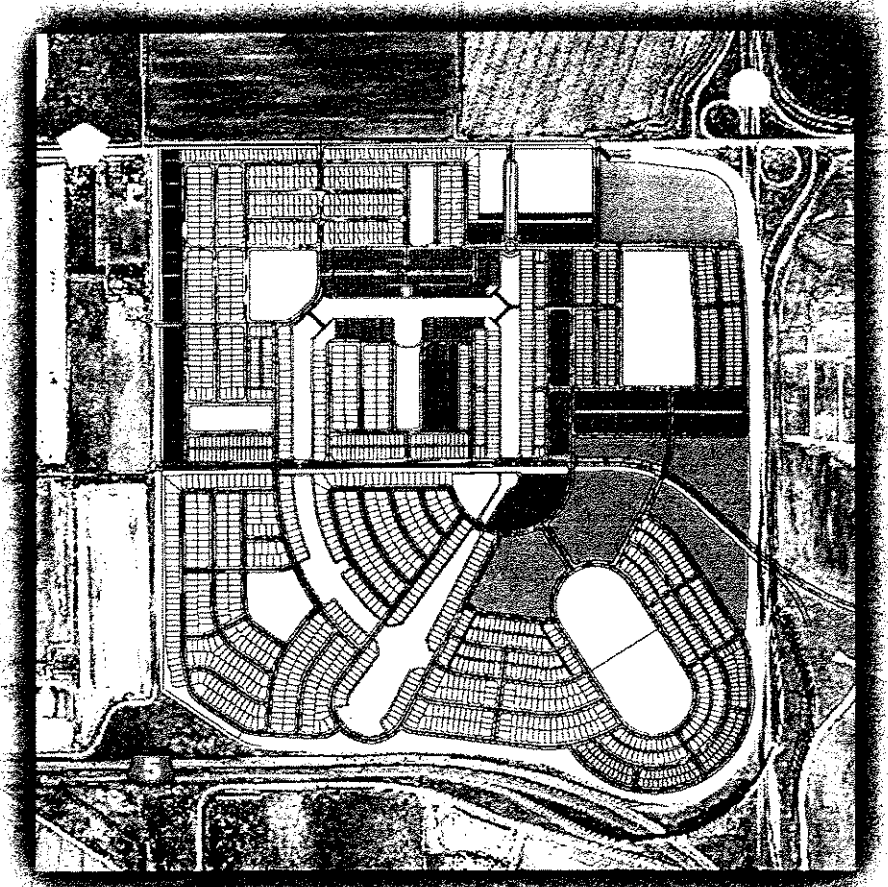


APPENDIX I

GREENBRIAR SEWER STUDY

Greenbriar

Sewer Study



July 2005

Prepared by

WOOD RODGERS

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Sewer Study

For

Greenbriar

Sacramento County, California

July 2005

Prepared By:



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TABLE OF CONTENTS

Executive Summary	1
Purpose Statement.....	1
Major Project and Study Characteristics.....	1
Conclusion	2
Introduction	3
Level of Study.....	3
Detail Description	3
Location	3
Topography.....	3
Land Use and Zoning.....	4
Design	4
Assumptions.....	4
Approach.....	5
Design Criteria	5
Sewer Flow Information	6
Onsite Flows (Total Project Acreages, ESD's & PWWF).....	6
Offsite Flows.....	7
Sewer Alignment and Facilities	7
Ultimate Sewer Alignment	7
System A.....	8
System B	8
Conclusions	8

TABLE OF TABLES

Table 1 Design flow criteria	6
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EXHIBITS

-
- Exhibit A - Greenbriar Vicinity Map
 - Exhibit B - Preliminary Greenbriar Tentative Map
 - Exhibit C - CSD-1 Sewerage Facilities Expansion Master Plan (portions of)
 - Exhibit D - Greenbriar Sewer System Exhibits
 - Exhibit E - Greenbriar Sewer Study Calculations
 - Exhibit F - Greenbriar Schematic Sewer Study

EXECUTIVE SUMMARY

Purpose Statement

This sewer study is a preliminary study for the purpose of the preparing the Environmental Impact Report (EIR) and to provide support documentation for the use in the Greenbriar improvement plans. This study will demonstrate the ability of the required facilities to service the site by a combination of gravity and force main and provide a general guideline of the domestic and commercial collection system for the Greenbriar development. This analysis will ensure that the proposed sewer system will be designed appropriately to meet or exceed the County Sanitation District 1 (CSD-1) system design criteria.

Major Project and Study Characteristics

The Greenbriar project will consist of mixed land use and densities. Mixed use includes low, medium and high-density residential, parks, open space, commercial and school land use. The project site is located west of the North Natomas area, bordered to the south by Interstate 5 and bordered to the north by Elkhorn Boulevard. The project site is currently located outside the City of Sacramento limits, but the application process for annexation has been initiated. This study depicts the ultimate service design; therefore interim facilities are not required. Offsite flows include two 16-inch force main sewer lines from Metro Air Park that will converge with on site sewerage at the most easterly on-site manhole.

The methodology used in this analysis was consistent with the County Sanitation District-1 design standards. The total acreage to be served is approximately 577 acres designed for approximately 4,650 equivalent dwelling units yielding an on-site peak wet weather design flow (PWWF) of 3.05 mgd. The ESD's differ from the 3,723 units depicted on the Tentative Subdivision Map dated May 2, 2005 due to the CSD-1 minimum design criteria of 6 ESD's per acre.

Upstream flows from Metro Air Park (MAP and Sacramento International Airport (SIA) will be conveyed by two 16-inch force mains that will be located in the open space buffer adjacent to Elkhorn Boulevard, following the buffer south adjacent to Highway 99. The force mains will convey design 8.73 mgd PWWF as presented in the Metro Air Park Sanitary Sewer Study prepared by Stantec Consulting, Inc.

The Greenbriar and Metro Air Park upstream sewerage converge with a combined design PWWF of 11.78 mgd, gravity across Highway 99 into the 33-inch diameter North Natomas Interceptor located in Greg Thatch Circle.

Development phasing will likely occur, however this study looked at build out conditions.

A lift station and 10-inch force main will be required to service approximately 75% of the site. This facility is anticipated to be permanent and no interim facilities will be needed.

The Greenbriar project has not been considered in the CSD-1 Sewerage Facilities Master Expansion Master Plan shed delineation due to being outside the current Urban Services Boundary.

Conclusion

The upstream flow of 11.78 mgd (including Greenbriar and Metro Air Park) does not appear to adversely affect the North Natomas Interceptor. Capacity was verified in the existing downstream 33, 36, and 42-inch diameter pipe lines extending south to Del Paso Boulevard. Our project team will be working with SCRSD to analyze the existing capacity in the SCRSD system south of Del Paso Boulevard. This will involve coordination with SCRSD and their regional sewer system model. It is anticipated that this report will be updated in the future based on the review, analysis and comments from SCRSD and CSD-1.

Details regarding the proposed on-site lift station, proposed on-site gravity service and connection to the existing system will also be provided pending comments from SCRSD and CSD-1.

INTRODUCTION

Level of Study

The Greenbriar sewer system analysis presented in this document is consistent with the Tentative Subdivision Map dated May 2, 2005 (**Exhibit B**) for the Greenbriar development project. This study is intended to provide a general guideline of the domestic and commercial collection system for the Greenbriar development. This analysis will ensure that the proposed sewer lines will be designed appropriately to meet or exceed the County Sanitation District-1 (CSD-1) system design criteria.

Detail Description

The Greenbriar site boundary contains Lone Tree Canal along the western border. This canal is of special interest and will be preserved due to the Giant Garder snake habitat. There is currently an unused RD-1000 canal at the east border adjacent to Highway 99/70. The site will require bore and jacking under Highway 99/70 in order to connect to the North Natomas Interceptor.

The adjacent Metro Air Park (MAP) and Sacramento International Airport (SIA) will be utilizing the same interceptor connection under Highway 99/70. Metro Air Park has proposed pumping sewerage to the crossing location.

Location

Interstate 5 binds Greenbriar to the south, Elkhorn Boulevard to the North, and Highway 99/70 to the east and Sacramento Metro Airport to the west. The project site is outside the City of Sacramento limits, however the annexation application process has been initiated. Refer to **Figure 1 - Location Map** for the project location. **Exhibit A** for a scaled vicinity map.

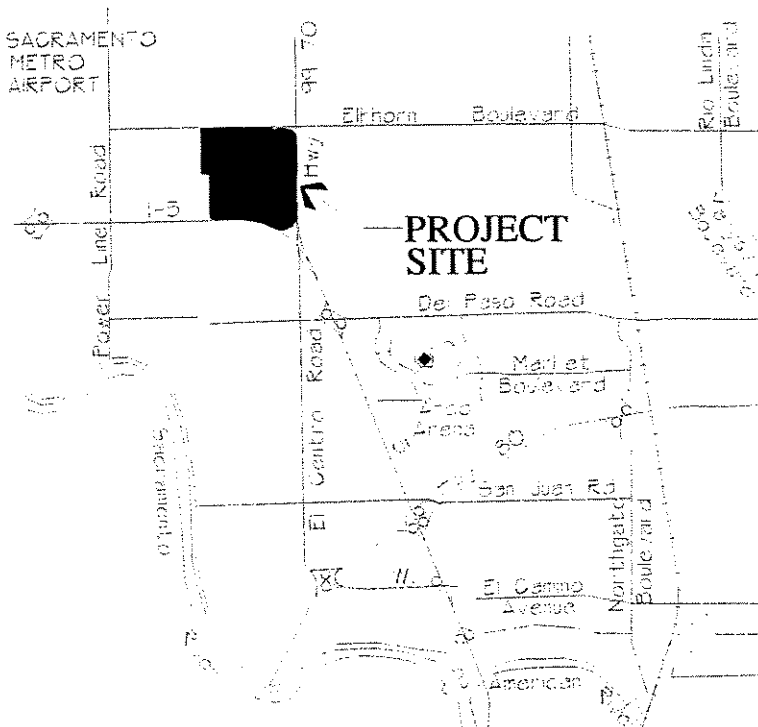


Figure 1 - Location Map

Topography

The existing site's topography is characterized by its previous agricultural use. The geometry of the several pond areas previously used for growing

rice are still evident and render the site's existing ground elevations as exceptionally irregular particularly in the change in elevation between adjacent pond areas where these may change from 3-5 feet in elevation. Despite the sites irregular topography, the drainage pattern is still clear and can be classified as draining in a north-east to south-west direction. The existing ground elevations range from elevation 21.3 feet to 10.5 feet (NGVD 29). There is a dirt oval track in the upper northwest section of the site with adjacent stables structures.

The adjacent lands are very similar in nature, with erratic elevation differences due to the levy / channelizing of drains and water for agricultural uses.

Land Use and Zoning

The projects site's current land use is classified as agricultural. The site is predominantly vacant with a few horse stables and other structures located at the northwest corner of the site. The annexation application includes an amendment to the General Plan land use.

The proposed development will consist of approximately 577 acres of mixed land uses and densities. Mixed use includes low, medium, and high density residential, commercial, parks, light rail and school consistent with the Tentative Subdivision Map dated May 2, 2005. These proposed land uses were the basis of the sewer flow flow calculations within this study.

The property to the north of Elkhorn Boulevard is outside the City of Sacramento limits and still used for agriculture consistent with the General Plan. Metro Air Park to the west is considered as heavy industrial use in the General Plan, but is proposed as mixed land use including industrial and commercial uses.

DESIGN

The Greenbriar sewer analysis consisted of calculating the sewer flows and of designing the sewer system that would service the site.

Assumptions

The following assumptions were used as part of this analysis:

- Offsite sewer flows will not be served by the onsite sewer system until converging at the manhole prior to crossing Highway 99/70.
- The downstream North Natomas Interceptor does have capacity to carry the study area flows based on the Schumacher Property North Natomas Sanitary Sewer Master Plan dated February 20,2003 prepared by Wood Rodgers, Inc and the CSD-1 Sewerage Facilities Final Report.
- The North Natomas Interceptor extension is built to within 550 feet east of Highway 99/70. This study assumes the gravity extension will be built by others to the west of Highway 99/70 prior to the construction of the Greenbriar project.
- Groundwater is relatively high in the project area, and will be confirmed through future geotechnical studies for the project.

- The school site was assumed to be an elementary school site.
- The North Natomas Interceptor has capacity downstream without surcharge conditions.

Approach

The following approach was used to calculate the project site's sewer flows:

- Gross areas based on the Greenbriar Tentative Subdivision Map dated May 2, 2005 were used to calculate sewer flows.
- The centerline of the street adjacent to the service area was used as the shed boundary.
- Sub-shed areas were defined by service line and land use.
- Land use densities were determined by calculating the ratio of dwelling units to shed area.
- 310 gpd per unit was assumed to be the average flow for all land use densities.
- Sewer lines and services were placed in alley ways as required to avoid parallel lines.
- Slope adjustments to the sewer lines were used in preference to drop connections to shallow sewer lines were needed.
- The proposed rough grading ground elevations were used to set sewer depth.
- Minimum sewer line slopes were used to set vertical alignment, except at the end of each of the runs where slopes were doubled.
- For large area sites (i.e. commercial) 8-inch lines with a minimum slope of 0.006 were used to serve the site. Lines were run from connecting node to furthest shed line boundary distance.
- Minimum sewer depth was set between 5-6 feet from proposed ground elevation at centerline.
- Flows were determined based on the County improvement standards and on the design criteria listed in this study

Design Criteria

Section 7 of the County of Sacramento Public Works Agency Improvement Standards dated June 1, 1999 and Chapter 7 of the County Sanitation District 1 Sanitary Trunk Sewer design manual dated April 2002 were used as the basis for this design. The flows were generated using the guidelines found in the design flow criteria table located in section 7-3 of the County of Sacramento Public improvement standards. That table was modified to include CSD-1 Peak flow criteria for the use of this report and is presented as Table 1.

