U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

NUCLEAR WASTE TECHNICAL REVIEW BOARD
STRUCTURAL GEOLOGY & GEOENGINEERING PANEL MEETING

SUBJECT: THE BASELINE EXPLORATORY STUDIES FACILITY (ESF) CONFIGURATION

PRESENTER: EDGAR PETRIE

PRESENTER'S TITLE AND ORGANIZATION: BRANCH CHIEF, ENGINEERING & DEVELOPMENT DIVISION
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
LAS VEGAS, NEVADA

PRESENTER'S TELEPHONE NUMBER: (702) 794-7961

PLAZA-SUITE HOTEL • LAS VEGAS, NEVADA
NOVEMBER 4 - 6, 1992

Revised Construction Approach

- Procurement for one large diameter TBM to begin mid-November 92
- Procurement results (new or used machine) will determine TBM startup date
- TBM receipt could occur as early as Nov 93
- TBM operation could begin as early as Feb 94
- One large diameter TBM (~ 7.6 - 9.1 meters) will start at the north portal, excavate the north ramp to the TSL, the TSL main drift, and the south ramp from the TSL to the surface (Approximately 26,000 ft)
- A second, smaller, TBM (~ 5.8 meters) will be employed to drive the north CH ramp to the CH level, the CH main drift (from north to south), and the south CH ramp from the CH to connection with the south TSL ramp

Purpose of the ESF

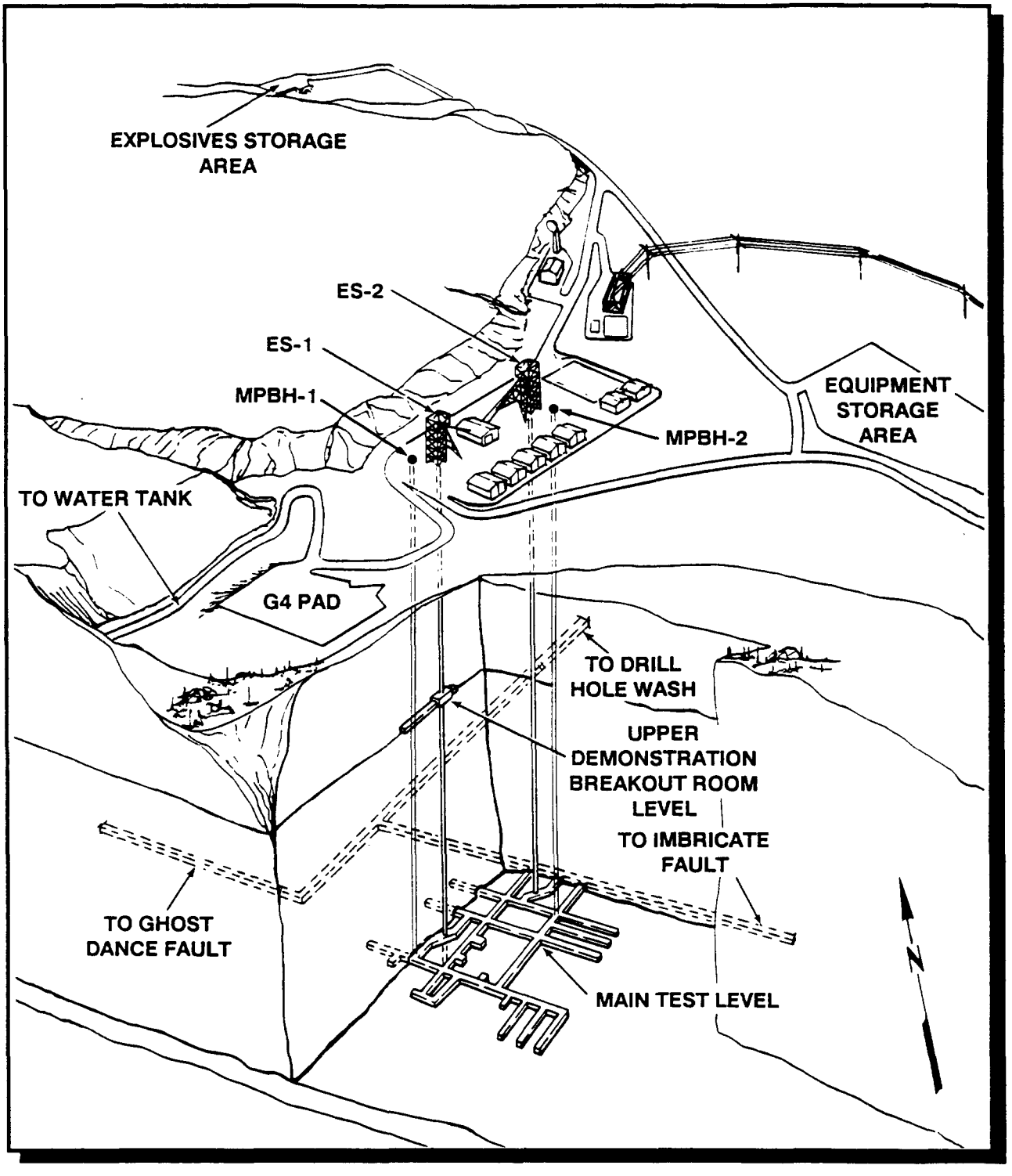
Determine the suitability of Yucca Mountain as a potential repository site

