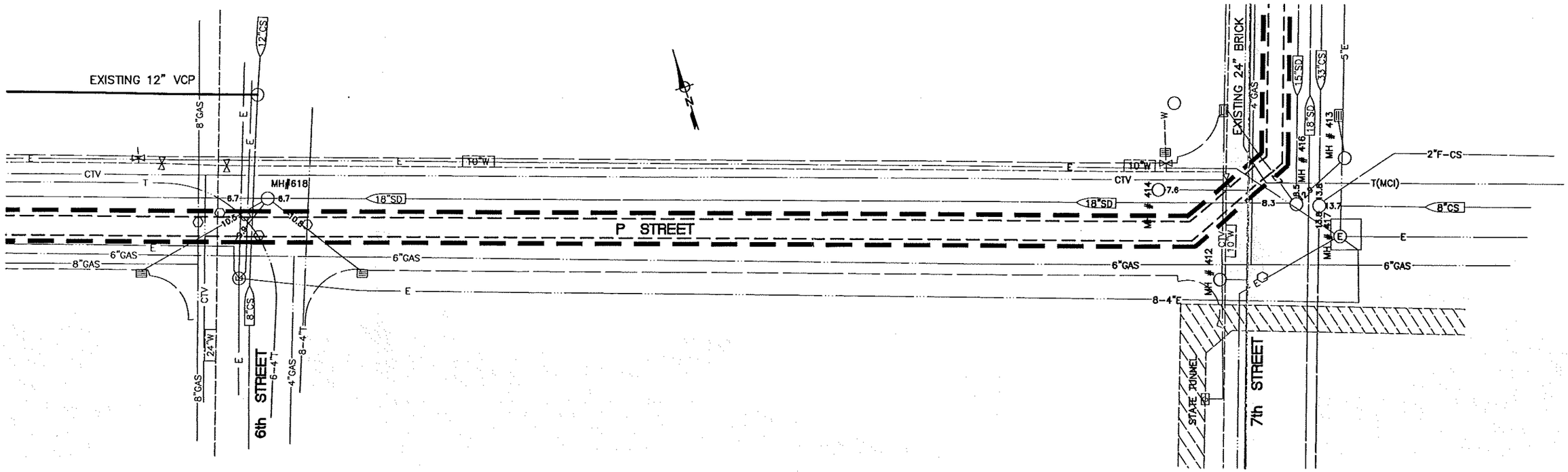
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 11+90 TO 17+90

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 4 OF 13



PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

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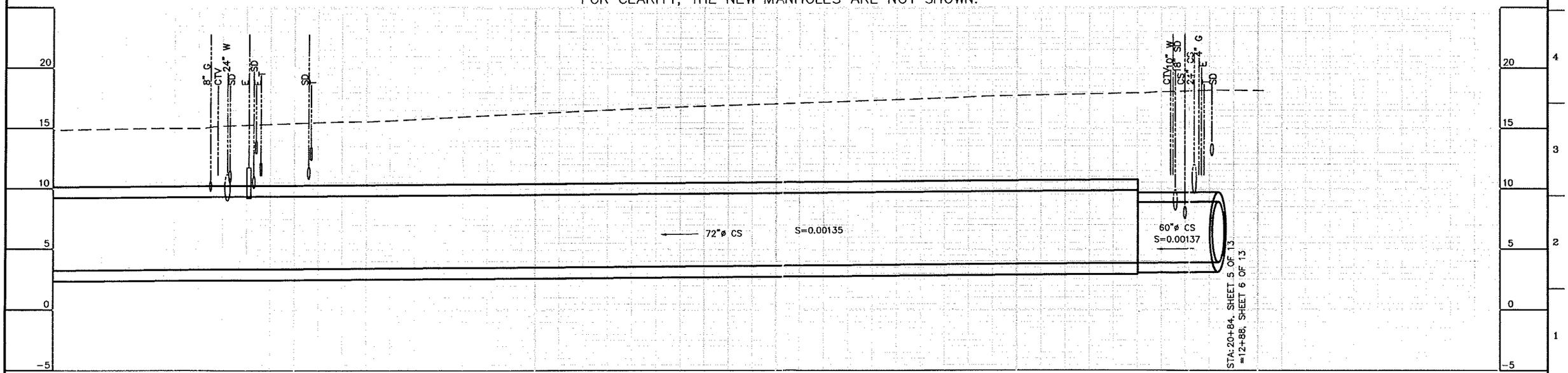
HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

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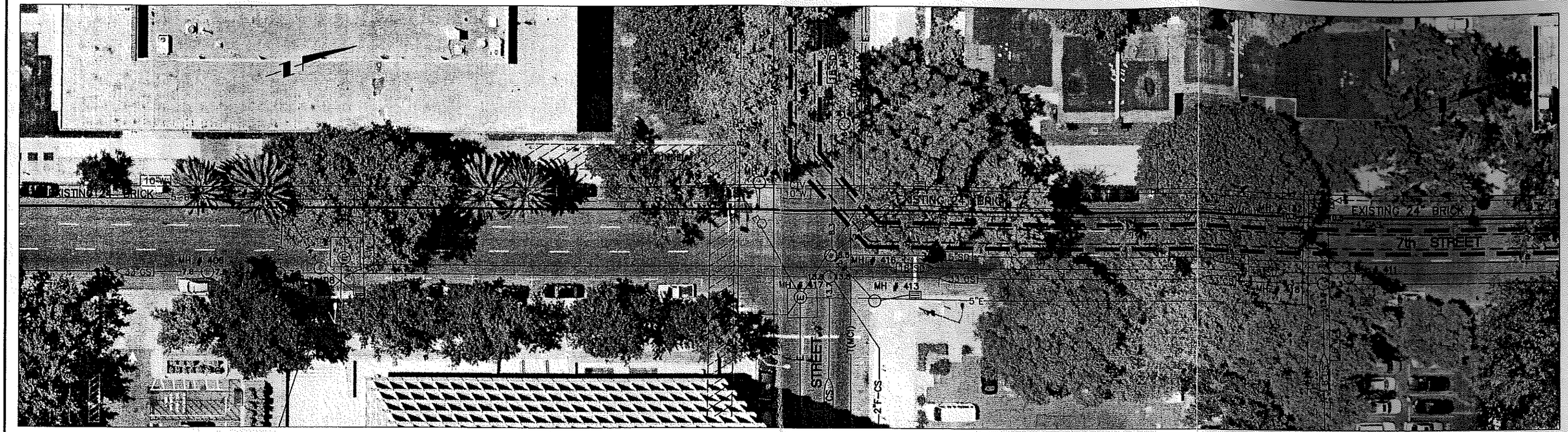
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 16+00 TO 20+84

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 5 OF 13



PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

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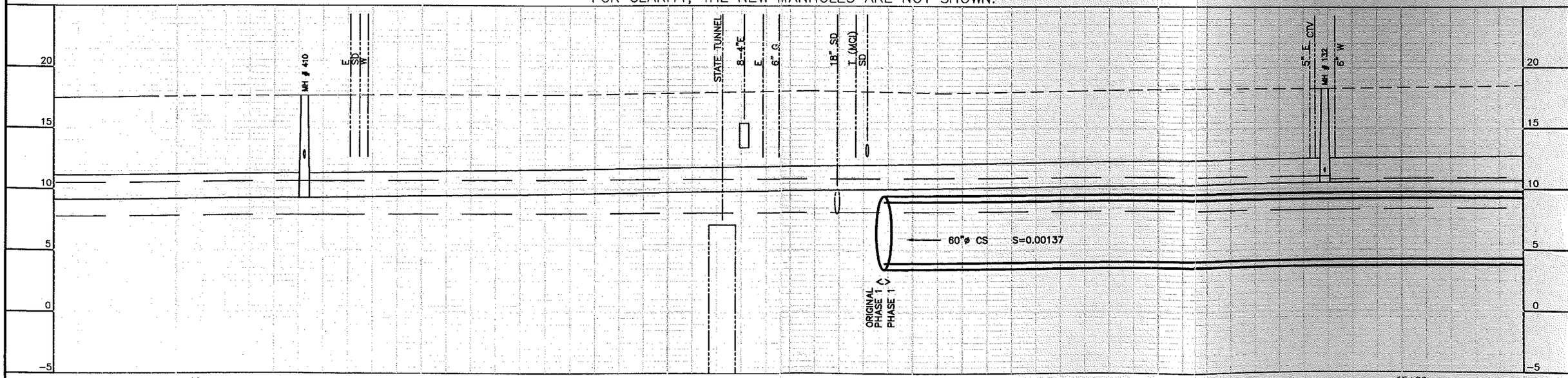
HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

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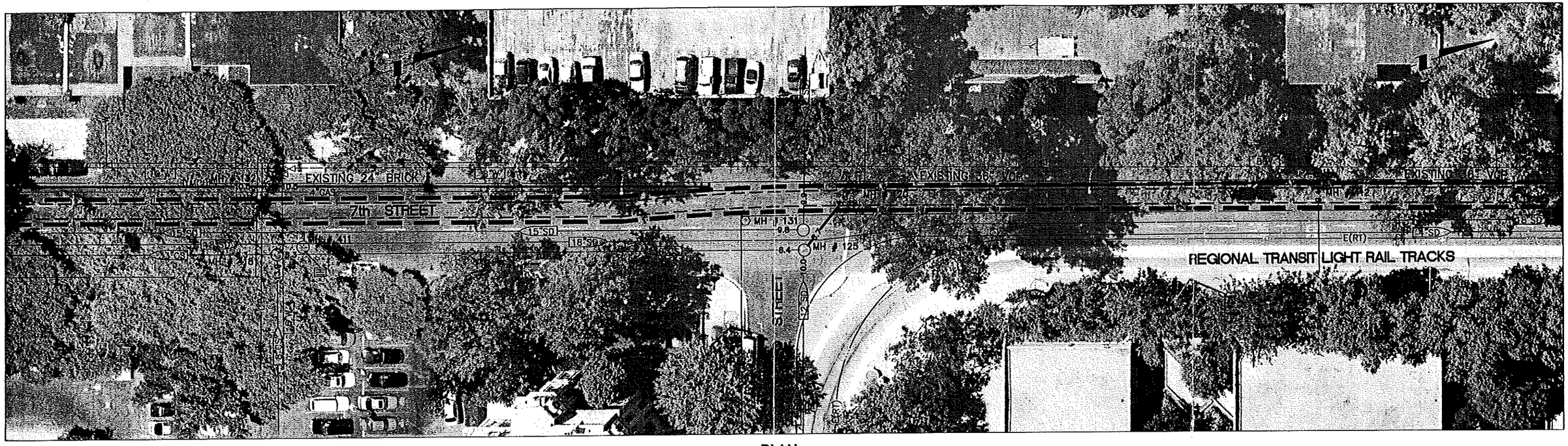
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 9+50 TO 15+50

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 6 OF 13



PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

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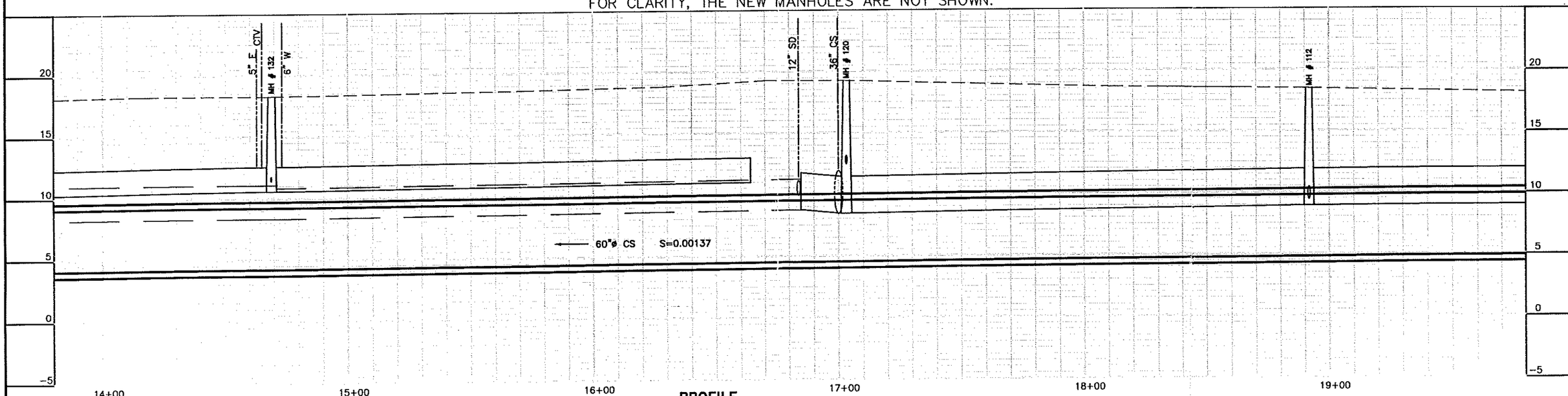
HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
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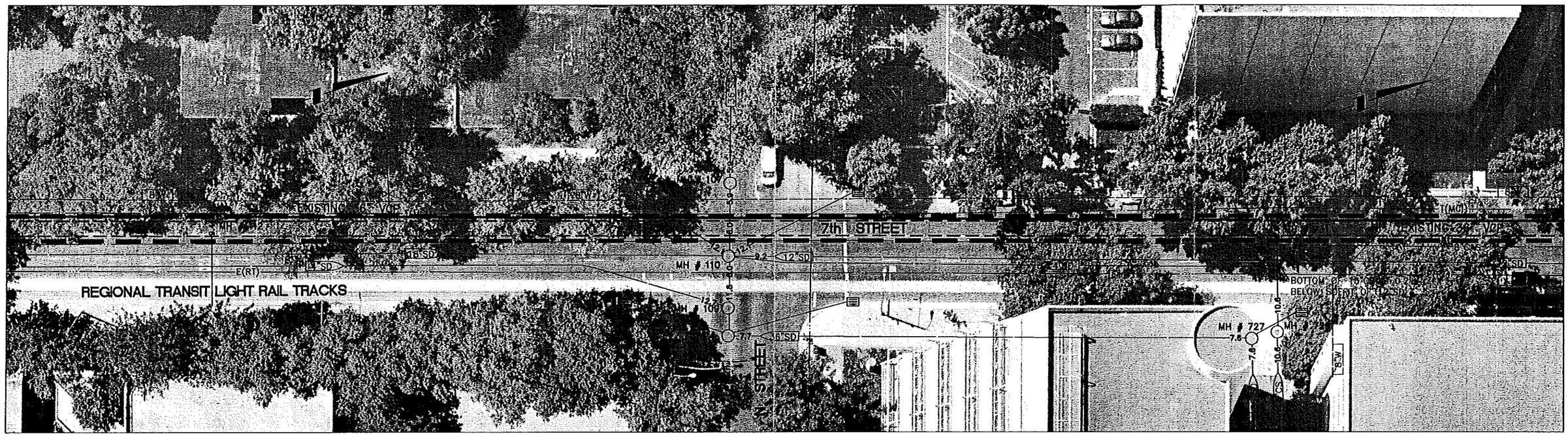
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 13+80 TO 19+80

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 7 OF 13



PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

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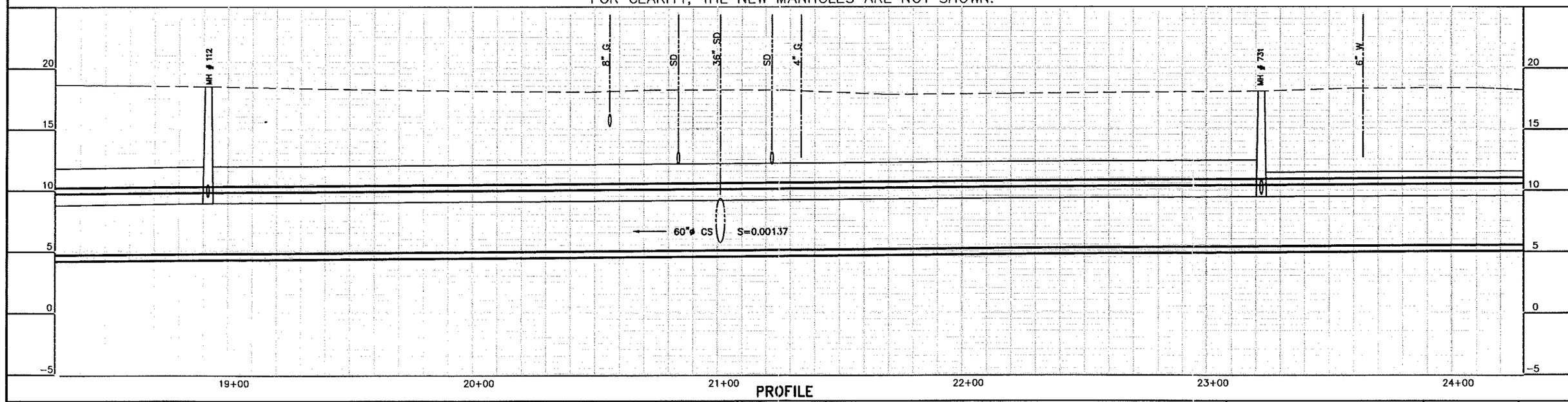
HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

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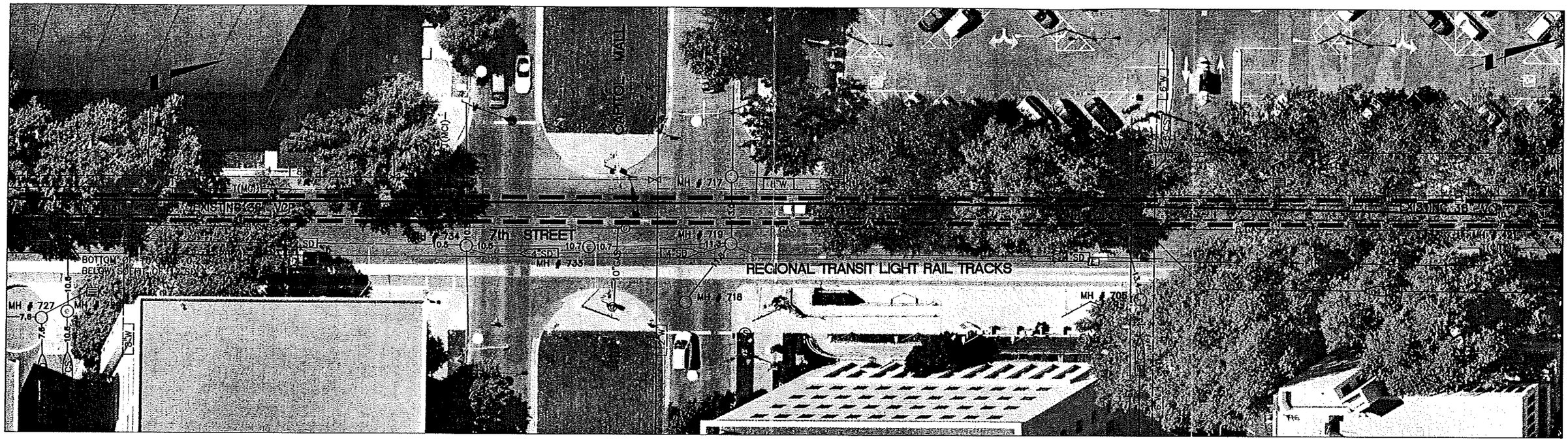
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 18+30 TO 24+30

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 8 OF 13



PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

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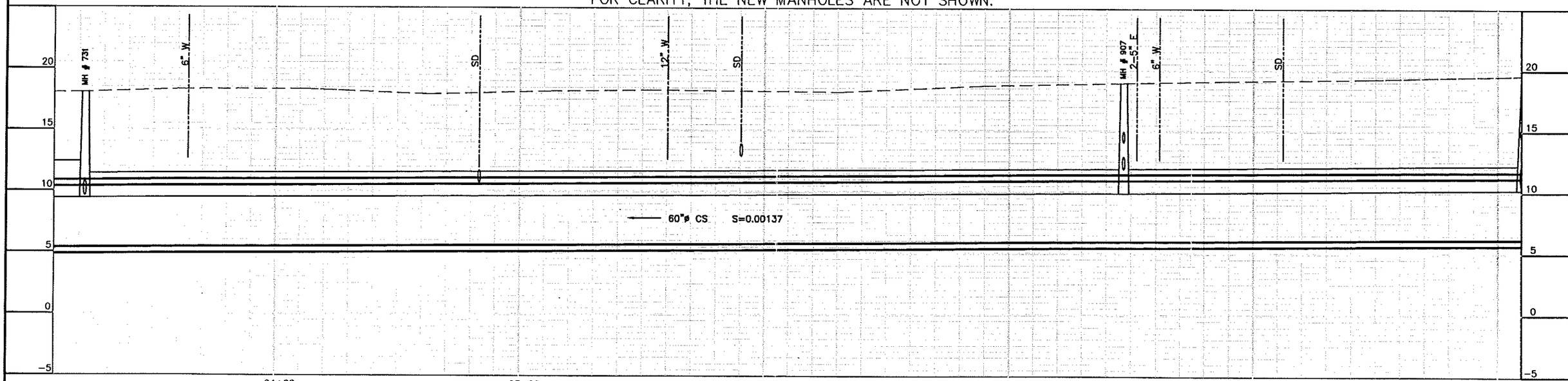
HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. ____ DATE: ____
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

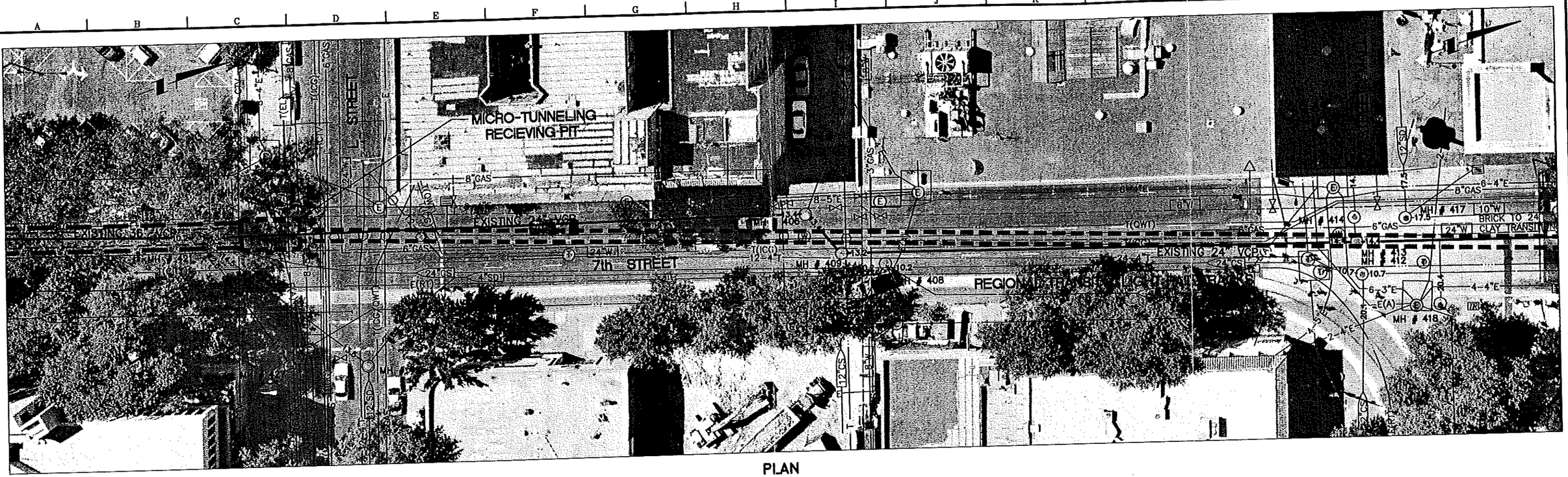
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 23+10 TO 29+10