Table 1 Design flow criteria

Category	Conditions				Modifiers
	Low Density Residential	Medium Density Residential	Commercial/Industrial	Transit Oriented Development	Minimum Plan density shall be RD-6
Flow generation (310 gpd/ESD)	6 ESD/Ac	15 ESD/Ac	6 ESD/Ac	11 ESD/Ac	Rainfall dependent I/I: Existing Areas -1,600 gpd/Ac *New areas - 1,200 gpd/Ac
Peaking Factor	$PF=3.5-1.8Qa^{0.05}$ (Qa=ADWF,mgd) –Collectors $PF=3.3-1.8Q^{0.04}$ (Q=BWF, MGD) - Trunk				Minimum shall be 1.2
Velocity Criteria	Minimum 2 fps at Peak Dry Weather Flow				
Hydraulic Grade Line	Maximum HGL at crown of pipe at Peak Wet Weather Flow				
Friction Factor	n=0.013				
Minimum Depth	5' at periphery of service area				8" sewer from periphery to collection point

For the onsite elementary school site, the greater of the specified average daily flow was used as stated in section 7-2A.4 of the Sacramento County Improvement standards.

Sewer flows were calculated by land use in accordance with the Tentative Subdivision Map. Collector peaking factors were used until the flows exceeded 1 mgd. After the flows exceeded 1 mgd, the trunk peaking factor was utilized. Greenbriar sewer study calculations are included in spreadsheet form in **Exhibit E**.

SEWER FLOW INFORMATION

Flow data from this project were calculated within this study. Upstream flow data was obtained from the Metro Air Park CSD-1 Sanitary Sewer Study prepared by Stantec Consulting Inc.

Onsite Flows (Total Project Acreages, ESD's & PWWF)

The combined sewer system for the Greenbriar project site will serve approximately 577 acres (4650 ESD's). The proposed development will produce approximately 3.05 mgd PWWF of which an onsite lift station will service approximately 2.07 mgd. Development phasing was not considered at this time.

The lift station design is not included in this study and will be a separate design report. The lift station is expected to be located generally in the middle of the site as shown on the schematic sewer study, **Exhibit F**. The depth of the lift station will be roughly 25 feet. A 10-inch force

main will convey flows from the wet well approximately 200 feet to a transition manhole. Flows of 2 mgd will produce velocities of roughly 6 fps.

Offsite Flows

The upstream flows from Metro Air Park and the Sacramento International Airport are considered at full development to be 8.73 mgd based on the Metro Air CSD-1 Sewer Study prepared by Stantec Consulting, Inc. Upstream flows were considered at build out conditions and phasing was not considered. The upstream flows converge with onsite flows for combined flow of 11.78 mgd at Node 1 (located in **Exhibit F**) before connecting with the North Natomas Interceptor. Upstream flows will be conveyed to Node 1 by two 16-inch force mains proposed to be located within the Greenbriar green space buffer adjacent to Elkhorn Boulevard and Highway 99/70. Upstream flows will not be conveyed through the onsite system until Node 1 shown on **Exhibit F**) where flows cross the Highway to the existing interceptor.

The downstream connection to the North Natomas Interceptor is at the end of Greg Thatch Circle on the east side of Highway 99/70. Our connection is to a 33-inch interceptor with a slope of 0.0020 with an available capacity of 15.28 mgd PWWF. The 33-inch continues at this slope connecting to a 36-inch section of interceptor (at minimum slope $S=0.0010$) with a capacity of 11.78 mgd in Greg Thatch Circle.

Estimated flows from the west of Highway 99/70 were higher than those reflected in the Schumacher Property North Natomas Sanitary Sewer Master Plan dated February 20, 2003 prepared by Wood Rodgers, Inc. Estimated flows from the west of Highway 99/70 in the Schumacher study were 7.70 mgd PWWF (not including the Greenbriar project). The flows reflected in the CSD-1 Sewerage Facilities Expansion Master Plan for the area west of Highway 99 (not including the Greenbriar project) are 9.79 mgd (**Exhibit C**). Though the actual flows from the combined west area (MAP, SIA, and the Greenbriar project) are higher than those originally assumed, it appears that the North Natomas Interceptor has capacity for the additional flows down to Del Paso Boulevard.

The impact to the existing downstream interceptor (south of Del Paso Road) is not known at this time. CSD-1 / SRCSD are in the process of initiating modeling of this interceptor conditions downstream and searching for the interceptor studies and design reports. We expect to update this study when the information is available.

SEWER ALIGNMENT AND FACILITIES

Ultimate Sewer Alignment

The Greenbriar site will be served by a combination of gravity flow and force main sewer system. Approximately $\frac{1}{4}$ of the project area will be able to gravity flow to the existing North Natomas interceptor. The remaining project site area will gravity flow to a centrally located lift station lift station (**Exhibit D**). Flows from the lift station will be conveyed to the gravity line via an 18-inch sewer force main or combination 16 and 12-inch force mains. A preliminary location for the lift station has been selected. A detailed design report for the lift station will be prepared for submittal as the project progresses.

For the purpose of presenting this analysis, the Greenbriar sewer system was divided into two major sewer systems: System A and System B. System A is a gravity system that will convey the onsite flows to the existing 33-inch sewer line bypassing the lift station. System B is also a gravity system; however, this system will convey the onsite flows to the lift station which will subsequently connect to System A via a sewer force main. **Exhibit D** shows the System A and System B service areas.

System A

Sewer system A will serve approximately 123.5 Acres. Approximately 0.98 mgd will bypass the lift station and gravity flow directly into the existing 33-inch sewer trunk line. Minimum sewer line depth from existing ground to the top of pipe for this system is of 6.0 feet.

System B

Two separate pipe systems will convey flows to the lift station. The first system approaches the lift station from the west and services approximately 45% of the lift station flows. This system will convey approximately 0.86 mgd via a 15-inch sewer line. The second system B sub shed approaches the lift station from the south and services the remaining 55% of the lift station service area. This system will convey approximately 0.62 mgd by means of a 10-inch sewer line. The sewer invert entering the lift station is approximately 22.2 feet and 22.9 feet respectively. Flows from the lift station will be conveyed via an 10-inch sewer force main line to the nearest manhole, Node 4 on **Exhibit F**, and will gravity flow under Highway 99-70 to the existing North Natomas Interceptor. The hydraulic head between the lift station's sump elevation and the manhole's sump elevation is 13.6 feet. The length of the 10-inch sewer force main is approximately 200 feet, producing velocities of approximately 6 fps.

The flows from Metro Air Park, Sacramento International Airport and the Greenbriar development converge at Node 1, **Exhibit F**, prior to crossing Highway 99/70. The depth of the sewer line crossing Highway 99/70 is 17.0 feet to top of pipe. The slope of the 33-inch interceptor crossing is designed to convey the flows at a velocity of 3 ft/s.

CONCLUSIONS

This sewer study is a preliminary study for the purpose of the preparing the Environmental Impact Report (EIR) and to provide support documentation for the use in the Greenbriar improvement plans. As configured, the on site project flows and off site shed flows converge and ultimately gravity sewer to the North Natomas interceptor.

The overall Greenbriar project of 577 acres account for 4,650 ESD's producing a peak wet weather flow of 3.05 mgd. Off site flows from the MAP and SIA include 1,911 acres accounting for 8.726 mgd PWWF. The combined flow of 11.78 mgd does not appear to adversely affect the North Natomas Interceptor. Conditions downstream of the North Natomas Interceptor are unclear and under investigation and further analysis by CSD-1 and not considered in this analysis.



EXHIBIT A
GREENBRIAR VICINITY MAP

VICINITY MAP

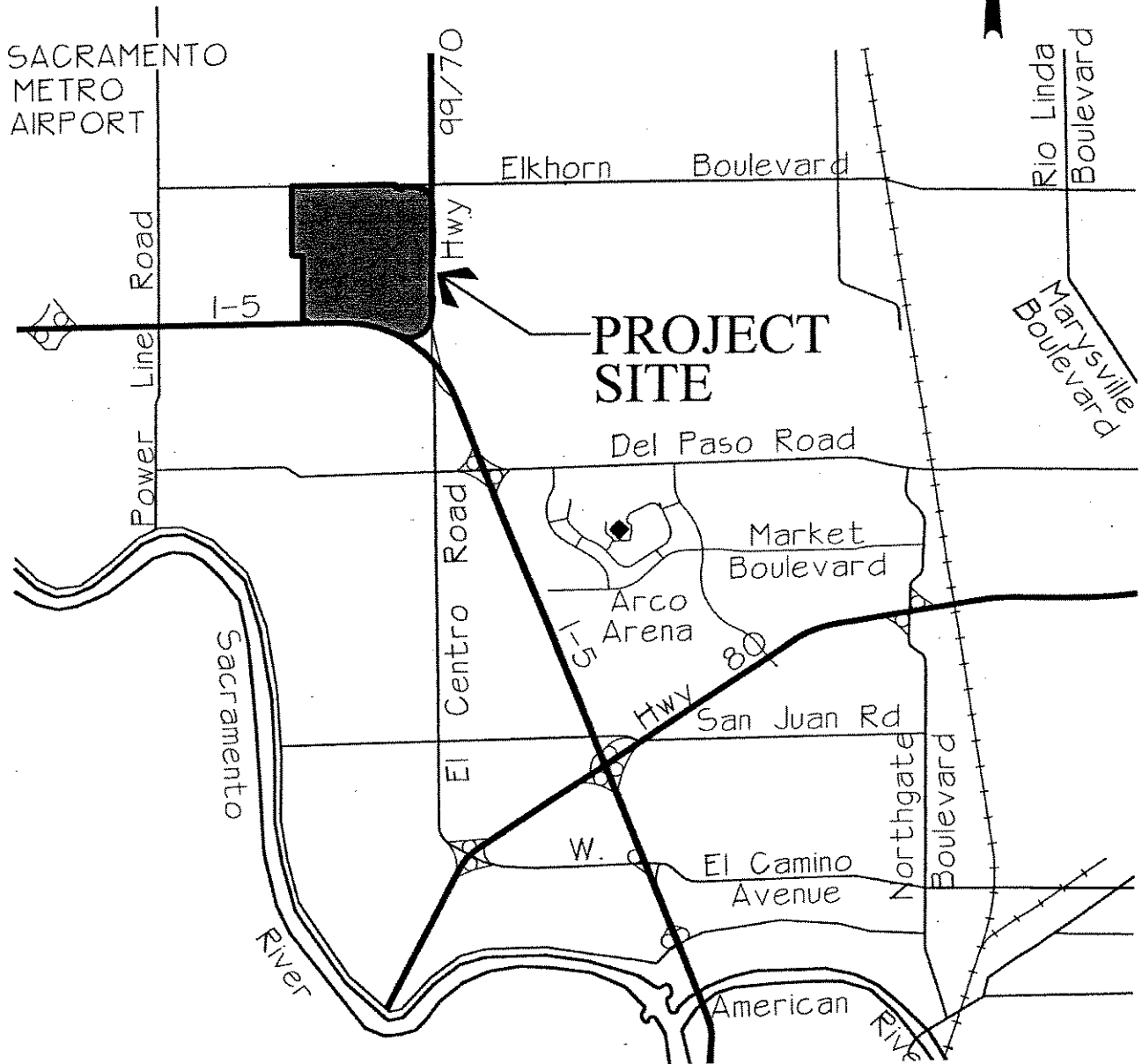
GREENBRIAR

AKT DEVELOPMENT

CITY OF SACRAMENTO

CALIFORNIA

JULY 2005



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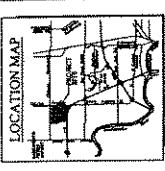
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EXHIBIT B
PRELIMINARY GREENBRIAR TENTATIVE MAP

