GJBX-76(78)

DOE-GRAND JUNCTION LOGGING MODEL DATA SYNOPSIS

May 1978

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION OFFICE
UNDER CONTRACT NO. EY-76-C-13-1664

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights.

GJBX-76(78)

DOE-GRAND JUNCTION LOGGING MODEL DATA SYNOPSIS

Mark A. Mathews
Carl J. Koizumi
Hilton B. Evans

BENDIX FIELD ENGINEERING CORPORATION
Grand Junction Operations
Grand Junction, Colorado 81501

May 1978

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
UNDER CONTRACT NO. EY-76-C-13-1664

TABLE OF CONTENTS

	Page Nos.
List of Illustrations	*ii*
List of Tables	*iii*
Introduction	1
The Models	1
Model Grade Assignment	2
Other Model Parameters	3
Conclusions	4
References	5

LIST OF ILLUSTRATIONS

		Page Nos.
Figure 1.	Relative Location of Models	6
Figure 2.	C Model	13
Figure 3.	"R" Model	15
Figure 4.	P-D Model	17
Figure 5.	P-W Model	19
Figure 6.	N-1 Model	21
Figure 7.	N-2 Model	23
Figure 8.	N-3 Model	25
Figure 9.	N-4 Model	27
Figure 10.	N-5 Model	29
Figure 11.	Gross Gamma-Ray Water Factor Model	31
Figure 12.	U-1 Model	33
Figure 13.	U-2 Model	35
Figure 14.	U-3 Model	37
Figure 15.	S Model; Hole Size Calibration	39
Figure 16.	T-1 Model	41
Figure 17.	T-2 Model	43
Figure 18.	T-3 Model	45
Figure 19.	U Model	47
Figure 20.	T Model	49
Figure 21.	K Model	51

LIST OF TABLES

	Page Nos.
Table 1	7
Table 2	8
Table 3	9
Table 4	10
Table 5	11
Table 6	12
Table 7	14
Table 8	16
Table 9	18
Table 10	20
Table 11	22
Table 12	24
Table 13	26
Table 14	28
Table 15	30
Table 16	32
Table 17	34
Table 18	36
Table 19	38
Table 20	40
Table 21	42
Table 22	44
Table 23	46
Table 24	48
Table 25	50
Table 26	52

INTRODUCTION

This report is a summary of existing information concerning the 20 logging models available at the U.S. Department of Energy (DoE) Grand Junction facility at the end of 1976. The relative location of these models is shown in Figure 1. Model N-3 is a calibration standard and Models N-3, U-1, U-2, and U-3 are used as standards for determining dead-time corrections for gross gamma-ray logging equipment. Three KUT (potassium, uranium, and thorium) models are used as standards for calibration of gamma-ray spectral logging equipment. The water factor model is used in conjunction with gross gamma-ray logging equipment to determine correction factors for borehole fluid (water), borehole size, and borehole casing. The remainder of the models are used either for research purposes or are infrequently used.

THE MODELS

Table 1 lists, in summary form, the available physical/chemical data relating to the on-site models. Figure 1 and Table 1 show the dates of construction of the various models. The physical/chemical construction data for the gross gamma-ray models are further detailed in Tables 1 through 5 and Tables 7 through 23. The KUT data are found in Tables 5 and 6 and Tables 24 through 26 (Knapp and Bush, 1975). Schematic drawings of the models are presented in Figures 2 through 21. Statements of need and work, construction details, and assays for the various models are presented in another report (Mathews, 1975). A review of all DoE calibration facilities is also available (Evans, 1978).

Methods used for calibrating industry logging units have been published (Eschliman, 1969; Duray, 1976). Following calibration, industry gamma-ray logging units are used to estimate the radiometric grades

(percent eU_3O_8) detected during exploration logging in the field.

MODEL GRADE ASSIGNMENT

The DoE-Grand Junction Geochemical Analysis Department Laboratory (operated by BFEC) has assigned grades (chemical and radiometric) to the models from samples obtained during construction of these models. The different grades (gross gamma-ray, chemical, and gamma-ray spectrometer) are individually averaged and listed in Tables 1 through 26. A detailed list of the samples and assays of these samples from each model has been published (Dodd and Droullard, 1964).

A detailed review of the radiometric grades of the primary counting standards used in determining the radiometric grades (gross gamma-ray, percent eU_3O_8) of the various models was carried out (Higgins, et al., 1972); as a conclusion of this review, the radiometric grades of the primary counting standards were changed and all available samples from previously constructed models were reanalyzed. The reanalyses included samples from models N-3, U-1, U-2, and U-3. As a result of these analyses, the radiometric grades (percent eU_3O_8) assigned to the N-3, U-1, U-2, and U-3 models were revised. These updated values are tabulated in this report.

An alternate method of grade determination of the models was devised by Eschliman and Key (Eschliman and Key, 1972; Eschliman and Key, 1972a). This method involved a multiple model calibration technique utilizing a least-squares regression analysis to fit a curve of the form $y = ax^b$ to the count rate data that were corrected for the presence of free water in the model matrix. In this equation, the laboratory radiometric grade is represented by y; the area under the gamma-ray log response curve (A) divided by the zone thickness (T), is represented by x ($x = A/T$). The logarithm of a is the intercept, and b is the slope of the curve. This approach

corrects for variations among models of the average atomic number (Z), and for other effects which disturb the direct proportionality between y and x. When the coefficients a and b had been determined, a mean radiometric grade for each model (N-3, U-1, U-2, U-3) was assigned. The grade assignments, computed in this way, are tabulated in this report and listed in Tables 1 through 6 under the heading Gamma Log Analysis.

OTHER MODEL PARAMETERS

The physical parameters (dimensions, density, water content, ore type, porosity, etc.) of each model are listed in Table 1. The density of each model was determined by the Geochemical Analysis Department from samples obtained during construction of these models. This density is an approximation for each model, because it is determined on a dry-weight basis and does not take into account the free water in the matrix of the model.

The water content of each model was determined by the Geochemical Analysis Department from samples obtained during construction of these models. This water content is determined by a loss on drying (LOD) technique in which the sample is ground to 100 mesh and dried at 110°C for 24 hours. Also, another method for determining the water content of a model was used because the LOD technique does not account for the bound water in the matrix of the model. The on-site contractor logged the models (N-3, U-1, U-2, U-3) with a ^{252}Cf-based neutron-neutron probe (Eschliman and Key, 1972). This probe, when calibrated, provides a measure of the amount of in-situ hydrogen in a specific volume. The water content in the models was determined using this method for each model. These results are listed in Tables 1 through 6 under the heading % Water Content In-Situ Analysis.

Corrections for the influence of borehole size and borehole fluid type on the gross gamma-ray log response are obtained in a water factor model

(Knapp and Bush, 1975a). A drawing of this model is shown in Figure 11.

CONCLUSION

This synopsis provides the available data concerning the logging models at the DoE-Grand Junction facility, to date (1976). Because gamma-ray logs are used in uranium exploration to estimate the grade (percent eU_3O_8) and the thickness of uranium ore zones in exploration drill holes, logging models are required to calibrate the gamma-ray logging equipment in order to obtain accuracy, uniformity, standardization, and repeatibility during logging. This quality control is essential for accurate ore reserve calculations and for estimates of ore potential. The logging models at the DoE-Grand Junction facility have been, and are available for use by private industry in calibrating their gamma-ray logging equipment.

REFERENCES

Dodd, P.H. and Droullard, R.F., 1964, Some current concepts of nuclear borehole logging for uranium exploration and evaluation, 9th Annual Minerals Symposium by AIME, Moab, Utah, May.

Duray, John R., 1976, A brief review of the basis for, and the procedures currently utilized in gross gamma-ray log calibration. GJBX-61(76) (Open File Report, October).

Eschliman, D.H., 1969, Calibration procedure for industry logging units, Lucius Pitkin Report, Grand Junction, Colorado (Internal Report).

Eschliman, D.H. and Key, B.N., 1972, Report of second calibration tour of USAEC gamma-ray logging calibration models, Lucius Pitkin Report, Grand Junction, Colorado (Internal Report, April).

Eschliman, D.H. and Key, B.N., 1972a, A change of assigned radiometric grades for the USAEC gamma-ray logging calibration models, Geophysical/Electronics Report No. 5, Grand Junction, Colorado (Internal Report, October).

Evans, Hilton B., 1978, A review of U.S. DoE calibration facilities, NEA/IAEA Workshop on Borehole Logging for Uranium, Grand Junction, Colorado, February 14-16.

Higgins, L.J., Shay, R.S., Kaufman, F., Bush, W.E., 1972, An analytical review of the USAEC test pits used for borehole logging and of the standards used for calibration of these pits, Analytical and Research Laboratory Report No. 25, Grand Junction, Colorado (Internal Report, August).

Knapp, K.E. and Bush, W.E., 1975, Construction of the "KUT" test pits, Lucius Pitkin Report, Grand Junction, Colorado (Internal Report, April).

Knapp, K.E. and Bush, W.E., 1975a, The construction of the new water factor model, Lucius Pitkin Report, Grand Junction, Colorado (Internal Report, May).

Mathews, M.A., 1975, Data compendium for the logging test pits at the ERDA Grand Junction Compound, Bendix Field Engineering Report No. BFEC-1976-11, Grand Junction, Colorado (Internal Report, December, BFEC-1976-11).

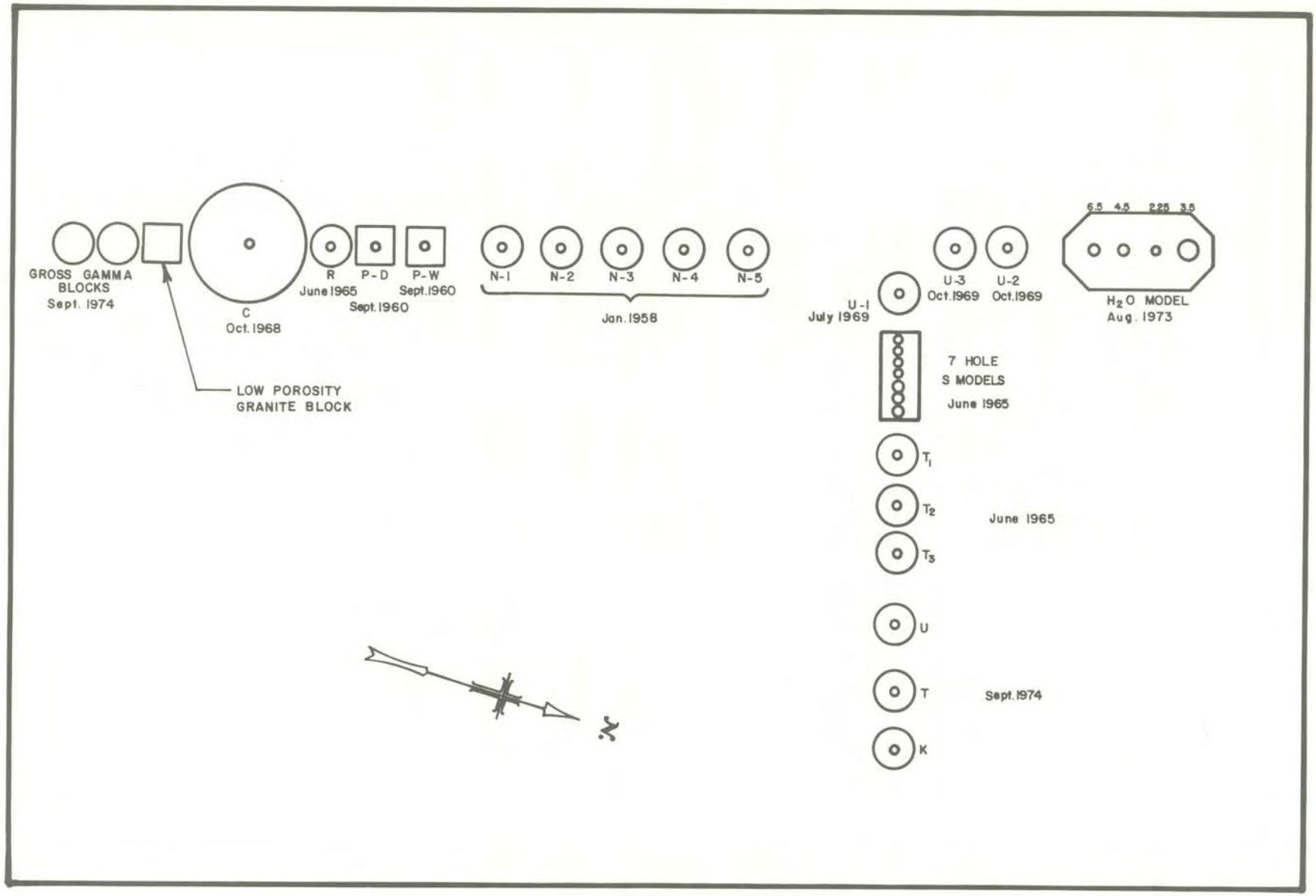


Figure I. Test Model Location

TABLE 1. Physical/Chemical Properties of the C, R, P-D and P-W Models

	C Model 1968			R Model 1965			P-D Model 1960			P-W Model 1960		
	UB	OZ	LB	UB	OZ	LB	UB	OZ	LB	UB	OZ	LB
Gamma Only Analysis by Dry Weight % eU_3O_8		0.200			0.496			0.50			0.362 wet 0.489 dry	
Chemical Analysis by Dry Weight % U_3O_8		0.282			6.536			0.05			0.044	
Gamma Logging Analysis Δ % eU_3O_8												
Gamma Spec Analysis by Dry Weight												
Thickness in Feet	4.49	6.39	7.07	1.95	1.97	1.56	3.03	1.93	1.0	2.93	2.04	1.0
GT Product Gross Gamma Grade Times Thickness		1.789			0.977			0.965			0.738 wet 0.998 dry	
%Water Content (LOD at 110°C) Lab Analysis	5.06	6.58	3.59					0.686*			26.19*	
%Water Content In-Situ Analysis												
Density g/cc (dry) Lab Analysis	1.940	1.876	1.956		1.673			1.310			1.787	
Density g/cc In-Situ Analysis												
Borehole Size (inches) and Casing Type	4.5 in. uncased			4.5 in. uncased			4.5 in. uncased	4.4 in. cased (20 gal. stainless)	4.5 in. uncased	4.5 in. uncased	4.4 in. cased (20 gal. stainless)	4.5 in. uncased
Magnetic Susceptibility (10^{-6} cgs)												
Ore Type & Amount and Grade % eU_3O_8	None	17000 lb of 0.287% S; 240 lb of 4.64%MV	None	None	286 lb 84.03% Climax Concen.	None	None	Climax Mill Tailings	None	None	Climax Mill Tailings	None
Sand Type & Amount		None		3parts sand	2038 lb	3 parts sand		None			None	
Cement Amount		5690 lb		1 part cement	764 lb	1 part cement		None			None	
Water Amount												
Porosity												
Cracks or Fractures												
Diameter in Feet	7.0	7.0	7.0	4.0	4.0	4.0	5.0 sq	5.0	5.0 sq	5.0 sq	5.0	5.0 sq
Petrographic Analysis (Z eq.)												