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 9 OF 13



PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

HORIZONTAL SCALE: (FEET) 0 10 20 30 40

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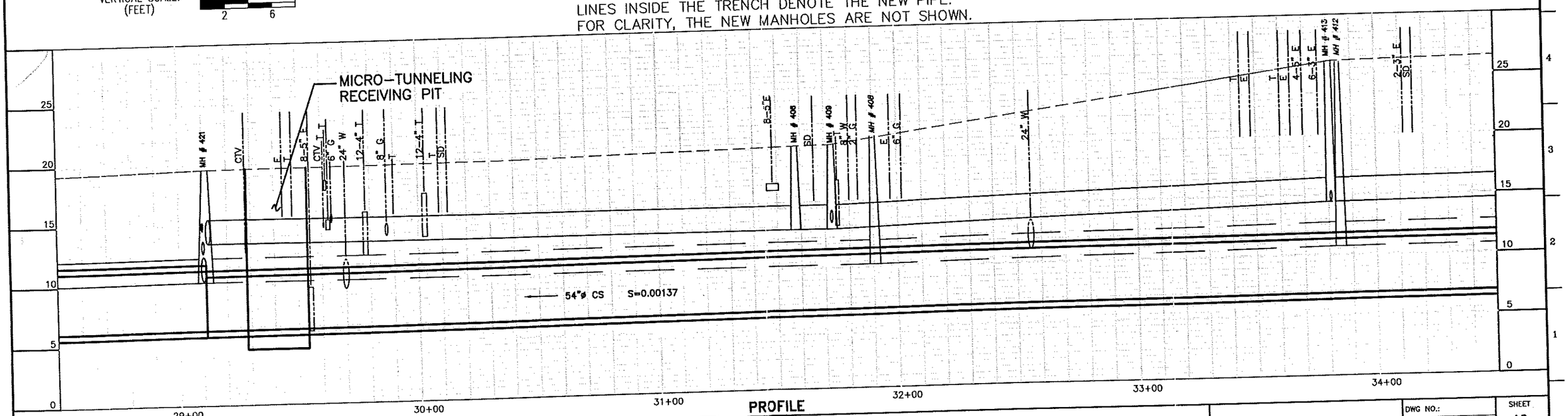


PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE | DESIGNED BY: N/A | CHECKED BY: RLM | RE. NO. 17115 | DATE: 5/01

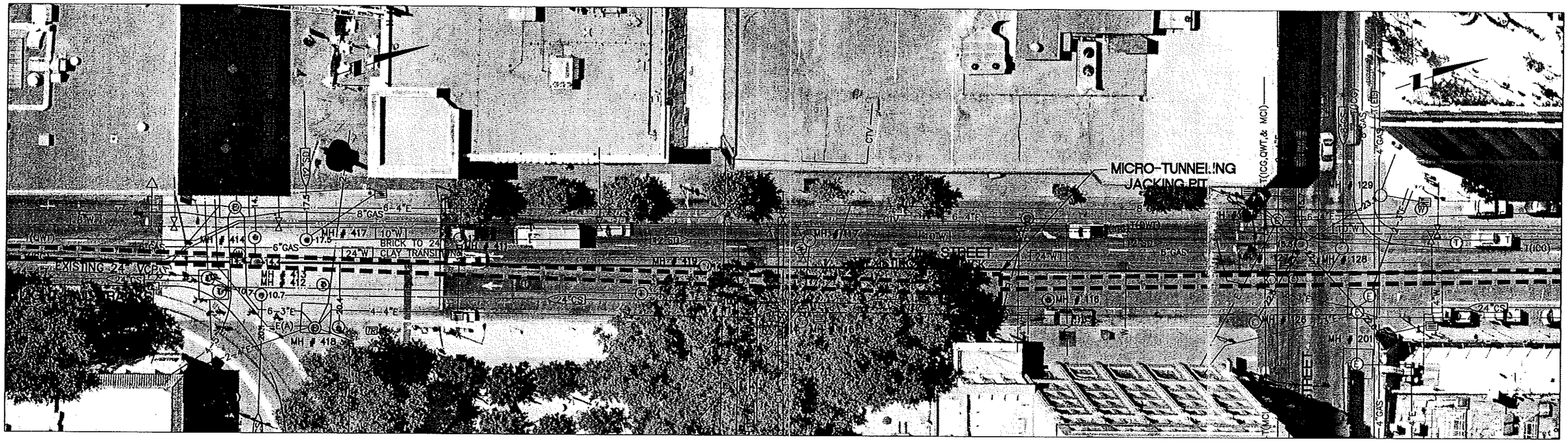
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 28+50 TO 34+50

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 10 OF 13

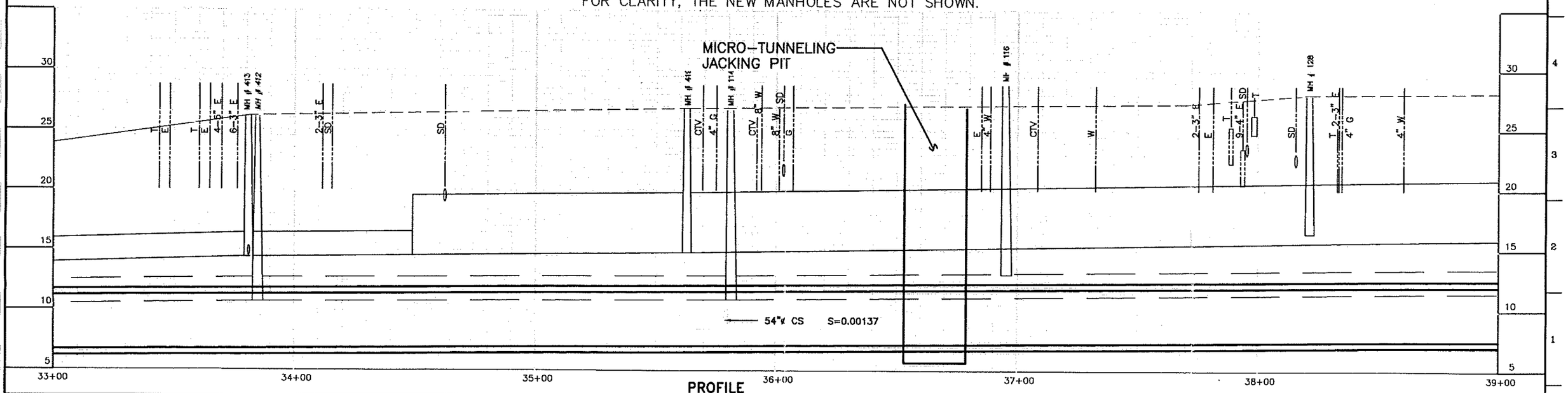


PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

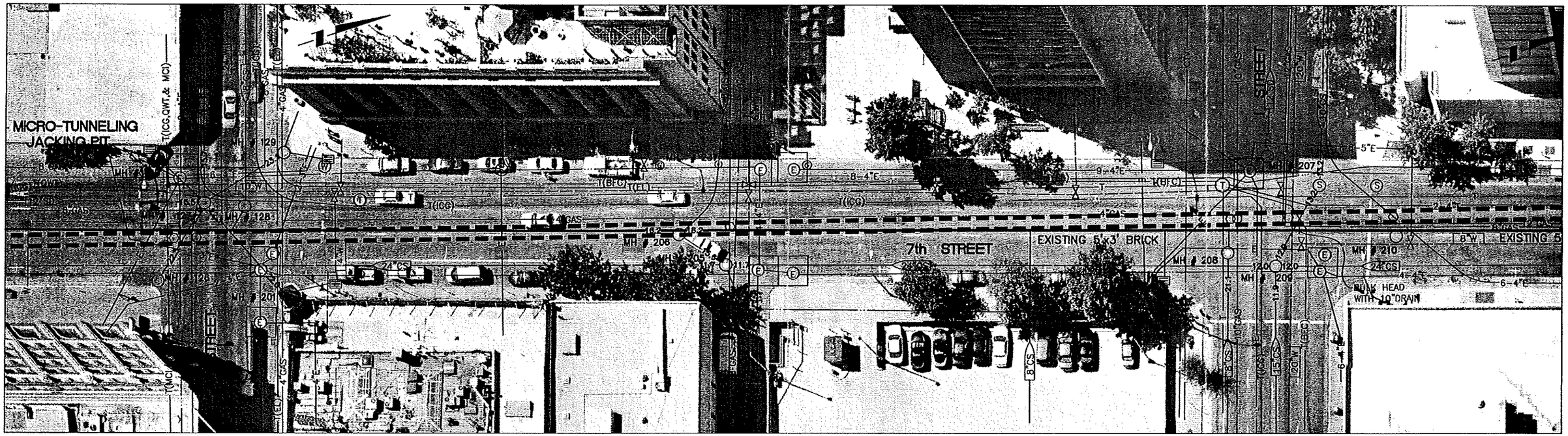
NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO DEPARTMENT OF UTILITIES	BROWN AND CALDWELL SACRAMENTO, CA	DOWNTOWN LARGE SEWERS PROJECT PRE-DESIGN PHASE 1	STA 33+00 TO 39+00
DRAWN BY: MRPE DATE: 5/01 · DESIGNED BY: N/A P.E. NO. DATE: · CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01			DWG NO.: · REVISION NO. : △ · SECTION: · SHEET 11 OF 13

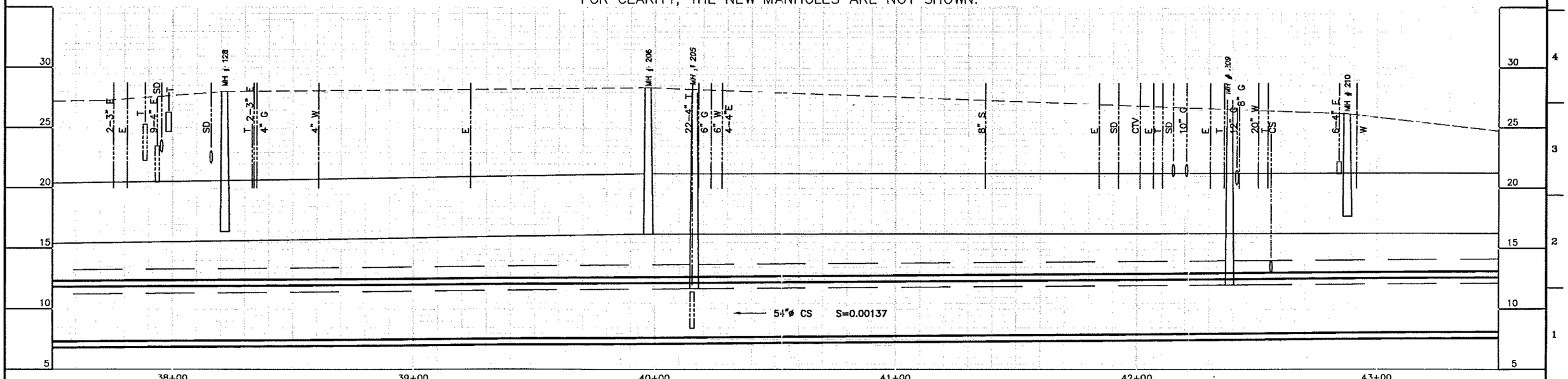


PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. ____ DATE: ____
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

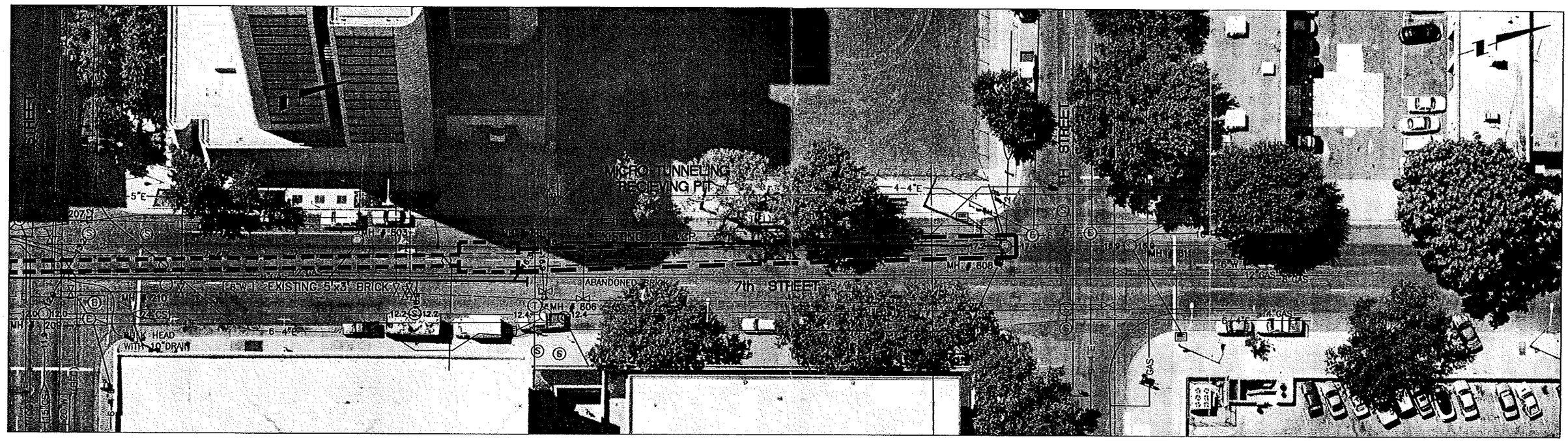
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 37+50 TO 43+50

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 12 OF 13

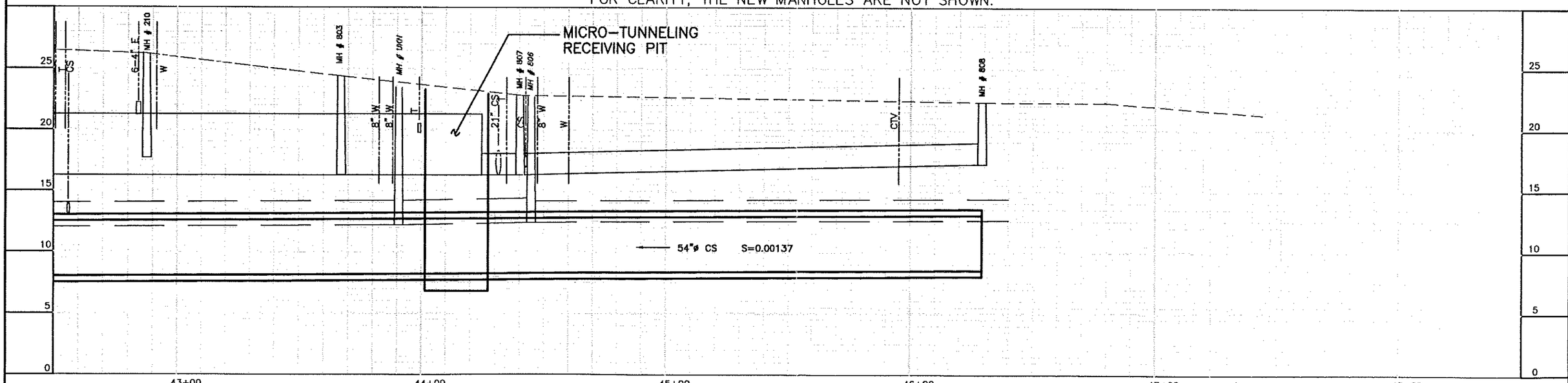


PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01 | DESIGNED BY: N/A P.E. NO. ____ DATE: ____ | CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 1

STA 42+50 TO 46+30

DWG NO.:
REVISION NO. : △
SECTION:

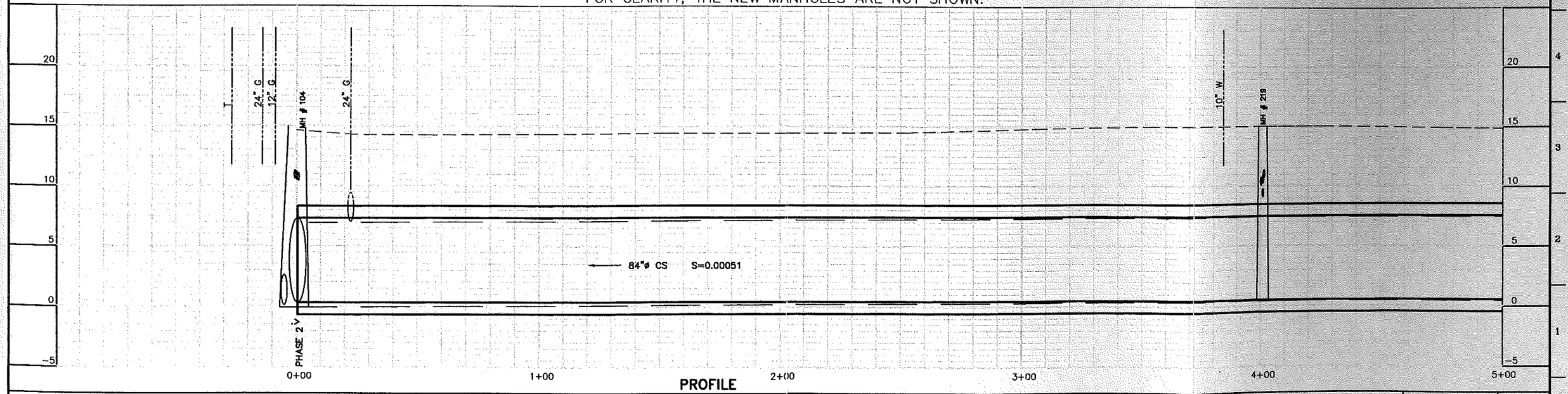
SHEET 13 OF 13

PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. ____ DATE: ____
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 2

STA 0+00 TO 5+00

DWG NO.:
REVISION NO. : △
SECTION:

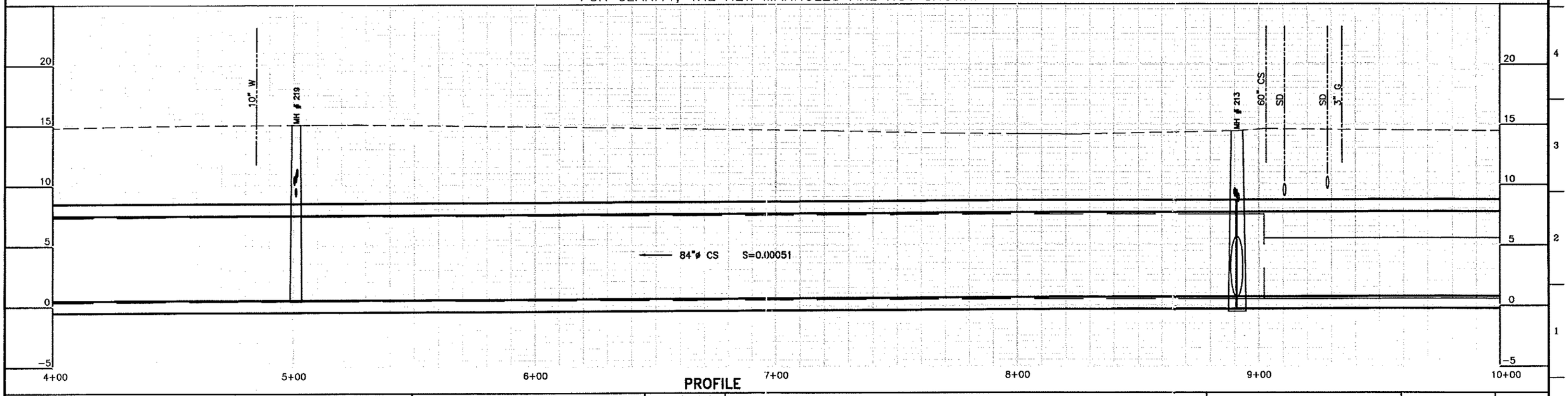
SHEET 1 OF 6

PLAN

VERTICAL SCALE: (FEET) 0 4 8 / 2 6

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 20 40 / 10 30



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01 | DESIGNED BY: N/A P.E. NO. DATE: | CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 2

STA 4+00 TO 10+00

DWG NO.:
REVISION NO. : △
SECTION:

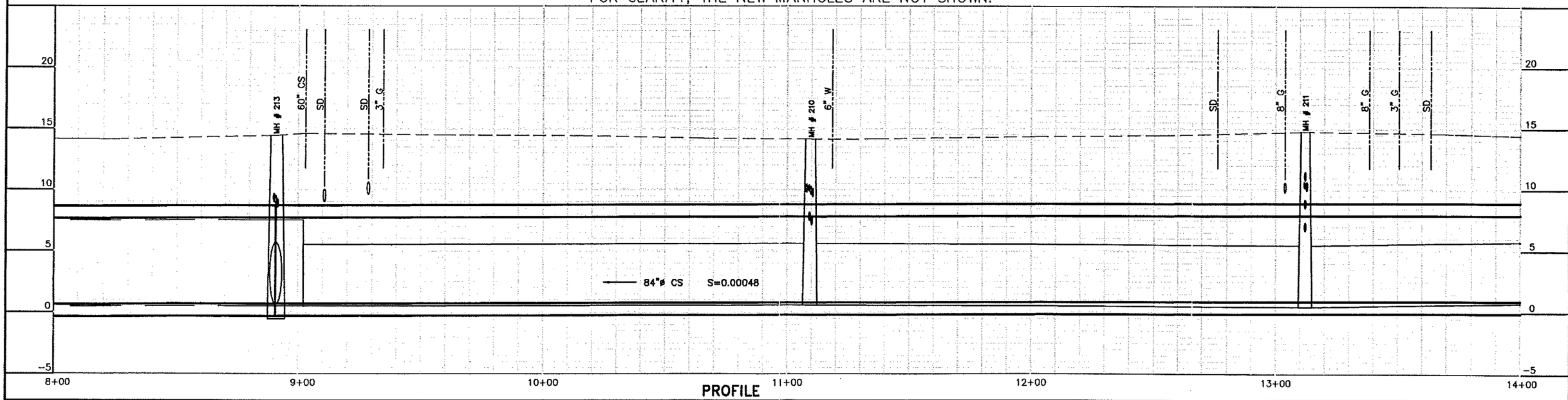
SHEET 2 OF 6

PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE 5/01 | DESIGNED BY: N/A P.E. NO. DATE: | CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 2

STA 8+00 TO 14+00

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 3 OF 6

PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40

PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01 | DESIGNED BY: N/A P.E. NO. ____ DATE: ____ | CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

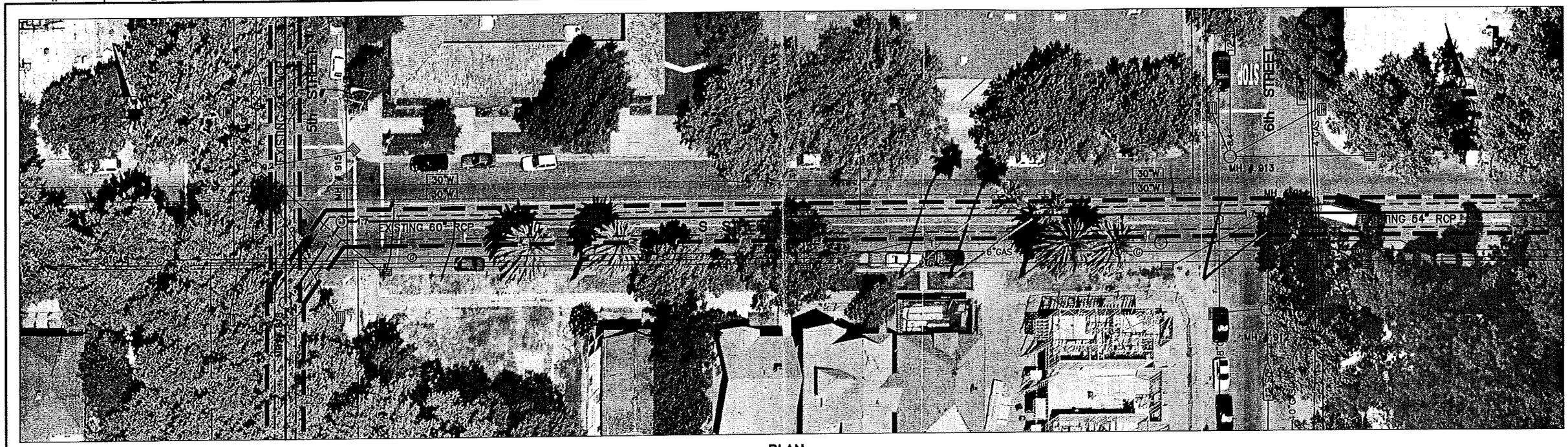
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 2

