Prepared for the

Sacramento Regional County Sanitation District

Interceptor System Master Plan 2000

Appendix A

Costing Criteria

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October 5, 2000

SRCSD Interceptor System Master Plan 2000

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1.0 Introduction

The purpose of this Memorandum is to present the criteria used to estimate cost of new facilities required to meet existing and projected sewer flows for the SRCSD service area. The SRCSD Master Plan 2000 includes interceptors that range in size from 36-inch to 120-inch in diameter. Projects of this size inherently have a variety of components that must be evaluated in order to estimate the overall cost of construction. These components relate to cost of materials, labor, equipment, and right of way and are impacted by the interceptor route because of differing soils, groundwater, narrow construction corridors, crossings and existing utilities.

1.1 Development of Estimated Costs

Cost Estimates for Master Plan facilities are typically developed using unit cost tables. For MP2000 a more sophisticated approach to estimating Capital Improvement Costs was utilized.

For this Master Plan a model was developed to estimate construction costs directly from materials, labor and equipment costs (see Figure 1-1). In order to do this, assumptions were made regarding type of construction and production rates.

As part of the estimating process, construction techniques to be utilized for installation of the interceptors were identified for each project segment. During the evaluation of construction right-of-way requirements three open cut trench configurations were considered, benched trench, vertical trench, and laid-back trench. Additionally, three general construction methods were evaluated including stockpiling soil on site, trucking soil off site, and sharing using a shared construction corridor to minimize required construction width. This resulted in nine construction techniques shown in Figure 1-2. For the purposes of cost estimating Techniques 1 and 8 were used. These techniques are the most commonly used construction methods for installation of large diameter pipeline in this region, and therefore were consider to be appropriate for use in cost estimating.

The first method includes benched construction with layback of the trench (Construction Technique 1), this method requires a wide construction corridor (see Figure 1-3). This type of construction is applicable for areas that are generally outside of the roadway in open fields. The second construction technique utilizes a vertical trench (Construction Technique 8), this technique is most applicable within constrained areas such as roadways where lanes of travel must be kept in service thereby limiting the width of the corridor (see Figure 1-4).

Development of costs for construction of the interceptors required assumptions made regarding elements of construction used to install the interceptor. These assumptions relate to the level of development within the area that the interceptor is to be constructed,

Sacramento Regional County Sanitation Disctrict
Master Plan 2000
Pipe Installation Costs
Materials, Equipment and Labor

Construction Type	8		AC/AB	Yes	Dewatering No
Soil Type	b		Depth of Bench		15
Production Rate	**65**	ft./day	Depth from Bench to Invert		20
ENR Index	1.035		Total Depth to Invert		35
Area Designation	D				

Dia.	Materials					Crew					Equipment								Material Costs								Total	Crew Costs		Total	Equip	Total	Total	Ovrhd &	TOTAL	TOTAL
(in.)	Pipe ($/ft.)	Bed qnty. (cy)	CDF (cy)	Asphalt (sq. ft.)	Spoil (cy)	S	F	PL	CL	O	E	C	FL	B	SF	SC	T	SC Ratio	Pipe ($/day)	Bedding ($/day)	AC/AB ($/day)	CDF ($/day)	Dewatering ($/day)	Spoil Rem ($/day)	Sheeting ($/day)	Trch Box ($/day)	Material ($/day)	Crew ($/day)	Operators ($/day)	Crew ($/day)	Cost ($/month)	Equip. ($/day)	($/day)	Profit ($/day)	($/day)	($/ft.)
36	$123	64.1	n/a	888	92	1	1	4	4	5	2	1	1	1	0	0	5	0.60	$7,963	$524	$3,218	n/a	$0	$276	$0	$205	$13,485	$2,670	$3,543	$6,213	$114,975	$3,833	$24,354	$4,881	$29,235	$450
39	$133	72.1	n/a	959	104	1	1	4	4	5	2	1	1	1	0	0	5	0.62	$8,653	$590	$3,473	n/a	$0	$313	$0	$205	$14,534	$2,670	$3,543	$6,213	$114,975	$3,833	$25,440	$5,071	$30,511	$469
42	$144	80.5	n/a	1,028	117	1	1	4	4	5	2	1	1	1	0	0	5	0.64	$9,344	$658	$3,723	n/a	$0	$352	$0	$205	$15,581	$2,670	$3,543	$6,213	$114,975	$3,833	$26,524	$5,261	$31,785	$489
48	$165	98.6	n/a	1,167	145	1	1	4	4	5	2	1	1	1	0	0	5	0.68	$10,725	$806	$4,229	n/a	$0	$436	$0	$205	$17,701	$2,670	$3,543	$6,213	$114,975	$3,833	$28,718	$5,645	$34,362	$529
54	$188	118.2	n/a	1,305	176	1	2	4	4	5	2	1	1	1	0	0	5	0.72	$12,188	$967	$4,729	n/a	$0	$529	$0	$205	$19,917	$3,070	$3,543	$6,613	$114,975	$3,833	$31,425	$6,158	$37,583	$578
60	$213	140.4	n/a	1,449	212	1	2	4	4	5	2	1	1	1	0	0	7	0.79	$13,813	$1,148	$5,249	n/a	$0	$636	$0	$205	$22,350	$3,070	$4,166	$7,236	$141,975	$4,733	$35,520	$6,937	$42,457	$653
66	$233	76.4	32	1,200	194	1	2	4	4	5	2	1	1	1	0	0	7	0.71	$15,153	$625	$4,346	$2,236	$0	$582	$0	$205	$24,837	$3,070	$4,166	$7,236	$147,950	$4,932	$38,300	$7,423	$45,723	$703
72	$254	83.1	36	1,276	220	1	2	4	4	5	2	1	1	1	0	0	7	0.74	$16,494	$679	$4,621	$2,507	$0	$660	$0	$205	$26,856	$3,070	$4,166	$7,236	$147,950	$4,932	$40,390	$7,789	$48,179	$741
78	$277	89.7	40	1,349	247	1	2	5	4	6	1	1	2	1	1	0	7	0.76	$17,997	$733	$4,886	$2,780	$0	$740	$0	$205	$29,031	$3,295	$4,791	$8,087	$159,150	$5,305	$43,907	$8,489	$52,397	$806
84	$300	97.0	44	1,427	277	1	2	5	4	6	1	1	2	1	1	0	7	0.88	$19,500	$793	$5,170	$3,086	$0	$831	$0	$205	$31,860	$3,295	$4,791	$8,087	$178,500	$5,950	$47,503	$9,118	$56,621	$871
90	$323	104.2	48	1,503	308	1	2	5	4	6	1	1	2	1	1	0	7	0.91	$20,963	$852	$5,445	$3,394	$0	$924	$0	$205	$34,057	$3,295	$4,791	$8,087	$178,500	$5,950	$49,777	$9,516	$59,293	$912
96	$345	110.7	53	1,571	337	1	2	5	4	6	1	1	2	1	1	0	10	0.93	$22,425	$905	$5,690	$3,679	$0	$1,011	$0	$205	$36,191	$3,295	$5,726	$9,021	$219,000	$7,300	$54,350	$10,410	$64,760	$996
102	$369	117.2	57	1,636	366	1	2	5	4	6	1	1	2	1	1	0	10	0.95	$23,969	$958	$5,926	$3,963	$0	$1,098	$0	$205	$38,393	$3,295	$5,726	$9,021	$219,000	$7,300	$56,630	$10,808	$67,438	$1,038
108	$400	124.9	61	1,712	402	1	2	5	4	6	1	1	2	1	1	0	10	0.97	$26,000	$1,021	$6,200	$4,304	$0	$1,205	$0	$205	$41,210	$3,295	$5,726	$9,021	$219,000	$7,300	$59,545	$11,318	$70,863	$1,090
114	$419	132.8	67	1,788	439	1	2	5	4	6	1	1	2	1	1	0	10	0.99	$27,219	$1,085	$6,475	$4,658	$0	$1,316	$0	$205	$43,233	$3,295	$5,726	$9,021	$219,000	$7,300	$61,639	$11,685	$73,324	$1,128
120	$438	140.8	72	1,863	477	1	2	5	4	6	1	1	2	1	1	0	10	1.02	$28,438	$1,151	$6,750	$5,025	$0	$1,432	$0	$205	$45,275	$3,295	$5,726	$9,021	$219,000	$7,300	$63,752	$12,054	$75,807	$1,166