- **Provide access to the potential repository horizon (Topopah Spring) for inspection and testing**
- **Provide access to the Calico Hills level for testing and inspection**

Develop data for potential repository design and construction

THE EVOLUTION OF THE ESF CONCEPT

THE ESF LAYOUT AS IT APPEARED IN THE SITE CHARACTERIZATION PLAN (SCP) IN 1988

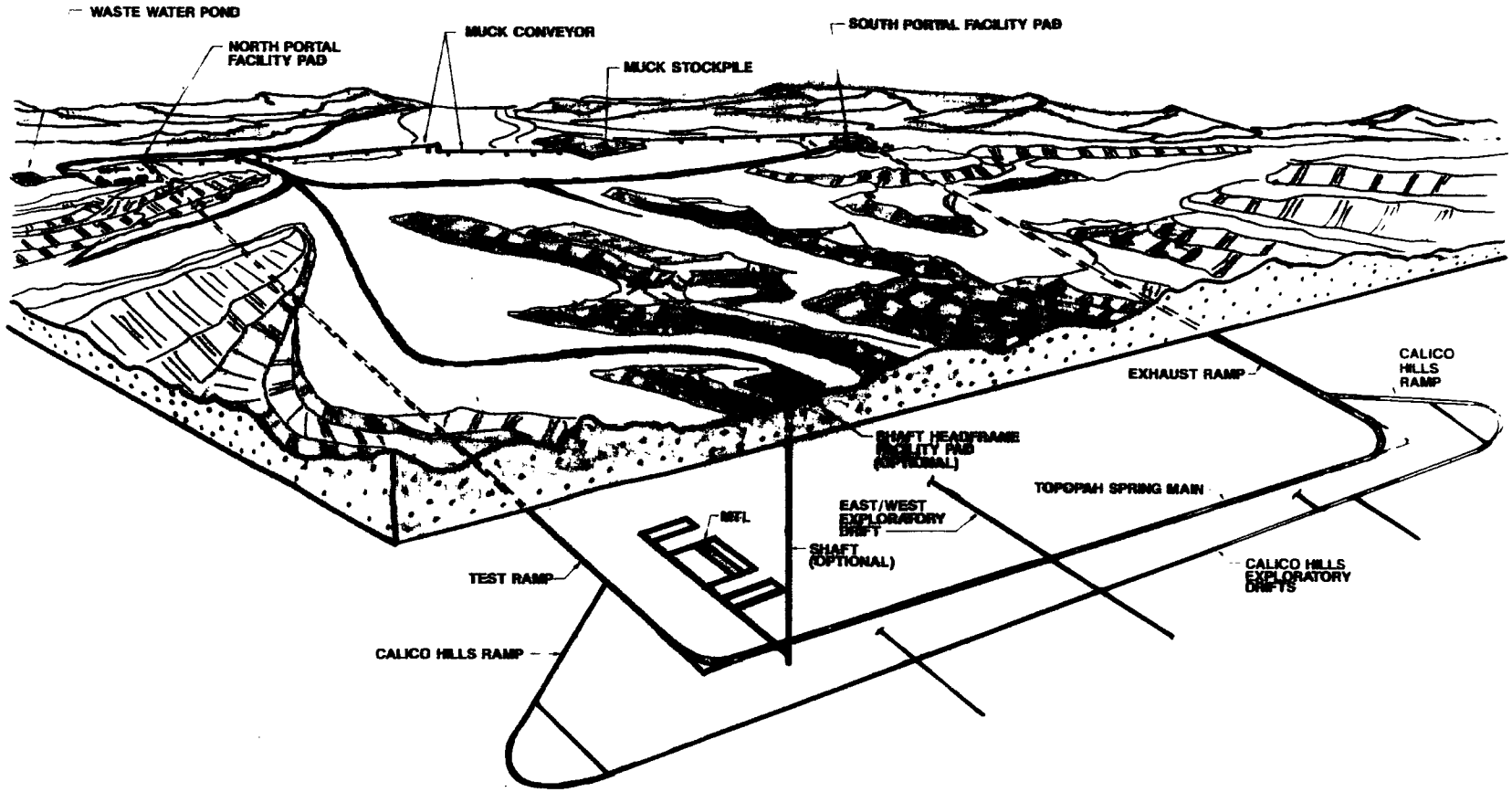

EXPLOSIVES STORAGE AREA
ES-2
ES-1
MPBH-1
MPBH-2
EQUIPMENT STORAGE AREA
TO WATER TANK
G4 PAD
TO DRILL HOLE WASH
UPPER DEMONSTRATION BREAKOUT ROOM LEVEL
TO IMBRICATE FAULT
TO GHOST DANCE FAULT
MAIN TEST LEVEL
N

As a result of the review of the SCP (and the associated comment resolution) by the Nuclear Regulatory Commission, the NWTRB, and others, the ESF was enlarged in order to allow data collection over the entire potential repository block, the primary excavation method became mechanical as opposed to drill and blast, and ramps became the primary access mode.

The Exploratory Studies Facility Alternatives Study (ESFAS) was conducted, utilizing a structured, well documented process of evaluation and selection, to determine the ESF configuration.

The preferred configuration formed the basis for the completed Title I and ongoing Title II design activities.