STA 12+00 TO 18+00

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 4 OF 6

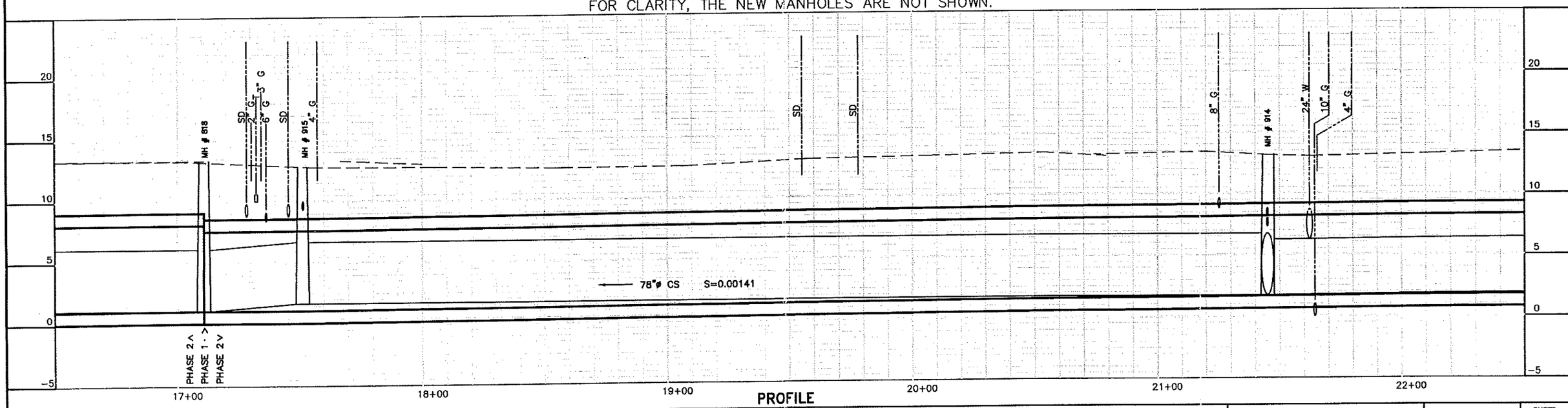


PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. ____ DATE: ____
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 2

STA 16+50 TO 22+50

DWG NO.:
REVISION NO. : △
SECTION:

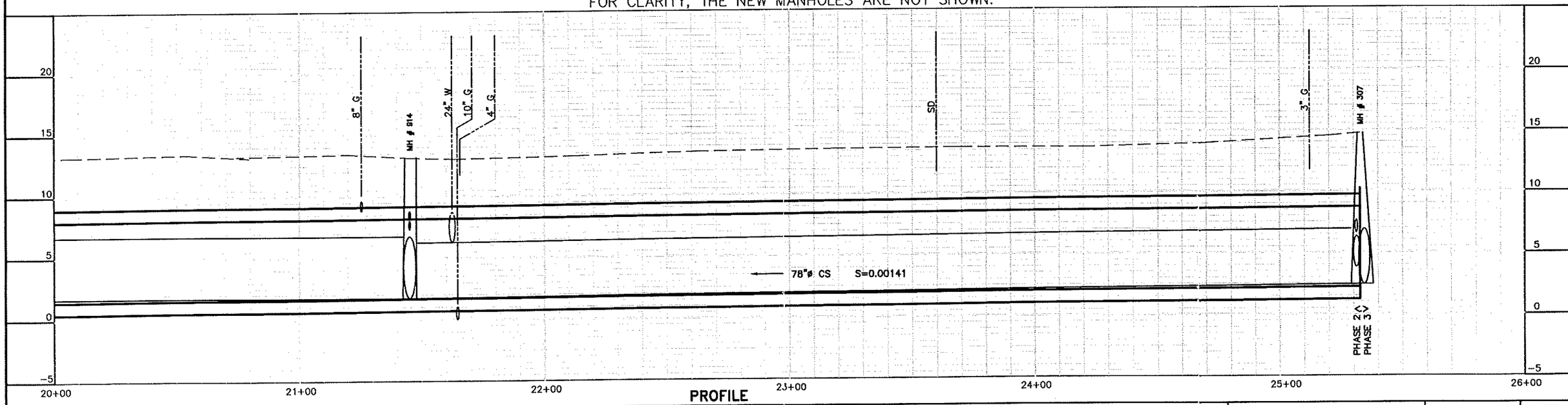
SHEET 5 OF 6

PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. ____ DATE: ____
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 2

STA 20+00 TO 25+33

DWG NO.:
REVISION NO. : △
SECTION:

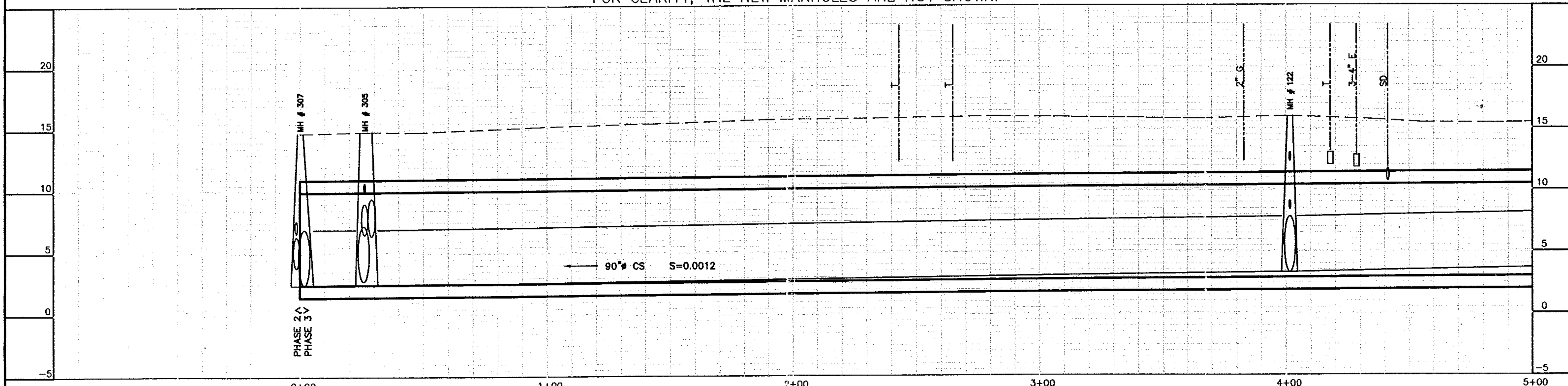
SHEET 6 OF 6

PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

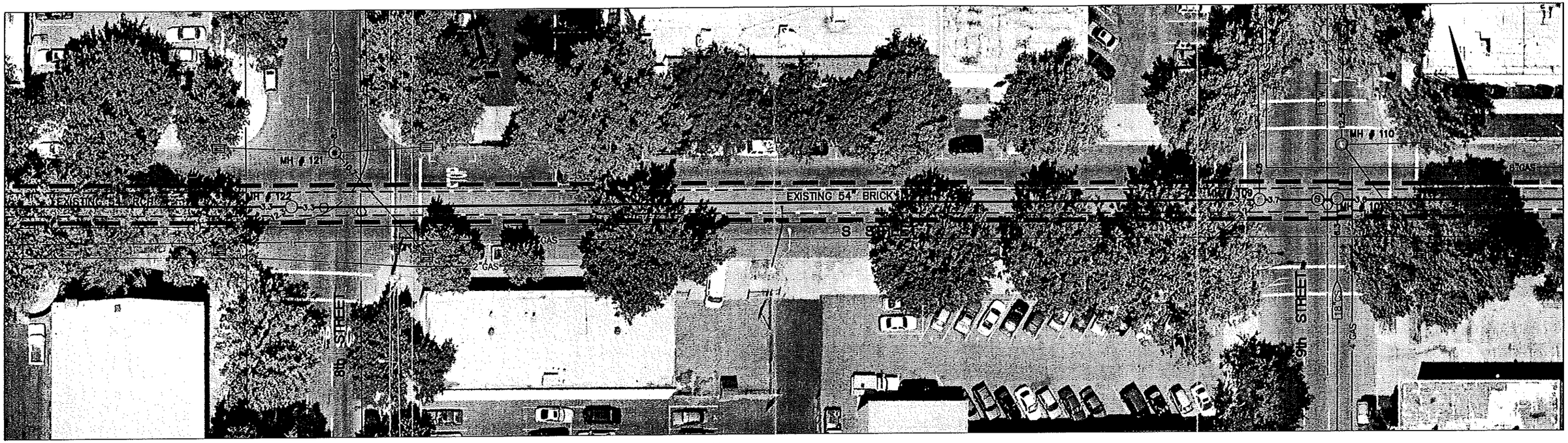
NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO DEPARTMENT OF UTILITIES	BROWN AND CALDWELL SACRAMENTO, CA	DOWNTOWN LARGE SEWERS PROJECT PRE-DESIGN PHASE 3	STA 0+00 TO 5+00
DRAWN BY: MRPE DATE: 5/01	DESIGNED BY: N/A P.E. NO. DATE:	CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01	DWG NO.: REVISION NO.: △ SECTION: SHEET 1 OF 10

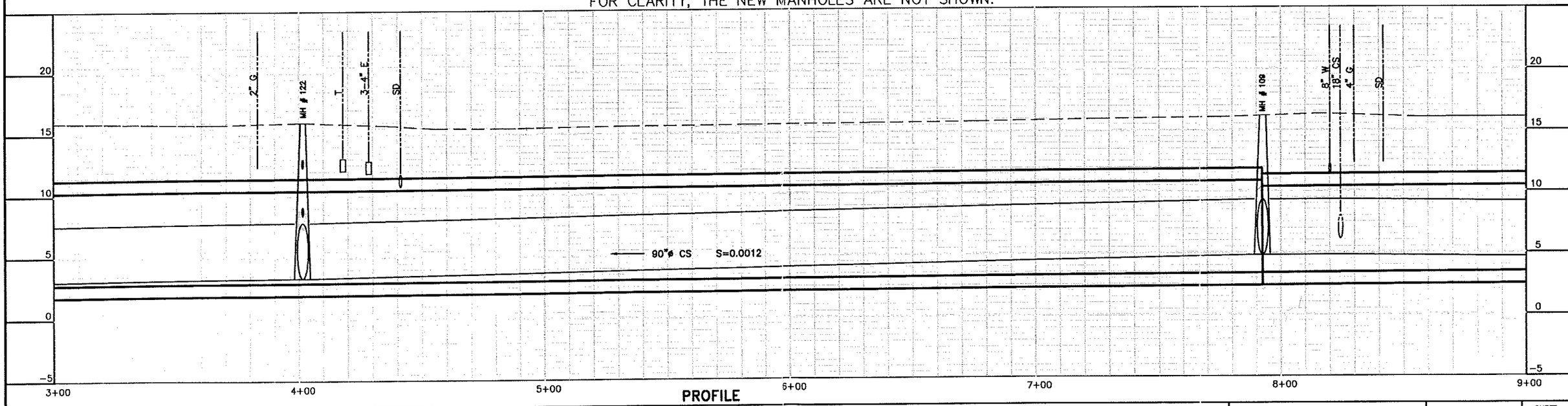


PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. _____ DATE: _____
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

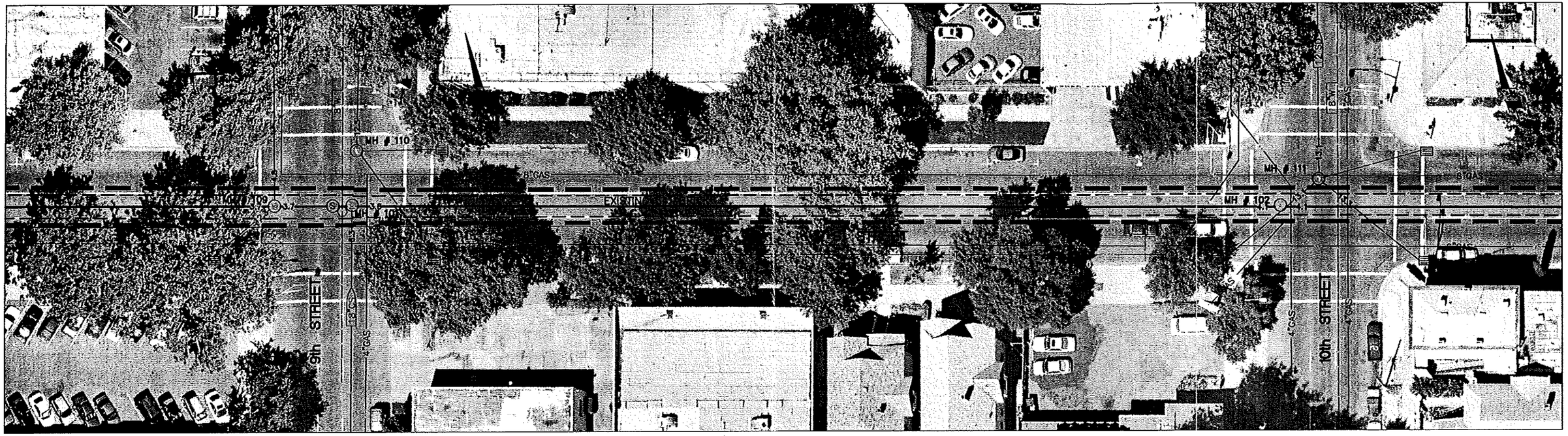
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 3

STA 3+00 TO 9+00

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 2 OF 10

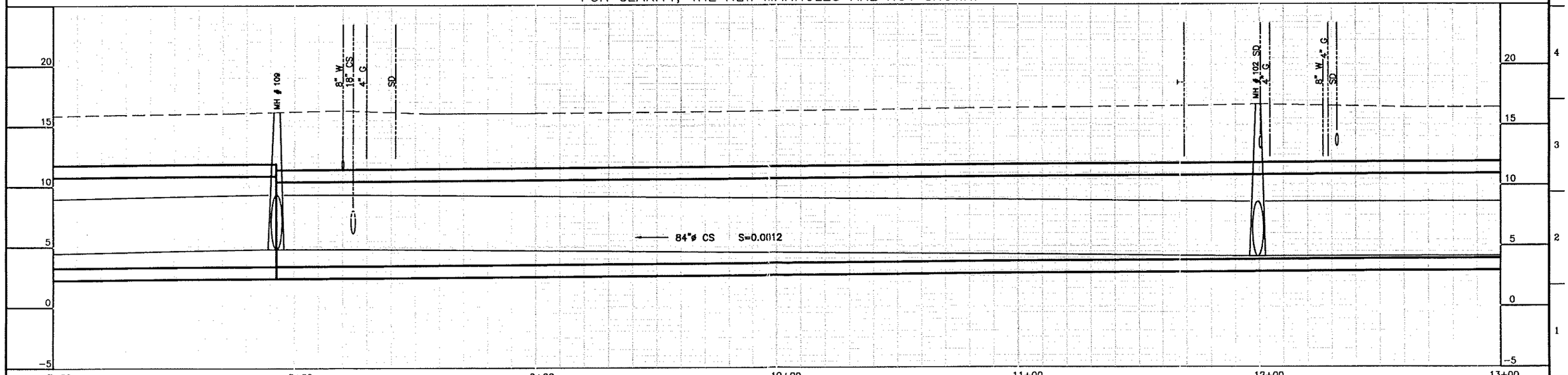


PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. ____ DATE: ____
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 3

STA 7+00 TO 13+00

DWG NO.:
REVISION NO. : △
SECTION:

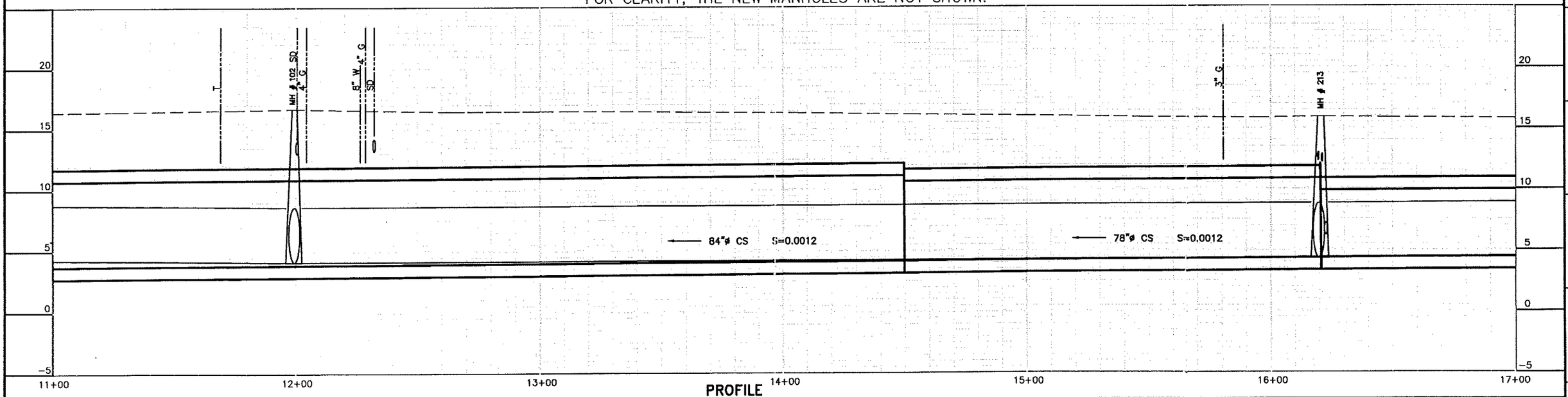
SHEET 3 OF 10

PLAN

VERTICAL SCALE: (FEET) 0 4 8 / 2 6

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 20 40 / 10 30



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01 | DESIGNED BY: N/A P.E. NO. ____ DATE: ____ | CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 3

STA 11+00 TO 17+00

DWG NO.:
REVISION NO. : △
SECTION:

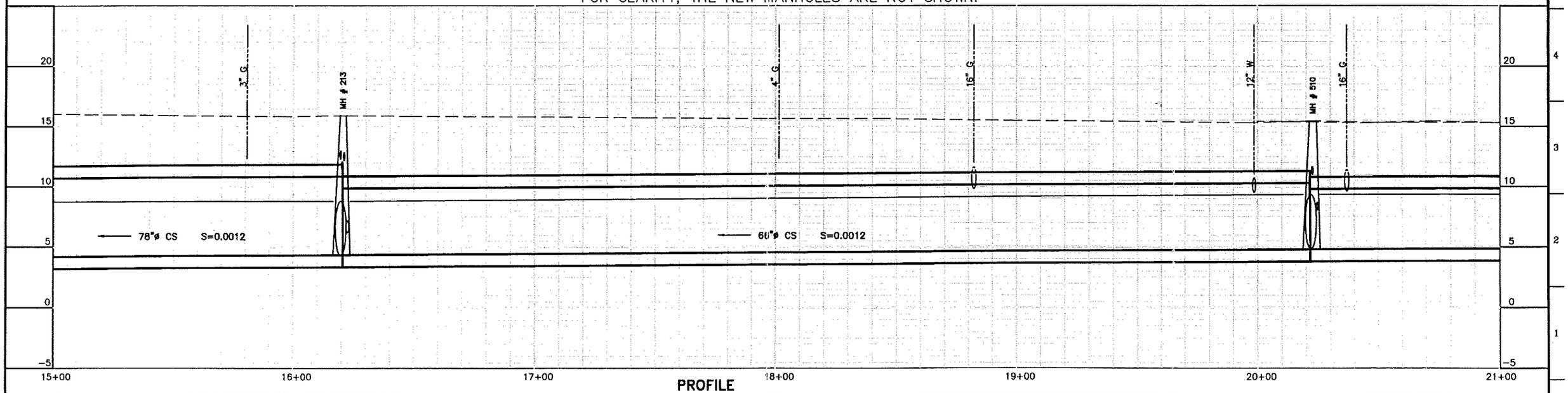
SHEET 4 OF 10

PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. DATE:
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 3

STA 15+00 TO 21+00

DWG NO.:
REVISION NO. : △
SECTION:

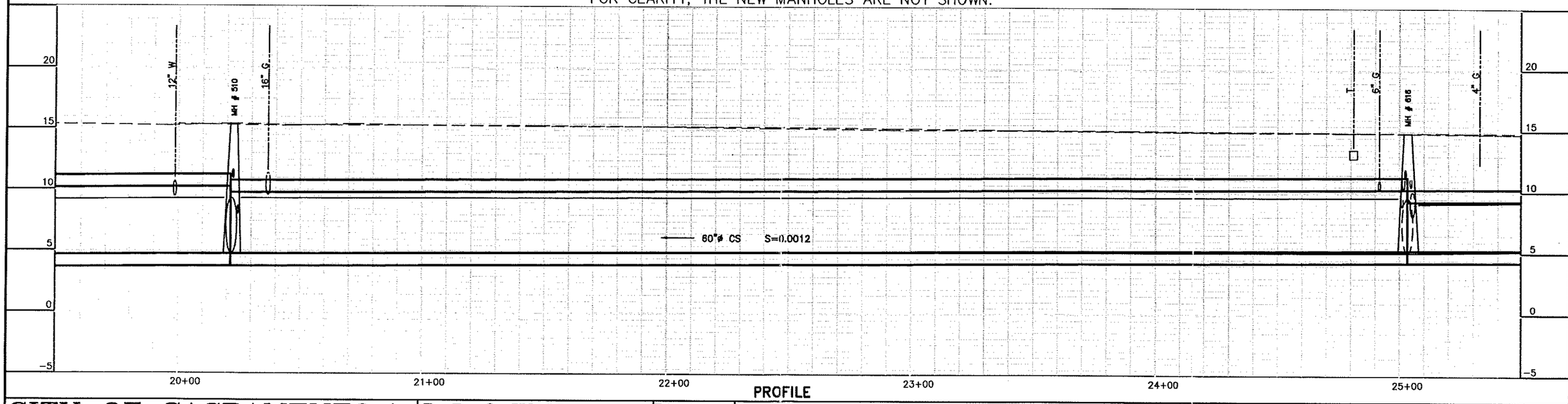
SHEET 5 OF 10

PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. ____ DATE: ____
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

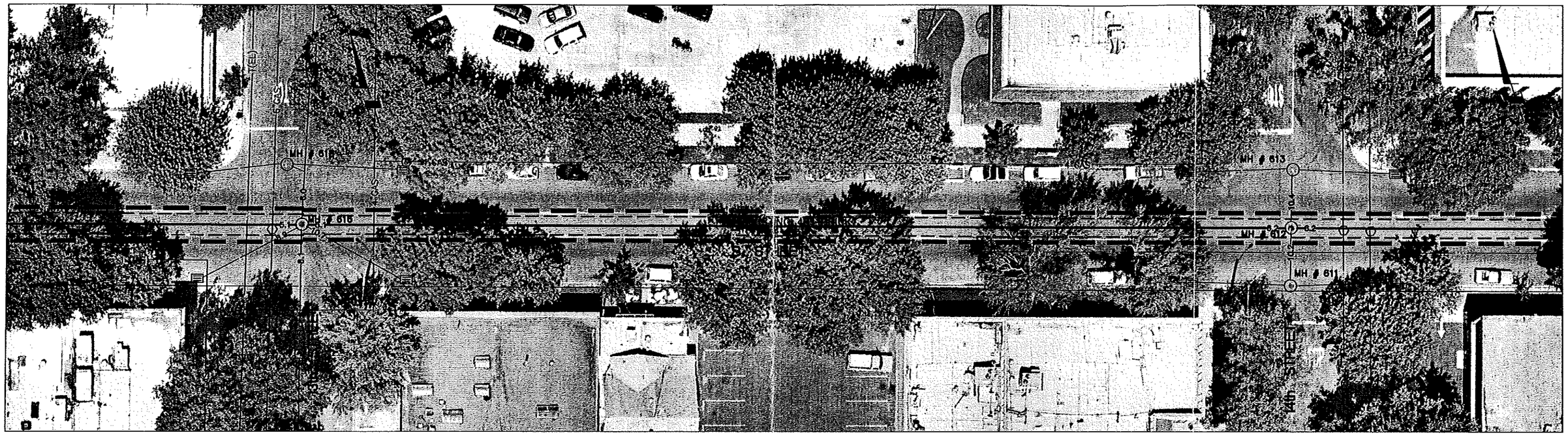
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 3