NOTES

1. Crew abbreviations	Labor Cost ($/hr)	Equip Rental [1] ($/mo)
S - Superintendent	$60.00	
F - Foreman	$50.00	
PL - Pipelayer	$28.10	
CL - Construction Laborers	$27.85	
MS - CIP MH form setters	$28.80	
PS - Precast MH Setters	$28.10	
C - Concrete Laborers	$27.95	
O - Operator	SEE BELOW	
2. Eqpt abbreviations	36"-81" 84"-120"	
E - Excavator	$41.60 $43.08	
240C		$7,200
325L		$8,000
375L		$21,500
C - Crane	$45.49	
3900		$15,625
3900W S-2		$20,000
888 S-2		$25,850
FL - Front Loader	$40.22	$6,500
B - Backhoe	$40.22	$6,756
SF - Self Prop. Sheeps' Foot	$36.49	$4,700
SC - Scraper	$40.22	$15,500
DT - Delivery Truck	$38.95	$8,448
T - Spoil Removal Truck	$38.95	$13,500
WT - Water Truck	$38.95	$3,194

3. Materials

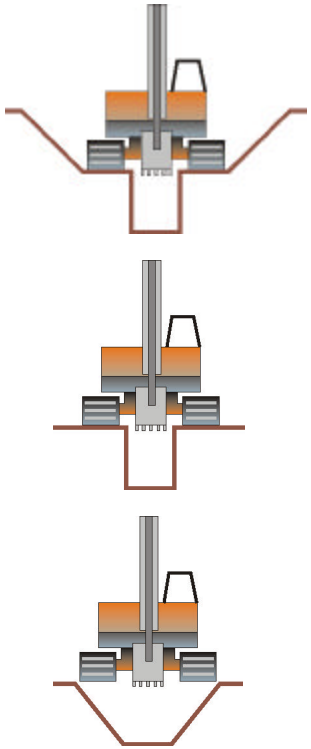
Bedding	$8.18	cy	Sheeting	$4	sq. ft.
Crushed Rock (AB)	$14.36	cy			
5 1/2 A.C./12" AB	$3.62	sq. ft.			
CDF	$70	cy			
Concrete	$100	cy			
Dewatering	$0.00	/ft./30 days			
Spoil Removal	$3	cy	(taken as the volume of bedding material, cdf & ac/ab)		
Misc Construction Equipment	$1,000	per day			

- pickup, generator, jack hammer, asphalt cutter, misc. tools

1. Equipment Rental costs include mobilization to and from site, plus cost for maintenance every 30 days.

Figure 1-1
Costing Model

SRCSD MP 2000
Interceptor Construction



On Site Spoil	Trucked Spoil	Shared Corridor
Technique 1	Technique 4	Technique 7
Technique 2	Technique 5	Technique 8
Technique 3	Technique 6	Technique 9

