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9. ABSTRACT

Irrigation is a relatively new factor in agriculture in El Salvador. In the past, the crops have been mainly produced during the rainy season (May-October).

Because of the ideal climate, with irrigation, crops can be produced year round, and with this intent, the Ministry of Agriculture, (Ministerio de Agriculura y Ganaderia, MAG) has formed two irrigation districts, Zapotitan and Atiocoyo-Nueva Concepcion.

The Zapotitan District is composed of individual farmers who own their farms. For the most part, the land is relatively flat with slopes less than 2%. Zapotitan covers an area of 3950 hectares (Ha), with 600 Ha divided into 2 Ha farms. The average farm in the remaining 3350 Has. is between 15-20 Has.

Atiocoyo-Nueva Concepcion is a government owned district, with the land to be redistributed to individual farmers, with 50 Has. as a limit for one farmer. The district is composed of 3721 Has., much of which is rolling hills or land with slopes greater than 2%.

The purpose of this study is to compare the cost of sprinkler versus surface irrigation, determine the variable factors in the costs, and present some guidelines in selecting the most economic irrigation method for any area, given specifications of soil type, crop, and topography.

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ECONOMIC ANALYSIS OF ALTERNATE IRRIGATION METHODS IN EL SALVADOR

by

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January, 1974

TABLE OF CONTENTS

TABLES

FIGURES

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The information and conclusions in this report do not necessarily reflect the position of Utah State University, USAID, or the United States Government.

Grant R. Hanson

INTRODUCTION

Irrigation is a relatively new factor in agriculture in El Salvador. In the past, the crops have been mainly produced during the rainy season (May-October).

Because of the ideal climate, with irrigation, crops can be produced year round, and with this intent, the Ministery of Agriculture, (Ministerio de Agricultúra y Ganadería, MAG) has formed two irrigation districts, Zapotitán and Atiocoyo-Nueva Concepción.

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Atiocoyo-Nueva Concepción is a government owned district, with the land to be redistributed to individual farmers, with 50 Has. as a limit for one farmer. The district is composed of 3721 Has., much of which is rolling hills or land with slopes greater than 2%.

Of the two districts, Zapotitán is the most developed, having electricity, and with irrigation water provided by wells with electric pumps. The water source for Atiocoyo-Nueva Concepcion is the Rio Lempa and Rio Sucio rivers.

In considering irrigation methods, there are two feasible methods within the projects: surface (furrow or border), and sprinkler. At

the present time, emphasis is being placed on land leveling for furrow irrigation within the projects.

Regarding irrigation outside of the two districts, it is not known how much land, if any, has been leveled privately for surface irrigation, but in regards to sprinkler irrigation, approximately 10,000 Has, are presently under sprinkler irrigation, all on private farms or plantations (Yarri, 1974).

The purpose of this study is to compare the cost of sprinkler versus surface irrigation, determine the variable factors in the costs, and present some guidelines in selecting the most economic irrigation method for any area, given specific ations of soil type, crop, and topography.

PROCEDURE

In instigating irrigation, preliminary studies were conducted within the two irrigation districts. In 1970 Tahal Consulting Engineers compiled a preliminary study of Zapotitán and in 1972, DGORD, (Dirección General de Obras de Riego y Drenaje) conducted a preliminary study in the Atiocoyo-Neuva Concepción district.

In order to determine the accuracy of the soil and topographic data collected in these two preliminary studies, sample sites were selected in each of the irrigation districts. The sites were surveyed, and in Atiocoyo, soil samples were taken to a depth of two meters. The size of the areas surveyed were limited, due to breaks in the natural terrain, and crops already planted, such as sorghum and corn.

The survey data was read into a computer program which computed the cuts and fills at each station on a 20 meter grid. (See Appendix A)

Due to a lack of any existing efficient method for manually calculating volumes of cut and fill in land leveling, a table was compiled giving cuts and fills in cubic meters on a 20 m. by 20 m. grid, which is the customary grid spacing in metric units. (See Appendix B)

To obtain land leveling costs, three companies renting earth moving equipment were consulted and the average of the costs was used in the economic analysis. Due to the fact that ditching costs and land planing costs were not available from private contractors, the costs used are those used by the engineers in DGORD.

The cuts and fills at each station were calculated by use of the computer program, but since the program used the stations as center points of an area 20 m. by 20 m., the cut and fill volumes were not accurate, therefore, using the four point method and the table (Appendix B), the cuts and fills were calculated and adjusted to a cut/fill ratio of 1.4.

With 50 Has. being the average area of a farm in Atiocoyo, both sprinkler and furrow irrigation systems were designed for a 50 Has. area (710 m. by 710 m.), to obtain the average cost for each method, using the three main crops: corn, beans, and alfalfa.

RESULTS AND DISCUSSION

In analyzing the cost of sprinkler versus surface irrigation, several assumptions were made: (1) The same number of workers are necessary whether the system be sprinkler or surface, thus the manual labor cost is the same for both systems. (2) The water source will always be at the highest point of the farm or field.

Soil Data

The bulk density and water holding capacity of the soils tested were approximately the same as compared to data obtained in the preliminary studies for the corresponding soils. The problem in analyzing the soil data is that for any given soil type, the variation in infiltration rates and water holding capacities in different tests is very great, with no apparent relationship. (See Appendix C)

Due to the diversity of infiltration rates and water holding capacities of the soil types, the soils were divided into four types, according to infiltration rates, and are given in Table 1.

Table 1. Infiltration rates used in economic analysis.

Group	Infiltration Rates cm/hr	Design Infiltration Rate cm/hr
I	0.25 - 0.65	0.50
II	0.66 - 0.85	0.75
III	0.86 - 1.15	1.00
IV	1.16 - +	1.30

An average water holding capacity of 2.00 mm/cm was used in the calculations

The majority of the soils in both districts are very shallow, having a topsoil layer between 15-30 cm, (See Appendix C) which places a restriction on the depth of cut allowable in land leveling without ruining the topsoil.

Topographic Data

The results of the volumes of cuts computed for the areas surveyed are listed in Table 2.

Table 2. Volume of cuts from land leveling computations of areas surveyed in Atiocoyo-Nueva Concepcion and Zapotitan

Area Ha.	Average Slope	Cut, m^3/Ha.	Maximum depth of cut, cm.
2.7	.3	483	30
7.7	.4	384	30
1.0	.5	190	14
3.2	.5	357	23
1.0	.6	310	29
1.5	.6	1681	159
.48	.9	339	16
1.4	1.0	928	50
3.2	1.0	985	103
.96	1.4	595	31

As shown from the results, the volumes of cut cannot be calculated as a function of slope alone, as indulations in terrain cause a great variation in volume of cut, regardless of average slope. Therefore, to compute land leveling costs, the volume of cuts will be divided into thirds; the lowest third, the average third, and the highest third. The

averages within these three divisions will be used for calculating costs (See Table 3).

Table 3. Volumes of cuts and averages used in cost analysis

Group	Volume of cut, m^3/Ha.	Average volume of cut, m^3/Ha.
	190	
	310	
I	339	280
	357	
	384	
II	483	487
	595	
	928	
	985	
III	1500	1273
	1681	

Sprinkler irrigation equipment and land leveling equipment costs

The costs used in the cost analysis are presented in Appendix D.

In amortizing the costs of each system, the expected lifetimes of machinery, land leveling, and structures were decreased to compensate for maintenance and repair.

The equipment was amortized for the expected lifetime at a rate of 10%. The interest rates range from 6% to 12% for this type of loan, but because a loan with an interest rate of 6-8% generally must be repaid within 4-6 years, 10% was chosen in order to extend the time period so that the actual yearly cost could be shown.

A farmer could obtain a loan at 6% for a period of 4-6 years, but to compare the yearly costs of a sprinkler irrigation system versus a surface irrigation system amortized over a period of 6 years would not be a valid comparison.

The equipment, the expected lifetimes of the equipment, and the capital recovery factor are shown in Table 4.

Table 4. Equipment, expected lifetimes, and capital recovery factor (CRF)

Equipment	Expected Lifetime (years)	CRF
Laterals/Mainlines/ Accessories	13	.141
Suction hose	13	.141
Sprinklers	4	.264
Pump	8	.187
Diesel Engine	10	.162
Electric Motor	20	.117
Land Grading	15	.131
Land Planing	1	1.100
Drop/Check Structures	5	.264
Ditches (head)	5	.264
Ditches (tail or drain)	1	1.100

Surface irrigation design

The main variable factors in the surface irrigation design are the land leveling cost, and drop/check structure cost, with the land leveling cost being a function of slope and undulations in terrain, and the drop/check structure cost a function of the slope of the canal.

In computing land leveling costs, a 6-9 cubic yard self-loading scraper was used. The scraper was assumed to load, transport, and unload 9 yards each six minutes for a total of 90 yard^3 or 70 m^3 each hour.

The layout of the surface irrigation system used in determining the average costs as shown in Figure 1.

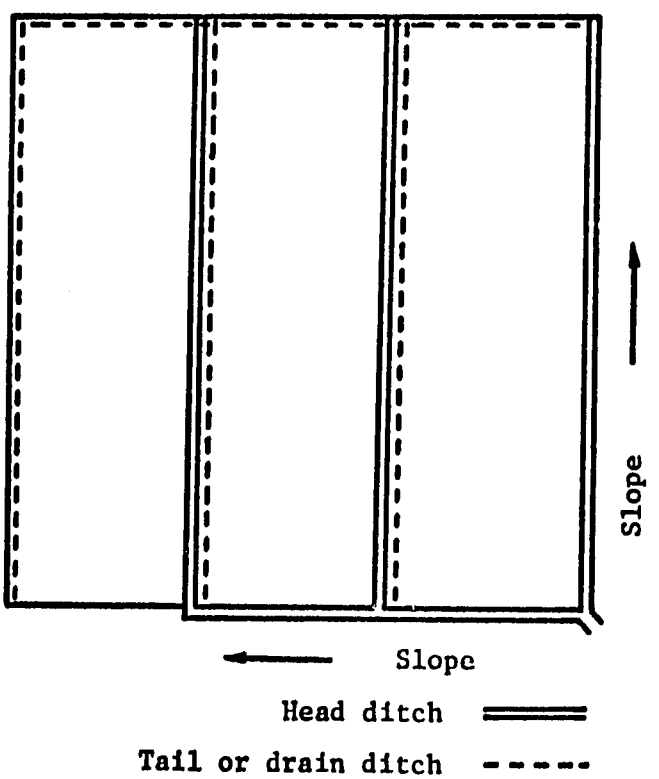

Figure 1. Layout of 50 Ha surface irrigation system (710 m x 710 m)

A typical itemized cost for a surface irrigation system is listed in Table 5 for a 50 Ha field with an average slope of .5% and an average cut of 487 m^3/Ha (Group I), located in Atiocoyo (70 km from San Salvador).

Table 5. Cost analysis for surface irrigation with average slope of .5% and an average cut of 487 m^3/Ha

Equipment or Structure	Cost	Initial Cost ¢ (1)	Yearly Cost ¢
Plow	¢ 35/Ha	1750	229
Disk (2 passes)	¢ 42/Ha	2100	275
Survey	¢ 28/Ha	1400	183
Land leveling with scraper	¢ 50/Hr	17393	2778
Supervision of land leveling	10% above	1739	278
Land plane	¢ 31/Ha	1550	1705
Drop/check structures (30)	¢ 70 ea	2100	554
Siphons (500)	¢ 2 ea	1000	264
Head ditch (2500 m)	¢ 1.00/m	2500	660
Supervision of ditching	10% above	250	66
Tail ditch (2500 m.)	¢ 0.15/m.	375	412
Transport of scraper (70 km)	¢2.50/km	175	23
Transport of tractor (70 km) with disk/plow/plane	¢2.50/km	175	193
	Total	¢32507	¢7070
	Cost/Ha	¢ 650	¢ 141

The average costs for a 50 Ha field with various slopes and different volumes of cut are shown in Table 6.

(1) [illegible] "colones"
1 colon = US $.40

Table 6. Average cost for 50 Ha field according to slope and volume of cut.

Slope %	Volume of Cut m^3/Ha	Initial Cost		Yearly Cost	
		Total	Cost/Ha	Total	Cost/Ha
.5	280	¢24375	¢ 488	¢ 5324	¢ 106
.5	487	32507	650	7070	141
.5	1273	63385	1268	10565	211
1.0	280	26125	523	5786	116
1.0	487	34257	685	7532	151
1.0	1273	65135	1303	11027	221
2.0	280	29625	593	6700	134
2.0	487	37757	755	8446	169
2.0	1273	68635	1373	11941	239

Sprinkler irrigation design

The main variable in the sprinkler irrigation design is the infiltration rate of the soil, which controls the maximum application rate allowable.

The layout of the 50 Ha. sprinkler irrigation design is shown in Figure 2, with the costs listed in Table 7.

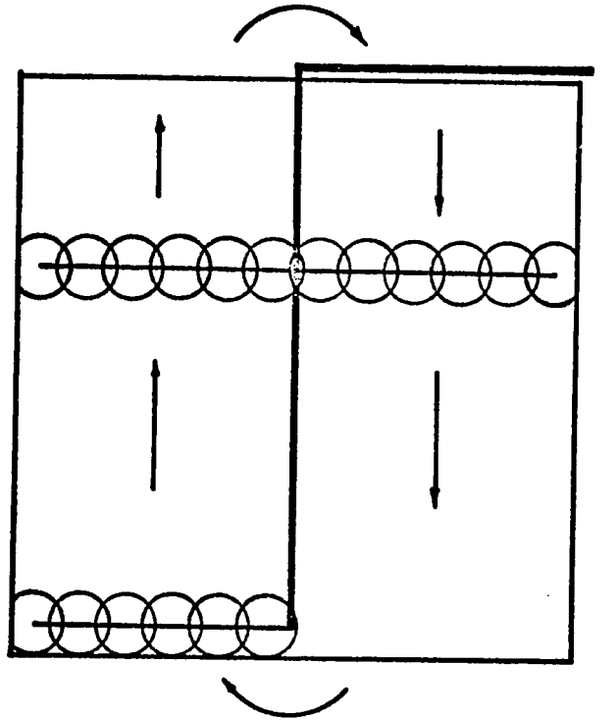

Figure 2.

need title + labels

Table 7. Costs of a 50 Ha. sprinkler irrigation system, for corn grown on soil having a water holding capacity of 2.0 mm/cm and an average infiltration rate of 1.0 cm/hr. (System: 40 x 60 foot sprinkler spacing; total discharge = 840 gpm; total dynamic head = 195 feet).

Quantity	Item	Cost, ¢	Initial Cost ¢	Yearly Cost ¢
76	6" x 30 ft. pipe	152,40	11,582	1,633
168	4" x 20 ft. pipe	67,95	11,416	1,610
3	4" x 30 ft. pipe	84.55	254	36
6	4" elbows	85.00	187	26
38	6" valves	85.00	3,230	455
1	6" plug	16.25	16	2
3	4" plugs	8.13	24	3
84	Sprinklers	20.30	1,705	450
84	3/4" x 3 m. risers	22.00	1,848	260
84	Stabilizers	6.00	504	71
1	Pump	3,300.00	3,300	612
1	60 HP motor	8,000.00	8,000	912
1	Suction hose	1,100.00	1,100	155
1	Installation	600.00	600	70
2	Trucks for Transport of Equipment	100.00	200	24
		Subtotal	43,966	6,324
Yearly pumping cost: .051/BHP-Hr x 2150 hrs x 60 BHP				6,579
Overhead and Maintenance				65
		Total	¢43,966	¢12,968
		Cost/Ha	¢ 879	¢ 259

The costs of sprinkler irrigation systems for the three main crops are shown in Table 8. The irrigation season used for calculating the yearly costs for each of the three crops is: Corn - 90 days; Beans - 70 days; Alfalfa - 150 days.

Table 8. Sprinkler irrigation system costs for corn, beans, and alfalfa on 50 Ha.

Crop	Infiltration Rate, cm/hr.	Initial Cost, ¢		Yearly Cost, ¢	
		Total	Cost/Ha	Total	Cost/Ha
Corn	.5	53,202	1,064	15,007	300
Corn	.75	47,497	950	14,063	281
Corn	1.0	43,966	879	12,968	259
Corn	1.30	54,884	1,098	13,931	270
Beans	.5	52,026	1,040	11,862	237
Beans	.75	46,712	934	10,975	220
Beans	1.00	43,378	868	10,742	214
Beans	1.30	37,271	745	10,145	202
Alfalfa	.5	65,970	1,310	22,961	459
Alfalfa	.75	58,896	1,178	21,516	430
Alfalfa	1.00	54,509	1,090	19,859	397
Alfalfa	1.30	68,056	1,361	21,314	427

CONCLUSIONS AND RECOMMENDATIONS

In comparing the costs of the surface irrigation system designs with the sprinkler systems, it can be seen that surface irrigation is more economical where the volume of land cuts is approximately 1,000 m^3/Ha. or less, where topsoil depth is greater than the depth of cut.

However, not included in the cost of the surface irrigation systems, is the decrease in production caused by removal of topsoil where the depth of cut exceeds the depth of topsoil. As shown in Table 2, leveling a 1 Ha. area with an average slope of .5% will produce cuts of 20-30 cm. In the majority of the soils in both irrigation districts, the depth of topsoil is 20-30 cm.

Therefore, in comparing the costs of the two methods of irrigation, one important factor to be considered is that because of land leveling, production could be significantly decreased from 3 to 5 years, depending on the depth and area of cut.

