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Author

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FY 1995 Project Review/Validation

Lawrence Berkeley Laboratory



Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720
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April 27, 1993

**FY 1995 Project Review/Validation
Lawrence Berkeley Laboratory**



Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720
Prepared for U.S. Department of Energy under Contract No. DE-AC03-76SF00098

Agenda

Project Validation Review

Building 90 Room 1099

Tuesday, April 27, 1993

	<u>Subject</u>	<u>Previously Validated</u>	<u>Presenter</u>
8:30 A	Introduction (15 min)		Camper/Schleifer
8:45 A	LBL Overhead Discussion (20 min)		Stoffey
9:05 A	Induction Linac Systems Experiment (ILSE) (45 min) <i>New Start FY95</i>	Yes (92)	Fessenden/Pickrell
9:50 A	Chemical Dynamics Research Laboratory (45 min) <i>New Start FY95</i>	Yes (91)	Gough/Truchlikova
10:35 A	Break (15 min)		
10:50 A	ALS Beamlines Initiative (45 min) <i>New Start FY95</i>	Yes (92)	Yourd/Harkins
11:35 A	Safety and Support Services Facility (35 min) <i>New Start FY95</i>	Yes (92)	Gain
12:10 P	Lunch		
1:15 P	Upgrade of Site Mechanical Utilities, Phase II - Sewer Monitoring (35 min) <i>New Start FY95</i>	Yes (92)	Koenigshofer
1:50 P	Human Genome Laboratory (25 min) <i>Budget FY94</i>	Yes (92)	Hong
2:15 P	ALS Structural Biology Support Facilities (25 min) <i>Budget FY94</i>	Yes (92)	Harkins
2:40 P	Fire and Safety Systems Upgrade, Phase I (25 min) <i>Funded FY93</i>	Yes (92)	Stanton
3:05 P	Break (15 min)		
3:20 P	Hazardous Materials Safeguards, Phase I (25 min) <i>Funded FY93</i>	Yes (92)	Stanton
3:45 P	East Canyon Electrical Safety Project (25 min) <i>Funded FY92</i>	Yes (92)	Stanton
4:10 P	Summary Discussion / Adjourn		

FY 1995 Project Review/Validation

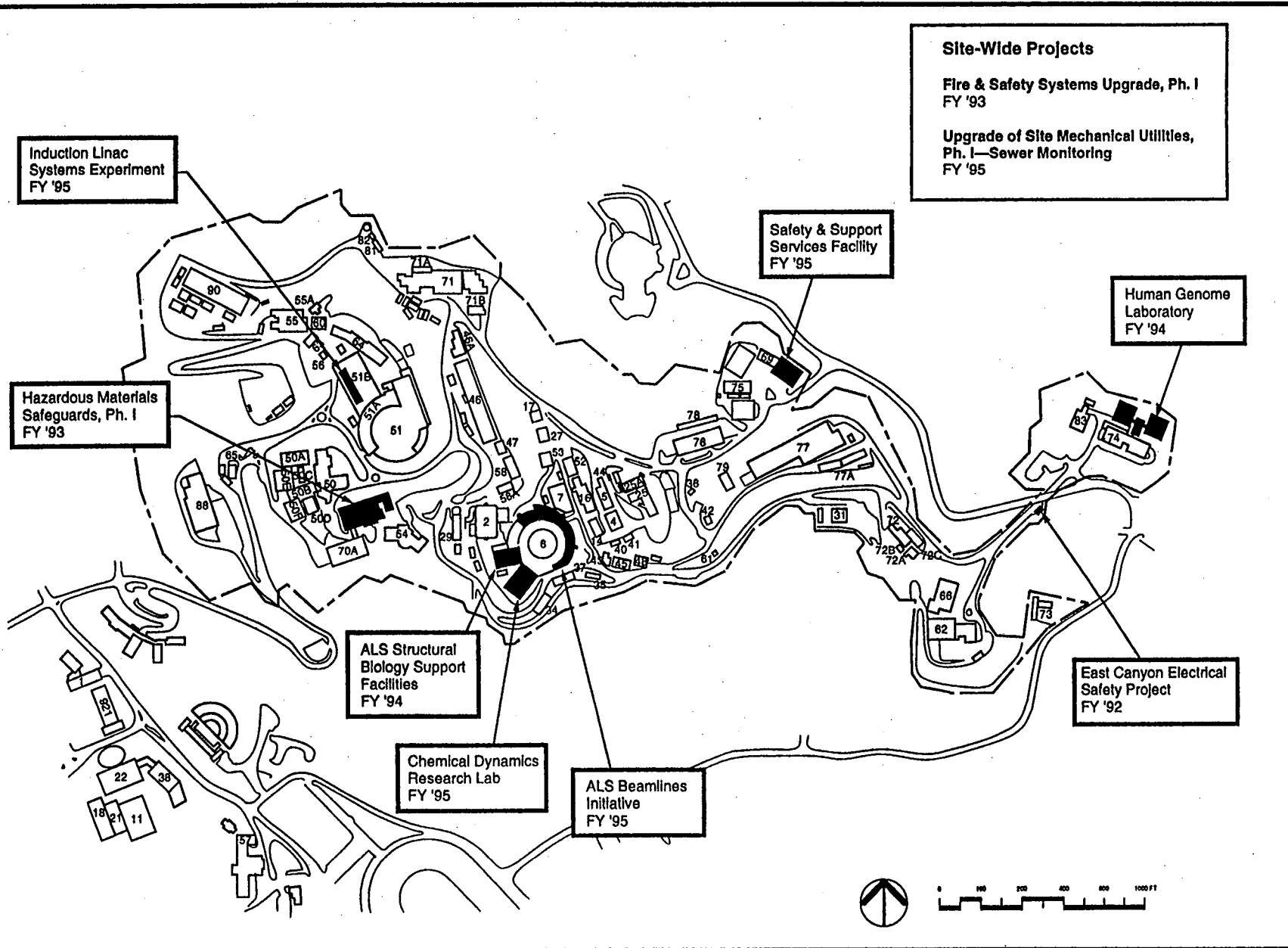
INTRODUCTION



LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

FY 1995 PROJECT REVIEW / VALIDATION

4/15/93



LAWRENCE BERKELEY LABORATORY

FY 1995 CONSTRUCTION PROJECTS FOR VALIDATION REVIEW

<u>Program</u>	<u>Project</u>	<u>FY95 Funding (\$K)*</u>	<u>TEC* (\$K)</u>	<u>Data Sheet</u>	<u>FY95 CDR</u>	<u>New Start</u>	<u>Last Validation</u>	<u>NEPA Status</u>
<u>FY95 Starts</u>								
1. IFE	Induction Linac Systems Experiments (ILSE)	9,200	38,300	x	x	x	92	Sched
2. BES	Chemical Dynamics Research Laboratory	7,100	55,900	x	x	x	91	Sched
3. BES	ALS Beamlines Initiative	9,800	44,000	x	x	x	92	Sched
4. MEL-FS	Safety and Support Services Facility	1,600	11,500	x	x	x	92	Sched
5. MEL-FS	Upgrade of Site Mechanical Utilities, Phase II - Sewer Monitoring	1,000	7,600	x	x	x	92	Sched
<u>FY94 Budgeted</u>								
6. OHER	ALS Structural Biology Support Facilities	4,700	7,900	x			92	Sched
7. OHER	Human Genome Laboratory	15,600	24,700	x			92	In Progress
<u>Funded Projects</u>								
8. MEL-FS	Fire and Safety Systems Upgrade, Phase I	2,000	4,600	x			92	Compl
9. MEL-FS	Hazardous Materials Safeguards, Phase I	3,600	5,100	x			92	In Progress
10. MEL-FS	East Canyon Electrical Safety Project	<u>1,000</u>	<u>3,900</u>	x			92	Compl
	TOTAL	55,600	203,500					

*Application of 16% LBL Overhead Not Included in TEC

GENERAL INFORMATION

- **All Projects are in General Conformance with the LBL Site Development Plan Approved by DOE in 1992; Draft Updated Site Development Plan Submitted in March 1993**
- **Cost Estimates Utilize Escalation Rates Updated August 1992**
- **Cost Estimates Include Design and Construction Activities Required by Current Codes and EH&S Regulations and DOE Order (6430.1A General Design Criteria)**
- **Construction Estimates**
 - **Are Based upon Quantity Take Offs and Vendor Quotations where Applicable**
 - **Have been Summarized in Conformance with Construction Specification Institute (CSI) Format**
- **ED&I Estimates**
 - **LBL Activities; Based on Time and Wage Rates**
 - **LBL Consultant Tasks; Fee Estimates Based on Historical Data**
 - **A/E Design; Percentage Fees Based on Historical Data; 6% Fee Limitation Applies for Direct Title I and Title II Design Activities**

GENERAL INFORMATION (continued)

- **MEL-FS Projects Have Been Prioritized Based upon the Capital Assets Management Program (CAMP) Requirements**
- **NEPA/SARS Schedules**
 - **FY 1992 Starts**
 - **East Canyon Electrical Safety Project**
NEPA Categorical Exclusion
SARS Exempt
 - **FY 1993 Starts**
 - **Fire and Safety Systems Upgrade, Phase I**
NEPA Categorical Exclusion
SARS Exempt
 - **Hazardous Materials Safeguards, Phase I**
NEPA Categorical Exclusion
Recommended. Review in Progress
SARS Exemption Recommended.
Review in Progress

GENERAL INFORMATION (continued)

- **FY 1994 Starts**

- **Human Genome Laboratory**

- NEPA EA In Progress**

- SARS PSAD in Progress**

- **ALS Structural Biology Support Facilities**

- NEPA Evaluating Required Level of
NEPA Document**

- SARS Evaluating Required Level of
SARS Document**

- **FY 1995 Starts**

- **Scheduled in CDR**

ESCALATION RATES

All Projects Used Historical and Anticipated Economic Escalation Rates for DOE Construction Projects August 1992

Fiscal Year	Energy Research and Nuclear
Historical	
1989	4.2
1990	3.1
1991	2.7
1992	1.8
Anticipated	
1993	3.0
1994	3.9
1995	4.1
1996	4.3
1997	4.5
1998	4.5

Escalation Analysis Provided for Each Project Proposed for FY95

PRESENTATION MATERIALS

Previously Validated Projects:

- **Brief Description for Orientation**
- **Summary of Changes Since Last Review**
 - Scope**
 - Schedule**
 - TEC**
- **Changes in Cost Estimate Since Last Review**
 - Changes Due to Scope Modifications**
 - Changes Due to Escalation**
- **Financial Schedule and Total Project Costs (TPC)**
- **Contingency Analysis**
- **BA/BO and Time Schedules**
- **Status of NEPA and SARS Process**
- **Additional Data in Hard Copy**

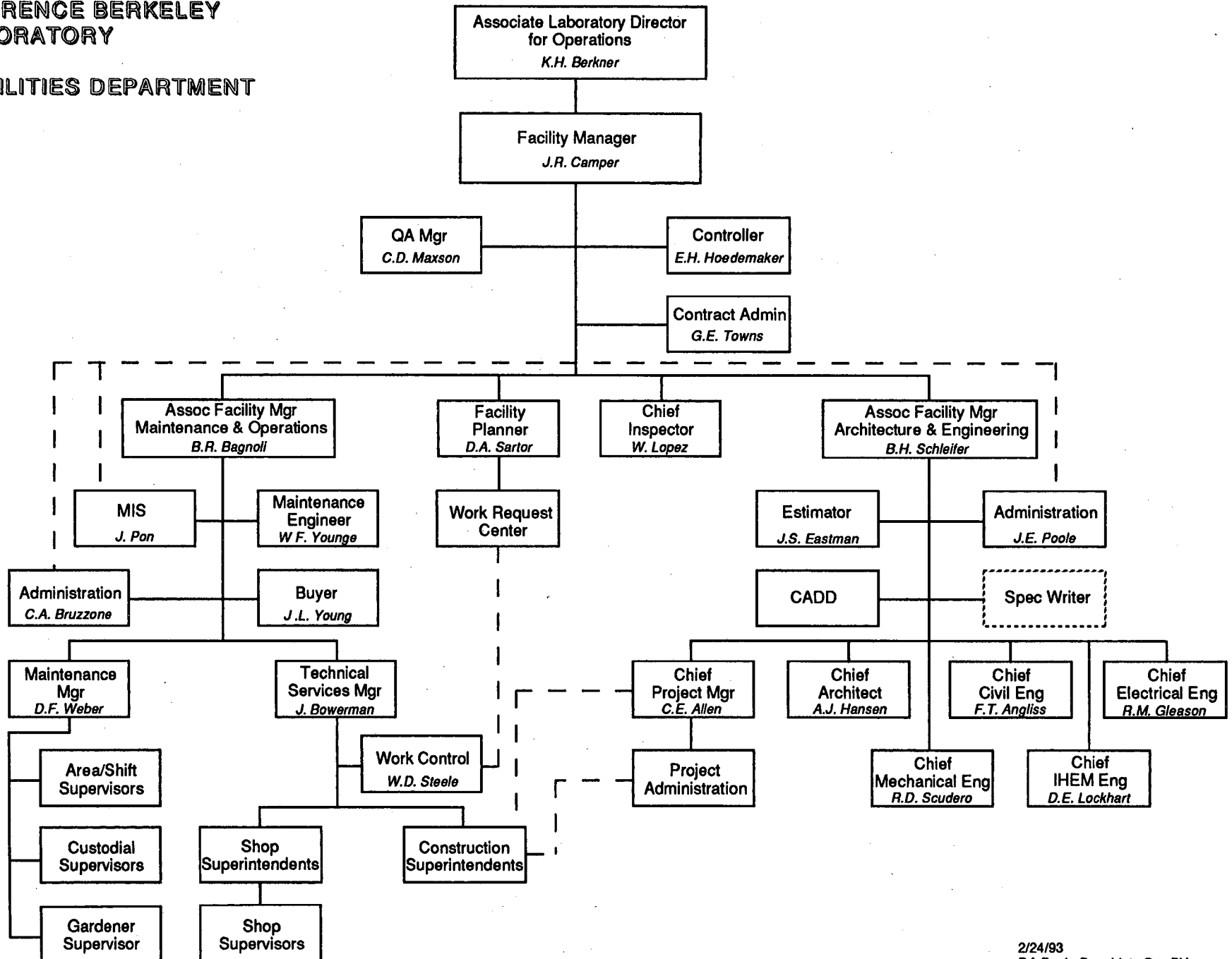
PRESENTATION MATERIALS (continued)

Projects Not Previously Validated / Projects with Significant Changes:

- **Site Plan**
- **Justification**
- **Project Description and Drawings**
- **Basis of Conceptual Design**
- **Method of Accomplishment**
- **Cost Estimate with Schedules I and II**
- **Financial Schedule and Total Project Costs (TPC)**
- **Contingency Analysis**
- **BA/BO and Time Schedules**
- **Additional Data in Hard Copy**

**LAWRENCE BERKELEY
LABORATORY**

FACILITIES DEPARTMENT





A/E FEE PROPOSAL ESTIMATE

THIS INFORMATION IS REQUIRED TO EVALUATE FEE PROPOSALS AND
COMPLY WITH DOE AUDIT REQUIREMENTS ON NEGOTIATED CONTRACT

A/E Firm Name: TYPE HERE #####												S.C. No.:		Est. Construction Cost: \$			
Project Name: TYPE HERE #####												Project Manager: TYPE HERE #####					
Task Description: TYPE HERE #####												Requester: TYPE HERE #####					
SECTION A DESIGN SERVICES	Design Discipline	Est. No. Dwgs.	Hourly Rate	Est. Hrs.	Estimated Cost		Est. Hrs.	Estimated Cost		Total Design							
					A/E	Consultant		A/E	Consultant	Hrs.	Estimated Cost						
	D Project Engineer				0			0		0	0						
	R Architect				0			0		0	0						
	A Struct Engineer				0			0		0	0						
	W Mech Engineer				0			0		0	0						
	I Elec Engineer				0			0		0	0						
	N Civil Engineer				0			0		0	0						
	G Fire Engineer				0			0		0	0						
	S Coord Consults				0			0		0	0						
					0			0		0	0						
					0			0		0	0						
					0			0		0	0						
					0			0		0	0						
					0			0		0	0						
					0			0		0	0						
	Arch Draftsman				0			0		0	0						
	Struct Draftsman				0			0		0	0						
	Mech Draftsman				0			0		0	0						
	Elec Draftsman				0			0		0	0						
	Civil Draftsman				0			0		0	0						
	Fire Draftsman				0			0		0	0						
					0			0		0	0						
					0			0		0	0						
					0			0		0	0						
					0			0		0	0						
	Total Drawings	0				0			0			0					
	Spec Writer					0			0		0	0					
	Typist					0			0		0	0					
	Total Specs	0				0			0			0					
Total Est. Cost A/E & Consultant					0	0		0	0		0						
Overhead % A/E		Consultant			0	0		0	0		0						
Subtotal					0	0		0	0		0						
Profit %					0	0		0	0		0						
Subtotal					0	0		0	0		0						
					\$	/sheet		% of ECC									
Total cost of section A (Design)					0												

ENGINEERING SERVICES SUMMARY SHEET			TITLE I	TITLE II	TITLE III	TOTAL
Section B Post Construction Award Services (PCAS)	Review of Shop Drawing Submittals					0
	Inspection Services					0
	Prepare As-Built Drawings					0
						0
						0
Total Cost of Section B				0	0	
SECTION C DESIGN SUPPORT SERVICES	Interior Design					0
	Conferences					0
	Reproduction of Plans and Specs					0
	Field Work					0
	Soil Borings and Analysis					0
	Topographic Survey					0
	Concept Submission					0
	Storm Water Management Report					0
	Economic Analysis					0
	Energy Conservation Study					0
	Total Energy Study					0
	Energy Conservation Report					0
	Energy Systems Operation Guide					0
	Environmental Permits Report					0
	Fire Protection Analysis					0
	Model or Rendering					0
	Cost Engineer					0
	Project Engineering Documentation (PED)					0
	Value Engineering Services					0
						0
						0
						0
						0
					0	
					0	
Travel and Per Diem					0	
Total Cost of Section C		0	0	0	0	
DESIGN	30% Submit/Rev = _____ wks	Total Section A (Titles I-II, Line 48)			N/A	0
	60% Submit/Rev = _____ wks	Total Section B (PCAS)			0	0
	90% Submit/Rev = _____ wks	Total Section C (Engr Serv)	0	0	0	0
	Final Submit/Rev = _____ wks	GRAND TOTAL				
	Total = _____ 0 wks	Fee Proposal	0	0	0	0
SIGNATURE		APPROVAL		DATE		

ENGINEERING AND DESIGN ACTIVITIES

Section A Design Services

	TITLE I ACTIVITIES	TITLE II ACTIVITIES	TITLE III ACTIVITIES
	Preliminary Design Calculations and Analyses	Final Design Calculations and Analyses	
	Preliminary Drawings	Definitive Drawings	
P	Preliminary Plans	Definitive Plans	
A	Outline Specifications	Procurement and Construction Specs	
G	Project Schedules	Project Schedules	
E	CADD and Computer Services	CADD and Computer Services	
	A/E Internal Design Coordination	A/E Internal Design Coordination	
1	Design Cost and Schedule Analysis and Control	Design Cost and Schedule Analysis and Control	
	Design Progress Reporting	Design Progress Reporting	
	Regulatory/Code Overview by A/E	Design QA Plan and Overview	

Section C Design Support Services

Section B Post Construction Award Services

	TITLE I ACTIVITIES	TITLE II ACTIVITIES	TITLE III ACTIVITIES
	Surveys to Support Design (Surveys, soil testing, etc.)	Travel to Support Design	Inspection Services
	Design QA Plan and Overview	Reproduction During Design	Review Shop Drawings
P	Travel to Support Design	Design Reviews (not Third Party)	Prepare As-Built Drawings
A	Reproduction During Design	CADD and Computer Services (Support)	
G	Design Kickoff Meeting	Project Schedules	
E	CADD and Computer Services (Support)	Constructability Reviews	
	Project Schedules	Safety Reviews by A/E	
2	Construction Cost Estimates	Construction Cost Estimates	
	Constructability Reviews	Acceptance Procedures	
	Safety Reviews by A/E	Certified Engineering Reports	
	Value Engineering	Bid Package Preparation	
	Identify Long Lead Procurements	Bid Evaluation/Opening/Award	
	Design Studies Not Included in Pre-Title I	Design Change Control	
	Preliminary Safety Analysis Report if Not Included in the CDR	Modification of Existing Safety Analysis Report	
	Design Change Control	Inspection Planning	
	Modification of Existing Safety Analysis Report		

NOTE: This representative list of functions was developed from FAR and DOE definitions. All functions meet FAR criteria, and the categories are segregated according to the FAR.

Induction Linac Systems Experiments



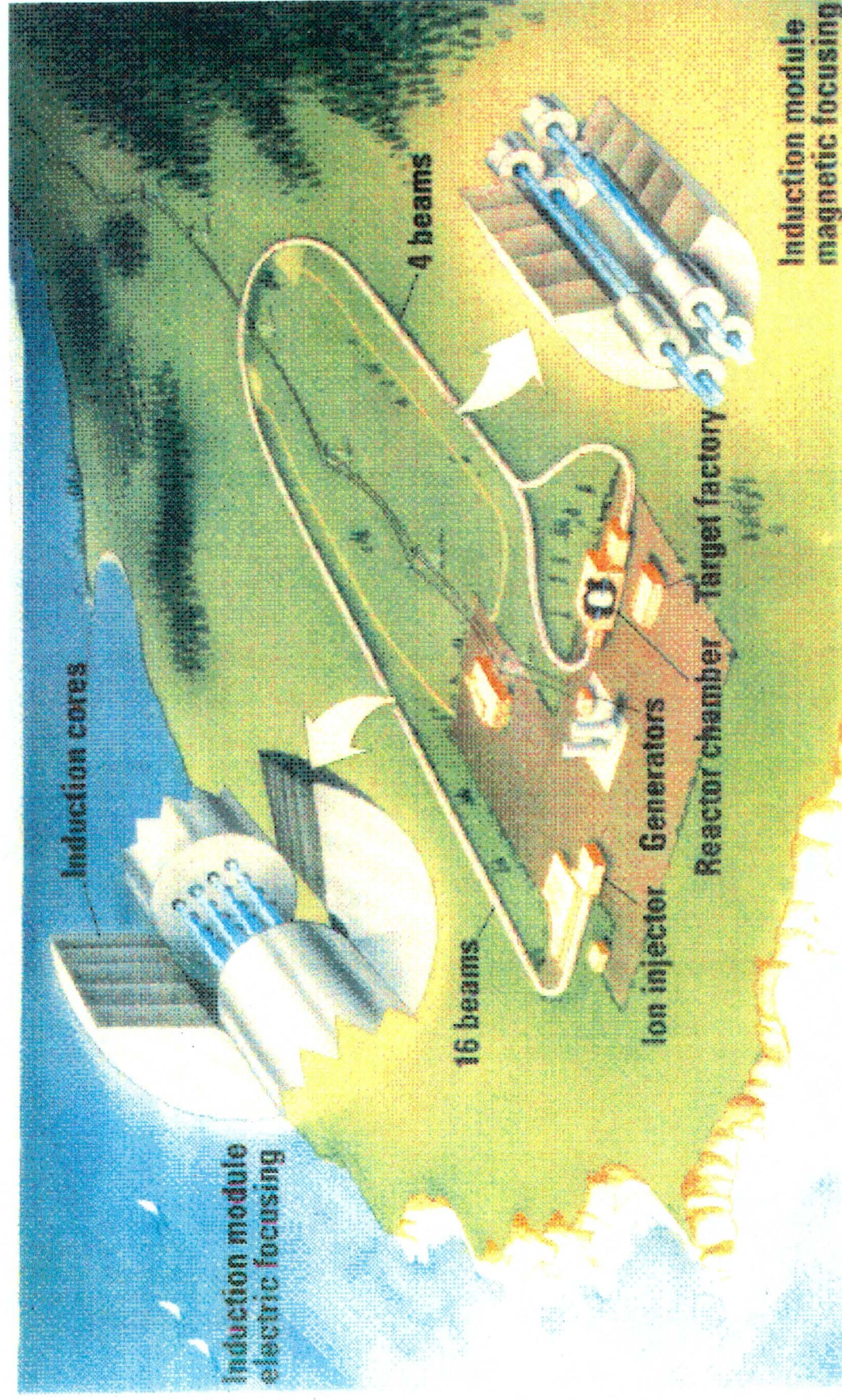
**Tom Fessenden - HIFAR program
John Pickrell - Facilities Department**

presented at the

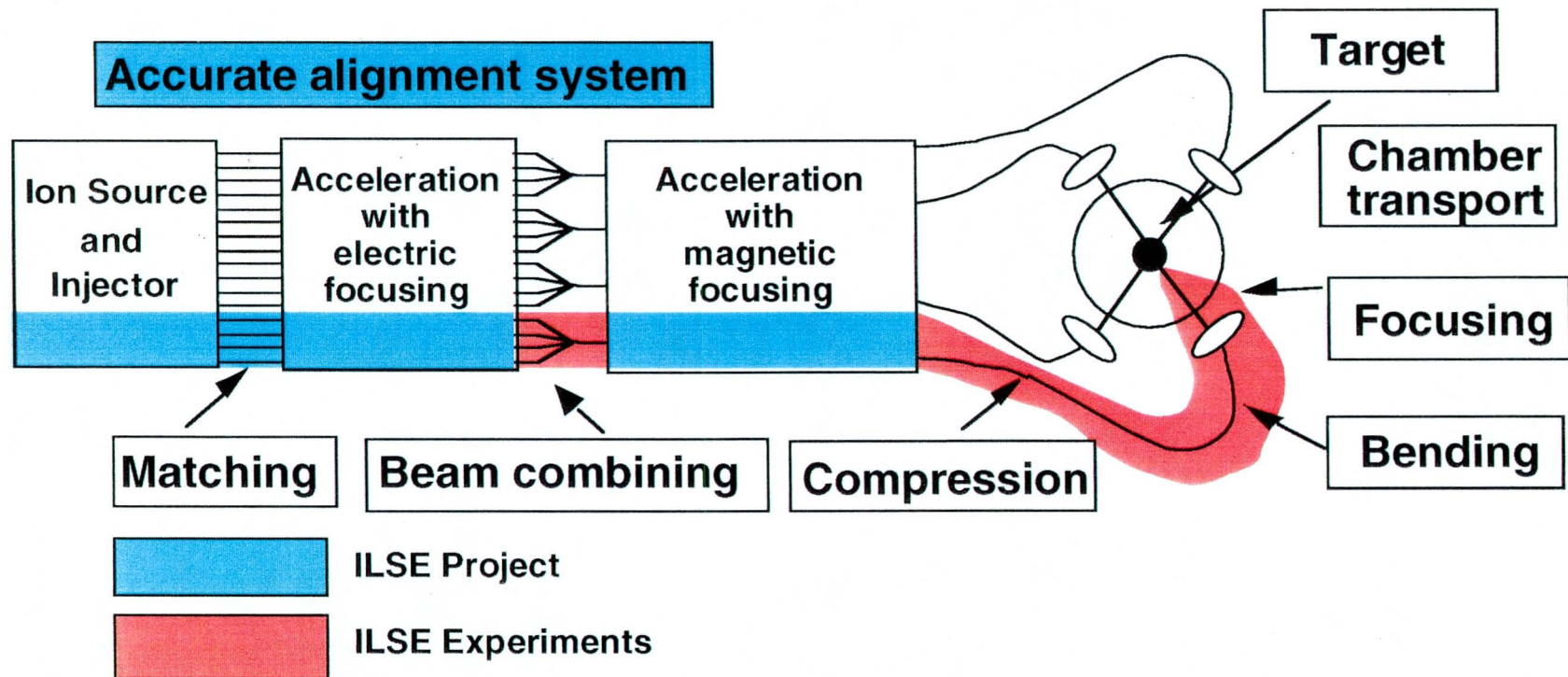
**Project Validation Review
Tuesday April 27, 1992**

**Lawrence Berkeley Laboratory
Berkeley, California**

Our long term goal is fusion power production



ILSE will model the elements and beam manipulations of a fusion driver

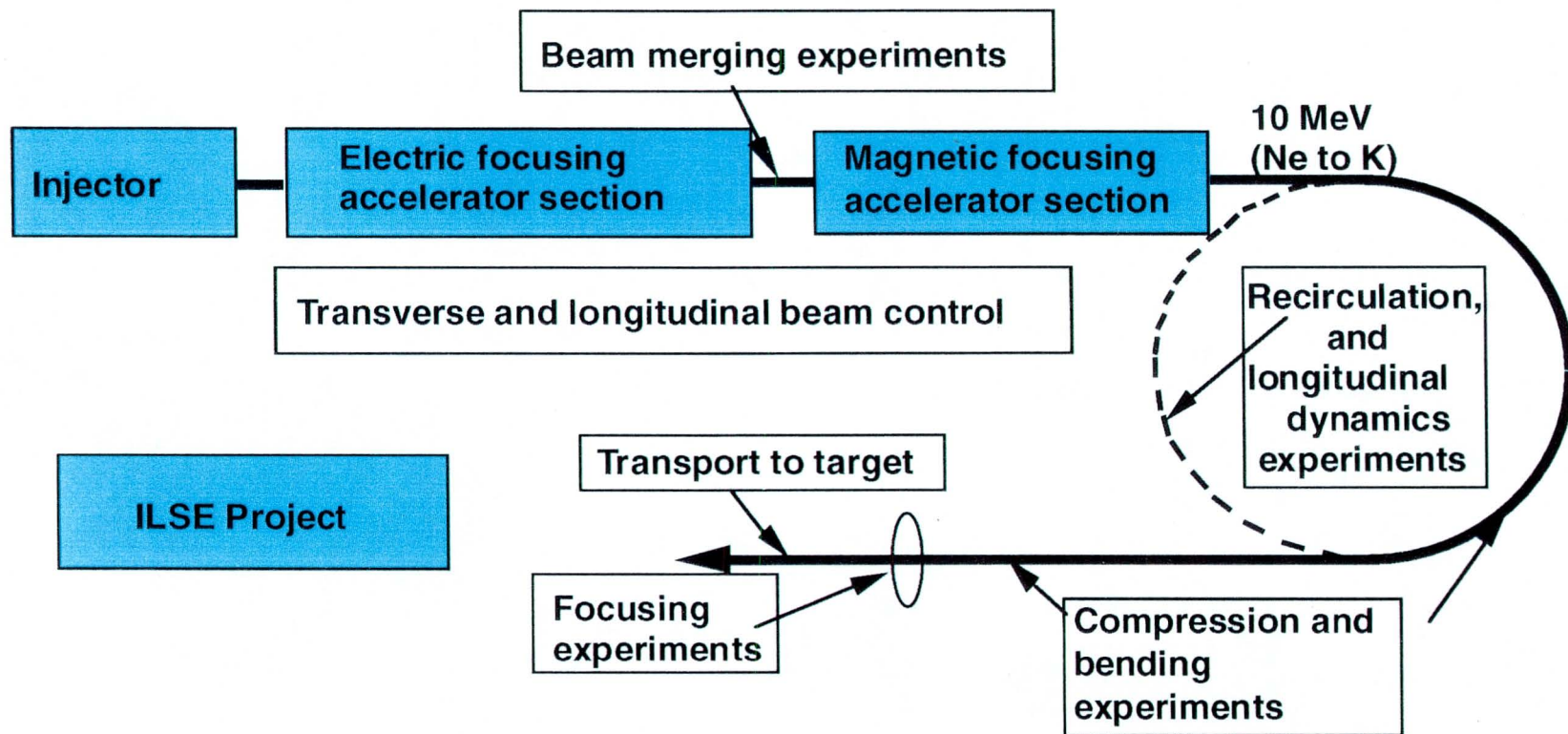


- The ILSE beams will be equal in diameter to those of a driver.
- To minimize cost, ILSE will be shorter than a driver and have fewer beams.

The ILSE project will provide the accelerator for a heavy ion fusion research program



- ILSE is a versatile experimental facility that will enable us to test most of the remaining HIF accelerator issues

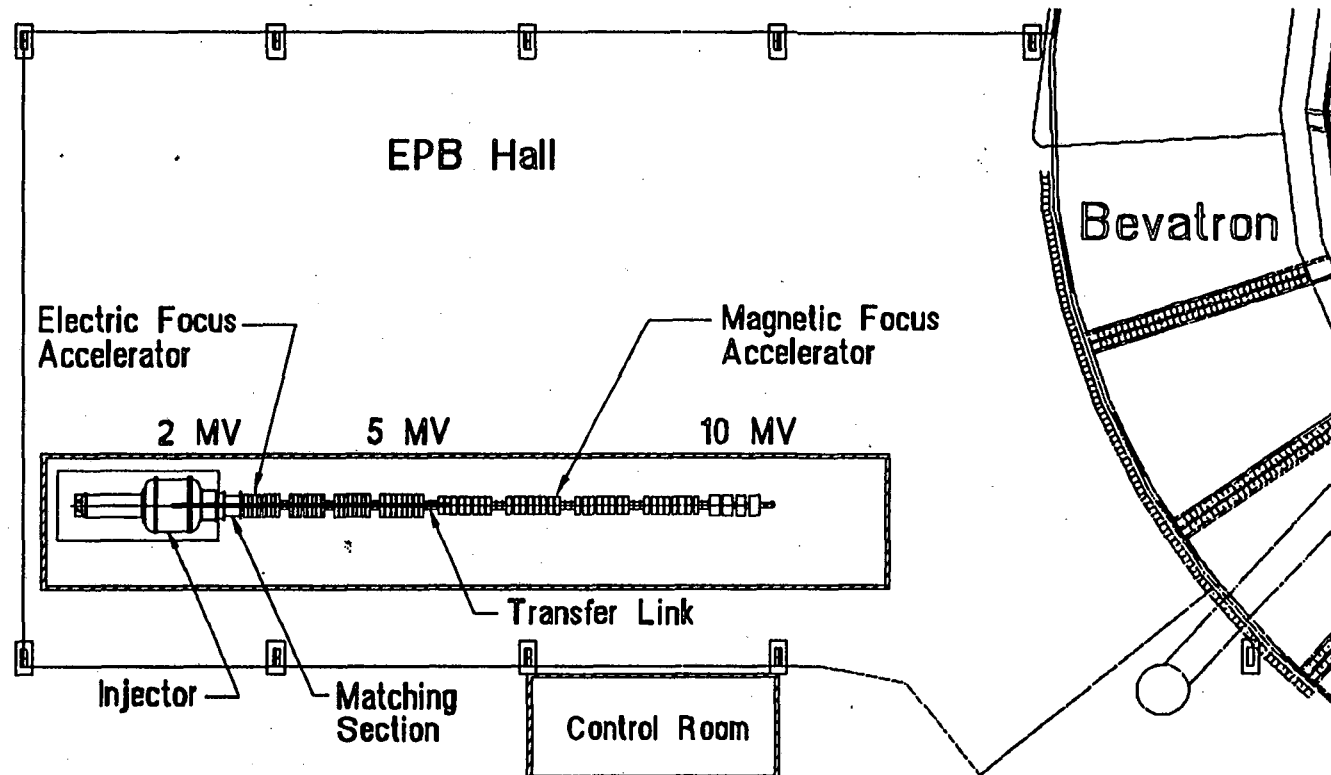


ILSE was designed to address induction heavy ion driver issues

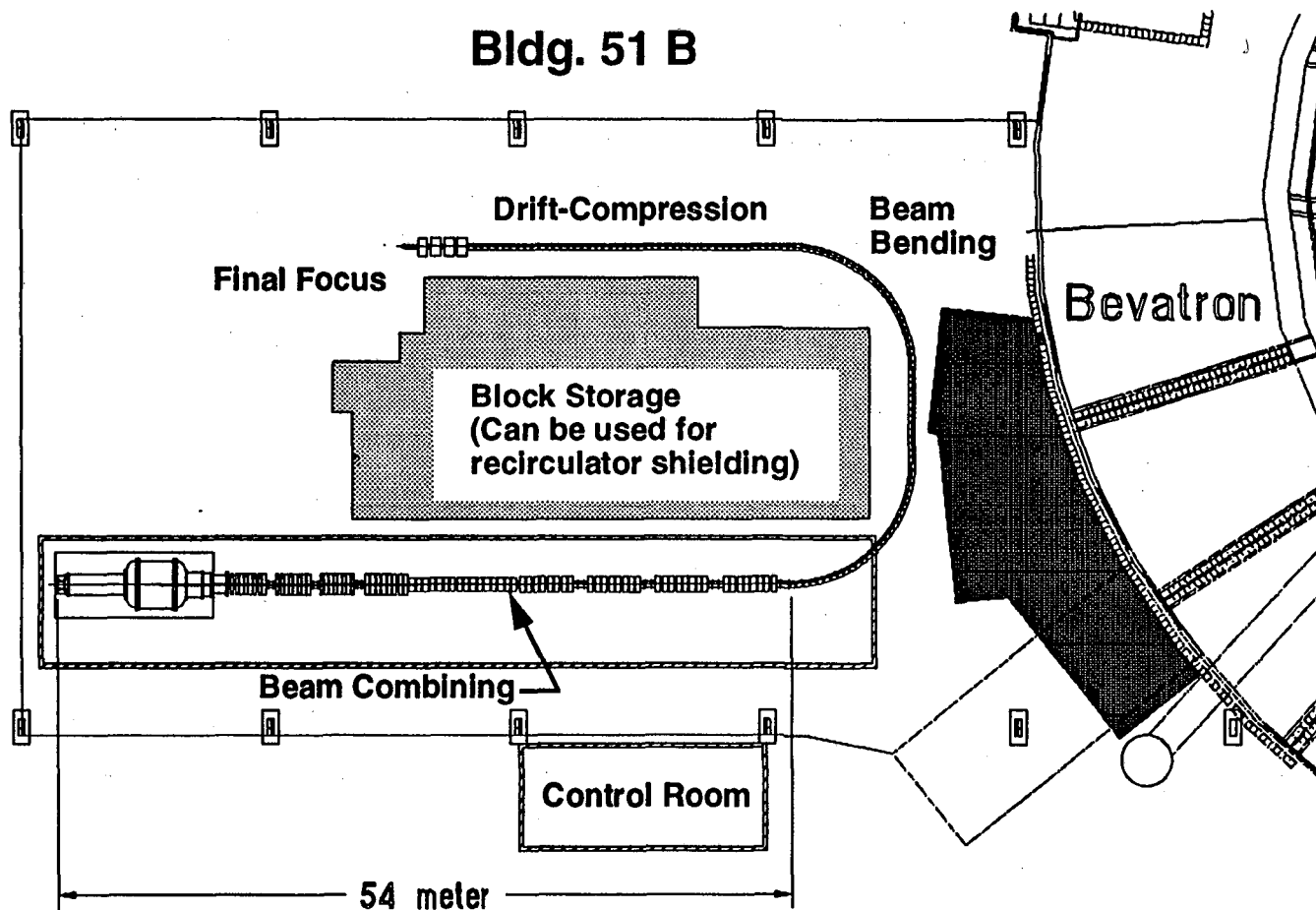


- **The beams are at full driver scale in size and line charge density (0.25→1.0 $\mu\text{C/m}$).**
- **The electrostatic quad focusing voltages are those needed for a driver.**
- **A lighter ion (Ne^+ or K^+) permits magnetic transport at lower beam energy and therefore cost.**
- **A short pulse length (3.2 m) permits longitudinal beam-dynamic studies in a short (≈ 40 m) accelerator.**
- **These beams will allow us to experimentally investigate remaining HIF accelerator issues .**

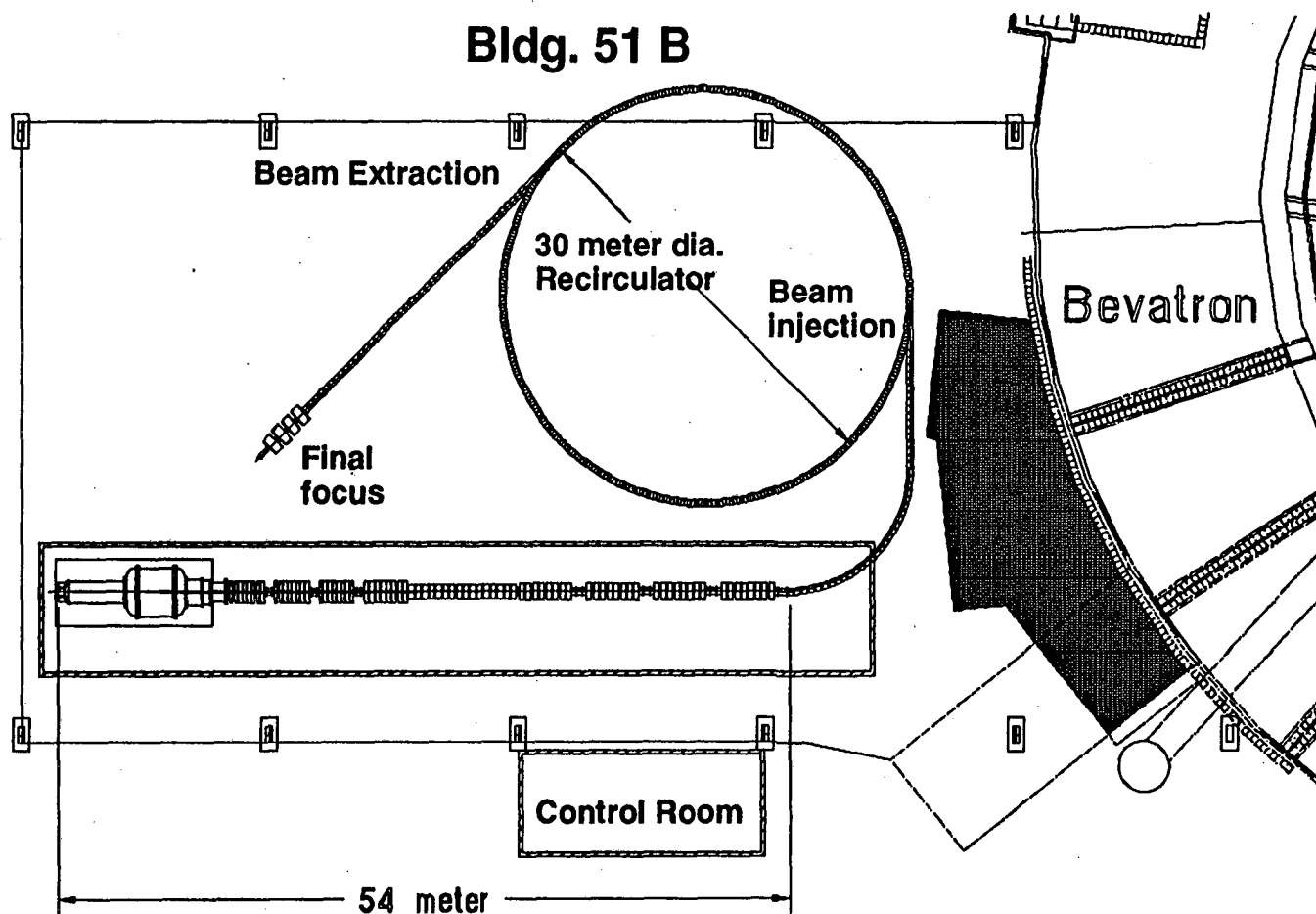
The ILSE project will be located in BLDG 51B



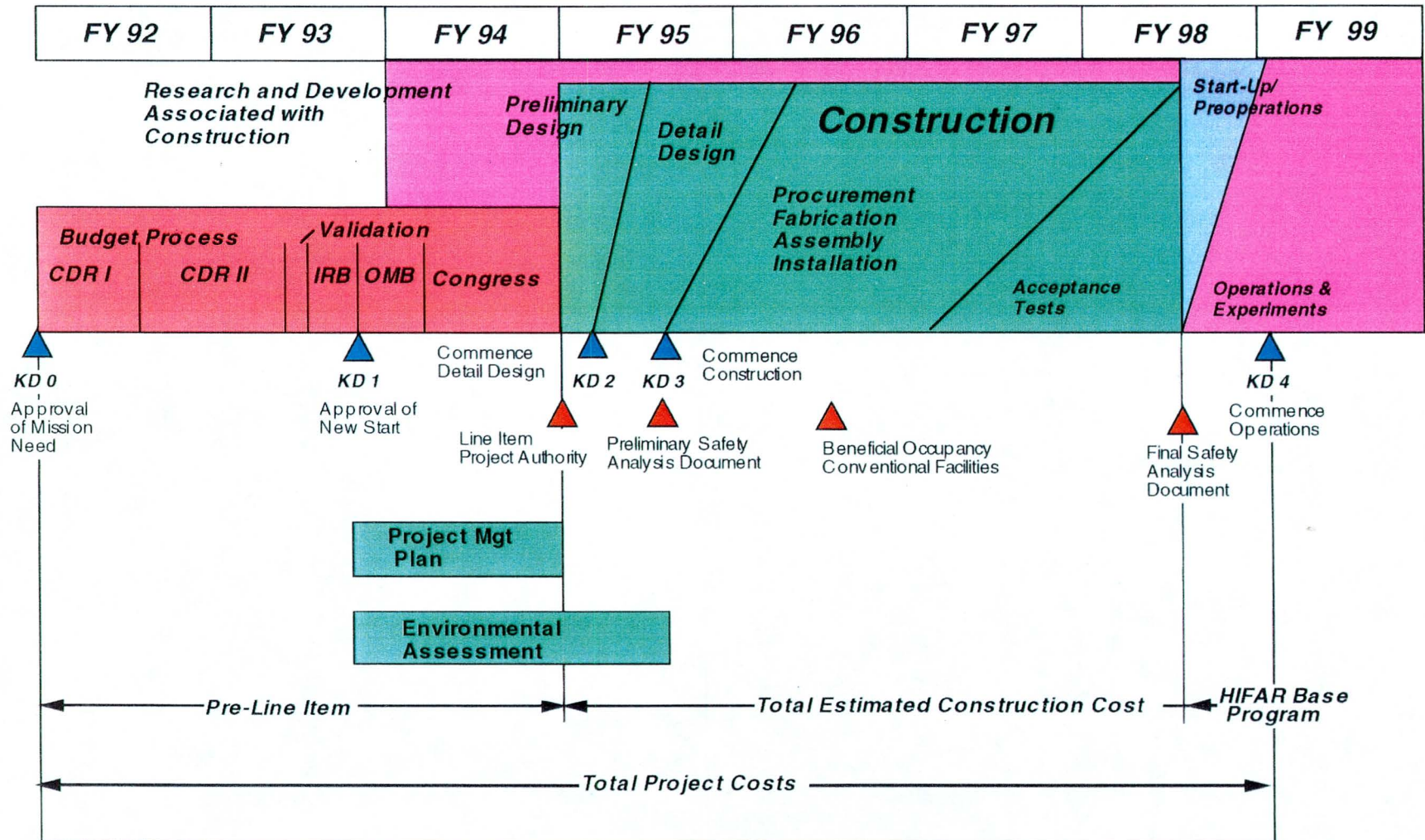
ILSE experiments will study beam combining, bending, drift-compression and final focus

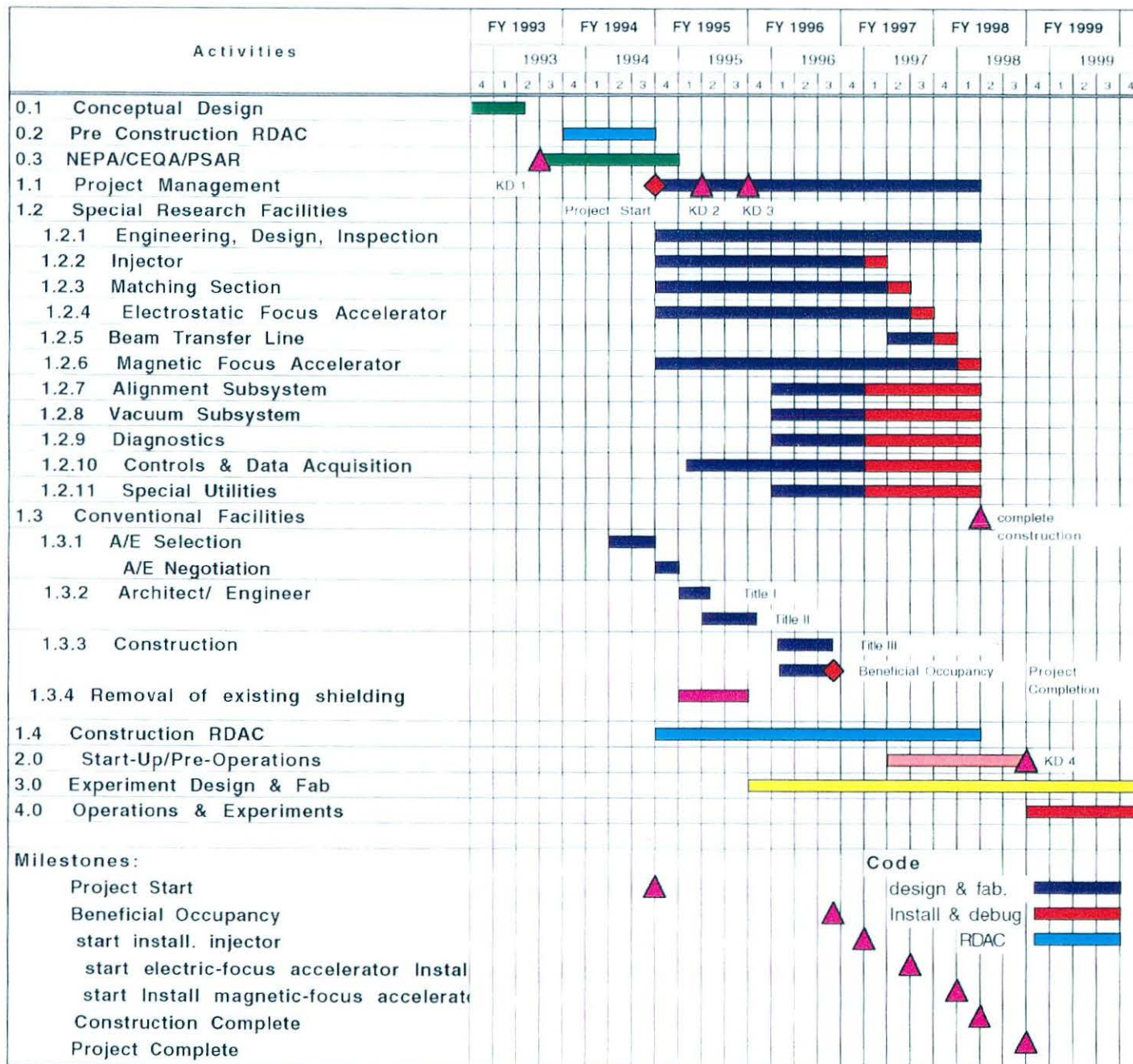


Later experiments will study beam storage and acceleration in recirculators



INDUCTION LINAC SYSTEMS EXPERIMENT Project Schedule





Induction Linac Systems Experiment

Escalation and Contingency Analysis

(LBL 16% overhead not included)

for the Total Estimated Construction and Project Cost

WBS Level	Cost (FY93 k\$)	Cost (then-year) (11.6% escal.)		Contingency	TECC	TPC
1. Induction Linac Systems Experiment	27683	30608	25.2%	7754	38362	47571
1.1. Project Management & Administration	2282	2500	25%	525	3025	
1.1.1 Project Office Effort	1680	1875	25%	469	2344	
1.1.2 Supplies & Expense (12% of 1.1.1)	202	225	25%	56	281	
1.1.3 Incremental Indirect (@1% of TEC)	400	400	0%	0	400	
1.2. Special Research Facilities	23502	26228	26.0%	6809	33037	
1.2.1. Engineering, Design & Inspection						
ELECTRICAL ED&I	2925	3264	20%	653	3916	
MECHANICAL ED&I	3355	3744	20%	749	4493	
1.2.2. Injector	2570	2868	45%	1291	4159	
1.2.3. Matching Section	891	995	25%	249	1243	
1.2.4. Electric Focus Acceleration Section	5168	5767	25%	1442	7209	
1.2.5. Beam Transfer Line	11	12	15%	2	14	
1.2.6. Magnetic Focus Acceleration Section	6097	6804	25%	1701	8505	
1.2.7. Alignment System	533	594	30%	178	773	
1.2.8. Vacuum System	568	633	25%	158	792	
1.2.9. Diagnostics	145	161	25%	40	202	
1.2.10. Controls and Data Acquisition Systems	878	980	25%	245	1225	
1.2.11. Special Utilities & Support	363	405	25%	101	506	
1.3. Conventional Facilities (see appen. A)		1880	22.3%	420	2300	
1.3.1. E D & I @ 18 % of construction		270	23%	61	331	
1.3.2 Construction		1500	22%	335	1835	
1.3.3 Project Management		110	22%	24	134	
CDR Preparation etc. FY 92						1735
CDR FY 93						750
RDAC FY94						2250
RDAC during construction						2450
Start-up and Pre-ops						2024

ILSE SPECIAL RESEARCH FACILITIES

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates" of February 1993.

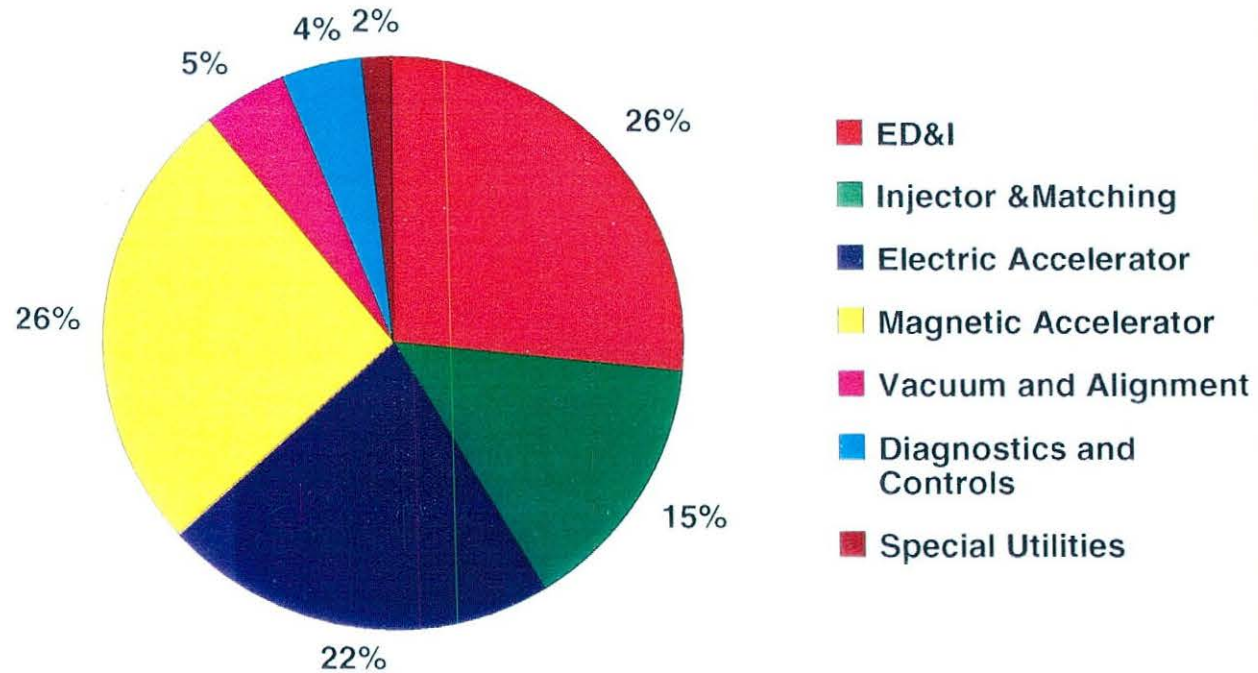
Start of Construction	Oct-94
Construction period	42 months
Finish Construction	Apr-98
Midpoint of Construction	Jun-96
Estimate Date	Mar-93

FY 1993	Mar 1993 - Sep 1993	7 months	@ 2.4%	= 1.4%
FY 1994	Oct 1993 - Sep 1994	12 months	@ 3.3%	= 3.3%
FY 1995	Oct 1994 - Sep 1995	12 months	@ 3.6%	= 3.6%
FY 1996	Oct 1995 - July 1996	9 months	@ 3.7%	= 2.8%

Total Compounded Escalation	11.6%
------------------------------------	--------------

Special Facilities

23.2 M\$



Material Costs 12.2 M\$

Labor Costs 11.0 M\$

Vendor Quotes	55.1%
Engineering Estimates	29.0%
Catalog Price	8.0%
Misc.	7.9%

Elec. Eng	25.5%
Elec. Fab.	23.7%
Mech. Eng	26.6%
Mech. Fab	24.1%

ILSE total project costs



	<u>FY 1992</u>	<u>FY 1993</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>Total</u>
a. Total Project Cost (TPC)								
(1) Total Facility Costs (TEC)	0	0	0	7,000	9,900	12,300	9,100	38,300
(2) Other Project Costs								
(a) R&D Associated with Construction	0	0	2,300	700	700	700	400	4,800
(b) Conceptual Design and Documentation	1,700	800	0	0	0	0	0	2,500
(c) Start-Up and Preoperations	0	0	0	0	0	0	2,000	2,000
Total Project Cost (TPC)	<u>1,700</u>	<u>800</u>	<u>2,300</u>	<u>7,700</u>	<u>10,600</u>	<u>13,000</u>	<u>11,500</u>	<u>47,600</u>

(Application of 16% LBL Overhead to New FY 1995 Construction Projects Will Increase the TPC to \$55,200K)

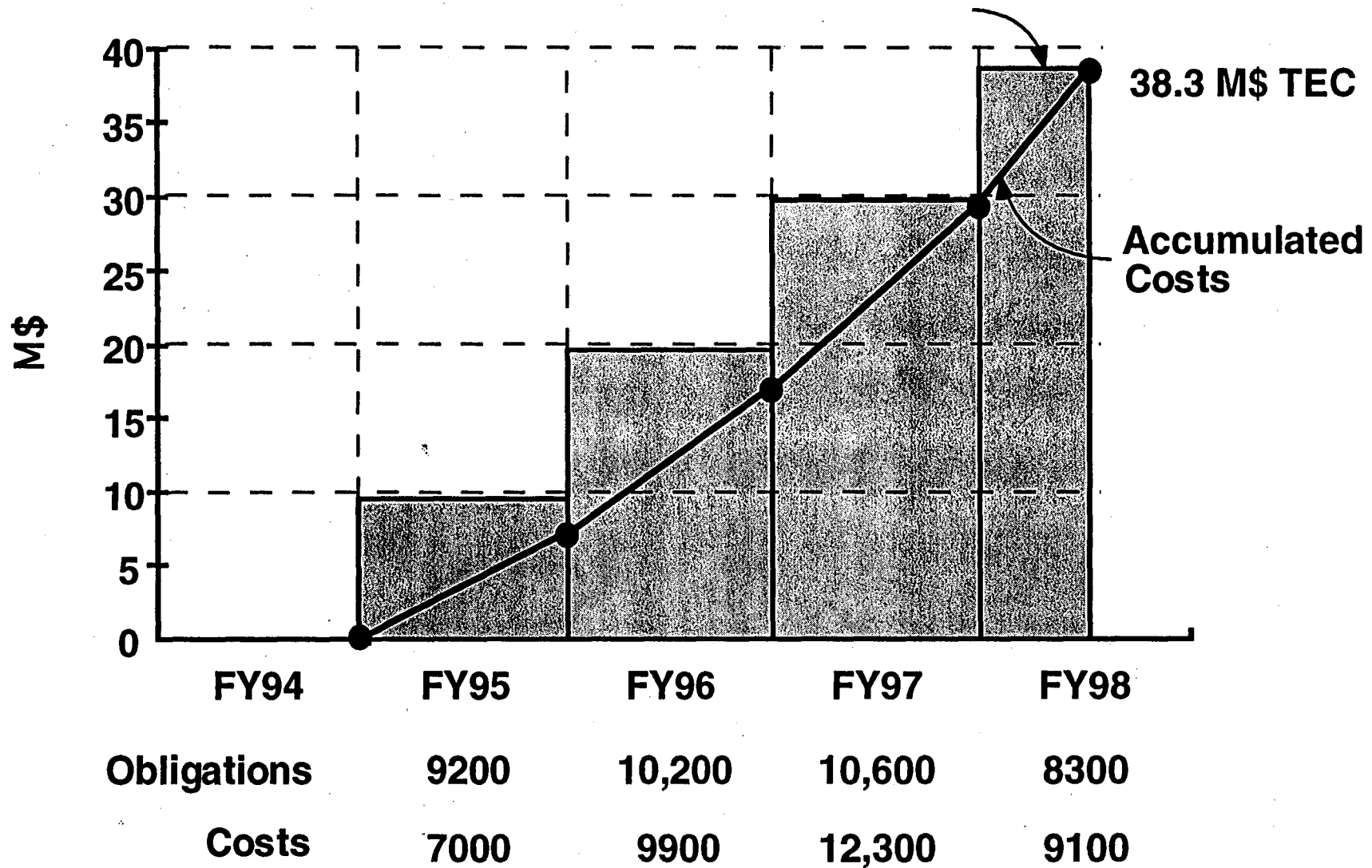
b. Funding requirements for conducting the experimental program (estimated annual costs)

(1) Facility operating costs	\$ 800
(2) Operating expenses .	7,000
(3) Capital equipment	3,000
(4) Maintenance, repair, GPP or other construction.	<u>700</u>
Total related annual costs	\$11,500

Financial Schedule for ILSE Construction



Total Appropriations



Several factors led to a significant reduction in the ILSE cost estimate



WBS Code	Subsystem	Cost (FY93 K\$)	Change (93-92)	Change TEC (TY K\$)	Change TPC (TY K\$)
1	Induction Linac Systems Experiments	27,497	(13,581)	(22,589)	(24,423)
1.1	Project Management & Administration	2,282	(1,694)	(2,811)	
1.2	Special Research Facilities	23,501	(7,478)	(13,548)	
1.3	Conventional Facilities	1,714	(4,408)	(6,230)	
	Other Project Costs	9,416			(1,834)

- The Bevatron EPB location is much more suitable
- Metglas® can be obtained for less than estimated in 1992
- The time for construction is 3.5 instead of 5 years
- R&D this last year reduced our estimates for the ED&I
- Diagnostics only include those necessary to commission the accelerator

Summary



- The ILSE experimental program is designed to address induction heavy ion driver issues at relevant scale.
- The ILSE project will provide the accelerator for a heavy ion fusion accelerator research program in the Bevatron EPB Hall
- The time of construction is 3.5 years with a TEC of 38.3 M\$
- The project is projected to finish at the end of FY 98 with a TPC of 47.6 M\$
- Since the validation last year the TEC was reduced by 38 % and the TPC reduced by 35 %
- These costs do not include the 16% LBL overhead.