Figure 1-2
Construction Techniques

SRCSD MP 2000
Interceptor Construction

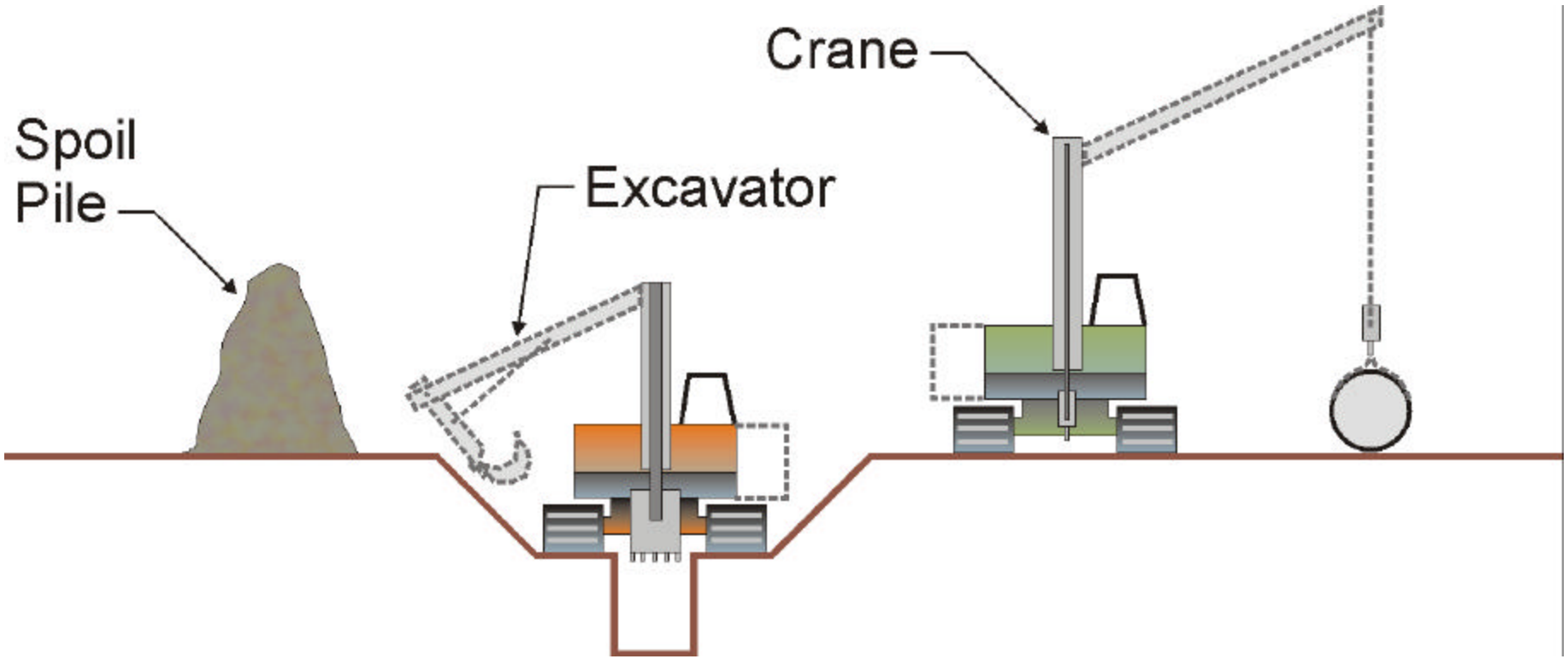


Figure 1-3
Benched Trench Construction

SRCSD MP 2000
Interceptor Construction

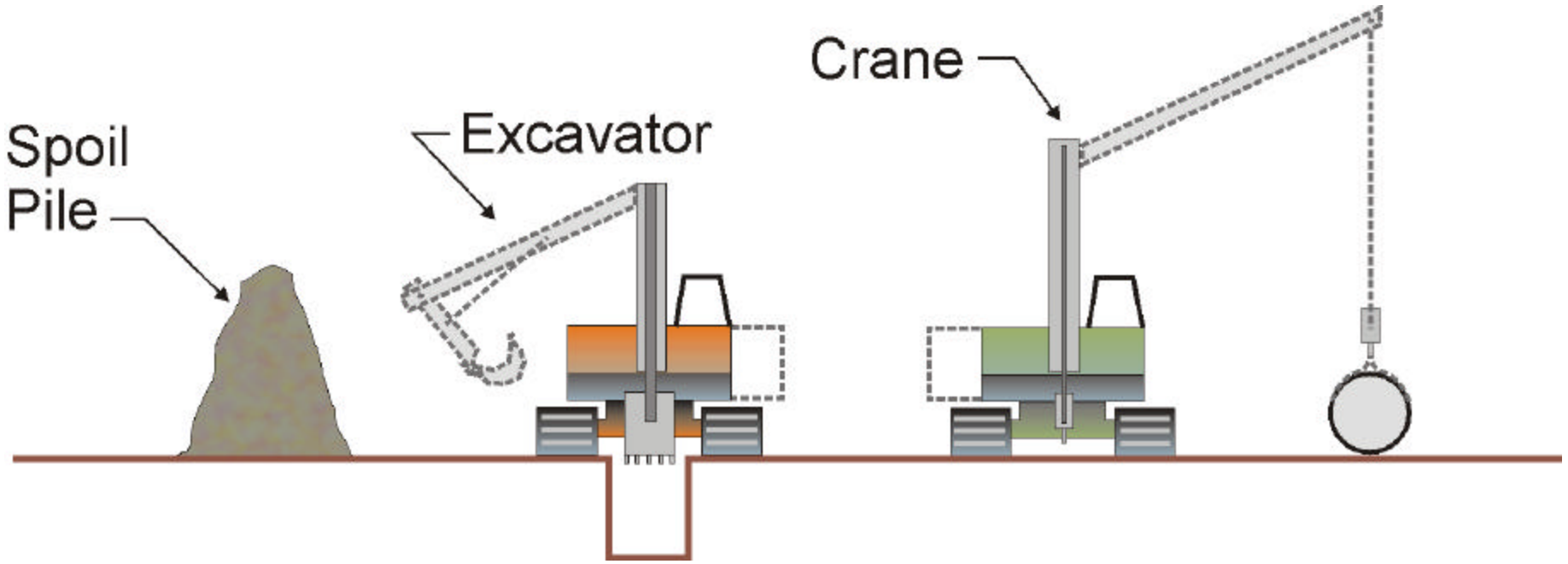


Figure 1-4
Vertical Trench Construction

the type of soils that will be encountered and whether there will be a need for dewatering. Preliminary geotechnical studies, ground water mapping, growth projections, and research into methods of construction support those assumptions. All these elements affect the overall cost of each interceptor project. For example, interceptors constructed within the paved sections must have costs included for replacement of asphalt concrete and aggregate base. In addition, interceptors that are constructed in highly developed areas will generally have numerous utilities that must be protected during excavation prior to placing the interceptor in the trench. Both of these examples affect the rate at which a contractor can physically install the pipe. Project costs for construction are directly tied to how many feet per day of interceptor can be installed. Rate of production is key to interceptor construction, and can vary significantly depending on the size of pipe, depth of construction, presence of groundwater, soils, and location of the pipeline corridor. Rate of production for the differing construction cases were carefully established based on recent SRCSD interceptor projects.