LB - Lower barren zone
UB - Upper barren zone
OZ - Ore Zone
LOD - Loss on drying

Δ - Best grade estimate from free water normalization and regression analysis. See text for more detail.
GT - Grade times thickness

S - Schwartzwalder Ore
MV - Monument Valley Ore
* - Original water content
sq - square

TABLE 2. Physical/Chemical Properties of the N-1, N-2, N-3 and N-4 Models.

	N-1 Model 1958			N-2 Model 1958			N-3 Model 1958			N-4 Model 1958				
	UB	OZ	LB	UB	OZ	LB	UB	OZ	LB	UB	$OZ_U(Z_2)$	MB	$OZ_L(Z_1)$	LB
Gamma Only Analysis by Dry Weight % eU_3O_8		0.2480			0.4296			0.240			0.9183		0.2459	
Chemical Analysis by Dry Weight % U_3O_8		0.1936			0.3794			0.1855			0.8875		0.1920	
Gamma Logging Analysis Δ % eU_3O_8								0.241 ±0.0008						
Gamma Spec Analysis by Dry Weight														
Thickness in Feet	4.0	1.17	4.0	4.0	1.04	4.0	4.0	4.15	4.0	4.0	1.0	4.0	2.31	4.0
GT Product Gross Gamma Grade Times Thickness		0.290			0.447			0.988			0.918		0.569	
%Water Content (LOD at 110°C) Lab Analysis								12.01						
%Water Content In-Situ Analysis								12.32						
Density g/cc (dry) Lab Analysis								1.83 dry 2.09 wet						
Density g/cc In-Situ Analysis														
Borehole Size (inches) and Casing Type	4.5 in. uncased			4.5 in. uncased			4.5 in. uncased			4.5 in. uncased				
Magnetic Susceptibility (10^{-6} cgs)														
Ore Type & Amount and Grade % eU_3O_8	None	Little Man Mine	None	None	Little Man Mine	None	None	Little Man Mine	None	None	Little Man Mine	None	Little Man Mine	None
Sand Type & Amount														
Cement Amount														
Water Amount														
Porosity														
Cracks or Fractures														
Diameter in Feet	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Petrographic Analysis (Z eq.)														

LB - Lower barren zone
UB - Upper barren zone
OZ - Ore Zone
LOD - Loss on drying
GT - Grade times thickness

Δ - Best grade estimate from free water normalization and regression analysis. See text for more detail.
S - Schwartzwalder Ore
MV - Monument Valley Ore

* - Origninal water content
sq - square
$OZ_U(Z_2)$ - Upper ore zone
$OZ_L(Z_1)$ - Lower ore zone
MB - Middle barren zone

TABLE 3. Physical/Chemical Properties of the N-5 and the Gross Gamma-Ray Water Factor Models.

	N-5 Model 1958								Gross Gamma-Ray Water Factor 1973					
	UB	$OZ_{U1}(Z_6)$	$OZ_{U2}(Z_5)$	$MB(Z_4)$	$OZ_{L1}(Z_3)$	$OZ_{LM}(Z_2)$	$OZ_{LZ}(Z_1)$	LB	UB			OZ	LB		
Gamma Only Analysis by Dry Weight % eU_3O_8		1.7145	0.2192		0.9464	0.1030	0.2500					0.320			
Chemical Analysis by Dry Weight % U_3O_8		1.6308	0.1714		0.9095	0.0840	0.1960					0.321			
Gamma Logging Analysis Δ % eU_3O_8															
Gamma Spec Analysis by Dry Weight									K % 1.79	U ppm 3.1	Th ppm 8.5		K % 1.73	U ppm 2.8	Th ppm 6.8
Thickness in Feet	4.0	0.47	0.57	0.54	1.10	0.74	0.50	4.0	4.0			4.0	4.0		
GT Product Gross Gamma Grade Times Thickness		0.806	0.125		1.041	0.0762	0.125					1.280			
% Water Content (LOD at 110°C) Lab Analysis									1.12			6.77	0.96		
%Water Content In-Situ Analysis															
Density g/cc (dry) Lab Analysis									2.145			1.534	2.129		
Density g/cc In-Situ Analysis															
Borehole Size (inches) and Casing Type	4.5 in. uncased								4.5 in. uncased						
Magnetic Susceptibility (10^{-6} cgs)															
Ore Type & Amount and Grade % eU_3O_8	None	Little Man Mine	Little Man Mine	None	Little Man Mine	Little Man Mine	Little Man Mine	None	None			See below*	None		
Sand Type & Amount												10503 lb			
Cement Amount												6876 lb			
Water Amount															
Porosity															
Cracks or Fractures															
Diameter in Feet	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.5 x 12 rectangle			4.5 x 12 rectangle	4.5 x 12 rectangle		
Petrographic Analysis (Z eq.)															

LB - Lower barren zone
UB - Upper barren zone
OZ - Ore Zone
LOD - Loss on drying
GT - Grade times thickness
OZ_{LM} - lower middle ore zone

Δ - Best grade estimate from free water normalization and regression analysis. See text for more detail.
OZ_{L1} - top lower ore zone
OZ_{L2} - bottom lower ore zone
OZ_{U1} - top upper ore zone
OZ_{U2} - bottom upper ore zone

*Water Factor Model only:

Climax Ore	4632 lb.	0.301 %eU_3O_8
Residue U-2	1885 lb.	1.107 %eU_3O_8
Residue U-3	2260 lb.	0.418 %eU_3O_8
Schwartzwalder	1553 lb.	3.008 %eU_3O_8

TABLE 4. Physical/Chemical Properties of the U-1, U-2, U-3, S and T-1 Models

	U-1 Model 1969			U-2 Model 1969			U-3 Model 1969			S Model 1965			T-1 Model 1965		
	UB	OZ	LB	UB	OZ	LB	UB	OZ	LB				UB	OZ	LB
Gamma Only Analysis by Dry Weight % eU_3O_8		2.422			1.229			0.473						0.940%$eThO_2$ 0.398%eU_3O_8	
Chemical Analysis by Dry Weight % U_3O_8		2.415			1.233			0.481						0.979%ThO_2 0.018%U_3O_8	
Gamma Logging Analysis Δ % eU_3O_8		2.482 ±0.0071			1.201 ±0.0038			0.459 ±0.0015							
Gamma Spec Analysis by Dry Weight										K % 1.34	U ppm 1.9	Th ppm 6.2			
Thickness in Feet	3.0	4.18	2.99	3.12	4.06	3.08	3.16	4.03	3.08	3.0			1.93	3.11	1.97
GT Product Gross Gamma Grade Times Thickness		10.208			5.091			1.890							
% Water Content (LOD at 110°C) Lab Analysis		4.45			9.21			7.93						2.58	
%Water Content In-Situ Analysis		10.13			14.34										
Density g/cc (dry) Lab Analysis		2.074			1.699			1.667						2.212	
Density g/cc In-Situ Analysis															
Borehole Size (inches) and Casing Type	4.5 in. uncased			4.5 in. uncased			4.5 in. uncased			4.5 in. uncased			4.5 in. uncased		
Magnetic Susceptibility (10^{-6} cgs)															
Ore Type & Amount and Grade % eU_3O_8	None	430.8 lb of 11.19% S 4861.7lb of 2.62% S	None	None	See Below*	None	None	See Below**	None	None			None		None
Sand Type & Amount										3:1 concrete grout mix					
Cement Amount		1755 lb			1755 lb										
Water Amount															
Porosity															
Cracks or Fractures															
Diameter in Feet	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4 x 12 rectangle			4.0	4.0	4.0
Petrographic Analysis (Z eq.)															

LB - Lower barren zone
UB - Upper barren zone
OZ - Ore Zone
LOD - Loss on drying
GT - Grade times thickness
Δ - Best grade estimate from free water normalization and regression analysis. See text for more detail.
S - Schwartzwalder Ore

*U-2 Model only:

Residue U-1	716 lb	2.442 %eU_3O_8
Schwartzwalder	1980 lb	2.62 %eU_3O_8
Residue Texas high grade pit	1413 lb	2.205 %eU_3O_8
Residue C model	1484 lb	0.280 %eU_3O_8

**U-3 Model only:

Residue Texas low grade pit	1925 lb	0.257 %eU_3O_8
Schwartzwalder Ore	1653 lb	2.62 %eU_3O_8
Schwartzwalder Ore	689 lb	0.287 %eU_3O_8
Residue C model	1821 lb	0.280 %eU_3O_8

TABLE 5. Physical/Chemical Properties of the T-2, T-3, and U Models

	T-2 Model 1965			T-3 Model 1965			U Model 1974								
	UB	OZ	LB	UB	OZ	LB	UB			OZ			LB		
Gamma Only Analysis by Dry Weight % eU_3O_8		0.499%$eThO_2$ 0.221%eU_3O_8			0.105%$eThO_2$ 0.047%eU_3O_8					0.0655					
Chemical Analysis by Dry Weight % U_3O_8		0.506%ThO_2 0.011%U_3O_8			0.093%ThO_2 0.010%U_3O_8		K	U	Th	K	U O	Th	K	U	Th
							% 2.03	ppm 3	ppm 5	% 1.27	% 0.0634	ppm 8.0	% 1.97	ppm 4.5	ppm 12
Gamma Logging Analysis Δ % eU_3O_8															
Gamma Spec Analysis by Dry Weight							K	U	Th	K	U	Th	K	U	Th
							% 1.9	ppm 3	ppm 8.3	% 0.95	ppm 522	ppm 18.7	% 1.99	ppm 3.5	ppm 8.9
Thickness in Feet	1.93	3.17	1.95	2.01	2.99	1.97	2.97			5.0			3.03		
GT Product Gross Gamma Grade Times Thickness										0.328					
%Water Content (LOD at 110°C) Lab Analysis		2.59			4.75		2.62			5.58			2.09		
%Water Content In-Situ Analysis															
Density g/cc (dry) Lab Analysis		2.099			2.014		2.22			2.56			2.25		
Density g/cc In-Situ Analysis															
Borehole Size (inches) and Casing Type	4.5 in. uncased			4.5 in. uncased			4.5 in. uncased								
Magnetic Susceptibility (10^{-6} cgs)							982			356			1084		
Ore Type & Amount and Grade % eU_3O_8	None		None	None		None	None			1723 lb. of 0.33% Climax Ore			None		
Sand Type & Amount										4850 lb.					
Cement Amount										2193 lb.					
Water Amount															
Porosity															
Cracks or Fractures															
Diameter in Feet	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0			4.0		
Petrographic Analysis (Z eq.)															

LB - Lower barren zone
UB - Upper barren zone
OZ - Ore Zone
LOD - Loss on drying

Δ - Best grade estimate from free water normalization and regression analysis. See text for more detail.
GT - Grade times thickness

TABLE 6. Physical/Chemical Properties of the T and K Models

	T Model 1974									K Model 1974								
	UB			OZ			LB			UB			OZ			LB		
Gamma Only Analysis by Dry Weight % eU_3O_8																		
Chemical Analysis by Dry Weight % U_3O_8	K	U	Th	K	U	Th	K	U	Th	K	U	Th	K	U	Th	K	U	Th
	% 1.95	ppm 2.5	ppm 10.5	% 1.32	ppm 24	ppm 502	%	ppm	ppm	% 1.77	ppm 4	ppm 11	% 6.28	ppm 10	ppm 4	% 1.74	ppm 3	ppm 7.5
Gamma Logging Analysis Δ % eU_3O_8																		
Gamma Spec Analysis by Dry Weight	K	U	Th	K	U	Th	K	U	Th	K	U	Th	K	U	Th	K	U	Th
	% 1.84	ppm 3	ppm 8.4	% 1.36	ppm 26.1	ppm 508	%	ppm	ppm	% 1.90	ppm 2.9	ppm 8.1	% 6.30	ppm 2.9	ppm 2.5	% 1.77	ppm 2.9	ppm 7.5
Thickness in Feet	2.97			4.94			3.08			2.97			5.03			2.91		
GT Product Gross Gamma Grade Times Thickness																		
%Water Content (LOD at 110°C) Lab Analysis	2.40			5.77						1.98			2.88			1.78		
%Water Content In-Situ Analysis																		
Density g/cc (dry) Lab Analysis	2.20			1.88						2.23			1.86			2.24		
Density g/cc In-Situ Analysis																		
Borehole Size (inches) and Casing Type	4.5 in. uncased									4.5 in. uncased								
Magnetic Susceptibility (10^{-6} cgs)	1053			484						931			65			860		
Ore Type & Amount and Grade % eU_3O_8	None			106.33 lb. of monazite sand			None			None			4379.7 lb feldspar (Canon City) 1855.3 lb feldspar (Grand Junction)			None		
Sand Type & Amount				6475 lb									None					
Cement Amount				2193 lb									2080 lb					
Water Amount																		
Porosity																		
Cracks or Fractures																		
Diameter in Feet	4.0			4.0			4.0			4.0			4.0			4.0		
Petrographic Analysis (Z eq.)																		