Another important consideration is the efficiency of each method of irrigation. The efficiency of a sprinkler irrigation system would be 60-80 percent, as compared to an efficiency of 20-40 percent for a surface irrigation system. Because of the low infiltration rates of the soils, much of the water is lost as runoff with a surface irrigation system.

Also to be considered is that if the area of the system was increased, the average cost per hectare for the sprinkler system would decrease, since the cost of the pump and motor is a large part of the cost. Costs taken from sprinkler irrigation systems designed and installed by a private engineering firm in El Salvador show an initial

cost per hectare of ¢ 557 for a 124 Mz. (87 Has.) system, and ¢ 493 for a 96 Mz (67 Has.) system. (See Appendix D) This is a sizable decrease in cost, when compared to an initial cost of ¢ 800 to ¢ 1,000 per hectare for a 50 Ha. system.

In selecting the most economical irrigation system for a given area or field, it is recommended that:

1. A detailed soil survey be made to determine an average infiltration rate and the depth of the topsoil.
2. A preliminary land survey be conducted to estimate the volume and depth of cut required for land leveling.
3. The total area where depth of cut exceeds topsoil depth be calculated.

Using these three steps, surface and sprinkler irrigation systems can be designed for a given area, and then the costs of each system can be analyzed. In comparing the costs of each system there are two important factors to be considered before selecting one method over the other, which are:

1. If water supply is limited, the efficiency of the system will become a critical factor, which may favor sprinkler irrigation even though the cost may be higher than that of surface irrigation
2. If a large area of topsoil is removed from a field, the decrease in profits due to loss in crop production might justify the additional expenditure in installing a sprinkler irrigation system.

The selection of an irrigation system must be considered from several viewpoints. As before stated, a decrease in production from loss of topsoil is a real factor, but estimating the loss of profits

may not be easy, nevertheless, it must be considered. Another viewpoint would be the case where a loan must be repaid within six years, in which case, the initial cost would be the controlling factor.

These are a few examples to impress that after the cost of each system is determined, the least expensive system from the design viewpoint, must meet the other criteria previously discussed to assure feasibility.

LITERATURE CITED

1. Yarri Dov, Irrigation engineer, Goldtree Liebes, S. A., Per. Comm., Jan. 1974.

APPENDIX A

Computer Program for Land Leveling

```
$FOR,IS MATN,MAIN
FOR MOD1-09/30/73-17:09:46 (.0)

   MAIN PROGRAM

   STORAGE USED: CODE(1) 000370; DATA(0) 002442; BLANK COMMON(2) 000000

   EXTERNAL REFERENCES (BLOCK, NAME)

    0003   NINTR$
    0004   NTOU$
    0005   NTO2$
    0006   NWOU$
    0007   NSTOP$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000   002337 101F      0001   000032 1226      0001   000205 1610      0001   000260 2026      0000   002356 203F
    0000   002363 204F      0000   002341 205F      0000   002400 206F      0001   000165 3L        0000 D 002310 A
    0000 D 002250 AN        0000 D 002327 AREA      0000 D 002314 B         0000 D 002312 C         0000 D 002325 CF
    0000 D 002331 CFH       0000 D 002244 CRF       0000 D 002276 CX11      0000 D 002304 CX12      0000 D 002306 CX13
    0000 D 002350 CX22      0000 D 002310 CX23      0000 D 002302 CX33      0000 D 001430 D         0000 D 001172 DZ
    0000 T 002275 T         0000 I 002324 J         0000 I 001736 JX2       0000 I 002101 JX3       0000 I 002252 N
    0000 D 002333 SLOPEX    0000 D 002335 SLOPEY    0000 D 002246 SP        0000 D 002320 SUMCUT    0000 D 002322 SUMFIL
    0000 D 002253 SX1       0000 D 002201 SX11      0000 D 002263 SX12      0000 D 002265 SX13      0000 D 002255 SX2
    0000 D 002267 SX22      0000 D 002271 SX23      0000 D 002257 SX3       0000 D 002273 SX33      0000 D 000000 X1
    0000 D 000306 X2        0000 D 000614 X3

000100      1*      C     LAND LEVELLING COMPUTATION BY THE REGRESSION OF Z=A+BX+CY                    000000
000100      2*      C                                                                                   000000
000100      3*      C                                                                                   000000
000100      4*      C     INPUT DATA                                                                    000000
000100      5*      C     1   NO OF STICKS        AN                                                    000000
000100      6*      C     2   SPACE (M)           SP                                                    000000
000100      7*      C     3   CUT/FILL            CRF                                                   000000
000100      8*      C     ORDER OF THE DATA ON THE CARD    Z  X  Y                                     000000
000101      9*            DIMENSION X1(99),X2(99),X3(99),DZ(99),D(99),JX2(99),JX3(99)                   000000
000103     10*            IMPLICIT DOUBLE PRECISION (A-H,O-Z)                                           000000
000104     11*            CRF=1.2                                                                       000001
000105     12*            SP=20.0                                                                       000003
000106     13*            AN=75                                                                         000005
000107     14*            N=AN                                                                          000007
000110     15*            SX1=0.0                                                                       000014
000111     16*            SX2=0.0                                                                       000015
000112     17*            SX3=0.0                                                                       000017
000113     18*            SX11=0.0                                                                      000020
000114     19*            SX12=0.0                                                                      000021
000115     20*            SX13=0.0                                                                      000022
000116     21*            SX22=0.0                                                                      000023
000117     22*            SX23=0.0                                                                      000024
000120     23*            SX33=0.0                                                                      000025
000121     24*            DO 2 I=1,N                                                                    000032
```

```
00124     25•          READ(5,101)X1(I),X2(I),X3(I)                                  000032
00131     26•      101 FORMAT(F4.0,2F7.0)                                            000041
00132     27•          SX1=SX1+X1(I)                                                 000041
00133     28•          SX2=SX2+X2(I)                                                 000044
00134     29•          SX3=SX3+X3(I)                                                 000047
00135     30•          SX11=SX11+X1(I)*X1(I)                                         000052
00136     31•          SX22=SX22+X2(I)*X2(I)                                         000056
00137     32•          SX33=SX33+X3(I)*X3(I)                                         000062
00140     33•          SX12=SX12+X1(I)*X2(I)                                         000066
00141     34•          SX13=SX13+X1(I)*X3(I)                                         000072
00142     35•        2 SX23=SX23+X2(I)*X3(I)                                         000076
00144     36•          CX11=SX11-(SX1**2)/AN                                         000103
00145     37•          CX22=SX22-(SX2**2)/AN                                         000110
00146     38•          CX33=SX33-(SX3**2)/AN                                         000115
00147     39•          CX12=SX12-(SX1*SX2)/AN                                        000121
00150     40•          CX13=SX13-(SX1*SX3)/AN                                        000126
00151     41•          CX23=SX23-(SX2*SX3)/AN                                        000133
00152     42•          C=(CX23*CX12-CX13*CX22)/(CX23**2-CX33*CX22)                   000142
00153     43•          B=(CX12-C*CX23)/CX22                                          000151
00154     44•          A=(SX1-B*SX2-C*SX3)/AN                                        000155
00155     45•        3 A=A-0.1                                                       000166
00156     46•          SUMCUT=0.0                                                    000175
00157     47•          SUMFIL=0.0                                                    000177
00160     48•          DO 4 J=1,N                                                    000205
00163     49•          DZ(J)=A+B*X2(J)+C*X3(J)                                       000205
00164     50•          D(J)=DZ(J)-X1(J)                                              000213
00165     51•          IF(D(J).GT.0.0)SUMFIL=SUMFIL+D(J)                             000215
00167     52•          IF(D(J).LT.0.0)SUMCUT=SUMCUT-D(J)                             000225
00171     53•        4 CONTINUE                                                      000240
00173     54•          CF=SUMCUT/SUMFIL                                              000240
00174     55•          IF(CF.LT.CRF)GO TO 3                                          000243
00176     56•          WRITE(6,205)                                                  000247
00200     57•      205 FORMAT(1H1,30H  X  Y  GROUND  DESIGN  CUT OR/                 000260
00200     58•         1 1H ,8X,23HFLE(M)  FLE(M) FILL(CM)//)                         000260
00201     59•          DO 5 I=1,N                                                    000260
00204     60•          X1(I)=X1(I)/100.0                                             000262
00205     61•          DZ(I)=DZ(I)/100.0                                             000262
00206     62•          JX2(I)=X2(I)                                                  000265
00207     63•          JX3(I)=X3(I)                                                  000273
00210     64•      203 FORMAT(1H ,2(1X,I2),F7.2,F9.2,F8.0)                           000301
00211     65•        5 WRITE(6,203)JX2(I),JX3(I),X1(I),DZ(I),D(I)                    000301
00221     66•          AREA=(SP**2)*AN/10000.0                                       000314
00222     67•          SUMCUT=SUMCUT*(SP**2)/100.0                                   000320
00223     68•          SUMFIL=SUMFIL*(SP**2)/100.0                                   000324
00224     69•          CPH=SUMCUT/AREA                                               000330
00225     70•          SLOPEX=B*0.01/SP                                              000332
00226     71•          SLOPEY=C*0.01/SP                                              000336
00227     72•          WRITE(6,204)                                                  000342
00231     73•      204 FORMAT(///1HO,6GH  AREA(HA)   CUT(M3)  FILL(M3)  SLOPE X  SLOPE Y  000347
00231     74•         1 CUT/HA  CUT/FILL)                                            000347
00232     75•      206 FORMAT(1H0,F7.2,F12.0,F10.0,2F9.5,F8.0,F9.2)                  000347
00233     76•          WRITE(6,206)AREA,SUMCUT,SUMFIL,SLOPEX,SLOPEY,CPH,CF           000347
00244     77•          STOP                                                          000363
00245     78•          END                                                           000367
```

END OF COMPILATION: NO DIAGNOSTICS.

X	Y	GROUND ELE(M)	DESIGN ELE(M)	CUT OR FILL(CM)
1	1	21.32	21.10	-22.
1	2	21.21	21.16	-5.
1	3	21.08	21.22	14.
1	4	21.14	21.28	14.
1	5	21.27	21.34	7.
1	6	21.31	21.40	9.
1	7	21.43	21.46	3.
1	8	21.73	21.52	-21.
2	1	21.20	21.04	-16.
2	2	21.03	21.10	7.
2	3	21.06	21.16	10.
2	4	21.20	21.23	3.
2	5	21.11	21.29	18.
2	6	21.34	21.35	1.
2	7	21.45	21.41	-4.
2	8	21.61	21.47	-14.
3	1	21.27	20.32	-29.
3	2	21.02	21.05	3.
3	3	21.13	21.11	-2.
3	4	21.09	21.17	8.
3	5	21.10	21.23	7.
3	6	21.29	21.29	0.
3	7	21.60	21.35	-25.
3	8	21.56	21.41	-15.
4	1	20.86	20.93	7.
4	2	20.64	20.99	35.
4	3	20.94	21.05	11.
4	4	21.11	21.11	0.
4	5	21.07	21.17	10.
4	6	21.19	21.23	4.
4	7	21.51	21.29	-22.
4	8	21.66	21.36	-30.
5	1	20.88	20.87	-1.
5	2	20.53	20.93	40.
5	3	20.72	21.00	28.
5	4	20.87	21.06	19.
5	5	21.02	21.12	10.
5	6	21.21	21.18	-3.
5	7	21.44	21.24	-20.
5	8	21.65	21.30	-35.
5	9	21.35	21.35	-0.
6	1	21.06	20.82	-24.
6	2	20.97	20.88	-9.
6	3	20.96	20.94	-2.
6	4	21.05	21.00	-5.
6	5	20.91	21.06	15.
6	6	21.22	21.12	-10.
6	7	21.37	21.18	-19.
6	8	21.45	21.24	-21.
6	9	21.53	21.30	-23.
6	10	21.35	21.36	1.
7	1	20.96	20.76	-20.
7	2	20.94	20.82	-12.

7	3	20.80	20.88	8.
7	4	20.95	20.94	-1.
7	5	20.93	21.00	7.
7	6	21.07	21.06	-1.
7	7	21.14	21.13	-1.
7	8	21.40	21.19	-21.
7	9	21.37	21.25	-12.
7	10	21.28	21.31	3.
7	11	21.22	21.37	15.
7	12	21.20	21.43	23.
8	1	20.80	20.71	-9.
8	2	20.86	20.77	-9.
8	3	20.88	20.83	-5.
8	4	20.99	20.89	-10.
8	5	20.97	20.95	-2.
8	6	20.96	21.01	5.
8	7	21.10	21.07	-3.
8	8	21.12	21.13	1.
8	9	21.11	21.19	8.
8	10	21.22	21.25	3.
8	11	21.26	21.31	5.
8	12	21.00	21.37	37.

AREA(HA)	CUT(M3)	FILL(M3)	SLOPE X	SLOPE Y	CUT/HA	CUT/FILL
3.00	1934.	1604.	-.00282	.00303	645.	1.21

APPENDIX B

Metric Table of Cuts and Fills

The table gives cut and fill volumes in cubic meters based on the formulas:

$$V_c = \frac{L^2}{4} \cdot \frac{(\Sigma\, h_c^{\,2})}{\Sigma h_c + \Sigma h_f}$$

$$V_f = \frac{L^2}{4} \cdot \frac{(\Sigma\, h_f^{\,2})}{h_c + h_f}$$

where: V_c = volume of cut, m^3

V_f = volume of fill, m^3

L = length between stations, m.