These techniques were further refined based on the construction corridors selected, soils, groundwater, and required construction width. The model relies on material costs combined with the construction technique and rate of production to estimate the material cost per foot for the specific diameter. Similarly, the model calculates labor and equipment costs based on manually entered labor rates and equipment rental rates, which are converted to cost per foot. The summation of the material, labor and rental equipment costs comprise the Base Pipeline Costs. The labor and equipment rates were referenced from the Caltrans Labor and Surcharge, and Caltrans Rental Cost publications respectively.

The project cost for each interceptor were developed based on the following components, associated costs were applied where they were determined applicable.

Base Construction Cost

Base Pipeline Costs
Labor and Equipment Costs
SWPPP/Environmental Mitigation
Sheeting and Shoring/Trench box
Mobilization/Demobilization
Manholes
Overhead and Profit
Bonds and Insurance

Additional Construction Cost

Special Structures
Traffic Control
Dewatering Cost
Right of Way
Pump Stations

Contingencies
Engineering/Administration/Legal

Total Construction Cost =
((Base Construction Costs) + (Additional Construction Costs))

1.2 Base Construction Costs

Unit costs were developed for pipes ranging in diameter from 36 to 120 inches. These costs were evaluated for open cut construction using the methods of construction described above.

1.2.1 Base Pipeline Costs

The reference costs used for the Baseline pipe costs were evaluated based on 1) review of local manufacturers' information, 2) review of recent construction bids, 3) prior SRCSD Master Plans, and 4) interviews with local contractors. The baseline pipe costs include costs for installation of the pipe as follows:

- Pipe material for Interceptors is Reinforced Concrete Pipe, T-Lock-Lined, Double Gasketed.

- Pipe material for Force mains include Ductile Iron, Cement Mortar Lined Steel Pipe, or Concrete Cylinder Pipe

- Backfill will be select imported backfill in the pipe zone (which extends both above and below the pipe) and native backfill above to the structural base of the pavement section. Pipes with diameters of 66-inch and larger have Controlled Density Fill (1/2 sack mix) used as backfill to the spring line. Spoil removal is dependant on construction method, under a benched section Scrapers will excavate the benched portion and take it to a offsite storage location with the remainder of the spoil stored adjacent to the trench. Under the vertical wall trench method spoil will be trucked to offsite storage and returned prior to backfilling trench.

- Manholes will be located at point of intersection on interceptor alignments, within straight sections manholes are located at a minimum of 1000-foot intervals.

- Minimum depth to crown of 5 feet.

- Restoration of all types of surfaces to preconstruction conditions.

1.2.2 Labor and Equipment Costs

Labor Costs were taken from the General Prevailing Wage Determination made by the Director of Industrial Relations Pursuant to California Labor Code Part 7, Chapter 1 Article 2, Sections 1770, 1773, and 1773.1. Review of the General Prevailing Wage Determination was completed for construction crew members and operator hourly wages as they relate to the methods of construction previously discussed. Crew size and equipment for pipeline construction was confirmed with various local contractors and Black & Veatch staff. Local equipment manufacturers' were contacted for equipment rental rates for use with the costing model

1.2.3 SWPPP/Environmental Mitigation

Environmental Mitigation costs were added where it was determined there were sensitive areas such as creeks, wetlands, etc. that were in the proximity of the interceptor alignment. In some cases construction of the interceptor was evaluated as special construction, which for planning purposes assumes that the areas would not be crossed using conventional open cut construction. Storm Water Pollution Prevention Plans (SWPPP) costs would also be included in this item.

1.2.4 Sheeting and Shoring/Trench box

The requirement, and applied cost for sheeting and shoring is based on the type of construction that was assigned for the interceptor. It was assumed that the contractor would use a trench box for benched construction. For the case of vertical trench wall construction, the soil type determined whether cost for a continuous shoring system(1) was applied or a trench box. For soils that were determined unable to hold a vertical face a continuous shoring system was used in evaluation of construction costs. A cost of $4/sq. ft. was used for a continuous shoring system.

(1) A continuous shoring system merely provides a positive and active means of preventing trench walls from falling during construction.

1.2.5 Mobilization and Demobilization

Contractor Mobilization and Demobilization includes move in and out cost that the contractor incurs to set up the interceptor construction operation. These costs are generally taken as a percent of the overall construction cost and are therefore dependent on the diameter, length and location of the interceptor. For the purposes of Master Planning a cost of $1000/dia. inch/mile was used for Mobilization and Demobilization. For example, a 96-inch diameter, 10,000-foot long interceptor project would have allocated $182,000 for Mobilization and Demobilization.

1.2.6 Manholes

Manhole locations were as required for angle points along the interceptor route based on in roadway alignments. In addition, manholes were located at change in diameter (where needed), Junction Structures, Drop Structures, and in general at intervals of every 1000 feet. Cost for manhole construction was included in the Base Pipeline Costs. Manhole costs were evaluated based on diameter and depth of interceptor, these costs were also calibrated against recent District projects.

1.2.7 Overhead and Profit

Overhead and Profit percentages were as referenced in the County of Sacramento Department of Public Works Standard Construction Specifications for change order work and force account. These percentages are applied to the material, labor and equipment costs for overall contractor Overhead and Profit. The following represent the current county policy for Overhead and Profit percentages:

Labor	25 percent
Materials	15 percent
Equipment Rental	15 percent

1.2.8 Bonds and Insurance

The percentage for Contractor Bonds required for performing the work were referenced in the County of Sacramento Department of Public Works Standard Construction Specifications for change order work and force account. The percentage for Bonds as listed in the county document is 2 percent of the material, labor and equipment used on the project. That figure was increased from 2 to 3 percent to include Bonds and Insurance for MP2000.

1.3 Additional Construction Costs

1.3.1 Special Structures

Special Structures include Junction Structures, Diversion Structures, and Drop Structures along interceptor routes or for transfer of flow to and from interceptors. These structures were evaluated based on interceptor junctions and deep crossings that necessitated pipe raising or lowering. These structures were inventoried and categorized according to depth of structure and diameters of flow through and connecting pipes. Bid results from several local interceptor projects were used to gain a level of confidence for assigning cost to the structures anticipated for the interceptor system (see Table 1-1).