LB - Lower barren zone
UB - Upper barren zone
OZ - Ore zone
LOD - Loss on drying

Δ - Best grade estimate from free water normalization and regression analysis. See text for more detail.
GT - Grade times thickness

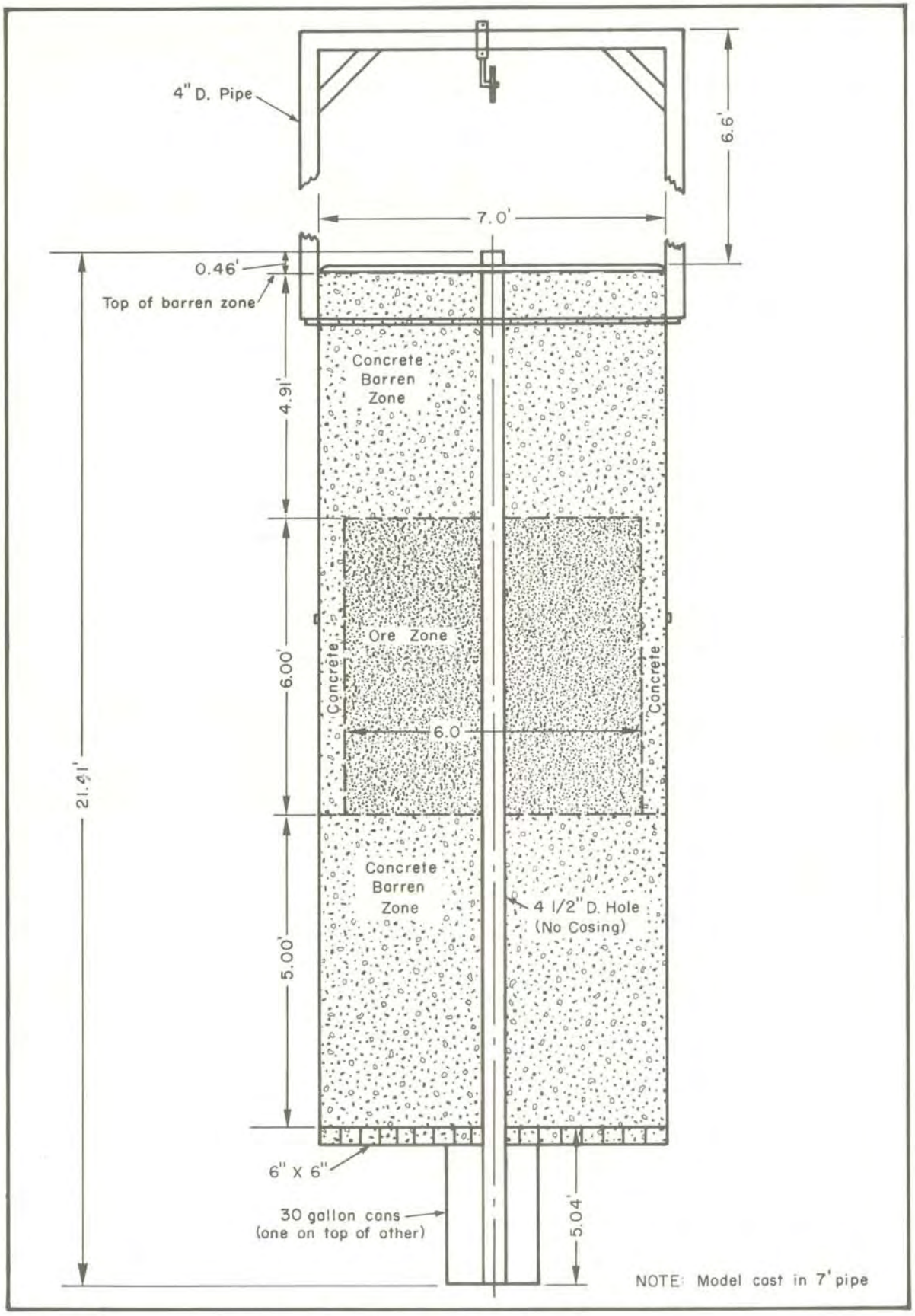


Figure 2. C Model

Table 7
Construction/Analysis Characteristics
of the C Model

ORE ZONES	ore type & amount	17000 lbs. 0.287% eU_3O_8 Schwartzwalder 240 lbs. 4.640% eU_3O_8 Monument Valley			
	cement amount	5690 lbs.			
	water amount	unknown			
	sand type & amount	none			
BARREN ZONE	sand type & amount	unknown			
	cement amount	unknown			
	water amount	unknown			
ASSAY ANALYSIS ORE ZONE	chemical	0.282% U_3O_8			
	gamma only	0.280% eU_3O_8			
	gamma spec	unknown			
	gamma logging	unknown			
ASSAY ANALYSIS BARREN ZONES	chemical	unknown			
	gamma only	unknown			
	gamma spec	unknown			
	gamma logging	unknown			
DENSITY	chemical analysis	upper barren 1.940 g/cc	ore zone 1.876 g/cc	lower barren 1.956 g/cc	
	in-situ	unknown			
WATER OR H^+	chemical analysis	average loss on drying at 110°C	upper bar. 5.06%	ore zone 6.58%	lower bar. 3.59%
	in-situ	unknown			
ZEQ (PETROGRAPHIC ANALYSIS)	unknown				
POROSITY	unknown				
CRACKS OR FRACTURES	unknown				
MAGNETIC SUSCEPTIBILITY	unknown				

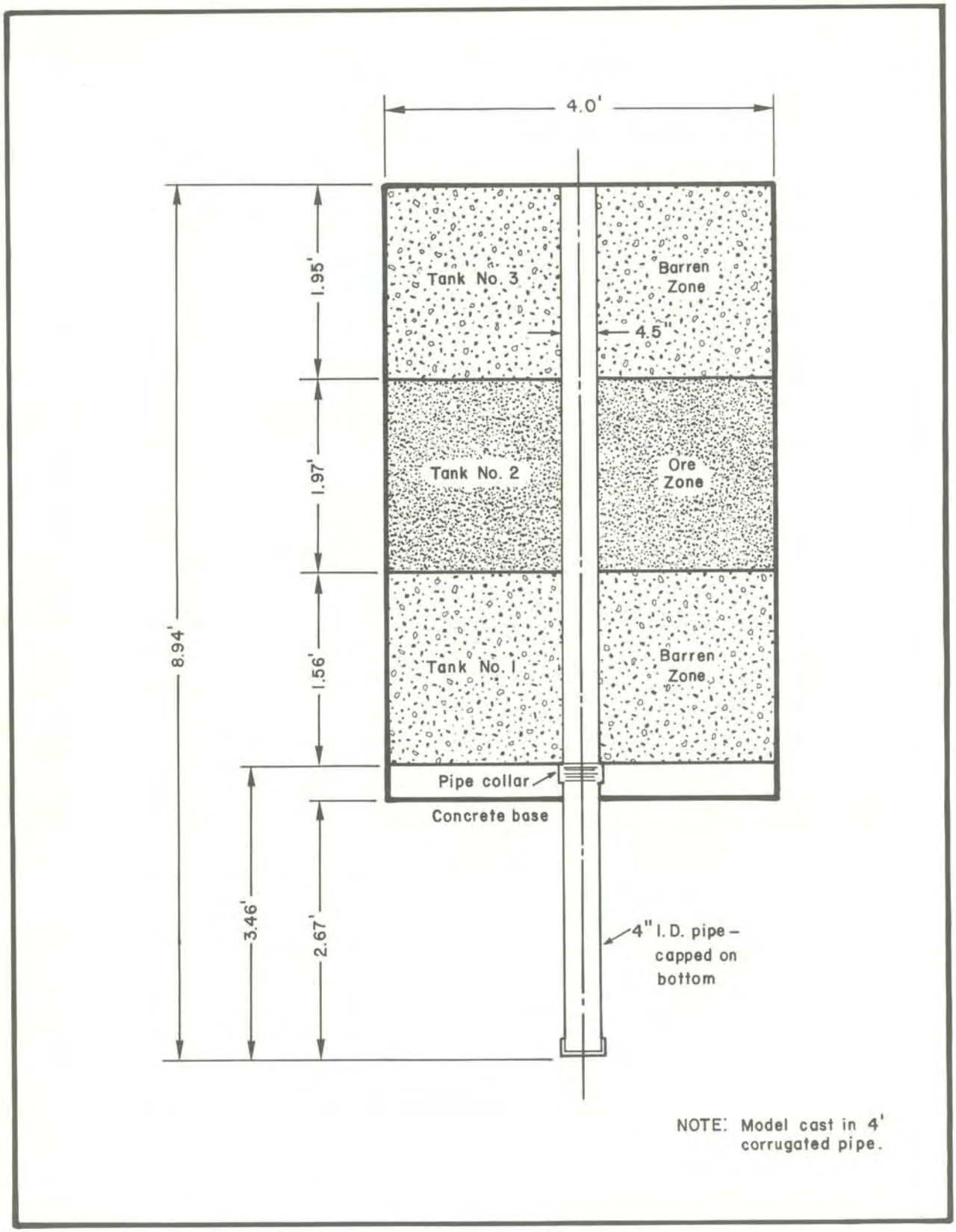


Figure 3. R Model

Table 8
Construction/Analysis Characteristics
of the R Model

ORE ZONES	ore type & amount	268 lbs. concentrate from Climax lot #111 (84.03% U_3O_8)
	cement amount	764 lbs.
	water amount	unknown
	sand type & amount	2038 lbs. (unknown)
BARREN ZONE	sand type & amount	3 parts sand (unknown)
	cement amount	1 part cement
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	6.536% U_3O_8
	gamma only	0.496% eU_3O_8
	gamma spec	unknown
	gamma logging	unknown
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	1.673 g/cc
	in-situ	unknown
WATER OR H^+	chemical analysis	unknown
	in-situ	unknown
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

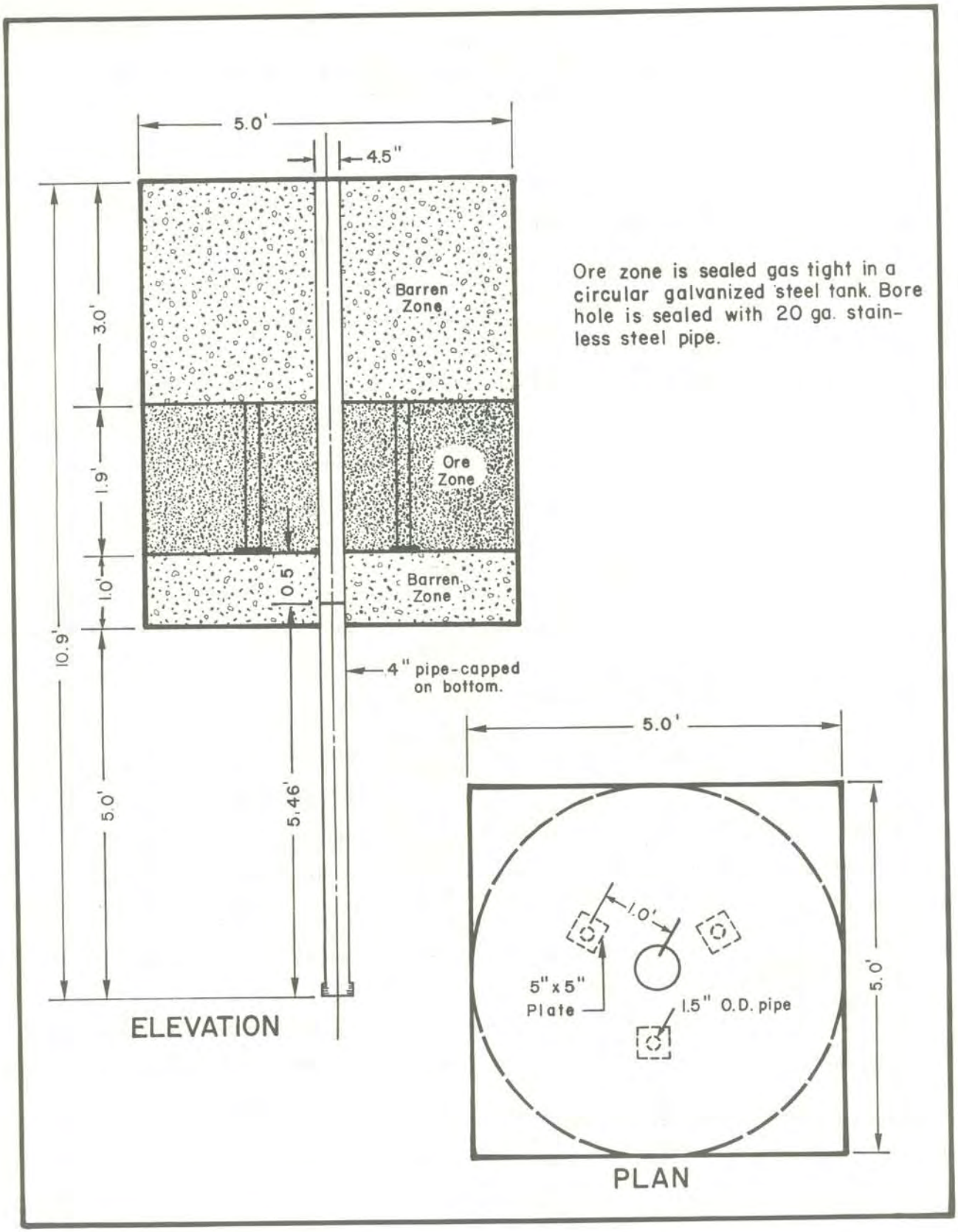


Figure 4. P-D Model

Table 9
Construction/Analysis Characteristics
of the P-D Model

ORE ZONES	ore type & amount	Climax maroon colored "slime" mill tailings unknown weight
	cement amount	none
	water amount	---
	sand type & amount	none
BARREN ZONE	sand type & amount	unknown
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	0.05% U_3O_8
	gamma only	0.50% eU_3O_8
	gamma spec	unknown
	gamma logging	unknown
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	1.310 g/cc
	in-situ	unknown
WATER OR H^+	chemical analysis	0.6860% Loss on drying at 110°C by weight
	in-situ	unknown
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

