GOVERNO DO ESTADO

CEARÁ

AVANÇANDO NAS MUDANÇAS

GOVERNO DO ESTADO DO CEARÁ

SECRETARIA DOS RECURSOS HÍDRICOS - SRH

COMPANHIA DE GESTÃO DOS RECURSOS HIDRICOS COGERH

PROJETO DE DESENVOLVIMENTO URBANO E GESTÃO DOS RECURSOS HÍDRICOS PROURB / CE

PROJETO EXECUTIVO DA BARRAGEM ARACOIABA E ADUTORAS DE ARACOIABA E BATURITÉ

RELATÓRIO DE CONCEPÇÃO

VOLUME 3 MEMÓRIA DE CÁLCULO

RHAR - 971210 - RE

CONSÓRCIO GEODINÂMICA COBA

FORTALEZA- CE
DEZEMBRO DE 1997

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PROJETO DE DESENVOLVIMENTO URBANO E GESTÃO DOS RECURSOS HÍDRICOS
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RELATÓRIO DE CONCEPÇÃO
MEMÓRIAS DE CÁLCULO

VOLUME 3

RHAR-971210-RE

CONSÓRCIO *GEODINÂMICA* COBA

FORTALEZA
DEZEMBRO/97

1 - APRESENTAÇÃO

Neste volume estão apresentadas as memórias de cálculo relativas aos estudos do projeto executivo para a barragem do açude de Aracoiaba

Os estudos correspondem à

- Estudos Hidráulicos
- Cálculos dos quantitativos da barragem de terra
- Cálculos dos quantitativos das estruturas hidráulicas
- Análise de estabilidade dos taludes da barragem
- Estudos de Otimização

2 - ESTUDOS HIDRÁULICOS

A seguir são apresentadas as memórias de cálculo relativas aos estudos hidráulicos

- Anexo 2 1 - Vertedouro Soleira Livre - cálculos da geração do hidrograma decamilenar para a chuva com 24 h de duração
- Anexo 2 2 - Vertedouro Soleira Livre - cálculos do amortecimento da descarga de projeto para T=1 000 anos
- Anexo 2 3 - Vertedouro Soleira Livre - cálculos do amortecimento da descarga de projeto para a cheia de verificação de T=10 000 anos
- Anexo 2 4 - Vertedouro tipo Tulipa - cálculos de laminação para cheia de projeto de T=1 000 anos
- Anexo 2 5 - Vertedouro tipo Tulipa - cálculos de laminação para cheia de projeto de T=10 000 anos
- Anexo 2 6 - Desvio de 1° Fase - cálculos de verificação da brecha
- Anexo 2 7 - Galeria de Desvio - Dimensionamento para T=50 anos

ANEXO 2.1

BACIA DO RIO ARACOIABA
VERIFICAÇÃO DA ENCHENTE DECAMILENAR T=10 000 anos
(chuva d=24horas => P=254 3 mm)

ARQUIVO T2410000 I DATA 21/09/97

AREA DE DRENAGEM = 584 050 km2
COMP TALVEGUE = 53 1 km
DIFERENCA DE COTAS = 765 0 m

CURVE NUMBER	73
TA	290 8 min
TB	775 5
TC	434 7
DEL	60 0

REGIOES DEFINIDAS

REGIOES	TIPO DE SOLO	COBERTURA	CONDICOES	PORCENTAGEM
1	B	10	P	100 00

TEMPO (min)	PRECIPITACAO (mm)		RUN-OFF (mm)		VOLUME DE RUN-OFF	PICO DA HIDROG
	SIMPLES	ACUMULADA	SIMPLES	ACUMULADO	(m3)	(m3/S)
60 0	18 82	18 82	00	00	5 96	00
120 0	19 07	37 89	3 23	3 23	1884964 00	81 03
180 0	28 23	66 12	12 63	15 86	7376323 00	317 07
240 0	33 57	99 69	21 58	37 43	12601280 00	541 67
300 0	31 53	131 22	23 82	61 25	13911000 00	597 97
360 0	22 12	153 34	17 98	79 23	10501240 00	451 40
420 0	22 12	175 46	18 71	97 94	10928070 00	469 75
480 0	11 95	187 41	10 35	108 29	6043304 00	259 77
540 0	9 41	196 82	8 25	116 54	4816675 00	207 05
600 0	8 65	205 47	7 65	124 19	4467837 00	192 05
660 0	6 61	212 08	5 89	130 07	3437875 00	147 78
720 0	6 61	218 69	5 92	135 99	3456880 00	148 60
780 0	4 07	222 76	3 66	139 65	2137438 00	91 88
840 0	4 07	226 83	3 67	143 32	2143899 00	92 16
900 0	4 07	230 90	3 68	147 00	2150093 00	92 42
960 0	4 07	234 97	3 69	150 69	2156055 00	92 68
1020 0	4 07	239 04	3 70	154 40	2161785 00	92 93
1080 0	4 07	243 11	3 71	158 11	2167293 00	93 16
1140 0	4 07	247 18	3 72	161 83	2172587 00	93 39
1200 0	2 03	249 21	1 86	163 68	1085540 00	46 66
1260 0	1 27	250 48	1 16	164 85	679763 80	29 22
1320 0	1 27	251 75	1 16	166 01	680253 90	29 24
1380 0	1 27	253 02	1 17	167 18	680726 30	29 26
1440 0	1 27	254 29	1 17	168 35	681189 60	29 28

ANEXO 2.1 (CONTINUAÇÃO)

BACIA DO RIO ARACOIABA
VERIFICAÇÃO DA ENCHENTE DECAMILENAR T=10 000 anos
(chuva d=24horas => P=254 3 mm)

HIDROGRAFA SINTETICA COMPOSTA

TEMPO (min)	VAZAO COMPOSTA (m3/seg)	(Q/QPICO)
60 00	00	000
120 00	16 72	007
180 00	98 86	044
240 00	292 76	130
300 00	610 05	270
360 00	1016 36	450
420 00	1480 90	656
480 00	1882 99	834
540 00	2146 12	950
600 00	2258 90	1 000
660 00	2252 22	997
720 00	2131 75	944
780 00	1947 16	862
840 00	1714 74	759
900 00	1452 48	643
960 00	1201 87	532
1020 00	991 84	439
1080 00	843 34	373
1140 00	739 73	327
1200 00	671 40	297
1260 00	610 16	270
1320 00	549 76	243
1380 00	487 98	216
1440 00	422 09	187
1500 00	359 54	159
1560 00	298 72	132
1620 00	239 65	106
1680 00	182 37	081
1740 00	128 38	057
1800 00	85 90	038
1860 00	54 95	024
1920 00	35 13	016
1980 00	20 92	009
2040 00	10 32	005
2100 00	3 35	001

ANEXO 2.2

BARRAGEM DO RIO ARACOIABA - Dimensionamento do vertedouro
Soleira livre L=20 m. Descarga de projeto T=1 000 anos, chuva d= 8 horas

HIDROGRAMA PADRAO (Q/QPICO) AFLUENTE

000	036	095	212	306	496	664	802	908	981	1 000	970	861	745
620	452	299	240	146	080	036	000						

DADOS DA CURVA COTA-VOLUME (106 M3)**

65 000	000	70 000	1 090	75 000	8 060	80 000	26 040
85 000	57 020	90 000	104 350	95 000	171 380	100 000	262 780

DADOS DE COTA-VAZAO (M3/S)

95 000	000	95 500	14 100	96 000	40 000	96 500	73 500
97 000	113 100	97 500	158 100	98 000	207 900	98 500	261 900
99 000	320 000						

BARRAGEM DO RIO ARACOIABA - Dimensionamento do vertedouro
Soleira livre L=20 m Descarga de projeto T=1 000 anos chuva d= 8 horas

TEMPO (HORAS)	VAZAO AFLUENTE (M3/S)	VAZAO INTERMED (M3/S)	AFLUENTE TOTAL (M3/S)	VOLUME RESERVAT (E06 M3)	N A RESERVAT (M)	DESCARGA (M3/S)	GRAFICO DE VAZOES (M3/S) 0 300 600 900 1200 1500	(A)=AFLUENTE TOTAL (D)=DEFLUENTE
00	00	00	00	171 38	95 00	00	*D	
1 00	49 36	00	49 36	171 47	95 00	14	*D A	
2 00	130 24	00	130 24	171 79	95 02	63	*D A	
3 00	290 65	00	290 65	172 54	95 06	1 80	*D A	
4 00	419 53	00	419 53	173 81	95 13	3 75	*D A	
5 00	680 02	00	680 02	175 77	95 24	6 78	*D A	
6 00	910 34	00	910 34	178 60	95 40	11 14	*D A	
7 00	1099 54	00	1099 54	182 17	95 59	18 78	* D A	
8 00	1244 87	00	1244 87	186 30	95 82	30 48	* D A	
9 00	1344 95	00	1344 95	190 83	96 06	44 29	* D A	
10 00	1371 00	00	1371 00	195 53	96 32	61 51	* D A	
11 00	1329 87	00	1329 87	200 14	96 57	79 30	* D A	
12 00	1180 43	00	1180 43	204 34	96 80	97 50	* D A	
13 00	1021 40	00	1021 40	207 92	97 00	113 03	* D A	
14 00	850 02	00	850 02	210 86	97 16	127 47	* D A	
15 00	619 69	00	619 69	213 03	97 28	138 14	* D A	
16 00	409 93	00	409 93	214 37	97 35	144 76	* D A	
17 00	329 04	00	329 04	215 17	97 40	148 71	* D A	
18 00	200 17	00	200 17	215 59	97 42	150 74	* D A	
19 00	109 68	00	109 68	215 60	97 42	150 82	* AD	
20 00	49 36	00	49 36	215 35	97 41	149 56	* A D	
21 00	00	00	00	214 90	97 38	147 37	*A D	

VOLUME DA HIDROGRAMA AFLUENTE (E*06 M3) = 49 10

49 hm³

ANEXO 2.3

BARRAGEM DO RIO ARACOIABA - Amortecimento de cheias
Soleira livre L=20 m; Verificação para T=10 000 anos, chuva d=24 horas

HIDROGRAMA PADRAO (Q/QPICO) AFLUENTE

007	044	130	270	450	656	834	950	1 000	997	944	862	759	643	532
439	373	327	297	270	243	216	187	159	132	106	081	057	038	024
016	009													

DADOS DA CURVA COTA-VOLUME (106 M3)**

65 000	000	70 000	1 090	75 000	8 060	80 000	26 040
85 000	57 020	90 000	104 350	95 000	171 380	100 000	262 780

DADOS DE COTA-VAZAO (M3/S)

95 000	000	95 500	14 100	96 000	40 000	96 500	73 500
97 000	113 100	97 500	158 100	98 000	207 900	98 500	261 900
99 000	320 000						

BARRAGEM DO RIO ARACOIABA - Amortecimento de cheias
Soleira livre L=20 m; Verificação para T=10 000 anos chuva d=24 horas

TEMPO (HORAS)	VAZAO AFLUENTE (M3/S)	VAZAO INTERMED (M3/S)	AFLUENTE TOTAL (M3/S)	VOLUME RESERVAT (E06 M3)	N A RESERVAT (M)	DESCARGA (M3/S)	GRAFICO DE VAZOES (M3/S) 0 500 1000 1500 2000 2500	(A)=AFLUENTE TOTAL (D)=DEFLUENTE
00 00	15 81	00	15 81	171 38	95 00	00	D	
1 00	99 40	00	99 40	171 59	95 01	32	D A	
2 00	293 67	00	293 67	172 29	95 05	1 41	D A	
3 00	609 93	00	609 93	173 91	95 14	3 90	D A	
4 00	1016 55	00	1016 55	176 81	95 30	8 38	D A	
5 00	1481 90	00	1481 90	181 27	95 54	16 22	D A	
6 00	1884 01	00	1884 01	187 24	95 87	33 14	D A	
7 00	2146 05	00	2146 05	194 34	96 26	57 14	D A	
8 00	2259 00	00	2259 00	202 01	96 68	87 41	D A	
9 00	2252 22	00	2252 22	209 75	97 10	122 04	D A	
10 00	2132 50	00	2132 50	217 14	97 50	158 44	D A	
11 00	1947 26	00	1947 26	223 85	97 87	194 99	D A	
12 00	1714 58	00	1714 58	229 68	98 19	228 36	D A	
13 00	1452 54	00	1452 54	234 51	98 45	256 88	D A	
14 00	1201 79	00	1201 79	238 32	98 66	280 73	D A	
15 00	991 70	00	991 70	241 23	98 82	299 19	D A	
16 00	842 61	00	842 61	243 43	98 94	313 17	D A	
17 00	738 69	00	738 69	245 13	99 03	323 98	D A	
18 00	670 92	00	670 92	246 48	99 11	332 59	D A	
19 00	609 93	00	609 93	247 58	99 17	339 56	D A	
20 00	548 94	00	548 94	248 43	99 22	344 98	D A	
21 00	487 94	00	487 94	249 05	99 25	348 91	D A	
22 00	422 43	00	422 43	249 43	99 27	351 31	DA	
23 00	359 18	00	359 18	249 57	99 28	352 21	D	
24 00	298 19	00	298 19	249 48	99 27	351 68	AD	
25 00	239 45	00	239 45	249 19	99 26	349 80	A D	
26 00	182 98	00	182 98	248 69	99 23	346 66	A D	
27 00	128 76	00	128 76	248 02	99 19	342 35	A D	
28 00	85 84	00	85 84	247 18	99 15	337 03	A D	
29 00	54 22	00	54 22	246 23	99 09	330 93	A D	
30 00	36 14	00	36 14	245 21	99 04	324 52	A D	
31 00	20 33	00	20 33	244 16	98 98	317 82	A D	

VOLUME DA HIDROGRAGA AFLUENTE (E*06 M3) = 97 95

ANEXO 2.4

BARRAGEM DO RIO ARACOIABA - Dimensionamento do vertedouro
Tulipa D=0 m; Descarga de projeto T=1 000 anos, chuva d= 8 horas

HIDROGRAMA PADRAO (Q/QPICO) AFLUENTE

000	036	095	212	306	496	664	802	908	981	1 000	970	861	745	620
452	299	240	146	080	036	000								

DADOS DA CURVA COTA-VOLUME (106 M3)**

65.000	000	70 000	1 090	75 000	8 060	80 000	26 040
85 000	57 020	90 000	104 350	95 000	171 380	100 000	262 780

DADOS DE COTA-VAZAO (M3/S)

95 000	000	95 800	38 700	96 200	68 400	96 600	100 200
97 000	131 500	97 400	159 800	97 800	182 500	98 200	198 500
99 000	225 200	100 000	210 000				

BARRAGEM DO RIO ARACOIABA - Dimensionamento do vertedouro PAGINA 3
Tulipa D=0 m: Descarga de projeto T=1 000 anos chuva d= 8 horas

TEMPO (HORAS)	VAZAO AFLUENTE (M3/S)	VAZAO INTERMED (M3/S)	AFLUENTE TOTAL (M3/S)	VOLUME RESERVAT (E06 M3)	N A RESERVAT (M)	DESCARGA (M3/S)	GRAFICO DE VAZOES (M3/S) 0 300 600 900 1200 1500	(A)=AFLUENTE TOTAL (D)=DEFLUENTE
00	00	00	00	171 38	95 00	00	D	
1 00	49 36	00	49 36	171 47	95 00	23	D A	
2 00	130 24	00	130 24	171 79	95 02	1 08	D A	
3 00	290 65	00	290 65	172 54	95 06	3 07	D A	
4 00	419 53	00	419 53	173 80	95 13	6 41	D A	
5 00	680 02	00	680 02	175 75	95 24	11 56	D A	
6 00	910 34	00	910 34	178 56	95 39	18 99	D A	
7 00	1099 54	00	1099 54	182 09	95 59	28 34	D A	
8 00	1244 87	00	1244 87	186 19	96 81	39 44	D A	
9 00	1344 95	00	1344 95	190 67	96 06	57 67	D A	
10 00	1371 00	00	1371 00	195 32	96 31	77 12	D A	
11 00	1329 87	00	1329 87	199 87	96 56	96 90	D A	
12 00	1180 43	00	1180 43	204 01	96 78	114 66	D A	
13 00	1021 40	00	1021 40	207 53	96 98	129 74	D A	
14 00	850 02	00	850 02	210 41	97 14	141 05	D A	
15 00	619 69	00	619 69	212 53	97 25	149 27	D A	
16 00	408 93	00	408 93	213 84	97 32	154 33	D A	
17 00	329 04	00	329 04	214 61	97 36	157 31	D A	
18 00	200 17	00	200 17	214 99	97 39	158 79	D A	
19 00	109 68	00	109 68	214 98	97 38	158 74	AD	
20 00	49 36	00	49 36	214 69	97 37	157 64	A D	
21 00	00	00	00	214 22	97 34	155 80	A D	

VOLUME DA HIDROGRAMA AFLUENTE (E*06 M3) = 49 10

ANEXO 2.5

BARRAGEM DO RIO ARACOIABA - Amortecimento de cheias
Tulipa D=0 m, Verificação para T=10 000 anos, chuva d=24 horas

HIDROGRAMA PADRAO (Q/QPICO) AFLUENTE

007	044	130	270	450	656	834	950	1 000	997	944	862	759	643	532
439	373	327	297	270	243	216	187	159	132	106	081	057	038	024
016	009													

DADOS DA CURVA COTA-VOLUME (106 M3)**

65 000	000	70 000	1 090	75 000	8 060	80 000	26 040
85 000	57 020	90 000	104 350	95 000	171 380	100 000	262 780

DADOS DE COTA-VAZAO (M3/S)

95 000	000	95 800	38 700	96 200	68 400	96 600	100 200
97 000	131 500	97 400	159 800	98 200	182 500	98 600	198 500
99 000	225 200	100 000	210 000				

BARRAGEM DO RIO ARACOIABA - Amortecimento de cheias — PAGINA 3
Tulipa D=0 m Verificação para T=10 000 anos chuva d=24 horas

TEMPO (HORAS)	VAZAO AFLUENTE (M3/S)	VAZAO INTERMED (M3/S)	AFLUENTE TOTAL (M3/S)	VOLUME RESERVAT (E06 M3)	N A RESERVAT (M)	DESCARGA (M3/S)	GRAFICO DE VAZOES (M3/S) 0 500 1000 1500 2000 2500	(A)=AFLUENTE TOTAL (D)=DEFLUENTE
00	15 81	00	15 81	171 38	95 00	00	D	
1 00	99 40	00	99 40	171 59	95 01	55	D A	
2 00	293 67	00	293 67	172 29	95 05	2 40	D A	
3 00	609 93	00	609 93	173 90	95 14	6 67	D A	
4 00	1016 55	00	1016 55	176 79	95 30	14 31	D A	
5 00	1481 90	00	1481 90	181 21	95 54	26 02	D A	
6 00	1884 01	00	1884 01	187 15	95 86	43 35	D A	
7 00	2146 05	00	2146 05	194 20	96 25	72 23	D A	
8 00	2259 00	00	2259 00	201 81	96 66	105 24	D A	
9 00	2252 22	00	2252 22	209 49	97 08	137 49	D A	
10 00	2132 50	00	2132 50	216 83	97 49	162 26	D A	
11 00	1947 26	00	1947 26	223 57	97 86	172 72	D A	
12 00	1714 58	00	1714 58	229 53	98 18	161 96	D A	
13 00	1452 54	00	1452 54	234 56	98 46	192 75	D A	
14 00	1201 79	00	1201 79	238 83	98 68	203 76	D A	
15 00	991 70	00	991 70	241 82	98 85	215 42	D A	
16 00	842 61	00	842 61	244 33	98 99	224 58	D A	
17 00	738 69	00	738 69	246 37	99 10	223 64	D A	
18 00	670 92	00	670 92	248 11	99 20	222 20	D A	
19 00	609 93	00	609 93	249 61	99 28	220 95	D A	
20 00	548 94	00	548 94	250 91	99 35	219 87	D A	
21 00	487 94	00	487 94	251 98	99 41	218 98	D A	
22 00	422 43	00	422 43	252 83	99 46	218 27	D A	
23 00	359 18	00	359 18	253 46	99 49	217 75	D A	
24 00	298 19	00	298 19	253 86	99 51	217 42	D A	
25 00	239 45	00	239 45	254 04	99 52	217 27	DA	
26 00	182 98	00	182 98	254 02	99 52	217 29	D	
27 00	128 76	00	128 76	253 80	99 51	217 47	AD	
28 00	85 84	00	85 84	253 40	99 49	217 80	A D	
29 00	54 22	00	54 22	252 87	99 46	218 24	A D	
30 00	36 14	00	36 14	252 24	99 42	218 76	A D	
31 00	20 33	00	20 33	251 55	99 39	219 33	A D	

VOLUME DA HIDROGRAGA AFLUENTE (E*06 M3) = 97 95

ANEXO 2.6

BARRAGEM DO RIO ARACOIABA - DESVIO 1a CHEIA
BRECHA b=90 m, Descarga de projeto T=50 anos, chuva d= 8 horas

HIDROGRAMA PADRAO (Q/QPICO) AFLUENTE

000	036	095	212	306	496	664	802	908	981	1 000
970	861	745	620	452	299	240	146	080	036	000

DADOS DA CURVA COTA-VOLUME (106 M3)**

65 000	000	70 000	1 090	75 000	8 060	80 000	26 040
85 000	57 020	90 000	104 350	95 000	171 380	100 000	262 780

DADOS DE COTA-VAZAO (M3/S)

70 0 000	71 750	208 400	73 500	589 300	75 250	1082 600

BARRAGEM DO RIO ARACOIABA - DESVIO 1a CHEIA
BRECHA b=90 m Descarga de projeto T=50 anos chuva d= 8 horas

TEMPO (HORAS)	VAZAO AFLUENTE (M3/S)	VAZAO INTERMED (M3/S)	AFLUENTE TOTAL (M3/S)	VOLUME RESERVAT (E06 M3)	N A RESERVAT (M)	DESCARGA (M3/S)	GRAFICO DE VAZOES (M3/S) 0 200 400 600 800 1000	(A)=AFLUENTE TOTAL (D)=DEFLUENTE
00	00	00	00	1 09	70 00	00	D	
1 00	29 81	00	29 81	1 14	70 03	3 97	DA	
2 00	78 66	00	78 66	1 29	70 15	17 37	D A	
3 00	175 54	00	175 54	1 64	70 39	46 62	D A	
4 00	253 37	00	253 37	2 16	70 77	91 35	D A	
5 00	410 69	00	410 69	2 91	71 31	155 51	D A	
6 00	549 79	00	549 79	3 88	72 00	263 82	D A	
7 00	664 06	00	664 06	4 85	72 70	414 36	D A	
8 00	751 82	00	751 82	5 67	73 29	543 18	D A	
9 00	812 27	00	812 27	6 32	73 75	660 69	D A	
10 00	828 00	00	828 00	6 74	74 06	745 79	D A	
11 00	803 16	00	803 16	6 93	74 19	783 04	DA	
12 00	712 91	00	712 91	6 86	74 14	769 69	A D	
13 00	616 86	00	616 86	6 58	73 94	713 75	A D	
14 00	513 36	00	513 36	6 19	73 66	634 42	A D	
15 00	374 26	00	374 26	5 67	73 29	542 76	A D	
16 00	247 57	00	247 57	5 02	72 82	441 03	A D	
17 00	198 72	00	198 72	4 41	72 38	345 43	A D	
18 00	120 89	00	120 89	3 89	72 01	263 98	A D	
19 00	66 24	00	66 24	3 39	71 65	196 74	A D	
20 00	29 81	00	29 81	2 93	71 32	157 10	A D	
21 00	00	00	00	2 49	71 00	119 20	A D	

VOLUME DA HIDROGRAGA AFLUENTE (E*06 M3) = 29 66

ANEXO 2.7

BARRAGEM DO RIO ARACOIABA - Dimensionamento ESTRUTURA DE DESVIO
1 galeria (3,5m x 3,5m), Descarga de projeto T=50 anos, chuva d= 8 horas

HIDROGRAMA PADRAO (Q/QPICO) AFLUENTE

000	036	095	212	306	496	664	802	908	981 1 000
970	861	745	620	452	299	240	146	080	036 000

DADOS DA CURVA COTA-VOLUME (106 M3)**

65 000	000	70 000	1 090	75 000	8 060	80 000	26 040
85 000	57 020	90 000	104 350	95 000	171 380	100 000	262 780

DADOS DE COTA-VAZAO (M3/S)

70 000	000	71 750	6 000	73 500	17 200	75 250	32 700
77 500	40 500	78 750	47 300	80 500	53 500		

BARRAGEM DO RIO ARACOIABA - Dimensionamento ESTRUTURA DE DESVIO
1 galerias (3,5m x 3,5m) Descarga de projeto T=50 anos chuva d= 8 horas

TEMPO (HORAS)	VAZAO AFLUENTE (M3/S)	VAZAO INTERMED (M3/S)	AFLUENTE TOTAL (M3/S)	VOLUME RESERVAT (E06 M3)	N A RESERVAT (M)	DESCARGA (M3/S)	GRAFICO DE VAZOES (M3/S) 0 200 400 600 800 1000	(A)=AFLUENTE TOTAL (D)=DEFLUENTE
00	00	00	00	1 09	70 00	00	D	
1 00	29 81	00	29 81	1 14	70 04	13	DA	
2 00	78 66	00	78 66	1 34	70 18	61	D A	
3 00	175 54	00	175 54	1 79	70 50	1 72	D A	
4 00	253 37	00	253 37	2 55	71 05	3 60	D A	
5 00	410 69	00	410 69	3 73	71 89	6 92	D A	
6 00	549 79	00	549 79	5 42	73 11	14 68	D A	
7 00	664 06	00	664 06	7 53	74 62	27 12	D A	
8 00	751 82	00	751 82	9 97	75 53	33 67	D A	
9 00	812 27	00	812 27	12 66	76 28	36 27	D A	
10 00	828 00	00	828 00	15 48	77 06	38 98	D A	
11 00	803 16	00	803 16	18 27	77 84	42 34	D A	
12 00	712 91	00	712 91	20 84	78 55	46 23	D A	
13 00	616 86	00	616 86	23 06	79 17	48 79	D A	
14 00	513 36	00	513 36	24 91	79 69	50 62	D A	
15 00	374 26	00	374 26	26 33	80 05	51 89	D A	
16 00	247 57	00	247 57	27 26	80 20	52 42	D A	
17 00	198 72	00	198 72	27 87	80 30	52 78	D A	
18 00	120 89	00	120 89	28 26	80 36	53 00	D A	
19 00	66 24	00	66 24	28 40	80 38	53 08	D	
20 00	29 81	00	29 81	28 38	80 38	53 07	A D	
21 00	00	00	00	28 25	80 36	52 99	A D	

VOLUME DA HIDROGRAGA AFLUENTE (E*06 M3) = 29 66

3 - QUANTITATIVOS DAS OBRAS DE TERRA

Os quantitativos para as obras de terra tiveram como base os seguintes desenhos de projeto

- AR-GR-1001 - Arranjo Geral - Alternativa 1 - Planta
- AR-GR-1005 - Esquema de Desvio - Alternativas 1, 2, 3 e 4
- AR-BT-3005 - Seções Típicas e Perfil Longitudinal de Saneamento - Alternativas 1, 2, 3 e 4
- AR-BT-3006 - Seções Típicas da Barragem - Alternativas 1, 2, 3 e 4
- AR-BT-3007 - Anteprojeto - Seções Transversais da Barragem
- AR-GR-1006 - Anteprojeto - Arranjo Geral - Planta
- AR-GR-1007 - Anteprojeto - Esquema de Desvio e Cronograma Físico

Foram calculados os volumes dos materiais de acordo com a memória de cálculo apresentada a seguir

Barragem Aracoiaba

Cálculo de Volumes

1. Barragem da Margem Direita

1.1. Seção típica entre as estacas 0+0,00 a 25+0,00

a) cota fundação = 98,50

(S) $(4+10)/2 \times 1,5 = 10,5\ m^2$

(T) $1 \times 1,5 = 1,5\ m^2$

(RR) $2 \times 1,5 = 3,0\ m^2$

b) cota 97,50

(S) $4+14/2 \times 2,5 = 22,5\ m^2$

(T) $1 \times 2,5 = 2,5\ m^2$

(RR) $2 \times 2,5 = 5,0\ m^2$

1.2. Seção típica entre 25+0,00 e 37+0,00

a) cota 97,50 (escavação) e 91,00 (cut-off)

(S) $[4+26,5)/2 \times 5,5] + [(19+14)/2 \times 5,5] - [10 \times 5] = 126,7\ m^2$

(T) $1 \times 6,5 = 6,5\ m^2$

(RR) $2 \times 6,5 = 13,0\ m^2$

(F) $(1 \times 5) + (1,5 \times 9) = 18,5\ m^2$

b) cota 81,00 (eixo)

(S) $[(4+27)/2 \times 5] + [(27+45)/2 \times 5] + [48+5, 2 \times 5] + (5 \times 5,5/2)$
$= 833,0\ m^2$

(F) $(1 \times 15) + (1,5 \times 44) = 81,0\ m^2$

(T) $1 \times 16 = 16\ m^2$

(RR) $2 \times 10 = 20\ m^2$

(E) $2 \times 6 = 12\ m^2$

c) cota 69,00 – Est 39 + 0,00

(S) $[(4+24)/2 \times 5] + [(24+46)/2 \times 5] + [(49+95)/2 \times 10] +$
$+ [(98+147)/2 \times 11] - 126 = 2\,186{,}5\ m^2$

(F) $(1 \times 27) + (1{,}5 \times 66) = 126\ m^2$

(T) $1 \times 81 = 81\ m^2$

(RR) $2 \times 10 = 20\ m^2$

(E) $2 \times 21 = 42\ m^2$

10 km Empréstimo Pagem Direita

(S) $(10{,}5/2 \times 120) + [(10{,}5 + 22{,}5)/2 \times 70] + (22{,}5 \times 300) + (26{,}7 \times 50)$
$+ [(26{,}7 + 833)/2 \times 80] + [(833 + 2\,186{,}5)/2 \times 145] = 2\,2[illegible]\ m^3$

(F) $(185 \times 50) + [(18{,}5 + 81)/2 \times 80] + [(81 + 126)/2 \times 75] = 12\,9[illegible]\ m^3$

(T) $(1.5/2 \times 120) + [(1.5 + 2.5)/2 \times 70] + [2.5 \times 300] + [6{,}5 \times 50] + [(6{,}5 + 16)/2 \times 80]$
$+ [(16 + 8)/2 \times 145] = 5\,6[illegible]\ m^3$

(RR) $(8/2 \times 120) + [(8 + 5)/2 \times 80] + [5 \times 300] + [13 \times 50] + [(13 + 20)/2 \times 80]$
$+ [20 \times 145] = 6\,870\ m^3$

(E) $[12/2 \times 80] + [(12 + 42)/2 \times 145] = 4\,335\ m^3$

TOTAL – $308\,963\ m^3$

Dreno de Pé (1 ≅ 270)

(T) $[(0.5 \times 5) \times 270] = 675\ m^3$

(E) $[(5 \times 2/2 + 1 \times 1) \times 270] = 1\,620\ m^3$

2- Barragem da Margem Esquerda

2.1- Seção típica entre as estacas 90+0,00 e 100,00

a) cota 96,50

(S) $[(4+20)/2 \times 4] = 48\ m^2$

(T) $1 \times 4 = 4\ m^2$

(RR) $2 \times 4 = 8\ m^2$

b) cota 93,50

(S) $[(4+31)/2 \times 6,5] - 21 = 93\ m^2$

(F) $(1,5 \times 13) + (1 \times 1,5) = 21\ m^2$

(T) $1 \times 6 = 6\ m^2$

(RR) $2 \times 6 = 12\ m^2$

2.2 Seção típica entre estacas 75+0,00 a 90+0,00

a) cota 91,50 - est 85+0,00

(S) $[(4+39)/2 \times 8,5] - 16,2 = 169\ m^2$

(F) $(1 \times 4) + (1,5 \times 8) = 16\ m^2$

(T) $1 \times 8,0 = 8\ m^2$

(RR) $2 \times 8 = 16$

b) cota 90,00

(S) $169 + (2,5 \times 44) + 4 = 283\ m^2$

(F) $16 + (1,5 \times 4) + (1 \times 2,5) = 24,5\ m^2$

(T) $8 + (1 \times 2) = 10\ m^2$

(RR) $16 + (2 \times 2) = 20\ m^2$

c) cota 92,00

(S) $[(4+38)/2 \times 8] + 5 - 16 = 157\ m^2$

(F) $(1 \times 4) + (1{,}5 \times 13) = 23{,}5\ m^2$

(T) $1 \times 8 = 8\ m^2$

(RR) $2 \times 8 = 16\ m^2$

2.3 Seção típica entre as estacas 63+900 a 73+0,00

a) cota 93,00 - est. 73+0,00

(S) $(4+32)/2 \times 7 = 126 - 19{,}5 = 106{,}5\ m^2$

(T) $1 \times 6{,}5 = 6{,}5\ m^2$ (F) $(1 \times 5 + 5 \times 1) = 19{,}5\ m^2$

(RR) $2 \times 6{,}5 = 13\ m^2$

b) cota 96,00 - est 69+000

(S) $(4+21)/2 \times 4 + 2 = 52\ m^2$

(T) $(1 \times 3) = 6$

(RR) $2 \times 3 = 6$

c) cota 92 (eixo) - est 65+0,00

(S) $126 + (35 \times 3/2) = 178{,}5 - 23 = 155{,}5\ m^2$

(T) $1 \times 6{,}5 = 6{,}5\ m^2$ (F) $(1 \times 5) + (1{,}5 \times 12) = 23\ m^2$

(RR) $2 \times 6{,}5 = 13{,}0\ m^2$

d) cota 87 (eixo) - est 63+0,00

(S) $[(4+52)/2 \times 12] + (52 \times 2{,}5/2) - 48{,}5 = 352{,}5\ m^2$

(F) $(1 \times 9{,}5) + (1{,}5 \times 26) = 48{,}5\ m^2$

(T) $1 \times 12 = 12\ m^2$

(RR) $2 \times 10 = 20$

(E) $2 \times 2 = 4\ m^2$

24. Seção típica entre estacas 58+000 e 62+000

a) cota 82,50 – est 63+0,00

(S) [(4 + 24)/2 × 5] + [(24 + 46)/2 × 5] + [(49 + 69)/2 × 4,5] + [(19 + 14)/2 × 3] + 5 – 56 = 509 m²

(F) (1 × 12,5) + (15 × 29) = 56 m²

(T) 1 × 13 = 13 m²

(RR) 2 × 10 = 20 m²

(E) 2 × 3 = 6 m²

b) cota 76,00 – est 58+0,00

(S) [(4 + 20)/2 × 5] + [24 + 46/2 × 5] + [49 + 69 2 × 5 + 33 + 05 2 × 4] + [38/2 × 2,5] + [(8 + 14,2 × 3,5] – 50 = 212,50 m²

(F) (1 × 20) + (1,5 × 55) = 805 m²

(T) 1 × 22 = 22 m²

(RR) 2 × 10 = 20 m²

(E) 2 × 2 = 24 m²

c) cota 68,50 – est 58+0,00

(S) [4 + 24,/2 × 5] + [24 + 46, 2 × 5] + [49 + 14?,/2 × 21] + [(17 + 14/2 × 1) + (7 × 2) – 125,5 = 207 m²

(F) (28 × 1) + (1,5 × 65) = 125,5 m²

(T) 1 × 22 = 22 m²

(RR) 2 × 10 = 20 m²

(E) 2 × 19 = 38 m²

10.ª Bacia Barragem Margem Esquerda

(G) $[48/2 \times 90] + [(48+93)/2 \times 100] + [(93+69)/2 \times 100] +$
$+ [(169+283)/2 \times 100] + [(283+57)/2 \times 100] + [(57+106,5)/2 \times 40] +$
$+ [(106,5+52)/2 \times 80] + [(52+155,5)/2 \times 80] + [(155,5+352,5)/2 \times 40] +$
$+ [(509+212,5)/2 \times 100] + [(212,5+207)/2 \times 100] = 354\,030\ m^3$

(F) $[21/2 \times 100] + [(21+16)/2 \times 100] + [(16+24,5)/2 \times 100] +$
$+ [24,5+235/2 \times 100] + [(235+18,5)/2 \times 40] + [(2,5+23)/2 \times 80] +$
$(0+23)/2 \times 80 + (23+48,5)/2 \times 40] + [(56+80,5)/2 \times 100] +$
$[(80,5+125,5)/2 \times 100] = 23\,400\ m^3$

(T) $4/2 \times 90 + [(4+6)/2 \times 100] + [(6+8)/2 \times 100] + [(8+10)/2 \times 100] +$
$+ [(10+5)/2 \times 100] + [8+65/2 \times 40] + [(65+6)/2 \times 80] + [(6+65)/2 \times 80]$
$+ [6,5+2)/2 \times 40] + [(13+22/2 \times 100] + [(22+22)/2 \times 100] = 8\,720\ m^3$

(RF) $[5/2 \times 90] + [(8+12)/2 \times 00] + [(12+16)/2 \times 00] + [16+20)/2 \times 00] +$
$+ [(20+16)/2 \times 100] + [(16+13/2 \times 40] + [(13+6)/2 \times 20] + [(6+13)/2 \times 80]$
$+ [(13+20)/2 \times 40] + [20 \times 200] = 13\,120\ m^3$

Dreno de Pé ($l_1 = 660$; $l_2 = 200$)

(T) $[(0,5 \times 2,0) \times 660] + [(0,5 \times 5) \times 200] = 1\,160\ m^3$

(E) $[(1 \times 1) \times 660] + [(5 \times 2/2 + 1 \times 1) \times 200] = 2\,100\ m^3$

(E) $[4/2 \times 40] + [(6+24)/2 \times 00] + [(24+38)/2 \times 100] = 4\,680\ m^3$

3 - BARRAGEM do Leito do Rio

3.1. Seção típica Est 37 + 0,00 a 53 + 0,00

a) cota 69 — est 37 + 0,00

(S) 2 186,5 m²
(F) 126,0 m²
(T) 0 m²
(RR) 20,0 m²
(E) 42,0 m²

b) cota 68 — est. 40 + 10,00

(S) $[4 + 24)/2 \times 5] + [(24 + 47)/2 \times 5] + [(40 + 94)/2 \times 10] + [(97 + 153)/2 \times 12$

$+ [(34 + 24)/2 \times 5] - 137,5 = 2582,5 m^2$

(F) $(1 \times 84) + (15 \times 69) = 137,5 m^2$

(T) $1 \times 25 = 25 m^2$

(RR) $2 \times 10 = 200 m^2$

(E) $2 \times 15 = 30 m^2$

c) cota 68,5 — est 53 + 0,00

(S) 2 207 m²
(F) 25,5 m²
(T) 22,0 m²
(RR) 20,0 m²
(E) 38,0 m²

Doero de Pé ($l = 300$ m)

(T) $(1 \times 12) \times 300 = 3600 m^3$
(E) $(14 \times 5/2) \times 300 = 10\,500 m^3$

Volume da Barragem de [illegible] de [illegible]

(S) $[(2186,5 + 2532,5)/2 \times 30] + [2532,5 \times 130] + [(2532,5 + 2207)/2 \times 120]$

$= 684\,380\ m^3$

(F) $[(126 + 137,5)/2 \times 30] + [137,5 \times 130] + [(137,5 + 125,5)/2 \times 120]$

$= 37\,607\ m^3$

(T) $[(31 + 25)/2 \times 30] + [25 \times 30] + [(25 + 22)/2 \times 120] = 6\,810\ m^3$

(RR) $[(20 + 20)/2 \times 30] + [20 \times 130] + [(20 + 20)/2 \times 120] = 5\,600\ m^3$

(E) $[(42 + 30)/2 \times 30] + [30 \times 130] + [(30 + 38)/2 \times 120] = 9\,060\ m^3$