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

CHANGES SINCE 1992 VALIDATION

SCOPE

- **New Site**
- **Revised Design of Conventional Construction**

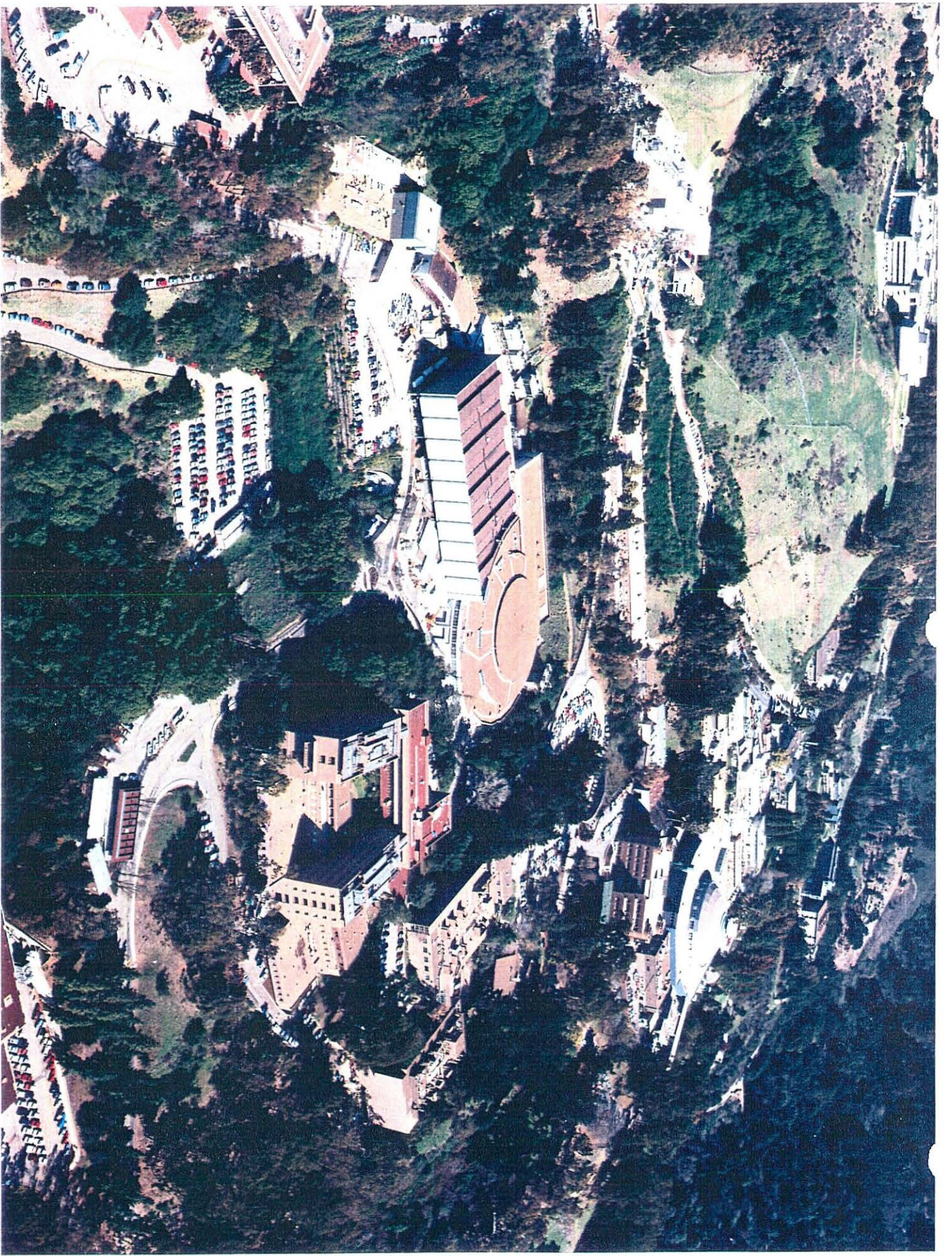
Schedule

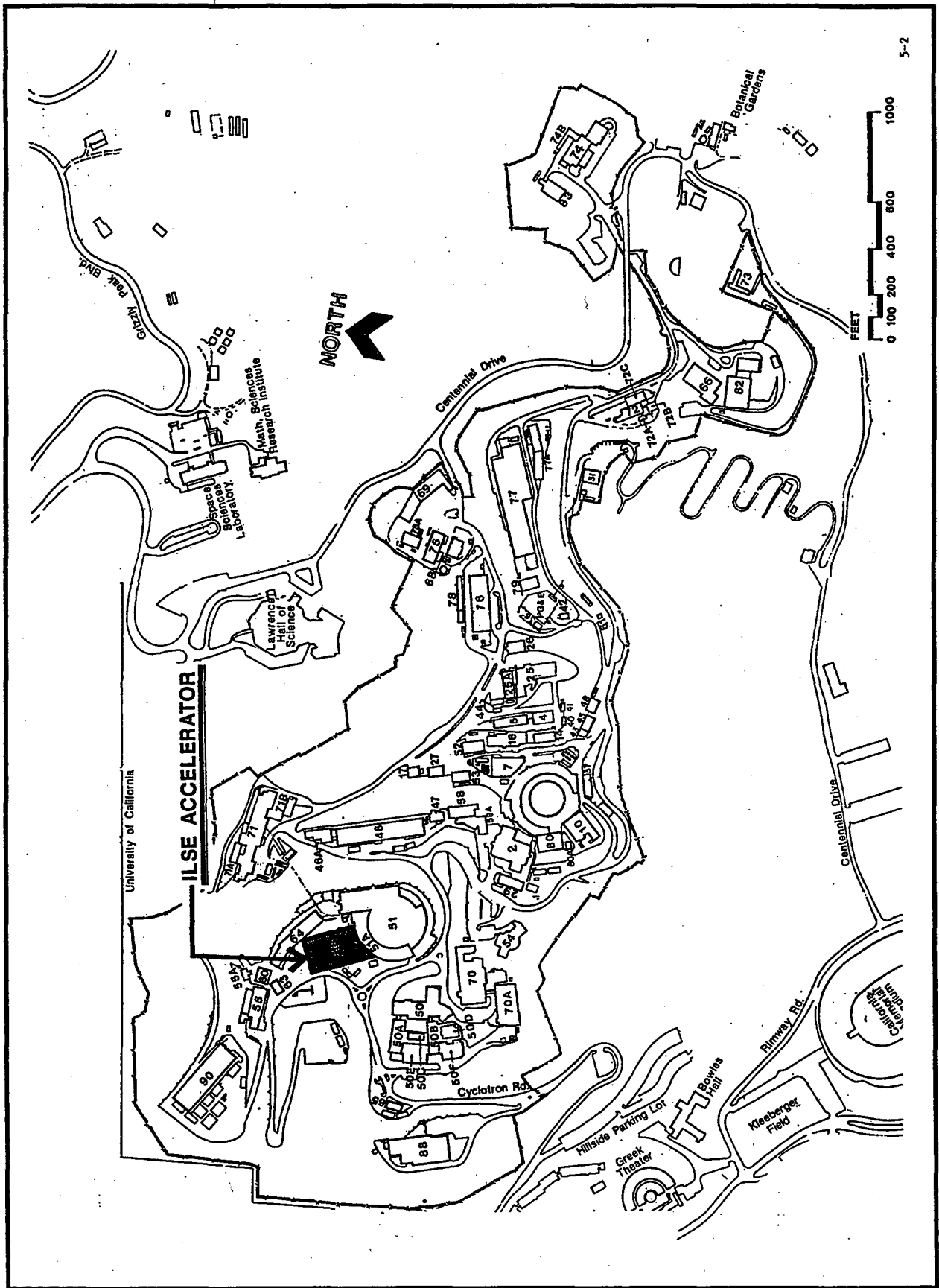
- **Updated to Accommodate New Design at New Site**

TEC*

- **Major Reduction**

***Application of 16% LBL Overhead Not Included in TEC**



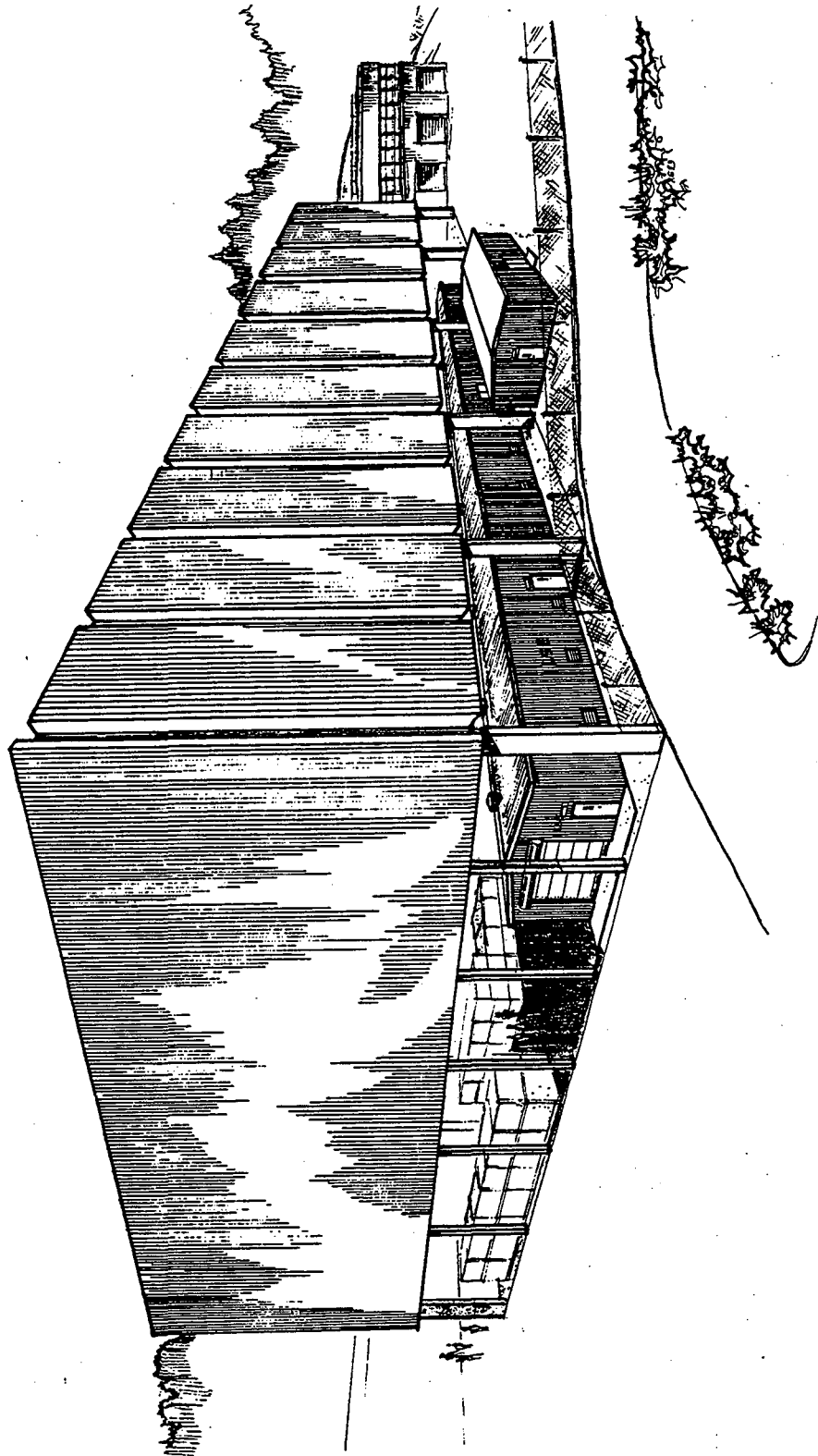


LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Induction Linac Systems Experiment
LOCATION PLAN

A-1

4/15/93



5-1



LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Induction Linac Systems Experiment

PERSPECTIVE

T-1

4/15/93

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

PROJECT DESCRIPTION

- **Removal of Existing Shielding and Beamlines**
- **The Project Includes a Heavy Laboratory Experimental Space and an Accelerator Control Room**
- **Occupied Space Includes**
 - **Heavy Laboratory Space (2,000 PSF Floor Slab) with Access to Existing Building 64 Hibay and Support Facilities (6,400 GSF)**
 - **Accelerator Control Room (1,500 GSF)**
- **Prefabricated Steel Frame Enclosure Structure**
- **Ventilation of Laboratory Space**

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

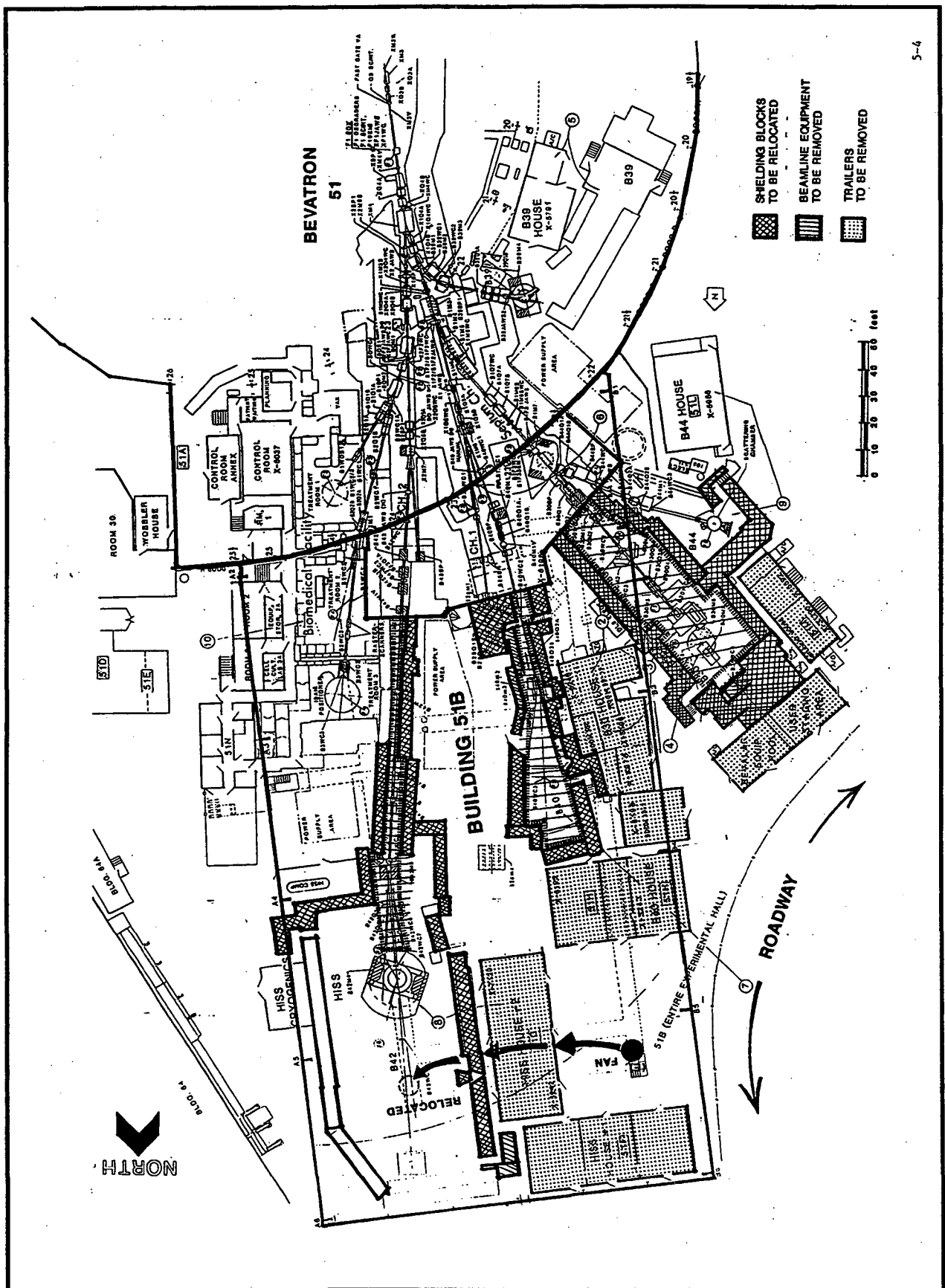
PROJECT DESCRIPTION (continued)

- **Fire Protection System Includes Fire Sprinklers and Fire Alarm Connected to LBL System**
- **Electrical Power from New Substation Includes 480/208/240V Distribution Panelboards**
- **Energy Management and Control System**

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

CURRENT AND SUBSEQUENT USE OF SPACE

Building	Current Area		Subsequent Area		Difference		Remarks
	(GFS)	(NSF)	(GFS)	(NSF)	(GFS)	(NSF)	
51B	38,906	34,701	38,906	34,701	0	0	
<i>Space Inside 51B</i>							
51F	1,543	1,370	0	0	-1,543	-1,370	Removed
51G	1,467	1,316	0	0	-1,467	-1,316	Moved to Outside
51H	1,551	1,394	0	0	-1,551	-1,394	Removed
ILSE	0	0	6,400	6,000	6,400	6,000	New Prefab Enclos
<i>Space Outside 51B</i>							
51M	532	507	0	0	-532	-507	Removed
51G	0	0	1,467	1,316	1,467	1,316	Relocated from Inside (Control Room)
Total 51B Plus Outside	39,438	35,208	40,373	36,017	935	809	

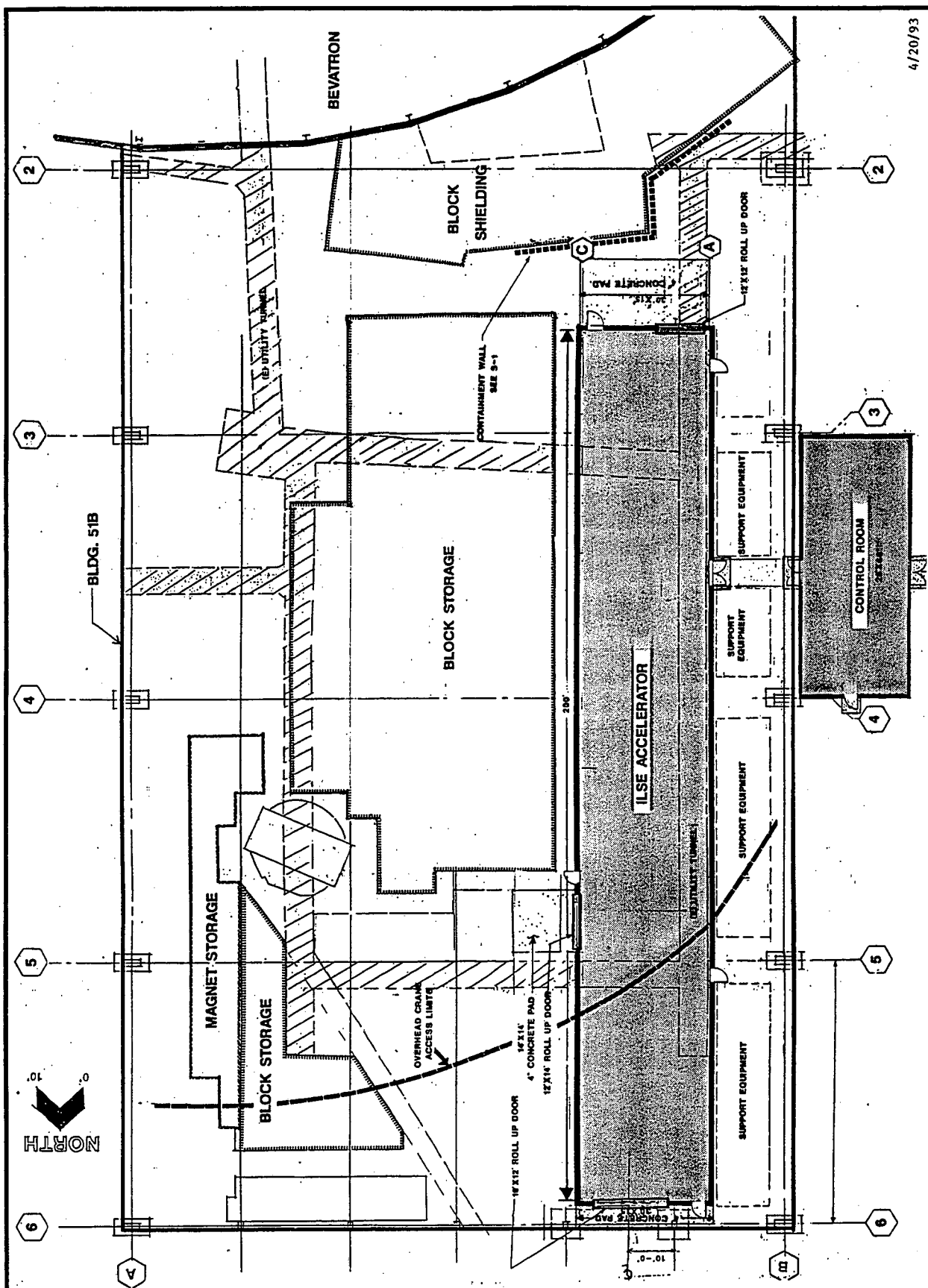


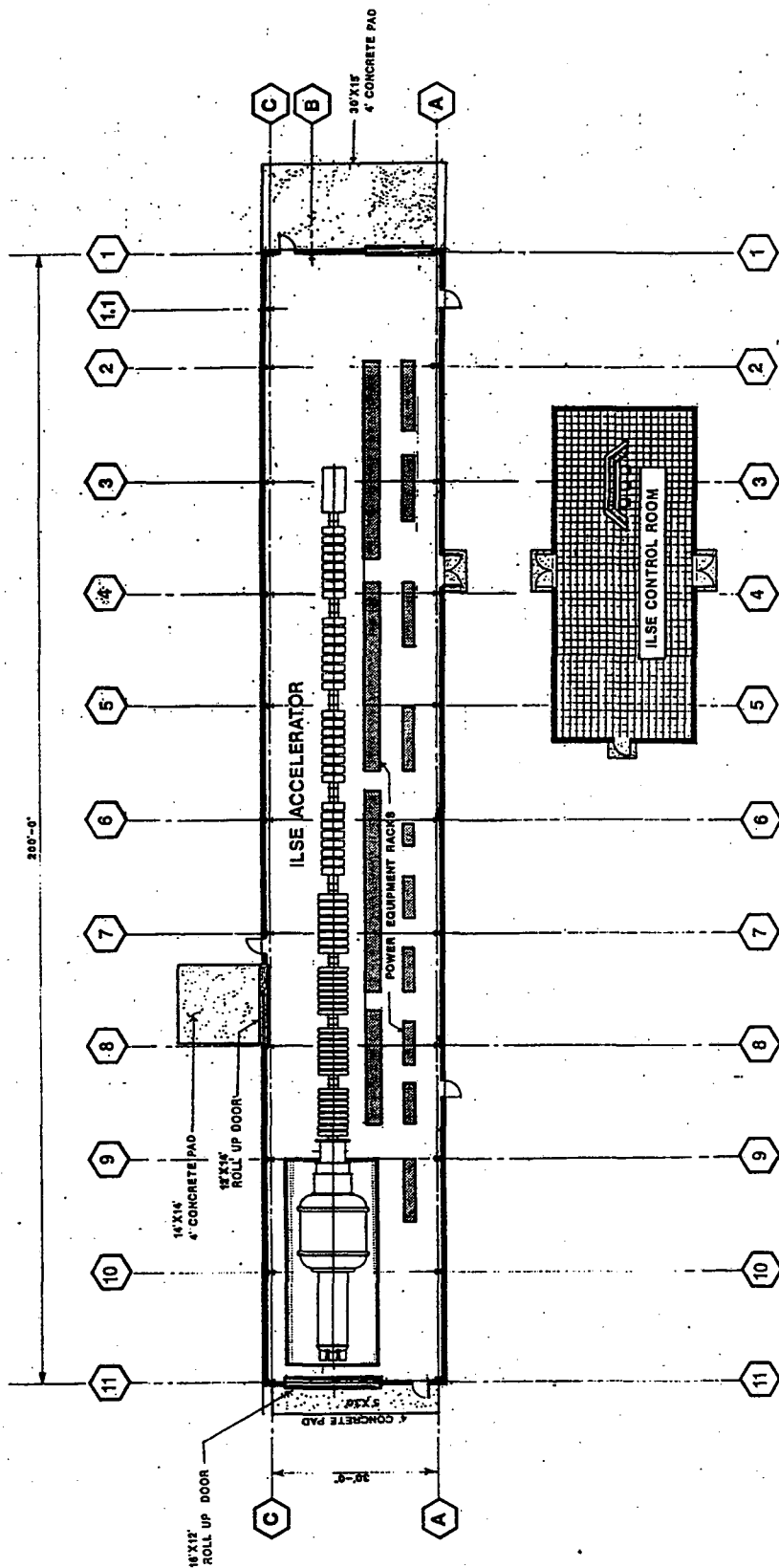
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Induction Linac Systems Experiment
BUILDING 51B REMOVALS PLAN

A-3

4/15/93





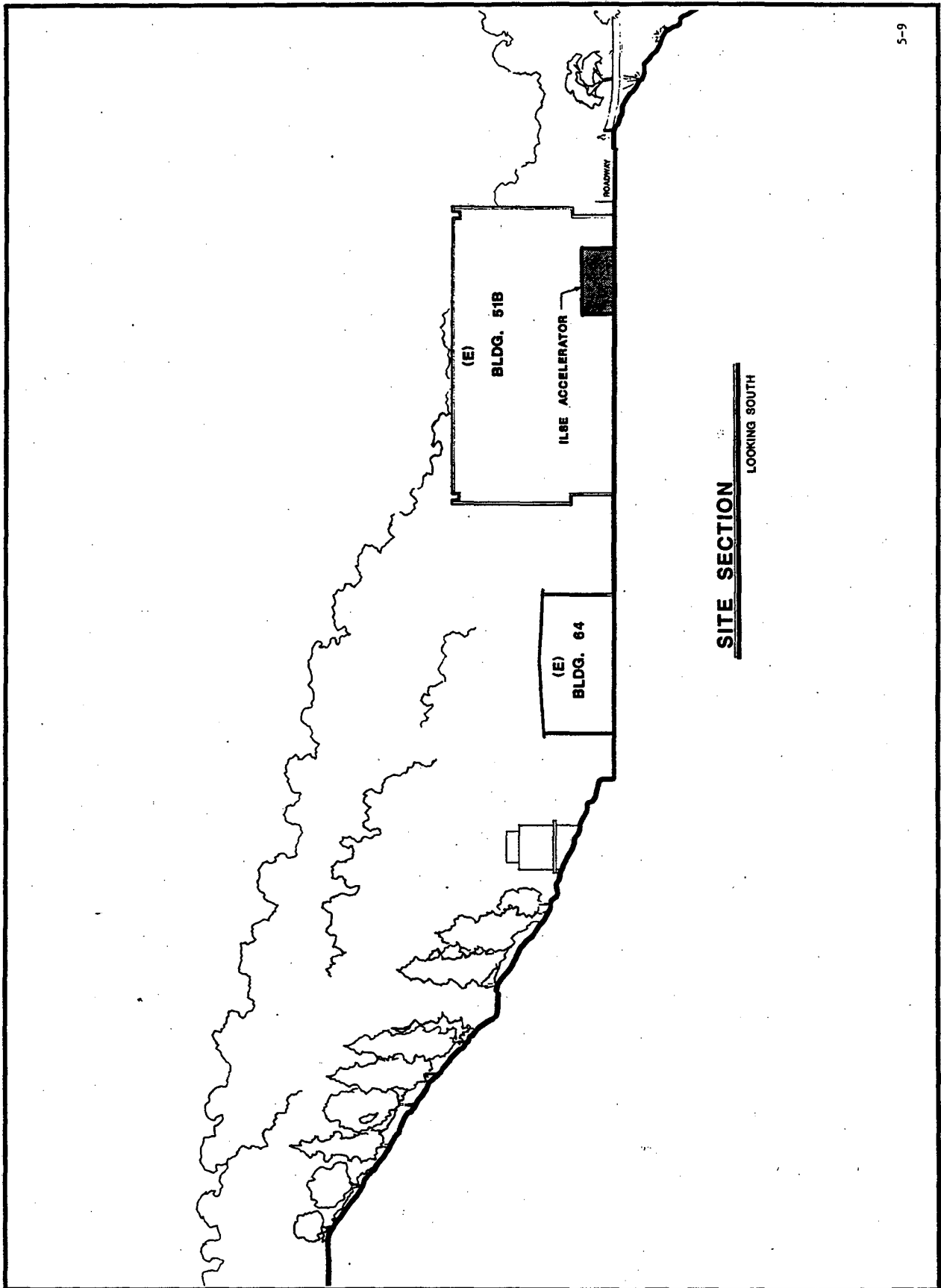
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Induction Linac Systems Experiment

ILSE BLDG. FLOOR PLAN

A-5

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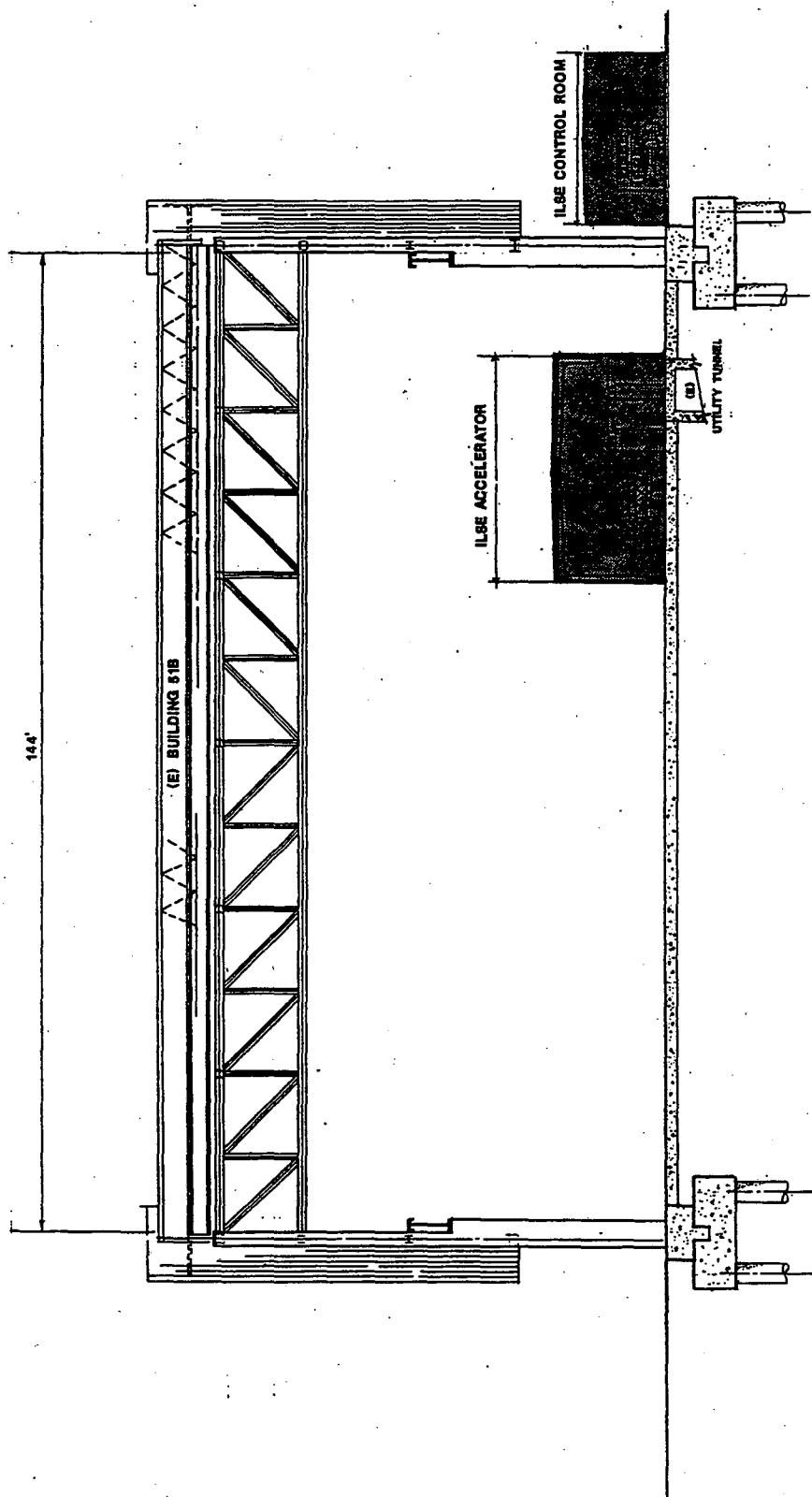
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Induction Linac Systems Experiment

SITE SECTION

A-8

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SCALE IN FEET :
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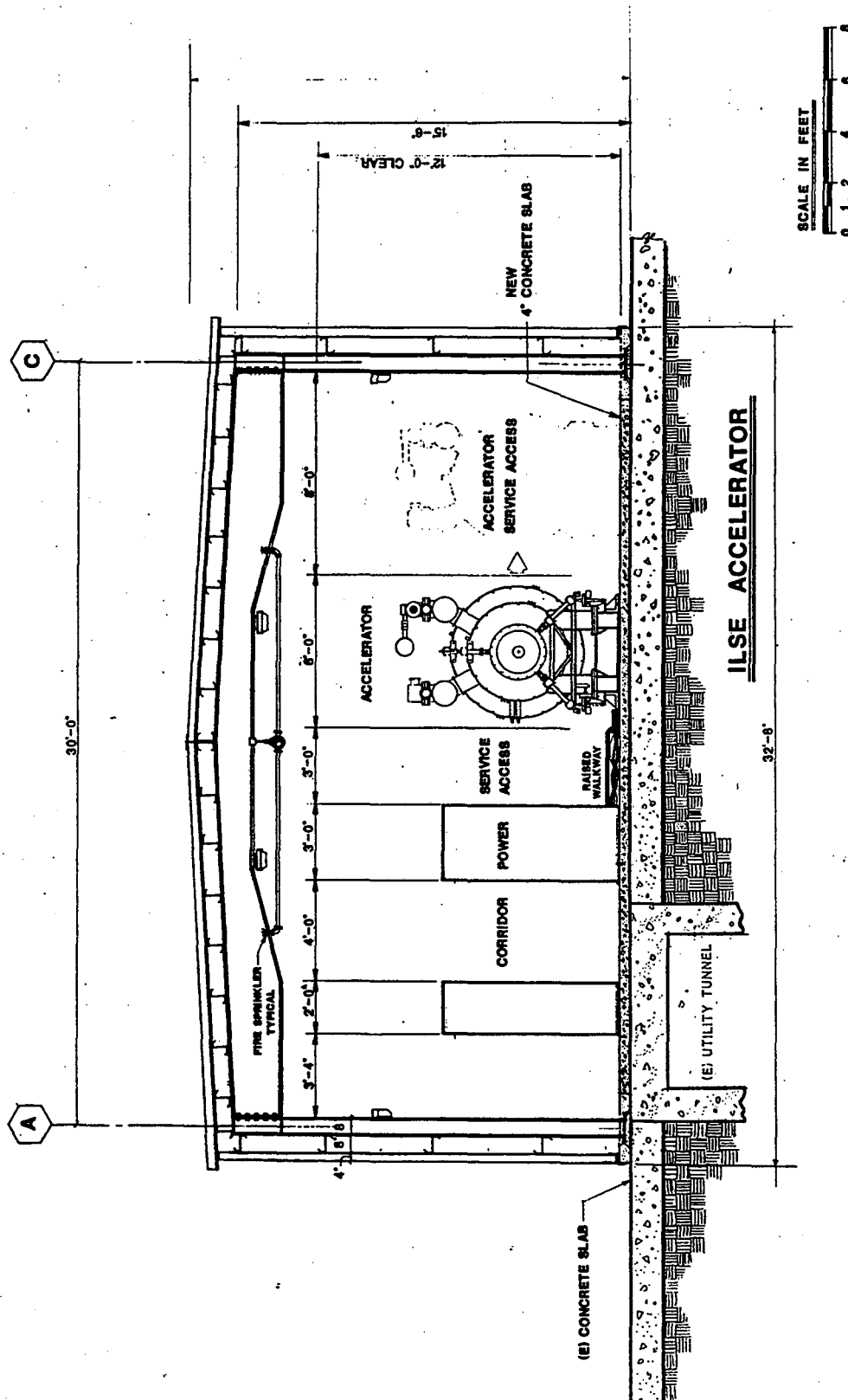
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Induction Linac Systems Experiment

BLDG. 51B SECTION

A-9

4/15/93



5-11



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Induction Linac Systems Experiment

ILSE BLDG. SECTION

A-10

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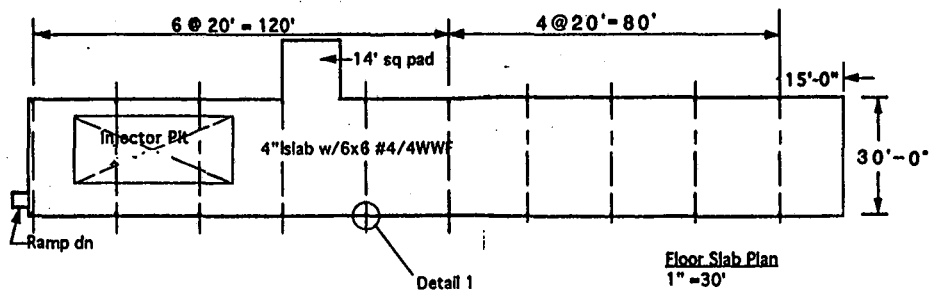
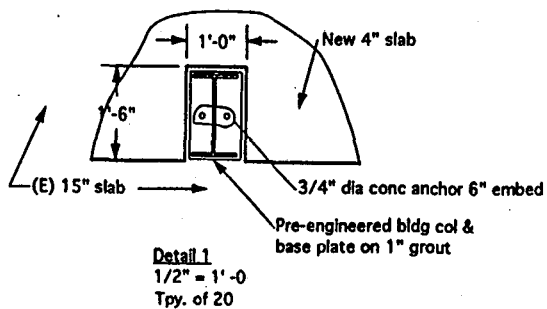
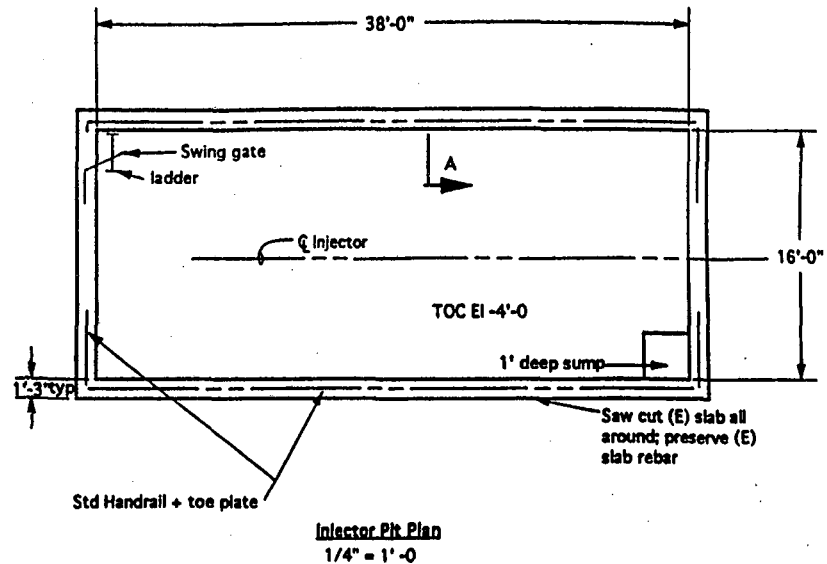
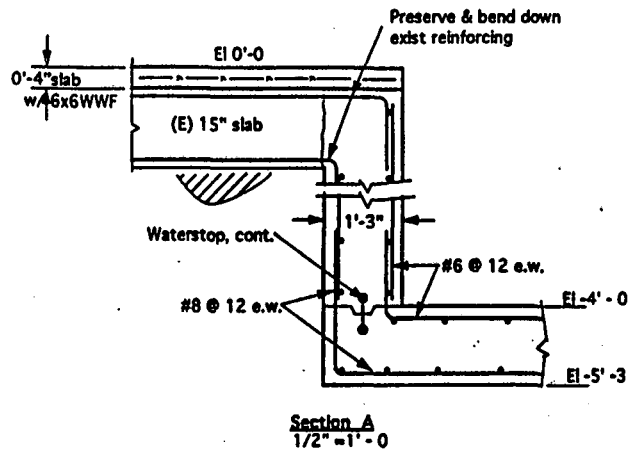


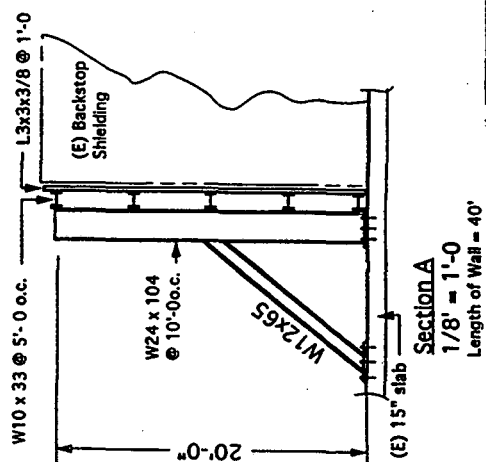
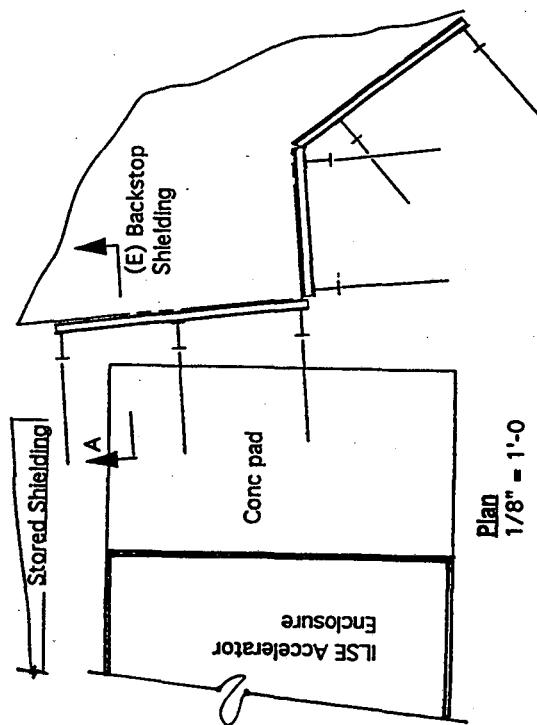
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Induction Linac Systems Experiment
FLOOR SLAB PLAN & INJECTOR PIT
DETAILS & SECTION

S-1

4/15/83





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Induction Linac Systems Experiment
SHIELDING CONTAINMENT WALL &
SECTION

S-2

4/15/93

**INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)
CONVENTIONAL FACILITIES
SUMMARY OF COST ESTIMATE
(Amounts in Then-Year \$K)**

WBS

1.3.1	ED&I (@ ~ 18% of Construction, WBS 1.3.2)	270
1.3.2	CONSTRUCTION	1,500
	Land Improvements	40
	Site Utilities	110
	Buildings	750
	Other Structures (Removals)	600
1.3.3	PROJECT MANAGEMENT (@~7% of Construction, WBS 1.3.2)	<u>110</u>
	Subtotal	1,880
	Contingency (~22% of above costs)	<u>420</u>
	Conventional Facilities - Total Estimated Cost*	2,300

***Application of 16% LBL Overhead Not Included in TEC**

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)
CONVENTIONAL FACILITIES
FINANCIAL SCHEDULE
(Amounts in Then-Year \$K)

<u>Fiscal Year</u>	<u>Obligations</u>	<u>Costs</u>
1995	1,080	1,050
1996	<u>1,220</u>	<u>1,250</u>
Total	2,300	2,300

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

ILSE REMOVALS

	k\$
1.3.2.4.1 DEMOLISH BLDGS 51F, 51H, move 51G	14
1.3.2.4.2 Disconnect/RELOCATE 3 stacks of P.S. near beam 42	25
1.3.2.4.3 RELOCATE (4) BL 26 MAGNETS TO HISS CAVE (B26M4 is 16 yoke pcs+10 pancakes, wt= 325 kips)	20
1.3.2.4.4 DEMOLISH BEAM 40	
132441 Relocate (6) BL40 magnets in 51B	4
132442 Move (141)BL 40 shield blks to NW corrn of 51B,1137T	23
132443 Seismic restraint on BL40 shield pile per detail below	50
1.3.2.4.5 DEMOLISH BEAM 30 storage/staging hses & expt hses	
132451 demolition including hauling*	22
132452 Remove and relocate fire alarm system power	10
1.3.2.4.6 DEMOLISH BEAM 42	
132461 Relocate BL42 magnets to HISS cave	7
132462 Move dnstream BL42 walls & all 42 roof to BL 40 area	27
132463 Seismic restraint on BL42 shield pile per detail below	50
1.3.2.4.7 REMOVE HISS ROOF & UPPER PART OF N & E WALLS	
132471 Remove HISS detectors and electronics	28
132472 Remove equip from roof	2
132473 Remove wood roof, ship to dump	11
132474 Remove roof framing to salvage	4
132476 Lower about 100 blocks to pad, lv N&E walls half ht	29
132477 Load/ship (46) West wall blocks to 901 @ \$500/ea	12
132478 Seismic restraint on (54) blocks per detail below	50
1.3.2.4.8 SEISMIC RESTRAINT ON MAIN SHIELD'G(costed elsewhere)	
1.3.2.4.9	
1.3.2.4.10 BL30 SAFETY WORK & ESH WORK for 3 beamlines	
Disconn conduit+move (22) roof blks to flr,10mh/ea	21
Remove, crush, box, ship, bury vac. systems	35
Move magnets B30M2, 3,4,5,6,7, Q3 to HISS cave*	11
Move detectors out of 51B to salvage or 901 (do in 1993)	0
Remove platforms, haul away	7
Lower BL30 walls to 8' hi by putting wall blocks into cave	20
Put roof blks on cave floor. Tiedown wall blks(weak frdatn)	20
Mark 825 blks on 4 sides & monitor 6 sides when moved	55

TOTAL ILSE REMOVALS

557

STANDDOWN ACTIVITIES

	k\$
132444 Crush and cut up vacuum equip	5
132445 Remove platforms, haul away	5
132446 Ship 10 boxes (640 CF) beamline parts @ 3k\$/load	6
132447 Bury 640 CF beamline parts in Hanford @ \$86/CF	55
132464 Crush and cut up vacuum equip	5
132465 Remove platforms, haul away	5
132466 Ship 4 boxes (256 CF) beamline parts @ 3k\$/load	3
132467 Bury 256 CF beamline parts in Hanford @ \$86/CF	22
132475 Dismantle 170 CF,42T HISS backstop, ship to Hanford	22
132479 5 yrs of block storage at 901 @ \$12/SF/yr*890 SF	41
RELOCATE FIBEROPTICS from HISS house	105
Take 1 core frm ea. blk moved , 825 blks @ \$110/ea	91

TOTAL STANDDOWN REMOVALS

365

ESCALATED TOTAL k\$ ESCALATED TO REMOVALS MIDPOINT

600

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)
CONVENTIONAL FACILITIES
CONTINGENCY ANALYSIS

	Estimated Cost (\$K)	Contingency (%)	(\$K)
<u>LBL Activities</u>			
Engineering			
Title I	30	20	6
Title II	60	20	12
Title III	20	25	5
Inspection	40	20	8
Consultants	10	25	3
<u>Architect/Engineer</u>			
Title I	30	20	6
Title II	60	27	16
Title III	20	25	5
<u>Construction</u>			
Improvements to Land	40	20	8
Utilities	110	20	22
Building	750	21	159
Other Structures (Removals)	600	24	146
<u>Project Management</u>	<u>110</u>	21	<u>24</u>
Subtotal	1,880		420
Contingency (22%)	420		
TOTAL	2,300		

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

CONVENTIONAL FACILITIES

BA/BO SCHEDULE (\$K)

WBS NO.	WBS ELEMENT	TOTAL BUDGET	F Y 1995												F Y 1996															
			1				2				3				1				2				3				4			
			O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S				
1.3	Conventional Facilities																													
1.3.1	Engineering, Design & Inspection																													
1.3.1.1	LBL Activities																													
1.3.1.1.1	Title I	30				30/30																								
1.3.1.1.2	Title II	60										50/50	10/10																	
1.3.1.1.3	Title III	20																				20/20								
1.3.1.1.4	Inspection	40								20/20												20/20								
1.3.1.1.5	Consultants	10								10/10																				
1.3.1.2	Architect/Engineer																													
1.3.1.2.1	Title I	30				30/30																								
1.3.1.2.2	Title II	60										60/60																		
1.3.1.2.3	Title III	20								20/0													0/20							
1.3.2	Construction																													
1.3.2.1	Improvements to Land	40																					40/40							
1.3.2.2	Utilities	110																					110/110							
1.3.2.3	Building	750																					750/750							
1.3.2.4	Other Struc. (Removals)	600								600/600																				
1.3.3	Project Management	110								60/60										50/50										
Contingency by Year		420/420	200 / 190												220 / 230															
Total BA/BO by Year		2300/2300	1080 / 1050												1220 / 1250															
Current Funding Plan		2300	1080												1220															

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

TIME SCHEDULE

Activities	Fiscal Year 1993				Fiscal Year 1994				Fiscal Year 1995				Fiscal Year 1996				Fiscal Year 1997			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
NEPA/SARS																				
A/E Selection																				
A/E Negotiation																				
Funding Authorization																				
Title I																				
Title II																				
Bid and Award																				
Title III																				
Construction																				
Other Structures (Removals- of existing shielding and beamlines)																				

4/15/93

A&E:CDR:ILSE:CDR

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

BASIS OF CONCEPTUAL DESIGN

- **Programmatic Criteria for Functional Requirements Developed by LBL Heavy Ion Fusion Acceleration Research (HIFAR) Group**
- **Conceptual Design, Drawings and Specifications Prepared by LBL Facilities Department**
- **Site in General Conformance with LBL Site Development Plan (Approved by DOE in 1992)**
- **Consultants**
 - **Vibration Engineering Consultants, Inc.,
Vibration Engineers**
- **Cost Estimate, except Removals, Prepared by Independent Cost Estimating Firm, Lee Saylor, Inc.**
- **Construction Costs Escalated 11% from March 1993 to Midpoint of Construction, May 1996 Using DOE Guidelines**

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

METHOD OF ACCOMPLISHMENT

- **Removal of Existing Shielding and Beamlines Will Be by LBL Riggers and Engineers**
- **Design Program Will Be Prepared by LBL Facilities Department from Programmatic Criteria Supplied by LBL Heavy Ion Fusion Acceleration Research (HIFAR) Group**
- **A/E Will Be Selected by LBL for Titles I and II Design and Title III Technical Oversight**
- **Construction Work Will Be Awarded After Competitive Bidding as a Lump-Sum Subcontract**
- **Project Management, Construction Contract Administration and Inspection by LBL**

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

CONVENTIONAL FACILITIES

MAJOR COST ELEMENTS AND THEIR PERCENTAGES OF TOTAL

Item	Cost (\$K)	Percent of Building Total	Percent of Construction Total
Demolition	27		1
Concrete	71	1	6
Containment Wall	36		3
Special Constr Building	114	26	9
Finishes	33	8	1
HVAC	6	1	
Fire Protection	18	4	1
Electrical	262	60	22
Site Utilities	85		7
Removals	557		46

**Costs Used Are Direct Costs from LSI Estimate Without Markups
or Direct Removals Costs**

Building Construction Total Cost Is \$433K

Total Construction Cost Is \$1209K

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

ESTIMATE SUMMARY

Site Preparation

Demolition		<u>26,750</u>
Subtotal Direct Cost		26,750
General Conditions/Mobilize	8%	2,140
Estimating Contingency		<u>In Project Contingency</u>
		28,890
Bond	2%	578
Prime Contractor OH & Fee	13%	<u>3,756</u>
Total Estimated Construction Cost at March 1993		<u>33,224</u>
Total Escalated Construction Cost to May 1996	11%	<u>36,878</u>
	Say	40,000

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

ESTIMATE SUMMARY (Continued)

Building

Div 3	Concrete	71,496
Div 5	Metals	41,133
Div 7	Thermal and Moisture Protection	3,075
Div 8	Doors and Windows	17,950
Div 9	Finishes	2,000
Div 12	Furnishings	5,344
Div 13	Special Construction	114,250
Div 15	HVAC	6,250
Div 15	Fire Protection	18,590
Div 16	Electrical	<u>262,381</u>

Subtotal Direct Cost		542,469
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General Conditions/Mobilize	8%	43,398
Estimating Contingency		<u>In Project Contingency</u>

585,867

Bond	2%	11,717
Prime Contractor OH & Fee	13%	<u>76,163</u>

Total Estimated Construction Cost at March 1993		<u>673,746</u>
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Total Escalated Construction Cost to May 1996	11%	<u>747,859</u>
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Say		750,000
-----	--	---------

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

ESTIMATE SUMMARY (Continued)

Site Utilities

Div 2 Site Work		<u>79,470</u>
Subtotal Direct Cost		79,470
General Conditions/Mobilize Estimating Contingency	8%	6,358 <i>In Project Contingency</i>
		85,828
Bond	2%	1,717
Prime Contractor OH & Fee	13%	<u>11,158</u>
Total Estimated Construction Cost at March 1993		<u>98,702</u>
Total Escalated Construction Cost to May 1996	11%	<u>109,559</u>
	Say	110,000

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

ESTIMATE SUMMARY (Continued)

Other Structures (Removals)

Existing Shielding and Beamlines Removals (To be performed by LBL personnel)	<u>557,000</u>
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Total Estimated Construction Cost at October 1993	<u>557,000</u>
--	----------------

Total Escalated Construction Cost to May 1995	6%	<u>590,420</u>
--	----	----------------

Say	600,000
-----	---------

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)
CONVENTIONAL FACILITIES
OBLIGATIONS AND COSTS SCHEDULE DETAIL
(\$K)

DESCRIPTION	TOTAL	FY 1995		FY 1996	
		O	C	O	C
<u>LBL Activities</u>					
Title I	30	30	30		
Title II	60	50	50	10	10
Title III	20			20	20
Inspection	40	20	20	20	20
Consultants	<u>10</u>	<u>10</u>	<u>10</u>	—	—
Subtotal	160	110	110	50	50
<u>Architect/Engineer</u>					
Title I	30	30	30		
Title II	60	60	60		
Title III	<u>20</u>	<u>20</u>	<u>0</u>	<u>0</u>	<u>20</u>
Subtotal	110	110	90	0	20
<u>Construction</u>					
Improvements to Land	40			40	40
Utilities	110			110	110
Building	750			750	750
Other Structure (Removals)	<u>600</u>	<u>600</u>	<u>600</u>	<u>0</u>	<u>0</u>
Subtotal	1,500	600	600	900	900
<u>Project Management</u>	110	60	60	50	50
Subtotal	1,880	880	860	1,000	1,020
Contingency (22%)	<u>420</u>	<u>200</u>	<u>190</u>	<u>220</u>	<u>230</u>
TOTAL	2,300	1,080	1,050	1,220	1,250

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

CONVENTIONAL FACILITIES

ESCALATION ANALYSIS

**Based on DOE "Anticipated Economic Escalation Rates"
(Updated February 1993)**

Start Construction: February 1996

Construction Period: 6 Months

Finish Construction: August 1996

Midpoint Construction: May 1996

Estimate Date: March 1993

								<u>%</u>
FY 1993	Mar 1993	-	Sep 1993	7 mo	@	2.4	=	1.4
FY 1994	Oct 1994	-	Sep 1994	12 mo	@	3.3	=	3.3
FY 1995	Oct 1995	-	Sep 1995	12 mo	@	3.6	=	3.6
FY 1996	Oct 1995	-	May 1996	7 mo	@	3.7	=	2.2

Total Compounded Escalation 11.0

INDUCTION LINAC SYSTEMS EXPERIMENT (ILSE)

CONVENTIONAL FACILITIES

ED&I ANALYSIS (\$K)

LBL Activities

Title I	3.0MM at 10.3/mo		=	30
Proj Engineer 1	x 0.25 time x 3.9 mos	=	1.0 MM	
Proj Team 2	x 0.25 time x 3.9 mos	=	2.0 MM	
Title II	5.9MM at 10.3/mo		=	60
Proj Engineer 1	x 0.25 time x 6.1 mos	=	1.5 MM	
Proj Team 3	x 0.25 x 6.1 mos	=	4.4 MM	
Title III	2.0MM at 10.3/mo		=	20
Proj Engineer 1	x 0.12 x 6.0 mos	=	0.7 MM	
Proj Team 2	x 0.11 x 6.0 mos	=	1.3 MM	
Inspection	4.0MM at 10.3/mo		=	40
Inspectors 1	x 0.33 time x 12.0 mos	=	4.0 MM	
Consultants				10
Independent Seismic Reviews		2		
Independent Cost Estimates		3		
Radiologic Survey and Removal		5		

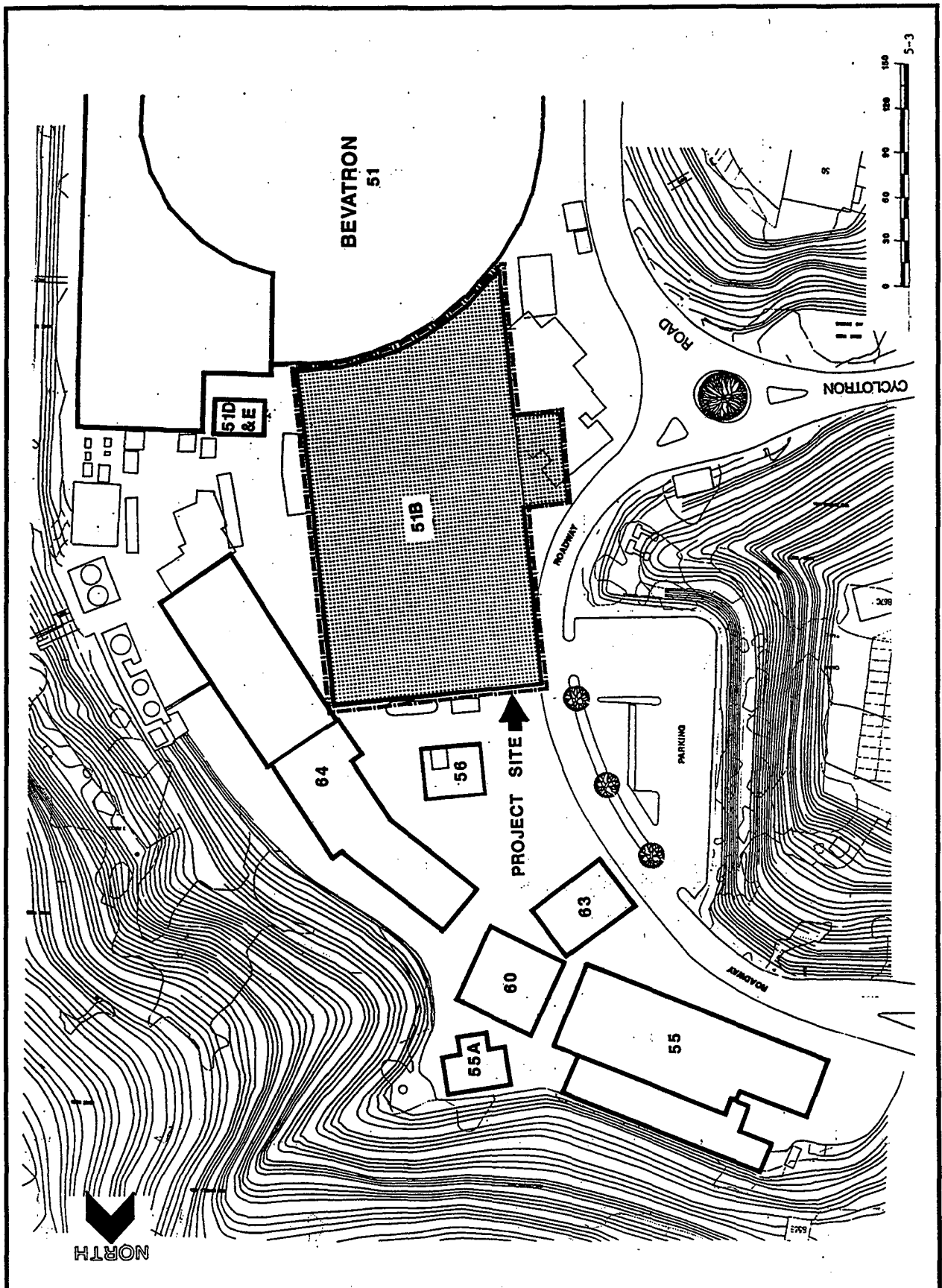
A/E Activities

Approximately 7% of Designed Construction Costs	(\$1,500K)	110
Title I (30%)	30	
Title II (50%)	60	
Title III (20%)	20	

Total Estimated ED&I 270

Current FY93 LBL Rate: 9.0K/MM

Escalation to February 1996 at 1:14 x 9.0K/MM = 10.3K/MM



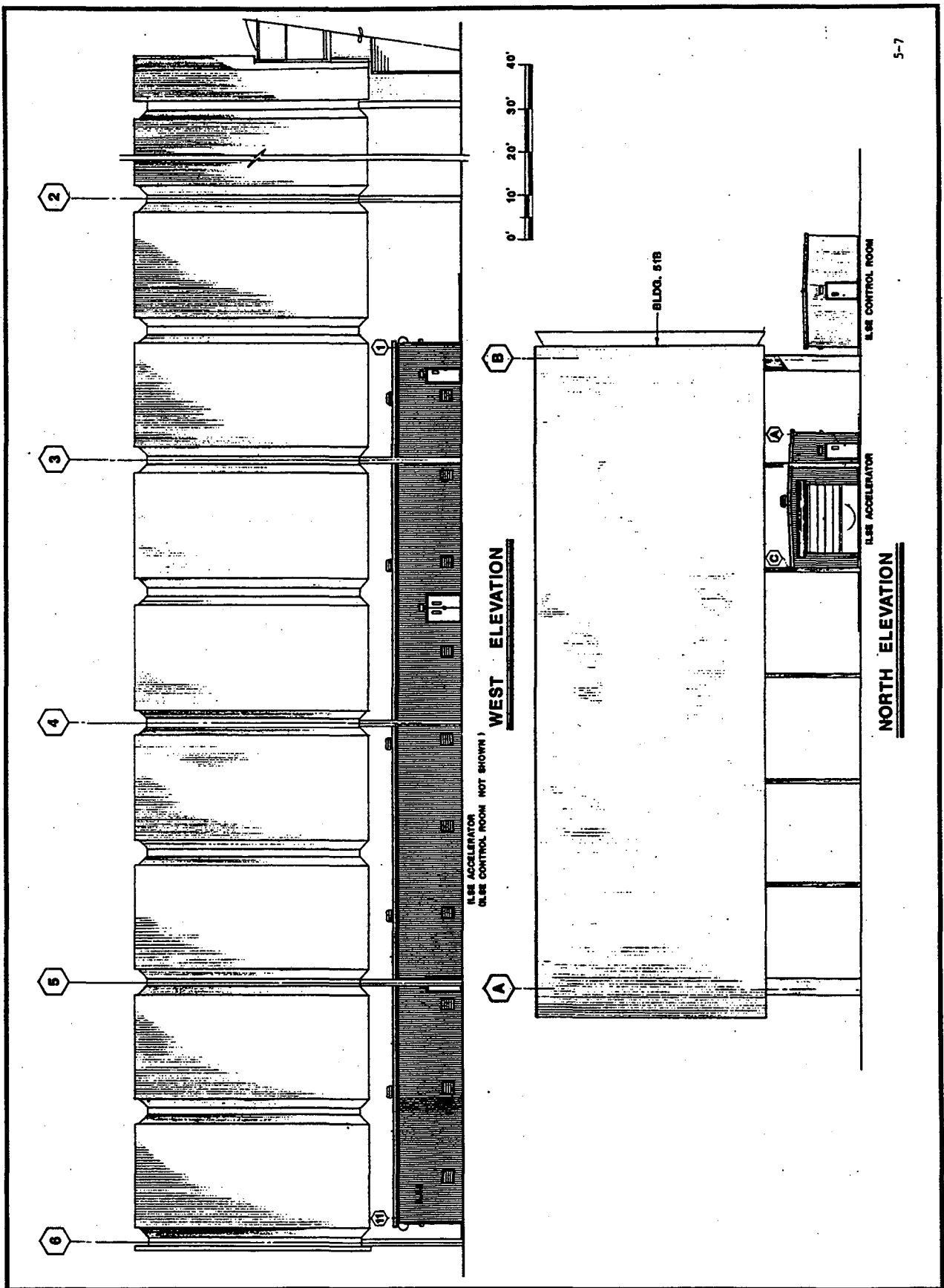
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Induction Linac Systems Experiment

SITE PLAN

A-2

4/15/93



5-7

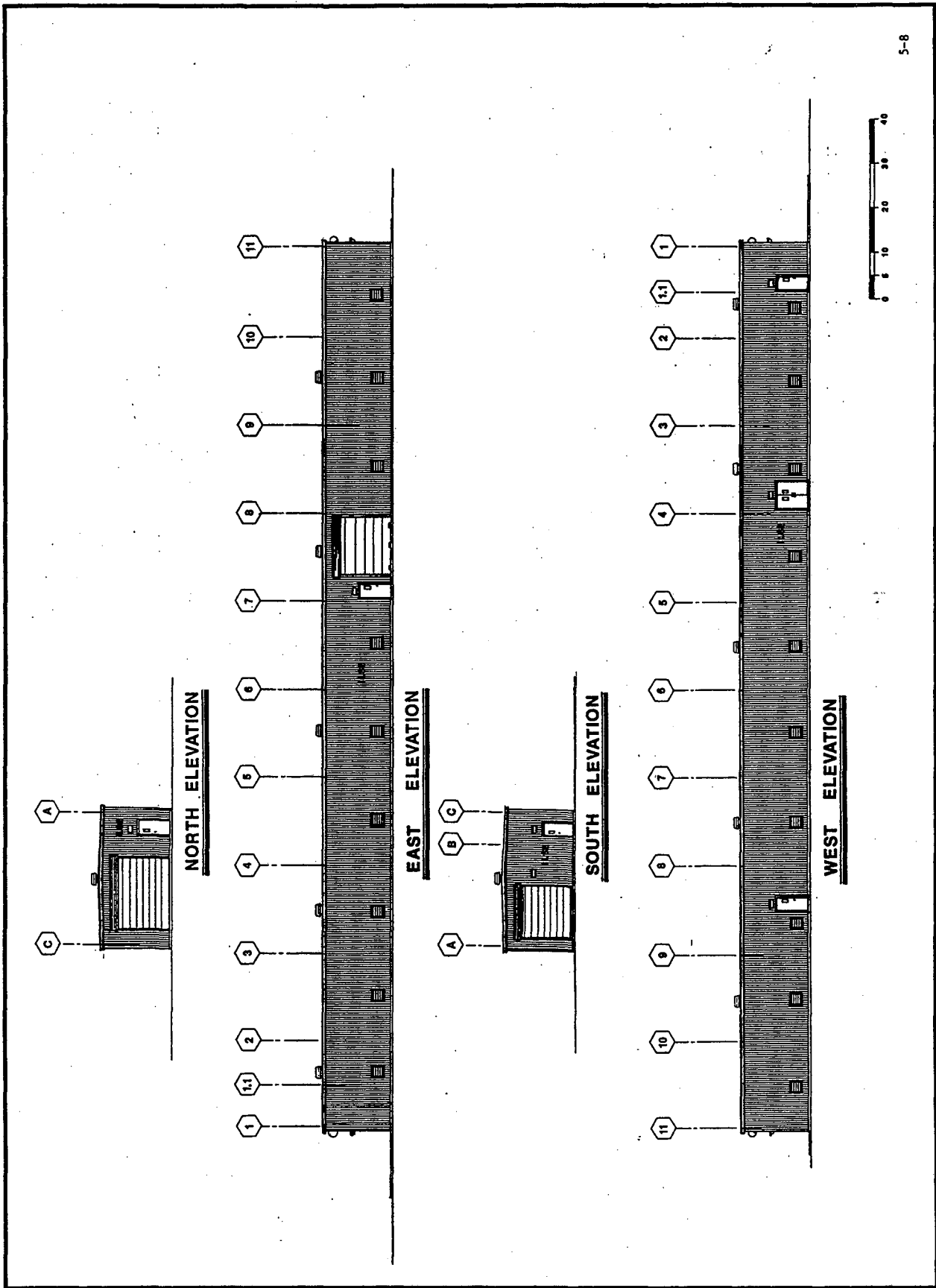


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Induction Linac Systems Experiment
BUILDING 51B ELEVATIONS

A-6

4/15/93

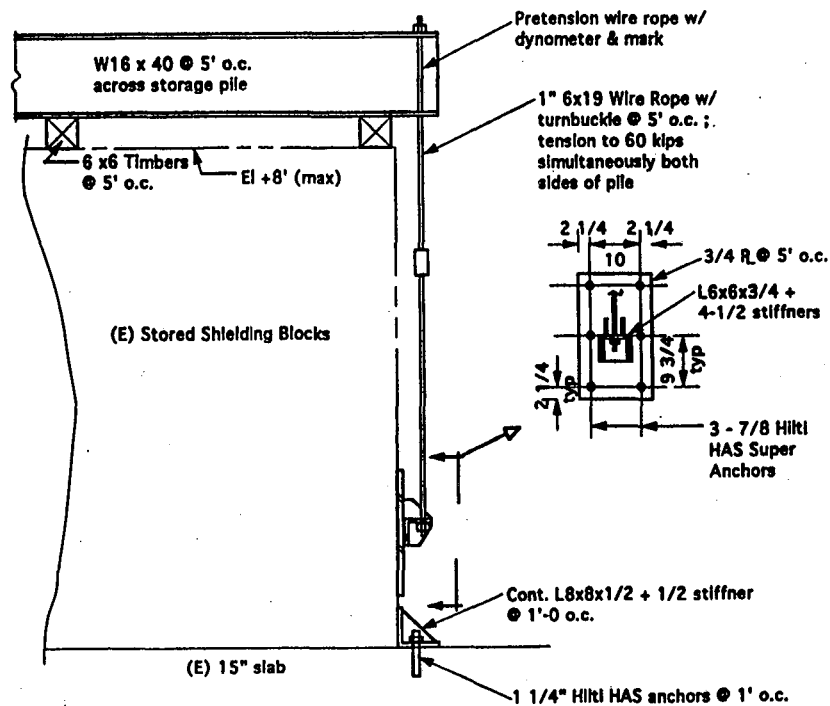


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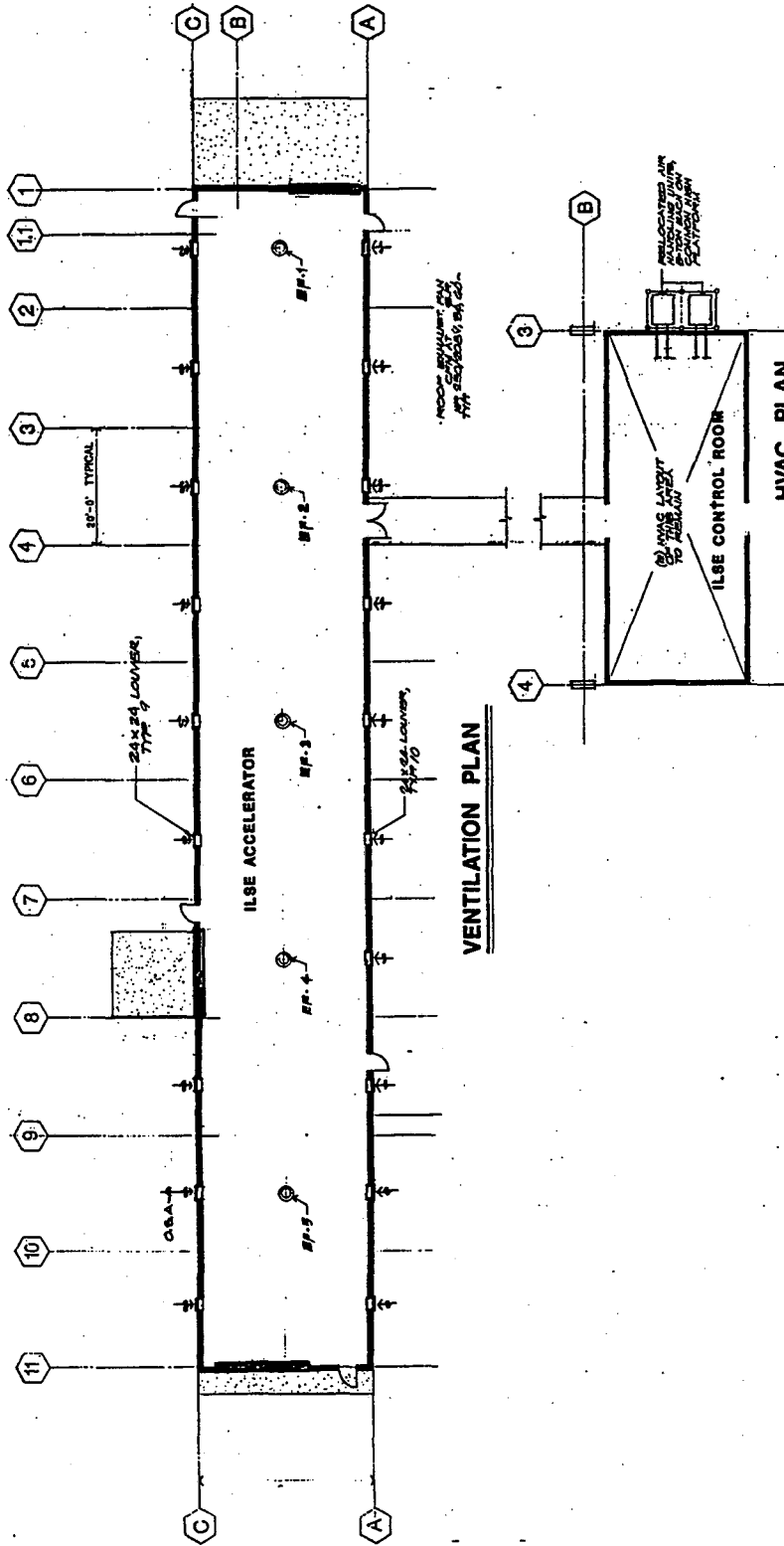
Induction Linac Systems Experiment
ILSE BUILDING ELEVATIONS