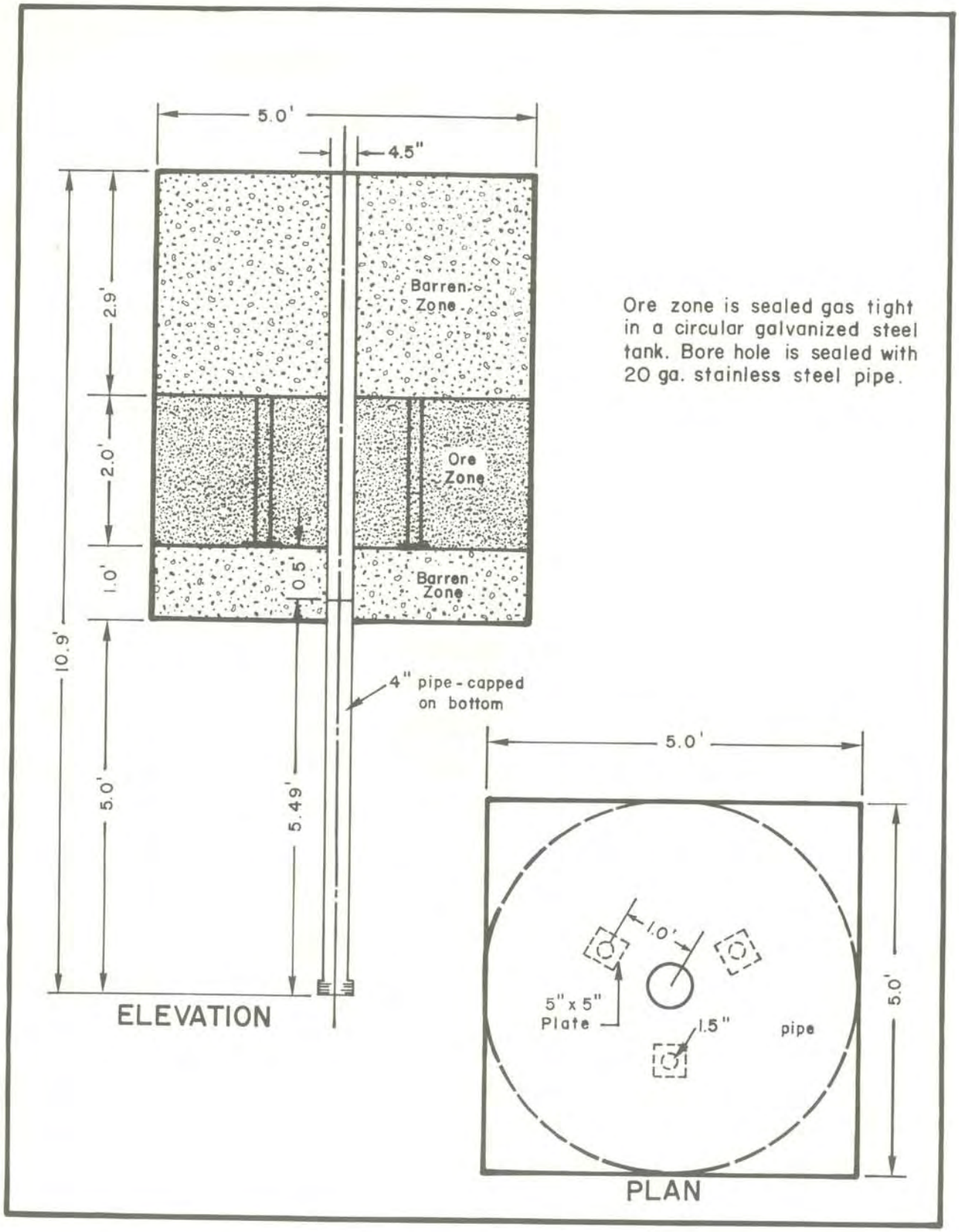


Figure 5. P-W Model

Table 10
Construction/Analysis Characteristics
of the P-W Models

ORE ZONES	ore type & amount	Climax maroon colored "slime" mill tailings unknown weight
	cement amount	none
	water amount	---
	sand type & amount	none
BARREN ZONE	sand type & amount	unknown
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	0.044% U_3O_8
	gamma only	0.362% eU_3O_8 w/H_2O---0.489% eU_3O_8 dry
	gamma spec	unknown
	gamma logging	unknown
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	1.787 g/cc
	in-situ	unknown
WATER OR H^+	chemical analysis	26.19% Loss on drying at 110°C by weight
	in-situ	unknown
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

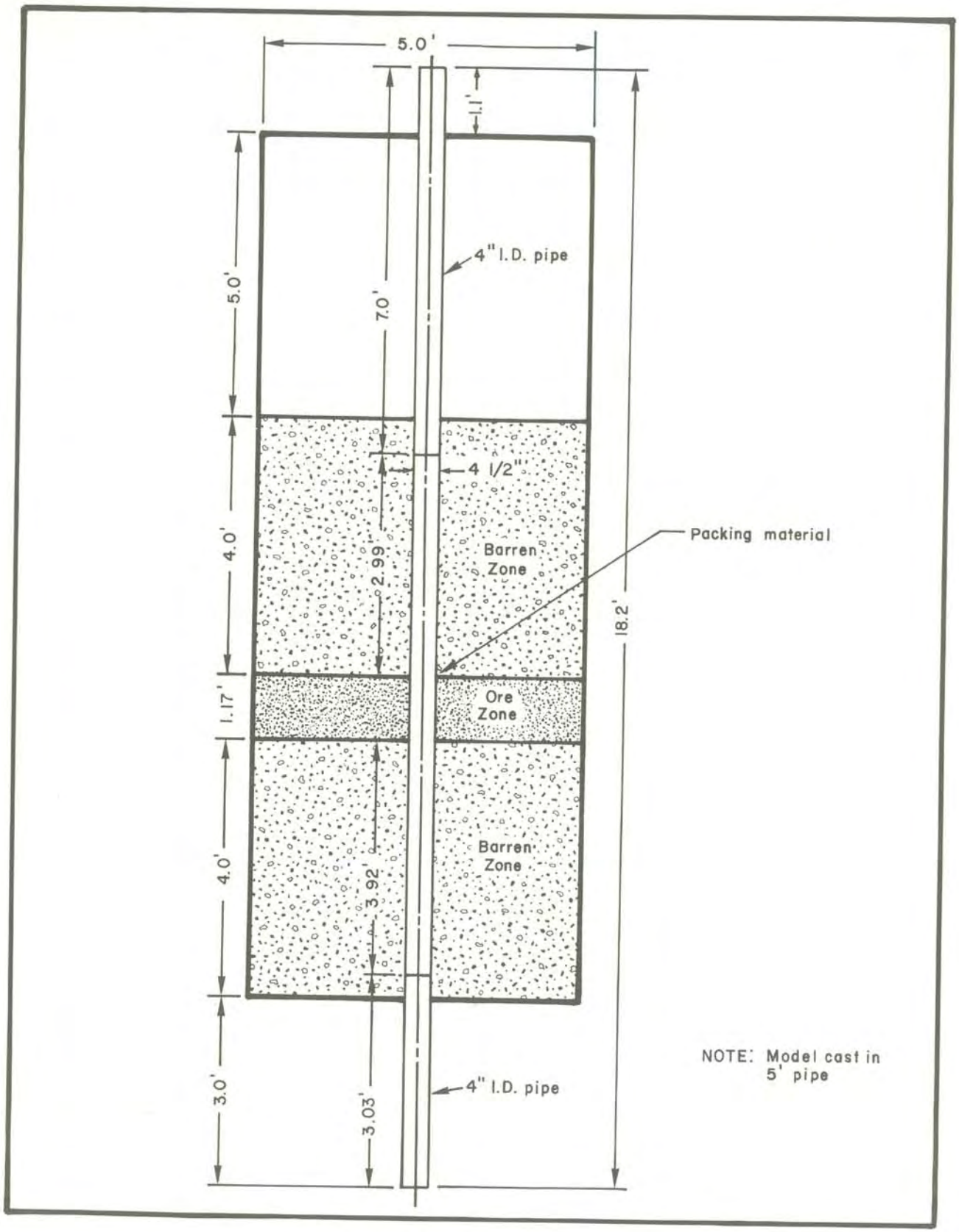


Figure 6. N-1 Model

Table 11
Construction/Analysis Characteristics
of the N-1 Model

ORE ZONES	ore type* & amount	unknown weight (3:1) ratio of aggregate to cement
	cement amount	unknown
	water amount	unknown
	sand type & amount	unknown
BARREN ZONE	sand type & amount	unknown (3:1) ratio of aggregate to cement
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	0.1936 % U_3O_8
	gamma only	0.2480 % eU_3O_8
	gamma spec	unknown
	gamma logging	unknown
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	unknown
	in-situ	unknown
WATER OR H^+	chemical analysis	unknown
	in-situ	unknown
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

*The ore came from the Little Man Mine,
SE ¼ S 14 T 27 N R 84 W, Carbon County, Wyoming;
a vein type ore (pitchblende) in Precambrian rock.

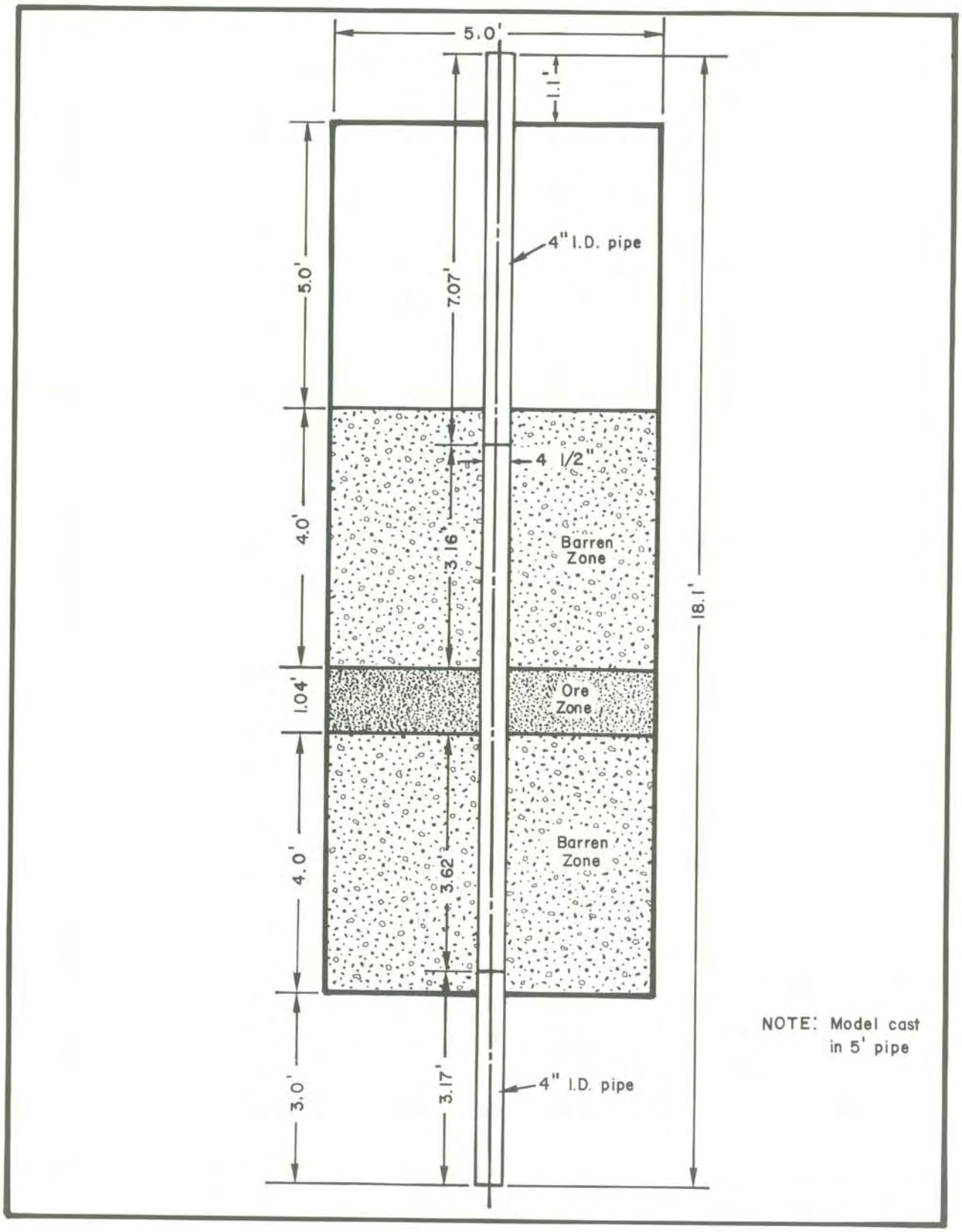


Figure 7. N-2 Model

Table 12
Construction/Analysis Characteristics
of the N-2 Model

ORE ZONES	ore type* & amount	unknown (3:1) ratio aggregate to cement
	cement amount	unknown
	water amount	unknown
	sand type & amount	unknown
BARREN ZONE	sand type & amount	unknown (3:1) ratio aggregate to cement
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	0.3794% U_3O_8
	gamma only	0.4296% eU_3O_8
	gamma spec	unknown
	gamma logging	unknown
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	unknown
	in-situ	unknown
WATER OR H^+	chemical analysis	unknown
	in-situ	unknown
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

*The ore came from the Little Man Mine,
SE ¼ S 14 T 27 N R 84 W, Carbon County, Wyoming;
a vein type ore (pitchblende) in Precambrian rock.