STA 19+50 TO 25+50

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 6 OF 10

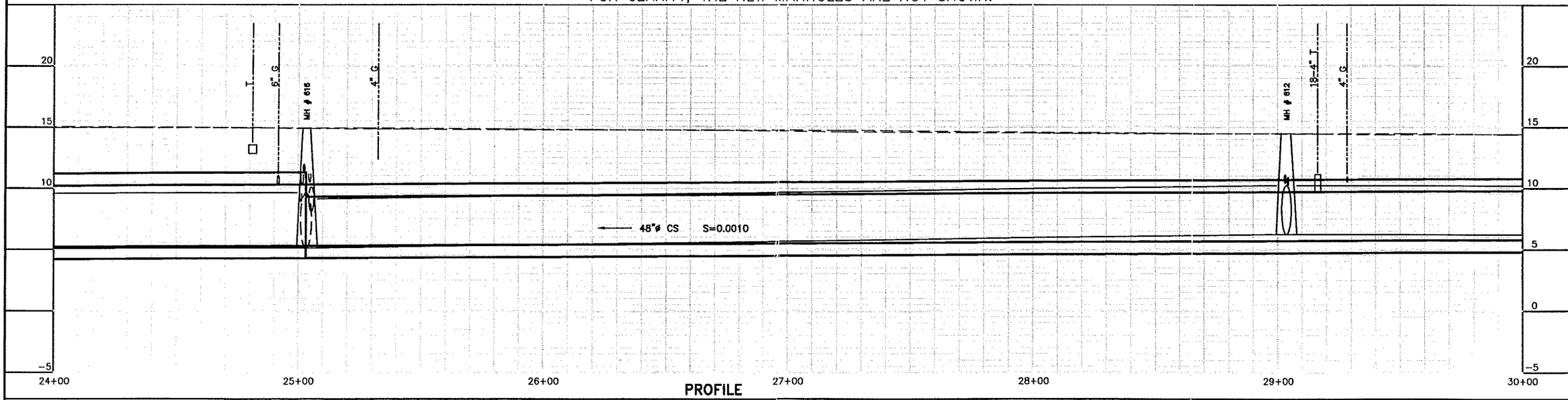


PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. DATE:
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 3

STA 24+00 TO 30+00

DWG NO.:
REVISION NO. : △
SECTION:

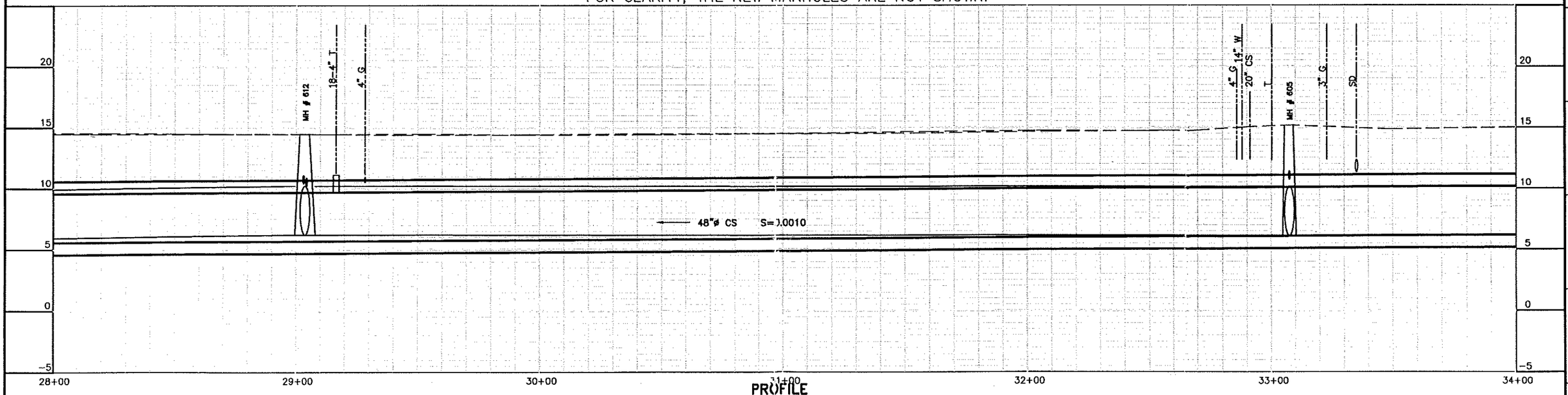
SHEET 7 OF 10

PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01 | DESIGNED BY: N/A P.E. NO. DATE: | CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

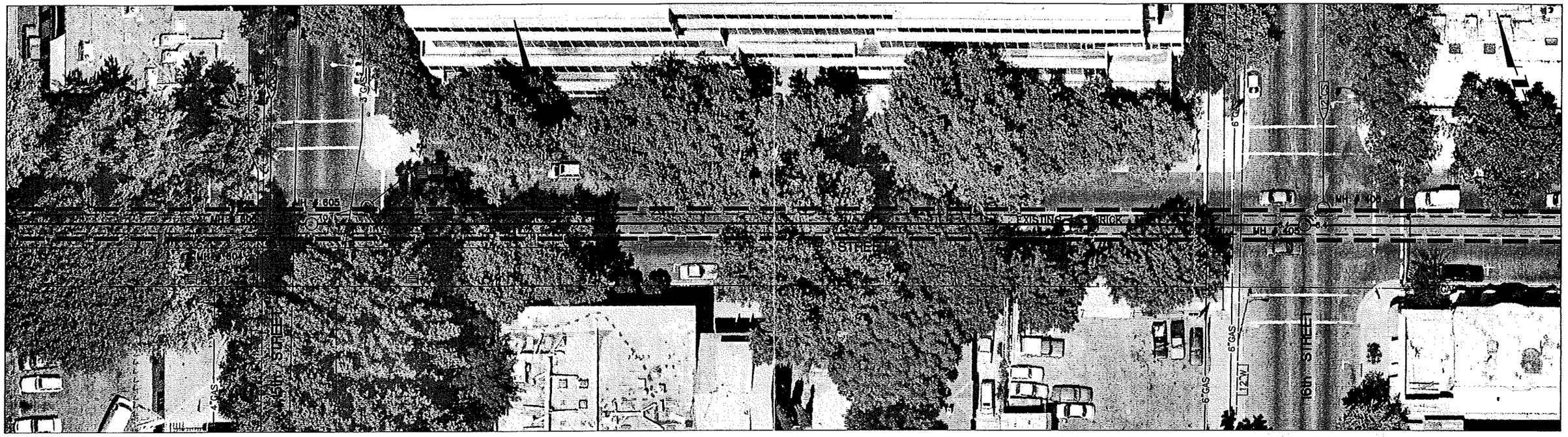
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 3

STA 28+00 TO 34+00

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 8 OF 10

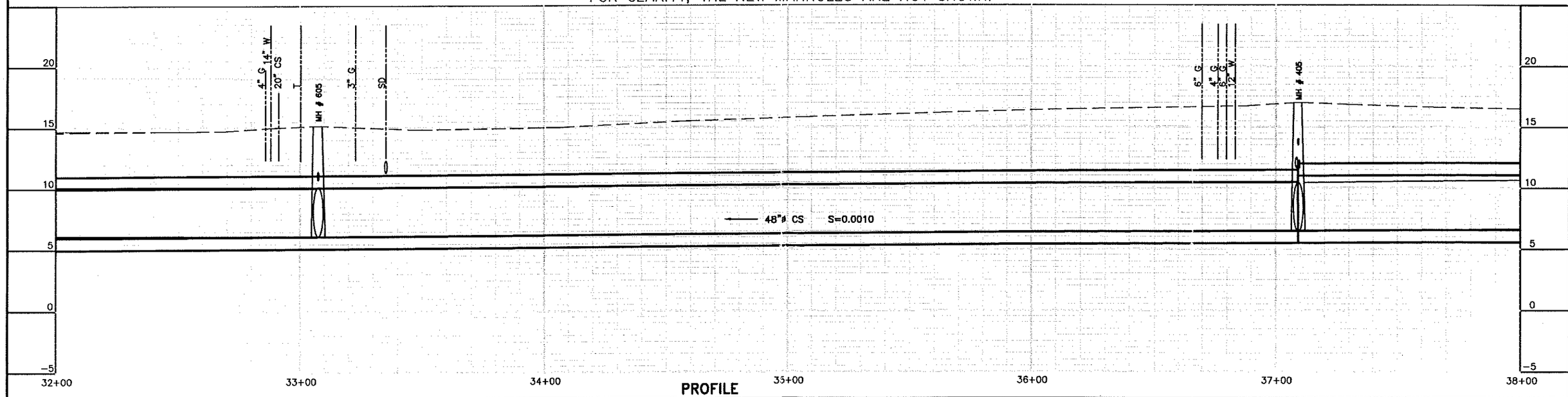


PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

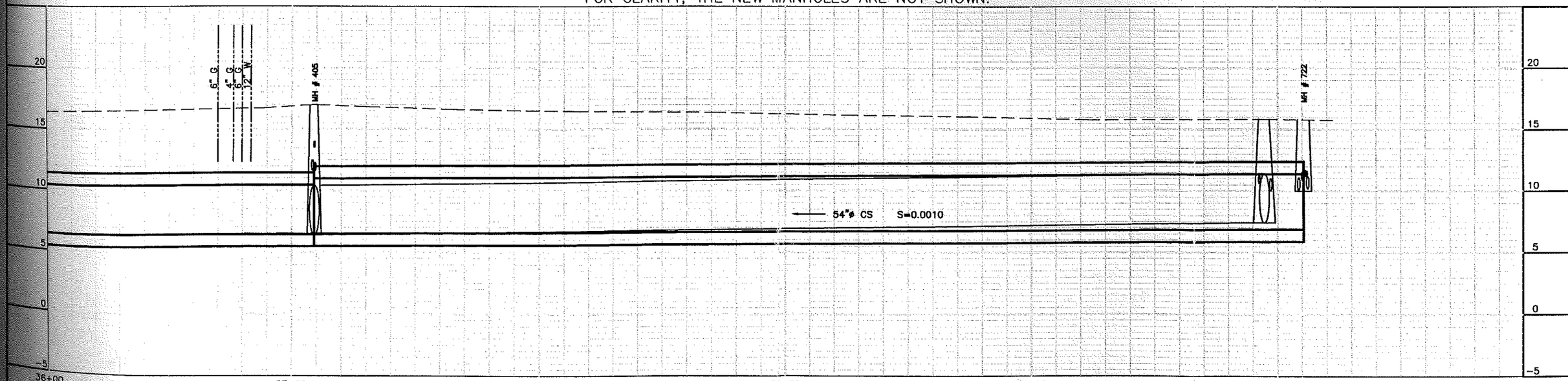
CITY OF SACRAMENTO DEPARTMENT OF UTILITIES	BROWN AND CALDWELL SACRAMENTO, CA	DOWNTOWN LARGE SEWERS PROJECT PRE-DESIGN PHASE 3	STA 32+00 TO 38+00
DRAWN BY: MRPE DATE: 5/01 · DESIGNED BY: N/A P.E. NO. ____ DATE: ____ · CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01			DWG NO.: REVISION NO. : △ SECTION: SHEET 9 OF 10

PLAN

VERTICAL SCALE: (FEET) 0 2 4 6 8

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MRPE DATE: 5/01
DESIGNED BY: N/A P.E. NO. DATE:
CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

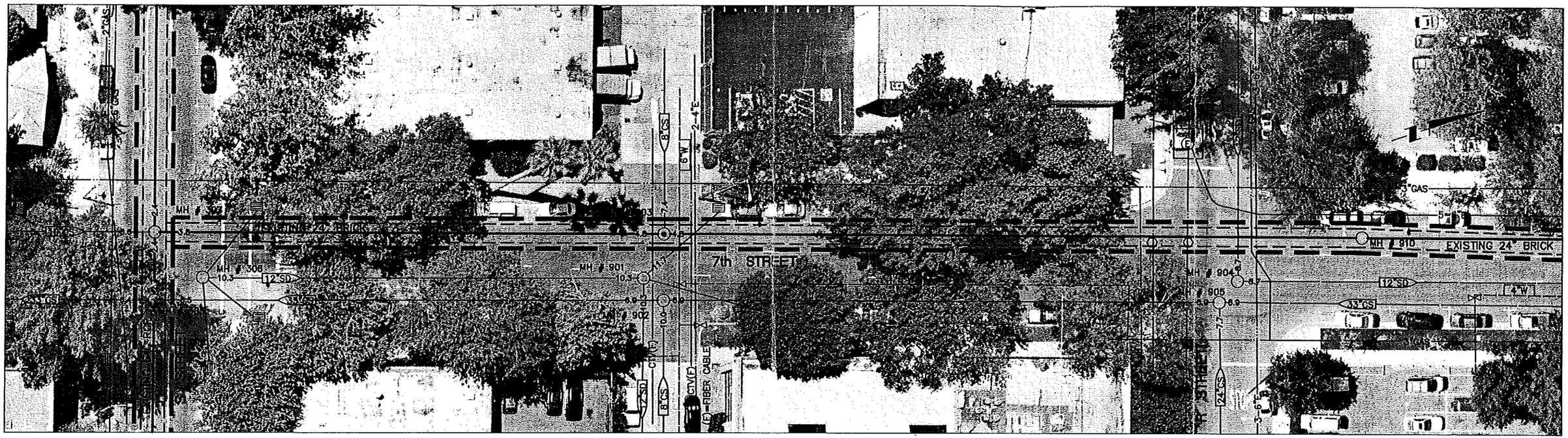
BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN PHASE 3

STA 36+00 TO 41+11

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 10 OF 10

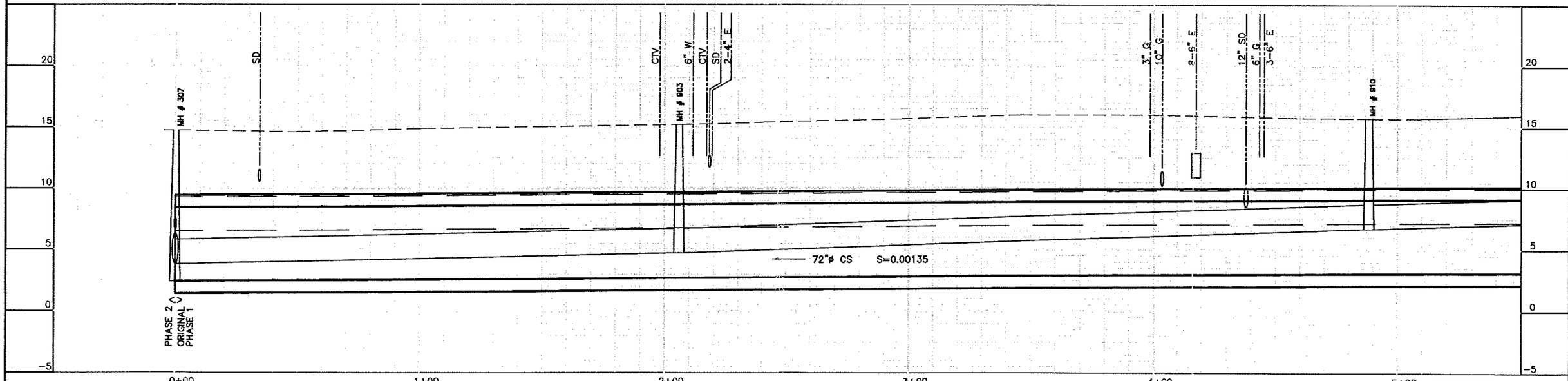


PLAN

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

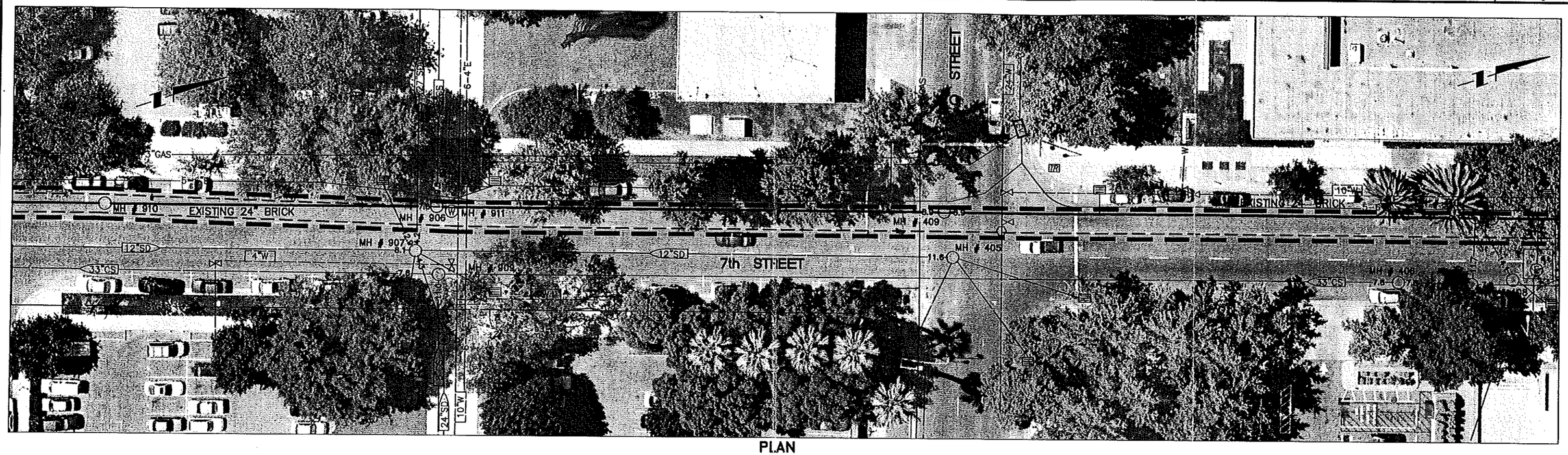
VERTICAL SCALE: (FEET) 0 2 4 6 8

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO DEPARTMENT OF UTILITIES	BROWN AND CALDWELL SACRAMENTO, CA	DOWNTOWN LARGE SEWERS PROJECT PRE-DESIGN ORIGINAL PHASE 1	ORIGINAL ALIGNMENT (NOT RECOMMENDED) STA 0+00 TO 5+50
DRAWN BY: MR/CEC DATE: 5/01 DESIGNED BY: N/A P.E. NO. ____ DATE: ____ CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01			DWG NO.: REVISION NO. : △ SECTION: SHEET 1 OF 3

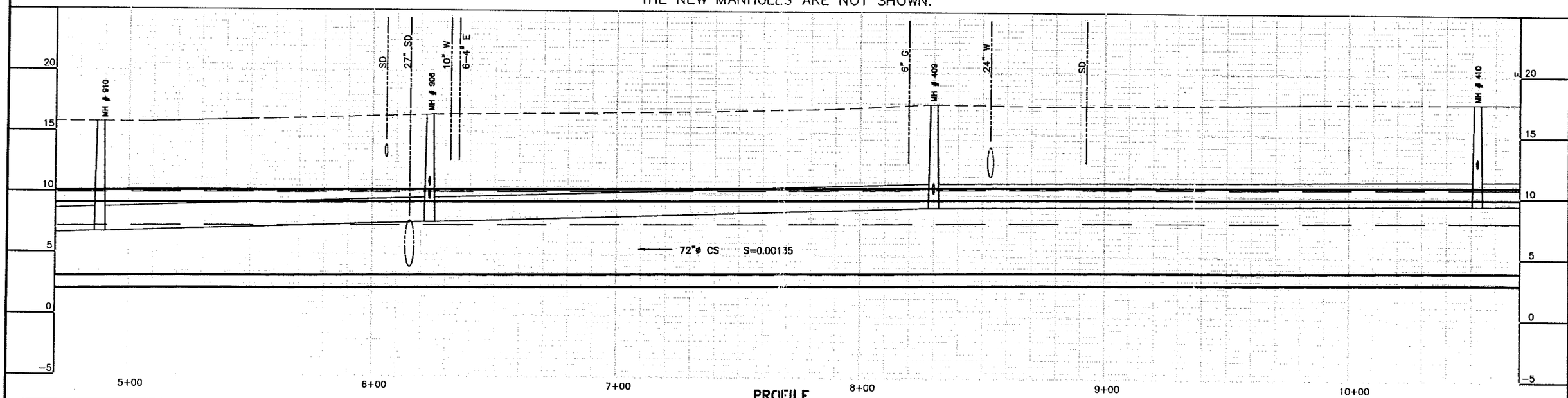


PLAN

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

VERTICAL SCALE: (FEET) 0 2 4 6 8

HORIZONTAL SCALE: (FEET) 0 10 20 30 40



PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MR/CEC DATE: 5/01 | DESIGNED BY: N/A P.E. NO.____ DATE:____ | CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN ORIGINAL PHASE 1

ORIGINAL ALIGNMENT
(NOT RECOMMENDED)

STA 4+70 TO 10+70

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 2 OF 3

PLAN

NOTE: THE HEAVY DASHED LINES DENOTE THE OPEN TRENCH DURING CONSTRUCTION. THE LIGHTER DASHED LINES INSIDE THE TRENCH DENOTE THE NEW PIPE. FOR CLARITY, THE NEW MANHOLES ARE NOT SHOWN.

VERTICAL SCALE: (FEET) 0 2 4 6 8

HORIZONTAL SCALE: (FEET) 0 10 20 30 40

PROFILE

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: MR/CEC DATE: 5/01 | DESIGNED BY: N/A P.E. NO. ____ DATE: ____ | CHECKED BY: RLM P.E. NO. 17115 DATE: 5/01

BROWN AND CALDWELL
SACRAMENTO, CA

DOWNTOWN LARGE SEWERS PROJECT
PRE-DESIGN ORIGINAL PHASE 1

ORIGINAL ALIGNMENT
(NOT RECOMMENDED)
STA 9+50 TO 15+50

DWG NO.:
REVISION NO. : △
SECTION:

SHEET 3 OF 3

APPENDIX E

BACPAC COST ESTIMATES FOR RECOMMENDED ALTERNATIVES

****** ESTIMATE SUMMARY SHEET ******

ESTIMATE #: 18292-1C
JOB #: 18292-1C
EST DATE:
PRT DATE: 1-11-01
PRT TIME: 8:33 am

Project: CITY OF SACRAMENTO DEPT OF UTILITIES
PH1-5TH ST ALTERNATIVE W/MICRO TUNNELING
MADE BY: SB
CHKD BY: _____

SUMMARY TOTALS

Labor:	$ 913,540	Sales Tax:	$ 90,782
Material:	$ 1,171,378	Markup:	$ 611,435
Subs:	$ 4,685,556	Subtotal:	$ 7,719,445
Equipmnt:	$ 246,755	Bond:	$ 77,194
		Revised Subtotal:	$ 7,796,640
		Contingency:	$
		Grand Total:	$ 7,796,640

MARKUP DATA

Labor M/U:	18.00%	Sales Tax (Mat'l):	7.75%
Material M/U:	15.00%	Sales Tax (Equip):	.00%
Subs M/U:	5.00%	Bond Rate:	1.00%
Equipmnt M/U:	15.00%	Contingency:	.00%

GRP#	Process Area	<------Labor------> M/C Hrs	Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Sales Tax($)	Markup($)	Total($)	Job%
010	CONTRACTOR INDIRECTS	2,564	107,767	7,000	253,517	11,730	543	34,883	415,440	5.4 %
204	LARGE SEWER REPLACEMENT	14,986	695,868	1,089,379	4,432,040	226,876	84,426	544,297	7,072,883	91.6 %
205	REMOVE EXISTING SEWER	3,263	109,903	75,000		8,150	5,813	32,255	231,121	3.0 %
	Estimate Subtotal:	20,815	$ 913,540	$ 1,171,378	$ 4,685,556	$ 246,755	90,782	$ 611,435	$ 7,719,445	100.0 %
	Plus Bond, If Reqd:								$ 77,194	1.0 %
	Revised Subtotal:								$ 7,796,640	101.0 %
	Contingency:								$	.0 %
	GRAND TOTAL:								$ 7,796,640	

ESTIMATE #: 18292-1C Project: CITY OF SACRAMENTO DEPT OF UTILITIES Date: 1-11-01 Time: 8:34 am

