(b) Rockshed tunnel is provided at dangerous gullies crossing the main roads/railway for protecting the important transportation route against rockfall/slope failure.

(c) Retaining wall with net fences on its top is provided along the dangerous slopes which have important properties and/or transportation routes on or nearby the slopes. Shot-creting works are provided on the slope for not only preventing weathering action but also fixing unstable rocks.

Though the appurtenant structures will be required for the definite individual plan in each area, it is considered that the structures explained above are reasonable measures at this stage of study.

Besides the matters mentioned above, the following matters are considered for structural plan.

(A) Availability of materials

Materials usually used in the basin and materials available nearby the site are selected.

(B) Easiness of construction

Special structures which will have difficulties for construction are avoided.

As a conclusion, it is judged that all the structural plans are technically viable.

11.3 Economic Evaluation

The results of EIRR for structural plan of each divided area are obtained as follows:

Group	Mean EIRR(%)
"A"	6.59
Qda of "B"	5.98
Spe of "B"	3.89

As a general, the EIRR of Group "A" is more or less higher than Group "B", though the EIRR of some areas in Group "B" is higher than some areas in Group "A".

There is no definite criteria of EIRR for the economic viability, as the conditions of evaluation are different by the country, region, kind of project and etc. However, it is generally said that the disaster prevention project should be viable even in case of comparatively small EIRR such as 2 or 3%.

Though some areas in Group "B" showed comparatively small EIRR values which are less than 2% or 3%, it is considered to be not reasonable to remove these areas from the proposed project due to the following reasons.

(a) The most important and beneficial object is to prevent the traffic blockage of main roads and railway. The project will make full function for this object after all the probable danger areas are protected by the structures.

(b) The results of EIRR calculation will be easily changed by the method of assumptions for various conditions such as damage rate of each damageable items, economic development rate in the future and etc.

(c) The calculation is made for all the areas by assuming that the construction will start from the fiscal year of 1990 for comparing the results on the same condition. However, it will be actually difficult to start the construction at the same time for all the areas of Groups "A" and "B". If the projects will start later, the EIRR values for these areas will be much higher than the case of earlier start.

(d) Most serious damage will be injury and death of human. However, such factor is not counted as a economic loss.

It is concluded that the structural plans proposed in areas of Groups "A" and "B" are economically viable as a whole.

11.4 Proposed Structural Plan

The structural plans for all the areas in Groups "A" and "B" are to be recommended as the proposed project.

The proposed project is summarized in Table X-11-1 where the following items are shown.

(a) Name of project areas

(b) Type of structural plan (for Qda areas)

(c) List of proposed main structures in each area

(d) Economic project cost

(e) EIRR

In addition, the following figures are prepared for brief understanding of proposed project for debris flow and slope failure disaster prevention.

(a) Classification of Type of Qda Areas
: Fig. x-11-1

(b) Proposed Structural Plans for Qda Areas
(Schematical Features of 5 types of Structural plan in Quebrada and Proposed Structural Plans for Qda Areas) : Fig. X-1-2

(c) Proposed Structures for Spe Areas
: Fig. X-11-3

The reason of project viability is summarized as follows:

(a) All the structural plans are technically viable.

(b) The economic aspects of structural plans for Group "B" as well as Group "A" are viable as a whole.

(c) Social impact will be strong on the safety of human life and the acceleration of regional development. Especially, it is usual to consider the priority on the importance of human life in case of disaster prevention project.

Tables

Table X -3-1 PRINCIPAL FEATURE OF MAJOR TRIBUTARY AREAS (1/2)

*1 No.	*2 Name of tributaries	*3 Distance (km)	*4 River Length A (m)	*5 River Length B (m)	*6 Area (km2)	*7 Elevation (m) Highest	*8 Elevation (m) Lowest	*9 Height Difference of River (m)	*10 Average Slope A	*11 Average Slope B
Qda. (R-0)	Q. Jicamarca	20.8	49,000	50,000	489.3	4,230	260	3,970	12.3	4.6
(R-1)	Q. Chacracayo	44.9	3,900	5,100	9.8	1,875	690	1,185	3.3	16.9
(R-2)	Q. Chacrasana	46.1	3,900	4,200	4.7	1,800	705	1,090	3.6	15.6
(R-3)	Q. Carifornia	47.9	4,000	5,000	8.4	1,700	750	950	4.2	13.4
(R-4)	Q. Santa Maria	47.9	4,000	5,000	4.6	1,650	755	895	4.5	12.6
(R-5)	Q. La Cantura	50.4	6,000	6,700	15.0	2,210	800	1,410	4.3	13.2
(R-6)	Q. Quirio	50.5	5,200	5,600	10.4	2,010	805	1,215	4.3	13.2
(R-7)	Q. Pedregal (San Antonio)	51.5	5,800	6,100	10.6	2,330	820	1,480	3.9	14.3
(R-8)	Q. Carosio (Moyopampa)	53.4	1,100	1,300	0.4	1,675	840	835	1.3	37.2
(R-9)	Q. Corrales (Rayus de Sol)	54.0	1,600	2,400	1.4	2,000	850	1,150	1.4	35.7
(R-10)	Q. La Ronda	54.0	5,000	5,600	9.0	2,210	890	1,320	3.8	14.8
(R-11)	Q. Santa Ana	59.1	5,200	5,800	13.5	2,300	1,030	1,270	4.1	13.7
(R-12)	Q. San Juan	60.3	6,000	6,300	8.8	2,950	1,150	1,800	3.3	16.7
(R-13)	Q. Cupiche	62.7	4,500	5,400	9.3	2,600	1,150	1,450	3.1	17.9
(R-14)	Q. Lloquepampa	62.7	2,500	3,700	2.7	2,650	1,150	1,500	1.7	31.0
(R-15)	Rio Canchacalla	64.8	21,200	22,000	118.0	4,850	1,230	3,620	5.9	9.7
(R-16)	Q. Guayabo	67.4	3,900	4,600	6.8	2,650	1,280	1,370	2.8	19.4
(R-17)	Q. Agua Salada	69.2	5,000	7,000	15.3	3,200	1,320	1,880	2.7	20.6
(R-18)	Q. Del Pate	69.5	5,200	7,200	10.3	3,605	1,350	2,255	2.3	23.4
(R-19)	Q. Rio Seco	72.9	12,200	13,000	49.3	4,630	1,520	3,110	3.9	14.3
(R-20)	Q. Esperanza	75.1	2,800	3,700	4.4	3,750	1,550	2,200	1.3	38.2
(R-21)	Q. Verrugas	77.8	4,800	5,800	9.4	4,470	1,650	2,820	1.7	30.4
(R-22)	Q. Linday	80.0	5,800	8,200	19.4	4,800	1,780	3,020	1.9	27.5
(R-23)	Q. Huacre	83.0	4,400	5,600	7.5	4,470	1,950	2,520	1.7	29.8
(R-24)	Q. Matata	83.3	6,900	7,200	14.8	4,630	1,970	2,660	2.6	21.1
(R-25)	Q. Cuchimachay	83.9	5,000	5,800	6.6	4,580	2,010	2,570	1.9	27.2
(R-26)	Q. Chacamaza	84.5	4,200	5,000	7.5	4,500	2,030	2,470	1.7	30.5
(R-27)	Q. Yamajune	86.3	8,000	9,000	18.6	4,880	2,100	2,780	2.9	19.2
(R-28)	Q. Palcacancha	87.9	9,800	11,900	29.3	4,900	2,200	2,700	3.6	15.4
(R-29)	Q. Barranco	88.0	6,900	8,000	14.8	4,680	2,200	2,480	2.8	19.8
(R-30)	Q. Lucumo	90.0	2,600	3,500	2.3	4,260	2,320	1,940	1.3	36.7
(R-31)	Q. Chucumayo	90.5	8,000	9,200	34.8	5,020	2,360	2,660	3.0	18.4
(R-32)	Q. Paihua (Llanahuallia)	92.0	6,100	6,100	14.9	4,760	2,400	2,360	2.6	21.2
(R-33)	Q. Chacahuaro	95.6	4,100	4,100	5.3	4,720	2,490	2,230	1.8	28.5
(R-34)	Q. Pancha	96.1	11,200	13,300	69.3	5,300	2,510	2,790	4.0	14.0
(R-35)	Q. Viso	98.1	7,400	8,100	20.9	5,315	2,750	2,565	2.9	19.1
(R-36)	Q. Ocatara	101.0	2,600	3,200	3.7	4,750	2,850	1,900	1.4	36.2
(R-37)	Q. Parac	104.3	20,600	21,200	130.6	5,310	2,950	2,360	8.7	6.5
(R-38)	Q. Challumay	104.7	3,300	5,900	6.1	5,000	2,950	2,050	1.6	31.8
(R-39)	Q. Turumanya	108.8	8,500	9,000	26.2	5,250	3,200	2,050	4.1	13.6
(R-40)	Rio Blanco	111.8	33,500	35,000	235.7	5,650	3,450	2,200	15.2	3.8
(R-41)	Q. Tranquilla	114.5	4,200	5,600	4.9	5,250	3,700	1,500	2.8	19.7
(R-42)	Q. Santa Rosa	118.5	7,900	8,300	23.4	5,300	3,900	1,400	5.6	10.0
(R-43)	Q. Tacpin	120.0	9,500	10,000	32.9	5,280	3,980	1,300	7.3	7.8
(R-44)	Q. Veintiuno	121.1	2,200	3,000	2.3	5,020	4,050	970	2.3	23.8
(R-47)	Q. Carmen	122.1	5,100	6,600	11.9	5,300	4,150	1,150	4.4	12.7
(R-46)	Q. Chinchan	124.5	8,100	9,000	42.0	5,200	4,280	920	8.8	6.5
(R-47)	Q. Corina	125.6	2,600	4,200	8.3	5,200	4,380	820	3.2	17.5
(R-48)	Q. Antaranra	125.6	3,400	4,600	12.6	5,000	4,380	620	5.5	10.3

Remarks : *3 : From river mouth
*4 : To the end of river-like section
*5 : To the border line of catchment area
*10 : *4/*9
*11 : Degree (o)

Table X -3-1 PRINCIPAL FEATURE OF MAJOR TRIBUTARY AREAS (2/2)

*1 No.	*2 Name of tributaries	*3 Distance (km)	*4 River Length A (m)	*5 River Length B (m)	*6 Area (km2)	*7 Elevation (m) Hihest	*8 Elevation (m) Lowest	*9 Height Difference of River (m)	*10 Average Slope A	*11 Average Slope B
Qda. (S-1)	Q. Cashahuacra	57.1	5,200	6,600	15.1	2,600	980	1,620	3.2	17.3
(S-2)	Q. Redonda	62.1	6,000	7,100	12.1	3,220	1,190	2,030	3.0	18.7
(S-3)	Q. Infiernillo	65.0	3,200	5,100	6.7	3,220	1,320	1,900	1.7	30.7
(S-4)	Q. Alcula	65.1	7,900	9,000	16.4	3,820	1,320	2,500	3.2	17.6
(S-5)	Q. Lucuma	69.4	3,900	5,000	40.3	3,520	1,570	1,950	2.0	26.6
(S-6)	Q. Santo Domingo	69.6	11,700	14,800	9.5	4,765	1,570	3,195	3.7	15.3
(S-7)	Q. Huanchunya	72.4	4,000	6,900	12.9	4,230	1,680	2,550	1.6	32.5
(S-8)	Q. San Antonio	73.3	4,000	5,900	8.0	4,000	1,790	2,210	1.8	28.9
(S-9)	Q. Negro	73.5	2,900	3,300	5.9	3,920	1,800	2,120	1.4	36.2
(S-10)	Q. Vado	73.6	4,800	6,200	2.1	4,030	1,800	2,230	2.2	24.9
(S-11)	Q. Mito Mito	77.2	6,500	8,000	18.4	4,230	1,970	2,260	2.9	19.2
(S-12)	Rio Carhuayuma	77.8	15,800	16,500	59.7	4,830	2,020	2,810	5.6	10.1
(S-13)	Q. del Zorrillo	79.9	5,200	7,000	14.4	4,470	2,200	2,270	2.3	23.6
(S-14)	Q. Marropuquio	81.4	6,000	6,600	9.1	4,470	2,300	2,170	2.8	19.9
(S-15)	Q. Carhuachayo	82.1	5,100	5,900	6.8	4,820	2,330	2,490	2.0	26.0
(S-16)	Q. Maquerhua	83.1	7,600	8,100	25.3	4,750	2,420	2,330	3.3	17.0
(S-17)	Q. Challamayllo	87.0	7,300	8,900	17.9	4,750	2,660	2,090	3.5	16.0
(S-18)	Q. Pozo	87.5	9,700	10,900	22.8	4,910	2,700	2,210	4.4	12.8
(S-19)	Q. Huancacocha	90.5	4,800	6,000	6.5	4,750	2,950	1,800	2.7	20.6
(S-20)	Q. Chilcacocha	90.8	3,300	4,400	5.1	4,710	2,970	1,740	1.9	27.8
(S-21)	Q. Pillihua	91.8	18,600	19,900	99.3	5,035	3,030	2,005	9.3	6.2
(S-22)	Q. Acobamba	93.1	19,000	259,000	178.5	5,360	3,120	2,240	8.5	6.7
(S-23)	Q. Collque	96.3	19,000	19,600	78.5	5,100	3,330	1,770	10.7	5.3
(S-24)	Rio Shuncha	97.5	18,800	21,900	137.8	5,300	3,460	1,840	10.2	5.6
(S-25)	Q. Yanac	102.7	4,000	5,200	6.1	5,500	3,840	1,660	2.4	22.5
(S-26)	Q. Huasca	108.1	11,200	12,900	41.7	5,120	4,100	1,020	11.0	5.2
(S-27)	Rio Pallca	108.1	6,060	11,900	54.8	5,280	4,100	1,180	5.1	11.0

Remarks : *3 : From river mouth
*4 : To the end of river-like section
*5 : To the border line of catchment area
*10 : *4/*9
*11 : Degree (o)

Table X -3-2 PRINCIPAL FEATURE OF SLOPE AREAS (1/2)

*1 No.	*2 Name of Slope	*3 Distance (km)	*4 Section Length (m)	*5 Slope Length (m)	*6 Area (km2)	*7 Slope Elevation (m) Highest	*8 Slope Elevation (m) Lowest	*9 Height (m)	*10 Average Slope A	*11 Average Slope B
Spe.(R-/0)	(river mouth) - Jicamarca	10.4	20,800	-	149.5	2,200	-	-	-	-
(R-/1)	(river mouth) - Chacracayo	24.0	47,900	-	198.6	1,760	-	-	-	-
(R-0/2)	Jicamarca - Chacrasana	33.5	25,300	-	63.0	1,850	-	-	-	-
(R-1/3)	Chacracayo - Carfornia	46.7	2,900	2,600	4.1	1,550	830	720	3.6	15.5
(R-2/4)	Chacrasana - Santa Maria	47.0	1,800	2,500	2.1	1,450	730	720	3.5	16.1
(R-3/5)	Carfornia - La Cantuta	49.2	2,500	1,000	0.9	1,150	770	380	2.6	20.8
(R-4/6)	Santa Maria - Quirio	49.2	2,600	2,600	3.0	1,600	770	830	3.1	17.7
(R-5/10)	La Cantuta - La Ronda	52.2	3,600	3,900	7.1	1,950	850	1,100	3.5	15.8
(R-6/7)	Quirio - Pedregal	52.7	1,100	700	0.2	1,000	810	190	3.7	15.2
(R-7/8)	Pedregal - Carosio	53.5	3,500	2,250	4.6	1,950	870	1,080	2.1	25.6
(R-8/9)	Carosio - Corrales	53.8	600	1,000	0.3	1,550	830	720	1.4	35.8
(R-9/-)	Corrales - (confluence)	54.4	800	1,000	0.4	1,400	840	560	1.8	29.2
(R-10/-)	La Ronda - (confluence)	54.8	1,500	1,300	0.9	1,450	910	540	2.4	22.6
(R-/11)	(confluence) - Santa Ana	57.3	3,600	2,650	7.3	2,070	1,000	1,070	2.5	22.0
(R-/12)	(confluence) - San Juan	57.9	4,800	2,000	5.2	2,165	1,000	1,165	1.7	30.2
(R-11/13)	Santa Ana - Cupiche	60.9	3,600	1,500	2.6	1,820	1,080	740	2.0	26.3
(R-12/14)	San Juan - Lloquepampa	61.5	2,400	1,500	0.7	1,760	1,100	660	2.3	23.7
(R-13/16)	Cupiche - Guayabo	65.1	4,700	1,950	5.7	2,110	1,210	900	2.2	24.8
(R-14/15)	Lloquepampa - R.Canchacalla	63.8	2,100	2,400	2.7	2,450	1,700	750	3.2	17.4
(R-15/22)	R.Canchacalla - Linday	72.4	15,200	3,800	24.3	3,650	1,570	2,080	1.8	28.7
(R-16/17)	Guayabo - Agua Salada	68.3	1,800	1,250	1.8	2,070	1,360	710	1.8	29.6
(R-18/19)	Del Pate - R.Seco	71.2	3,400	2,250	3.7	2,150	1,390	760	3.0	18.7
(R-19/20)	R.Seco - Esperanza	74.0	2,200	1,800	3.7	2,600	1,510	1,090	1.7	31.2
(R-20/21)	Esperanza - Verrugas	76.5	2,700	1,950	2.6	2,800	1,600	1,200	1.6	31.6
(R-21/23)	Verrugas - Huacre	80.4	5,200	3,700	7.4	4,000	1,810	2,190	1.7	30.6
(R-22/27)	Linday - Yamajune	83.2	6,300	2,500	8.3	3,620	2,000	1,620	1.5	32.9
(R-26/29)	Chacamaza - Barranco	86.3	3,500	3,100	4.8	3,800	2,150	1,650	1.9	28.0
(R-27/28)	Yamajune - Palcacancha	87.1	1,600	1,750	1.3	3,100	2,250	850	2.1	25.9
(R-28/32)	Palcacancha - Llanahualla	90.0	4,100	2,750	5.2	3,800	2,320	1,480	1.9	28.3
(R-29/30)	Barranco - Lucumo	89.0	2,000	1,900	1.9	3,550	2,280	1,270	1.5	33.8
(R-31/33)	Chucumayo - Chacahuaro	93.1	5,100	4,000	10.0	4,570	2,450	2,120	1.9	27.9
(R-32/34)	Llamahualla - Pancha	94.1	4,100	3,100	4.8	3,950	2,480	1,470	2.1	25.4
(R-33/35)	Chacahuaro - Viso	96.9	2,500	2,050	3.0	4,250	2,600	1,650	1.2	38.8
(R-34/36)	Pancha - Ocatara	98.6	4,900	2,200	5.5	4,270	2,820	1,450	1.5	33.4
(R-35/37)	Viso - Parac	101.2	6,200	2,200	5.8	4,400	2,950	1,450	1.5	33.4
(R-36/38)	Ocatara - Challumay	102.9	3,700	1,400	1.7	3,850	2,900	950	1.5	34.2
(R-37/40)	Parac - R.Blanco	108.1	7,500	2,950	11.2	4,950	3,200	1,750	1.7	30.7
(R-38/39)	Challumay - Turumanya	106.8	4,100	3,000	7.9	4,800	3,150	1,650	1.8	28.8
(R-39/41)	Turumanya - Tranquilla	111.7	5,700	2,100	7.7	4,640	3,500	1,140	1.8	28.5
(R-40/44)	R.Blanco - Veintiuno	116.5	9,300	3,000	14.8	4,950	3,900	1,050	2.9	19.3
(R-41/42)	Tranquilla - Santa Rosa	116.5	4,000	1,550	3.6	4,800	3,810	990	1.6	32.6
(R-42/43)	Santa Rosa - Tacpin	119.3	1,500	950	0.9	4,580	3,950	630	1.5	33.6
(R-43/46)	Tacpin - Chinchan	122.3	4,500	1,550	3.6	5,050	4,210	840	1.8	28.5
(R-44/45)	Veintiuno - Carmen	121.6	1,000	900	0.5	4,520	4,100	520	1.7	30.0
(R-45/47)	Carmen - Corina	123.9	3,500	2,550	3.7	5,170	4,230	940	2.7	20.2

Remarks : *3 : From river mouth to the middle reach of the section
*5, *6 : Horizontal length
*7, *8 : Elevation at logenst slope
*9 : *7 - *8
*10 : *5 / *9
*11 : Degree (o)

Table X -3-2 PRINCIPAL FEATURE OF SLOPE AREAS (2/2)

*1 No.	*2 Name of Slope	*3 Distance (km)	*4 Section Length (m)	*5 Slope Length (m)	*6 Area (km2)	*7 Slope Elevation (m) Highest	*8 Slope Elevation (m) Lowest	*9 Height (m)	*10 Average Slope A	*11 Average Slope B
Spe.(S—/1)	(Confluence) - Cashahuscra	56.3	1,600	2,100	1.5	1,550	950	600	3.5	15.9
(S—/4)	(Confluence) - Alcula	60.3	9,600	2,100	18.0	2,200	1,160	1,040	2.0	26.3
(S-1/2)	Cashahuacra - Redonda	59.6	5,000	4,150	10.4	2,400	1,090	1,310	3.2	17.5
(S-2/3)	Redonda - Infiernillo	63.6	2,900	2,050	2.4	1,970	1,250	720	2.8	19.4
(S-3/5)	Infiernillo - Lucuma	67.2	4,600	2,600	5.4	2,760	1,450	1,310	2.0	26.7
(S-4/6)	Alcula - Santo Domingo	67.4	4,300	4,300	11.1	3,450	1,450	2,000	2.2	24.9
(S-5/7)	Lucuma - Huanchunya	76.9	3,900	3,050	3.0	3,200	1,630	1,570	1.9	27.2
(S-6/8)	Santo Domingo - San Antonio	71.5	2,800	3,750	5.4	3,400	1,640	1,760	2.1	25.1
(S-7/10)	Huanchunya - Vado	73.0	1,100	2,100	1.4	3,200	1,740	1,460	1.4	34.8
(S-9/12)	Negro - Carhuayuma	75.7	3,700	2,800	7.2	3,600	2,040	1,560	1.8	29.1
(S-10/11)	Vado - Mito Mito	75.4	4,200	4,200	6.4	3,770	2,080	1,690	2.5	21.9
(S-11/13)	Mito Mito - del Zorrillo	78.6	2,700	3,850	7.6	3,970	2,200	1,770	2.2	24.7
(S-12/15)	R.Carhuayuma - Carhuachayo	80.0	4,300	3,750	8.4	4,250	2,200	2,050	1.8	28.7
(S-13/14)	del Zorrillo - Marcopuquio	80.7	1,500	1,850	1.3	3,300	2,270	1,030	1.8	29.1
(S-14/16)	Marcopuquio - Maquerhua	82.3	1,700	1,850	1.1	3,450	2,350	1,100	1.7	30.7
(S-15/17)	Carhuachayo - Challamayllo	84.6	4,900	4,900	11.2	4,820	2,570	2,250	2.2	24.7
(S-16/18)	Maquerhua - Pozo	85.3	4,400	2,800	5.7	4,250	2,600	1,650	1.7	30.5
(S-17/20)	Challamayllo - Chilcacocha	88.9	3,800	2,600	5.6	4,240	2,800	1,440	1.8	29.0
(S-18/19)	Pozo - Huancacocha	89.0	3,000	3,450	6.2	4,380	2,800	1,580	2.2	24.6
(S-19/22)	Huancacocha - Acobamba	91.8	2,600	3,400	5.0	4,400	3,080	1,320	2.6	21.2
(S-20/21)	Chilcacocha - Pillihua	91.3	1,000	900	0.4	3,700	3,000	700	1.3	37.9
(S-21/24)	Pillihua - R.Shuncha	94.7	5,700	2,800	7.9	4,730	3,400	1,330	2.1	25.4
(S-22/23)	Acobamba - Collque	94.7	3,200	2,800	4.7	4,480	3,350	1,130	2.5	22.0
(S-23/26)	Collque - Huasca	102.2	11,800	2,850	20.7	5,230	3,970	1,260	2.3	23.9
(S-24/25)	R.Shuncha - Yanac	100.1	5,200	1,650	4.4	4,650	3,780	870	1.9	27.8
(S-25/27)	Yanac - R.Pallca	105.4	5,400	2,500	10.7	5,060	3,980	1,080	2.3	23.4

Remarks : *3 : From river mouth to the middle reach of the section
*5, *6 : Horizontal length
*7, *8 : Elevation at logenst slope
*9 : *7 – *8
*10 : *5 / *9
*11 : Degree (o)

Table X-4-1 Calssification of Group A, B or C for Qda Area (1/4)

No.	Protective Object				Danger Level	Overall (Group)	Remarks
	House	Transportation	Public Structure	Overall			
R1	A	B (C.H.) (R.W.)	C	A	B	B	
R2	A	B (C.H.)	C	A	B	B	
R3	A	C	C	A	B	B	
R4	A	B (C.H.)	C	A	B	B	
R5	B	B (R.W.) (M.R.)	B (Club)	B	A	B	Disaster in March 1987
R6	A	B (C.H.)	C	A	A	A	Disaster in March 1987
R7	A	B (C.H.)	C	A	A	A	Disaster in March 1987
R8	A	B (C.H.)	C	A	A	A	Disaster in March 1987
R9	A	B (C.H.)	C	A	A	A	Disaster in March 1987
R10	B	B (R.W.) (M.R.)	B (School)	B	A	B	
R11	C	B (R.W.) (C.H.)	C	B	A	B	
R12	C	C	C	C	B	C	
R13	C	B (C.H.) (R.W.)	B (School)	B	A	B	
R14	C	C	C	C	B	C	
R15	C	B (C.H.) (R.W.)	C	B	A	B	Possible secondary disaster due to damming in the main river
R16	C	B (C.H.) (R.W.)	B (Mine)	B	B	B	Outlet of Qda is not clear as a mine is located there
R17	C	B (C.H.) (R.W.)	C	B	A	B	Under construction for relocation of C.H.