TABLE 1-1
PRELIMINARY JUNCTION STRUCTURE
COST ESTIMATE

Project ID	Interceptor Name	Mainline Diameter In (in.)	Mainline Diameter Out (in.)	Connecting Diameter (in.)	Depth (ft.)	Structure Cost ($)
BR-1	Bradshaw 1&2	Taken from bid tab for all structures				$1,968,400
BR-6A	Bradshaw 6A	-	-	-	-	-
BR-6B	Bradshaw 6B	84	108	84	32	$1,629,091
	Bradshaw 6B	84	84	36	35	$593,939
BR-7	Bradshaw 7	84	84	66	30	$933,333
BR-8	Bradshaw 8	48	72	48	30	$332,468
SR-1	Sunrise 1*	24	48	-	20	$96,970
SR-2	Sunrise 2	36	24	24	14	$19,394
FE-1B	Folsom East 1B	48	48	???	???	-
FE-3	Folsom East 3	-	-	-	-	-
FE-3PS	PS	-	-	-	-	-
LE-1	Laguna Extension**	60	108	102	29	$1,280,519
DRR-1	Dry Creek Relief	42	42	-	-	-
NNI-1	North Natomas	42	42	-	-	-
UNW1	Upper Northwest 1	-	-	-	-	-
UNW2	Upper Northwest 2	-	-	-	-	-
UNW-3	Upper Northwest 3	-	-	-	-	-
UNW-4	Upper Northwest 4	66	84	54	44	$880,000
UNW-5	Upper Northwest 5	54	66	42	39	$390,000
UNW-6	Upper Northwest 6*	48	48	-	31	$300,606
UNW-7	Upper Northwest 7	-	-	-	-	-
UNW-8	PS	-	-	-	-	-
UNW-9	Upper Northwest 9	-	-	-	-	-
LNW-1	Lower Northwest 1	-	-	-	-	-
LNW-2	Lower Northwest 2*	84	120	-	19	$806,061
LNW-3	Lower Northwest 3	84	84	???	???	-
WSTPM	West Sac Treat. Plant Mod.	-	-	-	-	-
SO-1	South Interceptor-1	54	54	???	???	-
SO-2	South Interceptor- 2	-	-	-	-	-
SO-3	South Interceptor- 3	-	-	-	-	-
LC-1	Laguna Creek 1	102	102	???	???	-
LC-2	Laguna Creek 2	84	96	60	56	$1,810,101
LC-3	Laguna Creek 3	-	-	-	-	-
LC-4	Laguna Creek 4	-	-	-	-	-
LC-5	Laguna Creek 5	-	-	-	-	-
DC-1	Deer Creek 1	-	-	-	-	-
DC-2	Deer Creek 2	-	-	-	-	-
DC-3	Deer Creek 3	36	39	36	15	$50,649
DC-4	Deer Creek 4	-	-	-	-	-
MA-1	Mather Aerojet*	60	66	-	59	$983,333
	Mather Aerojet***	60	60	60	26	$375,180
AJ-1	Aerojet 1*	36	42	-	????	-
AJ-2	Aerojet 2	48	60	36	32	$221,645
AJ-3	Aerojet 3	-	-	-	-	-
AJ-4	Aerojet 4*	72	66	-	33	$660,000
RL-1	Rio Linda	-	-	-	-	-
FS-1	South Folsom PS & FM	-	-	-	-	-
AR-1	Arden Pump Station Site	-	-	-	-	-
					Total	$13,331,690

*-Drop Structure
**-LE-1 Manhole LE1030 is a junction structure with 3 inlets (102", 60", 54") and 1 outlet (108")
***-MA-1 Manhole MA1300 is a diversion/junction structure with 3 inlets (60", 42", 42") and 2 outlets (60", 60")

1.3.2 Traffic Control

Traffic control needs for interceptor construction have been assessed based on the selected pipeline corridors, expected method of construction, and existing and future road right of way width. The minimum requirement to maintain at least one lane of travel in each direction was observed and used in combination with the Right of Way Analysis described in Chapter 7 of the Master Plan and in Appendix G. Associated costs for Traffic Control are based on this minimum requirement and ranged from 1 to 5 percent of the cost of construction for the interceptor for the project segments that require traffic control.

1.3.3 Dewatering Costs

Dewatering for open cut trench construction was required for 30% of the interceptor projects evaluated. Groundwater mapping and geotechnical resources were used for determination of the need to provide dewatering for the various interceptor projects throughout Sacramento County. The variation in geological conditions within the SRCSD service area made it necessary to evaluate the cost of dewatering in general terms. Local drillers were contacted for input on these costs and an average cost was used for all interceptors. The cost for dewatering consists of drilling well points at 50 foot on center at a cost of $1200/well plus a $700/ pump package. Based on 1000 foot of trench the cost was evaluated as ($1200) x 20 wells plus ($700) x 20 wells = $38,000 or $38/ft.

1.3.4 Right of Way

Right of Way for each interceptor was evaluated based on the Right of Way Analysis as described in Chapter 7 of the Master Plan and in Appendix G. Cost for Right of Way is further separated into Temporary Construction Easements (TCE) and Permanent Right of Way (PRW). The TCE is the right of way width required for construction of the interceptor. The PRW is the permanent width along the interceptor required for maintenance and repair. The right of way widths required are directly affected by the type of construction technique used for installing the interceptor. Cost for land acquisition was assumed based on anticipated development. The SRCSD service area was evaluated based on three categories; developed areas, semi-developed areas, and undeveloped areas. The costs for land acquisition depend on existing and future land use for the areas impacted by construction (see Table 1-2). The land use categories that were evaluated included agricultural, industrial, commercial, and residential. Costs associated with each category of land use were converted to a cost per square foot of interceptor and are as shown below:

Agricultural	$0.50/sq.ft.
Undeveloped Residential	$1.50/sq.ft.
Developed Residential	$7.75/sq.ft.
Mixed use (Residential/Commercial)	$3.00/sq.ft.
Industrial	$2.00/sq.ft.