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Labor Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph									
Descript									
GRP # 010	CONTRACTOR INDIRECTS								
	1.000 GENERAL CONDITIO								
	1.110 FIELD MANAGEMENT								
1111	Project Super	6.0	MO	1,038.0	51,900				51,900
1115	PROJECT SAFETY ENGINEER	6.0	MO	1,038.0	39,444				39,444
	1.150 MOBILIZATION								
1510	Office Trailer,50x10	6.0	MO					2,310	2,310
1514	Porta Potty	6.0	MO					468	468
1515	Job Phone	6.0	MO					1,800	1,800
1516	Misc Supplies	6.0	MO					1,200	1,200
1517	Project Truck,3/4 Ton	6.0	MO					5,952	5,952
1518	Survey/Stakeout	30.0	DY				14,700		14,700
	1.153 LIFTING EQUIPMEN								
1531	Crane, 18T Hydro/w OP	120.0	DY				94,200		94,200
	1.170 MISC. CONDITIONS								
1502	Traffic Sign	28.0	EA	61.6	2,075	7,000			9,075
1701	General Cleanup	85,200.0	SF	255.6	8,609				8,609
1702	Final Cleanup	85,200.0	SF	170.4	5,739				5,739
	"K" Rail Traffic Barrier	19.0	EA				101,787		101,787
	Temp Fence	19.0	EA				42,830		42,830
	CSI Division Subtotal:			2,563.6	$ 107,766	$ 7,000	$ 253,517	$ 11,730	$ 380,014
GENERAL CONDITIONS	Group Subtotal:			2,563.6	$ 107,766	$ 7,000	$ 253,517	$ 11,730	$ 380,014
								SALES TAX:	543
								MARK UP:	34,883
							GROUP # 010	Total:	$ 415,439

ESTIMATE #: 18292-1C Project: CITY OF SACRAMENTO DEPT OF UTILITIES Date: 1-11-01 Time: 8:34 a

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph									
Descript									
GRP # 204	LARGE SEWER REPLACEMENT								
	2.000 SITE WORK								
	2.050 DEMOLITION & REM								
0505	Sawcut Asphalt	7,700.0	LF	169.4	5,705	1,694		2,464	9,863
0510	Pavement Removal	42,350.0	SF				74,113		74,113
	2.100 SITE PREPARATION								
	Utilities Protection	1.0	LS				200,000		200,000
	2.160 SHEET PILING								
1603	Shoring, For Pits	2,880.0	SF				43,517		43,517
	Soldier Pile	115,500.0	SF				1,745,205		1,745,205
	2.220 EXCAVATE & BACKF								
2203	Excav,Bulk,Cat 235 To 24	42,350.0	CY	1,270.5	65,977			67,760	133,737
2215	Backfill,Native,966 Load	29,802.0	CY	3,159.0	164,047			69,737	233,784
2217	Backfill,Gravel,966 Load	1,141.0	CY	120.9	6,281	16,248		2,670	25,199
2219	Bedding For Pipe, Sand	1,579.0	CY	167.4	5,637	14,507		3,695	23,839
2226	Compaction,Vib-Roller,8"	29,802.0	CY	3,874.3	201,190			27,418	228,608
2230	Compaction,Wacker,12"Lif	1,579.0	CY	236.9	7,977			3,316	11,293
2238	Haul-off,17CY Trans,10 M	12,548.0	CY	2,045.3	106,214			49,816	156,029
	2.500 PAVING/SURFACING								
2504	AC Patch	42,350.0	SF				124,933		124,933
	2.600 PIPED UTILITIES								
2626	MH w Cover	16.0	EA	256.0	8,622	72,000			80,622
2669	54" RCP Pipe	1,715.0	LF	960.4	32,346	250,390			282,736
2670	60" RCP Pipe	1,720.0	LF	1,066.4	35,916	287,240			323,156
2672	72" RCP Pipe	2,130.0	LF	1,661.4	55,956	447,300			503,256
	Inverted Syphon/30" SD	1.0	LS				50,000		50,000
	Temporary Service Connec	1.0	LS				333,900		333,900
	Reconnect Service Latera	40.0	EA				60,000		60,000
	Reconnect Drop Inlets	20.0	EA				30,000		30,000
	2.650 BORING & JACKING								
6003	Receiving Pit	1.0	EA				27,686		27,686
6003	Tunneling Pit	1.0	EA				27,686		27,686
	Tunneling For 54"	1,715.0	LF				1,715,000		1,715,000
	CSI Division Subtotal:			14,987.9	$ 695,870	$ 1,089,378	$ 4,432,039	$ 226,875	$ 6,444,162

ESTIMATE #: 18292-1C Project: CITY OF SACRAMENTO DEPT OF UTILITIES Date: 1-11-01 Time: 8:34 am

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Labor Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph Descript									
GRP # 204	LARGE SEWER REPLACEMENT								cont
SITE WORK	Group Subtotal:			14,987.9	$ 695,870	$ 1,089,378	$ 4,432,039	$ 226,875	$ 6,444,162
								SALES TAX:	84,427
								MARK UP:	544,296
							GROUP # 204	Total:	$ 7,072,885
GRP # 205	REMOVE EXISTING SEWER								
2.000	SITE WORK								
2.050	DEMOLITION & REM								
0536	Manhole Removal	17.0	EA	136.0	4,580			850	5,430
0550	Pipe Removal, 21" Sewer	205.0	LF	55.4	1,864			457	2,321
0550	Pipe Removal, 24" Sewer	1,291.0	LF	348.6	11,740			2,879	14,619
0551	Pipe Removal, 36" Sewer	1,231.0	LF	923.3	31,095			3,964	35,059
2.600	PIPED UTILITIES								
	Temp. Service	1.0	LS	1,800.0	60,624	75,000			135,624
	CSI Division Subtotal:			3,263.2	$ 109,904	$ 75,000	$	$ 8,150	$ 193,053
SITE WORK	Group Subtotal:			3,263.2	$ 109,904	$ 75,000	$	$ 8,150	$ 193,053
								SALES TAX:	5,813
								MARK UP:	32,255
							GROUP # 205	Total:	$ 231,121

ESTIMATE #: 18292-1C Project: CITY OF SACRAMENTO DEPT OF UTILITIES Date: 1-11-01 Time: 8:34 am

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph									
Descript									
	Estimate Totals:	20,814.6			$ 913,540	$ 1,171,378	$ 4,685,556	$ 246,755	$ 7,017,229

Sales Tax:	$ 90,782
Mark Up:	$ 611,435
Bond:	$ 77,194
Subtotal:	$ 7,796,640
Contingency:	$
Estimate 18292-1C Grand Total:	$ 7,796,640

****** ESTIMATE SUMMARY SHEET ******

Project: CITY OF SACRAMENTO
PH2 MATE TO 5TH ST ALT/PH1 W/84"/U ST
MADE BY: JW/SB
CHKD BY: _____

ESTIMATE #: 18292-2D
JOB #: 18292-600
EST DATE:
PRT DATE: 1-10-01
PRT TIME: 10:54 am

SUMMARY TOTALS

Labor:	$ 461,895	Sales Tax:	$ 41,080
Material:	$ 530,068	Markup:	$ 247,108
Subs:	$ 1,331,553	Subtotal:	$ 2,730,896
Equipmnt:	$ 119,192	Bond:	$ 27,309
		Revised Subtotal:	$ 2,758,205
		Contingency:	$
		Grand Total:	$ 2,758,205

MARKUP DATA

Labor M/U:	18.00%	Sales Tax (Mat'l):	7.75%
Material M/U:	15.00%	Sales Tax (Equip):	.00%
Subs M/U:	5.00%	Bond Rate:	1.00%
Equipmnt M/U:	15.00%	Contingency:	.00%

GRP#	Process Area	<------Labor------> M/C Hrs	Labor Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Sales Tax($)	Markup($)	Total($)	Job%
010	CONTRACTOR INDIRECTS	1,792	74,638	6,000	169,338	7,820	465	23,975	282,236	10.3 %
204	LARGE SEWER REPLACEMENT	6,837	319,232	492,418	1,162,215	105,913	38,162	205,323	2,323,264	85.1 %
205	REMOVE EXISTING SEWER	2,020	68,025	31,650		5,458	2,453	17,811	125,398	4.6 %
	Estimate Subtotal:	10,648	$ 461,895	$ 530,068	$ 1,331,553	$ 119,192	41,080	$ 247,108	$ 2,730,896	100.0 %
	Plus Bond, If Reqd:								$ 27,309	1.0 %
	Revised Subtotal:								$ 2,758,205	101.0 %
	Contingency:								$	.0 %
	GRAND TOTAL:								$ 2,758,205	

ESTIMATE #: 18292-2D Project: CITY OF SACRAMENTO Date: 1-10-01 Time: 10:54 am

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Labor Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph									
Descript									
GRP # 010	CONTRACTOR INDIRECTS								
1.000	GENERAL CONDITIO								
1.110	FIELD MANAGEMENT								
1111	Project Super	4.0	MO	692.0	34,600				34,600
1115	PROJECT SAFETY ENGINEER	4.0	MO	692.0	26,296				26,296
1.150	MOBILIZATION								
1510	Office Trailer,50x10	4.0	MO					1,540	1,540
1514	Porta Potty	4.0	MO					312	312
1515	Job Phone	4.0	MO					1,200	1,200
1516	Misc Supplies	4.0	MO					800	800
1517	Project Truck,3/4 Ton	4.0	MO					3,968	3,968
1518	Survey/Stakeout	15.0	DY				7,350		7,350
1.153	LIFTING EQUIPMEN								
1531	Crane, 18T Hydro/w OP	90.0	DY				70,650		70,650
1.170	MISC. CONDITIONS								
1502	Traffic Sign	24.0	EA	48.0	1,617	6,000			7,617
1701	General Cleanup	72,000.0	SF	216.0	7,275				7,275
1702	Final Cleanup	72,000.0	SF	144.0	4,850				4,850
	"K" Rail Traffic Barrier	12.0	EA				64,287		64,287
	Temp Fence	12.0	EA				27,051		27,051
	CSI Division Subtotal:			1,792.0	$ 74,637	$ 6,000	$ 169,338	$ 7,820	$ 257,795
GENERAL CONDITIONS	Group Subtotal:			1,792.0	$ 74,637	$ 6,000	$ 169,338	$ 7,820	$ 257,795
	SALES TAX:								465
	MARK UP:								23,975
GROUP # 010	Total:								$ 282,235

ESTIMATE #: 18292-2D Project: CITY OF SACRAMENTO Date: 1-10-01 Time: 10:54 am

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Labor Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph									
Descript									
GRP # 204	LARGE SEWER REPLACEMENT								
	2.000 SITE WORK								
	2.050 DEMOLITION & REM								
0505	Sawcut Asphalt,4"Thk	3,422.0	LF	75.3	2,536	753		1,095	4,383
0510	Pavement Removal,To 4"Th	18,821.0	SF				32,937		32,937
	2.100 SITE PREPARATION								
	Utility Protection	1.0	LS				50,000		50,000
	2.160 SHEET PILING								
1603	Stl w Acc,To 25',No Salv	51,330.0	SF				775,596		775,596
	2.220 EXCAVATE & BACKF								
2203	Excav,Bulk,Cat 235 To 24	18,821.0	CY	564.6	29,321			30,114	59,435
2215	Backfill,Native,966 Load	13,244.0	CY	1,403.9	72,903			30,991	103,894
2217	Backfill,Gravel,966 Load	697.0	CY	73.9	3,837	9,925		1,631	15,393
2219	Bedding For Pipe, Sand	634.0	CY	67.2	2,263	5,825		1,484	9,572
2226	Compaction,Vib-Roller,8"	13,244.0	CY	1,721.7	89,409			12,184	101,593
2230	Compaction,Wacker,12"Lif	634.0	CY	95.1	3,203			1,331	4,534
2238	Haul-off,17CY Trans,10 M	6,822.0	CY	1,112.0	57,745			27,083	84,829
	2.500 PAVING/SURFACING								
2504	AC Patch	18,821.0	SF				55,522		55,522
	2.600 PIPED UTILITIES								
2674	84" RCP	1,711.0	LF	1,642.6	55,321	453,415			508,736
	Tie In 84/72"	1.0	EA				60,000		60,000
	Mh w Cover	5.0	EA	80.0	2,694	22,500			25,194
	Temporary Service Connec	1.0	LS				102,660		102,660
	Reconnect Service Latera	38.0	EA				57,000		57,000
	Reconnect Drop Inlets	19.0	EA				28,500		28,500
	CSI Division Subtotal:			6,836.2	$ 319,233	$ 492,418	$ 1,162,215	$ 105,913	$ 2,079,779
SITE WORK	Group Subtotal:			6,836.2	$ 319,233	$ 492,418	$ 1,162,215	$ 105,913	$ 2,079,779
								SALES TAX:	38,162
								MARK UP:	205,322
							GROUP # 204	Total:	$ 2,323,264

ESTIMATE #: 18292-2D Project: CITY OF SACRAMENTO Date: 1-10-01 Time: 10:54 am

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Labor Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph									
Descript									
GRP # 205	REMOVE EXISTING SEWER								
	2.000 SITE WORK								
	2.050 DEMOLITION & REM								
0536	Manhole Removal	4.0	EA	32.0	1,078			200	1,278
0551	Pipe Removal, 54" Sewer	390.0	LF	292.5	9,851			1,256	11,107
0551	Pipe Removal, 60" Sewer	1,243.0	LF	932.3	31,398			4,002	35,401
	2.600 PIPED UTILITIES								
	Temp. Service	1.0	LS	763.0	25,698	31,650			57,348
	CSI Division Subtotal:			2,019.8	$ 68,025	$ 31,650	$	$ 5,458	$ 105,133
SITE WORK	Group Subtotal:			2,019.8	$ 68,025	$ 31,650	$	$ 5,458	$ 105,133
								SALES TAX:	2,453
								MARK UP:	17,811
							GROUP # 205	Total:	$ 125,397
	Estimate Totals:			10,648.0	$ 461,895	$ 530,068	$ 1,331,553	$ 119,192	$ 2,442,708
								Sales Tax:	$ 41,080
								Mark Up:	$ 247,108
								Bond:	$ 27,309
								Subtotal:	$ 2,758,205
								Contingency:	$
							Estimate 18292-2D	Grand Total:	$ 2,758,205

****** ESTIMATE SUMMARY SHEET ******

Project: CITY OF SACRAMENTO DEPT OF UTILITIES
PH3-MATE TO 5TH ST ALIGNMENT PH 1
MADE BY: SB
CHKD BY: _____

ESTIMATE #: 18292-3B
JOB #: 18292-3B
EST DATE:
PRT DATE: 1-10-01
PRT TIME: 12:22 pm

SUMMARY TOTALS

Labor:	$ 1,150,652	Sales Tax:	$ 118,370
Material:	$ 1,527,354	Markup:	$ 667,002
Subs:	$ 3,704,240	Subtotal:	$ 7,471,414
Equipmnt:	$ 303,797	Bond:	$ 74,714
		Revised Subtotal:	$ 7,546,128
		Contingency:	$
		Grand Total:	$ 7,546,128

MARKUP DATA

Labor M/U:	18.00%	Sales Tax (Mat'l):	7.75%
Material M/U:	15.00%	Sales Tax (Equip):	.00%
Subs M/U:	5.00%	Bond Rate:	1.00%
Equipmnt M/U:	15.00%	Contingency:	.00%

GRP#	Process Area	<------Labor------> M/C Hrs	Labor Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Sales Tax($)	Markup($)	Total($)	Job%
010	CONTRACTOR INDIRECTS	2,693	112,125	16,500	199,360	11,730	1,279	34,385	375,379	5.0 %
204	LARGE SEWER REPLACEMENT	18,585	863,281	1,426,104	3,504,880	278,328	110,523	586,300	6,769,418	90.6 %
205	REMOVE EXISTING SEWER	5,203	175,245	84,750		13,738	6,568	46,318	326,618	4.4 %
	Estimate Subtotal:	26,481	$ 1,150,652	$ 1,527,354	$ 3,704,240	$ 303,797	118370	$ 667,002	$ 7,471,414	100.0 %
	Plus Bond, If Reqd:								$ 74,714	1.0 %
	Revised Subtotal:								$ 7,546,128	101.0 %
	Contingency:								$	.0 %
	GRAND TOTAL:								$ 7,546,128	

ESTIMATE #: 18292-3B Project: CITY OF SACRAMENTO DEPT OF UTILITIES Date: 1-10-01 Time: 12:22 pm

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Labor Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph									
Descript									
GRP # 010	CONTRACTOR INDIRECTS								
	1.000 GENERAL CONDITIO								
	1.110 FIELD MANAGEMENT								
1111	Project Super	6.0	MO	1,038.0	51,900				51,900
1115	PROJECT SAFETY ENGINEER	6.0	MO	1,038.0	39,444				39,444
	1.150 MOBILIZATION								
1510	Office Trailer,50x10	6.0	MO					2,310	2,310
1514	Porta Potty	6.0	MO					468	468
1515	Job Phone	6.0	MO					1,800	1,800
1516	Misc Supplies	6.0	MO					1,200	1,200
1517	Project Truck,3/4 Ton	6.0	MO					5,952	5,952
1518	Survey/Stakeout	20.0	DY				9,800		9,800
	1.153 LIFTING EQUIPMEN								
1531	Crane, 18T Hydro/w OP	120.0	DY				94,200		94,200
	1.170 MISC. CONDITIONS								
1502	Traffic Sign	66.0	EA	132.0	4,446	16,500			20,946
1701	General Cleanup	97,000.0	SF	291.0	9,801				9,801
1702	Final Cleanup	97,000.0	SF	194.0	6,534				6,534
	"K" Rail Traffic Barrier	16.0	EA				95,360		95,360
	CSI Division Subtotal:			2,693.0	$ 112,125	$ 16,500	$ 199,360	$ 11,730	$ 339,715
GENERAL CONDITIONS	Group Subtotal:			2,693.0	$ 112,125	$ 16,500	$ 199,360	$ 11,730	$ 339,715

SALES TAX: 1,279
MARK UP: 34,385
GROUP # 010 Total: $ 375,378

ESTIMATE #: 18292-3B Project: CITY OF SACRAMENTO DEPT OF UTILITIES Date: 1-10-01 Time: 12:22 pm

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Labor Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph									
Descript									
GRP # 204	LARGE SEWER REPLACEMENT								
	2.000 SITE WORK								
	2.050 DEMOLITION & REM								
0505	Sawcut Asphalt	9,160.0	LF	201.5	6,787	2,015		2,931	11,734
0510	Pavement Removal	68,700.0	SF				120,225		120,225
	2.100 SITE PREPARATION								
	Utilities Relocation	1.0	LS				200,000		200,000
	2.160 SHEET PILING								
	Soldier Piles/No Salvage	148,650.0	SF				2,246,102		2,246,102
	2.220 EXCAVATE & BACKF								
2203	Excav,Bulk,Cat 235 To 24	52,246.0	CY	1,567.4	81,394			83,594	164,988
2215	Backfill,Native,966 Load	37,319.0	CY	3,955.8	205,425			87,326	292,752
2217	Backfill,Gravel,966 Load	1,866.0	CY	197.8	10,272	26,572		4,366	41,210
2219	Bedding For Pipe, Sand	1,468.0	CY	155.6	5,241	13,487		3,435	22,163
2226	Compaction,Vib-Roller,8"	37,319.0	CY	4,851.5	251,937			34,333	286,270
2230	Compaction,Wacker,12"Lif	1,468.0	CY	220.2	7,416			3,083	10,499
2238	Haul-off,17CY Trans,10 M	14,927.0	CY	2,433.1	126,351			59,260	185,611
	2.500 PAVING/SURFACING								
2504	AC Patch	68,700.0	SF				202,665		202,665
	2.600 PIPED UTILITIES								
2626	MH w Cover	14.0	EA	224.0	7,544	63,000			70,544
2672	72" RCP Pipe	1,620.0	LF	1,263.6	42,558	340,200			382,758
2674	84" RCP Pipe	1,690.0	LF	1,622.4	54,642	447,850			502,492
2675	96" RCP Pipe	1,645.0	LF	1,891.8	63,714	532,980			596,694
	Temporary Service Connec	1.0	LS				297,300		297,300
	Reconnect Service Latera	102.0	EA				153,000		153,000
	Reconnect Drop Inlet	51.0	EA				76,500		76,500
	2.800 SITE IMPROVEMENT								
	Chain Link Fence	16.0	EA				209,088		209,088
	CSI Division Subtotal:			18,584.6	$ 863,282	$ 1,426,104	$ 3,504,880	$ 278,329	$ 6,072,595

ESTIMATE #: 18292-3B Project: CITY OF SACRAMENTO DEPT OF UTILITIES Date: 1-10-01 Time: 12:22 pm

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph									
Descript									
GRP # 204	LARGE SEWER REPLACEMENT								cont
				18,584.6	$ 863,282	$ 1,426,104	$ 3,504,880	$ 278,329	$ 6,072,595
SITE WORK	Group Subtotal:								
							SALES TAX:		110,523
							MARK UP:		586,300
							GROUP # 204 Total:		$ 6,769,418
GRP # 205	REMOVE EXISTING SEWER								
2.000	SITE WORK								
2.050	DEMOLITION & REM								
0536	Manhole Removal	10.0	EA	80.0	2,694			500	3,194
0551	Pipe Removal, 48" Sewer	1,608.0	LF	1,206.0	40,618			5,178	45,796
0551	Pipe Removal, 54" Sewer	2,503.0	LF	1,877.3	63,226			8,060	71,285
2.600	PIPED UTILITIES								
	Temp. Service	1.0	LS	2,040.0	68,707	84,750			153,457
	CSI Division Subtotal:			5,203.3	$ 175,245	$ 84,750	$	$ 13,737	$ 273,733
SITE WORK	Group Subtotal:			5,203.3	$ 175,245	$ 84,750	$	$ 13,737	$ 273,733
							SALES TAX:		6,568
							MARK UP:		46,317
							GROUP # 205 Total:		$ 326,618

ESTIMATE #: 18292-3B Project: CITY OF SACRAMENTO DEPT OF UTILITIES Date: 1-10-01 Time: 12:22 pm

Item	Description	Takeoff Quantity	T/O Unit	<-------Labor--------> MHrs/CHrs	Amount($)	Material Amount($)	Sub Amount($)	Equipment Amount($)	Total Amount($)
Group Ph									
Descript									
Estimate Totals:		26,480.9			$ 1,150,652	$ 1,527,354	$ 3,704,240	$ 303,797	$ 6,686,042

Sales Tax:	$ 118,370
Mark Up:	$ 667,002
Bond:	$ 74,714
Subtotal:	$ 7,546,128
Contingency:	$
Estimate 18292-3B Grand Total:	$ 7,546,128

P Street Sewer 60% Design

CITY OF SACRAMENTO

IMPROVEMENT PLANS FOR

P STREET SEWER PROJECT

BETWEEN 5TH & 7TH STS

APPROVED BY: _____ _____
RICHARD S. BATHA R.C.E. 36129 DATE
SUPERVISING ENGINEER
DEPARTMENT OF UTILITIES

APPROVED BY: _____ _____
ROB JACK DATE
SEWER SUPERINTENDENT
DEPARTMENT OF UTILITIES

SUBMITTED BY: _____ _____
DALE MATHISON R.C.E. 62992 DATE
PROJECT MANAGER
DEPARTMENT OF UTILITIES

REGISTERED PROFESSIONAL ENGINEER
DALE A. MATHISON
No. 62992
Exp. 6/30/12
CIVIL
STATE OF CALIFORNIA

GENERAL NOTES

1. ALL CONSTRUCTION SHALL CONFORM TO THE CITY OF SACRAMENTO STANDARD SPECIFICATIONS DATED JUNE 2007 AND THE SPECIAL PROVISIONS.

2. THREE WORKING DAYS PRIOR TO PROJECT STAKING, THE CONTRACTOR SHALL SUBMIT TO THE RESIDENT ENGINEER A COMPLETED CONSTRUCTION STAKING REQUEST FORM.

3. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR FURNISHING, INSTALLING AND MAINTAINING ALL WARNING SIGNS AND DEVICES NECESSARY TO SAFEGUARD THE GENERAL PUBLIC AND THE WORK, AND FOR PROVIDING PROPER AND SAFE ROUTING OF THE VEHICULAR AND PEDESTRIAN TRAFFIC DURING THE PERFORMANCE OF THE WORK. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND SHALL NOT BE LIMITED TO WORKING HOURS. THE USE OF FLAGGERS, BARRICADES AND CONSTRUCTION SIGNING SHALL COMPLY WITH THE CURRENT EDITION OF MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (M.U.T.C.D.).

4. THE CONTRACTOR SHALL CONTACT UNDERGROUND SERVICE ALERT (1-800-642-2444) TWO WORKING DAYS PRIOR TO COMMENCEMENT OF WORK. IN ACCORDANCE WITH ALL APPROPRIATE LAWS, INCLUDING BUT NOT LIMITED TO CALIFORNIA GOVERNMENT CODE 4216, CONTRACTOR SHALL TAKE THE PROPER CARE AND PROTECTION WHEN EXCAVATING NEAR AND LOCATING UNDERGROUND UTILITIES.