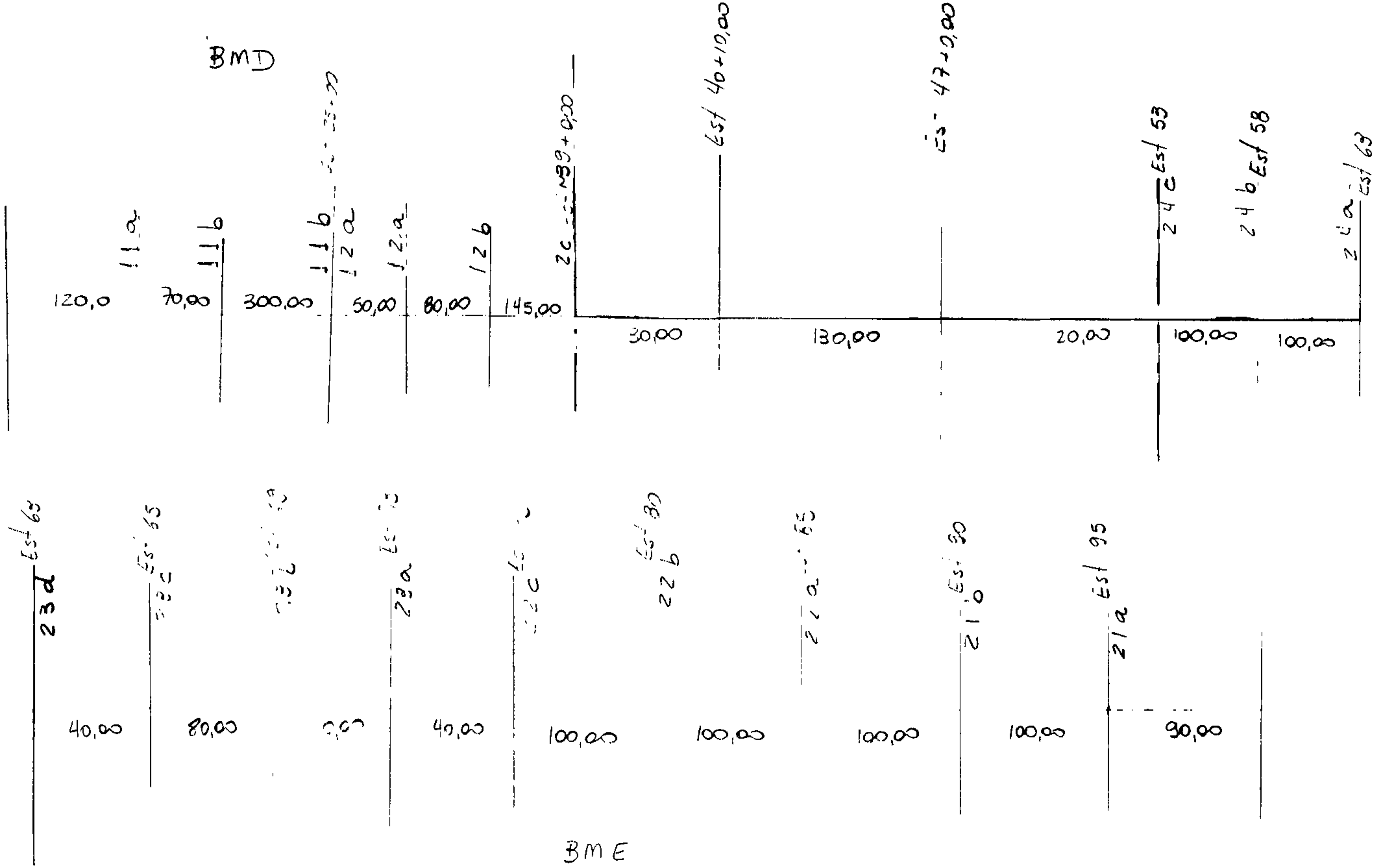
ARACOIABA

RESUMO DE QUANTITATIVOS

Volumes Compactados

para as Barragem de Terra

MATERIAIS		BMD	BLR	BME	TOTAL
(S)		272 200	684.400	354 100	1.310.700
(F)		20 000	37 600	28 500	86 100
(T)		5 600	7 000	6 800	21 400
(RR)		6 900	5 600	13 200	25 700
(E)		4 400	9 100	4 700	18 200
TOTAL (1)		309.100	743.700	409 300	1.462.100
DRENO DE PÉ	(T)	700	3 600	1 200	5 500
	(E)	1 700	10 500	2 200	14 400
	TOTAL 2	2 400	14 100	3 400	19.900
TOTAL		311 500	771.900	412 700	1.501.900


BMD
11a
11b
12a
12b
120,0
70,00
300,00
50,00
80,00
145,00
Est 40+10,00
30,00
130,00
20,00
100,00
100,00
Est 53
Est 58
24c
24b
24a
23d
Est 65
23a
22b
21b
21a
Est 90
Est 95
40,00
80,00
40,00
100,00
100,00
100,00
100,00
90,00
BME

VOLUMES DE ESCAVAÇÃO

1 - Barragem de Terra

1.1. Desmatamento e Limpeza

$$A = \left(25+20/2 \times 450\right) + \left(30+25/2 \times 70\right) + \left(30+180/2 \times 400\right) + \left(190+60/2 \times 330\right) + \left(60+30/2 \times 80\right) + \left(30+60/2 \times 220\right) + \left(60+20/2 \times 400\right) = 124\,800\ m^2$$

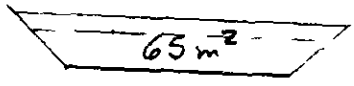
1.2 - Escavação

1.2.1 - Comum

$$1_{200} = \left[\left(25+20/2 \times 480\right) \times 0,5\right] + \left[\left(50+30/2 \times 55\right) \times 3,5\right] + \left[130 \times \left(130+50/2\right) \times 3\right] + \left(160 \times 80 \times 6\right) + \left[160 \times 80 \times 1\right] + \left[\left(160+80/2 \times 200\right) \times 1,70\right] + \left[50+30/2 \times 240 \times 1\right] + \left[40+60/2 \times 300 \times 1\right] + \left[40+20/2 \times 200 \times 0,5\right] = 158\,200\ m^3$$

$$cut\text{-}off_{MD} = \left[\left(22+15/2 \times 3,5\right) \times 60\right] + \left[65/2 \times 70\right] = 15\,873\ m^3$$

$$cut\text{-}off_{ME} = \left(15+19,5/2 \times 2,5\right) \times 210 = 9\,056\ m^3$$



$$V_{solo} = 189.200\ m^3$$

1.2.2 - Rocha

$$V_{ROCHA} = \left(50 \times 50\right) \times 2 \times 2 = 10\,000\ m^3$$

1.3 - Tratamentos de Fundação

1.3.1 - Em rocha

$A_R = (350 \times 80) + (120 \times 90) = 38\,800\ m^2 \Rightarrow 40\,000\ m^2$

1.3.2 - Em Solo

$A_S = 125\,000 - 40\,000 = 85\,000\ m^2$

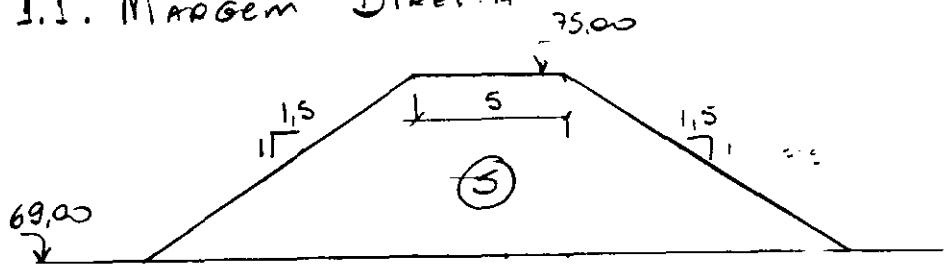
PROTEÇÃO com GRAMA

$$A_{GRAMA} = [7/2 \times 500] + [7 \times 60] + [7 + 42/2 \times 240] + [42 \times 300]$$
$$+ [42 + 21/2 \times 240] + [21/2 \times 160] + [21 \times 300] + [21/2 \times 190]$$
$$= 38185\ m^2$$

VOLUMES DAS ENSECADEIRAS

1. Ensecadeiras de 1ª Fase

1.1. Margem Direita



a) cota 69,00

S $[(5+23)/2 \times 6] = 84\ m^2$

$V_{MD} = (84/2 \times 180) + (84 \times 410) = 42.000\ m^3$

1.2. Margem Esquerda

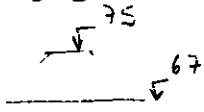
a) cota 69,00

S $84\ m^2$

$V_{ME} = [84/2 \times (2{,}5 + 1{,}5)] + [84 \times 310] = 34.860\ m^3$

2. Ensecadeiras de 2ª Fase

2.1. Jusante

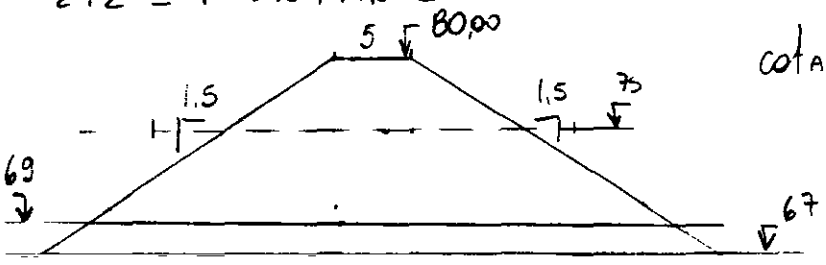


a) cota 69 — $84\ m^2$

b) cota 67 — $(5+23)/2 \times 8 = 136\ m^2$

$V_{JUS} = [84 \times 60] + [136 \times 35] = 9\,800\ m^3$

2.2 - Montante



cota 75 — $[5+20/2 \times 5] = 62{,}5\ m^2$

a) cota 69,00

① $[5+38/2 \times 11] = 236,5\ m^2$

b) cota 67,00

⑤ $[5+44/2 \times 13] = 318,5\ m^2$

$V_{MONT} = [236,5 \times (70+80)] + [318,5 \times 40] + [236,5/2 \times 35]$
$+ (62,5 \times 40) + [62,5/2 \times 15] = 55\,322\ m^3$

TOTAL

⑤ $42\,000 + 34\,860 + 9\,800 + 55\,322 = 141\,982\ m^3$

① 142 000

3. Remoção

MD $- (84 \times 220) = 18\,480\ m^3$

ME $- (84 \times 320) + [5+15/2 \times 3,5] + 84/2 \times 90 = 32\,235\ m^3$

Total remoção $= 50\,715\ m^3$

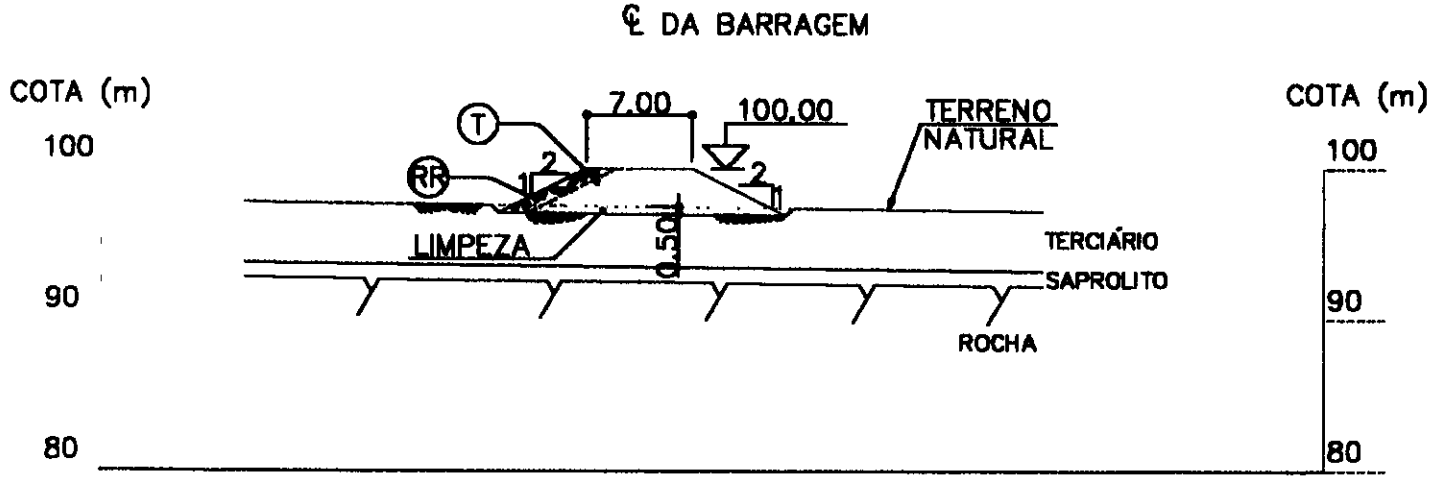
4. Preenchimento entre ensecadeira montante e a

Barragem

$A = [(29+7)/2 \times 6] = 108\ m^2$

$V = [108 \times 105] + [108/2 \times 65] = 14\,850\ m^3$

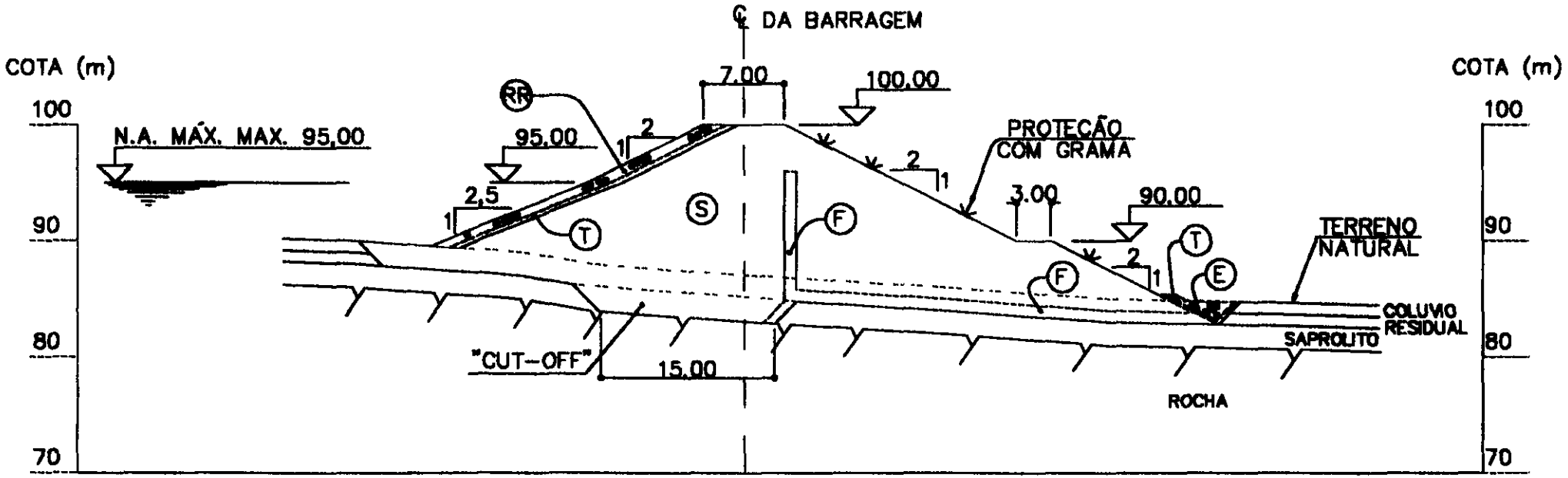
Volume solo ensecadeira $-$ 142 000 + 15 000 = 157 000 m



ESTACA 15+0,00

ESC. 1:500

TÍPICA ENTRE ESTACAS 0+0,00 A 25+0,00

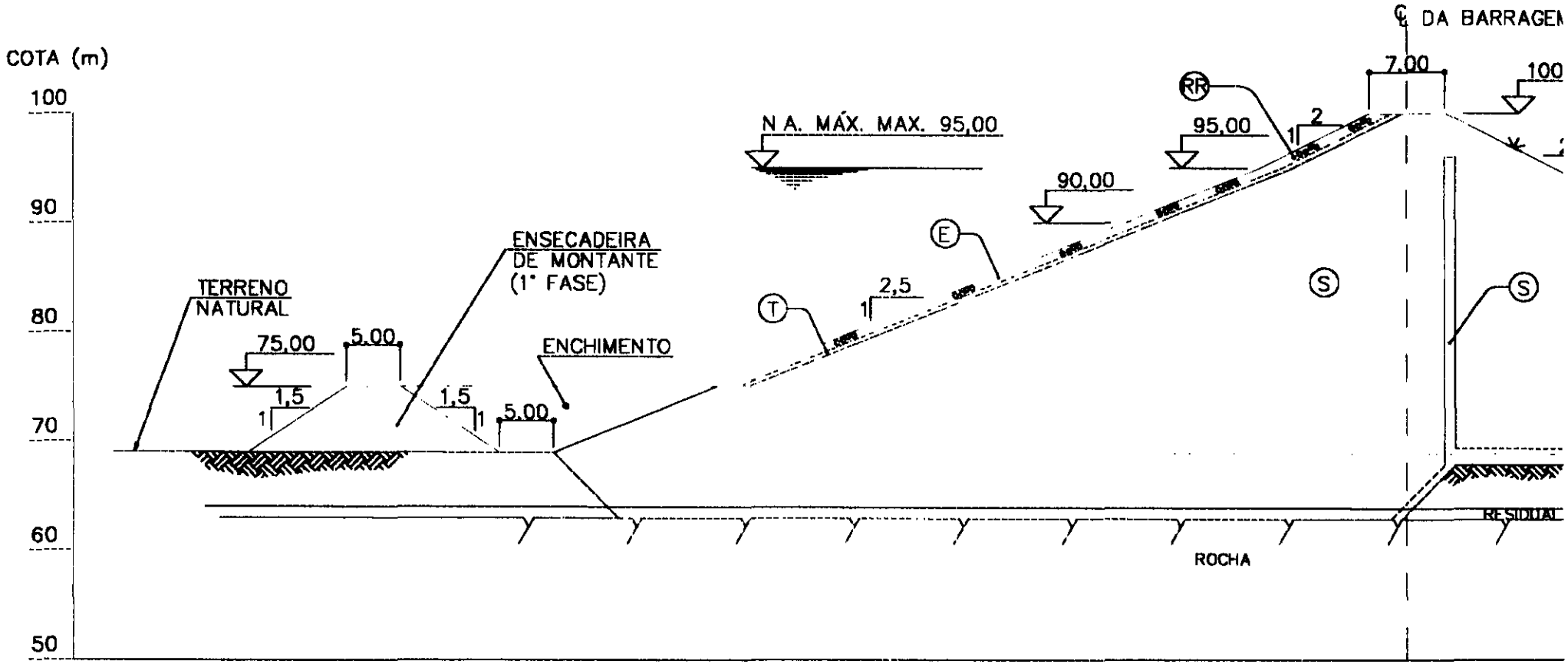


ESTACA 30+0,00

ESC. 1:500

TÍPICA ENTRE ESTACAS 25+0,00 A 37+0,00

030



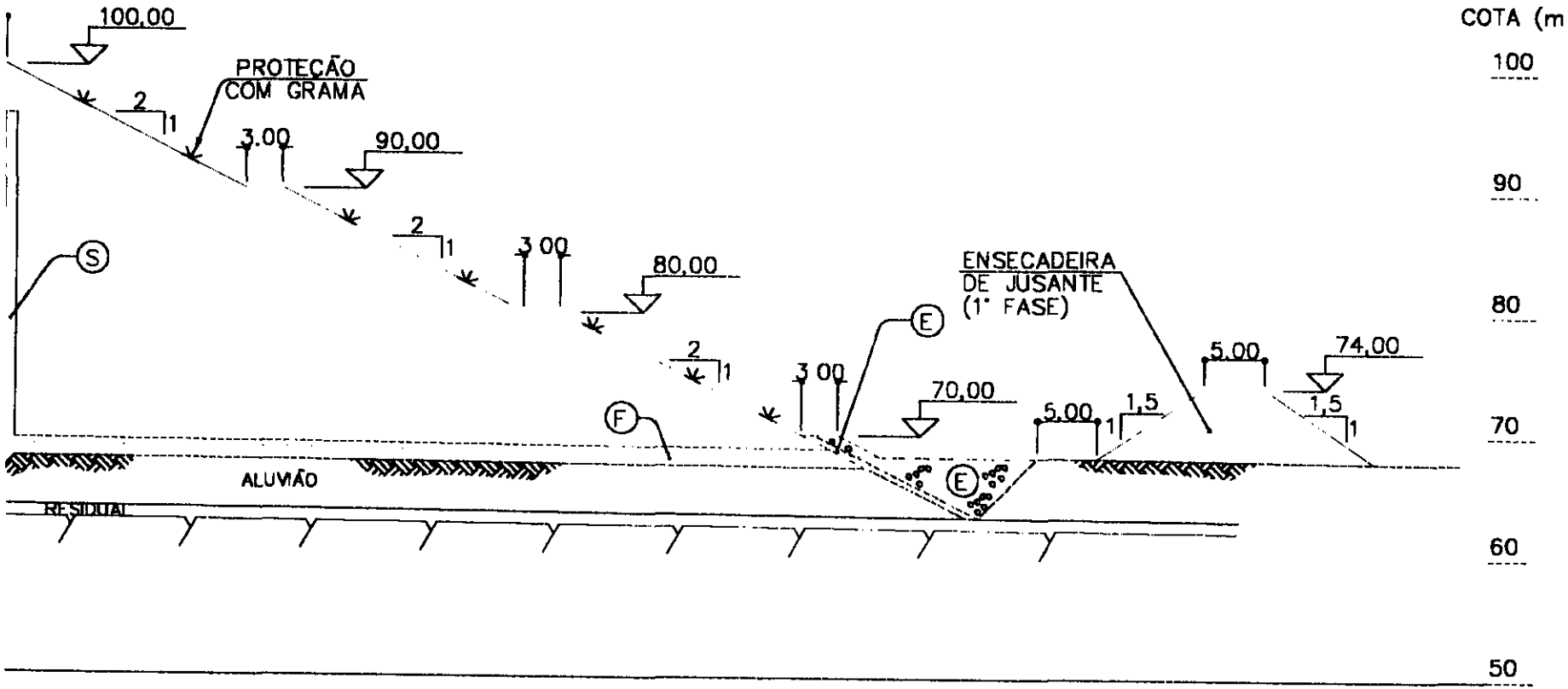
ESTACA 45 - 0,(

ESC 1 500

TÍPICA ENTRE ESTACAS 37+0,

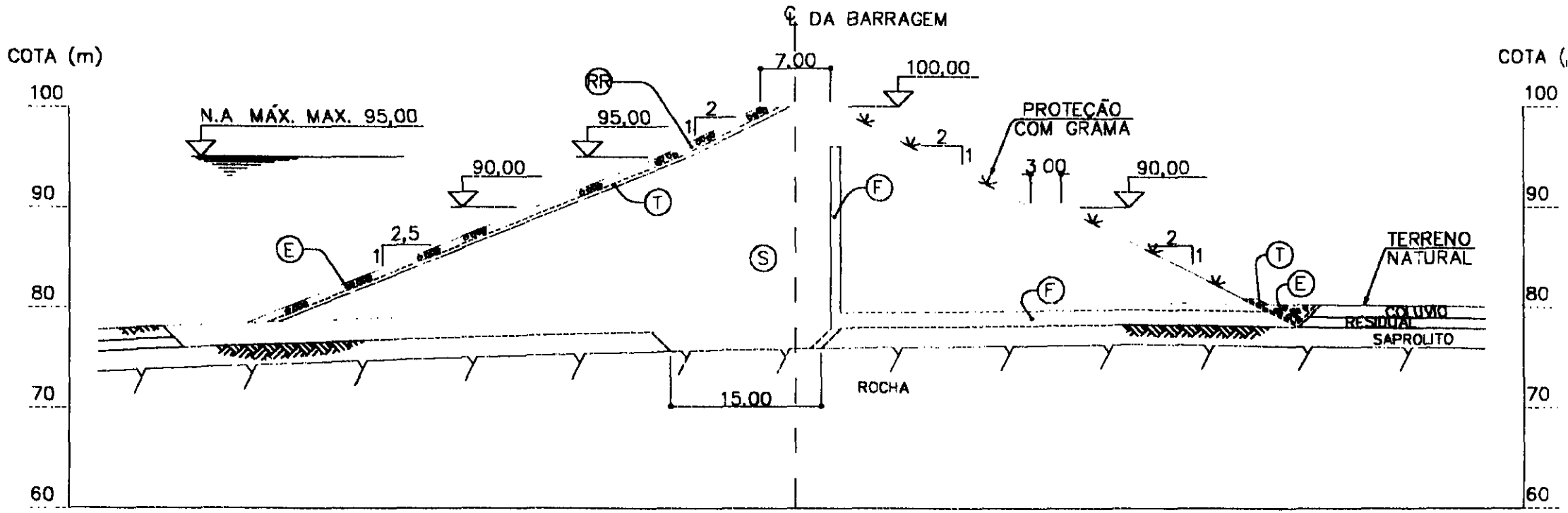
000031

\ BARRAGEM



45+0,00

S 37+0 00 A 53+0,00

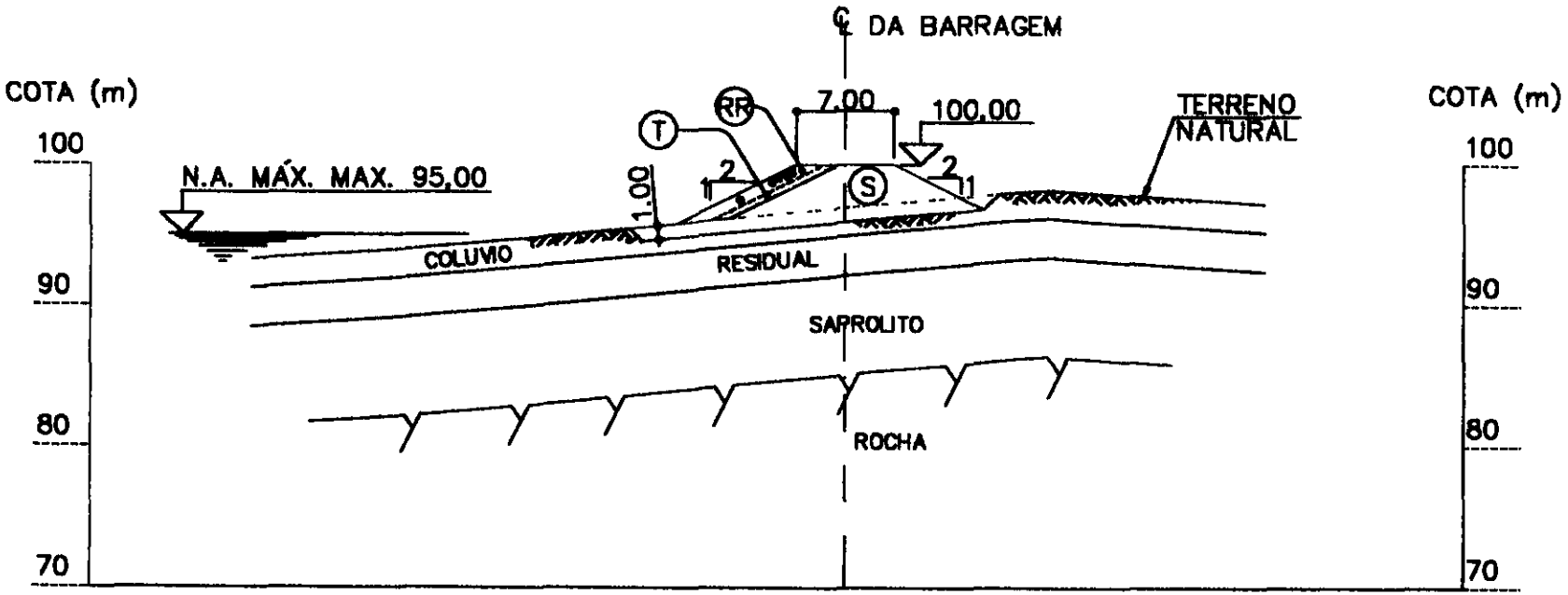


ESTACA 60+0,00

ESC 1 500

TÍPICA ENTRE ESTACAS 53+0,00 A 63+0,00

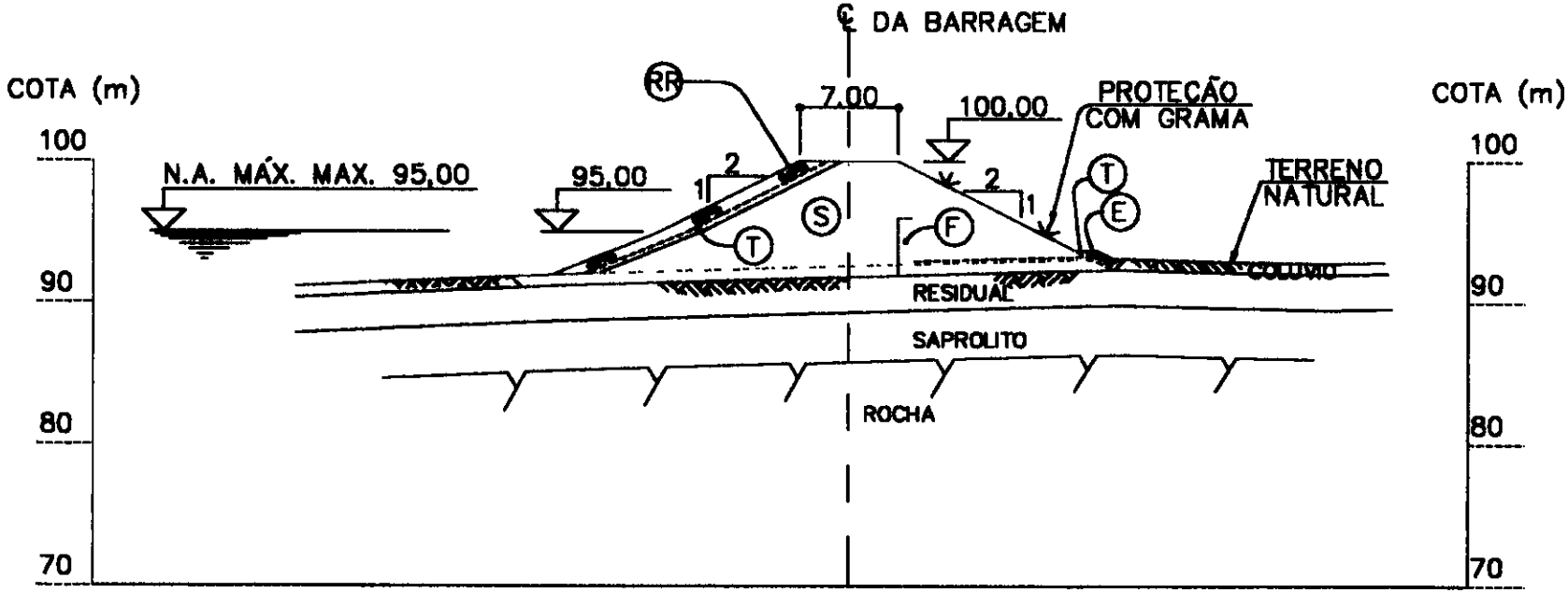
0033



ESTACA 70+0,00

ESC. 1:500

TÍPICA ENTRE ESTACAS 63+0,00 A 73+0,00



ESTACA 75+0,00

ESC. 1:500

TÍPICA ENTRE ESTACAS 73+0,00 A 90+0,00

ANTEPROJETO

QUANTITATIVOS DAS OBRAS DE TERRA

1. Dreno de Pé - BLR até cota 70,00 + BME - $l \cong 200$ m

BLR (T) 3.600
(E) 10 500

BME (T) 500
(L) 1 200

2 - Filtro

Secção A A - O
B B - 43,17 — 1.59
C - C - 142,73 — 33,00
D - D - 59,97 — 59
E - E - —
F - F - 0,95
G - G - 8 5

Acção - $[43,17/2 \times 30] + [(43,17 + 142,73)/2 \times 500] +$
$[(142,73 + 59,97)/2 \times 300] + [59,97/2 \times 170] + [10,95/2 \times 120]$
$+ [(10,95 + 15)/2 \times 150] + [15 + 8,5/2 \times 150] + [8,15/2 \times 200]$

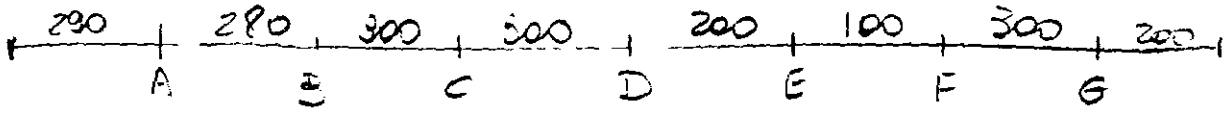
(A) 69.080 m³

Bruta - $[1,59/2 \times 30] + [(1.59 + 33)/2 \times 300] + [(33 + 1.59)/2 \times 300]$
$[1.59/2 \times 170] = 10.536$ m³

3. Cascalho

Secção A - A – 3,65 m²
B B – 22,12 m²
C - C – 48,34 m²
D - D – 27 76 m²
E - E – 3,86
F - F – 9,22
G - G – 8,45

} valores retirados no CAD



(C) $(3,65/2 \times 290) + [3,65 + 22,12/2 \times 280] + [22,12 + 48,34)/2 \times 500$
$+ [48,34 + 27,76)/2 \times 300] + [27,76 + 3,86)/2 \times 200] + [(3,86 + 9,22)/2 \times 100$
$+ [(9,22 + 8,45)/2 \times 300] + [8,45/2 \times 200] = 33\,432\ m^3$

(C) 33 500 m³

4 - TOTAIS

(S) alternativa 1 = 1.310.700
(F) " " = 86.100
(T) " " = 21.400
(RR) " " = 25 700
(E) " " = 18 200

PARA ANTEPROJETO

(S) $1.310.700 - 33.500 = 1277.200\ m^3$

(C) $33\,500\ m^3$

(F_A) $69.100\ m^3$

(F_D) $10\,600\ m^3$

(T) $21\,400 + 4100 = 25\,500\ m^3$

(RR) $25.700\ m^2$

(E) $18\,200 + 11.700 = 29\,900\ m^3$

ANTE PROJETO

ENSECADEIRAS

1. MD

cota 69 – 84 m²

$V_{MD} = [84/2 \times 190] + [84 \times 40] + [84 \times 400] = 44\,940$
$+ (84 \times 20) = 46\,620$

2 – LR

cota 67 – 318,5 m² custa 80
cota 67 – 180 custa 78

cota 69 – 236,5 – custa 80
cota 69 – 166,5 custa 78

$V_{ME_M} = [236,5/2 \times 150] + [236,5 + 318,5/2 \cdot 50] + [236,5 \times 80]$
$[62,5 \times 50] = 55.657\ m^3$

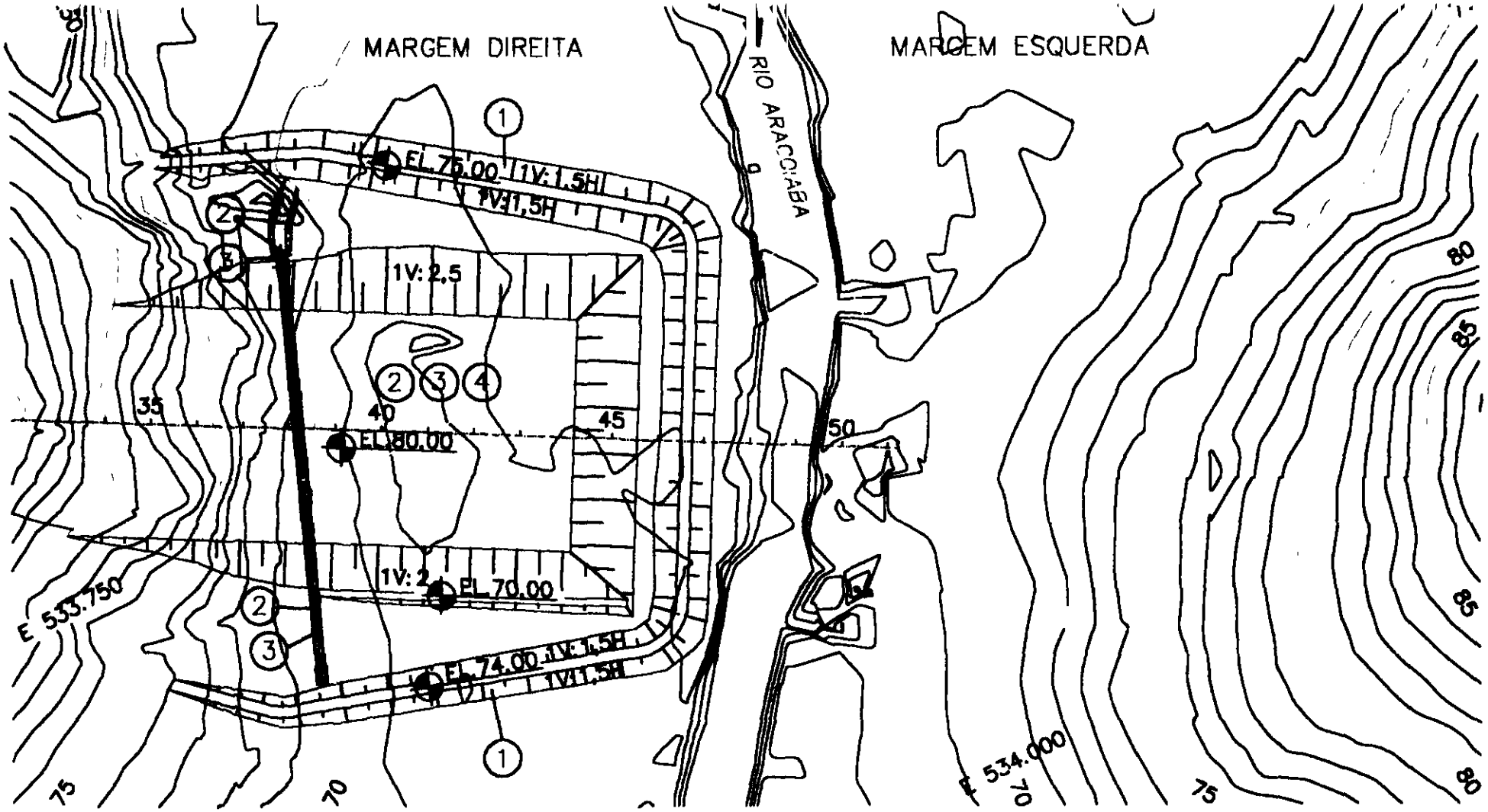
$V_{ME_J} = [166,5/2 \times 130] + [166,5 \times 120] + [166,5 + 180/2 \times 40]$
$+ [166,5 \times 20] = 41.063\ m^3$

TOTAL – 141.340 m³ + 3000 = 54 340

Remoção –

(5) 84 x 170 = 14.280 m³ → 14 300 m³

Preenchimento – 13 000 m³



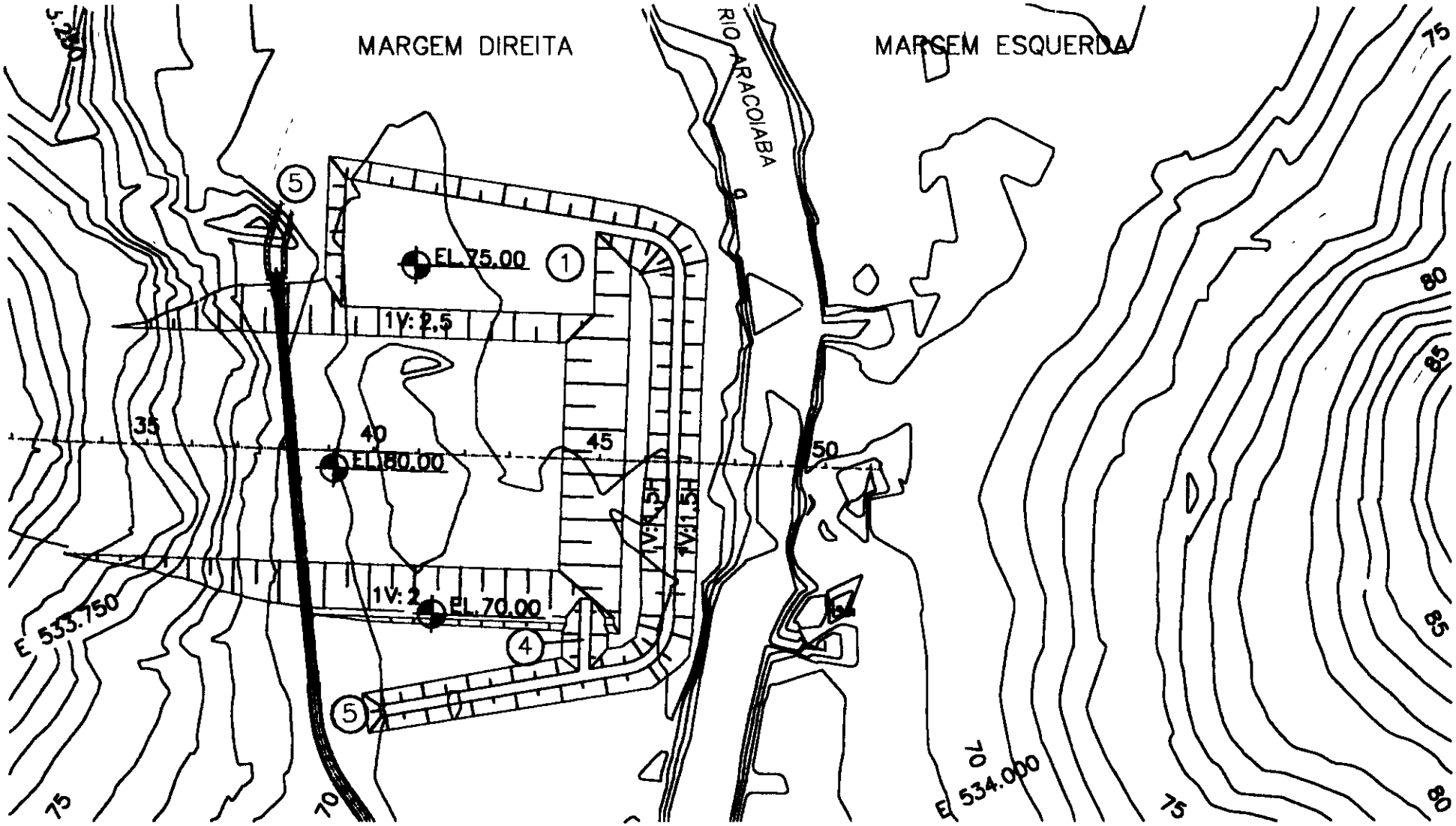
FASE 1A

1– CONSTRUÇÃO DA ENSECADEIRA, COM MATERIAL DAS ESCAVAÇÕES DA BARRAGEM, EM PONTA DE ATERRO OU EM CAMADAS, ATÉ A ELEVAÇÃO 75,00 A MONTANTE E 74,00 A JUSANTE.