TENTATIVE SUBDIVISION MAP
GREENBRIAR
 CITY OF SACRAMENTO, CALIFORNIA
 MAY 7, 2005

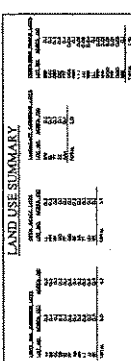


PROJECT NOTES

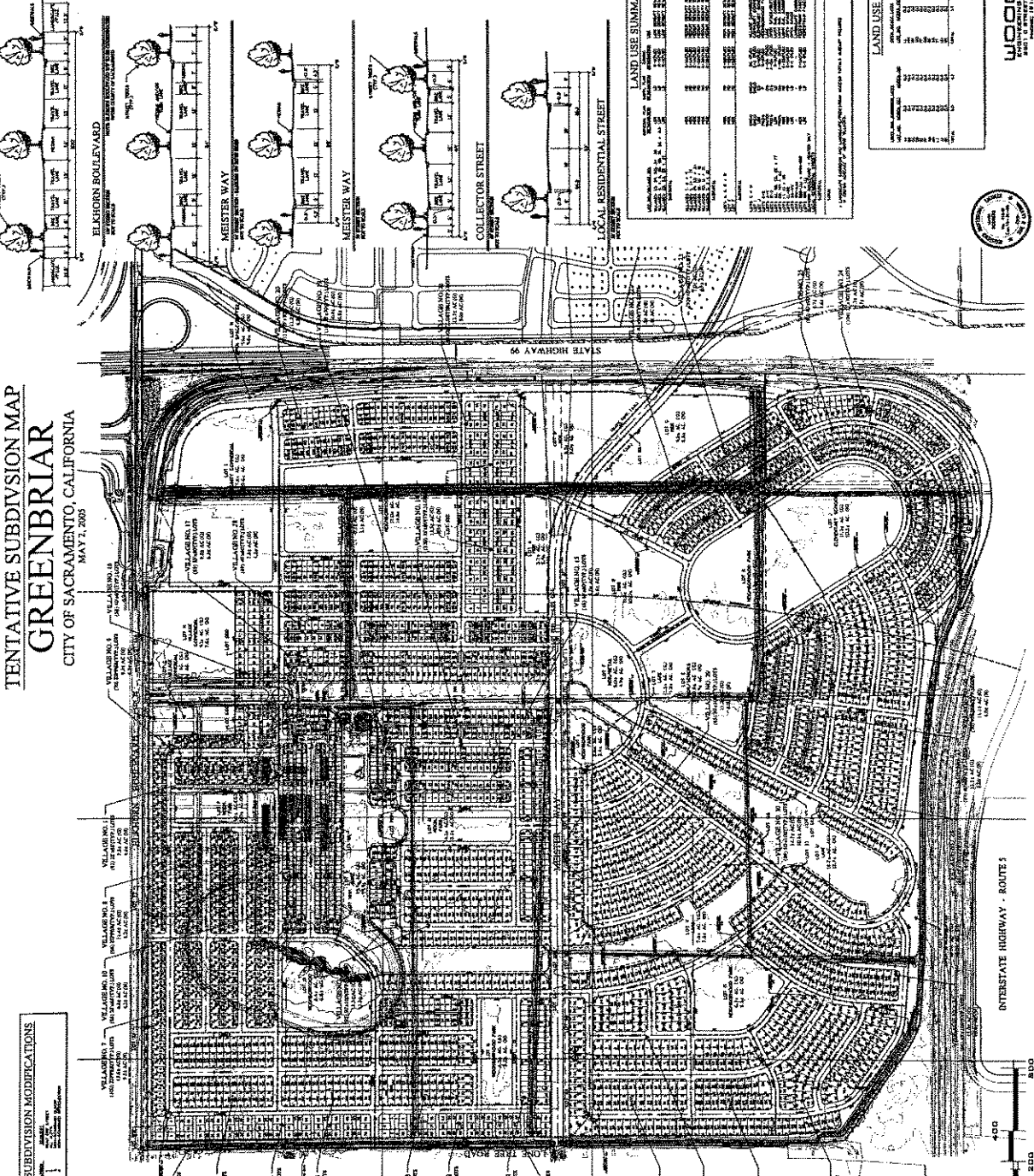
1. THIS TENTATIVE SUBDIVISION MAP IS PREPARED IN ACCORDANCE WITH THE SUBDIVISION MAP ACT, CHAPTER 472, CIVIL CODE, CALIFORNIA.
2. THE CITY OF SACRAMENTO HAS REVIEWED THIS TENTATIVE SUBDIVISION MAP AND HAS ISSUED A TENTATIVE MAP NUMBER.
3. THIS TENTATIVE SUBDIVISION MAP IS SUBJECT TO THE APPROVAL OF THE CITY OF SACRAMENTO AND THE STATE OF CALIFORNIA.
4. THE CITY OF SACRAMENTO HAS REVIEWED THIS TENTATIVE SUBDIVISION MAP AND HAS ISSUED A TENTATIVE MAP NUMBER.
5. THIS TENTATIVE SUBDIVISION MAP IS SUBJECT TO THE APPROVAL OF THE CITY OF SACRAMENTO AND THE STATE OF CALIFORNIA.
6. THE CITY OF SACRAMENTO HAS REVIEWED THIS TENTATIVE SUBDIVISION MAP AND HAS ISSUED A TENTATIVE MAP NUMBER.
7. THIS TENTATIVE SUBDIVISION MAP IS SUBJECT TO THE APPROVAL OF THE CITY OF SACRAMENTO AND THE STATE OF CALIFORNIA.
8. THE CITY OF SACRAMENTO HAS REVIEWED THIS TENTATIVE SUBDIVISION MAP AND HAS ISSUED A TENTATIVE MAP NUMBER.
9. THIS TENTATIVE SUBDIVISION MAP IS SUBJECT TO THE APPROVAL OF THE CITY OF SACRAMENTO AND THE STATE OF CALIFORNIA.
10. THE CITY OF SACRAMENTO HAS REVIEWED THIS TENTATIVE SUBDIVISION MAP AND HAS ISSUED A TENTATIVE MAP NUMBER.

LAND USE SUMMARY

LAND USE	ACRES	PERCENTAGE
RESIDENTIAL	100.00	100.00%
COMMERCIAL	0.00	0.00%
INDUSTRIAL	0.00	0.00%
AGRICULTURAL	0.00	0.00%
UNDEVELOPED	0.00	0.00%
TOTAL	100.00	100.00%



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SUBDIVISION MODIFICATIONS

1. THIS TENTATIVE SUBDIVISION MAP IS SUBJECT TO THE APPROVAL OF THE CITY OF SACRAMENTO AND THE STATE OF CALIFORNIA.



TENTATIVE SUBDIVISION MAP



EXHIBIT C
CSD-1 SEWERAGE FACILITIES EXPANSION MASTER PLAN
(PORTIONS OF)

CSD-1 SEWERAGE FACILITIES EXPANSION MASTER PLAN

NN NATOMAS NORTH TRUNK SHED

Area Description

The NN Natomas North Trunk Shed is located east of Highway 99, north of Del Paso Road, and south of Elkhorn Boulevard. The Trunk Shed includes the Schumacher, Northborough, and a portion of the Northpointe Park developments, which are located, respectively, in the western, central, and eastern portions of the trunk shed. The Schumacher and Northborough developments are anticipated to develop within the 2000 to 2005 year time frame. The portion of the Northpointe Park development contained in the NN Natomas North Trunk Shed is anticipated to start developing within the 2005 to 2010 year time frame.

Trunk System Facilities

A major trunk sewer (Trunk NNI) extending north along the western side of the East Drainage Canal and a permanent pump station would serve most of the Northborough development. This trunk would connect into the recently constructed trunk sewer that discharges to the existing North Natomas Interceptor. Minor trunk sewers that cross the East Drainage Canal and connect to Trunk NNI would serve the portion of the Northpointe Park development that is part of this trunk shed. The Schumacher development would be served by minor trunks and local collectors that would connect to the future extension of the North Natomas Interceptor.

Since the downstream trunk and interceptor sewers that would serve the Northborough and Northpoint Park developments are already constructed, interim facilities would not be required for these areas. Similarly, because the extension of the North Natomas Interceptor is expected to be on line prior to the time trunk sewer connections are required to serve the Schumacher Development, there would be no need for interim facilities for this area.

Trunk Projects

Four trunk projects are identified for this trunk shed, as shown in the table below.

Project ID	Diam. (in.)	Length (ft.)	Phase	Estimated Construction Cost (\$)	Estimated Capital Cost (\$)
NNH	12-15	1,650	1	489,000	611,000
NNI	15-27	7,300	1	3,801,000	4,751,000
NNJ-3	18	2,450	1	665,000	831,000
NNJ-4	15	3,050	1	1,003,000	1,254,000

NN Natomas North Trunk Shed

Attachments

- Trunk shed map showing proposed trunk sewers, sizes, model manhole ID numbers, and sewersheds.
- Project map showing trunk projects and interim facilities (if needed).
- Trunk shed ESD projections by sewershed.
- Sewershed load manholes.
- Cross-reference sewershed manholes to recently constructed manholes (as of February 2002).
- Trunk sewer data and model results.
- Profile(s) of major trunk sewers.
- Trunk project cost estimates.

NN Natomas N
Trunk Shed Buildout Projections

Sewershed	ESDs				Area (acres)			
	2005	2010	2020	Buildout	2005	2010	2020	Buildout
NNH-01	0	0	281	490	0	0	45	78
NNH-02	0	0	335	585	0	0	34	59
NNH-03	0	0	177	309	0	0	24	42
NNH-04	0	0	687	1,199	0	0	89	156
NNH-05	351	351	351	1,459	36	36	36	150
NNH-06	87	246	307	377	9	26	32	40
NNH-07	184	184	184	764	21	21	21	87
NNH-08	97	97	97	403	16	16	16	67
NNH-09	71	71	71	297	12	12	12	49
NNH-10	169	475	592	728	19	54	68	83
NNI-01	50	57	64	86	8	10	11	14
NNI-02	568	647	729	974	74	84	95	126
NNI-03	256	719	896	1,102	31	87	109	134
NNI-04	435	495	558	746	70	80	90	121
NNI-05	257	293	330	441	37	42	47	63
NNI-06	85	240	299	368	9	24	30	37
NNI-07	63	177	221	272	8	21	27	33
NNI-08	159	448	558	687	26	73	91	112
NNI-09	312	878	1,095	1,346	49	137	171	211
NNI-10	94	264	330	405	16	44	55	68
NNJ-04	1	588	1,521	1,836	0	74	191	230
NNJ-05	1	1	11	531	0	0	2	85
NNJ-06	0	144	373	451	0	24	62	75
NNJ-07	0	371	959	1,158	0	55	141	170
NNJ-08	1	1	11	577	0	0	2	96
Total	3,243	6,748	11,038	17,591	441	921	1,501	2,387

**Trunk Shed NN Natomas North
Sewershed Load Manholes**

Sewershed	Load Manhole
NNH-01	NNH120
NNH-02	NNH120
NNH-03	NNH910
NNH-04	NNH210
NNH-05	NNH320
NNH-06	NNH310
NNH-07	NNH430
NNH-08	NNH440
NNH-09	NNH430
NNH-10	NNH420
NNI-01	NNI9030
NNI-02	NNI9090
NNI-03	NNI910
NNI-04	NNI9230
NNI-05	NNI010
NNI-06	NNI020
NNI-07	NNI030
NNI-08	NNI040
NNI-09	NNI070
NNI-10	NNI060
NNJ-04	NNJ120
NNJ-05	NNJ140
NNJ-06	NNJ910
NNJ-07	NNJ220
NNJ-08	NNJ240

Trunk Shed NN Natomas North
Cross-reference Sewershed Manholes to Recently Constructed Manholes
(as of February 2002)

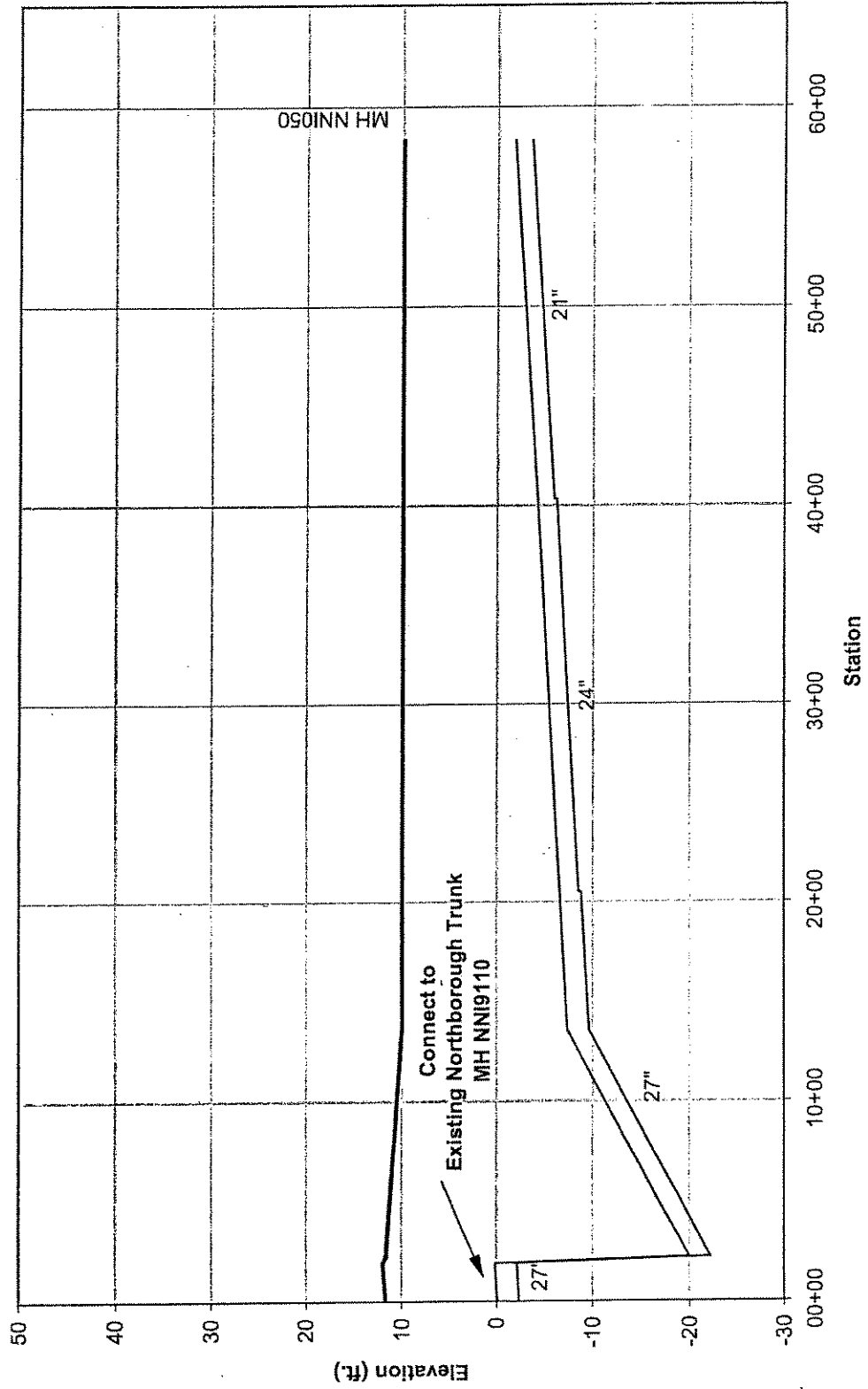
Trunk Shed	MH No. in Future Trunk Model ¹	GIS MH No. ²
NN Natomas North	NN1040	22500406
NN Natomas North	NNI9010	22500405
NN Natomas North	NNI9020	22500404
NN Natomas North	NNI9030	22500403
NN Natomas North	NNI9040	22500402
NN Natomas North	NNI9210	22500401
NN Natomas North	NNI9220	20103515
NN Natomas North	NNI9230	20103514
NN Natomas North	NNI9240	20103513
NN Natomas North	NNI9250	20103511
NN Natomas North	NNI9260	20103516
NN Natomas North	NNI9050	20103617
NN Natomas North	NNI9060	20103614
NN Natomas North	NNI9070	20103616
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NN Natomas North	NNI9110	22511401
NN Natomas North	NNJ9210	3
NN Natomas North	NNJ9220	3
NN Natomas North	NNJ9230	3
NN Natomas North	NNJ9240	3
1) The Trunk Shed Maps do not show all manholes below		
2) Closest manhole to future model node		
3) Not available		