h_f = depth of fill at station, cm

h_c = depth of cut at station, cm

Using the abscissa as sum of cuts, and the ordinate as sum of fills, the volumes are given with the cut on top and fill on the bottom in each box.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
0	—	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	—	0.5	1.3	2.3	3.2	4.2	5.1	6.1	7.1	8.1	9.1	10.1	11.1	12.1	13.1	14.1	15.1	16.1	17.1	18.0	19.0	20.0	21.0	22.0	23.0
		0.5	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2	—	0.3	1.0	1.8	2.7	3.6	4.5	5.4	6.4	7.4	8.3	9.3	10.3	11.3	12.3	13.2	14.2	15.2	16.2	17.2	18.2	19.2	20.2	21.2	22.2
		1.3	1.0	0.8	0.7	0.6	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
3	—	0.3	0.8	1.5	2.3	3.1	4.0	4.9	5.8	6.8	7.7	8.6	9.6	10.6	11.5	12.5	13.5	14.1	15.4	16.4	17.4	18.4	19.4	20.3	21.3
		2.3	1.8	1.5	1.3	1.1	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3
4	—	0.2	0.7	1.3	2.0	2.8	3.6	4.5	5.3	6.2	7.1	8.1	9.0	9.9	10.9	11.8	12.8	13.8	14.7	15.7	16.7	17.6	18.6	19.6	20.6
		3.2	2.7	2.5	2.0	1.8	1.6	1.5	1.3	1.2	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6
5	—	0.2	0.6	1.1	1.8	2.5	3.3	4.1	4.9	5.8	6.7	7.6	8.5	9.4	10.3	11.3	12.2	13.1	14.1	15.0	16.0	17.0	17.9	18.9	19.9
		4.2	3.6	3.1	2.8	2.5	2.3	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9
6	—	0.1	0.5	1.0	1.6	2.3	3.0	3.8	4.6	5.4	6.3	7.1	8.0	8.9	9.8	10.7	11.6	12.6	13.5	14.4	15.4	16.3	17.3	18.2	19.2
		5.1	4.6	4.0	3.6	3.3	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.4	1.3	1.3	1.2	1.2
7	—	0.1	0.4	0.9	1.5	2.1	2.8	3.5	4.3	5.1	5.9	6.7	7.6	8.4	9.3	10.2	11.1	12.0	13.0	13.9	14.8	15.8	16.7	17.6	18.6
		6.1	5.4	4.9	4.6	4.1	3.8	3.5	3.3	3.1	2.9	2.7	2.6	2.4	2.3	2.2	2.1	2.0	2.0	1.9	1.8	1.8	1.7	1.6	1.6
8	—	1.1	0.4	0.8	1.3	1.9	2.6	3.3	4.0	4.8	5.6	6.4	7.2	8.0	8.9	9.8	10.7	11.6	12.5	13.4	14.3	15.2	16.1	17.1	18.0
		7.1	6.4	5.8	5.3	4.9	4.6	4.3	4.0	3.8	3.6	3.4	3.2	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.1	2.0
9	—	0.1	0.4	0.8	1.2	1.8	2.4	3.1	3.8	4.5	5.3	6.0	6.9	7.7	8.5	9.4	10.2	11.1	12.0	12.9	13.8	14.7	15.6	16.5	17.5
		8.1	7.4	6.8	6.2	5.8	5.4	5.1	4.8	4.5	4.3	4.0	3.9	3.7	3.5	3.4	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.5
10	—	0.1	0.3	0.7	1.1	1.7	2.3	2.9	3.6	4.3	5.0	5.8	6.5	7.3	8.2	9.0	9.8	10.7	11.6	12.4	13.3	14.2	15.1	16.0	16.9
		9.1	8.3	7.7	7.1	6.7	6.3	5.9	5.6	5.3	5.0	4.8	4.5	4.3	4.2	4.0	3.8	3.7	3.6	3.4	3.3	3.2	3.1	3.0	2.9
11	—	0.1	0.3	0.6	1.1	1.6	2.1	2.7	3.4	4.0	4.8	5.5	6.3	7.0	7.8	8.7	9.5	10.3	11.2	12.0	12.9	13.8	14.7	15.6	16.5
		10.1	9.3	8.6	8.1	7.6	7.1	6.7	6.4	6.0	5.8	5.5	5.3	5.0	4.8	4.7	4.5	4.3	4.2	4.0	3.9	3.8	3.7	3.6	3.5
12	—	0.1	0.3	0.6	1.0	1.5	2.0	2.6	3.2	3.9	4.5	5.3	6.0	6.8	7.5	8.3	9.1	10.0	10.8	11.6	12.5	13.4	14.2	15.1	16.0
		11.1	10.3	9.6	9.0	8.5	8.0	7.6	7.2	6.9	6.5	6.3	6.0	5.8	5.5	5.3	5.1	5.0	4.8	4.6	4.5	4.4	4.2	4.1	4.0
13	—	0.1	0.3	0.6	0.9	1.4	1.9	2.4	3.0	3.7	4.3	5.0	5.8	6.5	7.3	8.0	8.8	9.6	10.5	11.3	12.1	13.0	13.8	14.7	15.6
		12.1	11.3	10.6	9.9	9.4	8.9	8.4	8.0	7.7	7.3	7.0	6.8	6.5	6.3	6.0	5.8	5.6	5.5	5.3	5.1	5.0	4.8	4.7	4.6
14	—	0.1	0.3	0.5	0.9	1.3	1.8	2.3	2.9	3.6	4.2	4.8	5.5	6.3	7.0	7.8	8.5	9.3	10.1	10.9	11.8	12.6	13.4	14.3	15.2
		13.1	12.3	11.5	10.9	10.3	9.8	9.3	8.9	8.5	8.2	7.8	7.5	7.3	7.0	6.8	6.5	6.3	6.1	5.9	5.8	5.6	5.4	5.3	5.2
15	—	0.1	0.2	0.5	0.8	1.3	1.7	2.2	2.8	3.4	4.0	4.7	5.3	6.0	6.8	7.5	8.3	9.0	9.8	10.6	11.4	12.3	13.1	13.9	14.8
		14.1	13.2	12.6	11.8	11.3	10.7	10.2	9.8	9.4	9.0	8.7	8.3	8.0	7.8	7.5	7.3	7.0	6.8	6.6	6.4	6.3	6.1	5.9	5.8
16	—	0.1	0.2	0.5	0.8	1.2	1.6	2.1	2.7	3.2	3.8	4.5	5.1	5.8	6.5	7.3	8.0	8.8	9.5	10.3	11.1	11.9	12.7	13.6	14.4
		15.1	14.2	13.5	12.8	12.2	11.6	11.1	10.7	10.2	9.8	9.6	9.1	8.8	8.5	8.3	8.0	7.8	7.5	7.3	7.1	6.9	6.7	6.6	6.4
17	—	0.1	0.2	0.4	0.8	1.1	1.6	2.0	2.6	3.1	3.7	4.3	5.0	5.6	6.3	7.0	7.8	8.5	9.3	10.0	10.8	11.6	11.4	13.2	14.0
		16.1	15.2	14.4	13.8	13.1	12.6	12.0	11.6	11.1	10.7	10.3	10.0	9.6	9.3	9.0	8.8	8.5	8.3	8.0	7.8	7.6	7.4	7.2	7.0
18	—	0.1	0.2	0.4	0.7	1.1	1.5	2.0	2.6	3.1	3.6	4.2	4.8	5.5	6.1	6.8	7.5	8.3	9.0	9.8	10.5	11.3	12.1	12.9	13.7
		17.1	16.2	15.4	14.7	14.1	13.5	13.0	12.5	12.0	11.6	11.2	10.8	10.5	10.1	9.8	9.5	9.3	9.0	8.8	8.5	8.3	8.1	7.9	7.7
19	—	0.0	0.2	0.4	0.7	1.0	1.4	1.9	2.4	2.9	3.4	4.0	4.6	5.3	5.9	6.6	7.3	8.0	8.8	9.5	10.3	11.0	11.8	12.6	13.4
		18.0	17.2	16.4	15.7	15.0	14.4	13.9	13.4	13.9	12.4	12.0	11.6	11.3	10.9	10.6	10.3	10.0	9.8	9.5	9.3	9.0	8.8	8.6	8.4
20	—	0.0	0.2	0.4	0.7	1.0	1.4	1.8	2.3	2.8	3.3	3.9	4.5	5.1	5.8	6.4	7.1	7.8	8.5	9.3	10.0	10.8	11.5	12.9	13.1
		19.0	18.2	17.4	16.7	16.0	15.4	14.8	14.3	13.8	13.3	12.9	12.5	12.1	11.8	11.4	11.1	10.8	10.5	10.3	10.0	9.8	9.5	9.3	9.1
21	—	0.0	0.2	0.4	0.6	1.0	1.3	1.8	2.2	2.7	3.2	3.8	4.4	5.0	5.6	6.3	6.9	7.6	8.3	9.0	9.8	10.5	11.3	12.10	12.8
		20.0	19.2	18.4	17.6	17.0	16.3	15.8	15.2	14.7	14.2	13.8	13.4	13.0	12.6	12.3	11.9	11.6	11.3	11.0	10.8	10.5	10.3	10.00	9.8
22	—	0.0	0.2	0.4	0.6	0.9	1.3	1.7	2.1	2.6	3.1	3.7	4.2	4.8	5.4	6.1	6.7	7.4	8.1	8.8	9.5	10.3	11.0	11.8	12.5
		21.0	20.2	19.4	18.6	17.9	17.3	16.7	16.1	15.6	15.1	14.7	14.2	13.8	13.4	13.1	12.7	12.4	12.1	11.8	11.5	11.3	11.0	10.8	10.5
23	—	0.0	0.2	0.3	0.6	0.9	1.2	1.6	2.1	2.5	3.0	3.6	4.1	4.7	5.3	5.9	6.6	7.2	7.9	8.6	9.3	10.0	10.8	11.5	12.3
		22.0	21.2	20.3	19.6	18.9	18.2	17.6	17.1	16.5	16.0	15.6	15.1	14.7	14.3	13.9	13.6	13.2	12.9	12.6	12.3	12.0	11.8	11.5	11.3
24	—	0.0	0.2	0.3	0.6	0.9	1.2	1.6	2.00	2.5	2.9	3.5	4.00	4.6	5.2	5.8	6.4	7.0	7.7	8.4	9.1	9.8	10.5	11.3	12.0
		23.0	22.2	21.3	20.6	19.9	19.2	18.6	18.00	17.5	16.9	16.5	16.00	15.6	15.2	14.8	14.4	14.0	13.7	13.4	13.1	12.8	12.5	12.3	12.0
25	—	0.0	0.1	0.3	0.6	0.8	1.2	1.5	1.9	2.4	2.9	3.4	3.9	4.4	5.0	5.6	6.2	6.9	7.5	8.2	8.9	9.6	10.3	11.0	11.8
		24.0	23.1	22.3	21.6	20.8	20.2	19.5	18.9	18.4	17.9	17.4	16.9	16.4	16.0	15.6	15.2	14.9	14.6	14.2	13.9	13.6	13.3	13.0	12.8

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
0	26.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0	36.0	37.0	38.0	39.0	40.0	41.0	42.0	43.0	44.0	45.0	46.0	47.0	48.0	49.0	50.0	
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1	25.0	26.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0	36.0	37.0	38.0	39.0	40.0	41.0	42.0	43.0	44.0	45.0	46.0	47.0	48.0	49.0	
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	24.1	25.1	26.1	27.1	28.1	29.1	30.1	31.1	32.1	33.1	34.1	35.1	36.1	37.1	38.1	39.1	40.1	41.1	42.1	43.1	44.1	45.1	46.1	47.1	48.1	
	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
3	23.3	24.3	25.3	26.3	27.3	28.3	29.3	30.3	31.2	32.2	33.2	34.2	35.2	36.2	37.2	38.2	39.2	40.2	41.2	42.2	43.2	44.2	45.2	46.2	47.2	
	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
4	22.5	23.5	24.6	25.5	26.5	27.5	28.4	29.4	30.4	31.4	32.4	33.4	34.4	35.4	36.4	37.4	38.3	39.3	40.3	41.3	42.3	43.3	44.3	45.3	46.3	
	0.5	0.5	0.6	0.5	0.5	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
5	21.8	22.8	23.8	24.7	25.7	26.7	27.7	28.7	29.6	30.6	31.6	32.6	33.6	34.6	35.6	36.5	37.5	38.5	39.5	40.5	41.5	42.5	43.5	44.5	45.5	
	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
6	21.1	22.1	23.1	24.0	25.0	26.0	26.9	27.9	28.9	29.9	30.9	31.8	32.8	33.8	34.8	35.8	36.8	37.7	38.7	39.7	40.7	41.7	42.7	43.7	44.6	
	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	
7	20.5	21.4	22.4	23.4	24.3	25.3	26.3	27.2	28.2	29.2	30.1	31.1	32.1	33.1	34.0	35.0	36.0	37.0	38.0	38.9	39.9	40.9	41.9	42.9	43.9	
	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	
8	19.9	20.9	21.8	22.7	23.7	24.6	25.6	26.6	27.5	28.5	29.6	30.4	31.4	32.4	33.3	34.3	35.3	36.3	37.2	38.2	39.2	40.2	41.1	42.1	43.1	
	1.9	1.8	1.8	1.7	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	
9	19.3	20.3	21.2	22.1	23.1	24.0	25.0	25.9	26.9	27.6	28.6	29.6	30.7	31.7	32.7	33.6	34.6	35.6	36.5	37.5	38.5	39.4	40.4	41.4	42.4	
	2.3	2.3	2.2	2.1	2.1	2.0	2.0	1.9	1.9	1.8	1.8	1.8	1.7	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.4	
10	18.8	19.7	20.6	21.6	22.5	23.4	24.4	25.3	26.3	27.2	28.2	29.1	30.1	31.0	32.0	33.0	33.9	34.9	35.9	36.8	37.8	38.8	39.7	40.7	41.7	
	2.8	2.7	2.6	2.6	2.5	2.4	2.4	2.3	2.3	2.2	2.2	2.1	2.1	2.2	2.2	2.2	1.9	1.9	1.9	1.8	1.8	1.8	1.7	1.7	1.7	
11	18.3	19.2	20.1	21.0	22.0	22.9	23.8	24.8	25.7	26.6	27.6	28.5	29.5	30.4	31.4	32.3	33.3	34.2	35.2	36.2	37.1	38.1	39.1	40.1	41.0	
	3.3	3.2	3.1	3.0	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.5	2.5	2.4	2.4	2.3	2.3	2.2	2.2	2.2	2.1	2.1	2.1	2.0	2.0	
12	17.8	18.7	19.6	20.5	21.4	22.3	23.3	24.2	25.1	26.1	27.0	27.9	28.9	29.8	30.8	31.7	32.7	33.6	34.6	35.5	36.5	37.4	38.4	39.4	40.3	
	3.8	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.8	2.8	2.7	2.7	2.6	2.6	2.5	2.5	2.4	2.4	2.4	2.3	
13	17.3	18.2	19.1	20.0	20.9	21.8	22.8	23.7	24.6	25.5	26.4	27.4	28.3	29.3	30.2	31.1	32.1	33.0	34.0	34.9	35.9	36.8	37.8	38.7	39.7	
	4.3	4.3	4.1	4.0	3.9	3.8	3.8	3.7	3.6	3.5	3.4	3.4	3.3	3.3	3.2	3.1	3.1	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.7	
14	16.9	17.8	18.7	19.6	20.5	21.4	22.3	23.2	24.1	25.0	25.9	26.8	27.8	28.7	29.6	30.6	31.5	32.4	33.4	34.3	35.3	36.2	37.2	38.1	39.1	
	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.8	3.7	3.6	3.6	3.5	3.4	3.4	3.3	3.3	3.2	3.2	3.1	3.1	
15	16.5	17.4	18.2	19.1	20.0	20.9	21.8	22.7	23.6	24.5	25.4	26.3	27.2	28.2	29.1	30.0	30.9	31.9	32.8	33.8	34.7	35.6	36.6	37.5	38.5	
	5.5	5.4	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.2	4.1	4.0	3.9	3.9	3.8	3.8	3.7	3.6	3.6	3.5	3.5	
16	16.1	17.0	17.8	18.7	19.6	20.4	21.3	22.2	23.1	24.0	24.9	25.8	26.7	27.7	28.6	29.5	30.4	31.3	32.3	33.2	34.1	35.1	36.0	36.9	37.9	
	6.1	6.0	5.8	5.7	5.6	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.7	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.1	4.0	3.9	3.9	
17	15.7	16.6	17.4	18.3	19.1	20.0	20.9	21.8	22.7	23.6	24.5	25.4	26.3	27.2	28.1	29.0	29.9	30.8	31.7	32.7	33.6	34.5	35.4	36.4	37.3	
	6.7	6.6	6.4	6.3	6.1	6.0	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.7	4.6	4.5	4.4	4.4	4.3	
18	15.4	16.2	17.0	17.9	18.8	19.6	20.5	21.4	22.2	23.1	24.0	24.9	25.8	26.7	27.6	28.5	29.4	30.3	31.2	32.1	33.1	34.0	34.9	35.8	36.8	
	7.4	7.2	7.0	6.9	6.8	6.6	6.5	6.4	6.2	6.1	6.0	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.1	5.1	5.0	4.9	4.8	4.8	
19	15.0	15.8	16.7	17.5	18.4	19.2	20.1	20.9	21.8	22.7	23.6	24.4	25.3	26.2	27.1	28.0	28.9	29.8	30.7	31.6	32.6	33.5	34.4	35.3	36.2	
	8.0	7.8	7.7	7.5	7.4	7.2	7.1	6.9	6.8	6.7	6.6	6.4	6.3	6.2	6.1	6.0	5.9	5.8	5.7	5.6	5.6	5.5	5.4	5.3	5.2	
20	14.7	15.5	16.3	17.2	18.0	18.8	19.7	20.5	21.4	22.3	23.1	24.0	24.9	25.8	26.7	27.6	28.5	29.3	30.3	31.2	32.1	33.0	33.9	34.8	35.7	
	8.7	8.5	8.3	8.2	8.0	7.8	7.7	7.5	7.4	7.3	7.1	7.0	6.9	6.8	6.7	6.6	6.5	6.3	6.3	6.2	6.1	6.0	5.9	5.8	5.7	
21	14.4	15.2	16.0	16.8	17.6	18.5	19.3	20.2	21.0	21.9	22.7	23.6	24.5	25.3	26.2	27.1	28.0	28.9	29.8	30.7	31.6	32.5	33.4	34.3	35.2	
	9.4	9.2	9.0	8.8	8.6	8.5	8.3	8.2	8.0	7.9	7.7	7.6	7.5	7.3	7.2	7.1	7.0	6.9	6.8	6.7	6.6	6.5	6.4	6.3	6.2	
22	14.1	14.9	15.7	16.5	17.3	18.1	19.0	19.8	20.6	21.5	22.3	23.2	24.1	24.9	25.8	26.7	27.6	28.4	29.3	30.2	31.1	32.0	32.9	33.8	34.7	
	10.1	9.9	9.7	9.5	9.3	9.1	9.0	8.8	8.6	8.5	8.3	8.2	8.1	7.9	7.8	7.7	7.6	7.4	7.3	7.2	7.1	7.0	6.9	6.8	6.7	
23	13.8	14.6	15.4	16.2	17.0	17.8	18.6	19.4	20.3	21.1	22.0	22.8	23.7	24.5	25.4	26.3	27.1	28.0	28.9	29.8	30.7	31.6	32.5	33.3	34.2	
	10.8	10.6	10.4	10.2	10.0	9.8	9.6	9.4	9.3	9.1	9.0	8.8	8.7	8.6	8.4	8.3	8.1	8.0	7.9	7.8	7.7	7.6	7.5	7.3	7.2	
24	13.5	14.3	15.1	15.9	16.7	17.5	18.3	19.1	19.9	20.8	21.6	22.4	23.3	24.1	25.0	25.9	26.7	27.6	28.5	29.3	30.2	31.1	32.0	32.8	33.8	
	11.5	11.3	11.1	10.9	10.7	10.5	10.3	10.1	9.9	9.8	9.6	9.4	9.3	9.1	9.0	8.9	8.7	8.6	8.6	8.3	8.2	8.1	8.0	7.9	7.8	
25	13.3	14.0	14.8	15.6	16.4	17.2	18.0	18.8	19.6	20.4	21.2	22.1	22.9	23.8	24.6	25.5	26.3	27.2	28.1	28.9	29.8	30.7	31.6	32.4	33.3	
	12.3	12.0	11.8	11.6	11.4	11.2	11.0	10.8	10.6	10.4	10.2	10.1	9.9	9.8	9.6	9.5	9.3	9.2	9.1	8.9	8.8	8.7	8.6	8.4	8.3	