A-7

4/15/93



Section thru Stored Shielding
1/2" = 1'-0



SCALE IN FEET :
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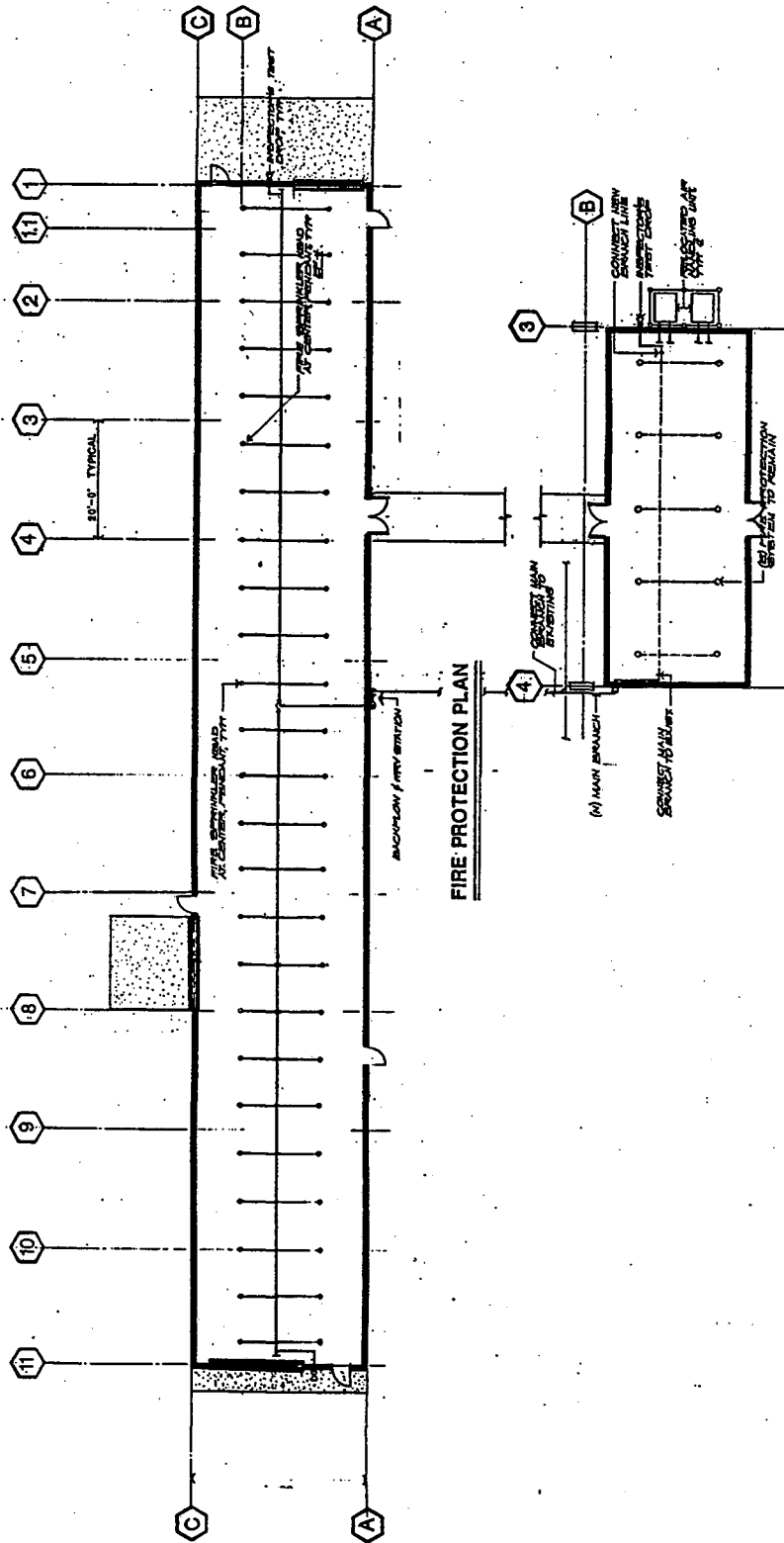
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Induction Linac Systems Experiment

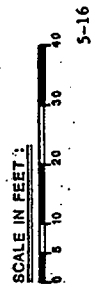
VENTING/ HVAC PLANS

M-1

4/15/93



B/51B PARTIAL FIRE PROTECTION PLAN



5-16



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**Induction Linac Systems Experiment
FIRE PROTECTION PLAN**

FP-1

4/15/93

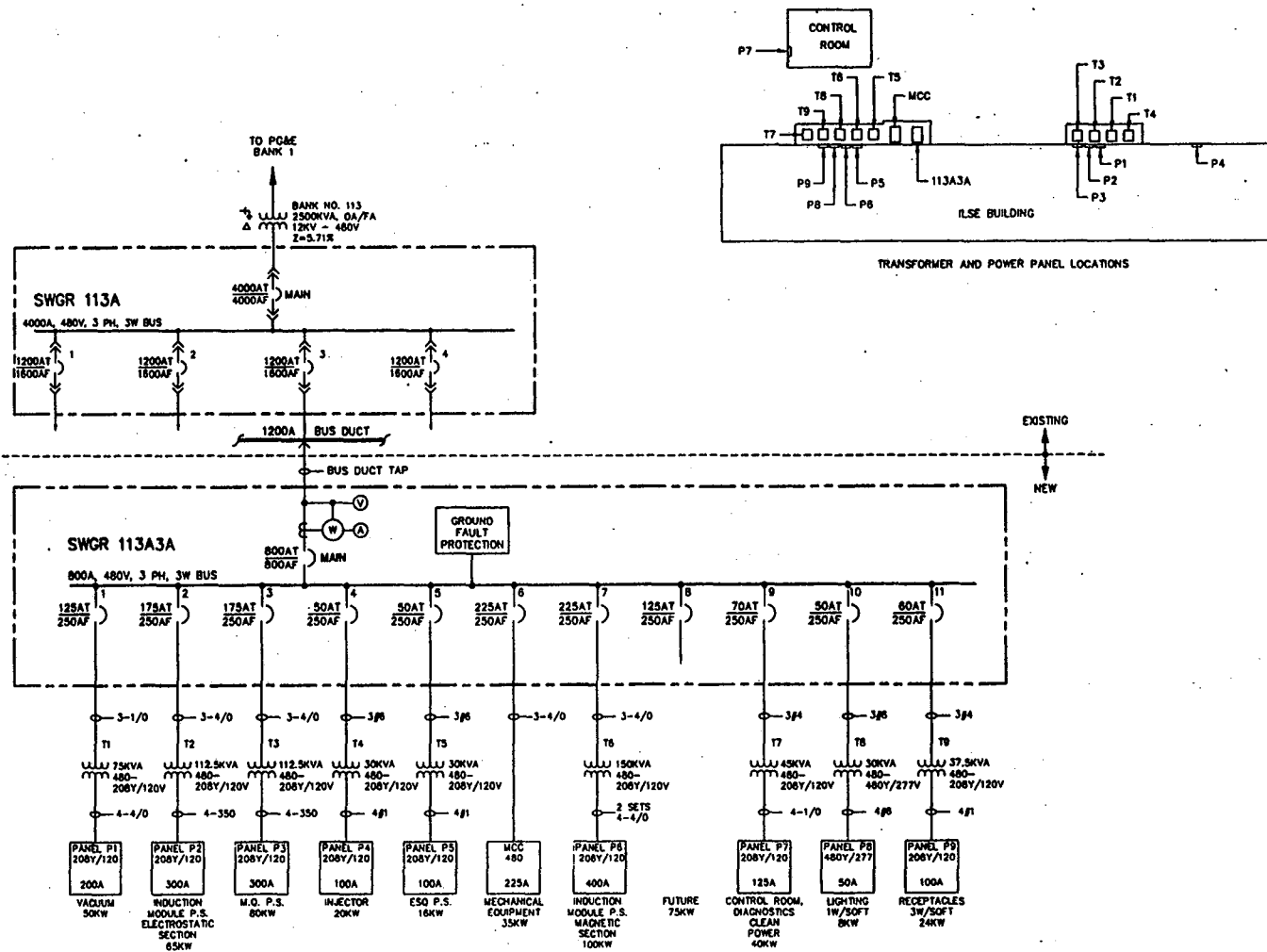


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Induction Linac Systems Experiment
ELECTRICAL WIRING DIAGRAM

E-1

4/15/83



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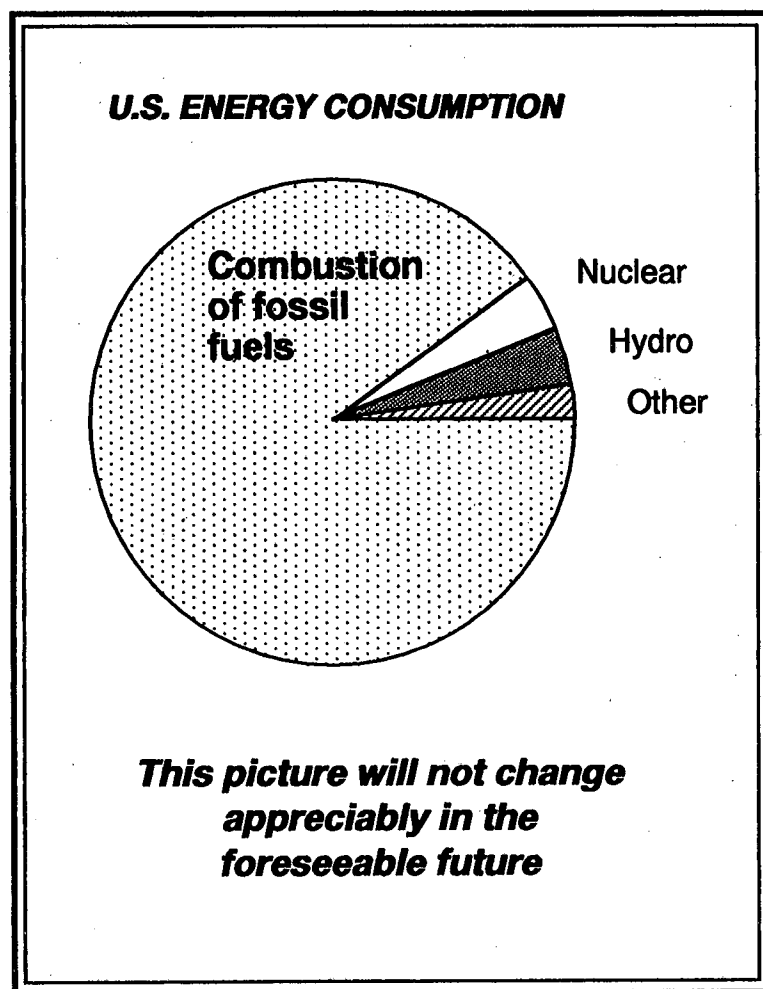
Chemical Dynamics Research Laboratory

-- Outline of Presentations --

- Introduction, scientific justification, and overview of Special Research Facilities R. Gough
- Overview of Conventional Facilities D. Truchlikova
- Cost and schedule methodology and summary R. Gough



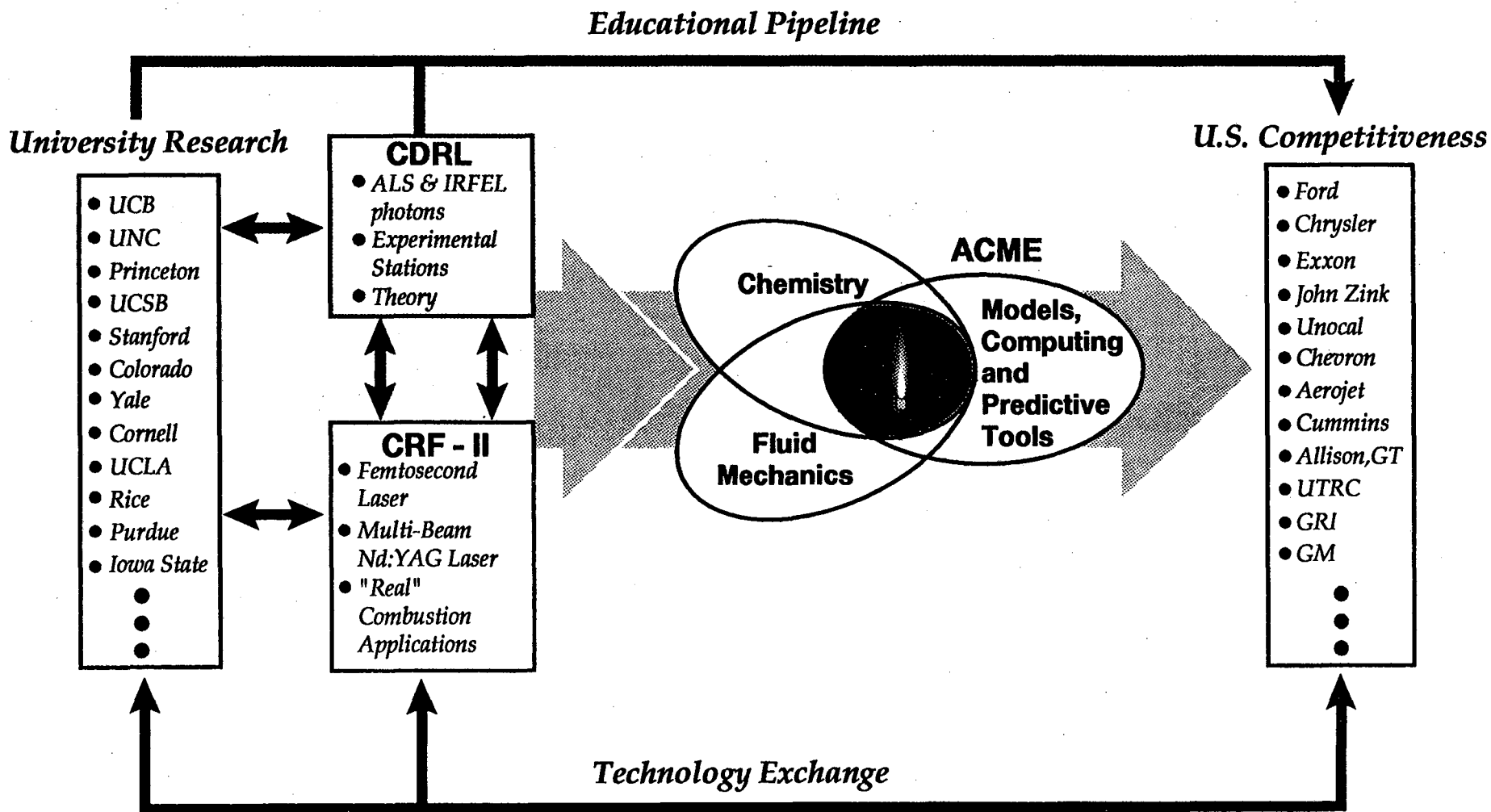
DOE's Role in the National Energy Strategy



- Increased energy and environmental efficiency
- Securing future energy supplies
- Enhancing environmental quality
- Fortifying foundations



The Combustion Dynamics Initiative



Introduction

- The Combustion Dynamics Initiative (CDI) is a programmatic response to the imperatives of the National Energy Strategy that will focus scientific research efforts in the chemical and combustion sciences
- The ***Chemical Dynamics Research Laboratory (CDRL)*** is the cornerstone new facility of the Combustion Dynamics Initiative
- The CDRL, to be sited at the Lawrence Berkeley Laboratory (LBL), is proposed jointly by LBL and by the Sandia National Laboratories (SNL), for a FY 1995 construction start
- A similar project was validated in FY90 as the Combustion Dynamics Facility at LBL (CDF/LBL); in FY91, a modified version was also validated

Programmatic Justification

- The CDRL is advanced as a national response to major scientific and technological challenges in combustion, chemical reaction dynamics, and related science and engineering fields.
- The creation of the CDRL and its proposed facilities will provide unique opportunities for research in chemical and combustion dynamics:
No facility in the world will match the powerful array of tunable photon sources covering an unparalleled spectral range that can be brought to bear on outstanding scientific problems that are vital to the US national interest.
- The CDRL will provide a multi-disciplinary setting of theoretical and experimental research to advance basic new knowledge that underlies scientific and technological leadership in internationally competitive combustion systems and control technology industries.
- The CDRL will be a facility at which advanced instrumentation and methodologies will be developed to educate and train new scientists in chemical dynamics and combustion chemistry.

National Reports & Surveys

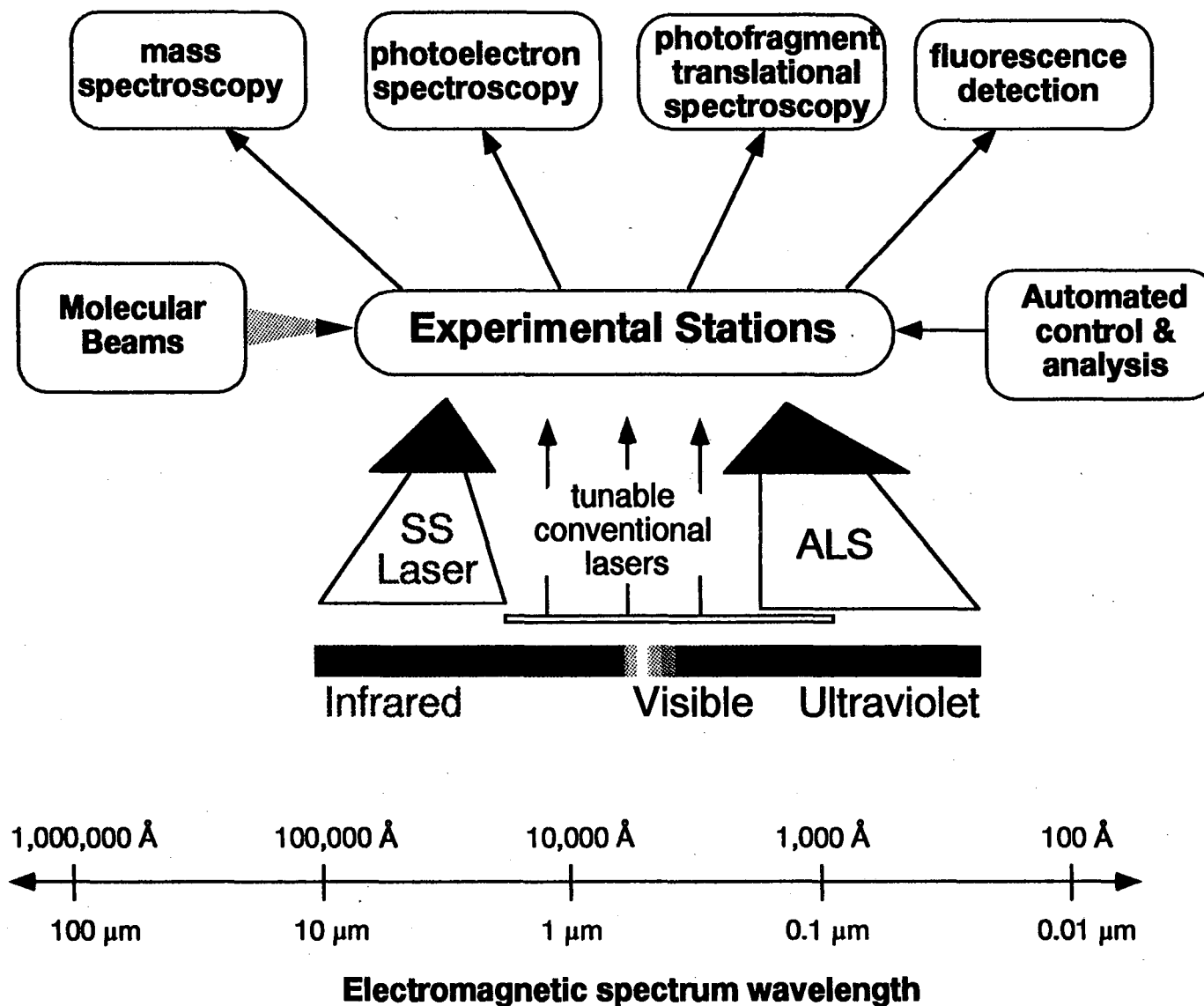
- The CDI was developed through a lengthy series of workshops and reviews beginning in July of 1986
- Since the mid 80's, several national reports and surveys have identified chemical and combustion dynamics as a high priority national need
- From the BESAC Report on the July 1991 review of the CDI...

"As requested, we have reviewed the goals and components of the CDI. We find pursuit of the science and engineering of combustion essential to raising the efficiency of many types of combustion processes and reducing pollutants. We consider this program to lie at the heart of the DOE mission and to epitomize the fundamental National Energy Strategy approach to increasing national energy and economic efficiency and enhancing environmental quality...In summary, we strongly endorse the CDI concept and plan."

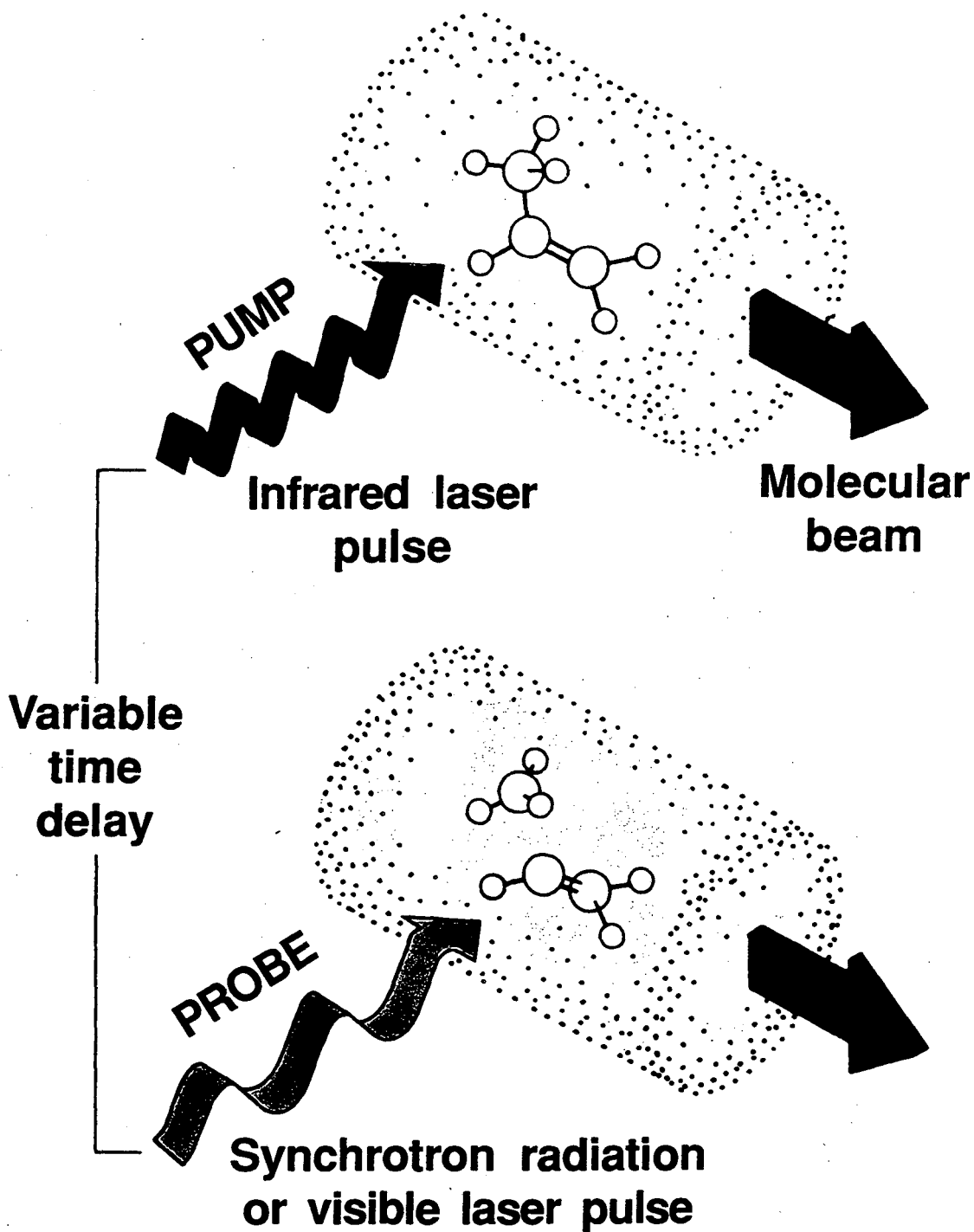
Scientific Techniques

- **Application of high-brilliance and coherent, tunable photon sources across a broad spectral range.**
- **Pump-probe experiments involving simultaneous application of multiple photon sources.**
- **Broad and vigorous interaction of theorists, experimental scientists, and instrumentation engineers.**

CDRL: Broad Spectral Coverage Plus Combustion Experimental Facilities



A Two-Color Experiment for Studying Chemical Reactions



Basis of Design

- **The design of the CDRL is based on programmatic criteria established by:**
 - members of the national combustion chemistry and chemical physics communities through the process of workshops and reviews;
 - Professor Yuan T. Lee, Nobel Laureate in Chemistry, UC Berkeley;
 - Professor C. Bradley Moore, Dean, College of Chemistry, UC Berkeley.
- **Scientific opportunities have been identified involving both simultaneous and independent application of tunable radiation sources:**
 - the Advanced Light Source (ALS);
 - advanced, high-performance lasers, extending the wavelength range up to 10 μm .
- **The project is designed to provide the facilities needed to carry out the broadly-based scientific programmatic objectives.**

Project Scope

Special Research Facilities

- **ALS Beamlines**
 - U10 undulator and associated beamline
 - bend magnet beamline
- **Experimental systems**
 - seven experimental stations
 - three advanced lasers (including a 3 - 10 μm solid state laser)

Conventional Facilities

- **A new laboratory building located adjacent to the ALS**
- **Associated utilities**
- **Special building facilities and standard building equipment**

Program-Guided Revisions to the CDRL Since 1991 Validation

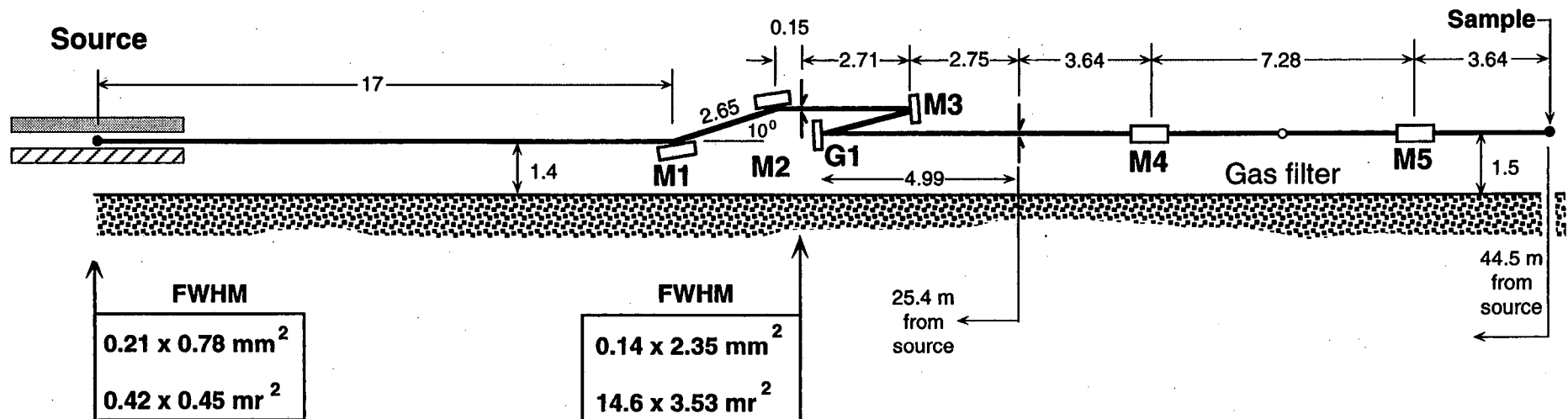
- Aspects of the proposed scientific program NOT related to combustion have been deleted
 - wavelength coverage above 10 μm has been eliminated
 - advances in solid state lasers (in particular, Ti / Al_2O_3 lasers) provide coverage from 3 - 10 μm , eliminating the need for the IRFEL
- Power and space requirements of the solid state laser substantially reduce the conventional facilities requirements, leading to a smaller, less expensive building
- Changes in the project scope reduced the TPC from \$95.4M to \$65.9M; the magnitude of these revisions, coupled with recent technological advances, led us to a new bottom-up cost estimate and to seek a validation of the CDRL as a "new project"

ALS Beamline Requirements

- **Photon energy range of 6-25 eV in the first harmonic**
 - low end overlaps capabilities of intense laser sources
 - high end allows exploration of valence-shell processes in molecules
- **Intensity of $\geq 10^{12}$ photons/sec at 0.1% bandwidth**
 - permits wide variety of measurements using dilute molecular beam targets of radicals, clusters, and complexes
- **High-brightness, tightly-focused beams**
 - two-color experiments often involve interaction volumes with linear dimensions as small as 50 μm
- **Resolving power of $\geq 50,000$**
 - high resolution is required for studying the rovibrational structure of molecules
- **High spectral purity**
 - many experiments will require suppression of the third harmonic to better than a part in 10^5 (ie $I_3 / I_1 < 10^{-5}$)

Undulator U10 Beamline

Elevation

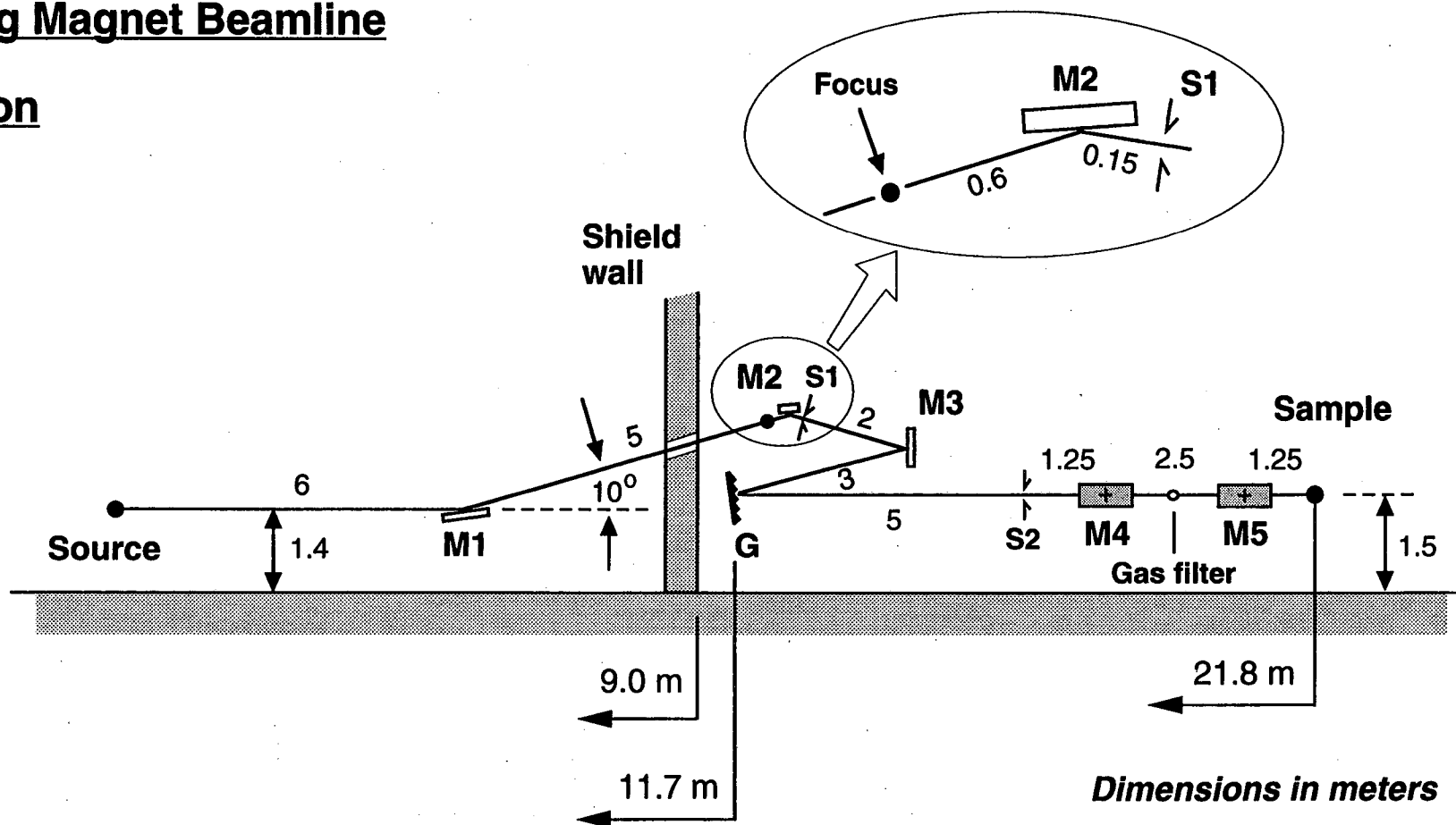


Dimensions in meters

NAME	SHAPE	MAGNIFICATION	FOCUSING DIRECTION
M1	Toroid	0.12	Both
M2	Sphere	0.25	V
M3	Flat	-	-
G1	Sphere	~1	Both
M4	Toroid	1	Both
M5	Toroid	0.5	Both

Bending Magnet Beamline

Elevation



Name	Shape	Magnification	Focusing Direction
M1	Toroid	0.83	Both
M2	Sphere	0.25	V
M3	Flat	-	-
G1, G2	Sphere	~1	Both
M4	Toroid	1	Both
M5	Toroid	1	Both

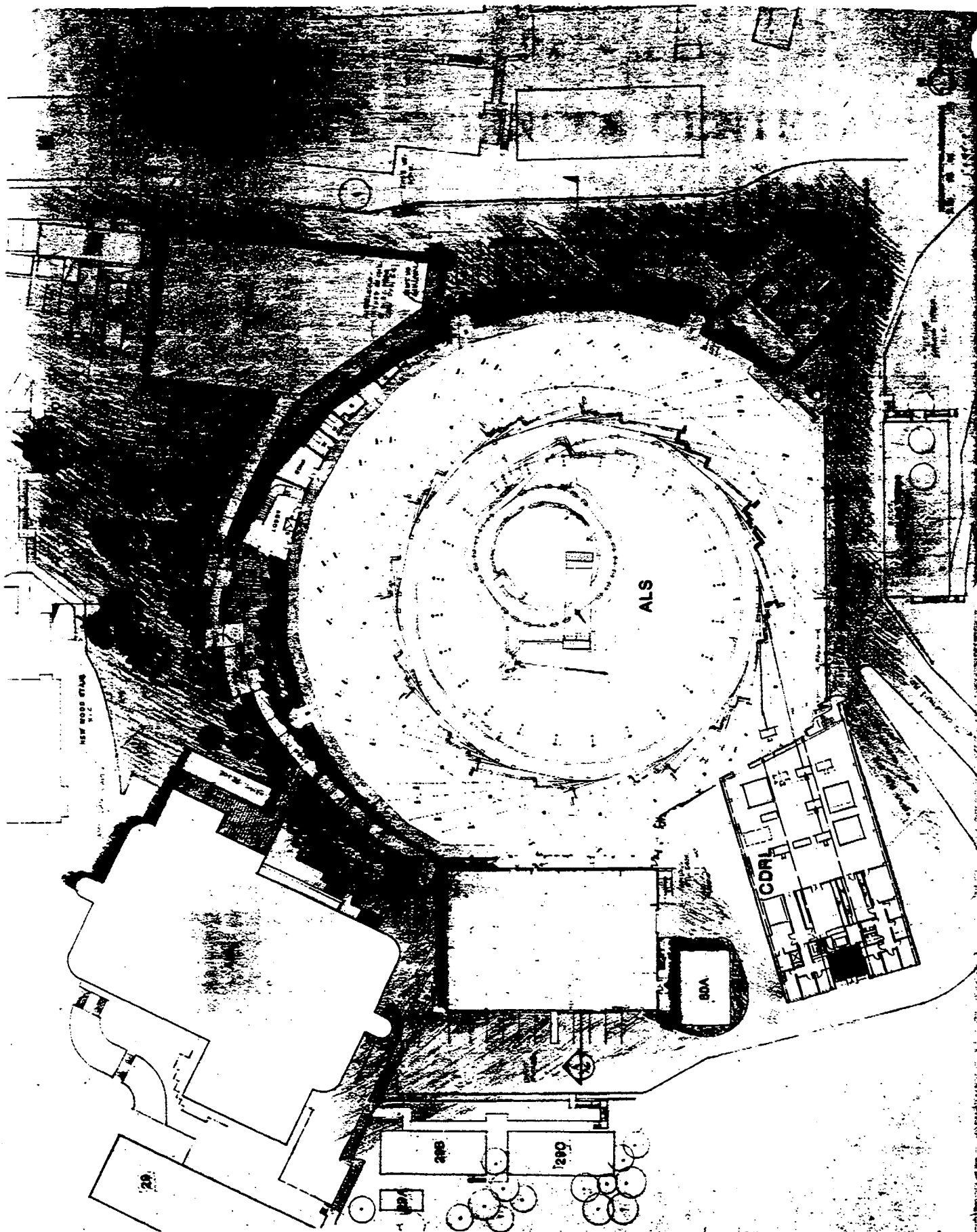
ALS Beamline Performance

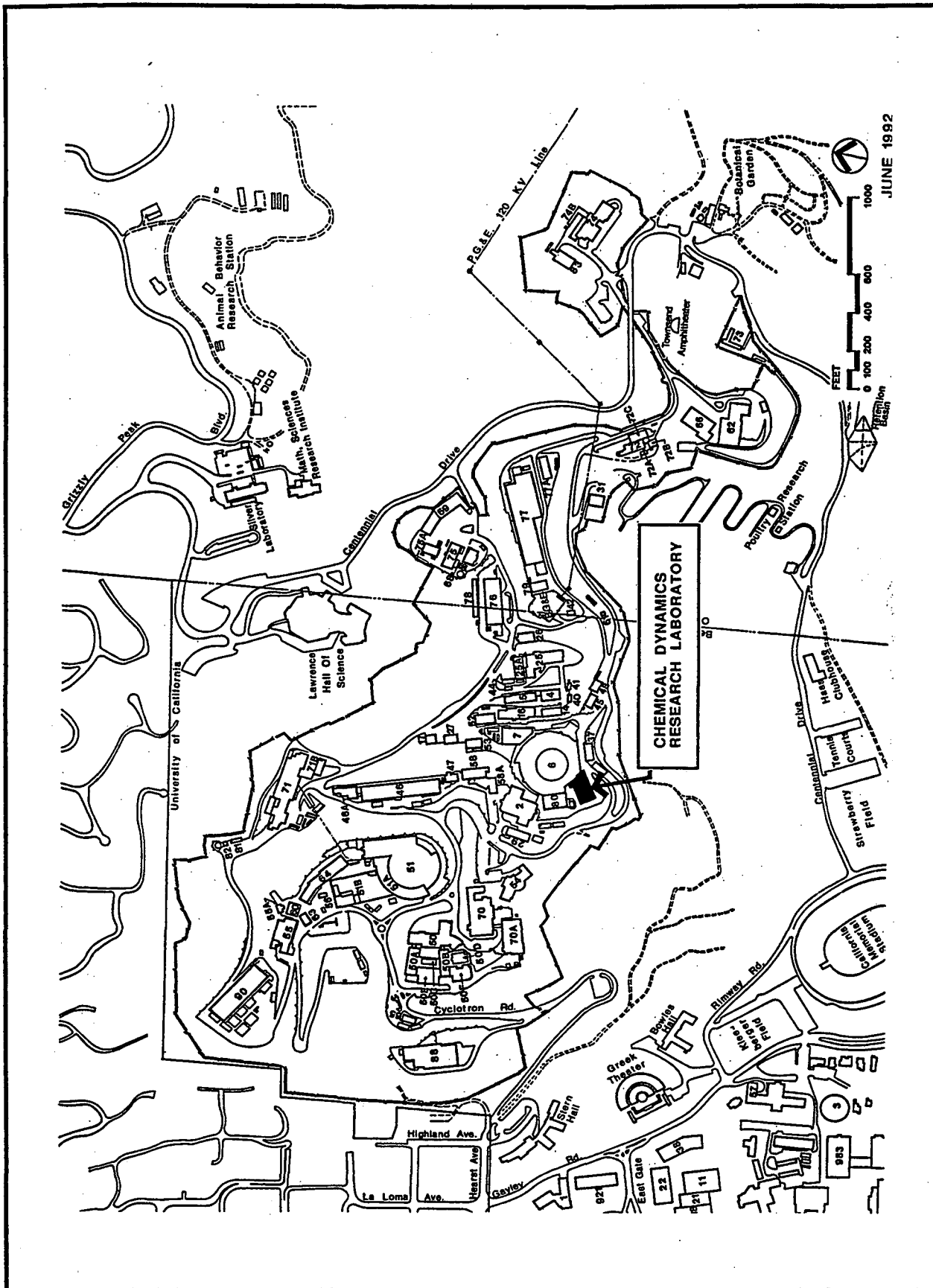
- **For the bend magnet beamline...**

- vertical phase space	0.09 x 12	mm mrad
- horizontal phase space	0.78 x 22	mm mrad
- resolution (DI/I)	1/50,000	
- intensity	1×10^{10}	photons/sec

- **For the U10 undulator beamline...**

- vertical phase space	0.011 x 4.9	mm mrad
- horizontal phase space	0.1 x 2.8	mm mrad
- resolution (DI/I)	1/50,000	
- intensity	3×10^{11}	photons/sec
- resolution (DI/I)	1/44	
- intensity	3×10^{14}	photons/sec





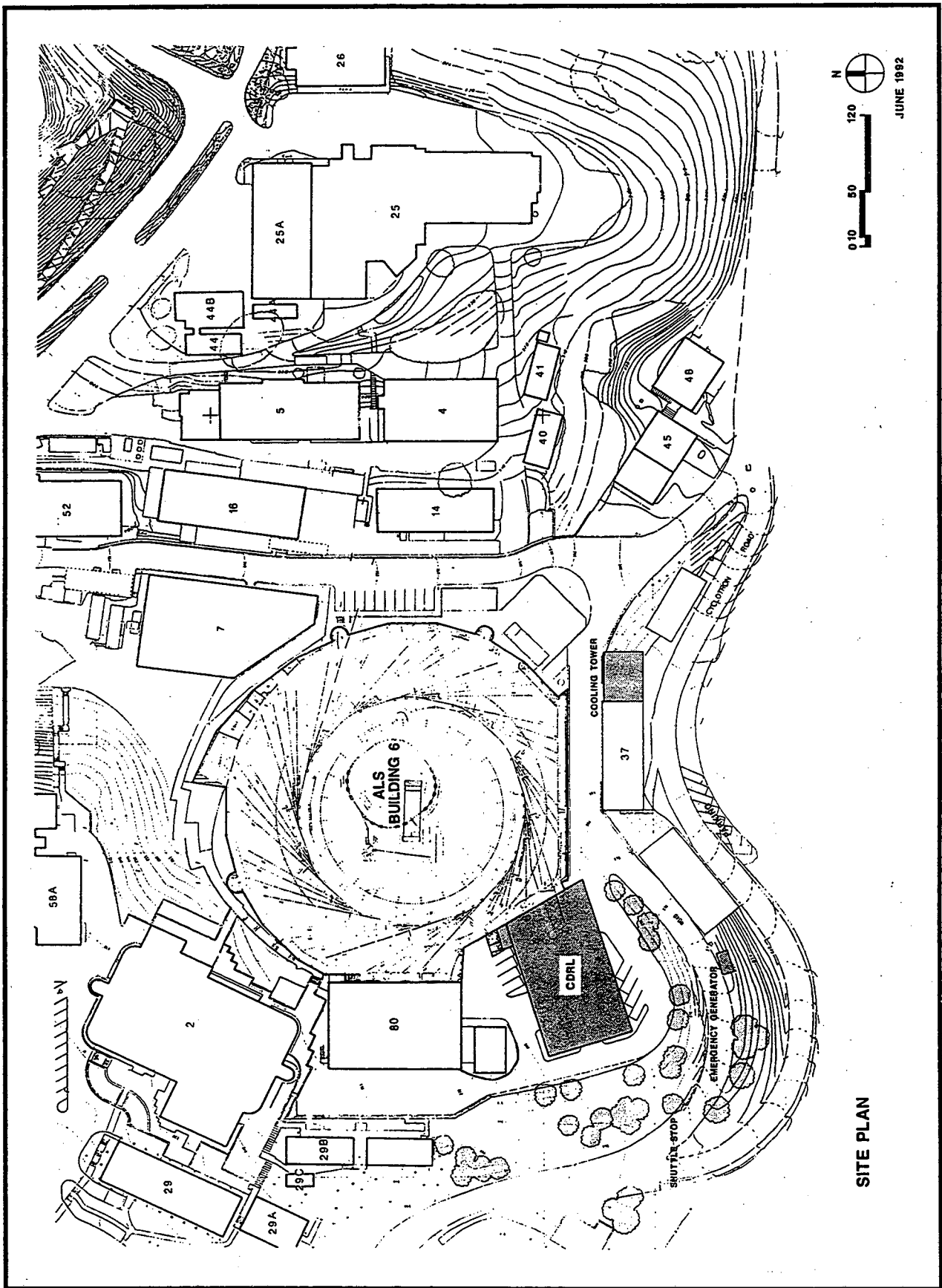
LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Chemical Dynamics Research Laboratory

LOCATION PLAN

T-1

4/15/93



SITE PLAN



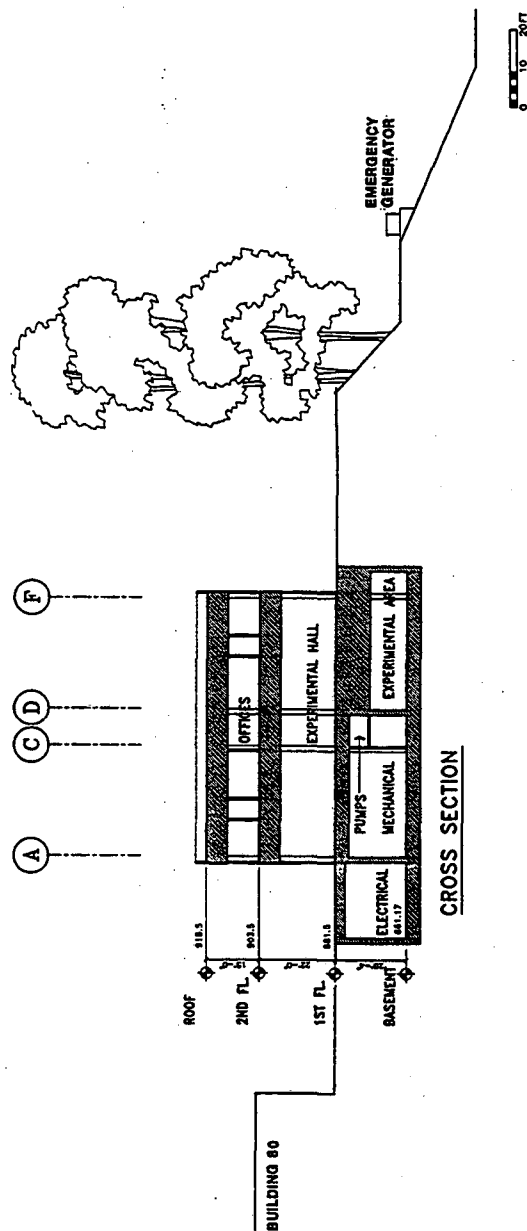
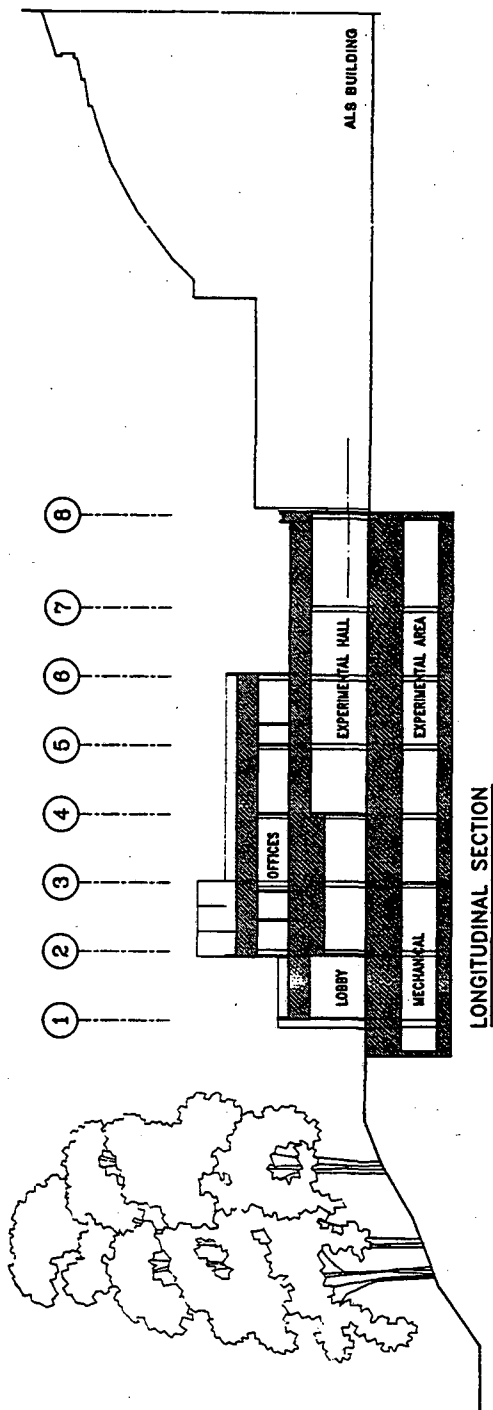
LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Chemical Dynamics Research Laboratory

SITE PLAN

T-2

4/15/93

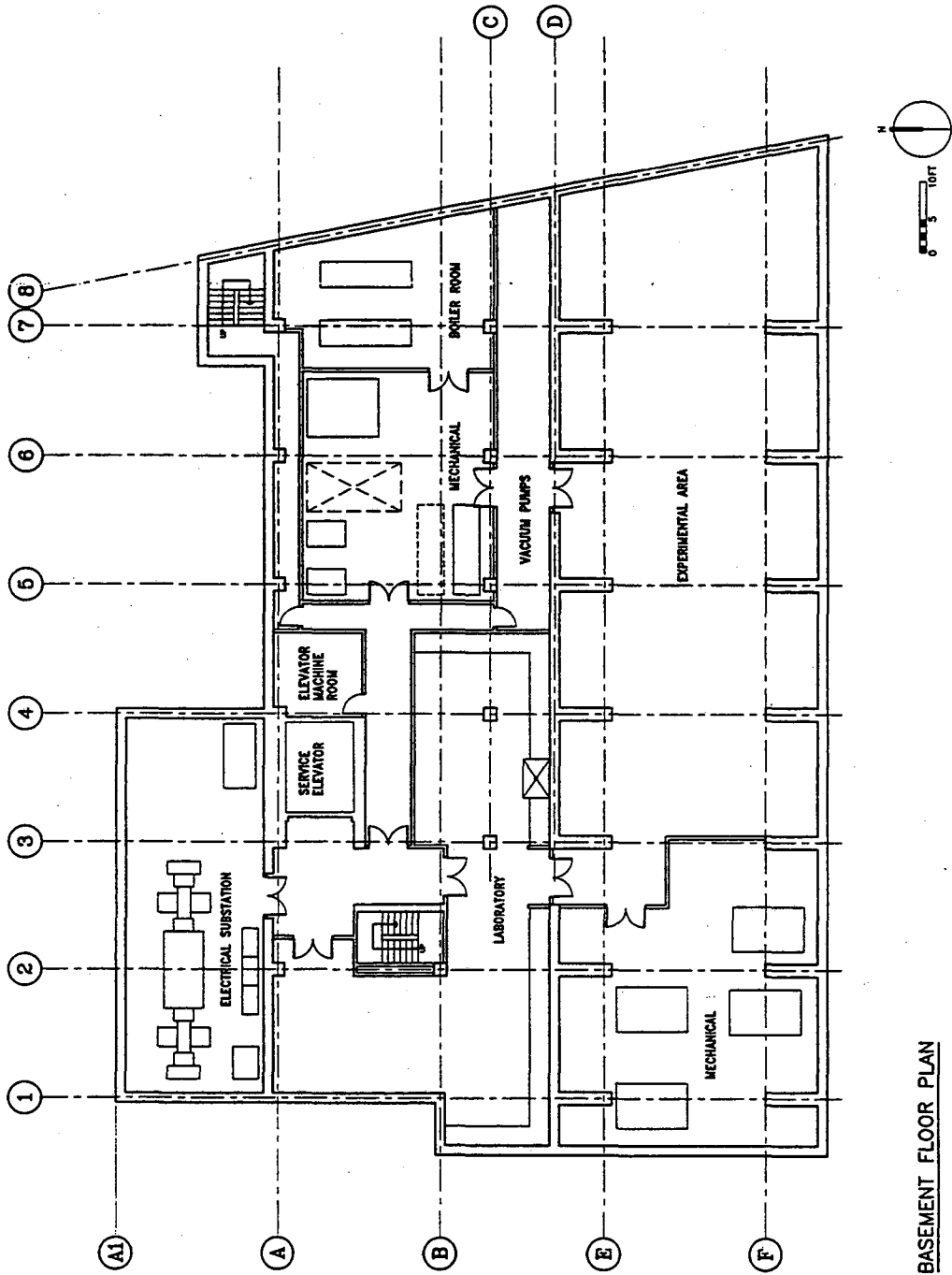


LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Chemical Dynamics Research Laboratory
BUILDING SECTIONS

A-5

4/15/93



BASEMENT FLOOR PLAN



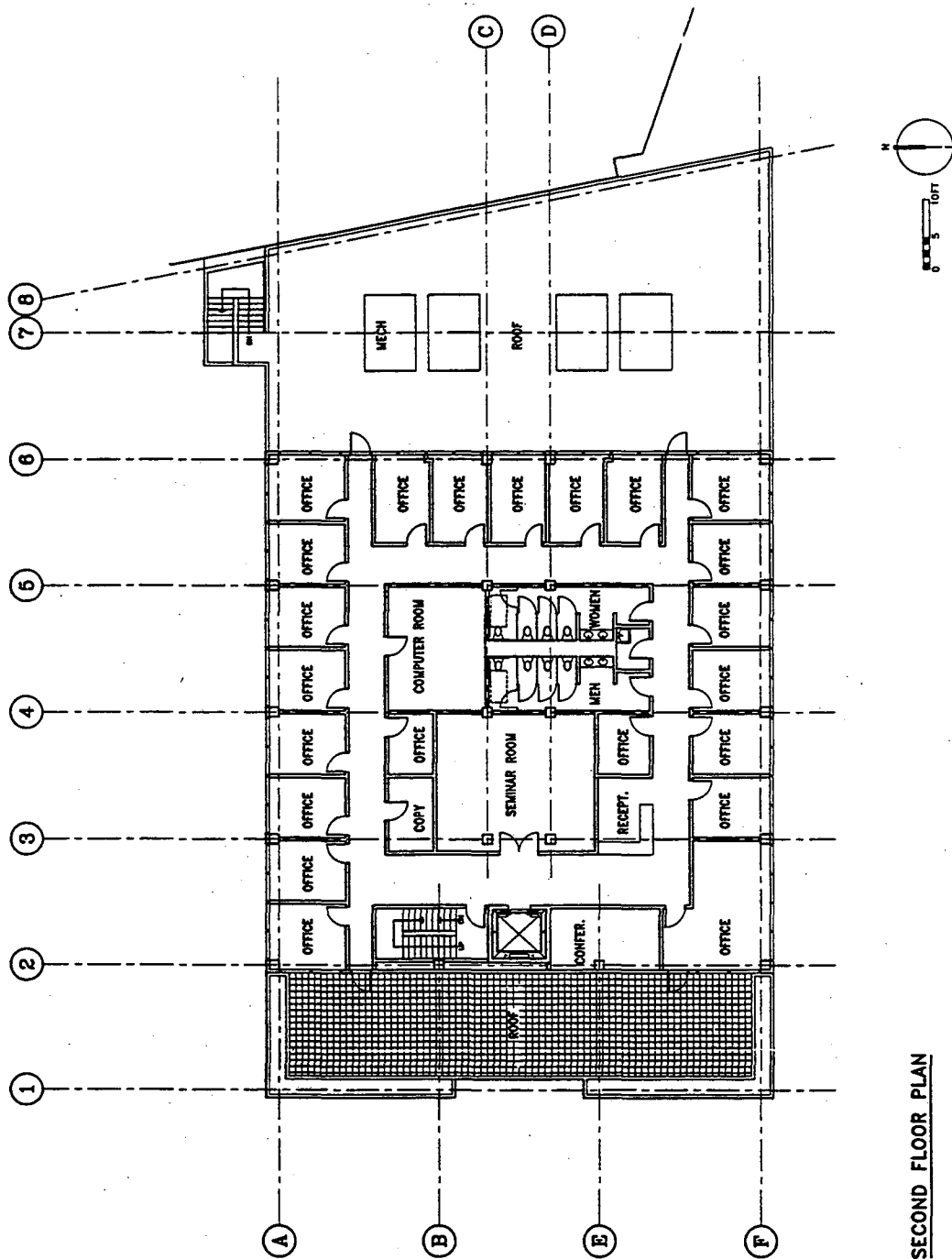
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Chemical Dynamics Research Laboratory

BASEMENT FLOOR PLAN

A-1

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SECOND FLOOR PLAN

JUNE 1992



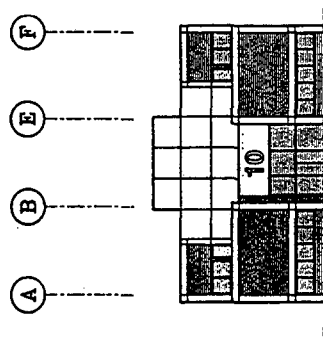
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Chemical Dynamics Research Laboratory

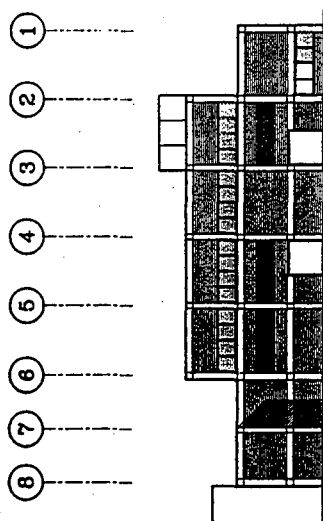
SECOND FLOOR PLAN

A-3

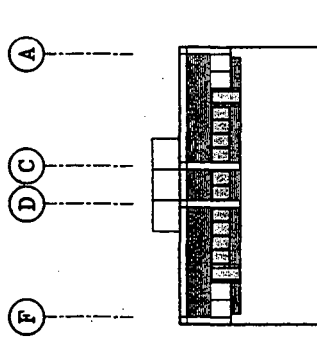
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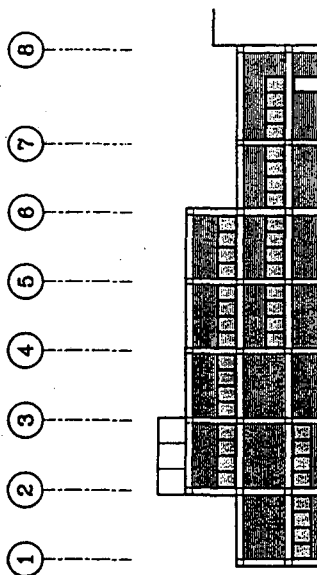
WEST ELEVATION



NORTH ELEVATION



EAST ELEVATION



SOUTH ELEVATION



JUNE 1992



LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Chemical Dynamics Research Laboratory
BUILDING ELEVATIONS

A-6

4/15/93

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONVENTIONAL FACILITIES PROJECT DESCRIPTION

- **The 33,000 GSF Two-Story Building with Full Basement Will House:**
 - **High Bay Heavy Laboratory Experimental Hall**
 - **Basement Experimental Area Designed for Future Conversion into a Free Electron Laser (FEL) Cave with Radiation Shielding**
 - **Support Laboratories**
 - **Offices, Conference and Seminar Rooms, and Computer Room**
- **35-45 Researchers, 20-30 Graduate Students**
- **8 Parking Spaces Adjacent to Building, 8 Parking Spaces on a Platform Extension of Cyclotron Road**

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONVENTIONAL FACILITIES PROJECT DESCRIPTION (continued)

- **Braced Steel Frame with Concrete Floors and Preformed Metal Siding, Extruded Aluminum Windows, Heat Absorbing Tinted Glass**
- **Air Conditioned**
- **Mechanical Utilities: Low Conductivity Water (LCW), Treated Water, Hot and Cold Water, Chilled Water, Compressed Air, Natural Gas, Vacuum**
- **Electrical Power Service from New 3,000 kVA Substation - 480/277V and 208/120V Distribution Systems, Emergency Generator 300 kVA**
- **Energy Management and Control System (EMCS)**
- **Integrated Communication System (ICS) and Fiber Optic Data Circuits, Paging, Fire Alarm and Security Systems**
- **TEC \$18.16M**

Chemical Dynamics Research Laboratory

CONVENTIONAL FACILITIES

SCHEDULE OF NET AREAS

Space	Net Area - Sq. Ft.		
	Labs	Lab Offices	Other
Experimental Hall	6,270		
Experimental Area	3,890		
Support Laboratories	2,500		
1 @			660
1 @			1,840
Wet Laboratory		490	
Lab Offices		3,760	
25 @			120
2 @			150
2 @			90
1 @			280
Conference Room		150	
Seminar Room		550	
Computer Room		300	
Reception		90	
Lobby		340	
Control Room		300	
Vacuum Pump Rooms		530	
Storage of Hazardous Chemicals		80	
	13,150	3,760	2,340
Total Net Area	19,250 Sq. Ft.		