TABLE 1-2
SUMMARY
ESTIMATED VALUE ALLOCATION

PE%= 95% of Fee
TCE%= 10% of Fee per Yr.

Project ID	Project Name	Portion Length	TCE Sq. Ft.	PRW Sq. Ft.	Time Period	TOTAL FEE VALUE	TOTAL PRW	TOTAL TCE	TOTAL FEE +TCE	TOTAL PRW +TCE
BR-6A	Bradshaw Interceptor Section 6A	14,875	1,279,250	1,026,375	1/00 -1/03	$41,055	$39,002	$15,351	$56,406	$54,353
BR-6B	Bradshaw Interceptor Section 6B and Jackson Connector	8,525	178,821	0	1/00 -1/04	$0	$0	$12,501	$12,501	$12,501
BR-7	Bradshaw Interceptor Section 7	26,300	683,040	154,224	9/00 -9/03	$470,539	$447,012	$521,175	$991,714	$968,187
BR-8	Bradshaw Interceptor Section 8	7,291	121,956	131,400	1/01 -1/05	$401,820	$381,729	$131,712	$533,532	$513,441
SR-1	Sunrise Interceptor Section 1	4,659	115,796	80,946	12/02 -12/06	$528,151	$501,744	$100,071	$628,222	$601,815
SR-2	Sunrise Interceptor Section 2	4,658	102,168	35,560	12/02 -12/06	$302,260	$287,147	$201,660	$503,920	$488,807
FE-1B	Folsom East Interceptor Section 1B	11,022	88,176	0	9/03 -3/06	$0	$0	$79,358	$79,358	$79,358
FE-3PS	Folsom East Interceptor Section 3 Pump Station	500	25,000	100,000	1/00 -9/01	$205,000	$194,750	$8,542	$213,542	$203,292
UNW-1	Upper Northwest Interceptor Section 1	11,398	0	775,064	1/05 -1/09	$31,003	$29,452	$0	$31,003	$29,452
UNW-2	Upper Northwest Interceptor Section 2	10,652	0	639,120	12/06 -12/10	$25,565	$24,287	$0	$25,565	$24,287
UNW-3	Upper Northwest Interceptor Section 3	6,129	220,644	0	8/09 -3/12	$0	$0	$2,648	$2,648	$2,648
UNW-4	Upper Northwest Interceptor Section 4	7,675	191,875	84,425	2/12 -8/14	$353,672	$335,988	$200,950	$554,622	$536,938
UNW-5	Upper Northwest Interceptor Section 5	8,550	307,800	0	6/00 -6/03	$0	$0	$160,272	$160,272	$160,272
UNW-7	Upper Northwest Interceptor Section 7	9,170	136,960	150,180	6/01 -6/04	$1,060,016	$1,007,015	$308,314	$1,368,330	$1,315,329
UNW-8	Van Maren Pump Station	400	40,000	40,000	6/01 -6/04	$288,000	$273,600	$86,400	$374,400	$360,000
UNW-9	Upper Northwest Interceptor Section 9	16,296	281,256	8,880	1/05 -1/08	$63,936	$60,739	$627,481	$691,417	$688,220
LNW-3	Lower Northwest Interceptor Section 3	30,000	478,800	496,800	6/02 -12/06	$611,892	$581,297	$998,487	$1,610,379	$1,579,784
LNW-4	Natomas Pump Station Expansion	500	25,000	100,000	7/02 -7/05	$4,000	$3,800	$300	$4,300	$4,100
SO-1	South Interceptor Section 1	2,810	207,940	160,170	1/05 -1/08	$1,153,224	$1,095,563	$449,150	$1,602,374	$1,544,713
SO-2	South Interceptor Section 2	8,032	0	457,824	1/08 -1/12	$3,066,489	$2,913,164	$0	$3,066,489	$2,913,164
SO-3	South Interceptor Section 3	18,720	429,000	326,040	1/12 -1/15	$1,879,621	$1,785,640	$741,956	$2,621,576	$2,527,595
LC-1	Laguna Creek Interceptor Section 1	9,507	0	646,476	1/10 -1/13	$2,108,732	$2,003,295	$0	$2,108,732	$2,003,295
LC-2	Laguna Creek Interceptor Section 2	20,045	0	1,363,060	1/13 -1/16	$4,411,690	$4,191,106	$0	$4,411,690	$4,191,106
LC-3	Laguna Creek Interceptor Section 3	26,500	14,000	1,754,400	1/16 -2/19	$4,216,408	$4,005,588	$18,354	$4,234,762	$4,023,942
LC-4	Laguna Creek Interceptor Section 4	21,700	1,761,500	1,410,000	2/19 -2/22	$56,400	$53,580	$21,138	$77,538	$74,718
LC-5	Laguna Creek Interceptor Section 5	5,700	410,400	342,000	2/22 -2/25	$13,680	$12,996	$4,925	$18,605	$17,921
DC-1	Deer Creek Interceptor Section 1	23,100	476,100	375,000	12/02 -12/06	$401,640	$381,558	$272,495	$674,135	$654,053
DC-2	Deer Creek Interceptor Section 2	25,450	1,845,000	1,450,650	1-13 -2/16	$339,606	$322,626	$131,717	$471,323	$454,343

Source: Bender Rosenthal Report
of Right of Way Acquisition Costs
SRCSD Interceptor System Master Plan 2000