	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
0	51.0	52.0	53.0	54.0	55.0	56.0	57.0	58.0	59.0	60.0	61.0	62.0	63.0	64.0	65.0	66.0	67.0	68.0	69.0	70.0	71.0	72.0	73.0	74
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1	50.0	51.0	52.0	53.0	54.0	55.0	56.0	57.0	58.0	59.0	60.0	61.0	62.0	63.0	64.0	65.0	66.0	67.0	68.0	69.0	70.0	71.0	72.0	73
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
2	49.1	50.1	51.1	52.1	53.1	54.1	55.1	56.1	57.1	58.1	59.1	60.1	61.1	62.1	63.1	64.1	65.1	66.1	67.1	68.1	69.1	70.1	71.1	72.
	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.
3	48.2	49.2	50.2	51.2	52.2	53.2	54.1	55.1	56.1	57.1	58.1	59.1	60.1	61.1	62.1	63.1	64.1	65.1	66.1	67.1	68.1	69.1	70.1	71.
	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.
4	47.3	48.3	49.3	50.3	51.3	52.3	53.3	54.3	55.3	56.3	57.2	58.2	59.2	60.2	61.2	62.2	63.2	64.2	65.2	66.2	67.2	68.2	69.2	70.
	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.
5	46.4	47.4	48.4	49.4	50.4	51.4	52.4	53.4	54.4	55.4	56.4	57.4	58.4	59.4	60.4	61.4	62.3	63.3	64.3	65.3	66.3	67.3	68.3	69.
	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
6	45.6	46.6	47.6	48.6	49.6	50.6	51.6	52.6	53.6	54.5	55.5	56.5	57.5	58.5	59.5	60.5	61.5	62.5	63.5	64.5	65.5	66.5	67.5	68.
	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.
7	44.8	45.8	46.8	47.8	48.8	49.8	50.8	51.8	52.7	53.7	54.7	55.7	56.7	57.7	58.7	59.7	60.7	61.7	62.6	63.6	64.6	65.6	66.6	67.
	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.
8	44.1	45.1	46.0	47.0	48.0	49.0	50.0	51.0	52.0	52.9	53.9	54.9	55.9	56.9	57.9	58.9	59.9	60.8	61.8	62.8	63.8	64.8	65.8	66.
	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.
9	43.3	44.3	45.3	46.3	47.3	48.2	49.2	50.2	51.2	52.2	53.2	54.1	55.1	56.1	57.1	58.1	59.1	60.1	61.0	62.0	63.0	64.0	65.0	66.
	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.
10	42.6	43.6	44.6	45.6	46.5	47.5	48.5	49.5	50.4	51.4	52.4	53.4	54.4	55.4	56.3	57.3	58.3	59.3	60.3	61.3	62.2	63.2	64.2	65.
	1.6	1.5	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.
11	42.0	42.9	43.9	44.9	45.8	46.8	47.8	48.8	49.7	50.7	51.7	52.7	53.6	54.6	55.6	56.6	57.6	58.5	59.5	60.5	61.5	62.5	63.4	64.
	2.0	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.
12	41.3	42.3	43.2	44.2	45.1	46.1	47.1	48.1	49.0	50.0	51.0	51.9	52.9	53.9	54.9	55.8	56.8	57.8	58.8	59.8	60.7	61.7	62.7	63.
	2.3	2.3	2.2	2.2	2.1	2.1	2.1	2.1	2.0	2.0	2.0	1.9	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.
13	40.6	41.6	42.6	43.5	44.5	45.4	46.4	47.4	48.3	49.3	50.3	51.3	52.2	53.2	54.2	55.1	56.1	57.1	58.1	59.0	60.0	61.0	62.0	62.
	2.6	2.6	2.6	2.5	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.0	2.0	2.0	2.0	1.
14	40.0	41.0	41.9	42.9	43.8	44.8	45.8	46.7	47.7	48.6	49.6	50.6	51.5	52.5	53.6	54.4	55.4	56.4	57.4	58.3	59.3	60.3	61.3	62.
	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.
15	39.4	40.4	41.3	42.3	43.2	44.2	45.1	46.1	47.0	48.0	49.0	49.9	50.9	51.8	52.8	53.8	54.7	55.7	56.7	57.6	58.6	59.6	60.6	61.
	3.4	3.4	3.3	3.3	3.2	3.2	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.
16	38.8	39.8	40.7	41.7	42.6	43.6	44.6	45.5	46.4	47.4	48.3	49.3	50.2	51.2	52.2	53.1	54.1	55.0	56.0	57.0	57.9	58.9	59.9	60.
	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.4	3.4	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.
17	38.3	39.2	40.1	41.1	42.0	43.0	43.9	44.9	45.8	46.8	47.7	48.7	49.6	50.6	51.5	52.5	53.4	54.4	55.4	56.3	57.3	58.2	59.2	60.
	4.3	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.2	3.2	3.
18	37.7	38.6	39.6	40.5	41.4	42.4	43.3	44.3	45.2	46.2	47.1	48.0	49.0	50.0	50.9	51.9	52.8	53.8	54.7	55.7	56.6	57.6	58.6	59.
	4.7	4.6	4.6	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.0	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.
19	37.2	38.1	39.0	39.9	40.9	41.8	42.8	43.7	44.6	45.6	46.5	47.5	48.4	49.3	50.3	51.2	52.2	53.1	54.1	55.1	56.0	57.0	57.9	58.
	5.2	5.1	5.0	4.9	4.9	4.8	4.8	4.7	4.6	4.6	4.5	4.5	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.0	4.0	3.9	3.
20	36.6	37.6	38.5	39.4	40.3	41.3	42.2	43.1	44.1	45.0	45.9	46.9	47.8	48.8	49.7	50.7	51.6	52.5	53.5	54.4	55.4	56.3	57.3	58.
	5.6	5.6	5.5	5.4	5.3	5.3	5.2	5.1	5.1	5.0	4.9	4.9	4.8	4.8	4.8	4.7	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.
21	36.1	37.0	38.0	38.9	39.8	40.7	41.7	42.6	43.5	44.4	45.4	46.3	47.3	48.2	49.1	50.1	51.0	52.0	52.9	53.8	54.8	55.7	56.7	57.
	6.1	6.0	6.0	5.9	5.8	5.7	5.7	5.6	5.5	5.4	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.8	4.8	4.7	4.7	4.
22	35.6	36.5	37.5	38.4	39.3	40.2	41.1	42.0	43.0	43.9	44.8	45.8	46.7	47.6	48.6	49.5	50.4	51.4	52.3	53.3	54.2	55.1	56.1	57.
	6.6	6.5	6.5	6.4	6.3	6.2	6.1	6.0	6.0	5.9	5.8	5.8	5.7	5.6	5.6	5.5	5.4	5.4	5.3	5.3	5.2	5.1	5.1	5.
23	35.1	36.1	37.0	37.9	38.8	39.7	40.6	41.5	42.5	43.4	44.3	45.2	46.2	47.1	48.0	48.9	49.9	50.8	51.8	52.7	53.6	54.6	55.5	56.
	7.1	7.1	7.0	6.9	6.8	6.7	6.6	6.5	6.5	6.4	6.3	6.2	6.2	6.1	6.0	5.9	5.9	5.8	5.8	5.7	5.6	5.6	5.5	5.
24	34.7	35.6	36.5	37.4	38.3	39.2	40.1	41.0	41.9	42.9	43.8	44.7	45.6	46.5	47.5	48.4	49.3	50.3	51.2	52.1	53.1	54.0	54.9	55.
	7.7	7.6	7.5	7.4	7.3	7.2	7.1	7.0	6.9	6.9	6.8	6.7	6.6	6.5	6.5	6.4	6.3	6.3	6.2	6.1	6.1	6.0	5.9	5.
25	34.2	35.1	36.0	36.9	37.8	38.7	39.6	40.5	41.4	42.4	43.3	44.2	45.1	46.0	46.9	47.9	48.8	49.7	50.6	51.6	52.5	53.4	54.4	55.
	8.2	8.1	8.0	7.9	7.8	7.7	7.6	7.5	7.4	7.4	7.3	7.2	7.1	7.0	6.9	6.9	6.8	6.7	6.6	6.6	6.5	6.4	6.4	6.

	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	1
0	76 0	77 0	78 0	79 0	80 0	81 0	82 0	83 0	84 0	85 0	86 0	87 0	88 0	89 0	90 0	91 0	92 0	93 0	94 0	95 0	96 0	97 0	98 0	99 0	1 0
1	76 0	76 0	77 0	78 0	79 0	80 0	81 0	82 0	83 0	84 0	85 0	86 0	87 0	88 0	89 0	90 0	91 0	92 0	93 0	94 0	95 0	96 0	97 0	98 0	9 0
2	74 0.1	75 0.1	76 0	77 0	78 0	79 0	80 0	81 0	82 0	83 0	84 0	85 0	86 0	87 0	88 0	89 0	90 0	91 0	92 0	93 0	94 0	95 0	96 0	97 0	9 0
3	73 0.1	74 0.1	75 0.1	76 0.1	77 0.1	78 0.1	79 0.1	80 0.1	81 0.1	82 0.1	83 0.1	84 0.1	85 0.1	86 0.1	87 0.1	88 0.1	89 0.1	90 0.1	91 0.1	92 0.1	93 0.1	94 0.1	95 0.1	96 0.1	9 0.
4	72 0.2	73 0.2	74 0.2	75 0.2	76 0.2	77 0.2	78 0.2	79 0.2	80 0.2	81 0.2	82 0.2	83 0.2	84 0.2	85 0.2	86 0.2	87 0.2	88 0.2	89 0.2	90 0.2	91 0.2	92 0.2	93 0.2	94 0.2	95 0.2	9 0.
5	71 0.3	72 0.3	73 0.3	74 0.3	75 0.3	76 0.3	77 0.3	78 0.3	79 0.3	80 0.3	81 0.3	82 0.3	83 0.3	84 0.3	85 0.3	86 0.3	87 0.3	88 0.3	89 0.3	90 0.3	91 0.2	92 0.2	93 0.2	94 0.2	9 0.
6	70 0.4	71 0.4	72 0.4	73 0.4	74 0.4	75 0.4	76 0.4	77 0.4	78 0.4	79 0.4	80 0.4	81 0.4	82 0.4	83 0.4	84 0.4	85 0.4	86 0.4	87 0.4	88 0.4	89 0.4	90 0.4	91 0.3	92 0.3	93 0.3	9 0.
7	70 1	71 1	72 1	73 1	74 1	75 1	76 1	77 1	78 1	79 1	80 1	81 1	82 1	83 1	84 1	85 1	86 1	87 1	88 1	89 1	90 1	91 1	92 1	93 1	9 1
8	69 1	70 1	71 1	72 1	73 1	74 1	75 1	76 1	77 1	78 1	79 1	80 1	81 1	82 1	83 1	84 1	85 1	86 1	87 1	88 1	89 1	90 1	91 1	92 1	9 1
9	68 1	69 1	70 1	71 1	72 1	73 1	74 1	75 1	76 1		78 1	79 1	80 1	81 1	82 1	83 1	84 1	85 1	86 1	87 1	88 1	89 1	90 1	91 1	9 1
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14	64 2	65 2	66 2	67 2	68 2	69 2	70 2	71 2	72 2	73 2	74 2	75 2	76 2	77 2	78 2	79 2	80 2	81 2	82 2	83 2	84 2	85 2	86 2	87 2	8 2
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16	63 3	64 3	65 3	66 3	67 3	68 3	69 3	70 3	71 3	72 3	73 3	74 3	75 3	75 2	76 2	77 2	78 2	79 2	80 2	81 2	82 2	83 2	84 2	85 2	8 2
17	62 3	63 3	64 3	65 3	66 3	67 3	68 3	69 3	70 3	71 3	72 3	73 3	74 3	75 3	76 3	77 3	78 3	79 3	80 3	81 3	82 3	83 3	84 3	85 3	8 3
18	61 3	62 3	63 3	64 3	65 3	66 3	67 3	68 3	69 3	70 3	71 3	72 3	73 3	74 3	75 3	76 3	77 3	78 3	79 3	80 3	81 3	82 3	83 3	84 3	85 3
19	61 4	62 4	63 4	64 4	65 4	66 4	67 4	68 4	69 4	70 4	70 3	71 3	72 3	73 3	74 3	75 3	76 3	77 3	78 3	79 3	80 3	81 3	82 3	83 3	8 3
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21	60 5	61 5	62 5	62 4	63 4	64 4	65 4	66 4	67 4	68 4	69 4	70 4	71 4	72 4	73 4	74 4	75 4	76 4	77 4	78 4	79 4	80 4	81 4	82 4	8 4
22	59 5	60 5	61 5	62 5	63 5	64 5	65 5	66 5	67 5	68 5	69 5	69 4	70 4	71 4	72 4	73 4	74 4	75 4	76 4	77 4	78 4	79 4	80 4	81 4	8 4
23	58 5	59 5	60 5	61 5	62 5	63 5	64 5	65 5	66 5	67 5	68 5	69 5	70 6	71 6	72 5	73 5	74 5	75 5	76 5	77 5	77 4	78 4	79 4	80 4	8 4
24	58 6	59 6	60 6	61 6	62 6	63 6	64 5	65 5	66 5	67 5	68 5	69 5	70 5	71 5	72 5	73 5	74 5	75 5	76 5	77 5	78 5	79 5	80 5	8 5
25	57 6	58 6	59 6	60 6	61 6	62 6	63 6	64 6	65 6	66 6	67 6	68 6	69 6	70 6	70 6	71 5	72 5	73 5	74 5	75 5	76 5	77 5	78 5	79 5	8 5