Gross Areas

Basement Floor	14,650
First Floor	11,320
Second Floor	6,500
Roof Penthouse	530
Total Gross Area	33,000 Sq. Ft.
Efficiency Ratio:	0.58

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONVENTIONAL FACILITIES BASIS OF CONCEPTUAL DESIGN

- **Programmatic Criteria for Functional Requirements
Developed by LBL Chemical Sciences and Accelerator and
Fusion Research Divisions Team led by Yuan T. Lee, Nobel
Laureate for Chemistry, 1986**
- **Conceptual Design, Drawings and Specifications Prepared
by LBL Facilities Department**
- **Site in General Conformance with LBL Site Development
Plan (Approved by DOE in 1991)**
- **Consultants**
 - **Geo/Resource Consultants, Inc.,
Geologists/Engineers/Environmental Scientists**
- **Cost Estimate by Lee Saylor Inc.**
- **Construction Costs Escalated 30.2% from December 1989
to Midpoint of Construction, September 1997 Using DOE
Guidelines**

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONVENTIONAL FACILITIES

METHOD OF ACCOMPLISHMENT

- **Design Program Will Be Prepared by LBL Facilities Department from Programmatic Criteria Supplied by LBL Chemical Sciences Division**
- **A/E Will Be Selected by LBL for Titles I and II Design and Title III Technical Oversight**
- **Title III Construction Work Will Be Accomplished by a Lump-Sum Contract Awarded After Competitive Bidding**
- **Project Management, Construction Contract Administration and Inspection by LBL**
- **Standard Equipment and Some Special Building Facilities Will Be Procured by LBL after Competitive Bidding**

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONVENTIONAL FACILITIES

SUMMARY COST ESTIMATE AND FINANCIAL SCHEDULE (Amounts in Then-Year \$K)

Date A-E Work Initiated:	2nd	Qtr.	FY95
Date Physical Construction Starts:	4th	Qtr.	FY95
Date Construction Ends:	3rd	Qtr.	FY99

Financial Schedule, Conventional Facilities Only (rounded):

<u>Fiscal Year</u>	<u>Obligations</u>	<u>Costs</u>
1995	1,630	890
1996	6,730	3,890
1997	8,820	8,620
1998	980	4,760

Summary of Cost Estimate:

WBS

ED&I (@ about 15% of Construction)		2,000
CONSTRUCTION		13,700
Improvements to Land	330	
Building (33,000 gsf @ \$280/gsf)*	9,260	
Special Building Facilities	630	
Utilities	3,480	
STANDARD EQUIPMENT		<u>100</u>
	Subtotal	15,800
Contingencies (@ about 15%)		<u>2,360</u>
Conventional Facilities - Total Estimated Cost		18,160

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONVENTIONAL FACILITIES

SCHEDULE I (Then Year \$K)

<u>Special Building Facilities</u>	<u>Estimated Cost</u>
Laboratory Benches	83
Chemical Storage Cabinets	4
Fume Hoods	156
Vacuum Systems	18
Laser Safety Control Systems	10
Vacuum Control Systems	18
Chemical Detection Systems	170
Instrument Racks	9
Data Acquisitions System	<u>162</u>
TOTAL	630

CHEMICAL DYNAMICS RESEARCH LABORATORY
CONVENTIONAL FACILITIES
SCHEDULE II (Then Year \$K)

<u>Standard Building Equipment</u>	<u>Estimated Cost</u>
Office Furniture and Equipment	<u>100</u>
TOTAL	100

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONVENTIONAL FACILITIES

OBLIGATIONS AND COSTS SCHEDULE DETAIL

(TY \$K)

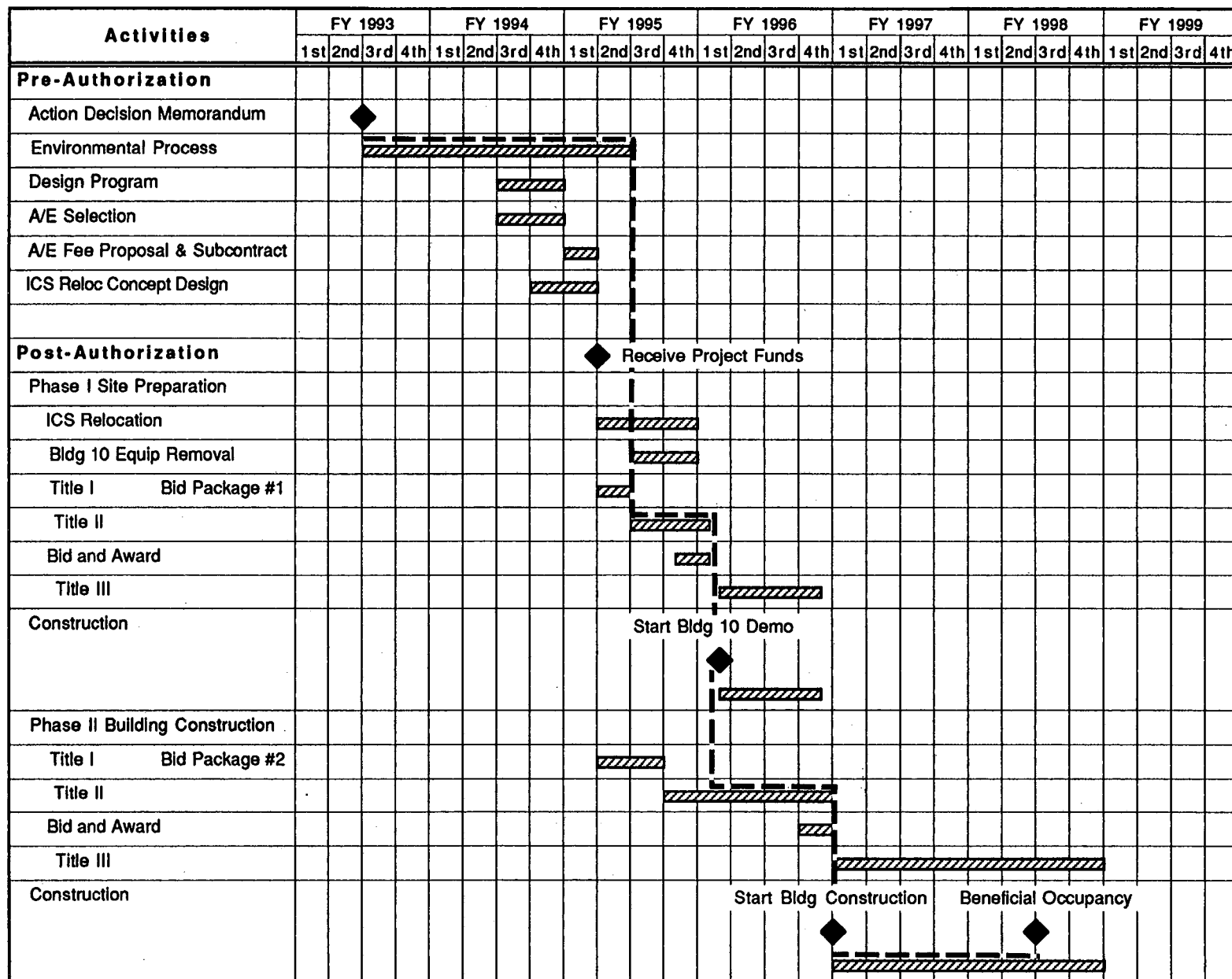
DESCRIPTION	TOTAL	FY 1995		FY 1996		FY 1997		FY 1998		FY 1999	
		O	C	O	C	O	C	O	C	O	C
<u>LBL Activities</u>											
EDI											
Title I	100	100	100								
Title II	250	90	90	160	160						
Title III	185			25	25	80	80	80	80		
Inspection	170			30	30	70	70	70	70		
Consultants	<u>65</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>20</u>	<u>20</u>		
Subtotal	770	205	205	230	230	165	165	170	170		
<u>Architect/Engineer</u>											
Title I	370	370	370								
Title II	620	620	210	0	410						
Title III	<u>240</u>	<u>240</u>	<u>0</u>	<u>0</u>	<u>60</u>	<u>0</u>	<u>90</u>	<u>0</u>	<u>90</u>		
Subtotal	1,230	1,230	580	0	470	0	90	0	90		
<u>Construction</u>											
Phase I-Site Dev											
Improv to Land	180			180	180						
Building	860			860	860						
Utilities	1,640			1,640	1,640						
Phase II-Bldg Const											
Improv to Land	150							150	150		
Building	8,400			2,700	0	5,700	5,200	0	3,200		
Spec Bldg Fac	630					200	200	430	430		
Utilities	<u>1,840</u>			<u>240</u>	<u>0</u>	<u>1,600</u>	<u>1,840</u>	<u>—</u>	<u>—</u>		
Subtotal	13,700			5,620	2,680	7,500	7,240	580	3,780		
<u>Standard Equipment</u>											
	100							100	100		
Subtotal	15,800	1,435	785	5,850	3,380	7,665	7,495	850	4,140		
Contingency (15%)	<u>2,360</u>	<u>195</u>	<u>105</u>	<u>880</u>	<u>510</u>	<u>1,155</u>	<u>1,125</u>	<u>130</u>	<u>620</u>		
TOTAL	18,160	1,630	890	6,730	3,890	8,820	8,620	980	4,760		

Project Management Cost included in Overall Project Management Cost (WBS 1.1).

**BA/BO SCHEDULE
(TY \$K)**

A&E:CDRL:Barb:BA/BO 4/22/93

CHEMICAL DYNAMICS RESEARCH LABORATORY CONVENTIONAL FACILITIES TIME SCHEDULE



4/16/93

A&E:CDRL:Bars:Time

The critical path is shown as a dashed line

Basis of Cost Estimate

1) Special Research Facilities

- Estimate is based on the conceptual design & project schedule using past history, recent experience, catalogue prices and vendor quotes
- ALS insertion device and beamlines estimates are based on updated ALS experience and validated data from the ALS project
- Experimental Systems estimates are based on recent experience with construction of similar hardware in operation at Berkeley and at Brookhaven National laboratory

Basis of Cost Estimate (cont'd)

2) Conventional Facilities

- The conceptual design was developed by LBL's Plant Engineering Department, with assistance from Geo/Resource Consultants, Inc. (Geologists / Engineers / Environmental Scientists)
- The construction cost estimate, based on quantity take-offs, was prepared by a professional estimator (Lee Saylor, Inc.), and has been reviewed and confirmed by LBL's Facilities Department
- Costs for standard equipment are based on vendor's quotations or catalogue data

Cost Estimate Methodology

- **Costs were first estimated by experienced engineering staff in \$FY92 (Dec 1990 dollars for Conventional Facilities) in accordance with a detailed Work Breakdown Structure (WBS)**
- **Cost were collected and rolled up with assistance of and oversight from ALS management using ALS management software**
- **Escalation was applied in accordance with an integrated BA/BO schedule**

Cost Estimate Summary Report

Work Breakdown Structure #	Description	Qty Reqd	Labor Hours	Labor K\$	ISC K\$	Cost K\$	Total Labor Hours	TOTAL Labor K\$	TOTAL ISC K\$	TOTAL COST K\$
1.2.2.1.1.1.3	Pole Assemblies	1	1936	74.75	93.42	168.17	1936	74.75	93.42	168.17
1.2.2.1.1.1.4	End Pole Assemblies	1	864	33.18	24.79	57.98	864	33.18	24.79	57.98
1.2.2.1.1.1.5	Backing Beams	1	456	17.60	92.66	110.26	456	17.60	92.66	110.26
1.2.2.1.1.1.6	Magnet Structure Assembly	1	1304	50.33	4.50	54.84	1304	50.33	4.50	54.84
1.2.2.1.1.1.7	Magnetic Measurements: Mechanical	1	608	22.65	0.53	23.18	608	22.65	0.53	23.18
1.2.2.1.1.1.8	Magnetic Measurements: Electrical	1	928	38.65	0.00	38.65	928	38.65	0.00	38.65
** *****										
1.2.2.1.1.2	Support & Drive Systems	1	2782	106.94	138.10	245.04	2782	106.94	138.10	245.04
** *****										
1.2.2.1.1.2.1	Support System Fabrication	1	1145	44.20	59.90	104.10	1145	44.20	59.90	104.10
1.2.2.1.1.2.2	Drive System Fabrication	1	1237	47.75	71.90	119.65	1237	47.75	71.90	119.65
1.2.2.1.1.2.3	Local Temperature Control Fabrication	1	400	14.99	6.30	21.29	400	14.99	6.30	21.29
** *****										
1.2.2.1.1.3	Vacuum System	1	1886	71.44	190.30	261.74	1886	71.44	190.30	261.74
** *****										
1.2.2.1.1.3.1	Vacuum Chamber	1	1140	44.00	123.11	167.12	1140	44.00	123.11	167.12
1.2.2.1.1.3.2	Pumping Systems & Instrumentation	1	200	7.72	41.47	49.19	200	7.72	41.47	49.19
1.2.2.1.1.3.3	Support Structure	1	300	11.58	3.25	14.84	300	11.58	3.25	14.84
1.2.2.1.1.3.4	Vacuum Diagnostics	1	246	8.13	22.46	30.59	246	8.13	22.46	30.59
** *****										
1.2.2.1.1.4	Motor Control System	1	360	13.67	20.12	33.79	360	13.67	20.12	33.79
1.2.2.1.1.5	Installation	1	454	17.46	2.15	19.61	454	17.46	2.15	19.61
** *****										
1.2.2.1.2	Undulator Beamline	1	19001	708.96	1628.92	2337.88	19001	708.96	1628.92	2337.88
** *****										
1.2.2.1.2.1	Front End	1	6463	240.29	347.08	587.37	6463	240.29	347.08	587.37
** *****										
1.2.2.1.2.1.1	Fixed Aperture	1	543	20.08	37.64	57.72	543	20.08	37.64	57.72
** *****										
1.2.2.1.2.1.1.1	Aperture Plate	1	80	2.96	1.40	4.36	80	2.96	1.40	4.36
1.2.2.1.2.1.1.2	Bellows	1	3	0.11	3.05	3.16	3	0.11	3.05	3.16
1.2.2.1.2.1.1.3	Collimating Spool	1	56	2.10	2.25	4.35	56	2.10	2.25	4.35
1.2.2.1.2.1.1.4	Isolation Valve	1	36	1.32	22.84	24.16	36	1.32	22.84	24.16
1.2.2.1.2.1.1.5	Support Stand	1	128	4.74	5.50	10.24	128	4.74	5.50	10.24
1.2.2.1.2.1.1.6	Assemble, Bakeout, Test	1	72	2.64	1.70	4.34	72	2.64	1.70	4.34
1.2.2.1.2.1.1.7	Installation	1	168	6.20	0.90	7.10	168	6.20	0.90	7.10
** *****										
1.2.2.1.2.1.2	Photon BPM #1	1	848	30.82	43.44	74.26	848	30.82	43.44	74.26

CHEMICAL DYNAMICS RESEARCH LABORATORY

COST ESTIMATE SUMMARY (Then Year \$K)

1	Chemical Dynamics Research Laboratory			55,900
1.1	Project Management and Administration			3,160
1.2	Special Research Facilities			26,430
1.2.1	ED&I		6,420	
1.2.1.1	ALS Beamlines	2,050		
1.2.1.2	Experimental Systems	4,370		
1.2.2	Construction		20,010	
1.2.2.1	ALS Beamlines	6,310		
1.2.2.2	Experimental Systems	13,700		
1.3	Conventional Facilities			15,800
1.3.1	ED&I		2,000	
1.3.2	Construction		13,700	
1.3.2.1	Phase I (Site Preparation)	2,680		
1.3.2.2	Phase II (Building Construction)	11,020		
1.3.3	Standard Equipment		100	
1.4	Contingency			10,510
1.4.1	Project Management		480	
1.4.2	Special Research Facilities		7,670	
1.4.2.1	ALS Beamlines	2,220		
1.4.2.2	Experimental Systems	5,450		
1.4.3	Conventional Facilities		2,360	

CHEMICAL DYNAMICS RESEARCH LABORATORY

COST ESTIMATE (THEN YEAR \$K)

Chemical Dynamics Research Laboratory		55,900*
A. Engineering, Design and Inspection		8,420
1. Special Facilities Construction (at 32% of Construction Costs, Item C.1)	6,420	
2. Conventional Facilities Construction (at 15% of Construction Costs, Item C.2)	2,000	
B. Project Management (at 9% of Construction Costs, Item C)		3,160
C. Construction Costs		33,710
1. Special Facilities Construction	20,010	
a. ALS Chemical Physics Beamlines, including Undulator and Beamline, Bend Magnent Beamline	6,310	
b. Experimental Systems including Experimental Stations and Advanced Lasers	13,700	
2. Conventional Facilities	13,700	
a. Improvements to Land	330	
b. Building (at ~ \$280/gsf)	9,260	
c. Special Building Facilities (Schedule I)	630	
d. Utilities	3,480	
D. Standard Equipment including Office Furniture and Equipment (Schedule II)		100
E. Contingency (at 23% of Above Costs)		10,510

*Application of 16% LBL Overhead Not included in TEC

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONTINGENCY ANALYSIS (FY 1992 \$K)

	<u>Estimated Cost</u> ((\$K))	<u>Contingency</u> (%)	<u>(\$K)</u>
<u>Project Management & Administration</u>	2,580	15	390
<u>Special Research Facilities</u>			
<u>ED&I</u>			
ALS Beamlines	1,700	30	515
Experimental Systems	3,579	30	1,090
<u>Construction</u>			
ALS Beamlines			
U10 Undulator	1,411	25	355
Undulator Beamline	2,338	25	595
Bend Mag Beamline	1,558	25	395
Experimental Systems			
Experimental Stations	8,214	30	2,450
Advanced Lasers	2,691	30	820
Laser Safety/Controls	127	35	45
User Control Interface	169	35	60
<u>Conventional Facilities</u>			
<u>ED&I</u>			
LBL Activities			
Engineering	430	16	70
Consultants	60	8	5
Inspection	140	7	10
A/E Activities	1,020	14	145
<u>Construction</u>			
Phase I (Site Preparation)	2,329	15	355
Phase II (Building Construction)	8,987	15	1,365
<u>Standard Equipment</u>	80	13	10
Subtotal	37,413		8,675
Contingency (23%)	8,675		
TOTAL	46,088		

Scheduling Assumptions

The Project Schedule was developed under the following assumptions:

- Construction funding will be available by Jan. 1, 1995.
- Funding will be available for concurrent R&D and preoperations activities.
- Program Development and Startup support will be provided concurrently to maintain and enhance the interface to the national user community.
- TEC profile is constrained to satisfy Program guidance

CHEMICAL DYNAMICS RESEARCH LABORATORY

PROJECT TIME SCHEDULE

Activities		FY 1995				FY 1996				FY 1997				FY 1998				FY 1999							
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st			
1.1	Project Management & Admin																								
1.2	Special Research Facilities																								
1.2.1	ED&I																								
	- ALS Beamlines																								
	- Experimental Systems																								
1.2.2	Construction																								
	- ALS Beamlines																								
	- Procure/Fab																								
	- Install																								
	- Commission/Test*																								
	-Experimental Systems																								
	- Procure/Fab																								
	- Install																								
	- Commission/Test*																								
1.3	Conventional Facilities																								
1.3.1	ED&I																								
	-Title I																								
	- Title II																								
	- Bid and Award																								
	- Title III																								
1.3.2	Construction																								
	- Phase I (Site Preparation)																								
	- Phase II (Building Construction)																								
	- Site Utilities																								
Project Milestones:																									
	- Project Start																								
	- Begin/Complete Bldg Const																								
	- Begin Beneficial Occupancy																								
	- Begin Installation																								
	- ALS Beamlines																								
	- Experimental Systems																								
	- Project Completion																								

A&E:CDRL:Bars:Time

The critical path is shown as a dashed line

*Funded by R&D/Preoperations

**BA/BO SCHEDULE
(TY \$K)**

[illegible]

CHEMICAL DYNAMICS RESEARCH LABORATORY

OBLIGATIONS AND COSTS SCHEDULE DETAIL (Then Year \$M)

DESCRIPTION	REVISED COST FY92M\$	FY 1995		FY 1996		FY 1997		FY 1998		FY 1999		TOTAL COST TYM\$
		O	C	O	C	O	C	O	C	O	C	
CDRL	46.09	7.13	6.14	16.91	13.55	16.21	15.64	10.21	14.40	5.44	6.17	55.90
Project Management	2.58	0.37	0.37	0.65	0.65	0.69	0.69	0.72	0.72	0.73	0.73	3.16
Spec Research Fac	21.79	4.00	3.74	7.44	6.92	5.20	4.84	6.41	6.82	3.38	4.11	26.43
ED&I	5.28	0.90	0.90	1.34	1.34	1.45	1.45	1.49	1.49	1.24	1.24	6.42
ALS Beamlines	1.70	0.31	0.31	0.46	0.46	0.50	0.50	0.53	0.53	0.25	0.25	2.05
Exper Systems	3.58	0.59	0.59	0.88	0.88	0.95	0.95	0.96	0.96	0.99	0.99	4.37
Construction	16.51	3.10	2.84	6.10	5.58	3.75	3.39	4.92	5.33	2.14	2.87	20.01
ALS Beamlines	5.31	1.30	1.17	2.50	2.38	1.38	1.27	0.96	1.22	0.17	0.27	6.31
Exper Systems	11.20	1.80	1.67	3.60	3.20	2.37	2.12	3.96	4.11	1.97	2.60	13.70
Conventional Facilities*	13.05	1.43	0.79	5.85	3.38	7.67	7.49	0.85	4.14	0.00	0.00	15.80
ED&I	1.65	1.43	0.79	0.23	0.70	0.17	0.25	0.17	0.26	0.00	0.00	2.00
Construction	11.32	0.00	0.00	5.62	2.68	7.50	7.24	0.58	3.78	0.00	0.00	13.70
Standard Equipment	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.00	0.00	0.10
Contingencies	8.67	1.33	1.24	2.97	2.60	2.65	2.62	2.23	2.72	1.33	1.33	10.51
Project Management	0.39	0.06	0.06	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.48
Spec Research Fac	6.32	1.07	1.07	1.99	1.99	1.40	1.40	1.99	1.99	1.22	1.22	7.67
ALS Beamlines	1.86	0.39	0.39	0.76	0.76	0.47	0.47	0.46	0.47	0.14	0.14	2.22
Exper Systems	4.46	0.68	0.68	1.23	1.23	0.93	0.93	1.53	1.53	1.08	1.08	5.45
Conventional Facilities*	1.96	0.20	0.11	0.88	0.51	1.15	1.12	0.13	0.62	0.00	0.00	2.36

*From BA/BO Schedule

Escalation Schedule

- DOE's *"Anticipated Economic Escalation Rates"* as updated in August, 1992, were applied consistent with the cost requirements associated with the project schedule:

FY93	FY94	FY95	FY96	FY97	FY98	FY99
3.0%	3.9%	4.1%	4.3%	4.5%	4.5%	4.5%

CHEMICAL DYNAMICS RESEARCH LABORATORY

FINANCIAL SCHEDULE (\$K)

<u>FISCAL YEAR</u>	<u>APPROPRIATIONS</u>	<u>OBLIGATIONS</u>	<u>COSTS</u>
1995	7,100	7,100	6,150
1996	16,900	16,900	13,550
1997	16,200	16,200	15,640
1998	10,200	10,200	14,400
1999	<u>5,500</u>	<u>5,500</u>	<u>6,160</u>
TOTAL	55,900	55,900	55,900

Note: Application of 16% LBL Overhead to New FY 1995 Construction Projects Will Increase the TEC and TPC to \$65,100K and \$75,100K, Respectively. The Appropriations and Obligations Columns Will Increase to \$8,800K in FY95, \$19,600K in FY96, \$18,800K in FY97, \$11,800K in FY98, and \$6,100K in FY99

CHEMICAL DYNAMICS RESEARCH LABORATORY

TOTAL PROJECT COSTS (TPC) (\$K)

	<u>Prior Years</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>Total</u>
Total Project Costs (TPC)							
(1) Total Facility Costs (Construction Line Item - TEC)	0	6,150	13,550	15,640	14,400	6,160	55,900
(2) Other Project Costs							
(a) R&D	0	700	1,000	800	500	0	3,000
(b) Preoperations	0	0	0	1,000	1,000	1,500	3,500
(c) Capital Equipment Related to (a) & (b)	0	300	300	300	400	500	1,800
(d) Program Development and Startup	0	0	0	200	500	700	1,400
(e) Conceptual Design and Environmental Compliance Activities	<u>300</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>300</u>
Total Other Project Costs	300	1,000	1,300	2,300	2,400	2,700	10,000
Total Project Cost	300	7,150	14,850	17,940	16,800	8,860	<u><u>65,900*</u></u>

*Application of 16% LBL Overhead to New FY 1995 Construction Projects Will Increase the TPC to \$75,100K

Supplementary Materials

Chemical Dynamics Research Laboratory

(CDRL)

R&D Highlights

FY 1995

- Optimization of user experimental station requirements and detailed matching requirements of the ALS beamlines

FY 1995-98

- Study and development of harmonic suppression techniques and development of optimal branchline configurations for ALS beamlines
- Diagnostic schemes required for high-precision two color experiments
- Experimental station R&D to develop interchangeable components that satisfy specific outside user requirements
- Advanced experimental apparatus concepts including high-speed detectors, and corrosive gas handling techniques
- Development of "Industrial strength" (user friendly) picosecond lasers systems
- High-fidelity magnetic structures for insertion device enhancements, and advanced beamline components suitable for high-brightness photon beams

Preoperational Activities

- Commissioning the ALS Beamlines systems
- Commissioning the Experimental systems
 - 7 Experimental Stations
 - 3 Advanced Lasers
- Synchronizing the photon sources

Program Development and Startup Activities

- Scientific Program development and direction
- User Liaison activities
- Support for workshops, reviews *etc*
- Development of staffing for Operations phase
- Administrative and operational support for preoperations activities

ES&H Activities

- Prospective *hazmat inventory* and *activities* in the experimental hall and 2nd floor laboratories have been incorporated into the building design
- ES&H review incorporated into planning in the pre-authorization period
- Operational Readiness review incorporated into planning at the beginning of FY99

CHEMICAL DYNAMICS RESEARCH LABORATORY

SPECIAL RESEARCH FACILITIES

ED&I ANALYSIS (FY 1992 \$K)

<u>WBS Element</u>		<u>Construction Costs</u>	<u>ED&I Rate(%)</u>	<u>ED&I Costs</u>
1.2.1.2	ALS Beamlines	5,307		1,700
1.2.1.2.1	U10 Undulator	1,411	32	450
1.2.1.2.2	Undulator Beamline	2,338	32	750
1.2.1.2.3	Bend Mag Beamline	1,558	32	500
1.2.1.3	Experimental Systems	11,201		3,579
1.2.1.3.1	Experimental Stn	8,214	30	2,505
1.2.1.3.2	Advanced Lasers	2,691	35	955
1.2.1.3.3	Laser Safety/Controls	127	40	51
1.2.1.3.4	User Control Interface	169	40	68

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONVENTIONAL FACILITIES

ED&I ANALYSIS (TY\$K)

LBL Activities

• Title I 9MM at 10.9/MM		= 100
Proj Arch 1 x 0.7 time x 6 mos	= 4	
Proj Team 2 x 0.4 time x 6 mos	= 5	
• Title II 23MM at 10.9/MM		= 250
Proj Arch 1 x 0.5 time x 18 mos	= 9	
Proj Team 2 x 0.4 time x 18 mos	= 14	
• Title III 17MM at 10.9/MM		= 185
Proj Arch 1 x 0.3 time x 33 mos	= 10	
Proj Team 2 x 0.1 time x 33 mos	= 7	
• Inspection 16MM at 10.9/MM		= 170
Inspectors (comb.) 0.5 x 33 mos	= 16	
• Consultants and Vendors		65
Soil Investigations	25	
3rd Party Structural Reviews	15	
Seismic Reviews	5	
Independent Cost Estimates	5	
Advertising	2	
Printing	2	
Equipment Testing (Elect/Mech)	11	
		<u>770</u>

A/E Activities

9% of Designed Construction Costs (13,700)		
including Special Facilities of 630		1,230
Title I (30%)	370	
Title II (50%)	620	
Title III (20%)	240	

Total Estimated ED&I	2,000
----------------------	-------

Current FY93 Engineering Rate: \$9.0K/MM

Then Year Engineering Rate: \$9.0K/MM x 1.214* = \$10.9K/MM

*Escalation of 21.4% to Midpoint of Construction (September 1997)

CHEMICAL DYNAMICS RESEARCH LABORATORY

SPECIAL RESEARCH FACILITIES AND PROJECT MANAGEMENT

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates" (Updated August 1992)

	<u>FY93</u>	<u>FY94</u>	<u>FY95</u>	<u>FY96</u>	<u>FY97</u>	<u>FY98</u>	<u>FY99</u>	<u>Total</u>
Cost Schedule In FY92 M\$*			4.71	8.31	5.80	7.62	4.65	31.08
• Project Management			0.33	0.56	0.57	0.57	0.55	2.58
• Special Research Facilities			3.36	5.96	3.99	5.38	3.10	21.79
• Contingency on Project Management			0.05	0.08	0.09	0.09	0.08	0.39
• Contingency on Special Research Facilities			0.96	1.71	1.15	1.58	0.92	6.32
DOE Escalation Rates	3.0%	3.9%	4.1%	4.3%	4.5%	4.5%	4.5%	
Cumulative Escalation Factor	1.030	1.070	1.114	1.162	1.214	1.269	1.326	
Cost Schedule In Then-Year M\$			5.24	9.66	7.04	9.64	6.17	37.74

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONVENTIONAL FACILITIES

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates" (Updated August 1992)

Phase I - Site Preparation

Start Construction:	December 1995
Construction Period:	9 Months
Finish Construction:	August 1996
Midpoint Construction:	April 1996
Estimate Date:	December 1989

					%
FY 1990	Dec 1989 - Sep 1990	10	mo @ 3.1	=	2.6
FY 1991	Oct 1990 - Sep 1991	12	mo @ 2.7	=	2.7
FY 1992	Oct 1991 - Sep 1992	12	mo @ 1.8	=	1.8
FY 1993	Oct 1992 - Sep 1993	12	mo @ 3.0	=	3.0
FY 1994	Oct 1993 - Sep 1994	12	mo @ 3.9	=	3.9
FY 1995	Oct 1994 - Sep 1995	12	mo @ 4.1	=	4.1
FY 1996	Oct 1995 - Mar 1996	6	mo @ 4.3	=	2.2
Total Compounded Escalation:					22.1

CHEMICAL DYNAMICS RESEARCH LABORATORY

CONVENTIONAL FACILITIES

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates" (Updated August 1992)

Phase II - Building Construction

Start Construction:	October 1996
Construction Period:	24 Months
Finish Construction:	September 1998
Midpoint Construction:	September 1997
Estimate Date:	December 1989

					<u>%</u>
FY 1990	Dec 1989 - Sep 1990	10 mo @	3.1	=	2.6
FY 1991	Oct 1990 - Sep 1991	12 mo @	2.7	=	2.7
FY 1992	Oct 1991 - Sep 1992	12 mo @	1.8	=	1.8
FY 1993	Oct 1992 - Sep 1993	12 mo @	3.0	=	3.0
FY 1994	Oct 1993 - Sep 1994	12 mo @	3.9	=	3.9
FY 1995	Oct 1994 - Sep 1995	12 mo @	4.1	=	4.1
FY 1996	Oct 1995 - Sep 1996	12 mo @	4.3	=	4.3
FY 1997	Oct 1996 - Sep 1997	12 mo @	4.5	=	4.5
Total Compounded Escalation:					30.2

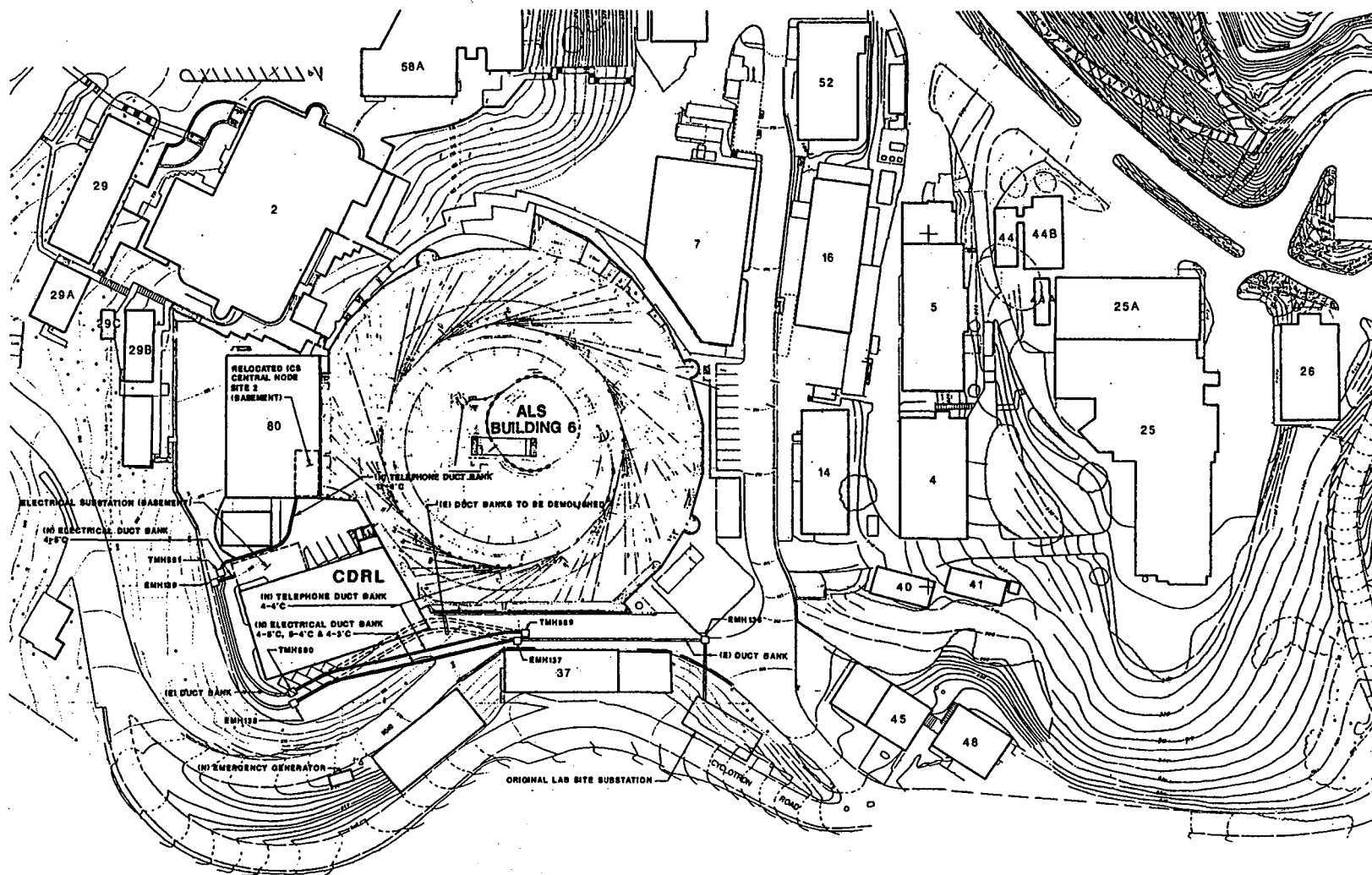


LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

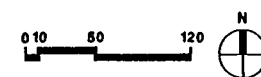
Chemical Dynamics Research Laboratory
SITE ELECTRICAL UTILITIES PLAN

T-4

4/15/93



SITE ELECTRICAL UTILITIES PLAN

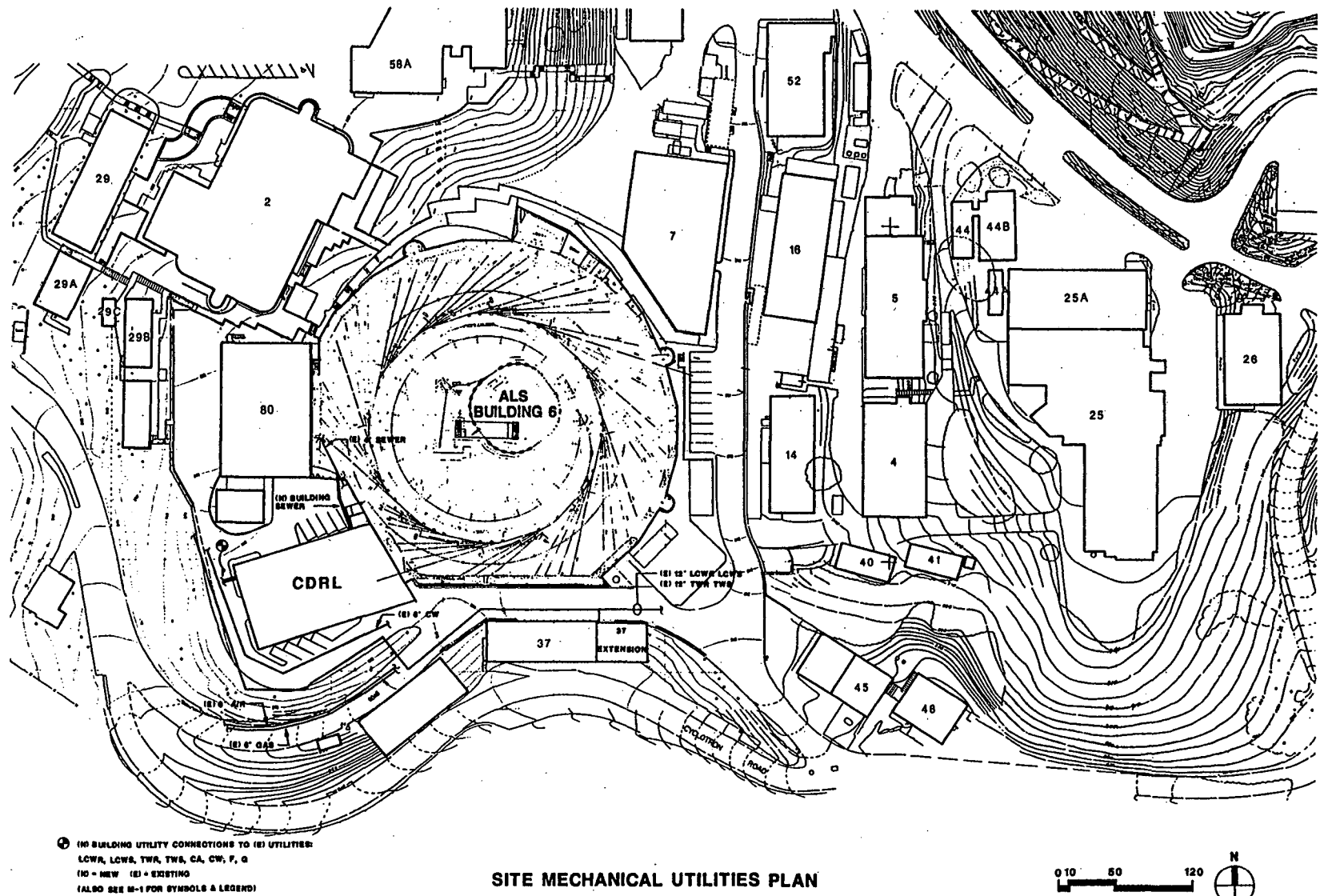


JUNE 1992

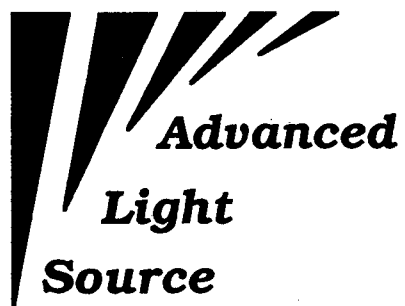
Chemical Dynamics Research Laboratory
SITE MECHANICAL UTILITIES PLAN

T-3

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JUNE 1992



ALS Beamlines Initiative

Validation Review
April 27, 1993
Ron Yourd, Joe Harkins

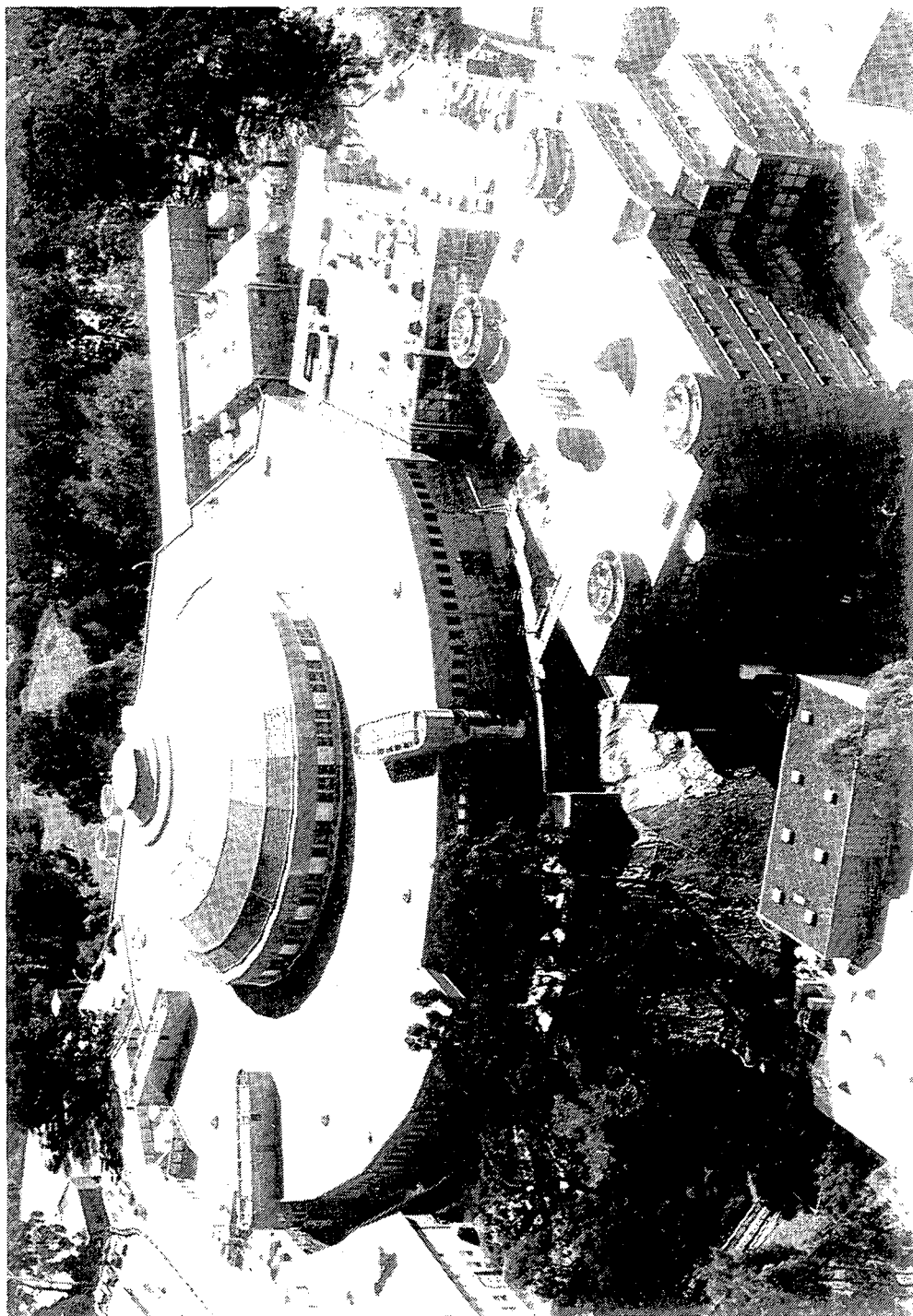


Figure 2-2. Photograph of the ALS, scheduled to begin operation in 1993.

- **Overview of ALS Construction Project**
- **Motivation & Overview for ALS Beamlines Initiative**
- **Conventional Facilities Details**
- **Cost & Schedule Details**

DEPARTMENT OF ENERGY
FY 1995 FIELD BUDGET PROCESS
PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH & DEVELOPMENT: PLANT & CAPITAL EQUIPMENT
BASIC ENERGY SCIENCES

(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and location of project: ALS Beamlines Initiative Lawrence Berkeley Laboratory Berkeley, California	2a. Project number: 95-LBL 2b. Construction funded
---	---

3a. Date A/E work initiated (Title I design start scheduled):	2nd Qtr. FY 1995	5. Previous: cost estimate (TEC):	none
3b. A/E work (Titles I & II) duration:	10 months	total project cost (TPC):	none

4a. Date physical construction starts:	3rd Qtr. FY 1995	6. Current estimate:	TEC: \$44,000
4b. Date construction ends:	4th Qtr. FY 1998	Date: 04/92	TPC: \$44,100

7. <u>Financial Schedule (Federal Funds):</u>	<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
	1995	\$ 9,800	\$ 9,800	\$ 4,600
	1996	14,300	14,300	14,000
	1997	13,300	13,300	15,500
	1998	6,600	6,600	9,900

Note: Application of 16% LBL overhead to new FY 1995 construction projects will increase the TEC and TPC of this project (Item 6) to \$51,000K and \$51,100K, respectively. The appropriations and obligations columns in Item 7 will increase to \$10,500K in FY95, \$16,500K in FY96, \$15,800K in FY97, and \$8,200K in FY98. Dollar amounts in Items 10 and 12 will also increase by 16%, except for the related annual costs.

ALS BEAMLINES INITIATIVE

CHANGES SINCE 1992 VALIDATION

- **SCOPE**

No Change

- **SCHEDULE**

Was: FY94 - FY97

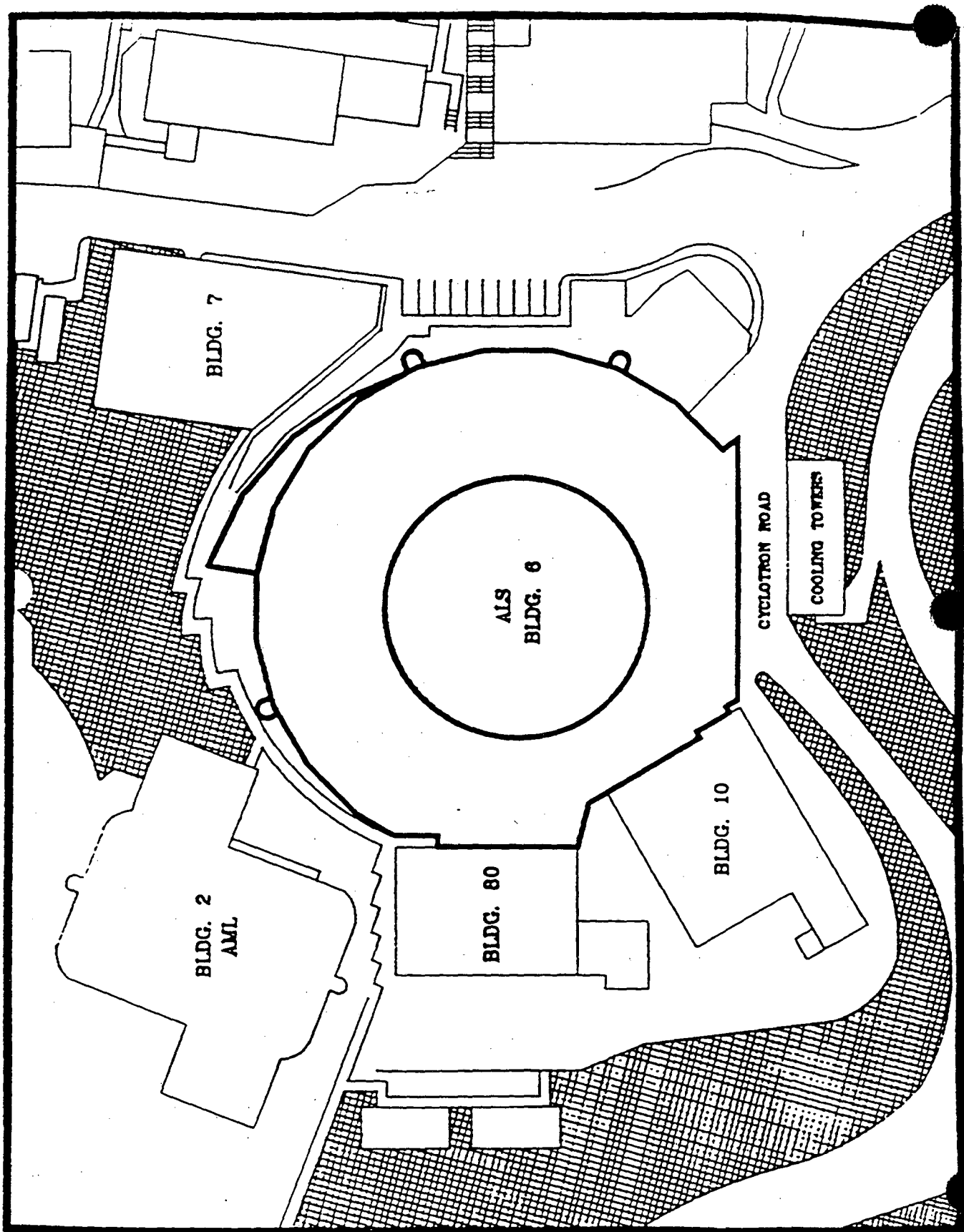
Now: FY95 - FY98

- **TOTAL ESTIMATED COST**

Was: \$42.5M

Now: \$44.0M*

* NOTE: Application of LBL overhead to new FY1995 construction projects will increase the TEC to \$51.0M.



WHAT IS THE ADVANCED LIGHT SOURCE (ALS)?

ALS

- National user facility
- Provides UV and soft x-ray beams of unprecedented brightness
 - Broadly tunable with narrow spectral features
 - Partially coherent
 - 30 psec time structure
- Utilized by researchers from industry, academic, and national laboratory communities
 - Technology (e.g., projection lithography)
 - Materials and surface science
 - Atomic and molecular physics
 - Chemistry
 - Life sciences
- Construction project began in late 1986
- Begin operations in spring 1993
- Construction cost — \$99.5 million

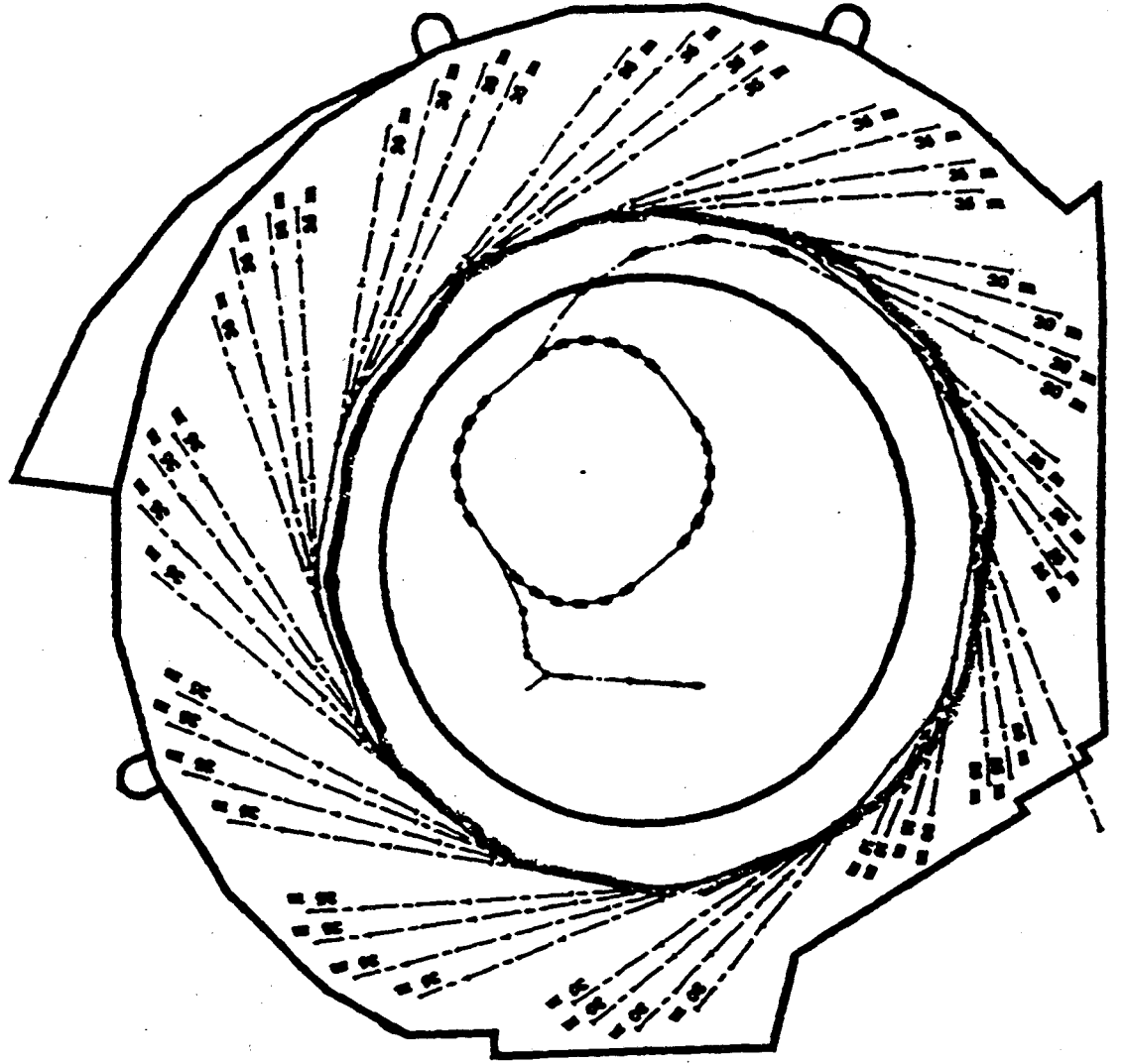
ADVANCED LIGHT SOURCE

ALS

- Next-generation VUV synchrotron radiation facility optimized for insertion devices
- Design concept emphasis
 - High spectral brightness and partial coherence from undulators
 - High flux from wigglers
 - Time structure: tens of picoseconds pulse length
 - Beam lifetime - six hours
 - Capability for large numbers of beamlines from undulators, wigglers, and bend magnets
 - Flexible operating modes so variety of user requirements can be satisfied

THE ALS HAS SPACE FOR 10 WIGGLERS AND UNDULATORS AND 36 BEND-MAGNET BEAMLINES

ALS



ALS CONSTRUCTION PROJECT (87-R-406)

ALS

- On schedule for completion mid-FY1993
- Facility can support
 - 10 undulators and wigglers
 - 10 beamlines from undulator and wiggler sources
 - 24 beamlines from bend magnet sources
- Construction Scope includes:
 - Building
 - Injector
 - Storage Ring
 - 3 Undulators
 - 2 Beamlines
- Users will provide for use at ALS
 - 2 undulators
 - 3 beamlines from undulators
 - 5 beamlines from bend magnets
- This leaves room for many additional undulator and wiggler sources and beamlines for future development (as planned)

FY1991 Congressional Budget Request

CONSTRUCTION PROJECT DATA SHEETS

-
- | | | |
|-----------------------------------|--|--------------------------|
| 1. Title and location of project: | 1-2 GeV Synchrotron Radiation Source
Lawrence Berkeley Laboratory
Berkeley, California | 2. Project No.: 87-R-406 |
|-----------------------------------|--|--------------------------|
-

8. Brief Physical Description of Project (continued)

devices (eleven could support insertion devices), an initial complement of insertion devices, and photon beamlines. Development of other straight sections and bending magnet ports are not included in the scope of this project. Their development in future years however, will provide flexibility to respond to new scientific directions and to take advantage of new materials, designs, and other technological advances. When fully developed, the facility will be able to provide up to 60 user stations.

9. Purpose, Justification of Need for, and Scope of Project

The 1-2 GeV Synchrotron Facility will be a dedicated synchrotron radiation source that is optimized for generating vacuum ultraviolet and soft x-ray (XUV) light from periodic magnetic devices. Investigators from industry, universities, and national laboratories will have access to unique capabilities--high spectral brilliance and very short pulse length (nominally tens of picoseconds). Multi-period undulators in the storage ring will provide spatially and longitudinally coherent radiation that is broadly tunable across the XUV region of the spectrum.

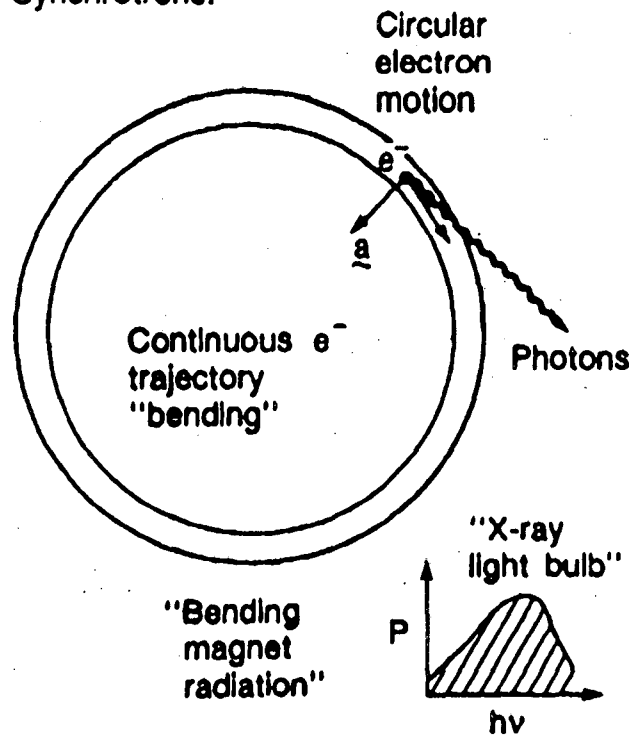
The 1-2 GeV Synchrotron will permit new studies in both basic and applied science. In biology, for example, the high photon flux combined with the capability for wavelength tuning, will enhance imaging and scattering techniques. Picosecond pulses and the ability to match soft x-rays to the absorption features of major structural biological elements, such as carbon, nitrogen, and oxygen, will make it possible to undertake dynamical response studies of specimens in something very close to their natural state. The coherence properties of undulator radiation will extend the use of synchrotron radiation into the phase-sensitive world of x-ray interferometry and biological microholography.

In atomic and molecular physics, very high photon fluxes are needed for spectroscopic studies of free atoms and molecules in the gas phase; with radiation from undulators and wigglers an acceptable signal-to-noise ratio can be obtained for many experiments in the x-ray region. The facility will introduce new standards for spectral resolution, and will provide access to new studies of atomic structure and dynamics, quantum interference effects, and threshold phenomena.

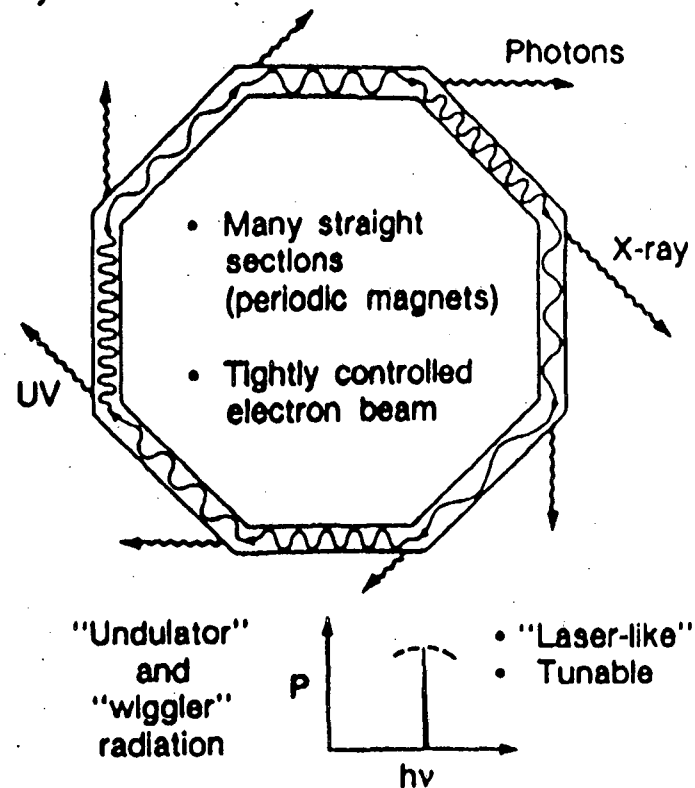
EVOLUTION OF SYNCHROTRON RADIATION

ALS

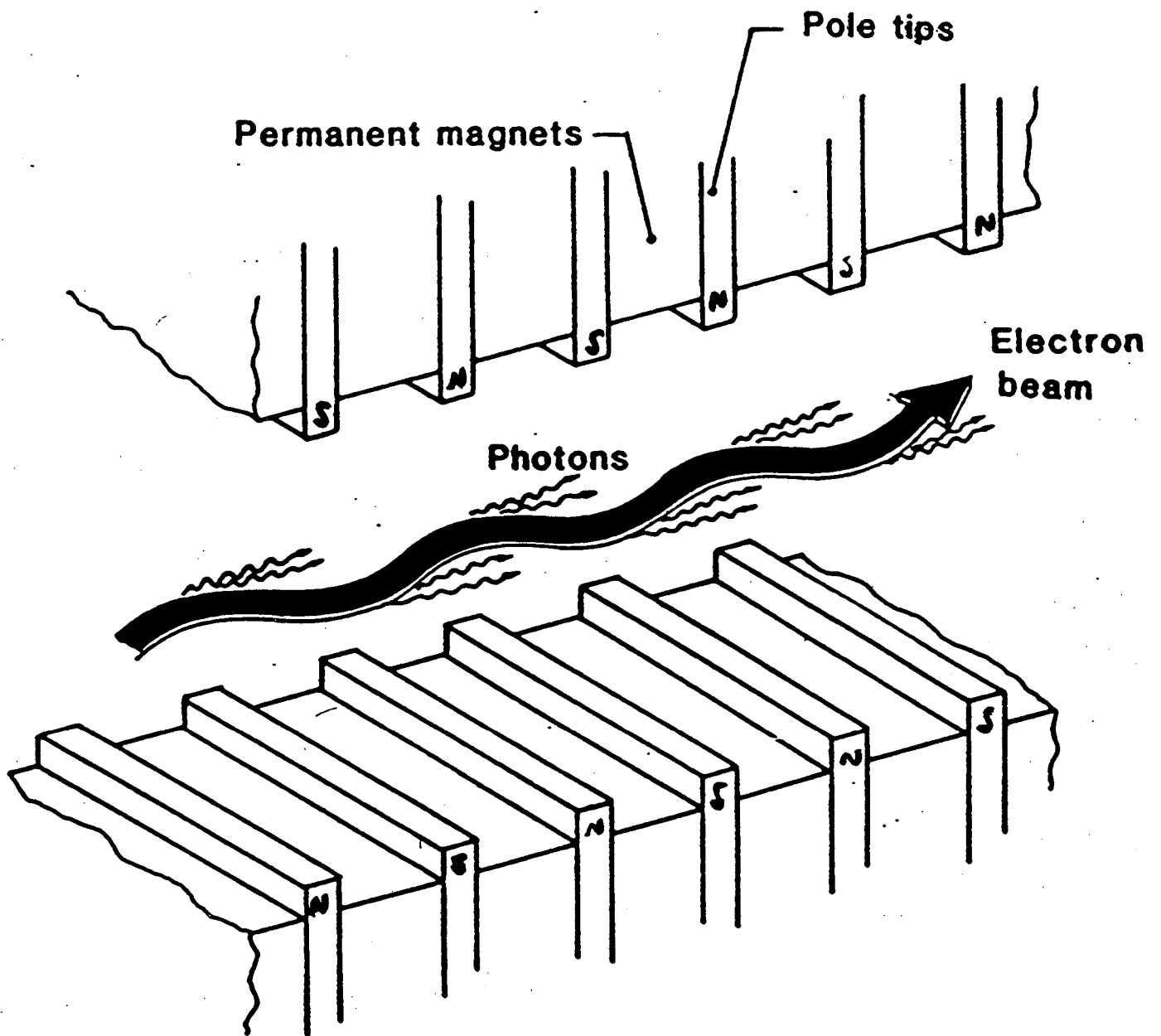
Today's
Synchrotrons:



Tomorrow's
Synchrotrons:



XBL 888-8937



Insertion Device Schematic

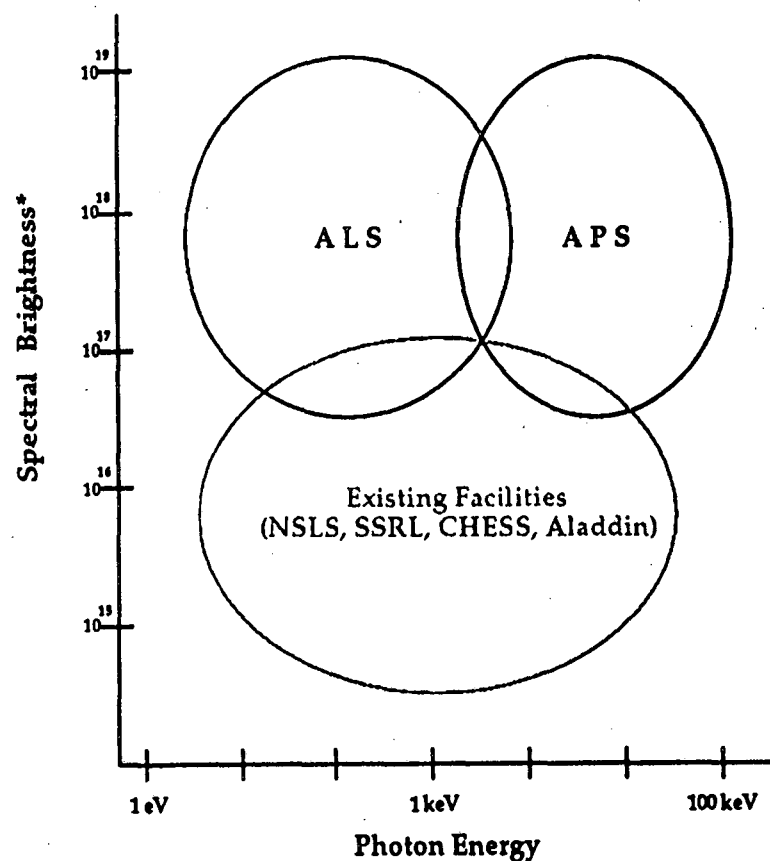
Incoherent Superposition-Wiggler

Coherent Superposition-Undulator

ADVANCED LIGHT SOURCE

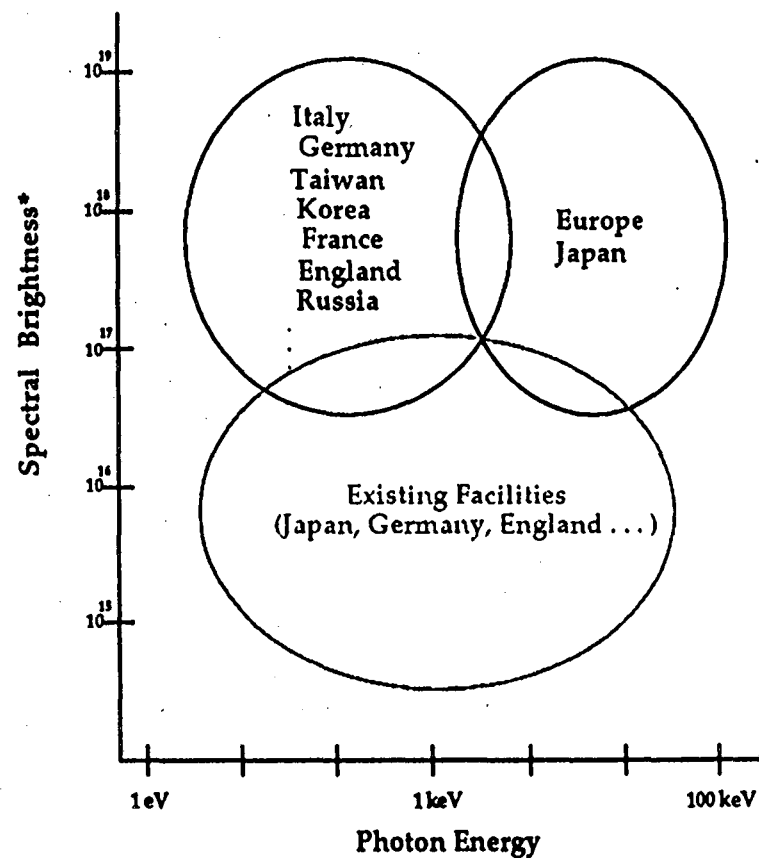
ALS

The U.S. Scene



* Photons/mrad²/mm²/0.1% BW

Competition Overseas



IDENTIFYING FOREFRONT SCIENTIFIC OPPORTUNITIES

ALS

- Many User Workshops
 - Nation's leading scientists consider opportunities at ALS in their field
- Scientific proposals from scientific teams
 - Peer review by Program Review Panel
- Many review committees and advisory groups have emphasized need for appropriate, contiguous space for outside users of ALS
- Program Review Panel and Executive Committee of ALS Users' Association endorse scientific targets of opportunity for "Beamlines Initiative" and need to develop 2nd floor as outside user space

Advanced Light Source Workshops

- ALS Users' Workshop May 9-11, 1983
- Advanced Soft X-Ray and Ultraviolet Synchrotron Source:
Appl's. to Science and Technology November 13-15, 1985
- New Directions in Soft X-Ray Near Threshold Phenomena March 1-4, 1987
- Chemical Applications of Undulator Radiation May 4-5, 1987
- New Opportunities in Optical Systems for Synchrotron Radiation August 3-4, 5-21, 1987
- International Symposium on X-Ray Microscopy August 31 - Sept. 3, 1987
- New Opportunities in Interface and Materials Research October 5-6, 1987
- Life Sciences at the ALS February 22-23, 1988
- New Opportunities in Surface Science April 28-29, 1988
- Surface Science at the ALS Spring, 1988
- ALS Annual Meeting June 2-3, 1988
- Workshop on Chemical Reaction Dynamics November 2-4, 1988
- Workshop on Diffraction Grating Monochromators for the ALS December 18, 1988
- X-Ray Microimaging for the Life Sciences May 24-26, 1989
- CDF Workshop May 5-7, 1990
- Challenges for Interfact Theory August 20-21, 1990
- Soft X-Ray Lithography (Attwood) January 15, 1991
- Industrial Applications January 17, 1991
- Photon-In, Photon-Out Spectroscopy April 25, 1991
- Circularly Polarized Radiation June 10-11, 1991
- Spectroscopic Imaging, Diffraction, Holography August 14, 1991
- Annual Users' Meeting August 15-16, 1991
- ALS Users' Association Annual Meeting August 23-24, 1991
- DOE/DMS Workshop on Future Synchrotron VUV
and X-Ray Beamlines October 21-23, 1991
- Earth, Soil, and Environmental Sciences December 11, 1991
- Industrial Applications: Analytic Methods January 17, 1992
- Workshop on Codes for Synchrotron Radiation Circulations February 28, 1992
- New Directions in Research
(NATO Advanced Study Institutes Program) June 28 - July 10, 1992
- Fifth Annual ALS Users' Association August 27-28, 1992

PRT PROPOSALS

ALS

<u>Spokesperson</u>	<u>Proposal Title</u>	
Hunt	Modulated Circular Polarization Source ...	ID: BM
Williams	Infrared Beamline	ID: BM
Perera	SXR Beamline for Material Studies ...	ID: BM
Perera	EUV Beamline for Optical Component ...	ID: BM
Wong	PRT Beamline for Polarized Photon Studies ...	ID: BM
Chatterjee	Interactions of VUV and Soft X-Ray with ...	ID: BM
Rothman	X-Ray Microscopy and Coherent Optics ...	ID: U3.9
Callcott	Soft X-Ray Emission Studies ...	ID: U5.0
Tonner	Undulator Spectro-Microscopy Facility	ID: U5.0
Kevan	Spectroscopy and Microscopy of Materials	ID: U5.0 + 2 BM
Stöhr	Core Level Spectroscopies and ...	ID: U5.0 + BM
Caldwell	Photoprocesses in Atoms, Molecules ...	ID: U8.0
Rehn	A Dual Undulator-Bending Magnet ...	ID: U8.0 + BM
Baer	Chemical Dynamics Research Laboratory ...	ID: U8.0 + BM
Ross	Materials Science Wiggler Beamline	ID: W13.6
Crasemann	Atomic, Molecular, and Optical Physics ...	ID: W13.6
Quintanilha	X-Ray Spectroscopy in the Life Sciences ...	ID: W13.6