TABLE 1-2
SUMMARY
ESTIMATED VALUE ALLOCATION

Project ID	Project Name	Portion Length	TCE Sq. Ft.	PRW Sq. Ft.	Time Period	TOTAL FEE VALUE	TOTAL PRW	TOTAL TCE	TOTAL FEE +TCE	TOTAL PRW +TCE
DC-3	Deer Creek Interceptor Section 3	34,250	2,288,800	1,918,000	2/16 -2/19	$76,720	$72,884	$27,466	$104,186	$100,350
DC-4	Deer Creek Interceptor Section 4	8,000	408,000	448,000	2/19 -8/21	$17,920	$17,024	$4,080	$22,000	$21,104
MA-1	Mather Interceptor Section 1	26,260	585,318	284,598	9/03 -3/06	$709,334	$673,867	$338,966	$1,048,300	$1,012,833
AJ-1	Aerojet 1	4,658	18,312	182,413	?	$7,297	$6,932	$220	$7,516	$7,151
AJ-2	Aerojet 2	13,871	34,146	634,851	?	$2,285,464	$2,171,190	$36,878	$2,322,341	$2,208,068
AJ-2S	Aerojet 2 Stub	6,605	0	416,115	?	$853,036	$810,384	$0	$853,036	$810,384
AJ-3	Aerojet 3	6,607	369,992	416,241	?	$853,294	$810,629	$227,545	$1,080,839	$1,038,174
AJ-3S	Aerojet 3 Stub	3,516	0	270,732	?	$555,001	$527,251	$0	$555,001	$527,251
AJ-4	Aerojet 4	16,801	201,612	0	?	$0	$0	$2,419	$2,419	$2,419
RL-1	Rio Linda Interceptor Section 1	16,800	0	940,800	4/13 -11/15	$37,632	$35,750	$0	$37,632	$35,750
FS-1	South Folsom PS & FM	2,000	0	136,000	1/05 -1/09	$278,800	$264,860	$0	$278,800	$264,860
		479,532	13,326,662	17,756,344		$27,708,895	$26,323,450	$5,732,529	$33,441,424	$32,055,979

Source: Bender Rosenthal Report
of Right of Way Acquisition Costs
SRCSD Interceptor System Master Plan 2000

Commercial	$6.00/sq.ft.

1.3.5 Pump Stations

The cost of construction for the pump stations have been estimated based on a cost curve developed in Pumping Station Design by Sanks. A relationship between gallons pumped and cost of construction of the pump stations was developed which included auxiliary power, nonclog sewage pumps, and pump redundancy. The curve shows an upper and lower limit for cost of construction, representing fully covered facilities with backup power as compared to slab on grade pumps exposed to the elements.

1.3.6 Contingency

Contingency for MP2000 was separated into three categories to included projects in the construction stage, projects in the Design Report stage and projects in the conceptual layout stage. Contingency for each of these categories was weighed according to the level of development of each. The percentage applied as contingency for each is as follows:

Construction stage	10%
Design Report stage	15%
Conceptual layout stage	25%

1.3.7 Regulatory Permits

Large scale construction projects, as is the case with interceptor construction, requires permits to be procured prior to beginning the work. Various agencies have jurisdiction over underground construction and require that proper procedures be followed before, during and after construction to ensure minimal impact to the area involved in construction. Table 1-3 summarizes the various agencies and permits that are often required for interceptor construction. The number and type of permits required for construction depends on where the interceptor is to be installed. Construction in established road right of way with creek, railroad, and highway crossing will normally require more permits than construction without crossings. The cost for permits is included in the costs for Engineering, Administration and Legal and these costs are discussed in Section 1.3.9.

TABLE 1-3
Regulatory Permits

Agency	Permit
County	Encroachment Permit
	Transportation Permit
City	Encroachment Permit
Caltrans	Encroachment Permit

SPRR	Encroachment Permit
CALOSHA	Underground Classification Permit
RWQCB	NPDES General Construction Activity Stormwater Permit
State Park	Access Permit
Regional Transit	Right of Way License Agreement
Army Corps of Engineers	Section 404 Permit
Department of Fish and Game	Streambed Alteration. Agreement, Incidental Take Permit

1.3.8 Public Outreach

Public Outreach for interceptor construction involves communication to area and business residents regarding the status of the project design and/or construction. This effort is primarily intended to keep the public informed of the anticipated changes in service to their area, and provide an avenue for feedback from area constituents. Historically, the cost of the Public Outreach Program has been included in the cost for consultant services which is included in Item 1.3.9 below.

1.3.9 Engineering/Administration/Legal

Engineering, Administration and Legal costs are those costs incurred in design, plan check, bid, award, inspection, and construction management of the interceptor projects. These costs are often divided between Design Consultants and District staff for design and construction management of the interceptors. Inclusion of a 25% multiplier on the Base and Additional Construction Costs comprises the cost for Engineering Administration and Legal.

1.4 Alternative Construction Method Costs

1.4.1 Special Construction – Trenchless Construction

There exist numerous physical constraints along the interceptor routes that may require a contractor to utilize special techniques of construction in order to install the interceptor in the designated route. Bore and Jack of a carrier pipe for insertion of the conveyance pipe is one standard technique, that may be required at railroad crossings, creek crossings, canal crossings, major street crossings, highway crossings, and potentially to avoid sensitive habitat. Similar to the cost assigned for Special Structures, the cost for Bore and Jack construction is a function of the diameter of pipe and the length of the crossing. For a compilation of interceptors and the respective crossings within their alignments (see Table 1-4). The cost for Bore and Jack construction was estimated at $20/dia. inch/ft.

A review of recently completed District tunneling projects was undertaken to determine planning level costs for interceptors planned for installation by tunneling techniques. Three projects were available for review, including Bradshaw 5A, Folsom East 2B, and