Note; C.H.: Carretera Central (Major National Road)
M.R.: Main Road
R.W.: Railway

Table X-4-1 Classification of Group A, B or C for Qda Area (2/4)

No.	Protective Object				Danger Level	Overall (Group)	Remarks
	House	Transportation	Public Structure	Overall			
R18	C	B (C.H.-(b)) (R.W.-(b))	C	B	A	B	- ditto -
R19	C	A (C.H.-(t)) (M.R.) (R.W.-(t)2,(b))	B R.W Station	A	A	A	Qda runs on tunnel
R20	C	C	C	C	B	C	Relocation of C.H. was completed
R21	C	C	C	C	A	C	- ditto -
R22	C	C	C	B	B	C	- ditto -
R23	B	B (M.R.-(b)) (R.W.-(b))	C	B	B	B	
R24	B	B (M.R.-(b)) (R.W.-(b))	C	B	B	B	
R25	A Surco	B (R.W.-(b)) (C.H.-(c))	B (Government Office, School)	A	B	B	
R26	C	B (R.W.-(b)) (C.H.-(b))	C	B	C	C	
R27	C	C	C	C	A	C	Relocation of road is completed and the bridge is high enough
R28	C	C	C	C	A	C	New main road crosses Qda but the bridge is high enough
R29	C	C(B) (C.H.-(b))	C	C	B	C	New relocated road is under construction on the opposit bank of river
R30	B	B (R.W.-(b))	C	B	C	C	
R31	B	B (C.H.-(b)) (R.W.-(b))	C	B	B	B	New road is under construction on the opposit bank of river

Note; (b): Bridge
(t): Tunnel
(c): Culvert

Table X-4-1 Classification of Group A, B or C for Qda Area (3/4)

No.	Protective Object				Danger Level	Overall (Group)	Remarks
	House	Transportation	Public Structure	Overall			
R32	A Matucana	B (C.H.)	B (Government Office, School)	A	A	A	Possibility of damming in the main river is high.
R33	C	B (C.H.-(b)) (R.W.-(b))	B (Mine)	B	B	B	
R34	C	B (C.H.)	C	B	B	B	Possibility of damming in the main river is high
R35	B	B (R.W.)	B (Station)	B	B	B	
R36	C	B (R.W.-(b))	C	B	C	C	
R37	C	B (R.W.-(c))	(B) (Intake of Electro Lima)	B	B	B	Railway crosses on embankment with a culvert channel for Qda, Spoil bank at the confluence
R38	C	B (C.H.)	C	B	C	C	
R39	C	B (C.H.-(c))	B (Mine)	B	C	C	Mine facilities at the outlet of Qda. Run-off through culvert
R40	C	C	C	C	C	C	
R41	B	B (C.H.) (R.W.-(c))	B (School)	B	C	C	
R42	B	(B) (C.H.)	C	B	C	C	Large scale spoil bank at Qda Outlet. Run-off through culvert
R43	C	B (C.H.)	C	B	C	C	- ditto -
R44	C	B (R.W.-(c))	B (Substation)	B	C	C	Railway crosses on embankment with culvert channel
R45	A	B (M.W.)	C	A	C	C	
R46	C	B (C.H.) (R.W.)	C	C	C	C	
R47	C	C	C	C	C	C	
R48	C	B (R.W.-(c))	C	B	C	C	Railway crosses on embankment with culvert channel

Table X-4-1 Classification of Group A, B or C for Qda Area (4/4)

No.	Protective Object				Danger Level	Overall (Group)	Remarks
	House	Transportation	Public Structure	Overall			
S-1	A	B (M.R.)	B (School, etc.)	A	A	A	Disaster in March 1987
S-2	B	B (M.R.)	B (School)	B	A	B	
S-3	C	B (M.R.)	C	B	B	B	
S-4	C	C	C	C	B	C	
S-5	B	B (M.R.)	C	B	B	B	
S-6	C	C	C	C	B	C	
S-7	C	B (M.R.)	C	B	C	C	
S-8	C	B (M.R.)	B (Intake)	B	C	C	
S-9	C	B (M.R.)	C	B	C	C	
S-10	C	C	C	C	C	C	
S-11	C	C	C	C	C	C	Main road corsses the way of Qda
S-12	C	C	C	C	C	C	- ditto -
S-13	C	C	C	C	C	C	- ditto -
S-14	C	C	C	C	C	C	- ditto -
S-15	C	C	C	C	C	C	- ditto -
S-16	C	C	C	C	C	C	- ditto -
S-17	C	C	C	C	C	C	- ditto -
S-18	C	C	C	C	C	C	- ditto -
S-19	C	C	C	C	C	C	- ditto -
S-20	C	C	C	C	C	C	- ditto -
S-21	C	B (MR.-(b))	C	B	C	C	Lagoons in the upstream area
S-22	C	C	B (Power Station)	B	C	C	- ditto -
S-23	C	C	C	C	C	C	- ditto -
S-24	C	B (M.R.-(b))	C	B	C	C	- ditto -
S-25	C	B (M.R.)	C	B	C	C	- ditto -
S-26	C	C	C	C	C	C	- ditto -
S-27	C	B	C (M.R.)	B	C	C	- ditto -

Table X-4-2 Classification of Group A, B or C for Spe Area (1/2)

No.	Protective Objects			Danger Level	Overall (Group)
	House	Transportation	Overall		
R(-/0)	A	B	A	B	B
R(-/1)	A	B	A	B	B
R(0/2)	A	B	A	B	B
R(1/3)	A	C	A	B	B
R(2/4)	C	C	C	B	C
R(3/5)	C	C	C	B	C
R(4/6)	C	C	A	B	B
R(5/10)	B	B	B	B	B
R(6/7)	B	C	B	C	C
R(7/8)	A	B	A	B	B
R(8/9)	B	B	B	B	B
R(9/-)	B	C	B	B	B
R(10/-)	B	B	B	B	B
R(-/11)	B	C	B	B	B
R(-/12)	B	C	B	B	B
R(11/13)	C	B	B	B	B
R(12/14)	C	C	C	B	C
R(13/16)	B	B	B	B	B
R(14/15)	C	C	C	B	C
R(15/22)	C	C	C	B	C
R(16/17)	B	B	B	B	B
R(18/19)	C	C	C	B	C
R(19/20)	C	B	B	B	B
R(20/21)	C	B	B	B	B
R(21/23)	C	B	B	B	B
R(22/27)	C	B	B	B	B
R(26/29)	C	B	B	B	B
R(27/28)	C	B	B	C	C
R(28/32)	C	B	B	C	C
R(29/30)	C	C	C	C	C
R(31/33)	B	B	B	B	B
R(32/34)	C	C	C	B	C
R(33/35)	C	C	C	C	C
R(34/36)	C	B	B	C	C
R(35/37)	C	C	C	C	C
R(36/38)	C	B	B	C	C
R(37/40)	B	C	B	B	B
R(38/39)	B	B	B	C	C
R(39/41)	C	C	C	B	C
R(40/44)	B	C	B	C	C
R(41/42)	B	C	B	C	C
R(42/43)	C	B	B	C	C
R(43/46)	C	B	B	C	C
R(44/45)	C	B	B	C	C
R(45/47)	B	C	B	C	C

Table X-4-2 Classification of Group A, B or C for Spe Area (2/2)

No.	Protective Objects			Danger Level	Overall (Group)
	House	Transportation	Overall		
S(-/1)	B	B	B	B	B
S(-/4)	B	C	B	B	B
S(1/2)	B	B	B	B	B
S(2/3)	B	B	B	B	B
S(3/5)	C	C	C	B	C
S(4/6)	C	C	C	B	C
S(5/7)	C	B	B	C	C
S(6/8)	C	C	C	C	C
S(7/10)	C	B	B	C	C
S(9/12)	C	C	C	C	C
S(10/11)	C	B	B	C	C
S(11/13)	C	B	B	C	C
S(12/15)	C	B	B	C	C
S(13/14)	C	C	C	C	C
S(14/16)	C	C	C	C	C
S(15/17)	C	B	B	C	C
S(16/18)	C	C	C	C	C
S(17/20)	C	C	C	C	C
S(18/19)	B	C	B	C	C
S(19/22)	C	C	C	C	C
S(20/21)	C	C	C	C	C
S(21/24)	C	B	B	C	C
S(22/23)	C	C	C	C	C
S(23/26)	C	C	C	C	C
S(24/25)	C	C	C	C	C
S(25/27)	C	C	C	C	C

Table X-5-1 Assumed Deposit Volume in Each Qda Area

Name of Qda	(1) Catchment Area (Km2)	(2) Total Deposit Volume in (m3) March 1987 Disaster	Reduction Factory (F)	Deposit Volume (3) Long-term scale (m3)	(4) Mid-term scale (m3)	(5) Short-term scale(m3)
Qda Quirio	10.4	14,100	1	184,700	92,400	18,500
Qda Pedregal	10.6	157,200	1	188,200	94,100	18,800
Qda Carosio	0.4	4,400	1	7,100	3,600	700
Qda Corrales	1.4	21,700	1	24,900	12,400	250
Qda Cashahuacra	15.1	102,000	1	268,200	134,100	26,800
Qda Rio Seco	41.2	-	0.4	292,700	146,400	29,300
Qda Paihua	28.0	-	0.4	198,900	99,400	19,900

Note: (3) = (1) 14,800* x 1.2 x F *: Deposit Volume per 1 Km2 in Qda Pedregal
(4) = (3) x 0.5
(5) = (3) x 0.2

TABLE X-5-2 DAMAGE QUANTITY IN QDA QUIRIO

Item \ Probability	Leng-term			Mid-term			Short-term		
	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed
House (No.)									
Upper class	0	0	0						
Middle class	40	20	90	20	10	30	5	5	10
Lower class	160	30	90	100	20	80	20	10	30
Total	200	50	180	120	30	110	25	15	40
Public building									
Market		-			-			-	
School		1 No.			1 No.			-	
Others		Gov.Office: 1 No.			Gov. Office: 1 No.			-	
Farm land									
Good harvest land		1 ha			1 ha			0.5 ha	
Poor harvest land		-			-			-	
Public structures/ facilities									
Road		(Central Caretera) 500 m			C.H. 300 m			20 m	
		M.R. 800 m			M.R. 800 m			100 m	
Bridge		-			-			-	
Well		-			-			-	
Park		1 place (0.7 ha)			1 place (0.7 ha)			-	
Other		(Electro Lima) Waterway			Waterway			Waterway	
Traffic block		3 days			2 days			0.5 day	
Rehabilitation works									
Removal of debris		129,300 m^3			64,700 m^3			12,900 m^3	
" mud		55,400 m^3			27,700 m^3			5,500 m^3	
Human damage									
Death		15 persons			9 persons			1 persons	
Wounded		5,700 persons			2,300 persons			100 persons	
Other damage									

Note: It is assumed that 70% of deposit is debris and 30% is mud.

TABLE X-5-3 DAMAGE QUANTITY IN QDA PEDREGAL

Probability / Item	Leng-term			Mid-term			Small scale		
	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed
House (No.)									
Upper class	0	0	30	0	0	0	0	0	0
Middle class	190	35	105	110	20	70	2	5	10
Lower class	195	40	165	120	25	110	3	5	20
Total	385	75	305	230	45	180	5	10	30
Public building									
Market		-			-			-	
School		3 No.			3 No.			1 No.	
Others								-	
Farm land									
Good harvest land		-			-			-	
Poor harvest land		-			-			-	
Public structures/ facilities									
Road	C.H. (Central Caretera) 1,200 m M.R. 2,300 m			C.H. 800 m M.R. 1,500 m			30 m 300 m		
Bridge		1 No.			1 No.			1 No.	
Well		-			-			-	
Park		1 place (0.2 ha)			1 place (0.2 ha)			-	
Other		(Electro Lima) Waterway			Waterway			-	
Traffic block		6 days			3 days			0.5 day	
Rehabilitation work									
Removal of debris		131,700 m^3			65,900 m^3			13,200 m^2	
" mud		56,500 m^3			28,200 m^3			5,600 m^2	
Human damage									
Death		45 persons			25 persons			1 person	
Wounded		7,800 persons			4,700 persons			200 persons	
Other damage									

Note: It is assumed that 70% of deposit is debris and 30% is mud.

TABLE X-5-4 DAMAGE QUANTITY IN QDA CAROSIO

Item \ Probability	Long-term			Mid-term			Short-term		
	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed
House (No.)									
Upper class									
Middle class	30	5	20	20	0	15	0	0	5
Lower class	50	5	20	30	5	20	0	2	5
Total	80	10	40	50	5	35	0	2	10
Public building									
Market		-			-			-	
School		1 No.			-			-	
Others		-			-			-	
Farm land									
Good harvest land		-			-			-	
Poor harvest land		-			-			-	
Public structures/ facilities									
Road	C.H. (Central Caretera)		250 m	C.H.		200 m	C.H.		20m
Bridge		-			-			-	
Well		-			-			-	
Park		-			-			-	
Other		-			-			-	
Traffic block		2 days			1 day			0.2 day	
Rehabilitation works									
Removal of debris		5,000 m3			2,500 m3			500 m^3	
" mud		2,100 m^3			1,100 m^3			200 m^3	
Human damage									
Death		2 persons			0 persons			0 person	
Wounded		820 persons			490 persons			20 persons	
Other damage									

Note: It is assumed that 70% of deposit is debris and 30% is mud.

TABLE X-5-5 DAMAGE QUANTITY IN QDA CORRALES

Item \ Probability	Long-term			Mid-term			Short term		
	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed
House (No.)									
Upper class									
Middle class	20	5	20	15	0	10	0	0	3
Lower class	30	5	20	15	5	15	0	3	5
Total	50	10	40	30	5	25	0	3	8
Public building									
Market		-			-			-	
School		0			0			-	
Others		-			-			-	
Farm land									
Good harvest land		0.5 ha			0.5 ha			-	
Poor harvest land		-			-			-	
Public structures/ facilities									
Road	C.H. (Central Caretera)		500 m		C.H.	200 m		C.H.	30 m
	M.R.		300 m		M.R.	50 m		M.K.	20 m
Bridge		-			-			-	
Well		-			-			-	
Park		-			-			-	
Other		-			-			-	
Traffic block		3 days			2 days			0.2 day	
Rehabilitation works									
Removal of debris		17,400 m^3			8,700 m^3			1,700 m^3	
" mud		7,500 m^3			3,700 m^3			800 m^3	
Human damage									
Death		4 persons			2 persons			0 persons	
Wounded		1,780 persons			1,070 persons			50 persons	
Other damage									

Note: It is assumed that 70% of deposit is debris and 30% is mud.

TABLE X-5-6 DAMAGE QUANTITY IN QDA RIO SECO

Item \ Probability	Long-term			Mid-term			Short-term		
	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed
House (No.)									
Upper class									
Middle class									
Lower class	2	0	0	0	0	2	0	0	0
Total	2	0	0	0	0	2	0	0	0
Public building									
Market		-			-			-	
School		-			-			-	
Others		-			-			-	
Farm land									
Good harvest land		19 ha			14 ha			8 ha	
Poor harvest land		8 ha			2 ha			2 ha	
Public structures/ facilities									
Road	C.H. (Central Caretera) 1,000 m M.R. 150 m			C.H. 500 m M.R. 100 m			C.H. 100 m M.R. 50 m		
Bridge	1 No. (Railway)			1 No. (Railway)			1 No. (Railway)		
Other	Tunnel 3 Nos. (Road - 1, Railway- 2) RW 1,500 m			Tunnel 3 Nos. (Road - 1, Railway - 2) RW 1,000 m			Tunnel 3 Nos. R.W. 200 m		
Traffic block	5 days			2 days			0.5 day		
Rehabilitation works									
Removal of debris	204,800 m^3			102,400 m^3			20,500 m^3		
" mud	87,800 m^3			43,900 m^3			8,800 m^3		
Human damage	Note: Damage of passenger on road is not to be counted.								
Death		-			-			-	
Wounded		-			-			-	
Other damage	If the main river is dammed up, Torna Mesa will be inundated. (Railway:1500m, station)								

Note: It is assumed that 70% of deposit is debris and 30% is mud.

TABLE X-5-7 DAMAGE QUANTITY IN QDA PAIHUA

Item \ Probability	Long-term			Mid-term			Short-term		
	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed
House (No.)									
Upper class									
Middle class	10	30	120	5	20	70	0	0	0
Lower class	20	30	100	15	20	60	0	0	0
Total	30	60	220	20	40	130	0	0	0
Public building									
Market		-			-			-	
School		1 No.			1 No.			-	
Others		Gov.Office: 1 No.			Gov. Office: 1 No.			-	
		Church : 1 No.			Church : 1 No.			-	
		Railway Sta.:1 No.			Railway Sta.: 1 No.			-	
Public structures/ facilities		C.H.							
Road		(Central Caretera) 1,300 m			-			-	
Bridge		-			-			-	
Well		-			-			-	
Park		1 place (0.2 ha)			-			-	
Other		R.W. 1,300 m			-			-	
Traffic block		3 days			2 days			0.5 day	
Rehabilitation works									
Removal of debris		139,200 m^3			69,600 m^3			13,900 m^3	
" mud		59,700 m^3			29,800 m^3			6,000 m^3	
Human damage									
Death		1 person			0 person			0 person	
Wounded		200 persons			100 persons			0 person	
Other damage									

Note: It is assumed that 70% of deposit is debris and 30% is mud.

TABLE X-5-8 DAMAGE QUANTITY IN QDA CASHAHUACRA

Item \ Probability	Long-term			Mid-term			Short-term		
	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed	Totally destroyed	Semi-destroyed	Partially destroyed
House (No.)									
Upper class									
Middle class	10	5	50	5		20	0	0	0
Lower class	5	5	30	5	5	30	0	2	5
Total	15	10	80	10	5	50	0	2	5
Public building									
Market		-			-			-	
School	1 No. (Play ground: 0.7 ha)				-			-	
Others		-			-			-	
Farm land									
Good harvest land		7.0 ha			2.0 ha			0.5 ha	
Poor harvest land		-			-			-	
Public structures/ facilities									
Road	C.H. (Central Caretera)		500 m		-			-	
	M.R.		1,500 m		M.R.	1,500 m		M.R.	100 m
Bridge		-			-			-	
Well		-			-			-	
Park		-			-			-	
Other	Club facilities but not be used now								
Traffic block		3 days			1 day			0.5 day	
Rehabilitation works									
Removal of debris		187,700 m^3			93,900 m^3			18,800 m^3	
" mud		80,500 m^3			40,230 m^3			8,000 m^3	
Human damage									
Death		1 person			0 person			0 person	
Wounded		1,620 persons			970 persons			50 persons	
Other damage									

Note: It is assumed that 70% of deposit is debris and 30% is mud.