2– ESCAVAÇÕES NA FUNDAÇÃO DA BARRAGEM, DA GALERIA DE DESVIO E DO VERTEDOURO

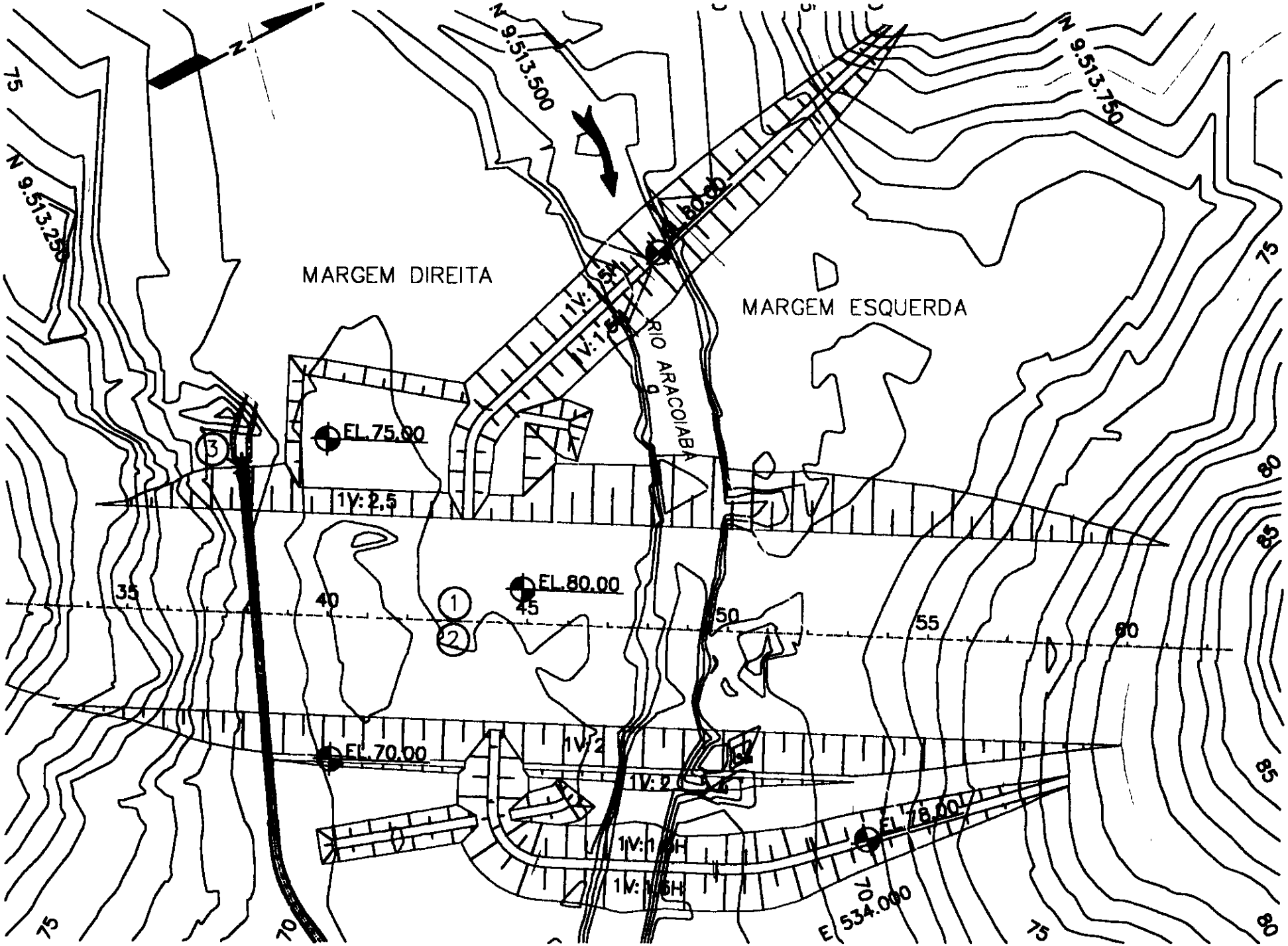
3– TRATAMENTO DA FUNDAÇÃO DA BARRAGEM E CONCRETAGEM DA GALERIA DE DESVIO.

4– EXECUÇÃO DA BARRAGEM NO RECINTO ENSECADO, ATÉ A COTA 80,00 E CONCRETAGEM DO VERTEDOURO

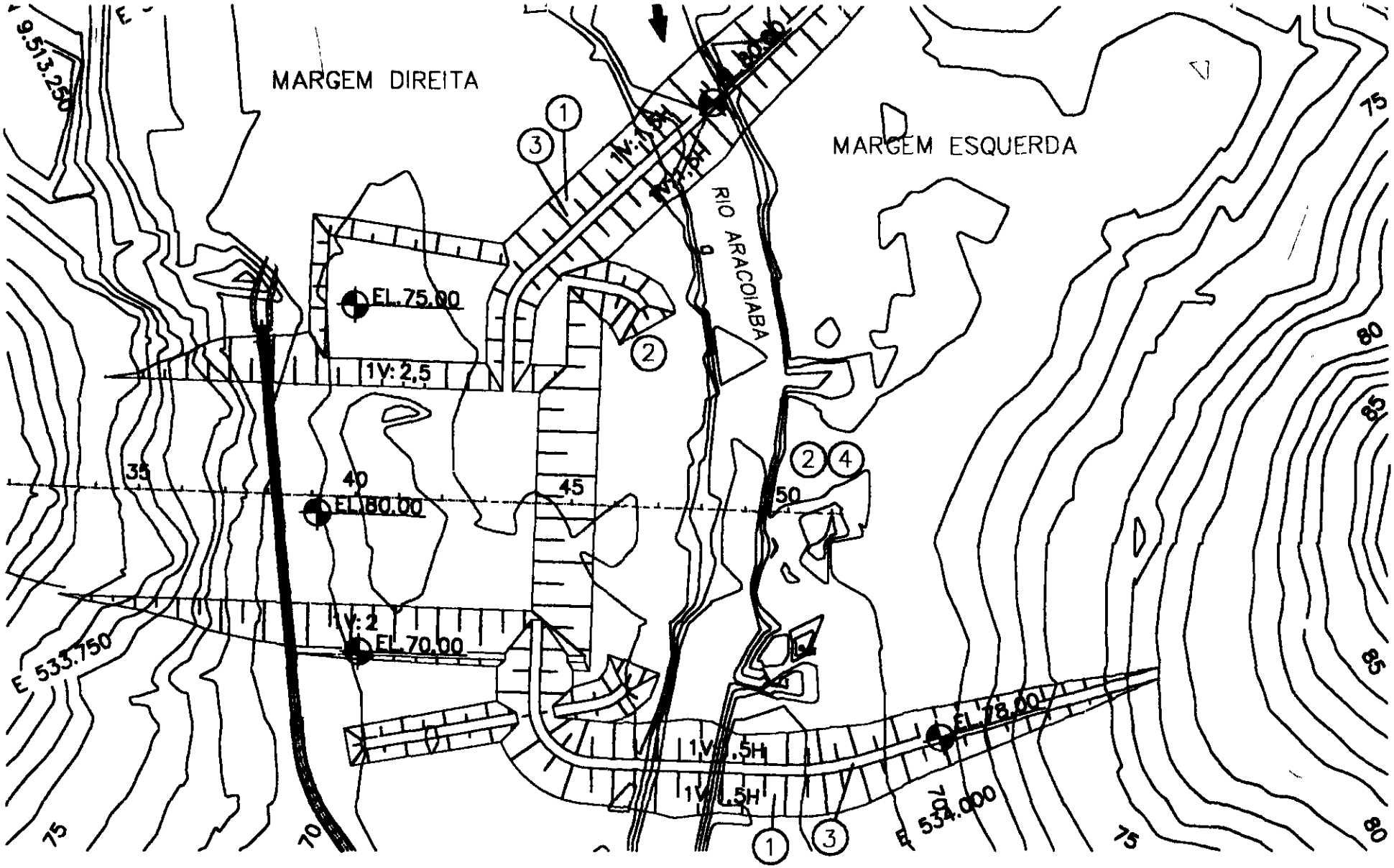


FASE 1B

1– PREENCHIMENTO ATÉ A COTA 75,00 DO ESPAÇO ENTRE A ENSECADEIRA DE MONTANTE E BARRAGEM
2– CONSTRUÇÃO DA BARRAGEM A DIREITA DO VERTEDOURO.
3– CONSTRUÇÃO DA BARRAGEM NA MARGEM ESQUERDA.
4– CONSTRUÇÃO DA ENSECADEIRA DE LIGAÇÃO ENTRE BARRAGEM E ENSECADEIRA DE JUSANTE.
5– REMOÇÃO DA ENSECADEIRA NA ENTRADA E SAÍDA DA GALERIA DE DESVIO.


N
N 9.513.500
N 9.513.750
N 9.513.250
MARGEM DIREITA
MARGEM ESQUERDA
RIO ARACOIABA
80.00
1V: 1,5H
1V: 1,5H
EL. 75,00
1V: 2,5
EL. 80,00
1V: 2
1V: 2
EL. 70,00
EL. 78,00
1V: 1,6H
1V: 1,6H
E 534.000
75
70
35
40
45
50
55
60
80
85

FASE 2B



FASE 2A

1– DESVIO DO RIO PARA A GALERIA ATRAVÉS DA CONSTRUÇÃO DAS ENSECADEIRAS DE MONTANTE E JUSANTE NA COTA 75,00.
2– REMOÇÃO DA ENSECADEIRA TRANSVERSAL DA ETAPA 1, ESCAVAÇÃO DA FUNDAÇÃO DA BARRAGEM.
3– ALTEAMENTO DA ENSECADEIRA DE MONTANTE PARA A COTA 80,00 E JUSANTE PARA A COTA 78,00.
4– TRATAMENTO DA FUNDAÇÃO DA BARRAGEM NA REGIÃO DO LEITO DO RIO.

4 - QUANTITATIVOS DAS ESTRUTURAS HIDRÁULICAS

Os quantitativos para as obras hidráulicas tiveram como base os seguintes desenhos de projeto

- AR-ET-4001 - Estruturas Hidráulicas - Alternativa 1 - Planta e Cortes
- AR-ET-4002 - Estruturas Hidráulicas - Alternativa 2 - Planta e Cortes
- AR-ET-4003 - Estruturas Hidráulicas - Alternativa 3 - Planta e Cortes
- AR-ET-4004 - Estruturas Hidráulicas - Alternativa 4 - Planta e Cortes
- AR-ET-4004 - Estruturas Hidráulicas - Galeria de Desvio - Alternativas 1, 2 e 3

Foram calculados os volumes das estruturas e de escavação de acordo com a memória de cálculo apresentada a seguir

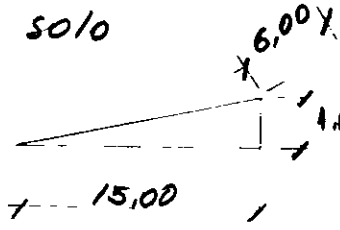
BARRAGEM ARACOIABA

GALERIA DE DESVIO

1- ESCAVAÇÃO

1.1- CANAL DE APROXIMAÇÃO

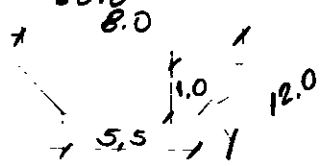
ESCAV. SOLO



$Vol = \left(\frac{15,0 \times 1,0}{2}\right) \times 6,0 = 45,00\ m^3$

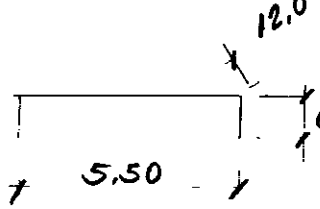
12- TOMADA D'ÁGUA

ESCAV SOLO



$Vol = \left(\frac{8,0+5,5}{2}\right) \times 1,0 \times 12,0 = 81,00\ m^3$

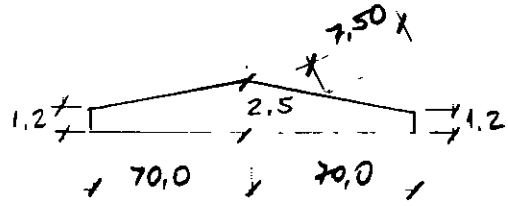
ESCAV Rocha



$Vol = (5,50 \times 0,40) \times 12,0 = 26,40\ m^3$

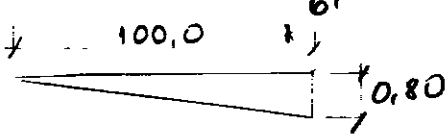
1.3- TÚNEL

ESCAV SOLO



$Vol = \left[\left(\frac{2,5+1,2}{2}\right) \times 70,0 \times 7,5\right] \times 2 = 1.950\ m^3$

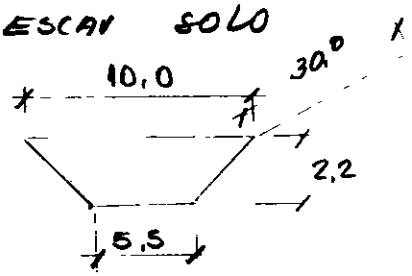
ESCAV Rocha



$Vol = \left(\frac{100,0 \times 0,80}{2}\right) \times 6,0 = 240,0\ m^3$

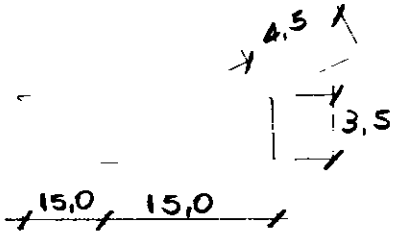
1.4 – BACIA DE DISSIPAÇÃO

ESCAV SOLO



$$Vol = \left(\frac{10,0+5,5}{2}\right) \times 2,20 \times 30,0 = 515,0\ m^3$$

ESCAV. Rocha

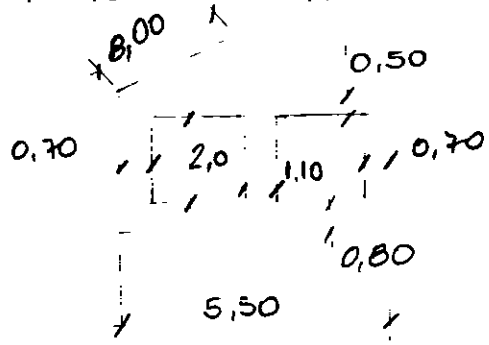


$$Vol = \left(\frac{15,0 \times 3,5}{2}\right) \times 4,50 = 120,0\ m^3$$

$$(15,0 \times 3,5) \times 4,50 = 236,0\ m^3$$

2- CONCRETO

2.1- TOMADA D'ÁGUA

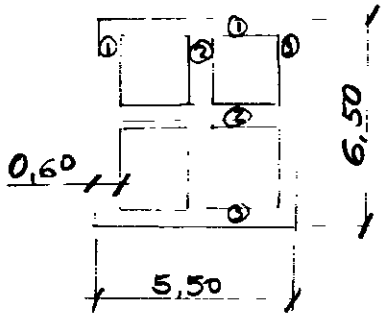


ÁREA = 5,50 × 0,50 = 2,75 m²
5,50 × 0,80 = 4,40 m²
2,00 × 0,70 = 1,40 m²
2,00 × 0,70 = 1,40 m²
2,00 × 1,10 = 2,20 m²
12,15 m²

Vol = 12,15 m² × 8,00 = 97,20 m³

2.2 – TORRE DA TOMADA D'ÁGUA

h = 27,0 m

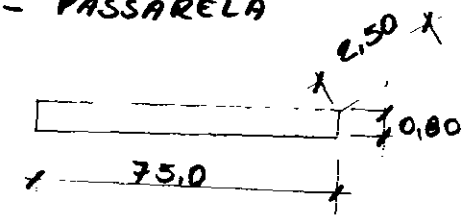


$$[(6,50 \times 0,60) \times 3] \times 27,0 = 315,90\ m^3$$

$$[(5,50 \times 0,60) \times 3] \times 27,0 = 267,30\ m^3$$

583,20 m³

2.3 - PASSARELA



Vol = 75,0 x 0,80 x 2,50 = 150,0 m³

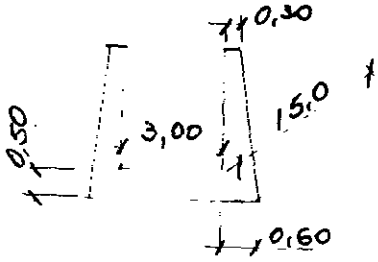
2.4 - TÚNEL

ÁREA DA SEÇÃO = 8,55 m² (MEDIDO NO CAD)

COMPRIMENTO DO TÚNEL = 140,0 m

Vol = 140,0 x 8,55 = 1 200,0 m³ − 350,00 m³ = 850 m

2.5 - BACIA DE DISSIPAÇÃO



Vol. com S/Forma = 5,0 x 140 x 0,50 = 350 m

h médio = 5,225 m

$$Vol: \left[\left(\frac{0,60+0,30}{2}\right) \times 5,225\right] \times 15,0 \times 2 = 70,50\ m^3$$

$$(3,00 \times 0,5) \times 15,0 = 22,50\ m^3$$

h = 7,50 m

$$Vol: \left[\left(\frac{0,60+0,30}{2}\right) \times 7,50\right] \times 15,0 \times 2 = 101,0\ m^3$$

$$(3,00 \times 0,5) \times 15,0 = 22,50\ m^3$$

total = 216,50 m³

LIMPEZA E TRATAMENTO DE FUNDAÇÃO EM ROCHA

COMPR - 220,0 m

Larg - 5,0 m

ÁREA = 1.100 m²

RESUMO CONCRETO

CONCRETO C/ FORMA	1700 m³
S/FORMA	410 m³

BARRAGEM - ARACOIABA

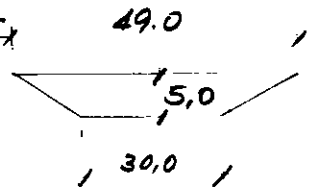
ESTRUTURAS HIDRÁULICAS - ALTERNATIVA 1

1- ESCAVAÇÃO

1.1 - CANAL DE APROXIMAÇÃO

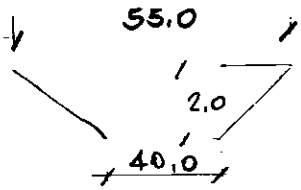
ESCAV. SOLO

Seção A



$$\text{Área} = \frac{(49{,}0 + 30{,}0)}{2} \times 5 = 198{,}00\ m^2$$

Seção 1



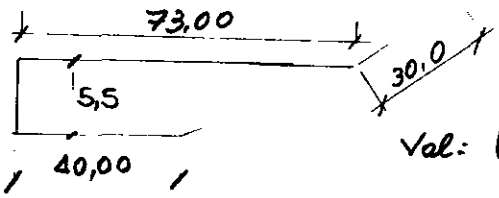
$$\text{Área} = \frac{(40{,}0 + 55{,}0)}{2} \times 2 = 95{,}00\ m^2$$

Volume

Seção	Área	Área/2	DIST	Vol
0	0			
		47,50	40,0	1 900
1	95,0			
		146,50	70,0	10 255
A	198,0			
		198,00	20,0	3.960
A'	198,0			
				16 115 m³

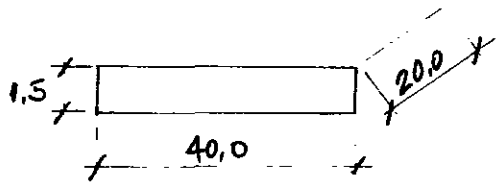
1.2 - VERTEDOURO

ESCAV SOLO

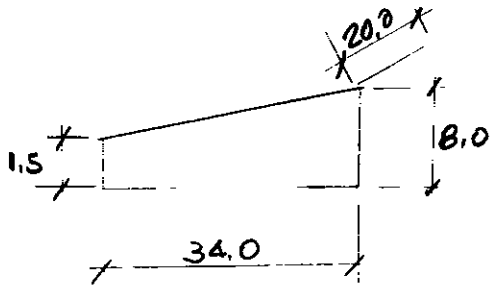


$$\text{Vol.} = \left(\frac{73{,}0 + 4{,}0}{2} \times 5{,}5\right) \times 30{,}0 = 9\,320\ m^3$$

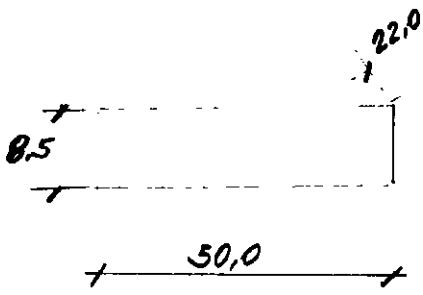
Escav Rocha



$$\text{Vol.} = 40{,}0 \times 1.5 \times 20{,}0 = 1.200\ m^3$$



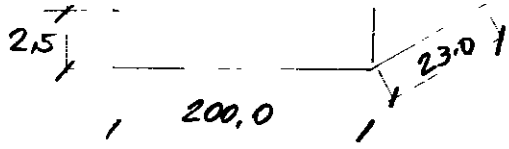
$Vol = \left(\frac{8,0 + 1,5}{2} \times 34,0\right) \times 20,0 = 3\,230\ m^3$



$Vol = (50,0 \times 8,5) \times 22,0 = 9\,350\ m^3$

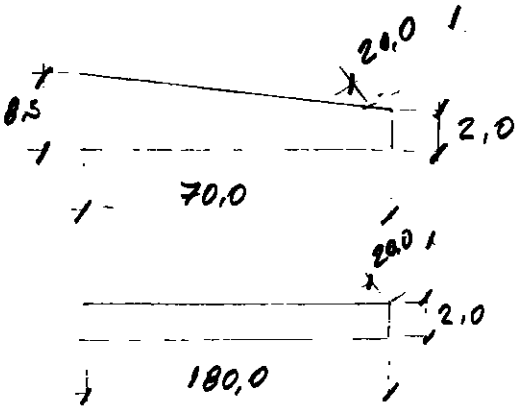
1.3 - CANAL DE RESTITUIÇÃO

ESCAV. EM SOLO



$Vol = (200,0 \times 2,5 \times 23,0) = 11.500\ m^3$

ESCAV EM ROCHA



$Vol = \left(\frac{8,5 + 2,0}{2}\right) \times 70,0 \times 20,0 = 7\,350\ m^3$

$Vol = (180,0 \times 2,0) \times 20,0 = 7.200\ m^3$

RESUMO

ESCAV SOLO = 36.935 m^3
ESCAV ROCHA = 28 330 m^3

DESMATAMENTO = 20.000 m^2
TRAT ROCHA = 8.000 m^2
TRAT. SOLO = 6.300 m^2

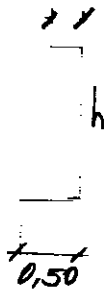
2- CONCRETO

21- VERTEDOURO

LAJE MONTANTE

$15,0 \times 0,50 \times 20,0 = 150,0\ m^3$

MUROS MONTANTE (2x)

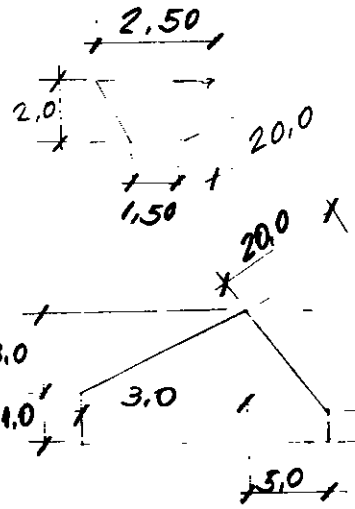


COMPR = 32,0 m

ÁREA = $\frac{0,30+0,50}{2} \times 6 = 2,4\ m^2$

Vol: $(2,4\ m^2 \times 32,0\ m) \times 2 = \underline{153,60\ m^3}$

VERTEDOURO



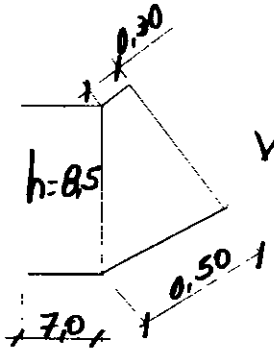
$\left(\frac{2,50 + 1,50}{2} \times 2,0\right) \times 20,0 = 80,0\ m^3$

ÁREA = $\frac{(4,0 + 1,0)}{2} \times 3,0 = 7,50\ m^2$

ÁREA = $\frac{(4,0+0,5)}{2} \times 5,0 = 11,25\ m^2$

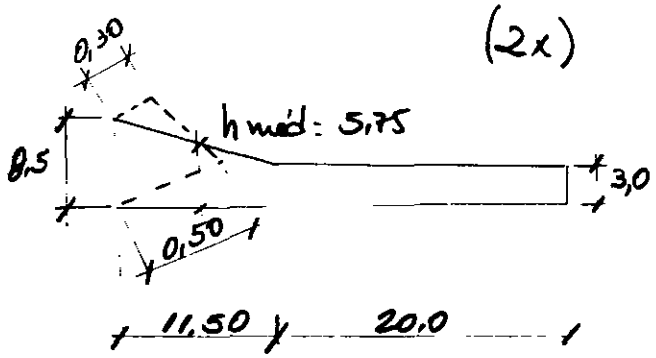
Vol = $(7,50\ m^2 + 11,25\ m^2) \times 20,0 = 375,0\ m^3$

MUROS VERTEDOURO



Vol = $\frac{(0,30+0,50)}{2} \times 8,5 \times 7,0 = 23,80\ m^3 \times 2 = 47,60\ m^3$

(2x)



$Vol = \frac{(0,30+0,50)}{2} \times 5,75 \times 11,50 = 26,45\ m^3$

$Vol = \frac{(0,30+0,50)}{2} \times 3,0 \times 20,0 = 24,00\ m^3$

total : 50,45 m³

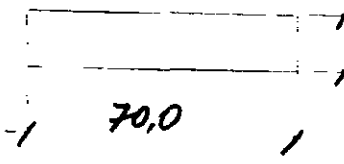
× 2

100,90 m³

LAGE JUSANTE

$Vol = 20,0 \times 100,00 \times 0,50 = 1.000,0\ m^3$

CONCRETO PROJETADO (ESP. 0,10)



ÁREA = 70,0 × 3,0 = 210,0 m² × 2 =

420,0 m²

RESUMO

CONCRETO c/FORMA – 775 m³

S/ FORMA – 1.150 m³

CONC. Projetado – 420 m²

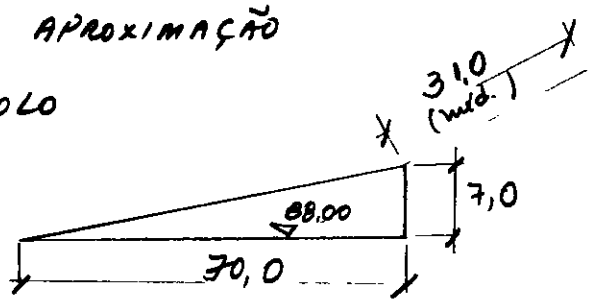
BARRAGEM ARACOIABA

ESTRUTURAS HIDRÁULICAS — ALTERNATIVA 2

1 - ESCAVAÇÃO

1.1 - CANAL DE APROXIMAÇÃO

ESCAV. SOLO



Vol: $\frac{70,0 \times 7,0}{2} \times 31,0 =$

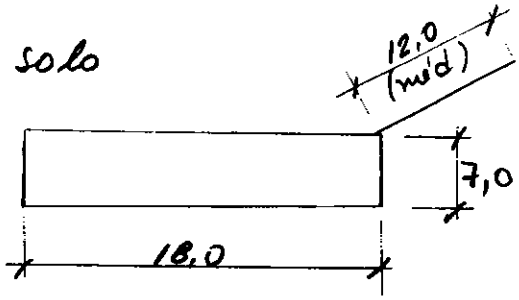
7 595 m³ ✓

TRATAMENTO EM SOLO

70,0 x 22,0 = 1.540 m² ✓

1.2 - VERTEDOURO

ESCAV. SOLO



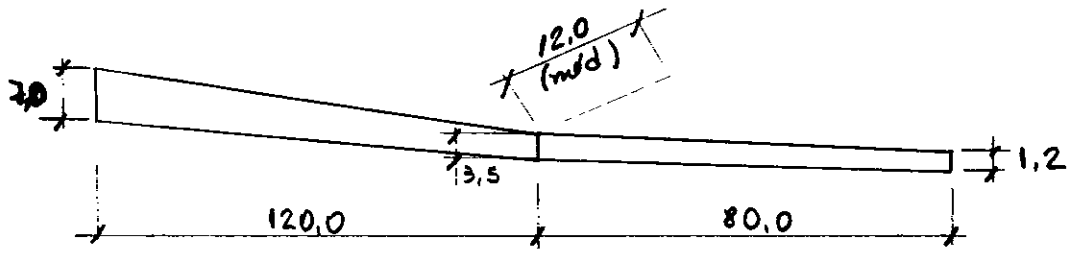
Vol: 18,0 x 7,0 x 12,0 = 1512,0 m³ ✓

TRATAMENTO EM SOLO

18,0 x 12,0 = 216,0 m² ✓

1.3 - CANAL - RÁPIDO

ESCAV EM SOLO



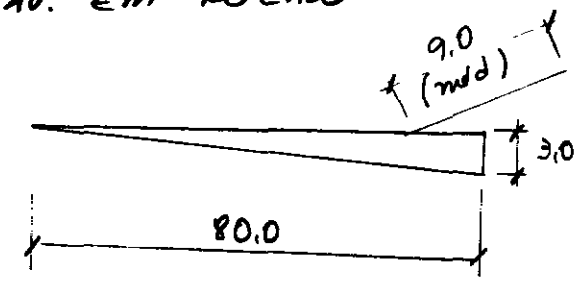
$$Vol = \left[\left(\frac{7,0 + 3,5}{2}\right) \times 120,0\right] \times 12,0 + \left[\left(\frac{3,5 + 1,2}{2}\right) \times 80,0\right] \times 12,0 =$$

7 560 + 2 256 = 9 816,0 m³ ✓

TRATAMENTO SOLO

120,0 x 8,0 = 960,0 m² ✓

ESCAV. EM Rocha



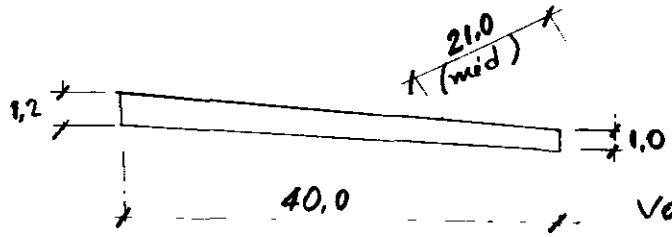
Vol: $\frac{(80,0 \times 3,0)}{2} \times 9,0 = 1.080\,m^3$ ✓

LIMPEZA E TRATAMENTO (Rocha) ✓

$80,0 \times 9,0 = 720\,m^2$

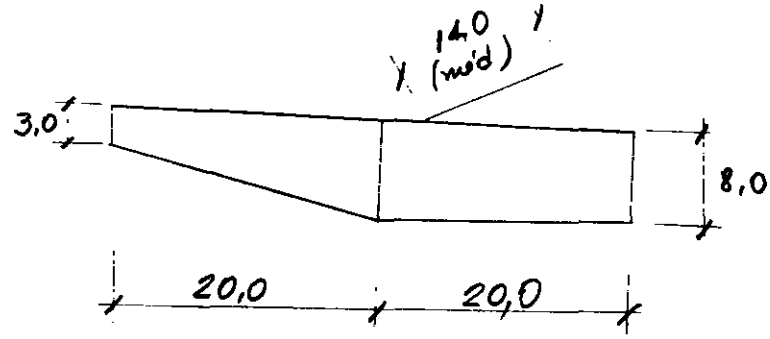
1.4 - BACIA DE DISSIPAÇÃO

ESCAV EM SOLO



Vol: $\left[\frac{(1,2+1,0)}{2} \times 40\right] \times 21,0 = 924,0\,m^3$ ✓

ESCAV EM Rocha



Vol = $\left[\frac{(3,0+8,0)}{2} \times 20,0\right] \times 14,0 + (20,0 \times 8,0) \times 14,0 =$

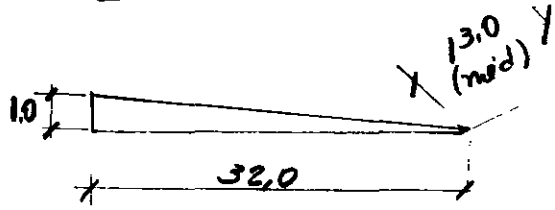
$1\,540,0 + 2\,240,0 = 3\,780,0\,m^3$

LIMPEZA E TRATAMENTO (Rocha)

$40,0 \times 14,0 = 560,0\,m^2$ ✓

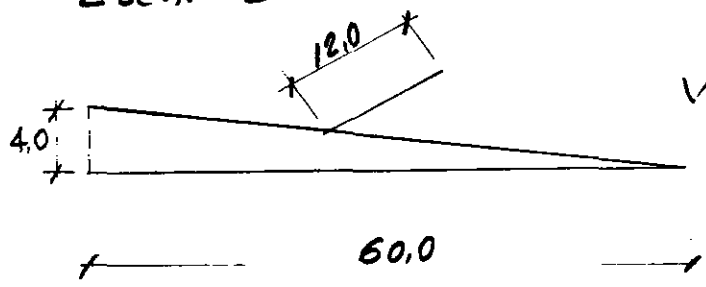
1.5 - CANAL DE RESTITUIÇÃO

ESCAV EM SOLO



Vol: $\frac{(32,0 \times 1,0)}{2} \times 13,0 = 208,0\,m^3$ ✓

ESCAV EM Rocha



Vol: $\frac{(60,0 \times 4,0)}{2} \times 12,0 = 1.440,0\ m^3$

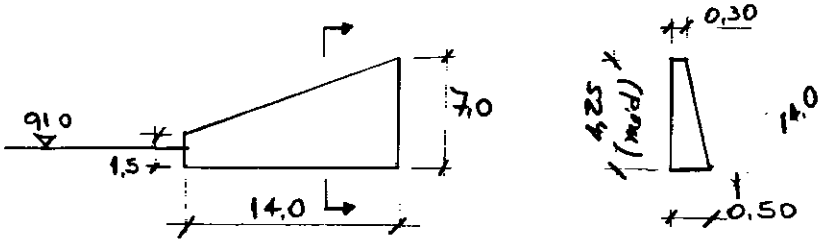
LIMPEZA E TRATAMENTO (Rocha)

$(60,0 \times 12,0) = 720,0\ m^3$ ✓

2- CONCRETO ESTRUTURAL

21 - CANAL DE APROXIMAÇÃO

MURO LATERAL ESQUERDO

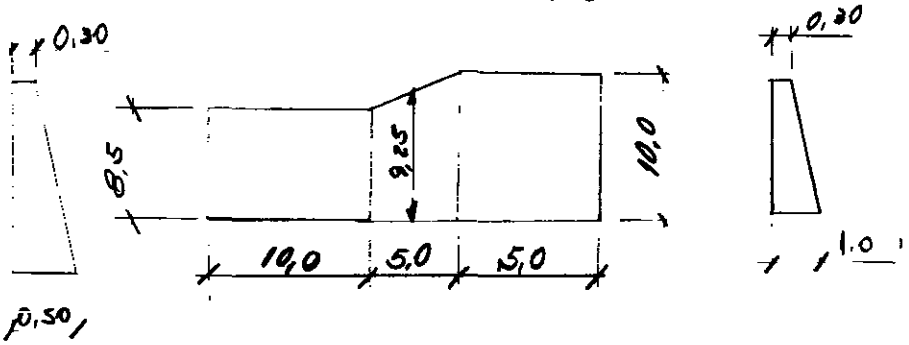


Vol = $\left[\frac{(0,30+0,50)}{2} \times 4,25\right] \times 14,0 =$

$23,80\ m^3$ ✓

22 - VERTEDOURO

MUROS LATERAIS



Vol = $\left[\frac{(0,30+0,50)}{2} \times 8,5\right] \times 10,0 = 34,0\ m^3$

Vol $\left[\frac{(0,30+0,50)}{2} \times 9,25\right] \times 5,0 = 24,5\ m^3$

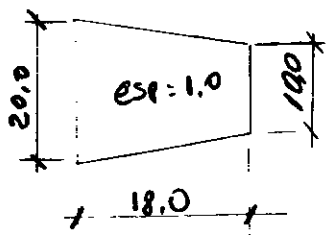
Vol: $\left[\frac{(0,30+1,00)}{2} \times 10,0\right] \times 5,0 = 32,5\ m^3$

$\cong 91,0\ m^3$

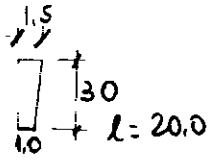
$\times 2$

Total = $182,0\ m^3$

LAJE -

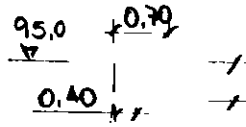


$Vol = \left[\left(\frac{20,0 + 10,0}{2}\right) \times 1,0\right] \times 18,0 = 270,0\ m^3$ ✓



$Vol = \left(\frac{1,5 + 1,0}{2} \times 3,0\right) \times 20,0 = 75,0\ m^3$

MURO DA SOLEIRA (comp = 24,5 m)

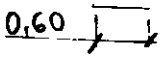


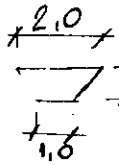
$Vol = (0,70 \times 0,50 \times 24,5) = 8,6\ m^3$

$Vol = \left[\left(\frac{0,40 + 0,60}{2}\right) \times 6,50\right] \times 24,5 = 80,0\ m^3$

6,50

total = 88,6 m³ ✓

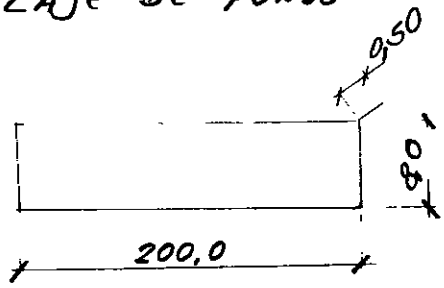




$Vol = \left(\frac{2,0 + 1,0}{2} \times 1,0\right) \times 24,5 = 37,0\ m^3$ ✓

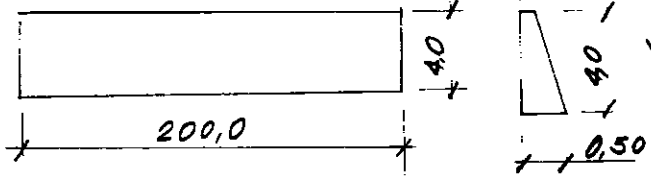
2.3 - CANAL - RÁPIDO

LAJE DE FUNDO



$Vol = (200,0 \times 8,0 \times 0,50) = 800,0\ m^3$ ✓

MUROS LATERAIS (2x)



$Vol = \left[\left(\frac{0,30 + 0,50}{2}\right) \times 4,0\right] \times 200,0 =$