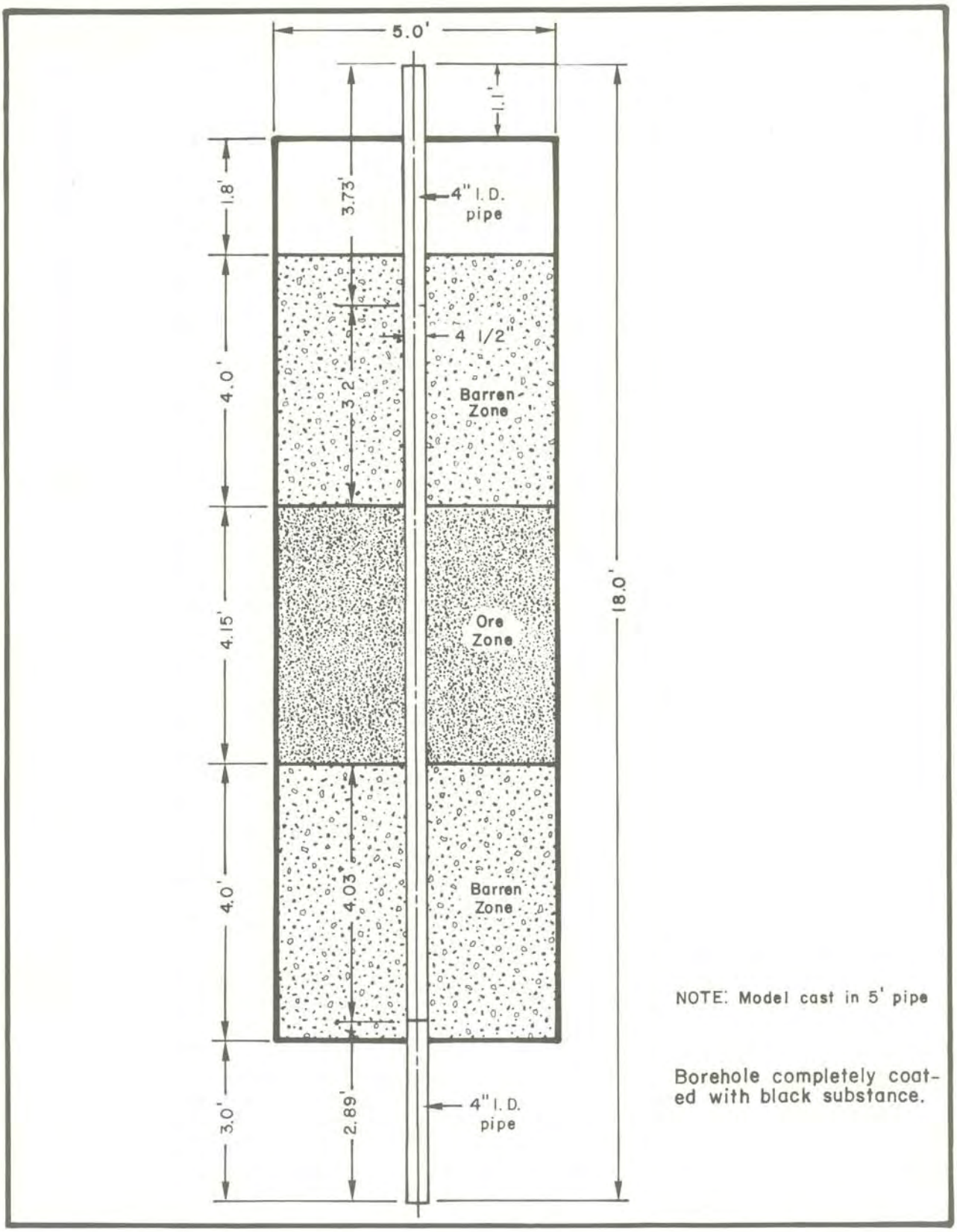


Figure 8. N-3 Model

Table 13
Construction/Analysis Characteristics
of the N-3 Model

ORE ZONES	ore type* & amount	unknown weight (3:1) ratio of aggregate to cement
	cement amount	unknown
	water amount	unknown
	sand type & amount	unknown
BARREN ZONE	sand type & amount	unknown (3:1) ratio of aggregate to cement
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	0.1855% U_3O_8
	gamma only	0.240% eU_3O_8
	gamma spec	unknown
	gamma logging	0.241 ± 0.0008% eU_3O_8
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	1.83 g/cc (dry); 2.09 g/cc (wet)
	in-situ	unknown
WATER OR H^+	chemical analysis	12.01% Loss on drying at 110°C by weight
	in-situ	12.32% by weight (neutron-neutron probe 601)
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

*The ore came from the Little Man Mine,
SE ¼ S 14 T 27 N R 84 W, Carbon County, Wyoming;
a vein type ore (pitchblende) in Precambrian rock.

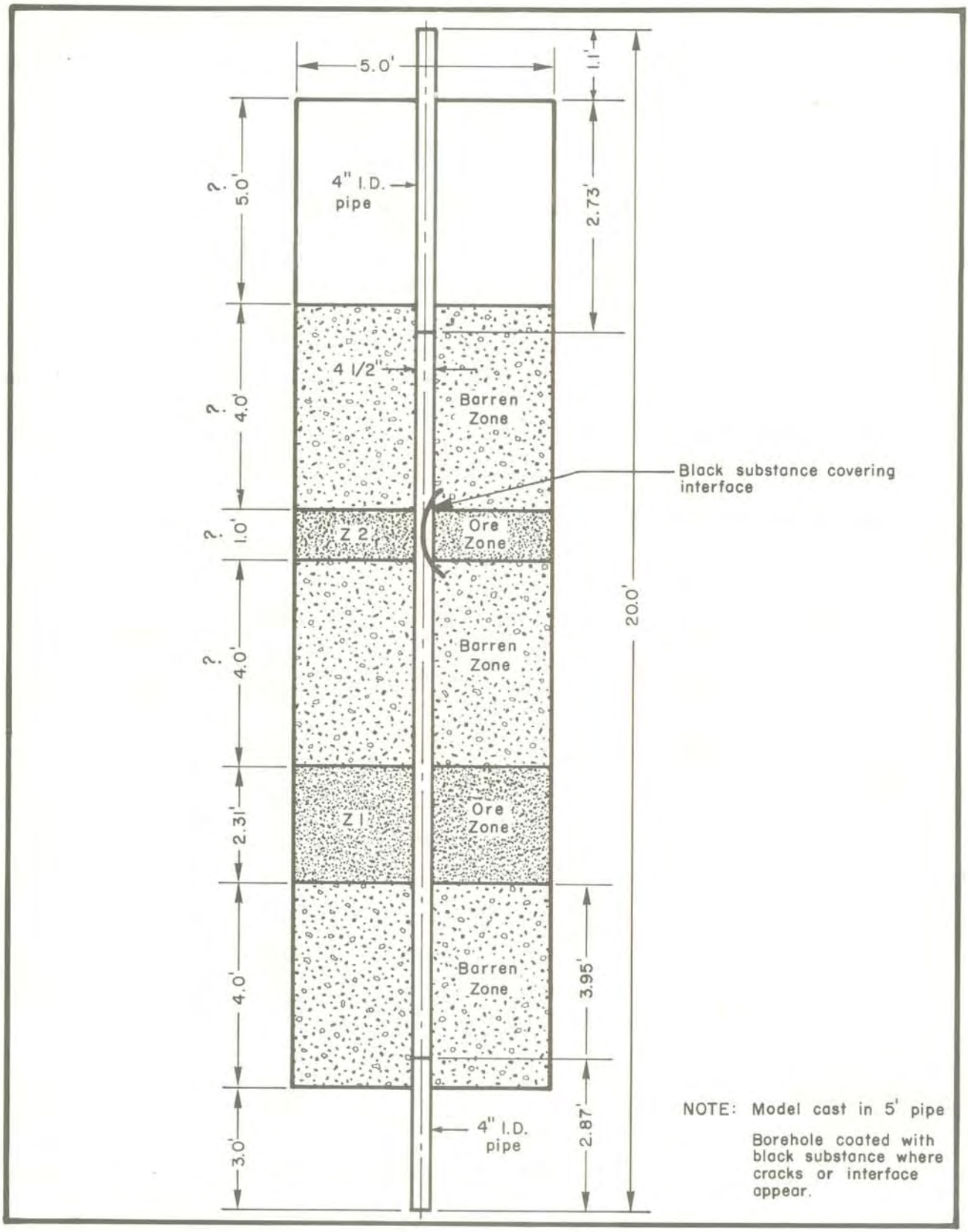


Figure 9. N-4 Model

Table 14
Construction/Analysis Characteristics
of the N-4 Model

ORE ZONES	ore type*& amount	unknown weight (3:1) ratio of aggregate to cement	
	cement amount	unknown	
	water amount	unknown	
	sand type & amount	unknown	
BARREN ZONE	sand type & amount	unknown (3:1) ratio of aggregate to cement	
	cement amount	unknown	
	water amount	unknown	
ASSAY ANALYSIS ORE ZONE	chemical	lower zone (Z_1) 0.1920% U_3O_8	upper zone (Z_2) 0.8875% U_3O_8
	gamma only	0.2459% eU_3O_8	0.9183% eU_3O_8
	gamma spec	unknown	unknown
	gamma logging	unknown	unknown
ASSAY ANALYSIS BARREN ZONES	chemical	unknown	
	gamma only	unknown	
	gamma spec	unknown	
	gamma logging	unknown	
DENSITY	chemical analysis	unknown	
	in-situ	unknown	
WATER OR H^+	chemical analysis	unknown	
	in-situ	unknown	
ZEQ (PETROGRAPHIC ANALYSIS)	unknown		
POROSITY	unknown		
CRACKS OR FRACTURES	unknown		
MAGNETIC SUSCEPTIBILITY	unknown		

*The ore came from the Little Man Mine
SE ¼ S 14 T 27 N R 84 W, Carbon County, Wyoming;
a vein type ore (pitchblende) in Precambrian rock.

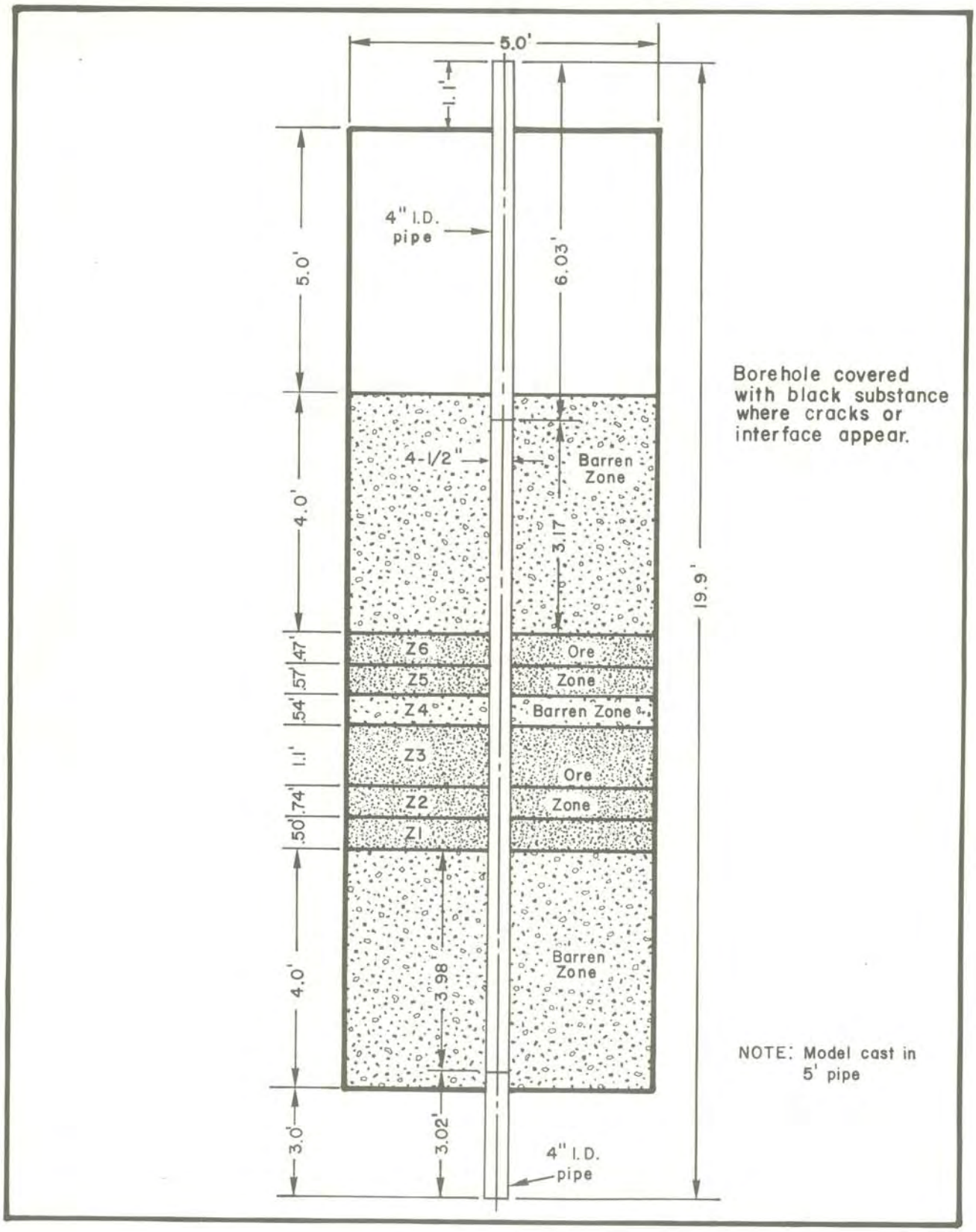


Figure 10. N-5 Model

Table 15
Construction/Analysis Characteristics
of the N-5 Model

ORE ZONES	ore type* & amount	unknown weight (3:1) ratio of aggregate to cement					
	cement amount	unknown					
	water amount	unknown					
	sand type & amount	unknown					
BARREN ZONE	sand type & amount	unknown (3:1) ratio of aggregate to cement					
	cement amount	unknown					
	water amount	unknown					
ASSAY ANALYSIS ORE ZONE	chemical $\%U_3O_8$	Z_1 0.1960	Z_2 0.0840	Z_3 0.9096	Z_4 BARREN unknown	Z_5 0.1714	Z_6 1.6308
	gamma only $\%eU_3O_8$	0.2500	0.1030	0.9464	unknown	0.2192	1.7145
	gamma spec	unknown	unknown	unknown	unknown	unknown	unknown
	gamma logging	unknown	unknown	unknown	unknown	unknown	unknown
ASSAY ANALYSIS BARREN ZONES	chemical	unknown					
	gamma only	unknown					
	gamma spec	unknown					
	gamma logging	unknown					
DENSITY	chemical analysis	unknown					
	in-situ	unknown					
WATER OR H^+	chemical analysis	unknown					
	in-situ	unknown					
ZEQ (PETROGRAPHIC ANALYSIS)	unknown						
POROSITY	unknown						
CRACKS OR FRACTURES	unknown						
MAGNETIC SUSCEPTIBILITY	unknown						

*The ore came from the Little Man Mine,
SE ¼ S 14 T 27 N R 84 W, Carbon County, Wyoming;
a vein type ore (pitchblende) in Precambrian rock.