5. THE CONTRACTOR SHALL MAINTAIN ALL EXISTING WATER, SEWER AND/OR DRAINAGE FACILITIES WITHIN THE CONSTRUCTION AREA UNTIL THE PROPOSED IMPROVEMENTS ARE PLACED AND FUNCTIONING.

6. EXACT LIMITS OF PAVEMENT REMOVAL AND RECONSTRUCTION SHALL BE DETERMINED IN THE FIELD BY THE ENGINEER.

7. DEMOLITION OF EXISTING IS TO BE LIMITED TO THE ITEMS SHOWN ON THE PLANS AND DESCRIBED IN THE SPECIAL PROVISIONS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO REPAIR AND/OR REPLACE ALL EXISTING FEATURES DAMAGED BY HIS OPERATIONS, AT HIS EXPENSE.

8. THE CONTRACTOR SHALL BE COMPLETELY RESPONSIBLE FOR PROTECTING EXISTING TREES. ANY TREE DAMAGED SHALL BE REPLACED BY THE CONTRACTOR AS DIRECTED BY THE ENGINEER.

9. AT THE TIME THE CONTRACT IS AWARDED, THE CONTRACTOR SHALL POSSESS A CLASS A LICENSE, OR A COMBINATION OF CLASSES REQUIRED BY THE CATEGORIES AND CLASSES OF WORK INCLUDED IN THIS CONTRACT.

10. THE CONTRACTOR SHALL OBTAIN A PERMIT FROM THE DIVISION OF OCCUPATIONAL SAFETY & HEALTH (2424 ARDEN WAY SUITE 165, SACRAMENTO, CA PHONE 263-2800) PRIOR TO ANY TRENCHING EXCAVATION 5 FEET OR MORE IN DEPTH. A COPY OF THIS PERMIT SHALL BE AVAILABLE AT THE CONSTRUCTION SITE AT ALL TIMES.

11. CALL PG&E 48 HOURS IN ADVANCE TO REQUEST "STANDBY" WHEN WORKING NEAR (WITHIN 5') OR CROSSING HIGH PRESSURE FEEDER GAS MAINS AS DESIGNATED ON THE PLANS OR IN THE FIELD. CONTACT PG&E BY CALLING 386-5153.

12. ALL CURB, GUTTER AND SIDEWALK SHOWN TO BE REMOVED SHALL BE REMOVED TO THE NEAREST EXPANSION JOINT OR SCORE MARK. DAMAGE TO EXISTING CURB, GUTTER, AND SIDEWALK WHICH IS SHOWN ON THE PLANS TO REMAIN, SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.

13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING RECORD DRAWINGS FOR ALL UNDERGROUND WORK THROUGHOUT THE COURSE OF CONSTRUCTION. SUCH DRAWINGS SHALL RECORD THE LOCATION AND GRADE (CITY DATUM) OF ALL UNDERGROUND IMPROVEMENTS AND SHALL BE DELIVERED TO THE CITY PRIOR TO CONSIDERATION OF THE ACCEPTANCE OF WORK.

14. THE CONTRACTOR SHALL BE COMPLETELY RESPONSIBLE FOR PRESERVING ALL EXISTING SURVEY MONUMENTS WHICH WILL BE DISTURBED OR REMOVED AS REQUIRED BY CONTRACTOR'S WORK. CONTRACTOR SHALL COORDINATE WITH ENGINEER/SURVEYOR PRIOR TO DISTURBANCE OF EXISTING MONUMENTS, AND SHALL RESET MONUMENTS OR PROVIDE PERMANENT WITNESS MONUMENTS AND FILE DOCUMENTATION WITH THE COUNTY SURVEYOR PURSUANT TO BUSINESS AND PROFESSIONS CODE SECTION 8771.

15. REPLACEMENT OF LIVE SEWER SERVICES SHALL BE TO THE PROPERTY LINE. REPLACEMENT SEWER CLEANOUTS AND SERVICE DIAMETERS SHALL MATCH EXISTING, OR BE A MINIMUM OF 4 INCHES.

16. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING THE EXACT LOCATION OF ALL WATER SERVICES WITHIN THE PROJECT BOUNDARY. SERVICE LOCATIONS SHOWN ON THE PLANS WERE OBTAINED FROM SOURCES OF VARYING RELIABILITY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ALL DAMAGE INCURRED WHILE LOCATING SERVICES.

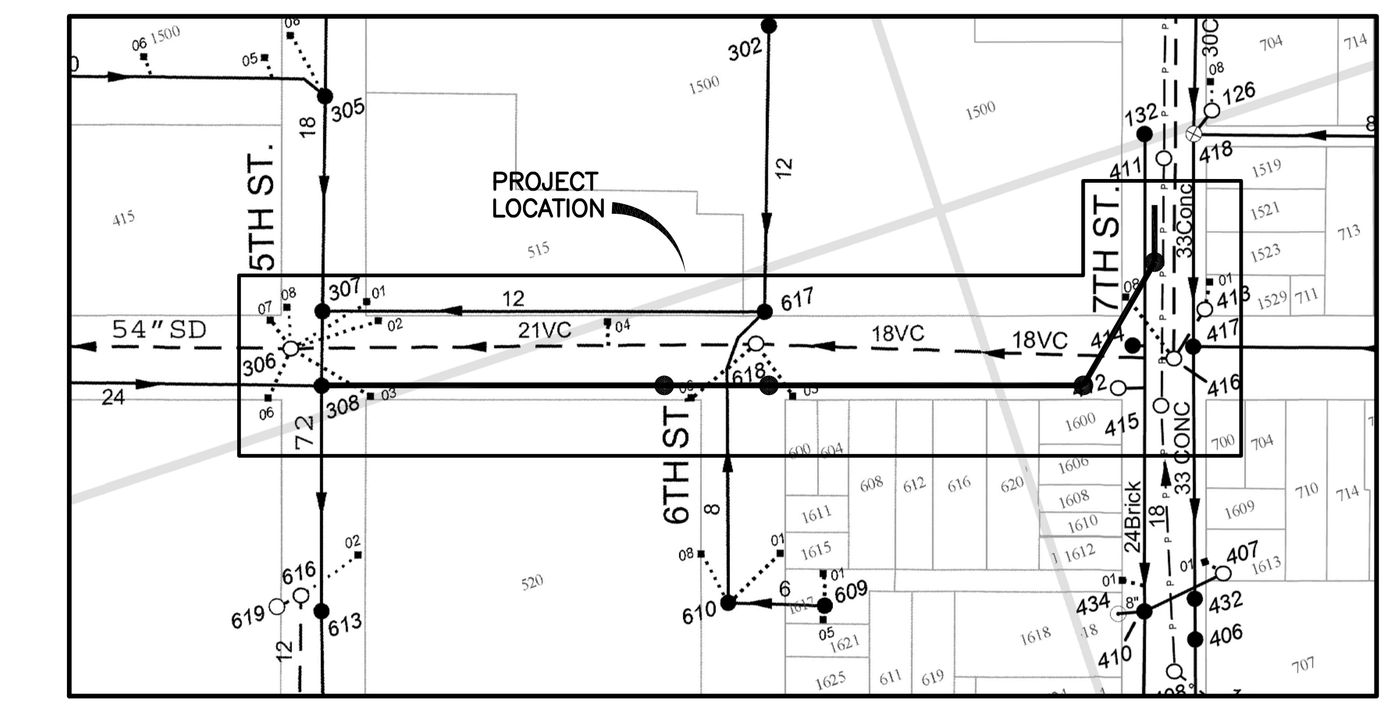
17. ALL WATER TAPS, TIE-INS, AND SHUT DOWNS ARE TO BE SCHEDULED DIRECTLY WITH THE ENGINEER BY THE CONTRACTOR. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE ENGINEER TO SCHEDULE AND COORDINATE SUCH WORK.

18. WITHOUT EXCEPTION, ALL OPENING AND CLOSING OF VALVES ON EXISTING WATER MAINS SHALL BE EXECUTED BY UTILITIES DEPARTMENT CREWS ONLY.

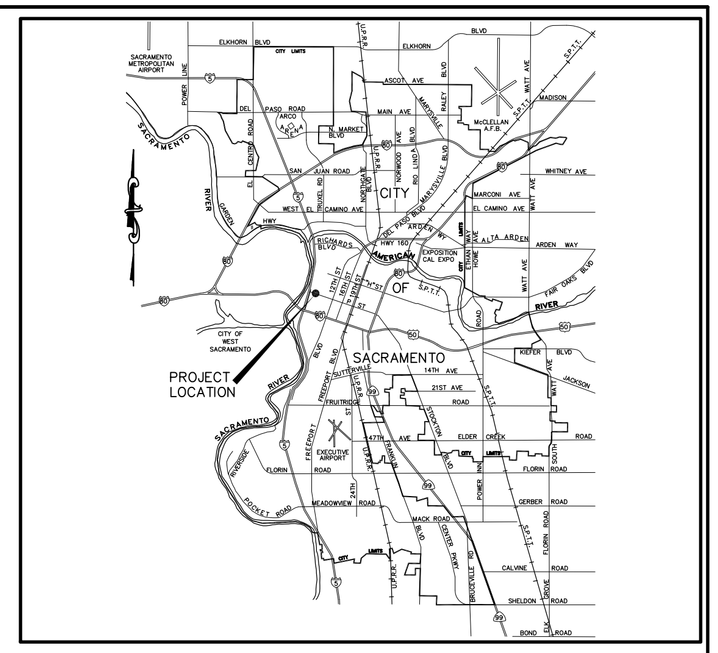
19. ALL TAPS INTO SEWER AND DRAIN MANHOLES SHALL BE CORE BORED WITH KOR-N-SEAL TAPS OR APPROVED EQUAL
UNLESS OTHERWISE APPROVED BY THE ENGINEER.

INDEX OF SHEETS

LOCATION MAP



VICINITY MAP



LEGEND

	EXISTING	PROPOSED
NO. 22 DRAIN INLET	□	■
TYPE B DROP INLET	▭	▬
MANHOLE	○ ✕ TO BE REMOVED OR ABANDONED	●
COMBINED SEWER MAIN	6"CS	6"CS
SANITARY SEWER MAIN	6"SS	6"SS
STORM DRAINAGE MAIN	6"SD	6"SD
SEWER SERVICE W/CLEANOUT	SS SVC	TO BE DETERMINED IN FIELD
WATER MAIN	24"W	24"W
WATER MAIN W/BLOW-OFF		
WATER MAIN W/AIR RELEASE VALVE		
WATER MAIN W/GATE VALVE		
WATER MAIN W/BUTTERFLY VALVE		
STANDARD FIRE HYDRANT		
WHARF FIRE HYDRANT		
WATER SERVICE & METER BOX	WMTR	WTR METER
WATER SERVICE & CURB STOP	CS	
BACKFLOW PREVENTER	RP DEVICE	
CURB, GUTTER & SIDEWALK		
CENTER LINE		
RIGHT-OF-WAY		
GAS MAIN & GAS VALVE	GAS 4"G	
ELECTRICAL CONDUIT	E	
POWER POLE W/GUY WIRE	PP	
TELEPHONE CONDUIT	TEL	
CABLE BOX/POD	CTV	
STREET LIGHT	ST	
ELEVATION	x 34.34	34.34
FENCE	x x x	x x x
BENCH MARK		
SIGN		
BOLLARD GATE POST OR POST	Post	
ADDRESS	2008	
PLUG OR CAP		
PIPE TO ABANDON		
PIPE TO REMOVE		
BUILDING		
RAILROAD		
TREE OR BUSH	TO BE REMOVED	TO BE REMOVED

STANDARD ABBREVIATIONS

A.B.	AGGREGATE BASE	(E), EXIST.	EXISTING	PP	POWER POLE
A.C.	ASPHALT CONCRETE	FA	FIRE ALARM	PCC	PORTLAND CONCRETE
APPROX.	APPROXIMATE	FG	FINISHED GRADE	(P), PROP.	PROPOSED
AT&T	AT&T TELECOMMUNICATIONS	FH	FIRE HYDRANT	PVC	POLY VINYL CHLORIDE
AVE.	AVENUE	FL or ℄	FLOW LINE	PED	PEDESTAL
BC	BEGIN CURVE	FM	FORCE MAIN	R or RT.	RADIUS OR RIGHT
BLDG	BUILDING	FO	FIBER OPTIC	RCP	REINFORCED CONC. PIPE
BOC	BACK OF CURB	FOC	FACE OF CURB	R/W, ROW	RIGHT-OF-WAY
CAB	CABINET	G	GAS	S=	SLOPE EQUALS
C&G	CURB AND GUTTER	G.B.	GRADE BREAK	SD	STORM DRAIN
CG&S	CURB, GUTTER AND SIDEWALK	GMTR	GAS METER	SDWK	SIDEWALK
CL or ℄	CENTER LINE	G.V.	GATE VALVE	SHT.	SHEET
CO	CLEANOUT	JP	JOINT POLE	SS	SANITARY SEWER
CONC.	CONCRETE	L=	LENGTH EQUALS	SS SVC	SANITARY SEWER SERVICE
CONST.	CONSTRUCT	LF	LINEAR FEET	STA.	STATION
CTV	CABLE TV	LT. or L	LEFT	STD.	STANDARD
CS	COMBINED SEWER	MFG.	MANUFACTURER	T or TEL	TELEPHONE
D.B.	DITCH BOX	MH	MANHOLE	TOB	TOP OF BANK
DI	DROP INLET	MB	MAILBOX	TYP.	TYPICAL
DRWY	DRIVEWAY	MAX., MIN.	MAXIMUM, MINIMUM	W	WATER
DWG	DRAWING	No.	NUMBER	WKWY	WALKWAY
EC	END CURVE	N.T.S.	NOT TO SCALE	WV	WATER VALVE
EL. or ELEV.	ELEVATION	PB	PULL BOX	< or AP	ANGLE POINT
EMTR	ELECTRICAL METER	PI	POINT OF INTERSECTION		
EP or EOP	EDGE OF PAVEMENT	PL or ℄	PROPERTY LINE		

DRAFT

P ST SEWER PROJECT BETW 5TH & 7TH
R:\SDSKPROJ\Civil3D Projects\14457_P_Street_Sewer_5th to 7th\dwg\14457_Base

PN: 14457 P ST SEWER REPL 5TH TO 7TH STS

PN: X14010064

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1			
2			
3			
4			
5			

BENCH MARK ELEV. 14.693
297-C4H
V.C. : RAMSET NAIL TRAFFIC SIGNAL BASE NW CORNER 'P' ST & 5TH ST.
H.C. : GPS SITE CALIBRATION BASE ON ROS 63-29 "CITY OF SACRAMENTO GPS

FIELD BOOK 1460
SCALE: H:_____ V:_____

1"
ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

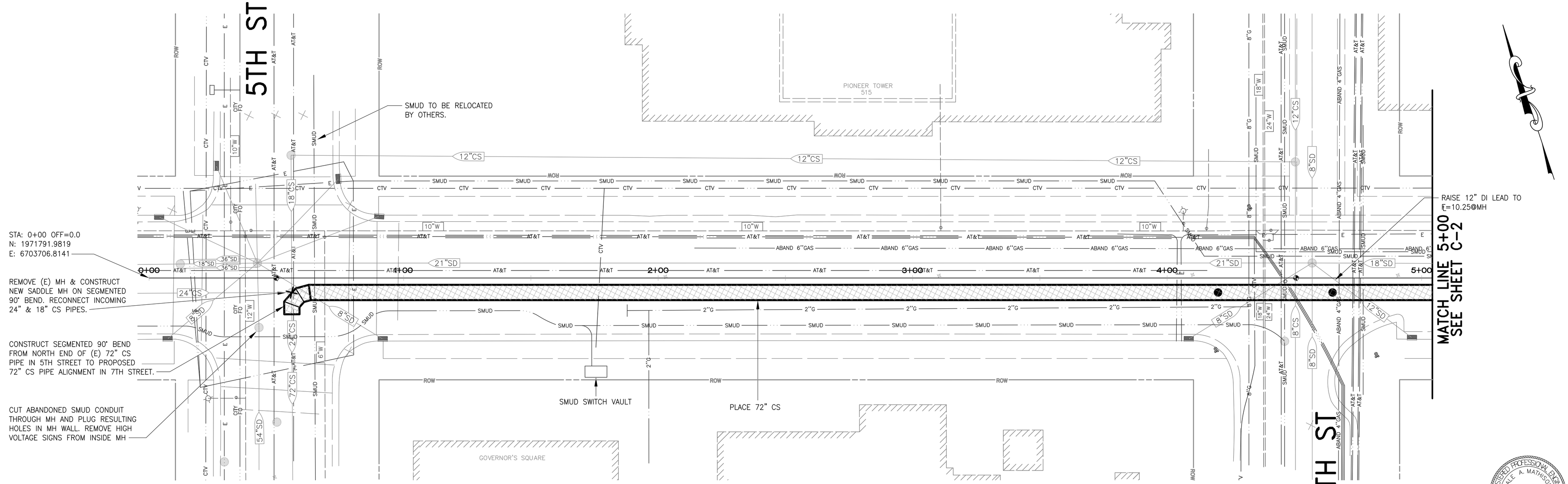
DRAWN BY: A. VELAZQUEZ DATE: DEC 2010
DESIGNED BY: DALE MATHISON R.C.E. NO. 62962 DATE: DEC 2010
CHECKED BY: R. BATHA R.C.E. NO. 67006 DATE: DEC 2010

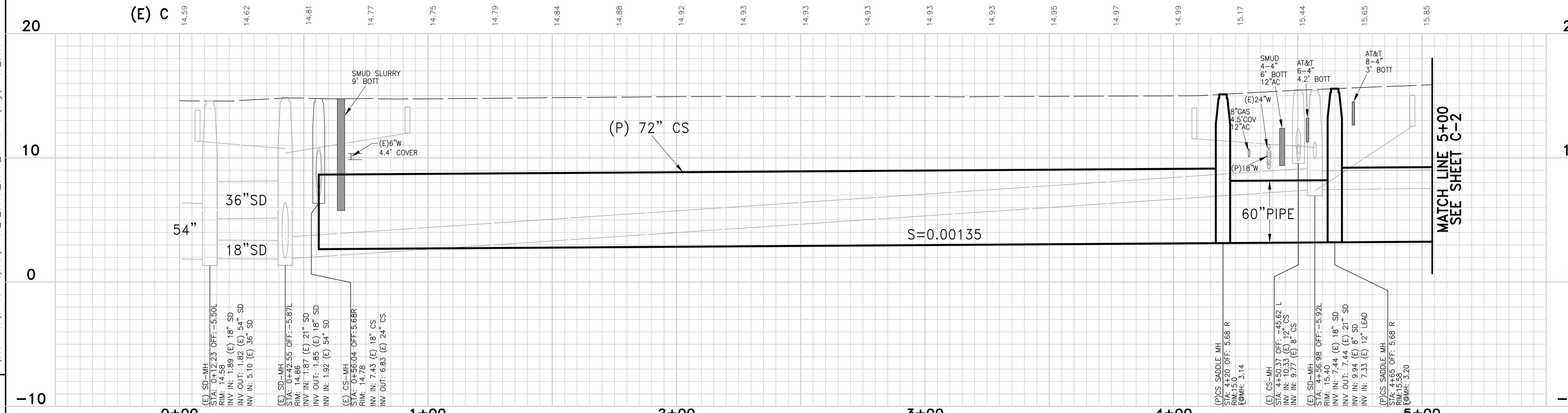
IMPROVEMENT PLANS FOR:
P STREET SEWER PROJECT
BETWEEN 5TH & 7TH STS
COVER

PLANNING NO. PN:X14010064
WATER DWG NO.
GIS GRID NO. DD13, DD14

DWG. NO. G-1
SHEET 1 OF 3

DRAFT





P ST SEWER PROJECT BETW 5TH & 7TH
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PN: 14457 P ST SEWER REPL 5TH TO 7TH STS

PN: X14010064

REVISIONS NO.	DESCRIPTION	DATE	BY

BENCH MARK ELEV. _____

FIELD BOOK 1460
SCALE: H: _____ V: _____
1"
ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

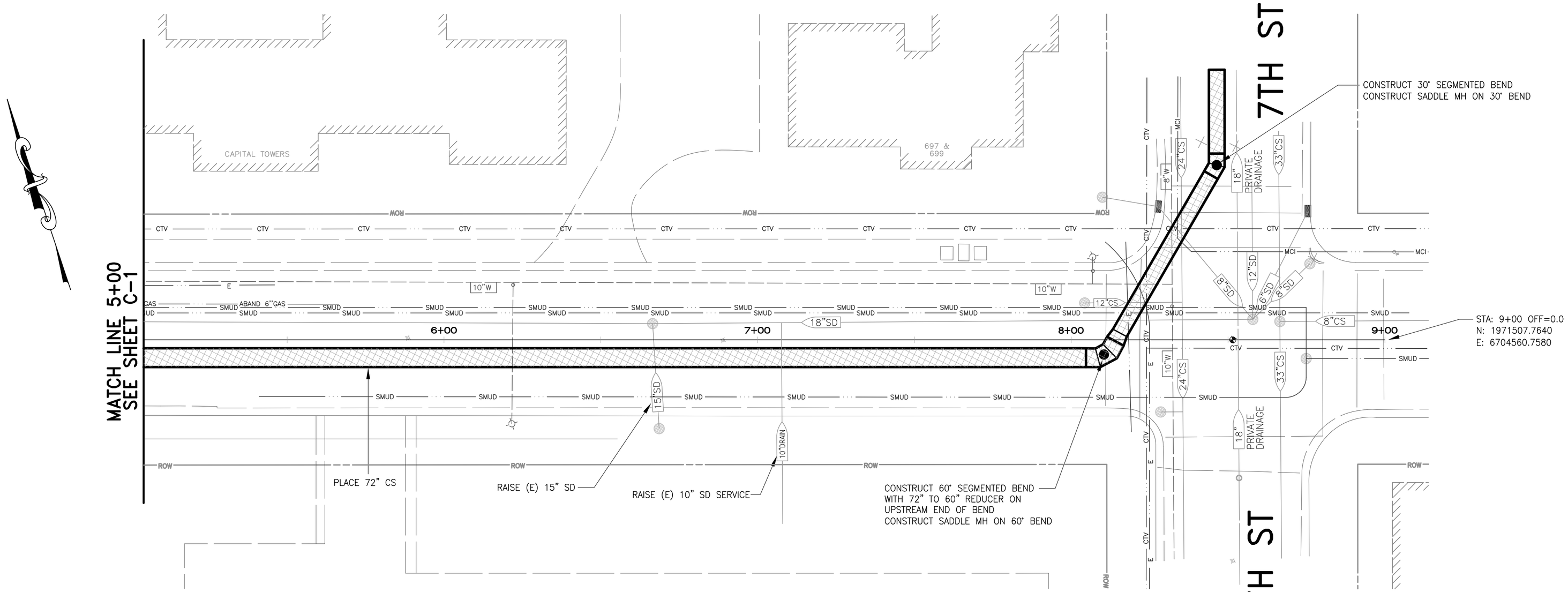
DRAWN BY: A. VELAZQUEZ DATE: DEC 2010
DESIGNED BY: DALE MATHISON R.C.E. NO. 62962 DATE: DEC 2010
CHECKED BY: R. BATHA R.C.E. NO. 67006 DATE: DEC 2010