**Trunk Shed NN Natomas North
Buildout 10-Year Design Storm**

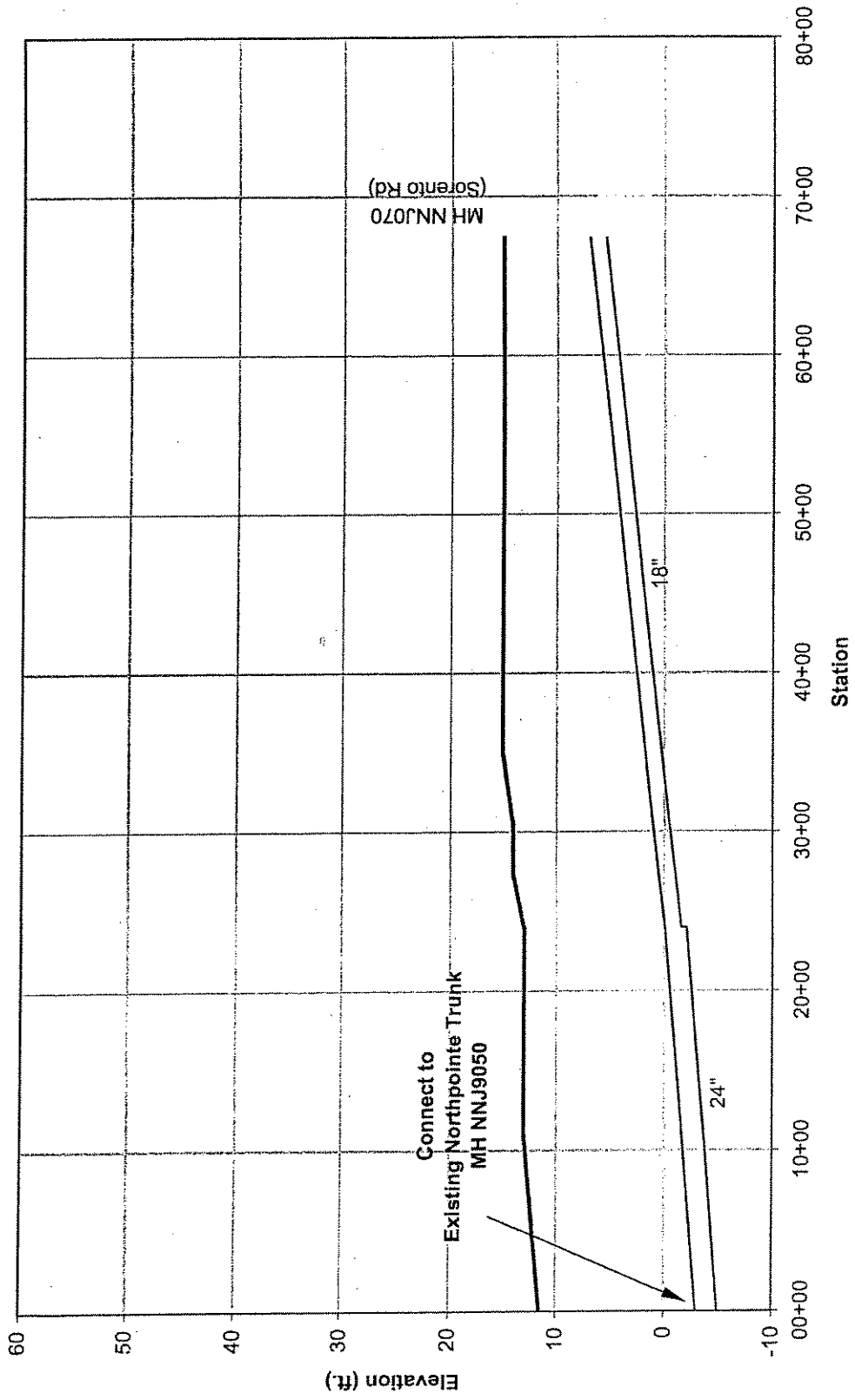
US Manhole	DS Manhole	Dia. (in.)	Length (ft.)	US Rim Elev.	DS Rim Elev.	US Invert Elev.	DS Invert Elev.	Slope	Full Cap. (mgd)	Peak Flow (mgd)	% Full Cap.	DS d/D
NNH110	NN1010	12	151	20	22	-2.46	-2.80	0.0022	1.1	0.78	71	0.47
NNH120	NNH110	12	591	20	20	-1.04	-2.46	0.0024	1.1	0.78	68	0.61
NNH910	NN1050	10	299	20	10	-1.12	-2.17	0.0035	0.8	0.23	27	0.32
NNH210	NN1060	12	591	20	10	0.07	-1.35	0.0024	1.1	0.87	76	0.49
NNH410	NN1080	42	541	20	10	-3.29	-3.62	0.0006	16.0	10.34	65	0.35
NNH420	NNH410	42	1040	20	20	-2.67	-3.29	0.0006	15.9	10.38	65	0.51
NNH430	NNH420	42	1460	20	20	-1.80	-2.67	0.0006	15.9	10.11	63	0.57
NNH440	NNH430	42	2139	20	20	-0.51	-1.80	0.0006	16.0	9.65	60	0.58
NNH310	NN1080	15	659	20	10	1.16	-0.09	0.0019	1.8	1.23	68	0.44
NNH320	NNH310	12	991	20	20	3.78	1.41	0.0024	1.1	0.98	88	0.52
NNI9010	NN1040	36	440	15	15	-5.29	-5.53	0.0006	10.1	8.01	79	0.37
NNI9020	NNI9010	36	479	17	15	-5.05	-5.29	0.0005	9.6	8.01	83	0.55
NNI9030	NNI9020	36	479	18	17	-4.80	-5.05	0.0005	9.8	8.01	81	0.61
NNI9040	NNI9030	36	469	17	18	-4.56	-4.80	0.0005	9.7	7.94	81	0.64
NNI9050	NNI9040	36	961	12	17	-4.09	-4.56	0.0005	9.5	6.64	70	0.66
NNI9060	NNI9050	36	230	12	12	-3.97	-4.09	0.0005	9.9	6.64	67	0.64
NNI9070	NNI9060	36	509	11	12	-3.72	-3.97	0.0005	9.5	6.64	70	0.63
NNI9080	NNI9070	36	449	12	11	-3.49	-3.72	0.0005	9.7	6.64	68	0.63
NNI9090	NNI9080	36	341	12	12	-3.32	-3.49	0.0005	9.6	6.64	69	0.62
NNI9110	NNI9090	36	469	12	12	-3.09	-3.32	0.0005	9.5	5.98	63	0.62
NNIFM1	NNI9110	27	194	30	12	-2.11	-2.34	0.0012	6.9	6.00	87	0.48
NNIFM2	NNIFM1	24	30	12	30	-21.96	-2.11	-0.6616	-120.2	6.00	-5	0.68
NNI9210	NNI9040	15	279	16	17	-2.88	-3.30	0.0015	1.6	1.37	85	0.57
NNI9220	NNI9210	15	459	16	16	-2.20	-2.88	0.0015	1.6	1.37	86	0.68
NNI9230	NNI9220	15	381	16	16	-1.63	-2.20	0.0015	1.6	1.37	85	0.71
NNI9240	NNI9230	15	381	16	16	-1.06	-1.63	0.0015	1.6	0.78	48	0.71
NNI9250	NNI9240	15	180	19	16	-0.69	-0.96	0.0015	1.6	0.78	48	0.44
NNI9260	NNI9250	15	331	20	19	-0.20	-0.69	0.0015	1.6	0.78	49	0.49
NNI910	NNI9260	12	591	20	20	1.22	-0.20	0.0024	1.1	0.78	68	0.62
NNI010	NNIPS1	27	1129	10	12	-9.61	-10.96	0.0012	6.9	6.05	87	0.70
NNI020	NNI010	27	699	10	10	-8.77	-9.61	0.0012	7.0	5.73	82	0.72
NNJ9210	NNI020	18	200	19	10	-0.60	-0.92	0.0016	2.7	1.73	64	0.42
NNJ9220	NNJ9210	18	69	19	19	-0.49	-0.60	0.0016	2.7	1.73	63	0.56
NNJ9230	NNJ9220	18	390	14	19	0.13	-0.49	0.0016	2.7	1.73	64	0.57
NNJ9240	NNJ9230	18	341	15	14	0.67	0.13	0.0016	2.7	1.73	64	0.58
NNJ110	NNJ9240	18	1260	11	15	2.69	0.67	0.0016	2.7	1.73	64	0.58
NNJ120	NNJ110	18	1201	13	11	4.61	2.69	0.0016	2.7	1.73	64	0.58
NNJ130	NNJ120	10	1381	11	13	10.10	5.27	0.0035	0.8	0.41	49	0.43
NNJ140	NNJ130	10	679	15	11	12.48	10.10	0.0035	0.8	0.41	49	0.50
NNI030	NNI020	24	1030	10	10	-7.28	-8.52	0.0012	5.1	3.77	74	0.67
NNI040	NNI030	24	951	10	10	-6.14	-7.28	0.0012	5.1	3.58	71	0.64
NNJ910	NNI040	10	322	11	10	-2.35	-3.48	0.0035	0.8	0.37	43	0.40
NNI050	NNI040	21	1801	10	10	-3.55	-5.89	0.0013	3.7	2.69	73	0.58
NNJ210	NNI050	15	2090	11	10	0.92	-3.05	0.0019	1.8	1.35	74	0.50
NNJ220	NNJ210	15	971	11	11	2.76	0.92	0.0019	1.8	1.35	74	0.64
NNJ230	NNJ220	10	761	11	11	5.84	3.18	0.0035	0.8	0.46	54	0.46
NNJ240	NNJ230	10	699	25	11	8.29	5.84	0.0035	0.8	0.46	54	0.54
NNI060	NNI050	15	322	10	10	-2.43	-3.05	0.0019	1.8	1.37	75	0.50
NNI070	NNI060	15	1181	10	10	-0.18	-2.43	0.0019	1.8	1.05	57	0.64

Note: Pipes with peak flow less than 1 mgd are considered local collectors and are labeled "LC" on the trunk shed maps.