ESF Design


WASTE WATER POND
NORTH PORTAL FACILITY PAD
MUCK CONVEYOR
MUCK STOCKPILE
SOUTH PORTAL FACILITY PAD
EXHAUST RAMP
CALICO HILLS RAMP
TOPOPAH SPRING MAIN
EAST/WEST EXPLORATORY DRIFT
MTL
SHAFT (OPTIONAL)
TEST RAMP
CALICO HILLS EXPLORATORY DRIFTS
CALICO HILLS RAMP

Summary of Title I ESF Drifting

Component	Length (Feet)	Gradient (%)	Tonnage	Drift Config.	Driven By
North Ramp, Surface to TSL	6,450	-6.9	226,900	25' Round	TBM
South Ramp, Surface to TSL	9,100	-1.6	320,100	25' Round	TBM
North Ramp to Calico Hills	6,665	-10/-6	107,700	18' Round	TBM
South Ramp to Calico Hills	7,260	-10/-6	117,400	18' Round	TBM
TSL Main Drift	10,550	4.7	371,100	25' Round	TBM
TSL East Drift	3,250	-2.6	55,900	12 x 20	Mob. Miner
TSL West Drift	3,850	2.1	66,200	12 x 20	Mob. Miner
TSL Imbricate Drift	2,250	0.5	36,400	18' Round	TBM
Main Test Level	9,400	N/A	161,700	12 x 20	Mob. Miner
CH Main Drift	11,200	3.8	181,000	18' Round	TBM
CH East Ghost Dance Drift	1,520	0.5	13,900	9 x 16	Roadheader
CH West Ghost Dance Drift	1,075	0.5	9,800	9 x 16	Roadheader
CH Imbricate Drift	2,150	0.5	19,700	9 x 16	Roadheader
CH Solitario Drift	2,200	8.75/0	20,100	9 x 16	Roadheader
TOTALS	76,920		1,707,900		