TABLE 1-4
BORE AND JACK
COST ESTIMATE

Project ID	Interceptor Name	Distance (ft.)	Diameter (in.)	Depth (ft.)	Bore & Jack Cost ($)
BR-1	Bradshaw 1&2	1,169	120	20	$3,740,800
BR-6A	Bradshaw 6A	110	108	30	$237,600
BR-6B	Bradshaw 6B	140	108	33	$302,400
	Bradshaw 6B	-	-	-	-
BR-7	Bradshaw 7	100	72	16	$144,000
BR-8	Bradshaw 8	12,672	72	25	$18,247,680
SR-1	Sunrise 1	350	48	29	$336,000
SR-2	Sunrise 2	-	-	-	-
FE-1B	Folsom East 1B	100	48	20	$96,000
FE-3	Folsom East 3	240	42	15	$201,600
FE-3PS	PS	-	-	-	-
LE-1	Laguna Extension	1,000	108	23	$2,160,000
	Laguna Extension	1,000	60	24	$1,200,000
DRR-1	Dry Creek Relief	-	-	-	-
NNI-1	North Natomas	-	-	-	-
UNW1	Upper Northwest 1	11,750	84	22	$19,740,000
UNW2	Upper Northwest 2	5,150	72	10	$7,416,000
UNW-3	Upper Northwest 3	270	72	14	$388,800
UNW-4	Upper Northwest 4	220	72	30	$316,800
UNW-5	Upper Northwest 5	370	48	25	$355,200
UNW-6	Upper Northwest 6	500	36	26	$360,000
UNW-7	Upper Northwest 7	1,530	36	18	$1,101,600
UNW-8	PS	-	-	-	-
UNW-9	Upper Northwest 9	4,110	36	30	$2,959,200
LNW-1	Lower Northwest 1	300	96	23	$576,000
		800	72	23	$2,073,600
LNW-2	Lower Northwest 2	1,050	120	29	$2,520,000
LNW-3	Lower Northwest 3	3,500	84	20	$5,880,000
		1,150	60	20	$2,484,000
WSTPM	West Sac Treat. Plant Mod.	-	-	-	-
SO-1	South Interceptor-1	600	54	30	$648,000
SO-2	South Interceptor- 2	200	54	18	$216,000
SO-3	South Interceptor- 3	-	-	-	-
LC-1	Laguna Creek 1	2,000	102	15	$4,080,000
LC-2	Laguna Creek 2	2,000	96	15	$3,840,000
LC-3	Laguna Creek 3	150	84	12	$252,000
LC-4	Laguna Creek 4	500	66	25	$660,000
LC-5	Laguna Creek 5	100	36	20	$72,000
DC-1	Deer Creek 1	-	-	-	-
DC-2	Deer Creek 2	2,000	48	20	$1,920,000
DC-3	Deer Creek 3	200	36	20	$144,000
DC-4	Deer Creek 4	100	33	10	$66,000
MA-1	Mather Aerojet	500	72	55	$720,000
	Mather Aerojet	200	36	25	$144,000
AJ-1	Aerojet 1	600	42	10	$504,000
AJ-2	Aerojet 2	1,400	72	60	$2,016,000
AJ-3	Aerojet 3	-	-	-	-
AJ-4	Aerojet 4	1,700	72	60	$2,448,000
RL-1	Rio Linda	100	54	8	$108,000
FS-1	South Folsom PS & FM	-	-	-	-
AR-1	Arden Pump Station Site	-	-	-	-
				Total	$90,675,280

Bradshaw 1&2 (Jacked Pipe Portion). These projects ranged in cost from approximately $15/dia. inch to over $36/dia inch. This comparison showed a wide variation in ground conditions, pipe diameters, and length of interceptor. For the purpose of estimating costs associated with Microtunneling, a cost of $20/dia inch/ft. was used unless information on geology within the pipeline alignment revealed the need for adjustment.

1.4.2 Nighttime and Weekend Construction

Construction of interceptors through specific areas within city limits often times has the potential to create financial hardship for businesses. There is the possibility that construction can temporarily negatively affect the ability for the public to access certain areas. When those areas include businesses, the public reaction to avoid such construction zones can keep potential clients or consumers away from these businesses. When a definite need is established, the time of construction can be altered to after business hours, thereby reducing the impact that a business may suffer due to daytime construction. Nighttime construction is more expensive, contractors must pay additional fees for lighting, generators and overtime for the pipeline installation crews and equipment. As is shown in Figure 1-4, the cost for materials remains the same but labor and equipment costs increase for nighttime and weekend construction. Based on a 108-inch diameter interceptor construction within a developed area using a vertical trench excavation technique, it is estimated that nighttime and weekend construction would add an additional 14.5% and 20.5% in construction costs respectively.

1.4.3 Special Backfill Requirements

During interceptor construction there exists conditions that require alternate materials for backfill of the trench prior to project completion. Some of those conditions include unsuitable native material to be used as backfill, and inability to meet compaction requirements (beneath pipe haunches). These conditions may require that imported material such as structural fill or controlled density fill is brought in from offsite for completion of the trench section. In addition, there are cases where the percentage of compaction required is higher than optimum for a native material. Depending on the native material used as backfill there exists the possibility that chemical assistance will be needed in order to obtain set percentages for backfill compaction. Under this condition, extra compactors and chemicals required to obtain set compaction percentages add additional cost for interceptor installation.

1.5 Cost Criteria Summary

The costs presented in this section for design and construction of new facilities reflect January 2000 price levels. Probable costs for major structures and equipment are based on construction costs for similar projects and on information provided by equipment suppliers. Probable costs include allowances for contingencies and general requirements (contractor mobilization, supervision, and equipment rental) and for rate of production based on the anticipated construction technique, soil type, and ground water level.

Specific unit costs for bedding, pipe, controlled density fill (CDF), concrete, lift stations, sheeting, trench boxes, etc., were developed based on data provided from recent District projects, vendor quotes and Black & Veatch inspection staff. Capital cost opinions were based on projected price levels for the San Francisco Area and reflect Engineering News Record (ENR) Construction Cost Index (CCI) of 6474.

As discussed previously, this analysis and the resulting costs focused primarily on Construction Techniques 1 & 8. These techniques were evaluated for the various master planned pipelines. The cost of installation is directly related to the anticipated soils, production rate, and ease of construction. Assumptions were made for the methods of construction for each Construction Technique (see Table 1-5).

TABLE 1-5
Cost Criteria Summary

Item	Unit	Cost Factor
Planning Period	years	20-30
Land Cost	acres	Varies
Interceptor Pipelines	36-inch to 120-inch	$123/lf to $438/lf
Right of Way	Easements	Varies
Dewatering	lf	$38
Pumping Stations	n/a	Sanks Pump Curve
Special Structures	n/a	Previous projects
Manholes	n/a	Previous projects
Bedding	cubic yards	$8.18
Crushed Rock	cubic yards	$14.36
Concrete	cubic yards	$100/cy
(CDF)	cubic yards	$70/cy
Asphalt	square feet	$3.62.
Labor	$/hr	Caltrans Labor Surcharge
Rental Costs	$/month	Caltrans Rental Cost

The costs developed in Table 1-5 are for construction only for interceptors and do not include O&M costs. These costs take into account the area of construction, soil type, depth of interceptor, diameter of interceptor, special construction, manholes, and depth to groundwater. As the interceptor projects move into the Design Phase, more information will be available allowing for a more accurate estimate for overall construction of each specific interceptor project.