BEAMLINES INITIATIVE

ALS

Scope

- 4 insertion devices and associated beamlines matched to forefront scientific opportunities at ALS in late 1990's
 - Dynamical phenomena in chemical and material sciences
 - Chemical dynamics
 - Circular polarization as a probe of spin properties of matter
 - Spectroscopic studies of matter with wiggler radiation
- Development of 2nd floor in ALS building to provide necessary space for users

Cost/Schedule

- Cost - \$44.0M (TEC, TPC)
- Schedule: FY95 - FY98

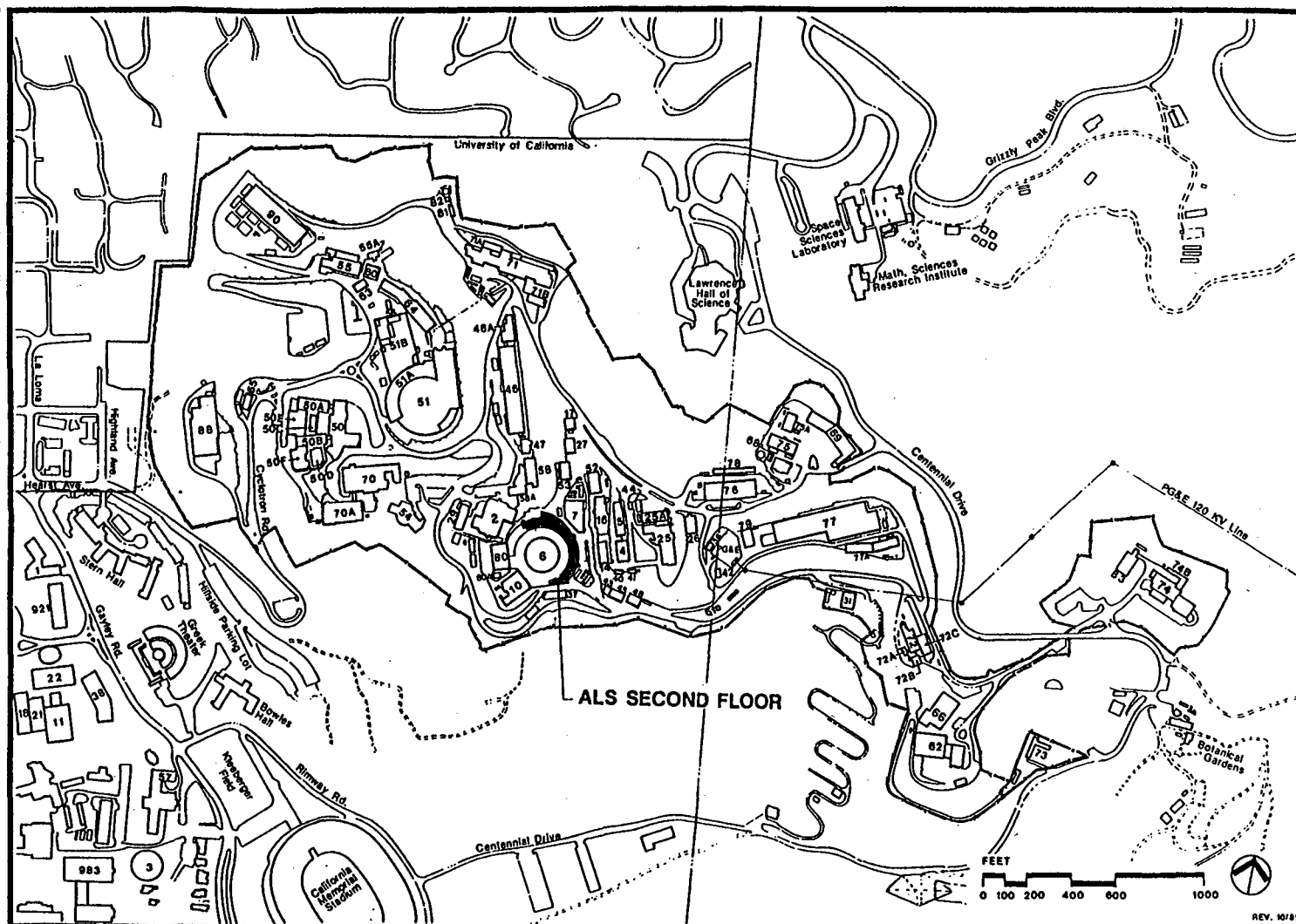
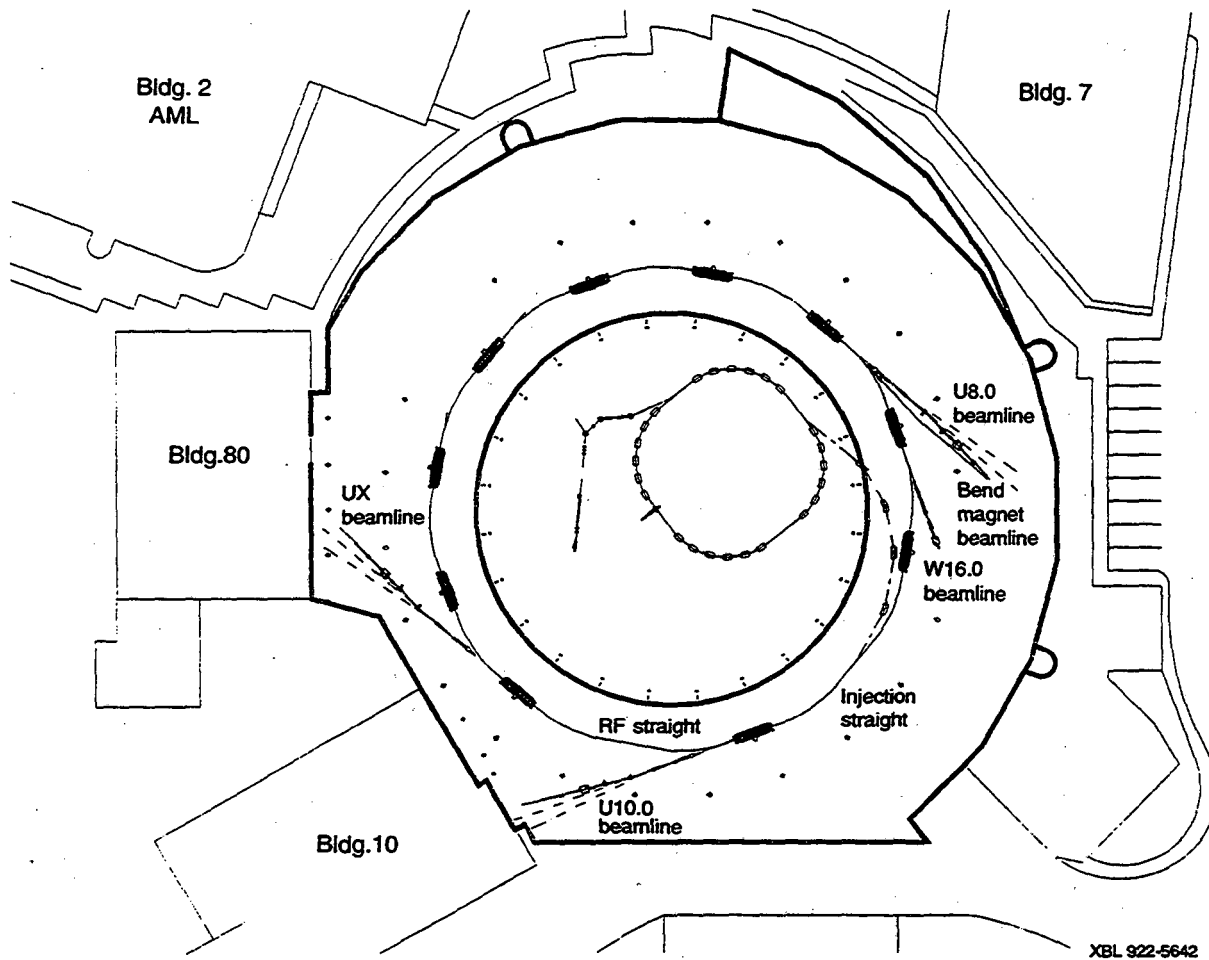


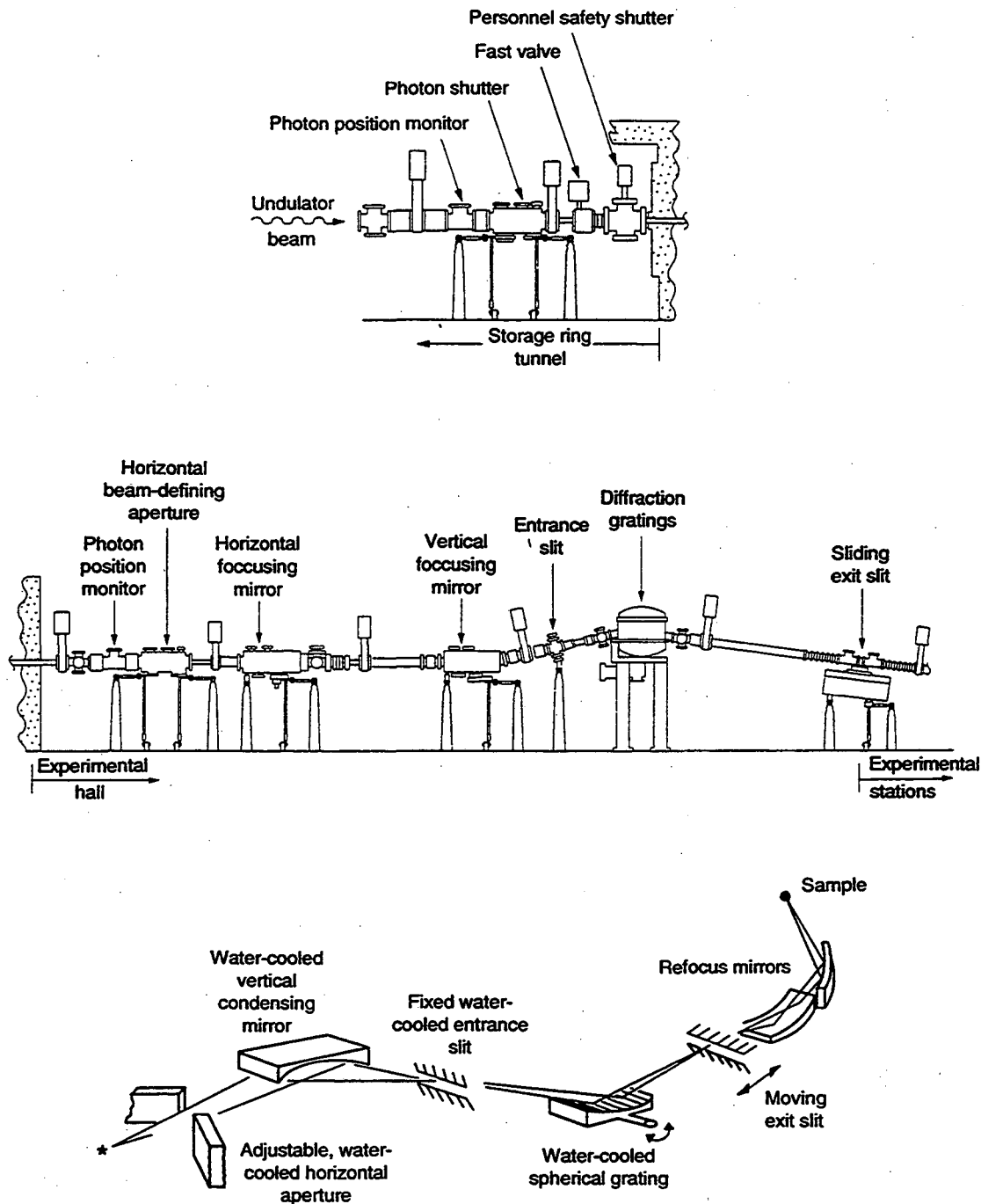
Figure 5-1. Site plan of the Lawrence Berkeley Laboratory, showing the proposed location of the project described here.



XBL 922-5642

Figure I-1. A plan view of the Advanced Light Source at the Lawrence Berkeley Laboratory showing schematically the scope of the project described in the following chapters. The project includes outfitting of 20,200 gross square feet of light lab and office space in the second floor of the ALS building, as well as the construction of insertion devices and beamlines for use by ALS experimental teams. Three undulators, a wiggler, four insertion-device beamlines, and one bend-magnet beamline are described here, but the specific facilities to be constructed will depend on the expressed needs of the user community.

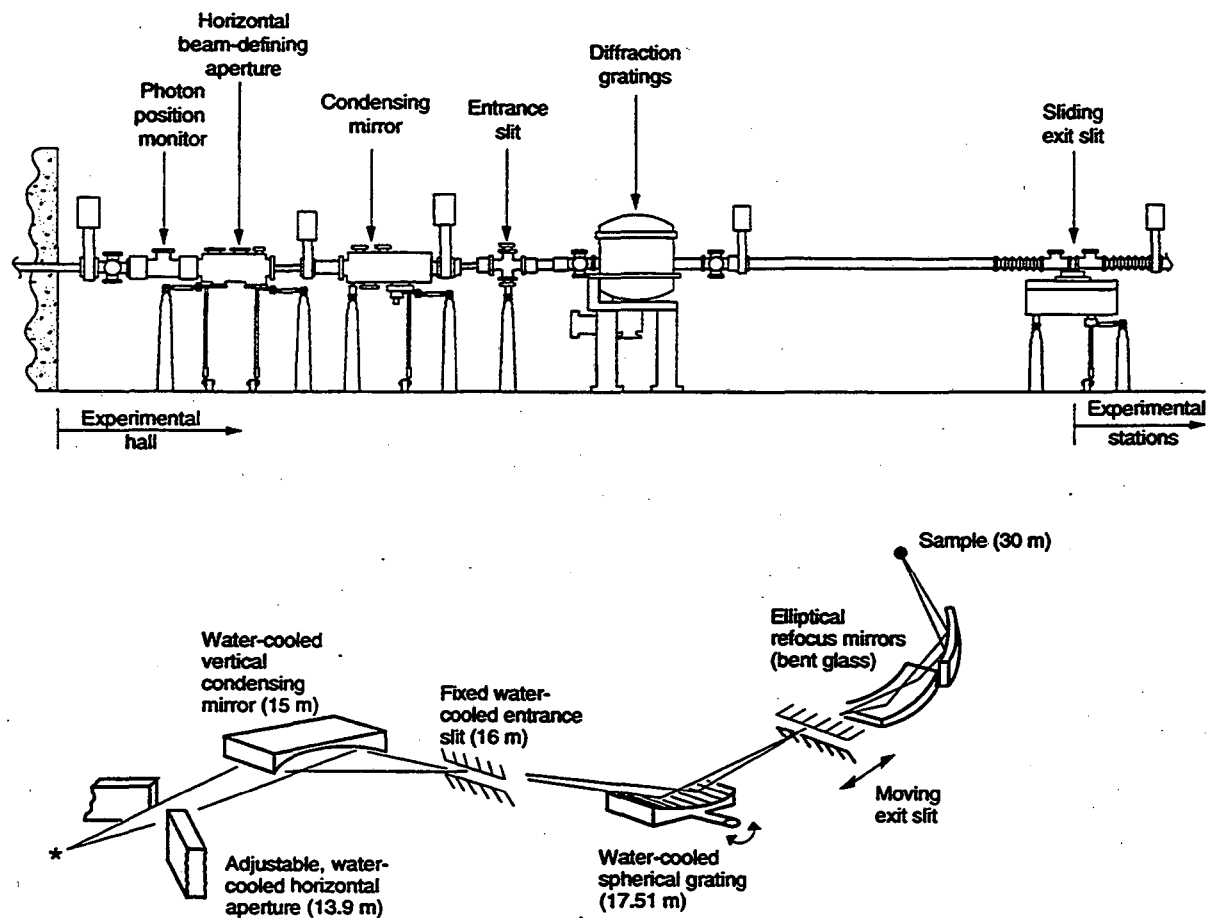
4. BEAM LINES



XBL 922-5627

Figure 4-1. Layout for the spherical grating monochromator beamline for undulator U8.0 (top) and a schematic illustration of the photon beam path through the optical components. The front-end components shown in the upper half of the top illustration will be identical on all ALS beamlines.

4. BEAM LINES



XBL-909-6738A

Figure 4-9. Layout for the spherical grating monochromator branch line for wiggler W16.0 (top) and a schematic illustration of the photon beam path through the optical components. The front-end components (not shown) will be similar in all ALS beamlines.

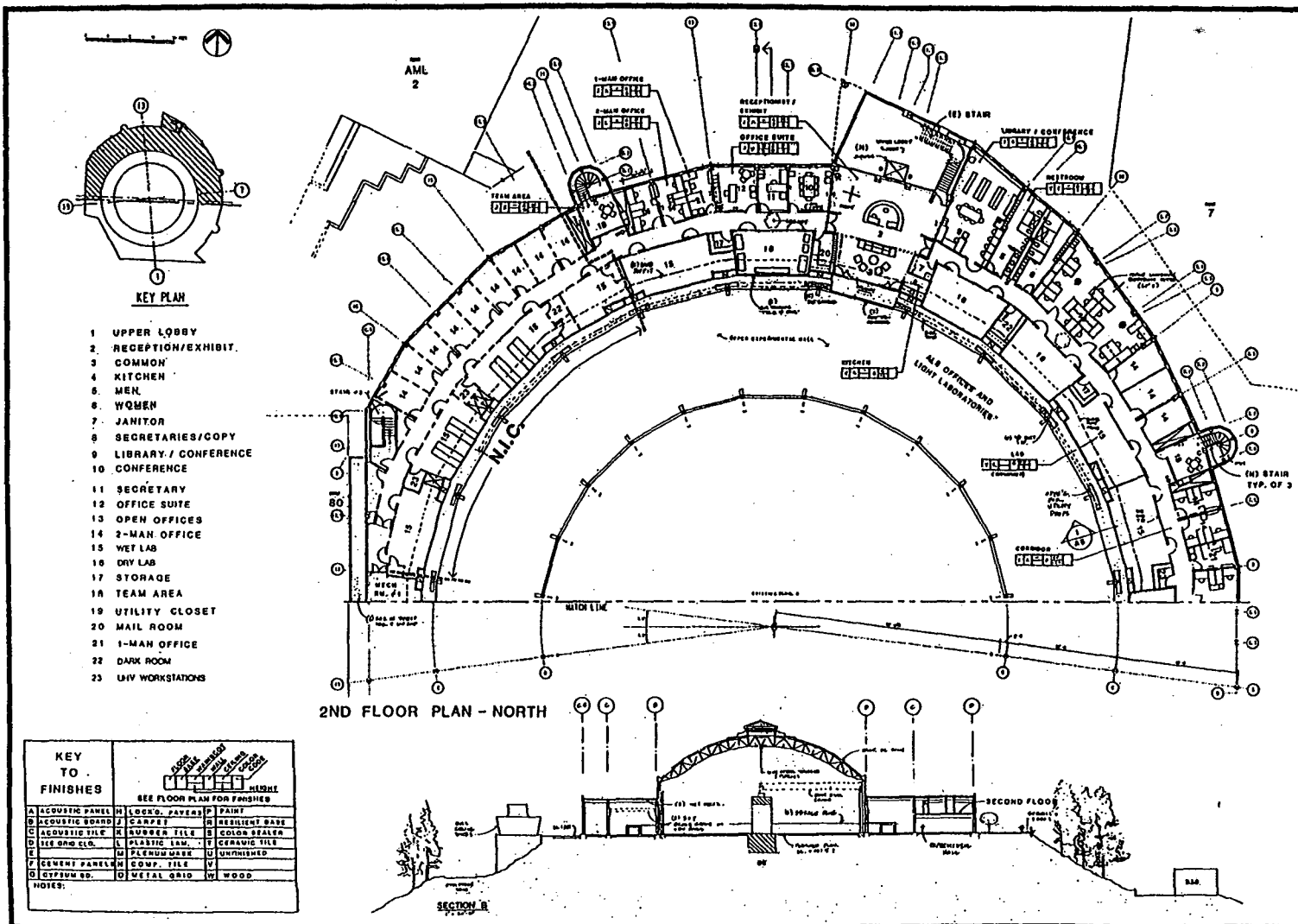


Figure 5-2. Plan view of the north half of the second floor of the ALS building.

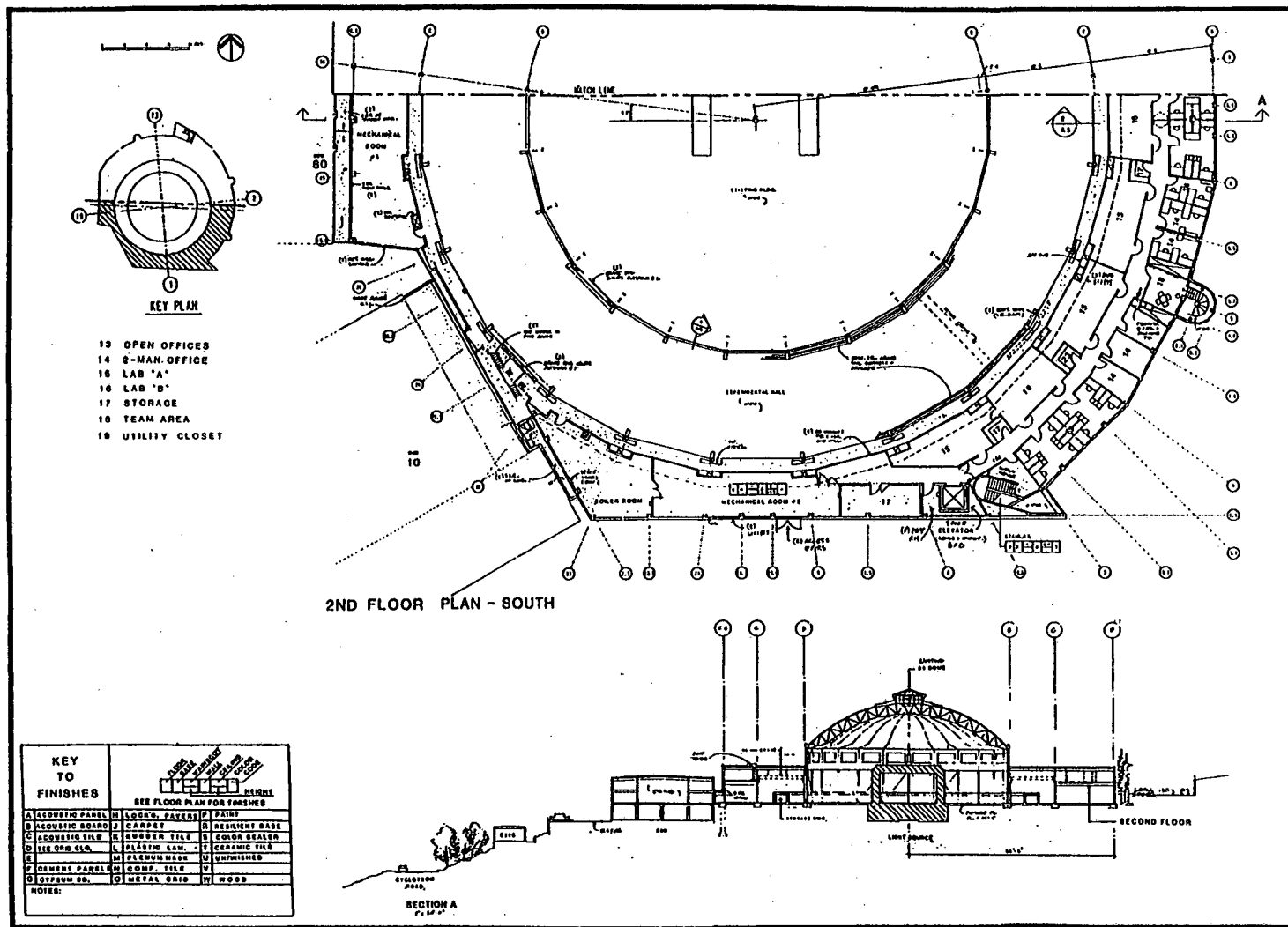


Figure 5-3. Plan view of the south half of the second floor of the ALS building.

ALS BEAMLINES INITIATIVE

CONVENTIONAL FACILITIES

PROJECT DESCRIPTION

- **The ALS Beamlines Initiative Will Support Research Activities at the Advanced Light Source (ALS) Conducted by Researchers from Industry, Universities, and National Laboratories**
- **The Conventional Facilities for ALS User Groups Include Improvements to 20,200 GSF of the Existing, Unfinished Space on the Second Floor of the ALS Building**
- **The Project Program Includes Light Laboratories, Offices, Support Spaces, Library, Conference Room, and Storage**
- **58 Occupants**
- **Air Conditioned**

ALS BEAMLINES INITIATIVE
CONVENTIONAL FACILITIES
PROJECT DESCRIPTION (Continued)

- **Mechanical Utilities**
 - **Acid Neutralization System**
 - **Hot and Cold Industrial Water**
 - **Low Conductivity Water**
 - **Natural Gas**
- **Electrical Power: 480/277V; 208/120V**
- **Energy Management and Control System (Existing)**
- **Integrated Communication System (ICS), Paging**
- **TEC \$5.9M**

ALS BEAMLINES INITIATIVE

SCHEDULE OF NET AREAS

	Net Area - Sq. Ft.		
	Labs	Lab Offices	Support
Wet Laboratories	3,200		
Dry Laboratories	2,200		
Laboratory Offices		5,220	
Conference/Meeting Rooms			710
Library			790
Dark Rooms			110
Storage			700
Mail Room			110
Visitors' Area			370
Reception/Exhibit Area			980
Kitchenette			60
Subtotal:	5,400	5,220	3,830

Total Net Area: 14,450 sq. ft.

Total Gross Enclosed Area: 20,200 sq. ft.

ALS BEAMLINES INITIATIVE

CONVENTIONAL FACILITIES

COST ESTIMATE (\$K)

A. Engineering, Design, and Inspection (at ~15% of Construction Costs)	640
B. Construction Costs	4,250
1. Land Improvements	0
2. Building (20,200 GSF at \$146/SF)	2,950
3. Special Building Facilities	530
4. Utilities	770
C. Standard Equipment	<u>130</u>
Subtotal	5,020
D. Contingency (at ~17% of Above Costs)	<u>880</u>
Total Estimated Cost	5,900

**ALS BEAMLINES INITIATIVE
CONVENTIONAL FACILITIES**

**SCHEDULE I
(FY 1992 \$K)**

Special Facilities

Laboratory Benches	154
Chemical Storage Cabinets	13
Fume Hoods	73
Laminar Flow Hoods	43
Acid Neutralization System	5
UHV Workstations	43
Demountable Office Systems Furniture and Partitions	<u>200</u>
Total	531*

*** Included in Construction and A/E Subcontracts**

**ALS BEAMLINES INITIATIVE
CONVENTIONAL FACILITIES**

**SCHEDULE II
(FY 1992 \$K)**

Standard Equipment

Laboratory Furniture	32
Office Furniture	82
Office Equipment	<u>16</u>
Total	<u><u>130</u></u>

**ALS BEAMLINES INITIATIVE
CONVENTIONAL FACILITIES
FINANCIAL SCHEDULE
(\$K)**

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1995	700	700	500
1996	4,600	4,600	2,700
1997	<u>600</u>	<u>600</u>	<u>2,700</u>
Total	5,900	5,900	5,900

ALS BEAMLINES INITIATIVE
CONVENTIONAL FACILITIES
CONTINGENCY ANALYSIS
(FY 1992 \$K)

	Estimated Cost (\$K)	Contingency (%)	Contingency (\$K)
<u>LBL Activities</u>			
Engineering	102	20	20
Consultants	17	20	3
Inspection	51	20	10
<u>Architect/Engineer</u>			
Title I	102	20	20
Title II	179	20	36
Title III	94	20	19
<u>Construction Contract</u>			
Improvements to Land	0		
Building	2,517	16	404
Special Building Facilities	452	20	90
Utilities	657	20	131
<u>Standard Equipment</u>	<u>110</u>	15	<u>17</u>
Subtotal	4,281		750
Contingency (17%)	<u>750</u>		
TOTAL	5,031		

BA/BO SCHEDULE (TY \$K)

Clerical:ALS-LIFE SCIENCES CENTER:BA/BO ALS-LSC
11/24/92

ALS BEAMLINES INITIATIVE

CONVENTIONAL FACILITIES

TIME SCHEDULE

Activities	Fiscal Year 1994				Fiscal Year 1995				Fiscal Year 1996				Fiscal Year 1997				Fiscal Year 1998			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
NEPA/SARS																				
A/E SELECTION																				
A/E NEGOTIATION																				
FUNDING AUTHORIZATION																				
TITLE I																				
TITLE II																				
BID AND AWARD																				
TITLE III																				
CONSTRUCTION																				
BUILDING IMPROVEMENTS																				
SPECIAL BUILDING FACILITIES																				
UTILITIES																				
STANDARD EQUIPMENT																				

3/12/93

A&E:ALS-Beam:CDR

Table B.1
Cost Estimate Summary

WBS		All costs shown in FY1992 K\$	
1..	ALS Beamlines Initiative		36,779.6
1.1.	Management & Administrative Support		2,068.3
1.2.	ALS Beamlines Systems		23,297.0
1.2.1	Dynamical Phenomena U8 & BM Beamlines		7,363.7
1.2.1.1	Engineering, Design, & Inspection	1,726.4	
1.2.1.2	Construction	5,637.3	
1.2.1.2.1	U8 Undulator	1,110.6	
1.2.1.2.2	U8 Front End	587.4	
1.2.1.2.3	U8 Branchline	1,595.7	
1.2.1.2.4	Bend Magnet Front End	368.3	
1.2.1.2.5	Bend Magnet Branchline	1,975.3	
1.2.2	Chemical Dynamics U10 Beamline		4,873.4
1.2.2.1	Engineering, Design, & Inspection	1,124.2	
1.2.2.2	Construction	3,749.2	
1.2.2.2.1	U10 Undulator	1,411.3	
1.2.2.2.2	U10 Front End	587.4	
1.2.2.2.3	U10 Branchline	1,750.5	
1.2.3	Circular Polarization UX Beamline		5,120.1
1.2.3.1	Engineering, Design, & Inspection	1,301.0	
1.2.3.2	Construction	3,819.1	
1.2.3.2.1	UX Undulator	1,636.0	
1.2.3.2.2	UX Front End	587.4	
1.2.3.2.3	UX Branchline	1,595.7	
1.2.4	Spectroscopy W16 Beamline		5,939.8
1.2.4.1	Engineering, Design, & Inspection	1,630.3	
1.2.4.2	Construction	4,309.5	
1.2.4.2.1	W16 Wiggler	1,059.2	
1.2.4.2.2	W16 Front End	622.4	
1.2.4.2.3	W16 Branchline	2,627.9	
1.3.	Conventional Construction		4,280.3
1.3.1	Engineering, Design, & Inspection		543.9
1.3.1.1	LBL Activities	168.9	
1.3.1.2	AE Activities	375.0	
1.3.2	Construction		3,736.4
1.3.2.1	Bldg. 6 Construction	2,515.6	
1.3.2.2	Special Building Facilities	452.4	
1.3.2.3	Utilities; Elect Transformer/Switchgear	657.7	
1.3.2.4	Standard Equipment	110.7	
1.4.	Contingency		7,134.1
1.4.1	Project Management & Support	413.7	
1.4.2	ALS Beamline Systems	5,970.5	
1.4.3	Conventional Facilities	749.9	

Example:Page No. 2
03/10/93Cost Estimate Report
Summary of Material and Labor in FY92K\$
by Rollup Levels

Work Breakdown Structure # -----	Description -----	Material & Labor Total K\$ -----
1.2.1.2.1.1.8	Magnetic Measurements: Electrical	34.33
** *****		
1.2.1.2.1.2	Support & Drive Systems	245.04
** *****		
1.2.1.2.1.2.1	Support System Fabrication	104.10
1.2.1.2.1.2.2	Drive System Fabrication	119.65
1.2.1.2.1.2.3	Local Temperature Control Fabrication	21.29
** *****		
1.2.1.2.1.3	Vacuum System	240.74
** *****		
1.2.1.2.1.3.1	Vacuum Chamber	167.12
1.2.1.2.1.3.2	Pumping Systems & Instrumentation	28.19
1.2.1.2.1.3.3	Support Structure	14.84
1.2.1.2.1.3.4	Vacuum Diagnostics	30.59
** *****		
1.2.1.2.1.4	Motor Control System	33.79
1.2.1.2.1.5	Installation	19.61
** *****		
1.2.1.2.2	U8 Front End	587.37
** *****		
1.2.1.2.2.1	Fixed Aperture	57.72
** *****		
1.2.1.2.2.1.1	Aperture Plate	4.36
1.2.1.2.2.1.2	Bellows	3.16
1.2.1.2.2.1.3	Collimating Spool	4.35
1.2.1.2.2.1.4	Isolation Valve	24.16
1.2.1.2.2.1.5	Support Stand	10.24
1.2.1.2.2.1.6	Assemble, Bakeout, Test	4.34
1.2.1.2.2.1.7	Installation	7.10
** *****		
1.2.1.2.2.2	Photon BPM #1	74.26
** *****		
1.2.1.2.2.2.1	Fab/Buy Mech Parts & Subassy's	14.35
1.2.1.2.2.2.2	Fab/Buy Electrical and Controls	26.89
1.2.1.2.2.2.3	Fab/Buy Support Stand	6.31
1.2.1.2.2.2.4	Bellows	8.84

Example :

B-37

Page No. 5
03/10/93

Technical Components Cost Estimate

ITM	ITM	UNIT	NBR	UNIT	COST	TOTAL	LBR	HRS/	TOTAL	CRAFT	CRAFT	TOTAL	ISC +
NBR	DESCRIPTION	MEAS	UNITS	COST	BASIS	ISC K\$	UNTS	UNIT	HRS	CODE	RATE	LABOR K\$	LABOR K\$
**	Subtotal **					1.4			80			3.0	4.4
**	WBS: 1.2.1.2.2.1.2	Bellows											
1	Welded Bellows Assy	ea	1	3000.00	A91	3.0	1	1.0	1 MS	37.73	0.0	3.0	
2	Inspect, Clean, Bake	ea	1	50.00	eu	0.1	1	2.0	2 MU	35.92	0.1	0.1	
**	Subtotal **					3.0			3			0.1	3.2
**	WBS: 1.2.1.2.2.1.3	Collimating Spool											
1	Spool Piece	ea	1	1250.00	A91	1.2	1	8.0	8 MU	35.92	0.3	1.5	
2	Misc. Flanges/UHV Hardware	lot	1	500.00	eu	0.5	1	8.0	8 MS	37.73	0.3	0.8	
3	Lead Shielding & Mounting	lot	1	500.00	eu	0.5	1	40.0	40 MS	37.73	1.5	2.0	
**	Subtotal **					2.2			56			2.1	4.3
**	WBS: 1.2.1.2.2.1.4	Isolation Valve											
1	Valve & Controller Proc.	ea	1	22140.00	A91	22.1	0	0.0	0	0.00	0.0	22.1	
2	Prelim Assemble & Test	lot	1	50.00	ea	0.1	1	8.0	8 MU	35.92	0.3	0.3	
3	Inspect/Clean/Etc.	lot	1	50.00	eu	0.1	1	4.0	4 MU	35.92	0.1	0.2	
4	Cables & connectors	lot	1	200.00	eu	0.2	1	4.0	4 EI	33.00	0.1	0.3	
5	Blank flngs & mntng hrdwr	lot	2	200.00	eu	0.4	1	20.0	20 MS	37.73	0.8	1.2	
**	Subtotal **					22.8			36			1.3	24.2
**	WBS: 1.2.1.2.2.1.5	Support Stand											
1	Support stand, misc. hrdw	ea	1	1500.00	eu	1.5	1	40.0	40 MS	37.73	1.5	3.0	
2	Struts & hardware	ea	6	500.00	A91	3.0	6	8.0	48 MU	35.92	1.7	4.7	
3	Misc.	lot	1	1000.00	eu	1.0	1	40.0	40 MS	37.73	1.5	2.5	
**	Subtotal **					5.5			128			4.7	10.2
**	WBS: 1.2.1.2.2.1.6	Assemble, Bakeout, Test											
1	Clean parts	lot	1	100.00	eu	0.1	1	16.0	16 MU	35.92	0.6	0.7	
2	Final vac assy, leak check	lot	1	100.00	eu	0.1	1	16.0	16 MU	35.92	0.6	0.7	
3	Fiducialize		0	0.00		0.0	2	8.0	16 MS	37.73	0.6	0.6	
3	Bakeout jackets	ea	1	1500.00	A91	1.5	1	8.0	8 MU	35.92	0.3	1.8	
4	RGA scans, UHV pre-qualfy		0	0.00		0.0	1	16.0	16 MS	37.73	0.6	0.6	
**	Subtotal **					1.7			72			2.6	4.3
**	WBS: 1.2.1.2.2.1.7	Installation											
1	Install/check valves/cntrl	lot	1	200.00	eu	0.2	1	16.0	16 EI	33.00	0.5	0.7	
2	Install utilities	lot	1	500.00	eu	0.5	1	16.0	16 MU	35.92	0.6	1.1	
3	Install/align supprt stnd	lot	1	200.00	eu	0.2	2	16.0	32 MU	35.92	1.1	1.3	
4	Instll/align vac hardware		0	0.00		0.0	2	16.0	32 MU	35.92	1.1	1.1	
5	Vac cnctns, leak check		0	0.00		0.0	2	16.0	32 MU	35.92	1.1	1.1	
6	Bakeout		0	0.00		0.0	2	16.0	32 MU	35.92	1.1	1.1	
7	Elec. installation		0	0.00		0.0	1	8.0	8 IEL	62.85	0.5	0.5	
**	Subtotal **					0.9			168			6.2	7.1
**	WBS: 1.2.1.2.2.2.1	Fab/Buy Mech Parts & Subassy's											
1	Flange/mntng plate fab	ea	1	600.00	eu	0.6	1	40.0	40 MS	37.73	1.5	2.1	
2	CF feed-thrus for electr	ea	8	200.00	eu	1.6	0	0.0	0	0.00	0.0	1.6	
3	Brazing & fixtures	lot	1	100.00	eu	0.1	1	20.0	20 MU	35.92	0.7	0.8	
4	Feedthrus welding	lot	1	50.00	eu	0.1	1	20.0	20 MS	37.73	0.8	0.8	
5	Blades fab	ea	2	100.00	eu	0.2	2	20.0	40 MS	37.73	1.5	1.7	
6	In-vac parts & elec fab	lot	1	200.00	eu	0.2	1	40.0	40 MS	37.73	1.5	1.7	
7	LCV hardware	lot	1	100.00	eu	0.1	1	8.0	8 MU	35.92	0.3	0.4	
8	2-axis translation mech	ea	1	3000.00	eu	3.0	0	0.0	0	0.00	0.0	3.0	
9	Outside vac mntng hardware	lot	1	500.00	eu	0.5	1	20.0	20 MS	37.73	0.8	1.3	
10	Blade alignment fixtures	lot	1	200.00	eu	0.2	1	20.0	20 MS	37.73	0.8	1.0	
**	Subtotal **					6.6			208			7.8	14.3

nd; Fixed Aperture

US: Front

noted BPM#1

Example:

B-38

Technical Components Cost Estimate

ITEM DESCRIPTION	UNIT MEAS	NBR UNITS	UNIT COST COST BASIS	TOTAL ISC K\$	LBR UNITS	HRS/ UNIT	TOTAL CRAFT HRS CODE	CRAFT RATE	TOTAL LABOR K\$	ISC + LABOR K\$
** WBS: 1.2.1.2.2.2.2 Fab/Buy Electrical and Controls										
1 Bias power supply	ea	2	3000.00 eu	6.0	2	8.0	16 EI	33.00	0.5	6.5
2 ILC & SBX	ea	3	1500.00 eu	4.5	3	20.0	60 EI	33.00	2.0	6.5
3 Electrometer	ea	2	1695.00 cp	3.4	2	8.0	16 EI	33.00	0.5	3.9
4 Eurocard crate	ea	1	1000.00 eu	1.0	1	16.0	16 EI	33.00	0.5	1.5
5 Thermocouples & controls	ea	2	500.00 eu	1.0	2	8.0	16 EI	33.00	0.5	1.5
6 Stepper motor controller	ea	1	3000.00 eu	3.0	1	16.0	16 EI	33.00	0.5	3.5
7 Cables	lot	1	1000.00 eu	1.0	1	40.0	40 EI	33.00	1.3	2.3
8 Flow switch	ea	2	400.00 eu	0.8	2	4.0	8 EI	33.00	0.3	1.1
** Subtotal **				20.7			188		6.2	26.9
** WBS: 1.2.1.2.2.2.3 Fab/Buy Support Stand										
1 Slides mounting hardware	ea	1	200.00 eu	0.2	1	8.0	8 MS	37.73	0.3	0.5
2 Support post & hardware	lot	1	3000.00 eu	3.0	1	8.0	8 MS	37.73	0.3	3.3
3 Misc hardware & fixtures	lot	1	1000.00 eu	1.0	1	40.0	40 MS	37.73	1.5	2.5
** Subtotal **				4.2			56		2.1	6.3
** WBS: 1.2.1.2.2.2.4 Bellows										
1 Welded bellows assy	ea	2	4000.00 A91	8.0	0	0.0	0	0.00	0.0	8.0
2 Blank flanges,gaskets,etc	lot	2	300.00 cp	0.6	0	0.0	0	0.00	0.0	0.6
3 Inspect, clean, bake	lot	2	50.00 eu	0.1	2	2.0	4 MU	35.92	0.1	0.2
** Subtotal **				8.7			4		0.1	8.8
** WBS: 1.2.1.2.2.2.5 Assemble, Bakeout, Test (Assembly Shop)										
1 Assemble/test PBPM mech	ea	1	500.00 eu	0.5	2	20.0	40 MU	35.92	1.4	1.9
2 Assemble/test PBPM elec	ea	1	500.00 eu	0.5	1	40.0	40 EI	33.00	1.3	1.8
3 Bakeout/UHV pre-qualify	ea	1	500.00 eu	0.5	1	40.0	40 MU	35.92	1.4	1.9
4 Fiducialization		0	0.00	0.0	2	16.0	32 MU	35.92	1.1	1.1
5 Visc assy equip,jackets,	lot	1	1000.00 eu	1.0	1	20.0	20 MU	35.92	0.7	1.7
** Subtotal **				2.5			172		6.1	8.6
** WBS: 1.2.1.2.2.2.6 Installation										
1 LCW Hardware & connection	lot	1	300.00 eu	0.3	2	20.0	40 MU	35.92	1.4	1.7
2 Transport & on-site setup	lot	1	200.00 eu	0.2	2	8.0	16 MU	35.92	0.6	0.8
3 Vac assemble & leak check	lot	1	100.00 eu	0.1	2	16.0	32 MU	35.92	1.1	1.2
4 Installation alignment		0	0.00	0.0	2	16.0	32 MS	37.73	1.2	1.2
5 Mech install, test, debug	lot	1	100.00 eu	0.1	2	20.0	40 MU	35.92	1.4	1.5
6 Elec. installation	lot	1	100.00 eu	0.1	1	20.0	20 IEL	62.85	1.3	1.4
7 Final bake & UHV qualify		0	0.00	0.0	2	20.0	40 MU	35.92	1.4	1.4
** Subtotal **				0.8			220		8.5	9.3
** WBS: 1.2.1.2.2.3.1 Fab/Buy Mech Parts & Subassy's										
1 Machine absorber blades	ea	2	1000.00 A91	2.0	2	40.0	80 MS	37.73	3.0	5.0
2 Braze absorber blades	ea	2	100.00 eu	0.2	2	20.0	40 MS	37.73	1.5	1.7
3 Brazing tooling/fixtures	ea	1	200.00 eu	0.2	1	20.0	20 MS	37.73	0.8	1.0
4 Blade/pivot mounting	ea	2	500.00 A91	1.0	2	60.0	120 MS	37.73	4.5	5.5
5 Pneumatic actuator mechan	ea	2	500.00 eu	1.0	2	40.0	80 MS	37.73	3.0	4.0
6 Limit stops & switches	ea	2	100.00 eu	0.2	2	20.0	40 MS	37.73	1.5	1.7
7 Bellows/conflat ass'y/weld	ea	2	1000.00 A91	2.0	2	40.0	80 MS	37.73	3.0	5.0
** Subtotal **				6.6			460		17.4	24.0
** WBS: 1.2.1.2.2.3.2 Fab/Buy Electrical and Controls										
1 ILC & SBX	ea	1	1500.00 eu	1.5	1	20.0	20 EI	33.00	0.7	2.2
2 Cables	lot	1	200.00 eu	0.2	1	8.0	8 EI	33.00	0.3	0.5
3 Flow switch & interlocks	ea	2	400.00 eu	0.8	2	4.0	8 EI	33.00	0.3	1.1
4 Position indicators	set	1	500.00 eu	0.5	1	8.0	8 EI	33.00	0.3	0.8
5 Air solenoids	ea	4	500.00 eu	2.0	4	8.0	32 EI	33.00	1.1	3.1
6 Air pressure interlocks	ea	1	500.00 eu	0.5	1	16.0	16 EI	33.00	0.5	1.0

Table B.2
Contingency Analysis Table

(All costs shown in FY1992 K\$)

WBS No.	Description	Base Costs	Contingencies		
			% Conting.	K\$ Conting	K\$ Conting Subtotal
1..	ALS Beamlines Initiative	36,780			7,134
1.1.	Management & Administrative Support	2,068	20		414
1.2.	ALS Beamlines Systems	23,297			5,971
1.2.1	Dynamical Phenomena Beamlines	7,364			1,864
1.2.1.1	Engineering, Design, & Inspection	1,726			452
1.2.1.1.1	EDI, U8 Undulator	333	25	83	
1.2.1.1.2	EDI, U8 Beamline Front End	88	15	13	
1.2.1.1.3	EDI, U8 Branchline	559	25	140	
1.2.1.1.4	EDI, Bend Magnet Frontend	55	15	8	
1.2.1.1.5	EDI, Bend Magnet Branchline	691	30	207	
1.2.1.2	Dynamical Phenomena BL Constr.	5,637			1,413
1.2.1.2.1	U8 Undulator	1,111	25	278	
1.2.1.2.2	U8 Beamline Front End	587	15	88	
1.2.1.2.3	U8 Branchline	1,596	25	399	
1.2.1.2.4	Bend Magnet Frontend	368	15	55	
1.2.1.2.5	Bend Magnet Branchline	1,975	30	593	
1.2.2	Chemical Dynamics Beamline	4,873			1,151
1.2.2.1	Engineering, Design, & Inspection	1,124			272
1.2.2.1.1	EDI, U10 Undulator	423	25	106	
1.2.2.1.2	EDI, U10 Beamline Front End	88	15	13	
1.2.2.1.3	EDI, U10 Branchline	613	25	153	
1.2.2.2	Chemical Dynamics BL Constr.	3,749			879
1.2.2.2.1	U10 Undulator	1,411	25	353	
1.2.2.2.2	U10 Beamline Front End	587	15	88	
1.2.2.2.3	U10 Branchline	1,751	25	438	

Table B.2, Continued
Contingency Analysis Table

(All costs shown in FY1992 K\$)

			% Conting.	K\$ Conting	K\$ Conting Subtotal
1.23	Circular Polarization Beamline	5,120			1,212
1.23.1	Engineering, Design, & Inspection	1,301			316
1.23.1.1	EDI, UX Undulator	654	25	164	
1.23.1.2	EDI, UX Beamline Front End	88	15	13	
1.23.1.3	EDI, UX Branchline	559	25	140	
1.23.2	Circular Polarization BL Constr.	3,819			896
1.23.2.1	UX Undulator	1,636	25	409	
1.23.2.2	UX Beamline Front End	587	15	88	
1.23.2.3	UX Branchline	1,596	25	399	
1.24	Spectroscopy Beamlines	5,940			1,743
1.24.1	Engineering, Design, & Inspection	1,630			481
1.24.1.1	EDI, W16 Wiggler	424	30	127	
1.24.1.2	EDI, W16 Beamline Front End	156	25	39	
1.24.1.3	EDI, W16 Branchline	1,051	30	315	
1.24.2	Spectroscopy BL Constr.	4,310			1,262
1.24.2.1	W16 Wiggler	1,059	30	318	
1.24.2.2	W16 Beamline Front End	622	25	156	
1.24.2.3	W16 Branchline	2,628	30	788	
1.3.	Conventional Facilities	4,280			750
1.3.1	Engineering, Design, & Inspection	544			109
1.3.1.1	LBL Activities	169	20	34	
1.3.1.2	Architect/Engineering Activities	375	20	75	
1.3.2	Construction	3,736			641
1.3.2.1	Building 6 Construction	2,516	16	402	
1.3.2.2	Special Building Facilities	452	20	90	
1.3.2.3	Utilities; Elect Transformer/Switchgear	658	20	132	
1.3.2.4	Standard Equipment	111	15	17	
1.4.	Contingency	7,134			
1.4.1	Management & Support	414			
1.4.2	ALS Beamlines Systems	5,971			
1.4.3	Conventional Facilities	750			

Table 6-3. Escalation schedule. Costs are given in thousands of dollars.

	FY92	FY93	FY94	FY95	FY96	FY97	FY98	Total
FY 1992 K\$				4,106	12,024	12,847	7,803	36,780
Inflation (%)		3.0	3.9	4.1	4.3	4.5	4.5	
Escalation factor	1.000	1.030	1.078	1.070	1.114	1.214	1.269	
Then-year K\$				4,600	14,000	15,500	9,900	44,000

6. SCHEDULE AND COST ESTIMATE

Table 6-5. Cost schedule by major categories, in thousands of then-year dollars. An obligation schedule for the complete project is given at the bottom of the table.

	FY95	FY96	FY97	FY98	Total
1.1 Project Management	446	697	729	594	2,466
1.2 ALS Beamlines Systems					
Dynamical Phenomena Beamlines	1,337	3,602	3,720		8,659
Chemical Dynamics Beamline	1,225	2,208	2,275		5,708
Circular Polarization Beamline	223	1,511	2,186	2,309	6,228
Spectroscopy Beamlines	111	1,743	2,307	3,096	7,257
1.3 Conventional Facilities	370	2,390	2,260		5,020
1.4 Contingency	888	1,850	2,024	3,901	8,662
Costs, totals by year	4,600	14,000	15,500	9,900	44,000
Obligations, totals by year	9,800	14,300	13,300	6,600	44,000

Table 6-4. Project cost summary in thousands of then-year dollars.

1	ALS Beamlines Initiative (TEC)	\$ 44,000
1.1	Project Management	2,466
1.2	ALS Beamlines Systems	27,853
1.2.1	Dynamical Phenomena Beamlines	8,659
1.2.2	Chemical Dynamics Beamline	5,706
1.2.3	Circular Polarization Beamline	6,228
1.2.4	Spectroscopy Beamlines	7,257
1.3	Conventional Facilities	5,020
1.3.1	Engineering, Design & Inspection	640
1.3.2	Construction	4,380
1.4	Contingency	8,662
1.4.1	Project Management	493
1.4.2	ALS Beamlines Systems	7,289
1.4.3	Conventional Facilities	880

ALS BEAMLINES INITIATIVE

FINANCIAL SCHEDULE (\$K)

<u>FISCAL YEAR</u>	<u>APPROPRIATIONS</u>	<u>OBLIGATIONS</u>	<u>COSTS</u>
1995	9,800	9,800	4,600
1996	14,300	14,300	14,000
1997	13,300	13,300	15,500
1998	<u>6,600</u>	<u>6,600</u>	<u>9,900</u>
TOTAL	44,000	44,000	44,000

Note: Application of LBL overhead to new FY1995 construction projects will increase the TEC and TPC of this project to \$51,000K. The appropriations and obligations columns will increase to \$10,500K in FY95, \$16,500K in FY96, \$15,800K in FY97, and \$8,200K in FY98.

ALS BEAMLINES INITIATIVE

TOTAL PROJECT COSTS (TPC) (\$K)

	<u>Prior Years</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>Total</u>
Total Project Costs (TPC)						
(1) Total Facility Costs (Construction Line Item - TEC)	0	4,600	14,000	15,500	9,900	44,000
(2) Other Project Costs						
(b) Conceptual Design Cost	50					50
(a) Environmental Compliance Documentation Costs	<u>50</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>50</u>
Total Other Project Costs	100	4,600	14,000	15,500	9,900	100
Total Project Cost	100	4,600	14,000	15,500	9,900	<u>44,100*</u>

*Application of 16% LBL Overhead to New FY 1995 Construction Projects Will Increase the TPC to \$51,100K

6. SCHEDULE AND COST ESTIMATE

ELEMENT	FY95	FY96	FY97	FY98
1.1 Project Management				
1.2 ALS Beamline Facilities				
U8 Dynamical Phenomena				
EDI				
U8 Undulator & Beamline				
Bend Magnet Beamline				
U10 Chemical Dynamics				
EDI				
U10 Undulator & Beamline				
UX Circular Polarization				
EDI				
UX Undulator & Beamline				
W16 Spectroscopy				
EDI				
W16 Wiggler & Beamline				
1.3 Conventional Facilities				
EDI				
Conventional Construction				
Special Facilities				
Electrical Utilities				
Standard Equipment				

Figure 6-1. Overall project schedule.

ALS BEAMLINES INITIATIVE
CONVENTIONAL FACILITIES
BASIS OF CONCEPTUAL DESIGN

- **Programmatic Criteria for Functional Requirements
Developed by the ALS User Groups**
- **Conceptual Design, Drawings and Specifications
Prepared by LBL Facilities Department**
- **Site in General Conformance with LBL Site
Development Plan (Approved by DOE in 1991)**
- **Consultants**
 - **Keller and Gannon, Engineer-Architects**
- **Cost Estimate by Gosliner/McLean Associates, Inc.**
- **Construction Costs Escalated 17.2% from April 1992
to Midpoint of Construction, September 1996 using
DOE Guidelines**

ALS BEAMLINES INITIATIVE

CONVENTIONAL FACILITIES

METHOD OF ACCOMPLISHMENT

- **Design Program Will Be Prepared by LBL Facilities Department from Programmatic Criteria Supplied by the ALS User Groups**
- **A/E Will Be Selected for Titles I and II Design and Title III Technical Oversight**
- **Title III Construction Work Will Be Accomplished by a Lump-Sum Contract Awarded After Competitive Bidding**
- **Construction Contract Administration and Inspection by LBL**
- **Standard Equipment and Special Building Facilities Will Be Procured by LBL**

**ALS BEAMLINES INITIATIVE
CONVENTIONAL FACILITIES
CONSTRUCTION COST SUMMARY**

	<u>Estimate April 1992</u>	<u>Escalate 17.2% to September 1996</u>
Improvements to Land	---	---
Building	2,515,560	2,948,240
Special Building Facilities	452,400	530,210
Utilities	<u>657,720</u>	<u>770,850</u>
Total Estimated Construction Cost	<u>3,625,680</u>	<u>4,249,300</u>

ALS BEAMLINES INITIATIVE

CONVENTIONAL FACILITIES

ESTIMATE SUMMARY

CONSTRUCTION - BUILDING

DIV

3	Concrete		26,790
5	Metals		162,030
6	Wood and Plastics		42,240
7	Thermal/Moisture Protection		41,030
8	Doors/Windows		133,350
9	Finishes		404,130
10	Specialties		22,540
11	Equipment		3,000
12	Furnishings		15,450
14	Conveying Systems		140,000
15	Mechanical:		285,990
	Plumbing		
	HVAC		496,770
	Fire Protection		52,200
16	Electrical		<u>239,800</u>
	Subtotal Direct Cost		2,065,320
	General Conditions/Mobilize	5.0%	103,270
	Estimating Contingency		<u>In Project Contingency</u>
			2,168,590
	Bond	2.0%	43,370
	Prime Contractor OH & Fee	14.0%	<u>303,600</u>
	Total Estimated Construction Cost at April 1992		<u>2,515,560</u>
	Total Escalated Construction Cost to September 1996	17.2%	<u>2,948,240</u>

ALS BEAMLINES INITIATIVE

CONVENTIONAL FACILITIES

ESTIMATE SUMMARY (continued)

CONSTRUCTION - SPECIAL BUILDING FACILITIES

Laboratory Benches		108,000
Chemical Storage Cabinets		9,000
Fume Hoods		51,000
Laminar Flow Hoods		30,000
Acid Neutralization System		3,430
UHV Workstations		30,000
Demountable Office Systems		
Furniture and Partitions		<u>140,000</u>
Subtotal Direct Cost		371,430
General Conditions/ Mobilize	5.0%	18,570
Estimating Contingency		<u>In Project Contingency</u>
		390,000
Bond	2.0%	7,800
Prime Contractor OH & Fee	14.0%	<u>54,600</u>
Total Estimated Construction Cost at April 1992		<u>452,400</u>
Total Estimated Construction Cost to September 1996	17.2%	<u><u>530,210</u></u>

ALS BEAMLINES INITIATIVE
CONVENTIONAL FACILITIES
ESTIMATE SUMMARY (continued)

CONSTRUCTION - UTILITIES

Transformer and Switchgear Equipment		475,000
Ethernet Distribution		<u>65,000</u>
Subtotal Direct Cost		540,000
General Conditions/Mobilize	5.0%	27,000
Estimating Contingency		<u><i>In Project Contingency</i></u>
		567,000
Bond	2.0%	11,340
Prime Contractor OH & Fee	14.0%	<u>79,380</u>
Total Estimated Construction Cost at April 1992		<u>657,720</u>
Total Escalated Construction Cost to September 1996	17.2%	<u><u>770,850</u></u>

ALS BEAMLINES INITIATIVE
CONVENTIONAL FACILITIES
ESTIMATE SUMMARY (continued)

STANDARD EQUIPMENT

Laboratory Furniture		25,960
Office Furniture		66,500
Office Equipment		<u>13,000</u>

Subtotal Direct Cost		105,460
Storage, Handling, Delivery and Set-up	5.0%	<u>5,270</u>

Total Estimated Construction Cost at April 1992		110,730
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Total Escalated Construction Cost to September 1996	17.2%	<u>129,780</u>
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ALS BEAMLINES INITIATIVE

CONVENTIONAL FACILITIES

OBLIGATIONS AND COSTS SCHEDULE
(TY \$K)

DESCRIPTION	TOTAL	FY 1995		FY 1996		FY 1997	
		O	C	O	C	O	C
<u>LBL Activities</u>							
Engineering	120	70	70	30	30	20	20
Consultants	20	10	10	10	10		
Inspection	<u>60</u>	—	—	<u>30</u>	<u>30</u>	<u>30</u>	<u>30</u>
Subtotal	200	80	80	70	70	50	50
<u>Architect/Engineer</u>							
Title I	120	120	120				
Title II	210	210	170	0	40		
Title III	<u>110</u>	<u>110</u>	<u>0</u>	<u>0</u>	<u>50</u>	<u>0</u>	<u>60</u>
Subtotal	440	440	290	0	90	0	60
Total ED&I	640	520	370	70	160	50	110
<u>Construction</u>							
Land Improvements	0						
Building	2,950			2,950	1,400	0	1,550
Special Bldg Facilities	530			320	170	210	360
Utilities	<u>770</u>			<u>770</u>	<u>660</u>	<u>0</u>	<u>110</u>
Subtotal	4,250			4,040	2,230	210	2,020
<u>Standard Equipment</u>	130					130	130
Subtotal	5,020	520	370	4,110	2,390	390	2,260
Contingency (17%)	<u>880</u>	<u>180</u>	<u>130</u>	<u>490</u>	<u>310</u>	<u>210</u>	<u>440</u>
TOTAL	5,900	700	500	4,600	2,700	600	2,700

ALS BEAMLINES INITIATIVE

CONVENTIONAL FACILITIES

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates"
(Updated August 1992)

Start Construction: February 1996
Construction Period: 16 Months
Finish Construction: May 1997
Midpoint Construction: September 1996
Estimate Date: April 1992

					<u>%</u>	
FY 1992	Apr 1992 - Sep 1992	6	mo @	1.8	=	0.9
FY 1993	Oct 1992 - Sep 1993	12	mo @	3.0	=	3.0
FY 1994	Oct 1993 - Sep 1994	12	mo @	3.9	=	3.9
FY 1995	Oct 1994 - Sep 1995	12	mo @	4.1	=	4.1
FY 1996	Oct 1995 - Sep 1996	12	mo @	4.3	=	4.3

Total Compounded Escalation 17.2

ALS BEAMLINES INITIATIVE CONVENTIONAL FACILITIES

ED&I ANALYSIS (TY \$K)

LBL Activities

Engineering

• Title I (2.4 MM at 10.5/mos)		=	25
Proj Arch 1 x 0.3 time x 3 mos	=	0.8MM	
Proj Team 3 x 0.2 time x 3 mos	=	1.6	
• Title II (5.3 MM at 10.5/mos)		=	55
Proj Arch 1 x 0.2 x 7 mos	=	1.2MM	
Proj Team 3 x 0.2 x 7 mos	=	4.1	
• Title III (3.8 MM at 10.5/mos)		=	40
Proj Team 4 x 0.1 x 16 mos	=	3.8	
• Inspection (5.7 MM at 10.5/mos)		=	60
Inspectors 1 x 0.4 x 16 mos	=	5.7	
• Consultants and Vendors		=	20
Independent Seismic Reviews		5	
Independent Cost Estimate		5	
Advertisements/Printing		5	
Construction Testing		5	
			<u>200</u>

A/E Activities

10.4% of designed construction costs (4,250)	440
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Total Estimated ED&I	640
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Current (October 1992) Engineering Rate: \$9.0K/MM

Then Year Engineering Rate: \$9.0K/MM x 1.162* = \$10.5K/MM

*Escalation of 1.162 to Midpoint of Construction

6. SCHEDULE AND COST ESTIMATE

Table 6-2. Project cost summary. All figures are given in thousands of FY 1992 dollars, except the total escalated cost, which is given in thousands of then-year dollars.

1	ALS Beamlines and Experimental Facilities (TEC, then-year \$)	\$ 44,000
1.1	Project Management	2,068
1.2	ALS Beamlines Systems	23,297
1.2.1	Dynamical Phenomena Beamlines	7,364
1.2.2	Chemical Dynamics Beamline	4,873
1.2.3	Circular Polarization Beamline	5,120
1.2.4	Spectroscopy Beamlines	5,940
1.3	Conventional Facilities	4,280
1.3.1	Engineering, Design & Inspection	544
1.3.2	Construction	3,736
1.4	Contingency	7,134
1.4.1	Project Management	414
1.4.2	ALS Beamlines Systems	5,971
1.4.3	Conventional Facilities	750
	Escalation	7,220

6. SCHEDULE AND COST ESTIMATE

Table 6-1. Summary of the bottom-up cost estimate. All costs are shown in thousands of FY 1992 dollars.

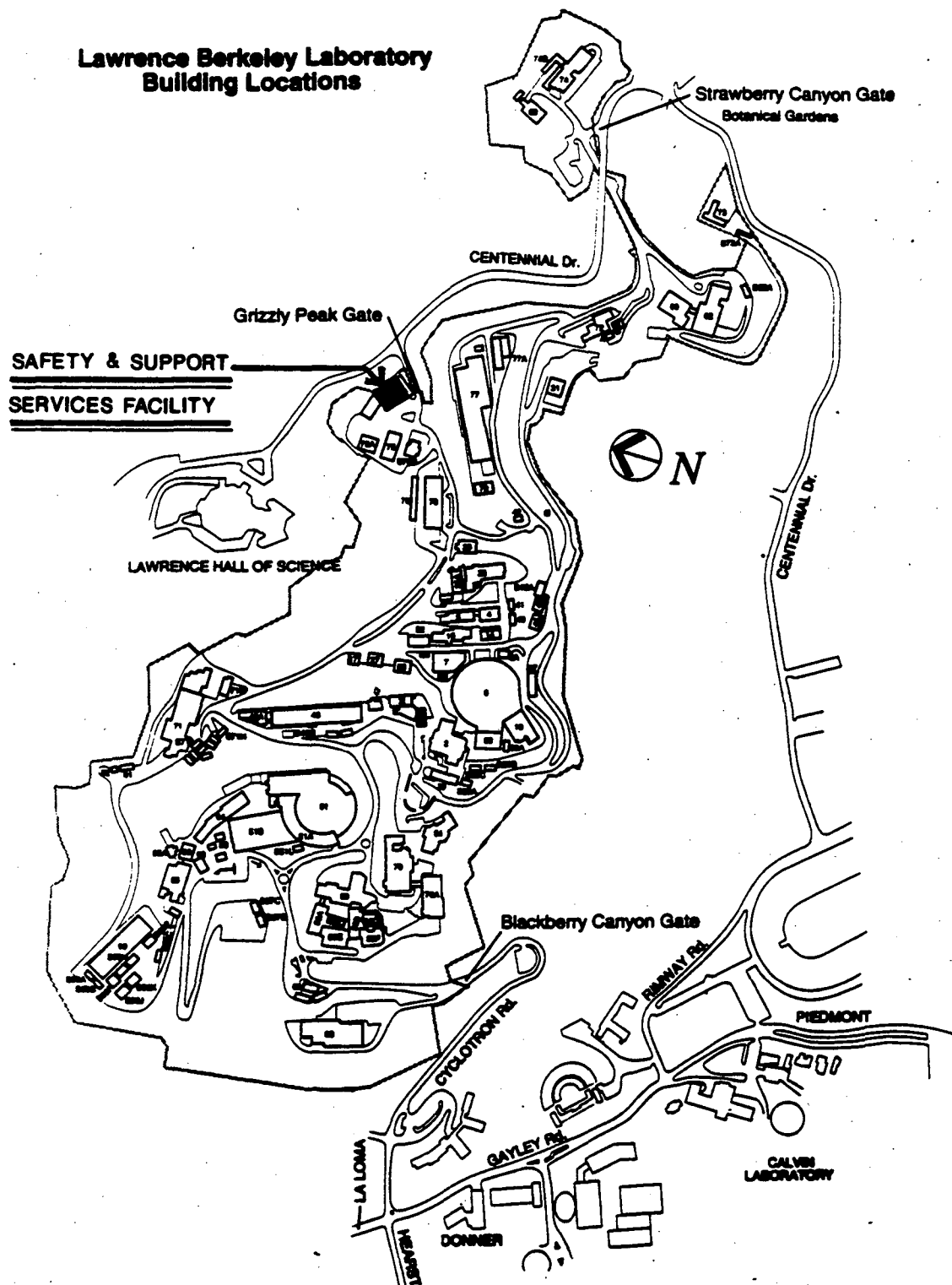
1..	ALS Beamlines Initiative - TEC (costs shown in FY1992 KS)	36,780
1.1.	Project Management	2,068
1.2.	ALS Beamline Systems	23,297
1.2.1	Dynamical Phenomena Beamlines	7,364
1.2.1.1	Engineering, Design, & Inspection	1,726
1.2.1.2	Dynamical Phenomena Beamlines Construction	5,637
1.2.1.2.1	U8 Undulator	1,111
1.2.1.2.2	U8 Beamline Front End	587
1.2.1.2.3	U8 Branchline	1,596
1.2.1.2.4	Bend Magnet Beamline Frontend	368
1.2.1.2.5	Bend Magnet Branchline	1,975
1.2.2	Chemical Dynamics Beamline	4,873
1.2.2.1	Engineering, Design, & Inspection	1,124
1.2.2.2	Chemical Dynamics Beamline Construction	3,749
1.2.2.2.1	U10 Undulator	1,411
1.2.2.2.2	U10 Beamline Front End	587
1.2.2.2.3	U10 Branchline	1,751
1.2.3	Circular Polarization UX Beamline	5,120
1.2.3.1	Engineering, Design, & Inspection	1,301
1.2.3.2	Circular Polarization UX Beamline Construction	3,819
1.2.3.2.1	UX Undulator	1,636
1.2.3.2.2	UX Beamline Front End	587
1.2.3.2.3	UX Branchline	1,596

- continued -

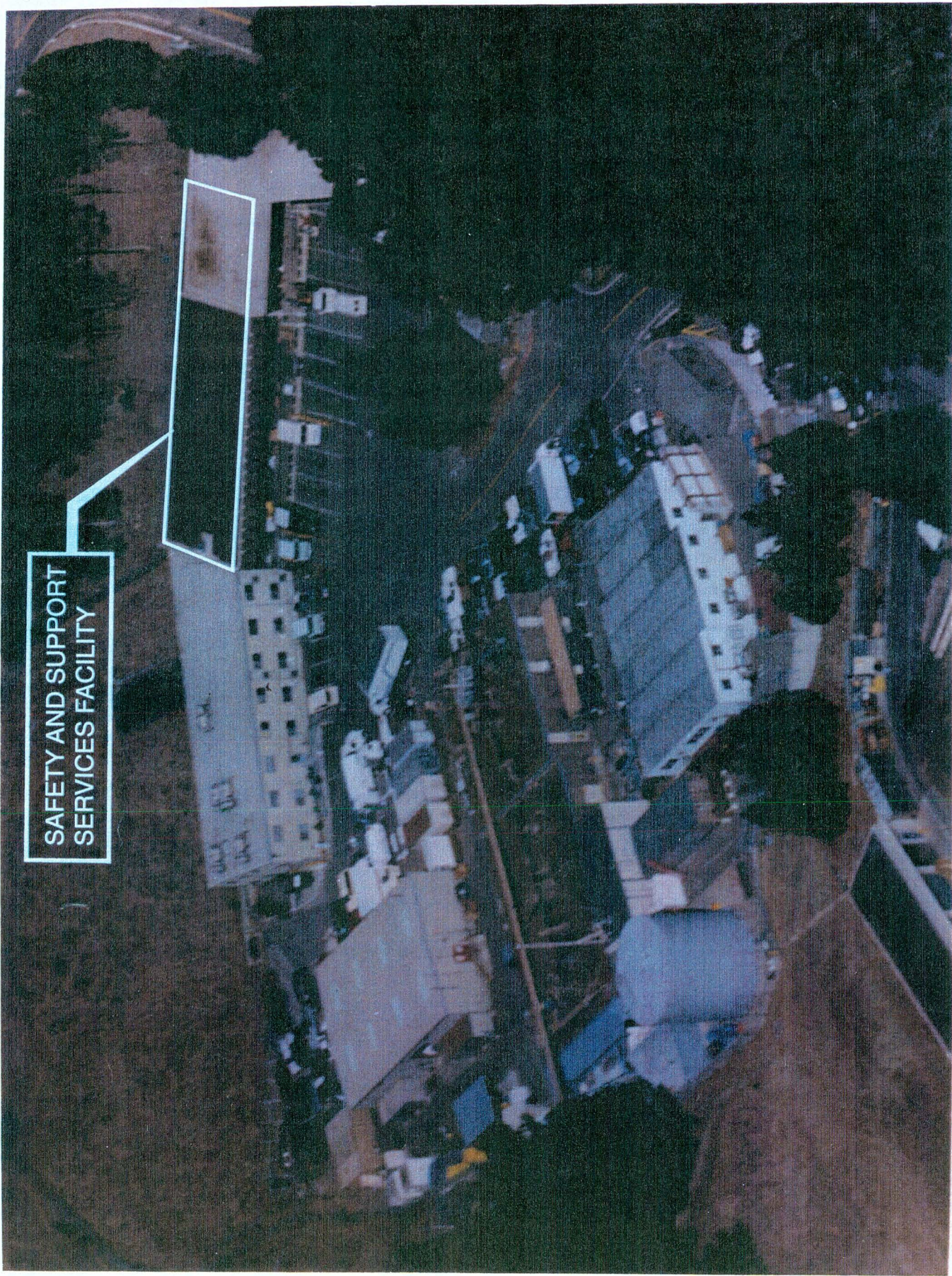
Table 6-1 continued.