ESF TITLE II DESIGN

ESF Title II Design

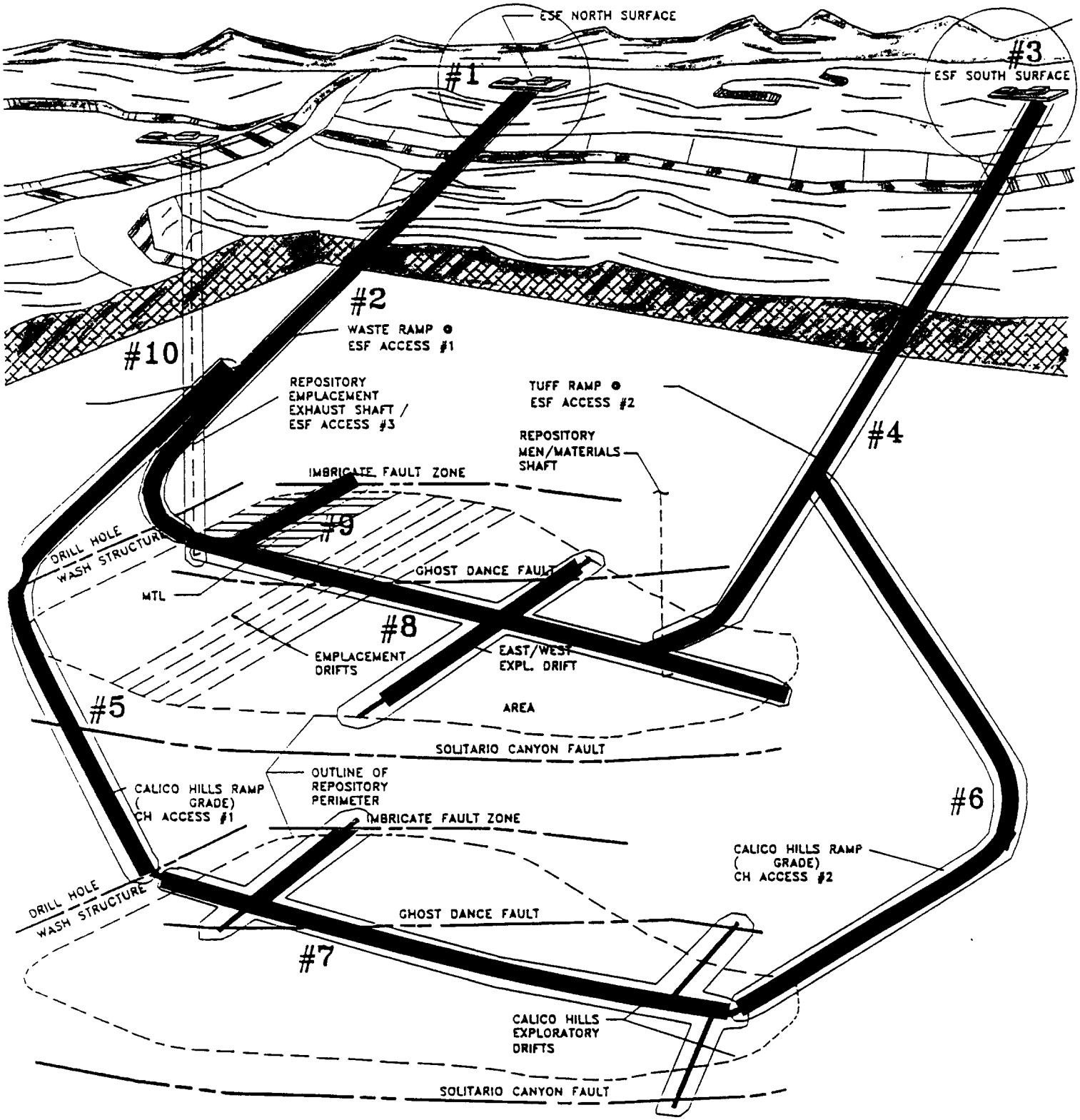
Title II design began on 1 OCT 91

- Responsibility of Title II design has been transitioned from Raytheon Services Nevada (RSN) to the CRWMS M&O effective OCT 92

- RSN performed design of the north portal site preparation, TBM launch chamber, and mined rock/ topsoil storage area during FY92