TABLE X-5-9 DAMAGE AMOUNT IN QDA QUIRIO

Item	Unit Cost (106 Intis)	Long-Term (106 Intis)			Mid-Term (106 Intis)			Short-Term (106 Intis)		
		T.D.	S.D.	P.D.	T.D.	S.D.	P.D.	T.D.	S.D.	P.D.
1. House										
Upper class	2.45/no.	0	0	0	0	0	0	0	0	0
Middle class	0.70/no.	25.20	7.00	12.60	12.60	3.50	4.20	2.80	1.75	1.40
Lower class	0.13/no.	18.72	1.95	2.34	11.70	1.30	2.08	2.08	0.65	0.78
Sub-total			67.81			35.38			9.46	
2. Public Building										
Market	3.76/no.		0			0			0	
School	2.50/no.		2.5			2.5			0	
Government office	3.50/no.		3.5			3.5			0	
Sub-total			6.0			6.0			0	
3. Farm Land										
Good harvest	0.03/ha		0.03			0.03			0.02	
Poor harvest	0.01/ha		0			0			0	
Sub-total			0.03			0.03			0.02	
4. Public Structures										
Paved road	0.003/m2		18.0			10.8			0.72	
Non-paved road	0.0001/m2		0.40			0.40			0.05	
Main bridge	0.008/m2		0			0			0	
Common bridge	0.003/m2		0			0			0	
Park	0.0005/m2		3.5			3.5			0	
Others (waterway)	L.S.		2.0			1.0			0.5	
Sub-total			23.9			15.7			1.27	
5. Rehabilitation Works										
Removal of debris	0.00020/m3		25.86			12.94			2.58	
Removal of mud	0.00007/m3		3.88			1.94			0.38	
Sub-total			29.74			14.88			2.96	
6. Other Direct Damage	10% of (1-5)		12.75			7.2			1.37	
7. Total of Direct Damage			140.23			79.19			15.08	
8. Traffic Block	25/day		75.0			50.0			12.5	
9. Other Indirect Damage	10% of 7		14.02			7.91			1.51	
10. Total of Indirect Damage			89.02			57.92			14.01	
Total			229.25			137.11			29.09	

Note: (1) T.D.; Totally destroyed, S.D.; Semi-destroyed, P.D.; Partially destroyed.
(2) 1 and 2 include the indoor movables.
(3) Specific quantities of 4 are estimated for each item though not shown.

TABLE X-5-10 DAMAGE AMOUNT IN QDA PEDREGAL

Item	Unit Cost (106 Intls)	Large-Term (106 Intls)			Mid-Term (106 Intls)			Short-Term (106 Intls)		
		T.D.	S.D.	P.D.	T.D.	S.D.	P.D.	T.D.	S.D.	P.D.
1. House										
Upper class	2.45/no.	0	0	1.47	0	0	0	0	0	0
Middle class	0.70/no.	119.7	12.25	14.70	69.30	7.00	9.80	1.12	1.75	1.40
Lower class	0.13/no.	22.82	2.60	4.29	14.04	1.62	2.86	0.31	0.32	0.52
Sub-total			176.36			104.62			5.42	
2. Public Building										
Market	3.76/no.		0			0			0	
School	2.50/no.		7.5			7.5			2.5	
Government office	3.50/no.		0			0			0	
Sub-total			7.5			7.5			2.5	
3. Farm Land										
Good harvest	0.03/ha		0			0			0	
Poor harvest	0.01/ha		0			0			0	
Sub-total			0			0			0	
4. Public Structures										
Paved road	0.003/m2		43.2			28.8			1.08	
Non-paved road	0.0001/m2		1.15			0.75			0.15	
Main bridge	0.008/m2		0			0			0	
Common bridge	0.003/m2		0.15			0.15			0.15	
Park	0.0005/m2		1.0			1.0			0	
Others (waterway)	L.S.		2.0			1.0			0.2	
Sub-total			47.5			31.7			1.58	
5. Rehabilitation Works										
Removal of debris	0.00020/m3		26.34			13.18			2.64	
Removal of mud	0.00007/m3		3.96			1.97			0.39	
Sub-total			30.3			15.15			3.03	
6. Other Direct Damage	10% of (1-5)		26.17			15.9			1.25	
7. Total of Direct Damage			287.83			174.87			13.78	
8. Traffic Block	25/day		150			75			12.5	
9. Other Indirect Damage	100% of 7		28.78			17.49			1.38	
10. Total of Indirect Damage			178.78			92.49			13.48	
Total			466.61			267.36			27.66	

Note: (1) T.D.; Totally destroyed, S.D.; Semi-destroyed, P.D.; Partially destroyed.
(2) 1 and 2 include the indoor movables.
(3) Specific quantities of 4 are estimated for each item though not shown.

TABLE X-5-11 DAMAGE AMOUNT IN QDA CAROSIO

Item	Unit Cost (106 Intls)	Large-Term (106 Intls)			Mid-Term (106 Intls)			Short-Term (106 Intls)		
		T.D.	S.D.	P.D.	T.D.	S.D.	P.D.	T.D.	S.D.	P.D.
1. House										
Upper class	2.45/no.	0	0	0	0	0	0	0	0	0
Middle class	0.70/no.	18.90	1.75	2.80	12.60	0	2.10	0	0	0.70
Lower class	0.13/no.	5.85	0.32	0.52	3.51	0.32	0.52	0	0.13	0.13
Sub-total			30.14			19.05			0.96	
2. Public Building										
Market	3.76/no.		0			0			0	
School	2.50/no.		2.5			0			0	
Government office	3.50/no.		0			0			0	
Sub-total			2.5			0			0	
3. Farm Land										
Good harvest	0.03/ha		0			0			0	
Poor harvest	0.01/ha		0			0			0	
Sub-total			0			0			0	
4. Public Structures										
Paved road	0.003/m2		9.0			7.2			0.72	
Non-paved road	0.0001/m2		0			0			0	
Main bridge	0.008/m2		0			0			0	
Common bridge	0.003/m2		0			0			0	
Others	L.S.		0			0			0	
Sub-total			9.0			7.2			0.72	
5. Rehabilitation Works										
Removal of debris	0.00020/m3		1.00			0.50			0.10	
Removal of mud	0.00007/m3		0.15			0.07			0.01	
Sub-total			1.15			0.57			0.11	
6. Other Direct Damage	10% of (1-5)		4.28			2.68			0.18	
7. Total of Direct Damage			47.07			29.5			1.97	
8. Traffic Block	25/day		50			25			5.0	
9. Other Indirect Damage	100% of 7		4.71			2.95			0.20	
10. Total of Indirect Damage			54.71			27.95			5.2	
Total			101.78			57.45			7.17	

Note: (1) T.D.; Totally destroyed, S.D.; Semi-destroyed, P.D.; Partially destroyed.
(2) 1 and 2 include the indoor movables.
(3) Specific quantities of 4 are estimated for each item though not shown.

TABLE X-5-12 DAMAGE AMOUNT IN QDA CORRALES

Item	Unit Cost (106 Intls)	Long-Term (106 Intls)			Mid-Term (106 Intls)			Short-Term (106 Intls)		
		T.D.	S.D.	P.D.	T.D.	S.D.	P.D.	T.D.	S.D.	P.D.
1. House										
Upper class	2.45/no.	0	0	0	0	0	0	0	0	0
Middle class	0.70/no.	12.60	1.75	2.80	9.45	0	1.40	0	0	0.42
Lower class	0.13/no.	3.51	0.32	0.52	1.76	0.32	0.39	0	0.20	0.33
Sub-total			21.50			13.32			0.75	
2. Public Building										
Market	3.76/no.		0			0			0	
School	2.50/no.		0			0			0	
Government office	3.50/no.		0			0			0	
Sub-total			0			0			0	
3. Farm Land										
Good harvest	0.03/ha		0.02			0.02			0	
Poor harvest	0.01/ha		0			0			0	
Sub-total			0.02			0.02			0	
4. Public Structures										
Paved road	0.003/m2		18.0			7.2			1.08	
Non-paved road	0.0001/m2		0.15			0.02			0.01	
Main bridge	0.008/m2		0			0			0	
Common bridge	0.003/m2		0			0			0	
Others	L.S.		0			0			0	
Sub-total			18.15			7.22			1.09	
5. Rehabilitation Works										
Removal of debris	0.00020/m3		3.48			1.74			0.34	
Removal of mud	0.00007/m3		0.52			0.26			0.06	
Sub-total			4.00			2.00			0.40	
6. Other Direct Damage	10% of (1-5)		4.37			2.26			0.22	
7. Total of Direct Damage			38.04			24.82			2.46	
8. Traffic Block	25/day		75			50			5.0	
9. Other Indirect Damage	100% of 7		4.80			2.48			0.25	
10. Total of Indirect Damage			79.80			52.48			5.25	
Total			127.84			77.30			7.71	

Note: (1) T.D.; Totally destroyed, S.D.; Semi-destroyed, P.D.; Partially destroyed.
(2) 1 and 2 include the indoor movables.
(3) Specific quantities of 4 are estimated for each item though not shown.

TABLEX-5-13 DAMAGE AMOUNT IN QDA RIO SECO

Item	Unit Cost (106 Intls)	Long-Term (106 Intls)			Mid-Term (106 Intls)			Short-Term (106 Intls)		
		T.D.	S.D.	P.D.	T.D.	S.D.	P.D.	T.D.	S.D.	P.D.
1. House										
Upper class	2.45/no.	0	0	0	0	0	0	0	0	0
Middle class	0.70/no.	0	0	0	0	0	0	0	0	0
Lower class	0.13/no.	0.23	0	0	0	0	0.05	0	0	0
Sub-total			0.23			0.05				
2. Public Building										
Market	3.76/no.		0			0			0	
School	2.50/no.		0			0			0	
Government office	3.50/no.		0			0			0	
Sub-total			0			0			0	
3. Farm Land										
Good harvest	0.03/ha		0.57			0.42			0.24	
Poor harvest	0.01/ha		0.08			0.02			0.02	
Sub-total			0.65			0.44			0.26	
4. Public Structures										
Paved road	0.003/m2		24.0			12.0			1.20	
Non-paved road	0.0001/m2		0.08			0.05			0.02	
Main bridge	0.008/m2		0			0			0	
Common bridge	0.003/m2		0.09			0.09			0.09	
Others (Tunnel)	L.S.		3.0			2.0			1.0	
Sub-total			27.17			14.14			2.31	
5. Rehabilitation Works										
Removal of debris	0.00020/m3		40.98			20.49			4.10	
Removal of mud	0.00007/m3		6.15			3.08			0.62	
Sub-total			47.13			23.57			4.72	
6. Other Direct Damage	10% of (1-5)		7.52			3.82			0.73	
7. Total of Direct Damage			82.70			42.02			8.02	
8. Traffic Block	25/day		125			50			12.5	
9. Other Indirect Damage	100% of 7		8.27			4.20			0.80	
10. Total of Indirect Damage			133.27			54.20			13.30	
Total			215.97			96.22			21.32	

Note: (1) T.D.; Totally destroyed, S.D.; Semi-destroyed, P.D.; Partially destroyed.
(2) 1 and 2 include the indoor movables.
(3) Specific quantities of 4 are estimated for each item though not shown.

TABLE X-5-14 DAMAGE AMOUNT IN QDA PAIHUA

Item	Unit Cost (106 Intls)	Long-Term (106 Intls)			Mid-Term (106 Intls)			Short-Term (106 Intls)		
		T.D.	S.D.	P.D.	T.D.	S.D.	P.D.	T.D.	S.D.	P.D.
1. House										
Upper class	2.45/no.	0	0	0	0	0	0	0	0	0
Middle class	0.70/no.	6.30	10.50	16.80	3.15	7.00	9.80	0	0	0
Lower class	0.13/no.	2.34	1.95	2.60	1.76	1.30	1.56	0	0	0
Sub-total			40.49			24.57			0	
2. Public Building										
Market	3.76/no.		0			0			0	
School	2.50/no.		5.00			5.00			0	
Government office	3.50/no.		7.00			7.00			0	
Sub-total			12.00			12.00			0	
3. Farm Land										
Good harvest	0.03/ha		0			0			0	
Poor harvest	0.01/ha		0			0			0	
Sub-total			0			0			0	
4. Public Structures										
Paved road	0.003/m2		31.20			0			0	
Non-paved road	0.0001/m2		0			0			0	
Main bridge	0.008/m2		0			0			0	
Common bridge	0.003/m2		0			0			0	
Park	0.0005/m2		1.0			0			0	
Others (Railway)	L.S.		5.0			0			0	
Sub-total			37.2			0			0	
5. Rehabilitation Works										
Removal of debris	0.00020/m3		27.85			13.92			2.78	
Removal of mud	0.00007/m3		4.18			2.09			0.42	
Sub-total			32.03			16.01			3.20	
6. Other Direct Damage	10% of (1-5)		12.17			5.26			0.32	
7. Total of Direct Damage			133.87			57.84			3.52	
8. Traffic Block	25/day		75			50			12.5	
9. Other Indirect Damage	100% of 7		13.39			5.78			0.35	
10. Total of Indirect Damage			88.39			55.78			12.85	
Total			222.28			113.62			16.37	

Note: (1) T.D.; Totally destroyed, S.D.; Semi-destroyed, P.D.; Partially destroyed.
(2) 1 and 2 include the indoor movables.
(3) Specific quantities of 4 are estimated for each item though not shown.

TABLE X-5-15 DAMAGE AMOUNT IN QDA CASHAHUACRA

Item	Unit Cost (106 Intis)	Long-Term (106 Intis)			Mid-Term (106 Intis)			Short-Term (106 Intis)		
		T.D.	S.D.	P.D.	T.D.	S.D.	P.D.	T.D.	S.D.	P.D.
1. House										
Upper class	2.45/no.	0	0	0	0	0	0	0	0	0
Middle class	0.70/no.	6.30	1.75	7.00	3.20	0	2.80	0	0	0
Lower class	0.13/no.	0.58	0.32	0.78	0.58	0.32	0.78	0	0.13	0.13
Sub-total			16.73			7.68			0.26	
2. Public Building										
Market	3.76/no.		0			0			0	
School	2.50/no.		2.50			0			0	
Government office	3.50/no.		0			0			0	
Sub-total			2.50			0			0	
3. Farm Land										
Good harvest	0.03/ha		0.21			0.06			0.02	
Poor harvest	0.01/ha		0			0			0	
Sub-total			0.21			0.06			0.02	
4. Public Structures										
Paved road	0.003/m2		10.50			0			0	
Non-paved road	0.0001/m2		0.75			0.75			0.05	
Main bridge	0.008/m2		0			0			0	
Common bridge	0.003/m2		0			0			0	
Others	L.S.		0			0			0	
Sub-total			11.25			0.75			0.05	
5. Rehabilitation Works										
Removal of debris	0.00020/m3		37.54			18.77			3.76	
Removal of mud	0.00007/m3		5.64			2.82			0.56	
Sub-total			43.18			21.59			4.32	
6. Other Direct Damage	10% of (1-5)		7.39			3.01			0.46	
7. Total of Direct Damage			81.26			33.09			5.12	
8. Traffic Block	25/day		7.5			2.5			1.25	
9. Other Indirect Damage	100% of 7		8.13			3.31			0.51	
10. Total of Indirect Damage			15.63			5.81			1.76	
Total			96.89			38.90			6.88	

Note: (1) T.D.; *Totally destroyed*, S.D.; *Semi-destroyed*, P.D.; Partially destroyed.
(2) 1 and 2 include the indoor movables.
(3) Specific quantities of 4 are estimated for each item though not shown.

TABLE X-6-1 DISASTER DEPOSIT VOLUME IN QDA AREAS OF GROUP 'B'

Qda Area		(3)		Assumed Deposit Volume		
(1) No.	(2) Name	Catchment Area (km2)	Reduction Factor (F)	(4) Long-term	(5) Mid-term	(6) Short-term
R 1	Q. Chacracayo	9.8	1	174,000	87,000	17,400
R 2	Q. Chacrsana	4.7	1	83,500	41,700	8,400
R 3	Q. California	8.4	1	149,200	74,600	14,900
R 4	Q. Santa Maria	4.6	1	81,700	40,800	8,200
R 5	Q. La Cantuta	15.0	1	266,400	133,200	26,600
R10	Q. La Ronda	9.0	1	159,800	79,900	16,000
R11	Q. Santa Ana	13.5	0.8	191,800	96,000	19,200
R13	Q. Cupiche	9.3	0.8	132,200	66,100	13,200
R15	Q. Rio Canchacalla	118.0	0.4	838,300	419,100	83,800
R16	Q. Guayabo	6.8	0.8	96,600	48,300	9,700
R17	Q. Agua Salada	15.3	0.6	163,000	81,500	16,300
R18	Q. Del Pate	10.3	0.6	109,700	54,900	11,000
R23	Q. Huacra	7.5	0.4	53,300	26,600	5,300
R24	Q. Matata	14.8	0.4	105,100	52,600	10,500
R25	Q. Cuchimachay	6.6	0.4	46,900	23,400	4,700
R31	Q. Chucumayo	34.8	0.4	247,200	123,600	24,700
R33	Q. Chacahuaro	5.3	0.4	37,600	18,800	3,800
R34	Q. Pancha	69.3	0.2	246,200	123,100	24,600
R35	Q. Viso	20.9	0.2	74,200	37,100	7,400
R37	Q. Parac	130.6	0.2	464,000	231,900	46,400
S 2	Q. Redonda	12.1	0.8	171,900	86,000	17,200
S 3	Q. Infiernillo	6.7	0.8	95,200	47,600	9,500
S 5	Q. Lucuma	9.5	0.6	101,200	50,600	10,100

Note: (4) = (3) x 14,800 x 1.2 x F
(5) = (4) x 0.5
(6) = (4) x 0.1

Table X-6-2 Ratio of Damage Amount in Each Scale of Group "A"

Name of Qda	Long-term scale		Mid-term scale		Short-term scale	
	Amount	Ratio	Amount	Ratio	Amount	Ratio
Quirio	229	1	137	0.60	29	0.13
Pedregal	467	1	267	0.57	28	0.06
Carosio	102	1	57	0.56	7	0.07
Corrales	128	1	7	0.60	8	0.06
Rio Seco	216	1	96	0.44	21	0.10
Paihua	222	1	114	0.51	16	0.07
Cashahuacra	97	1	39	0.40	7	0.07
Mean	-	1	-	0.52	-	0.08

Note : Unit of amount is x 10^6 Intis

Table X-6-3 DAMAGE ON HOUSES (C1)

Name and No. of Qda	No. of Houses	Reduction Factor (F)	Class of Houses	Damage on Houses (I./)
Q. Chaclacayo (R1)	100-200	1	High	367.5×10^6
Q. Chacrasana (R2)	20-30	1	Low	3.25×10^6
Q. California (R3)	50-100	1	High	183.75×10^6
Q. Santa Maria (R4)	30-50	1	Low	5.2×10^6
Q. La Cantuta (R5)	20-40	1	High	73.5×10^6
Q. La Ronda (R10)	100-200	1	Middle	105.0×10^6
Q. Santa Ana (R11)	5-15	0.8	Low	1.04×10^6
Q. Cupiche (R13)	15-20	0.8	Low	1.78×10^6
Q. Rio Canchacalla (R15)	0	0.4	-	0
Q. Guayabo (R16)	1-3	0.8	Low	0.21×10^6
Q. Agua Salada (R17)	0	0.6	-	0
Q. Del Pate (R18)	1	0.6	Low	0.07×10^6
Q. Huacre (R23)	2-3	0.4	Middle	0.70×10^6
Q. Matata (R24)	10-15	0.4	Middle	3.50×10^6
Q. Cuchimachay (R25)	100-150	0.4	Middle	35.0×10^6
Q. Chucumayo (R31)	20-30	0.4	Middle	4.20×10^6
Q. Chacahuacra (R33)	10-15	0.4	Low	0.65×10^6
Q. Pancha (R34)	1-2	0.2	Low	0.04×10^6
Q. Viso (R35)	10	0.2	Middle	1.40×10^6
Q. Parac (R37)	0	0.2	-	0
Q. Redonda (S2)	10-20	0.8	Middle	8.40×10^6
Q. Infiernillo (S3)	5-10	0.8	Middle	4.21×10^6
Q. Lucuma (S5)	5-10	0.6	Middle	3.16×106

Note : (1) Unit Cost of house

High	:	I./ 2.45×10^6
Middle	:	I./ 0.7×10^6
Low	:	I./ 0.13×10^6

Table X-6-4 DAMAGE AMOUNT FOR DEPOSIT REMOVAL (C2)

Name and No. of Qda	Estimated Deposit Volume (m3)	Necessary ratio of removal	Damage on Houses (I./)
Q. Chaclacayo (R1)	174 x 10^3	High	27.36 x 106
Q. Chacrasana (R2)	83.5 x 10^3	High	13.36 x 10^6
Q. California (R3)	149.2 x 10^3	High	23.87 x 10^6
Q. Santa Maria (R4)	81.7 x 10^3	High	13.07 x 10^6
Q. La Cantuta (R5)	266.4 x 10^3	High	42.62 x 10^6
Q. La Ronda (R10)	159.8 x 10^3	High	25.57 x 10^6
Q. Santa Ana (R11)	191.8 x 10^3	High	30.69 x 10^6
Q. Cupiche (R13)	132.2 x 10^3	High	21.15 x 10^6
Q. Rio Canchacalla (R15)	838.3 x 10^3	Low	26.83 x 10^6
Q. Guayabo (R16)	96.6 x 10^3	High	15.46 x 10^6
Q. Agua Salada (R17)	163.0 x 10^3	High	26.08 x 10^6
Q. Del Pate (R18)	109.7 x 10^3	High	17.55 x 10^6
Q. Huacre (R23)	53.3 x 10^3	High	8.53 x 10^6
Q. Matata (R24)	105.1 x 10^3	High	16.82 x 10^6
Q. Cuchimachay (R25)	46.9 x 10^3	High	7.50 x 10^6
Q. Chucumayo (R31)	247.2 x 10^3	High	39.55 x 10^6
Q. Chacahuacra (R33)	37.6 x 10^3	High	6.02 x 10^6
Q. Pancha (R34)	246.2 x 10^3	Low	7.88 x 10^6
Q. Viso (R35)	74.2 x 10^3	Middle	5.94 x 10^6
Q. Parac (R37)	464.0 x 10^3	Low	14.85 x 106
Q. Redonda (S2)	171.9 x 10^3	High	27.50 x 10^6
Q. Infiernillo (S3)	95.2 x 10^3	High	15.23 x 10^6
Q. Lucuma (S5)	101.2 x 10^3	High	16.19 x 10^6

Note : (1) Unit Cost of deposit removal works;I./ 160 per m^3
(2) Necessary ratio of removal

(a) High : 1.0
(b) Middle : 0.5
(c) Low : 0.2

Table X-6-5 DAMAGE DUE TO TRAFFIC BLOCK (C3)

Name and No. of Qda	Days of Traffic Blcok	Damage Cost Per day (I./)	Damage on Traffic (I./)
Q. Chaclacayo (R1)	4	$25. \times 10^6$	100×10^6
Q. Chacrasana (R2)	3	$25. \times 10^6$	75×10^6
Q. California (R3)	4	$1.0. \times 10^6$	4×10^6
Q. Santa Maria (R4)	3	$25. \times 10^6$	75×10^6
Q. La Cantuta (R5)	5	$1.0. \times 10^6$	5×10^6
Q. La Ronda (R10)	4	$1.0. \times 10^6$	4×10^6
Q. Santa Ana (R11)	5	$25. \times 10^6$	125×10^6
Q. Cupiche (R13)	4	$25. \times 10^6$	100×10^6
Q. Rio Canchacalla (R15)	5*	$25. \times 10^6$	125×10^6
Q. Guayabo (R16)	4	$25. \times 10^6$	100×10^6
Q. Agua Salada (R17)	4	$25. \times 10^6$	100×10^6
Q. Del Pate (R18)	4	$25. \times 10^6$	100×10^6
Q. Huacre (R23)	3	$1.0. \times 10^6$	3×10^6
Q. Matata (R24)	4	$1.0. \times 10^6$	4×10^6
Q. Cuchimachay (R25)	3	$1.0. \times 10^6$	3×10^6
Q. Chucumayo (R31)	5	$25. \times 10^6$	100×10^6
Q. Chacahuacra (R33)	2	$25. \times 10^6$	50×10^6
Q. Pancha (R34)	2*	$25. \times 10^6$	50×10^6
Q. Viso (R35)	2*	$25. \times 10^6$	50×10^6
Q. Parac (R37)	4*	$25. \times 10^6$	100×10^6
Q. Redonda (S2)	4	$2.5. \times 10^6$	10×10^6
Q. Infiernillo (S3)	4	$2.5. \times 10^6$	10×10^6
Q. Lucuma (S5)	4	$2.5. \times 10^6$	10×106

Note : (1) *; Reduction of days for deposit removal volume is considered as these quebradas are located on the opposit side of main road.