Trunk NNI



Trunk NNJ



TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:.....NNH TRUNK SHED..... NN Natomas North
 LOCATION:..... South of Elkhorn Boulevard and east of Interstate 5. Connects to North Natomas Interceptor at MH NN1080.
 BRIEF PROJECT DESCRIPTION:..... 1,650 feet of 12" and 15" pipe
 MODEL REFERENCE:..... NNH320 to NN1080
 LOCATION OF CAPACITY DEFICIENCY: N/A
 REASON FOR PROJECT:..... Expansion for future development (Schumacher)
 DESIGN FLOW:..... 1.0 mgd (upstream) to 1.26 mgd (downstream)
 PERCENT FOR EXISTING FLOW:..... 0%
 PERCENT FOR FUTURE FLOW:..... 100%
 SPECIAL CONSIDERATIONS:..... Project requires the North Natomas Interceptor.
 ASSUMPTIONS:..... Assumes easements granted by developer and interceptor/trunk junction structure constructed with interceptor.
 ALTERNATIVES:..... Pipeline location could be modified to accommodate development patterns.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
Baseline Pipe Construction Cost					
NNH320 to NNH310	12	16-20	990'	120 \$/ft	\$118,800
NNH310 to NN1080	15	16-20	660'	130 \$/ft	\$85,800
Geotechnical Factors					
Increased Dewatering			1,650'	53 \$/ft	\$87,450
Increased Sheet piling/Shoring			1,650'	40 \$/ft	\$66,000
Traffic and Productivity Factors					
Surface Restoration					
Structures, Pits, and Pump Stations					
Subtotal					\$358,050
Mobilization and Demobilization				5%	\$17,903
Construction Cost Subtotal					\$375,953
Contingencies for Unknown Subsurface Conditions				30%	\$112,786
Construction Cost Total					\$488,738
Engineering, Administration, and Legal Costs				25%	\$122,185
Capital Improvement Cost Total					\$610,923
ENR =6474 (Average of S.F. and 20 Cities, January 2000)				rounded	\$611,000

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:..... NNI TRUNK SHED..... NN Natomas North
 LOCATION:..... South of Elkhorn Boulevard and west of the East Drainage Canal. Connects to existing trunk at MH NNI9110.
 BRIEF PROJECT DESCRIPTION:..... 7,300 feet of 15" to 27" pipe and 6.5 mgd pump station
 MODEL REFERENCE:..... NNI070 to NNI9110
 LOCATION OF CAPACITY DEFICIENCY:..... N/A
 REASON FOR PROJECT:..... Expansion for future development (Northborough)
 DESIGN FLOW:..... .105 mgd (upstream) to 6.0 mgd (downstream)
 PERCENT FOR EXISTING FLOW:..... 0%
 PERCENT FOR FUTURE FLOW:..... 100%
 SPECIAL CONSIDERATIONS:..... The flow from the east side of the canal provides the initial start-up flow for the North Natomas Interceptor and maintains cleaning velocities. The NNI trunk should be designed at a depth that enables trunks from east side of the Main Drainage Canal to connect and maintain clearance under the canal and the Upper Northwest Interceptor.
 ASSUMPTIONS:..... Assumes easements granted by developer and trunk junction structure constructed with existing trunk.
 ALTERNATIVES:..... Pipeline location could be modified to accommodate development patterns.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
Baseline Pipe Construction Cost					
NNI070 to NNI060	15	8-16	1,180'	110 \$/ft	\$129,800
NNI060 to NNI050	15	8-16	320'	110 \$/ft	\$35,200
NNI050 to NNI040	21	8-16	1,800'	140 \$/ft	\$252,000
NNI040 to NNI030	24	8-16	950'	160 \$/ft	\$152,000
NNI030 to NNI020	24	16-20	1,030'	185 \$/ft	\$190,550
NNI020 to NNI010	27	16-20	700'	210 \$/ft	\$147,000
NNI010 to NNIPS1	27	20-24	1,130'	240 \$/ft	\$271,200
NNIPS1 to NNI9110	27	20-24	194'	240 \$/ft	\$46,560
Geotechnical Factors					
Increased Dewatering			7,304'	53 \$/ft	\$387,112
Increased Sheet piling/Shoring					
Partially Laid Back Trench			7,304'	40 \$/ft	\$292,160
Traffic and Productivity Factors					
Surface Restoration					
Structures, Pits, and Pump Stations					
2-Trunk Junction Structure (24- to 36-inch dia outlet pipe)					\$16,000
Pump Station - 6.5 mgd					\$865,000
Subtotal					\$2,784,582
Mobilization and Demobilization				5%	\$139,229
Construction Cost Subtotal					\$2,923,811
Contingencies for Unknown Subsurface Conditions				30%	\$877,143
Construction Cost Total					\$3,800,954
Engineering, Administration, and Legal Costs				25%	\$950,239
Capital Improvement Cost Total					\$4,751,193
ENR = 6474 (Average of S.F. and 20 Cities, January 2000)				rounded	\$4,751,000

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

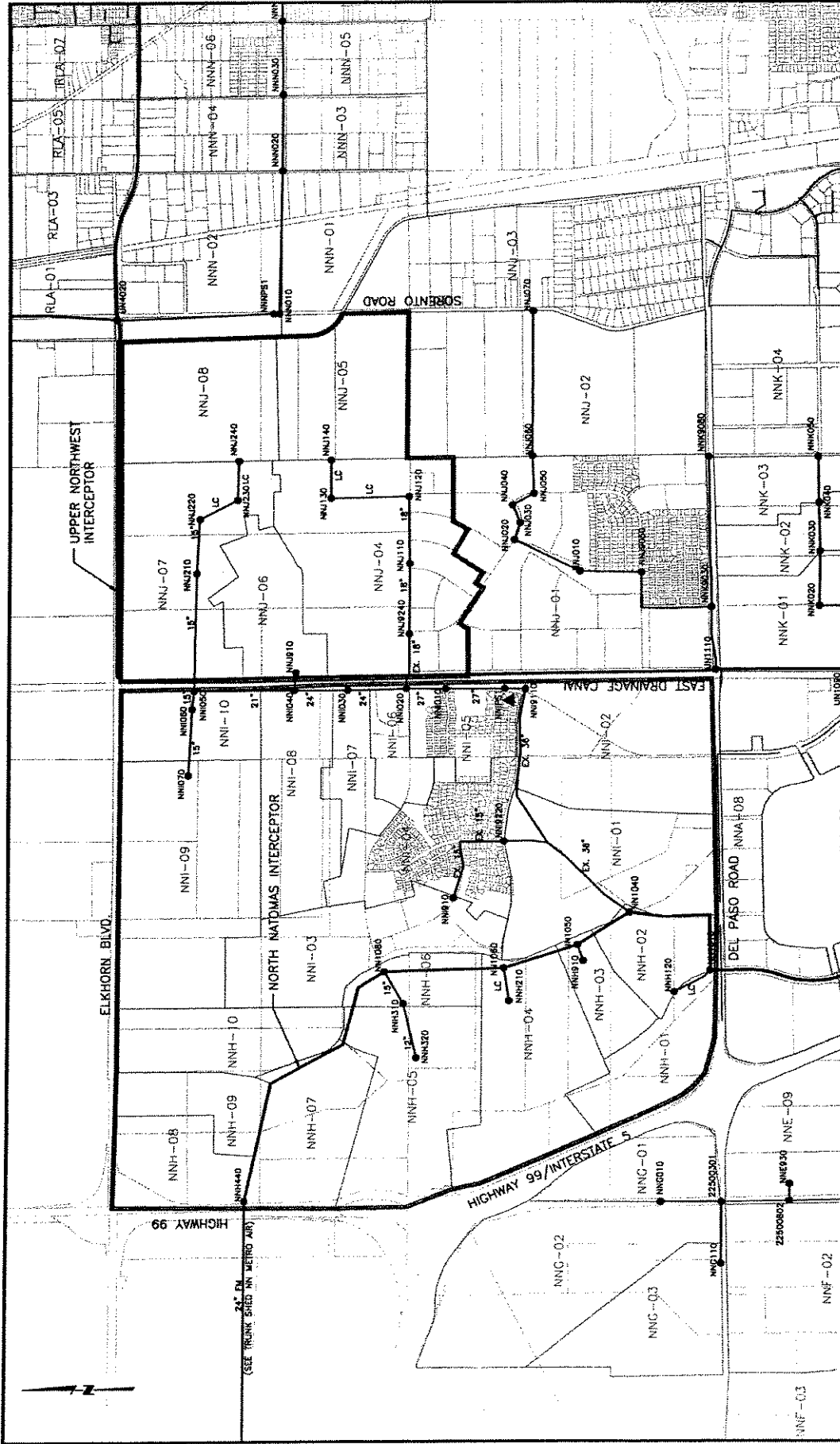
PROJECT ID:..... NNJ-3 TRUNK SHED..... NN Natomas North
 LOCATION:..... South of Elkhorn Boulevard and east of the East Drainage Canal. Connects to existing trunk at MH NNJ9240.
 BRIEF PROJECT DESCRIPTION:..... 2,450 feet of 18" pipe
 MODEL REFERENCE:..... NNJ120 to NNJ9240
 LOCATION OF CAPACITY DEFICIENCY: N/A
 REASON FOR PROJECT:..... Expansion for future development (Northpoint)
 DESIGN FLOW:..... 1.73 mgd
 PERCENT FOR EXISTING FLOW:..... 0%
 PERCENT FOR FUTURE FLOW:..... 100%
 SPECIAL CONSIDERATIONS:..... Project requires Trunk Project NNI.
 ASSUMPTIONS:..... Assumes easements granted by developer and trunk junction structure constructed with existing trunk.
 ALTERNATIVES:..... Pipeline location could be modified to accommodate development patterns.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
Baseline Pipe Construction Cost					
NNJ120 to NNJ110	18	8-16	1,200'	125 \$/ft	\$150,000
NNJ110 to NNJ9240	18	8-16	1,260'	125 \$/ft	\$157,500
Geotechnical Factors					
Increased Dewatering			2,460'	53 \$/ft	\$130,380
Increased Sheet piling/Shoring					
Partially Laid Back Trench			2,460'	20 \$/ft	\$49,200
Traffic and Productivity Factors					
Surface Restoration					
Structures, Pits, and Pump Stations					
Subtotal					\$487,080
Mobilization and Demobilization				5%	\$24,354
Construction Cost Subtotal					\$511,434
Contingencies for Unknown Subsurface Conditions				30%	\$153,430
Construction Cost Total					\$664,864
Engineering, Administration, and Legal Costs				25%	\$166,216
Capital Improvement Cost Total					\$831,080
ENR = 6474 (Average of S.F. and 20 Cities, January 2000)				rounded	\$831,000

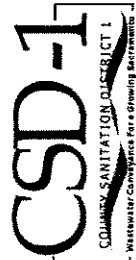
TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:..... NNJ-4 TRUNK SHED..... NN Natomas North
 LOCATION:..... South of Elkhorn Boulevard and east of the East Drainage Canal. Connects to Project NNI at MH NNI050.
 BRIEF PROJECT DESCRIPTION:..... 3,050 feet of 15" pipe
 MODEL REFERENCE:..... NNJ220 to NNI050
 LOCATION OF CAPACITY DEFICIENCY: N/A
 REASON FOR PROJECT:..... Expansion for future development (Northpoint)
 DESIGN FLOW:..... 1.35 mgd
 PERCENT FOR EXISTING FLOW:..... 0%
 PERCENT FOR FUTURE FLOW:..... 100%
 SPECIAL CONSIDERATIONS:..... Project requires Trunk Project NNI-1.
 ASSUMPTIONS:..... Assumes easements granted by developer.
 ALTERNATIVES:..... Pipeline location could be modified to accommodate development patterns.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
Baseline Pipe Construction Cost					
NNJ220 to NNJ210	15	8-16	970'	110 \$/ft	\$106,700
NNJ210 to NNI050	15	8-16	2,090'	110 \$/ft	\$229,900
Channel Crossing (36" casing)	15	Microtunnel	100'	800 \$/ft	\$80,000
Jacking Pit					\$60,000
Receiving Pit					\$35,000
Geotechnical Factors					
Increased Dewatering			3,060'	53 \$/ft	\$162,180
Increased Sheetpiling/Shoring					
Partially Laid Back Trench			3,060'	20 \$/ft	\$61,200
Traffic and Productivity Factors					
Surface Restoration					
Structures, Pits, and Pump Stations					
Subtotal					\$734,980
Mobilization and Demobilization				5%	\$36,749
Construction Cost Subtotal					\$771,729
Contingencies for Unknown Subsurface Conditions				30%	\$231,519
Construction Cost Total					\$1,003,248
Engineering, Administration, and Legal Costs				25%	\$250,812
Capital Improvement Cost Total					\$1,254,060
ENR = 6474 (Average of S.F. and 20 Cities, January 2000)				rounded	\$1,254,000