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
26	—	0.0	0.1	0.3	0.5	0.6	1.1	1.5	1.9	1.3	1.8	3.3	3.8	4.4	4.9	5.5	6.1	6.7	7.4	8.0	8.7	9.4	10.1	10.8
		25.0	24.1	23.3	22.5	21.6	21.1	20.5	19.9	19.3	18.6	18.3	17.8	17.3	16.9	16.5	16.1	15.7	15.4	15.0	14.7	14.4	14.1	13.1
27	—	0.0	0.1	0.2	0.5	0.6	1.1	1.4	1.8	2.3	2.7	3.2	3.7	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.5	9.2	9.9	10.6
		26.0	25.1	24.3	23.5	22.8	22.1	21.4	20.8	20.0	19.7	19.2	18.7	18.2	17.8	17.4	17.0	16.6	16.2	15.8	15.5	15.2	14.9	14.6
28	—	0.0	0.1	0.3	0.5	0.8	1.1	1.4	1.8	2.2	2.6	3.1	3.6	4.1	4.7	5.2	5.8	6.4	7.0	7.7	8.3	9.0	9.7	10.4
		27.0	26.1	25.3	24.5	23.8	23.1	24.4	21.8	21.2	20.6	20.1	19.6	19.1	18.7	18.2	17.8	17.4	17.0	16.7	16.3	16.0	15.7	15.4
29	—	0.0	0.1	0.3	0.6	0.7	1.0	1.4	1.7	2.1	2.6	3.0	3.5	4.0	4.6	5.1	5.7	6.3	6.9	7.5	8.2	8.0	9.5	10.2
		28.0	27.1	26.3	25.5	24.7	24.0	23.4	22.7	22.1	21.6	21.0	20.5	20.0	19.6	19.1	18.7	18.3	17.9	17.5	17.2	16.8	16.5	16.2
30	—	0.0	0.1	0.3	0.5	0.7	1.0	1.3	1.7	2.1	2.5	3.0	3.4	3.9	4.5	5.0	5.6	6.1	6.8	7.4	8.0	8.6	9.3	10.0
		29.0	28.1	27.3	26.5	25.7	25.0	24.3	23.7	23.1	22.5	22.0	21.4	20.9	20.5	20.0	19.6	19.1	18.8	18.4	18.0	17.6	17.3	17.0
31	—	0.0	0.1	0.3	0.5	0.7	1.0	1.3	1.6	2.0	2.4	2.9	3.3	3.8	4.4	4.9	5.4	6.0	6.6	7.2	7.8	8.5	9.1	9.8
		30.0	29.1	28.3	27.5	26.7	26.0	25.3	24.6	24.0	23.4	22.9	22.3	21.8	21.4	20.9	20.4	20.0	19.6	19.2	18.8	18.5	18.1	17.8
32	—	0.0	0.1	0.2	0.4	0.7	0.9	1.3	1.6	2.0	2.4	2.8	3.3	3.8	4.3	4.8	5.3	5.9	6.5	7.1	7.7	8.3	9.0	9.6
		31.0	30.1	29.3	28.4	27.7	26.9	26.3	25.6	25.0	24.4	23.8	23.3	22.8	22.3	21.8	21.3	20.9	20.5	20.1	19.7	19.3	19.0	18.6
33	—	0.0	0.1	0.3	0.4	0.7	0.9	1.2	1.6	1.9	2.3	2.8	3.2	3.7	4.2	4.7	5.2	5.8	6.4	6.9	7.5	8.2	8.8	9.4
		32.0	31.1	30.3	29.4	28.7	27.9	27.2	26.6	25.9	25.3	24.8	24.2	23.7	23.2	22.7	22.2	21.8	21.4	20.9	20.5	20.2	19.8	19.4
34	—	0.0	0.1	0.2	0.4	0.6	0.9	1.2	1.5	1.9	2.3	2.7	3.1	3.6	4.1	4.6	5.1	5.7	6.2	6.8	7.4	8.0	8.6	9.3
		33.0	32.1	31.2	30.4	29.6	28.9	28.2	27.5	26.9	26.3	25.7	25.1	24.6	24.1	23.6	23.1	22.7	22.2	21.8	21.4	21.0	20.0	20.3
35	—	0.0	0.1	0.2	0.4	0.6	0.9	1.2	1.5	1.8	2.2	2.6	3.1	3.5	4.0	4.5	5.0	5.6	6.1	6.7	7.3	7.9	8.5	9.1
		34.0	33.1	32.2	31.4	30.6	29.9	29.2	28.5	27.8	27.2	26.6	26.1	25.5	25.0	24.5	24.0	23.6	23.1	22.7	22.3	21.9	21.5	21.1
36	—	0.0	0.1	0.2	0.4	0.6	0.9	1.1	1.5	1.8	2.2	2.6	3.0	3.4	3.9	4.4	4.9	5.5	6.0	6.6	7.1	7.7	8.3	9.0
		35.0	34.1	33.2	32.4	31.6	30.9	30.1	29.5	28.8	28.2	27.6	27.0	26.4	25.9	25.4	24.9	24.5	24.0	23.6	23.1	22.7	22.3	22.0
37	—	0.0	0.1	0.2	0.4	0.6	0.8	1.1	1.4	1.8	2.1	2.5	2.9	3.4	3.8	4.3	4.8	5.4	5.9	6.4	7.0	7.6	8.2	8.8
		36.0	35.1	34.2	33.4	32.6	31.8	31.1	30.4	29.8	29.1	28.5	27.9	27.4	26.8	26.3	25.8	25.4	24.9	24.4	24.0	23.6	23.2	22.8
38	—	0.0	0.1	0.2	0.4	0.6	0.8	1.1	1.4	1.7	2.5	2.5	2.9	3.3	3.8	4.2	4.7	5.3	5.8	6.3	6.9	7.5	8.1	8.7
		37.0	36.1	35.2	34.4	33.6	32.8	32.1	31.4	30.7	30.1	29.5	28.9	28.3	27.8	27.2	26.7	26.3	25.8	25.3	24.9	24.5	24.1	23.7
39	—	0.0	0.1	0.2	0.4	0.6	0.8	1.1	1.4	1.7	2.0	2.4	2.8	3.3	3.7	4.2	4.7	5.2	5.7	6.2	6.8	7.3	7.9	8.5
		38.0	37.1	36.2	35.4	34.6	33.8	33.1	32.4	31.7	31.0	30.4	29.8	29.3	28.7	28.2	27.7	27.2	26.7	26.2	25.8	25.3	24.9	24.5
40	—	0.0	0.1	0.2	0.4	0.6	0.8	1.0	1.3	1.7	2.0	2.4	2.8	3.2	3.6	4.1	4.6	5.1	5.6	6.1	6.7	7.2	7.8	8.4
		39.0	38.1	37.2	36.4	35.6	34.8	34.0	33.3	32.7	32.0	31.4	30.8	30.2	29.6	29.1	28.6	28.1	27.6	27.1	26.7	26.2	25.8	25.4
41	—	0.0	0.1	0.2	0.4	0.6	0.8	1.0	1.3	1.6	2.0	2.3	2.7	3.1	3.6	4.0	4.5	5.0	5.5	6.0	6.6	7.1	7.7	8.3
		40.0	39.1	38.2	37.4	36.5	35.8	35.0	34.3	33.6	33.0	32.3	31.7	31.1	30.6	30.0	29.5	29.0	28.5	28.0	27.6	27.1	26.7	26.3
42	—	0.0	0.1	0.2	0.3	0.5	0.8	1.0	1.3	1.6	1.9	2.3	2.7	3.1	3.5	3.9	4.4	4.9	5.4	5.9	5.6	7.0	7.6	8.1
		41.0	40.1	39.2	38.3	37.5	36.8	36.0	35.3	34.6	33.9	33.3	32.7	32.1	31.5	30.9	30.4	29.9	29.4	28.9	28.5	28.0	27.6	27.1
43	—	0.0	0.1	0.2	0.3	0.5	0.7	1.0	1.3	1.6	1.9	2.2	2.6	3.0	3.4	3.9	4.3	4.8	5.3	5.8	6.3	6.9	7.4	8.0
		42.0	41.1	40.2	39.3	38.5	37.7	37.0	36.3	35.6	34.9	34.2	33.6	33.0	32.4	31.9	31.3	30.8	30.3	29.8	29.3	28.9	28.4	28.0
44	—	0.0	0.1	0.2	0.3	0.5	0.7	1.0	1.2	1.5	1.9	2.2	2.6	3.0	3.4	3.8	4.3	4.7	5.2	5.7	6.3	6.8	7.3	7.9
		43.0	42.1	41.2	40.3	39.5	38.7	38.0	37.2	36.5	35.9	35.2	34.6	34.0	33.4	32.8	32.3	31.7	31.2	30.7	30.3	29.8	29.3	28.9
45	—	0.0	0.1	0.2	0.3	0.5	0.7	0.9	1.2	1.5	1.8	2.2	2.5	2.9	3.3	3.8	4.2	4.7	5.1	5.6	6.2	6.7	7.2	7.8
		44.0	43.1	42.2	41.3	40.5	39.7	38.9	38.2	37.5	36.8	36.2	35.5	34.9	34.3	33.8	33.2	32.7	32.1	31.6	31.2	30.7	30.2	29.8
46	—	0.0	0.1	0.2	0.3	0.5	0.7	0.9	1.2	1.5	1.8	2.1	2.5	2.9	3.3	3.7	4.1	4.6	5.1	5.6	6.1	6.6	7.1	7.7
		45.0	44.1	43.2	42.3	41.5	40.7	39.9	39.2	38.5	37.8	37.1	36.5	35.9	35.3	34.7	34.1	33.6	33.1	32.6	32.1	31.6	31.1	30.7
47	—	0.0	0.1	0.2	0.3	0.5	0.7	0.9	1.2	1.4	1.8	2.1	2.4	2.8	3.2	3.6	4.1	4.5	5.0	5.5	6.0	6.5	7.0	7.6
		46.0	45.1	44.2	43.3	42.5	41.7	40.9	40.2	39.4	38.8	38.1	37.4	36.8	36.2	35.6	35.1	34.5	34.0	33.5	33.0	32.5	32.0	31.6
48	—	0.0	0.1	0.2	0.3	0.6	0.7	0.9	1.1	1.4	1.7	2.1	2.4	2.8	3.2	3.6	4.0	4.4	4.9	5.4	5.9	6.4	6.9	7.5
		47.0	46.1	45.2	44.3	43.5	42.7	41.9	41.1	40.4	39.7	39.1	38.4	37.8	37.2	36.6	36.0	35.4	34.9	34.4	33.9	33.4	32.9	32.5
49	—	0.0	0.1	0.2	0.3	0.5	0.7	0.9	1.1	1.4	1.7	2.0	2.4	2.7	3.1	3.5	3.9	4.4	4.8	5.3	5.8	6.3	6.8	7.3
		48.0	47.1	46.2	45.3	44.5	43.7	42.9	42.1	41.4	40.7	40.0	39.4	38.7	38.1	37.5	36.9	36.4	35.8	35.3	34.8	34.3	33.8	33.3
50	—	0.0	0.1	0.2	0.3	0.5	0.6	0.9	1.1	1.4	1.7	2.0	2.3	2.7	3.1	3.5	3.9	4.3	4.8	5.2	5.7	6.2	6.7	7.2
		49.0	48.1	47.2	46.3	45.5	44.6	43.9	43.1	42.4	41.7	41.0	40.3	39.7	39.1	38.5	37.9	37.3	36.8	36.2	35.7	35.2	34.7	34.2

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
26	13.0	13.8	14.5	15.3	16.1	16.9	17.7	18.5	19.3	20.1	20.9	21.7	22.6	23.4	24.2	25.1	25.9	26.8	27.7	28.5	29.4	30.3	31.1	32.0	32.9
	13.0	12.8	12.6	12.3	12.1	11.9	11.7	11.5	11.3	11.1	10.9	10.7	10.6	10.4	10.2	10.1	9.9	9.8	9.7	9.5	9.4	9.3	9.1	9.0	8.9
27	12.8	13.5	14.3	15.0	15.8	16.6	17.4	18.1	19.0	19.8	20.6	21.4	22.2	23.0	23.9	24.7	25.6	26.4	27.3	28.1	29.0	29.9	30.7	31.6	32.5
	13.8	13.5	13.3	13.0	12.8	12.6	12.4	12.1	11.9	11.8	11.6	11.4	11.2	11.0	10.9	10.7	10.6	10.4	10.3	10.1	10.0	9.9	9.7	9.6	9.5
28	12.5	13.3	14.0	14.8	15.5	16.3	17.1	17.9	18.6	19.4	20.3	21.1	21.9	22.7	23.5	24.4	25.2	26.0	26.9	27.7	28.6	29.5	30.3	31.2	32.1
	14.5	14.3	14.0	13.8	13.6	13.3	13.1	12.9	12.6	12.4	12.3	12.1	11.9	11.7	11.5	11.4	11.2	11.0	10.9	10.7	10.6	10.5	10.3	10.2	10.1
29	12.3	13.0	13.8	14.5	15.3	16.0	16.8	17.6	18.3	19.1	19.9	20.7	21.6	22.4	23.2	24.0	24.8	25.7	26.5	27.4	28.2	29.1	29.9	30.8	31.6
	15.3	15.0	14.8	14.5	14.3	14.0	13.8	13.6	13.3	13.1	12.9	12.7	12.6	12.4	12.2	12.0	11.8	11.7	11.5	11.4	11.2	11.1	10.9	10.8	10.6
30	12.1	12.8	13.5	14.3	15.0	15.8	16.6	17.3	18.1	18.8	19.6	20.4	21.2	22.0	22.9	23.7	24.5	25.3	26.2	27.0	27.8	28.7	29.5	30.4	31.3
	16.1	15.8	15.5	15.3	15.0	14.8	14.5	14.3	14.1	13.8	13.6	13.4	13.2	13.0	12.9	12.7	12.5	12.3	12.2	12.0	11.8	11.7	11.5	11.4	11.3
31	16.9	16.6	16.3	16.0	15.8	15.5	15.3	17.0	17.8	18.6	19.6	20.1	20.9	21.7	22.5	23.3	24.2	25.0	25.8	26.6	27.5	28.3	29.2	30.0	30.9
	16.9	16.6	16.3	16.0	15.8	15.5	15.3	15.0	14.8	14.6	14.3	14.1	13.9	13.7	13.5	13.3	13.2	13.0	12.8	12.6	12.5	12.3	12.2	12.0	11.9
32	11.7	12.4	13.1	13.8	14.5	15.3	16.0	16.8	17.5	18.3	19.1	19.8	20.6	21.4	22.2	23.0	23.8	24.7	25.5	26.3	27.1	28.0	28.8	29.6	30.5
	17.7	17.4	17.1	16.8	16.6	16.3	16.0	15.8	15.5	15.3	15.1	14.8	14.6	14.4	14.1	13.9	13.8	13.7	13.5	13.3	13.1	13.0	12.8	12.6	12.5
33	11.6	12.1	12.9	13.6	14.3	15.0	15.8	16.5	17.3	18.0	18.8	19.6	20.3	21.1	21.9	22.7	23.6	24.3	25.1	26.0	26.8	27.6	28.4	29.3	30.1
	18.5	18.1	17.9	17.6	17.3	17.0	16.8	16.5	16.3	16.0	15.8	15.6	15.3	15.1	14.9	14.7	14.5	14.3	14.1	14.0	13.8	13.6	13.4	13.3	13.1
34	11.3	12.0	12.6	13.3	14.1	14.8	15.5	16.3	17.0	17.8	18.5	19.3	20.1	20.8	21.6	22.4	23.2	24.0	24.8	25.6	26.4	27.3	28.1	28.9	29.8
	19.3	19.0	18.6	18.3	18.1	17.8	17.5	17.3	17.0	16.8	16.5	16.3	16.1	15.8	15.6	15.4	15.2	15.0	14.8	14.6	14.4	14.3	14.1	13.9	13.8
35	11.1	11.8	12.4	13.1	13.8	14.6	15.3	16.0	16.8	17.5	18.3	19.0	19.8	20.6	21.3	22.1	22.9	23.7	24.5	25.3	26.1	26.9	27.8	28.6	29.4
	20.1	19.8	19.4	19.1	18.8	18.6	18.3	18.0	17.8	17.5	17.3	17.0	16.8	16.6	16.3	16.1	15.9	15.7	15.5	15.3	15.1	14.9	14.8	14.6	14.4
36	10.9	11.6	12.3	12.9	13.6	14.3	15.1	16.8	16.5	17.3	18.0	18.8	19.5	20.3	21.1	21.8	22.6	23.4	24.2	25.0	25.8	26.6	27.4	28.2	29.1
	20.9	20.6	20.3	19.9	19.6	19.3	19.1	18.8	18.5	18.3	18.0	17.8	17.5	17.3	17.1	16.8	16.6	16.4	16.2	16.0	15.8	15.6	15.4	15.2	15.1
37	10.7	11.4	12.1	12.7	13.4	14.1	14.8	15.6	16.3	17.0	17.8	18.5	19.3	20.0	20.8	21.6	22.3	23.1	23.9	24.7	25.5	26.3	27.1	27.9	28.7
	21.7	21.4	21.1	20.7	20.4	20.1	19.8	19.6	19.3	19.0	18.8	17.5	17.3	17.0	17.8	17.6	17.3	17.1	16.9	16.7	16.5	16.3	16.1	15.9	15.7
38	10.6	11.2	11.9	12.6	13.2	13.9	14.6	15.3	16.1	16.8	17.5	18.3	19.0	19.8	20.5	21.3	22.0	22.8	23.6	24.4	25.2	26.0	26.8	27.6	28.4
	22.6	22.2	21.9	21.6	21.2	20.9	20.6	20.3	20.1	19.8	19.5	19.3	19.0	18.8	18.5	18.3	18.0	17.8	17.6	17.4	17.2	17.0	16.8	16.6	16.4
39	10.4	11.0	11.7	12.4	13.0	13.7	14.4	15.1	15.8	16.6	17.3	18.0	18.8	19.5	20.3	21.0	21.8	22.5	23.3	24.1	24.9	25.7	26.5	27.3	28.1
	23.4	23.0	22.7	22.4	22.0	21.7	21.4	21.1	20.8	20.6	20.3	20.0	19.8	19.5	19.3	19.0	18.8	18.5	18.3	18.1	17.9	17.7	17.5	17.3	17.1
40	10.2	10.9	11.6	12.2	12.9	13.6	14.2	14.9	15.6	16.3	17.1	17.8	18.5	19.3	20.0	20.8	21.5	22.3	23.0	23.8	24.6	25.4	26.2	27.0	27.8
	24.3	23.9	23.6	23.2	22.9	22.5	22.2	21.9	21.6	21.3	21.1	20.8	20.5	20.3	20.0	19.8	19.5	19.3	19.0	18.8	18.6	18.4	18.2	18.0	17.8
41	10.1	10.7	11.4	12.0	12.7	13.3	14.0	14.7	15.4	16.1	16.8	17.4	18.3	19.0	19.8	20.5	21.3	22.0	22.7	23.5	24.3	25.1	25.9	26.7	27.5
	25.1	24.7	24.4	24.0	23.7	23.3	22.0	22.7	22.4	22.1	21.8	21.6	21.3	21.0	20.8	20.5	20.3	20.0	19.8	19.5	19.3	19.1	18.9	18.7	18.5
42	9.9	10.6	11.2	11.8	12.5	13.2	13.8	14.5	15.2	15.9	16.6	17.3	18.0	18.8	19.5	20.3	21.0	21.8	22.5	23.3	24.0	24.8	25.6	26.4	27.2
	25.9	25.6	25.2	24.8	24.5	24.2	23.8	23.5	23.2	22.9	22.6	22.3	22.0	21.8	21.5	21.3	21.0	20.8	20.5	20.3	20.0	19.8	19.6	19.4	19.2
43	9.8	10.4	11.0	11.7	12.3	13.0	13.7	14.3	15.0	15.7	16.4	17.1	17.8	18.5	19.3	20.0	20.8	21.5	22.3	23.0	23.8	24.5	25.3	26.1	26.9
	26.8	26.4	26.0	25.7	25.3	25.0	24.7	24.3	24.0	23.7	23.4	23.1	22.8	22.5	22.3	22.0	21.8	21.5	21.3	21.0	20.8	20.5	20.3	20.1	19.9
44	9.7	10.3	10.9	11.5	12.2	12.8	13.5	14.1	14.8	15.5	16.2	16.9	17.6	18.3	19.0	19.8	20.5	21.3	22.0	22.8	23.5	24.3	25.0	25.8	26.6
	27.7	27.3	26.9	26.5	26.2	25.8	25.5	25.1	24.8	24.5	24.2	23.9	23.6	23.3	23.0	22.8	22.5	22.3	22.0	21.8	21.5	21.3	21.0	20.8	20.6
45	9.5	10.1	10.7	11.4	12.0	12.6	13.3	14.0	14.6	15.3	16.0	16.7	17.4	18.1	18.8	19.5	20.3	21.0	21.8	22.5	23.3	24.0	24.8	25.5	26.3
	28.5	28.1	27.7	27.4	27.0	26.6	26.3	26.0	25.6	25.3	25.0	24.7	24.4	24.1	23.8	23.5	23.3	23.0	22.8	22.5	22.3	22.0	21.8	21.5	21.3
46	9.4	10.0	10.6	11.2	11.8	12.5	13.1	13.8	14.4	15.1	15.8	16.5	17.2	17.9	18.6	19.3	20.0	20.8	21.5	22.3	23.0	23.8	24.5	25.3	26.0
	29.4	29.0	28.6	28.2	27.8	27.5	27.1	26.8	26.4	26.1	25.8	25.5	25.2	24.9	24.6	24.3	24.0	23.8	23.5	23.3	23.0	22.8	22.5	22.3	22.0
47	9.3	9.9	10.5	11.1	11.7	12.3	13.0	13.6	14.3	14.9	15.6	16.3	17.0	17.7	18.4	19.1	19.8	20.5	21.3	22.0	22.8	23.5	24.3	25.0	25.8
	30.3	29.9	29.5	29.1	28.7	28.3	28.0	27.6	27.3	26.9	26.6	26.3	26.0	25.7	25.4	25.1	24.8	24.5	24.3	24.0	23.8	23.5	23.3	23.0	22.8
48	9.1	9.7	10.3	10.9	11.5	12.2	12.8	13.4	14.1	14.8	15.4	16.1	16.8	17.5	18.2	18.9	19.6	20.3	21.0	21.7	22.5	23.2	24.0	24.8	25.5
	31.1	30.7	30.3	29.9	29.5	29.2	28.8	28.4	28.1	27.8	27.4	27.1	26.8	26.5	26.2	25.9	25.6	25.3	25.0	24.8	24.5	24.3	24.0	23.8	23.5
49	9.0	9.6	10.2	10.8	11.4	12.0	12.6	13.3	13.9	14.6	15.2	15.9	16.6	17.3	18.0	18.7	19.4	20.1	20.8	21.5	22.3	23.0	23.8	24.5	25.3
	32.0	31.6	31.2	30.8	30.4	30.0	29.6	29.3	28.9	28.6	28.2	27.9	27.6	27.3	27.0	26.7	26.4	26.1	25.8	25.5	25.3	25.0	24.8	24.5	24.3
50	8.9	9.5	10.1	10.6	11.3	11.9	12.5	13.1	13.8	14.4	15.1	15.7	16.4	17.1	17.8	18.5	19.2	19.9	20.6	21.3	22.0	22.8	23.5	24.3	25.0
	32.9	32.5	32.1	31.6	31.3	30.9	30.5	30.0	29.8	29.6	29.1	28.7	28.4	28.1	27.8	27.5	27.2	26.9	26.6	26.3	26.0	25.8	25.5	25.3	25.0