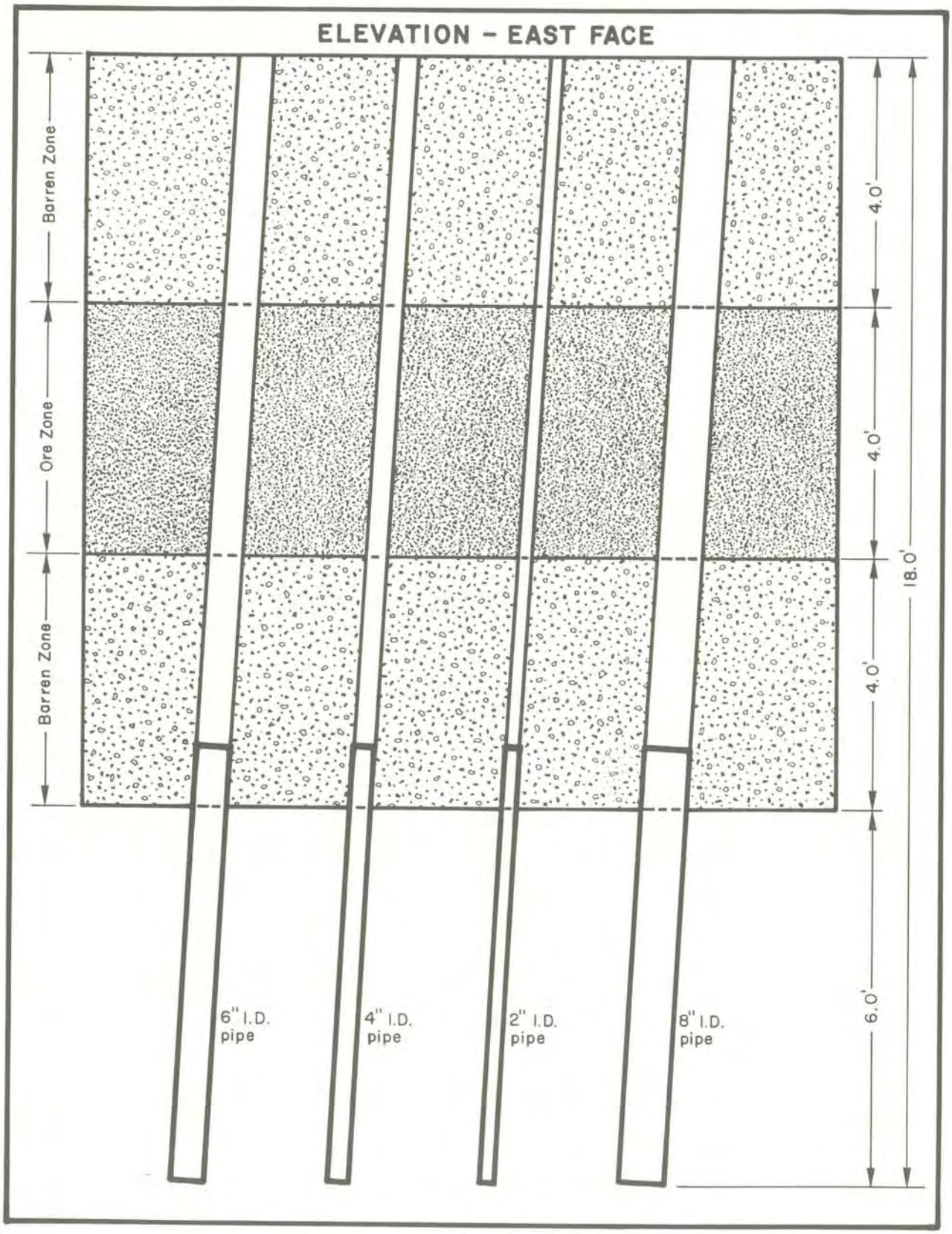


Figure 11. Water Factor Model

Table 16
Construction/Analysis Characteristics
of the Gross Gamma-Ray Water Factor Model

ORE ZONES	ore type & amount	See below		
	cement amount	6876 lbs.		
	water amount	unknown		
	sand type & amount	unknown 10503 lbs.		
BARREN ZONE	sand type & amount	unknown		
	cement amount	unknown		
	water amount	unknown		
ASSAY ANALYSIS ORE ZONE	chemical	0.321% U_3O_8		
	gamma only	0.320% eU_3O_8		
	gamma spec	unknown		
	gamma logging	unknown		
ASSAY ANALYSIS BARREN ZONES	chemical	Upper Barren unknown		Lower Barren unknown
	gamma only	unknown		unknown
	gamma spec	e Th 8.5ppm;eU 3.1ppm; eK 1.79%		eTh 6.8ppm;eU 2.8ppm; eK 1.73%
	gamma logging	unknown		unknown
DENSITY	chemical analysis	Upper Barren 2.145 g/cc	Ore Zone 1.534 g/cc	Lower Barren 2.129 g/cc
	in-situ	unknown		
WATER OR H^+	chemical analysis	Upper Barren 1.12% Loss on drying	Ore Zone 6.77% Loss on drying	Lower Barren 0.96% Loss on drying
	in-situ	unknown		
ZEQ (PETROGRAPHIC ANALYSIS)	unknown			
POROSITY	unknown			
CRACKS OR FRACTURES	unknown			
MAGNETIC SUSCEPTIBILITY	unknown			

Ore Used	Weight (lbs.)	% U_3O_8	% eU_3O_8
Climax Ore	4,632	0.134	0.301
Residue Model U-2	1,885	1.172	1.107
Residue Model U-3	2,260	0.426	0.418
Schwartzwalder Ore	1,553	2.924	3.008

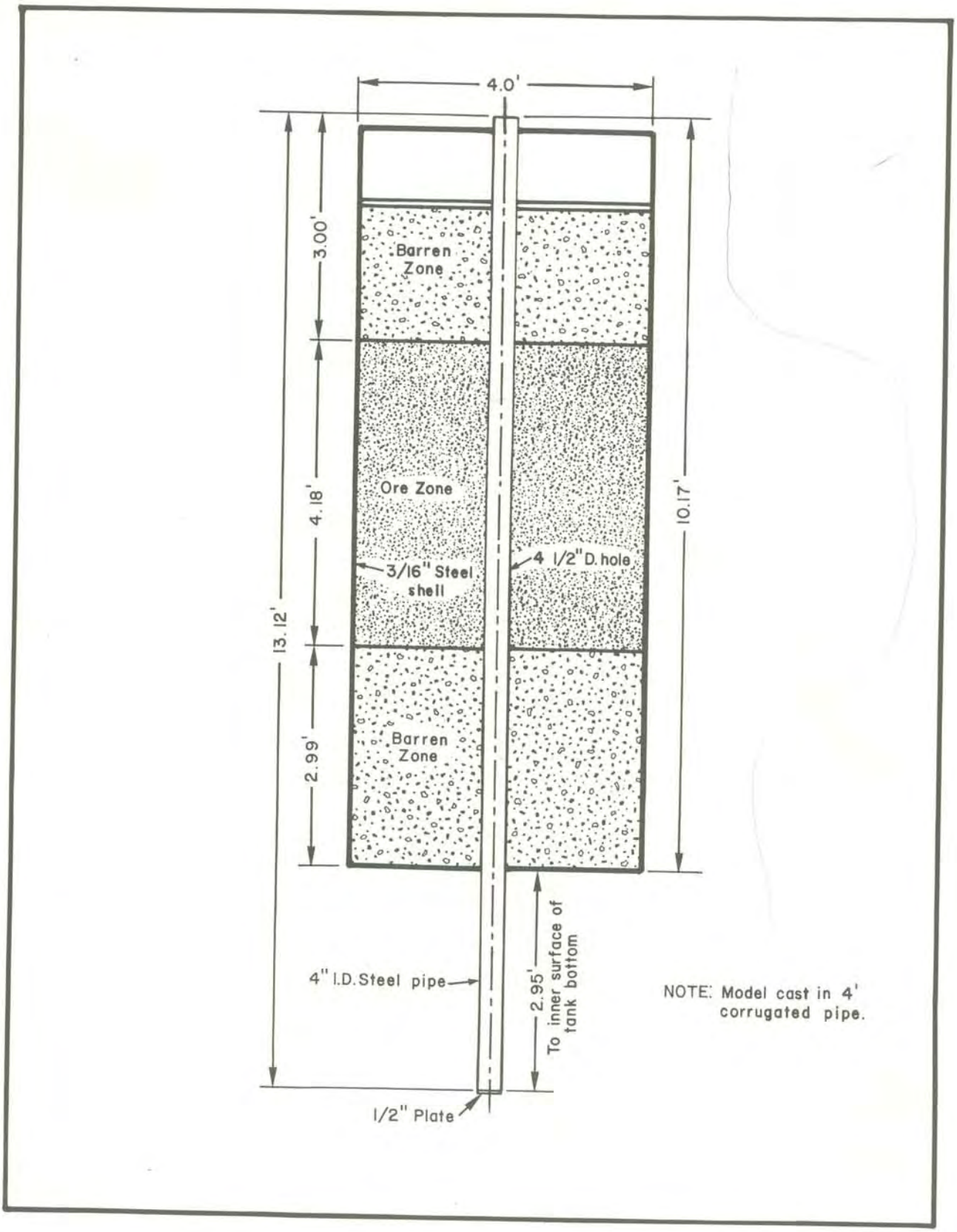


Figure 12. U-1 Test Model

Table 17
Construction/Analysis Characteristics
of the U-1 Model

ORE ZONES	ore type & amount	430.8 lbs. of 11.19% eU_3O_8 Schwartzwalder Ore 4861.7 lbs. of 2.62% eU_3O_8 Schwartzwalder Ore
	cement amount	1755 lbs.
	water amount	unknown
	sand type & amount	unknown
BARREN ZONE	sand type & amount	unknown
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	2.415 % U_3O_8
	gamma only	2.422 % eU_3O_8
	gamma spec	unknown
	gamma logging	2.482 ± 0.0071% eU_3O_8
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	2.074 g/cc
	in-situ	unknown
WATER OR H^+	chemical analysis	4.45% Loss on drying at 110°C
	in-situ	10.13% (neutron-neutron probe)
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

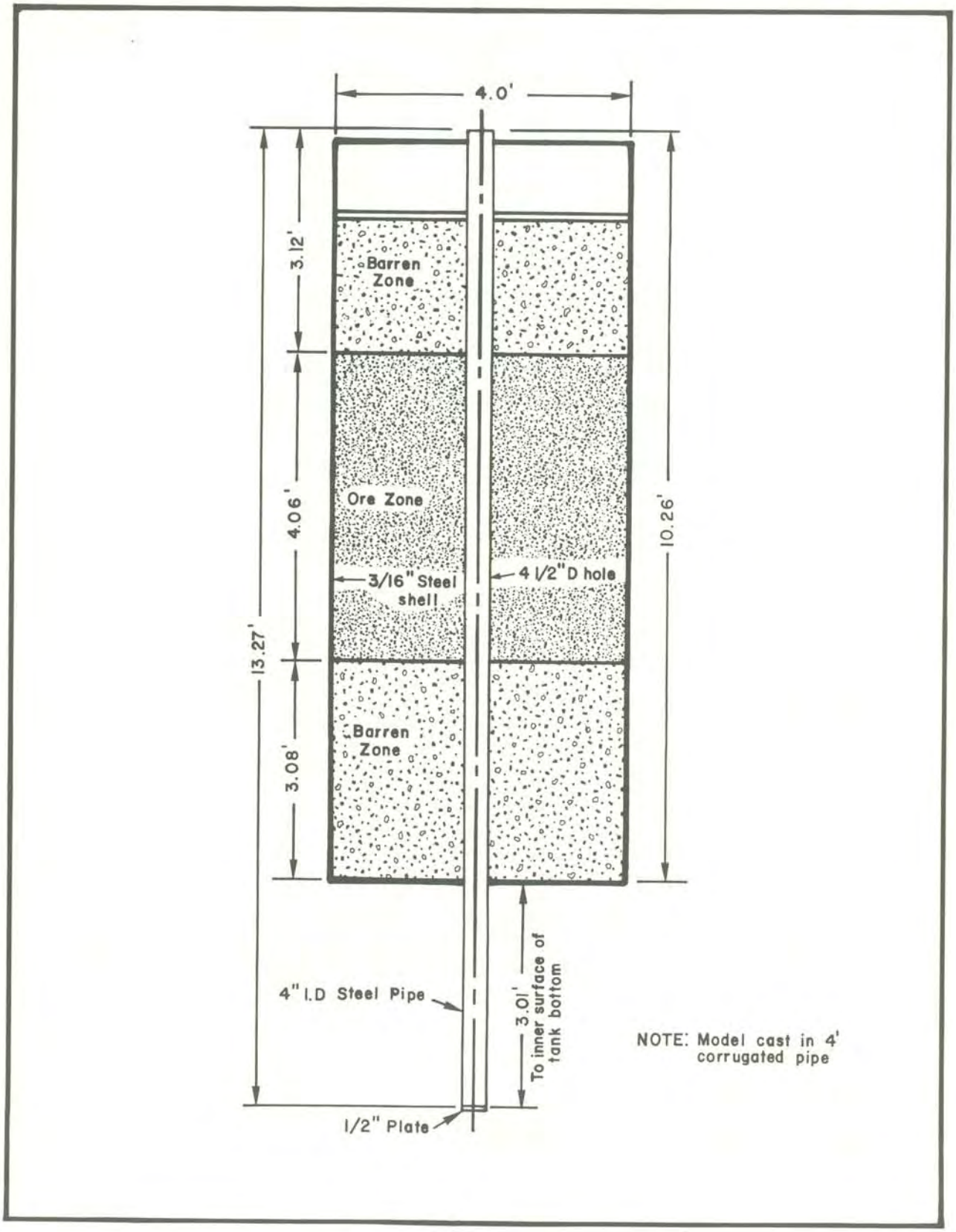


Figure 13. U-2 Test Model

Table 18
Construction/Analysis Characteristics
of the U-2 Model

ORE ZONES	ore type & amount	See below
	cement amount	1755 lbs.
	water amount	unknown
	sand type & amount	unknown
BARREN ZONE	sand type & amount	unknown
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	1.233% U_3O_8
	gamma only	1.229% eU_3O_8
	gamma spec	unknown
	gamma logging	1.201 ± 0.0038% eU_3O_8
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	1.699 g/cc
	in-situ	unknown
WATER OR H^+	chemical analysis	9.21% Loss on drying at 110°C
	in-situ	14.34% (neutron-neutron probe)
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