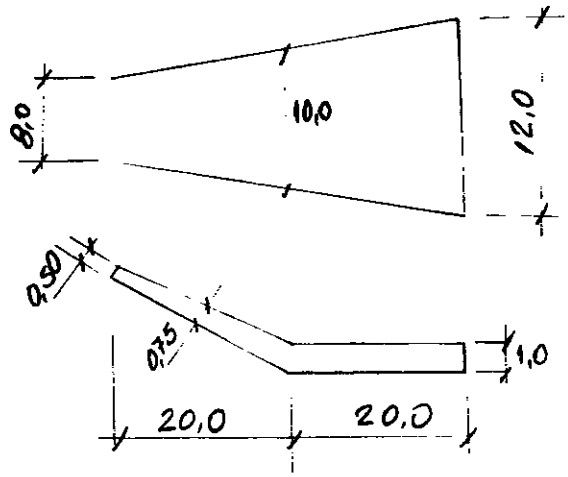
320,0 m³

× 2

640,0 m³ ✓

2.4- BACIA DE DISSIPAÇÃO

LAJE DE FUNDO

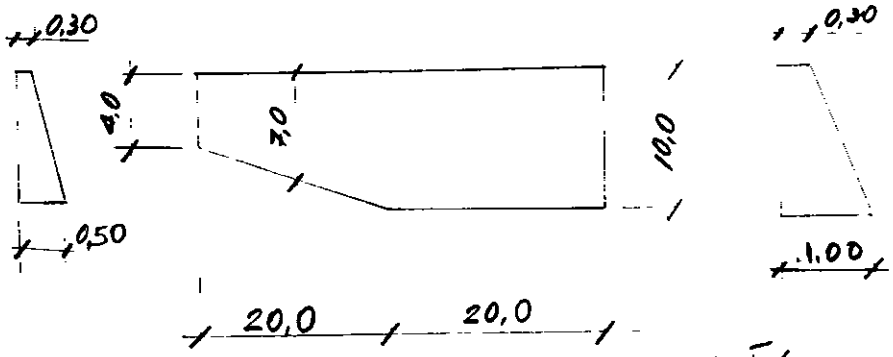


$Vol = \left[\left(\frac{8,0 + 10,0}{2} \times 0,75\right)\right] \times 20,0 = 135,0\ m^3$

$Vol = \left[\left(\frac{10,0 + 12,0}{2} \times 1,0\right)\right] \times 20,0 = 220,0\ m^3$

total: 355,0 m³

MUROS LATERAIS (2x)



$Vol = \left[\left(\frac{0,30 + 0,50}{2} \times 7,0\right)\right] \times 20,0 = 56,0\ m^3$

$Vol = \left[\left(\frac{0,30 + 1,0}{2} \times 10,0\right)\right] \times 20,0 = 130,0\ m^3$

total 186,00 m³

x 2

372,00 m³

DESMATAMENTO E LIMPEZA

$(300,0 \times 60,0) + (300,0 \times 25,0) = 9\,300\ m^2$

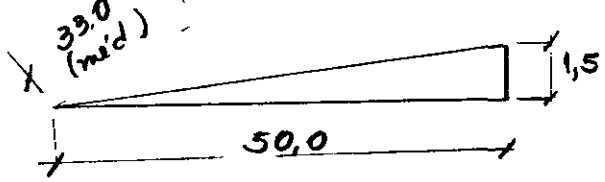
BARRAGEM ARACOIABA

ESTRUTURAS HIDRÁULICAS – ALTERNATIVA 3

1- ESCAVAÇÃO

1.1- CANAL DE APROXIMAÇÃO

ESCAV. SOLO

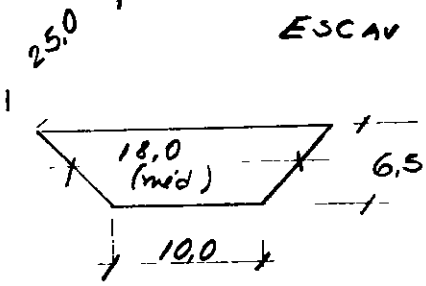


Vol. $\frac{50,0 \times 1,5}{2} \times 33,0 = 1.237\ m^3$ ✓

TRATAMENTO EM SOLO:
$50,0 \times 33,0 = 1.650\ m^2$ ✓

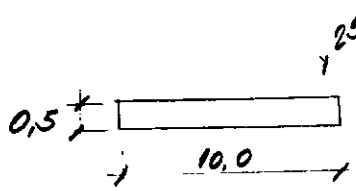
1.2- VERTEDOURO

ESCAV SOLO



Vol: $\left(\frac{18,0+10,0}{2} \times 6,5\right) \times 25,0 = 2\,275\ m^3$ ✓

ESCAV Rocha

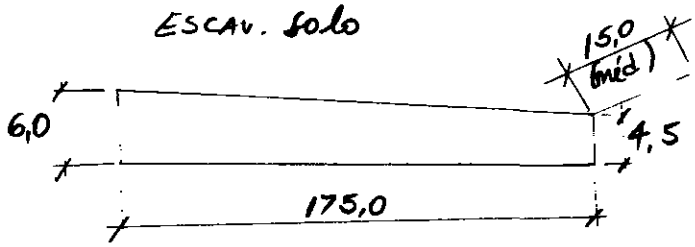


Vol. $10,0 \times 0,5 \times 25,0 = 125,0\ m^3$ ✓

LIMPEZA E TRATAMENTO
$10,0 \times 25,0 = 250,0\ m^2$

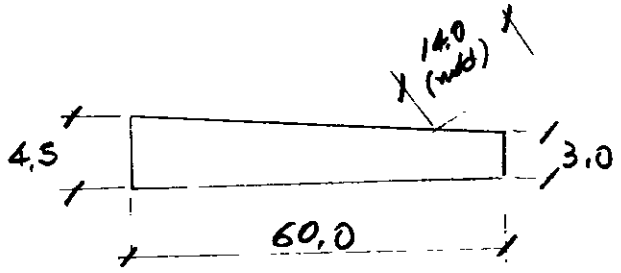
1.3 – CANAL – RÁPIDO

ESCAV. SOLO



Vol: $\left(\frac{6,0+4,5}{2} \times 175,0\right) \times 15,0 =$

$13.780,0\ m^3$ ✓

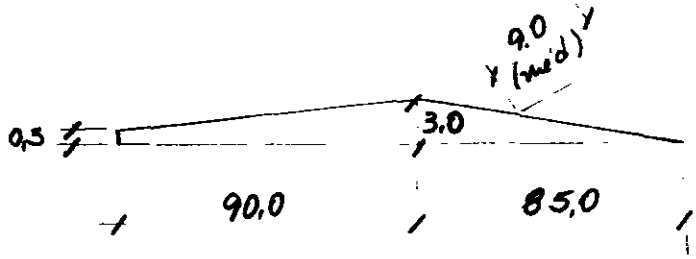


Vol: $\left(\frac{4,5+3,0}{2} \times 60,0\right) \times 14,0 =$

$3\,150,0\ m^3$

total = $16.930\ m^3$ ✓

ESCAV. Rocha



Vol = $\frac{(0,5+3,0)}{2} \times 90,0 \times 9,0 = 1.417\ m^3$

Vol = $\frac{(3,0 \times 85,0)}{2} \times 9,0 = 1147\ m^3$

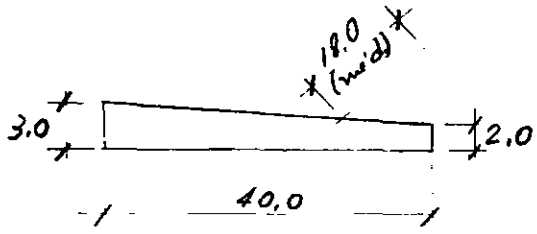
total = 2 564 m^3 ✓

LIMPEZA E TRATAMENTO

$175,0 \times 9 = 1.575\ m^2$ ✓

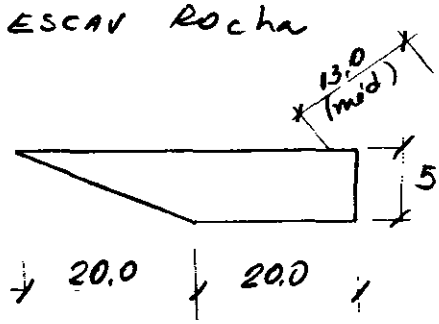
1.4 - BACIA DE DISSIPAÇÃO

ESCAV SOLO



Vol = $\frac{(3,0+2,0)}{2} \times 40,0 \times 18,0 = 1.800,0\ m^3$ ✓

ESCAV Rocha



Vol = $\frac{(5,0 \times 20,0)}{2} \times 13,0 = 650,0\ m^3$

Vol = $(5,0 \times 20,0) \times 13,0 = 1.300,0\ m^3$

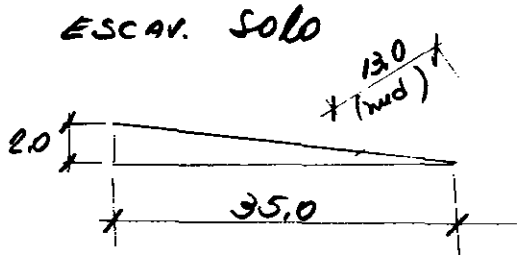
total = 1.950,0 m^3 ✓

LIMPEZA E TRATAMENTO

$40,0 \times 13,0 = 520,0\ m^2$

1.5 - CANAL DE RESTITUIÇÃO

ESCAV. SOLO

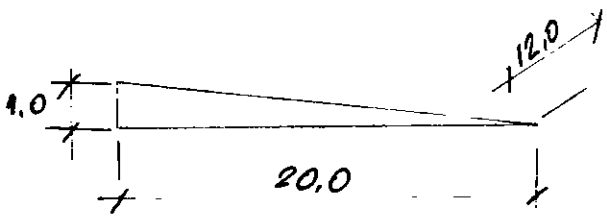


Vol = $\frac{(3,5 \times 2,0)}{2} \times 13,0 = 455,0\ m^3$ ✓

TRATAMENTO EM SOLO

$35,0 \times 13,0 = 455\ m^2$ ✓

ESCAV EM ROCHA



Vol: $\frac{(20,0 \times 1,0)}{2} \times 12,0 = 120,0\ m^3$ ✓

LIMPEZA E TRATAMENTO EM Rocha

$20,0 \times 12,0 = 240,0\ m^2$

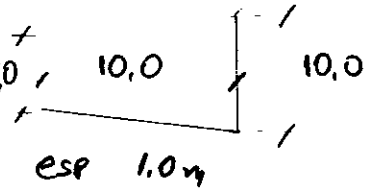
DESMATAMENTO E LIMPEZA

$(40 \times 60) + (150 \times 25) + (120 \times 30) = 9\,750\ m^2$

2 - CONCRETO ESTRUTURAL

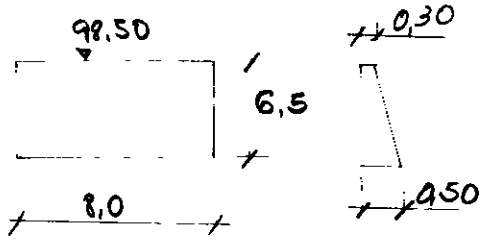
2.1 - VERTEDOURO

LAJE



Vol: $\left[\left(\frac{10,0+8,0}{2}\right) \times 10,0\right] \times 1,0 = 90,0\ m^3$ ✓

MUROS LATERAIS (x 2)

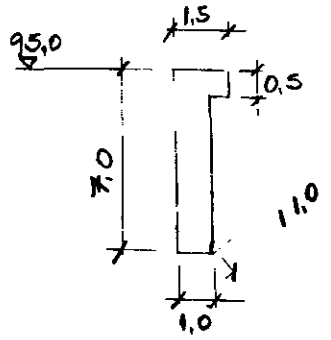


Vol: $\left[\left(\frac{0,30+0,50}{2}\right) \times 6,5\right] \times 8,0 = 20,80\ m^3$

x 2

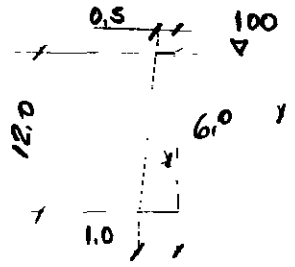
total - $41,60\ m^3$ ✓

MURO DA SOLEIRA



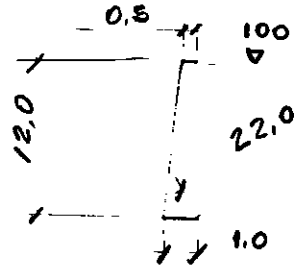
Vol: $(6,5 \times 1,0 \times 11,0) + (1,5 \times 0,5 \times 11,0) =$
$71,5\ m^3 + 8,25\ m^3 = 80,0\ m^3$ ✓

MURO LATERAL



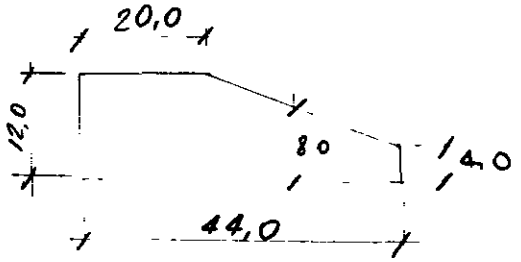
Vol: $\left(\frac{0,5+1,0}{2} \times 12,0\right) \times 6,0 = 54,0\ m^3$ ✓

MURO DE FUNDO



Vol: $\left(\frac{0,5+1,0}{2} \times 12,0\right) \times 22,0 = 198,0\ m^3$ ✓

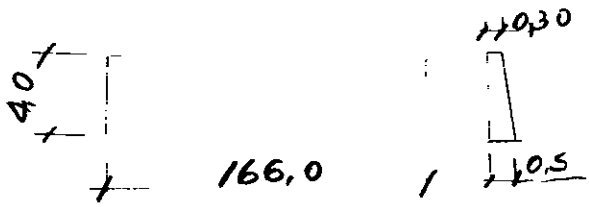
2 2 - CANAL - RÁPIDO



PAREDES (2x)

Vol: $\left(\frac{0,3+0,5}{2} \times 12,0\right) \times 20,0 = 96,0\ m^3$

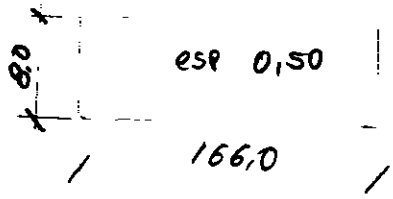
Vol: $\left(\frac{0,3+0,5}{2} \times 8,0\right) \times 24,0 = 76,8\ m^3$



Vol: $\left(\frac{0,3+0,5}{2} \times 4,0\right) \times 166,0 = 265,6\ m^3$

total $531,2\ m^3 \times 2 = 1.062\ m^3$ ✓

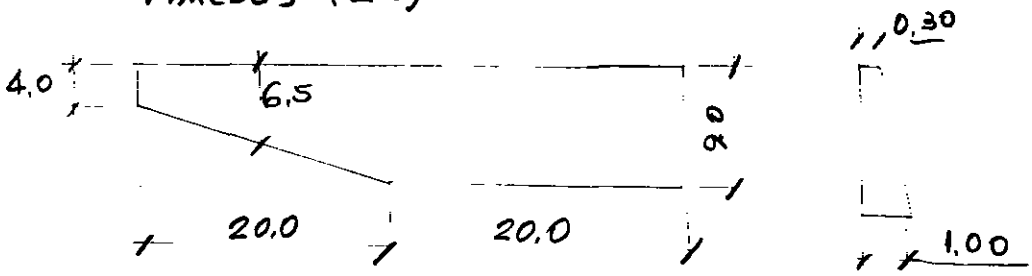
LAJE



Vol: $166,0 \times 8,0 \times 0,50 = 664,0\ m^3$ ✓

23 - BACIA DE DISSIPAÇÃO

PAREDES (2x)



Vol: $\frac{(0,3+0,5}{2} \times 6,5) \times 20,0 = 52,0\ m^3$

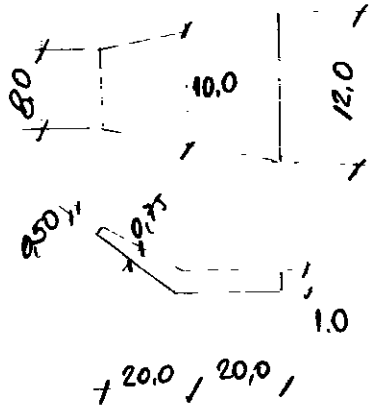
Vol: $\frac{(0,3+1,0}{2} \times 9,0) \times 20,0 = 117,0\ m^3$

total: $169,0\ m^3$

x2

$338,0\ m^3$ ✓

LAJE



Vol: $\frac{(8,0+10,0}{2} \times 0,75) \times 20,0 = 135,0\ m^3$

Vol: $\frac{(10,0+12,0}{2} \times 1,0) \times 20,0 = 220,0\ m^3$

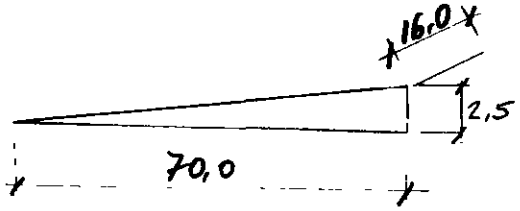
total: $355,0\ m^3$ ✓

BARRAGEM - ARACOIABA

ESTRUTURAS HIDRÁULICAS - ALTERNATIVA 4
(TULIDA)

1- ESCAVAÇÃO

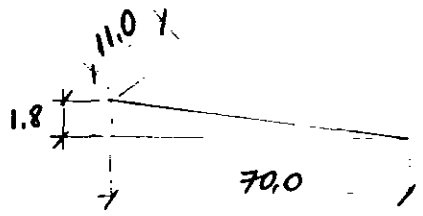
1.1- CANAL DE APROXIMAÇÃO



Vol Solo = $\frac{70,0 \times 2,5}{2} \times 16,0 = 1.400\ m^3$

TRAT. Solo = $70,0 \times 14,0 = 980,0\ m^2$

1.2- CANAL DE RESTITUIÇÃO

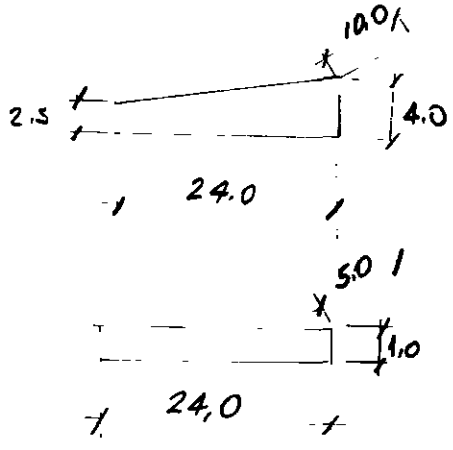


ESCA. SOLO

Vol: $\frac{70,0 \times 1,8}{2} \times 11,0 = 693,00\ m^3$

TRAT Rocha: $70,0 \times 10,0 = 700\ m^2$

1.3- TOMADA D'AGUA



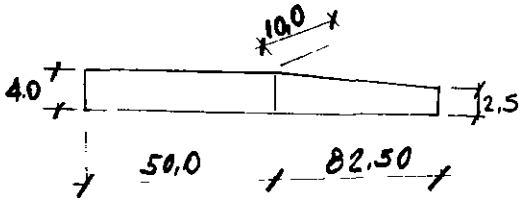
ESCAV solo: $\left(\frac{2,5 + 4,0}{2} \times 24,0\right) \times 10,0 = 780,0\ m^3$

ESCAV Rocha: $(24,0 \times 1,0) \times 5,0 = 120,0\ m^3$

TRAT Rocha: $24,0 \times 5,0 = 120,0\ m^2$

1.4 - GALERIA

ESCAV. Solo

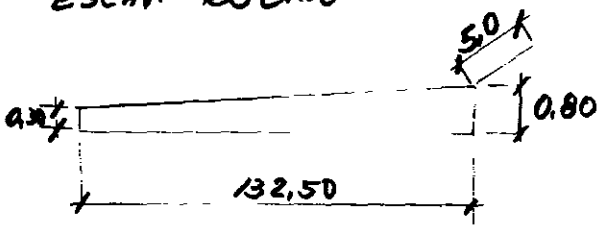


Vol: $(50,0 \times 4,0) \times 10,0 = 2\ 000\ m^3$

$\left(\frac{4,0 + 2,5}{2}\right) \times 82,50 \times 10 = 2.680\ m^3$

TOTAL $4.680\ m^3$

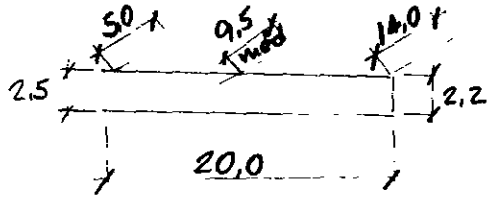
ESCAV. ROCHA



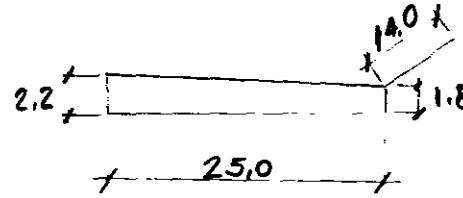
Vol: $\frac{(0,30+0,80)}{2} \times 132,5 \times 5,0 = 365\ m^3$

TRAT Rocha: $132,50 \times 5,0 = 662,50\ m^2$

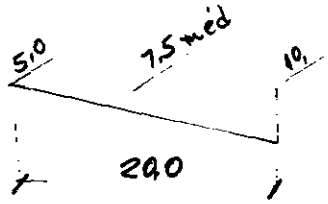
15- BACIA DE DISSIPAÇÃO



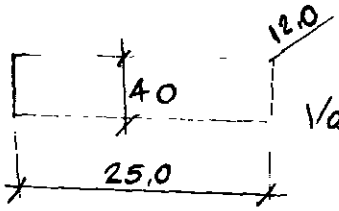
Vol: Esc Solo: $\frac{(2,5+2,2)}{2} \times 20,0 \times 9,5 = 446\ m^3$



Vol - Esc Solo: $\frac{(2,2+1,8)}{2} \times 25,0 \times 14,0 = 700\ m^3$



Vol - Esc Rocha: $\frac{(20,0 \times 4,0)}{2} \times 7,5 = 300\ m^3$



Vol - Esc. Rocha: $\frac{(25,0 \times 4,0)}{2} \times 12,0 = 1.200\ m^3$

TRAT Rocha: $(7,5 \times 20,0) + (25,0 \times 12,0) = 450\ m^2$

RESUMO

ESCAV SOLO = 8.700 m³

ESCAV ROCHA: 1 700 m³

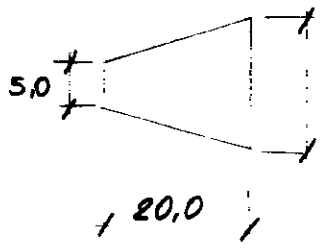
TRAT SOLO: 980 m²

TRAT. ROCHA: 1 950 m²

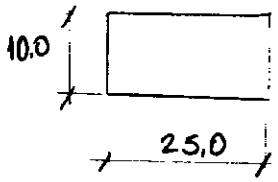
2 - CONCRETO

BACIA DE DISSIPAÇÃO

LAJE - ESP 0,50

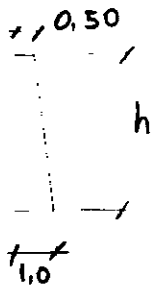


$Vol = \frac{5,0 + 10,0}{2} \times 20,0 \times 0,50 = 75,00\ m^3$



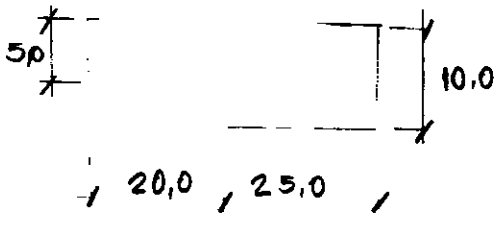
$Vol = 25,0 \times 10,0 \times 0,50 = 125,0\ m^3$

MUROS (2x)



$A_1 = \frac{0,5 + 1,0}{2} \times 10,0 = 7,5\ m^2$

$A_2 = \frac{0,5 + 0,75}{2} \times 5,0 = 3,13\ m^2$



$Vol = 7,5\ m^2 \times 20,0\ m = 150,0\ m^3$

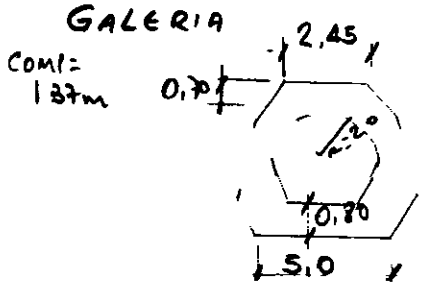
$3,13\ m^2 \times 25,0\ m = 78,25\ m^3$

$228,25\ m^3$

$\times 2$

$total = 450\ m^3$

GALERIA



ÁREA = $18,0\ m^2$

$Vol = 18,0\ m^2 \times 137,0\ m = 2466\ m^3$

TULIPA = 64,50 m² x 20m = 1290 m³

PASSARELA = 130,00 m³

RESUMO

CONCRETO	C/ FORMA	4 330,0 m³
CONCRETO	S/ FORMA	200,0 m³

5 - ANÁLISES DE ESTABILIDADE

5.1 - Metodologia

A estabilidade dos taludes da barragem e de suas fundações foi verificada para a condição de equilíbrio limite, considerando superfícies de ruptura circulares, pelo método de Bishop Simplificado Os cálculos foram efetuados em computador, utilizando o programa GSLOPE 3 32 Nesta fase, considerou-se a seção máxima da barragem, na baixada aluvionar junto à calha do rio (ver desenho AR-BT-3006 - Seções Típicas da Barragem - Seção na Estaca 45 + 0,00)

As análises foram feitas por tensões efetivas, com as poropressões no maciço determinadas segundo o seguinte critério

- Condição de "Final de Construção" - poropressões obtidas a partir de estimativas do valor do parâmetro "r_u",

- Condição de "Regime Permanente e Rebaixamento Rápido" - poropressões obtidas a partir de linhas piezométricas

Na condição de regime permanente considerou-se o nível d'agua no reservatório à cota 95,00 m, correspondente ao máximo operacional, e uma piezométrica no maciço partindo da face do talude de montante nesta cota, com leve inclinação até atingir o filtro vertical de areia Ao longo do tapete de areia até a saída, ao nível do rio, considerou-se um gradiente de 10%

Na condição de rebaixamento rápido manteve-se a mesma piezométrica dentro do maciço, prolongando-se para montante coincidente com a superfície do talude, até a cota da ensecadeira (75,00 m)

Na fundação, as poropressões foram sempre referidas a uma linha piezométrica, para todas as condições de carregamento

Em todas as condições analisadas, considerou-se a ação de um sismo, representada por uma aceleração de 0,05g

5.2 - Fatores de Segurança

Os fatores de segurança mínimos estabelecidos para os estudos de estabilidade são os fornecidos na tabela 5 2 a seguir

Tabela 5.2 - Fatores de Segurança Admitidos

CONDIÇÕES DE CARREGAMENTO	TALUDE	FATOR DE SEGURANÇA
Final de Construção	Montante e Jusante	1,3
Regime Permanente	Jusante	1,5
Rebaixamento Rápido	Montante	1,1

Estas condições haviam sido definidas no relatório RHAR-970515-RE - Critérios de Projeto

5.3 - Parâmetros Geotécnicos

Os parâmetros de resistência ao cisalhamento (ângulo de atrito e coesão) foram obtidos de ensaios triaxiais adensados, não drenados, saturados, com medida de poropressão (CIU_{sat}) e ensaios de cisalhamento direto lento, executados nos materiais de empréstimo e materiais da fundação, cujos resultados foram apresentados no relatório RHAR-970930-RE - rev 1 - Estudos Geológico - Geotécnicos

Para os materiais integrantes da seção analisada, dispõe-se nesta fase de resultados de ensaios no material do maciço compactado e solo residual da fundação, subjacente ao aluvião No primeiro caso, os parâmetros foram obtidos de ensaios de cisalhamento direto lento, enquanto no segundo, a partir de ensaios triaxiais CIU_{sat} realizados em corpos de prova talhados de amostras indeformadas tipo bloco

Os parâmetros dos demais materiais, constituídos pelo filtro/tapete de areia e aluvião, foram estimados No caso da areia do sistema de drenagem, a partir de experiência em obras anteriores e, no caso dos aluviões, a partir da classificação de campo e ensaios SPT

Para análise do talude de montante, foi necessário ter em conta a contribuição física da ensecadeira e do material de enchimento a ser aplicado entre esta e o maciço da barragem Como o controle construtivo nesses materiais de aterro será menos rigoroso que no maciço da barragem, foram considerados parâmetros minorados nestes casos

A tabela 5 3 abaixo resume os valores adotados em cada caso

Tabela 5.3 - Parâmetros Geotécnicos Adotados

MATERIAL	Υ (tf/m^3)	c' (tf/m^2)	ϕ' (°)	r_u	OBSERVAÇÃO
Aterro (Barragem)	2,0	2,0 *	31	0,20	Cis Direto Lento
Aterro (Ensecadeira)	2,0	1,0	28	0,20	Estimado
Aterro (Enchimento)	1,9	0,0	20	0,20	Estimado
Filtro (Areia)	1,8	0,0	30	-	Estimado
Aluvião	1,8	1,5	28	-	Estimado
Solo Residual	1,9	1,4	30	-	Triaxial CIU_{sat}

* minorado nesta fase (valor obtido de ensaio = 5,3 tf/m^2)

5.4 - Resultados Obtidos

Os resultados obtidos nas análises estão apresentados nas listagens de computador apresentadas no final deste item A tabela 4 4 a seguir relaciona os valores dos fatores de segurança referentes às superfícies críticas de escorregamento, ilustradas nas figuras apresentadas ao final de cada listagem de computador

Tabela 5.4 - Fatores de Segurança Obtidos

CONDIÇÕES DE CARREGAMENTO	TALUDE	FATOR DE SEGURANÇA
Final de Construção	Montante	1,54
	Jusante	1,35
Regime Permanente	Jusante	1,51
Rebaixamento Rápido	Montante	1,13

Estes resultados demonstram que o talude de jusante está otimizado dentro dos critérios preconizados em ambas as situações de carregamento a que será submetido No caso do talude de montante, sua inclinação é condicionada pelo rebaixamento rápido do nível d'água do reservatório

DATA FILE NAME..... C:\GSLOPE\ARACO-03.GSL

Job No.	Relatorio de Concepcao
Title	Barragem Aracoiaba
Date	17/11/1997
Label A	Estaca 45 + 0,00
Label B	Talude Mon. - Final Construcao

Max Slice Width	10
No. of Materials	7
Seismic Acceleration	.05
External Forces	0
Piezometric Surfaces	1
Unit Wt. of Pore Fluid	1
No. of Geogrid Layers	0
FoS for Geogrid Pullout	0

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surf.	Ru	Interaction Coefficient
1 Enchimento	1.9	0	20	1	.2	0
2 Ensecadeira	2	1	28	1	.2	0
3 Aterro Compact.	2	2	31	1	.2	0
4 Filtro de Areia	1.8	0	30	1	0	0
5 Aluviao	1.8	1.5	28	1	0	0
6 Solo Residual	1.9	1.4	30	1	0	0
7 Rocha	2.2	100	50	1	0	0

Upper Surface of Material # 1 (Enchimento)

X-Coord	Y-Coord
4	69
20	69
29	75
34	75
63	75
113	95
123	100
130	100
150	90

Upper Surface of Material # 2 (Ensecadeira)

X-Coord	Y-Coord
4	69
20	69
29	75
34	75
43	69
48	69
63	75
113	95
123	100
130	100
150	90

Upper Surface of Material # 3 (Aterro Compact.)

X-Coord	Y-Coord
4	69
20	69
43	69
48	69
63	75
113	95
123	100
130	100
150	90

Upper Surface of Material # 4 (Filtro de Areia)

X-Coord	Y-Coord
4	69
20	69
43	69
48	69
49	67.5
95.5	67.5
99.5	63.5
100.5	62.5
125.5	62.5
126.5	63.5
130.5	67.5
131	95
132	95
132.5	69
150	69

Upper Surface of Material # 5 (Aluviao)

X-Coord	Y-Coord
4	69
20	69
43	69
48	69
49	67.5
95.5	67.5
99.5	63.5
100.5	62.5
125.5	62.5
126.5	63.5
130.5	67.5
150	67.5

Upper Surface of Material # 6 (Solo Residual)

X-Coord	Y-Coord
4	63.5
99.5	63.5
100.5	62.5
125.5	62.5
126.5	63.5
150	63.5

Upper Surface of Material # 7 (Rocha)

X-Coord	Y-Coord
4	62.5
54	62.5
125.5	62.5

150	62.5

Piezometric Surface No. 1

X-Coord	Y-Coord
4	74
27.5	74
43	69
150	69

There are no explicit external forces in the data set.

Geogrid Layer No.	Horizontal Extents X1 <-------> X2	Geogrid Layer Elevation	Strength per unit width

GSLOPE 3.32

LIMIT EQUILIBRIUM SLOPE STABILITY ANALYSIS

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COBA - Lisboa

Results are for Bishop's Modified Method unless otherwise noted.

File C:\GSLOPE\ARACO-03.GSL Output dated 12-01-1997 at 15:55:51

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surf.	Ru	Interaction Coefficient
1 Enchimento	1.9	0	20	1	.2	0
2 Ensecadeira	2	1	28	1	.2	0
3 Aterro Compact.	2	2	31	1	.2	0
4 Filtro de Areia	1.8	0	30	1	0	0
5 Aluviao	1.8	1.5	28	1	0	0
6 Solo Residual	1.9	1.4	30	1	0	0
7 Rocha	2.2	100	50	1	0	0

X-centre	Y-centre	Radius	Factor of Safety	Iterations	Slices	M Alpha Warnings
50.00	110.00	50.00	13.9446	3	15	0
50.00	110.00	52.00	15.1038	3	16	0
50.00	110.00	48.00	9.2127	4	15	0
50.00	110.00	46.00	3.2721	4	12	0
50.00	110.00	44.00	3.8612	4	12	0
		MIN THIS CENTRE	3.272			
52.00	110.00	50.00	13.2593	3	16	0
52.00	110.00	52.00	14.5762	3	18	0
52.00	110.00	48.00	8.8109	4	17	0
52.00	110.00	46.00	3.1054	4	12	0
52.00	110.00	44.00	3.5059	4	12	0
		MIN THIS CENTRE	3.105			
54.00	110.00	50.00	12.5877	3	17	0
54.00	110.00	52.00	13.9374	3	19	0
54.00	110.00	48.00	8.1489	4	17	0
54.00	110.00	46.00	2.9471	4	12	0
54.00	110.00	44.00	3.2118	4	12	0
		MIN THIS CENTRE	2.947			
50.00	112.00	52.00	13.4505	3	16	0
50.00	112.00	54.00	14.5770	3	16	0
50.00	112.00	50.00	8.9939	4	16	0
50.00	112.00	48.00	3.1233	4	12	0
50.00	112.00	46.00	3.6541	4	12	0
		MIN THIS CENTRE	3.123			
52.00	112.00	52.00	12.7999	3	16	0

52.00	112.00	54.00	14.0449	3	19	0
52.00	112.00	50.00	8.4478	4	18	0
52.00	112.00	48.00	2.9771	4	12	0
52.00	112.00	46.00	3.3502	4	12	0
		MIN THIS CENTRE	2.977			

54.00	112.00	52.00	12.1588	3	18	0
54.00	112.00	54.00	13.4431	3	19	0
54.00	112.00	50.00	7.8743	4	17	0
54.00	112.00	48.00	2.8365	4	13	0
54.00	112.00	46.00	3.0912	4	12	0
		MIN THIS CENTRE	2.836			

50.00	114.00	54.00	13.0310	3	16	0
50.00	114.00	56.00	14.1054	3	18	0
50.00	114.00	52.00	8.6332	4	17	0
50.00	114.00	50.00	2.9914	4	12	0
50.00	114.00	48.00	3.4743	4	12	0
		MIN THIS CENTRE	2.991			

52.00	114.00	54.00	12.3726	3	17	0
52.00	114.00	56.00	13.5561	3	19	0
52.00	114.00	52.00	8.1449	4	18	0
52.00	114.00	50.00	2.8634	4	12	0
52.00	114.00	48.00	3.2113	4	12	0
		MIN THIS CENTRE	2.863			

54.00	114.00	54.00	11.7520	3	18	0
54.00	114.00	56.00	12.9769	3	19	0
54.00	114.00	52.00	7.6098	4	18	0
54.00	114.00	50.00	2.7526	4	13	0
54.00	114.00	48.00	2.9809	4	12	0
		MIN THIS CENTRE	2.752			

SF!(9) = 2.752553

56.00	112.00	48.00	2.7231	4	14	0
56.00	112.00	50.00	7.4289	4	19	0
56.00	112.00	46.00	2.8566	4	12	0
		MIN THIS CENTRE	2.723			

56.00	114.00	50.00	2.6456	4	15	0
56.00	114.00	52.00	7.1956	4	19	0
56.00	114.00	48.00	2.7910	4	13	0
		MIN THIS CENTRE	2.645			

52.00	116.00	52.00	2.7669	4	13	0
52.00	116.00	54.00	7.7675	4	17	0
52.00	116.00	50.00	3.0870	4	12	0
		MIN THIS CENTRE	2.766			

54.00	116.00	52.00	2.6718	4	13	0
54.00	116.00	54.00	7.3700	4	19	0
54.00	116.00	50.00	2.8804	4	12	0
		MIN THIS CENTRE	2.671			

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    56.00     116.00     52.00    2.5749     4          16          0
    56.00     116.00     54.00    6.9705     4          19          0
    56.00     116.00     50.00    2.7237     4          13          0
                         MIN THIS CENTRE     2.574

SF!( 9 ) =  2.574889
    58.00     114.00     50.00    2.5133     4          15          0
    58.00     114.00     52.00    6.7652     4          19          0
    58.00     114.00     48.00    2.6122     4          12          0
                         MIN THIS CENTRE     2.513

    58.00     116.00     52.00    2.4563     4          15          0
    58.00     116.00     54.00    6.5504     4          19          0
    58.00     116.00     50.00    2.5622     4          14          0
                         MIN THIS CENTRE     2.456

    54.00     118.00     54.00    2.5961     4          15          0
    54.00     118.00     56.00    7.1413     4          19          0
    54.00     118.00     52.00    2.8057     4          13          0
                         MIN THIS CENTRE     2.596

    56.00     118.00     54.00    2.5063     4          16          0
    56.00     118.00     56.00    6.7532     4          19          0
    56.00     118.00     52.00    2.6565     4          14          0
                         MIN THIS CENTRE     2.506

    58.00     118.00     54.00    2.3998     4          15          0
    58.00     118.00     56.00    6.3453     4          19          0
    58.00     118.00     52.00    2.5140     4          15          0
                         MIN THIS CENTRE     2.399

SF!( 9 ) =  2.399836
    60.00     116.00     52.00    2.3548     4          15          0
    60.00     116.00     54.00    6.1477     4          19          0
    60.00     116.00     50.00    2.4144     4          14          0
                         MIN THIS CENTRE     2.354

    60.00     118.00     54.00    2.3023     4          15          0
    60.00     118.00     56.00    6.0353     4          20          0
    60.00     118.00     52.00    2.3705     4          14          0
                         MIN THIS CENTRE     2.302

    56.00     120.00     56.00    2.4417     4          16          0
    56.00     120.00     58.00    6.5419     4          19          0
    56.00     120.00     54.00    2.5957     4          15          0
                         MIN THIS CENTRE     2.441

    58.00     120.00     56.00    2.3444     4          15          0
    58.00     120.00     58.00    6.1503     4          19          0
    58.00     120.00     54.00    2.4639     4          15          0
                         MIN THIS CENTRE     2.344

    60.00     120.00     56.00    2.2513     4          15          0
    60.00     120.00     58.00    5.8731     4          20          0
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    60.00     120.00      54.00    2.3278     4          14          0
                          MIN THIS CENTRE   2.251


SF!( 9 ) =  2.251319
    62.00     118.00      54.00    2.1973     4          14          0
    62.00     118.00      56.00    5.6921     4          20          0
    62.00     118.00      52.00    2.1797     4          18          0
    62.00     118.00      50.00    2.0993     4          13          0
    62.00     118.00      48.00    2.0780     4          13          0
    62.00     118.00      46.00    2.0523     4          10          0
    62.00     118.00      44.00    2.1604     5           7          0
                          MIN THIS CENTRE   2.052


    62.00     120.00      56.00    2.1852     4          16          0
    62.00     120.00      58.00    5.5727     4          20          0
    62.00     120.00      54.00    2.1551     4          18          0
    62.00     120.00      52.00    2.0673     4          13          0
    62.00     120.00      50.00    2.0498     4          13          0
    62.00     120.00      48.00    2.0246     4          10          0
    62.00     120.00      46.00    2.1164     5           7          0
                          MIN THIS CENTRE   2.024


    58.00     122.00      58.00    2.2904     4          15          0
    58.00     122.00      60.00    6.0438     4          20          0
    58.00     122.00      56.00    2.4137     4          15          0
                          MIN THIS CENTRE   2.290


    60.00     122.00      58.00    2.2256     4          16          0
    60.00     122.00      60.00    5.7296     4          21          0
    60.00     122.00      56.00    2.2845     4          14          0
                          MIN THIS CENTRE   2.225


    62.00     122.00      58.00    2.1503     4          17          0
    62.00     122.00      60.00    5.4480     4          20          0
    62.00     122.00      56.00    2.1283     4          18          0
    62.00     122.00      54.00    2.0353     4          13          0
    62.00     122.00      52.00    2.0213     4          13          0
    62.00     122.00      50.00    1.9985     4          11          0
    62.00     122.00      48.00    2.0818     5           8          0
                          MIN THIS CENTRE   1.998