- The CRWMS M&O ESF design in FY93 will include a portion of the north portal surface facilities, and the north ramp from surface to the Topopah Spring Level (TSL)

ESF LAYOUT



NOTE: THIS IS PICTORIAL ONLY AND NOT DRAWN TO SCALE

NOTE: DESIGN, CONSTRUCTION, AND TESTING PHASES SHOWN --- ( )

#2

ESF Title II Design

The design of the ESF has been divided into 10 design packages:

1. Site preparation and surface facilities, north portal
2. North ramp - surface to Topopah Spring Level (TSL)
3. Site preparation and surface facilities, south portal
4. South ramp - surface to TSL
5. North ramp to Calico Hills Level (CHL)
6. South ramp to CHL
7. CHL drifting
8. TSL drifting except Main Test Level (MTL)
9. Main Test Level
10. Optional shaft

The numbering of the packages does not indicate the order of either design or construction

ESF COST ESTIMATES

Summary of ESF Cost Estimates

Item	Option 30	Title I	'93 Validation	'94 Validation	ICE **
Management & Integration	$117,300,000	$108,241,000	$96,900,000	$124,100,000	$121,600,000
Engineering	$51,300,000	$50,880,000	$38,900,000	$56,800,000	$42,400,000
Operations	$71,700,000	$131,717,000	$144,200,000	$126,000,000	$98,800,000
Site Prep.	$43,700,000	$37,179,000	$61,300,000	$31,100,000	$40,100,000
Surface Fac.	Incl. in Site	$7,814,000	$21,400,000	$6,500,000	$8,200,000
North Access	$126,700,000	$24,679,000	$17,400,000	$22,700,000	$64,200,000
South Access	$126,900,000	$28,373,000	$13,300,000	$28,000,000	$71,700,000
Optional Access	$0	$15,904,000	$20,500,000	$15,900,000	$40,100,000
Subsurf. Excav.	$197,800,000	$75,496,000	$85,300,000	$80,500,000	$129,800,000
Capital Equip.	Incl. Above	$163,067,000	$133,500,000	$127,300,000	Incl. Above
Contingency	Incl. Above	$72,152,000	$71,300,000	$69,600,000	$0
Subtotal	$735,400,000	$715,502,000	$704,000,000	$688,500,000	$616,900,000
Prior Expenditures	$85,800,000	$104,600,000	$98,200,000	$111,700,000	$104,600,000
Total Cost	$821,200,000	$820,102,000	$802,200,000	$800,200,000	$721,500,000

** Independent Cost Estimate by Gilbert-Commonwealth

TBM Unit Costs - 25 FT Diameter Machine in TSL Formation

Item	Option 30	Title I	'93 Validation	'94 Validation	ICE **
Total Project Cost/Foot	$11,422	N/A	N/A	$10,071	$9,081
Total Construction Cost/Foot	$6,886	N/A	N/A	$4,803	$4,457
TSL Base TBM Cost/Foot	$3,057	N/A	N/A	$1,510	N/A
With Capital	$3,861	N/A	N/A	$2,654	$2,993
W/Capital & Contin.	$8,626	N/A	N/A	$3,159	N/A

E.S.F. TITLE I REVISED
RSN CONSTRUCTION COST ESTIMATE
YUCCA MOUNTAIN PROJECT

7/23/92 14:32

WORK ORDER NO.:
W.B.S. NUMBER : 1.2.6.2.1.1

TASK TITLE : N.A. PORTAL PAD
TASK DURATION : 150 DAYS

QUANTITY : SEE REMARKS
RATE :