IMPROVEMENT PLANS FOR:
P STREET SEWER PROJECT BETWEEN 5TH & 7TH STS STATION 0+00 TO STATION 5+00

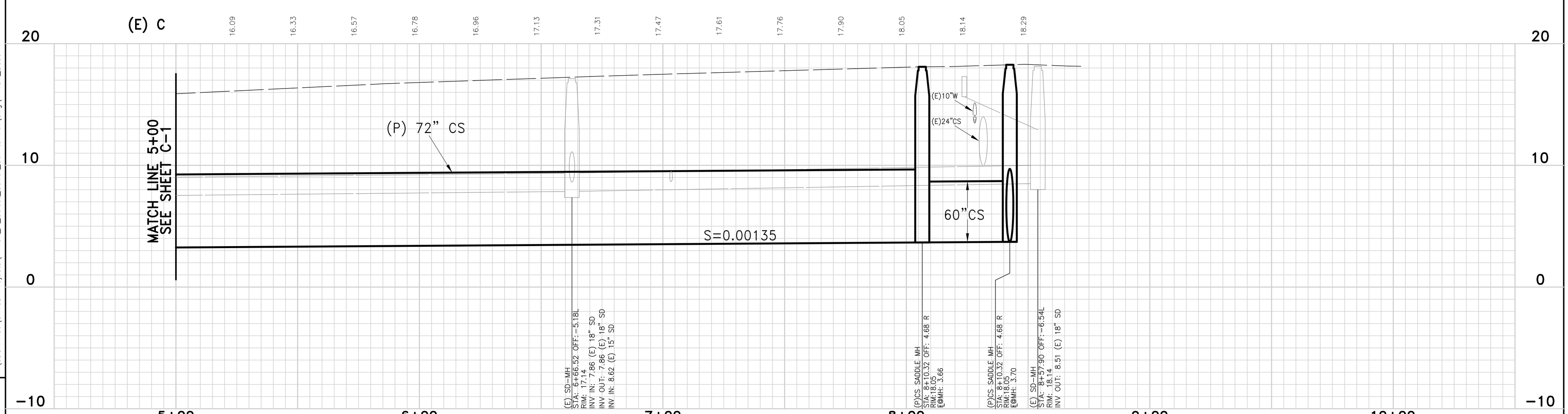
PLANNING NO. PN:X14010064
WATER DWG NO.
GIS GRID NO. DD13, DD14

DWG. NO. C-1
SHEET 2 OF X

DRAFT



P STREET



P ST SEWER PROJECT BETW 5TH & 7TH
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PN: 14457 P ST SEWER REPL 5TH TO 7H STS

PN: X14010064

REVISIONS NO.	DESCRIPTION	DATE	BY
1			
2			
3			
4			
5			

BENCH MARK ELEV. _____

FIELD BOOK 1460
SCALE: H:_____ V:_____
1" ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"

CITY OF SACRAMENTO
DEPARTMENT OF UTILITIES

DRAWN BY: A. VELAZQUEZ DATE: DEC 2010
DESIGNED BY: DALE MATHISON R.C.E. NO. 62962 DATE: DEC 2010
CHECKED BY: R. BATHA R.C.E. NO. 67006 DATE: DEC 2010

IMPROVEMENT PLANS FOR:
P STREET SEWER PROJECT
BETWEEN 5TH & 7TH STS
STATION 5+00 TO STATION 9+00

PLANNING NO. PN:X14010064
WATER DWG NO.
GIS GRID NO. DD13, DD14
DWG. NO. C-2
SHEET 3 OF X

California Sportfishing Protection Alliance Petition

Bill Jennings
California Sportfishing Protection Alliance
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Stockton, CA 95204
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Fax: 209-464-1028
E-mail: deltakeep@aol.com

Mike Jackson
Law Office of Mike Jackson
P.O. Box 207
429 W. Main Street
Quincy, CA 95971
Tel: 530-283-1007
Fax: 530-283-0712
E-mail: mjatty@sbcglobal.net

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Law Office of Andrew Packard
319 Pleasant Street
Petaluma, CA 94952
Tel: 707-763-7227
Fax: 707-763-9227
E-mail: andrew@packardlawoffices.com

For Petitioner California Sportfishing Protection Alliance

BEFORE THE STATE WATER RESOURCES CONTROL BOARD

In the Matter of Waste Discharge Requirements For City of Sacramento, Combined Wastewater Collection and Treatment System; California Regional Water Quality Control Board – Central Valley Region Order No. R5-2010-0004 NPDES No. CA0079111	**PETITION FOR REVIEW**

Pursuant to Section 13320 of California Water Code and Section 2050 of Title 23 of the California Code of Regulations (CCR), California Sportfishing Protection Alliance ("CSPA" or "petitioner") petitions the State Water Resources Control Board (State Board) to review and vacate the final decision of the California Regional Water Quality Control Board for the Central Valley Region ("Regional Board") in adopting Waste

Discharge Requirements (NPDES No. CA0079111) for City of Sacramento, Combined Wastewater Collection and Treatment System, on 28 January 2010. See Order No. R5-2010-0004. The issues raised in this petition were raised in timely written comments.

1. NAME AND ADDRESS OF THE PETITIONERS:

California Sportfishing Protection Alliance
3536 Rainier Avenue
Stockton, California 95204
Attention: Bill Jennings, Executive Director

2. THE SPECIFIC ACTION OR INACTION OF THE REGIONAL BOARD WHICH THE STATE BOARD IS REQUESTED TO REVIEW AND A COPY OF ANY ORDER OR RESOLUTION OF THE REGIONAL BOARD WHICH IS REFERRED TO IN THE PETITION:

Petitioner seeks review of Order No. R5-2010-0004, Waste Discharge Requirements (NPDES No. CA0079111) for the City of Sacramento, Combined Wastewater Collection and Treatment System. A copy of the adopted Order is attached as Attachment No. 1.

3. THE DATE ON WHICH THE REGIONAL BOARD ACTED OR REFUSED TO ACT OR ON WHICH THE REGIONAL BOARD WAS REQUESTED TO ACT:

28 January 2010

4. A FULL AND COMPLETE STATEMENT OF THE REASONS THE ACTION OR FAILURE TO ACT WAS INAPPROPRIATE OR IMPROPER:

CSPA submitted a detailed comment letter on 4 January 2010. That letter and the following comments set forth in detail the reasons and points and authorities why CSPA believes the Order fails to comport with statutory and regulatory requirements. The specific reasons the adopted Orders are improper are:

The City of Sacramento owns and operates a combined sewer system (CSS) that conveys domestic and commercial wastewater and storm water runoff from 7,510 acres (approximately 334 miles of sewer pipe) in downtown Sacramento, East Sacramento, and Land Park areas. The Discharger also owns and operates a separate sanitary sewer system that conveys domestic and commercial wastewater from 3,690 acres (approximately 566 miles of sewer pipe) from parts of the City surrounding the CSS to the north, east, and south. A portion of the flow from the separate sanitary sewer system flows into the CSS; the remainder flows by gravity or is pumped to the Regional Interceptors to the Sacramento Regional County Sanitation District's regional

wastewater treatment plant (SRWTP). The entire collection system serves approximately 300,000 people.

A. The City of Sacramento has established a Dismal Record of Compliance with the Clean Water Act and US EPA's Combined Sewer Overflow Policy.

On April 19th 1994 US EPA published (Federal Register (Vol. 59. No. 75)) a "Combined Sewer Overflow (CSO) Control Policy." The Policy requires that permittees with combined sewer systems (CSSs) that have CSOs should immediately undertake a process to accurately characterize their CSS and CSO discharges, demonstrate implementation of minimum technology-based controls identified in the Policy, and develop long-term CSO control plans which evaluate alternatives for attaining compliance with the CWA, including compliance with water quality standards and protection of designated uses. Once the long-term CSO control plans are completed, permittees will be responsible to implement the plans' recommendations as soon as practicable. Permittees with CSOs should submit appropriate documentation demonstrating implementation of nine minimum controls including any proposed schedules for completing minor construction activities. CSS permits must contain monitoring for compliance with water quality standards and a reopener clause authorizing the NPDES authority to reopen and modify the permit if it is determined that the CSO controls fail to meet water quality standards or protect designated uses. The nine minimum controls are:

1. Proper operation and regular maintenance programs for the sewer system and the CSUs;

2. Maximum use of the collection system for storage;

3. Review and modification of pretreatment requirements to assure CSO impacts are minimized;

4. Maximization of flow to the POTW for treatment;

5. Prohibition of CSOs during dry weather;

6. Control of solid and floatable materials in CSOs;

7. Pollution prevention:

8. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts, and

9. Monitoring to effectively characterize CSO impacts and the efficacy of CSO controls.

Beginning on page F-8 of the Permit is a Compliance Summary. The Compliance Summary is heavily reliant on a 13 December 2005 Final Draft Clean Water Act Compliance Evaluation Report prepared by US EPA. US EPA's report documented that the Discharger failed to comply with several of the USEPA CSO Control Policy Nine Minimum Controls, as specified in Attachment C to Order No. 5-01-258. USEPA found deficiencies in the City's programs and practices under control measure #1 (proper operations and maintenance), measure #2 (maximize use of the collection system for storage), measure #3 (pretreatment program), measure #6 (control solid and floatable material), measure #8 (public notification), and measure #9 (measuring the efficacy of CSO controls). Other findings by US EPA include:

- The Discharger had 10 CSO discharge events to the Sacramento River over the last 3 years. In storm year 2002/2003, the City exceeded the total suspended solids effluent limit at CSO Discharge Point No. 006.

- The Discharger's hydraulic model estimates that many parts of the CSS service area remain at risk for outflows and flooding from a 10-year storm. It is likely that outflows and flooding will result from smaller storms, but it not known how small of a storm will cause CSS outflows.

- The Discharger has not adequately documented its progress towards attaining the LTCP goals related to outflows and street flooding. It is not known how many CSS outflows have occurred or if outflows are decreased because the Discharger does not keep records of outflows.

- The Discharger has not identified all of the additional projects needed to meet the interim or final LTCP goals of controlling outflows resulting from 5-year and 10- year storms.

- The Discharger's spill response plan does not include adequate procedures for many important spill response activities.

- In fiscal year 2004/2005, the Discharger recorded 102 sewage spills totaling 7,435 gallons (these figures do not include the outflows on September 19, 2004).

- The Discharger does not have a program to regulate restaurant grease discharges to the sewer system. The Discharger has not evaluated what impact restaurant grease is having on the Discharger's sewer system.

- The Discharger lacks data on the condition of its sewers. Fiscal Year 2004/2005, when the Discharger inspected 31 miles of sewer pipes, was the first year that the Discharger

had an established procedure for documenting pipe condition findings.

- The Discharger has rehabilitated or replaced about 3 percent of its collection system over the last 10 to 20 years. At this rate, it will take several hundred years to renew the Discharger's sewer infrastructure compared to a useful life expectancy of about 100 years.

On 25 August 2008 the Regional Water Board issued a Record of Violations (ROV) to the Discharger for periodic violations of effluent limitations for chlorine residual, TSS, and pH for the period January 2001 through January 2008. On 10 November 2008 the Regional Water Board issued an Administrative Civil Liability Complaint (R5-2008-0609) based on the ROV.

Beginning on page F-12 of the Permit, Planned Changes, it is documented that: "The most recent City Utilities Capital Improvement Program (CIP) provides the projected expenditures for the CSS Improvement Plan (i.e., the July 1995 Combined Sewer System Improvement Plan) for 2008 through 2013. The CIP acknowledges the total cost for the CSS Improvement Plan is $132 million; the total budget for sewer programs for 2008/2009 was $4.1 million (which includes budgets for the combined system; however, it is uncertain what the total funding is specifically for the combined systems). The CIP also described $63.5 million in additional funding for the CSS Improvement Plan, including $10.5 million in federal grants and $53 million in loans from the State Revolving Fund. Finally, the CIP budget includes additional funding for the Combined System Improvement Plan Update."

B. The Combined Sewer Overflows from the City of Sacramento degrade the Beneficial Uses of the Sacramento River and Exceed Water Quality Standards contrary to US EPA's Combined Sewer Overflow Control Policy.

The Permit, page 6 states that: "According to the CSO Control Policy, a permittee is required to develop and implement a long-term CSO control plan which evaluates alternatives for attaining compliance with the CWA, including compliance with applicable water quality standards and protection of designated uses. It further states that once long-term CSO control plans are completed, permittees are responsible for implementing the plan to ensure compliance with applicable water quality standards."

The Permit identifies the designated beneficial uses of the Sacramento river as Municipal and domestic supply (MUN); agricultural supply, including stock watering (AGR); industrial process (PROC) and service supply (IND); water contact recreation (REC-1); non-contact water recreation (REC-2); warm freshwater aquatic habitat (WARM), cold freshwater aquatic habitat (COLD); warm migration, cold migration (MIGR); warm spawning habitat (SPWN), wildlife habitat (WILD); and navigation (NAV).

The Permit contains a summary, Table F-7, of toxic pollutant monitoring for storm water years 2002 through 2008 for dissolved copper, lead, zinc and the pesticides diazinon, chlorpyrifos and diuron.

- The discharge is toxic to aquatic life.

    - Dissolved copper was sampled in the discharge at a maximum of 99 ug/l (at discharge point 002), 22 ug/l (at discharge point 006) and 13 ug/l (at discharge points 004 and 005). The water quality standard for copper to protect aquatic life is 5.0 ug/l, assuming a hardness of 50 mg/l. The discharge clearly exceeds toxic levels.

    - Dissolved lead was sampled in the discharge at a maximum of 5.1 ug/l (at discharge point 006). The water quality standard for lead is 1.8 ug/l assuming a hardness of 50 mg/l. The discharge clearly exceeds toxic levels.

        - The minimum detection levels for sampling of lead was 5.0 ug/l which exceeds the toxic standard of 1.8. The discharge could have exceeded toxic levels at the other discharge points but would not be documented due to the elevated detection levels.

    - Dissolved zinc was sampled in the discharge at a maximum of 360 ug/l (at discharge point 002) and 200 ug/l (at discharge point 006). The water quality standard for zinc to protect aquatic life is 65.7.0 ug/l, assuming a hardness of 50 mg/l. The discharge clearly exceeds toxic levels.

    - The pesticide diuron was detected at 4.1 (at discharge point 002) and 1.8 ug/l (at discharge point 006). The Basin Plan water quality objective is for non-detectable concentrations.

        - The documented discharge of diuron exceeds the Permit Receiving Water Limitation, No. 9 for Pesticides which prohibits total identifiable persistent chlorinated hydrocarbon pesticides to be present in the water column at concentrations detectable within the accuracy of analytical methods approved by USEPA or the Executive Officer

    - The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP) exempts combined sewer systems from compliance with the California Toxics Rule (CTR). The CTR contains water quality standards, many of which are for toxic pollutants. Copper, lead and zinc are CTR regulated constituents. Although the SIP exempts the

discharge from compliance with the CTR, the discharge may not degrade the aquatic life beneficial uses and cause toxicity. Section 122.44(d) of 40 CFR requires that permits include water quality-based effluent limitations (WQBELs) to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water. The Permit must contain effluent Limitations for copper, lead, zinc and pesticides.

- The discharge of toxic constituents in toxic concentrations exceeds the Permit Receiving Water Limitation, No. 16 for Toxicity which prohibits the discharge of toxic substances to be present, individually or in combination, in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.

- The CTR contains a long list of toxic pollutants that are common to wastewater discharges. The City of Sacramento has apparently not, and has not been required to, characterized the discharge for other toxic constituents that are common to wastewater discharges. Although exempted by the SIP for compliance with CTR toxic water quality standards, the toxic standards are applicable if the discharge is toxic to aquatic life. The Permit does not contain sufficient information regarding potential toxic pollutants to adequately regulate the discharge.

- The Regional Board is "uncertain" whether the discharge is toxic and therefore cannot state that the aquatic life beneficial use of the Sacramento River is protected. The Permit states that: "The Basin Plan contains a narrative toxicity objective that states, "All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life." (Basin Plan at page III-8.00) The Basin Plan also states that, "…effluent limits based upon acute biotoxicity tests of effluents will be prescribed where appropriate…". USEPA Region 9 provided guidance for the development of acute toxicity effluent limitations in the absence of numeric water quality objectives for toxicity in its document titled "Guidance for NPDES Permit Issuance", dated February 1994. In section B.2. "Toxicity Requirements" (pgs. 14-15) it states that, "In the absence of specific numeric water quality objectives for acute and chronic toxicity, the narrative criterion 'no toxics in toxic amounts' applies. Achievement of the narrative criterion, as applied herein, means that ambient waters shall not demonstrate for acute toxicity: 1) less than 90% survival, 50% of the time, based on the monthly median, or 2) less than 70% survival, 10% of the time, based on any monthly median. For chronic toxicity, ambient waters shall not demonstrate a test result of greater than 1 TUc." No WET data exists for any of the CSO discharges from the Facility. Therefore, it is uncertain whether

reasonable potential exists to exceed the Basin Plan narrative toxicity objective. Also due to the short-term, periodic nature of the discharges, the Regional Water Board is primarily concerned with the potential short-term, acute, toxicity in the CSO discharges. As part of the CSO Water Quality Assessment required in Section VI.C.2.a. of the Order, the Discharger will propose and implement a monitoring plan that will include an appropriate schedule for WET monitoring to assess the potential for the CSO discharges to exceed the narrative toxicity objective." (Emphasis added)

- Ammonia is present in domestic wastewater. The City of Sacramento's wastewater system contains no means of removing ammonia. Ammonia is toxic to aquatic life. Ammonia concentrations will be diluted by the stormwater in the combined system. However, the Regional Board has no knowledge whether ammonia is present in the discharge at toxic concentrations. It is reasonable to assume that ammonia concentrations in the discharge will be present exceeding toxic levels. The Permit fails to protect the aquatic life beneficial use of the receiving water by failing to include an effluent Limitation for ammonia.

- The Permit contains Effluent Limitations for fecal coliform organisms that are not protective of the contact recreational (REC-1) beneficial uses of the Sacramento River. The Permit contains Effluent Limitation for:

> "d. Fecal Coliform Organisms. Effluent total coliform organisms shall not exceed: i. 1,000 MPN/100 mL in any three consecutive samples; and ii. 200 MPN/100 mL, as a storm year (1 October through 30 September) median."

Since the title "fecal coliform organisms" conflicts with the following sentence for "total coliform organisms" it is assumed that the title is correct and the intent is to regulate fecal coliform organisms.

There is no technical basis for the Permit bacteria (coliform organisms) limitation. The Basin Plan contains a water quality standard for Bacteria of: "In waters designated for contact recreation (REC-1),the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed 400/100 ml." The Permit limitation is significantly less stringent that the Basin Plan water quality objective.

The Basin Plan bacteria objective was based on the coliform water quality index used during a USPHS epidemiological study that was translated into a fecal coliform index in

the mid- '60s by using the ratio of fecal coliforms to total coliforms at the location on the Ohio River where the original study had been conducted in 1949. In 1986 US EPA developed (EPA 440/5-86-001) Quality Criteria for Water. EPA's evaluation of the bacteriological data indicated that using the fecal coliform indicator group at the maximum geometric mean of 200 per 100 ml, recommended in Quality Criteria for water would cause an estimated 8 illnesses per 1,000 swimmers at freshwater beaches. EPA then recommended that: "Based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period), the geometric mean of the indicated bacterial densities should not exceed one or the other of the following:(') E. coli 126 per 100 ml; or enterococci 33 per 100 ml; no sample should exceed a one sided confidence limit (C.L.) calculated using the following as guidance: designated bathing beach 75% C.L., moderate use for bathing 82% C.L., light use for bathing 90% C.L. infrequent use for bathing 95% C.L., based on a site-specific log standard deviation, or if site data are insufficient to establish a log standard deviation, then using 0.4 as the log standard deviation for both indicators." The US EPA criteria were not based on sewage discharges.

The California Department of Public Health (DPH) has developed reclamation criteria, California Code of Regulations, Title 22, Division 4, Chapter 3 (Title 22), for the reuse of wastewater. Title 22 requires that for recreational impoundments, spray irrigation of food crops, parks, playgrounds, schoolyards, and other areas of similar public access, wastewater be adequately disinfected, oxidized, coagulated, clarified, and filtered, and that the effluent total coliform levels not exceed 2.2 MPN/100 ml as a 7-day median. Title 22 specifically requires that recycled water used as a source of water supply for nonrestricted recreational impoundments be disinfected tertiary recycled water that has been subjected to conventional treatment. A nonrestricted recreational impoundment is defined as "…an impoundment of recycled water, in which no limitations are imposed on body-contact water recreational activities." Title 22 is not directly applicable to surface waters; however, an equivalent level of treatment to that required by DHS's reclamation criteria because would be necessary to protect the non-restricted recreational use of the Sacramento River. The science behind DPH's is to protect contact recreation uses regardless of whether discharging to the Sacramento River or another recreational impoundment. The Permit limitation for coliform organisms is not protective of the contact recreational (REC-1) beneficial use of the receiving stream.

- The Permit contains an erroneous statement that the effluent Limitations for coliform organisms are protective of the municipal (MUN) beneficial use of the Sacramento River. Pages F-30 and F-31 discuss pathogens with regard to protecting beneficial uses, stating that: "Because CSO discharges typically occur for relatively short durations and only during extreme storm events, it is unlikely that recreational activities will occur

concurrently with the CSO discharges. However, protection of the MUN use will be provided by carrying over the existing effluent limitations and discharge requirements to control the discharge of coliform bacteria. These coliform limits are imposed to protect the beneficial uses of the receiving water. These effluent limitations will apply to the Pioneer Reservoir and CWTP discharge points." The letter cited by the Regional Board from DPH regarding 20-to-1 dilution only applies to contact recreation and irrigation of food crops. Despite the Regional Board's contention, there is no recommendation presented by the DPH regarding what level of pathogens from wastewater treatment plants will protect the municipal (MUN) beneficial use of the Sacramento River. The discharge of primary treated sewage is not equivalent to secondary treated wastewater and any recommendation by DPH regarding protection of recreational and irrigation uses does not apply to drinking water. There is no information in the Permit that the drinking water beneficial use is protected.

Also with regard to drinking water uses: "The Basin Plan states that material and relevant information, including numeric criteria, and recommendations from other agencies and scientific literature will be utilized in evaluating compliance with the narrative toxicity objective. The narrative chemical constituents objective states that waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, "…water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs)" in Title 22 of CCR." The Permit does not contain an assessment of drinking water maximum contaminant levels to show that the drinking water beneficial use of the Sacramento River is protected.

- There is no information in the Permit regarding constituents of concern, such as salts or boron, regarding the irrigated agricultural beneficial of the Sacramento River. Absent any data the Regional Board cannot conclude that the agricultural beneficial use is protected.

C. The Sacramento River is 303(d) listed (impaired) for unknown toxicity. As cited above copper, lead, zinc and pesticides were sampled above toxic levels. The Permit cites that WET sampling has not been conducted and the Regional Board "is uncertain" whether reasonable potential exists for the discharge to exceed the Basin Plan water quality objective for toxicity. The discharge at a minimum contributes to the unknown toxicity in the Sacramento River.

D. The Permit contains an inadequate antidegradation analysis that does not comply with the requirements of Section 101(a) of the Clean Water Act, Federal Regulations 40 CFR § 131.12, the State Board's Antidegradation Policy (Resolution 68-16) and California Water Code (CWC) Sections 13146 and 13247.

The construction of each and any new structure within the service area brings additional domestic wastewater flow. Each expansion of impermeable surfaces brings more stormwater flow. Therefore it can be concluded that the flows are continuously expanding. The Permit has no flow limitation. Contrary to this, the Permit Fact Sheet states that: "4. Satisfaction of Antidegradation Policy, This Order does not allow for an increase in flow or mass of pollutants to the receiving water. Therefore, a complete antidegradation analysis is not necessary." The Regional Board has no record of flow rate or mass of discharges from the City of Sacramento combined sewer system. The Regional Board assessment that flows are not increasing is not based on substance and contrary to the fact that Sacramento is a growing community. The Permit contains no antidegradation analysis.

CWC Sections 13146 and 13247 require that the Board in carrying out activities which affect water quality shall comply with state policy for water quality control unless otherwise directed by statute, in which case they shall indicate to the State Board in writing their authority for not complying with such policy. The State Board has adopted the Antidegradation Policy (Resolution 68-16), which the Regional Board has incorporated into its Basin Plan. The Regional Board is required by the CWC to comply with the Antidegradation Policy.

Section 101(a) of the Clean Water Act (CWA), the basis for the antidegradation policy, states that the objective of the Act is to "restore and maintain the chemical, biological and physical integrity of the nation's waters." Section 303(d)(4) of the CWA carries this further, referring explicitly to the need for states to satisfy the antidegradation regulations at 40 CFR § 131.12 before taking action to lower water quality. These regulations (40 CFR § 131.12(a)) describe the federal antidegradation policy and dictate that states must adopt both a policy at least as stringent as the federal policy as well as implementing procedures.