SF!( 9 ) =  1.998502
    64.00     120.00      48.00    1.9233     4          12          0
    64.00     120.00      50.00    1.9540     4          13          0
    64.00     120.00      46.00    1.9800     5           7          0
                          MIN THIS CENTRE   1.923


    64.00     122.00      50.00    1.9011     4          12          0
    64.00     122.00      52.00    1.9256     4          13          0
    64.00     122.00      48.00    1.9545     4           7          0
                          MIN THIS CENTRE   1.901


    60.00     124.00      52.00    2.0988     4          11          0
    60.00     124.00      54.00    2.1057     4          13          0
    60.00     124.00      50.00    2.2377     5           7          0
                          MIN THIS CENTRE   2.098
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62.00	124.00	52.00	1.9743	4	12	0
62.00	124.00	54.00	1.9926	4	13	0
62.00	124.00	50.00	2.0539	5	8	0
		MIN THIS CENTRE		1.974		
64.00	124.00	52.00	1.8781	4	12	0
64.00	124.00	54.00	1.8972	4	13	0
64.00	124.00	50.00	1.9324	4	9	0
		MIN THIS CENTRE		1.878		

SF!(9) = 1.878069

66.00	122.00	50.00	1.8209	4	11	0
66.00	122.00	52.00	1.8420	4	12	0
66.00	122.00	48.00	1.8636	4	9	0
		MIN THIS CENTRE		1.820		
66.00	124.00	52.00	1.7973	4	11	0
66.00	124.00	54.00	1.8390	4	13	0
66.00	124.00	50.00	1.8431	4	9	0
		MIN THIS CENTRE		1.797		
62.00	126.00	54.00	1.9499	4	12	0
62.00	126.00	56.00	1.9637	4	13	0
62.00	126.00	52.00	2.0242	5	8	0
		MIN THIS CENTRE		1.949		
64.00	126.00	54.00	1.8543	4	12	0
64.00	126.00	56.00	1.8690	4	13	0
64.00	126.00	52.00	1.9102	4	10	0
		MIN THIS CENTRE		1.854		
66.00	126.00	54.00	1.7733	4	11	0
66.00	126.00	56.00	1.8180	4	14	0
66.00	126.00	52.00	1.8214	4	9	0
		MIN THIS CENTRE		1.773		

SF!(9) = 1.773333

68.00	124.00	52.00	1.7259	4	10	0
68.00	124.00	54.00	1.7813	4	14	0
68.00	124.00	50.00	1.7713	4	9	0
		MIN THIS CENTRE		1.725		
68.00	126.00	54.00	1.7311	4	11	0
68.00	126.00	56.00	1.7662	4	14	0
68.00	126.00	52.00	1.7481	4	9	0
		MIN THIS CENTRE		1.731		
64.00	128.00	56.00	1.8301	4	12	0
64.00	128.00	58.00	1.8643	4	14	0
64.00	128.00	54.00	1.8873	4	10	0
		MIN THIS CENTRE		1.830		

66.00	128.00	56.00	1.7493	4	12	0
66.00	128.00	58.00	1.8012	4	15	0
66.00	128.00	54.00	1.7987	4	9	0
		MIN THIS CENTRE	1.749			
68.00	128.00	56.00	1.7156	4	12	0
68.00	128.00	58.00	1.7491	4	14	0
68.00	128.00	54.00	1.7245	4	9	0
		MIN THIS CENTRE	1.715			

SF!(9) = 1.715594

70.00	126.00	54.00	1.6919	4	12	0
70.00	126.00	56.00	1.7195	4	14	0
70.00	126.00	52.00	1.7142	4	10	0
		MIN THIS CENTRE	1.691			
70.00	128.00	56.00	1.6779	4	12	0
70.00	128.00	58.00	1.6991	4	14	0
70.00	128.00	54.00	1.6967	4	10	0
		MIN THIS CENTRE	1.677			
66.00	130.00	58.00	1.7520	4	13	0
66.00	130.00	60.00	1.7848	4	15	0
66.00	130.00	56.00	1.7754	4	9	0
		MIN THIS CENTRE	1.752			
68.00	130.00	58.00	1.7037	4	12	0
68.00	130.00	60.00	1.7303	4	14	0
68.00	130.00	56.00	1.7264	4	10	0
		MIN THIS CENTRE	1.703			
70.00	130.00	58.00	1.6619	4	12	0
70.00	130.00	60.00	1.6775	4	14	0
70.00	130.00	56.00	1.6846	4	11	0
		MIN THIS CENTRE	1.661			

SF!(9) = 1.661876

72.00	128.00	56.00	1.6412	4	12	0
72.00	128.00	58.00	1.6515	4	13	0
72.00	128.00	54.00	1.6700	4	11	0
		MIN THIS CENTRE	1.641			
72.00	130.00	58.00	1.6211	4	12	0
72.00	130.00	60.00	1.6476	4	15	0
72.00	130.00	56.00	1.6542	4	11	0
		MIN THIS CENTRE	1.621			
68.00	132.00	60.00	1.6898	4	12	0
68.00	132.00	62.00	1.7100	4	14	0
68.00	132.00	58.00	1.7092	4	10	0
		MIN THIS CENTRE	1.689			
70.00	132.00	60.00	1.6440	4	12	0
70.00	132.00	62.00	1.6685	4	16	0

70.00	132.00	58.00	1.6720	4	11	0
		MIN THIS CENTRE		1.644		
72.00	132.00	60.00	1.6000	4	12	0
72.00	132.00	62.00	1.6336	4	16	0
72.00	132.00	58.00	1.6363	4	11	0
		MIN THIS CENTRE		1.599		

SF!(9) = 1.599998

74.00	130.00	58.00	1.5990	4	13	0
74.00	130.00	60.00	1.6232	4	15	0
74.00	130.00	56.00	1.6215	4	9	0
		MIN THIS CENTRE		1.599		
74.00	132.00	60.00	1.5849	4	13	0
74.00	132.00	62.00	1.6147	4	16	0
74.00	132.00	58.00	1.5992	4	9	0
		MIN THIS CENTRE		1.584		
70.00	134.00	62.00	1.6247	4	12	0
70.00	134.00	64.00	1.6519	4	16	0
70.00	134.00	60.00	1.6570	4	11	0
		MIN THIS CENTRE		1.624		
72.00	134.00	62.00	1.5959	4	14	0
72.00	134.00	64.00	1.6230	4	17	0
72.00	134.00	60.00	1.6165	4	11	0
		MIN THIS CENTRE		1.595		
74.00	134.00	62.00	1.5741	4	14	0
74.00	134.00	64.00	1.6087	4	16	0
74.00	134.00	60.00	1.5927	4	11	0
		MIN THIS CENTRE		1.574		

SF!(9) = 1.574105

76.00	132.00	60.00	1.5738	4	15	0
76.00	132.00	62.00	1.6082	4	16	0
76.00	132.00	58.00	1.5862	4	11	0
		MIN THIS CENTRE		1.573		
76.00	134.00	62.00	1.5677	4	15	0
76.00	134.00	64.00	1.6047	4	17	0
76.00	134.00	60.00	1.5731	4	11	0
		MIN THIS CENTRE		1.567		
72.00	136.00	64.00	1.5825	4	14	0
72.00	136.00	66.00	1.6152	4	18	0
72.00	136.00	62.00	1.5955	4	11	0
		MIN THIS CENTRE		1.582		
74.00	136.00	64.00	1.5665	4	15	0
74.00	136.00	66.00	1.6045	4	17	0
74.00	136.00	62.00	1.5767	4	13	0
		MIN THIS CENTRE		1.566		

76.00	136.00	64.00	1.5637	4	15	0
76.00	136.00	66.00	1.6034	4	18	0
76.00	136.00	62.00	1.5638	4	12	0
		MIN THIS CENTRE	1.563			

SF!(9) = 1.563717

78.00	134.00	62.00	1.5731	4	15	0
78.00	134.00	64.00	1.6126	4	19	0
78.00	134.00	60.00	1.5697	4	13	0
78.00	134.00	58.00	1.6059	4	10	0
		MIN THIS CENTRE	1.569			

78.00	136.00	64.00	1.5713	4	17	0
78.00	136.00	66.00	1.6156	4	20	0
78.00	136.00	62.00	1.5649	4	13	0
78.00	136.00	60.00	1.5939	4	11	0
		MIN THIS CENTRE	1.564			

74.00	138.00	66.00	1.5613	4	15	0
74.00	138.00	68.00	1.6016	4	18	0
74.00	138.00	64.00	1.5644	4	13	0
		MIN THIS CENTRE	1.561			

76.00	138.00	66.00	1.5614	4	15	0
76.00	138.00	68.00	1.6049	4	19	0
76.00	138.00	64.00	1.5574	4	13	0
76.00	138.00	62.00	1.6030	4	10	0
		MIN THIS CENTRE	1.557			

78.00	138.00	66.00	1.5724	4	18	0
78.00	138.00	68.00	1.6208	4	21	0
78.00	138.00	64.00	1.5620	4	13	0
78.00	138.00	62.00	1.5856	4	12	0
		MIN THIS CENTRE	1.562			

SF!(8) = 1.557416

74.00	140.00	66.00	1.5556	4	14	0
74.00	140.00	68.00	1.5580	4	15	0
74.00	140.00	64.00	1.6227	4	10	0
		MIN THIS CENTRE	1.555			

76.00	140.00	66.00	1.5532	4	13	0
76.00	140.00	68.00	1.5605	4	17	0
76.00	140.00	64.00	1.5910	4	11	0
		MIN THIS CENTRE	1.553			

78.00	140.00	66.00	1.5605	4	14	0
78.00	140.00	68.00	1.5758	4	19	0
78.00	140.00	64.00	1.5801	4	12	0
		MIN THIS CENTRE	1.560			

SF!(8) = 1.553224

74.00	142.00	68.00	1.5494	4	15	0

74.00	142.00	70.00	1.5562	4	16	0
74.00	142.00	66.00	1.6060	4	10	0
		MIN THIS CENTRE		1.549		
76.00	142.00	68.00	1.5508	4	13	0
76.00	142.00	70.00	1.5621	4	18	0
76.00	142.00	66.00	1.5826	4	12	0
		MIN THIS CENTRE		1.550		
78.00	142.00	68.00	1.5611	4	16	0
78.00	142.00	70.00	1.5813	4	20	0
78.00	142.00	66.00	1.5768	4	12	0
		MIN THIS CENTRE		1.561		

SF!(7) = 1.549431

72.00	140.00	66.00	1.5731	4	13	0
72.00	140.00	68.00	1.5653	4	16	0
72.00	140.00	70.00	1.6058	4	18	0
		MIN THIS CENTRE		1.565		
72.00	142.00	68.00	1.5611	4	13	0
72.00	142.00	70.00	1.5603	4	16	0
72.00	142.00	72.00	1.6032	4	19	0
		MIN THIS CENTRE		1.560		
72.00	144.00	70.00	1.5524	4	14	0
72.00	144.00	72.00	1.5571	4	16	0
72.00	144.00	68.00	1.6329	4	10	0
		MIN THIS CENTRE		1.552		
74.00	144.00	70.00	1.5454	4	15	0
74.00	144.00	72.00	1.5554	4	18	0
74.00	144.00	68.00	1.5935	4	11	0
		MIN THIS CENTRE		1.545		
76.00	144.00	70.00	1.5496	4	14	0
76.00	144.00	72.00	1.5659	4	19	0
76.00	144.00	68.00	1.5769	4	12	0
		MIN THIS CENTRE		1.549		

SF!(8) = 1.545435

72.00	146.00	72.00	1.5464	4	15	0
72.00	146.00	74.00	1.5554	4	16	0
72.00	146.00	70.00	1.6150	4	10	0
		MIN THIS CENTRE		1.546		
74.00	146.00	72.00	1.5432	4	15	0
74.00	146.00	74.00	1.5571	4	19	0
74.00	146.00	70.00	1.5844	4	12	0
		MIN THIS CENTRE		1.543		
76.00	146.00	72.00	1.5502	4	15	0
76.00	146.00	74.00	1.5715	4	20	0
76.00	146.00	70.00	1.5734	4	12	0

MIN THIS CENTRE 1.550

SF!(8) = 1.543162

72.00	148.00	74.00	1.5423	4	15	0
72.00	148.00	76.00	1.5547	4	18	0
72.00	148.00	72.00	1.6012	4	11	0

MIN THIS CENTRE 1.542

74.00	148.00	74.00	1.5420	4	16	0
74.00	148.00	76.00	1.5607	4	20	0
74.00	148.00	72.00	1.5781	4	12	0

MIN THIS CENTRE 1.541

76.00	148.00	74.00	1.5531	4	16	0
76.00	148.00	76.00	1.5786	4	20	0
76.00	148.00	72.00	1.5716	4	12	0

MIN THIS CENTRE 1.553

SF!(8) = 1.541995

72.00	150.00	76.00	1.5400	4	15	0
72.00	150.00	78.00	1.5561	4	19	0
72.00	150.00	74.00	1.5910	4	12	0

MIN THIS CENTRE 1.540

74.00	150.00	76.00	1.5423	4	17	0
74.00	150.00	78.00	1.5660	4	21	0
74.00	150.00	74.00	1.5740	4	12	0

MIN THIS CENTRE 1.542

76.00	150.00	76.00	1.5578	4	17	0
76.00	150.00	78.00	1.5863	4	22	0
76.00	150.00	74.00	1.5707	4	13	0

MIN THIS CENTRE 1.557

SF!(7) = 1.540002

70.00	148.00	74.00	1.5554	4	14	0
70.00	148.00	76.00	1.5614	4	17	0
70.00	148.00	72.00	1.6502	4	10	0

MIN THIS CENTRE 1.555

70.00	150.00	76.00	1.5489	4	15	0
70.00	150.00	78.00	1.5594	4	17	0
70.00	150.00	74.00	1.6302	4	10	0

MIN THIS CENTRE 1.548

70.00	152.00	78.00	1.5444	4	15	0
70.00	152.00	80.00	1.5583	4	19	0
70.00	152.00	76.00	1.6145	4	10	0

MIN THIS CENTRE 1.544

72.00	152.00	78.00	1.5389	4	16	0
72.00	152.00	80.00	1.5594	4	19	0
72.00	152.00	76.00	1.5837	4	12	0

MIN THIS CENTRE 1.538

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    74.00     152.00      78.00    1.5448     4          18          0
    74.00     152.00      80.00    1.5728     4          21          0
    74.00     152.00      76.00    1.5717     4          12          0
                          MIN THIS CENTRE   1.544


SF!( 8 ) =  1.538873
    70.00     154.00      80.00    1.5416     4          15          0
    70.00     154.00      82.00    1.5591     4          20          0
    70.00     154.00      78.00    1.6027     4          11          0
                          MIN THIS CENTRE   1.541


    72.00     154.00      80.00    1.5387     4          17          0
    72.00     154.00      82.00    1.5643     4          21          0
    72.00     154.00      78.00    1.5786     4          12          0
                          MIN THIS CENTRE   1.538


    74.00     154.00      80.00    1.5490     4          19          0
    74.00     154.00      82.00    1.5807     4          21          0
    74.00     154.00      78.00    1.5704     4          13          0
                          MIN THIS CENTRE   1.549

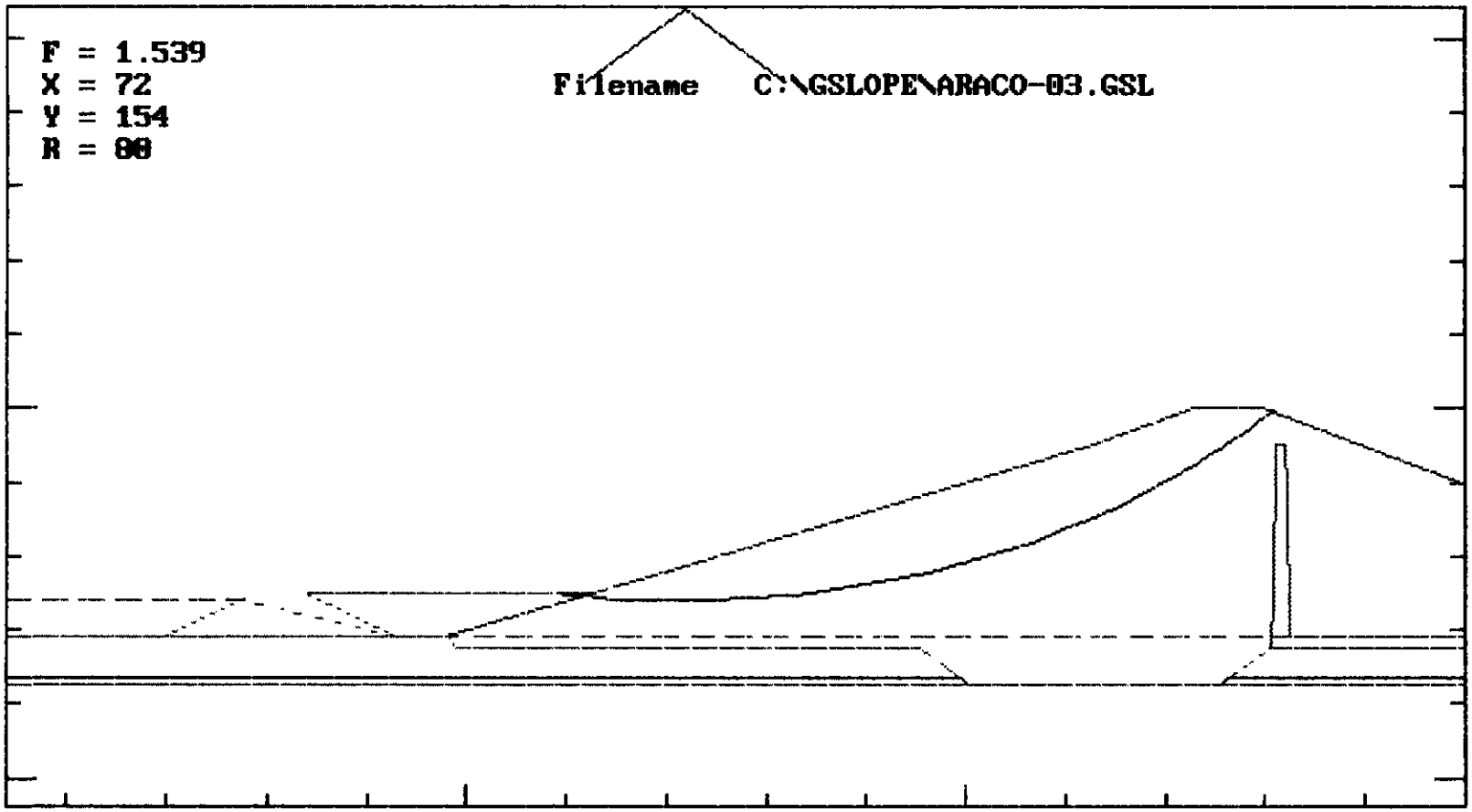

SF!( 8 ) =  1.538673
    70.00     156.00      82.00    1.5402     4          15          0
    70.00     156.00      84.00    1.5618     4          21          0
    70.00     156.00      80.00    1.5938     4          12          0
                          MIN THIS CENTRE   1.540


    72.00     156.00      82.00    1.5405     4          18          0
    72.00     156.00      84.00    1.5706     4          21          0
    72.00     156.00      80.00    1.5754     4          12          0
                          MIN THIS CENTRE   1.540


    74.00     156.00      82.00    1.5548     4          20          0
    74.00     156.00      84.00    1.5881     4          23          0
    74.00     156.00      80.00    1.5703     4          14          0
                          MIN THIS CENTRE   1.554


SF!( 5 ) =  1.538673

Minimum Bishop Factor of Safety this run:
    72.00     154.00      80.00    1.5387     4          17          0
```


F = 1.539
X = 72
Y = 154
R = 80
Filename C:\GSLOPE\ARACO-03.GSL

DATA FILE NAME..... C:\GSLOPE\ARACO-01.GSL

Job No.	Relatorio de Concepcao
Title	Barragem Aracoiaba
Date	14/11/1997
Label A	Estaca 45 + 0,00
Label B	Talude Jus. - Final Construcao

Max Slice Width	10
No. of Materials	6
Seismic Acceleration	.05
External Forces	0
Piezometric Surfaces	1
Unit Wt. of Pore Fluid	1
No. of Geogrid Layers	0
FoS for Geogrid Pullout	0

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surf.	Ru	Interaction Coefficient
1 Enrocamento	2.1	0	38	1	0	0
2 Aterro Compact.	2	2	31	1	.2	0
3 Filtro de Areia	1.8	0	30	1	0	0
4 Aluviao	1.8	1.5	28	1	0	0
5 Solo Residual	1.9	1.4	30	1	0	0
6 Rocha	2.2	100	50	1	0	0

Upper Surface of Material # 1 (Enrocamento)

X-Coord	Y-Coord
0	91.4
9	95
19	100
26	100
46	90
49	90
69	80
72	80
92	70
97	70
101	68
115	68
130	68

Upper Surface of Material # 2 (Aterro Compact.)

X-Coord	Y-Coord
0	91.4
9	95
19	100
26	100
46	90
49	90
69	80
72	80
92	70

94	69
97	67.5
105.5	63.5
110.5	63.5
115	68
130	68

Upper Surface of Material # 3 (Filtro de Areia)

X-Coord	Y-Coord
0	63.5
22.5	63.5
26.5	67.5
27	95
28	95
28.5	69
94	69
97	67.5
105.5	63.5
110.5	63.5
115	68
130	68

Upper Surface of Material # 4 (Aluviao)

X-Coord	Y-Coord
0	63.5
22.5	63.5
26.5	67.5
97	67.5
105.5	63.5
110.5	63.5
130	63.5

Upper Surface of Material # 5 (Solo Residual)

X-Coord	Y-Coord
0	63.5
22.5	63.5
105.5	63.5
110.5	63.5
130	63.5

Upper Surface of Material # 6 (Rocha)

X-Coord	Y-Coord
0	62.5
22	62.5
130	62.5

Piezometric Surface No. 1

X-Coord	Y-Coord
0	68
130	68

There are no explicit external forces in the data set.

Geogrid Layer No.	Horizontal Extents X1 <-------> X2	Geogrid Layer Elevation	Strength per unit width

GSLOPE 3.32

LIMIT EQUILIBRIUM SLOPE STABILITY ANALYSIS

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COBA - Lisboa

Results are for Bishop's Modified Method unless otherwise noted.

File C:\GSLOPE\ARACO-01.GSL Output dated 12-02-1997 at 09:42:47

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surf.	Ru	Interaction Coefficient
1 Enrocamento	2.1	0	38	1	0	0
2 Aterro Compact.	2	2	31	1	.2	0
3 Filtro de Areia	1.8	0	30	1	0	0
4 Aluviao	1.8	1.5	28	1	0	0
5 Solo Residual	1.9	1.4	30	1	0	0
6 Rocha	2.2	100	50	1	0	0

X-centre	Y-centre	Radius	Factor of Safety	Iterations	Slices	M Alpha Warnings
50.00	110.00	50.00	7.5411	3	24	0
50.00	110.00	52.00	8.9726	3	25	0
50.00	110.00	48.00	4.8560	4	23	0
50.00	110.00	46.00	2.4092	4	23	0
50.00	110.00	44.00	2.3334	4	22	0
50.00	110.00	42.00	2.2390	4	19	0
50.00	110.00	40.00	2.0874	4	18	0
50.00	110.00	38.00	2.0059	4	18	0
50.00	110.00	36.00	1.9215	4	17	0
50.00	110.00	34.00	1.8853	4	15	0
50.00	110.00	32.00	1.8297	4	14	0
50.00	110.00	30.00	1.7836	4	14	0
50.00	110.00	28.00	1.7587	4	12	0
50.00	110.00	26.00	1.8471	4	8	0
		MIN THIS CENTRE	1.758			
52.00	110.00	50.00	7.2247	3	23	0
52.00	110.00	52.00	8.5896	3	25	0
52.00	110.00	48.00	4.6395	4	24	0
52.00	110.00	46.00	2.2663	4	24	0
52.00	110.00	44.00	2.1962	4	20	0
52.00	110.00	42.00	2.1291	4	19	0
52.00	110.00	40.00	1.9944	4	18	0
52.00	110.00	38.00	1.9201	4	18	0
52.00	110.00	36.00	1.8485	4	17	0
52.00	110.00	34.00	1.8156	4	14	0
52.00	110.00	32.00	1.7693	4	14	0
52.00	110.00	30.00	1.7383	4	12	0
52.00	110.00	28.00	1.7479	4	10	0
		MIN THIS CENTRE	1.738			
54.00	110.00	50.00	6.9327	3	25	0

54.00	110.00	52.00	8.2534	3	25	0
54.00	110.00	48.00	4.4420	4	27	0
54.00	110.00	46.00	2.1287	4	21	0
54.00	110.00	44.00	2.1024	4	20	0
54.00	110.00	42.00	2.0375	4	19	0
54.00	110.00	40.00	1.9152	4	18	0
54.00	110.00	38.00	1.8490	4	18	0
54.00	110.00	36.00	1.7903	4	17	0
54.00	110.00	34.00	1.7295	4	16	0
54.00	110.00	32.00	1.7242	4	12	0
54.00	110.00	30.00	1.7193	4	10	0
54.00	110.00	28.00	1.7368	4	6	0
		MIN THIS CENTRE		1.719		

50.00	112.00	52.00	7.5569	3	24	0
50.00	112.00	54.00	8.9861	3	25	0
50.00	112.00	50.00	4.8612	4	23	0
50.00	112.00	48.00	2.4117	4	23	0
50.00	112.00	46.00	2.3381	4	22	0
50.00	112.00	44.00	2.2321	4	19	0
50.00	112.00	42.00	2.0827	4	18	0
50.00	112.00	40.00	2.0014	4	18	0
50.00	112.00	38.00	1.9163	4	17	0
50.00	112.00	36.00	1.8733	4	15	0
50.00	112.00	34.00	1.8126	4	15	0
50.00	112.00	32.00	1.7679	4	14	0
50.00	112.00	30.00	1.7360	4	12	0
50.00	112.00	28.00	1.8045	4	11	0
		MIN THIS CENTRE		1.735		

52.00	112.00	52.00	7.2407	3	23	0
52.00	112.00	54.00	8.6024	3	25	0
52.00	112.00	50.00	4.6375	4	25	0
52.00	112.00	48.00	2.2647	4	24	0
52.00	112.00	46.00	2.1900	4	20	0
52.00	112.00	44.00	2.1217	4	19	0
52.00	112.00	42.00	1.9875	4	18	0
52.00	112.00	40.00	1.9125	4	18	0
52.00	112.00	38.00	1.8396	4	18	0
52.00	112.00	36.00	1.7971	4	15	0
52.00	112.00	34.00	1.7514	4	14	0
52.00	112.00	32.00	1.7154	4	13	0
52.00	112.00	30.00	1.7120	4	12	0
52.00	112.00	28.00	1.7753	5	8	0
		MIN THIS CENTRE		1.712		

54.00	112.00	52.00	6.9429	3	25	0
54.00	112.00	54.00	8.2644	3	25	0
54.00	112.00	50.00	4.4493	4	25	0
54.00	112.00	48.00	2.1187	4	21	0
54.00	112.00	46.00	2.0944	4	20	0
54.00	112.00	44.00	2.0285	4	19	0
54.00	112.00	42.00	1.9056	4	18	0
54.00	112.00	40.00	1.8375	4	18	0
54.00	112.00	38.00	1.7749	4	18	0
54.00	112.00	36.00	1.7152	4	16	0
54.00	112.00	34.00	1.7009	4	13	0
54.00	112.00	32.00	1.6845	4	12	0
54.00	112.00	30.00	1.7180	4	8	0
		MIN THIS CENTRE		1.684		

50.00	114.00	54.00	7.5814	3	24	0
50.00	114.00	56.00	9.0407	3	26	0
50.00	114.00	52.00	4.8723	4	23	0
50.00	114.00	50.00	2.4156	4	21	0
50.00	114.00	48.00	2.3458	4	22	0
50.00	114.00	46.00	2.2639	4	21	0
50.00	114.00	44.00	2.0833	4	18	0
50.00	114.00	42.00	2.0025	4	18	0
50.00	114.00	40.00	1.9183	4	17	0
50.00	114.00	38.00	1.8695	4	15	0
50.00	114.00	36.00	1.8059	4	15	0
50.00	114.00	34.00	1.7568	4	14	0
50.00	114.00	32.00	1.7268	4	14	0
50.00	114.00	30.00	1.7708	4	11	0
		MIN THIS CENTRE	1.726			

52.00	114.00	54.00	7.2637	3	24	0
52.00	114.00	56.00	8.6246	3	25	0
52.00	114.00	52.00	4.6484	4	25	0
52.00	114.00	50.00	2.2665	4	24	0
52.00	114.00	48.00	2.2187	4	22	0
52.00	114.00	46.00	2.1196	4	19	0
52.00	114.00	44.00	1.9862	4	18	0
52.00	114.00	42.00	1.9110	4	18	0
52.00	114.00	40.00	1.8373	4	18	0
52.00	114.00	38.00	1.7883	4	15	0
52.00	114.00	36.00	1.7382	4	15	0
52.00	114.00	34.00	1.7039	4	14	0
52.00	114.00	32.00	1.6906	4	12	0
52.00	114.00	30.00	1.7470	4	10	0
		MIN THIS CENTRE	1.690			

54.00	114.00	54.00	6.9612	3	24	0
54.00	114.00	56.00	8.2853	3	25	0
54.00	114.00	52.00	4.4596	4	25	0
54.00	114.00	50.00	2.1396	4	24	0
54.00	114.00	48.00	2.0913	4	20	0
54.00	114.00	46.00	2.0250	4	19	0
54.00	114.00	44.00	1.9018	4	18	0
54.00	114.00	42.00	1.8327	4	18	0
54.00	114.00	40.00	1.7678	4	18	0
54.00	114.00	38.00	1.7056	4	17	0
54.00	114.00	36.00	1.6875	4	14	0
54.00	114.00	34.00	1.6651	4	12	0
54.00	114.00	32.00	1.6906	4	10	0
		MIN THIS CENTRE	1.665			

SF!(9) = 1.665084

56.00	112.00	32.00	1.6810	4	9	0
56.00	112.00	34.00	1.6677	4	12	0
56.00	112.00	36.00	1.6787	4	16	0
		MIN THIS CENTRE	1.667			

56.00	114.00	34.00	1.6530	4	12	0
56.00	114.00	36.00	1.6478	4	12	0
56.00	114.00	38.00	1.6673	4	17	0
		MIN THIS CENTRE	1.647			

52.00	116.00	36.00	1.6966	4	14	0
52.00	116.00	38.00	1.7326	4	15	0
52.00	116.00	34.00	1.6792	4	13	0
52.00	116.00	32.00	1.7195	4	12	0
		MIN THIS CENTRE		1.679		
54.00	116.00	36.00	1.6535	4	14	0
54.00	116.00	38.00	1.6782	4	14	0
54.00	116.00	34.00	1.6629	4	12	0
		MIN THIS CENTRE		1.653		
56.00	116.00	36.00	1.6287	4	12	0
56.00	116.00	38.00	1.6357	4	14	0
56.00	116.00	34.00	1.6838	4	9	0
		MIN THIS CENTRE		1.628		

SF!(9) = 1.628724

58.00	114.00	34.00	1.6559	4	7	0
58.00	114.00	36.00	1.6043	4	14	0
58.00	114.00	38.00	1.6338	4	15	0
		MIN THIS CENTRE		1.604		
58.00	116.00	36.00	1.6345	4	10	0
58.00	116.00	38.00	1.5888	4	14	0
58.00	116.00	40.00	1.6237	4	17	0
		MIN THIS CENTRE		1.588		
54.00	118.00	38.00	1.6481	4	14	0
54.00	118.00	40.00	1.6728	4	15	0
54.00	118.00	36.00	1.6476	4	12	0
54.00	118.00	34.00	1.7292	4	10	0
		MIN THIS CENTRE		1.647		
56.00	118.00	38.00	1.6157	4	12	0
56.00	118.00	40.00	1.6287	4	14	0
56.00	118.00	36.00	1.6578	4	10	0
		MIN THIS CENTRE		1.615		
58.00	118.00	38.00	1.6108	4	12	0
58.00	118.00	40.00	1.5803	4	15	0
58.00	118.00	42.00	1.6173	4	17	0
		MIN THIS CENTRE		1.580		

SF!(9) = 1.580251

60.00	116.00	38.00	1.6002	4	13	0
60.00	116.00	40.00	1.5993	4	15	0
60.00	116.00	42.00	1.6261	4	17	0
		MIN THIS CENTRE		1.599		
60.00	118.00	40.00	1.5791	4	15	0
60.00	118.00	42.00	1.5884	4	16	0
60.00	118.00	38.00	1.6269	4	8	0
		MIN THIS CENTRE		1.579		

56.00	120.00	42.00	1.6246	4	14	0
56.00	120.00	44.00	1.6563	4	18	0
56.00	120.00	40.00	1.6105	4	14	0
56.00	120.00	38.00	1.6350	4	12	0
		MIN THIS CENTRE	1.610			
58.00	120.00	42.00	1.5778	4	16	0
58.00	120.00	44.00	1.6135	4	18	0
58.00	120.00	40.00	1.5918	4	12	0
		MIN THIS CENTRE	1.577			
60.00	120.00	42.00	1.5668	4	15	0
60.00	120.00	44.00	1.5828	4	17	0
60.00	120.00	40.00	1.6053	4	10	0
		MIN THIS CENTRE	1.566			

SF!(9) = 1.566847

62.00	118.00	40.00	1.5934	4	12	0
62.00	118.00	42.00	1.5731	4	15	0
62.00	118.00	44.00	1.5889	4	17	0
		MIN THIS CENTRE	1.573			
62.00	120.00	42.00	1.5745	4	13	0
62.00	120.00	44.00	1.5617	4	15	0
62.00	120.00	46.00	1.5818	4	17	0
		MIN THIS CENTRE	1.561			
58.00	122.00	44.00	1.5781	4	16	0
58.00	122.00	46.00	1.6135	4	18	0
58.00	122.00	42.00	1.5834	4	13	0
		MIN THIS CENTRE	1.578			
60.00	122.00	44.00	1.5608	4	17	0
60.00	122.00	46.00	1.5796	4	17	0
60.00	122.00	42.00	1.5856	4	12	0
		MIN THIS CENTRE	1.560			
62.00	122.00	44.00	1.5562	4	15	0
62.00	122.00	46.00	1.5552	4	17	0
62.00	122.00	48.00	1.5771	4	17	0
		MIN THIS CENTRE	1.555			

SF!(9) = 1.555244

64.00	120.00	44.00	1.5597	4	15	0
64.00	120.00	46.00	1.5591	4	15	0
64.00	120.00	48.00	1.5839	4	17	0
		MIN THIS CENTRE	1.559			
64.00	122.00	46.00	1.5434	4	15	0
64.00	122.00	48.00	1.5521	4	17	0
64.00	122.00	44.00	1.5776	4	13	0
		MIN THIS CENTRE	1.543			
60.00	124.00	48.00	1.5785	4	18	0

60.00	124.00	50.00	1.6139	4	18	0
60.00	124.00	46.00	1.5589	4	17	0
60.00	124.00	44.00	1.5686	4	12	0
		MIN THIS CENTRE		1.558		
62.00	124.00	48.00	1.5521	4	17	0
62.00	124.00	50.00	1.5748	4	18	0
62.00	124.00	46.00	1.5462	4	15	0
62.00	124.00	44.00	1.5905	4	10	0
		MIN THIS CENTRE		1.546		
64.00	124.00	48.00	1.5348	4	16	0
64.00	124.00	50.00	1.5478	4	17	0
64.00	124.00	46.00	1.5594	4	13	0
		MIN THIS CENTRE		1.534		

SF!(9) = 1.534821

66.00	122.00	46.00	1.5539	4	13	0
66.00	122.00	48.00	1.5371	4	15	0
66.00	122.00	50.00	1.5405	4	18	0
		MIN THIS CENTRE		1.537		
66.00	124.00	48.00	1.5367	4	15	0
66.00	124.00	50.00	1.5286	4	16	0
66.00	124.00	52.00	1.5357	4	18	0
		MIN THIS CENTRE		1.528		
62.00	126.00	50.00	1.5510	4	17	0
62.00	126.00	52.00	1.5763	4	18	0
62.00	126.00	48.00	1.5422	4	17	0
62.00	126.00	46.00	1.5736	4	10	0
		MIN THIS CENTRE		1.542		
64.00	126.00	50.00	1.5308	4	17	0
64.00	126.00	52.00	1.5454	4	18	0
64.00	126.00	48.00	1.5430	4	15	0
		MIN THIS CENTRE		1.530		
66.00	126.00	50.00	1.5227	4	15	0
66.00	126.00	52.00	1.5240	4	17	0
66.00	126.00	48.00	1.5706	4	13	0
		MIN THIS CENTRE		1.522		

SF!(9) = 1.522743

68.00	124.00	48.00	1.5549	4	11	0
68.00	124.00	50.00	1.5227	4	15	0
68.00	124.00	52.00	1.5132	4	18	0
68.00	124.00	54.00	1.5297	4	18	0
		MIN THIS CENTRE		1.513		
68.00	126.00	50.00	1.5378	4	13	0
68.00	126.00	52.00	1.5119	4	15	0
68.00	126.00	54.00	1.5085	4	18	0
68.00	126.00	56.00	1.5259	4	19	0
		MIN THIS CENTRE		1.508		

64.00	128.00	52.00	1.5292	4	17	0
64.00	128.00	54.00	1.5453	4	18	0
64.00	128.00	50.00	1.5335	4	15	0
		MIN THIS CENTRE		1.529		
66.00	128.00	52.00	1.5161	4	16	0
66.00	128.00	54.00	1.5215	4	17	0
66.00	128.00	50.00	1.5531	4	13	0
		MIN THIS CENTRE		1.516		
68.00	128.00	52.00	1.5225	4	15	0
68.00	128.00	54.00	1.5057	4	17	0
68.00	128.00	56.00	1.5057	4	18	0
		MIN THIS CENTRE		1.505		

SF!(9) = 1.505717

70.00	126.00	52.00	1.5182	4	13	0
70.00	126.00	54.00	1.4915	4	16	0
70.00	126.00	56.00	1.5011	4	18	0
		MIN THIS CENTRE		1.491		
70.00	128.00	54.00	1.5028	4	15	0
70.00	128.00	56.00	1.4862	4	18	0
70.00	128.00	58.00	1.4978	4	18	0
		MIN THIS CENTRE		1.486		
66.00	130.00	56.00	1.5205	4	18	0
66.00	130.00	58.00	1.5350	4	19	0
66.00	130.00	54.00	1.5133	4	17	0
66.00	130.00	52.00	1.5380	4	15	0
		MIN THIS CENTRE		1.513		
68.00	130.00	56.00	1.5025	4	17	0
68.00	130.00	58.00	1.5044	4	19	0
68.00	130.00	54.00	1.5093	4	15	0
		MIN THIS CENTRE		1.502		
70.00	130.00	56.00	1.4935	4	15	0
70.00	130.00	58.00	1.4833	4	18	0
70.00	130.00	60.00	1.4961	4	19	0
		MIN THIS CENTRE		1.483		

SF!(9) = 1.483264

72.00	128.00	56.00	1.4758	4	16	0
72.00	128.00	58.00	1.4770	4	18	0
72.00	128.00	54.00	1.5076	4	14	0
		MIN THIS CENTRE		1.475		
72.00	130.00	58.00	1.4690	4	17	0
72.00	130.00	60.00	1.4738	4	18	0
72.00	130.00	56.00	1.4930	4	14	0
		MIN THIS CENTRE		1.469		

68.00	132.00	60.00	1.5058	4	19	0
68.00	132.00	62.00	1.5316	4	19	0
68.00	132.00	58.00	1.5012	4	17	0
68.00	132.00	56.00	1.5037	4	16	0
		MIN THIS CENTRE		1.501		
70.00	132.00	60.00	1.4819	4	18	0
70.00	132.00	62.00	1.4972	4	19	0
70.00	132.00	58.00	1.4888	4	17	0
		MIN THIS CENTRE		1.481		
72.00	132.00	60.00	1.4653	4	18	0
72.00	132.00	62.00	1.4720	4	19	0
72.00	132.00	58.00	1.4798	4	16	0
		MIN THIS CENTRE		1.465		

SF!(9) = 1.465326

74.00	130.00	58.00	1.4686	4	16	0
74.00	130.00	60.00	1.4573	4	17	0
74.00	130.00	62.00	1.4548	4	19	0
74.00	130.00	64.00	1.4645	4	24	0
		MIN THIS CENTRE		1.454		
74.00	132.00	60.00	1.4576	4	16	0
74.00	132.00	62.00	1.4537	4	18	0
74.00	132.00	64.00	1.4529	4	20	0
74.00	132.00	66.00	1.4664	4	24	0
		MIN THIS CENTRE		1.452		
70.00	134.00	62.00	1.4818	4	19	0
70.00	134.00	64.00	1.5006	4	19	0
70.00	134.00	60.00	1.4864	4	17	0
		MIN THIS CENTRE		1.481		
72.00	134.00	62.00	1.4635	4	18	0
72.00	134.00	64.00	1.4718	4	19	0
72.00	134.00	60.00	1.4717	4	16	0
		MIN THIS CENTRE		1.463		
74.00	134.00	62.00	1.4522	4	17	0
74.00	134.00	64.00	1.4518	4	18	0
74.00	134.00	66.00	1.4530	4	20	0
		MIN THIS CENTRE		1.451		

SF!(9) = 1.451762

76.00	132.00	62.00	1.4424	4	16	0
76.00	132.00	64.00	1.4256	4	19	0
76.00	132.00	66.00	1.4428	4	24	0
		MIN THIS CENTRE		1.425		
76.00	134.00	64.00	1.4378	4	18	0
76.00	134.00	66.00	1.4240	4	21	0
76.00	134.00	68.00	1.4445	4	24	0
		MIN THIS CENTRE		1.423		

72.00	136.00	66.00	1.4740	4	19	0
72.00	136.00	68.00	1.4955	4	20	0
72.00	136.00	64.00	1.4631	4	18	0
72.00	136.00	62.00	1.4682	4	18	0
		MIN THIS CENTRE		1.463		
74.00	136.00	66.00	1.4510	4	19	0
74.00	136.00	68.00	1.4553	4	20	0
74.00	136.00	64.00	1.4493	4	18	0
74.00	136.00	62.00	1.4718	4	16	0
		MIN THIS CENTRE		1.449		
76.00	136.00	66.00	1.4352	4	18	0
76.00	136.00	68.00	1.4234	4	22	0
76.00	136.00	70.00	1.4482	4	24	0
		MIN THIS CENTRE		1.423		

SF!(9) = 1.423351

78.00	134.00	66.00	1.4021	4	22	0
78.00	134.00	68.00	1.4225	4	24	0
78.00	134.00	64.00	1.4331	4	16	0
		MIN THIS CENTRE		1.402		
78.00	136.00	68.00	1.4005	4	22	0
78.00	136.00	70.00	1.4229	4	25	0
78.00	136.00	66.00	1.4262	4	16	0
		MIN THIS CENTRE		1.400		
74.00	138.00	70.00	1.4594	4	20	0
74.00	138.00	72.00	1.4839	4	24	0
74.00	138.00	68.00	1.4518	4	19	0
74.00	138.00	66.00	1.4482	4	18	0
74.00	138.00	64.00	1.4634	4	16	0
		MIN THIS CENTRE		1.448		
76.00	138.00	70.00	1.4247	4	22	0
76.00	138.00	72.00	1.4534	4	24	0
76.00	138.00	68.00	1.4341	4	18	0
		MIN THIS CENTRE		1.424		
78.00	138.00	70.00	1.4002	4	22	0
78.00	138.00	72.00	1.4253	4	25	0
78.00	138.00	68.00	1.4225	4	18	0
		MIN THIS CENTRE		1.400		

SF!(9) = 1.400245

80.00	136.00	68.00	1.3861	4	21	0
80.00	136.00	70.00	1.4069	4	25	0
80.00	136.00	66.00	1.4310	4	14	0
		MIN THIS CENTRE		1.386		
80.00	138.00	70.00	1.3842	4	22	0
80.00	138.00	72.00	1.4067	4	26	0

80.00	138.00	68.00	1.4206	4	16	0
		MIN THIS CENTRE		1.384		
76.00	140.00	72.00	1.4280	4	22	0
76.00	140.00	74.00	1.4600	4	24	0
76.00	140.00	70.00	1.4339	4	19	0
		MIN THIS CENTRE		1.427		
78.00	140.00	72.00	1.4008	4	23	0
78.00	140.00	74.00	1.4293	4	25	0
78.00	140.00	70.00	1.4206	4	18	0
		MIN THIS CENTRE		1.400		
80.00	140.00	72.00	1.3836	4	22	0
80.00	140.00	74.00	1.4076	4	26	0
80.00	140.00	70.00	1.4141	4	16	0
		MIN THIS CENTRE		1.383		

SF!(9) = 1.383593

82.00	138.00	70.00	1.3658	4	23	0
82.00	138.00	72.00	1.3937	4	25	0
82.00	138.00	68.00	1.4327	4	14	0
		MIN THIS CENTRE		1.365		
82.00	140.00	72.00	1.3625	4	24	0
82.00	140.00	74.00	1.3929	4	25	0
82.00	140.00	70.00	1.4220	4	14	0
		MIN THIS CENTRE		1.362		
78.00	142.00	74.00	1.4032	4	23	0
78.00	142.00	76.00	1.4347	4	25	0
78.00	142.00	72.00	1.4201	4	18	0
		MIN THIS CENTRE		1.403		
80.00	142.00	74.00	1.3786	4	24	0
80.00	142.00	76.00	1.4105	4	25	0
80.00	142.00	72.00	1.4110	4	18	0
		MIN THIS CENTRE		1.378		
82.00	142.00	74.00	1.3615	4	24	0
82.00	142.00	76.00	1.3930	4	25	0
82.00	142.00	72.00	1.4123	4	16	0
		MIN THIS CENTRE		1.361		

SF!(9) = 1.361505

84.00	140.00	72.00	1.3684	4	21	0
84.00	140.00	74.00	1.3783	4	25	0
84.00	140.00	70.00	1.4387	4	12	0
		MIN THIS CENTRE		1.368		
84.00	142.00	74.00	1.3563	4	22	0
84.00	142.00	76.00	1.3767	4	25	0
84.00	142.00	72.00	1.4275	4	14	0
		MIN THIS CENTRE		1.356		

80.00	144.00	76.00	1.3798	4	25	0
80.00	144.00	78.00	1.4148	4	25	0
80.00	144.00	74.00	1.4095	4	18	0
		MIN THIS CENTRE		1.379		
82.00	144.00	76.00	1.3618	4	24	0
82.00	144.00	78.00	1.3939	4	25	0
82.00	144.00	74.00	1.4057	4	16	0
		MIN THIS CENTRE		1.361		
84.00	144.00	76.00	1.3539	4	23	0
84.00	144.00	78.00	1.3762	4	25	0
84.00	144.00	74.00	1.4170	4	14	0
		MIN THIS CENTRE		1.353		

SF!(9) = 1.353943

86.00	142.00	74.00	1.3668	4	19	0
86.00	142.00	76.00	1.3662	4	23	0
86.00	142.00	78.00	1.3519	3	26	0
86.00	142.00	80.00	3.8076	4	33	0
		MIN THIS CENTRE		1.351		
86.00	144.00	76.00	1.3598	4	21	0
86.00	144.00	78.00	1.3639	4	25	0
86.00	144.00	74.00	1.4380	4	12	0
		MIN THIS CENTRE		1.359		
82.00	146.00	78.00	1.3630	4	24	0
82.00	146.00	80.00	1.3965	4	25	0
82.00	146.00	76.00	1.4028	4	18	0
		MIN THIS CENTRE		1.363		
84.00	146.00	78.00	1.3532	4	24	0
84.00	146.00	80.00	1.3764	4	26	0
84.00	146.00	76.00	1.4079	4	16	0
		MIN THIS CENTRE		1.353		
86.00	146.00	78.00	1.3529	4	20	0
86.00	146.00	80.00	1.3630	4	25	0
86.00	146.00	76.00	1.4265	4	14	0
		MIN THIS CENTRE		1.352		

SF!(3) = 1.351876

84.00	140.00	76.00	1.3595	4	25	0
84.00	140.00	78.00	3.7480	4	31	0
84.00	140.00	74.00	1.3783	4	25	0
		MIN THIS CENTRE		1.359		
86.00	140.00	76.00	1.3520	3	25	0
86.00	140.00	78.00	3.8300	4	32	0
86.00	140.00	74.00	1.3709	4	23	0
		MIN THIS CENTRE		1.351		