DAYS	LABOR FORCE	LAB CODE	LABOR/SHIFT 1	2	3	DAILY RATE	LABOR COST	FTE [2080]
	TEAMSTER	18						
150	WAREHSE CLRK					155	0	0.00
150	TRUCK DRIVER		6.0			156	140688	3.46
150	CEMENT MASON	19				138	0	0.00
	CARPENTER	3						
150	MILLWRIGHT					177	0	0.00
150	PAINTER	4				159	0	0.00
150	IRON WORKER	5				173	0	0.00
	OPER. ENGR (SUR)	6						
150	HOISTMAN					169	0	0.00
150	COMPRESSOR					169	0	0.00
150	F.E.L./UTIL		11.0			169	278520	6.35
150	LABORER (SUR)	7	8.0			132	158304	4.62
150	ELECTRICIAN	8				185	0	0.00
150	SHEETMETAL WRKR	12				164		0.00
150	PIPEFITTER	13				202	0	0.00
	OPER. ENGR (UG)	10						
150	L.H.D.					202	0	0.00
150	UTILITY					202	0	0.00
150	MECHANIC					202	0	0.00
150	CORE DRILL					202	0	0.00
	LABORER (UG)	14						
150	MINER - TUNNEL					165	0	0.00
150	MINER - JUMBO					165	0	0.00
150	MINER - SHAFT					167	0	0.00
150	SHIFTER					168	0	0.00
150	BULL GANG/TUNNEL	15				163	0	0.00

QTY.	MATERIALS DESCRIPTION	UNIT PRICE	MATERIAL COST
	CONSUMABLES		
22222	TYPE II	6.50	144443
1E+05	SELECT	2.50	277778
1E+05	BLASTING MAT.	1.33	188860
			0
			0
			0
1	*SMALL TOOLS	5775.12	5775
1	FUEL & LUBE	213621.31	213621
	CAPITAL		
			0
			0
			0
			0
			0
			0
			0
			0
			0
			0
			0
			0
	SUBCONTRACT		
			0
			0

DAYS	NO. EACH	EQUIPMENT ITEM	UNIT PRICE	EQUIPMENT COST
		LONG TERM		
		RENTAL EQUIPMENT		0
111	22	DOZERS, 300 HP	455	50556
155	14	GRADERS, 12 FT.	189	29324
111	5.4	ROLLERS, 10 T.	95	10556
141	17	FEL, 4.25 YD.	296	41855
	32	SCRAPERS, 20 YD.	717	0
796	8.9	DUMP TRK.,16 T.	115	91519
169	9.1	WATER TK.,6K GAL	447	75511
473	7	SURF. DRILL	306	144840
0	8.1	SPREADER	225	0
33	3.8	VIB.ROLLER,7 FT.	315	10500
	19	PIPE LAYER	393	0
	8.7	BACKHOE, 1.5 YD.	171	0
473	20	AIR COMP. 1.2K	177	83780
	19	HYDRO CRANE, 13T	400	0
0	22	DOZER/RIPPER	603	0
				0
				0
				0
				0
				0
				0
				0
				0
				0
				0

TOTAL LABOR COST			577512
APPLIED TO LABOR	0.65		375383
GEN. & ADMIN.	0.16		152463
LABOR TOTAL		1,105,358	14.42

CAPITAL SUBTOTAL		0
CONSUMABLE SUBTOTAL		830477
S.T.& FREIGHT	0.11	91352
HANDLING	0.15	124572
GEN. & ADMIN.	0.16	167424
CAPITAL TOTAL	0.09	0
CONSUMABLE TOTAL		1213825
MATERIAL TOTAL		1,213,825
SUBCONTRACT @ 3%		0

EQUIPMENT SUBTOTAL		538440
GEN. & ADMIN.	0.16	91966
SALES TAX	0.068	36345
EQUIPMENT TOTAL		666,750

REMARKS:
85,800 CY CUT
89,800 CY FILL

COST WITH CONTINGENCY			
LABOR	$1271162	MAN HOURS	30000
SUBCONTRACT	$0	CONSUMABLE	$1395899
EQUIPMENT	$766763	CAPITAL	$0

CAPITAL EQUIPMENT COST		$0
CONSTRUCTION COST		$2985933
SUBTOTAL COST		$2985933
TOTAL CONTINGENCY	15%	$447890
TOTAL COST		$3433823
AVERAGE EMPLOYEES		25

MAJOR ESF SCHEDULE MILESTONES

Major ESF Schedule Milestones

Activity	Expected Dates
• Start site preparation	30 NOV 92
• Start TBM launch chamber construction	4 OCT 93
• Start TBM operations (both portals)	30 OCT 94
• Tunnel breakthrough on TSL	11 SEP 95
• Complete excavation of main test level	1 FEB 96
• Start ESF in-situ test phase	3 JUN 96
• Complete ESF excavation	5 JUL 96