California's antidegradation policy is composed of both the federal antidegradation policy and the State Board's Resolution 68-16 (State Water Resources Control Board, Water Quality Order 86-17, p. 20 (1986) ("Order 86-17); Memorandum from Chief Counsel William Attwater, SWRCB to Regional Board Executive Officers, "federal Antidegradation Policy," pp. 2, 18 (Oct. 7, 1987) ("State Antidegradation Guidance")). As a state policy, with inclusion in the Water Quality Control Plan (Basin Plan), the antidegradation policy is binding on all of the Regional Boards (Water Quality Order 86-17, pp. 17-18).

Implementation of the state's antidegradation policy is guided by the State Antidegradation Guidance, SWRCB Administrative Procedures Update 90-004, 2 July 1990 ("APU 90-004") and USEPA Region IX, "Guidance on Implementing the Antidegradation Provisions of 40 CFR 131.12" (3 June 1987) (" Region IX Guidance"), as well as Water Quality Order 86-17.

The Regional Board must apply the antidegradation policy whenever it takes an action that will lower water quality (State Antidegradation Guidance, pp. 3, 5, 18, and Region IX Guidance, p. 1). Application of the policy does not depend on whether the action will actually impair beneficial uses (State Antidegradation Guidance, p. 6). Actions that trigger use of the antidegradation policy include issuance, re-issuance, and modification of NPDES and Section 404 permits and waste discharge requirements, waiver of waste discharge requirements, issuance of variances, relocation of discharges, issuance of cleanup and abatement orders, increases in discharges due to industrial production and/or municipal growth and/other sources, exceptions from otherwise applicable water quality objectives, etc. (State Antidegradation Guidance, pp. 7-10, Region IX Guidance, pp. 2-3). Both the state and federal policies apply to point and nonpoint source pollution (State Antidegradation Guidance p. 6, Region IX Guidance, p. 4).

The federal antidegradation regulations delineate three tiers of protection for waterbodies. Tier 1, described in 40 CFR § 131.12(a)(1), is the floor for protection of all waters of the United States (48 Fed. Reg. 51400, 51403 (8 Nov. 1983); Region IX Guidance, pp. 1-2; APU 90-004, pp. 11-12). It states that "[e]xisting instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." Uses are "existing" if they were actually attained in the water body on or after November 28, 1975, or if the water quality is suitable to allow the use to occur, regardless of whether the use was actually designated (40 CFR § 131.3(e)). Tier 1 protections apply even to those waters already impacted by pollution and identified as impaired. In other words, already impaired waters cannot be further impaired.

Tier 2 waters are provided additional protections against unnecessary degradation in places where the levels of water quality are better than necessary to support existing uses. Tier 2 protections strictly prohibit degradation unless the state finds that a degrading activity is: 1) necessary to accommodate important economic or social development in the area, 2) water quality is adequate to protect and maintain existing beneficial uses and 3) the highest statutory and regulatory requirements and best management practices for pollution control are achieved (40 CFR § 131.12(a) (2)). Cost savings to a discharger alone, absent a demonstration by the project proponent as to how these savings are "necessary to accommodate important economic or social development in the area," are not adequate justification for allowing reductions in water quality (Water Quality Order 86-17, p. 22; State Antidegradation Guidance, p. 13). If the waterbody passes this test and the degradation is allowed, degradation must not impair existing uses of the waterbody (48 Fed. Reg. 51403). Virtually all waterbodies in California may be Tier 2 waters since the state, like most states, applies the antidegradation policy on a parameter-by-parameter basis, rather than on a waterbody basis (APU 90-004, p. 4). Consequently, a request to discharge a particular chemical to a river, whose level of that chemical was better than the state standards, would trigger a Tier 2 antidegradation review even if the river was already impaired by other chemicals.

Tier 3 of the federal antidegradation policy states "[w]here high quality waters constitute an outstanding national resource, such as waters of national and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water shall be maintained and protected (40 CFR § 131.12(a)(3)). These Outstanding National Resource Waters (ONRW) are designated either because of their high quality or because they are important for another reason (48 Fed. Reg. 51403; State Antidegradation Guidance, p. 15). No degradation of water quality is allowed in these waters other than short-term, temporary changes (Id.). Accordingly, no new or increased discharges are allowed in either ONRW or tributaries to ONRW that would result in lower water quality in the ONRW (EPA Handbook, p. 4-10; State Antidegradation Guidance, p. 15). Existing antidegradation policy already dictates that if a waterbody "should be" an ONRW, or "if it can be argued that the waterbody in question deserves the same treatment [as a formally designated ONRW]," then it must be treated as such, regardless of formal designation (State Antidegradation Guidance, pp. 15-16; APU 90-004, p. 4). Thus the Regional Board is required in each antidegradation analysis to consider whether the waterbody at issue should be treated as an ONRW. It should be reiterated that waters cannot be excluded from consideration as an ONRW simply because they are already "impaired" by some constituents. By definition, waters may be "outstanding" not only because of pristine quality, but also because of recreational significance, ecological significance or other reasons (40 CFR §131.12(a)(3)). Waters need not be "high quality" for every parameter to be an ONRW (APU 90-004, p. 4). For example, Lake Tahoe is on the 303(d) list due to sediments/siltation and nutrients, and Mono Lake is listed for salinity/TDC/chlorides but both are listed as ONRW.

The State Board's APU 90-004 specifies guidance to the Regional Boards for implementing the state and federal antidegradation policies and guidance. The guidance establishes a two-tiered process for addressing these policies and sets forth two levels of analysis: a simple analysis and a complete analysis. A simple analysis may be employed where a Regional Board determines that: 1) a reduction in water quality will be spatially localized or limited with respect to the waterbody, e.g. confined to the mixing zone; 2) a reduction in water quality is temporally limited; 3) a proposed action will produce minor effects which will not result in a significant reduction of water quality; and 4) a proposed activity has been approved in a General Plan and has been adequately subjected to the environmental and economic analysis required in an EIR. A complete antidegradation analysis is required if discharges would result in: 1) a substantial increase in mass emissions of a constituent; or 2) significant mortality, growth impairment, or reproductive impairment of resident species. Regional Boards are advised to apply stricter scrutiny to non-threshold constituents, i.e., carcinogens and other constituents that are deemed to present a risk of source magnitude at all non-zero concentrations. If a Regional Board cannot find that the above determinations can be reached, a complete analysis is required.

Even a minimal antidegradation analysis would require an examination of: 1) existing applicable water quality standards; 2) ambient conditions in receiving waters compared to standards; 3)

incremental changes in constituent loading, both concentration and mass; 4) treatability; 5) best practicable treatment and control (BPTC); 6) comparison of the proposed increased loadings relative to other sources; 7) an assessment of the significance of changes in ambient water quality and 8) whether the waterbody was a ONRW. A minimal antidegradation analysis must also analyze whether: 1) such degradation is consistent with the maximum benefit to the people of the state; 2) the activity is necessary to accommodate important economic or social development in the area; 3) the highest statutory and regulatory requirements and best management practices for pollution control are achieved; and 4) resulting water quality is adequate to protect and maintain existing beneficial uses. A BPTC technology analysis must be done on an individual constituent basis.

Any antidegradation analysis must comport with implementation requirements in State Board Water Quality Order 86-17, State Antidegradation Guidance, APU 90-004 and Region IX Guidance. The conclusory, unsupported, undocumented statements in the Permit are no substitute for a defensible antidegradation analysis.

The antidegradation review process is especially important in the context of waters protected by Tier 2. See EPA, Office of Water Quality Regulations and Standards, Water Quality Standards Handbook, 2nd ed. Chapter 4 (2nd ed. Aug. 1994). Whenever a person proposes an activity that may degrade a water protected by Tier 2, the antidegradation regulation requires a state to: (1) determine whether the degradation is "necessary to accommodate important economic or social development in the area in which the waters are located"; (2) consider less-degrading alternatives; (3) ensure that the best available pollution control measures are used to limit degradation; and (4) guarantee that, if water quality is lowered, existing uses will be fully protected. 40 CFR § 131.12(a)(2); EPA, Office of Water Quality Regulations and Standards, Water Quality Standards Handbook, 2nd ed. 4-1, 4-7 (2nd ed. Aug. 1994). These activity-specific determinations necessarily require that each activity be considered individually.

For example, the APU 90-004 states:

> "Factors that should be considered when determining whether the discharge is necessary to accommodate social or economic development and is consistent with maximum public benefit include: a) past, present, and probably beneficial uses of the water, b) economic and social costs, tangible and intangible, of the proposed discharge compared to benefits. The economic impacts to be considered are those incurred in order to maintain existing water quality. The financial impact analysis should focus on the ability of the facility to pay for the necessary treatment. The ability to pay depends on the facility's source of funds. In addition to demonstrating a financial impact on the publicly – or privately – owned facility, the analysis must show a significant adverse impact on the community. The long-term and short-term socioeconomic impacts of maintaining existing water quality must be considered. Examples of social and economic parameters that could be

> affected are employment, housing, community services, income, tax revenues and land value. To accurately assess the impact of the proposed project, the projected baseline socioeconomic profile of the affected community without the project should be compared to the projected profile with the project…EPA's Water Quality Standards Handbook (Chapter 5) provides additional guidance in assessing financial and socioeconomic impacts"

There is nothing resembling an economic or socioeconomic analysis in the Permit. There are viable alternatives that have never been analyzed. The evaluation contains no comparative costs. As a rule-of-thumb, USEPA recommends that the cost of compliance should not be considered excessive until it consumes more than 2% of disposable household income in the region. This threshold is meant to suggest more of a floor than a ceiling when evaluating economic impact. In the Water Quality Standards Handbook, USEPA interprets the phrase "necessary to accommodate important economic or social development" with the phrase "substantial and widespread economic and social impact."

The antidegradation analysis must discuss the relative economic burden as an aggregate impact across the entire region using macroeconomics. Considering the intrinsic value of the Delta to the entire state and the potential effects upon those who rely and use Delta waters, it must also evaluate the economic and social impacts to water supply, recreation, fisheries, etc. from the Discharger's degradation of water quality in the Delta. Nor has the case been made that there is no alternative for necessary housing other than placing it where its wastewater must discharge directly into sensitive but seriously degraded waters. It is unfortunate that the agency charged with implementing the Clean Water Act has apparently decided it is more important to protect the polluter than the environment.

There is nothing in the Permit resembling an alternatives analysis evaluating less damaging and degrading alternatives. Unfortunately, the Permit fails to evaluate and discuss why there is no alternative other than discharging to surface waters. Other communities have successfully disposed of wastes without discharging additional pollutants to degraded rivers. A proper alternatives analysis would cost out various alternatives and compare each of the alternatives' impacts on beneficial uses.

There is nothing resembling an analysis buttressing the unsupported claim that BPTC is being provided. An increasing number of wastewater treatment plants around the country and state are employing reverse-osmosis (RO), or even RO-plus. Clearly, micro or nano filtration can be considered BPTC for wastewater discharges of impairing pollutants into critically sensitive ecological areas containing listed species that are already suffering serious degradation. The City does not meet the federally mandated minimum secondary level of treatment. If this is not the case, the antidegradation analysis must explicitly detail how and why a primary treatment system that facilitate increased mass loadings of impairing constituents can be considered BPTC.

There is nothing in the Permit resembling an analysis that ensures that existing beneficial uses are protected. While the Permit identifies the constituents that are included on the 303(d) list as impairing receiving waters, it fails to discuss how and to what degree the identified beneficial uses will be additionally impacted by the discharge. Nor does the Permit analyze the incremental and cumulative impact of increased loading of non-impairing pollutants on beneficial uses. In fact, there is almost no information or discussion on the composition and health of the identified beneficial uses. Any reasonably adequate antidegradation analysis must discuss the affected beneficial uses (i.e., numbers and health of the aquatic ecosystem; extent, composition and viability of agricultural production; people depending upon these waters for water supply; extent of recreational activity; etc.) and the probable effect the discharge will have on these uses.

Alternatively, Tier 1 requires that existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected. By definition, any increase in the discharge of impairing pollutants to impaired waterways unreasonably degrades beneficial uses and exceeds applicable water quality standards. Prohibition of additional mass loading of impairing pollutants is a necessary stabilization precursor to any successful effort in bringing an impaired waterbody into compliance.

The State Board has clearly articulated its position on increased mass loading of impairing pollutants. In Order WQ 90-05, the Board directed the San Francisco Regional Board on the appropriate method for establishing mass-based limits that comply with state and federal antidegradation policies. That 1990 order stated "[I]n order to comply with the federal antidegradation policy, the mass loading limits should also be revised, based on mean loading, concurrently with the adoption of revised effluent limits. The [mass] limits should be calculated by multiplying the [previous year's] annual mean effluent concentration by the [four previous year's] annual average flow (Order WQ 90-05, p. 78). USEPA points out, in its 12 November 1999 objection letter to the San Francisco Regional Board concerning Tosco's Avon refinery, that '[a]ny increase in loading of a pollutant to a water body that is impaired because of that pollutant would presumably degrade water quality in violation of the applicable antidegradation policy."

Any project that allows a single new community to artificially minimize waste management costs by externalizing the disposal of wastes to already degraded waterways that are part of the common property right of all 36 million Californians has not met the test of "maximum benefit of the people of the State" and cannot be consistent with state and federal antidegradation policies. The continued pollutant mass loading will inescapably and detrimentally affect aquatic life, contribute to violations of water quality standards and increase the risks and costs to the millions of people who depend upon the Delta for their drinking/irrigation/recreation water. Any increase housing and/or economic expansion facilitated by the Permit will be at the expense of

other communities that will incur the consequences of larger load reductions when TMDL load allocations are instituted.

The antidegradation analysis in the Permit is not simply deficient, it is literally nonexistent. NPDES permits must include any more stringent effluent limitation necessary to implement the Regional Board Basin Plan (Water Code 13377). The Permit fails to properly implement the Basin Plan's Antidegradation Policy.

E. The Permit requires:

"B. Notification Requirements

1. For any CSS outflow that results in a discharge to a drainage channel or a surface water, the Discharger shall, as soon as possible, but not later than two (2) hours after becoming aware of the discharge, notify CALEMA, the local health officer or directors of environmental health with jurisdiction over affected water bodies, and the Regional Water Board.

2. As soon as possible, but no later than twenty-four (24) hours after becoming aware of a CSS outflow that results in a discharge to a drainage channel or a surface water, the Discharger shall submit to the appropriate Regional Water Quality Control Board a certification that CALEMA and the local health officer or directors of environmental health with jurisdiction over the affected water bodies have been notified of the discharge."

The eighth of US EPA's nine minimum controls is that: "8. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts." The Permit requirements do not inform the <u>public</u>. The City should be required to post the Sacramento River at all public access points and inform local TV and radio station for all discharges to surface waters from their system. The Permit was revised by late revision to require that the City "consider" but not requiring notifying the public.

F. The Permit does not comply with water quality standards and objectives contained in the Basin Plan.

Bacteria

In waters designated for contact recreation (REC-1), the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed 400/100 ml. The Permit limitation for fecal coliform organisms is significantly less stringent than the Basin Plan water quality objective for bacteria.

Biostimulatory Substances

Water shall not contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses. The discharge contains significant concentrations of ammonia. Ammonia and its conversion to other forms of nitrogen may reasonably contribute to unacceptable aquatic growths. Phosphorus levels are also known to be elevated in domestic wastewater and are not assessed in the Permit.

Chemical Constituents

Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in the following provisions of Title 22 of the California Code of Regulations, which are incorporated by reference into this plan: Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431, Table 64444-A (Organic Chemicals) of Section 64444, and Tables 64449-A (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits) and 64449-B (Secondary Maximum Contaminant Levels-Ranges) of Section 64449. The City of Sacramento's wastewater discharge may reasonably contain constituents contained in Title 22 at concentrations exceeding MCLs. The Permit contains no analysis of compliance with drinking water MCLs.

Color

Water shall be free of discoloration that causes nuisance or adversely affects beneficial uses. Sewage and the associated industrial constituents may discolor the Sacramento River. Title 22 contains an MCL for color. The Permit contains no assessment of whether the CSO discharges exceed the MCL for color.

Dissolved Oxygen

Within the legal boundaries of the Delta, the dissolved oxygen concentration shall not be reduced below: 7.0 mg/l in the Sacramento River (below the I Street Bridge) and in all Delta waters west of the Antioch Bridge; 6.0 mg/l in the San Joaquin River (between Turner Cut and Stockton, 1 September through 30 November); and 5.0 mg/l in all other Delta waters except for those bodies of water which are constructed for special purposes and from which fish have been excluded or where the fishery is not important as a beneficial use. The discharge of raw or primary treated sewage contains oxygen demanding substances such as BOD and ammonia. There is no analysis or assessment of whether the discharge of raw or primary treated wastewater from the City of Sacramento causes a dissolved oxygen sag below 7.0 mg/l.

Floating Material

Water shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses. With regard to the US EPA Findings that the City failed to adequately regulate

grease discharges, the Permit states that: "The Discharger claimed that this finding is incorrect as the City did participate in a regional study that concluded that regulation of restaurants was unnecessary. The Discharger has since implemented an outreach program for the community and restaurants. The Permit fails to recognize the site specific characteristics of oil and grease discharges and that the "requirement" to install grease traps in restaurants is commonplace. An "outreach" program does not "regulate" grease discharges.

The City of Sacramento has not undertaken an acceptable oil and grease control program. Monitoring at other local wastewater treatment plants, which likely provide a minimum of secondary treatment, is not validation of the absence of oil and grease in the raw or primary treated wastewater discharges from the City. Floating material, by definition will be at the top of the water column. Sampling for oil and grease should be conducted at the top of the water column.

G. The Permit does not require maximization of flows to the wastewater treatment plant for treatment.

The fourth of US EPA's nine minimum controls requires maximization of flow to the POTW for treatment. As is stated above; a portion of the flow from the separate sanitary sewer system flows into the CSS; the remainder flows by gravity or is pumped to the Regional Interceptors to the Sacramento Regional County Sanitation District's regional wastewater treatment plant (SRWTP). Combined sewer systems are not exempt from the requirements of the Clean water Act. Combined sewer systems are known to discharge inadequately treated sewage to surface waters as "combined system overflows" during wet weather. US EPA's Combined Sewer Overflow Policy has the goal of eliminating sewer system overflows and compliance with the CWA. Adding flows from the separate sewer system will only contribute to excessive flows in the combined system and result in additional overflows. The Permit does not discuss why the separate sewer system is allowed to be discharged into the combined sewer system.

H. The Permit fails to contain adequate effluent Limitation to protect the beneficial uses of the Sacramento River.

Permit Finding No. G. states that:

> "Water Quality-Based Effluent Limitations (WQBELs). Section 301(b) of the CWA and 40 CFR 122.44(d) require that permits include limitations more stringent than applicable federal technology-based requirements where necessary to achieve applicable water quality standards. 40 CFR 122.44(d)(1)(i) mandates that permits include effluent limitations for all pollutants that are or may be discharged at levels that have the reasonable potential to cause or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard. Where reasonable potential

> has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELs must be established using: (1) USEPA criteria guidance under CWA section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information, as provided in 40 CFR 122.44(d)(1)(vi).
>
> According to the CSO Control Policy, a permittee is required to develop and implement a long-term CSO control plan which evaluates alternatives for attaining compliance with the CWA, including compliance with applicable water quality standards and protection of designated uses. It further states that once long-term CSO control plans are completed, permittees are responsible for implementing the plan to ensure compliance with applicable water quality standards. A detailed discussion of the water quality-based requirements included in this Order is provided in the Fact Sheet (Attachment F).

It is well documented in the Permit that the discharge exceeds water quality standards and toxic levels for copper, lead, zinc and pesticides. The Effluent limitation for coliform organisms is significantly less stringent than the Basin Plan water quality objective and does not protect the contact recreational use of the Sacramento River. There is no technical justification for an Effluent Limitation for suspended solids as high as 100 mg/l which could directly translate to exceedance of turbidity objectives. There is no assessment of the need for Effluent Limits for drinking water constituents with associated MCLs. There is no assessment of biostimulatory substances, particularly ammonia and phosphorus. There is no assessment of toxic substances such as ammonia and aluminum. There is no assessment of toxic materials that can be discharged from the documented under regulated industrial segment of the community such as metals from plating shops. While the State may have exempted combined sewerage discharges from CTR compliance; each of the CTR priority pollutants is based on protecting a beneficial use such as aquatic life (from toxicity) or human health in drinking water. An assessment of all priority pollutants and drinking water constituents must be undertaken and adequately limited before the permit is adopted.

California Water Code, section 13377, requires that: "Notwithstanding any other provision of this division, the state board and the regional boards shall, as required or authorized by the Federal Water Pollution Control Act, as amended, issue waste discharge and dredged or fill material permits which apply and ensure compliance with all applicable provisions of the act and acts amendatory thereof or supplementary, thereto, together with any more stringent effluent standards or limitations necessary to implement water quality control plans, or for the protection of beneficial uses, or to prevent nuisance." The application for permit renewal is incomplete and in accordance with 40 CFR 122.21(e) the Regional Board should not issue a permit.

5. THE MANNER IN WHICH THE PETITIONERS ARE AGGRIEVED.

CSPA is a non-profit, environmental organization that has a direct interest in reducing pollution to the waters of the Central Valley. CSPA's members benefit directly from the waters in the form of recreational hiking, photography, fishing, swimming, hunting, bird watching, boating, consumption of drinking water and scientific investigation. Additionally, these waters are an important resource for recreational and commercial fisheries. Central Valley waterways also provide significant wildlife values important to the mission and purpose of the Petitioners. This wildlife value includes critical nesting and feeding grounds for resident water birds, essential habitat for endangered species and other plants and animals, nursery areas for fish and shellfish and their aquatic food organisms, and numerous city and county parks and open space areas. CSPA's members reside in communities whose economic prosperity depends, in part, upon the quality of water. CSPA has actively promoted the protection of fisheries and water quality throughout California before state and federal agencies, the State Legislature and Congress and regularly participates in administrative and judicial proceedings on behalf of its members to protect, enhance, and restore declining aquatic resources. CSPA member's health, interests and pocketbooks are directly harmed by the failure of the Regional Board to develop an effective and legally defensible program addressing discharges to waters of the state and nation.

6. THE SPECIFIC ACTION BY THE STATE OR REGIONAL BOARD WHICH PETITIONER REQUESTS.

Petitioners seek an Order by the State Board to:

A. Vacate Order No. R5-2010-0004 (NPDES No. CA0079111) and remand to the Regional Board with instructions prepare and circulate a new tentative order that comports with regulatory requirements.

B. Alternatively; prepare, circulate and issue a new order that is protective of identified beneficial uses and comports with regulatory requirements.

7. A STATEMENT OF POINTS AND AUTHORITIES IN SUPPORT OF LEGAL ISSUES RAISED IN THE PETITION.

CSPA's arguments and points of authority are adequately detailed in the above comments and our 4 January 2010 comment letter. Should the State Board have additional questions regarding the issues raised in this petition, CSPA will provide additional briefing on any such questions. The petitioners believe that an evidentiary hearing before the State Board will not be necessary to resolve the issues raised in this petition. However, CSPA welcomes the opportunity to present oral argument and respond to any questions the State Board may have regarding this petition.

8. A STATEMENT THAT THE PETITION HAS BEEN SENT TO THE APPROPRIATE REGIONAL BOARD AND TO THE DISCHARGERS, IF NOT THE PETITIONER.

A true and correct copy of this petition, without attachment, was sent electronically and by First Class Mail to Ms. Pamela Creedon, Executive Officer, Regional Water Quality Control Board, Central Valley Region, 11020 Sun Center Drive #200, Rancho Cordova, CA 95670-6114. A true and correct copy of this petition, without attachment, was sent to the Discharger in care of: Mr. Marty Hanneman, Director, Combined Sewer Collection and Treatment System, City of Sacramento, 1395 35th Avenue, Sacramento, CA 95822.

9. A STATEMENT THAT THE ISSUES RAISED IN THE PETITION WERE PRESENTED TO THE REGIONAL BOARD BEFORE THE REGIONAL BOARD ACTED, OR AN EXPLANATION OF WHY THE PETITIONER COULD NOT RAISE THOSE OBJECTIONS BEFORE THE REGIONAL BOARD.

CSPA presented the issues addressed in this petition to the Regional Board in 4 January 2010 comment letter that was accepted into the record.

If you have any questions regarding this petition, please contact Bill Jennings at (209) 464-5067 or Michael Jackson at (530) 283-1007.

Dated: 26 February 2010

Respectfully submitted,

Bill Jennings, Executive Director
California Sportfishing Protection Alliance

Attachment No. 1: Order No. R5-2010-0004.