```
    88.00     140.00      76.00    1.3530     4          25          0
    88.00     140.00      78.00    3.9417     4          31          0
    88.00     140.00      74.00    1.3801     4          20          0
                          MIN THIS CENTRE   1.352

    88.00     142.00      78.00    1.3502     3          26          0
    88.00     142.00      80.00    3.9099     4          32          0
    88.00     142.00      76.00    1.3723     4          20          0
                          MIN THIS CENTRE   1.350

    88.00     144.00      80.00    1.3492     3          27          0
    88.00     144.00      82.00    3.8823     4          33          0
    88.00     144.00      78.00    1.3649     4          23          0
                          MIN THIS CENTRE   1.349


SF!( 9 ) =  1.349175
    90.00     142.00      78.00    1.3594     4          25          0
    90.00     142.00      80.00    4.0416     4          31          0
    90.00     142.00      76.00    1.3818     4          19          0
                          MIN THIS CENTRE   1.359

    90.00     144.00      80.00    1.3539     4          25          0
    90.00     144.00      82.00    4.0049     4          30          0
    90.00     144.00      78.00    1.3742     4          21          0
                          MIN THIS CENTRE   1.353

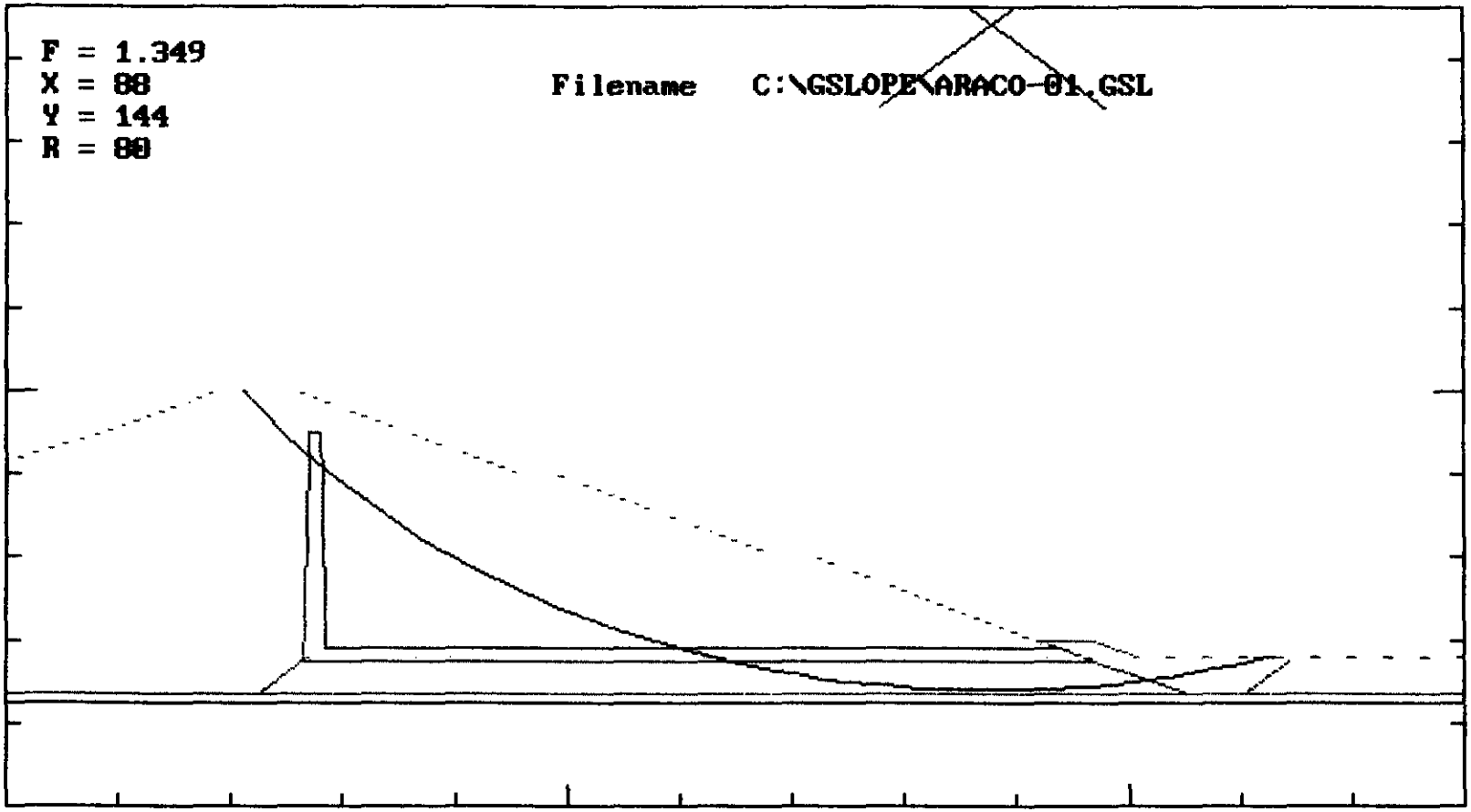
    86.00     146.00      82.00    1.3540     3          27          0
    86.00     146.00      84.00    3.7799     4          33          0
    86.00     146.00      80.00    1.3630     4          25          0
                          MIN THIS CENTRE   1.353

    88.00     146.00      82.00    1.3492     3          27          0
    88.00     146.00      84.00    3.8600     4          33          0
    88.00     146.00      80.00    1.3604     4          23          0
                          MIN THIS CENTRE   1.349

    90.00     146.00      82.00    1.3512     3          28          0
    90.00     146.00      84.00    3.9727     4          30          0
    90.00     146.00      80.00    1.3667     4          21          0
                          MIN THIS CENTRE   1.351


SF!( 5 ) =  1.349175

Minimum Bishop Factor of Safety this run:
    88.00     144.00      80.00    1.3492     3          27          0
```



08/098

DATA FILE NAME..... C:\GSLOPE\ARACO-02.GSL

Job No.	Relatorio de Concepcao
Title	Barragem Aracoiaba
Date	17/11/1997
Label A	Estaca 45 + 0,00
Label B	Talude Jus. - Operacao NA 95

Max Slice Width	10
No. of Materials	6
Seismic Acceleration	.05
External Forces	0
Piezometric Surfaces	1
Unit Wt. of Pore Fluid	1
No. of Geogrid Layers	0
FoS for Geogrid Pullout	0

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surf.	Ru	Interaction Coefficient
1 Enrocamento	2.1	0	38	1	0	0
2 Aterro Compact.	2	2	31	1	0	0
3 Filtro de Areia	1.8	0	30	1	0	0
4 Aluviao	1.8	1.5	28	1	0	0
5 Solo Residual	1.9	1.4	30	1	0	0
6 Rocha	2.2	100	50	1	0	0

Upper Surface of Material # 1 (Enrocamento)

X-Coord	Y-Coord
0	91.4
9	95
19	100
26	100
46	90
49	90
69	80
72	80
92	70
97	70
101	68
115	68
130	68

Upper Surface of Material # 2 (Aterro Compact.)

X-Coord	Y-Coord
0	91.4
9	95
19	100
26	100
46	90 .
49	90
69	80
72	80
92	70

94	69
97	67.5
105.5	63.5
110.5	63.5
115	68
130	68

Upper Surface of Material # 3 (Filtro de Areia)

X-Coord	Y-Coord
0	63.5
22.5	63.5
26.5	67.5
26.9	90
27	95
28	95
28.45	76.5
28.5	69
94	69
97	67.5
105.5	63.5
110.5	63.5
115	68
130	68

Upper Surface of Material # 4 (Aluviao)

X-Coord	Y-Coord
0	63.5
22.5	63.5
26.5	67.5
97	67.5
105.5	63.5
110.5	63.5
130	63.5

Upper Surface of Material # 5 (Solo Residual)

X-Coord	Y-Coord
0	63.5
22.5	63.5
105.5	63.5
110.5	63.5
130	63.5

Upper Surface of Material # 6 (Rocha)

X-Coord	Y-Coord
0	62.5
22	62.5
130	62.5

Piezometric Surface No. 1

X-Coord	Y-Coord
0	95
9	95
26.9	90
28.48	70
99	68
111.5	68
130	68

There are no explicit external forces in the data set.

Geogrid Layer No.	Horizontal Extents X1 <-------> X2	Geogrid Layer Elevation	Strength per unit width

GSLOPE 3.32

LIMIT EQUILIBRIUM SLOPE STABILITY ANALYSIS

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Results are for Bishop's Modified Method unless otherwise noted.

File C:\GSLOPE\ARACO-02.GSL Output dated 12-02-1997 at 09:31:34

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surf.	Ru	Interaction Coefficient
1 Enrocamento	2.1	0	38	1	0	0
2 Aterro Compact.	2	2	31	1	0	0
3 Filtro de Areia	1.8	0	30	1	0	0
4 Aluviao	1.8	1.5	28	1	0	0
5 Solo Residual	1.9	1.4	30	1	0	0
6 Rocha	2.2	100	50	1	0	0

X-centre	Y-centre	Radius	Factor of Safety	Iterations	Slices	M Alpha Warnings
50.00	110.00	50.00	7.2454	3	26	0
50.00	110.00	52.00	8.6286	3	27	0
50.00	110.00	48.00	4.6254	4	25	0
50.00	110.00	46.00	2.2609	4	25	0
50.00	110.00	44.00	2.2935	4	24	0
		MIN THIS CENTRE	2.260			
52.00	110.00	50.00	6.9710	3	25	0
52.00	110.00	52.00	8.2895	3	27	0
52.00	110.00	48.00	4.4433	4	26	0
52.00	110.00	46.00	2.1690	4	26	0
52.00	110.00	44.00	2.1992	4	22	0
		MIN THIS CENTRE	2.168			
54.00	110.00	50.00	6.7154	3	27	0
54.00	110.00	52.00	7.9940	3	27	0
54.00	110.00	48.00	4.2839	4	29	0
54.00	110.00	46.00	2.0751	4	23	0
54.00	110.00	44.00	2.1480	4	22	0
		MIN THIS CENTRE	2.075			
50.00	112.00	52.00	7.2495	3	26	0
50.00	112.00	54.00	8.6318	3	27	0
50.00	112.00	50.00	4.6192	4	25	0
50.00	112.00	48.00	2.2453	4	24	0
50.00	112.00	46.00	2.2802	4	24	0
		MIN THIS CENTRE	2.245			
52.00	112.00	52.00	6.9744	3	25	0
52.00	112.00	54.00	8.2916	3	27	0

52.00	112.00	50.00	4.4298	4	27	0
52.00	112.00	48.00	2.1494	4	26	0
52.00	112.00	46.00	2.1748	4	22	0
		MIN THIS CENTRE		2.149		
54.00	112.00	52.00	6.7151	3	27	0
54.00	112.00	54.00	7.9942	3	27	0
54.00	112.00	50.00	4.2740	4	27	0
54.00	112.00	48.00	2.0472	4	23	0
54.00	112.00	46.00	2.1220	4	22	0
		MIN THIS CENTRE		2.047		
50.00	114.00	54.00	7.2629	3	26	0
50.00	114.00	56.00	8.6750	3	28	0
50.00	114.00	52.00	4.6197	3	25	0
50.00	114.00	50.00	2.2347	4	23	0
50.00	114.00	48.00	2.2706	4	24	0
		MIN THIS CENTRE		2.234		
52.00	114.00	54.00	6.9860	3	26	0
52.00	114.00	56.00	8.3041	3	27	0
52.00	114.00	52.00	4.4292	4	27	0
52.00	114.00	50.00	2.1340	4	26	0
52.00	114.00	48.00	2.1898	4	24	0
		MIN THIS CENTRE		2.134		
54.00	114.00	54.00	6.7237	3	26	0
54.00	114.00	56.00	8.0047	3	27	0
54.00	114.00	52.00	4.2726	4	27	0
54.00	114.00	50.00	2.0537	4	26	0
54.00	114.00	48.00	2.1019	4	22	0
		MIN THIS CENTRE		2.053		

SF!(6) = 2.047168

56.00	110.00	46.00	2.0179	4	23	0
56.00	110.00	48.00	4.1355	4	27	0
56.00	110.00	44.00	2.0876	4	24	0
		MIN THIS CENTRE		2.017		
56.00	112.00	48.00	1.9893	4	23	0
56.00	112.00	50.00	4.1513	4	29	0
56.00	112.00	46.00	2.0583	4	24	0
		MIN THIS CENTRE		1.989		
56.00	114.00	50.00	1.9665	4	23	0
56.00	114.00	52.00	4.1458	4	29	0
56.00	114.00	48.00	2.0354	4	24	0
		MIN THIS CENTRE		1.966		

SF!(9) = 1.966477

58.00	112.00	48.00	1.9380	4	23	0
58.00	112.00	50.00	4.0327	4	27	0
58.00	112.00	46.00	2.0209	4	24	0
		MIN THIS CENTRE		1.938		

58.00	114.00	50.00	1.9149	4	23	0
58.00	114.00	52.00	4.0086	4	27	0
58.00	114.00	48.00	1.9949	4	24	0
		MIN THIS CENTRE		1.914		
54.00	116.00	52.00	2.0415	4	26	0
54.00	116.00	54.00	4.2766	4	27	0
54.00	116.00	50.00	2.0940	4	25	0
		MIN THIS CENTRE		2.041		
56.00	116.00	52.00	1.9701	4	25	0
56.00	116.00	54.00	4.1458	4	29	0
56.00	116.00	50.00	2.0178	4	24	0
		MIN THIS CENTRE		1.970		
58.00	116.00	52.00	1.8966	4	23	0
58.00	116.00	54.00	4.0392	4	29	0
58.00	116.00	50.00	1.9746	4	24	0
		MIN THIS CENTRE		1.896		

SF!(9) = 1.896595

60.00	114.00	50.00	1.8694	4	23	0
60.00	114.00	52.00	3.9334	4	27	0
60.00	114.00	48.00	1.9485	4	24	0
		MIN THIS CENTRE		1.869		
60.00	116.00	52.00	1.8507	4	23	0
60.00	116.00	54.00	3.9131	4	27	0
60.00	116.00	50.00	1.9274	4	24	0
		MIN THIS CENTRE		1.850		
56.00	118.00	54.00	1.9613	4	25	0
56.00	118.00	56.00	4.1507	4	29	0
56.00	118.00	52.00	2.0044	4	24	0
		MIN THIS CENTRE		1.961		
58.00	118.00	54.00	1.8820	4	23	0
58.00	118.00	56.00	4.0300	4	30	0
58.00	118.00	52.00	1.9589	4	24	0
		MIN THIS CENTRE		1.882		
60.00	118.00	54.00	1.8358	4	23	0
60.00	118.00	56.00	3.9347	4	30	0
60.00	118.00	52.00	1.9106	4	24	0
		MIN THIS CENTRE		1.835		

SF!(9) = 1.835837

62.00	116.00	52.00	1.8140	4	24	0
62.00	116.00	54.00	3.8569	4	27	0
62.00	116.00	50.00	1.8839	4	23	0
		MIN THIS CENTRE		1.814		
62.00	118.00	54.00	1.7979	4	24	0
62.00	118.00	56.00	3.8401	4	27	0

```
    62.00     118.00      52.00   1.8714     4          23          0
                          MIN THIS CENTRE   1.797

    58.00     120.00      56.00   1.8910     4          25          0
    58.00     120.00      58.00   4.0360     4          30          0
    58.00     120.00      54.00   1.9469     4          24          0
                          MIN THIS CENTRE   1.891

    60.00     120.00      56.00   1.8243     4          23          0
    60.00     120.00      58.00   3.9378     4          30          0
    60.00     120.00      54.00   1.8976     4          24          0
                          MIN THIS CENTRE   1.824

    62.00     120.00      56.00   1.7852     4          24          0
    62.00     120.00      58.00   3.8300     4          27          0
    62.00     120.00      54.00   1.8575     4          23          0
                          MIN THIS CENTRE   1.785

SF!( 9 ) =  1.785232
    64.00     118.00      54.00   1.7573     4          25          0
    64.00     118.00      56.00   3.7949     4          29          0
    64.00     118.00      52.00   1.8242     4          23          0
                          MIN THIS CENTRE   1.757

    64.00     120.00      56.00   1.7435     4          25          0
    64.00     120.00      58.00   3.7820     4          29          0
    64.00     120.00      54.00   1.8138     4          23          0
                          MIN THIS CENTRE   1.743

    60.00     122.00      58.00   1.8303     4          25          0
    60.00     122.00      60.00   3.9448     4          30          0
    60.00     122.00      56.00   1.8879     4          24          0
                          MIN THIS CENTRE   1.830

    62.00     122.00      58.00   1.7740     4          23          0
    62.00     122.00      60.00   3.8580     4          29          0
    62.00     122.00      56.00   1.8468     4          23          0
                          MIN THIS CENTRE   1.774

    64.00     122.00      58.00   1.7329     4          25          0
    64.00     122.00      60.00   3.7753     4          29          0
    64.00     122.00      56.00   1.8064     4          23          0
                          MIN THIS CENTRE   1.732

SF!( 9 ) =  1.732854
    66.00     120.00      56.00   1.7090     4          25          0
    66.00     120.00      58.00   3.7533     4          30          0
    66.00     120.00      54.00   1.7755     4          23          0
                          MIN THIS CENTRE   1.709

    66.00     122.00      58.00   1.6994     4          25          0
    66.00     122.00      60.00   3.7440     4          29          0
    66.00     122.00      56.00   1.7650     4          23          0
                          MIN THIS CENTRE   1.699
```

62.00	124.00	60.00	1.7623	4	24	0
62.00	124.00	62.00	3.8659	4	31	0
62.00	124.00	58.00	1.8353	4	24	0
		MIN THIS CENTRE		1.762		
64.00	124.00	60.00	1.7247	4	25	0
64.00	124.00	62.00	3.7737	4	30	0
64.00	124.00	58.00	1.7977	4	23	0
		MIN THIS CENTRE		1.724		
66.00	124.00	60.00	1.6904	4	27	0
66.00	124.00	62.00	3.7407	4	29	0
66.00	124.00	58.00	1.7596	4	23	0
		MIN THIS CENTRE		1.690		

SF!(9) = 1.690441

68.00	122.00	58.00	1.6661	4	27	0
68.00	122.00	60.00	3.7408	4	30	0
68.00	122.00	56.00	1.7329	4	23	0
		MIN THIS CENTRE		1.666		
68.00	124.00	60.00	1.6620	4	28	0
68.00	124.00	62.00	3.7310	4	30	0
68.00	124.00	58.00	1.7247	4	23	0
		MIN THIS CENTRE		1.661		
64.00	126.00	62.00	1.7187	4	25	0
64.00	126.00	64.00	3.8072	4	32	0
64.00	126.00	60.00	1.7915	4	23	0
		MIN THIS CENTRE		1.718		
66.00	126.00	62.00	1.6839	4	27	0
66.00	126.00	64.00	3.7419	4	29	0
66.00	126.00	60.00	1.7555	4	23	0
		MIN THIS CENTRE		1.683		
68.00	126.00	62.00	1.6560	4	28	0
68.00	126.00	64.00	3.7263	4	30	0
68.00	126.00	60.00	1.7191	4	23	0
		MIN THIS CENTRE		1.656		

SF!(9) = 1.656014

70.00	124.00	60.00	1.6355	4	27	0
70.00	124.00	62.00	3.7339	4	29	0
70.00	124.00	58.00	1.6895	4	24	0
		MIN THIS CENTRE		1.635		
70.00	126.00	62.00	1.6327	4	26	0
70.00	126.00	64.00	3.7230	4	29	0
70.00	126.00	60.00	1.6845	4	24	0
		MIN THIS CENTRE		1.632		

66.00	128.00	64.00	1.6794	4	27	0
66.00	128.00	66.00	3.7692	4	32	0
66.00	128.00	62.00	1.7504	4	23	0
		MIN THIS CENTRE		1.679		
68.00	128.00	64.00	1.6512	4	28	0
68.00	128.00	66.00	3.7225	4	29	0
68.00	128.00	62.00	1.7173	4	23	0
		MIN THIS CENTRE		1.651		
70.00	128.00	64.00	1.6334	4	27	0
70.00	128.00	66.00	3.7171	4	29	0
70.00	128.00	62.00	1.6795	4	24	0
		MIN THIS CENTRE		1.633		

SF!(6) = 1.632708

72.00	124.00	60.00	1.6151	4	28	0
72.00	124.00	62.00	3.7364	4	28	0
72.00	124.00	58.00	1.6637	4	25	0
		MIN THIS CENTRE		1.615		
72.00	126.00	62.00	1.6114	4	28	0
72.00	126.00	64.00	3.7232	4	28	0
72.00	126.00	60.00	1.6562	4	26	0
		MIN THIS CENTRE		1.611		
72.00	128.00	64.00	1.6074	4	28	0
72.00	128.00	66.00	3.7152	4	28	0
72.00	128.00	62.00	1.6518	4	26	0
		MIN THIS CENTRE		1.607		

SF!(9) = 1.607393

74.00	126.00	62.00	1.5938	4	28	0
74.00	126.00	64.00	3.7358	4	30	0
74.00	126.00	60.00	1.6352	4	25	0
		MIN THIS CENTRE		1.593		
74.00	128.00	64.00	1.5903	4	28	0
74.00	128.00	66.00	3.7161	4	31	0
74.00	128.00	62.00	1.6325	4	26	0
		MIN THIS CENTRE		1.590		
70.00	130.00	66.00	1.6299	4	28	0
70.00	130.00	68.00	3.7155	4	29	0
70.00	130.00	64.00	1.6772	4	26	0
		MIN THIS CENTRE		1.629		
72.00	130.00	66.00	1.6064	4	28	0
72.00	130.00	68.00	3.7080	4	28	0
72.00	130.00	64.00	1.6504	4	27	0
		MIN THIS CENTRE		1.606		
74.00	130.00	66.00	1.5884	4	28	0
74.00	130.00	68.00	3.7079	4	31	0

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    74.00    130.00     64.00   1.6285     4         26          0
                        MIN THIS CENTRE   1.588


SF!( 9 ) =  1.588401
    76.00    128.00     64.00   1.5758     4         28          0
    76.00    128.00     66.00   3.7417     4         31          0
    76.00    128.00     62.00   1.6158     4         25          0
                        MIN THIS CENTRE   1.575


    76.00    130.00     66.00   1.5710     4         27          0
    76.00    130.00     68.00   3.7263     4         31          0
    76.00    130.00     64.00   1.6150     4         25          0
                        MIN THIS CENTRE   1.571


    72.00    132.00     68.00   1.6081     4         28          0
    72.00    132.00     70.00   3.7050     4         28          0
    72.00    132.00     66.00   1.6488     4         27          0
                        MIN THIS CENTRE   1.608


    74.00    132.00     68.00   1.5867     4         28          0
    74.00    132.00     70.00   3.7034     4         31          0
    74.00    132.00     66.00   1.6270     4         26          0
                        MIN THIS CENTRE   1.586


    76.00    132.00     68.00   1.5686     4         27          0
    76.00    132.00     70.00   3.7164     4         31          0
    76.00    132.00     66.00   1.6150     4         26          0
                        MIN THIS CENTRE   1.568


SF!( 9 ) =  1.568586
    78.00    130.00     66.00   1.5527     4         26          0
    78.00    130.00     68.00   3.7675     4         32          0
    78.00    130.00     64.00   1.6041     4         25          0
                        MIN THIS CENTRE   1.552


    78.00    132.00     68.00   1.5499     4         27          0
    78.00    132.00     70.00   3.7520     4         32          0
    78.00    132.00     66.00   1.6037     4         25          0
                        MIN THIS CENTRE   1.549


    74.00    134.00     70.00   1.5871     4         28          0
    74.00    134.00     72.00   3.6999     4         31          0
    74.00    134.00     68.00   1.6281     4         26          0
                        MIN THIS CENTRE   1.587


    76.00    134.00     70.00   1.5675     4         27          0
    76.00    134.00     72.00   3.7125     4         31          0
    76.00    134.00     68.00   1.6141     4         26          0
                        MIN THIS CENTRE   1.567


    78.00    134.00     70.00   1.5470     4         28          0
    78.00    134.00     72.00   3.7398     4         32          0
    78.00    134.00     68.00   1.5987     4         26          0
                        MIN THIS CENTRE   1.547
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```
SF!( 9 ) =  1.547033
    80.00     132.00      68.00    1.5320     4          27          0
    80.00     132.00      70.00    3.8039     4          32          0
    80.00     132.00      66.00    1.5877     4          26          0
                          MIN THIS CENTRE   1.531

    80.00     134.00      70.00    1.5311     4          28          0
    80.00     134.00      72.00    3.7856     4          32          0
    80.00     134.00      68.00    1.5865     4          27          0
                          MIN THIS CENTRE   1.531

    76.00     136.00      72.00    1.5667     4          27          0
    76.00     136.00      74.00    3.7112     4          31          0
    76.00     136.00      70.00    1.6147     4          26          0
                          MIN THIS CENTRE   1.566

    78.00     136.00      72.00    1.5465     4          28          0
    78.00     136.00      74.00    3.7327     4          32          0
    78.00     136.00      70.00    1.5994     4          27          0
                          MIN THIS CENTRE   1.546

    80.00     136.00      72.00    1.5307     4          28          0
    80.00     136.00      74.00    3.7736     4          32          0
    80.00     136.00      70.00    1.5866     4          27          0
                          MIN THIS CENTRE   1.530

SF!( 9 ) =  1.530713
    82.00     134.00      70.00    1.5176     4          26          0
    82.00     134.00      72.00    3.8532     4          33          0
    82.00     134.00      68.00    1.5798     4          25          0
                          MIN THIS CENTRE   1.517

    82.00     136.00      72.00    1.5182     4          27          0
    82.00     136.00      74.00    3.8314     4          33          0
    82.00     136.00      70.00    1.5774     4          27          0
                          MIN THIS CENTRE   1.518

    78.00     138.00      74.00    1.5471     4          28          0
    78.00     138.00      76.00    3.7305     4          32          0
    78.00     138.00      72.00    1.5999     4          27          0
                          MIN THIS CENTRE   1.547

    80.00     138.00      74.00    1.5299     4          28          0
    80.00     138.00      76.00    3.7642     4          32          0
    80.00     138.00      72.00    1.5875     4          28          0
                          MIN THIS CENTRE   1.529

    82.00     138.00      74.00    1.5188     4          28          0
    82.00     138.00      76.00    3.8156     4          33          0
    82.00     138.00      72.00    1.5768     4          27          0
                          MIN THIS CENTRE   1.518
```

SF!(3) = 1.517603

80.00	132.00	68.00	1.5320	4	27	0
80.00	132.00	70.00	3.8039	4	32	0
80.00	132.00	66.00	1.5877	4	26	0
		MIN THIS CENTRE	1.531			
82.00	132.00	68.00	1.5182	4	25	0
82.00	132.00	70.00	3.8783	4	31	0
82.00	132.00	66.00	1.5856	4	25	0
		MIN THIS CENTRE	1.518			
84.00	132.00	68.00	1.5119	4	25	0
84.00	132.00	70.00	3.9708	4	32	0
84.00	132.00	66.00	1.5890	4	21	0
		MIN THIS CENTRE	1.511			
84.00	134.00	70.00	1.5092	4	25	0
84.00	134.00	72.00	3.9395	4	32	0
84.00	134.00	68.00	1.5814	4	22	0
		MIN THIS CENTRE	1.509			
84.00	136.00	72.00	1.5083	4	27	0
84.00	136.00	74.00	3.9120	4	32	0
84.00	136.00	70.00	1.5720	4	24	0
		MIN THIS CENTRE	1.508			

SF!(9) = 1.508287

86.00	134.00	70.00	1.5146	4	26	0
86.00	134.00	72.00	4.0515	4	30	0
86.00	134.00	68.00	1.5818	4	19	0
		MIN THIS CENTRE	1.514			
86.00	136.00	72.00	1.5074	4	26	0
86.00	136.00	74.00	4.0163	4	34	0
86.00	136.00	70.00	1.5762	4	23	0
		MIN THIS CENTRE	1.507			
82.00	138.00	74.00	1.5188	4	28	0
82.00	138.00	76.00	3.8156	4	33	0
82.00	138.00	72.00	1.5768	4	27	0
		MIN THIS CENTRE	1.518			
84.00	138.00	74.00	1.5088	4	27	0
84.00	138.00	76.00	3.8887	4	33	0
84.00	138.00	72.00	1.5669	4	24	0
		MIN THIS CENTRE	1.508			
86.00	138.00	74.00	1.5056	4	26	0
86.00	138.00	76.00	3.9858	4	34	0
86.00	138.00	72.00	1.5694	4	23	0
		MIN THIS CENTRE	1.505			

SF!(9) = 1.50555

88.00	136.00	72.00	1.5197	4	25	0

```
    88.00     136.00      74.00    4.1505     4          31          0
    88.00     136.00      70.00    1.5844     4          15          0
                          MIN THIS CENTRE   1.519

    88.00     138.00      74.00    1.5141     4          27          0
    88.00     138.00      76.00    4.1088     4          32          0
    88.00     138.00      72.00    1.5790     4          18          0
                          MIN THIS CENTRE   1.514

    84.00     140.00      76.00    1.5104     4          27          0
    84.00     140.00      78.00    3.8691     4          33          0
    84.00     140.00      74.00    1.5650     4          27          0
                          MIN THIS CENTRE   1.510

    86.00     140.00      76.00    1.5051     4          27          0
    86.00     140.00      78.00    3.9588     4          34          0
    86.00     140.00      74.00    1.5611     4          25          0
                          MIN THIS CENTRE   1.505

    88.00     140.00      76.00    1.5079     4          27          0
    88.00     140.00      78.00    4.0736     4          33          0
    88.00     140.00      74.00    1.5735     4          22          0
                          MIN THIS CENTRE   1.507

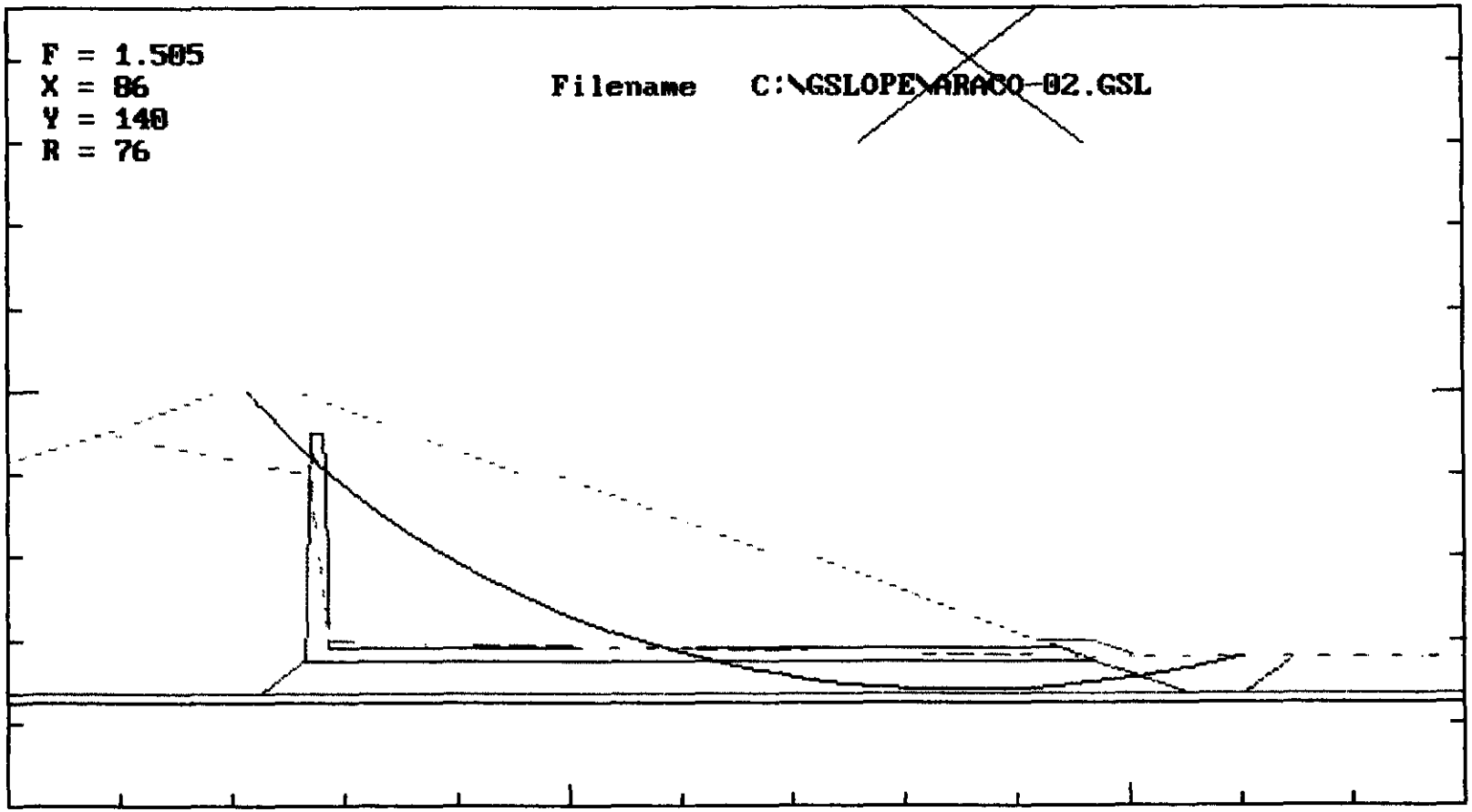

SF!( 8 ) =  1.505137
    84.00     142.00      78.00    1.5119     4          28          0
    84.00     142.00      80.00    3.8548     4          33          0
    84.00     142.00      76.00    1.5646     4          27          0
                          MIN THIS CENTRE   1.511

    86.00     142.00      78.00    1.5063     4          28          0
    86.00     142.00      80.00    3.9363     4          35          0
    86.00     142.00      76.00    1.5570     4          25          0
                          MIN THIS CENTRE   1.506

    88.00     142.00      78.00    1.5066     4          28          0
    88.00     142.00      80.00    4.0427     4          34          0
    88.00     142.00      76.00    1.5675     4          22          0
                          MIN THIS CENTRE   1.506


SF!( 5 ) =  1.505137

Minimum Bishop Factor of Safety this run:
    86.00     140.00      76.00    1.5051     4          27          0
```


F = 1.505
X = 86
Y = 140
R = 76
Filename C:\GSLOPE\ARACO-02.GSL

DATA FILE NAME..... C:\GSLOPE\ARACO-04.GSL

Job No.	Relatorio de Concepcao
Title	Barragem Aracoiaba
Date	17/11/1997
Label A	Estaca 45 + 0,00
Label B	Talude Mon. - Rebaixamento

Max Slice Width	10
No. of Materials	7
Seismic Acceleration	.05
External Forces	0
Piezometric Surfaces	1
Unit Wt. of Pore Fluid	1
No. of Geogrid Layers	0
FoS for Geogrid Pullout	0

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surf.	Ru	Interaction Coefficient
1 Enchimento	1.9	0	20	1	0	0
2 Ensecadeira	2	1	28	1	0	0
3 Aterro Compact.	2	2	31	1	0	0
4 Filtro de Areia	1.8	0	30	1	0	0
5 Aluviao	1.8	1.5	28	1	0	0
6 Solo Residual	1.9	1.4	30	1	0	0
7 Rocha	2.2	100	50	1	0	0

Upper Surface of Material # 1 (Enchimento)

X-Coord	Y-Coord
4	90
24	100
31	100
41	95
91	75
120	75
125	75
134	69
150	69

Upper Surface of Material # 2 (Ensecadeira)

X-Coord	Y-Coord
4	90
24	100
31	100
41	95
91	75
106	69
111	69
120	75
125	75
134	69
150	69

Upper Surface of Material # 3 (Aterro Compact.)