716 lbs. of ground ore zone from the U-1 model
1980 lbs. of 2.62% eU_3O_8 Schwartzwalder Ore
1413 lbs. of ground ore zone from the high grade Texas model
1480 lbs. of ground ore zone from the C model

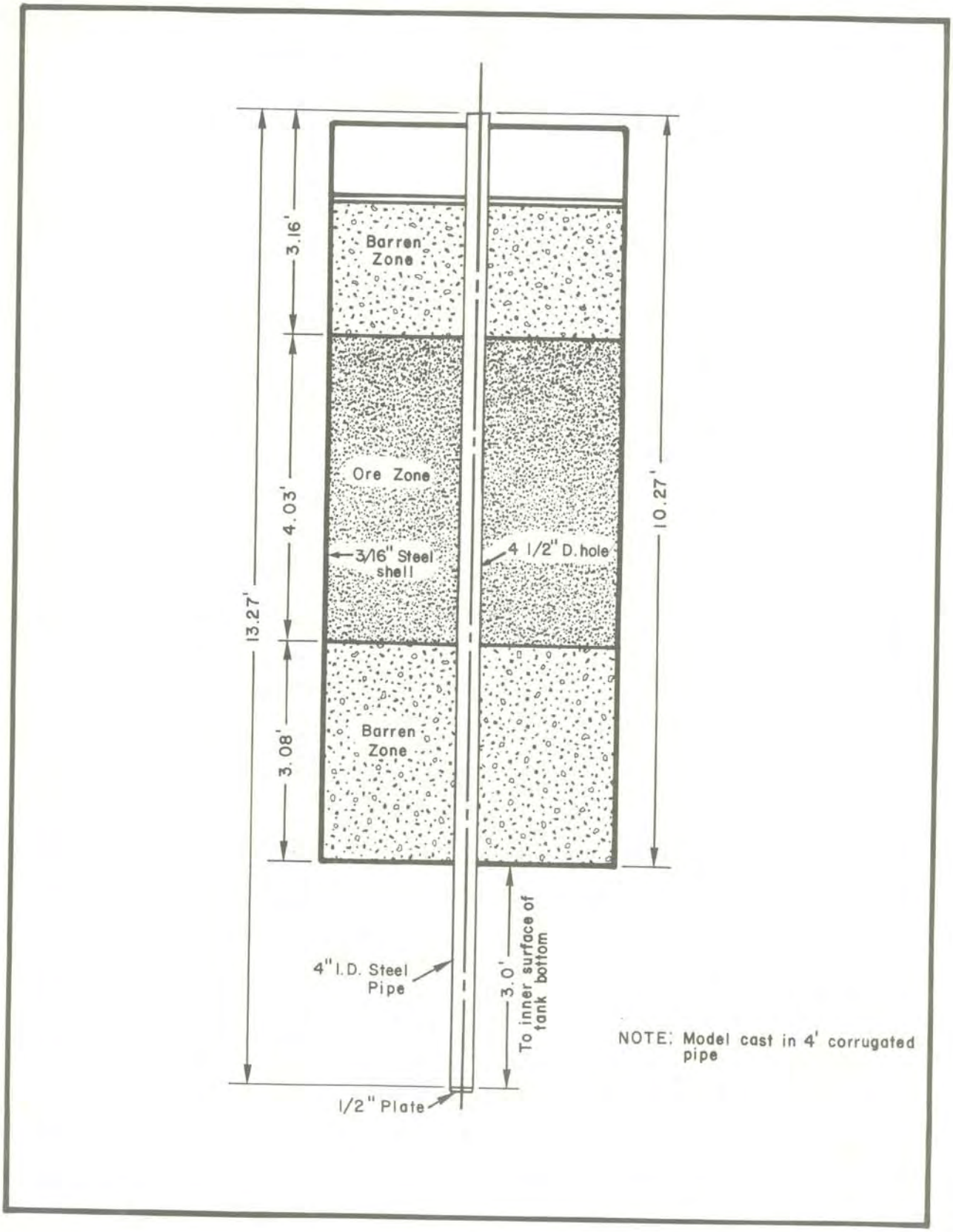


Figure 14. U-3 Test Model

Table 19
Construction/Analysis Characteristics
of the U-3 Model

ORE ZONES	ore type & amount	See below
	cement amount	1755 lbs.
	water amount	unknown
	sand type & amount	unknown
BARREN ZONE	sand type & amount	unknown
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	0.481% U_3O_8
	gamma only	0.473% eU_3O_8
	gamma spec	unknown
	gamma logging	0.459 ± 0.0015% eU_3O_8
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	1.667 g/cc
	in-situ	unknown
WATER OR H^+	chemical analysis	7.93% Loss on drying at 110°C
	in-situ	14.86% (neutron-neutron probe)
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

1925 lbs. of ground ore zone from the low grade Texas model.
1653 lbs. of 2.62% eU_3O_8 Schwartzwalder Ore
689 lbs. of 0.287% eU_3O_8 Schwartzwalder Ore
1821 lbs. of ground ore zone from the C Model

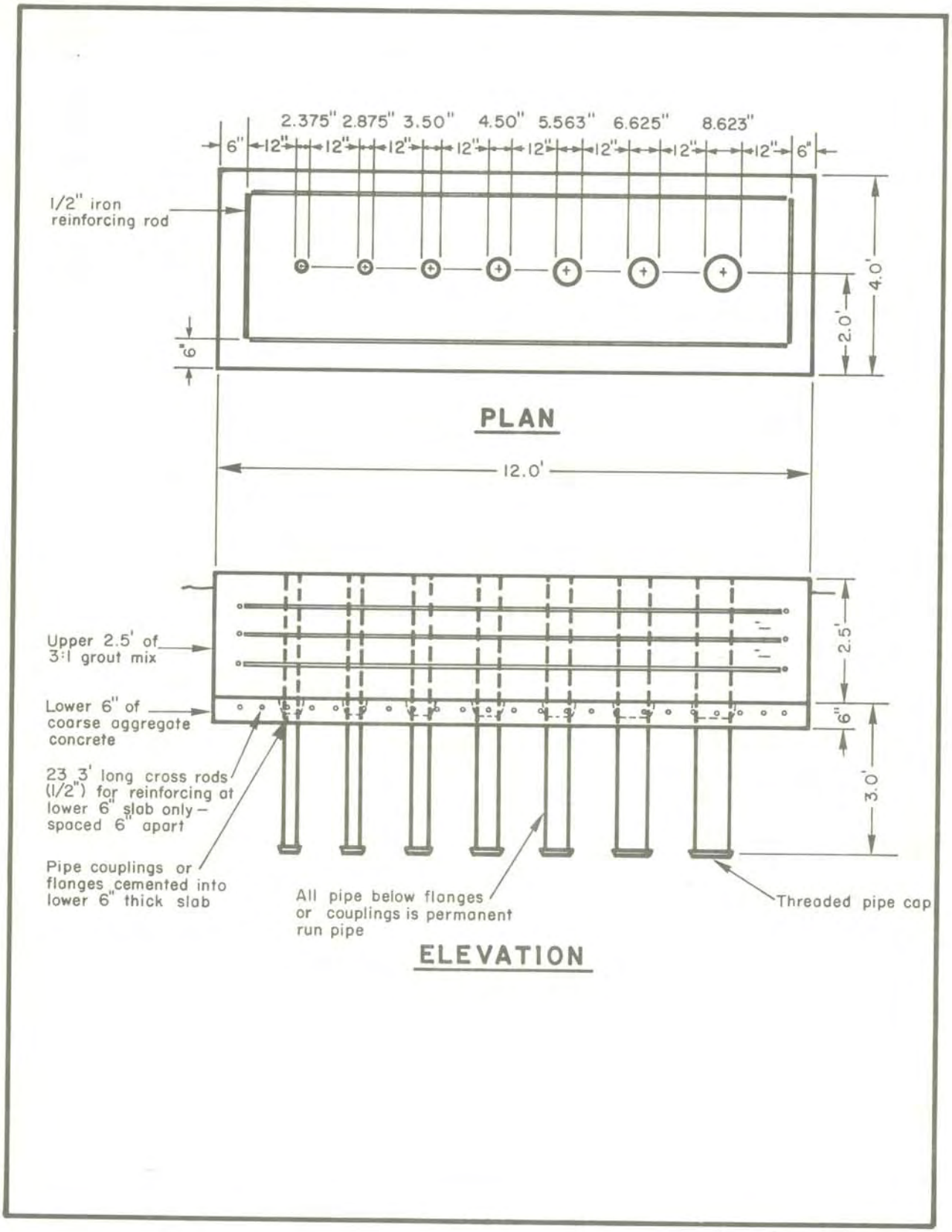
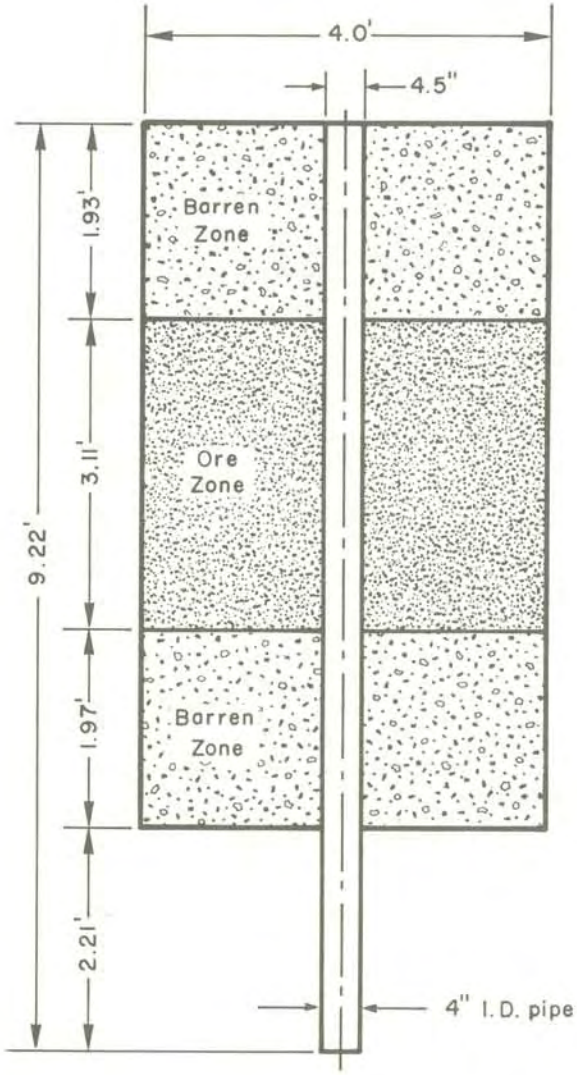


Figure 15. S Model for Hole Size Calibration

Table 20
Construction/Analysis Characteristics
of the S Model

ORE ZONES	ore type & amount	None
	cement amount	None
	water amount	None
	sand type & amount	None
BARREN ZONE	sand type & amount	Unknown (3:1) concrete grout mix & course concrete aggregate
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	None
	gamma only	None
	gamma spec	None
	gamma logging	None
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	1.34% K 1.9 ppm eU 6.2 ppm eTh
	gamma logging	unknown
DENSITY	chemical analysis	unknown
	in-situ	unknown
WATER OR H^+	chemical analysis	unknown
	in-situ	unknown
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

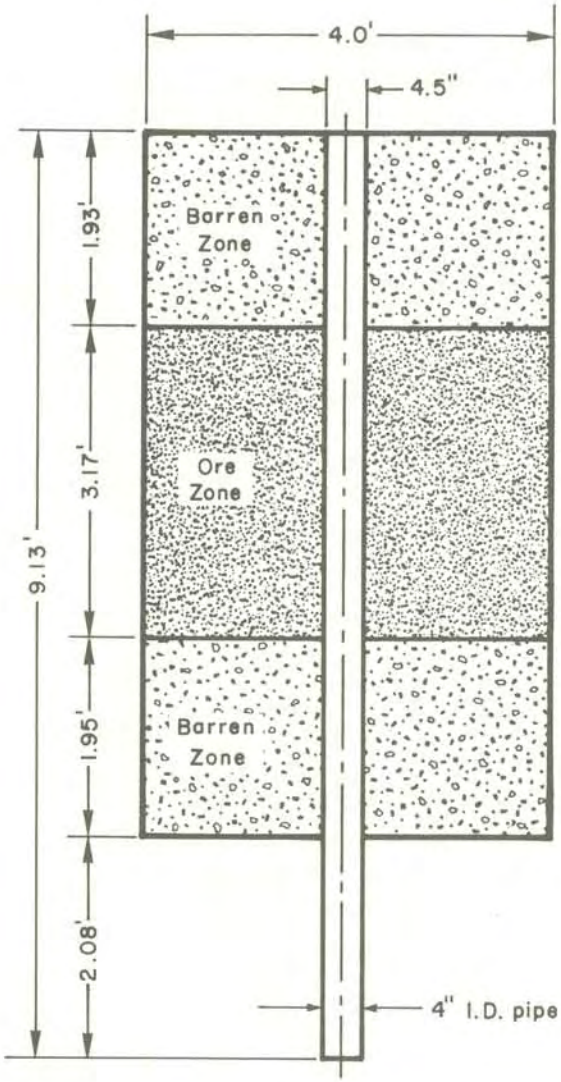


Note: Model cast in 4' corrugated pipe

Figure 16. T-1 Model

Table 21
Construction/Analysis Characteristics
of the T-1 Model

ORE ZONES	ore type & amount	unknown grout mix concrete and thorium ore
	cement amount	unknown
	water amount	unknown
	sand type & amount	unknown
BARREN ZONE	sand type & amount	unknown coarse concrete
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	0.979% ThO_2; 0.018% U_3O_8
	gamma only	0.940% $eThO_2$; 0.398% eU_3O_8
	gamma spec	unknown
	gamma logging	unknown
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	2.212 g/cc
	in-situ	unknown
WATER OR H^+	chemical analysis	2.58% Loss on drying at 110°C
	in-situ	unknown
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