(2) Unit cost of traffic block (per day)

National Road	I./25 x 10^6
Sta Eulalia road	I./2.5 x 10^6
Other main road	I./1.0 x 10^6

Table X-6-6 ESTIMATED DAMAGE OF QDA AREA (LONG-TERM SCALE)

Name and No. of Qda	Damage Amout (I./ x 10^6)			
	House (C1)	Deposit Removal (C2)	Traffic Block (C3)	Total* (C*)
Q. Chaclacayo (R1)	367.5	27.36	100	583.8
Q. Chacrasana (R2)	3.25	13.36	75	102.4
Q. California (R3)	183.75	23.87	4	253.5
Q. Santa Maria (R4)	5.2	13.07	75	104.4
Q. La Cantuta (R5)	73.5	42.62	5	144.8
Q. La Ronda (R10)	105.0	25.57	4	161.1
Q. Santa Ana (R11)	1.04	30.69	125	175.6
Q. Cupiche (R13)	1.78	21.15	100	137.5
Q. Rio Canchacalla (R15)	0	26.83	125	169.7
Q. Guayabo (R16)	0.21	15.46	100	128.8
Q. Agua Salada (R17)	0	26.08	100	138.7
Q. Del Pate (R18)	0.07	17.55	100	131.1
Q. Huacre (R23)	0.70	8.53	3	14.4
Q. Matata (R24)	3.50	16.82	4	28.8
Q. Cuchimachay (R25)	35.0	7.50	3	54.3
Q. Chucumayo (R31)	4.20	39.55	100	162.5
Q. Chacahuacra (R33)	0.65	6.02	50	63.0
Q. Pancha (R34)	0.04	7.88	50	64.5
Q. Viso (R35)	1.40	5.94	50	63.8
Q. Parac (R37)	0	14.85	100	127.8
Q. Redonda (S2)	8.40	27.50	10	54.1
Q. Infiernillo (S3)	4.21	15.23	10	34.3
Q. Lucuma (S5)	3.16	16.19	10	34.2

* : $Ct = (C_1 + C_2) \times 1.2 + C_3 \times 1.1$

Table X-6-7 ESTIMAGED DAMAGE OF QDA AREA (MID-TERM AND SHORT-TERM)

Name and No. of Qda	Damage Amout (I./ x 10^6)		
	Long-term scall	Mid-term scale	Short-term scale
Q. Chaclacayo (R1)	583.8	303.6	46.7
Q. Chacrasana (R2)	102.4	53.2	8.2
Q. California (R3)	253.5	131.8	20.3
Q. Santa Maria (R4)	104.4	54.3	8.4
Q. La Cantuta (R5)	144.8	75.3	11.6
Q. La Ronda (R10)	161.1	83.8	12.9
Q. Santa Ana (R11)	175.6	91.3	14.0
Q. Cupiche (R13)	137.5	71.5	11.0
Q. Rio Canchacalla (R15)	169.7	88.2	13.6
Q. Guayabo (R16)	128.8	67.0	10.3
Q. Agua Salada (R17)	138.7	72.1	11.1
Q. Del Pate (R18)	131.1	68.2	10.5
Q. Huacre (R23)	14.4	7.5	1.2
Q. Matata (R24)	28.8	15.0	2.3
Q. Cuchimachay (R25)	54.3	28.2	4.3
Q. Chucumayo (R31)	162.5	84.5	13.0
Q. Chacahuacra (R33)	63.0	32.8	5.0
Q. Pancha (R34)	64.5	33.5	5.2
Q. Viso (R35)	63.8	33.2	5.1
Q. Parac (R37)	127.8	66.4	10.2
Q. Redonda (S2)	54.1	28.1	4.3
Q. Infiernillo (S3)	34.3	17.8	2.7
Q. Lucuma (S5)	34.2	17.8	2.7

Note : Damage of Mid-term scale
= 0.52 x Damage of long-term scale
Damage of Short-term scale
= 0.08 x Damage of lont-term scale

Table X-6-8 REDUCTION FACTOR FOR DAMAGE ESTIMATE IN SPE AREAS

Name and No. of Qda	Vegetation Factor (F1)	Factor of Slope gradient	Reduction Factor (F)
River mouth-Jicamarca (R-¯/0)	1	0.05	0.05
River mouth-Chaclacayo (R-¯/1)	1	0.05	0.05
Jicamarca Chacrasana (R-0/2)	1	0.05	0.05
Chaclacayo-California (R-1/3)	1	0.1	0.1
Snata Maria-Quirio (R-4/6)	1	0.1	0.1
La Cantuta-La Ronda (R-5/10)	1	0.1	0.1
Pedregal-Carosio (R-7-8)	1	0.3	0.3
Carosio-Corrales (R-8/9)	1	0.5	0.5
Corrales-Cashahuacra (R-9/- and S-¯/1)	1	0.3	0.3
La Ronda-Confluence (R-10/-)	1	0.2	0.2
Confluence-Santa Ana (R-¯/11)	1	0.2	0.2
Confluence-San Juan (R-¯/12)	1	0.4	0.4
Santa Ana-Cupiche (R-¯11/13)	1	0.3	0.3
Cupiche-Guayabo (R-13/16)	1	0.2	0.2
Guayabo-Agua Salada (R-16/17)	1	0.3	0.3
R.Seco-Esperanza (R-19/20)	1	0.4	0.4
Eseranza-Verrugas (R-20/21)	1	0.4	0.4
Verrugas-Huacre (R-21/23)	0.8	0.4	0.32
Linday-Yamajune (R-22/27)	0.8	0.4	0.32
Chacamaza-Barranco (R-26/29)	0.8	0.3	0.24
Chucumayo-Chacahuaro (R-31/33)	0.6	0.2	0.12
Parac-R. Blanco (R-37/40)	0.4	0.4	0.16
Confluence-Alcula (S-¯4)	1	0.3	0.3
Cashahuacra-Redonda (S-1/2)	1	0.2	0.2
Rendonda-Infiernillo (S-2/3)	1	0.2	0.2

Table X-6-9 DAMAGE ON HOUSES IN SPE AREA (LONG-TERM)

Name and No. of Qda	No. of Houses Qda/Gulley	No. of Houses Slope	Class of Houses	Damage on Houses
River mouth-Jicamarca (R-¯/0)	500-1000	1000-5000	Middle	131.2 x 10^6
River mouth-Chaclacayo (R-¯/1)	1000-2000	1000-3000	Middle	122.5 x 10^6
Jicamarca Chacrasana (R-0/2)	100-200	100-200	Low	2.0 x 10^6
Chaclacayo-California (R-1/3)	5-10	5-10	High	3.7 x 10^6
Snata Maria-Quirio (R-4/6)	5-10	10-20	Low	0.3 x 10^6
La Cantuta-La Ronda (R-5/10)	100-200	100-200	Low	3.9 x 10^6
Pedregal-Carosio (R-7-8)	50-70	50-100	Low	5.3 x 10^6
Carosio-Corrales (R-8/9)	0	30-50	Low	2.6 x 10^6
Corrales-Cashahuacra (R-9/- and S-¯/1)	20-30	10-20	Low	1.6 x 10^6
La Ronda-Confluence (R-10/-)	0	5-10	Low	0.2 x 10^6
Confluence-Santa Ana (R-¯/11)	30-70	10-20	Middle	6.8 x 10^6
Confluence-San Juan (R-¯/12)	0	10-20	Middle	4.0 x 10^6
Santa Ana-Cupiche (R-¯11/13)	0	0	Middle	0
Cupiche-Guayabo (R-13/16)	5-10	100-150	Middle	37.0 x 10^6
Guayabo-Agua Salada (R-16/17)	0	0	Middle	0
R.Seco-Esperanza (R-19/20)	1-5	5-10	Middle	2.8 x 10^6
Eseranza-Verrugas (R-20/21)	0-3	0	Middle	0.4 x 10^6
Verrugas-Huacre (R-21/23)	5-10	5-10	Middle	3.4 x 10^6
Linday-Yamajune (R-22/27)	0	5-10	Middle	1.6 x 10^6
Chacamaza-Barranco (R-26/29)	5-10	0-5	Low	0.3 x 10^6
Chucumayo-Chacahuaro (R-31/33)	80-130	50-100	Middle	15.1 x 10^6
Parac-R. Blanco (R-37/40)	100-200	50-100	Middle	25.2 x 10^6
Confluence-Alcula (S-¯4)	5-10	10-20	Middle	2.1 x 10^6
Cashahuacra-Redonda (S-1/2)	5-10	10-20	Middle	3.2 x 10^6
Rendonda-Infiernillo (S-2/3)	0-5	10-20	Middle	3.0 x 10^6

(1) Unit Cost of House (UCh)
High Class I/.2.45 x 10^6
Middle Class I/.0.7 x 10^6
Low Class I/.0.13 x 10^6
(2) Amount = Number of house x F x Uch
(3) F : Refer to Table IV-6-8

Table X-6-10 LENGTH OF SLOPE AND NUMBER OF GULLEY/QUEBRADA IN DANGER OF SPE AREA (FOR TRAFFIC DAMAGE)

Name and No. of Spe Area	1 (Km)	n		1 (Km)	n'	
		n(G)	N(Q)		n'(G)	n'(Q)
River mouth-Jicamarca (R-¯/0)	0	0	0	0	0	0
River mouth-Chaclacayo (R-¯/1)	0.5	0	0	0	0	0
River mouth-Chaclacayo (R-¯/1)	0.5	0	0	0	0	0
Chaclacayo-California (R-1/3)	0	0	0	0	0	0
Snata Maria-Quirio (R-4/6)	0	0	0	0	0	0
La Cantuta-La Ronda (R-5/10)	0	0	0	0	0	0
Pedregal-Carosio (R-7-8)	0	0	0	0	0	0
Carosio-Corrales (R-8/9)	0	0	0	0	0	0
Corrales-Cashahuacra (R-9/- and S-¯/1)	0	0	0	0	0	0
La Ronda-Confluence (R-10/-)	0	0	0	1	0	0
Confluence-Santa Ana (R-¯/11)	0	0	0	0	0	0
Confluence-San Juan (R-¯/12)	0	0	0	0	0	0
Santa Ana-Cupiche (R-¯11/13)	1.5	2	1	0.5	1	0
Cupiche-Guayabo (R-13/16)	1.5	2	0	2.0	5	0
Guayabo-Agua Salada (R-16/17)	1.0	2	0	0	0	0
R.Seco-Esperanza (R-19/20)	2.5	3	1	2.5	5	1
Eseranza-Verrugas (R-20/21)	2.5	6	1	2.5	7	1
Verrugas-Huacre (R-21/23)	2	3	1	4.0	5	1
Linday-Yamajune (R-22/27)	2.5	2	1	0	0	0
Chacamaza-Barranco (R-26/29)	0	0	0	3.0	7	0
Chucumayo-Chacahuaro (R-31/33)	0	0	0	3.0	3	0
Parac-R. Blanco (R-37/40)	0	2	2	0	2	2
Confluence-Alcula (S-¯4)	0	0	0	0	0	0
Cashahuacra-Redonda (S-1/2)	0	0	0	1.0	5	1
Rendonda-Infiernillo (S-2/3)	0	0	0	1.5	4	0
Total	14	22	7	20	44	6
	L=14km	n=57		L'=20	N'=74	

Table X-6-11 ANNUAL DAMAGE DUE TO TRAFFIC BLOCK IN SPE AREA

Name and No. of Spe Area	1	n	Day	1'	n'	Day'	Damage Amount
River mouth-Jicamarca (R-⁻/10)	0	0	0	0	0	0	0
River mouth-Chaclacayo (R-⁻/1)	0.5	0	0.018	0	0	0	4.5×10^5
Jicamarca Chacrasana (R-0/2)	0	0	0	0	0	0	0
Chaclacayo-California (R-1/3)	0	0	0	0	0	0	0
Snata Maria-Quirio (R-4/6)	0	0	0	0	0	0	0
La Cantuta-La Ronda (R5/10)	0	0	0	0	0	0	0
Pedregal-Carosio (R-7-8)	0	0	0	0	0	0	0
Carosio-Corrales (R-8/9)	0	0	0	0	0	0	0
Corrales-Cashahuacra (R-9/- and S-⁻/1)	0	0	0	0	0	0	0
La Ronda-Confluence (R-10/-)	0	0	0	1	0	0.012	0.3×10^5
Confluence-Santa Ana (R-⁻/11)	0	0	0	0	0	0	0
Confluence-San Juan (R-⁻/12)	0	0	0	0	0	0	0
Santa Ana-Cupiche (R-⁻11/13)	1.5	7	0.115	0.5	1	0.009	28.98×10^5
Cupiche-Guayabo (R-13/16)	1.5	2	0.071	2.0	5	0.042	18.8×10^5
Guayabo-Agua Salada (R-16/17)	1.0	2	0.053	0	0	0	13.25×10^5
R.Seco-Esperanza (R-19/20)	2.5	8	0.159	2.5	10	0.065	41.38×10^5
Eseranza-Verrugas (R-20/21)	2.5	11	0.186	2.5	12	0.072	48.3×10^5
Verrugas-Huacre (R-21/23)	2	8	0.142	4.0	10	0.084	37.6×10^5
Linday-Yamajune (R-22/27)	2.5	7	0.151	0	0	0	37.8×10^5
Chacamaza-Barranco (R-26/29)	0	0	0	3.0	7	0.061	1.52×10^5
Chucumayo-Chacahuaro (R-31/33)	0	0	0	3.0	3	0.048	1.20×10^5
Parac-R. Blanco (R-37/40)	0	12	0.105	0	12	0.040	27.25×10^5
Confluence-Alcula (S-⁻4)	0	0	0	0	0	0	0
Cashahuacra-Redonda (S-1/2)	0	0	0	1.2	10	0.046	1.15×10^5
Rendonda-Infiernillo (S-2/3)	0	0	0	1.5	4	0.032	0.80×10^5

$$\text{Day} = \frac{D1}{2L} + \frac{Dn}{2N}$$

$$\text{Day}' = \frac{1'D}{2L'} + \frac{n'D}{2N'}$$

D = 1 day D' = 0.5 day
L = 14 km L' = 20 km
N = 57 N' = 74

The description of each letter is to referred to Sub-Section 6.3.2.

$UCT = I./25 \times 10^6/day$
$UCT' = I./2.5 \times 10^6/day$

Table X-6-12 SUMMARY OF ESTIMATED DAMAGE OF SPE AREA

Name and No. of Spe Area	Estimated Damage (I/. x 10^6)			
	Direct Damage			Indirect Damage
	Long-term scale	Mid-term scale	Short-term scale	(Annual)
River mouth-Jicamarca (R-¯/10)	196.8	102.3	15.7	0
River mouth-Chaclacayo (R-¯/1)	183.8	95.6	14.7	0.495
Jicamarca Chacrasana (R-0/2)	3.0	1.6	0.2	0
Chaclacayo-California (R-1/3)	5.5	2.9	0.4	0
Snata Maria-Quirio (R-4/6)	0.5	0.2	0.1	0
La Cantuta-La Ronda (R5/10)	5.9	3.1	0.5	0
Pedregal-Carosio (R-7-8)	8.0	4.2	0.6	0
Carosio-Corrales (R-8/9)	3.9	2.0	0.3	0
Corrales-Cashahuacra (R-9/- and S-¯/1)	2.4	1.2	0.2	0
La Ronda-Confluence (R-10/-)	0.3	0.2	0.1	0.033
Confluence-Santa Ana (R-¯/11)	13.7	7.1	1.1	0
Confluence-San Juan (R-¯/12)	6.4	3.3	0.5	0
Santa Ana-Cupiche (R-¯11/13)	0	0	0	3.188
Cupiche-Guayabo (R-13/16)	27.8	14.5	2.2	2.068
Guayabo-Agua Salada (R-16/17)	0	0	0	1.458
R.Seco-Esperanza (R-19/20)	4.4	2.3	0.4	4.552
Eseranza-Verrugas (R-20-21)	0.5	0.3	0.1	5.313
Verrugas-Huacre (R-21/23)	5.2	2.8	0.4	4.136
Linday-Yamajune (R-22/27)	2.4	1.2	0.2	4.158
Chacamaza-Barranco (R-26/29)	0.4	0.2	0.1	0.167
Chucumayo-Chacahuaro (R-31/33)	22.7	11.8	1.8	0.132
Parac-R. Blanco (R-37/40)	37.8	19.6	3.0	2.998
Confluence-Alcula (S-¯4)	7.2	3.8	0.6	0
Cashahuacra-Redonda (S-1/2)	4.8	2.5	0.4	0.126
Rendonda-Infiernillo (S-2/3)	4.5	2.3	0.3	0.088

Note: (1) Direct damage = Damage on House x 1.5
(2) Indirect damage = Traffic damage x 1.1
(3) Mid-term scale damage = Large scale damae x 0.52
(4) Short-term scall damage = Large scale damage x 0.08
(5) Probable period of occurence is much different by the Area.
(6) Indirect damage is shown as an annual amount as the recurrence period will be estimated later for the evaluation of the project.

TABLE X-8-1 PEAK RUN-OFF OF DEBRIS AND MUD FLOW FOR 100-YEAR PROBABLE FLOOD
(Upstream of Dam Site)

	Name of Qda.	Peak run-off: Qw(m3/sec)	Without project				With project			
			tanO	Cd	C*/C*-Cd)	Qp(m3/sec)	ton(O/2)	Cd	C*/(C*-Cd)	Qp(m3/sec)
1.	Quirio	75	1/10.0	0.131	1.25	94	1/15.0	0.082	1.14	86
2.	Pedregal	73	1/8.4	0.162	1.33	97	1/12.6	0.100	1.81	86
3.	Carosio	8	1/4.8	0.352	2.17	18	1/9.6	0.138	1.27	10
4.	Corrales	18	1/5.2	0.312	1.91	35	1/10.4	0.125	1.24	22
5.	Rio Seco	220	1/10.4	0.124	1.24	273	1/10.4	0.124	1.24	273
6.	Paihua	114	1/5.8	0.266	1.69	193	1/11.6	0.109	1.20	137
7.	Cashahuacra	100	1/9.4	0.141	1.28	128	1/18.4	0.065	1.11	111

$Cd = \rho .\tan/(\sigma - \rho)(\tan\phi - \tan O)$ $\quad \phi = 30°,$ $\quad \sigma = 2.6$ t/m3, $\quad \rho = 1.0$ t/m3

$\alpha = C^*/C^*-Cd)$ $\quad C^* = 0.65$ $\quad Cd \leq 0.9\ C^* = 0.63$

Table X-8-2 Work Quantity of Main Construction Works in Qda Areas of Group "A" (1/2)

Description	Unit	Qda Quirio	Qda Pedregal	Qda Carosio	Qda Corrales	Qda Rio Seco	Qda Paihua	Qda Cashahuacra
I. Main Dam								
- Excavation, common	cu.m	25,700	27,900	-	-	-	76,300	-
- Backfill with randam materials	cu.m	71,200	22,300	-	-	-	5,000	-
- Concrete	cu.m	4,000	2,800	-	-	-	42,000	-
- Rubble concrete	cu.m	23,900	13,500	-	-	-	0	-
- Backfill concrete	cu.m	13,500	11,000	-	-	-	9,000	-
- Reinforcing bar	tons	71	86	-	-	-	126	-
- Protection works with wet masonry	sq.m	1,900	3,000	-	-	-	4,100	-
- Gabion mattress	nos	40	40	-	-	-	50	-
II. Lower Erosion Control Dam								
- Excavation, common	cu.m	33,500	30,200	6,800	7,600	-	7,700	-
- Backfill with randam materials	cu.m	1,000	600	1,700	1,300	-	450	-
- Concrete	cu.m	9,000	8,700	6,200	10,800	-	4,300	-
- Rubble concrete	cu.m	0	0	0	0	-	0	-
- Backfill concrete	cu.m	0	0	0	0	-	0	-
- Reinforcing bar	tons	44	50	15	37	-	15	-
- Protection works with wet masonry	sq.m	1,000	1,000	1,800	1,600	-	450	-
- Gabion mattress	tnos	40	40	0	15	-	25	-
III. Upper Erosion Control Dam								
- Excavation, common	cu.m	-	43,400	-	6,300	-	-	10,700
- Backfill with randam materials	cu.m	-	600	-	1,200	-	-	13,000
- Concrete	cu.m	-	8,700	-	9,900	-	-	9,500
- Rubble concrete	cu.m	-	0	-	0	-	-	0
- Backfill concrete	cu.m	-	0	-	0	-	-	7,500
- Reinforcing bar	tons	-	50	-	32	-	-	41
- Protection works with wet masonry	sq.m	-	1,300	-	1,200	-	-	170
- Gabion mattress	nos	-	40	-	15	-	-	260

(to be continued)

Table X-8-2 Work Quantity of Main Construction Works in Qda Areas of Group "A" (2/2)