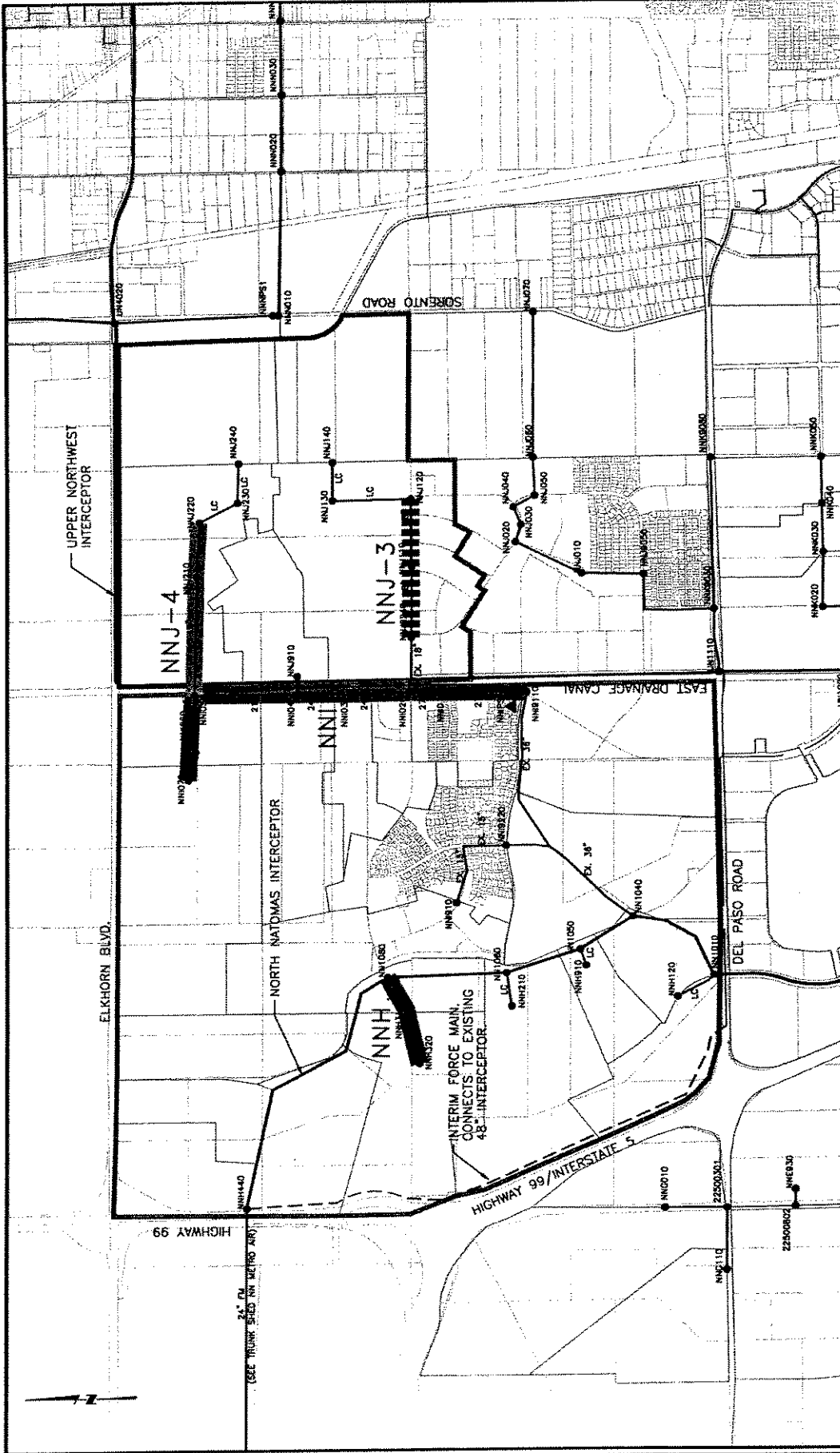
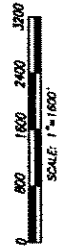


NN NATOMAS NORTH TRUNK SHED



NN NATOMAS NORTH PROJECT PHASING

- CONSTRUCTION COMPLETED
- PHASE 1 (2000-2008)
- PHASE 2 (2008-2010)
- PHASE 3 (2011-2020)
- PHASE 4 (after 2020)



CSD-1 SEWERAGE FACILITIES EXPANSION MASTER PLAN

NN METRO AIR TRUNK SHED

Area Description

The NN Metro Air Trunk Shed is located north of Interstate 5 and west of Lone Tree Road. The Trunk Shed includes the Metro Air Park development and the Sacramento International Airport. Metro Air Park is anticipated to start developing within the 2000 to 2005 year time frame. It is anticipated that Sacramento International Airport will cease treating their wastewater on-site and convey wastewater to the CSD-1 system when the Metro Air Park trunk facilities come on line.

Trunk System Facilities

The trunk shed would be served by a major trunk sewer (Trunk NNM) and a permanent pump station located in the Metro Air Park development. This gravity trunk sewer would discharge to the pump station located in the south portion of the development, and a force main would connect to the future extension of the North Natomas Interceptor at El Centro Road.

If the North Natomas Interceptor extension to El Centro Road is not on line by the time the trunk facilities are constructed to serve this trunk shed, an interim connection could be made extending the force main to the existing upstream end of the North Natomas Interceptor north of Del Paso Road .

Trunk Project

Three trunk projects are identified for this trunk shed, as shown in the table below.

Project ID	Diam. (in.)	Length (ft.)	Phase	Estimated Construction Cost (\$)	Estimated Capital Cost (\$)
NNM-1	27-33 & 24 (FM)	2,900	1	6,665,000	8,973,000
NNM-2	12-24	10,500	1	4,903,000	6,128,000
NNM-3	15-18	5,500	1	2,396,000	2,995,000

Attachments

- Trunk shed map showing proposed trunk sewers, sizes, model manhole ID numbers, and sewersheds.
- Project map showing trunk projects and interim facilities (if needed).
- Trunk shed ESD projections by sewershed.
- Sewershed load manholes.
- Trunk sewer data and model results.
- Profile(s) of major trunk sewers.
- Trunk project cost estimates.

**NN Metro Air
Trunk Shed Buildout Projections**

Sewershed	ESDs				Area (acres)			
	2005	2010	2020	Buildout	2005	2010	2020	Buildout
NNM-01	0	0	0	594	0	0	0	99
NNM-02	0	0	0	289	0	0	0	48
NNM-03	0	0	0	171	0	0	0	28
NNM-04	0	0	0	229	0	0	0	38
NNM-05	0	0	0	778	0	0	0	130
NNM-06	0	0	0	584	0	0	0	97
NNM-07	1	1	1	907	0	0	0	151
NNM-08	0	0	0	470	0	0	0	78
NNM-09	0	0	0	796	0	0	0	133
NNM-10	1	1	1	906	0	0	0	151
NNM-11	1	1	1	574	0	0	0	96
NNM-12	2	2	2	1,025	0	0	0	171
NNM-13	1	1	1	1,071	0	0	0	179
NNM-14	2	2	2	728	0	0	0	121
NNM-15	0	0	0	0	0	0	0	0
Total	9	9	9	9,122	1	1	1	1,520
Note: ESDs reflect residential development only.								

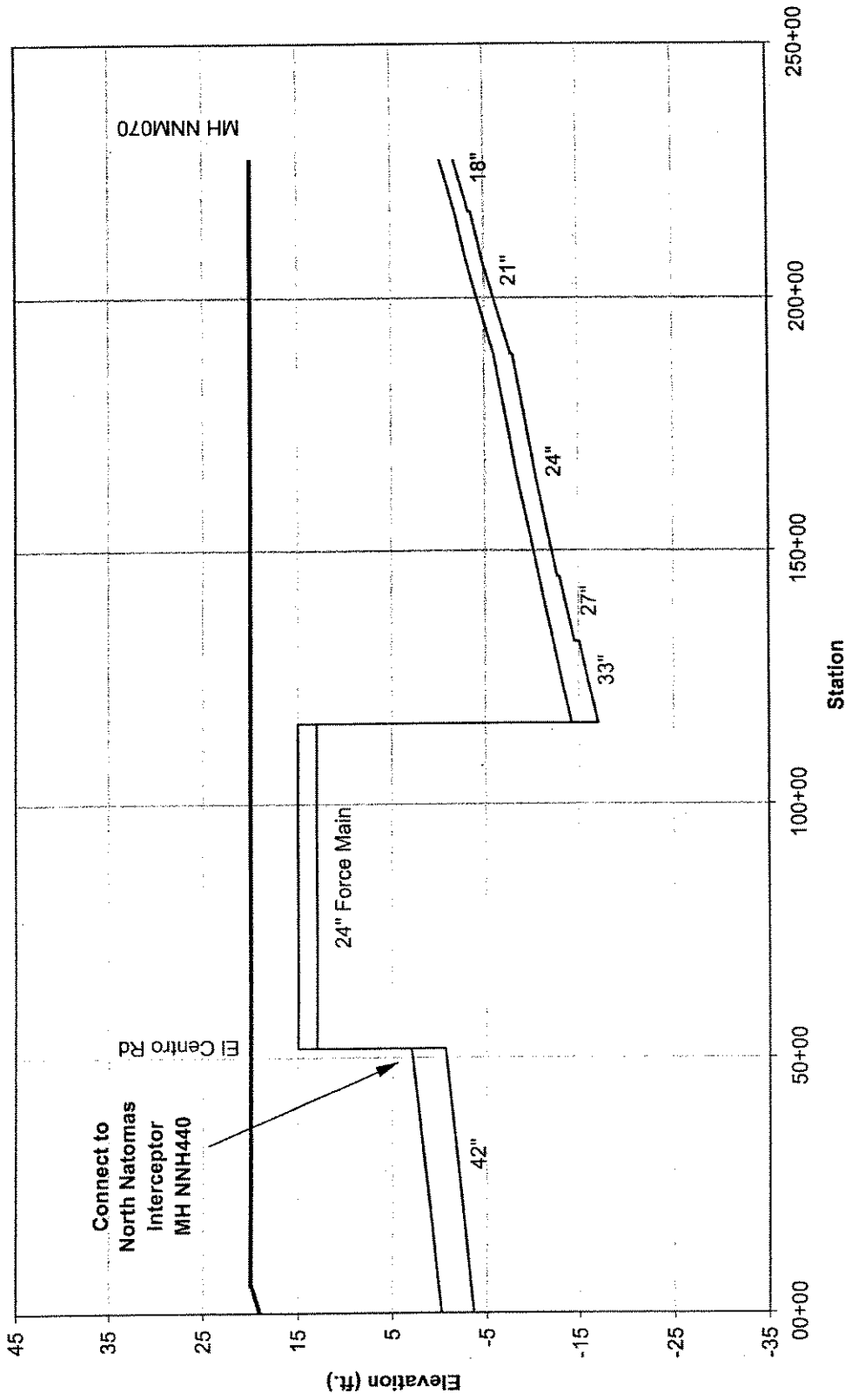
**Trunk Shed NN Metro Air
Sewershed Load Manholes**

Sewershed	Load Manhole
NNM-01	NNM090
NNM-02	NNM090
NNM-03	NNM080
NNM-04	NNM080
NNM-05	NNM070
NNM-06	NNM070
NNM-07	NNM060
NNM-08	NNM060
NNM-09	NNM040
NNM-10	NNM040
NNM-11	NNM120
NNM-12	NNM010
NNM-13	NNMPS1
NNM-14	NNM010
NNM-15	NNM130

**Trunk Shed NN Metro Air
Buildout 10-Year Design Storm**

US Manhole	DS Manhole	Dia. (in.)	Length (ft.)	US Rim Elev.	DS Rim Elev.	US Invert Elev.	DS Invert Elev.	Slope	Full Cap. (mgd)	Peak Flow (mgd)	% Full Cap.	DS d/D
NNMFM1	NNH440	24	6414	20	20	-27.35	-2.51	-0.0039	-9.1	9.79	-107	1.00
NNM010	NNMPS1	33	1601	20	20	-15.08	-17.00	0.0012	11.8	8.35	71	0.54
NNM020	NNM010	27	1299	20	20	-13.02	-14.58	0.0012	7.0	6.34	91	0.49
NNM030	NNM020	24	2001	20	20	-10.37	-12.77	0.0012	5.1	4.50	89	0.71
NNM040	NNM030	24	2402	20	20	-7.99	-10.37	0.0010	4.6	4.50	98	0.73
NNM050	NNM040	21	1860	20	20	-4.82	-7.24	0.0013	3.7	3.17	86	0.50
NNM060	NNM050	21	951	20	20	-3.58	-4.82	0.0013	3.7	3.17	86	0.72
NNM070	NNM060	18	1001	20	20	-1.73	-3.33	0.0016	2.7	2.10	77	0.67
NNM080	NNM070	12	2349	20	20	4.40	-1.23	0.0024	1.1	1.03	90	0.53
NNM090	NNM080	12	1499	20	20	8.00	4.40	0.0024	1.1	0.71	62	0.76
NNM110	NNM020	18	2369	20	20	-7.35	-11.14	0.0016	2.7	1.85	68	0.43
NNM120	NNM110	18	699	20	20	-6.23	-7.35	0.0016	2.7	1.85	68	0.61
NNM130	NNM120	15	2500	20	20	-1.23	-5.98	0.0019	1.8	1.39	76	0.54

Trunk NNM



TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:..... NNM-1 TRUNK SHED..... NN Metro Air
 LOCATION:..... North of Interstate 5 and east of Powerline Road. Connects to North Natomas Interceptor at MH NNH440.
 BRIEF PROJECT DESCRIPTION:..... 2,900 feet of 27" to 33" pipe and 9.6 mgd pump station
 MODEL REFERENCE:..... NNM020 to NNH440
 LOCATION OF CAPACITY DEFICIENCY: N/A
 REASON FOR PROJECT:..... Expansion for future development (Metro Air Park)
 DESIGN FLOW:..... 6.34 mgd (upstream) to 9.79 mgd (downstream)
 PERCENT FOR EXISTING FLOW:..... 14%
 PERCENT FOR FUTURE FLOW:..... 86%
 SPECIAL CONSIDERATIONS:..... Project requires the future North Natomas Interceptor. Sewer studies showed oversized trunks to minimize slope. The CSD-1 Master Plan designed trunks and the slopes consistent with the master plan design criteria.
 ASSUMPTIONS:..... Assumes easements granted by developer with the exception of the area east of the Metro Air Park development (force main alignment). The interceptor/junction structure will be constructed with interceptor. Pipes designed to accommodate existing flow from the Sacramento International Airport.
 ALTERNATIVES:..... Pipeline location could be modified to accommodate development patterns.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
Baseline Pipe Construction Cost					
NNM020 to NNM010	27	>28	1,300'	345 \$/ft	\$448,500
NNM010 to NNMP51	33	>28	1,600'	360 \$/ft	\$576,000
NNMFM1 to NNH440	24	8-16	6,415'	140 \$/ft	\$898,100
Highway 99 (49" casing)	24	Microtunnel	375'	1,040 \$/ft	\$390,000
Jacking Pit					\$60,000
Receiving Pit					\$35,000
Geotechnical Factors					
Increased Dewatering			9,315'	53 \$/ft	\$493,695
Increased Sheet Piling/Shoring			9,315'	80 \$/ft	\$745,200
Partially Laid Back Trench					
Traffic and Productivity Factors					
Surface Restoration					
Revegetation		80' wide	6,415'	0.25 \$/sf	\$128,300
Structures, Pits, and Pump Stations					
Pump Station - 9.6 mgd					\$1,108,000
Subtotal					\$4,882,795
Mobilization and Demobilization				5%	\$244,140
Construction Cost Subtotal					\$5,126,935
Contingencies for Unknown Subsurface Conditions				30%	\$1,538,080
Construction Cost Total					\$6,665,015
Land Acquisition - Temporary Easement Cost		80' wide	6,415'	0.50 \$/sf	\$256,600
Land Acquisition - Permanent Easement Cost		30' wide	6,415'	2 \$/sf	\$384,900
Engineering, Administration, and Legal Costs				25%	\$1,666,254
Capital Improvement Cost Total					\$8,972,769
ENR = 6474 (Average of S.F. and 20 Cities, January 2000)					rounded \$8,973,000

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:..... NNM-2 TRUNK SHED..... NN Metro Air

LOCATION:..... North of Interstate 5 and east of Powerline Road. Connects to Project NNM-1 at MH NNM020.