X-Coord	Y-Coord
4	90
24	100
31	100
41	95
91	75
106	69
111	69
134	69
150	69

Upper Surface of Material # 4 (Filtro de Areia)

X-Coord	Y-Coord
4	69
21.5	69
22	95
23	95
23.5	67.5
27.5	63.5
28.5	62.5
53.5	62.5
54.5	63.5
58.5	67.5
105	67.5
106	69
111	69
134	69
150	69

Upper Surface of Material # 5 (Aluviao)

X-Coord	Y-Coord
4	67.5
23.5	67.5
27.5	63.5
28.5	62.5
53.5	62.5
54.5	63.5
58.5	67.5
105	67.5
106	69
111	69
134	69
150	69

Upper Surface of Material # 6 (Solo Residual)

X-Coord	Y-Coord
4	63.5
27.5	63.5
28.5	62.5
53.5	62.5
54.5	63.5
150	63.5

Upper Surface of Material # 7 (Rocha)

X-Coord	Y-Coord
4	62.5
28.5	62.5
100	62.5

150	62.5

Piezometric Surface No. 1

X-Coord	Y-Coord
4	69
21.55	70
23.1	90
41	95
91	75
120	75
125	75
150	75

There are no explicit external forces in the data set.

Geogrid Layer No.	Horizontal Extents X1 <--------> X2	Geogrid Layer Elevation	Strength per unit width

GSLOPE 3.32

LIMIT EQUILIBRIUM SLOPE STABILITY ANALYSIS

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COBA - Lisboa

Results are for Bishop's Modified Method unless otherwise noted.

File C:\GSLOPE\ARACO-04.GSL Output dated 12-01-1997 at 15:33:52

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surf.	Ru	Interaction Coefficient
1 Enchimento	1.9	0	20	1	0	0
2 Ensecadeira	2	1	28	1	0	0
3 Aterro Compact.	2	2	31	1	0	0
4 Filtro de Areia	1.8	0	30	1	0	0
5 Aluviao	1.8	1.5	28	1	0	0
6 Solo Residual	1.9	1.4	30	1	0	0
7 Rocha	2.2	100	50	1	0	0

X-centre	Y-centre	Radius	Factor of Safety	Iterations	Slices	M Alpha Warnings
60.00	110.00	50.00	5.9583	3	23	0
60.00	110.00	52.00	7.3282	3	25	0
60.00	110.00	48.00	3.6412	4	24	0
60.00	110.00	46.00	1.5092	4	21	0
60.00	110.00	44.00	1.4846	4	21	0
60.00	110.00	42.00	1.4916	4	19	0
		MIN THIS CENTRE	1.484			
62.00	110.00	50.00	5.8189	3	23	0
62.00	110.00	52.00	7.0689	3	25	0
62.00	110.00	48.00	3.5197	4	26	0
62.00	110.00	46.00	1.4156	4	24	0
62.00	110.00	44.00	1.4044	3	21	0
62.00	110.00	42.00	1.4332	4	18	0
		MIN THIS CENTRE	1.404			
64.00	110.00	50.00	5.7082	3	24	0
64.00	110.00	52.00	6.9519	3	26	0
64.00	110.00	48.00	3.4337	4	26	0
64.00	110.00	46.00	1.3536	3	23	0
64.00	110.00	44.00	1.3422	3	21	0
64.00	110.00	42.00	1.3690	3	15	0
		MIN THIS CENTRE	1.342			
60.00	112.00	52.00	6.0342	3	24	0
60.00	112.00	54.00	7.3743	3	25	0
60.00	112.00	50.00	3.6452	4	24	0
60.00	112.00	48.00	1.5133	4	21	0
60.00	112.00	46.00	1.4868	4	21	0
60.00	112.00	44.00	1.4898	4	19	0

MIN THIS CENTRE 1.486

62.00	112.00	52.00	5.8323	3	23	0
62.00	112.00	54.00	7.1588	3	26	0
62.00	112.00	50.00	3.5239	4	26	0
62.00	112.00	48.00	1.4180	4	24	0
62.00	112.00	46.00	1.4027	3	21	0
62.00	112.00	44.00	1.4230	4	19	0

MIN THIS CENTRE 1.402

64.00	112.00	52.00	5.7149	3	25	0
64.00	112.00	54.00	6.9649	3	26	0
64.00	112.00	50.00	3.4357	4	26	0
64.00	112.00	48.00	1.3522	3	23	0
64.00	112.00	46.00	1.3334	3	23	0
64.00	112.00	44.00	1.3620	3	17	0

MIN THIS CENTRE 1.333

60.00	114.00	54.00	6.0744	3	24	0
60.00	114.00	56.00	7.4300	3	26	0
60.00	114.00	52.00	3.6577	4	24	0
60.00	114.00	50.00	1.5191	4	23	0
60.00	114.00	48.00	1.4926	4	21	0
60.00	114.00	46.00	1.4933	4	19	0

MIN THIS CENTRE 1.492

62.00	114.00	54.00	5.8570	3	23	0
62.00	114.00	56.00	7.2057	3	26	0
62.00	114.00	52.00	3.5358	4	26	0
62.00	114.00	50.00	1.4244	4	24	0
62.00	114.00	48.00	1.4060	4	21	0
62.00	114.00	46.00	1.4221	4	19	0

MIN THIS CENTRE 1.405

64.00	114.00	54.00	5.7298	3	25	0
64.00	114.00	56.00	6.9904	3	26	0
64.00	114.00	52.00	3.4458	4	26	0
64.00	114.00	50.00	1.3559	3	23	0
64.00	114.00	48.00	1.3321	3	23	0
64.00	114.00	46.00	1.3519	3	20	0

MIN THIS CENTRE 1.332

SF!(9) = 1.332073

66.00	112.00	46.00	1.2819	3	20	0
66.00	112.00	48.00	1.2936	2	23	0
66.00	112.00	44.00	1.3132	3	14	0

MIN THIS CENTRE 1.281

66.00	114.00	48.00	1.2735	3	23	0
66.00	114.00	50.00	1.2949	2	23	0
66.00	114.00	46.00	1.3085	2	16	0

MIN THIS CENTRE 1.273

62.00	116.00	50.00	1.4125	4	21	0
62.00	116.00	52.00	1.4336	4	24	0
62.00	116.00	48.00	1.4140	4	20	0

```
                        MIN THIS CENTRE  1.412

    64.00     116.00      50.00    1.3354     3          23          0
    64.00     116.00      52.00    1.3632     3          23          0
    64.00     116.00      48.00    1.3520     3          20          0
                        MIN THIS CENTRE  1.335

    66.00     116.00      50.00    1.2751     3          23          0
    66.00     116.00      52.00    1.3004     1          23          0
    66.00     116.00      48.00    1.3053     2          20          0
                        MIN THIS CENTRE  1.275

SF!( 6 ) =  1.273549
    68.00     112.00      46.00    1.2319     3          18          0
    68.00     112.00      48.00    1.2555     3          20          0
    68.00     112.00      44.00    1.2734     3          15          0
                        MIN THIS CENTRE  1.231

    68.00     114.00      48.00    1.2305     3          20          0
    68.00     114.00      50.00    1.2501     3          23          0
    68.00     114.00      46.00    1.2653     3          15          0
                        MIN THIS CENTRE  1.230

    68.00     116.00      50.00    1.2273     3          24          0
    68.00     116.00      52.00    1.2530     3          23          0
    68.00     116.00      48.00    1.2606     3          18          0
                        MIN THIS CENTRE  1.227

SF!( 9 ) =  1.227261
    70.00     114.00      48.00    1.1986     4          16          0
    70.00     114.00      50.00    1.2242     3          20          0
    70.00     114.00      46.00    1.2337     3          15          0
                        MIN THIS CENTRE  1.198

    70.00     116.00      50.00    1.1966     4          19          0
    70.00     116.00      52.00    1.2155     4          25          0
    70.00     116.00      48.00    1.2268     4          15          0
                        MIN THIS CENTRE  1.196

    66.00     118.00      52.00    1.2798     3          23          0
    66.00     118.00      54.00    1.3091     2          23          0
    66.00     118.00      50.00    1.3011     2          22          0
                        MIN THIS CENTRE  1.279

    68.00     118.00      52.00    1.2273     3          24          0
    68.00     118.00      54.00    1.2589     3          24          0
    68.00     118.00      50.00    1.2616     3          19          0
                        MIN THIS CENTRE  1.227

    70.00     118.00      52.00    1.1995     4          20          0
    70.00     118.00      54.00    1.2175     4          25          0
    70.00     118.00      50.00    1.2243     4          17          0
                        MIN THIS CENTRE  1.199
```

SF!(6) = 1.196629

72.00	114.00	48.00	1.1739	4	16	0
72.00	114.00	50.00	1.1932	4	18	0
72.00	114.00	46.00	1.2075	4	14	0
		MIN THIS CENTRE	1.173			
72.00	116.00	50.00	1.1694	4	17	0
72.00	116.00	52.00	1.1931	4	21	0
72.00	116.00	48.00	1.2022	4	15	0
		MIN THIS CENTRE	1.169			
72.00	118.00	52.00	1.1680	4	19	0
72.00	118.00	54.00	1.1952	4	22	0
72.00	118.00	50.00	1.1997	4	15	0
		MIN THIS CENTRE	1.167			

SF!(9) = 1.16799

74.00	116.00	50.00	1.1535	4	17	0
74.00	116.00	52.00	1.1707	4	19	0
74.00	116.00	48.00	1.1871	4	13	0
		MIN THIS CENTRE	1.153			
74.00	118.00	52.00	1.1511	4	17	0
74.00	118.00	54.00	1.1688	4	22	0
74.00	118.00	50.00	1.1810	4	15	0
		MIN THIS CENTRE	1.151			
70.00	120.00	54.00	1.1974	4	23	0
70.00	120.00	56.00	1.2237	3	25	0
70.00	120.00	52.00	1.2251	4	18	0
		MIN THIS CENTRE	1.197			
72.00	120.00	54.00	1.1702	4	20	0
72.00	120.00	56.00	1.1934	4	26	0
72.00	120.00	52.00	1.1977	4	15	0
		MIN THIS CENTRE	1.170			
74.00	120.00	54.00	1.1506	4	18	0
74.00	120.00	56.00	1.1710	4	23	0
74.00	120.00	52.00	1.1797	4	16	0
		MIN THIS CENTRE	1.150			

SF!(9) = 1.150601

76.00	118.00	52.00	1.1416	4	18	0
76.00	118.00	54.00	1.1523	4	20	0
76.00	118.00	50.00	1.1765	4	14	0
		MIN THIS CENTRE	1.141			
76.00	120.00	54.00	1.1413	4	18	0
76.00	120.00	56.00	1.1517	4	21	0
76.00	120.00	52.00	1.1683	4	15	0
		MIN THIS CENTRE	1.141			

72.00	122.00	56.00	1.1748	4	24	0
72.00	122.00	58.00	1.1982	4	26	0
72.00	122.00	54.00	1.1987	4	18	0
		MIN THIS CENTRE		1.174		
74.00	122.00	56.00	1.1522	4	20	0
74.00	122.00	58.00	1.1727	4	27	0
74.00	122.00	54.00	1.1792	4	16	0
		MIN THIS CENTRE		1.152		
76.00	122.00	56.00	1.1401	4	19	0
76.00	122.00	58.00	1.1531	4	23	0
76.00	122.00	54.00	1.1656	4	16	0
		MIN THIS CENTRE		1.140		

SF!(9) = 1.14013

78.00	120.00	54.00	1.1349	4	18	0
78.00	120.00	56.00	1.1430	4	21	0
78.00	120.00	52.00	1.1739	4	14	0
		MIN THIS CENTRE		1.134		
78.00	122.00	56.00	1.1327	4	19	0
78.00	122.00	58.00	1.1414	4	21	0
78.00	122.00	54.00	1.1646	4	14	0
		MIN THIS CENTRE		1.132		
74.00	124.00	58.00	1.1571	4	22	0
74.00	124.00	60.00	1.1747	4	27	0
74.00	124.00	56.00	1.1797	4	17	0
		MIN THIS CENTRE		1.157		
76.00	124.00	58.00	1.1410	4	21	0
76.00	124.00	60.00	1.1581	4	24	0
76.00	124.00	56.00	1.1665	4	16	0
		MIN THIS CENTRE		1.141		
78.00	124.00	58.00	1.1336	4	19	0
78.00	124.00	60.00	1.1423	4	23	0
78.00	124.00	56.00	1.1597	4	17	0
		MIN THIS CENTRE		1.133		

SF!(6) = 1.132745

80.00	120.00	54.00	1.1417	4	17	0
80.00	120.00	56.00	1.1417	4	20	0
80.00	120.00	58.00	3.4914	4	24	0
		MIN THIS CENTRE		1.141		
80.00	122.00	56.00	1.1321	4	17	0
80.00	122.00	58.00	1.1394	4	21	0
80.00	122.00	54.00	1.1708	4	16	0
		MIN THIS CENTRE		1.132		
80.00	124.00	58.00	1.1280	4	20	0
80.00	124.00	60.00	1.1385	4	21	0

80.00	124.00	56.00	1.1682	4	16	0
		MIN THIS CENTRE		1.128		

SF!(9) = 1.128001

82.00	122.00	56.00	1.1426	4	19	0
82.00	122.00	58.00	1.1459	4	19	0
82.00	122.00	54.00	1.1851	4	14	0
		MIN THIS CENTRE		1.142		

82.00	124.00	58.00	1.1369	4	19	0
82.00	124.00	60.00	1.1414	4	20	0
82.00	124.00	56.00	1.1783	4	14	0
		MIN THIS CENTRE		1.136		

78.00	126.00	60.00	1.1331	4	20	0
78.00	126.00	62.00	1.1456	4	24	0
78.00	126.00	58.00	1.1587	4	17	0
		MIN THIS CENTRE		1.133		

80.00	126.00	60.00	1.1273	4	20	0
80.00	126.00	62.00	1.1378	4	22	0
80.00	126.00	58.00	1.1602	4	17	0
		MIN THIS CENTRE		1.127		

82.00	126.00	60.00	1.1300	4	20	0
82.00	126.00	62.00	1.1406	4	21	0
82.00	126.00	58.00	1.1696	4	16	0
		MIN THIS CENTRE		1.129		

SF!(8) = 1.127316

78.00	128.00	62.00	1.1353	4	22	0
78.00	128.00	64.00	1.1516	4	26	0
78.00	128.00	60.00	1.1607	4	18	0
		MIN THIS CENTRE		1.135		

80.00	128.00	62.00	1.1289	4	20	0
80.00	128.00	64.00	1.1393	4	24	0
80.00	128.00	60.00	1.1569	4	18	0
		MIN THIS CENTRE		1.128		

82.00	128.00	62.00	1.1272	4	20	0
82.00	128.00	64.00	1.1405	4	21	0
82.00	128.00	60.00	1.1670	4	16	0
		MIN THIS CENTRE		1.127		

SF!(9) = 1.127202

84.00	126.00	60.00	1.1452	4	19	0
84.00	126.00	62.00	1.1488	4	20	0
84.00	126.00	58.00	1.1905	4	15	0
		MIN THIS CENTRE		1.145		

84.00	128.00	62.00	1.1395	4	19	0
84.00	128.00	64.00	1.1464	4	21	0
84.00	128.00	60.00	1.1771	4	17	0

MIN THIS CENTRE 1.139

80.00	130.00	64.00	1.1295	4	21	0
80.00	130.00	66.00	1.1429	4	25	0
80.00	130.00	62.00	1.1568	4	18	0

MIN THIS CENTRE 1.129

82.00	130.00	64.00	1.1277	4	20	0
82.00	130.00	66.00	1.1392	4	24	0
82.00	130.00	62.00	1.1606	4	17	0

MIN THIS CENTRE 1.127

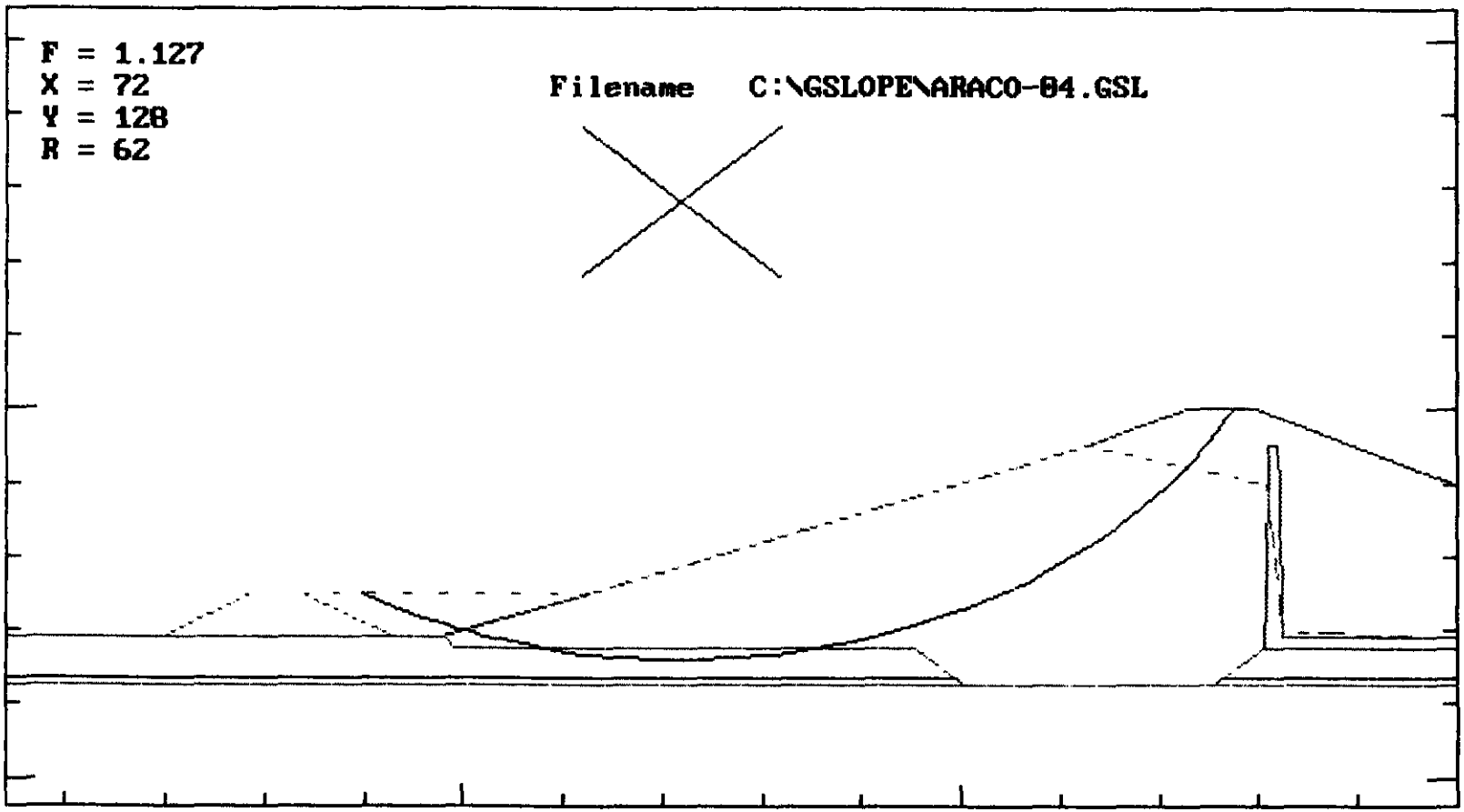
84.00	130.00	64.00	1.1343	4	21	0
84.00	130.00	66.00	1.1612	4	21	0
84.00	130.00	62.00	1.1731	4	17	0

MIN THIS CENTRE 1.134

SF!(5) = 1.127202

Minimum Bishop Factor of Safety this run:

82.00	128.00	62.00	1.1272	4	20	0


F = 1.127
X = 72
Y = 128
R = 62
Filename C:\GSLOPE\ARACO-04.GSL

6 - ESTUDOS DE OTIMIZAÇÃO

Para os estudos de otimização foram calculados os volumes das estruturas de terra e de concreto para os níveis d'água de operação de 95,00, 90,00 e 85,00 conforme os cálculos apresentados a seguir

6.1 - Obras de Terra

Para os cálculos dos volumes das obras de terra foram utilizadas planilhas de cálculo, com algumas simplificações

As três alternativas foram calculadas com base na Memória de Cálculo da Alternativa 1, examinada com detalhes anteriormente Os volumes foram determinados com aproximações percentuais relativos

6.2 - Vertedouro e Canais

Os cálculos para dimensionamento do vertedouro, considerado de soleira livre, das três alternativas são apresentados a seguir

Os volumes de escavação e de concreto a serem utilizados foram determinados a partir de croquis levantados nos locais de implantação dos mesmos

ANEXO 6.1
ESTUDOS HIDRÁULICOS

****
*
* AMORTECIMENTO DA ONDA DE CHEIA *
*
****

NIVEL DE PLENO ARMAZENAMENTO(m)..... 85.00
COTA DA SOLEIRA DESCARREGADORA(m)..... 85.00
COMPRIMENTO DA CRISTA(m).....120.00
COEFICIENTE DE VAZ╟O..... .400

CURVA DE VOLUMES:V=a(Z-c)**b
PARAMETRO a..... .0121610
PARAMETRO b..... 2.8147
PARAMETRO c..... 65.00

TEMPO (h)	Qafl (m3/s)	Vmed (hm3)	Vtot (hm3)	Zint (m)	Qdes (m3/s)	Vdes (hm3)	Vfin (hm3)	Zfin (m)
.0	.0	.00	.00	85.00	.0	.00	55.84	.00
1.0	40.0	.07	55.91	85.01	.2	.00	55.91	85.01
2.0	145.0	.33	56.24	85.05	2.5	.01	56.24	85.05
3.0	290.0	.78	57.02	85.15	12.2	.04	56.97	85.14
4.0	370.0	1.19	58.16	85.29	33.5	.12	58.04	85.28
5.0	680.0	1.89	59.93	85.51	77.1	.28	59.65	85.47
6.0	900.0	2.84	62.50	85.82	156.9	.56	61.93	85.75
7.0	1100.0	3.60	65.53	86.17	269.1	.97	64.56	86.06
8.0	1280.0	4.28	68.85	86.54	408.2	1.47	67.38	86.38
9.0	1350.0	4.73	72.11	86.90	557.8	2.01	70.11	86.68
10.0	1380.0	4.91	75.02	87.21	699.4	2.52	72.50	86.94
11.0	1300.0	4.82	77.33	87.45	816.3	2.94	74.39	87.15
12.0	1150.0	4.41	78.80	87.60	892.8	3.21	75.58	87.27
13.0	940.0	3.76	79.34	87.66	921.6	3.32	76.03	87.32
14.0	760.0	3.06	79.09	87.63	908.1	3.27	75.82	87.30
15.0	580.0	2.41	78.23	87.54	863.2	3.11	75.12	87.22
16.0	400.0	1.76	76.89	87.41	793.8	2.86	74.03	87.11
17.0	280.0	1.22	75.25	87.24	711.0	2.56	72.69	86.96
18.0	160.0	.79	73.48	87.05	623.7	2.25	71.24	86.81
19.0	100.0	.47	71.71	86.86	538.6	1.94	69.77	86.65
20.0	40.0	.25	70.02	86.67	460.6	1.66	68.36	86.49
21.0	.0	.07	68.43	86.50	390.0	1.40	67.03	86.34
22.0	.0	.00	67.03	86.34	330.1	1.19	65.84	86.21
23.0	.0	.00	65.84	86.21	281.4	1.01	64.83	86.09
24.0	.0	.00	64.83	86.09	241.6	.87	63.96	85.99
25.0	.0	.00	63.96	85.99	208.8	.75	63.21	85.90
26.0	.0	.00	63.21	85.90	181.6	.65	62.55	85.82
27.0	.0	.00	62.55	85.82	158.8	.57	61.98	85.76
28.0	.0	.00	61.98	85.76	139.6	.50	61.48	85.70
29.0	.0	.00	61.48	85.70	123.3	.44	61.04	85.64
30.0	.0	.00	61.04	85.64	109.4	.39	60.64	85.59

****
*
* AMORTECIMENTO DA ONDA DE CHEIA *
*
****

NIVEL DE PLENO ARMAZENAMENTO(m)..... 85.00
COTA DA SOLEIRA DESCARREGADORA(m)..... 85.00
COMPRIMENTO DA CRISTA(m).....120.00
COEFICIENTE DE VAZ||O..... .400

CURVA DE VOLUMES:V=a(Z-c)**b
PARAMETRO a..... .0121610
PARAMETRO b..... 2.8147
PARAMETRO c..... 65.00

TEMPO (h)	Qafl (m3/s)	Vmed (hm3)	Vtot (hm3)	Zint (m)	Qdes m3/s)	Vdes (hm3)	Vfin (hm3)	Zfin (m)
.0	.0	.00	.00	85.00	.0	.00	55.84	.00
1.0	64.0	.12	55.96	85.01	.4	.00	55.95	85.01
2.0	232.0	.53	56.49	85.08	5.0	.02	56.47	85.08
3.0	464.0	1.25	57.72	85.24	24.5	.09	57.63	85.23
4.0	592.0	1.90	59.53	85.46	66.4	.24	59.30	85.43
5.0	1088.0	3.02	62.32	85.80	150.8	.54	61.78	85.73
6.0	1440.0	4.55	66.33	86.26	301.0	1.08	65.24	86.14
7.0	1760.0	5.76	71.00	86.78	505.7	1.82	69.18	86.58
8.0	2048.0	6.85	76.04	87.32	750.5	2.70	73.34	87.03
9.0	2160.0	7.57	80.91	87.82	1004.9	3.62	77.29	87.45
10.0	2208.0	7.86	85.15	88.23	1236.9	4.45	80.70	87.80
11.0	2080.0	7.72	88.42	88.55	1420.5	5.11	83.31	88.05
12.0	1840.0	7.06	90.36	88.73	1531.5	5.51	84.85	88.20
13.0	1504.0	6.02	90.87	88.78	1560.6	5.62	85.25	88.24
14.0	1216.0	4.90	90.15	88.71	1519.1	5.47	84.68	88.19
15.0	928.0	3.86	88.54	88.56	1427.1	5.14	83.40	88.06
16.0	640.0	2.82	86.22	88.34	1296.4	4.67	81.55	87.88
17.0	448.0	1.96	83.51	88.07	1146.1	4.13	79.39	87.66
18.0	256.0	1.27	80.65	87.79	991.2	3.57	77.09	87.43
19.0	160.0	.75	77.83	87.50	842.6	3.03	74.80	87.19
20.0	64.0	.40	75.20	87.23	708.6	2.55	72.65	86.96
21.0	.0	.12	72.77	86.97	589.1	2.12	70.65	86.74
22.0	.0	.00	70.65	86.74	489.2	1.76	68.89	86.55
23.0	.0	.00	68.89	86.55	409.8	1.48	67.41	86.38
24.0	.0	.00	67.41	86.38	346.1	1.25	66.16	86.24
25.0	.0	.00	66.16	86.24	294.4	1.06	65.10	86.12
26.0	.0	.00	65.10	86.12	252.3	.91	64.20	86.02
27.0	.0	.00	64.20	86.02	217.7	.78	63.41	85.92
28.0	.0	.00	63.41	85.92	188.9	.68	62.73	85.84
29.0	.0	.00	62.73	85.84	164.9	.59	62.14	85.77
30.0	.0	.00	62.14	85.77	144.8	.52	61.62	85.71

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*
* AMORTECIMENTO DA ONDA DE CHEIA
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NIVEL DE PLENO ARMAZENAMENTO(m)..... 90.00
COTA DA SOLEIRA DESCARREGADORA(m)..... 90.00
COMPRIMENTO DA CRISTA(m)..... 60.00
COEFICIENTE DE VAZ||O..... .400

CURVA DE VOLUMES:V=a(Z-c)**b
PARAMETRO a..... .0121610
PARAMETRO b..... 2.8147
PARAMETRO c..... 65.00

TEMPO (h)	Qafl (m3/s)	Vmed (hm3)	Vtot (hm3)	Zint (m)	Qdes (m3/s)	Vdes (hm3)	Vfin (hm3)	Zfin (m)
.0	.0	.00	.00	90.00	.0	.00	104.64	.00
1.0	40.0	.07	104.71	90.01	.0	.00	104.71	90.01
2.0	145.0	.33	105.04	90.03	.7	.00	105.04	90.03
3.0	290.0	.78	105.83	90.10	3.3	.01	105.81	90.10
4.0	370.0	1.19	107.00	90.20	9.4	.03	106.97	90.20
5.0	680.0	1.89	108.86	90.35	22.3	.08	108.78	90.35
6.0	900.0	2.84	111.62	90.58	46.9	.17	111.45	90.57
7.0	1100.0	3.60	115.05	90.86	84.2	.30	114.75	90.83
8.0	1280.0	4.28	119.03	91.17	134.7	.48	118.55	91.13
9.0	1350.0	4.73	123.28	91.50	195.1	.70	122.58	91.45
10.0	1380.0	4.91	127.49	91.82	260.4	.94	126.56	91.75
11.0	1300.0	4.82	131.38	92.10	324.6	1.17	130.21	92.02
12.0	1150.0	4.41	134.62	92.34	380.6	1.37	133.25	92.24
13.0	940.0	3.76	137.01	92.51	423.2	1.52	135.49	92.40
14.0	760.0	3.06	138.55	92.62	451.1	1.62	136.93	92.51
15.0	580.0	2.41	139.34	92.68	465.6	1.68	137.66	92.56
16.0	400.0	1.76	139.43	92.68	467.2	1.68	137.74	92.56
17.0	280.0	1.22	138.97	92.65	458.8	1.65	137.32	92.53
18.0	160.0	.79	138.11	92.59	443.1	1.60	136.51	92.48
19.0	100.0	.47	136.98	92.51	422.7	1.52	135.46	92.40
20.0	40.0	.25	135.71	92.42	399.9	1.44	134.27	92.32
21.0	.0	.07	134.34	92.32	375.7	1.35	132.99	92.22
22.0	.0	.00	132.99	92.22	352.2	1.27	131.72	92.13
23.0	.0	.00	131.72	92.13	330.4	1.19	130.53	92.04
24.0	.0	.00	130.53	92.04	310.3	1.12	129.42	91.96
25.0	.0	.00	129.42	91.96	291.7	1.05	128.37	91.88
26.0	.0	.00	128.37	91.88	274.5	.99	127.38	91.81
27.0	.0	.00	127.38	91.81	258.5	.93	126.45	91.74
28.0	.0	.00	126.45	91.74	243.7	.88	125.57	91.67
29.0	.0	.00	125.57	91.67	230.0	.83	124.74	91.61
30.0	.0	.00	124.74	91.61	217.2	.78	123.96	91.55

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* AMORTECIMENTO DA ONDA DE CHEIA *

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NIVEL DE PLENO ARMAZENAMENTO(m)..... 90.00
COTA DA SOLEIRA DESCARREGADORA(m)..... 90.00
COMPRIMENTO DA CRISTA(m)..... 60.00
COEFICIENTE DE VAZ||O..... .400

CURVA DE VOLUMES:V=a(Z-c)**b
PARAMETRO a..... .0121610
PARAMETRO b..... 2.8147
PARAMETRO c..... 65.00

TEMPO (h)	Qafl (m3/s)	Vmed (hm3)	Vtot (hm3)	Zint (m)	Qdes (m3/s)	Vdes (hm3)	Vfin (hm3)	Zfin (m)
.0	.0	.00	.00	90.00	.0	.00	104.64	.00
1.0	64.0	.12	104.76	90.01	.1	.00	104.75	90.01
2.0	232.0	.53	105.29	90.05	1.3	.00	105.28	90.05
3.0	464.0	1.25	106.54	90.16	6.8	.02	106.51	90.16
4.0	592.0	1.90	108.41	90.32	18.9	.07	108.34	90.31
5.0	1088.0	3.02	111.37	90.56	44.4	.16	111.21	90.55
6.0	1440.0	4.55	115.76	90.91	92.7	.33	115.42	90.89
7.0	1760.0	5.76	121.18	91.34	164.5	.59	120.59	91.29
8.0	2048.0	6.85	127.45	91.81	259.6	.93	126.51	91.74
9.0	2160.0	7.57	134.09	92.30	371.2	1.34	132.75	92.20
10.0	2208.0	7.86	140.61	92.77	489.2	1.76	138.85	92.64
11.0	2080.0	7.72	146.57	93.18	602.5	2.17	144.40	93.03
12.0	1840.0	7.06	151.46	93.51	698.8	2.52	148.94	93.34
13.0	1504.0	6.02	154.96	93.74	769.4	2.77	152.19	93.56
14.0	1216.0	4.90	157.09	93.88	812.9	2.93	154.16	93.69
15.0	928.0	3.86	158.02	93.94	832.0	3.00	155.02	93.75
16.0	640.0	2.82	157.85	93.93	828.5	2.98	154.86	93.74
17.0	448.0	1.96	156.82	93.86	807.4	2.91	153.92	93.67
18.0	256.0	1.27	155.18	93.76	774.0	2.79	152.40	93.57
19.0	160.0	.75	153.15	93.62	732.7	2.64	150.51	93.45
20.0	64.0	.40	150.91	93.47	687.9	2.48	148.43	93.31
21.0	.0	.12	148.55	93.31	641.2	2.31	146.24	93.16
22.0	.0	.00	146.24	93.16	596.1	2.15	144.09	93.01
23.0	.0	.00	144.09	93.01	554.9	2.00	142.10	92.87
24.0	.0	.00	142.10	92.87	517.0	1.86	140.24	92.74
25.0	.0	.00	140.24	92.74	482.2	1.74	138.50	92.62
26.0	.0	.00	138.50	92.62	450.2	1.62	136.88	92.50
27.0	.0	.00	136.88	92.50	420.8	1.51	135.36	92.39
28.0	.0	.00	135.36	92.39	393.7	1.42	133.95	92.29
29.0	.0	.00	133.95	92.29	368.8	1.33	132.62	92.20
30.0	.0	.00	132.62	92.20	345.8	1.24	131.37	92.10

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* AMORTECIMENTO DA ONDA DE CHEIA *

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NIVEL DE PLENO ARMAZENAMENTO(m)..... 95.00
COTA DA SOLEIRA DESCARREGADORA(m)..... 95.00
COMPRIMENTO DA CRISTA(m)..... 20.00
COEFICIENTE DE VAZ||O..... .400

CURVA DE VOLUMES:V=a(Z-c)**b
PARAMETRO a..... .0121610
PARAMETRO b..... 2.8147
PARAMETRO c..... 65.00

TEMPO (h)	Qafl (m3/s)	Vmed (hm3)	Vtot (hm3)	Zint (m)	Qdes (m3/s)	Vdes (hm3)	Vfin (hm3)	Zfin (m)
.0	.0	.00	.00	95.00	.0	.00	174.82	.00
1.0	40.0	.07	174.89	95.00	.0	.00	174.89	95.00
2.0	145.0	.33	175.22	95.02	.1	.00	175.22	95.02
3.0	290.0	.78	176.01	95.07	.7	.00	176.01	95.07
4.0	370.0	1.19	177.19	95.14	1.9	.01	177.19	95.14
5.0	680.0	1.89	179.08	95.26	4.6	.02	179.06	95.26
6.0	900.0	2.84	181.90	95.43	9.9	.04	181.87	95.42
7.0	1100.0	3.60	185.47	95.64	18.0	.06	185.40	95.63
8.0	1280.0	4.28	189.69	95.88	29.4	.11	189.58	95.88
9.0	1350.0	4.73	194.32	96.15	43.6	.16	194.16	96.14
10.0	1380.0	4.91	199.07	96.42	59.8	.22	198.86	96.40
11.0	1300.0	4.82	203.68	96.67	76.7	.28	203.41	96.66
12.0	1150.0	4.41	207.82	96.90	92.8	.33	207.48	96.88
13.0	940.0	3.76	211.24	97.09	106.8	.38	210.86	97.07
14.0	760.0	3.06	213.92	97.23	118.0	.42	213.49	97.21
15.0	580.0	2.41	215.91	97.34	126.5	.46	215.45	97.31
16.0	400.0	1.76	217.21	97.41	132.2	.48	216.74	97.38
17.0	280.0	1.22	217.96	97.45	135.5	.49	217.47	97.42
18.0	160.0	.79	218.27	97.46	136.8	.49	217.77	97.44
19.0	100.0	.47	218.24	97.46	136.7	.49	217.75	97.43
20.0	40.0	.25	218.00	97.45	135.7	.49	217.51	97.42
21.0	.0	.07	217.58	97.43	133.8	.48	217.10	97.40
22.0	.0	.00	217.10	97.40	131.7	.47	216.63	97.37
23.0	.0	.00	216.63	97.37	129.7	.47	216.16	97.35
24.0	.0	.00	216.16	97.35	127.6	.46	215.70	97.33
25.0	.0	.00	215.70	97.33	125.7	.45	215.25	97.30
26.0	.0	.00	215.25	97.30	123.7	.45	214.80	97.28
27.0	.0	.00	214.80	97.28	121.8	.44	214.37	97.25
28.0	.0	.00	214.37	97.25	119.9	.43	213.93	97.23
29.0	.0	.00	213.93	97.23	118.1	.43	213.51	97.21
30.0	.0	.00	213.51	97.21	116.3	.42	213.09	97.19

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* AMORTECIMENTO DA ONDA DE CHEIA *
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NIVEL DE PLENO ARMAZENAMENTO(m)..... 95.00
COTA DA SOLEIRA DESCARREGADORA(m)..... 95.00
COMPRIMENTO DA CRISTA(m)..... 20.00
COEFICIENTE DE VAZ╟O..... .400