Description	Unit	Qda Quirio	Qda Pedregal	Qda Carosio	Qda Corrales	Qda Rio Seco	Qda Paihua	Qda Cashahuacra
IV. Channel Works								
- Excavation, common	cu.m	120,000	128,500	9,400	10,100	-	5,000	21,500
- Backfill with randam materials	cu.m	11,700	12,800	800	800	-	0	0
- Concrete	cu.m	0	0	0	0	-	0	0
- Rubble concrete	cu.m	18,500	20,600	4,000	1,700	-	0	1,700
- Backfill concrete	cu.m	0	0	0	1,200	-	0	0
- Reinforcing bar	tons	0	0	0	0	-	0	0
- Protection works with wet masonry	aq.m	21,500	8,200	3,300	1,600	-	0	2,300
- Gabion mattress	nos	860	860	75	60	-	0	15
- New Bridge/Rockshed tunnel	NA	LS	LS	LS	LS		0	0
V. Dike								
- Excavation, common	cu.m	-	-	-	-	44,700	3,300	23,500
- Backfill with randam materials	cu.m	-	-	-	-	6,200	-	3,300
- Backfill with gravel	cu.m	-	-	-	-	3,400	470	1,800
- Backfill with cobble & rubble	cu.m	-	-	-	-	50,900	0	18,600
- Concrete	cu.m	-	-	-	-	0	0	0
- Rubble concrete	cu.m	-	-	-	-	0	0	0
- Backfill concrete	cu.m	-	-	-	-	0	0	0
- Reinforcing bar	tons	-	-	-	-	0	0	0
- Protection works with wet masonry	sq.m	-	-	-	-	25,700	1,900	2,300
- Gabion mattress	nos	-	-	-	-	2,360	500	15
VI. Improvement of Structures								
- Extention of road tunnel	m	-	-	-	-	60	-	-
- Extention of railway tunnel No.1	m	-	-	-	-	60	-	-
- Extention of railway tunnel No.2	m	-	-	-	-	80	-	-
- New road bridge (L=20 m)	sq.m	-	-	-	-	120	-	-
- New railway bridge (L=20 m)	sq.m	-	-	-	-	80	-	-

Table X-8-3 Economic Cost of Main Construction Works In Qda Areas of Group "A" (1/2)

Description	Unit of Q'ty	Unit Price (US$)	Qda Quirio	Qda Pedregal	Qda Carosio	Qda Corrales	Qda Rio Seco	Qda Paihua	Qda Cashahuacra
I. Main Dam									
- Excavation, common	cu.m	4.00	102.8	111.6	-	-	-	305.2	-
- Backfill with randam materials	cu.m	4.00	284.8	89.2	-	-	-	20.0	-
- Concrete	cu.m	80.00	320	224.0	-	-	-	3,360.0	-
- Rubble concrete	cu.m	45.00	1,075.5	607.5	-	-	-	0	-
- Backfill concrete	cu.m	45.00	607.5	495.0	-	-	-	405.0	-
- Reinforcing bar	tons	267.00	19.0	23.0	-	-	-	33.6	-
- Protection works with wet masonry	sq.m	22.00	41.8	66.0	-	-	-	90.2	-
- Gabion mattress	nos	45.00	1.8	1.8	-	-	-	2.3	-
Sub-total			2,453.2	1,618.1				4,216.3	
II. Lower Erosion Control Dam									
- Excavation, common	cu.m	4.00	130.4	120.8	27.2	30.4	-	30.8	42.8
- Backfill with randam materials	cu.m	4.00	4.0	2.4	6.8	5.2	-	1.8	52.0
- Concrete	cu.m	80.00	720.0	696.0	496.0	864.0	-	344.0	760.0
- Rubble concrete	cu.m	45.00	0.0	0.0	0.0	0.0	-	0	0
- Backfill concrete	cu.m	45.00	0.0	0.0	0.0	0.0	-	0	337.5
- Reinforcing bar	tons	267.00	11.7	13.4	4.0	9.9	-	4.0	10.9
- Protection works with wet masonry	sq.m	22.00	22.0	22.0	39.6	35.2	-	9.9	3.7
- Gabion mattress	tnos	45.00	1.8	1.8	0.0	0.7	-	1.1	11.7
Sub-total			893.5	856.4	578.4	945.4		391.6	1,218.7
III. Upper Erosion Control Dam									
- Excavation, common	cu.m	4.00	0.0	173.6	-	25.2	-	-	-
- Backfill with randam materials	cu.m	4.00	0.0	2.4	-	4.8	-	-	-
- Concrete	cu.m	80.00	0.0	696.0	-	792.0	-	-	-
- Rubble concrete	cu.m	45.00	0.0	0.0	-	0.0	-	-	-
- Backfill concrete	cu.m	45.00	0.0	0.0	-	0.0	-	-	-
- Reinforcing bar	tons	267.00	0.0	13.4	-	8.5	-	-	-
- Protection works with wet masonry	sq.m	22.00	0.0	28.6	-	26.4	-	-	-
- Gabion mattress	nos	45.00	0.0	1.8	-	0.7	-	-	-
Sub-total				915.8		857.6			

(to be continued)

Table X-8-3 Economic Cost of Main Construction Works in Qda Areas of Group "A" (2/2)

Description	Unit of Q'ty	Unit Price (US$)	Qda Quirio	Qda Pedregal	Qda Carosio	Qda Corrales	Qda Rio Seco	Qda Paihua	Qda Cashahuacra
IV. Channel Works									
- Excavation, common	cu.m	4.00	480.0	514.0	37.6	40.4	-	20.0	86.0
- Backfill with randam materials	cu.m	4.00	46.8	51.2	3.2	3.2	-	0	0
- Concrete	cu.m	80.00	0.0	0.0	0.0	0.0	-	0	0
- Rubble concrete	cu.m	45.00	832.5	927.0	180.0	76.5	-	0	76.5
- Backfill concrete	cu.m	45.00	0.0	0.0	0.0	54.0	-	0	0
- Reinforcing bar	tons	267.00	0.0	0.0	0.0	0.0	-	0	0
- Protection works with wet masonry	aq.m	22.00	473.0	180.4	72.6	35.2	-	0	50.6
- Gabion mattress	nos	45.00	38.7	38.7	3.4	2.7	-	0	0.7
- Rockshed tunnel/Bridge	NA	LS	815.6	1,856.0	55.7	84.8	-	0	0
Sub-total			2,056.6	3,567.3	352.5	296.8		20.0	
V. Dike									
- Excavation, common	cu.m	4.00	-	-	-	-	178.8	13.2	94.0
- Backfill with randam materials	cu.m	4.00	-	-	-	-	24.8	0	13
- Backfill with gravel	cu.m	7.00	-	-	-	-	23.8	3.3	12.6
- Backfill with cobble & rubble	cu.m	10.00	-	-	-	-	509.0	0	186.0
- Concrete	cu.m	80.00	-	-	-	-	0	0	0
- Rubble concrete	cu.m	45.00	-	-	-	-	0	0	0
- Backfill concrete	cu.m	45.00	-	-	-	-	0	0	0
- Reinforcing bar	tons	267.00	-	-	-	-	0	0	0
- Protection works with wet masonry	sq.m	22.00	-	-	-	-	565.4	41.8	572.0
- Gabion mattress	nos	45.00	-	-	-	-	106.2	22.5	55.4
Sub-total							1,408.0	80.8	933.2
VI. Improvement of Structures									
- Extention of road tunnel	m	4,240	-	-	-	-	254.4	-	-
- Extention of railway tunnel No.1	m	2,120	-	-	-	-	172.2	-	-
- Extention of railway tunnel No.2	m	2,120	-	-	-	-	169.6	-	-
- New road bridge (L=20 m)	sq.m	870	-	-	-	-	104.4	-	-
- New railway bridge (L=20 m)	sq.m	1,100	-	-	-	-	88.0	-	-
Sub-total							743.6		
TOTAL*			5,403.3	6,957.5	930.9	2,099.8	2,151.6	4,708.7	2,365.6

* Total amount does not include the cost for miscellaneous works.

Table X-8-4 Compensation Cost in Areas of Group "A"

Name of Qda	Land Acqusition			Relocation of house			Compensation Cost
	Area	Unit Cost	Cost	No.	Unit Cost	Cost	Total
Qda Quirio	50	0.2	10.0	30	0.7	21.0	31.0 (1,033.3)
Qda Redregal	50	0.2	10.0	60	0.7	42.0	52.0 (1,733.3)
Qda Carosio	2	0.2	0.4	5	0.7	3.5	3.9 (130.0)
Qda Carrales	5	0.2	1.0	10	0.7	3.5	4.5 (150.0)
Qda Rio Seco	50	0.1	5.0	0	0.7	0	5.0 (166.7)
Qda Paihua	2	0.1	0.2	0	0.7	0	0.2 (6.7)
Qda Cashahuacra	20	0.1	0.2	5	0.7	0.35	0.55 (18.3)

Unit : Area; x 10^3 m
Unit cost; x 106 Intis (x 10^3 US$)

Table X-8-5 Economic Project Cost in Qda Areas of Group "A"

(Unit: x 10^3 US$)

Description	Quirio	Redregal	Carosio	Corrales	Rio Seco	Paihua	Cashahuacra
1. Preparatory Works	284.4	366.2	49.0	110.5	113.2	247.8	124.5
2. Construction Works							
(1) Check dam	2,453.2	1,618.1	-	-	-	4,216.3	-
(2) Erosion control/ sand arrosting dam	893.5	1,772.2	578.4	1,803.0	-	391.6	1,218.7
(3) Channel works	2,056.6	3,567.3	352.5	296.8	-	20.0	213.8
(4) Training/Polder dike	-	-	-	-	1,408.0	-	933.2
(5) Protection of road and railway	-	-	-	-	743.6	80.8	-
(6) Miscellaneous	284.4	366.2	49.0	110.5	113.2	247.8	124.5
Sub-Total	5,687.7	7,323.7	979.9	2,210.3	2,264.8	4,956.5	2,490.1
3. Compensation	1,003.3	1,733.3	130.0	150.0	166.7	6.7	18.3
4. Engineering Service and Government administration	523.2	706.7	86.9	185.3	190.8	390.8	197.5
5. Phsical Contingency	1,124.8	1,519.5	186.8	398.4	410.3	840.3	424.6
Total	8,623.4	11,649.4	1,432.7	3,054.5	3,145.9	6442.1	3,057.4

Note: 1.; 5% of 2.
4.; 7.5% of (1. + 2. + 3.)
5.; 15% of (1. + 2. + 3. + 4.)

Table X-8-6 Annual Benefit for Qda Quirio

Table ESTIMATION OF EXPECTED MEAN ANNUAL DAMAGE OF DEBLIS FLOW
Qda. No.: QUIRIO
Case :
Unit : US$ 10^3

Return period	Probability	Incremental value	Deblis flow damage	Averaged deblis flow damage	Incremental deblis flow damage
1.01	0.9901	-	-	-	-
1.5	0.6667	0.3234	0.00	0.00	0.00
2	0.5000	0.1667	0.00	0.00	0.00
5	0.2000	0.3000	0.00	0.00	0.00
10	0.1000	0.1000	969.67	484.84	48.48
20	0.0500	0.0500	2100.14	1534.91	76.75
30	0.0333	0.0167	3006.13	2553.14	42.64
40	0.0250	0.0083	3807.19	3406.66	28.28
50	0.0200	0.0050	4570.33	4188.76	20.94
80	0.0125	0.0075	6501.22	5535.78	41.52
100	0.0100	0.0025	7641.67	7071.45	17.68
200	0.0050	0.0050			
TOTAL		0.9851			276.28

Table X-8-7 Annual Benefit for Qda Pedregal

Table ESTIMATION OF EXPECTED MEAN ANNUAL DAMAGE OF DEBLIS FLOW
Qda. No.: PEDREGAL
Case :
Unit : US$ 10^3

Return period	Probability	Incremental value	Deblis flow damage	Averaged deblis flow damage	Incremental deblis flow damage
1.01	0.9901	-	-	-	-
1.5	0.6667	0.3234	0.00	0.00	0.00
2	0.5000	0.1667	0.00	0.00	0.00
5	0.2000	0.3000	0.00	0.00	0.00
10	0.1000	0.1000	922.00	461.00	46.10
20	0.0500	0.0500	2762.63	1842.32	92.12
30	0.0333	0.0167	4548.52	3655.58	61.05
40	0.0250	0.0083	6316.92	5432.72	45.09
50	0.0200	0.0050	8912.00	7614.46	38.07
80	0.0125	0.0075	13291.92	11101.96	83.26
100	0.0100	0.0025	15553.67	14422.80	36.06
200	0.0050	0.0050			
TOTAL		0.9851			401.75

Table X-8-8 Annual Benefit for Qda Carosio

Table ESTIMATION OF EXPECTED MEAN ANNUAL DAMAGE OF DEBLIS FLOW
Qda. No.: CAROSIO
Case :
Unit : US$ 10^3

Return period	Probability	Incremental value	Deblis flow damage	Averaged deblis flow damage	Incremental deblis flow damage
1.01	0.9901	-	-	-	-
1.5	0.6667	0.3234	0.00	0.00	0.00
2	0.5000	0.1667	0.00	0.00	0.00
5	0.2000	0.3000	0.00	0.00	0.00
10	0.1000	0.1000	239.00	119.50	11.95
20	0.0500	0.0500	662.03	450.52	22.53
30	0.0333	0.0167	1055.97	859.00	14.35
40	0.0250	0.0083	1436.19	1246.08	10.34
50	0.0200	0.0050	1915.00	1675.60	8.38
80	0.0125	0.0075	2882.30	2398.65	17.99
100	0.0100	0.0025	3426.00	3154.15	7.89
200	0.0050	0.0050			
TOTAL		0.9851			93.42

Table X-8-9 Annual Benefit for Qda Corrales

Table ESTIMATION OF EXPECTED MEAN ANNUAL DAMAGE OF DEBLIS FLOW
Qda. No.: CORRALES
Case :
Unit : US$ 10^3

Return period	Probability	Incremental value	Deblis flow damage	Averaged deblis flow damage	Incremental deblis flow damage
1.01	0.9901	-	-	-	-
1.5	0.6667	0.3234	0.00	0.00	0.00
2	0.5000	0.1667	0.00	0.00	0.00
5	0.2000	0.3000	0.00	0.00	0.00
10	0.1000	0.1000	257.00	128.50	12.85
20	0.0500	0.0500	775.48	516.24	25.81
30	0.0333	0.0167	1276.33	1025.91	17.13
40	0.0250	0.0083	1772.13	1524.23	12.65
50	0.0200	0.0050	2576.67	2174.40	10.87
80	0.0125	0.0075	3726.88	3151.78	23.64
100	0.0100	0.0025	4261.33	3994.11	9.99
200	0.0050	0.0050			
TOTAL		0.9851			112.94

Table X-8-10 Annual Benefit for Qda Rio Seco

Table ESTIMATION OF EXPECTED MEAN ANNUAL DAMAGE OF DEBLIS FLOW
Qda. No.: RIO SECO
Case :
Unit : US$ 10^3

Return period	Proba-bility	Incre-mental value	Deblis flow damage	Averaged deblis flow damage	Incremental deblis flow damage
1.01	0.9901	-	-	-	-
1.5	0.6667	0.3234	0.00	0.00	0.00
2	0.5000	0.1667	0.00	0.00	0.00
5	0.2000	0.3000	0.00	0.00	0.00
10	0.1000	0.1000	710.67	355.34	35.53
20	0.0500	0.0500	1588.47	1149.57	57.48
30	0.0333	0.0167	2346.29	1967.38	32.86
40	0.0250	0.0083	3033.65	2689.97	22.33
50	0.0200	0.0050	3207.33	3120.49	15.60
80	0.0125	0.0075	5428.90	4318.12	32.39
100	0.0100	0.0025	7199.00	6313.95	15.78
200	0.0050	0.0050			
TOTAL		0.9851			211.97

Table X-8-11 Annual Benefit for Qda Paihua

Table ESTIMATION OF EXPECTED MEAN ANNUAL DAMAGE OF DEBLIS FLOW
Qda. No.: PAIHUA
Case :
Unit : US$ 10^3

Return period	Proba-bility	Incre-mental value	Deblis flow damage	Averaged deblis flow damage	Incremental deblis flow damage
1.01	0.9901	-	-	-	-
1.5	0.6667	0.3234	0.00	0.00	0.00
2	0.5000	0.1667	0.00	0.00	0.00
5	0.2000	0.3000	0.00	0.00	0.00
10	0.1000	0.1000	545.67	272.84	27.28
20	0.0500	0.0500	1440.70	993.19	49.66
30	0.0333	0.0167	2264.19	1852.45	30.94
40	0.0250	0.0083	3049.55	2656.87	22.05
50	0.0200	0.0050	3787.33	3418.44	17.09
80	0.0125	0.0075	5986.38	4886.86	36.65
100	0.0100	0.0025	7409.33	6697.86	16.74
200	0.0050	0.0050			
TOTAL		0.9851			200.42

Table X-8-12 Annual Benefit for Qda Cashahuacra

Table ESTIMATION OF EXPECTED MEAN ANNUAL DAMAGE OF DEBLIS FLOW
Qda. No.: CASHAHUACRA
Case :
Unit : US$ 10^3

Return period	Probability	Incremental value	Deblis flow damage	Averaged deblis flow damage	Incremental deblis flow damage
1.01	0.9901	-	-	-	-
1.5	0.6667	0.3234	0.00	0.00	0.00
2	0.5000	0.1667	0.00	0.00	0.00
5	0.2000	0.3000	0.00	0.00	0.00
10	0.1000	0.1000	229.33	114.67	11.47
20	0.0500	0.0500	576.50	402.92	20.15
30	0.0333	0.0167	900.66	738.58	12.33
40	0.0250	0.0083	1208.34	1054.50	8.75
50	0.0200	0.0050	1296.67	1252.51	6.26
80	0.0125	0.0075	2351.13	1823.90	13.68
100	0.0100	0.0025	3229.67	2790.40	6.98
200	0.0050	0.0050			
TOTAL		0.9851			79.62

Table X-8-13 EIRR Calculation for Qda Quirio

Name of Quebrada : QUIRIO Economic development rate : 3%/year

Discounted rate = 5.2494 % Unit : US$ 10^3

Year	Fisical Year	COST STREAM Construction Cost	O & M Cost	Cost Total	Discounted Total Cost	BENEFIT STREAM Annual Benefit	Discounted Total Benefit	Net Present Worth
1	1990/1991	1,724.7		1,724.7	1,638.7		0.0	(1,638.7)
2	1991/1992	3,449.4		3,449.4	3,113.9		0.0	(3,113.9)
3	1992/1993	1,724.7	21.6	1,746.2	1,497.8	175.0	150.1	(1,347.7)
4	1993/1994	1,724.7	21.6	1,746.2	1,423.1	175.0	142.6	(1,280.4)
5	1994/1995		43.1	43.1	33.4	350.0	271.0	237.6
6	1995/1996		43.1	43.1	31.7	360.5	265.2	233.5
7	1996/1997		43.1	43.1	30.1	371.3	259.5	229.4
8	1997/1998		43.1	43.1	28.6	382.5	254.0	225.4
9	1998/1999		43.1	43.1	27.2	393.9	248.6	221.4
10	1999/2000		43.1	43.1	25.8	405.8	243.3	217.4
11	2000/2001		43.1	43.1	24.6	417.9	238.1	213.5
12	2001/2002		43.1	43.1	23.3	430.5	233.0	209.6
13	2002/2003		43.1	43.1	22.2	443.4	228.0	205.8
14	2003/2004		43.1	43.1	21.1	456.7	223.1	202.1
15	2004/2005		43.1	43.1	20.0	470.4	218.4	198.3
16	2005/2006		43.1	43.1	19.0	484.5	213.7	194.7
17	2006/2007		43.1	43.1	18.1	499.0	209.1	191.0
18	2007/2008		43.1	43.1	17.2	514.0	204.6	187.5
19	2008/2009		43.1	43.1	16.3	529.4	200.3	184.0
20	2009/2010		43.1	43.1	15.5	545.3	196.0	180.5
21	2010/2011		43.1	43.1	14.7	561.7	191.8	177.1
22	2011/2012		43.1	43.1	14.0	578.5	187.7	173.7
23	2012/2013		43.1	43.1	13.3	595.9	183.7	170.4
24	2013/2014		43.1	43.1	12.6	613.7	179.8	167.1
25	2014/2015		43.1	43.1	12.0	632.2	175.9	163.9
26	2015/2016		43.1	43.1	11.4	651.1	172.2	160.8
27	2016/2017		43.1	43.1	10.8	670.7	168.5	157.7
28	2017/2018		43.1	43.1	10.3	690.8	164.9	154.6
29	2018/2019		43.1	43.1	9.8	711.5	161.4	151.6
30	2019/2020		43.1	43.1	9.3	732.8	157.9	148.6
31	2020/2021		43.1	43.1	8.8	754.8	154.5	145.7
32	2021/2022		43.1	43.1	8.4	777.5	151.2	142.8
33	2022/2023		43.1	43.1	8.0	800.8	148.0	140.0
34	2023/2024		43.1	43.1	7.6	824.8	144.8	137.3
35	2024/2025		43.1	43.1	7.2	849.6	141.7	134.6
36	2025/2026		43.1	43.1	6.8	875.0	138.7	131.9
37	2026/2027		43.1	43.1	6.5	901.3	135.8	129.3
38	2027/2028		43.1	43.1	6.2	928.3	132.8	126.7
39	2028/2029		43.1	43.1	5.9	956.2	130.0	124.1
40	2029/2030		43.1	43.1	5.6	984.9	127.2	121.7
41	2030/2031		43.1	43.1	5.3	1,014.4	124.5	119.2
42	2031/2032		43.1	43.1	5.0	1,044.9	121.9	116.8
43	2032/2033		43.1	43.1	4.8	1,076.2	119.2	114.5
44	2033/2034		43.1	43.1	4.5	1,108.5	116.7	112.2
45	2034/2035		43.1	43.1	4.3	1,141.7	114.2	109.9
46	2035/2036		43.1	43.1	4.1	1,176.0	111.8	107.7
47	2036/2037		43.1	43.1	3.9	1,211.3	109.4	105.5
48	2037/2038		43.1	43.1	3.7	1,247.6	107.0	103.3
49	2038/2039		43.1	43.1	3.5	1,285.0	104.8	101.2
50	2039/2040		43.1	43.1	3.3	1,323.6	102.5	99.2
Total		8,623.4	2,026.5	10,649.9	8,279.1	34,126.3	8,279.1	0.0