	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
26	34	35	36	36	37	38	39	40	41	42	43	45	46	46	46	47	48	49	50	51	52	53	54	55	56
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27	33	34	35	36	37	38	39	40	41	41	42	43	44	45	46	47	48	49	50	51	51	52	53	54	55
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28	33	34	35	36	36	37	38	39	40	41	42	43	44	45	45	46	47	48	49	50	51	52	53	54	55
	10	10	10	10	9	9	9	9	9	9	9	9	9	9	8	8	8	8	8	8	8	8	8	8	8
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32	31	32	33	34	35	36	37	37	38	39	40	41	42	43	44	44	45	46	47	48	49	50	51	52	53
	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	10	10	10	10	10	10	10	10	10	10
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	14	13	13	13	13	13	13	13	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	11
35	30	31	32	33	34	35	35	36	37	38	39	40	41	41	42	43	44	45	46	47	48	48	49	50	51
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36	30	31	32	32	33	34	35	36	37	38	38	39	40	41	42	43	44	45	45	46	47	48	49	50	51
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	16	15	15	15	15	15	16	14	14	14	14	14	14	14	13	13	13	13	13	13	13	13	12	12	12
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	16	16	16	16	16	15	16	15	15	15	15	14	14	14	14	14	14	14	14	13	13	13	13	13	13
39	29	30	31	31	32	33	34	35	36	36	37	38	39	40	41	42	42	43	44	45	46	47	48	49	49
	17	17	17	16	16	16	16	16	16	15	15	15	15	15	15	15	14	14	14	14	14	14	14	14	13
40	29	29	30	31	32	33	34	34	35	36	37	38	39	39	40	41	42	43	44	45	45	46	47	48	49
	18	17	17	17	17	17	17	16	16	16	16	16	16	15	15	15	15	15	15	15	14	14	14	14	14
41	28	29	30	31	32	32	33	34	35	36	37	37	38	39	40	41	42	42	43	44	45	46	47	48	49
	18	18	18	18	18	17	17	17	17	17	17	16	16	16	16	16	16	16	15	15	15	15	15	15	15
42	28	29	30	30	31	32	33	34	35	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47	48
	19	19	19	18	18	18	18	18	18	17	17	17	17	17	17	16	16	16	16	16	16	16	15	15	15
43	28	29	29	30	31	32	33	33	34	35	36	37	37	38	39	40	41	42	43	43	44	45	46	47	48
	20	20	19	19	19	19	19	18	18	18	18	18	17	17	17	17	17	17	17	16	16	16	16	16	16
44	27	28	29	30	31	31	32	33	34	35	35	36	37	38	39	40	40	41	42	43	44	45	46	46	47
	20	20	20	20	20	19	19	19	19	19	18	18	18	18	18	18	17	17	17	17	17	17	17	16	16
45	27	28	29	30	30	31	32	33	34	34	35	36	37	38	38	39	40	41	42	43	44	44	45	46	47
	21	21	21	21	20	20	20	20	20	19	19	19	19	19	18	18	18	18	18	18	18	17	17	17	17
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	22	22	21	21	21	21	21	20	20	20	20	20	19	19	19	19	19	19	18	18	18	18	18	18	18
47	27	27	28	29	30	30	31	32	33	34	35	35	36	37	38	39	39	40	41	42	43	44	44	45	46
	23	22	22	22	22	21	21	21	21	21	21	20	20	20	20	20	19	19	19	19	19	19	18	18	18
48	26	27	28	29	29	30	31	32	33	33	34	35	36	37	37	38	39	40	41	42	42	43	44	45	46
	23	23	23	23	22	22	22	22	22	21	21	21	21	21	20	20	20	20	20	20	19	19	19	19	19
49	26	27	28	28	29	30	31	31	32	33	34	35	35	36	37	38	39	40	40	41	42	43	44	45	45
	24	24	24	23	23	23	23	22	22	22	22	22	21	21	21	21	21	21	20	20	20	20	20	20	19
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	25	25	24	24	24	24	23	23	23	23	23	22	22	22	22	22	21	21	21	21	21	21	20	20	20

	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
26	57	58	59	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
	7	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
27	56	57	58	59	60	61	62	63	64	65	66	66	67	68	69	70	71	72	73	74	75	76	77	78
	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6
28	56	57	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	72	73	74	75	76	77
	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6
29	55	56	57	58	59	60	61	62	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
30	55	55	56	57	58	59	60	61	62	63	64	65	66	67	68	68	69	70	71	72	73	74	75	76
	9	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7
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	9	9	9	9	9	9	9	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	7
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33	53	54	55	56	57	58	59	59	60	61	62	63	64	65	66	67	68	69	70	71	71	72	73	74
	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	9	9	8	8	8	8
34	53	53	54	55	56	57	58	59	60	61	62	63	64	64	65	66	67	68	69	70	71	72	73	74
	11	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	9
35	52	53	54	55	56	57	58	58	59	60	61	62	63	64	65	66	67	68	69	69	70	71	72	73
	11	11	11	11	11	11	11	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9
36	52	53	53	54	55	56	57	58	59	60	61	62	63	63	64	65	66	67	68	69	70	71	72	73
	12	12	11	11	11	11	11	11	11	11	11	11	11	11	10	10	10	10	10	10	10	10	10	10
37	51	52	53	54	55	56	57	57	58	59	60	61	62	63	64	65	66	67	68	68	69	70	71	72
	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	11	11	11	11	10	10	10	10	10
38	51	52	52	53	54	55	56	57	58	59	60	61	62	62	63	64	65	66	67	68	69	70	71	72
	13	13	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	11	11	11
39	50	51	52	53	54	56	66	57	57	58	59	60	61	62	63	64	65	66	66	67	68	69	70	71
	13	13	13	13	13	13	13	13	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11
40	50	51	52	52	53	54	65	56	67	58	59	60	61	61	62	63	69	66	66	67	68	69	70	71
	14	14	14	13	13	13	13	13	13	13	13	13	13	13	13	12	12	12	12	12	12	12	12	12
41	49	60	61	62	53	54	55	56	56	57	58	69	60	61	62	63	64	65	66	66	67	68	69	70
	14	14	14	14	14	14	14	14	13	13	13	13	13	13	13	13	13	13	13	12	12	12	12	12
42	99	50	51	62	53	53	54	55	56	57	58	69	60	61	61	62	63	64	65	66	67	68	69	70
	16	15	15	15	15	14	14	14	14	14	14	14	14	14	13	13	13	13	13	13	13	13	13	13
43	99	49	50	51	52	53	54	55	56	59	57	58	69	60	61	62	63	64	65	65	66	67	68	69
	16	15	15	5	15	15	15	15	15	14	14	14	14	14	14	14	14	14	14	14	13	13	13	13
44	48	49	60	51	52	53	53	54	55	56	57	58	59	60	60	61	62	63	64	65	66	67	68	69
	16	16	16	16	16	16	15	15	15	15	15	15	15	15	14	14	14	14	14	14	14	14	14	14
45	48	49	50	50	51	52	53	54	56	56	57	57	58	59	60	61	62	63	64	65	65	66	67	68
	17	17	17	16	16	16	16	16	16	16	16	15	15	16	15	15	15	15	15	15	14	14	14	14
46	47	48	49	50	51	52	53	53	54	55	56	57	58	59	60	60	61	62	63	64	65	66	67	68
	17	17	17	17	17	17	17	16	16	16	16	16	16	16	16	15	15	15	15	15	15	15	15	15
47	47	48	49	50	50	51	52	53	54	55	56	57	57	58	59	60	61	62	63	64	64	65	66	67
	18	18	18	18	17	17	17	17	17	17	17	17	16	16	16	16	16	16	16	16	15	15	15	15
48	47	47	48	49	50	51	52	53	54	54	55	56	57	58	59	60	61	61	62	63	64	65	66	67
	19	18	18	18	18	18	18	18	18	17	17	17	17	17	17	17	17	16	16	16	16	16	16	16
49	46	47	48	49	50	51	51	52	53	54	55	56	57	57	58	59	60	61	62	63	64	64	65	66
	19	19	19	19	19	19	18	18	18	18	18	18	18	17	17	17	17	17	17	17	17	16	16	16
50	46	47	48	48	49	50	51	52	53	54	54	55	56	57	58	59	60	61	61	62	63	64	65	66
	20	20	20	19	19	19	19	19	19	19	18	18	18	18	18	18	18	18	17	17	17	17	17	17