BRIEF PROJECT DESCRIPTION:..... 10,500 ft of 12 to 24-inch pipe

MODEL REFERENCE:..... NNM080 to NNM020

LOCATION OF CAPACITY DEFICIENCY: N/A

REASON FOR PROJECT:..... Expansion for future development

DESIGN FLOW:..... 1.03 mgd to 4.50 mgd

PERCENT FOR EXISTING FLOW:..... 0%

PERCENT FOR FUTURE FLOW:..... 100%

SPECIAL CONSIDERATIONS:..... Project requires NNM-1 and future North Natomas Interceptor. Sewer studies showed oversized trunks to minimize slope. The CSD-1 Master Plan designed trunks and the slopes consistent with the master plan design criteria.

ASSUMPTIONS:..... Assumes easements granted by developer and high groundwater.

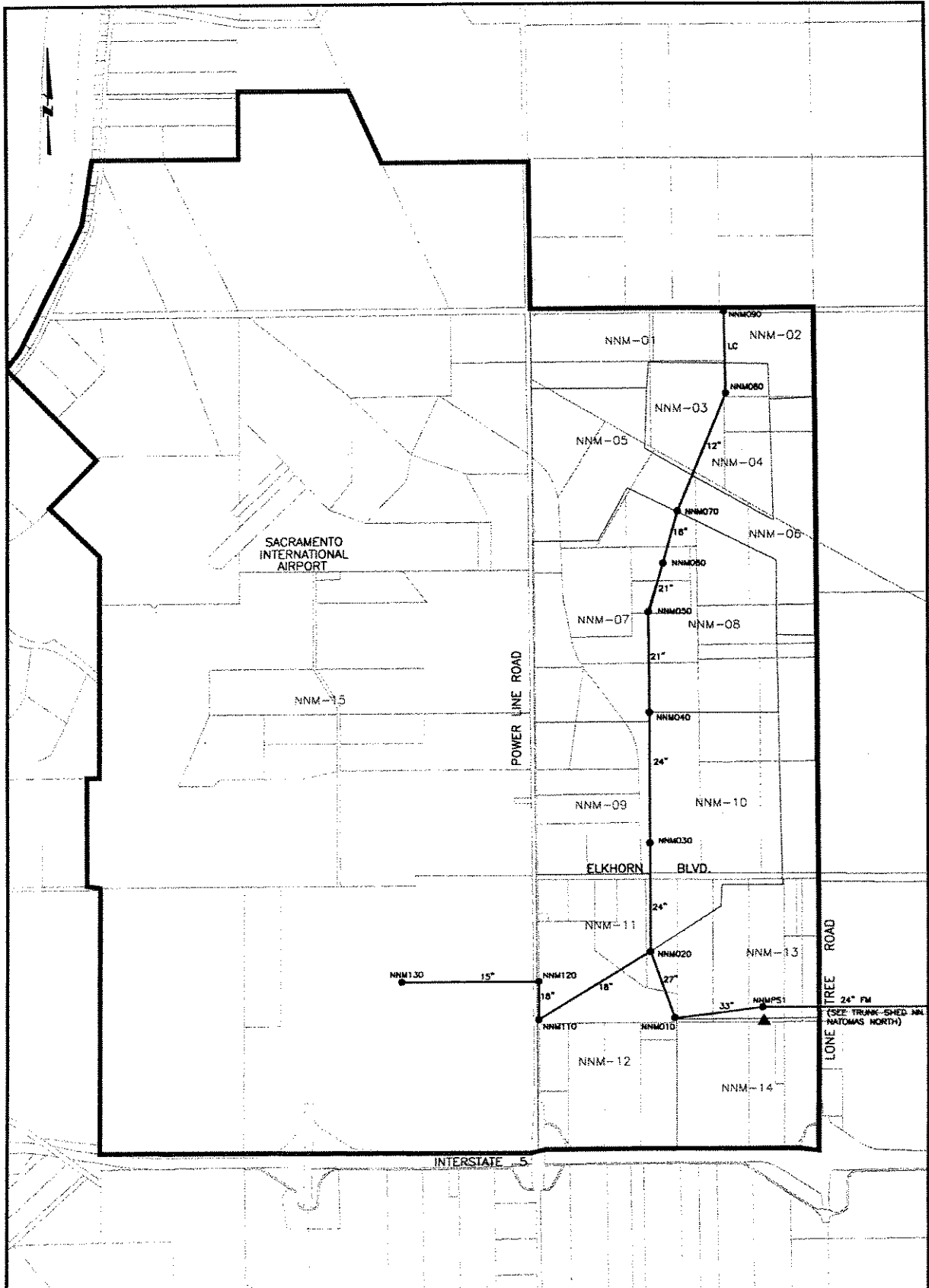
ALTERNATIVES:..... Pipeline location could be modified to accommodate development patterns.

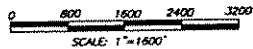
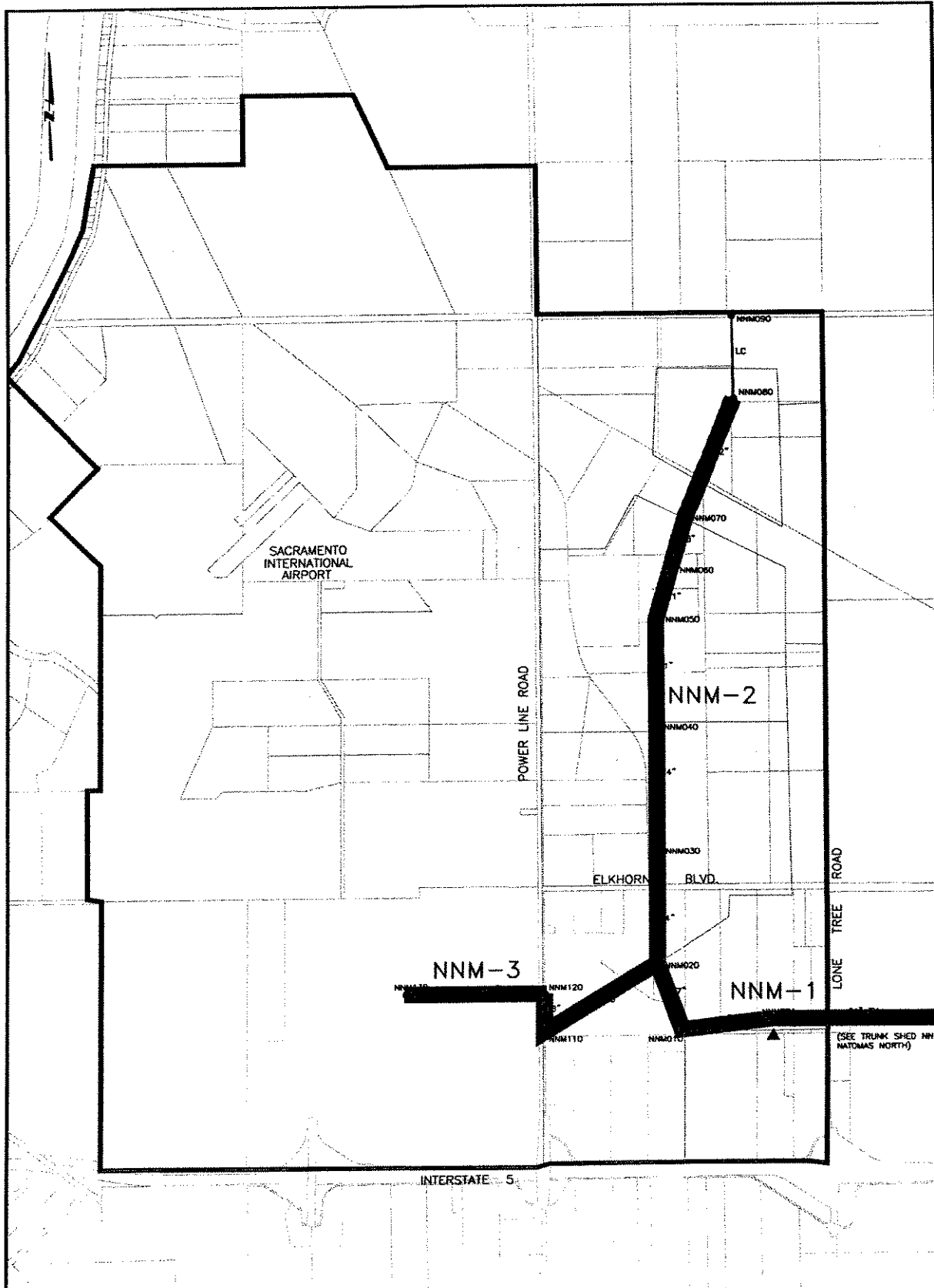
MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
Baseline Pipe Construction Cost					
NNM080 to NNM070	12	16-20	2,350'	120 \$/ft	\$282,000
NNM070 to NNM060	18	20-24	1,000'	165 \$/ft	\$165,000
NNM060 to NNM050	21	24-28	950'	215 \$/ft	\$204,250
NNM050 to NNM040	21	24-28	1,860'	215 \$/ft	\$399,900
NNM040 to NNM030	24	24-28	2,400'	245 \$/ft	\$588,000
NNM030 to NNM020	24	>28	2,000'	270 \$/ft	\$540,000
Geotechnical Factors					
Increased Dewatering			10,560'	53 \$/ft	\$559,680
Increased Sheetpiling/Shoring Partially Laid Back Trench			10,560'	80 \$/ft	\$844,800
Traffic and Productivity Factors					
Surface Restoration					
Structures, Pits, and Pump Stations					
Trunk Sewer Junction Structures (24- to 36-inch dia. outlet pipe)					\$8,000
Subtotal					\$3,591,630
Mobilization and Demobilization				5%	\$179,582
Construction Cost Subtotal					\$3,771,212
Contingencies for Unknown Subsurface Conditions				30%	\$1,131,363
Construction Cost Total					\$4,902,575
Engineering, Administration, and Legal Costs				25%	\$1,225,644
Capital Improvement Cost Total					\$6,128,219
ENR = 6474 (Average of S.F. and 20 Cities, January 2000)					rounded \$6,128,000

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:..... NNM-3 TRUNK SHED..... NN Metro Air
 LOCATION:..... North of Interstate 5 and east of Powerline Road. Connects to Project NNM-1 at MH NNM020.
 BRIEF PROJECT DESCRIPTION:..... 5,500 feet of 15" and 18" pipe
 MODEL REFERENCE:..... NNM130 to NNM020
 LOCATION OF CAPACITY DEFICIENCY: N/A
 REASON FOR PROJECT:..... Convey Sacramento International Airport flow to CSD-1 system.
 DESIGN FLOW:..... 1.4 mgd (upstream) to 1.85 mgd (downstream)
 PERCENT FOR EXISTING FLOW:..... 80%
 PERCENT FOR FUTURE FLOW:..... 20%
 SPECIAL CONSIDERATIONS:..... Project requires North Natomas Interceptor and Trunk Project NNM-1. Sewer studies showed oversized trunks to minimize slope. The CSD-1 Master Plan designed trunks and the slopes consistent with the master plan design criteria.
 ASSUMPTIONS:..... Costs assume easements granted by developer.
 ALTERNATIVES:..... Pipeline location could be modified to accommodate development patterns.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
Baseline Pipe Construction Cost					
NNM130 to NNM120	15	20-24	2,500'	150 \$/ft	\$375,000
NNM120 to NNM110	18	24-28	700'	185 \$/ft	\$129,500
NNM110 to NNM020	18	24-28	2,370'	185 \$/ft	\$438,450
Geotechnical Factors					
Increased Dewatering			5,573'	53 \$/ft	\$295,369
Increased Sheet piling/Shoring					
Partially Laid Back Trench			5,573'	80 \$/ft	\$445,840
Traffic and Productivity Factors					
Surface Restoration					
Pavement Restoration		15' wide	700'	2.00 \$/sf	\$21,000
Revegetation		80' wide	2,500'	0.25 \$/sf	\$50,000
Structures, Pits, and Pump Stations					
Subtotal					\$1,755,159
Mobilization and Demobilization				5%	\$87,758
Construction Cost Subtotal					\$1,842,917
Contingencies for Unknown Subsurface Conditions				30%	\$552,875
Construction Cost Total					\$2,395,792
Engineering, Administration, and Legal Costs				25%	\$598,948
Capital Improvement Cost Total					\$2,994,740
ENR = 6474 (Average of S.F. and 20 Cities, January 2000)					rounded \$2,995,000