Table X-8-14 EIRR Calculation for Qda Pedregal

Name of Quebrada : PEDREGAL Economic development rate : 3%/year

Discount rate = 5.6548 % Unit : US$ 10^3

	Year	Fisical Year	COST STREAM Construction Cost	O & M Cost	Cost Total	Discounted Total Cost	BENEFIT STREAM Annual Benefit	Discounted Total Benefit	Net Present Worth	
1	1990/1991		2,329.9		2,329.9	2,205.2		0.0	(2,205.2)	
2	1991/1992		4,659.8		4,659.8	4,174.3		0.0	(4,174.3)	
3	1992/1993		2,329.9	29.1	2,359.0	2,000.1	254.5	215.8	(1,784.4)	
4	1993/1994		2,329.9	29.1	2,359.0	1,893.1	254.5	204.2	(1,688.9)	
5	1994/1995			58.2	58.2	44.2	509.0	386.6	342.4	
6	1995/1996			58.2	58.2	41.9	524.3	376.9	335.0	
7	1996/1997			58.2	58.2	39.6	540.0	367.4	327.8	
8	1997/1998			58.2	58.2	37.5	556.2	358.2	320.7	
9	1998/1999			58.2	58.2	35.5	572.9	349.2	313.7	
10	1999/2000			58.2	58.2	33.6	590.1	340.4	306.8	
11	2000/2001			58.2	58.2	31.8	607.8	331.9	300.1	
12	2001/2002			58.2	58.2	30.1	626.0	323.5	293.4	
13	2002/2003			58.2	58.2	28.5	644.8	315.4	286.9	
14	2003/2004			58.2	58.2	27.0	664.1	307.5	280.5	
15	2004/2005			58.2	58.2	25.5	684.0	299.7	274.2	
16	2005/2006			58.2	58.2	24.2	704.6	292.2	268.0	
17	2006/2007			58.2	58.2	22.9	725.7	284.9	262.0	
18	2007/2008			58.2	58.2	21.6	747.5	277.7	256.1	
19	2008/2009			58.2	58.2	20.5	769.9	270.7	250.2	
20	2009/2010			58.2	58.2	19.4	793.0	263.9	244.5	
21	2010/2011			58.2	58.2	18.3	816.8	257.3	238.9	
22	2011/2012			58.2	58.2	17.4	841.3	250.8	233.5	
23	2012/2013			58.2	58.2	16.4	866.5	244.5	228.1	
24	2013/2014			58.2	58.2	15.6	892.5	238.4	222.8	
25	2014/2015			58.2	58.2	14.7	919.3	232.4	217.7	
26	2015/2016			58.2	58.2	13.9	946.9	226.6	212.6	
27	2016/2017			58.2	58.2	13.2	975.3	220.9	207.7	
28	2017/2018			58.2	58.2	12.5	1,004.5	215.3	202.8	
29	2018/2019			58.2	58.2	11.8	1,034.7	209.9	198.1	
30	2019/2020			58.2	58.2	11.2	1,065.7	204.6	193.4	
31	2020/2021			58.2	58.2	10.6	1,097.7	199.5	188.9	
32	2021/2022			58.2	58.2	10.0	1,130.6	194.5	184.5	
33	2022/2023			58.2	58.2	9.5	1,164.5	189.6	180.1	
34	2023/2024			58.2	58.2	9.0	1,199.5	184.8	175.8	
35	2024/2025			58.2	58.2	8.5	1,235.4	180.2	171.7	
36	2025/2026			58.2	58.2	8.0	1,272.5	175.7	167.6	
37	2026/2027			58.2	58.2	7.6	1,310.7	171.2	163.6	
38	2027/2028			58.2	58.2	7.2	1,350.0	166.9	159.7	
39	2028/2029			58.2	58.2	6.8	1,390.5	162.7	155.9	
40	2029/2030			58.2	58.2	6.5	1,432.2	158.7	152.2	
41	2030/2031			58.2	58.2	6.1	1,475.2	154.7	148.6	
42	2031/2032			58.2	58.2	5.8	1,519.4	150.8	145.0	
43	2032/2033			58.2	58.2	5.5	1,565.0	147.0	141.5	
44	2033/2034			58.2	58.2	5.2	1,612.0	143.3	138.1	
45	2034/2035			58.2	58.2	4.9	1,660.3	139.7	134.8	
46	2035/2036			58.2	58.2	4.6	1,710.1	136.2	131.5	
47	2036/2037			58.2	58.2	4.4	1,761.5	132.8	128.4	B - C =
48	2037/2038			58.2	58.2	4.2	1,814.3	129.4	125.3	0.0
49	2038/2039			58.2	58.2	3.9	1,868.7	126.2	122.2	
50	2039/2040			58.2	58.2	3.7	1,924.8	123.0	119.3	B / C =
										1.00
	Total		11,649.4	2,737.6	14,387.0	11,033.5	49,627.1	11,033.5	(0.0)	

Table X-8-15 EIRR Calculation for Qda Carosio

Name of Quebrada : CAROSIO Economic development rate : 3 %/year

E.I.R.R. = 9.85 % 0.0253269 Unit : US$ 10^3

Year	Fisical Year	COST STREAM Const-ruction Cost	O & M Cost	Cost Total	Discounted Total Cost	BENEFIT STREAM Annual Benefit	Discounted Total Benefit	Net Present Worth
1	1990/1991	429.8		429.8	391.3		0.0	(391.3)
2	1991/1992	573.1		573.1	474.9		0.0	(474.9)
3	1992/1993	429.8	3.6	433.4	327.0	57.4	43.3	(283.6)
4	1993/1994		7.2	7.2	4.9	114.9	78.9	74.0
5	1994/1995		7.2	7.2	4.5	118.3	74.0	69.5
6	1995/1996		7.2	7.2	4.1	121.9	69.4	65.3
7	1996/1997		7.2	7.2	3.7	125.5	65.0	61.3
8	1997/1998		7.2	7.2	3.4	129.3	61.0	57.6
9	1998/1999		7.2	7.2	3.1	133.2	57.2	54.1
10	1999/2000		7.2	7.2	2.8	137.2	53.6	50.8
11	2000/2001		7.2	7.2	2.5	141.3	50.3	47.7
12	2001/2002		7.2	7.2	2.3	145.5	47.1	44.8
13	2002/2003		7.2	7.2	2.1	149.9	44.2	42.1
14	2003/2004		7.2	7.2	1.9	154.4	41.4	39.5
15	2004/2005		7.2	7.2	1.8	159.0	38.9	37.1
16	2005/2006		7.2	7.2	1.6	163.8	36.4	34.8
17	2006/2007		7.2	7.2	1.5	168.7	34.2	32.7
18	2007/2008		7.2	7.2	1.3	173.8	32.0	30.7
19	2008/2009		7.2	7.2	1.2	179.0	30.0	28.8
20	2009/2010		7.2	7.2	1.1	184.3	28.2	27.1
21	2010/2011		7.2	7.2	1.0	189.9	26.4	25.4
22	2011/2012		7.2	7.2	0.9	195.6	24.8	23.9
23	2012/2013		7.2	7.2	0.8	201.4	23.2	22.4
24	2013/2014		7.2	7.2	0.8	207.5	21.8	21.0
25	2014/2015		7.2	7.2	0.7	213.7	20.4	19.7
26	2015/2016		7.2	7.2	0.6	220.1	19.1	18.5
27	2016/2017		7.2	7.2	0.6	226.7	18.0	17.4
28	2017/2018		7.2	7.2	0.5	233.5	16.8	16.3
29	2018/2019		7.2	7.2	0.5	240.5	15.8	15.3
30	2019/2020		7.2	7.2	0.4	247.7	14.8	14.4
31	2020/2021		7.2	7.2	0.4	255.2	13.9	13.5
32	2021/2022		7.2	7.2	0.4	262.8	13.0	12.7
33	2022/2023		7.2	7.2	0.3	270.7	12.2	11.9
34	2023/2024		7.2	7.2	0.3	278.8	11.4	11.1
35	2024/2025		7.2	7.2	0.3	287.2	10.7	10.5
36	2025/2026		7.2	7.2	0.2	295.8	10.1	9.8
37	2026/2027		7.2	7.2	0.2	304.7	9.4	9.2
38	2027/2028		7.2	7.2	0.2	313.8	8.8	8.6
39	2028/2029		7.2	7.2	0.2	323.2	8.3	8.1
40	2029/2030		7.2	7.2	0.2	332.9	7.8	7.6
41	2030/2031		7.2	7.2	0.2	342.9	7.3	7.1
42	2031/2032		7.2	7.2	0.1	353.2	6.8	6.7
43	2032/2033		7.2	7.2	0.1	363.8	6.4	6.3
44	2033/2034		7.2	7.2	0.1	374.7	6.0	5.9
45	2034/2035		7.2	7.2	0.1	386.0	5.6	5.5
46	2035/2036		7.2	7.2	0.1	397.5	5.3	5.2
47	2036/2037		7.2	7.2	0.1	409.5	5.0	4.9 B - C =
48	2037/2038		7.2	7.2	0.1	421.7	4.6	4.6 0.0
49	2038/2039		7.2	7.2	0.1	434.4	4.4	4.3
50	2039/2040		7.2	7.2	0.1	447.4	4.1	4.0 B / C = 1.00
	Total	1,432.7	340.3	1,773.0	1,247.4	11,590.0	1,247.4	0.0

Table X-8-16 EIRR Calculation for Qda Corrales

Name of Quebrada : CORRALES — Economic development rate : 3 %/year

E.I.R.R. = 6.02 % — 0.0329293 — Unit : US$ 10^3

Year	Fisical Year	COST STREAM: Construction Cost	O & M Cost	Cost Total	Discounted Total Cost	BENEFIT STREAM: Annual Benefit	Discounted Total Benefit	Net Present Worth
1	1990/1991	916.4		916.4	864.3		0.0	(864.3)
2	1991/1992	1,221.8		1,221.8	1,087.0		0.0	(1,087.0)
3	1992/1993	916.4	7.6	924.0	775.4	69.4	58.3	(717.2)
4	1993/1994		15.3	15.3	12.1	138.8	109.9	97.8
5	1994/1995		15.3	15.3	11.4	143.0	106.8	95.4
6	1995/1996		15.3	15.3	10.8	147.3	103.7	93.0
7	1996/1997		15.3	15.3	10.1	151.7	100.8	90.6
8	1997/1998		15.3	15.3	9.6	156.3	97.9	88.4
9	1998/1999		15.3	15.3	9.0	161.0	95.1	86.1
10	1999/2000		15.3	15.3	8.5	165.8	92.4	83.9
11	2000/2001		15.3	15.3	8.0	170.8	89.8	81.8
12	2001/2002		15.3	15.3	7.6	175.9	87.2	79.7
13	2002/2003		15.3	15.3	7.1	181.2	84.8	77.6
14	2003/2004		15.3	15.3	6.7	186.6	82.4	75.6
15	2004/2005		15.3	15.3	6.4	192.2	80.0	73.6
16	2005/2006		15.3	15.3	6.0	198.0	77.7	71.7
17	2006/2007		15.3	15.3	5.7	203.9	75.5	69.9
18	2007/2008		15.3	15.3	5.3	210.0	73.4	68.0
19	2008/2009		15.3	15.3	5.0	216.3	71.3	66.2
20	2009/2010		15.3	15.3	4.7	222.8	69.3	64.5
21	2010/2011		15.3	15.3	4.5	229.5	67.3	62.8
22	2011/2012		15.3	15.3	4.2	236.4	65.4	61.1
23	2012/2013		15.3	15.3	4.0	243.5	63.5	59.5
24	2013/2014		15.3	15.3	3.8	250.8	61.7	57.9
25	2014/2015		15.3	15.3	3.5	258.3	59.9	56.4
26	2015/2016		15.3	15.3	3.3	266.1	58.2	54.9
27	2016/2017		15.3	15.3	3.2	274.0	56.6	53.4
28	2017/2018		15.3	15.3	3.0	282.3	55.0	52.0
29	2018/2019		15.3	15.3	2.8	290.7	53.4	50.6
30	2019/2020		15.3	15.3	2.6	299.4	51.9	49.2
31	2020/2021		15.3	15.3	2.5	308.4	50.4	47.9
32	2021/2022		15.3	15.3	2.4	317.7	49.0	46.6
33	2022/2023		15.3	15.3	2.2	327.2	47.6	45.4
34	2023/2024		15.3	15.3	2.1	337.0	46.2	44.1
35	2024/2025		15.3	15.3	2.0	347.1	44.9	42.9
36	2025/2026		15.3	15.3	1.9	357.6	43.6	41.8
37	2026/2027		15.3	15.3	1.8	368.3	42.4	40.6
38	2027/2028		15.3	15.3	1.7	379.3	41.2	39.5
39	2028/2029		15.3	15.3	1.6	390.7	40.0	38.4
40	2029/2030		15.3	15.3	1.5	402.4	38.9	37.4
41	2030/2031		15.3	15.3	1.4	414.5	37.8	36.4
42	2031/2032		15.3	15.3	1.3	426.9	36.7	35.4
43	2032/2033		15.3	15.3	1.2	439.8	35.6	34.4
44	2033/2034		15.3	15.3	1.2	452.9	34.6	33.5
45	2034/2035		15.3	15.3	1.1	466.5	33.6	32.5
46	2035/2036		15.3	15.3	1.0	480.5	32.7	31.7
47	2036/2037		15.3	15.3	1.0	494.9	31.8	30.8 B - C =
48	2037/2038		15.3	15.3	0.9	509.8	30.9	29.9 0.0
49	2038/2039		15.3	15.3	0.9	525.1	30.0	29.1
50	2039/2040		15.3	15.3	0.8	540.8	29.1	28.3 B / C = 1.00
	Total	3,054.5	725.4	3,779.9	2,926.1	14,009.8	2,926.2	0.0

Table X-8-17 EIRR Calculation for Qda Rio Seco

Name of Quebrada : RIO SECO Economic development rate : 3%/year

Discount rate = 10.1167 % Unit : US$ 10^3

Year	Fisical Year	COST STREAM Construction Cost	O & M Cost	Cost Total	Discounted Total Cost	BENEFIT STREAM Annual Benefit	Discounted Total Benefit	Net Present Worth	
1	1990/1991	943.8		943.8	857.1		0.0	(857.1)	
2	1991/1992	1,258.4		1,258.4	1,037.8		0.0	(1,037.8)	
3	1992/1993	943.8	7.9	951.6	712.7	130.4	97.6	(615.1)	
4	1993/1994		15.7	15.7	10.7	260.7	177.3	166.6	
5	1994/1995		15.7	15.7	9.7	268.6	165.9	156.2	
6	1995/1996		15.7	15.7	8.8	276.6	155.1	146.3	
7	1996/1997		15.7	15.7	8.0	284.9	145.1	137.1	
8	1997/1998		15.7	15.7	7.3	293.5	135.7	128.5	
9	1998/1999		15.7	15.7	6.6	302.3	127.0	120.4	
10	1999/2000		15.7	15.7	6.0	311.3	118.8	112.8	
11	2000/2001		15.7	15.7	5.4	320.7	111.1	105.6	
12	2001/2002		15.7	15.7	4.9	330.3	103.9	99.0	
13	2002/2003		15.7	15.7	4.5	340.2	97.2	92.7	
14	2003/2004		15.7	15.7	4.1	350.4	90.9	86.8	
15	2004/2005		15.7	15.7	3.7	360.9	85.0	81.3	
16	2005/2006		15.7	15.7	3.4	371.7	79.5	76.2	
17	2006/2007		15.7	15.7	3.1	382.9	74.4	71.3	
18	2007/2008		15.7	15.7	2.8	394.4	69.6	66.8	
19	2008/2009		15.7	15.7	2.5	406.2	65.1	62.6	
20	2009/2010		15.7	15.7	2.3	418.4	60.9	58.6	
21	2010/2011		15.7	15.7	2.1	431.0	57.0	54.9	
22	2011/2012		15.7	15.7	1.9	443.9	53.3	51.4	
23	2012/2013		15.7	15.7	1.7	457.2	49.8	48.1	
24	2013/2014		15.7	15.7	1.6	470.9	46.6	45.1	
25	2014/2015		15.7	15.7	1.4	485.0	43.6	42.2	
26	2015/2016		15.7	15.7	1.3	499.6	40.8	39.5	
27	2016/2017		15.7	15.7	1.2	514.6	38.1	37.0	
28	2017/2018		15.7	15.7	1.1	530.0	35.7	34.6	
29	2018/2019		15.7	15.7	1.0	545.9	33.4	32.4	
30	2019/2020		15.7	15.7	0.9	562.3	31.2	30.3	
31	2020/2021		15.7	15.7	0.8	579.2	29.2	28.4	
32	2021/2022		15.7	15.7	0.7	596.5	27.3	26.6	
33	2022/2023		15.7	15.7	0.7	614.4	25.5	24.9	
34	2023/2024		15.7	15.7	0.6	632.9	23.9	23.3	
35	2024/2025		15.7	15.7	0.5	651.9	22.4	21.8	
36	2025/2026		15.7	15.7	0.5	671.4	20.9	20.4	
37	2026/2027		15.7	15.7	0.4	691.6	19.6	19.1	
38	2027/2028		15.7	15.7	0.4	712.3	18.3	17.9	
39	2028/2029		15.7	15.7	0.4	733.7	17.1	16.7	
40	2029/2030		15.7	15.7	0.3	755.7	16.0	15.7	
41	2030/2031		15.7	15.7	0.3	778.3	15.0	14.7	
42	2031/2032		15.7	15.7	0.3	801.7	14.0	13.7	
43	2032/2033		15.7	15.7	0.2	825.7	13.1	12.8	
44	2033/2034		15.7	15.7	0.2	850.5	12.3	12.0	
45	2034/2035		15.7	15.7	0.2	876.0	11.5	11.3	
46	2035/2036		15.7	15.7	0.2	902.3	10.7	10.5	
47	2036/2037		15.7	15.7	0.2	929.4	10.0	9.9	B - C =
48	2037/2038		15.7	15.7	0.2	957.3	9.4	9.2	0.0
49	2038/2039		15.7	15.7	0.1	986.0	8.8	8.6	
50	2039/2040		15.7	15.7	0.1	1,015.6	8.2	8.1	B / C =
									1.00
	Total	3,145.9	747.2	3,893.1	2,722.7	26,307.1	2,722.7	0.0	

Table X-8-18 EIRR Calculation for Qda Paihua

Name of Quebrada : PAIHUA Economic development rate : 3 %/year

E.I.R.R. = 5.0906 % Unit : US$ 10^3

Year	Fisical Year	COST STREAM Const-ruction Cost	O & M Cost	Cost Total	Discounted Total Cost	BENEFIT STREAM Annual Benefit	Discounted Total Benefit	Net Present Worth
1	1990/1991	1,288.4		1,288.4	1,226.0		0.0	(1,226.0)
2	1991/1992	2,576.8		2,576.8	2,333.2		0.0	(2,333.2)
3	1992/1993	1,288.4	16.1	1,304.5	1,124.0	126.9	109.4	(1,014.6)
4	1993/1994	1,288.4	16.1	1,304.5	1,069.5	126.9	104.1	(965.5)
5	1994/1995		32.2	32.2	25.1	253.9	198.1	172.9
6	1995/1996		32.2	32.2	23.9	261.5	194.1	170.2
7	1996/1997		32.2	32.2	22.8	269.3	190.2	167.5
8	1997/1998		32.2	32.2	21.7	277.4	186.5	164.8
9	1998/1999		32.2	32.2	20.6	285.7	182.8	162.2
10	1999/2000		32.2	32.2	19.6	294.3	179.1	159.5
11	2000/2001		32.2	32.2	18.7	303.1	175.6	156.9
12	2001/2002		32.2	32.2	17.8	312.2	172.1	154.3
13	2002/2003		32.2	32.2	16.9	321.6	168.6	151.8
14	2003/2004		32.2	32.2	16.1	331.2	165.3	149.2
15	2004/2005		32.2	32.2	15.3	341.2	162.0	146.7
16	2005/2006		32.2	32.2	14.6	351.4	158.8	144.2
17	2006/2007		32.2	32.2	13.8	361.9	155.6	141.8
18	2007/2008		32.2	32.2	13.2	372.8	152.5	139.3
19	2008/2009		32.2	32.2	12.5	384.0	149.5	136.9
20	2009/2010		32.2	32.2	11.9	395.5	146.5	134.6
21	2010/2011		32.2	32.2	11.4	407.4	143.6	132.2
22	2011/2012		32.2	32.2	10.8	419.6	140.7	129.9
23	2012/2013		32.2	32.2	10.3	432.2	137.9	127.7
24	2013/2014		32.2	32.2	9.8	445.1	135.2	125.4
25	2014/2015		32.2	32.2	9.3	458.5	132.5	123.2
26	2015/2016		32.2	32.2	8.9	472.3	129.9	121.0
27	2016/2017		32.2	32.2	8.4	486.4	127.3	118.9
28	2017/2018		32.2	32.2	8.0	501.0	124.8	116.7
29	2018/2019		32.2	32.2	7.6	516.0	122.3	114.6
30	2019/2020		32.2	32.2	7.3	531.5	119.8	112.6
31	2020/2021		32.2	32.2	6.9	547.5	117.5	110.5
32	2021/2022		32.2	32.2	6.6	563.9	115.1	108.5
33	2022/2023		32.2	32.2	6.3	580.8	112.8	106.6
34	2023/2024		32.2	32.2	6.0	598.2	110.6	104.6
35	2024/2025		32.2	32.2	5.7	616.2	108.4	102.7
36	2025/2026		32.2	32.2	5.4	634.7	106.2	100.8
37	2026/2027		32.2	32.2	5.1	653.7	104.1	99.0
38	2027/2028		32.2	32.2	4.9	673.3	102.0	97.2
39	2028/2029		32.2	32.2	4.6	693.5	100.0	95.4
40	2029/2030		32.2	32.2	4.4	714.3	98.0	93.6
41	2030/2031		32.2	32.2	4.2	735.8	96.1	91.9
42	2031/2032		32.2	32.2	4.0	757.8	94.2	90.2
43	2032/2033		32.2	32.2	3.8	780.6	92.3	88.5
44	2033/2034		32.2	32.2	3.6	804.0	90.5	86.8
45	2034/2035		32.2	32.2	3.4	828.1	88.7	85.2
46	2035/2036		32.2	32.2	3.3	852.9	86.9	83.6
47	2036/2037		32.2	32.2	3.1	878.5	85.2	82.0 B - C =
48	2037/2038		32.2	32.2	3.0	904.9	83.5	80.5 0.0
49	2038/2039		32.2	32.2	2.8	932.0	81.8	79.0
50	2039/2040		32.2	32.2	2.7	960.0	80.2	77.5 B / C = 1.00
Total		6,442.1	1,513.9	7,956.0	6,218.7	24,751.8	6,218.7	0.0