1.2.4	Spectroscopy Beamline	5,940
1.2.4.1	Engineering, Design, & Inspection	1,630
1.2.4.2	Spectroscopy Beamline Beamline Construction	4,310
1.2.4.2.1	W16 Wiggler	1,059
1.2.4.2.2	W16 Beamline Front End	622
1.2.4.2.3	W16 Branchlines	2,628
1.3.	Conventional Facilities	4,280
1.3.1	Engineering, Design, & Inspection	544
1.3.1.1	LBL Activities	169
1.3.1.2	AE Activities	375
1.3.2	Construction	3,736
1.3.2.1	Building 6 Construction	2,516
1.3.2.2	Special Building Facilities	452
1.3.2.3	Utilities; Elect Transformer/Switchgear	658
1.3.2.4	Standard Equipment	111
1.4.	Contingency	7,134
1.4.1	Management & Support	414
1.4.2	ALS Beamline Systems	5,971
1.4.3	Conventional Facilities	750

Lawrence Berkeley Laboratory Building Locations



SAFETY AND SUPPORT
SERVICES FACILITY



BBG 920-8335A

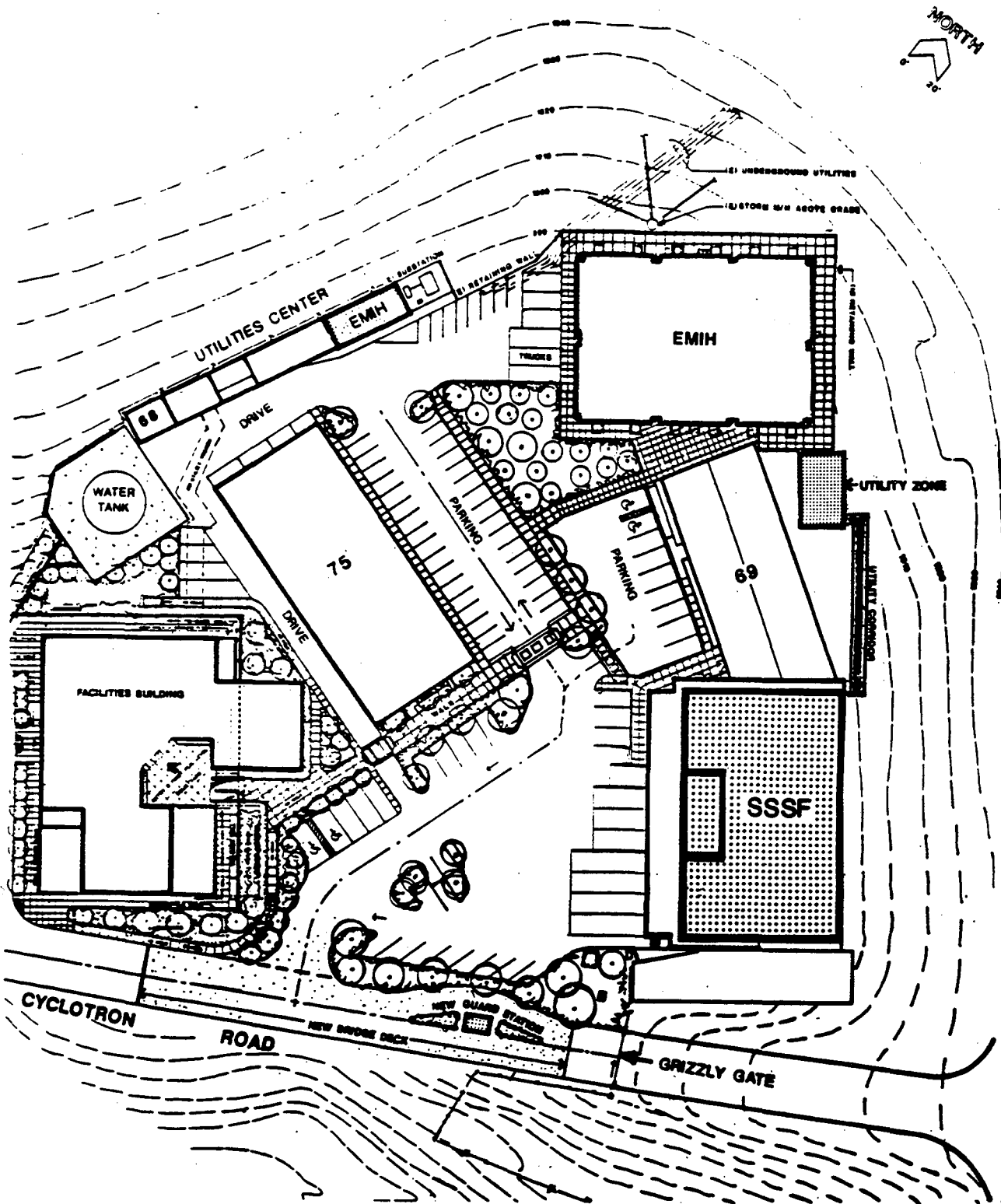
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LAWRENCE BERKELEY LABORATORY MASTER PLANNING
AREA 5

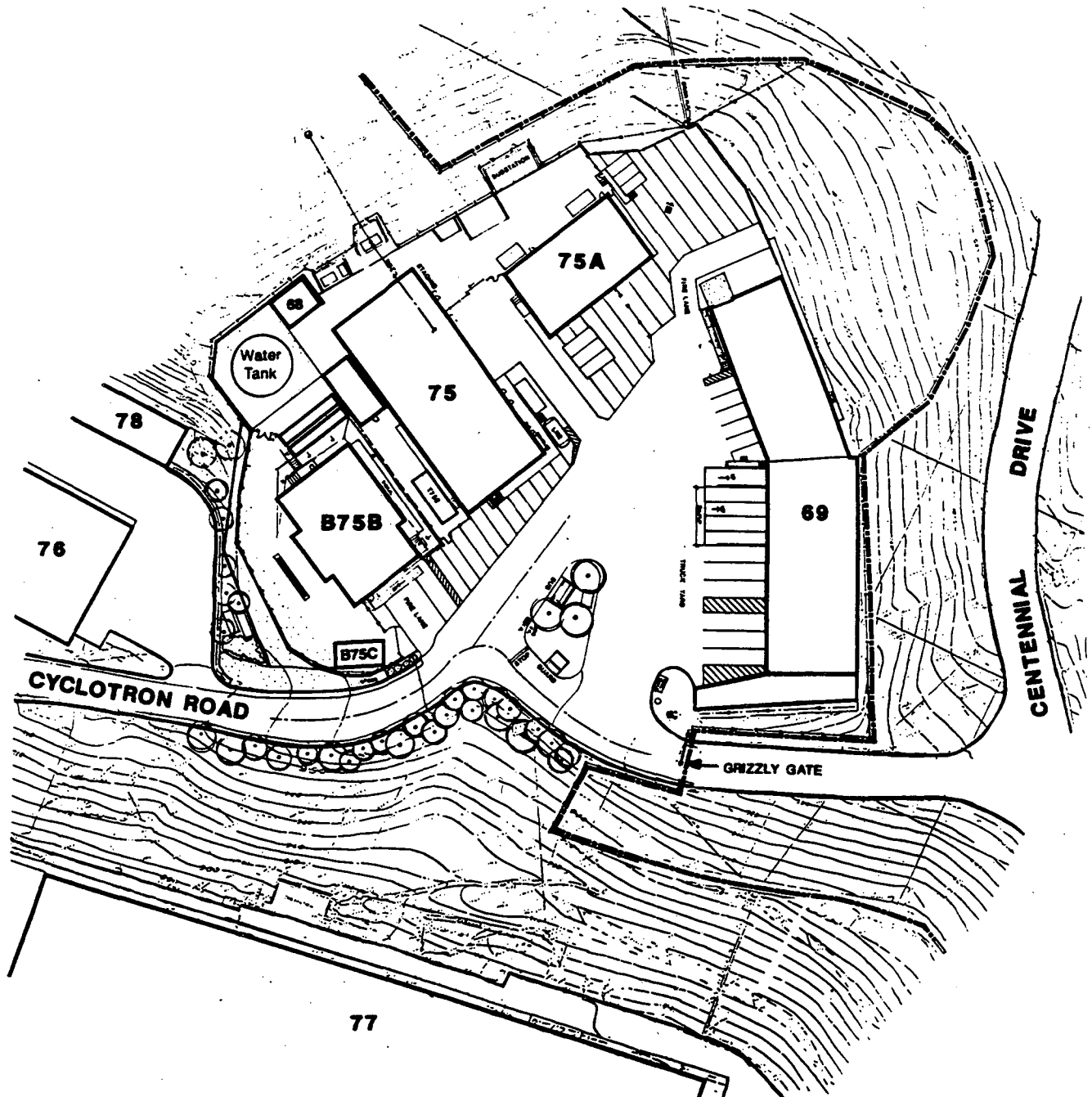


LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

SAFETY & SUPPORT SERVICES FACILITY

SITE PLAN

T-2



SAFETY AND SUPPORT SERVICES FACILITY

PROJECT JUSTIFICATION

- **Provides Necessary Space for Increased Environmental, Health and Safety Management and Planning**
- **Stores and Materiel Management Will Integrate Operations with Allied Business and Supply Services in Adjoining Building 69 to Permit Annual Savings of \$350K**
 - **Combined Supervision**
 - **Reduced Effort and Transportation**
 - **Improved Productivity**
 - **Reduced User Effort and Travel**
 - **Reduced Offsite Stores Activities**
 - **Reduced Maintenance Costs**
- **Physical Consolidation of Loading Dock/ Staging Operations Now in Scattered Locations**

SAFETY AND SUPPORT SERVICES FACILITY

PROJECT JUSTIFICATION (continued)

- **New Facility Will Reduce Inefficiencies through Consolidation of Scattered, Fragmented Activities in 14 Buildings and Trailers**
- **Building 7 is Currently in Violation of NFPA 101- Life Safety Code and DOE 5480.7 - Improved Risk Program**
 - **Building Fire Containment, Fire Suppression and Egress Systems Are Inadequate**
 - **Fire Hazard Presents Potential Threat of Loss to Life or Serious Injury and Loss of Property**
 - **Removal Is Key to Master Plan for Site Development, Will Allow Restoration of "Original Lab Site"**
- **Building 69 Does Not Meet Current Code Requirements for Provision of Restroom Facilities and Accessibility. The Connection to SSSF Will Provide these Amenities without Renovation to Building 69**

SAFETY AND SUPPORT SERVICES FACILITY

PROJECT JUSTIFICATION (continued)

- **34,404 GSF of Temporary Trailers and Old Substandard Building Space Will Be Removed**
- **45 Parking Spaces Will Be Regained and Represent a \$675K One Time Cost Avoidance**
- **Safety Hazards Due to Congested Operations, Traffic and Pedestrian Travel Will Be Mitigated**

SAFETY AND SUPPORT SERVICES FACILITY

PROJECT DESCRIPTION

- **Three Story General Purpose Facility**
 - **32,200 Gross Square Feet**
- **Occupants**
 - **First Level - Central Stores, Shipping and Receiving, and Transportation**
 - **Second Level - Environment, Health and Safety and Materiel Management**
 - **Third Level - Electronics Engineering Shops/ Offices and Environment, Health and Safety**
- **Building Systems**
 - **Structural Steel Braced Frame**
 - **Concrete Slab on Grade, Spread Footings and Caissons**
 - **Metal Panel Siding with Energy Efficient Windows**
 - **Fixed Partition Spaces**

SAFETY AND SUPPORT SERVICES FACILITY

PROJECT DESCRIPTION (continued)

- **Building Systems (continued)**
 - **Work Stations - Relocatable Open-Plan Modular Furniture and Partition Systems**
 - **Elevator**
 - **Automated Warehouse Equipment**
 - **Heating, Air Conditioning and Ventilation**
 - **Wet Pipe Fire Sprinkler System**
 - **Power - 120/208 V, 3 Phase 4 Wire and 277/480 3 Phase**
 - **Telephone and Computer Terminal Conduits**
 - **Public Address and Fire Alarm Systems**
- **Relocations to New Building**

SAFETY AND SUPPORT SERVICES FACILITY

SCHEDULE OF NET AREAS

	Net Area - Square Meters				
	Office	Storage	Shops	Misc Usable	Non Assignable
NET AREA					
First Floor	81	743	0	122	136
Mezzanine Level	0	0	0	0	111
Second Floor	709	0	0	29	142
Third Floor	283	0	288	41	215
Subtotal	1,073	743	288	191	604
Total Net Area	2,295				

GROSS ENCLOSED AREA

First Floor	1,081
Mezzanine Level	111
Second Floor	880
Third Floor	826
Total Gross Enclosed	2,899
Efficiency	0.79

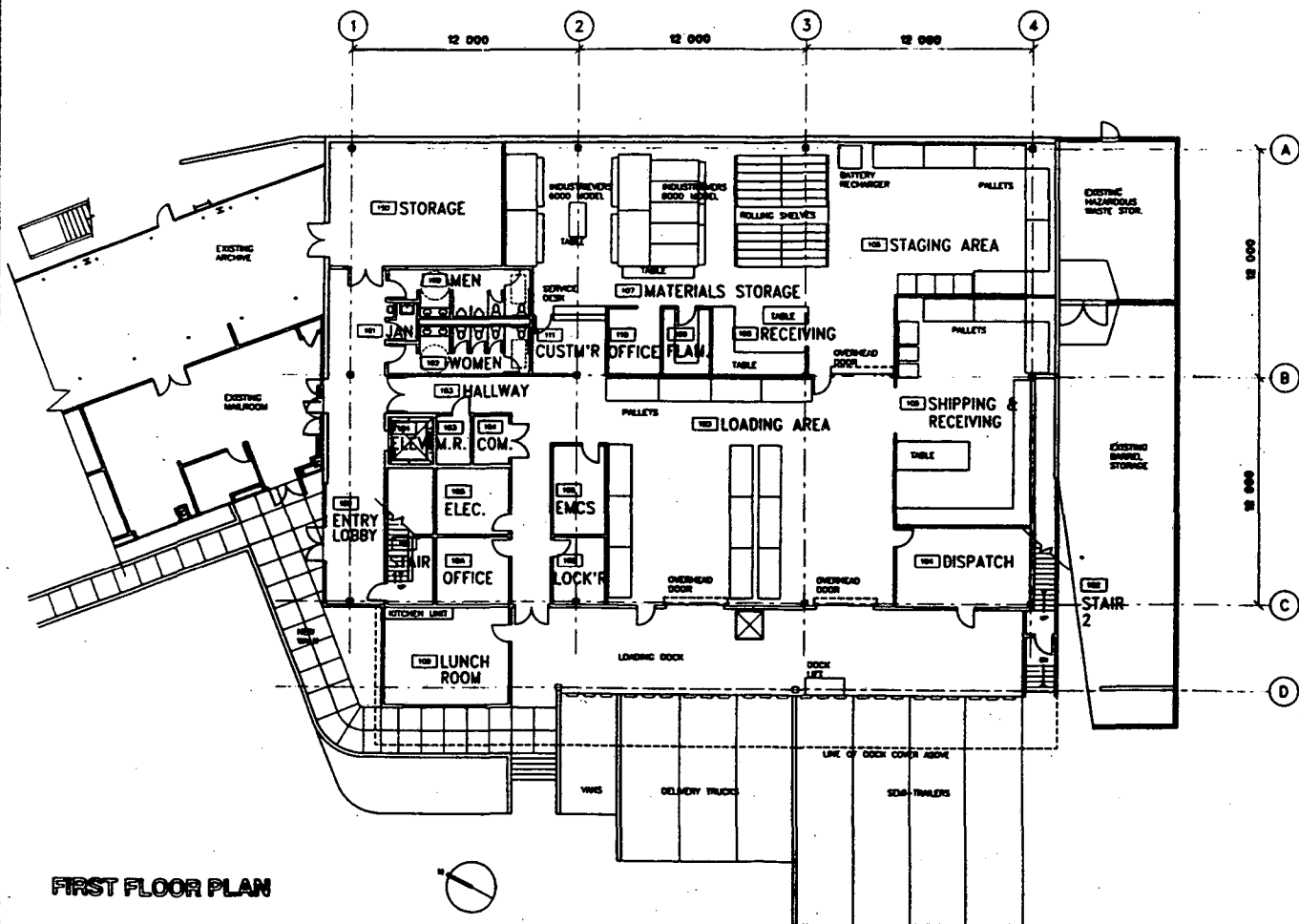
SAFETY AND SUPPORT SERVICES FACILITY

SCHEDULE OF NET AREAS

	Net Area - Square Feet				
	Office	Storage	Shops	Misc Usable	Non Assignable
NET AREA					
First Floor	900	8,250	0	1,350	1,515
Mezzanine Level	0	0	0	0	1,235
Second Floor	7,880	0	0	325	1,578
Third Floor	3,145	0	3,200	450	2,385
Subtotal	11,925	8,250	3,200	2,125	6,713
Total Net Area	25,500				

GROSS ENCLOSED AREA

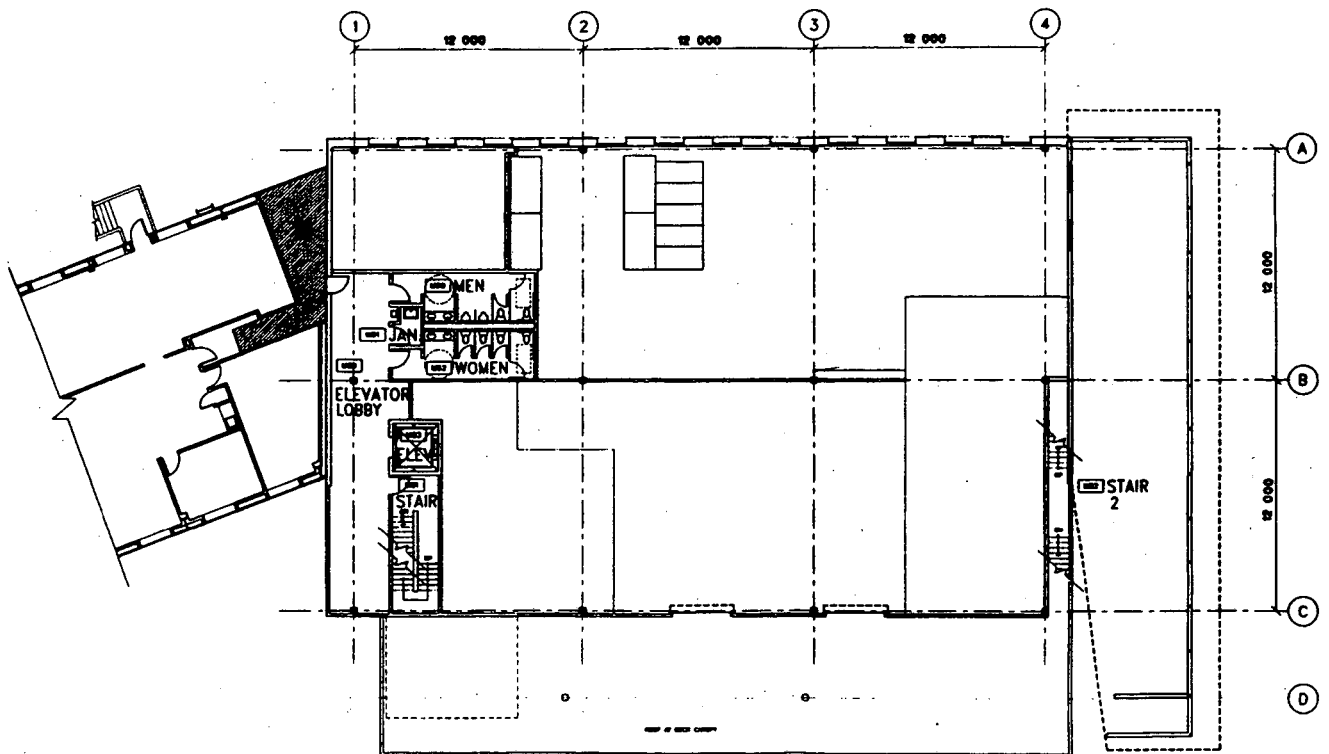
First Floor	12,015
Mezzanine Level	1,235
Second Floor	9,783
Third Floor	9,180
Total Gross Enclosed	32,213
Efficiency	0.79



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SAFETY & SUPPORT SERVICES FACILITY
FIRST FLOOR PLAN

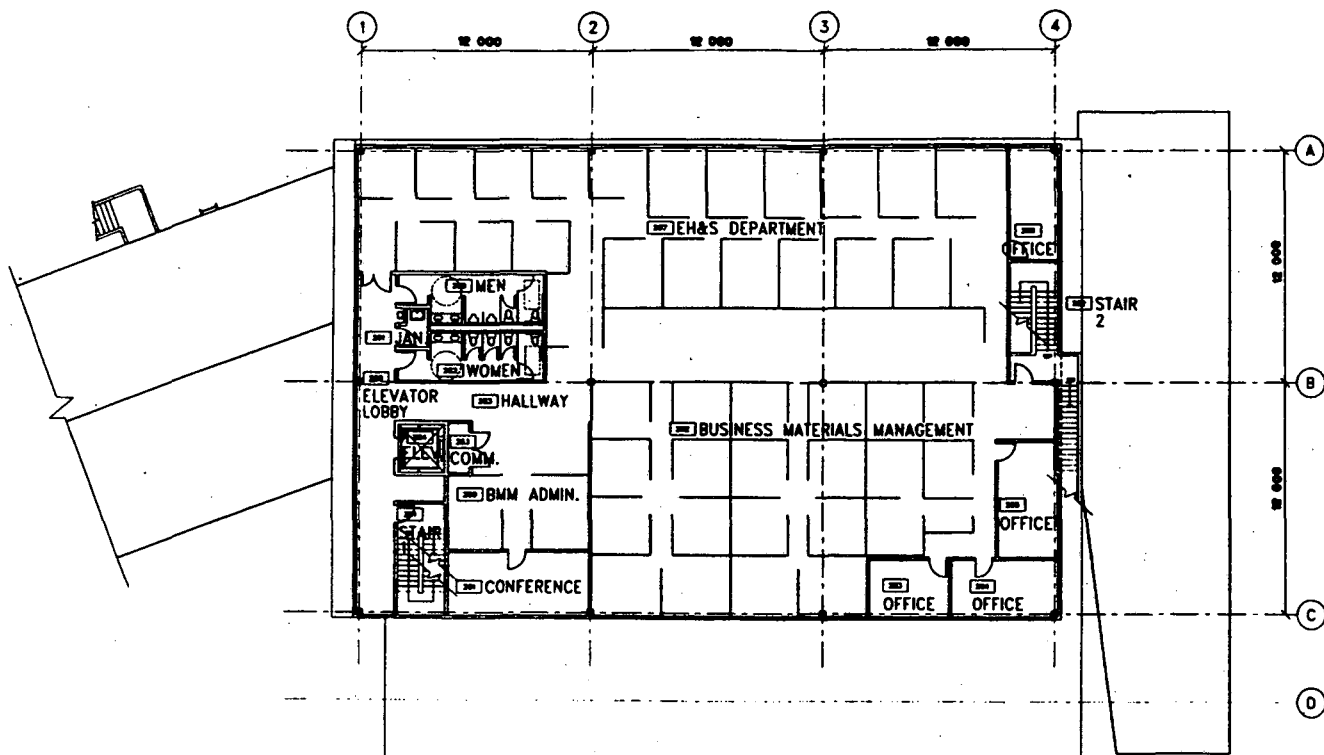
A-1



MEZZANINE FLOOR PLAN

SCALE IN MILLIMETERS





SECOND FLOOR PLAN

SCALE IN MILLIMETERS

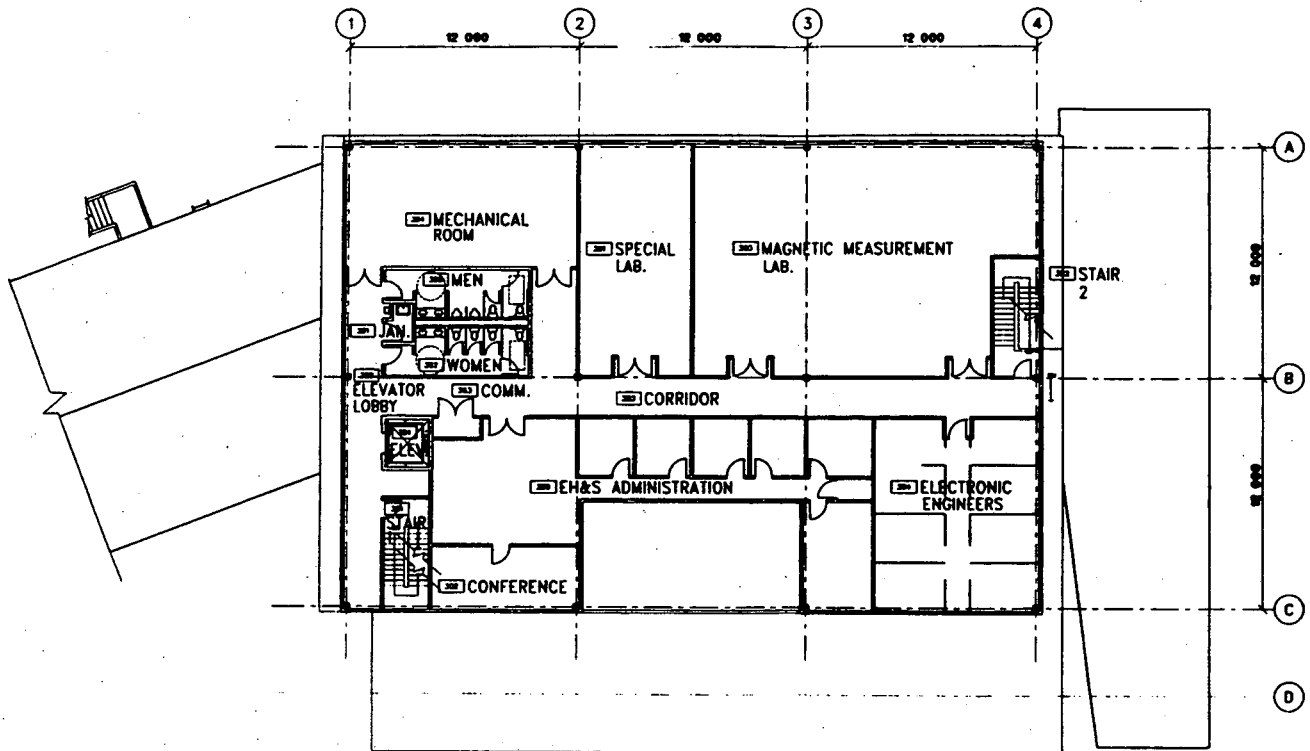


LAWRENCE BERKELEY LABORATORY
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SAFETY & SUPPORT SERVICES FACILITY

SECOND FLOOR PLAN

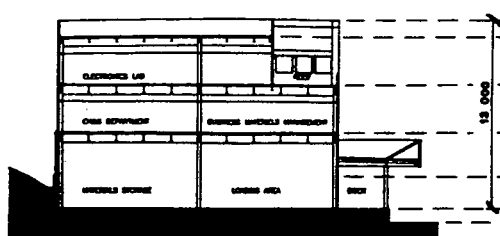
A-3



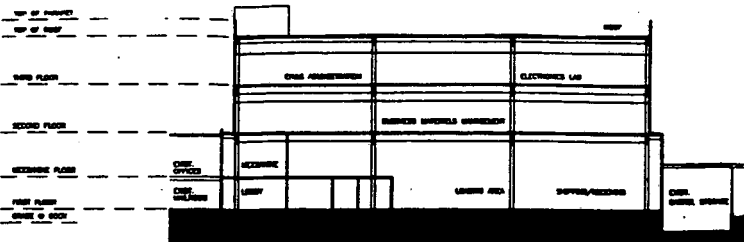
THIRD FLOOR PLAN

SCALE IN MILLIMETERS

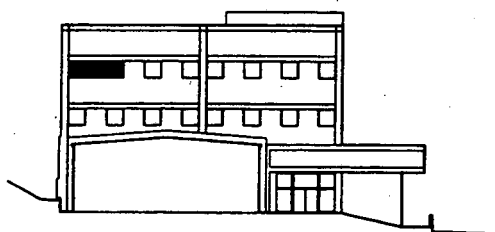




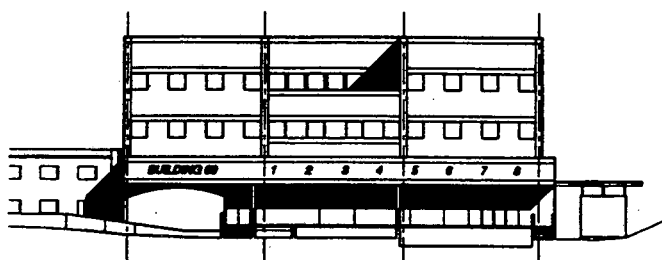
CROSS SECTION



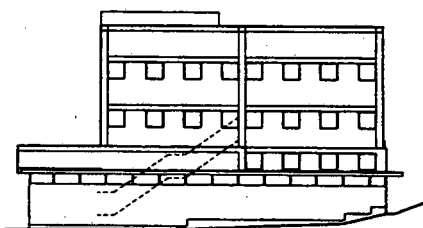
LONGITUDINAL SECTION



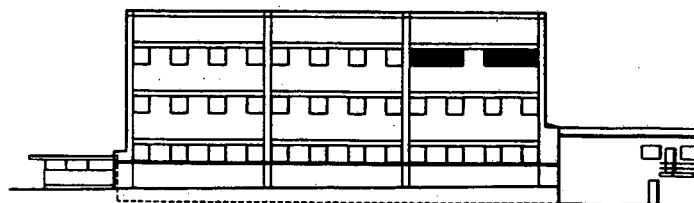
NORTH ELEVATION



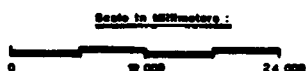
WEST ELEVATION



SOUTH ELEVATION



EAST ELEVATION



LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

SAFETY & SUPPORT SERVICES FACILITY
**BUILDING SECTIONS
&
ELEVATIONS**

A-5

SAFETY AND SUPPORT SERVICES FACILITY

BASIS OF CONCEPTUAL DESIGN

Conceptual Design by LBL Based on Programmatic Criteria Developed by the Environment, Health and Safety Division Staff. Functional Requirements Were Defined by:

- **Richard Medel, Business and Materiel Division Director**
- **Ed Burgess, Engineering Division Director**
- **David McGraw, Environmental Health and Safety Division Director**

The Conceptual Design for the Building, Site Improvements and Utilities Was Developed by the LBL Facilities Department, Architecture and Engineering Sections, with the Support of the Following Consultants:

- **Huntingdon Herzog Associates, Geoscientists**
- **Barfield Associates, Consulting Cost Engineers**
- **Hanscomb Associates, Consulting Cost Engineers**

The Estimate Was Prepared by the LBL Professional Estimator, Naikang Chang, Based on Quantity Take-Offs from Drawings and Specifications Produced by LBL and Input from the Consulting Estimating Firms of Hanscomb Associates and Barfield Associates

SAFETY AND SUPPORT SERVICES FACILITY

METHOD OF ACCOMPLISHMENT

- **Design Prepared by LBL Facilities Department Based upon Programmatic Criteria**
- **A/E Selected by LBL for Titles I and II Design and Title III Technical Oversight During Construction**
- **Construction Work Bid as Lump-Sum Subcontract Awarded After Competitive Bidding**
- **Project Management, Construction Contract Administration and Inspection by LBL**

SAFETY AND SUPPORT SERVICES FACILITY

Initial and Subsequent Use of Space

<u>Old Building</u>	<u>Old Area (NSF)</u>	<u>New Facility Floor Area (NSF)</u>	<u>Difference</u>	<u>New Facility Use</u>	<u>Remarks</u>
Building 7 Ground Floor	6,993	7,170	177	Stores	Demolish B7
Building 7 Ground Floor	2,891	2,400	-491	Matl Mgt	Demolish B7
Trailers 52B, 7A, 7B, 7C, 7E and 53A	3,095	2,000	-1,095	Matl Mgt	Remove Trailers
Building 75 and Trailer 75B	5,000	5,000	0	EH&S	Reduce Overcrowding
Building 7, 2nd Floor	5,565	5,565	0	Elec Engrg	Demolish B7
Building 69	3,272	2,000	-1,272	Trans Mat'l	Consolidate/ Shared Area
Building 69	2,280	1,200	-1,080	Gas Bottle	Inventory Reduction
	<u>29,096</u>	<u>25,335</u>	<u>-3,761</u>		

SAFETY AND SUPPORT SERVICES FACILITY
COST ESTIMATE
(\$K)

A.	1. Engineering, Design, and Inspection	1,440
	(at ~20% of Construction Costs)	
	2. Project Management	500
	(at ~7% of Construction Costs)	
B.	Construction Costs	7,210
	1. Improvements to Land	120
	2. Building (2,290 GSM or 32,200 GSF	5,870
	@ \$182/SF)	
	3. Special Facilities (Schedule I)	810
	4. Utilities	220
	5. Related Demolition and Removals	190
C.	Standard Equipment (Schedule II)	20
D.	Relocations	<u>400</u>
	Subtotal	9,570
E.	Contingency (at ~20% of Above Costs)	<u>1,930</u>
	Total Estimated Cost*	11,500

***Application of 16% LBL Overhead Not Included in TEC**

SAFETY AND SUPPORT SERVICES FACILITY

SCHEDULE I (\$K)

	<u>Estimated Cost</u>
<u>Special Facilities</u>	
Open Plan Partitions System and Ancillary Furniture	489
Mechanized Vertical Storage and Retrieval System	<u>321</u>
Total Estimated Cost	810

SCHEDULE II (\$K)

	<u>Estimated Cost</u>
<u>Standard Equipment</u>	
Office Furniture, Miscellaneous Cabinets	20

SAFETY AND SUPPORT SERVICES FACILITY

FINANCIAL SCHEDULE (\$K)

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1995	1,600	1,600	1,040
1996	800	800	1,200
1997	4,600	4,600	4,620
1998	<u>4,500</u>	<u>4,500</u>	<u>4,640</u>
Total	11,500	11,500	11,500

Note: Application of 16% LBL Overhead to New FY 1995 Construction Projects Will Increase the TEC and TPC of this Project to \$13,300K and \$13,600K, Respectively. The Appropriations and Obligations Columns Will Increase to \$1,900K in FY95, \$900K in FY96, \$5,300K in FY97, and 5,200K in FY98

SAFETY AND SUPPORT SERVICES FACILITY

TOTAL PROJECT COSTS (TPC) (\$K)

	<u>Prior Years</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>Total</u>
Total Project Costs (TPC)						
(1) Total Facility Costs (Construction Line Item - TEC)	0	1,040	1,200	4,620	4,640	11,500
(2) Other Project Costs						
(a) Conceptual Design	80	0	0	0	0	80
(b) Environmental and Safety (NEPA & SAD) Documentation	100	50	0	0	0	150
(c) Pre Title I	<u>40</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>40</u>
Total Other Project Costs	220	50	0	0	0	270
 Total Project Cost	 220	 1,090	 1,200	 4,620	 4,640	 <u>11,770*</u>

*Application of 16% LBL Overhead to New FY 1995 Construction Projects Will Increase the TPC to \$13,600K

SAFETY AND SUPPORT SERVICES FACILITY

CONTINGENCY ANALYSIS

	Estimated Cost (\$K)	Contingency (%)	Contingency (\$K)
<u>LBL Activities</u>			
Engineering			
Title I	130	15	20
Title II	200	15	30
Title III	80	20	16
Inspection	160	20	32
Consultants	70	15	14
<u>Architect/Engineer</u>			
Title I	280	15	42
Title II	360	15	54
Title III	160	20	32
<u>Construction</u>			
Improvements to Land	120	25	30
Utilities	220	25	55
Building	5,870	20	1,173
Special Facilities	810	25	203
Related Demolition and Removals	190	20	45
<u>Relocations</u>	400	25	80
<u>Standard Equipment</u>	20	25	4
<u>Project Management</u>	500	15	100
Subtotal	9,570		1,930
Contingency (20%)	1,930		
TOTAL	11,500		

SAFETY AND SUPPORT SERVICES FACILITY																																			
BA/BO SCHEDULE (\$K)																																			
WBS NO.	WBS ELEMENT	TOTAL BUDGET	FY 1995				FY 1996				FY 1997				FY 1998																				
			1		2		3		4		1		2		3		4																		
			O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
1.0	Engineering, Design & Inspection																																		
1.1	LBL Activities																																		
1.1.1.1	Title I	130																																	
1.1.1.2	Title II	200																																	
1.1.1.3	Title III	80																																	
1.1.2	Inspection	160																																	
1.1.3	Consultants	70																																	
1.2	Architect/Engineer																																		
1.2.1	Title I	280																																	
1.2.2	Title II	360																																	
1.2.3	Title III	160																																	
2.0	Construction																																		
2.1	Improvements to Land	120																																	
2.2	Utilities	220																																	
2.3	Building	5870																																	
2.4	Special Facilities	810																																	
2.5	Related Demolition/Removals	190																																	
3.0	Relocations	400																																	
4.0	Standard Equipment	20																																	
5.0	Project Management	500																																	
Contingency by Year			1930/1930				500 / 495				160 / 165				810 / 870				460 / 400																
Total BA/BO by Year			11500/11500				1600 / 1040				800 / 1200				4600 / 4620				4500 / 4640																
Current Funding Plan			11500				1600				800				4600				4500																

A&E: SSSF:CDR
4/21/93

SAFETY AND SUPPORT SERVICES FACILITY

TIME SCHEDULE

Activity Name	Fiscal Year 1994				Fiscal Year 1995				Fiscal Year 1996				Fiscal Year 1997				Fiscal Year 1998			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
NEPA/SARS																				
A/E SELECTION (COMPLETED IN FY93)																				
A/E NEGOTIATION																				
FUNDING AUTHORIZATION																				
TITLE I - DESIGN																				
TITLE II - DOCUMENTS																				
BID AND AWARD																				
TITLE III																				
CONSTRUCTION																				
BUILDING 7 DEMOLITION																				
RELOCATIONS/TEMPORARY FACILITIES/ACTIVATION																				

SAFETY AND SUPPORT SERVICES FACILITY

ESTIMATE SUMMARY

Improvements to Land (Div 2 Site Work)

General Site Work		<u>83,300</u>
General Conditions/Mobilize	8%	6,664
Estimating Contingency		<u>In Project Contingency</u>
		89,964
Bond	2%	1,799
Prime Contractor OH & Fee	12%	<u>10,796</u>
Total Estimated Construction Cost at January 1993		<u>102,559</u>
Total Escalated Construction Cost to July 1997	19%	<u>122,045</u>
	Say	120,000

SAFETY AND SUPPORT SERVICES FACILITY

ESTIMATE SUMMARY (continued)

Building 2,990 GSM (32,200 GSF)

Div 2	Sitework	208,170
Div 3	Concrete	480,688
Div 5	Metals	776,240
Div 7	Thermal and Moisture Protection	704,581
Div 8	Doors and Windows	165,240
Div 9	Finishes	296,113
Div 10	Specialties	120,260
Div 14	Conveying Systems	90,000
Div 15	Plumbing	140,340
Div 15	HVAC	540,000
Div 15	Fire Protection	74,550
Div 16	Electrical	300,650
Div 17	EMCS Controls	<u>110,000</u>

Subtotal Direct Cost 4,006,832

General Conditions/Mobilize 8% 320,547
Estimating Contingency In Project Contingency
4,327,379

Bond 2% 86,548
Prime Contractor OH & Fee 12% 519,285

Total Estimated Construction Cost
at January 1993 4,933,212

Total Escalated Construction Cost
to July 1997 19% 5,870,522

Say 5,870,000

SAFETY AND SUPPORT SERVICES FACILITY

ESTIMATE SUMMARY (continued)

Special Facilities

1. Open Plan Moveable Partitions and Ancillary Furniture	411,285
---	----------------

2. Mechanized Vertical Storage and Retrieval System	<u>270,000</u>
--	-----------------------

Total Estimated Construction Cost at January 1993	681,285
--	----------------

Total Escalated Construction Cost to July 1997	19%	<u>810,729</u>
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Say	810,000
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SAFETY AND SUPPORT SERVICES FACILITY

ESTIMATE SUMMARY (continued)

Site Utilities (Div 2 Site Work)

Mechanical and Electrical Site Utilities	<u>150,000</u>
---	-----------------------

General Conditions/Mobilize	8%	12,000
Estimating Contingency		<u>In Project Contingency</u>
		162,000

Bond	2%	3,240
Prime Contractor OH & Fee	12%	<u>19,440</u>

Total Estimated Construction Cost at January 1993	<u>184,680</u>
--	-----------------------

Total Escalated Construction Cost to July 1997	19%	<u>219,769</u>
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	Say	220,000
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SAFETY AND SUPPORT SERVICES FACILITY

ESTIMATE SUMMARY (continued)

Related Demolition and Removal

Demolish Building 7, Remove Building 52, Building 7A-B-C-E, and Building 53A	<u>150,000</u>
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Total Estimated Demolition and Removal Cost at February 1993	<u>150,000</u>
---	-----------------------

Total Escalated Construction Cost to July 1998	24%	<u>186,000</u>
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Say	190,000
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SAFETY AND SUPPORT SERVICES FACILITY

ESTIMATE SUMMARY (continued)

Standard Equipment

Subtotal	<u>20,000</u>
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Total Estimated Construction Cost at January 1993	20,000
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Total Escalated Construction Cost to July 1997	19%	<u>23,800</u>
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Say	20,000
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SAFETY AND SUPPORT SERVICES FACILITY

ESTIMATE SUMMARY (continued)

Relocations

Personnel	<u>377,000</u>
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Total Estimated Construction Cost at January 1993	377,000
--	----------------

Total Escalated Construction Cost to July 1997	18%	<u>397,600</u>
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Say	400,000
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SAFETY AND SUPPORT SERVICES FACILITY

OBLIGATIONS AND COSTS SCHEDULE DETAIL (\$K)

DESCRIPTION	TOTAL	FY 1995		FY 1996		FY 1997		FY 1998	
		O	C	O	C	O	C	O	C
<u>LBL Activities</u>									
Title I Engineering	130	130	130						
Title II Engineering	200			200	200				
Title III Engineering	80					40	40	40	40
Inspection	160					80	80	80	80
Consultants	<u>70</u>	<u>70</u>	<u>35</u>	<u>0</u>	<u>35</u>	—	—	—	—
Subtotal	640	200	165	200	235	120	120	120	120
<u>Architect/Engineer</u>									
Title I	280	280	280						
Title II	360	360	0	0	360				
Title III	<u>160</u>	<u>160</u>	<u>0</u>	—	—	<u>0</u>	<u>80</u>	<u>0</u>	<u>8</u>
Subtotal	800	800	280	0	360	0	80	0	80
<u>Construction</u>									
Improvements to Land	120					120	0	0	120
Utilities	220					110	110	110	110
Buildings	5,870					2,935	2,935	2,935	2,935
Special Facilities	810					405	405	405	405
Related Demolition	<u>190</u>					—	—	<u>190</u>	<u>190</u>
Subtotal	7,210					3,570	3,450	3,640	3,760
<u>Relocations</u>	400			340	340			60	60
<u>Standard Equipment</u>	20							20	20
<u>Project Management</u>	500	100	100	100	100	100	100	200	200
Subtotal	9,570	1,100	545	640	1,035	3,790	3,750	4,040	4,240
Contingency (20%)	<u>1,930</u>	<u>500</u>	<u>495</u>	<u>160</u>	<u>165</u>	<u>810</u>	<u>870</u>	<u>460</u>	<u>400</u>
TOTAL	11,500	1,600	1,040	800	1,200	4,600	4,620	4,500	4,640

SAFETY AND SUPPORT SERVICES

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates"
(Updated August 1992)

Start Construction: October 1996

Construction Period: 19 Months

Finish Construction: May 1998

Midpoint Construction: July 1997

Estimate Date: January 1993

CONSTRUCTION

							<u>%</u>
FY 1993	Feb 1993	-	Sep 1993	8 mo @	3.0	=	1.9
FY 1994	Oct 1993	-	Sep 1994	12 mo @	3.9	=	3.9
FY 1995	Oct 1994	-	Sep 1995	12 mo @	4.1	=	4.1
FY 1996	Oct 1995	-	Sep 1996	12 mo @	4.3	=	4.3
FY 1997	Oct 1996	-	Jul 1997	10 mo @	4.5	=	3.6
Total Compounded Escalation							19

SAFETY AND SUPPORT SERVICES

ESCALATION ANALYSIS (continued)

**Based on DOE "Anticipated Economic Escalation Rates"
(Updated August 1992)**

Start Construction: April 1998
Construction Period: 6 Months
Finish Construction: September 1998
Midpoint Construction: July 1998
Estimate Date: January 1993

DEMOLITION AND REMOVALS

								<u>%</u>
FY 1993	Feb 1993	-	Sep 1993	8	mo @	3.0	=	1.9
FY 1994	Oct 1993	-	Sep 1994	12	mo @	3.9	=	3.9
FY 1995	Oct 1994	-	Sep 1995	12	mo @	4.1	=	4.1
FY 1996	Oct 1995	-	Sep 1996	12	mo @	4.3	=	4.3
FY 1997	Oct 1996	-	Sep 1997	12	mo @	4.5	=	4.5
FY 1998	Oct 1997	-	Jul 1998	9	mo @	4.5	=	3.4

Total Compounded Escalation 24

SAFETY AND SUPPORT SERVICES FACILITY

ED&I ANALYSIS

(\$K)

LBL Activities

Title I	12.1MM at 10.7 K/mo		=	130
Proj Engineer	0.50 time x 9 mos	=	4.5 MM	
Proj Team	2 x 0.43 time x 9 mos	=	7.6 MM	
Title II	18.7MM at 10.7K/mo		=	200
Proj Engineer	0.50 time x 12 mos	=	6.0 MM	
Proj Team	3 x 0.35 x 12 mos	=	12.6 MM	
Title III	7.5MM at 10.7K/mo		=	80
Proj Engineer	0.20 time x 18 mos	=	3.6 MM	
Proj Team	1 x 0.22 x 18 mos	=	3.9 MM	
Inspection	14.9MM at 10.7K/mos		=	160
Inspectors	2 x 0.42 time x 18 mos	=	14.9 MM	
Consultants				70
Geotechnical Report and Inspection			10	
Independent Seismic Reviews			10	
Independent Cost Estimates			10	
Surveying/Soils			10	
Testing Laboratories			15	
Independent Design Reviews			15	

A/E Activities

Approximately 11% of Designed Construction Costs	(\$7,210)	800
Title I (35%)	280	
Title II (45%)	360	
Title III (20%)	160	

Total Estimated ED&I

1,440

Current FY93 LBL Rate: 9.0K/MM
Escalation to July 1997 at 19%: 10.7K/MM

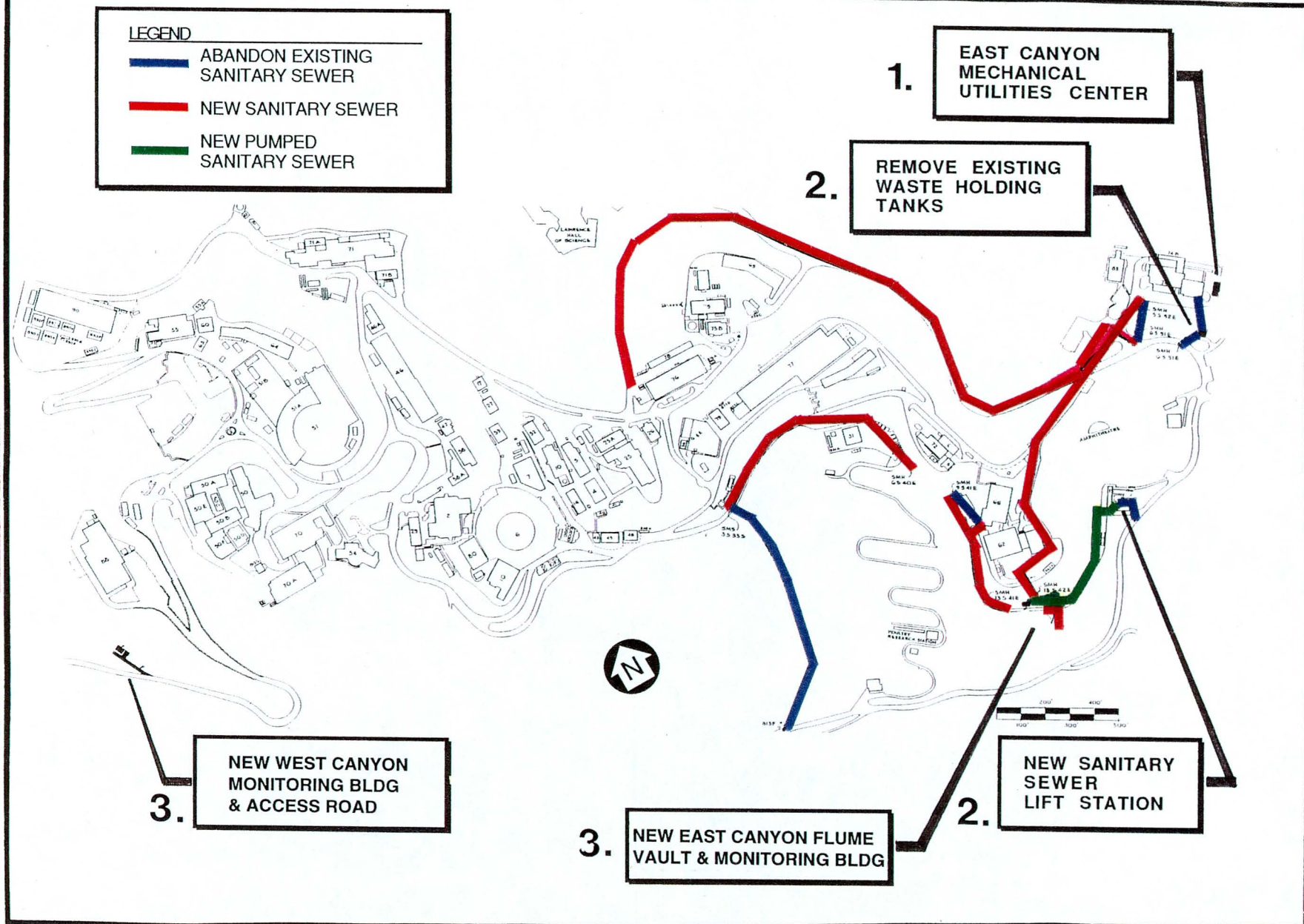


LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

LOCATION MAP
EAST CANYON SANITARY SEWER MODIFICATIONS
EAST & WEST CANYON WASTE MONITORING FACILITIES
EAST CANYON MECHANICAL UTILITIES CENTER

UPGRADE OF SITE MECHANICAL UTILITIES, PH II - SEWER MONITORING

1



UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

PROJECT DESCRIPTION

Four Distinct Parts

1. EAST CANYON UTILITY CENTER AND CENTRAL COOLING SYSTEM

- **Two-Story, Reinforced Concrete Central Plant**
- **Site Allows for Future Expansion**
- **One 300 Ton Cooling Tower**
- **Two 150 Ton Chillers**
- **Standby Generator**
- **1,000 kVA Substation (12 kV)**
- **Space for Two Future Air Compressors**
- **Underground Utility Tunnel**

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

PROJECT DESCRIPTION (continued)

2. EAST CANYON SANITARY SEWER MODIFICATIONS

- **Isolate Lawrence Hall of Science, Space Science, Math Science and Others to Campus System**
- **Isolate Buildings in East Canyon LBL System**
- **Abandon 2,000 LF of Existing Lines**
- **Install 6,300 LF of 6" and 8" PVC Lines**
- **New Manholes**

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

PROJECT DESCRIPTION (continued)

3. SEWER MONITORING FACILITIES

- **Two Separate Facilities - East Canyon and West Canyon**
- **Reinforced Concrete Underground Vault**
 - **Flume to Measure Flow**
 - **Sensors and Sampling Pumps**
- **20' x 30' Reinforced Concrete Monitoring Building**
 - **Flow Totalizer**
 - **Analysis Laboratory**
 - **Suspended Solids**
 - **pH**
 - **Radioactive Contaminants**
 - **Heavy Metals**
 - **Solvents**
- **Connected to EMCS**

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

PROJECT DESCRIPTION (continued)

4. CATHODIC PROTECTION

- **Existing CA, LCW and TRW Lines**
- **Impressed Current and Sacrificial Anode Type**

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

CHANGES SINCE 1992 VALIDATION

Scope

- **No Change**

Schedule

- **Funding and Schedule
Deferred from FY93 to FY95**

TEC*

- **Increased from \$7.1M to \$7.6M
Due to Escalation**
- **Project Management Costs
Increased from 5% to 7%**

***Application of 16% LBL Overhead Not Included in TEC**

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

COST ESTIMATE (\$K) CHANGES SINCE 1992 VALIDATION

		<u>1992 Validation</u>	<u>Changes</u>	<u>Escalation</u>		<u>1993 Validation</u>
A.	1. ED&I	(18%) 900	0	50	(18%)	950
	2. Project Management	(5%) 250	0	110	(7%)	360
B.	Construction Costs	4,980	0	190		5,170
	1. Utilities	4,980	0	190		5,170
	Subtotal	6,130	0	350		6,480
C.	Contingency	(16%) <u>970</u>	<u>0</u>	<u>150</u>	(17%)	<u>1,120</u>
	Total Estimated Cost	7,100	50	450		7,600

**UPGRADE OF SITE MECHANICAL UTILITIES,
PHASE II - SEWER MONITORING**

**FINANCIAL SCHEDULE
(\$K)**

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1995	1,000	1,000	550
1996	3,100	3,100	1,360
1997	3,100	3,100	2,840
1998	<u>400</u>	<u>400</u>	<u>2,850</u>
Total	7,600	7,600	7,600

Note: Application of LBL Overhead to New FY 1995 Construction Projects Will Increase the TEC to 8,700K. The Appropriations and Obligations Will Increase to \$1,400K in FY95, \$3,300K in FY96, \$3,300K in FY97 and \$700K in FY98

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

TOTAL PROJECT COSTS (TPC) (\$K)

	<u>Prior Years</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>Total</u>
Total Project Costs (TPC)						
(1) Total Facility Costs (Construction Line Item - TEC)	0	550	1,360	2,840	2,850	7,600
(2) Other Project Costs						
(a) Conceptual Design Cost	<u>50</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>50</u>
Total Project Cost	50	550	1,360	2,840	2,850	<u>7,650*</u>

*Application of 16% LBL Overhead to New FY 1995 Construction Projects Will Increase the TPC to \$75,100K

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

CONTINGENCY ANALYSIS

	Estimated Cost (\$K)	Contingency (%)	(\$K)
<u>LBL Activities</u>			
Title I	40	15	6
Title II	80	20	16
Title III	80	20	16
Inspection	50	20	10
Consultants	90	15	15
<u>Architect/Engineer</u>			
Title I	180	15	25
Title II	310	20	60
Title III	120	20	25
<u>Construction</u>			
Utilities	5,170	17	892
<u>Project Management</u>	<u>360</u>	15	<u>55</u>
Subtotal	6,480		1,120
Contingency (17%)	1,120		
TOTAL	7,600		

BA/BO SCHEDULE (\$K)

04-16-93
A&E:UpgMechUtilPhII:CDR

**UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II -
SEWER MONITORING**

TIME SCHEDULE

Activities	Fiscal Year 1994				Fiscal Year 1995				Fiscal Year 1996				Fiscal Year 1997				Fiscal Year 1998			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
NEPA/SARS																				
A/E SELECTION																				
A/E NEGOTIATION																				
FUNDING AUTHORIZATION																				
TITLE I																				
TITLE II																				
BID AND AWARD																				
TITLE II I																				
CONSTRUCTION																				

3/29/93

A&E:UpgMechUtilIII:CDR

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

PROJECT JUSTIFICATION

1. EAST CANYON UTILITY CENTER AND CENTRAL COOLING SYSTEM

- **Provide Needed Cooling Capacity for Building 74**
- **Serve Increased Utility Demands in the East Canyon Area**
- **Reduce Roof Maintenance at Building 74 by Removing Rooftop HVAC Equipment**

2. EAST CANYON SANITARY SEWER MODIFICATIONS

- **Protect DOE Interests by Separating LBL Waste From UC Waste**
- **Consolidate and Upgrade Monitoring Facilities**

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

PROJECT JUSTIFICATION (continued)

3. SEWER MONITORING FACILITIES

- **Comply with Current State and Local Environmental Regulations**
- **Not Economically Feasible to Upgrade West Canyon Monitoring Facility**
- **Reduce Number of Monitoring Facilities in East Canyon from Five to One**

4. CATHODIC CORROSION PROTECTION

- **Protect Buried Cooling Water and Compressed Air Lines**

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

BASIS OF CONCEPTUAL DESIGN

- **Project and Program Development by
LBL Facilities Department**
- **Conceptual Design Development by G.T.
Kuntz Consulting Engineering under the
Direction of LBL Facilities Department**
- **Construction Cost Estimate January 1991
by G.T. Kuntz Consulting Engineering
Checked by Derek Daniels, LBL Cost
Estimator**

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

METHOD OF ACCOMPLISHMENT

- **LBL Facilities Department Will Provide Project Management, Design Management, Construction Management and Construction Inspection**
- **LBL Environment, Health and Safety Division Will Provide Review of Design and Construction**
- **Titles I, II and III Engineering Will Be Accomplished by an A/E Firm under a Negotiated, Lump-Sum Subcontract**
- **Construction Will Be Accomplished by Competitively-Bid Construction Subcontracts**
- **LBL Facilities Department Will Provide Minor Amounts of Support to the Construction Subcontracts as Required**

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

COST ESTIMATE (\$K)

A.	1. Engineering, Design, and Inspection (at ~18% of Construction Costs)	950
	2. Project Management (at ~7% of Construction Costs)	360
B.	Construction Costs	5,170
	1. Utilities	5,170
C.	Relocations/Removals	<u>0</u>
	Subtotal	6,480
D.	Contingency (at ~17% of Above Costs)	<u>1,020</u>
	Total Estimated Cost*	7,600

***Application of 16% LBL Overhead Not Included in TEC**

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

ESTIMATE SUMMARY

Utilities

East Canyon Sanitary Sewer Modifications	647,720
East Canyon Waste Monitoring Facility	530,700
West Canyon Waste Monitoring Facility	404,270
East Canyon Mechanical Utilities Center	1,608,790
Energy Efficiency Measures	129,000
Cathodic Corrosion Protection	<u>103,000</u>

Subtotal Direct Cost 3,423,480

General Conditions/Mobilize	7%	239,640
Estimating Contingency		<u>In Project Contingency</u>
		3,663,120

Bond	2%	73,260
Prime Contractor OH & Fee	11%	<u>402,950</u>

Total Estimated Construction Cost at February 1991 4,139,330

Total Escalated Construction Cost to August 1997 25% 5,174,163

Say 5,170,000

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

OBLIGATIONS AND COSTS SCHEDULE DETAIL (\$K)

DESCRIPTION	TOTAL	FY 1995		FY 1996		FY 1997		FY 1998	
		O	C	O	C	O	C	O	C
<u>LBL Activities</u>									
Engineering									
Title I	40	40	40						
Title II	80	20	20	60	60				
Title III	80					40	40	40	40
Inspection	50			10	10	25	25	15	15
Consultants	<u>90</u>	<u>35</u>	<u>35</u>	<u>30</u>	<u>30</u>	<u>25</u>	<u>25</u>	—	—
Subtotal	340	95	95	100	100	90	90	55	55
<u>Architect/Engineer</u>									
Title I	180	180	180						
Title II	310	310	90	0	220				
Title III	<u>120</u>	<u>120</u>	<u>0</u>	<u>0</u>	<u>30</u>	<u>0</u>	<u>60</u>	<u>0</u>	<u>30</u>
Subtotal	610	610	270	0	250	0	60	0	30
<u>Construction</u>									
Subcontract	5,170			600	800	2,570	2,370	0	2,000
<u>Project Management</u>	360	70	70	95	95	105	105	90	90
Subtotal	6,480	775	435	2,795	1,245	2,765	2,625	145	2,175
Contingency (17%)	<u>1,120</u>	<u>215</u>	<u>115</u>	<u>215</u>	<u>115</u>	<u>315</u>	<u>215</u>	<u>375</u>	<u>675</u>
TOTAL	7,600	990	550	3,010	1,360	3,080	2,840	520	2,850

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates"
(Updated August 1992)

Start Construction: September 1996

Construction Period: 24 Months

Finish Construction: September 1998

Midpoint Construction: August 1997

Estimate Date: February 1991

					<u> %</u>
FY 1990	Feb 1991 - Sep 1991	7 mo @ 2.7	=	1.8	
FY 1991	Feb 1991 - Sep 1992	8 mo @ 1.8	=	1.8	
FY 1992	Oct 1992 - Sep 1993	12 mo @ 3.0	=	3.0	
FY 1993	Oct 1993 - Sep 1994	12 mo @ 3.9	=	3.9	
FY 1994	Oct 1994 - Sep 1995	12 mo @ 4.1	=	4.1	
FY 1995	Oct 1995 - Sep 1996	12 mo @ 4.3	=	4.3	
FY 1996	Oct 1996 - Sep 1997	11 mo @ 4.5	=	4.1	
Total Compounded Escalation				25.0	

UPGRADE OF SITE MECHANICAL UTILITIES, PHASE II - SEWER MONITORING

ED&I ANALYSIS (\$K)

LBL ACTIVITY

• Title I 4.0MM at 10.5K/MM					
Proj Team 4 FTEs x 0.20 time x 5 mos	=	4.0	=	40	
• Title II 7.5MM at 10.5K/MM					
Proj Team 4 FTEs x 0.17 time x 11.1 mos	=	7.5	=	80	
• Title III 7.7MM at \$10.5K/MM					
Proj Team 4 FTEs x 0.08 time x 24 mos	=	7.7	=	80	
• Inspection 4.8MM at \$10.5K/MM					
Team Member 1 FTEs x 0.20 time x 24 mos	=	4.8	=	50	
• Consultants					
Geotechnical Report and Inspection		20		90	
Independent Seismic Review		10			
Independent Cost Estimate		10			
Survey/Testing Lab		15			
Environmental Consultant		25			
Specialist Consultant		10			

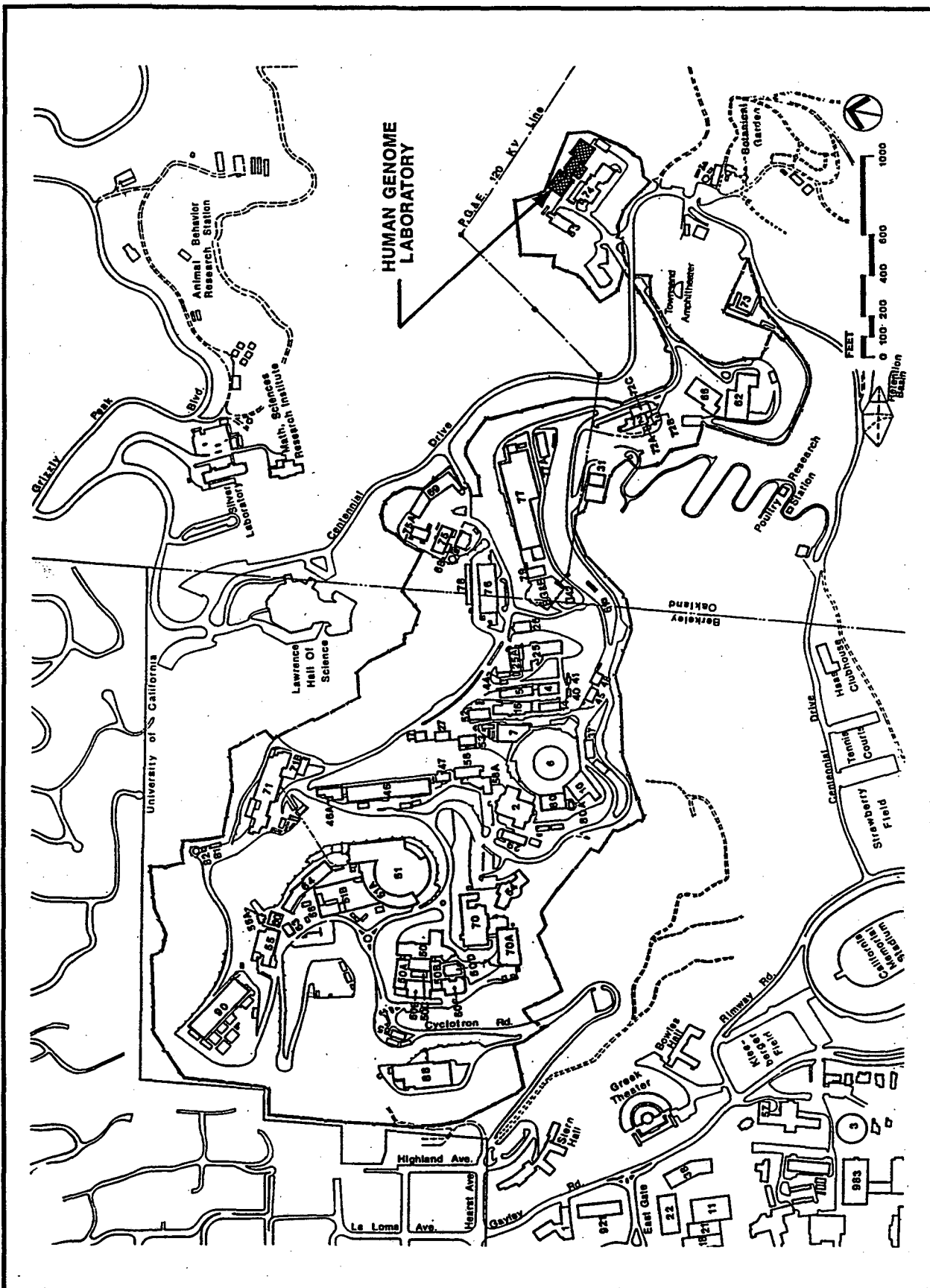
A/E SUBCONTRACT

12% of Designed Construction Costs (5,170)

Title I 30%	=	180
Title II 50%	=	310
Title III 20%	=	120

Total Estimated ED&I 950

Current FY92 Rate: 9.0K/MM
Escalation (August 1997) 17%: 10.5K/MM



LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Human Genome Laboratory
LBL 94-E-339
LOCATION PLAN

T-1

4/15/93

HUMAN GENOME LABORATORY

LBL 94-E-339

PROJECT DESCRIPTION

- **The Human Genome Laboratory Is an Interdisciplinary Research and Development Facility, Combining Biologists, Computer Scientists, Instrumentation Designers, Engineers, Robotics and Automation Groups**
- **The Project Includes Light Laboratories, Instrumentation and Support Space, Technician Work Stations, Service Spaces, Offices and Conference Rooms**
- **Occupied Space Includes Three Levels (41,160 GSF)**
 - **Open Laboratory Space with Adjacent Core of Laboratory Support Spaces on each Level**
 - **Laboratory Work Stations Include Local Network Access to Data Storage Facilities**
 - **Administrative Offices, Private Offices, Open Space Staff Offices, Conference Rooms and Library**
 - **92 Occupants**
 - **16 Additional Parking Spaces**

HUMAN GENOME LABORATORY

LBL 94-E-339

PROJECT DESCRIPTION (continued)

- **Steel Frame with Concrete Floors and Glass Fiber Reinforced Concrete Panel Walls**
- **Air Conditioned**
- **Electrical Power Service from New 1000 kVA Transformer Substation - 480/277V Distribution System**
- **Mechanical Utilities**
- **Telephone, Paging, and Card Key System**
- **TEC \$24.7M**

HUMAN GENOME LABORATORY

LBL 94-E-339

SCHEDULE OF NET AREAS

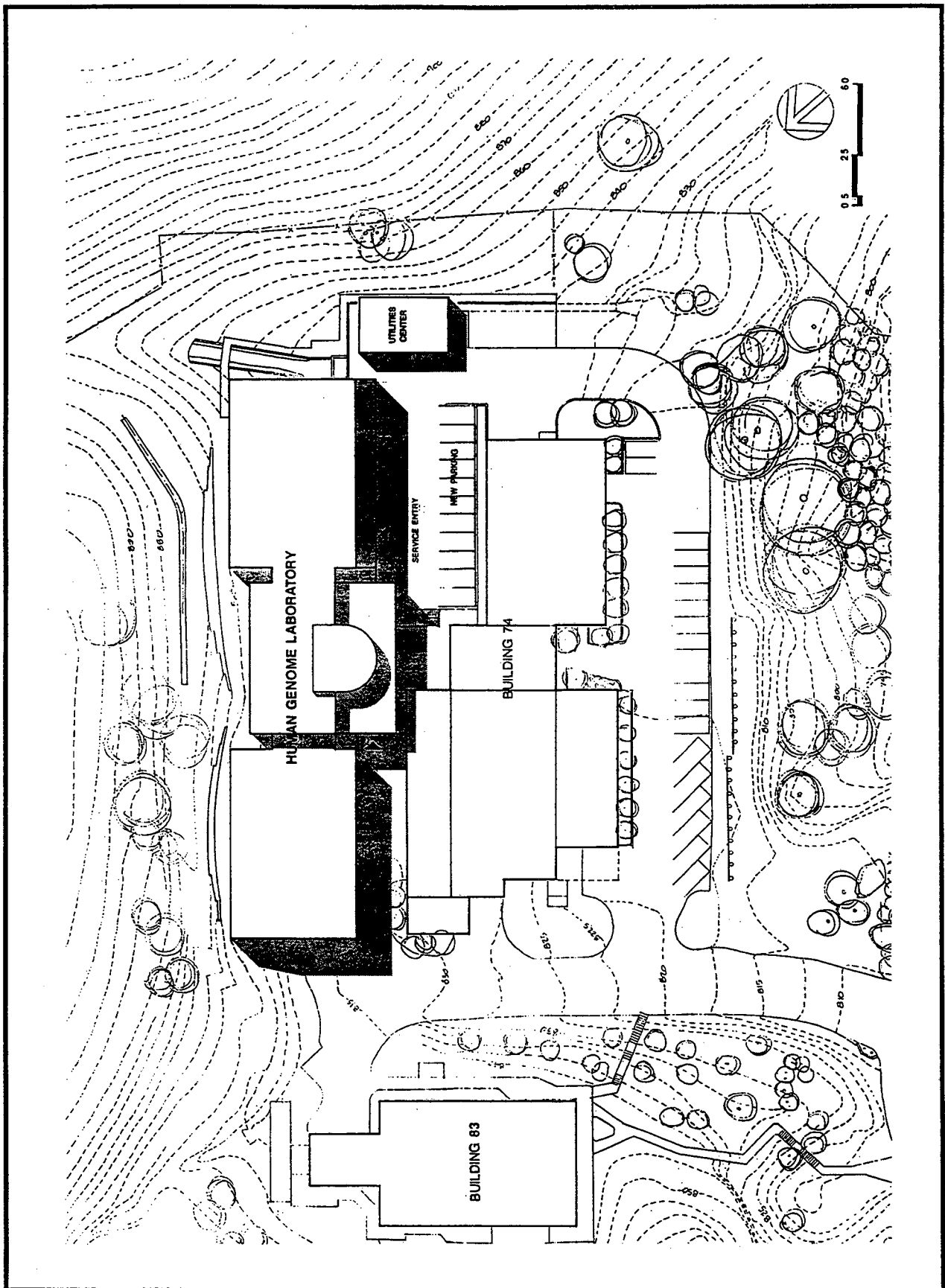
Space	Net Area - Sq. Ft.			
	Wet Labs	Dry Labs	Offices	Other
Biology/Chemistry Labs	10,220	(70 bench + desk spaces)		
Tissue Culture Room	300			
Media Preparation Room	210			
Sample Preparation Room	200			
Microscopy		150		
Robotics		2,040		
Mass Spectroscopy		500		
Optics		320		
Imaging Lab		150		
Administration			600	
Lab Offices (25)			3,050	
Modular Workstations (10)			730	
Conference /Seminar Room(50 people)			850	
Conference Room/Library			280	
Informal Meeting Rooms (4)			600	
Equipment Room (5)				780
DNA Sequencers				200
Freezers (5)				260
Cold Rooms (7)				700
Dark Rooms (3)				250
Shops (2)				420
Stock Room				200
Glasswashing				400
Storage Rooms (3)				240
Receiving				150
Entry Lobby/Reception				250
Subtotal	10,930	3,160	6,110	3,850

Total Net Area 24,050 Sq. Ft.