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	2
51	---	0.0	0.1	0.2	0.3	0.4	0.6	0.8	1.1	1.3	1.6	2.0	2.3	2.6	3.0	3.4	3.8	4.3	4.7	5.2	5.6	6.1	6.6	7.
		50.0	49.1	48.2	47.3	46.4	45.6	44.8	44.1	43.3	42.6	42.0	41.3	40.6	40.0	39.4	38.8	38.3	37.7	37.2	36.6	36.1	35.6	35
52	---	0.0	0.1	0.2	0.3	0.4	0.6	0.8	1.1	1.3	1.6	1.9	2.3	2.6	3.0	3.4	3.8	4.2	4.6	5.1	5.6	6.0	6.5	7.
		51.0	50.1	49.2	48.3	47.4	46.6	45.8	45.1	44.3	43.6	42.9	42.3	41.6	41.0	40.4	39.8	39.2	38.6	38.1	37.6	37.0	36.5	36
53	---	0.0	0.1	0.2	0.3	0.4	0.6	0.8	1.0	1.3	1.6	1.9	2.2	2.6	2.9	3.3	3.7	4.1	4.6	5.0	5.5	6.0	6.5	7.
		52.0	51.1	50.2	49.3	48.4	47.6	46.8	46.0	45.3	44.6	43.9	43.2	42.6	41.9	41.3	40.7	40.1	39.6	39.0	38.5	38.0	37.5	37.
54	---	0.0	0.1	0.2	0.3	0.4	0.6	0.8	1.0	1.3	1.6	1.9	2.2	2.5	2.9	3.3	3.7	4.1	4.5	4.9	5.4	5.9	6.4	6.
		53.0	52.1	51.2	50.3	49.4	48.6	47.8	47.0	46.3	45.6	44.9	44.2	43.5	42.9	42.3	41.7	41.1	40.5	39.9	39.4	38.9	38.4	37
55	---	0.0	0.1	0.2	0.3	0.4	0.6	0.8	1.0	1.3	1.6	1.9	2.1	2.5	2.8	3.2	3.6	4.0	4.4	4.9	5.3	5.8	6.3	6.
		54.0	53.1	52.2	51.3	50.4	49.6	48.8	48.0	47.3	46.5	45.8	45.1	44.5	43.8	43.2	42.6	42.0	41.4	40.9	40.3	39.8	39.3	38
56	---	0.0	0.1	0.2	0.3	0.4	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.3	5.7	6.2	6.
		55.0	54.1	53.2	52.3	51.4	50.6	49.8	49.0	48.2	47.5	46.8	46.1	45.4	44.8	44.2	43.6	43.0	42.4	41.8	41.3	40.7	40.2	39
57	---	0.0	0.1	0.1	0.3	0.4	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.8	3.1	3.5	3.9	4.3	4.8	5.2	5.7	6.1	6.
		56.0	55.1	54.1	53.3	52.4	51.6	50.8	50.0	49.2	48.5	47.8	47.1	46.4	45.8	45.1	44.5	43.9	43.3	42.8	42.2	41.7	41.1	40
58	---	0.0	0.1	0.1	0.3	0.4	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.7	3.1	3.5	3.9	4.3	4.7	5.1	5.6	6.0	6.
		57.0	56.1	55.1	54.3	53.4	52.6	51.8	51.0	50.2	49.5	48.8	48.1	47.4	46.7	46.1	45.5	44.9	44.3	43.7	43.1	42.6	42.0	41
59	---	0.0	0.1	0.1	0.3	0.4	0.6	0.7	1.0	1.2	1.4	1.7	2.0	2.3	2.7	3.0	3.4	3.8	4.2	4.6	5.1	5.5	6.0	6.
		58.0	57.1	56.1	55.3	54.4	53.6	52.7	52.0	51.2	50.4	49.7	49.0	48.3	47.7	47.0	46.4	45.8	45.2	44.6	44.1	43.6	43.0	42
60	---	0.0	.1	0.1	0.3	0.4	0.5	0.7	0.9	1.2	1.4	1.7	2.0	2.3	2.6	3.0	3.4	3.8	4.2	4.6	5.0	5.4	5.9	6.
		59	58	57	56	56	55	54	53	52	51	51	50	49	49	48	47	47	46	45	45	44	44	4
61	---	0.0	0.1	0.1	0.2	0.4	0.5	0.7	0.9	1.2	1.4	1.7	2.0	2.3	2.6	3.0	3.3	3.7	4.1	4.5	4.9	5.4	5.8	6.
		60	59	58	57	56	56	55	54	53	52	52	51	50	50	49	48	48	47	47	46	45	45	4
62	---	0.0	0.1	0.1	0.2	0.4	0.5	0.7	0.9	1.1	1.4	1.7	1.9	2.3	2.6	2.9	3.3	3.7	4.0	4.4	4.9	5.3	5.8	6.
		61	60	59	58	57	57	56	55	54	53	53	52	51	51	50	49	48	48	47	46	46	45	4
63	---	0.0	0.1	0.1	0.2	0.4	0.5	0.7	0.9	1.1	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.6	4.0	4.4	4.8	5.3	5.7	6.
		62	61	60	59	58	58	57	56	55	54	54	53	52	52	51	50	50	49	48	48	47	47	4
64	---	0.0	0.1	0.1	0.2	0.4	0.5	0.7	0.9	1.1	1.4	1.6	1.9	2.2	2.5	2.8	3.2	3.6	4.0	4.3	4.8	5.2	5.6	6.
		63	62	61	60	59	59	58	57	56	55	55	54	53	53	52	51	51	50	49	49	48	48	4
65	---	0.0	0.1	0.1	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.6	1.9	2.2	2.5	2.8	3.2	3.5	3.9	4.3	4.7	5.1	5.5	6.
		64	63	62	61	60	60	59	58	57	56	56	55	54	54	53	52	52	51	50	50	49	49	4
66	---	0.0	0.1	0.1	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.6	1.8	2.1	2.4	2.8	3.1	3.5	3.9	4.2	4.7	5.1	5.5	5.
		65	64	63	62	61	61	60	59	58	57	57	56	55	54	54	53	53	52	51	50	50	50	4
67	---	0.0	0.1	0.1	0.2	0.3	0.5	0.7	0.9	1.1	1.3	1.6	1.8	2.1	2.4	2.7	3.1	3.4	3.8	4.2	4.6	5.0	5.4	5.
		66	65	64	63	62	62	61	60	59	58	58	57	56	56	55	54	54	53	52	52	51	50	5
68	---	0.0	0.1	0.1	0.2	0.3	0.5	0.7	0.8	1.1	1.3	1.5	1.8	2.1	2.4	2.7	3.0	3.4	3.8	4.1	4.5	5.0	5.4	5.
		67	66	65	64	63	63	62	61	60	59	59	58	57	56	56	55	55	54	53	53	52	51	5
69	---	0.0	0.1	0.1	0.2	0.3	0.5	0.6	0.8	1.0	1.3	1.5	1.8	2.1	2.4	2.7	3.0	3.4	3.7	4.1	4.5	4.9	5.3	5.
		68	67	66	65	64	64	63	62	61	60	60	59	58	57	57	56	56	55	54	54	53	52	5
70	---	0.0	0.1	0.1	0.2	0.3	0.5	0.6	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.6	3.0	3.3	3.7	4.1	4.4	4.8	5.3	5.
		69	68	67	66	65	65	64	63	62	61	61	60	59	58	58	57	56	56	55	54	54	53	5
71	---	0.0	0.1	0.1	0.2	0.3	0.5	0.6	0.8	1.0	1.2	1.5	1.7	2.0	2.3	2.6	2.9	3.3	3.6	4.0	4.4	4.8	5.2	5.
		70	69	68	67	66	66	65	64	63	62	62	61	60	59	59	58	57	57	56	55	55	54	5
72	---	0.0	0.1	0.1	0.2	0.3	0.5	0.6	0.8	1.0	1.2	1.5	1.7	2.0	2.3	2.6	2.9	3.2	3.6	4.0	4.3	4.7	5.1	5.
		71	70	69	68	67	67	66	65	64	63	63	62	61	60	60	59	58	58	57	56	56	55	5
73	---	0.0	0.1	0.1	0.2	0.3	0.5	0.6	0.8	1.0	1.2	1.4	1.7	2.0	2.3	2.6	2.9	3.2	3.6	3.9	4.3	4.7	5.1	5.
		72	71	70	69	68	68	67	66	65	64	63	63	62	61	61	60	59	59	58	57	57	56	5
74	---	0.0	0.1	0.1	0.2	0.3	0.4	0.6	0.8	1.0	1.2	1.4	1.7	1.9	2.2	2.5	2.8	3.2	3.5	3.9	4.3	4.6	5.0	5.
		73	72	71	70	69	68	68	67	66	65	64	64	63	62	62	61	60	60	59	58	58	57	6
75	---	0.0	0.1	0.1	0.2	0.3	0.4	0.6	0.8	1.0	1.2	1.4	1.7	1.9	2.2	2.5	2.8	3.1	3.5	3.8	4.2	4.6	5.0	5.
		74	73	72	71	70	69	69	68	67	66	65	65	64	63	63	62	61	61	60	59	59	58	57
	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
51	8.8	9.3	9.9	10.5	11.1	11.7	12.3	13.0	13.6	14.2	14.9	15.6	16.2	16.9	17.6	18.3	19.0	19.7	20.4	21.1	21.8	22.5	23.3	24.0	24.
	33.8	33.3	32.9	32.5	32.1	31.7	31.3	31.0	30.6	30.2	29.9	29.6	29.2	28.9	28.6	28.3	28.0	27.7	27.4	27.1	26.8	26.5	26.3	26.0	25.
52	8.7	9.2	9.8	10.4	11.0	11.6	12.2	12.8	13.4	14.1	14.7	15.4	16.0	16.7	17.4	18.1	18.8	19.5	20.2	20.9	21.6	22.3	23.0	23.8	24.
	34.7	34.2	33.8	33.4	33.0	32.6	32.2	31.8	31.4	31.1	30.7	30.4	30.0	29.7	29.4	29.1	28.8	28.5	28.2	27.9	27.6	27.3	27.0	26.8	26.
53	8.6	9.1	9.7	10.3	10.8	11.4	12.0	12.7	13.3	13.9	14.6	15.2	15.9	16.5	17.2	17.9	18.6	19.3	20.0	20.7	21.4	22.1	22.8	23.6	24.
	35.4	35.1	34.7	34.3	33.8	33.4	33.0	32.7	32.3	31.9	31.6	31.2	30.9	30.5	30.2	29.9	29.6	29.3	29.0	28.7	28.4	28.1	27.8	27.5	27.
54	8.4	9.0	9.6	10.1	10.7	11.3	11.9	12.5	13.1	13.8	14.4	15.0	15.7	16.4	17.0	17.7	18.4	19.1	19.8	20.5	21.2	21.9	22.6	23.3	24.
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82	37	37	38	39	40	40	41	42	43	43	44	45	46	46	47	48	49	49	50	51	52	53	53	54	55
	43	42	42	42	42	41	41	41	41	40	40	40	40	39	39	39	39	38	38	38	38	38	37	37	37
83	36	37	38	39	39	40	41	42	42	43	44	45	45	46	47	48	48	49	50	51	52	52	53	54	55
	43	43	43	43	42	42	42	42	41	41	41	41	40	40	40	40	39	39	39	39	39	38	38	38	38
84	36	37	38	38	39	40	41	41	42	43	44	44	45	46	47	47	48	49	50	50	51	52	53	54	54
	44	44	44	43	43	43	43	42	42	42	42	41	41	41	41	40	40	40	40	39	39	39	39	39	38
85	36	37	37	38	39	40	40	41	42	43	43	44	45	46	46	47	48	49	49	50	51	52	53	53	54
	45	45	44	44	44	44	43	43	43	43	42	42	42	42	41	41	41	41	40	40	40	40	40	39	39
86	36	36	37	38	39	39	40	41	42	42	43	44	45	45	46	47	48	48	49	50	51	51	52	53	54
	46	45	45	45	46	44	44	44	44	43	43	43	43	42	42	42	42	41	41	41	41	40	40	40	40
87	35	36	37	38	38	39	40	41	41	42	43	44	44	45	46	47	47	48	49	50	50	51	52	53	54
	46	46	46	46	45	45	45	45	44	44	44	44	43	43	43	43	42	42	42	42	41	41	41	41	41
88	35	36	37	37	38	39	40	40	41	42	43	43	44	45	46	46	47	48	49	49	50	51	52	52	53
	47	47	47	46	46	46	46	45	45	45	45	44	44	44	44	43	43	43	43	42	42	42	42	41	41
89	35	36	36	37	38	39	39	40	41	42	42	43	44	45	45	46	47	48	48	49	50	51	51	52	53
	48	48	47	47	47	47	46	46	46	46	45	45	45	45	44	43	43	43	42	42	42	42	41	41	41
90	35	36	36	37	38	38	39	40	41	41	42	43	44	44	45	46	47	47	48	49	50	50	51	52	53
	49	49	48	48	48	47	47	47	47	46	46	46	46	45	45	45	45	44	44	44	44	43	43	43	43
91	35	35	36	37	37	38	39	40	40	41	42	43	43	44	45	46	46	47	48	49	49	50	51	52	52
	50	49	49	49	48	48	48	48	47	47	47	47	46	46	46	46	45	45	45	45	44	44	44	44	43
92	34	35	36	37	37	38	39	39	40	41	42	42	43	44	45	45	46	47	48	48	49	50	51	51	52
	50	50	50	50	49	49	49	49	48	48	48	47	47	47	47	46	46	46	46	45	45	45	45	44	44
93	34	35	36	36	37	38	38	39	40	41	41	42	43	44	44	45	46	47	47	48	49	50	50	51	52
	51	51	51	50	50	50	49	49	49	49	48	48	48	48	47	47	47	47	46	46	46	46	45	45	45
94	34	35	35	36	37	38	38	39	40	40	41	42	43	43	44	45	46	46	47	48	49	49	50	51	52
	51	52	51	51	51	51	50	50	50	49	49	49	49	48	48	48	48	47	47	47	47	46	46	46	46
95	34	35	35	36	37	37	38	39	39	40	41	42	42	43	44	46	45	46	47	48	48	49	50	51	51
	53	53	52	52	52	51	51	51	50	50	50	50	49	49	49	49	48	48	48	48	47	47	47	47	46
96	34	34	35	36	36	37	38	38	39	40	41	41	42	43	44	44	45	46	47	47	48	49	50	50	51
	54	53	53	53	52	52	52	52	51	51	51	50	50	50	50	49	49	49	49	48	48	48	48	47	47
97	33	34	35	36	36	37	38	38	39	40	40	41	42	43	43	44	45	46	46	47	48	49	49	50	51
	54	54	54	54	53	53	53	52	52	52	51	51	51	51	50	50	50	50	49	49	49	49	48	48	48
98	33	34	35	35	36	37	37	38	39	40	40	41	42	42	43	44	45	45	46	47	48	48	49	50	51
	55	55	55	54	54	54	53	53	53	53	52	52	52	51	51	51	51	50	50	50	50	49	49	49	49
99	33	34	34	35	36	36	37	38	39	39	40	41	41	42	43	44	44	45	46	47	47	48	49	50	50
	56	56	55	55	55	54	54	54	54	53	53	53	52	52	52	52	51	51	51	51	50	50	50	50	49
100	33	34	34	35	36	36	37	38	38	39	40	41	41	42	43	43	44	45	46	46	47	48	49	49	50
	57	57	56	56	56	55	55	55	54	54	54	54	53	53	53	52	52	52	52	51	51	51	51	50	50

APPENDIX C

Soil Data Taken In Atiocoyo-Nueva Concepcion

MINISTERIO DE AGRICULTURA Y GANADERIA

DIRECCION GENERAL DE OBRAS DE RIEGO Y DRENAJE

DEPARTAMENTO DE ESTUDIOS

SECCION DE AGROLOGIA

CARACTERISTICAS FISICAS DE LOS SUELOS

Proyecto No. 2, ATIOCOYO — Fecha 13 de Agosto de 1973

Departamento LA LIBERTAD - CHALATENANGO — Observaciones

Jurisdicción

Infiltración No.	Unidad de Suelo	Grado Básico de Infiltrac. Cm/Hora	Profundidad. Cms.	Densidad Aparente	PORCENTAJE DE Arena	Limo	Arcilla	TEXTURA	Humedad en % a (0.33 Atm.) Capacidad de Campo	(15 Atm.) Punto de Marchitez	Capac. de Retención mm / cms.
24	Atc	0.26	0 - 18	1.39	45.84	31.08	23.08	F	29.36	9.34	2.78
"	"		18 - 60	1.44	31.92	18.72	49.36	C	41.86	24.10	2.56
"	"		60 - 100	1.60	33.68	16.96	49.36	C	36.91	20.26	2.66
13	Atc	0.18	0 - 16	1.34	39.56	30.04	30.40	F.C.	42.13	14.43	3.71
"	"		16 - 28	1.26	43.00	31.32	25.68	F	29.09	14.73	1.81
"	"		28 - 60	1.16	18.88	16.92	64.20	C	50.13	28.42	2.52
"	"		60 - 100	1.31	15.24	17.12	67.64	C	49.84	27.66	2.91
22	Atc	0.17	0 - 20	1.10	39.92	32.84	27.24	F.C.	33.48	17.60	1.75
"	"		20 - 60	1.03	35.32	24.32	40.36	C	30.87	19.71	1.15
"	"		60 - 100	1.17	29.20	14.08	56.72	C	49.17	31.29	2.09
2 (C)	Ap	6.40	0 - 18	1.23	38.20	27.48	34.32	F.C.	35.05	17.54	2.15
"	"		18 - 45	1.12	26.56	42.68	30.76	F.C.	44.65	22.70	2.45
"	"		45 - 100	1.02	29.84	53.24	16.92	F.L.	50.72	16.45	3.49
3	Atc	0.11									

MINISTERIO DE AGRICULTURA Y GANADERIA

DIRECCION GENERAL DE OBRAS DE RIEGO Y DRENAJE

DEPARTAMENTO DE ESTUDIOS

SECCION DE AGROLOGIA

CARACTERISTICAS FISICAS DE LOS SUELOS

Proyecto No. 2, ATIOCOYO Fecha

Departamento LA LIBERTAD - CHALATENANGO Observaciones

Jurisdicción

Infiltración No.	Unidad de Suelo	Grado Básico de Infiltrac. Cm/Hora	Profundidad. Cms.	Densidad Aparente	PORCENTAJE DE Arena	Limo	Arcilla	TEXTURA	Humedad en % a (0.33 Atm.) Capacidad de Campo	(15 Atm.) Punto de Marchitez	Capac. de Retención mm / cms.
9	Boa	1.49									
31	Boa	0.56	0 - 32	1.06	53.56	24.28	22.16	F.C.A.	25.07	9.39	1.66
"	"		32 - 100	1.04	38.72	25.20	36.08	F.C.	31.27	18.52	1.33
16	Boa	0.04	0 - 20	1.02	34.50	39.10	26.40	F	44.35	15.64	2.93
"	"		20 - 60	1.21	28.52	13.48	58.00	C	49.39	27.15	2.69
"	"		60 - 100	1.22	32.64	17.32	50.04	C	45.43	25.01	2.49
29	Bob	0.98	0 - 52	1.03	43.08	27.12	29.80	F.C.	31.47	11.62	2.04
"	"		52 - 100	1.32	46.92	20.68	32.40	F.C.	28.55	10.28	2.41
5 (G)	Bob	0.76	0 - 20	1.01	48.36	25.64	26.00	F.C.A.	31.69	18.89	1.29
"	"		20 - 30	1.35	45.20	22.44	32.36	F.C.A.	37.51	15.24	3.01
"	"		30 - 65	1.33	35.20	19.20	45.60	C	43.46	21.36	2.94
"	"		65 - 100	1.14	27.00	14.64	58.36	C	55.75	31.10	2.81
6	Cma	0.50									
2	Cmc	5.00									

MINISTERIO DE AGRICULTURA Y GANADERIA

DIRECCION GENERAL DE OBRAS DE RIEGO Y DRENAJE

DEPARTAMENTO DE ESTUDIOS

SECCION DE AGROLOGIA

CARACTERISTICAS FISICAS DE LOS SUELOS

Proyecto **No. 2, ATIOCOYO** Fecha

Departamento **LA LIBERTAD - CHALATENANGO** Observaciones

Jurisdicción

Infiltración No.	Unidad de Suelo	Grado Básico de Infiltrac. Cm/Hora	Profundidad. Cms.	Densidad Aparente	PORCENTAJE DE Arena	Limo	Arcilla	TEXTURA	Humedad en % a (0.33 Atm.) Capacidad de Campo	(15 Atm.) Punto de Marchitez	Capac. de Retención mm / cms.
17	Coa	5.39	0 - 22	1.18	43.28	28.36	28.36	F.C.	31.47	13.71	2.10
"	"		22 - 34	1.22	40.40	25.32	34.28	F.C.	31.44	14.33	2.08
"	"		34 - 53	1.23	34.20	24.08	41.72	C	32.69	18.47	1.75
"	"		53 - 77	1.21	23.20	15.68	61.12	C	49.52	29.53	2.42
"	"		77 - 100	1.18	25.56	12.72	61.72	C	53.09	33.33	2.33
3(GDI)	Coa	2.20	0 - 40	1.15	40.92	29.76	29.32	F.C.	33.63	15.40	2.10
"	"		40 - 70	1.41	34.40	21.80	43.80	C	37.00	20.43	2.34
"	"		70 - 100	1.24	54.08	29.36	16.56	F.A.	29.28	7.25	2.73
8	Coa	0.32									
30	Chla	1.50	0 - 20	1.07	41.28	28.32	30.40	F.C.	36.13	14.62	2.30
"	"		20 - 100	1.52	30.12	13.08	56.80	C	46.27	23.06	3.53
28	Chla	0.74	0 - 14	1.03							
"	"		14 - 95	1.31							
"	"		95 - 100	1.40							

MINISTERIO DE AGRICULTURA Y GANADERIA

DIRECCION GENERAL DE OBRAS DE RIEGO Y DRENAJE

DEPARTAMENTO DE ESTUDIOS

SECCION DE AGROLOGIA

CARACTERISTICAS FISICAS DE LOS SUELOS

Proyecto **No. 2, ATIOCOYO** Fecha

Departamento **LA LIBERTAD - CHALATENANGO** Observaciones

Jurisdicción

Infiltración No.	Unidad de Suelo	Grado Básico de Infiltrac. Cm/Hora	Profundidad. Cms.	Densidad Aparente	PORCENTAJE DE Arena	Limo	Arcilla	TEXTURA	Humedad en % a (0.33 Atm.) Capacidad de Campo	(15 Atm.) Punto de Marchitez	Capac. de Retención mm / cms.
12	Chlá	0.55	0 - 20	1.19	53.28	29.76	16.96	F.A.	22.55	8.33	1.69
"	"		20 - 60	1.35	43.28	19.16	37.56	F.C.	35.56	16.54	2.57
"	"		60 - 80	1.45	37.00	17.00	46.00	C	43.49	22.37	3.06
"	"		80 - 100	1.42	33.28	19.72	47.00	C	45.77	24.09	3.07
5	Chla	0.21									
11	Chla	0.14	0 - 29	1.22	42.68	31.16	26.16	F	28.15	10.47	2.16
"	"		29 - 80	1.38	27.96	15.52	56.52	C	47.19	31.55	2.16
"	"		80 - 100	1.41	29.68	16.16	54.16	C	44.66	28.12	2.33
4 (G)	Chlaa	0.67	0 - 20	1.08	45.60	26.40	28.00	F.C.A.	33.63	18.55	2.17
"	"		20 - 30	1.35	39.56	27.64	32.80	F.C.	31.08	14.94	2.18
"	"		30 - 60	1.19	26.84	10.00	63.16	C	53.58	31.84	2.59
"	"		60 - 100	1.28	29.20	9.80	61.00	C	50.80	30.51	2.60
32	Chlap	6.30	0 - 67	1.04	52.56	33.28	14.16	F.A.	25.74	7.40	1.91
"	"		67 - 100	1.09	39.64	46.52	13.84	F	28.03	6.22	2.37