CURVA DE VOLUMES:V=a(Z-c)**b
PARAMETRO a..... .0121610
PARAMETRO b..... 2.8147
PARAMETRO c..... 65.00

TEMPO (h)	Qafl (m3/s)	Vmed (hm3)	Vtot (hm3)	Zint (m)	Qdes (m3/s)	Vdes (hm3)	Vfin (hm3)	Zfin (m)
.0	.0	.00	.00	95.00	.0	.00	174.82	.00
1.0	64.0	.12	174.94	95.01	.0	.00	174.94	95.01
2.0	232.0	.53	175.47	95.04	.3	.00	175.47	95.04
3.0	464.0	1.25	176.72	95.12	1.4	.00	176.71	95.11
4.0	592.0	1.90	178.62	95.23	3.9	.01	178.60	95.23
5.0	1088.0	3.02	181.63	95.41	9.3	.03	181.59	95.41
6.0	1440.0	4.55	186.14	95.68	19.7	.07	186.07	95.67
7.0	1760.0	5.76	191.83	96.01	35.8	.13	191.70	96.00
8.0	2048.0	6.85	198.56	96.39	58.0	.21	198.35	96.38
9.0	2160.0	7.57	205.92	96.80	85.4	.31	205.62	96.78
10.0	2208.0	7.86	213.48	97.21	116.1	.42	213.06	97.18
11.0	2080.0	7.72	220.78	97.59	148.0	.53	220.25	97.57
12.0	1840.0	7.06	227.30	97.93	178.0	.64	226.66	97.90
13.0	1504.0	6.02	232.68	98.21	203.5	.73	231.95	98.17
14.0	1216.0	4.90	236.84	98.42	223.8	.81	236.04	98.38
15.0	928.0	3.86	239.90	98.57	239.0	.86	239.04	98.53
16.0	640.0	2.82	241.86	98.67	248.8	.90	240.96	98.62
17.0	448.0	1.96	242.92	98.72	254.2	.92	242.01	98.67
18.0	256.0	1.27	243.27	98.74	256.0	.92	242.35	98.69
19.0	160.0	.75	243.10	98.73	255.1	.92	242.18	98.68
20.0	64.0	.40	242.59	98.70	252.5	.91	241.68	98.66
21.0	.0	.12	241.79	98.66	248.5	.89	240.90	98.62
22.0	.0	.00	240.90	98.62	244.0	.88	240.02	98.58
23.0	.0	.00	240.02	98.58	239.6	.86	239.16	98.53
24.0	.0	.00	239.16	98.53	235.3	.85	238.31	98.49
25.0	.0	.00	238.31	98.49	231.1	.83	237.48	98.45
26.0	.0	.00	237.48	98.45	227.0	.82	236.66	98.41
27.0	.0	.00	236.66	98.41	222.9	.80	235.86	98.37
28.0	.0	.00	235.86	98.37	219.0	.79	235.07	98.33
29.0	.0	.00	235.07	98.33	215.1	.77	234.29	98.29
30.0	.0	.00	234.29	98.29	211.4	.76	233.53	98.25

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* AMORTECIMENTO DA ONDA DE CHEIA *
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NIVEL DE PLENO ARMAZENAMENTO(m)..... 95.00
COTA DA SOLEIRA DESCARREGADORA(m)..... 95.00
COMPRIMENTO DA CRISTA(m)..... 20.00
COEFICIENTE DE VAZ||O..... .400

CURVA DE VOLUMES:V=a(Z-c)**b
PARAMETRO a..... .0121610
PARAMETRO b..... 2.8147
PARAMETRO c..... 65.00

TEMPO (h)	Qafl (m3/s)	Vmed (hm3)	Vtot (hm3)	Zint (m)	Qdes (m3/s)	Vdes (hm3)	Vfin (hm3)	Zfin (m)
.0	.0	.00	.00	95.00	.0	.00	174.82	.00
1.0	40.0	.07	174.89	95.00	.0	.00	174.89	95.00
2.0	145.0	.33	175.22	95.02	.1	.00	175.22	95.02
3.0	290.0	.78	176.01	95.07	.7	.00	176.01	95.07
4.0	370.0	1.19	177.19	95.14	1.9	.01	177.19	95.14
5.0	680.0	1.89	179.08	95.26	4.6	.02	179.06	95.26
6.0	900.0	2.84	181.90	95.43	9.9	.04	181.87	95.42
7.0	1100.0	3.60	185.47	95.64	18.0	.06	185.40	95.63
8.0	1280.0	4.28	189.69	95.88	29.4	.11	189.58	95.88
9.0	1350.0	4.73	194.32	96.15	43.6	.16	194.16	96.14
10.0	1380.0	4.91	199.07	96.42	59.8	.22	198.86	96.40
11.0	1300.0	4.82	203.68	96.67	76.7	.28	203.41	96.66
12.0	1150.0	4.41	207.82	96.90	92.8	.33	207.48	96.88
13.0	940.0	3.76	211.24	97.09	106.8	.38	210.86	97.07
14.0	760.0	3.06	213.92	97.23	118.0	.42	213.49	97.21
15.0	580.0	2.41	215.91	97.34	126.5	.46	215.45	97.31
16.0	400.0	1.76	217.21	97.41	132.2	.48	216.74	97.38
17.0	280.0	1.22	217.96	97.45	135.5	.49	217.47	97.42
18.0	160.0	.79	218.27	97.46	136.8	.49	217.77	97.44
19.0	100.0	.47	218.24	97.46	136.7	.49	217.75	97.43
20.0	40.0	.25	218.00	97.45	135.7	.49	217.51	97.42
21.0	.0	.07	217.58	97.43	133.8	.48	217.10	97.40
22.0	.0	.00	217.10	97.40	131.7	.47	216.63	97.37
23.0	.0	.00	216.63	97.37	129.7	.47	216.16	97.35
24.0	.0	.00	216.16	97.35	127.6	.46	215.70	97.33
25.0	.0	.00	215.70	97.33	125.7	.45	215.25	97.30
26.0	.0	.00	215.25	97.30	123.7	.45	214.80	97.28
27.0	.0	.00	214.80	97.28	121.8	.44	214.37	97.25
28.0	.0	.00	214.37	97.25	119.9	.43	213.93	97.23
29.0	.0	.00	213.93	97.23	118.1	.43	213.51	97.21
30.0	.0	.00	213.51	97.21	116.3	.42	213.09	97.19

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* AMORTECIMENTO DA ONDA DE CHEIA
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NIVEL DE PLENO ARMAZENAMENTO(m)..... 95.00
COTA DA SOLEIRA DESCARREGADORA(m)..... 95.00
COMPRIMENTO DA CRISTA(m)..... 20.00
COEFICIENTE DE VAZ||O..... .400

CURVA DE VOLUMES:V=a(Z-c)**b
PARAMETRO a..... .0121610
PARAMETRO b..... 2.8147
PARAMETRO c..... 65.00

TEMPO (h)	Qafl (m3/s)	Vmed (hm3)	Vtot (hm3)	Zint (m)	Qdes (m3/s)	Vdes (hm3)	Vfin (hm3)	Zfin (m)
.0	.0	.00	.00	95.00	.0	.00	174.82	.00
1.0	64.0	.12	174.94	95.01	.0	.00	174.94	95.01
2.0	232.0	.53	175.47	95.04	.3	.00	175.47	95.04
3.0	464.0	1.25	176.72	95.12	1.4	.00	176.71	95.11
4.0	592.0	1.90	178.62	95.23	3.9	.01	178.60	95.23
5.0	1088.0	3.02	181.63	95.41	9.3	.03	181.59	95.41
6.0	1440.0	4.55	186.14	95.68	19.7	.07	186.07	95.67
7.0	1760.0	5.76	191.83	96.01	35.8	.13	191.70	96.00
8.0	2048.0	6.85	198.56	96.39	58.0	.21	198.35	96.38
9.0	2160.0	7.57	205.92	96.80	85.4	.31	205.62	96.78
10.0	2208.0	7.86	213.48	97.21	116.1	.42	213.06	97.18
11.0	2080.0	7.72	220.78	97.59	148.0	.53	220.25	97.57
12.0	1840.0	7.06	227.30	97.93	178.0	.64	226.66	97.90
13.0	1504.0	6.02	232.68	98.21	203.5	.73	231.95	98.17
14.0	1216.0	4.90	236.84	98.42	223.8	.81	236.04	98.38
15.0	928.0	3.86	239.90	98.57	239.0	.86	239.04	98.53
16.0	640.0	2.82	241.86	98.67	248.8	.90	240.96	98.62
17.0	448.0	1.96	242.92	98.72	254.2	.92	242.01	98.67
18.0	256.0	1.27	243.27	98.74	256.0	.92	242.35	98.69
19.0	160.0	.75	243.10	98.73	255.1	.92	242.18	98.68
20.0	64.0	.40	242.59	98.70	252.5	.91	241.68	98.66
21.0	.0	.12	241.79	98.66	248.5	.89	240.90	98.62
22.0	.0	.00	240.90	98.62	244.0	.88	240.02	98.58
23.0	.0	.00	240.02	98.58	239.6	.86	239.16	98.53
24.0	.0	.00	239.16	98.53	235.3	.85	238.31	98.49
25.0	.0	.00	238.31	98.49	231.1	.83	237.48	98.45
26.0	.0	.00	237.48	98.45	227.0	.82	236.66	98.41
27.0	.0	.00	236.66	98.41	222.9	.80	235.86	98.37
28.0	.0	.00	235.86	98.37	219.0	.79	235.07	98.33
29.0	.0	.00	235.07	98.33	215.1	.77	234.29	98.29
30.0	.0	.00	234.29	98.29	211.4	.76	233.53	98.25

XA 85-1

BARRAGEM ARACOIABA

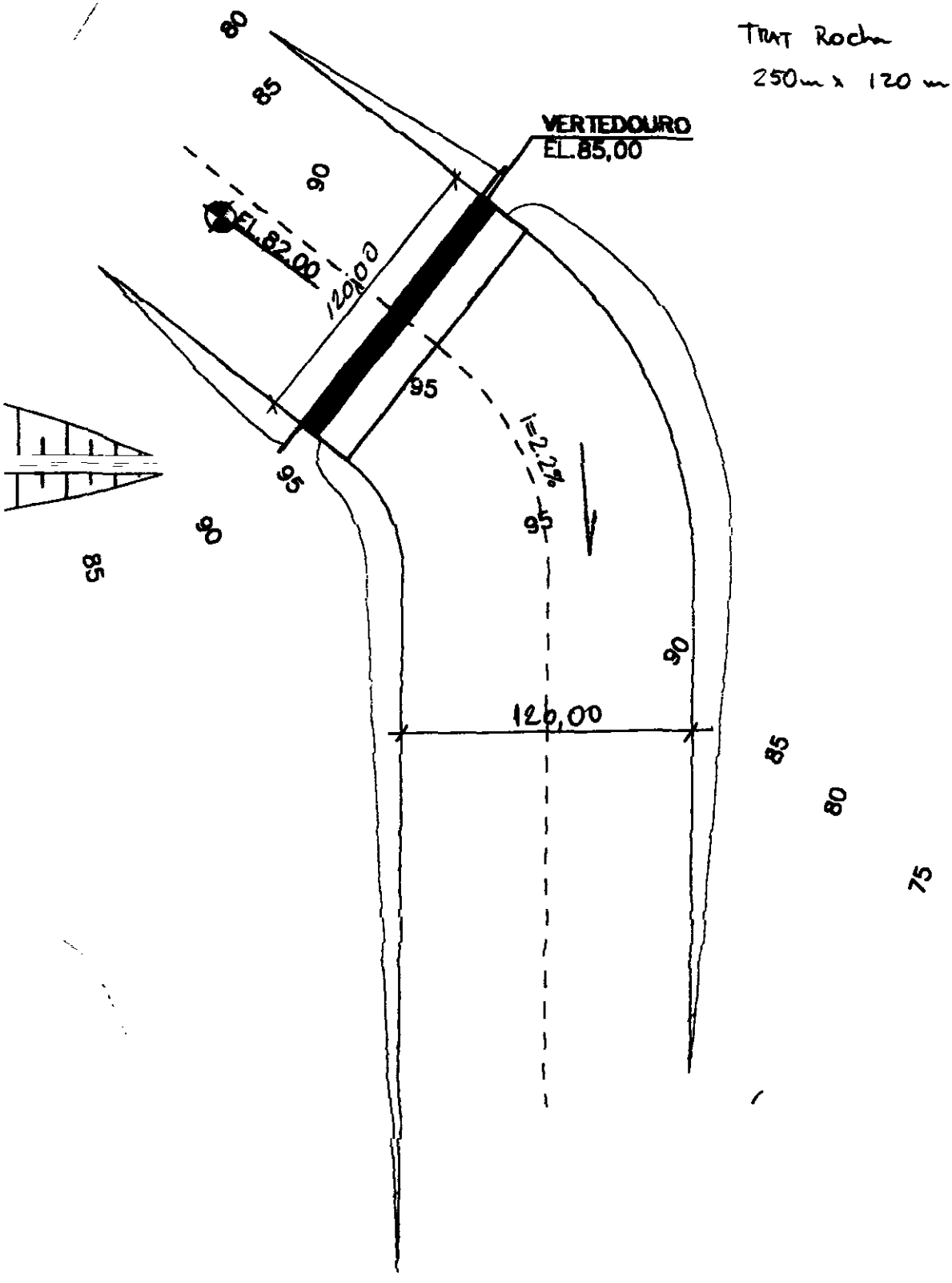
CRISTA EL. 90,00

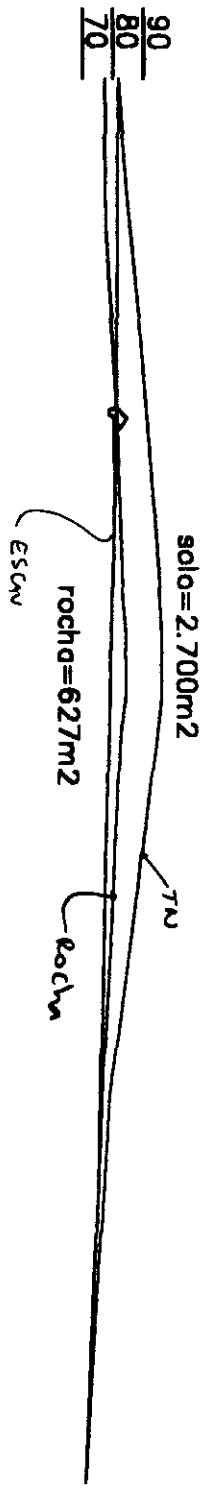
N.A. EL. 85,00

DESMATAMENTO
400 m x 130 m = 52 000 m²

TRAT Solo
110 m x 120 m = 18 200 m²

TRAT Rocha
250 m x 120 m = 30 000 m²





GALERIA DE DESVIO 25% MENOR QUE ALT. 1

ESCAV solo - 2 030
Rocha - 510

TRAT. solo - 360
Rocha - 830

CONC c/FORMA - ~~1.580~~ 1.270 m³
s/FORMA - ~~430~~ 310 m³

BARRAGEM ARAÇOIABA

CRISTA EL 90,00

1- ESCAVAÇÃO

Solo - ℓ média: 130,0 m

Volume: 2 700 m² x 130,0 = 351.000 m³

Rocha ℓ média = 123,0 m

Volume: 627,0 m² x 123,0 m = 77 120 m³

2- CONCRETO

largura do VERT = 120.00 m

CONCRETO S/ FORMA

Se . p/ 60,0 m = 600,00 m³

p/ 120,0 m = X

X = 1.200 m³

CONCRETO C/ FORMA

Se . p/ 60,0 m = 1510,0 m³

p/ 120,0 m = X

X = 3020 m³

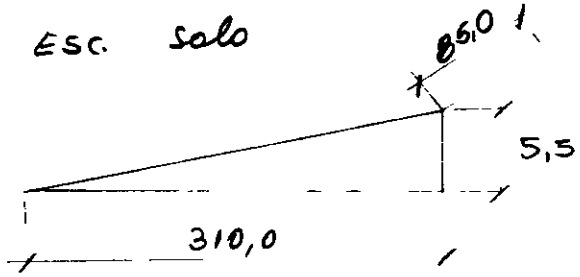
BARRAGEM ARACOIABA

CRISTA EL. 95,00
N.A EL. 90,00

1- ESCAVAÇÃO

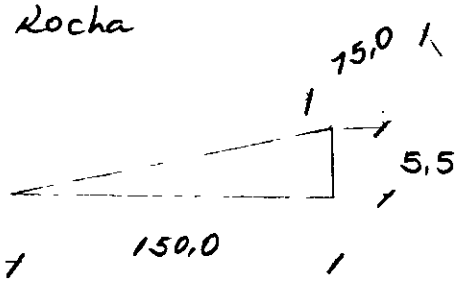
1.1. CANAL DE APROXIMAÇÃO

ESC. Solo



$Vol = \frac{310,0 \times 5,5}{2} \times 85,0 = 72\,460\,m^3$

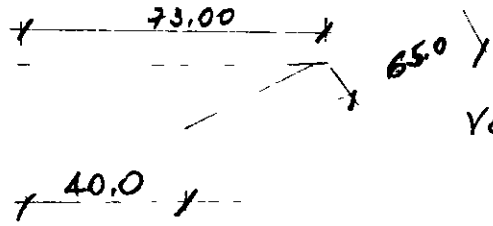
ESC Rocha



$Vol: \frac{150,0 \times 5,5}{2} \times 75,0 = 30\,930\,m^3$

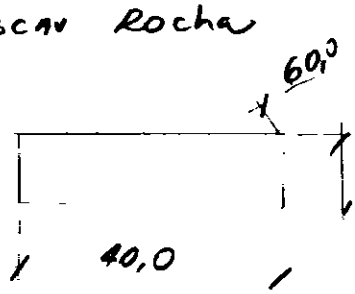
1.2 VERTEDOURO

ESC Solo

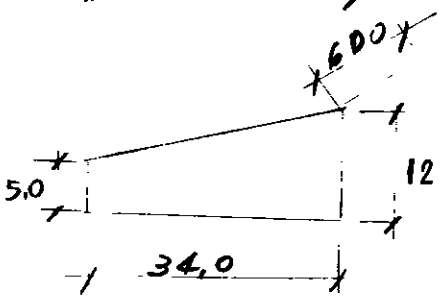


$Vol: \frac{73,0 + 40,0}{2} \times 65,0 = 3\,670\,m^3$

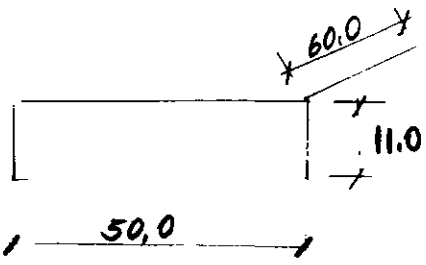
ESCAV Rocha



$Vol: \frac{40,0 \times 5,0}{2} \times 60,0 = 12.000\,m^3$



$Vol: \left[\frac{(5,0 + 12,0)}{2} \times 34,0\right] \times 60,0 = 17.340\,m^3$



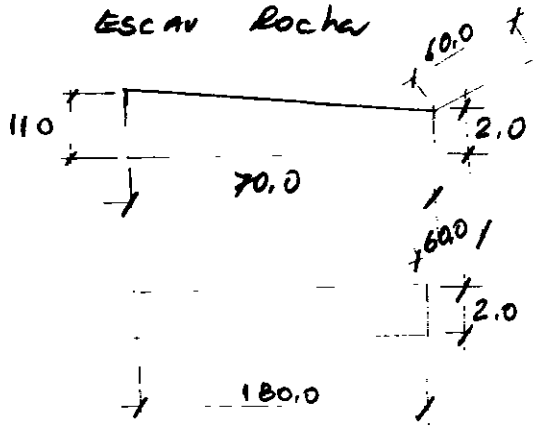
Vol: 50,0 × 11.0 × 60,0 = 33.000 m³

1.3 – CANAL DE RESTITUIÇÃO

ESCAV. SOLO

200,0 × 2.5 × 65,0 = 32 500,00 m³

ESCAV Rocha



Vol: $\left(\frac{11.0+2,0}{2} \times 70,0\right) \times 60,0 = 27\,300$ m

Vol: 180,0 × 2,0 × 60,0 = 21.600 m³

RESUMO ESCAVAÇÃO

Solo – 108 630 m³

Rocha – 142.200 m³

2 – CONCRETO

2.1 – VERTEDOURO

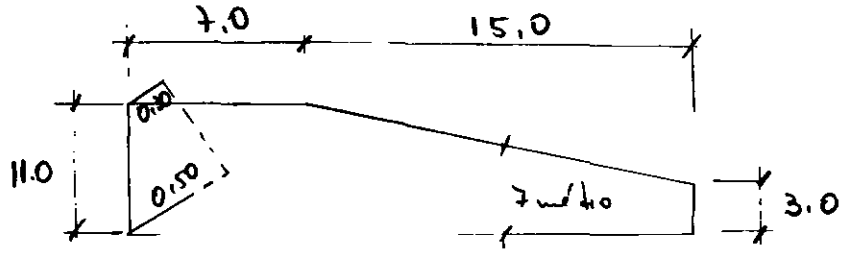
$\left(\frac{2,50 + 1.50}{2} \times 2,0\right) \times 60,0 =$ 240,0 m³

$\left(\frac{4,0 + 1,0}{2}\right) \times 3,0 \times 60,0 =$ 450,0 m³

$\left(\frac{4,0 + 0,5}{2} \times 5,0 \times 60,0 =\right.$ 675,0 m³

1.365,0 m³

2.2 MUROS VERTEDOURO



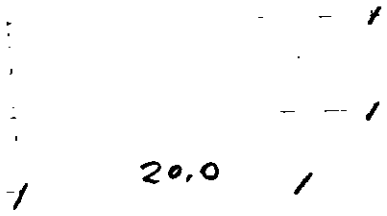
Vol: $\frac{(0.30+0,50)}{2} \times 11,0 \times 7,0 = 30,80\ m^3$

Vol: $\frac{(0.30+0,50)}{2} \times 7,0 \times 15,0 = \underline{42,00\ m^3}$

$72,80 \times 2 = 145,60\ m3$

2 3 LAJE

esp: 0,50



Vol = 20,0 x 60,0 x 0,50 = 600,0m³

RESUMO

CONCRETO S/ FORMA — 600,0 m³

C/ FORMA — 1.510,0 m³

TRATAMENTO DA ESC. SOLO

160,0 x 70,0 = 11 200 m²

TRATAMENTO DA ESC ROCHA

600,0 m x 60,0 = 36 000 m²

DESMATAMENTO

810,0m x 70,0 = 56 700 m²

GALERIA DE DESVIO — 15% MENOR QUE ALTERNATIVA 1

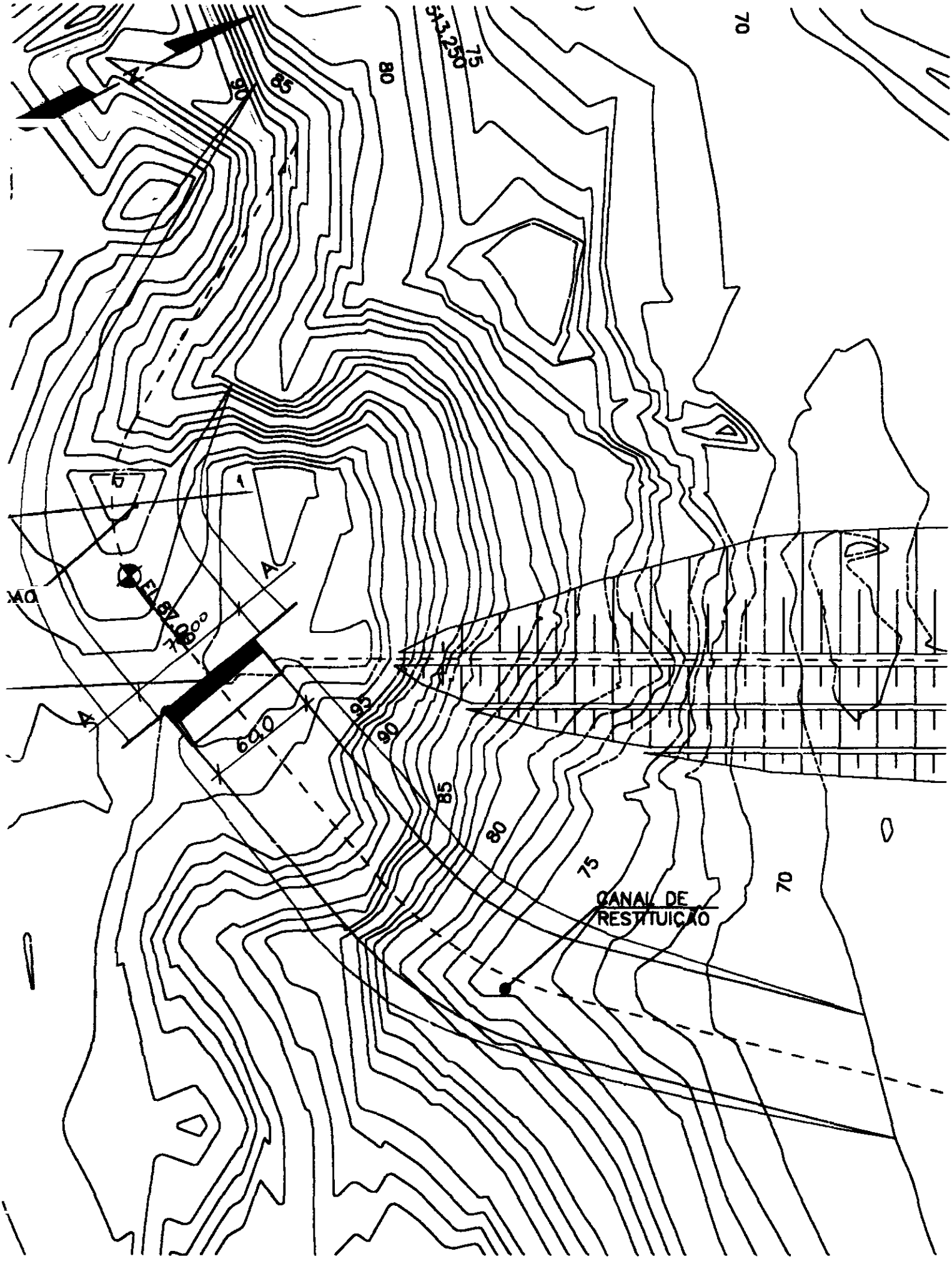
ESCAV SOLO 2 300 m³ TRATA SOLO 400 m²

ROCHA 600 m² ROCHA 940 m²

CONCRETO C/FORMA 1440 m³

S/FORMA 350 m³

NA90-4


543.250
70
75
80
85
90
95
A
A'
B
B'
EL 87,00
78,00°
60,0
CANAL DE
RESTITUIÇÃO

0.0140

ANEXO 6.2
OBRAS DE TERRA

Tal Mont (1V.xH)	2,2
Tal Jus (1V xH)	2
Largura Crista(m)	7
Cota Crista(m)	100
Altura Bermas(m)	10
Largura Bermas(m)	3
Espessura Escav (m)	1

BARRAGEM DE ARACOIABA - CE
ALTERNATIVA 1 - NA 95,00
Estudos de Otimização
Cálculo de Volumes e Áreas
Terreno Natural

Bermas	G
0	0
1	0
2	1
3	3
4	6

Ponto Estudo	Dist (x)	Terr Nat (y)	Terr.Escav (Y)	Altura (H)	Bermas (G)	Var=f(G) (J)	Base (L)	Area Transv (R)	Volume (V)	Dist (P)	Area Fund (S)
1	0,00	100,00	99,00	1,00	0	0	11,20	9,10	0,00	0,00	0,00
2	120,00	99,00	98,00	2,00	0	0	15,40	22,40	1 860,00	120,00	1 596,06
3	66,00	98,00	97,00	3,00	0	0	19,60	39,90	2 055,90	66,01	1 155,13
4	180,00	98,00	97,00	3,00	0	0	19,60	39,90	7 182,00	180,00	3 528,00
5	50,00	97,00	96,00	4,00	0	0	23,80	61,60	2.537,50	50,01	1 085,22
6	20,00	100,00	97,00	3,00	0	0	19,60	39,90	1 015,00	20,02	434,54
7	15,00	98,00	97,00	3,00	0	0	19,60	39,90	598,50	15,00	294,00
8	86,00	98,00	97,00	3,00	0	0	19,60	39,90	3 431,40	86,00	1 685,60
9	15,00	95,00	94,00	6,00	0	0	32,20	117,60	1 181,25	15,30	366,19
10	20,00	90,00	89,00	11,00	1	0	56,20	334,10	4 517,00	20,62	911,21
11	30,00	85,00	84,00	16,00	1	0	77,20	667,60	15 025,50	30,41	2 028,60
12	58,00	80,00	79,00	21,00	2	1	101,20	1 109,10	51 524,30	58,22	5 192,79
13	46,00	75,00	74,00	26,00	2	1	122,20	1 667,60	66 640,80	46,26	5 390,61
14	35,00	70,00	69,00	31,00	3	3	146,20	2 334,10	70 029,75	35,36	4 744,69
15	55,00	68,00	67,00	33,00	3	3	154,60	2 634,90	136 647,50	55,04	8 277,47
16	120,00	69,00	68,00	32,00	3	3	150,40	2 482,40	307 038,00	120,00	18 300,64
17	40,00	66,00	65,00	35,00	3	3	163,00	2 952,50	108 698,00	40,11	6 285,60
18	10,00	68,00	67,00	33,00	3	3	154,60	2 634,90	27 937,00	10,20	1 619,45
19	30,00	69,00	68,00	32,00	3	3	150,40	2 482,40	76.759,50	30,02	4 577,54
20	30,00	70,00	69,00	31,00	3	3	146,20	2 334,10	72.247,50	30,02	4 451,47
21	85,00	75,00	74,00	26,00	2	3	122,20	1 727,60	172 622,25	85,15	11 426,72
22	70,00	80,00	79,00	21,00	2	1	101,20	1 109,10	99 284,50	70,18	7 838,92
23	50,00	85,00	84,00	16,00	1	0	77,20	667,60	44 417,50	50,25	4 482,24
24	35,00	90,00	89,00	11,00	1	0	56,20	334,10	17 529,75	35,36	2 358,20
25	50,00	95,00	94,00	6,00	0	0	32,20	117,60	11 292,50	50,25	2 221,02
26	54,00	97,00	96,00	4,00	0	0	23,80	61,60	4 836,40	54,04	1 513,04
27	66,00	95,00	94,00	6,00	0	0	32,20	117,60	6 092,80	66,03	1 904,82
28	90,00	91,00	90,00	10,00	0	0	49,00	280,00	17 892,00	90,09	3 857,61
29	125,00	91,00	90,00	10,00	0	0	49,00	280,00	35 000,00	125,00	6 125,00
30	90,00	93,00	92,00	8,00	0	0	40,60	190,40	21 168,00	90,02	4 033,00
31	100,00	95,00	94,00	6,00	0	0	32,20	117,60	15 400,00	100,02	3 640,73
32	65,00	97,00	96,00	4,00	0	0	23,80	61,60	5.824,00	65,03	1 820,86
33	70,00	100,00	99,00	1,00	0	0	11,20	9,10	2 474,50	70,06	1 226,12

1.980,00
COMPR DO EIXO

1 410 792,60
VOLUME DE MACIÇO

124 203,06
ÁREA DE FUNDAÇÃO

ESTUDO DE OTIMIZAÇÃO

ALTERNATIVA 1

COTA DE CRISTA — 100,00
COTA DO NA$_{max}$ — 95,00

Volume Total — 1 482 300

(S) 1 311 000 — 88,4 %
(F) 86 100 — 5,5 %
(T) 26 900 — 1,8 %
(EE) 25 700 — 1,8 %
(E) 32 600 — 2,2 %

Volume Total Compactado — 1 410 Ecm.^{3}

(S) 1 247 200 m^3
(F) 81 800 m^3
(T) 25 400 m^3
(EE) 25 400 m^3
(E) 31 000 m^3

Desmatamento — 125 000 - 8% = 115 000 m^2
Tratamento em solo — 85 000 - 8% = 78 200 m^2
Tratamento em rocha — 40 000 - 8% = 36 800 m^2

Escavação

Comum — 183 200 - 8% = 168 600 m^3
Rocha — 10 000 m^3

Ensecadeiras

(S) 157 000 m^3
(E) 0 000 m^3
Remoção — 51 000 m^3

Tal Mont (1V x H)	2,2
Tal Jus (1V x H)	2
Largura Crista(m)	7
Cota Crista(m)	95
Altura Bermas(m)	10
Largura Bermas(m)	3
Espessura Escav (m)	1

BARRAGEM DE ARACOIABA - CE
ALTERNATIVA 2 - NA 90,00
Estudos de Otimização
Cálculo de Volumes e Áreas Fl 1/2
Terreno Natural

Bermas	G
0	0
1	0
2	1
3	3
4	6

Ponto Estudo	Dist (x)	Terr Nat (y)	Terr Escav. (Y)	Altura (H)	Bermas (G)	Var=f(G) (J)	Base (L)	Area Transv (R)	Volume (V)	Dist (P)	Area Fund (S)
1	0,00	95,00	94,00	1,00	0	0	11,20	9,10	0,00	0,00	0,00
2	50,00	85,00	84,00	11,00	1	0	58,20	334,10	8.580,00	50,99	1 718,37
3	50,00	80,50	79,50	15,50	1	0	75,10	629,53	24.090,63	50,20	3 295,77
4	50,00	76,00	75,00	20,00	1	0	94,00	1 010,00	40.986,13	50,20	4.244,59
5	40,00	70,00	69,00	26,00	2	0	122,20	1.637,60	52.982,00	40,46	4.372,37
6	40,00	69,00	68,00	27,00	2	0	126,40	1 761,90	67.990,00	40,01	4 975,55
7	146,00	69,00	68,00	27,00	2	0	126,40	1 761,90	255.475,50	146,00	18 328,00
8	30,00	66,00	65,00	30,00	2	0	139,00	2 160,00	58.828,50	30,15	4.000,86
9	55,00	69,00	68,00	27,00	2	0	126,40	1 761,90	107 852,25	55,08	7 309,35
10	20,00	70,00	69,00	26,00	2	0	122,20	1 637,60	33.996,00	20,02	2 486,11
11	50,00	73,00	72,00	23,00	2	0	109,80	1.289,90	73 187,50	50,09	5 805,42
12	100,00	80,00	79,00	16,00	1	1	77,20	697,80	99 375,00	100,24	9 382,86
13	85,00	80,00	89,00	6,00	0	1	32,20	147,80	35.921,00	85,59	4 881,57
14	50,00	85,00	94,00	1,00	0	3	11,20	99,10	6.167,50	50,25	1 090,41

785,00
COMPR DO EIXO

885.403,00
VOLUME DE MACIÇO

71 672,22
ÁREA DE FUNDAÇÃO

Tal Mont (1V.xH)	2,2
Tal Jus.(1V.xH)	2
Largura Crista(m)	7
Cota Crista(m)	95
Altura Bermas(m)	10
Largura Bermas(m)	3
Espessura Escav (m)	0,5

BARRAGEM DE ARACOIABA - CE
ALTERNATIVA 2 - NA 90,00
Estudos de Otimização
Cálculo de Volumes e Áreas Fl 2/2
Terreno Natural

Bermas	G
0	0
1	0
2	1
3	3
4	6

Ponto Estude	Dist (X)	Terr Nat (Y)	Terr Escav (Y')	Altura (H)	Bermas (G)	Var=f(G) (J)	Base (L)	Area Transv (R)	Volume (V)	Dist (P')	Area Fund (S)
1	0,00	95,00	94,50	0,50	0	0	9,10	4,03	0,00	0,00	0,00
2	90,00	72,00	71,50	23,50	2	0	111,70	1 345,23	60 716,25	92,89	5 610,70
3	100,00	90,50	90,00	5,00	0	0	28,00	87,50	71 636,25	101,70	7 103,53
4	85,00	92,00	91,50	3,50	0	0	21,70	50,23	5.863,31	85,01	2 112,58
5	100,00	94,00	93,50	1,50	0	0	13,30	15,23	3 272,50	100,02	1 750,35
6	80,00	95,00	94,50	0,50	0	0	9,10	4,03	481,25	50,01	560,11

425,00
COMPR DO EIXO

141 959,56
VOLUME DE MACIÇO

17 137,27
ÁREA DE FUNDAÇÃO

Dreno de Pé

(T) $(0,5 \times 5) \times 700 = 1750$

(E) $20m^2 \times 700 = 14000$ / $5 = 50m^3$

$V_{comparativo} = 865400 + 4960 + 15750 = 1023110\ m^3$

ESTUDO DE OTIMIZAÇÃO

ALTERNATIVA 2

COTA DA CRISTA – 95,00

COTA DO NA máx – 90,00

Volume Total Compartimentado

$V = 1.023.110\ m^3$ (– 28% do alteamento !)

(E) 88,4 %

(F) 5,8 %

(T) 1,8 %

(RR) 1,6 %

(L) 2,2 %

Volumes totais

(E) 904 500 m^3

(F) 59.400 m^3

(T) 18.500 m^3

(RR) 18.500 m^3

(L) 22 500 m^3

Desmatamento — 5 000 – 28% = 82 800 m^2

Tratamento em solo — 78 200 – 28% = 56.300 m^2

Tratamento em rocha – 36 800 – 28% = 26 500 m^2

ESCAVAÇÃO

Comum — 168.600 – 28% = 121.400 m^3

Rocha — 6.000 m^3

Ensecadeiras (alt 2)

1 _ Ens 1º Fasc (l = 410 - 20 = 390)

MD - (84/2 x 180) + (84 x 390) = 40.320 \
ME _ (84/2 x 210) + (84 x 390) = 33.180 } 73 500

2 Ens. 2º Fasc

Jus - 9800 m³

Mon _ 55 [illegible] m³

Total _ 38 600 m³ + [illegible] 900 = [illegible] 500 m

[illegible]

MD _ 84 x 200 = 16 800

ME _ (84 x 300) - 5 555 = 30 555

Total _ 47 400 m³

Tal Mont (1V:xH)	2,2
Tal Jus (1V:xH)	2
Largura Crista(m)	7
Cota Crista(m)	90
Altura Bermas(m)	10
Largura Bermas(m)	3
Espessura Escav (m)	1

BARRAGEM DE ARACOIABA - CE
ALTERNATIVA 3 - NA 85,00
Estudos de Otimização
Cálculo de Volumes e Áreas
Terreno Natural

Bermas	G
0	0
1	0
2	1
3	3
4	6

Ponto Estudo	Dist (x)	Terr Nat (y)	Terr Escav (y')	Altura (H)	Bermas (G)	Var=f(G) (J)	Base (L)	Area Transv (R)	Volume (V)	Dist (P)	Area Fund (S)
1	0,00	90,00	89,00	1,00	0	0	11,20	9,10	0,00	0,00	0,00
2	30,00	85,00	84,00	6,00	0	0	32,20	117,60	1 900,50	30,41	659,98
3	55,00	80,00	79,00	11,00	1	0	56,20	334,10	12 421,75	55,23	2 441,02
4	50,00	75,00	74,00	16,00	1	0	77,20	667,60	25 042,50	50,25	3 351,63
5	35,00	70,00	69,00	21,00	2	0	101,20	1 079,10	30 567,25	35,36	3 153,70
6	40,00	68,00	67,00	23,00	2	0	109,60	1 299,90	47 360,00	40,05	4 221,27
7	35,00	68,00	67,00	23,00	2	0	109,60	1 299,90	45 146,50	35,00	3 836,00
8	110,00	89,00	88,00	22,00	2	0	105,40	1 182,40	135 976,50	110,00	11 825,49
9	30,00	66,00	65,00	25,00	2	0	118,00	1 517,50	40 496,50	30,15	3 367,71
10	55,00	69,00	68,00	22,00	2	0	105,40	1 182,40	74 247,25	55,08	6 152,63
11	30,00	70,50	69,50	20,50	2	0	99,10	1 029,03	33 171,38	30,04	3 071,33
12	90,00	76,00	75,00	15,00	1	1	73,00	622,50	74 318,63	90,17	7 758,95
13	50,00	80,00	79,00	11,00	1	1	56,20	384,10	24 665,00	50,16	3 240,32
14	85,00	90,00	89,00	1,00	0	3	11,20	99,10	19 666,00	85,59	2 684,26

695,00
COMPR DO EIXO

565 021,75
VOLUME DE MACIÇO

55 984,29
ÁREA DE FUNDAÇÃO

Terreno de Dé

(T) $(0,5 \times 5) \times 570 = 1.425\ m^3$

(E) $20 \times 570 = 11\,400\ m^3$

$V_{Comp} = 565\,025 + 1.425 + 11.400 = 577\,850\ m^3$

ESTUDO DE OTIMIZAÇÃO

ALTERNATIVA 3

COTA DA CRISTA - 90,00
COTA DO NA - 55,00

Vcomp = 580 000 m³ (- 58% da alteada)

(S) 86.4 %
(F) 5,8 %
(T) 1,8 %
(Tv) 1,8 %
(I) 2,2 %

Volumes totais

(S) 512 600 m³
(I) 33 700 m³
(T) 10.400 m³
(Tv) 10 400 m³
(E) 12 800 m³

Desmatamento - 115 000 - 58% = 48 300 m²
Trat em solo - 78 200 - 58% = 32 800 m²
Trat. em rocha - 36.800 - 58% = 15 500 m²

Escavação
Comum - 168 600 - 58% = 70 800 m³
Rocha - 6.000 m³

Ensecadeiras (Alt 3)

1 - Ens 1ª Fase

MD - (84/2 x 80) + (84 x 370) = 34440
ME - (84/2 x 210) + (84 x 270) = 31500 > 65 940

2 - Ens 2ª Fase

Jus - 9800
Mon - 55 300 > 65 100

Total — 65940 + 65100 - 500 (ench.) = 130.540 m³

(5) 146.000 m³

Remoção

MD - 84 x 80 = 15 120 m³
ME - (84 x 280) + 5 355 = 29 875 m³ ∴ 40 000