Gross Areas

Lower Level	2,220
First Floor	12,140
Second Floor	17,220
Third Floor	9,580

Total Gross Area 41,160 Sq. Ft.

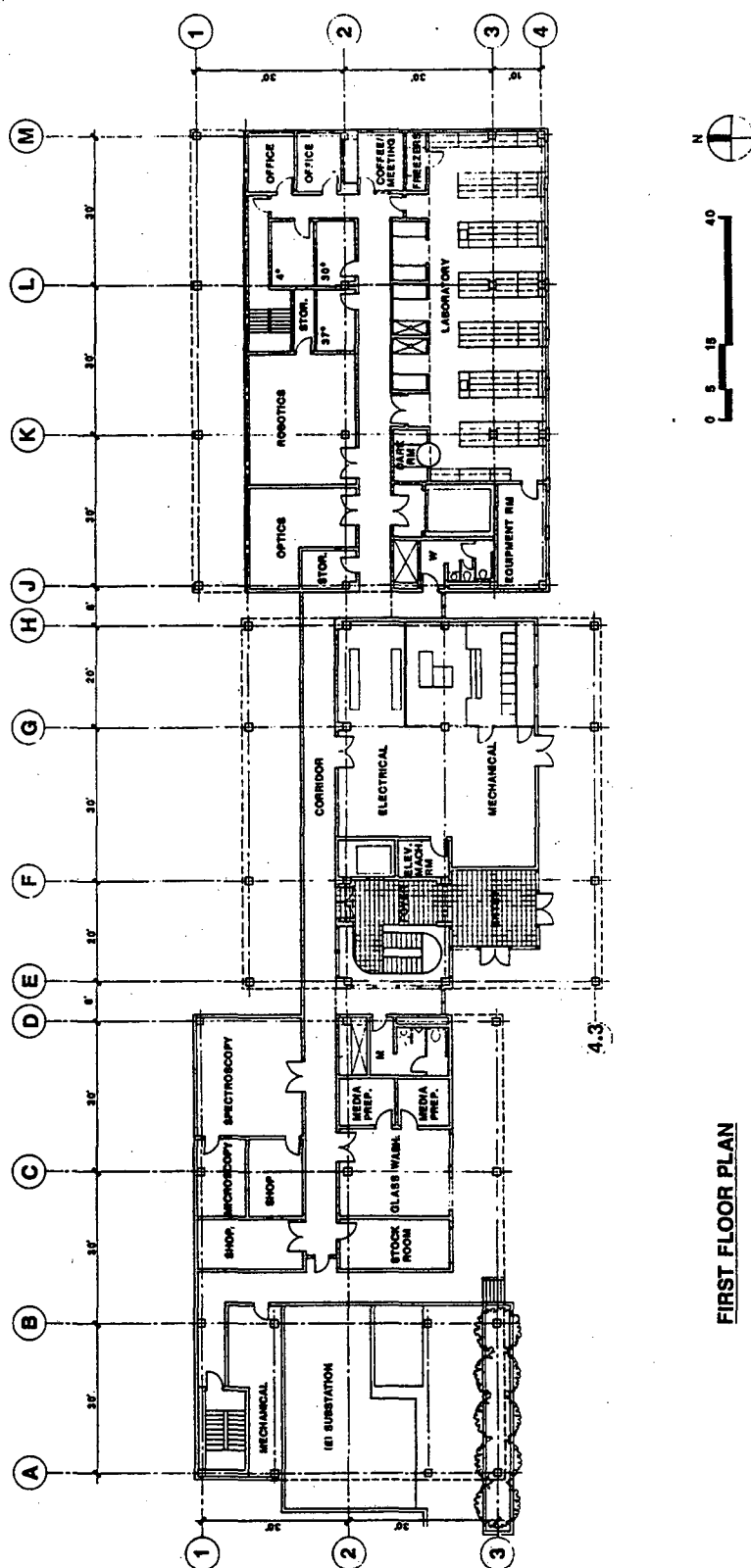


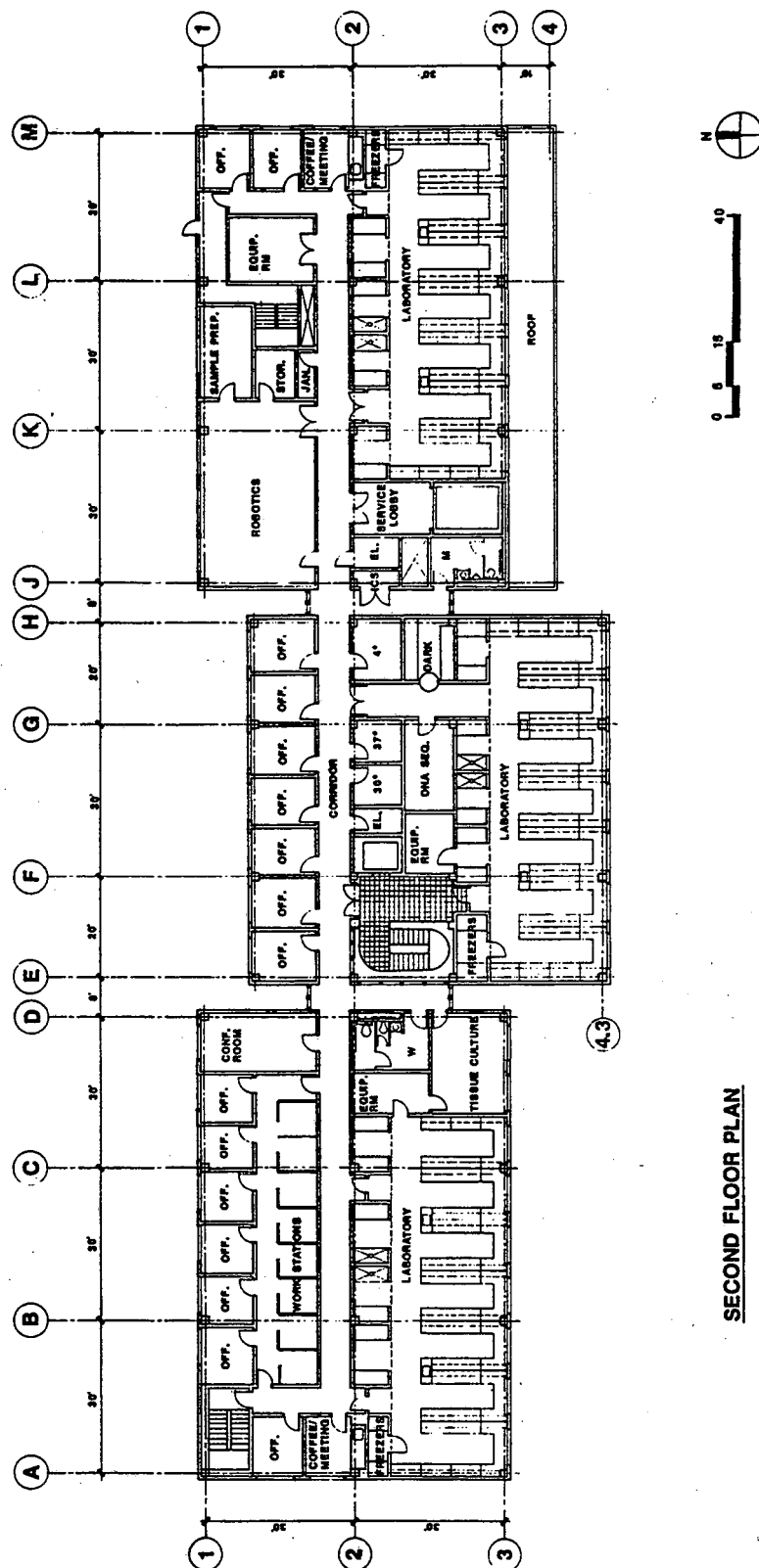
LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

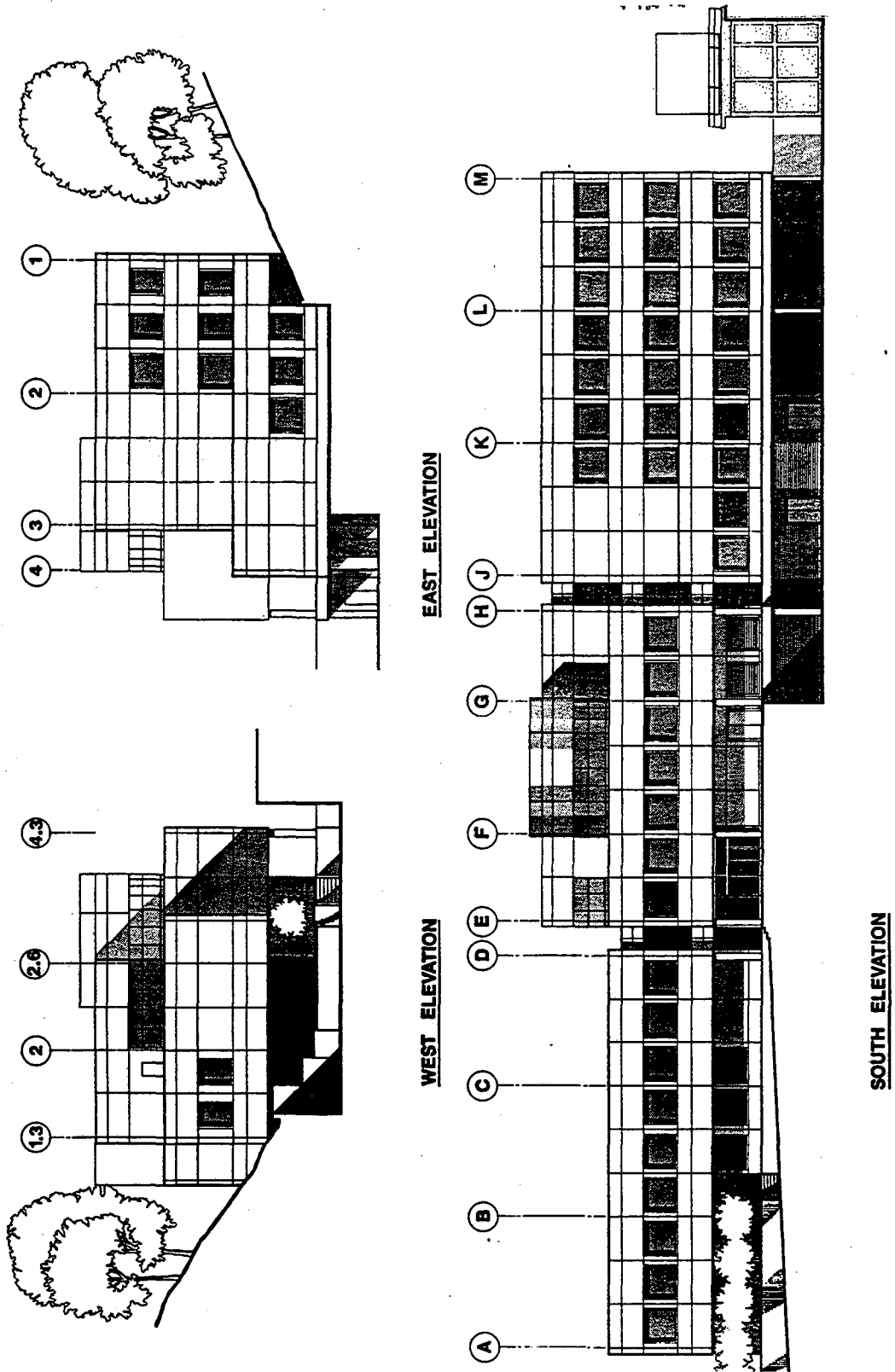
Human Genome Laboratory
LBL 94-E-339
SITE PLAN

T-2

4/15/93





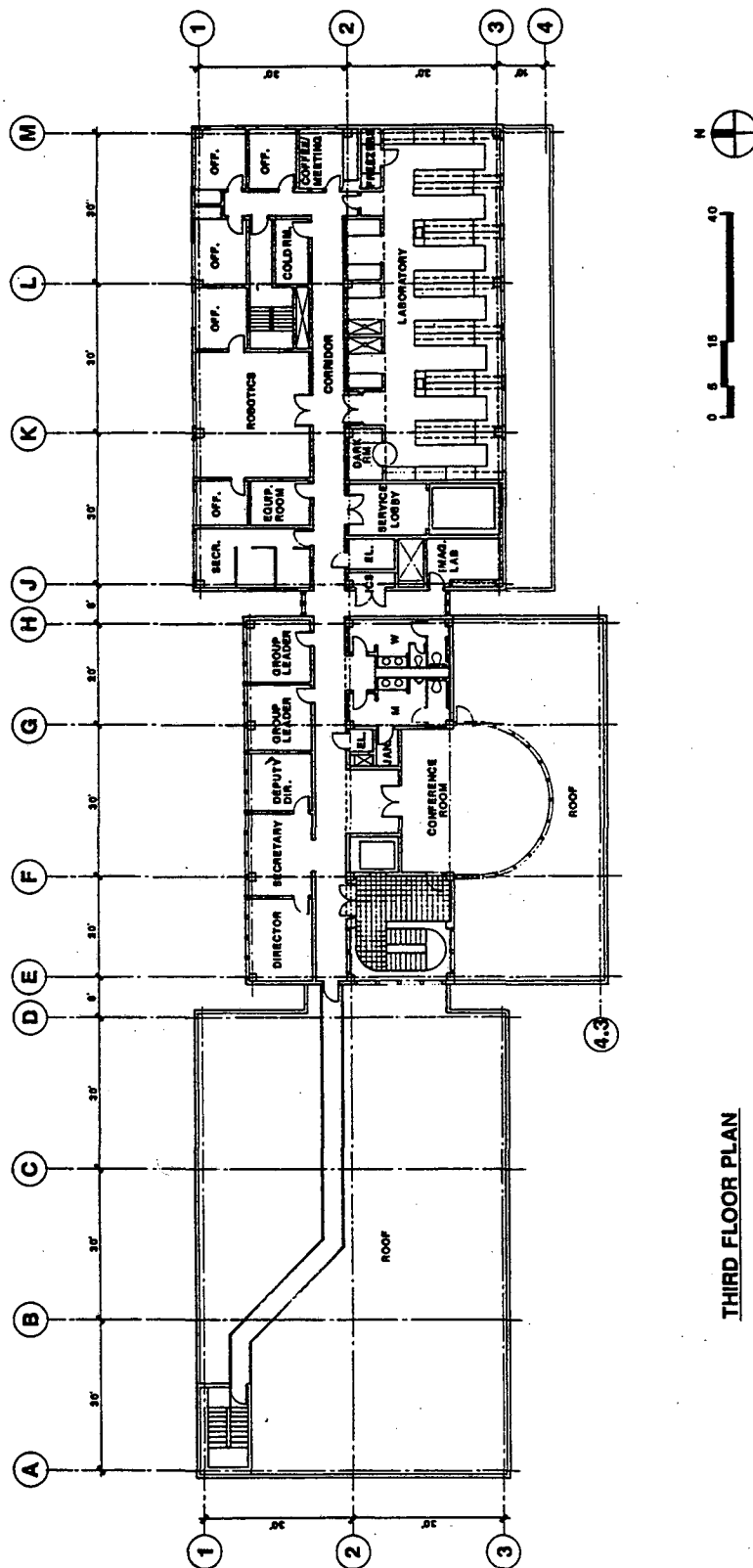


LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Human Genome Laboratory
LBL 94-E-339
BUILDING ELEVATIONS

A-6

4/15/93



THIRD FLOOR PLAN



LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Human Genome Laboratory
LBL 94-E-339
THIRD FLOOR PLAN

A-4

4/15/93

HUMAN GENOME LABORATORY

LBL 94-E-339

CHANGES SINCE 1992 VALIDATION

Scope

- **No Change**

Schedule

- **No Change**

TEC

- **No Change**

HUMAN GENOME LABORATORY

LBL 94-E-339

COST ESTIMATE (\$K) CHANGES SINCE 1992 VALIDATION

	<u>1992 Validation*</u>	<u>Changes</u>	<u>1993 Validation</u>
A. 1. ED&I (16%)	2,330	0	2,330
2. Project Management (7%)	1,020	0	1,020
B. Construction Costs	14,540	0	14,540
1. Improvements to Land	1,680	0	1,680
2. Buildings	11,120	0	11,120
3. Special Facilities	1,520	0	1,520
4. Utilities	220	0	220
C. Standard Equipment	3,080	0	3,080
D. Relocations	<u>300</u>	<u>0</u>	<u>300</u>
Subtotal	21,270	0	21,270
E. Contingency (16%)	<u>3,430</u>	<u>0</u>	<u>3,430</u>
Total Estimated Cost	24,700	0	24,700

*A Bottoms Up Estimate was Performed in January 1992 Due to Changes in Scope

HUMAN GENOME LABORATORY

LBL 94-E-339

FINANCIAL SCHEDULE (\$K)

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1994	2,200	2,200	1,270
1995	15,600	15,600	4,970
1996	5,900	5,900	9,850
1997	<u>1,000</u>	<u>1,000</u>	<u>8,610</u>
Total	24,700	24,700	24,700

HUMAN GENOME LABORATORY

LBL 94-E-339

TOTAL PROJECT COSTS (TPC) (\$K)

	<u>Prior Years</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>Total</u>
Total Project Costs (TPC)						
(1) Total Facility Costs (Construction Line Item - TEC)	0	1,270	4,970	9,850	8,610	24,700
(2) Other Project Costs						
(a) Conceptual Design Cost	70	0	0	0	0	70
(b) Environmental, Safety (NEPA, CEQA & SAD) State Permits Documentation Costs	<u>100</u>	<u>130</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>230</u>
Total Project Cost	170	1,400	4,970	9,850	8,610	<u><u>25,000</u></u>

HUMAN GENOME LABORATORY

LBL 94-E-339

CONTINGENCY ANALYSIS

	Estimated Cost (\$K)	Contingency (%)	Contingency (\$K)
<u>LBL Activities</u>			
Engineering			
Title I	160	20	32
Title II	180	15	27
Title III	210	20	42
Inspection	220	25	55
Consultants	170	20	34
<u>Architect/Engineer</u>			
Title I	410	15	63
Title II	700	15	105
Title III	280	20	56
<u>Construction</u>			
Improvements to Land	1,680	20	340
Buildings	11,120	15	1,662
Utilities	220	25	55
Special Facilities	1,520	15	231
<u>Standard Equipment</u>	3,080	15	464
<u>Relocations</u>	300	20	60
<u>Project Management</u>	1,020	20	204
Subtotal	21,270		3,430
Contingency (16%)	3,430		
TOTAL	24,700		

HUMAN GENOME LABORATORY
LBL 94-E-339
BA/BO SCHEDULE (\$K)

WBS NO.	WBS ELEMENT	TOTAL BUDGET	FY 1994								FY 1995								FY 1996								FY 1997											
			1		2		3		4		1		2		3		4		1		2		3		4		1		2		3		4					
			O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
1.0	LBL ACTIVITIES																																					
1.2	TITLE I	160																																				
1.3	TITLE II	180																																				
1.4	TITLE III	210																																				
1.5	INSPECTION	220																																				
1.6	CONSULTANTS	170																																				
2.0	ARCHITECT/ENGINEER																																					
2.1	TITLE I	410																																				
2.2	TITLE II	700																																				
2.3	TITLE III	280																																				
3.0	CONSTRUCTION																																					
3.1	IMPROVEMENTS TO LAND	1680																																				
3.2	BUILDING	11120																																				
3.3	UTILITIES	220																																				
3.4	SPECIAL FACILITIES	1520																																				
3.5	PROJECT MANAGEMENT	1020																																				
4.0	STANDARD EQUIPMENT	3080																																				
5.0	RELOCATIONS	300																																				
	Contingency by Year (16%)	3430/3430	300 / 170								2115 / 670								800 / 1330								215 / 1260											
	Total BA/BO by Year	24700/24700	2150 / 1270								15570 / 4970								5890 / 9850								1090 / 8610											
	Current Funding Plan	24700	2200								15600								5900								1000											

HUMAN GENOME LABORATORY
LBL 94-E-339
TIME SCHEDULE

Activities	Fiscal Year 1993				Fiscal Year 1994				Fiscal Year 1995				Fiscal Year 1996				Fiscal Year 1997			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
NEPA/SARS																				
A/E SELECTION (Selected)																				
A/E NEGOTIATION																				
FUNDING AUTHORIZATION																				
TITLE I																				
TITLE II																				
BID AND AWARD																				
TITLE III																				
IMPROVEMENTS TO LAND																				
BUILDING																				
UTILITIES																				
SPECIAL FACILITIES																				
STANDARD EQUIPMENT																				

4/1/93

A&E:HGL:CDR

HUMAN GENOME LABORATORY

LBL 94-E-339

STATUS OF NEPA AND SARS

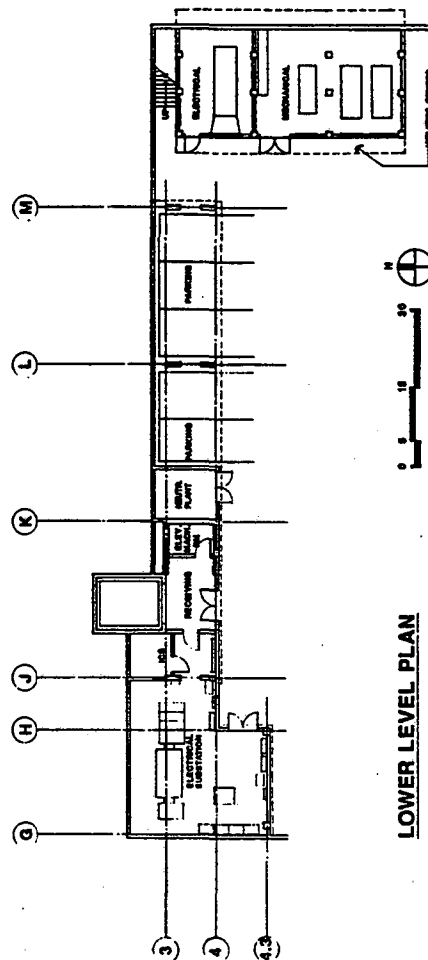
NEPA

- **Award Made to Science Applications International Corporation for the Preparation of NEPA and CEQA Documentation**
- **Administrative Draft EIR and EA Are in Progress**

SARS

- **Award Made to M. H. Chew and Associates for Preparation of the Preliminary Safety Analysis Document**





LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Human Genome Laboratory
LBL 94-E-339
LOWER LEVEL PLAN

A-1

4/15/93

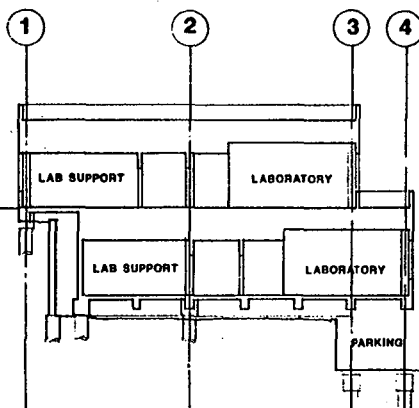
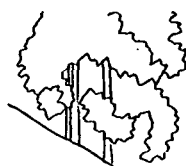


LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

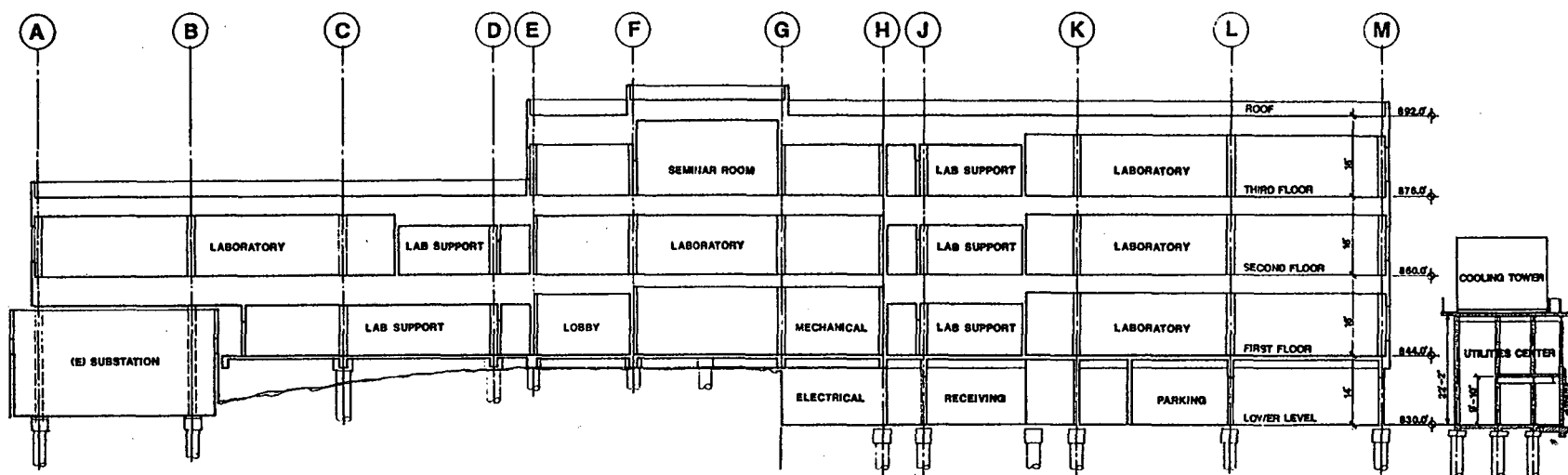
Human Genome Laboratory
LBL 94-E-339
BUILDING SECTIONS

4/15/93

A-5

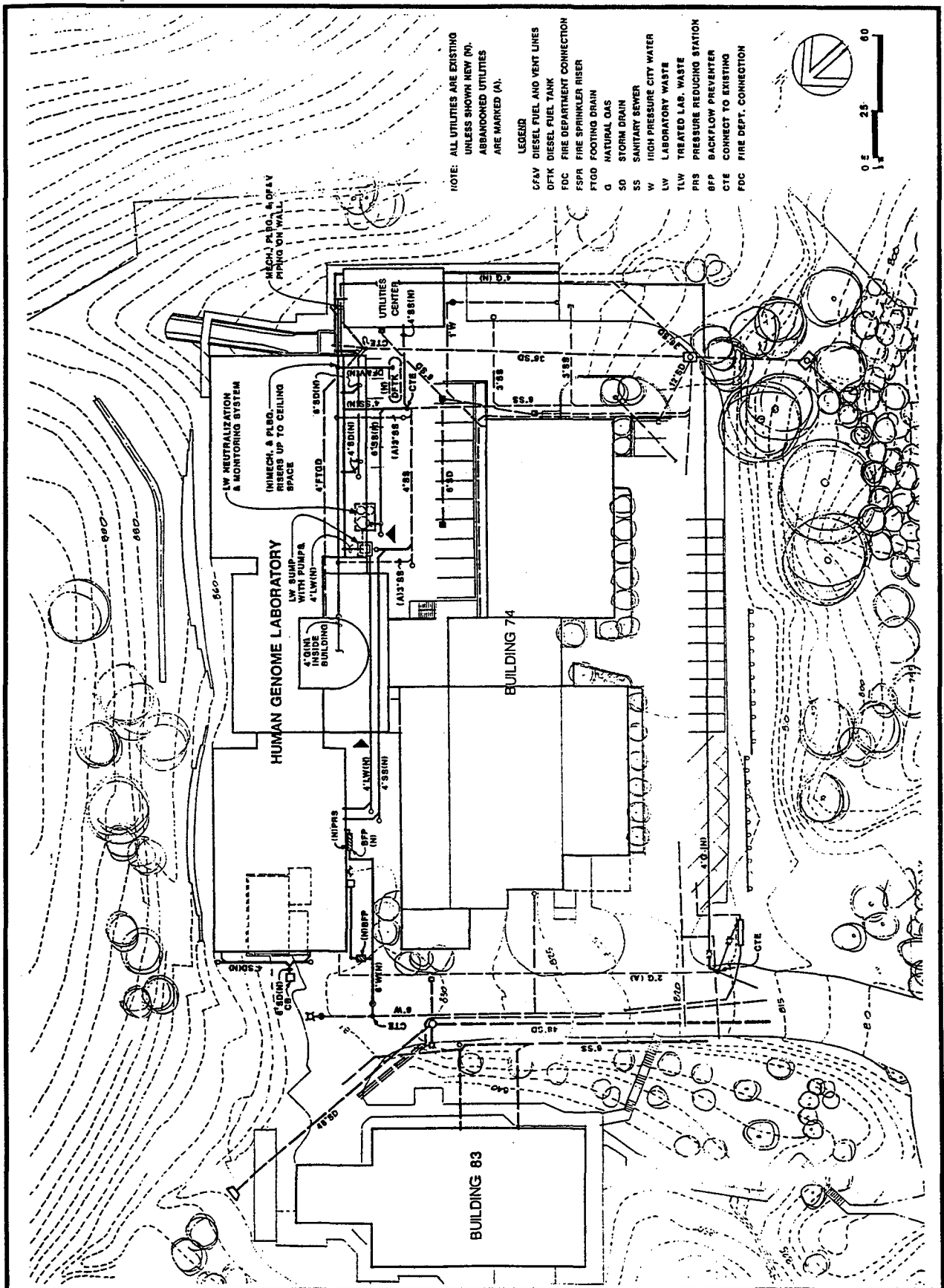


CROSS SECTION



LONGITUDINAL SECTION

0 5 15 40



LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Human Genome Laboratory
LBL 94-E-339
SITE MECHANICAL UTILITIES PLAN

T-3

4/15/93

HUMAN GENOME LABORATORY

LBL 94-E-339

BASIS OF DESIGN

- **Programmatic Criteria for Functional Requirements
Developed by LBL Life Sciences Directorate**
- **Conceptual Design, Drawings and Specifications
Prepared by LBL Facilities Department**
- **Site in General Conformance with LBL Site
Development Plan (Approved by DOE in 1991)**
- **Consultants**
 - **Harding Lawson Associates, Geotechnical
Engineers and Geologists**
- **Cost Estimate by Lee Saylor Inc.**
- **Construction Costs Escalated 19.0% from January
1992 to Midpoint of Construction, August 1996 Using
DOE Guidelines**

HUMAN GENOME LABORATORY

LBL 94-E-339

METHOD OF ACCOMPLISHMENT

- **Design Program Will Be Prepared by LBL Facilities Department from Programmatic Criteria Supplied by Life Sciences Directorate**
- **A/E Will Be Selected by LBL for Titles I and II Design and Title III Technical Oversight**
- **Title III Construction Work Will Be Accomplished by a Lump-Sum Contract Awarded After Competitive Bidding**
- **Project Management, Construction Contract Administration and Inspection by LBL**
- **Standard Equipment and Some Special Facilities Will Be Procured by LBL**

HUMAN GENOME LABORATORY

LBL 94-E-339

COST ESTIMATE (\$K)

A.	1. Engineering, Design, and Inspection (at ~16% of Construction Costs)	2,330
	2. Project Management (at ~7% of Construction Costs)	1,020
B.	Construction Costs	14,540
	1. Improvements to Land	1,680
	2. Buildings (41,160 GSF @\$270/sq ft)	11,120
	3. Special Facilities (Schedule I)	1,520
	4. Utilities	220
C.	Standard Equipment (Schedule II)	3,080
D.	Relocations	<u>300</u>
	Subtotal	21,270
E.	Contingency (at ~16% of Above Costs)	<u>3,430</u>
	Total Estimated Cost	24,700

HUMAN GENOME LABORATORY

LBL 94-E-339

SCHEDULE I (\$K)

<u>Special Facilities</u>	<u>Estimated Cost</u>
Modular Laboratory Furniture, Plastic Tops and Flume Hoods	920
Demountable Office Systems Furniture and Partitions	130
Acid Neutralization System	240
Chemical Detection and Alarm System	180
Cold Room	<u>50</u>
TOTAL	1,520

**Special Facilities Include Prime Contractor Mark-Ups
(Approximately 23%) and Escalation 19.0%**

HUMAN GENOME LABORATORY

LBL 94-E-339

SCHEDULE II

(\$K)

<u>Standard Equipment</u>	<u>Estimated Cost</u>
Computer Workstations (20)	500
Office Furniture and Equipment	70
Ultracentrifuges (4)	220
Robots (2)	80
DNA Sequencers (2)	350
Confocal Microscope (1)	210
Autoclaves (2)	170
Biological Containment Cabinets (10)	70
Tissue Culture Incubators (10)	70
Oligonucleotide Synthesizer (2)	260
Fast Protein Liquid Chromatograph (1)	90
Mass Spectrometer (1)	210
Laser Fluorometer (1)	170
Flow Cytometer (1)	280
Image Plate Reader (1)	110
Spectrophotometer with Microtiter Plate Reader (1)	50
Sterilizer (1)	110
High Pressure Liquid Chromatography System (1)	<u>60</u>
TOTAL	3,080

Standard Equipment Includes a 10% Mark-Up for Handling and Installation and 19.0% for Escalation

HUMAN GENOME LABORATORY

LBL 94-E-339

ESTIMATE SUMMARY

Improvements to Land (Div 2 Site Work)

Demolition		118,890
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Excavation, Fill and Grading		104,770
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Sitework		43,330
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Miscellaneous Site Improvements		10,000
---------------------------------	--	--------

Piling, Piers and Caissons		<u>872,180</u>
----------------------------	--	----------------

Subtotal Direct Cost		1,149,170
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General Conditions/Mobilize	8%	91,930
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Estimating Contingency		<u>In Project Contingency</u>
------------------------	--	-------------------------------

		1,241,100
--	--	-----------

Bond	2%	24,820
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Prime Contractor OH & Fee	12%	<u>148,930</u>
---------------------------	-----	----------------

Total Estimated Construction Cost at January 1992		<u>1,414,850</u>
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Total Escalated Construction Cost to August 1996	19%	<u>1,683,672</u>
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Say		1,680,000
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HUMAN GENOME LABORATORY

LBL 94-E-339

ESTIMATE SUMMARY (continued)

Building (41,000 GSF)

Div 3	Concrete	1,368,010
Div 4	Masonry	29,980
Div 5	Metals	1,037,890
Div 6	Wood and Plastics	26,570
Div 7	Thermal and Moisture Protection	217,000
Div 8	Doors and Windows	309,560
Div 9	Finishes	991,740
Div 10	Specialties	31,450
Div 12	Furnishings	43,600
Div 13	EMCS	230,010
Div 14	Conveying Systems	138,000
Div 15	Plumbing	694,150
Div 15	HVAC	1,106,930
Div 15	Fire Protection	90,860
Div 16	Electrical	<u>1,271,940</u>

Subtotal Direct Cost 7,587,690

General Conditions/Mobilize 8% 607,020

Estimating Contingency In Project Contingency
8,194,710

Bond 2% 163,890

Prime Contractor OH & Fee 12% 983,370

Total Estimated Construction Cost
at January 1992 9,341,970

Total Escalated Construction Cost
to August 1996 19% 11,116,944

Say 11,120,000

HUMAN GENOME LABORATORY

LBL 94-E-339

ESTIMATE SUMMARY (continued)

Site Utilities (Div 2 Site Work)

Mechanical Site Utilities		125,650
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Electrical Site Utilities		<u>27,360</u>
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Subtotal Direct Cost		153,010
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General Conditions/Mobilize	8%	12,240
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Estimating Contingency		<u><i>In Project Contingency</i></u>
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		165,250
--	--	---------

Bond	2%	3,310
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Prime Contractor OH & Fee	12%	<u>19,830</u>
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Total Estimated Construction Cost at January 1992		<u>188,390</u>
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Total Escalated Construction Cost to August 1996	19%	<u>224,184</u>
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Say		220,000
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HUMAN GENOME LABORATORY
LBL 94-E-339
OBLIGATIONS AND COSTS SCHEDULE DETAIL
(\$K)

DESCRIPTION	TOTAL	FY 1994		FY 1995		FY 1996		FY 1997	
		O	C	O	C	O	C	O	C
<u>LBL Activities</u>									
Engineering									
Title I	160	160	160						
Title II	180	60	60	120	120				
Title III	210			25	25	105	105	80	80
Inspection	220			30	30	110	110	80	80
Consultants	170	30	30	140	70	0	70		
Subtotal	940	250	250	315	245	215	285	160	160
<u>Architect-Engineer</u>									
Title I	410	410	410						
Title II	700	700	230	0	470				
Title III	280	280	0	0	35	0	140	0	105
Subtotal	1,390	1,390	640	0	505	0	140	0	105
<u>Construction Subcontracts</u>									
Improvements to Land	1,680			1,560	490	0	1,070	120	120
Building	11,120			11,120	2,710	0	5,150	0	3,260
Utilities	220			190	80	0	110	30	30
Special Facilities	1,520					1,520	740	0	780
Subtotal	14,540			12,870	3,280	1,520	7,070	150	4,190
<u>Standard Equipment</u>	3,080					3,080	750	0	2,330
<u>Relocations</u>	300							300	300
<u>Project Management</u>	1,020	210	210	270	270	275	275	265	265
Subtotal	21,270	1,850	1,100	13,455	4,300	5,090	8,520	875	7,350
Contingency (16%)	3,430	300	170	2,115	670	800	1,330	215	1,260
TOTAL	24,700	2,150	1,270	15,570	4,970	5,890	9,850	1,090	8,610

HUMAN GENOME LABORATORY

LBL 94-E-339

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates"
(Updated February 1992)

Start Construction: August 1995
Construction Period: 24 Months
Finish Construction: August 1997
Midpoint Construction: August 1996
Estimate Date: January 1992

					<u>%</u>
FY 1992	Jan 1992 - Sep 1992	9 mo @	2.1	=	1.6
FY 1993	Oct 1992 - Sep 1993	12 mo @	3.4	=	3.4
FY 1994	Oct 1993 - Sep 1994	12 mo @	4.3	=	4.3
FY 1995	Oct 1994 - Sep 1995	12 mo @	4.5	=	4.5
FY 1996	Oct 1995 - Aug 1996	10 mo @	4.7	=	3.9

Total Compounded Escalation 19.0

HUMAN GENOME LABORATORY

LBL 94-E-339

ED&I ANALYSIS (\$K)

LBL Activities

• Title I 7MM at \$8.9K/mo		= 160
Proj Arch 1 x 1.0 x 7	= 7.0	
Proj Team 3 x 0.5% x 7	= 10.5	
• Title II 20MM at \$8.9K/mo		= 180
Proj Arch 1 x 0.8 x 10	= 8.0	
Proj Team 3 x 0.4% x 10	= 12.0	
• Title III 23MM at \$8.9K/mo		= 210
Proj Arch 1 x 0.35 x 24	= 8.4	
Proj Team 3 x 0.20% x 24	= 14.6	
• Inspection 25.2MM at \$8.9K/mo		= 220
Inspectors (combination) 0.9% x 24	= 21.6	
Engineering Inspection 0.15% x 24	= 3.6	
• Consultants		= 170
Geotechnical report and inspection	45	
Independent seismic reviews (2)	25	
Independent cost estimates (2)	20	
Surveying/soils	45	
Environmental consultant (at Title I)	15	
Testing Labs	20	

<u>A/E Subcontract</u>		= 1,390
9.5% of Designed Construction Costs (\$14,540K)		
Title I (30%)	410	
Title II (50%)	700	
Title III (20%)	280	

Total Estimated ED&I 2,330

FY92 (January 1992) Engineering rate: \$7.5K/MM

Then Year Engineering Rate: \$7.5K/MM x 1.19* = \$8.9K/MM

*Escalation of 19% to midpoint of Construction (August 1996)

4/1/93

A&E:HGL:PV

HUMAN GENOME LABORATORY

LBL 94-E-339

SAFETY FEATURES

Separate Exhaust Ventilation System for Laboratory Areas

Manual Emergency Shut-off Switches for Lab Recirculation Air

Minimum One CFM per SF of Area for Mechanical Ventilation

Emergency Power for the Building

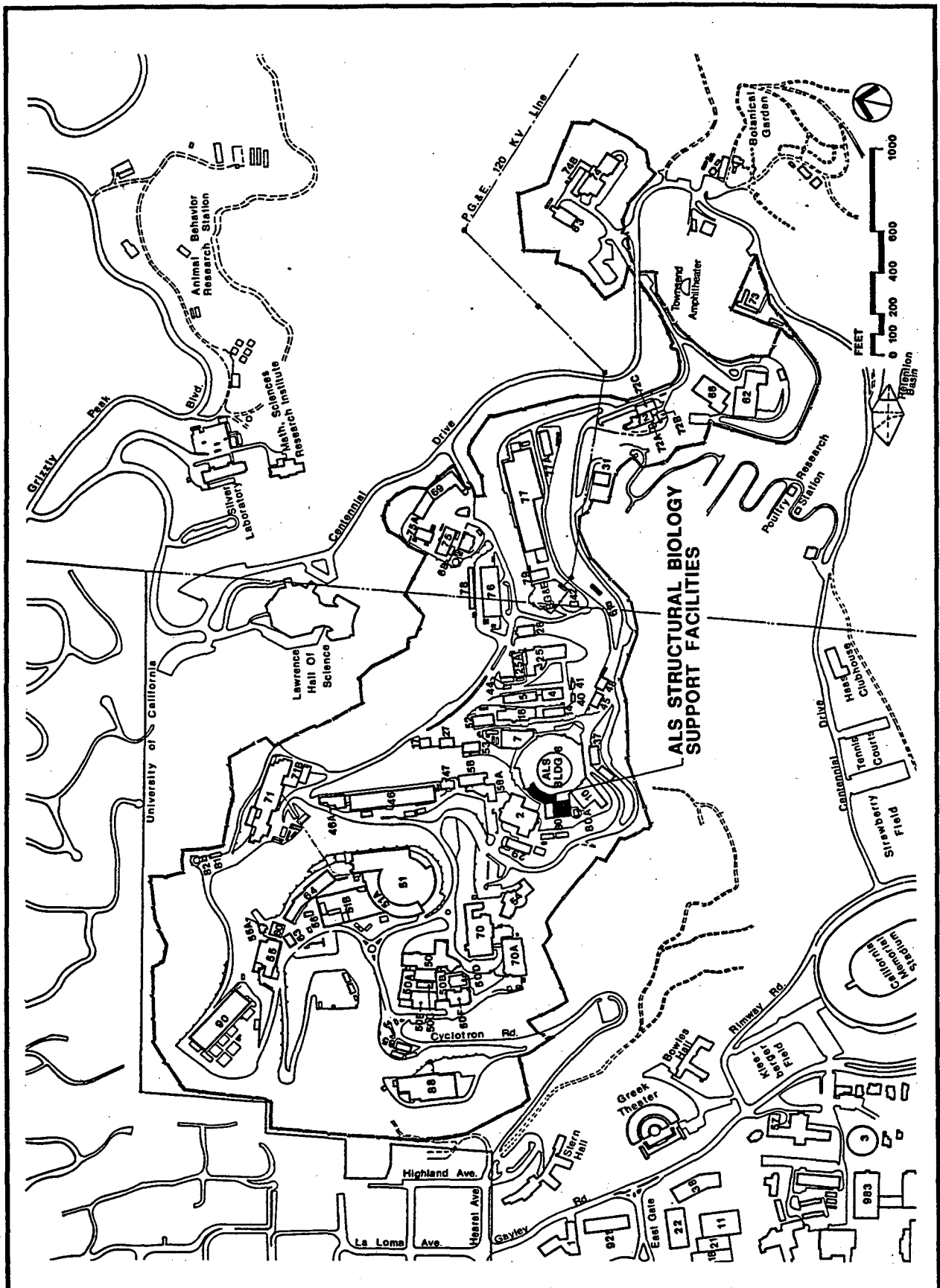
One-hour Separation of Laboratory and Office Areas. Two-hour Separation for Boiler Room

Two Exits Required for Labs Over 200 SF in Area. 75 Foot Maximum Distance to Exit

Ordinary Hazard Group 3 Automatic Sprinkler System

Liquid Tight Floors and Secondary Containment

Emergency Detection and Alarm System for Hazardous Materials



LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

ALS Structural Biology Support Facilities
LBL 94-E-337
LOCATION PLAN

T-1

4/15/93

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

PROJECT DESCRIPTION

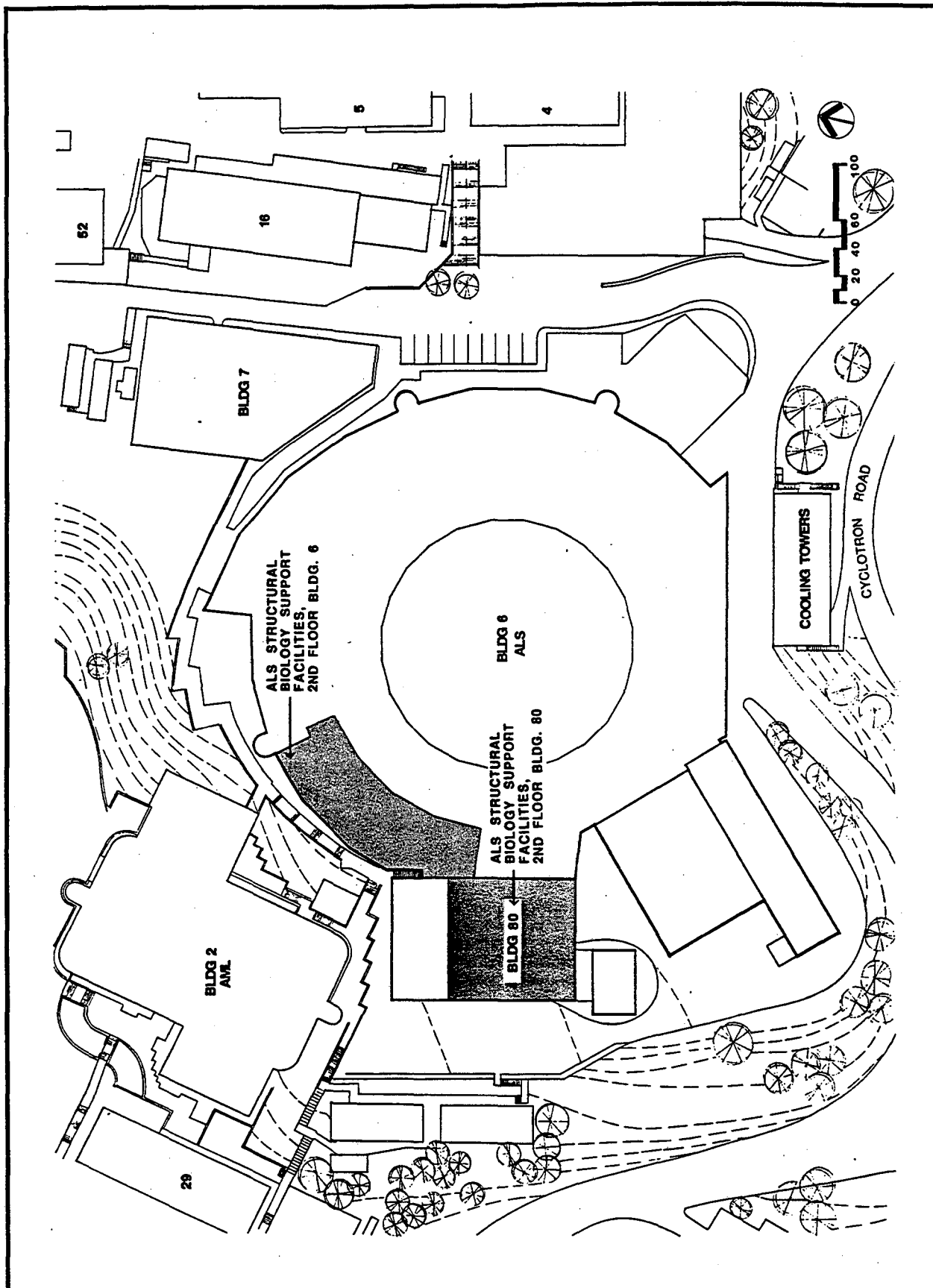
- **The ALS Structural Biology Support Facilities Will Support Life Sciences Research Activities at the Advanced Light Source (ALS)**
- **The Project Includes Improvements to 11,100 GSF of Existing Space**
 - **5,100 GSF on the Second Floor of ALS Building 6**
 - **6,000 GSF In Adjacent Building 80**
- **The Program Includes**
 - **Laboratories Including Biochemistry, Surgery, Cell and Tissue Culture, and Microscopy Suite**
 - **Laboratory Offices**
 - **Support Spaces Including Dark Rooms, Cold Rooms, Glasswashing, and Storage**

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

PROJECT DESCRIPTION (Continued)

- **32 Occupants**
- **Air Conditioned**
- **Mechanical Utilities**
- **Electrical Power 480/277V**
- **Energy Monitoring and Control System (Existing)**
- **Integrated Communication System (ICS), Paging and Card Key System**
- **TEC \$7.9M**

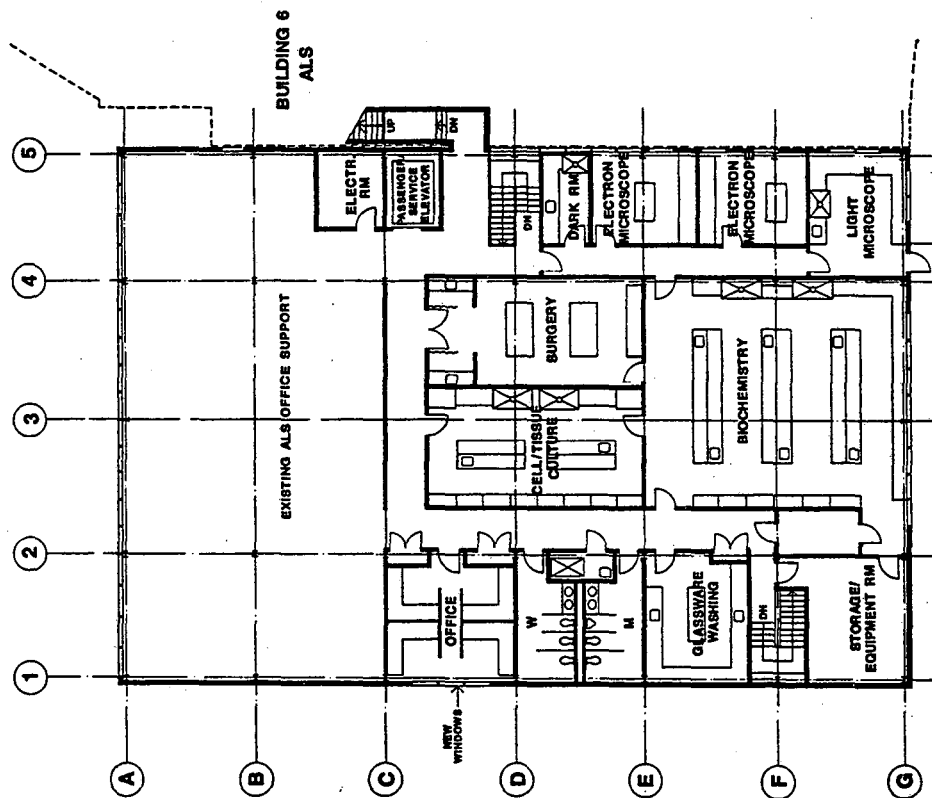


LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

ALS Structural Biology Support Facilities
LBL 94-E-337
SITE PLAN

T-2

4/15/93

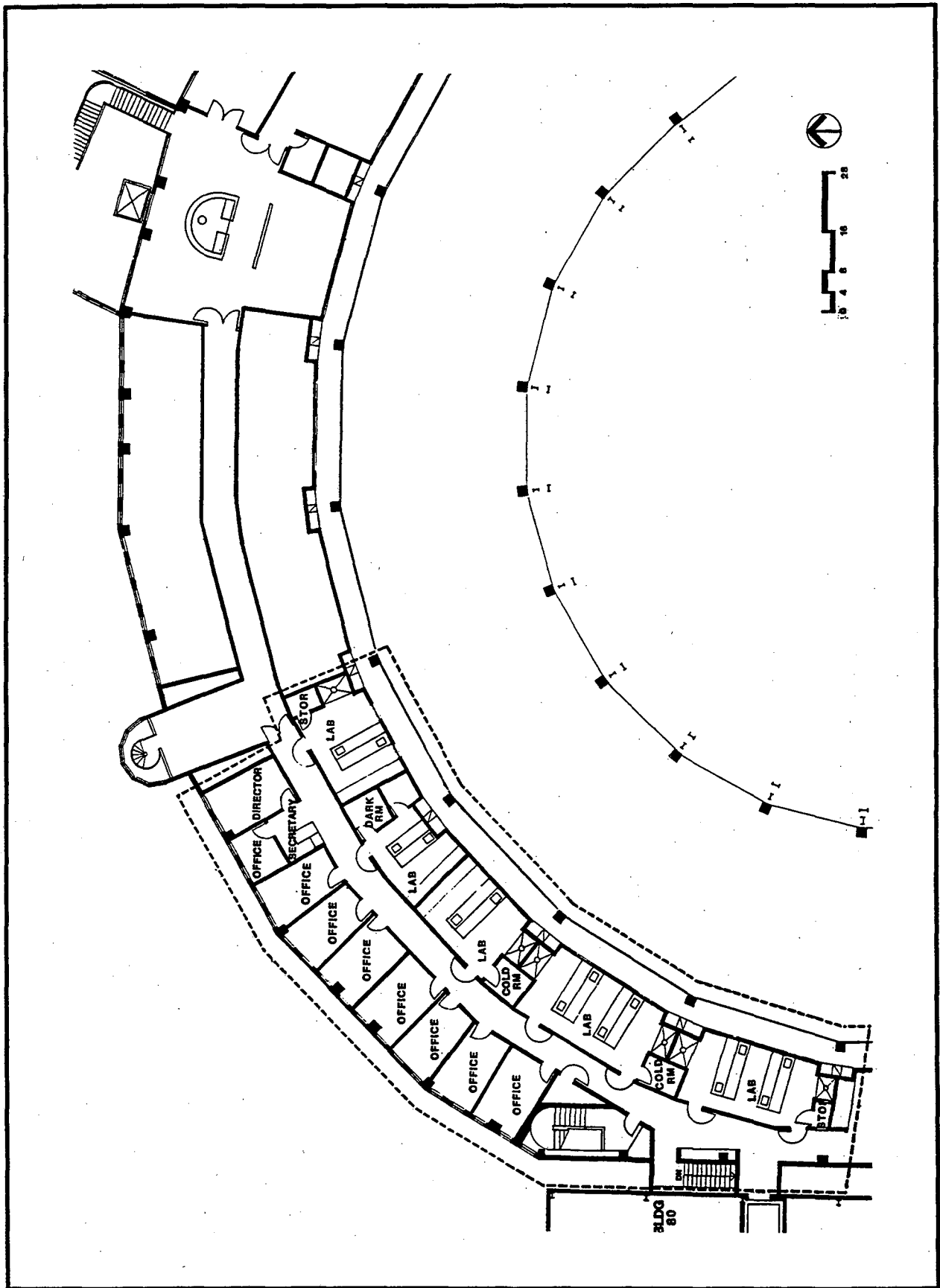


**LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA**

**ALS Structural Biology Support Facilities
LBL 94-E-337
BUILDING 80 - SECOND FLOOR PLAN**

A-1

4/15/93



LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

ALS Structural Biology Support Facilities
LBL 94-E-337
ALS BUILDING - PARTIAL SECOND
FLOOR PLAN

A-2

4/15/93

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

SCHEDULE OF NET AREAS AND OCCUPANCY

	Net Area - Sq. Ft.			
	Labs	Lab Offices	Other	Occupants
Building 80				
Biochemistry	1,430			
Microscopy Suite	1,035			
Surgery	530			
Cell and Tissue Culture	595			
Laboratory Offices		400		
Glassware, Dishwashing			300	
Cold Room			80	
Storage/Equipment Room			310	
Subtotal Building 80	3,590	400	690	18
Building 6				
Laboratories	1,990			
Laboratory Offices		1,470		
Cold Rooms			120	
Storage			195	
Subtotal Building 6	1,990	1,470	315	14
Subtotal All Floors	5,580	1,870	1,005	32
Total Net Useable Area	8,455 sq. ft.			
Gross Enclosed Areas				
Building 80	6,000 sq. ft.			
Building 6	5,100 sq. ft.			
Total Gross Enclosed	11,100 sq. ft.			