MINISTERIO DE AGRICULTURA Y GANADERIA

DIRECCION GENERAL DE OBRAS DE RIEGO Y DRENAJE

DEPARTAMENTO DE ESTUDIOS

SECCION DE AGROLOGIA

CARACTERISTICAS FISICAS DE LOS SUELOS

Proyecto **No. 2, ATIOCOYO** Fecha

Departamento **LA LIBERTAD - CHALATENANGO** Observaciones

Jurisdicción

Infiltración No.	Unidad de Suelo	Grado Básico de Infiltrac. Cm/Hora	Profundidad. Cms.	Densidad Aparente	PORCENTAJE DE Arena	Limo	Arcilla	TEXTURA	Humedad en % a (0.33 Atm.) Capacidad de Campo	(15 Atm.) Punto de Marchitez	Capac. de Retención mm / cms.
3 (G)	Chlap	1.58	0 - 18	1.12	51.20	16.68	32.12	F.C.A.	31.36	15.49	1.78
"	"		18 - 35	1.21	50.48	17.80	31.72	F.C.A.	28.92	12.46	1.99
"	"		35 - 60	1.31	54.56	30.08	15.36	F.A.	27.06	5.87	2.77
"	"		60 - 100	1.42	19.32	11.04	69.64	C	60.79	30.30	4.33
4(GDI)	Chlap	0.78	0 - 34	1.16	50.20	23.64	26.16	F.C.A.	27.58	12.30	1.77
"	"		34 - 54	1.11	51.04	30.80	18.16	F.A.	31.42	11.50	2.21
"	"		54 - 66	1.12	28.04	17.80	54.16	C	47.57	31.90	1.75
"	"		66 - 82	1.31	46.00	26.20	27.80	F.C.A.	33.43	14.23	2.51
"	"		82 - 100	1.25	28.96	14.52	56.52	C	46.38	28.36	2.25
1 (G)	Chlap	0.36	0 - 18	1.11	36.52	32.72	30.76	F.C.	37.72	18.92	2.08
"	"		18 - 45	1.34	37.60	29.32	33.08	F.C.	38.30	15.47	3.06
"	"		45 - 75	1.67	24.56	27.08	48.36	C	40.64	23.53	2.86
"	"		75 - 100	1.25	25.56	12.72	61.72	C	61.75	35.75	3.25
14	Chlap	0.35	0 - 55	1.39	32.64	35.36	32.00	F.C.	35.40	17.53	2.48
"	"		55 - 76	1.41	29.92	28.36	41.72	C	32.24	17.50	2.08
"	"		76 - 100	1.25	22.56	12.72	64.72	C	48.48	32.62	1.98

MINISTERIO DE AGRICULTURA Y GANADERIA

DIRECCION GENERAL DE OBRAS DE RIEGO Y DRENAJE

DEPARTAMENTO DE ESTUDIOS

SECCION DE AGROLOGIA

CARACTERISTICAS FISICAS DE LOS SUELOS

Proyecto **No. 2, ATIOCOYO** — Fecha

Departamento **LA LIBERTAD - CHALATENANGO** Observaciones

Jurisdicción

Infiltración No.	Unidad de Suelo	Grado Básico de Infiltrac. Cm/Hora	Profundidad. Cms.	Densidad Aparente	PORCENTAJE DE Arena	Limo	Arcilla	TEXTURA	Humedad en % a (0.33 Atm.) Capacidad de Campo	(15 Atm.) Punto de Marchitez	Capac. de Retención mm / cms.
23	Chlmo	0.78	0 - 18	1.21	44.96	22.48	32.56	F.C.	35.66	17.05	2.25
"	"		18 - 60	1.24	28.64	12.64	58.72	C	50.72	25.70	3.10
"	"		60 - 100	1.27	19.44	10.40	70.16	C	66.84	38.30	3.62
19	Chlmo	0.15	0 - 35	1.20	30.48	32.92	36.60	F.C.	23.46	9.33	1.69
"	"		35 - 77	1.36	32.56	20.80	46.64	C	35.10	23.07	1.64
"	"		77 - 100	1.31	31.12	5.48	63.40	C	45.83	28.22	2.31

MINISTERIO DE AGRICULTURA Y GANADERIA

DIRECCION GENERAL DE OBRAS DE RIEGO Y DRENAJE

DEPARTAMENTO DE ESTUDIOS

SECCION DE AGROLOGIA

CARACTERISTICAS FISICAS DE LOS SUELOS

Proyecto No. 2, ATIOCOYO

Departamento LA LIBERTAD - CHALATENANGO

Jurisdicción

Fecha

Observaciones

Infiltración No.	Unidad de Suelo	Grado Básico de Infiltrac. Cm/Hora	Profundidad. Cms.	Densidad Aparente	PORCENTAJE DE Arena	Limo	Arcilla	TEXTURA	Humedad en % a (0.33 Atm.) Capacidad de Campo	(15 Atm.) Punto de Marchitez	Capac. de Retención mm / cms.
21	Moa	0.38	0 - 18	1.11	38.96	35.68	25.36	F	36.02	14.86	2.57
"	"		18 - 60	1.32	29.56	18.04	52.40	C	43.33	24.44	2.49
"	"		60 - 100	1.36	30.60	19.20	50.20	C	42.88	23.85	2.59
15	Moa	0.35	0 - 16	1.24	40.56	33.92	25.12	F	34.62	12.15	2.78
"	"		16 - 33	1.26	40.56	34.72	24.72	F	32.51	10.33	2.79
"	"		33 - 73	1.15	25.12	13.76	61.12	C	55.71	28.48	3.13
"	"		73 - 100	1.31	24.20	25.28	50.52	C	54.74	27.53	3.56
1	Mob	0.23	-	-	-	-	-	-	-	-	-
25	MoBo	0.27	0 - 25	1.16	43.83	38.32	17.84	F	27.60	7.73	2.31
"	"		25 - 100	1.30	33.94	15.20	50.86	C	43.49	22.34	2.75
27	MoBo	0.27	0 - 31	1.19	54.84	29.92	15.24	F.A	47.22	26.59	2.45
"	"		31 - 73	1.32	34.56	11.24	54.20	C	39.76	22.33	2.30
"	"		73 - 100	1.39	44.88	15.10	40.02	C	49.96	23.76	3.63
26	MoBo	0.10	0 - 22	1.26	49.62	33.94	16.44	F	22.71	7.38	1.93
"	"		22 - 68	1.36	32.70	15.86	51.44	C	44.64	21.58	3.13
"	"		68 - 100	1.04	43.12	24.48	32.40	F.C.	22.12	6.87	1.58

MINISTERIO DE AGRICULTURA Y GANADERIA

DIRECCION GENERAL DE OBRAS DE RIEGO Y DRENAJE

DEPARTAMENTO DE ESTUDIOS

SECCION DE AGROLOGIA

CARACTERISTICAS FISICAS DE LOS SUELOS

Proyecto No. 2, ATIOCOYO Fecha

Departamento LA LIBERTAD - CHALATENANGO Observaciones

Jurisdicción

Infiltración No.	Unidad de Suelo	Grado Básico de Infiltrac. Cm/Hora	Profundidad. Cms.	Densidad Aparente	PORCENTAJE DE Arena	Limo	Arcilla	TEXTURA	Humedad en % a (0.33 Atm.) Capacidad de Campo	(15 Atm.) Punto de Marchitez	Capac. de Retención mm / cms.
20	Pqa	0.19	0 - 15	1.21	49.56	16.68	33.76	F.C.A.	29.69	9.86	2.40
"	"		15 - 60	1.45	32.20	17.72	50.08	C	41.24	20.95	2.94
"	"		60 - 100	1.25	30.20	15.08	54.72	C	47.35	23.92	2.93
4	Pqaa	0.12	-	-	-	-	-	-	-	-	-
7	Pqd	0.10	-	-	-	-	-	-	-	-	-
10	Tcha	2.90	-	-	-	-	-	-	-	-	-

APPENDIX D

Sprinkler Equipment and Land Leveling Costs for El Salvador

SURFACE IRRIGATION COSTS

Conveyance or head ditch:

Built up above surface: ¢ 1.00 linear meter

Constructed with ditches: ¢ 0.25 linear meter

Tail ditch: ¢ 0.15 linear meter

Brick drop structure: ¢70

Brick check structure: ¢70

Survey: ¢20/MZ = ¢28/Ha

Plow: ¢25 per pass MZ = ¢35/Ha

Disc: ¢15 per pass MZ = ¢21/Ha

6-9 yd. scraper: ¢50/hour including fuel and operator

Roadgrader: ¢30/hour including fuel and operator

Transport of equipment: ¢2.50/Km per machine

Land Plane: ¢21/MZ = ¢31/Ha

SPRINKLER IRRIGATION EQUIPMENT COSTS

Aluminum Pipe with Couplets:

Size Inches	Length 20'	30'
2	¢ 37.38	¢ 46.08
3	¢ 48.23	¢ 61.43
4	¢ 67.95	¢ 84.55
5	¢ 96.80	¢120.75
6	¢121.88	¢152.40
8	¢300.00	¢386.00

Rainbird Sprinklers:

30 TNT = ¢20.30

40B TNT = ¢33.00

70E TNT = ¢51.40

80 TNT = ¢96.00

Risers:

3/4" x 1 M aluminum = ¢11.40

3/4" x 2 M aluminum = ¢17.00

3/4" x 3 M aluminum = ¢22.00

Pumps (split case):

Discharge, QPM	Head, Ft.	Cost, ¢
220	180	2300
400-500	180	2100
500-600	180	2500
700-1000	180-210	3300
1000-2000	180-230	3900

Power:

Gasoline: ¢1.69/gallon

Diesel: ¢0.97/gallon

Electric: ¢ .06/kw-hr

APPENDIX E

Sprinkler Irrigation Costs For Systems Installed by Irrigation Company

Noviembre 3 de 1972

Estimado señor :

Tenemos el gusto en presentarle nuestro estudio del Sistema de riego por Aspersión.

SISTEMA No. 2

1) Area Total a regar : 124 manzanas.

2) Caudal de agua en el sistema: 300 m^3/h -= 1300 GPM.

3) ASPERSORES A USARSE : 233/91 Esq. 5.3mm -
capacitiante 12 x 10m.
caudal 2.5 m^3/h

4) Presión en la bomba : 6 a 7 atmosferas

5) Presión en los aspersores : 2.5 a 3 atmosferas

6) Precipitación : 12 mm/h.

7) Equipo de bombeo :
Bomba Deming 5x4x17, 1755 RPM.
300m^3/h. = 1300 GPM. TDH 63Mm 210'
(ver curva anexa)

8) Motor eléctrico : BROWN BOVERI, 120 HP. 440 voltios 1755 RPM.

9) El SISTEMA : Aplicando 50 mm. cada 9 días trabajando 5 horas por posición 4 posic. al día.

10) Lámina aplicada : 200mm. por mes

11) El sistema consiste de :

Moto-bomba electrica, que se ubicará en una sola posición en el lugar ya indicado por nosotros, la tubería principal de 775 m. en diámetros de 5" y 6" se moverá a su segunda posición, a los 5 días y trabajará 4 días en la tubería principal ...

Se moverán seis laterales de 230 metros cada uno, en diámetros 4", 3" y 2" con 20 aspersores cada uno.

12) POTREROS : En este sistema se ha dividido en 60 potreros, formando dos grupos de ganado, utilizando 27 potreros y tres de reserva para cada uno, los potreros están diseñados en forma que la rotación del ganado trabaje en la siguiente manera : El riego llega dos días después del ganado y el ganado de 5 a 6 días después del riego; los potreros oscilan entre 2 a 2½ manzana.

Nota:

En vista de que este año, parte del segundo sistema de Riego, se encuentra con KLKAF, no se podrá llevar a cabo la rotación del ganado como se ha proyectado.

13) PLANO DEL SISTEMA (ver plano)

14) CURVA DE LA DEMANDA (ver curva)

15) DESCRIPCION (adjunta)

DESCRIPCION DEL EQUIPO No. 2

110	Tubos 6" x 30'	
60	" 5 x 30	
6	" 4 x 30	
60	" 4 x 20	
120	" 3 x 20	
54	" 2 x 20	
11	Válvula línea	6-746-4
16	Válvula línea	5-746-4
99	Acoples	6-6-0
44	Acoples	5-6-0
60	Acoples	4-6-1
120	Acoples	3-6-3/4
54	Acoples	2-6-3/4
2	Codos	6-27-1
4	Adaptador a bomba	6-166-19
2	Reductor	6-310-5
2	Tapón	5-46
1	Tee	6-266-1
7	Válvula codo	4-766-4
7	Codos	4-27-1
6	Reductor	4-316-3
6	Reductor	3-316-2
6	Tapón final	2-46
220	Abrazaderas	06-6
120	Abrazaderas	06-5
132	Abrazaderas	06-4
240	Abrazaderas	06-3
108	Abrazaderas	06-2
1	Manomatro comp.	
40	Tapón	1-80
87	Tapón	3/4-80
120	Aspersores	233/91 boq. 6.3
120	Elevadores	3/4-90-40
120	Estabilizadores	A6-40
4	Válvula BANGT	46-6
1	Válvula descarga	8"
1	Succión aluminio	8"
2	Tubos hierro	6" x 10'
1	Tubo de hierro	8 x 10'
1	Base Motor y Bomba	
	Acoplamiento, motor y bomba	
	Reductor 6" a 4" para descarga	
	Reductor 6" a 6" para succión	
1	Bomba FUNING 6 x 4 x 17	
	Transporte, instalación y capacitación	
1	Motor Brown Boveri Vel.440; 120 HP. 144 amp. 1755 RPM.	

PRECIO DEL SISTEMA No. 2 .....$ 48.353.20

MZ/yFh-

Octubre 18 de 1972

Estimado señor :

Tenemos el gusto en presentarle nuestro estudio del Sistema de Riego por Aspersión.

SISTEMA No. 1

1 - AREA TOTAL A REGAR : 96 manzanas.

2 - CAUDAL DE AGUA EN EL SISTEMA : 220 M^3/h = 1000 GPM.

3 - ASPERSOR A USARSE : 233/01 BPC. 6.3 MM.

Espaciamiento: 12 x 18 M.

Caudal : 2.5 M^3/h.

4 - PRESION EN LA BOMBA: 5 a 6 Atmosferas

5 - PRESION EN LOS ASPERSORES : 2.5 a 3 Atmosferas

6 - PRECIPITACION : 12 MM/hora

7 - EQUIPO DE BOMBEO : Consta de bomba DEMING 6x4x14) (ver curva adjunta)
220 M^3/h. TDH 500 = 213' 1765 RPM.

8 - MOTOR ELECTRICO BROWN BOVERI: 72 HP. 440 voltios 1765 RPM.

9 - EL SISTEMA : Aplicando 50 mm cada 9 días trabajando 5 horas por posición, 4 posiciones al día.

10 - LAMINA DE AGUA APLICADA POR MES : 200 mm por mes

...2

11 - EL SISTEMA CONSISTE DE :

Moto-bomba eléctrica que se ubicará en una sola posición, en el lugar ya indicado por nosotros, de donde se derivarán dos tuberías una de 6" y 5" 640 M. de largo, en la cual se moverán dos rezales de 350M de longitud de tubería 4" con 20 aspersores cada uno.

La segunda tubería de 5" tendrá una longitud 160M. y se completará hasta los 320 metros, moviendo tubos de la primera tubería, o sea que el rezlo de la tubería principal es fija.

En la tubería de 5" se moverá un rezal de 350M de longitud 4" ø con aspersores; éstos rezales se moverán cada 5 horas.

12 - POTREROS: Estos 96 manzanas están divididos en 30 potreros, de los cuales 27 son para rotación del ganado y los tres restantes de reserva. Los potreros oscilan entre 3 a 3½ manzanas cada uno, están proyectados para que el riego llegue dos días después del ganado y el ganado de 5 a 6 días después del riego, así evitamos molestias al ganado y al mismo tiempo aprovechamiento por el pasto en tierra mojada, en los dos días que quedan entre el ganado el riego se puede utilizar para fertilizar.

13- PLANO DEL SISTEMA (ver plano)

14 - Curva de la Bomba (ver curva)

15 - DESCRIPCION (adjunta)

.....

DESCRIPCION DEL EQUIPO No.1

45	Tubos 6" x 30'	2014=20
37	" 5" x 30'	
3	" 4" x 30'	
171	" 4" x 20'	
7	Válvula línea	6-746-4
10	Válvula línea	5-746-4
37	Acople	6-6-0
20	Acople	5-6-0
1	Reductor	6-310-5
2	Tapón final	5-46
1	Codo	6-27-1
1	Codo	5-27-1
171	Acople	4-6-1
3	Codo	4-27-1
3	Tapón final	4-46
3	Válvula	4-766-4
87	Aspersores	233/91 Boq. 6.3
87	Elevadores	3/4-90-40
87	Estabilizadores	AB-40
87	Abrazaderas	06-6
74	Abrazaderas	06-5
348	Abrazaderas	06-4
1	Grate housing	6x4x14½
1	Succión code Rain	
3	Tubos de hierro	6" x 10'
1	Acoplador a bomba	6-166-19
1	Acoplador a bomba	5-166-19
2	Válvula BERET	44-6
1	Válvula descarga	6"
58	Unitrol FF2 2,5 m^3/h	
1	Manometro completo	
	Base motor y bomba	
	Reductor 8" a 6" para succión	
	Reductor 4" a 6" para descarga	
	Transporte instalación y supervisión	
1	Motor Brown Bovari Vo. 440 HP. 72,amp.87, RPM. 1765	

PRECIO DEL SISTEMA DE RIEGO No. 1 .....$ 33.136.00

J. Y. Boreu.

MAZ/yrh-