- PHASE 1 (2000-2005)
- ▨ PHASE 2 (2006-2010)
- ▩ PHASE 3 (2011-2020)
- ▧ PHASE 4 (after 2020)

NN METRO AIR PROJECT PHASING



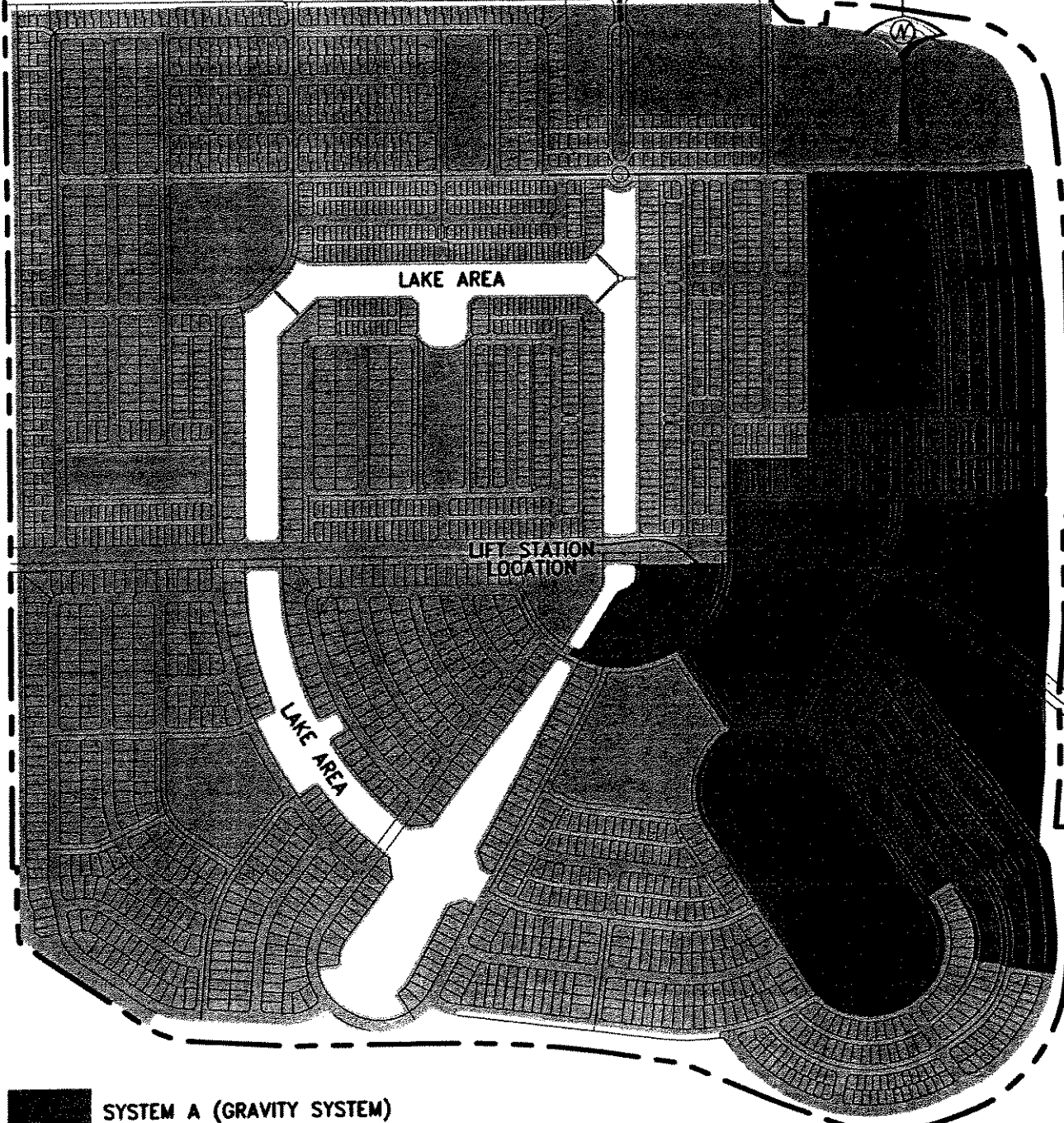
EXHIBIT D
GREENBRIAR SEWER SYSTEM EXHIBITS



EXHIBIT D
GREENBRIAR SEWER SYSTEM SHEDS

AKT DEVELOPMENT

CITY OF SACRAMENTO, CALIFORNIA

JULY, 2005



-  SYSTEM A (GRAVITY SYSTEM)
-  SYSTEM B (LIFT STATION)

WOOD RODGERS
ENGINEERING - MAPPING - PLANNING - SURVEYING
3501 C St. Bldg. 100-B Tel 916.341.7780
Sacramento, CA 95816 Fax 916.341.7787

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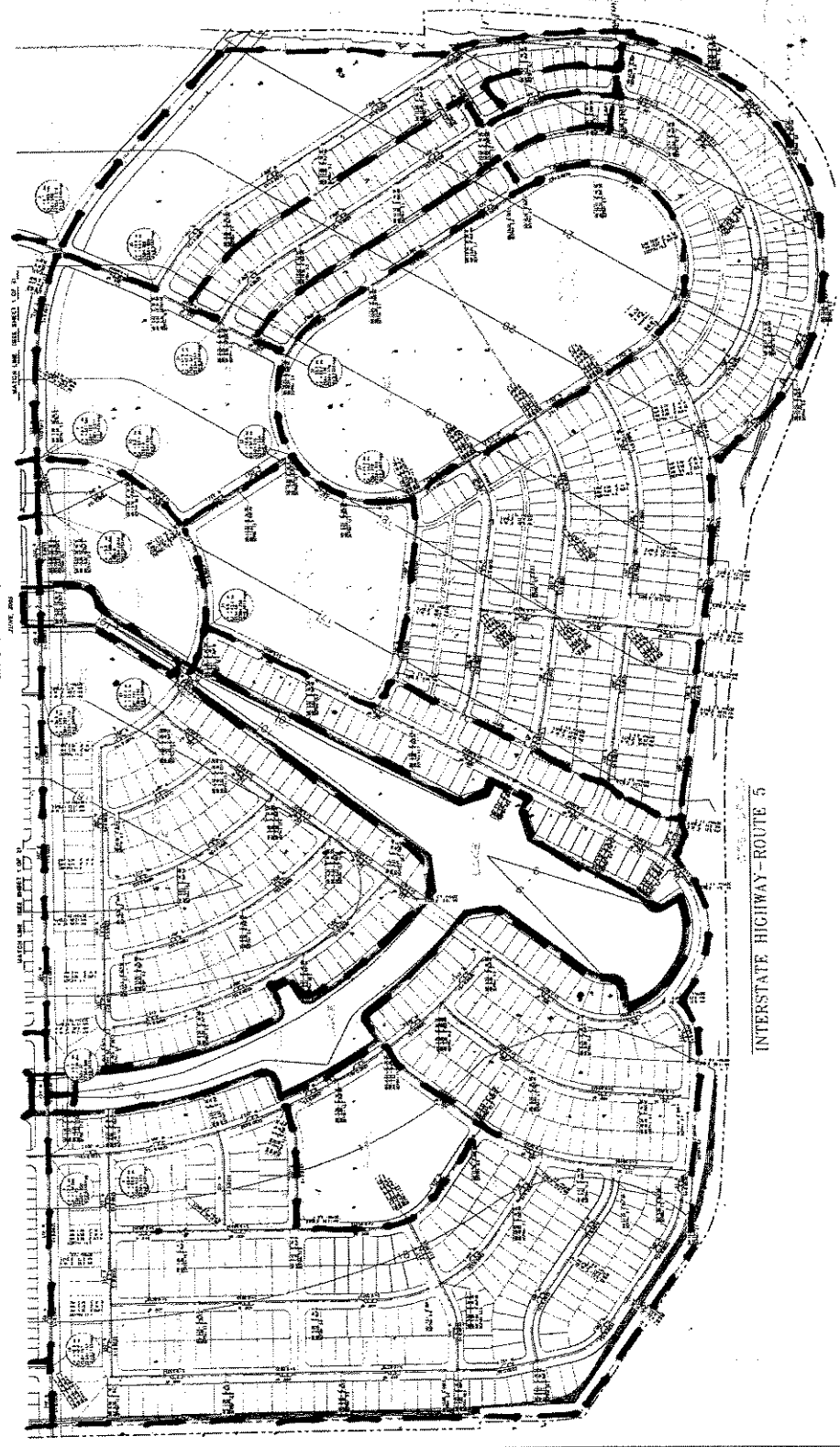
EXHIBIT D

(PRELIMINARY SEWER STUDY FOR)
GREENBRIAR
ART DEVELOPMENT
CITY OF SACRAMENTO, CALIFORNIA
JUNE, 1988



LEGEND

1" = 100'	PROPOSED SEWER MAIN
1" = 100'	EXISTING SEWER MAIN
1" = 100'	PROPOSED STORM MAIN
1" = 100'	EXISTING STORM MAIN
1" = 100'	PROPOSED STREET
1" = 100'	EXISTING STREET
1" = 100'	PROPOSED LOT
1" = 100'	EXISTING LOT
1" = 100'	PROPOSED DRIVE
1" = 100'	EXISTING DRIVE
1" = 100'	PROPOSED ALLEY
1" = 100'	EXISTING ALLEY
1" = 100'	PROPOSED PARKWAY
1" = 100'	EXISTING PARKWAY
1" = 100'	PROPOSED TRAIL
1" = 100'	EXISTING TRAIL
1" = 100'	PROPOSED WALKWAY
1" = 100'	EXISTING WALKWAY
1" = 100'	PROPOSED BIKEWAY
1" = 100'	EXISTING BIKEWAY
1" = 100'	PROPOSED CANAL
1" = 100'	EXISTING CANAL
1" = 100'	PROPOSED DRAINAGE
1" = 100'	EXISTING DRAINAGE
1" = 100'	PROPOSED FLOODPLAIN
1" = 100'	EXISTING FLOODPLAIN
1" = 100'	PROPOSED WETLAND
1" = 100'	EXISTING WETLAND
1" = 100'	PROPOSED OPEN SPACE
1" = 100'	EXISTING OPEN SPACE
1" = 100'	PROPOSED PARK
1" = 100'	EXISTING PARK
1" = 100'	PROPOSED PLAYGROUND
1" = 100'	EXISTING PLAYGROUND
1" = 100'	PROPOSED SCHOOL
1" = 100'	EXISTING SCHOOL
1" = 100'	PROPOSED CHURCH
1" = 100'	EXISTING CHURCH
1" = 100'	PROPOSED COMMUNITY CENTER
1" = 100'	EXISTING COMMUNITY CENTER
1" = 100'	PROPOSED LIBRARY
1" = 100'	EXISTING LIBRARY
1" = 100'	PROPOSED POST OFFICE
1" = 100'	EXISTING POST OFFICE
1" = 100'	PROPOSED POLICE STATION
1" = 100'	EXISTING POLICE STATION
1" = 100'	PROPOSED FIRE STATION
1" = 100'	EXISTING FIRE STATION
1" = 100'	PROPOSED TRANSIT STATION
1" = 100'	EXISTING TRANSIT STATION
1" = 100'	PROPOSED WATER TREATMENT PLANT
1" = 100'	EXISTING WATER TREATMENT PLANT
1" = 100'	PROPOSED WASTEWATER TREATMENT PLANT
1" = 100'	EXISTING WASTEWATER TREATMENT PLANT
1" = 100'	PROPOSED LANDFILL
1" = 100'	EXISTING LANDFILL
1" = 100'	PROPOSED INDUSTRIAL ZONE
1" = 100'	EXISTING INDUSTRIAL ZONE
1" = 100'	PROPOSED BUSINESS ZONE
1" = 100'	EXISTING BUSINESS ZONE
1" = 100'	PROPOSED RESIDENTIAL ZONE
1" = 100'	EXISTING RESIDENTIAL ZONE
1" = 100'	PROPOSED RECREATION ZONE
1" = 100'	EXISTING RECREATION ZONE
1" = 100'	PROPOSED OPEN SPACE ZONE
1" = 100'	EXISTING OPEN SPACE ZONE



INTERSTATE HIGHWAY - ROUTE 5

SHEET 2 OF 2

WOOD ROBBERS
3801 G ST., SUITE 100
SACRAMENTO, CA 95816
TEL: 916/441-1111



EXHIBIT E
GREENBRIAR SEWER STUDY CALCULATIONS