ALS STRUCTURAL BIOLOGY SUPPORT FACILITY

LBL 94-E-337

CHANGES SINCE 1992 VALIDATION

Scope

- **No Change**

Schedule

- **No Change**

TEC

- **No Change**

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

COST ESTIMATE (\$K) CHANGES SINCE 1992 VALIDATION

	<u>1992 Validation</u>	<u>Changes</u>	<u>Escalation</u>	<u>1993 Validation</u>
A. 1. ED&I (15%)	560	0	0	560
2. Project Management (7%)	250	0	0	250
B. Construction Costs	3,710	0	0	3,710
1. Improvements to Land	14	0	0	14
2. Building 80 improvements	1,417	0	0	1,417
3. Building 6 improvements	900	0	0	900
4. Special Facilities	1,279	0	0	1,279
5. Utilities	100	0	0	100
C. Standard Equipment	<u>2,230</u>	<u>0</u>	<u>0</u>	<u>2,230</u>
Subtotal	6,750	0	0	6,750
D. Contingency (17%)	<u>1,150</u>	<u>0</u>	<u>0</u>	<u>1,150</u>
Total Estimated Cost	7,900	0	0	7,900

4/23/93

A&E:ALS-SBSF:PV

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

FINANCIAL SCHEDULE (\$K)

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1994	600	600	500
1995	4,700	4,700	2,300
1996	<u>2,600</u>	<u>2,600</u>	<u>5,100</u>
Total	7,900	7,900	7,900

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

TOTAL PROJECT COSTS (TPC) (\$K)

	<u>Prior Years</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>Total</u>
Total Project Costs (TPC)					
(1) Total Facility Costs (Construction Line Item - TEC)	0	500	2,300	5,100	7,900
(2) Other Project Costs					
(a) Conceptual Design Cost	50	0	0	0	50
(b) Environmental Compliance Documentation Costs	<u>50</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>50</u>
Total Other Project Costs	100	0	0	0	100
Total Project Cost	100	500	2,300	5,100	<u>8,000</u>

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

CONTINGENCY ANALYSIS (FY 1990 \$K)

	Estimated Cost (\$K)	Contingency (%)	Contingency (\$K)
<u>LBL Activities</u>			
Engineering	112	15	17
Consultants	17	25	4
Inspection	53	25	13
<u>Architect/Engineer</u>			
Title I	90	18	16
Title II	150	18	27
Title III	60	18	11
<u>Construction Contract</u>			
Improvements to Land	12	20	2
Building 80	1,170	20	234
Building 6	741	20	148
Site Utilities	84	25	21
Special Facilities	1,043	15	156
Project Management	213	15	31
<u>Standard Equipment</u>	<u>1,822</u>	15	<u>273</u>
Subtotal	5,567		953
Contingency (17%)	<u>953</u>		
TOTAL	6,520		

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES
LBL 94-E-337
BA/BO SCHEDULE (TY\$K)

WBS NO.	WBS ELEMENT	TOTAL BUDGET	F Y 1994												F Y 1995												F Y 1996													
			1				2				3				4				1				2				3				4									
			O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S		
1.0	Engineering, Design & Inspection																																							
1.1	LBL Activities																																							
1.1.1	Engineering	129																																						
1.1.2	Consultants	20																																						
1.1.3	Inspection	64																																						
1.2	A/E Activities																																							
1.2.1	Title I	102																																						
1.2.2	Title II	171																																						
1.2.3	Title III	72																																						
2.0	Construction																																							
2.1.1	Land Improvements	14																																						
2.1.2	Building 80 Improvements	1417																																						
2.1.3	Building 6 Improvements	901																																						
2.1.4	Site Utilities	99																																						
2.1.5	Special Facilities-Schedule I	1279																																						
2.1.6	Project Management	250																																						
3.0	Standard Equipment	2230																																						
Contingency by Year		1152/1152	92 / 82												782 / 320												278 / 750													
Total BA/BO by Year		7900/7900	600 / 500												4700 / 2300												2600 / 5100													
Current Funding Plan		7900	600												4700												2600													

3/24/93
A&E/ALS-SBSF:CDR

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES
LBL 94-E-337
TIME SCHEDULE

Activities	Fiscal Year 1993				Fiscal Year 1994				Fiscal Year 1995				Fiscal Year 1996			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
NEPA/SARS																
A/E SELECTION																
A/E NEGOTIATION																
FUNDING AUTHORIZATION																
TITLE I																
TITLE II																
BID AND AWARD																
TITLE III																
CONSTRUCTION																
LAND IMPROVEMENTS																
UTILITIES																
BUILDING IMPROVEMENTS																
BUILDING SPECIAL FACILITIES																
STANDARD EQUIPMENT																

4/16/93

A&E:ALS-SBSF:CDR

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

STATUS OF NEPA AND SARS

NEPA

- **Evaluating Required Level of NEPA Document**

SARS

- **Evaluating Required Level of SARS Document**

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

BASIS OF DESIGN

- **Programmatic Criteria for Functional Requirements
Developed by LBL Center for X-Ray Optics**
- **Conceptual Design, Drawings and Specifications
Prepared by LBL Facilities Department**
- **Site in General Conformance with LBL Site
Development Plan (Approved by DOE in 1991)**
- **Consultants**
 - **Gerson-Overstreet, Architects**
 - **Keller and Gannon, Engineers-Architects**
- **Cost Estimate by Derek Daniels, LBL Cost Estimator**
- **Construction Costs Escalated 21.0% from December
1989 to Midpoint of Construction, November 1995
Using DOE Guidelines**

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

METHOD OF ACCOMPLISHMENT

- **Design Program Will Be Prepared by LBL Facilities Department from Programmatic Criteria Supplied by Life Sciences Directorate**
- **A/E Will Be Selected for Titles I and II Design and Title III Technical Oversight**
- **Title III Construction Work Will Be Accomplished by a Lump-Sum Contract Awarded After Competitive Bidding**
- **Construction Contract Administration and Inspection by LBL**
- **Standard Equipment and Some Special Building Facilities Will Be Procured by LBL**

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

COST ESTIMATE (\$K)

A.	1. Engineering, Design, and Inspection (at ~15% of Construction Costs)	560
	2. Project Management (at ~7% of Construction Costs)	250
B.	Construction Costs	3,710
	1. Improvements to Land	14
	2. Building 80 Improvements (6,000 GSF @\$236/SF)	1,417
	3. Building 6 Improvements (5,100 GSF at \$176/SF)	900
	4. Special Facilities (Schedule I)	1,279
	5. Utilities	100
C.	Standard Equipment, Including Office and Laboratory Furnishings (Schedule II)	<u>2,230</u>
	Subtotal	6,750
D.	Contingency (at ~17% of Above Costs)	<u>1,150</u>
	Total Estimated Cost	7,900

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

SCHEDULE I (\$K)

<u>Special Facilities</u>	<u>Estimated Cost</u>
Laboratory Furniture and Standard Fume Hoods	
Building 80	216
Building 6	153
Cold Rooms	
Building 80 (1)	22
Building 6 (2)	45
Laminar Flow Hoods (3)	54
Scientific Equipment	
Digital Scanning Electron Microscope with Analytical Workstation	327
High-Resolution Microscope with Cryoworkstation	254
Confocal Microscope	108
Image Analysis Package	<u>100</u>
TOTAL	1,279

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

SCHEDULE II (TY \$K)

<u>Standard Equipment</u>	<u>Estimated Cost</u>
Biochemistry*	720
Centrifuges	172
Spectrophotometers	70
Balances	50
Isotope Counters	54
Separation Equipment	168
General Laboratory Equipment	206
Microscopy*	132
Darkroom Equipment	67
General Laboratory Equipment	65
Cell and Tissue Culture*	142
Incubators	58
Sterilizer	46
General Laboratory Equipment	38
Surgical Suite*	96
Operating Tables, Surgical Instruments and Special Lighting	25
Operating Microscope and Video Equipment	59
General Laboratory Equipment	12
Spectroscopy Laboratories**	360

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

SCHEDULE II (continued) (TY \$K)

<u>Standard Equipment</u>	<u>Estimated Cost</u>
Crystallography Laboratories**	300
Rotating Anode X-Ray System	143
Graphics Equipment	140
Stereo Microscope System	17
General Support Equipment	480
Computation Equipment	310
Equipment for Glass Washing and Handling	108
Office Furniture	46
Office Equipment	16
TOTAL	2,230

* Based on FY 1989 Catalog Prices which have been Escalated 2.8% to FY 1990 \$K

** Based on FY 1992 Catalog Prices which have been De-Escalated 5.5% to FY 1990 \$K

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

ESTIMATE SUMMARY DETAIL

Improvements to Land

		<u>Building 80</u>	<u>Building 6</u>
Div 2	Sitework	10,000	---
	General Conditions/Mobilize 7%	700	---
	Estimating Contingency	<u>In Project Contingency</u>	
		10,700	---
	Bond 2%	210	---
	Prime Contractor OH & Fee 12%	<u>1,280</u>	---
Total Estimated Construction			
	Cost at November 1989	<u>12,190</u>	---
Total Estimated Construction			
	Cost to November 1995	21% <u>14,750</u>	<u>14,750</u>

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

ESTIMATE SUMMARY DETAIL (continued)

Buildings

<u>DIV</u>		<u>Building 80</u>	<u>Building 6</u>
2	Demolition	98,640	---
3	Concrete	16,950	---
5	Metals	134,290	15,100
6	Wood and Plastics	6,080	17,850
7	Thermal/Moisture Protection	10,020	---
8	Doors/Windows	31,930	25,570
9	Finishes	145,960	227,520
10	Specialties	7,570	1,530
12	Furnishings	2,100	---
13	Special Construction	---	---
14	Conveying Systems	90,000	---
15	Mechanical: Plumbing	83,000	77,000
	HVAC	184,000	152,000
	Fire Protection	5,200	5,500
16	Electrical	<u>143,110</u>	<u>85,750</u>
	Subtotal Direct Cost	958,850	607,820
	General Conditions/Mobilize 7%	67,120	42,550
	Estimating Contingency	<u>In Project Contingency</u>	
		1,025,970	650,370
	Bond 2%	20,520	13,010
	Prime Contractor OH & Fee 12%	<u>123,120</u>	<u>78,040</u>
	Total Estimated Construction Cost at November 1989	<u>1,169,610</u>	<u>741,420</u>
	Total Escalated Construction Cost to November 1995	21% <u>1,415,230</u>	<u>897,120</u> <u>2,312,350</u>

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

ESTIMATE SUMMARY DETAIL (continued)

Site Utilities

Div 15 Mechanical		10,000	5,000	
Div 16 Electrical		<u>34,450</u>	<u>19,700</u>	
Subtotal Direct Cost		44,450	24,700	
General Conditions/Mobilize	7%	3,110	1,730	
Estimating Contingency		<u>In Project Contingency</u>		
		47,560	26,430	
Bond	2%	950	530	
Prime Contractor OH & Fee	12%	<u>5,710</u>	<u>3,170</u>	
Total Estimated Construction				
Cost at November 1989		<u>54,220</u>	<u>30,130</u>	<u>84,350</u>
Total Escalated Construction	21%	<u>65,610</u>	<u>36,460</u>	<u>102,070</u>
Cost to November 1995				

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

OBLIGATIONS AND COSTS SCHEDULE DETAIL (TY \$K)

DESCRIPTION	TOTAL	1.130		1.181		1.236	
		FY 1994		FY 1995		FY 1996	
		O	C	O	C	O	C
<u>LBL Activities</u>							
Engineering	129	73	73	35	35	21	21
Consultants	20			20	20		
Inspection	<u>64</u>	<u>—</u>	<u>—</u>	<u>32</u>	<u>32</u>	<u>32</u>	<u>32</u>
Subtotal	213	73	73	87	87	53	53
<u>Architect/Engineer</u>							
Title I	102	102	102				
Title II	171	171	153	0	18		
Title III	<u>72</u>	<u>72</u>	<u>0</u>	<u>0</u>	<u>35</u>	<u>0</u>	<u>37</u>
Subtotal	345	345	255	0	53	0	37
Total ED&I	558	418	328	87	140	53	90
<u>Construction</u>							
Land Improvements	14			14	14		
Building 80	1,417			1,417	638	0	779
Building 6	901			901	308	0	593
Site Utilities	99			99	99		
Special Facilities	1,279			216	216	1,063	1,063
Project Management	<u>250</u>	<u>90</u>	<u>90</u>	<u>80</u>	<u>80</u>	<u>80</u>	<u>80</u>
Subtotal	3,960	90	90	2,727	1,355	1,143	2,515
<u>Standard Equipment</u>	<u>2,230</u>	<u>—</u>	<u>—</u>	<u>1,104</u>	<u>485</u>	<u>1,126</u>	<u>1,745</u>
Subtotal	6,748	508	418	3,918	1,980	2,322	4,350
Contingency (17%)	<u>1,152</u>	<u>92</u>	<u>82</u>	<u>782</u>	<u>320</u>	<u>278</u>	<u>750</u>
TOTAL	7,900	600	500	4,700	2,300	2,600	5,100

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates"
(Updated February 1992)

Start Construction: February 1995
Construction Period: 16 Months
Finish Construction: May 1996
Midpoint Construction: November 1995
Estimate Date: December 1989

						<u>%</u>	
FY 1990	Dec 1989 -	Sep 1990	9 mo @	2.8	=	2.1	
FY 1991	Oct 1990 -	Sep 1991	12 mo @	2.6	=	2.6	
FY 1992	Oct 1991 -	Sep 1992	12 mo @	2.1	=	2.1	
FY 1993	Oct 1992 -	Sep 1993	12 mo @	3.4	=	3.4	
FY 1994	Oct 1993 -	Sep 1994	12 mo @	4.3	=	4.3	
FY 1995	Oct 1994 -	Sep 1995	12 mo @	4.5	=	4.5	
FY 1996	Oct 1995 -	Nov 1995	1 mo @	4.7	=	0.4	

Total Compounded Escalation

21.0

ALS STRUCTURAL BIOLOGY SUPPORT FACILITIES

LBL 94-E-337

ED&I ANALYSIS (FY 1990 \$K)

LBL Activities

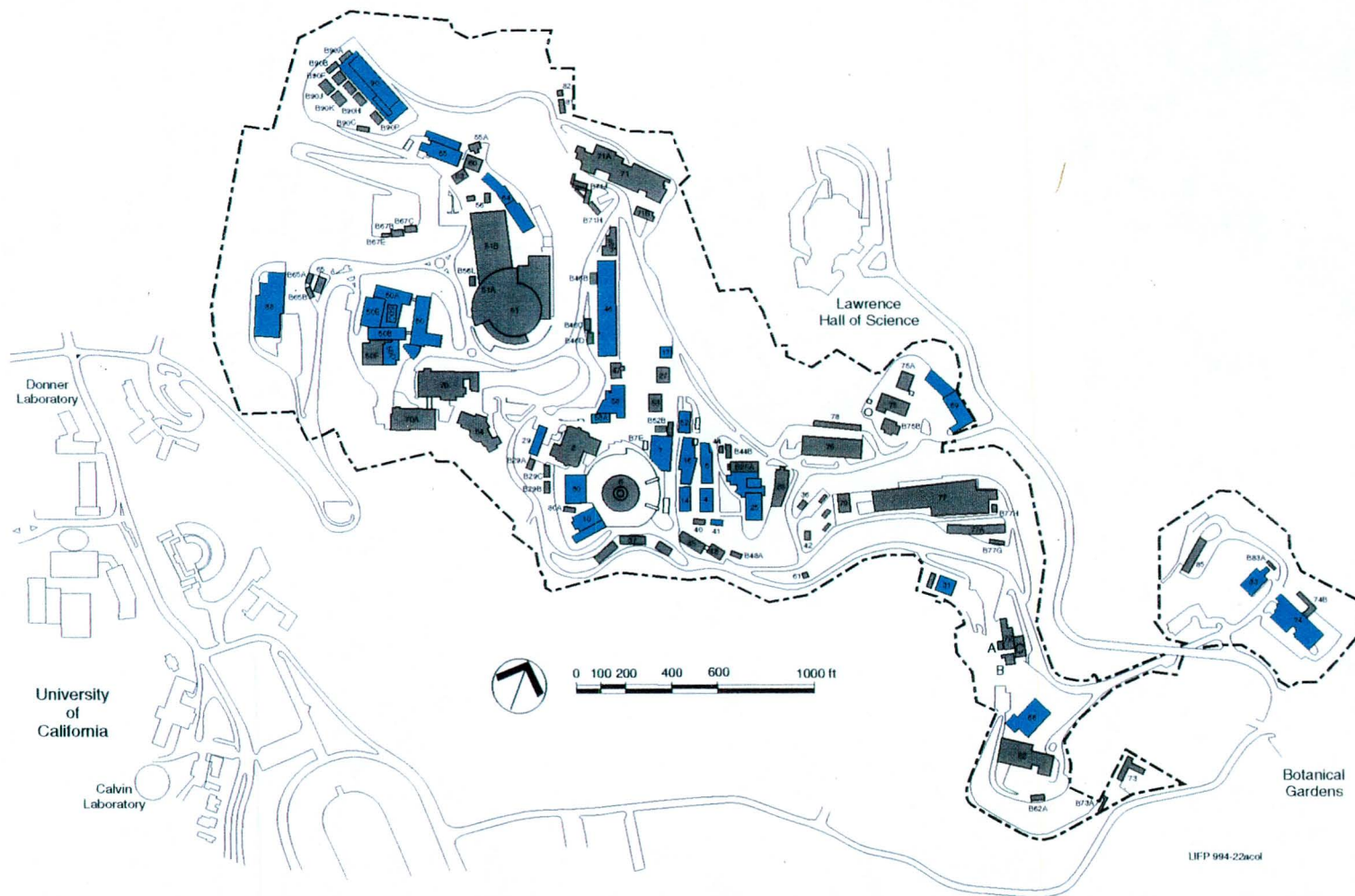
Engineering

• Title I (3 MM at 7.38/mo)			=	22
Proj Arch 1 x .4 time x 3	=	1.2MM		
Proj Team 3 x .2 time x 3	=	1.8		
• Title II (6.3 MM at 7.38/mo)			=	47
Proj Arch 1 x .3 x 7	=	2.1MM		
Proj Team 3 x .2 x 7	=	4.2		
• Title III (5.8 MM at 7.38/mo)			=	43
Proj Arch 1 x .15 x 16	=	2.4MM		
Proj Team 3 x .07 x 16	=	3.4		
• Inspection (7.2 MM at 7.38/mo)			=	53
Inspectors (combo) .45 x 16	=	7.2		
• Consultants and Vendors			=	17
Independent Seismic Reviews		3		
Independent Cost Estimate		5		
Advertisements		3		
Printing		6		
				182

A/E Activities

12.5% of Designed Construction Costs (2,407)	
Including Special Facilities of 400	300

Total Estimated ED&I 482



UFP 994-22accl

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

PROJECT DESCRIPTION

- **Examples of Work Items**
 - **Repair of Fire Rated Wall Assemblies Including Doors, Dampers, and Firestopping in Walls and Floors**
 - **Upgrade of Exit Signage and Emergency Exit Lighting**
 - **Improvements to Automatic Sprinkler Systems**
 - **Addition of Heat Detectors**
 - **Addition of Second Exits and Exit Passageways**
 - **Addition of Manual Emergency Shut-Off Switches for Laboratory Air Recirculating Systems**

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

CHANGES SINCE 1992 VALIDATION

Scope

- **Work Items are Unchanged**
- **Specific Building Locations Have Been Revised Based on Tiger Team and TSA Priorities**

Schedule

- **Construction Completion Has Been Extended to 4th Quarter FY96 Due to Change in Funding Profile**

TEC

- **No Change**

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

COST ESTIMATE (\$K) CHANGES SINCE 1992 VALIDATION

	<u>1992 Validation</u>	<u>Changes</u>	<u>Escalation</u>	<u>1993 Validation</u>
A. 1. ED&I (17%)	540	0	0	540
2. Project Management (6%)	190	0	0	190
B. Construction Costs	3,200	0	0	3,200
1. Buildings	3,200	0	0	3,200
Subtotal	3,930	0	0	3,930
C. Contingency (17%)	<u>670</u>	<u>0</u>	<u>0</u>	<u>670</u>
Total Estimated Cost	4,600	0	0	4,600

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

FINANCIAL SCHEDULE (\$K)

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1993	500	500	150
1994	1,000	1,000	1,200
1995	2,000	2,000	1,900
1996	<u>1,100</u>	<u>1,100</u>	<u>1,350</u>
Total	4,600	4,600	4,600

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

TOTAL PROJECT COSTS (TPC) (\$K)

	<u>Prior Years</u>	<u>FY 1993</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>Total</u>
Total Project Costs (TPC)						
(1) Total Facility Costs (Construction Line Item - TEC)	0	150	1,200	1,900	1,350	4,600
(2) Other Project Costs						
(a) Conceptual Design Costs	<u>30</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>30</u>
Total Project Cost	30	150	1,200	1,900	1,350	<u>4,630</u>

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

CONTINGENCY ANALYSIS

	Estimated Cost (\$K)	Contingency (%)	Contingency (\$K)
<u>LBL Activities</u>			
Engineering	130	18	24
Inspection	60	20	12
Consultants	30	15	4
<u>Architect-Engineer</u>			
Titles I & II	240	16	38
Title III	80	15	12
<u>Construction</u>			
Subcontract	3,200	17	551
<u>Project Management</u>	<u>190</u>	15	<u>29</u>
Subtotal	3,930		670
Contingency (17%)	<u>670</u>		
TOTAL	4,600		

FIRE AND SAFETY SYSTEMS UPGRAD, PHASE I

LBL 93-E-323

BA/BO SCHEDULE

WBS NO.	WBS ELEMENT	TOTAL BUDGET	F Y 1993				F Y 1994				F Y 1995				F Y 1996			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
			O N D	J F M	A M J	J A S	O N D	J F M	A M J	J A S	O N D	J F M	A M J	J A S	O N D	J F M	A M J	J A S
1.0	ENGINEERING,DES & INSP																	
1.1	LBL ACTIVITIES																	
1.1.1.1	TITLE I	45		12/12	12/12			11/11	10/10									
1.1.1.2	TITLE II	53				10/10	9/9	9/9		9/9	8/8	8/8						
1.1.1.3	TITLE III	32							4/4	3/3	3/3	3/3	4/4	3/3	3/3	3/3	3/3	3/3
1.1.2	INSPECTION	60							6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6
1.1.3	CONSULTANTS	30							3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
1.2	ARCHITECT/ENGINEER																	
1.2.1	TITLE I	112		112/28	0/28			0/28	0/28									
1.2.2	TITLE II	128		128/0		0/22	0/21	0/21		0/22	0/21	0/21						
1.2.3	TITLE III	80		80/0					0/8	0/8	0/8	0/8	0/8	0/8	0/8	0/8	0/8	0/8
2.0	CONSTRUCTION																	
2.1.2.1	SUBCONTRACT A	1700							800/400	0/400	900/450	0/450						
2.1.2.2	SUBCONTRACT B	1500											600/200	0/250	0/150	900/350	0/350	0/200
4.0	PROJECT MANAGEMENT	190		6/6	6/6	6/6	12/12	12/12	12/12	12/12	18/18	18/18	18/18	18/18	13/13	13/13	13/13	13/13
Contingency by Year		670/670	58 / 20				129 / 143				313 / 339				170 / 168			
Total BA/BO by Year		4600/4600	430 / 150				1050 / 1200				1950 / 1900				1170 / 1350			
Current Funding Plan		4600	500				1000				2000				1100			

FIRE AND SAFETY UPGRADE, PHASE I

LBL 93-E-323

TIME SCHEDULE

Activities	Fiscal Year 1993				Fiscal Year 1994				Fiscal Year 1995				Fiscal Year 1996			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
A/E Selection In FY92																
Design																
Group 1 Buildings																
Title I																
Title II																
Bid and Award																
Group 2 Buildings																
Title I																
Title II																
Bid and Award																
Construction																
Subcontract A																
Title III																
Construction																
Subcontract B																
Title III																
Construction																

04/15/93

A&E:FireSftyPhI:CDR

LEGEND: ORIGINAL SCHEDULE (FY92 VALIDATION)
REVISED SCHEDULE 93 VALIDATION)



FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

STATUS OF NEPA AND SARS

NEPA

- **Categorical Exclusion**

SARS

- **Exempt**

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

PROJECT JUSTIFICATION

- **First Phase of a Series of Projects to Upgrade LBL Buildings to Meet Life Safety Requirements**
- **1989 DOE Technical Safety Appraisal Identified LBL Facilities Which Were Not in Compliance with Life Safety Codes and Improved Risk Criteria - DOE Order 5480.7**
- **Most Buildings Were Built Between 1940 and 1960 and Have Been Modified Significantly**
- **Building Usages Have Significantly Changed**
- **Building Construction and Fire Protection Systems Need to Be Modified to Reflect the Changes in Use and Code Requirements**

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

BASIS OF DESIGN

- **Conceptual Design by LBL Facilities and Fire Departments**
- **Building Survey by Crawford Services (1991) Fire Protection Consultants**
- **Code Deficiencies Prioritized by LBL Fire Department**
- **Construction Cost Estimate**
 - **Cost Estimating by LBL Design Team**
 - **Checked by Derek Daniels, LBL Cost Estimator**

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

METHOD OF ACCOMPLISHMENT

- **Design Program Prepared by LBL Facilities and Fire Departments**
- **A/E Selected by LBL for Titles I and II Design and Title III Technical Oversight During Construction**
- **Construction Work Bid as Lump-Sum Contract Awarded after Competitive Bidding**
- **Some Minor Design Alterations and Modifications Will Be Accomplished by LBL Facilities Department Maintenance and Operations Group**
- **Project Management, Construction Contract Administration and Inspection by LBL**

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

COST ESTIMATE (\$K)

A.	1. Engineering, Design and Inspection (at ~17% of Construction Costs)	540
	2. Project Management (at ~6% of Construction Costs)	190
B.	Construction Costs	3,200
	1. Buildings	3,200
	Subtotal	3,930
C.	Contingency (at ~17% of Above Costs)	<u>670</u>
	Total Estimated Cost	4,600

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

COST ESTIMATE SUMMARY Subcontract A

Construction Cost		1,096,339
General Conditions	8%	87,707
Estimating Contingency		<u>In Project Contingency</u>
		1,184,046
Bond	2%	23,681
Prime Contractor OH & Fee	15%	<u>177,607</u>
Total Estimated Construction Cost at January 1991		<u>1,385,334</u>
Total Escalated Construction Cost to September 1994	19%	<u>1,648,547</u>
	Say	1,700,000

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

LBL 93-E-323

COST ESTIMATE SUMMARY (continued) Subcontract B

Construction Cost		922,079
General Conditions	8%	73,766
Estimating Contingency		<u>In Project Contingency</u>
		995,845
Bond	2%	19,917
Prime Contractor OH & Fee	15%	<u>149,377</u>
Total Estimated Construction Cost at January 1991		<u>1,165,139</u>
Total Escalated Construction Cost to November 1995	27.2%	<u>1,482,057</u>
	Say	1,500,000

FIRE AND SAFETY SYSTEMS UPGRADE PROJECT, PHASE I
LBL 93-E-323
OBLIGATIONS AND COSTS SCHEDULE DETAIL
(\$K)

DESCRIPTION	TOTAL	FY 1993		FY 1994		FY 1995		FY 1996	
		O	C	O	C	O	C	O	C
<u>LBL Activities</u>									
Title I	45	24	24	21	21				
Title II	53	10	10	27	27	16	16		
Title III	32			7	7	13	13	12	12
Inspection	60			12	12	24	24	24	24
Consultants	<u>30</u>	<u>—</u>	<u>—</u>	<u>6</u>	<u>6</u>	<u>12</u>	<u>12</u>	<u>12</u>	<u>12</u>
Subtotal	220	34	34	73	73	65	65	48	48
<u>Architect-Engineer</u>									
Title I	112	112	56	0	56				
Title II	128	128	22	0	64	0	42		
Title III	<u>80</u>	<u>80</u>	<u>0</u>	<u>0</u>	<u>16</u>	<u>0</u>	<u>32</u>	<u>0</u>	<u>32</u>
Subtotal	320	320	78	0	136	0	74	0	32
<u>Construction</u>									
Subcontract A	1,700			800	800	900	900		
Subcontract B	<u>1,500</u>			<u>—</u>	<u>—</u>	<u>600</u>	<u>450</u>	<u>900</u>	<u>1,050</u>
Subtotal	3,200			800	800	1,500	1,350	900	1,050
<u>Project Management</u>	190	18	18	48	48	72	72	52	52
Subtotal	3,930	372	130	921	1,057	1,637	1,561	1,000	1,182
Contingency (17%)	<u>670</u>	<u>58</u>	<u>20</u>	<u>129</u>	<u>143</u>	<u>313</u>	<u>339</u>	<u>170</u>	<u>168</u>
TOTAL	4,600	430	150	1,050	1,200	1,950	1,900	1,170	1,350

FIRE AND SAFETY UPGRADE, PHASE I

ESCALATION ANALYSIS Subcontract A

Based on DOE "Anticipated Economic Escalation Rates"
(Updated August 1990)

Start Construction: March 1994
Construction Period: 12 Months
Finish Construction: February 1995
Midpoint Construction: September 1994
Estimate Date: February 1991

							<u>%</u>
FY 1991	Jan 1991 -	Sep 1991	9 mo @	3.6	=	2.7	
FY 1992	Oct 1991 -	Sep 1992	12 mo @	4.5	=	4.5	
FY 1993	Oct 1992 -	Sep 1993	12 mo @	5.1	=	5.1	
FY 1994	Oct 1993 -	Sep 1994	12 mo @	5.6	=	5.6	

Total Compounded Escalation 19.0

FIRE AND SAFETY UPGRADE, PHASE I

ESCALATION ANALYSIS (continued) Subcontract B

Based on DOE "Anticipated Economic Escalation Rates"
(Updated August 1990)

Start Construction: May 1995
Construction Period: 12 Months
Finish Construction: April 1996
Midpoint Construction: November 1995
Estimate Date: February 1991

						<u>%</u>
FY 1991	Jan 1991 - Sep 1991	9 mo @ 3.6	=	2.7		
FY 1992	Oct 1991 - Sep 1992	12 mo @ 4.5	=	4.5		
FY 1993	Oct 1992 - Sep 1993	12 mo @ 5.1	=	5.1		
FY 1994	Oct 1993 - Sep 1994	12 mo @ 5.6	=	5.6		
FY 1995	Oct 1994 - Sep 1995	12 mo @ 5.7	=	5.7		
FY 1996	Sep 1995 - Nov 1995	2 mo @ 5.7	=	1.0		

Total Compounded Escalation 27.2

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

ED&I ANALYSIS (\$K)

LBL Activities

Title I 4.8MM x 9.4K/MM		= 45
Proj Architect 0.4 time x 6 mos	= 2.40	
Proj Team 0.4 time x 6 mos	= 2.40	
Title II 5.4MM x 9.4K/MM		= 51
Proj Architect 0.4 time x 6 mos	= 2.40	
Proj Team 0.5 time x 6 mos	= 3.00	
Title III 4.5MM x 9.4K/MM		= 42
Project Arch/Team 0.3 time x 15 mos	= 4.50	
Inspection 5.76MM x 9.4K/MM		= 54
Inspectors (Constr) 0.24 time x 24 mos	= 5.76	
Consultants and Vendors		= 28
Fire Protection Consultant	23	
Independent Cost Estimate	4	
Advertising	1	

A/E Activities

10% of Designed Construction Costs	(3,200)	320
Title I (35%)	112	
Title II (40%)	128	
Title III (25%)	80	
Total Estimated ED&I		<u>540</u>

Current FY91 LBL Rate: 7.5K/MM

Escalation to November 1995: 25.9% x 7.5K/MM = 9.4K/MM

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

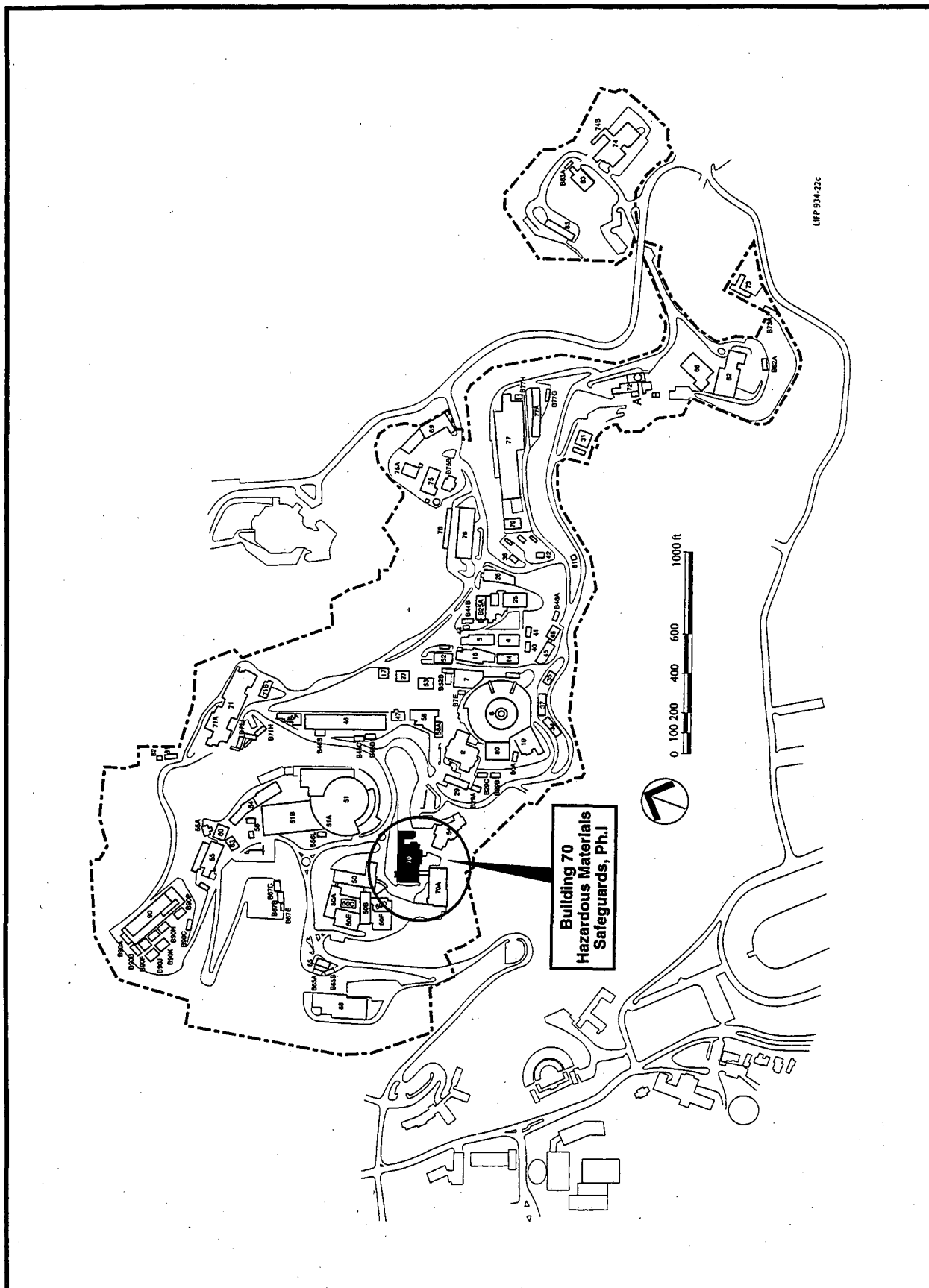
FINANCIAL SCHEDULE (\$K)

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1993	1,500	1,500	160
1994	2,000	2,000	1,480
1995	1,100	1,100	1,720
1996	<u>0</u>	<u>0</u>	<u>1,240</u>
Total	4,600	4,600	4,600

FIRE AND SAFETY SYSTEMS UPGRADE, PHASE I

BA/BO SCHEDULE (\$K)

WBS NO.	WBS ELEMENT	TOTAL BUDGET	FY 1993								FY 1994								FY 1995								FY 1996											
			1		2		3		4		1		2		3		4		1		2		3		4		1		2		3		4					
			O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
1.0	ENGINEERING,DES & INSP																																					
1.1	LBL ACTIVITIES																																					
1.1.1.1	TITLE I	45																																				
1.1.1.2	TITLE II	53																																				
1.1.1.3	TITLE III	32																																				
1.1.2	INSPECTION	60																																				
1.1.3	CONSULTANTS	30																																				
1.2	ARCHITECT/ENGINEER																																					
1.2.1	TITLE I	112																																				
1.2.2	TITLE II	128																																				
1.2.3	TITLE III	80																																				
2.0	CONSTRUCTION																																					
2.1.2.1	SUBCONTRACT A	1700																																				
2.1.2.2	SUBCONTRACT B	1500																																				
4.0	PROJECT MANAGEMENT	190																																				
Contingency by Year		670/670	103 / 23								223 / 226								332 / 262								12 / 159											
Total BA/BO by Year		4600/4600	400 / 160								2150 / 1480								1980 / 1720								70 / 1240											
Current Funding Plan		4600	1500								2000								1100								0											



LPP 934-22c



LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

Hazardous Materials Safeguards, Ph. I
LBL 93-E-324
SITE LOCATION PLAN

4/15/93

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

PROJECT DESCRIPTION

- **The Project Will Upgrade Building 70 Life Safety, Health and Environmental Protection Safeguards to Meet the 1991 Uniform Building Code B-2 Occupancy Requirements for Laboratories with Hazardous Materials**

- **Examples of Work Items**
 - **Separation of Each Floor into Two Control Areas for a Total of Four Control Areas**

 - **Providing Two Exits from Laboratories with Areas over 200 Square Feet**

 - **Installation of Manual Emergency Shut-Off Switches for Laboratory Air Recirculating Systems**

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

PROJECT DESCRIPTION (Continued)

- **Examples of Work Items (Continued)**
 - **Addition of Rated Doors at Elevator Openings on Each Floor**
 - **Upgrade of the Emergency Power System to Meet NFPA Level 1 Reliability**
 - **Providing Spill Control Secondary Containment for the Hazardous Materials Storage Room**
 - **Providing Hazardous Gas Monitoring System Infrastructure**

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

CHANGES SINCE 1992 VALIDATION

Scope

- **Deleted Chemical Delivery System**
- **Added Control Areas**
- **Added Two-Hour Enclosure for Boiler Room**
- **Added Rated Exitway Enclosures**
- **Added Spill Control Tank for Hazardous Materials Storage**

Schedule

- **Schedule Has Been Extended 15 Months Due to Change in Funding Profile**

TEC

- **No Change**
- **Deleted Removal Costs for Chemical Delivery System**
- **Increased Building Construction Costs for Code Changes**

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

COST ESTIMATE (\$K) CHANGES SINCE 1992 VALIDATION

	<u>1992 Validation</u>	<u>Changes</u>	<u>Escalation</u>	<u>1993 Validation</u>
A. 1. ED&I (16%)	610	0	0	610
2. Project Management (6%)	220	0	0	220
B. Construction Costs	3,600	0	0	3,600
1. Buildings	3,510	+90	0	3,600
2. Removals	90	-90	0	0
Subtotal	4,430	0	0	4,430
C. Contingency (15%)	<u>670</u>	<u>0</u>	<u>0</u>	<u>670</u>
Total Estimated Cost	5,100	0	0	5,100

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

FINANCIAL SCHEDULE

(\$K)

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1993	500	500	250
1994	1,000	1,000	670
1995	2,500	2,500	2,350
1996	<u>1,100</u>	<u>1,100</u>	<u>1,830</u>
Total	5,100	5,100	5,100

4/5/93

A&E: HazMatSfgrdPhl: PV

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 92-E-324

TOTAL PROJECT COSTS (TPC) (\$K)

	<u>Prior Years</u>	<u>FY 1993</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>Total</u>
Total Project Costs (TPC)						
(1) Total Facility Costs (Construction Line Item - TEC)	0	250	670	2,350	1,830	5,100
(2) Other Project Costs						
(a) Conceptual Design Cost	<u>60</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>60</u>
Total Project Cost	60	250	670	2,350	1,830	<u>5,160</u>

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

CONTINGENCY ANALYSIS

	Estimated Cost (\$K)	Contingency (%)	Contingency (\$K)
<u>LBL Activities</u>			
Engineering	144	15	22
Inspection	70	20	14
Consultants	36	15	5
<u>Architect/Engineer</u>			
Titles I & II	270	15	40
Title III	90	15	14
<u>Construction</u>			
Buildings	3,600	15	542
<u>Project Management</u>	<u>220</u>	15	<u>33</u>
Subtotal	4,430		670
Contingency (15%)	<u>670</u>		
TOTAL	5,100		

4/16/93

A&E: HazMatSfgrdPhl:PV

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I
LBL 93-E-324
BA/BO SCHEDULE(\$K)

WBS NO.	WBS ELEMENT	TOTAL BUDGET	FY 1993				FY 1994				FY 1995				FY 1996											
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4								
			O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
1.0	HAZARDOUS MATERIALS SAFEGUARDS, PHASE I																									
1.1	ENGINEERING, DESIGN & INSPECTION																									
1.1.1	LBL ACTIVITIES																									
1.1.1.1	ENGINEERING																									
1.1.1.1.1	TITLE I	50		20/20		15/15		15/15																		
1.1.1.1.2		58						15/15		15/15		15/15		13/13												
1.1.1.1.3		36													6/6	5/5	5/5	5/5	5/5	5/5	5/5					
1.1.1.2	INSPECTION	70													10/10	10/10	10/10	10/10	10/10	10/10	10/10					
1.1.1.3	CONSULTANTS	36		4/4		4/4		4/4		6/6		6/6		6/6												
1.1.2	ARCHITECT/ENGINEER																									
1.1.2.1	TITLE I	126		126/42		0/42		0/42																		
1.1.2.2	TITLE II	144		144/0					0/36	0/36		0/36		0/36												
1.1.2.3	TITLE III	90											90/0	0/13	0/13	0/13	0/13	0/13	0/13	0/13	0/13	0/12				
1.2.0	CONSTRUCTION																									
1.2.1.0	BUILDING	3600											600/300	0/300	2000/550	0/500	0/500	0/450	1000/500	0/500						
1.3.0	STANDARD EQUIPMENT																									
1.4.0	PROJECT MANAGEMENT	220		10/10		10/10		10/10		10/10		10/10		20/20	20/20	20/20	20/20	20/20	20/20	20/20	20/20					
	Contingency by Year	670/670	68 / 32				118 / 94				319 / 307				165 / 237											
	Total BA/BO by Year	5100/5100	430 / 250				940 / 670				2460 / 2350				1270 / 1830											
	Current Funding Plan	5100	500				1000				2500				1100											

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

TIME SCHEDULE

Activities	Fiscal Year 1993				Fiscal Year 1994				Fiscal Year 1995				Fiscal Year 1996			
	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth	First	Second	Third	Fourth
A/E Selection Complete in FY92																
Nepa/Sars																
Title I																
Title II																
Bid and Award																
Title III																
Construction																

4/15/93

A&E: HazMatSfgrdPhl:CDR

LEGEND: ORIGINAL SCHEDULE (FY92 VALIDATION)
REVISED SCHEDULE (FY93 VALIDATION)



HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324 STATUS OF NEPA AND SARS

NEPA

- **Categorical Exclusion Recommended**
- **LBL Review in Progress**

SARS

- **Exemption Recommended**
- **Review in Progress**

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

PROJECT JUSTIFICATION

- **Building 70 Laboratory Facility Is Used for Multiprogram Research in Basic Energy Sciences, High Energy Nuclear Physics, Life Sciences and Office of Health and Environmental Research**
- **The Research Activities Require a Wide Variation of Hazardous Materials Including Chemicals and Gases Which Are Flammable and Toxic**
- **The Facility Was Constructed in 1954 and Does Not Meet Current Building and Life Safety Code Standards**
- **Major Building and Building Systems Modifications Are Required to Continue Multiprogram Research Operations**

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

BASIS OF DESIGN

- **Experience with Retrofit of Hazardous Materials Laboratories at LBL**
- **Consultation with Hazardous Materials Consultants**
- **Current Building and Safety Requirements for Research Laboratories**
- **Current Industry Standards for Hazardous Materials Research**
- **Study Report by Consultants Fong and Chan Architects, Prepared in 1991**
- **Construction Cost Estimate**
 - **LBL Facilities Department Design Team**
 - **Reviewed by John Eastman, LBL Cost Estimator**

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

METHOD OF ACCOMPLISHMENT

- **Design Program Prepared by LBL Facilities Department Team with Consultation of a Hazardous Material Consultant**
- **A/E Selected by LBL for Titles I and II Design and Title III Technical Oversight During Construction**
- **Construction Work Bid as Lump-Sum Subcontract Awarded After Competitive Bidding**
- **Project Management, Construction Contract Administration and Inspection by LBL**

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

COST ESTIMATE

(\$K)

A.	1. Engineering, Design, and Inspection (at ~16% of Construction Costs)	610
	2. Project Management (at ~6% of Construction Costs)	220
B.	Construction Costs	3,600
	1. Buildings	3,600
	Subtotal	4,430
C.	Contingency (at ~15% of Above Costs)	<u>670</u>
	Total Estimated Cost	5,100

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

OBLIGATIONS AND COSTS SCHEDULE DETAIL

(\$K)

		FY 1993		FY 1994		FY 1995		FY 1996	
DESCRIPTION	TOTAL	O	C	O	C	O	C	O	C
<u>LBL Activities</u>									
Engineering									
Title I	50	50	50						
Title II	58			58	58				
Title III	36					21	21	15	15
Inspection	70					40	40	30	30
Consultants	<u>36</u>	<u>12</u>	<u>12</u>	<u>24</u>	<u>24</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Subtotal	250	62	62	82	82	61	61	45	45
<u>Architect/Engineer</u>									
Title I	126	126	126						
Title II	144	144	0	0	144				
Title III	<u>90</u>	<u>—</u>	<u>—</u>	<u>90</u>	<u>0</u>	<u>0</u>	<u>52</u>	<u>0</u>	<u>38</u>
Subtotal	360	270	126	90	144	0	52	0	38
<u>Construction</u>									
Building	3,600			600	300	2,000	1,850	1,000	1,450
<u>Project Management</u>	220	30	30	50	50	80	80	60	60
Subtotal	4,430	362	218	822	576	2,141	2,043	1,105	1,593
Contingency (15%)	<u>670</u>	<u>68</u>	<u>32</u>	<u>118</u>	<u>94</u>	<u>319</u>	<u>307</u>	<u>165</u>	<u>237</u>
TOTAL	5,100	430	250	940	670	2,460	2,350	1,270	1,830

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates"
(Updated August 1990)

Start Construction: January 1994
Construction Period: 15 Months
Finish Construction: April 1, 1995
Midpoint Construction: August 1994
Estimate Date: January 1991

						<u>%</u>
FY 1991	Jan 1991 - Sep 1991	9	mo @ 3.6	=	2.7	
FY 1992	Oct 1991 - Sep 1992	12	mo @ 4.5	=	4.5	
FY 1993	Oct 1992 - Sep 1993	12	mo @ 5.1	=	5.1	
FY 1994	Oct 1993 - Aug 1994	11	mo @ 5.6	=	5.1	

Total Compounded Escalation 18.5

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

LBL 93-E-324

ED&I ANALYSIS

(\$K)

LBL Activities

• Title I 5.6MM x 8.9K/MM		=	50
Proj Architect 0.47 time x 6 mos	=	2.8	
Proj Team 0.47 time x 6 mos	=	2.8	
• Title II 6.5MM x 8.9K/MM		=	58
Proj Architect 0.54 time x 6 mos	=	3.25	
Proj Team 0.54 time x 6 mos	=	3.25	
• Title III 4.0MM x 8.9K/MM		=	36
Project Arch/Team 0.27 time x 15 mos	=	4.0	
• Inspection 7.8MM x 8.9K/MM		=	70
Inspectors (Constr) 0.52 time x 15 mos	=	7.8	
• Consultants and Vendors			36
Hazardous Materials Consultant	24		
Independent Cost Estimate	2		
Advertising	1		
Equipment Testing (Elec/Mech)	4		
Materials Testing	5		

A/E Activities

10% of Designed Construction Costs	= (3,600)	360
Title I (35%)	126	
Title II (40%)	144	
Title III (25%)	90	

Total Estimated ED&I

610

Current FY91 Rate: 7.5K/MM

Escalation (August 1994) 7.5K/MM x 1.19 = 19%: 8.9K/MM

4/1/93

A&E: HazMatSfgrdPhI:PV

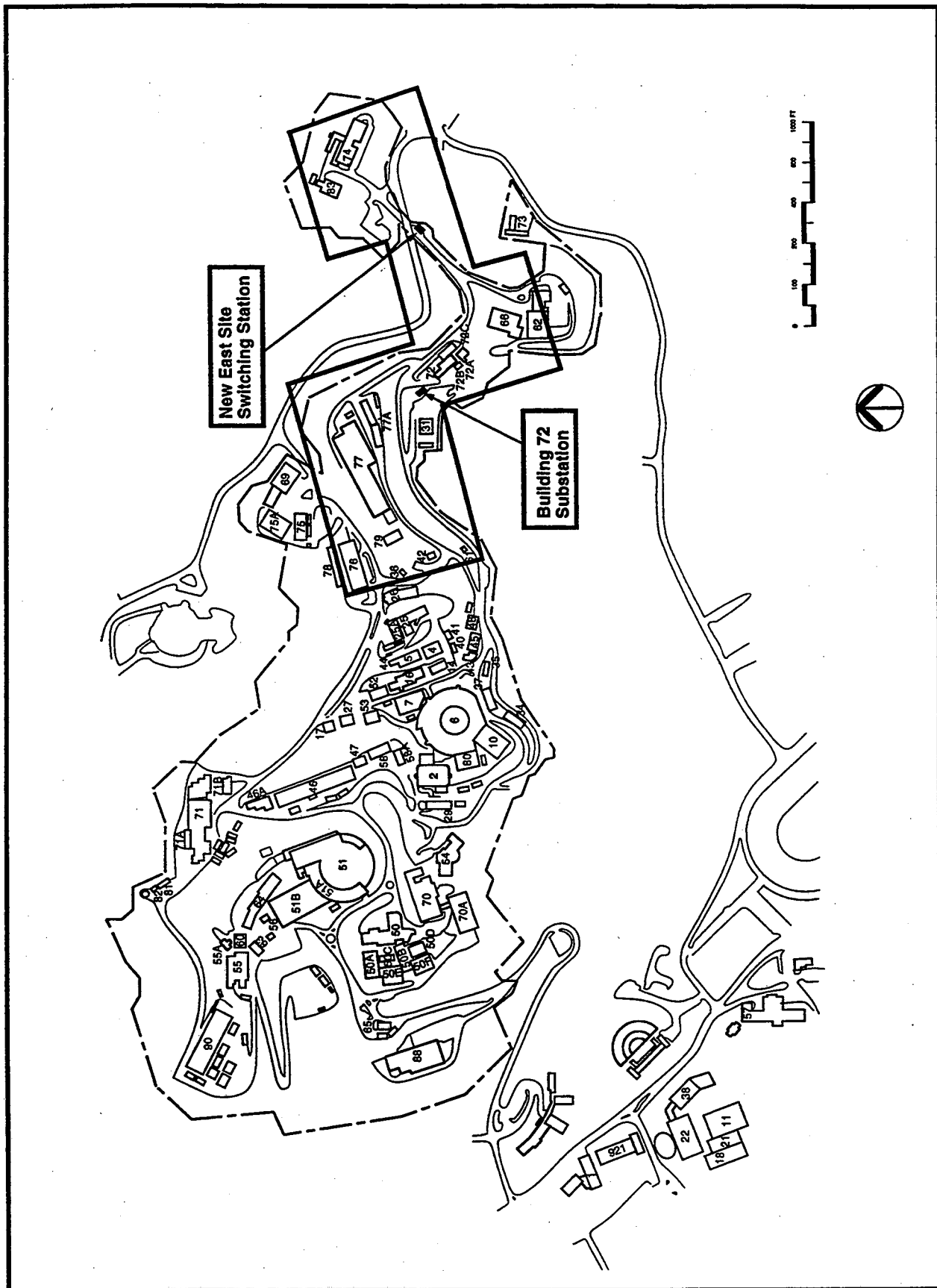
HAZARDOUS MATERIALS SAFEGUARDS, PHASE I

FINANCIAL SCHEDULE (\$K)

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1993	1,500	1,500	400
1994	3,600	3,600	2,570
1995	<u>0</u>	<u>0</u>	<u>2,130</u>
Total	5,100	5,100	5,100

HAZARDOUS MATERIALS SAFEGUARDS, PHASE I
BA/BO SCHEDULE (\$K)

WBS NO.	WBS ELEMENT	TOTAL BUDGET	FY 1993												FY 1994												FY 1995																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA

East Canyon Electrical Safety Project
LBL 93-E-322
SITE LOCATION PLAN

4/15/93

EAST CANYON SERVICE AREA



EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

PROJECT DESCRIPTION

The Project Includes the Following Major Elements

- **Double-Ended Switchgear**
 - **Switchgear Foundations**
 - **9 Metal-Clad 750 MVA Vacuum Circuit Breakers**
- **Underground Duct Banks and Power Cables**
 - **34,000 Feet of 12kV Cable**
 - **3,400 Feet of New Duct Bank, Including 30,000 Feet of Conduit**
 - **11 Manholes**
- **500 kVA Substation at Building 72**
 - **15kV Selector Switch**
 - **500 kVA Transformer**
 - **480V Low-Voltage Switchgear**
 - **125kW Standby Generator**

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

CHANGES SINCE 1992 VALIDATION

Scope

- **No Change**

Schedule

- **Project Completion Extended to 3rd Quarter FY96 Due to Change in Funding Profile**

TEC

- **No Change in TEC**
- **Project Management Costs Increased from 3% to 7%**
- **Contingency Decreased from 17% to 16%**
- **Construction Costs Decreased from \$1,887K to \$1,817K**

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

COST ESTIMATE (\$K) CHANGES SINCE 1992 VALIDATION

		<u>1992 Validation</u>	<u>Changes</u>	<u>Escalation</u>		<u>1993 Validation</u>
A. 1. ED&I	(15%)	425	0	0	(15%)	425
2. Project Management	(3%)	85	+100	0	(7%)	185
B. Construction Costs		2,810	-70	0		2,740
1. Improvements to Land		0	0	0		0
2. Utilities		1,887	-70	0		1,817
3. Special Facilities		923	0	0		923
Subtotal		3,320	+30	0		3,350
C. Contingency	(17%)	<u>580</u>	<u>-30</u>	<u>0</u>	(16%)	<u>550</u>
Total Estimated Cost		3,900	0	0		3,900

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

FINANCIAL SCHEDULE (\$K)

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1992	425	425	19
1993	907	907	370
1994	1,568	1,568	900
1995	1,000	1,000	1,461
1996	<u>0</u>	<u>0</u>	<u>1,150</u>
Total	3,900	3,900	3,900

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

TOTAL PROJECT COSTS (TPC) (\$K)

	<u>Prior Years</u>	<u>FY 1992</u>	<u>FY 1993</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>Total</u>
Total Project Costs (TPC)							
(1) Total Facility Costs (Construction Line Item - TEC)	0	19	370	900	1,461	1,150	3,900
(2) Other Project Costs							
(a) Conceptual Design Cost	<u>40</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>40</u>
Total Project Cost	40	19	370	900	1,461	1,150	<u>3,940</u>

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

CONTINGENCY ANALYSIS

	Estimated Cost (\$K)	Contingency (%)	Contingency (\$K)
<u>LBL Activities</u>			
Engineering	145	15	21
Inspection	50	15	8
Consultants	30	15	4
<u>Architect/Engineer</u>			
Titles I & II	160	15	24
Title III	40	15	6
<u>Construction</u>			
Utilities	1,817	18	326
Special Facilities (Engineered Equipment)	923	15	133
<u>Project Management</u>	<u>185</u>	15	<u>28</u>
Subtotal	3,350		550
Contingency (16%)	<u>550</u>		
TOTAL	3,900		

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

BA/BO SCHEDULE (\$K)

WBS NO.	WBS ELEMENT	TOTAL BUDGET	FY 1992								FY 1993								FY 1994								FY 1995								FY 1996							
			1		2		3		4		1		2		3		4		1		2		3		4		1		2		3		4									
			O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S				
1.0	ENGINEERING, DESIGN & INSPECTION																																									
1.1	LBL ACTIVITIES																																									
1.1.1	ENGINEERING																																									
1.1.1.1	TITLE I	30						10/10	7/7	7/7	6/6																															
1.1.1.2	TITLE II	60											10/10	10/10	10/10	10/10	10/10	10/10																								
1.1.1.3	TITLE III	55																								10/10	10/10	9/9	9/9	9/9	8/8											
1.1.2	INSPECTION	50																								9/9	9/9	8/8	8/8	8/8	8/8											
1.1.3	CONSULTANTS	30							20/7	0/7	0/6															10/1	0/2	0/2	0/2	0/2	0/2	0/1										
1.2	A/E ACTIVITIES																																									
1.2.1	TITLE I	40							40/13	0/14	0/13																															
1.2.2	TITLE II	120							120/0				0/20	0/20	0/20	0/20	0/20	0/20																								
1.2.3	TITLE III	40							40/0																	0/7	0/7	0/7	0/7	0/7	0/6											
2.0	CONSTRUCTION																																									
2.1.1	UTILITIES	1817				3/3																				1814/303	0/303	0/303	0/302	0/302	0/302	0/301										
2.2.1	SPECIAL FACILITIES (ENGINEERED EQUIPMENT)	923											815/180		108/594											0/149																
3.0	PROJECT MANAGEMENT	185		1/1	3/3	2/2	5/5	5/5	5/5	5/5	10/10	10/10	10/10	10/10	17/17	17/17	17/17	17/17	17/17	17/17	17/17	17/17	17/17	17/17	17/17	17/17	17/17	17/17	17/17													
Contingency by Year (17%)		550/550	0 / 0								195 / 60								52 / 146								294 / 224								9 / 120							
Total BA/BO by Year		3900/3900	19 / 19								1280 / 370								240 / 900								2251 / 1461								110 / 1150							
Current Funding Plan		3900	425								907								1568								1000								0							

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

TIME SCHEDULE

Activities	Fiscal Year 1992				Fiscal Year 1993				Fiscal Year 1994				Fiscal Year 1995				Fiscal Year 1996			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
A/E Selection	■	■	■																	
NEPA/SARS	■	■	■																	
Title I		▨	▨	▨	■	■	■	■												
Title II					▨	▨	▨	▨	▨	▨	▨	▨								
Bid and Award												▨		■						
Title III												▨	▨	▨	▨	▨	▨	▨	▨	
Construction												▨	▨	▨	▨	▨	▨	▨	▨	
Equipment Procurement																				
Bid and Award								▨	▨											
Design and Review								▨	▨	▨										
Fabrication and Delivery												▨	▨	▨	▨	▨				

4/15/93
A&E:E.Cany:CDR

LEGEND: ORIGINAL SCHEDULE (FY92 VALIDATION)
REVISED SCHEDULE (FY93 VALIDATION)



EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

STATUS OF NEPA AND SARS

NEPA

- **Categorical Exclusion**

SARS

- **Exempt**

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

PROJECT JUSTIFICATION

- **Need to Provide Redundancy**
 - **Only One Circuit Serves East Site**
 - **Power Failure Affects All East Site Facilities**
 - **Maintenance Difficult**
- **Need to Replace 12kV Feeder Cables**
 - **Existing Power Cable 23 Years in Service**
- **Need to Provide Independent 12kV Circuits**
 - **No Capability to Isolate Electrical System Faults**
- **Need to Improve Voltage Conditions at Building 72**
 - **Voltage Drop Problems at National Center for Electron Microscopy Require Higher than Normal Voltage Settings**

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

PROJECT JUSTIFICATION (continued)

The Project Will Provide

- **A Reliable 12kV Power Distribution Center**
 - **Efficient Fault Clearing**
 - **Selective Tripping**
- **12kV Feeders to All Major Facilities**
 - **Provides Redundancy and User Choice of Firm (High-Rate) Power or Interruptible (Low Rate) Power**
 - **Minimizes Outage Time**
 - **Permits Scheduled Maintenance**
- **Reliable Electrical Service for Building 72**
 - **Sufficient Low-Voltage Circuit Breakers**
 - **Improved Voltage Conditions**

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

COST ESTIMATE (\$K)

A. 1. Engineering, Design and Inspection (at ~ 15% of Construction Costs)	425
2. Project Management (at ~ 7% of Construction Costs)	185
B. Construction Costs	2,740
1. Improvements to Land	0
2. Utilities	1,817
3. Special Facilities (Schedule I) Engineered Equipment	<u>923</u>
Subtotal	3,350
C. Contingency (at ~ 16% of Above Costs)	<u>550</u>
Total Estimated Cost	3,900

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

SCHEDULE I (\$K) SPECIAL FACILITIES

<u>Engineered Equipment</u>	<u>Estimated Cost</u>
East Site Switching Station Equipment	679
B72 Substation Equipment	169
B77 Load Break Switch	24
East Site Sectionalizing Switches	<u>51</u>
Total Estimated Cost	923

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

CONSTRUCTION AND PROCUREMENT COST SUMMARY

		<u>CONSTRUCTION</u>	<u>PROCUREMENT</u>	<u>TOTAL</u>
Construction Cost (including Contractor OH & Profit)		1,539,000		1,539,000
LBL Purchased Major Electrical Equipment		<u> </u>	<u>879,000</u>	<u>879,000</u>
Subtotal		1,539,000	879,000	2,418,000
General Conditions	6%	92,000		92,000
Procurement Contingency		<u>In Equip Est</u>	<u>In Equip Est</u>	<u>In Equip Est</u>
Estimating Contingency		<u>In Proj Cont</u>	<u>In Proj Cont</u>	<u>In Proj Cont</u>
Subtotal		1,631,000	879,000	2,510,000
General Contractor		<u>In Const Est</u>	<u>In Const Est</u>	<u>In Const Est</u>
OH & Fee Bond	1%	16,000		16,000
Total Estimated Construction Cost at January 1993		1,647,000	879,000	2,526,000
Escalation		<u>x 1.103</u>	<u>x 1.05</u>	
Total Escalated Construction Cost*		1,817,000	923,000	2,740,000

*Construction Costs have been Escalated at 3.0% for FY 1993, 3.9% for FY 1994, and 4.1% for FY 1995, Compounded to Midpoint of Construction, September 1995 for a Total of 10.3%. Procurement Costs have been Escalated at 3.0% for FY 1993 and 3.9% for FY 1994, Compounded to Midpoint of Procurement, June 1994 for a Total of 5.0%.

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

OBLIGATIONS AND COSTS SCHEDULE DETAIL (\$K)

DESCRIPTION	FY 1992			FY 1993		FY 1994		FY 1995		FY 1996	
	TOTAL	O	C	O	C	O	C	O	C	O	C
<u>LBL Activities</u>											
Engineering	145	10	10	30	30	40	40	39	39	26	26
Inspection	50							26	26	24	24
Consultants	<u>30</u>	<u>—</u>	<u>—</u>	<u>20</u>	<u>20</u>	<u>—</u>	<u>—</u>	<u>10</u>	<u>5</u>	<u>0</u>	<u>5</u>
Subtotal	225	10	10	50	50	40	40	75	70	50	55
<u>Architect-Engineer</u>											
Titles I & II	160			160	60	0	80	0	20		
Title III	<u>40</u>			<u>40</u>	<u>0</u>	<u>—</u>	<u>—</u>	<u>0</u>	<u>21</u>	<u>0</u>	<u>19</u>
Subtotal	200			200	60	0	80	0	41	0	19
<u>Construction</u>											
Utilities	1,817	3	3					1,814	909	0	905
Special Facilities (Engineered Equipment)	<u>923</u>	<u>—</u>	<u>—</u>	<u>815</u>	<u>180</u>	<u>108</u>	<u>594</u>	<u>0</u>	<u>149</u>	<u>—</u>	<u>—</u>
Subtotal	2,740	3	3	815	180	108	594	1,814	1,058	0	905
<u>Project Management</u>											
Project Management	185	6	6	20	20	40	40	68	68	51	51
Subtotal	3,350	19	19	1,085	310	188	754	1,957	1,237	101	1,030
Contingency (16%)	<u>550</u>	<u>0</u>	<u>0</u>	<u>195</u>	<u>60</u>	<u>52</u>	<u>146</u>	<u>294</u>	<u>224</u>	<u>9</u>	<u>120</u>
TOTAL	3,900	19	19	1,280	370	240	900	2,251	1,461	110	1,150

EAST CANYON ELECTRICAL SAFETY PROJECT

ESCALATION ANALYSIS

Based on DOE "Anticipated Economic Escalation Rates"
(Updated August 1989)

CONSTRUCTION COST ESCALATION

Start Construction:	February 1994
Construction Period:	20 Months
Finish Construction:	September 1995
Midpoint Construction:	December 1994
Latest Estimate:	December 1986

FY 1987	Jan 1987 -	Sep	1987	9 mo @	1.9	=	1.4		
FY 1988	Oct 1987 -	Sep	1988	12 mo @	4.0	=	4.0		
FY 1989	Oct 1988 -	Sep	1989	12 mo @	4.4	=	4.4		
FY 1990	Oct 1989 -	Sep	1990	12 mo @	4.3	=	4.3		
FY 1991	Oct 1990 -	Sep	1991	12 mo @	4.7	=	4.7		
FY 1992	Oct 1991 -	Sep	1992	12 mo @	5.5	=	5.5		
FY 1993	Oct 1992 -	Sep	1993	12 mo @	5.7	=	5.7		
FY 1994	Oct 1993 -	Sep	1994	12 mo @	5.8	=	5.8		
FY 1995	Oct 1994 -	Dec	1994	3 mo @	6.0	=	1.5		

Total Compounded Escalation 43.6

Escalation Used in 1988 Valadation Cost Estimate = 27.7%.
Escalation Change from Previous Midpoint of Construction
(10/92) to New Midpoint of Construction (12/94):

$$\frac{1.436}{1.277} = 1.12 \text{ or } 12\%$$

EAST CANYON ELECTRICAL SAFETY PROJECT

ESCALATION ANALYSIS (continued)

Based on DOE "Anticipated Economic Escalation Rates"
(Updated August 1989)

PROCUREMENT COST ESCALATION

Start Procurement:	June 1993
Procurement Period:	30 Months
Finish Procurement:	November 1994
Midpoint Procurement:	February 1994
Latest Estimate:	December 1986

							%
FY 1987	Jan 1987 - Sep	1987	9 mo @	1.9	=	1.4	
FY 1988	Oct 1987 - Sep	1988	12 mo @	4.0	=	4.0	
FY 1989	Oct 1988 - Sep	1989	12 mo @	4.4	=	4.4	
FY 1990	Oct 1989 - Sep	1990	12 mo @	4.3	=	4.3	
FY 1991	Oct 1990 - Sep	1991	12 mo @	4.7	=	4.7	
FY 1992	Oct 1991 - Sep	1992	12 mo @	5.5	=	5.5	
FY 1993	Oct 1992 - Sep	1993	12 mo @	5.7	=	5.7	
FY 1994	Oct 1993 - Feb	1994	5 mo @	5.8	=	2.4	

Total Compounded Escalation 37.3

Escalation used in 1988 Valadation Cost Estimate = 24.3%.
Escalation Change from Previous Midpoint of Procurement
(4/92) to New Midpoint of Procurement (2/94):

$$\frac{1.373}{1.243} = 1.10 \text{ or } 10\%$$

EAST CANYON ELECTRICAL SAFETY PROJECT

LBL 92-E-322

ED&I ANALYSIS (\$K)

LBL Activities

- Title I (9 months in FY92)
 - Avg Rate = 8.2K/mo
 - Proj Eng 1 x .20 time x 9 = 1.8MM
 - Proj Team 2 x .10 time x 9 = 1.8
 - 3.6MM x 8.2K/mo 30
- Title II (12 months in FY93)
 - Avg Rate = 8.6K/mo
 - Proj Eng 1 x .30 time x 12 = 3.6MM
 - Proj Team 2 x .14 time x 12 = 3.4
 - 7.0MM x 8.6K/mo 60
- Title III (12 months in FY94; 12 months in FY95)
 - Avg Rate = 9.2K/mo
 - Proj Eng 1 x .15 time x 24 = 3.5MM
 - Proj Team 2 x .05 time x 24 = 2.4
 - 5.9MM x 9.3K/mo 55
- Inspection (8 months in FY94; 9 months in FY 95)
 - Avg Rate = 9.3K/mo
 - Inspector 1 x .32 time x 17 = 5.4MM x 9.3K/mo 50
- Consultants 30
 - Geotechnical Report (2) and Inspection (3) 5
 - Independent Cost Estimate 5
 - Testing Laboratories 15
 - Surveying 5

A/E Contract

7.2% of Engineering Equipment and
Construction Costs (\$2,797K) 200

Total Estimated ED&I 425

Base Rates: FY92 = 8.2K/mo; FY93 = 8.6K/mo; FY94 = 9.0K/mo;
FY95 = 9.5K/mo;

EAST CANYON ELECTRICAL SAFETY PROJECT

FINANCIAL SCHEDULE (\$K)

<u>Fiscal Year</u>	<u>Appropriations</u>	<u>Obligations</u>	<u>Costs</u>
1992	377	377	150
1993	1,507	1,507	450
1994	2,016	2,016	1,900
1995	<u>0</u>	<u>0</u>	<u>1,400</u>
Total	3,900	3,900	3,900

Project Budgeted for FY92 Start

EAST CANYON ELECTRICAL SAFETY PROJECT

BA/BO SCHEDULE (\$K)

WBS NO.	WBS ELEMENT	TOTAL BUDGET	F Y 1992								F Y 1993								F Y 1994								F Y 1995										
			1		2		3		4		1		2		3		4		1		2		3		4		1		2		3		4				
			O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A
1.0	LBL ACTIVITIES																																				
1.1	ENGINEERING	145					30/30						50/50							45/45												20/20					
1.2	INSPECTION	50																															25/25				
1.3	CONSULTANTS	30					20/20																											5/5			
2.0	ARCHITECT/ENGINEER	0																																			
2.1	TITLES I AND II	160					160/40						0/120																								
2.2	TITLE III	40					40/0																										0/20		0/20		
3.0	CONSTRUCTION																																				
3.1	UTILITIES	1887																																1887/950		0/937	
4.0	SPECIAL FACILITIES	0																																			
4.1	ENGINEERED EQUIPMENT	923																																	923/180	0/594	0/149
5.0	PROJECT MANAGEMENT	85					10/10						10/10																					35/35		30/30	
Contingency by Year (17%)		580/580	50 / 50								187 / 90								293 / 226								50 / 214										
Total BA/BO by Year		3900/3900	310 / 150								1170 / 450								2290 / 1900								130 / 1400										
Current Funding Plan		3900	377								1507								2016								0										

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