Table X-8-19 EIRR Calculation for Qda Cashahuacra

Name of Quebrada : CASHAHUACRA Economic development rate : 3 %/year

E.I.R.R. = 4.1538 % Unit : US$ 10^3

Year	Fisical Year	COST STREAM Construction Cost	O & M Cost	Cost Total	Discounted Total Cost	BENEFIT STREAM Annual Benefit	Discounted Total Benefit	Net Present Worth	
1	1990/1991	917.2		917.2	880.6		0.0	(880.6)	
2	1991/1992	1,223.0		1,223.0	1,127.4		0.0	(1,127.4)	
3	1992/1993	917.2	7.6	924.9	818.6	48.9	43.3	(775.2)	
4	1993/1994		15.3	15.3	13.0	97.9	83.2	70.2	
5	1994/1995		15.3	15.3	12.5	100.8	82.3	69.8	
6	1995/1996		15.3	15.3	12.0	103.9	81.4	69.4	
7	1996/1997		15.3	15.3	11.5	107.0	80.5	69.0	
8	1997/1998		15.3	15.3	11.0	110.2	79.6	68.5	
9	1998/1999		15.3	15.3	10.6	113.5	78.7	68.1	
10	1999/2000		15.3	15.3	10.2	116.9	77.8	67.6	
11	2000/2001		15.3	15.3	9.8	120.4	76.9	67.2	
12	2001/2002		15.3	15.3	9.4	124.0	76.1	66.7	
13	2002/2003		15.3	15.3	9.0	127.7	75.3	66.2	
14	2003/2004		15.3	15.3	8.6	131.6	74.4	65.8	
15	2004/2005		15.3	15.3	8.3	135.5	73.6	65.3	
16	2005/2006		15.3	15.3	8.0	139.6	72.8	64.8	
17	2006/2007		15.3	15.3	7.7	143.8	72.0	64.3	
18	2007/2008		15.3	15.3	7.3	148.1	71.2	63.8	
19	2008/2009		15.3	15.3	7.1	152.5	70.4	63.3	
20	2009/2010		15.3	15.3	6.8	157.1	69.6	62.8	
21	2010/2011		15.3	15.3	6.5	161.8	68.8	62.3	
22	2011/2012		15.3	15.3	6.2	166.7	68.1	61.8	
23	2012/2013		15.3	15.3	6.0	171.7	67.3	61.3	
24	2013/2014		15.3	15.3	5.8	176.8	66.6	60.8	
25	2014/2015		15.3	15.3	5.5	182.1	65.8	60.3	
26	2015/2016		15.3	15.3	5.3	187.6	65.1	59.8	
27	2016/2017		15.3	15.3	5.1	193.2	64.4	59.3	
28	2017/2018		15.3	15.3	4.9	199.0	63.7	58.8	
29	2018/2019		15.3	15.3	4.7	205.0	63.0	58.3	
30	2019/2020		15.3	15.3	4.5	211.1	62.3	57.8	
31	2020/2021		15.3	15.3	4.3	217.5	61.6	57.3	
32	2021/2022		15.3	15.3	4.2	224.0	60.9	56.7	
33	2022/2023		15.3	15.3	4.0	230.7	60.2	56.2	
34	2023/2024		15.3	15.3	3.8	237.6	59.6	55.7	
35	2024/2025		15.3	15.3	3.7	244.8	58.9	55.2	
36	2025/2026		15.3	15.3	3.5	252.1	58.2	54.7	
37	2026/2027		15.3	15.3	3.4	259.7	57.6	54.2	
38	2027/2028		15.3	15.3	3.3	267.4	57.0	53.7	
39	2028/2029		15.3	15.3	3.1	275.5	56.3	53.2	
40	2029/2030		15.3	15.3	3.0	283.7	55.7	52.7	
41	2030/2031		15.3	15.3	2.9	292.2	55.1	52.2	
42	2031/2032		15.3	15.3	2.8	301.0	54.5	51.7	
43	2032/2033		15.3	15.3	2.7	310.0	53.9	51.2	
44	2033/2034		15.3	15.3	2.6	319.3	53.3	50.7	
45	2034/2035		15.3	15.3	2.4	328.9	52.7	50.2	
46	2035/2036		15.3	15.3	2.4	338.8	52.1	49.8	
47	2036/2037		15.3	15.3	2.3	349.0	51.5	49.3	B - C =
48	2037/2038		15.3	15.3	2.2	359.4	51.0	48.8	0.0
49	2038/2039		15.3	15.3	2.1	370.2	50.4	48.3	
50	2039/2040		15.3	15.3	2.0	381.3	49.8	47.8	B / C =
									1.00
	Total	3,057.4	726.1	3,783.5	3,104.2	9,877.6	3,104.2	0.0	

Table X-9-1 Type of Qda Areas of Group "B"

Name and No. of Qda		Type
Q. Chaclacayo	(R1)	A1
Q. Chacrasana	(R2)	A1
Q. California	(R3)	A1
Q. Santa Maria	(R4)	A1
Q. La Cantuta	(R5)	A1
Q. La Ronda	(R10)	A1
Q. Santa Ana	(R11)	B1
Q. Cupiche	(R13)	B1
Q. Rio Canchacalla	(R15)	C
Q. Guayabo	(R16)	B2
Q. Agua Salada	(R17)	B1
Q. Del Pate	(R18)	B1
Q. Huacre	(R23)	B1
Q. Matata	(R24)	B1
Q. Cuchimachay	(R25)	A1
Q. Chucumayo	(R31)	B2
Q. Chacahuacra	(R33)	B2
Q. Pancha	(R34)	C
Q. Viso	(R35)	C
Q. Parac	(R37)	C
Q. Redonda	(S2)	B2
Q. Infiernillo	(S3)	B1
Q. Lucuma	(S5)	B1

Note : A1 : Quirio/Redregal Type
A2 : Carosio/Corrales Type
B1 : Rio Seco Type
B2 : Cashahuacra Type
C : Paihua Type

Table X-9-2 Quantity of Structural Plan for Qda Areas of Group "B"

Name and No. of Qda.	Q'ty of Structure			Others
	No. of Dam	Length of Channel Works	Length of Dike Section	
Q. Chaclacayo (R1)	3 Nos	3.3 km	-	
Q. Chacrasana (R2)	1	1.1	-	
Q. California (R3)	1	1.3	-	
Q. Santa Maria (R4)	1	1.0	-	
Q. La Cantuta (R5)	3	1.2	-	
Q. La Ronda (R10)	4	1.3	-	
Q. Santa Ana (R11)	-	(0.4)	0.6 km	Road & Railway Protection
Q. Cupiche (R13)	-	(0.4)	0.5	- ditto -
Q. Rio Canchacalla (R15)	5	(0.5)	0.5	
Q. Guayabo (R16)	2	0.4	-	Road & Railway Protection
Q. Agua Salada (R17)	-	(0.5)	0.5	- ditto -
Q. Del Pate (R18)	-	-	0.4	- ditto -
Q. Huacre (R23)	-	(0.5)	0.5	- ditto -
Q. Matata (R24)	-	(0.5)	0.5	- ditto -
Q. Cuchimachay (R25)	2	1.1	-	
Q. Chucumayo (R31)	1	0.7	1.6	Road & Raileay Protection
Q. Chacahuacra (R33)	1	0.3	-	- ditto -
Q. Pancha (R34)	3	(0.5)	-	
Q. Viso (R35)	2	(0.5)	-	
Q. Parac (R37)	3	(0.3)	-	
Q. Redonda (S2)	1	1.3	1.3	
Q. Infiernillo (S3)	-	(0.4)	0.4	
Q. Lucuma (S5)	-	(0.9)	0.9	

Note: Channel works with parenthesis : Excavation for improvement of existing channel

Table X-9-3 Economic Project Cost Estimated for Structural Plan for Qda Areas of Group "B"

(Unit: x 10^3 US$)

Name of No. of Qda	Construction Cost					Project Cost
	Dam	Channel Works	Dike	Others	Total	
Q. Chaclacayo (R1)	3,149.4	2,604.3	-	302.8	6,056.5	9,448.2
Q. Chacrasana (R2)	1,511.3	1,249.8	-	145.3	2,906.4	4,534.0
Q. California (R3)	2,700.5	2,233.1	-	259.7	5,193.3	8,101.6
Q. Santa Maria (R4)	1,478.8	1,222.8	-	142.2	2,843.8	4,436.3
Q. La Cantuta (R5)	4,821.8	3,987.3	-	463.6	9,272.8	14,465.5
Q. La Ronda (R10)	2,892.3	2,391.7	-	278.1	5,562.2	8,677.1
Q. Santa Ana (R11)	-	-	923.9	566.3	1,490.2	2,071.4
Q. Cupiche (R13)	-	-	636.9	390.3	1,027.2	1,427.8
Q. Rio Canchacalla (R15)	19,221.6	-	426.3	1,245.1	20,893.0	27,160.9
Q. Guayabo (R16)	438.7	250.7	-	197.0	895.3	1,101.2
Q. Agua Salada (R17)	-	-	785.2	481.3	1,266.5	1,760.4
Q. Del Pate (R18)	-	-	528.5	323.9	852.4	1,184.8
Q. Huacre (R23)	-	-	256.7	157.4	414.1	575.6
Q. Matata (R24)	-	-	506.3	310.3	816.6	1,135.1
Q. Cuchimachay (R25)	848.9	701.0	-	81.6	1,632.5	2,946.7
Q. Chucumayo (R31)	1,122.6	183.3	847.7	114.6	2,291.1	2,818.1
Q. Chacahuacra (R33)	170.7	127.9	-	46.3	348.4	428.6
Q. Pancha (R34)	5,645.2	-	-	490.9	6,136.1	7,976.9
Q. Viso (R35)	2,875.3	-	-	250.0	3,125.3	2,404.1
Q. Parac (R37)	10,639.2	-	-	925.1	11,564.3	15,033.6
Q. Redonda (S2)	780.7	127.4	589.5	79.7	1,593.2	1,959.7
Q. Infiernillo (S3)	-	-	458.6	281.1	739.7	1,028.2
Q. Lucuma (S5)	-	-	487.5	298.8	786.3	1,093.0

Note : (1) Unit : US$ x 10^6
(2) Project Cost : 1.56 x Construction cost for A1 type
1.54 x " for A2 type
1.39 x " for B1 type
1.23 x " for B2 type
1.30 x " for C type

Table X-9-4 Structures and Its Quantities in Spe Area of Group "B"

Name and No. of Spe Area	Kind of Structure and Number or Length (km)						
	Bridge		Bock S.Tunnel		Retain. Wall		Other
	Road	Rail	Road	Rail	High	Low	
River mouth-Jicamarca (R-~/0)	-	-	-	-	-	15	
River mough-Chaclacayo (R-~/1)	-	-	-	-	0.5	17.5	
Jicamarca-Chacrasana (R-0/2)	-	-	-	-	0.5	1.5	
Chaclacayo-California (R-1/3)	-	-	-	-	-	0.05	
Santa Maria-Quirio (R-4/6)	-	-	-	-	-	0.11	
La Cantuta-La Ronda (R-5/10)	-	-	-	-	-	1.5	
Pedregal-Carosio (R-7/8)	-	-	-	-	-	0.68	
Carosio-Corrales (R-8/9)	-	-	-	-	-	0.2	
Corrales-Cashauacra (R-9/1) and (S-~/1)	-	-	-	-	-	0.2	
La Ronda-Confluence (R-10/-)	-	-	-	-	-	0.04	
Confluence-Santa Ana (R-~/11)	-	-	-	-	-	0.32	
Confluence-San Juan (R-~/12)	-	-	-	-	-	0.08	
Santa Ana-Cupiche (R-11/13)	1	-	2	1	1.5	0	
Cupiche-Guayabo (R-13/16)	-	-	2	5	1.5	0.66	
Guayabo-Agua Salada (R-16/17)	-	-	2	0	1.0	0	
R. Seco-Esperanza (R-19/20)	1	1	3	5	2.5	0.05	
Esperanza-Verrugas (R-20/21)	1	1	6	7	2.5	0.01	
Verrugas-Huacre (R-21/23)	1	1	3	5	2.0	0.08	
Linday-Yamajune (R-22/27)	1	-	2	-	2.5	0.04	
Chacamaza-Barranco (R-26/29)	-	-	-	7	-	0.04	
Chucumayo-Chacahuaro (R-31/33)	-	-	-	3	-	0.9	
Parac-Rio Blanco (R-37/40)	2	2	2	2	-	1.12	
Confluence-Alcula (S-~/4)	-	-	-	-	-	0.11	
Cashahuacra-Redonda (S-1/2)	-	1	-	5	-	0.11	
Redonda-Infiernillo (S-2/3)	-	-	-	4	-	0.09	

Table X-9-5 Unit Cost of Typical Structures for Spe Areas of Group "B"

Kind of structure	Type	Unit	Unit Cost ($\times 10^3$ US$)
1. Bridge	Road	No.	139.2
2. Bridge	Railway	No.	88.0
3. Rockshed tunnel	Road	No.	127.2
4. Rockshed tunnel	Railway	No.	42.4
5. Retaining wall	High	m	1.2
6. Retaining wall	Low	m	0.7

Note: (1) Roadway bridge l = 20 m, b = 8 m, US$ 870/m^2
(2) Roadway bridge l = 20 m, b = 4 m, US$ 1,100/m^2
(3) Rockshed tunnel (Road) l = 30 m, US$ 4,240/m^2
(4) Rockshed tunnel (Railway) l = 20 m, US$ 2,120/m^2
(5) Unit cost of retaining wall includes the cost of slope surface protection works by concrete spraying method for approximately 30 m for high wall section and 20 m for low wall section. Unit cost of spraying works is assumed at US$20 per 1 m^2.

Table X-9-6 Economic Project Cost for Spe Areas of Group "B"

(Unit: x 10^6 US$)

Name and No. of Spe Area	Construction cost					Project cost
	Bridge	R. Tunnel	R. Wall	Others	Total	
River mouth-Jicamarca (R-¯/0)	-	-	10.5	0.553	11.053	15.585
River mough-Chaclacayo (R-¯/1)	-	-	12.85	0.676	13.53	19.077
Jicamarca-Chacrasana (R-0/2)	-	-	1.65	0.087	1.74	2.453
Chaclacayo-California (R-1/3)	-	-	0.035	0.002	0.037	0.052
Santa Maria-Quirio (R-4/6)	-	-	0.077	0.004	0.081	0.114
La Cantuta-La Ronda (R-5/10)	-	-	1.05	0.055	1.105	1.558
Pedregal-Carosio (R-7/8)	-	-	0.476	0.025	0.501	0.706
Carosio-Corrales (R-8/9)	-	-	0.14	0.007	0.147	0.207
Corrales-Cashauacra (R-9/1) and (S-¯/1)	-	-	0.14	0.007	0.147	0.207
La Ronda-Confluence (R-10/-)	-	-	0.028	0.001	0.029	0.041
Confluence-Santa Ana (R-¯/11)	-	-	0.224	0.012	0.236	0.333
Confluence-San Juan (R-¯/12)	-	-	0.056	0.003	0.059	0.083
Santa Ana-Cupiche (R-11/13)	0.139	0.297	1.8	0.118	2.354	3.319
Cupiche-Guayabo (R-13/16)	-	0.466	2.262	0.144	2.872	4.049
Guayabo-Agua Salada (R-16/17)	-	0.254	1.2	0.076	1.530	2.157
R. Seco-Esperanza (R-19/20)	0.227	0.594	3.035	0.203	4.059	5.723
Esperanza-Verrugas (R-20/21)	0.227	1.060	3.007	0.226	4.520	6.373
Verrugas-Huacre (R-21/23)	0.227	0.594	2.456	0.172	3.449	4.863
Linday-Yamajune (R-22/27)	0.139	0.254	3.028	0.180	3.601	5.077
Chacamaza-Barranco (R-26/29)	-	0.297	0.028	0.017	0.342	0.482
Chucumayo-Chacahuaro (R-31/33)	-	0.127	0.63	0.040	0.797	1.124
Parac-Rio Blanco (R-37-40)	0.454	0.339	0.784	0.083	1.660	2.34
Confluence-Alcula (S--/4)	-	-	0.077	0.004	0.081	0.114
Cashahuacra-Redonda (S-1/2)	-	0.121	0.077	0.015	0.304	0.429
Redonda-Infiernillo (S-2/3)	-	0.170	0.063	0.012	0.245	0.345

Note; (1) Project Cost = 1.41 x Construction Cost.
(2) 1.41 is the mean in case of Qda areas of Group "A"

Table X-9-7 Results of Economic Evaluation for Qda Areas of Group "B"

Name and No. of Qda	Project Cost ($\times 10^3$ US$)	EIRR (%)
Q. Chaclacayo (R1)	9,448.2	8.99
Q. Chacrasana (R2)	4,534.0	3.19
Q. California (R3)	8,101.6	4.79
Q. Santa Maria (R4)	4,436.3	3.39
Q. La Cantuta (R5)	14,465.5	-0.24
Q. La Ronda (R10)	8,677.1	2.31
Q. Santa Ana (R11)	2,071.4	11.54
Q. Cupiche (R13)	1,427.8	12.79
Q. Rio Canchacalla (R15)	27,160.9	-2.09
Q. Guayabo (R16)	1,101.2	14.94
Q. Agua Salada (R17)	1,760.4	10.90
Q. Del Pate (R18)	1,184.8	14.30
Q. Huacre (R23)	575.6	3.75
Q. Matata (R24)	1,135.1	3.71
Q. Cuchimachay (R25)	2,546.7	2.90
Q. Chucumayo (R31)	2,818.1	8.45
Q. Chacahuacra (R33)	428.6	17.90
Q. Pancha (R34)	7,976.9	-1.07
Q. Viso (R35)	2,404.1	3.96
Q. Parac (R37)	15,033.6	-0.89
Q. Redonda (S2)	1,959.7	4.12
Q. Infiernillo (S3)	1,028.2	5.07
Q. Lucuma (S4)	1,093.0	4.73

Note: Discount rate for Present value is 8%.

Table X-9-8 Results of Economic Evaluation for Spe Areas of Group "B"

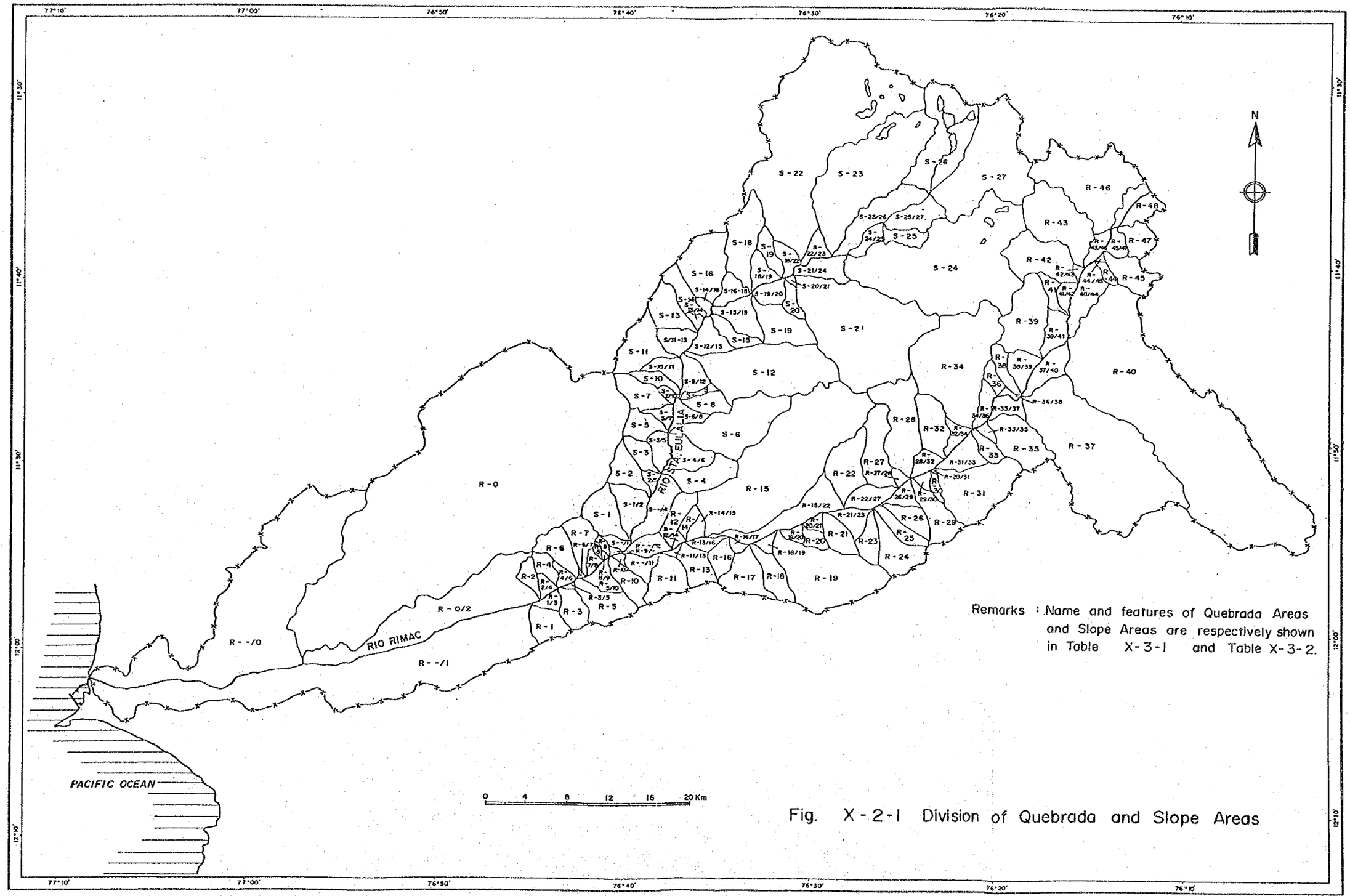
Name and No. of Spe Area	Project Cost ($\times 10^3$ US$)	EIRR (%)
River mouth-Jicamarca (R-¯/0)	15,585	0.68
River mough-Chaclacayo (R-¯/1)	19,077	-0.04
Jicamarca-Chacrasana (R-0/2)	2,453	-
Chaclacayo-California (R-1/3)	52	13.67
Santa Maria-Quirio (R-4/6)	0,114	-2.42
La Cantuta-La Ronda (R-5/10)	1,585	-4.06
Pedregal-Carosio (R-7/8)	706	0.15
Carosio-Corrales (R-8/9)	207	2.29
Corrales-Cashauacra (R-9/1) and (S-¯/1)	207	0.45
La Ronda-Confluence (R-10/-)	41	6.68
Confluence-Santa Ana (R-¯/11)	333	6.23
Confluence-San Juan (R-¯/12)	83	10.64
Santa Ana-Cupiche (R-11/12)	3,319	5.22
Cupiche-Guayabo (R-13/16)	4,049	3.64
Guayabo-Agua Salada (R-16/17)	2,157	3.46
R. Seco-Esperanza (R-19/20)	5,723	4.39
Esperanza-Verrugas (R-20/21)	6,373	4.50
Verrugas-Huacre (R-21/23)	4,863	4.76
Linday-Yamajune (R-22/27)	5,077	4.47
Chacamaza-Barranco (R-26/29)	482	1.02
Chucumayo-Chacahuaro (R-31/33)	1,124	3.50
Parac-Rio Blanco (R-37-40)	2,340	8.92
Confluence-Alcula (S-¯/4)	114	9.30
Cashahuacra-Redonda (S-1/2)	429	3.02
Redonda-Infiernillo (S-2/3)	345	2.86