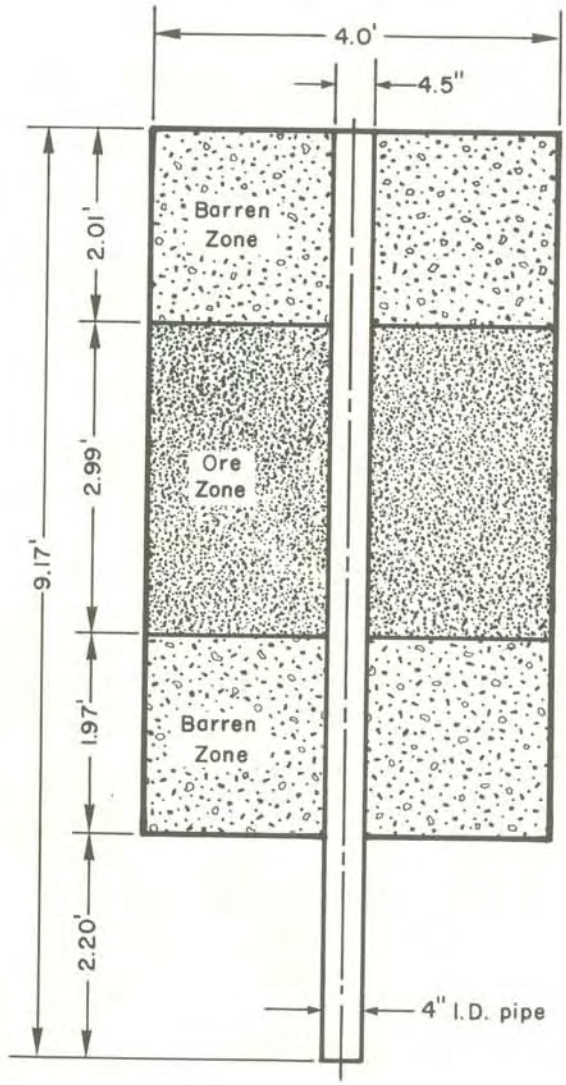


Note: Model cast in 4' corrugated pipe

Figure 17. T-2 Model

Table 22
Construction/Analysis Characteristics
of the T-2 Model

ORE ZONES	ore type & amount	unknown grout mix concrete and thorium ore
	cement amount	unknown
	water amount	unknown
	sand type & amount	unknown
BARREN ZONE	sand type & amount	unknown coarse concrete
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	0.506% ThO_2; 0.011% U_3O_8
	gamma only	0.499% $eThO_2$; 0.221% eU_3O_8
	gamma spec	unknown
	gamma logging	unknown
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	2.099 g/cc
	in-situ	unknown
WATER OR H^+	chemical analysis	2.59% Loss on drying at 110°C
	in-situ	unknown
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

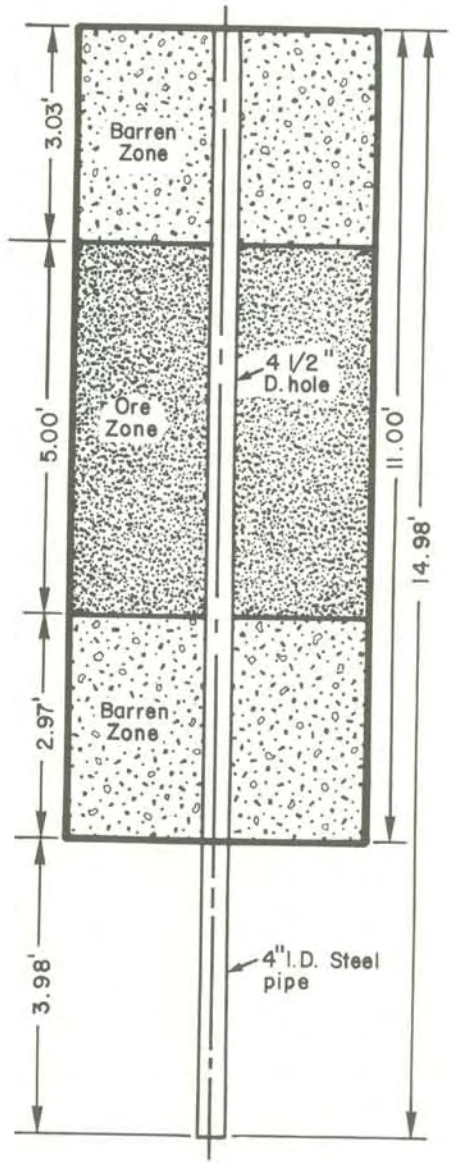


Note: Model cast in 4' corrugated pipe

Figure 18. T-3 Model

Table 23
Construction/Analysis Characteristics
of the T-3 Model

ORE ZONES	ore type & amount	unknown grout mix concrete and thorium ore
	cement amount	unknown
	water amount	unknown
	sand type & amount	unknown
BARREN ZONE	sand type & amount	unknown coarse concrete
	cement amount	unknown
	water amount	unknown
ASSAY ANALYSIS ORE ZONE	chemical	0.093% ThO_2; 0.010% U_3O_8
	gamma only	0.105% $eThO_2$; 0.047% eU_3O_8
	gamma spec	unknown
	gamma logging	unknown
ASSAY ANALYSIS BARREN ZONES	chemical	unknown
	gamma only	unknown
	gamma spec	unknown
	gamma logging	unknown
DENSITY	chemical analysis	2.014 g/cc
	in-situ	unknown
WATER OR H^+	chemical analysis	4.75% Loss on drying at 110°C
	in-situ	unknown
ZEQ (PETROGRAPHIC ANALYSIS)	unknown	
POROSITY	unknown	
CRACKS OR FRACTURES	unknown	
MAGNETIC SUSCEPTIBILITY	unknown	

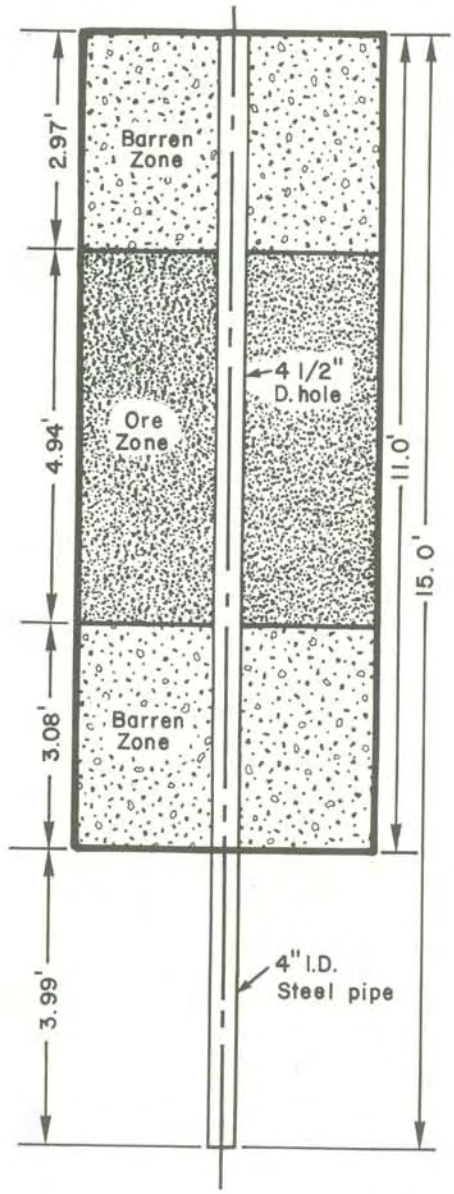


NOTE: Model cast in 4' corrugated pipe

Figure 19. U Model

Table 24
Construction/Analysis Characteristics
of the U Model

ORE ZONES	ore type & amount	1,723 lbs. Climax Ore (0.33% U_3O_8)		
	cement amount	2,193 lbs.		
	water amount	unknown		
	sand type & amount	4,850 lbs. plaster sand		
BARREN ZONE	sand type & amount	unknown (high pour redi-mix concrete)		
	cement amount	unknown		
	water amount	unknown		
ASSAY ANALYSIS ORE ZONE	chemical	1.27% K; 0.0634% U_3O_8; 8.0 ppm Th		
	gamma only	0.0655% eU_3O_8		
	gamma spec	0.95% K; 522 ppm U or 0.061% eU_3O_8; 18.7 ppm Th		
	gamma logging	unknown		
ASSAY ANALYSIS BARREN ZONES	chemical	Lower Barren 1.97%K; 4.5ppm U; 12ppm Th	Upper Barren 2.03%K; 3ppm U; 5ppm Th	
	gamma only	unknown	unknown	
	gamma spec	1.99%K; 3.5ppm U; 8.9ppm Th	1.9%K; 3ppm U; 8.3ppm Th	
	gamma logging	unknown	unknown	
DENSITY	chemical analysis	Upper Barren 2.22 g/cc	Ore Zone 2.56 g/cc	Lower Barren 2.25 g/cc
	in-situ	unknown		
WATER OR H^+	% L.O.D. at 110°C chemical analysis	Upper Barren 2.62%	Ore Zone 5.58%	Lower Barren 2.09%
	in-situ	unknown		
ZEQ (PETROGRAPHIC ANALYSIS)	unknown			
POROSITY	unknown			
CRACKS OR FRACTURES	unknown			
MAGNETIC SUSCEPTIBILITY (10^{-6} cgs)	Upper Barren 982	Ore Zone 356	Lower Barren 1084	

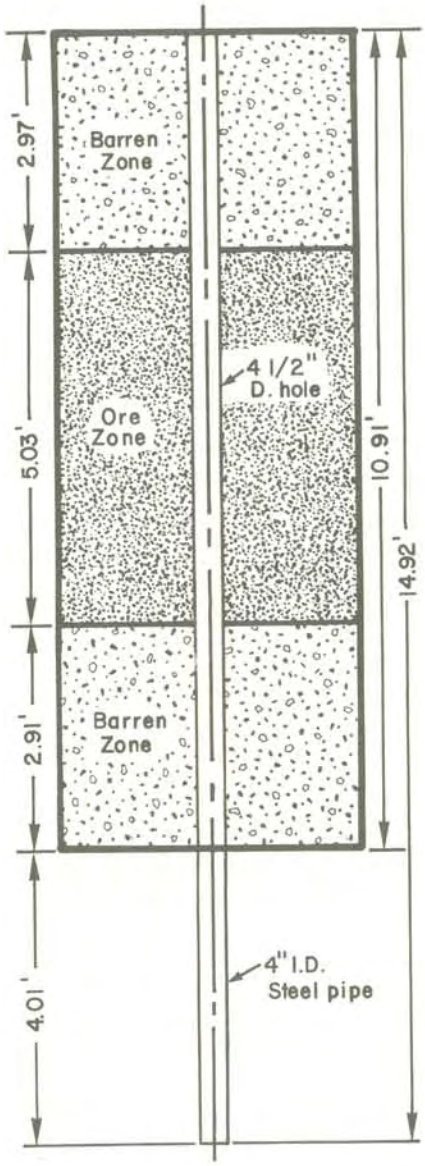


NOTE: Model cast in 4' corrugated pipe

Figure 20. T Model

Table 25
Construction/Analysis Characteristics
of the T - Model

ORE ZONES	ore type & amount	106.33 lbs. monazite sands		
	cement amount	2193 lbs.		
	water amount	unknown		
	sand type & amount	6475 lbs. plaster sand		
BARREN ZONE	sand type & amount	unknown (high pour redi-mix concrete)		
	cement amount	unknown		
	water amount	unknown		
ASSAY ANALYSIS ORE ZONE	chemical	1.32% K	24 ppm U	502 ppm Th
	gamma only	unknown		
	gamma spec	1.36% K	26.1 ppm U	508 ppm Th
	gamma logging	unknown		
ASSAY ANALYSIS BARREN ZONES	chemical	Upper Barren 1.95% K 2.5 ppm U 10.5 ppm Th		Lower Barren unknown
	gamma only	unknown		unknown
	gamma spec	1.84% K 3.0 ppm U 8.4 ppm Th		unknown
	gamma logging	unknown		unknown
DENSITY	chemical analysis	Upper Barren 2.20 g/cc	Ore Zone 1.88 g/cc	Lower Barren unknown
	in-situ	unknown		
WATER OR H^+	% LOD at 110°C chemical analysis	Upper Barren 2.40%	Ore Zone 5.77%	Lower Barren unknown
	in-situ	unknown		
ZEQ (PETROGRAPHIC ANALYSIS)	unknown			
POROSITY	unknown			
CRACKS OR FRACTURES	unknown			
MAGNETIC SUSCEPTIBILITY (10^{-6} cgs)	Upper Barren 1035	Ore Zone 484	Lower Barren unknown	



NOTE: Model cast in 4' corrugated pipe

Figure 21. K Model

Table 26
Construction/Analysis Characteristics
of the K Model

ORE ZONES	ore type & amount	4379.7 lbs. feldspar (Canon City) 1855.3 lbs. feldspar (Grand Jct.)		
	cement amount	2080 lbs.		
	water amount	unknown		
	sand type & amount	None		
BARREN ZONE	sand type & amount	unknown (high pour redi-mix concrete)		
	cement amount	unknown		
	water amount	unknown		
ASSAY ANALYSIS ORE ZONE	chemical	6.28% K; 10 ppm U; 4 ppm Th		
	gamma only	unknown		
	gamma spec	6.30% K; 2.9 ppm U; 2.5 ppm Th		
	gamma logging	unknown		
ASSAY ANALYSIS BARREN ZONES	chemical	Upper Barren 1.77% K; 4 ppm U; 11 ppm Th	Lower Barren 1.74% K; 3 ppm U; 7.5 ppm Th	
	gamma only	unknown	unknown	
	gamma spec	1.9% K; 2.9 ppm U; 8.1 ppm Th	1.77% K; 2.9 ppm U; 7.5 ppm Th	
	gamma logging	unknown	unknown	
DENSITY	chemical analysis	Upper Barren 2.23 g/cc	Ore Zone 1.86 g/cc	Lower Barren 2.24 g/cc
	in-situ	unknown		
WATER OR H^+	% L.O.D. at 110°C chemical analysis	Upper Barren 1.98%	Ore Zone 2.88%	Lower Barren 1.78%
	in-situ	unknown		
ZEQ (PETROGRAPHIC ANALYSIS)	unknown			
POROSITY	unknown			
CRACKS OR FRACTURES	unknown			
MAGNETIC SUSCEPTIBILITY (10^{-6} cgs)	Upper Barren 931	Ore Zone 65	Lower Barren 860	