Table X-11-1 Proposed Project for Debris Flow and Slope Failure Disaster Prevention

Description of Project Areas		Type of Stru. Plan	Proposed Main Structures						Economic Project Cost (x 10 US$)	EIRR (%)
			Dam (No.)	Channel Works (km)	Dike (km)	Bridge (No.)	Tunnel (No.)	Retaining Wall (km)		
(A) Group A (First Priority)										
(a) Oda Area	: 7 areas									
R-6	Q. Quirio	A1	2	1.8	-	2	-	-	8,623.4	5.25
R-7	Q. Pedregal	A1	3	1.9	-	2	-	-	11,649.4	5.65
R-8	Q. Carosio	A2	1	0.3	-	1	-	-	1,432.7	9.85
R-9	Q. Corrales	A2	2	0.2	-	-	1	-	3,054.5	6.02
R-19	Q. Rio Seco	B1	-	-	1.5	2	2	-	3,145.9	10.12
R-32	Q. Paihua	C	2	-	0.5	-	-	-	6,442.1	5.09
S-1	Q. Cashahuacra	B2	1	0.4	12.5	1	-	-	3,057.4	4.15
(b) Spe Area	: None									
(B) Group B (Second Priority)										
(a) Oda Area	: 23 areas									
R-1	Q. Chacracayo	A1	3	3.3	-	-	-	-	9,448.2	8.99
R-2	Q. Chacrasana	A1	1	1.1	-	-	-	-	4,534.0	3.19
R-3	Q. California	A1	1	1.3	-	-	-	-	8,101.6	4.79
R-4	Q. Santa Maria	A1	1	1.0	-	-	-	-	4,436.3	3.39
R-5	Q. La Cantuta	A1	3	1.2	-	-	-	-	14,465.5	-0.24
R-10	Q. La Ronda	A1	4	1.3	-	-	-	-	8,677.1	2.31
R-11	Q. Santa Ana	B1	-	0.4	0.6	1	-	-	2,071.4	11.54
R-13	Q. Cupiche	B1	-	0.4	0.5	1	-	-	1,427.8	12.79
R-15	Q. Canchacalla	C	5	0.5	0.5	-	-	-	27,160.9	-2.09
R-16	Q. Guayabo	B2	2	0.4	-	1	-	-	1,101.2	14.94
R-17	Q. Agua Salada	B1	-	0.5	0.5	1	-	-	1,760.4	10.90
R-18	Q. Esperanza	B1	-	-	0.4	1	-	-	1,184.8	14.30
R-23	Q. Huacre	B1	-	0.5	0.5	-	-	-	575.6	3.75
R-24	Q. Malata	B1	-	0.5	0.5	1	-	-	1,135.1	3.71
R-25	Q. Cuchimachay	A1	2	1.1	-	1	-	-	2,946.7	2.90
R-31	Q. Chucumayo	B2	1	0.7	1.6	1	-	-	2,818.1	8.45
R-33	Q. Chacahuaro	B2	1	0.3	-	-	-	-	428.6	17.90
R-34	Q. Pancha	C	3	0.5	-	-	-	-	7,976.9	-1.07
R-35	Q. Viso	C	2	0.5	-	-	-	-	2,404.1	3.96
R-37	Q. Parac	C	3	0.3	-	-	-	-	15,033.6	-0.89
S-2	Q. Redonda	B2	1	1.3	1.3	1	-	-	1,959.7	4.12
S-3	Q. Infiernilla	B1	-	0.4	0.4	-	-	-	1,028.2	5.07
S-5	Q. Lucuma	B1	-	0.9	0.9	1	-	-	1,093.0	4.73
(b) Spe Area	: 24 areas									
R--/0	River mouth - Jicamarca	-	-	-	-	-	-	15.0	15,535	0.68
R--/1	River mouth - Chacracayo	-	-	-	-	-	-	18.0	19,077	-0.04
R-0/2	Jicamarca - Chacrasana	-	-	-	-	-	-	2.0	2,453	-
R-1/3	Chacracayo - California	-	-	-	-	-	-	0.05	52	13.67
R-4/6	Santa Maria - Ronda	-	-	-	-	-	-	0.11	114	-2.42
R-6/7	Quirio - Pedregal	-	-	-	-	-	-	1.5	1,558	-4.06
R-7/8	Pedregal - Carosio	-	-	-	-	-	-	0.68	706	0.15
R-8/9	Carosio - Corrales	-	-	-	-	-	-	0.2	207	2.29
R-9/-*	Corrales - Confluence	-	-	-	-	-	-	0.2	207	0.45
R-10/-	La Ronda - Confluence	-	-	-	-	-	-	0.04	41	6.68
R--/11	Confluence - Santa Ana	-	-	-	-	-	-	0.32	333	6.23
R--/12	Confluence - San Juan	-	-	-	-	1	3	0.08	83	10.64
R-11/13	Santa Ana - Cupiche	-	-	-	-	-	7	0	3,319	5.22
R-13/16	Cupiche - Guayabo	-	-	-	-	-	2	0.66	4,049	3.64
R-16/17	Guayabo - Agua Salada	-	-	-	-	2	8	0	2,157	3.46
R-19/20	Rio Seco - Esperanza	-	-	-	-	2	13	0.05	5,723	4.39
R-20/21	Esperanza - Verrugas	-	-	-	-	2	8	0.01	6,373	4.50
R-21/23	Verrugas - Huacre	-	-	-	-	1	2	0.08	4,863	4.76
R-22/27	Linday - Yamajune	-	-	-	-	-	7	0.04	5,077	4.47
R-26/29	Chacamaza - Barranco	-	-	-	-	-	3	0.04	482	1.02
R-31/33	Chucumayo - Chacahuaro	-	-	-	-	4	4	0.9	1,124	3.50
R-37/40	Parac - R. Blanco	-	-	-	-	-	-	1.12	2,340	8.92
S--/4	Confluence - Alcula	-	-	-	-	-	-	0.11	114	9.30
S-1/2	Cashajuacra - Redonda	-	-	-	-	1	5	0.11	429	3.02
S-2/3	Redonda - Infiernilla	-	-	-	-	-	4	0.09	345	2.86

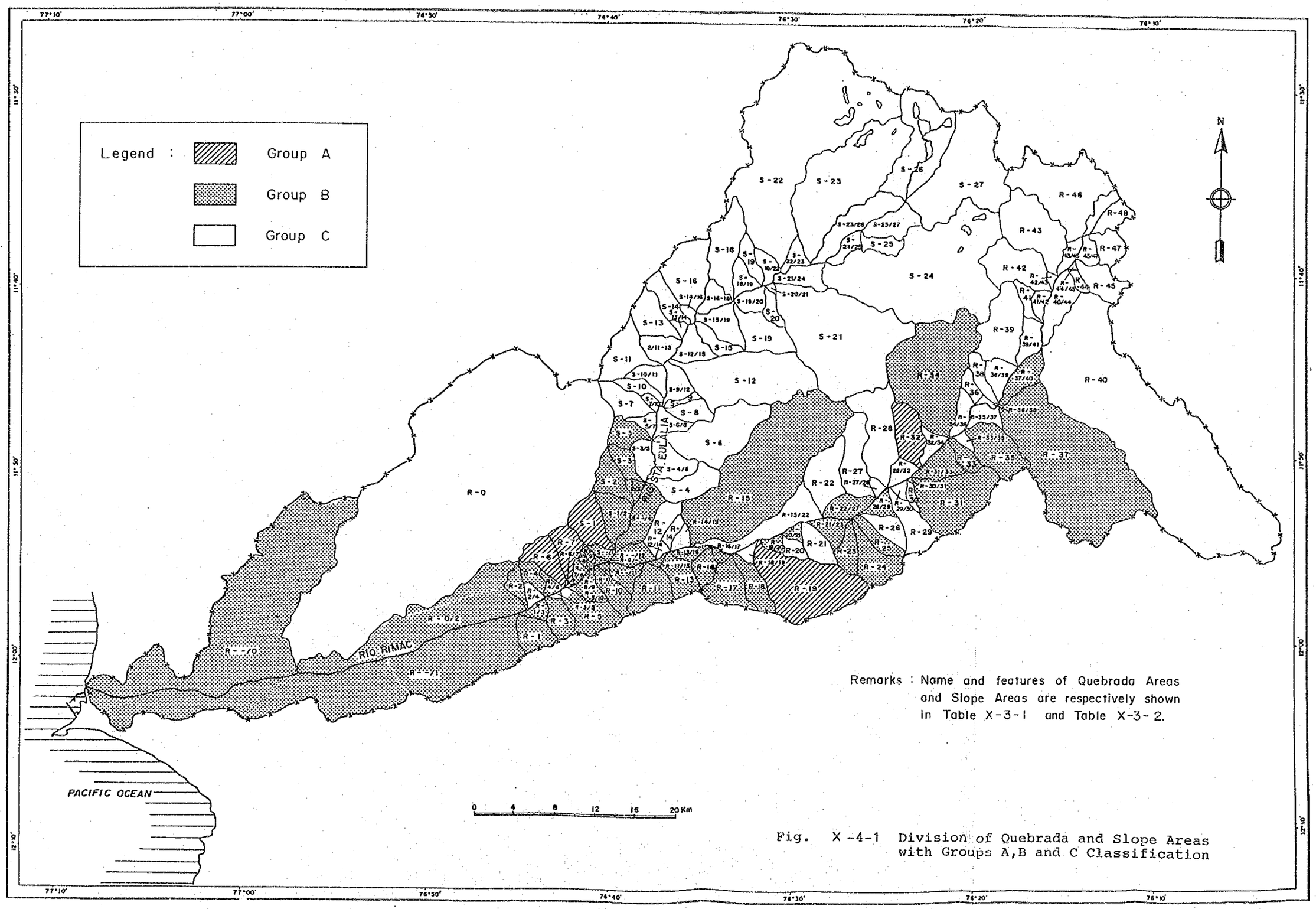
* Including S--/1 Confluence - Cashahuacra

Figures



Remarks : Name and features of Quebrada Areas and Slope Areas are respectively shown in Table X-3-1 and Table X-3-2.

Fig. X-2-1 Division of Quebrada and Slope Areas



Remarks : Name and features of Quebrada Areas and Slope Areas are respectively shown in Table X-3-1 and Table X-3-2.

Fig. X-4-1 Division of Quebrada and Slope Areas with Groups A,B and C Classification

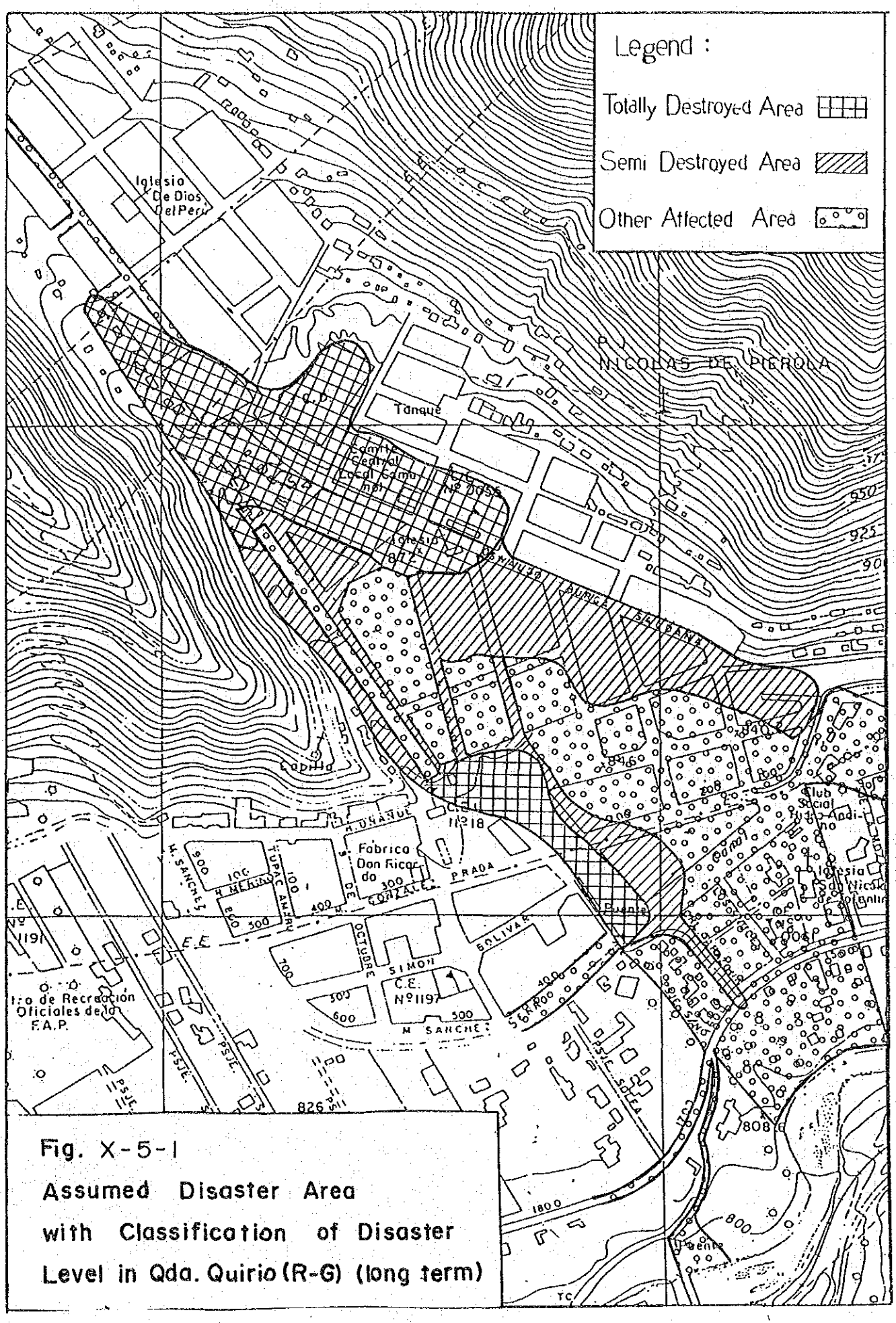


Fig. X-5-1

Assumed Disaster Area with Classification of Disaster Level in Qda. Quirio (R-G) (long term)

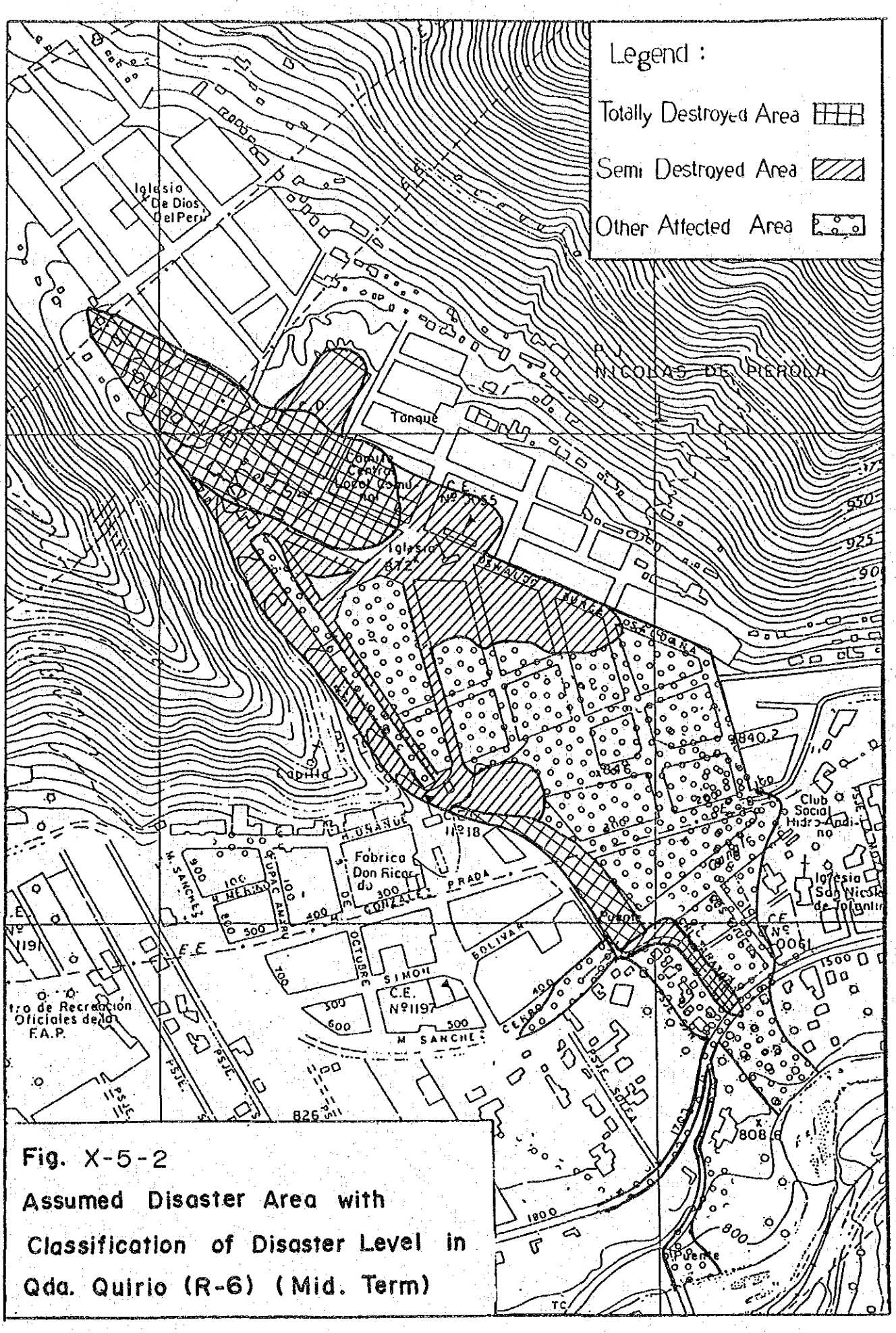


Fig. X-5-2
Assumed Disaster Area with Classification of Disaster Level in Qda. Quirio (R-6) (Mid. Term)

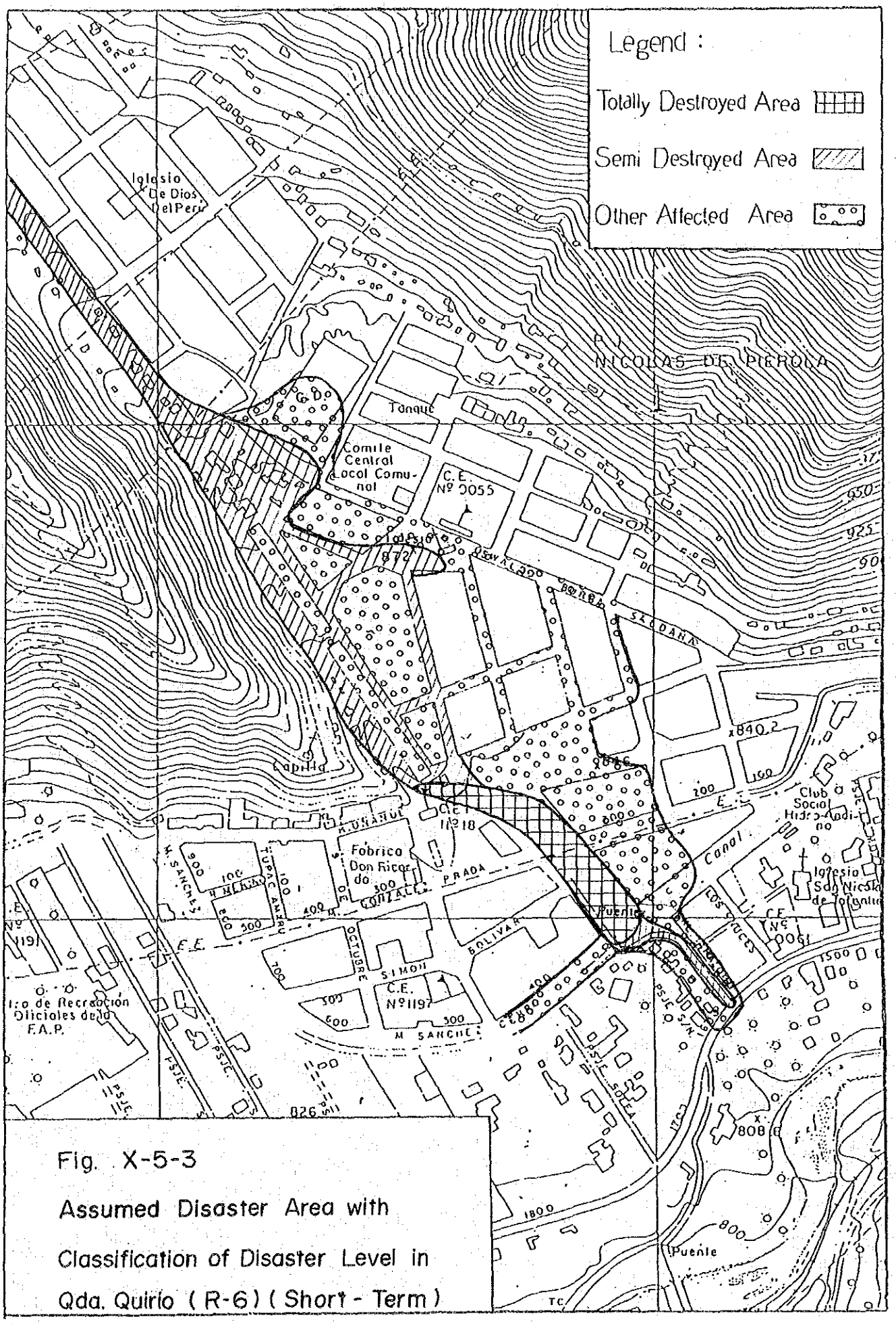


Fig. X-5-3

Assumed Disaster Area with Classification of Disaster Level in Qda. Quirlo (R-6) (Short - Term)

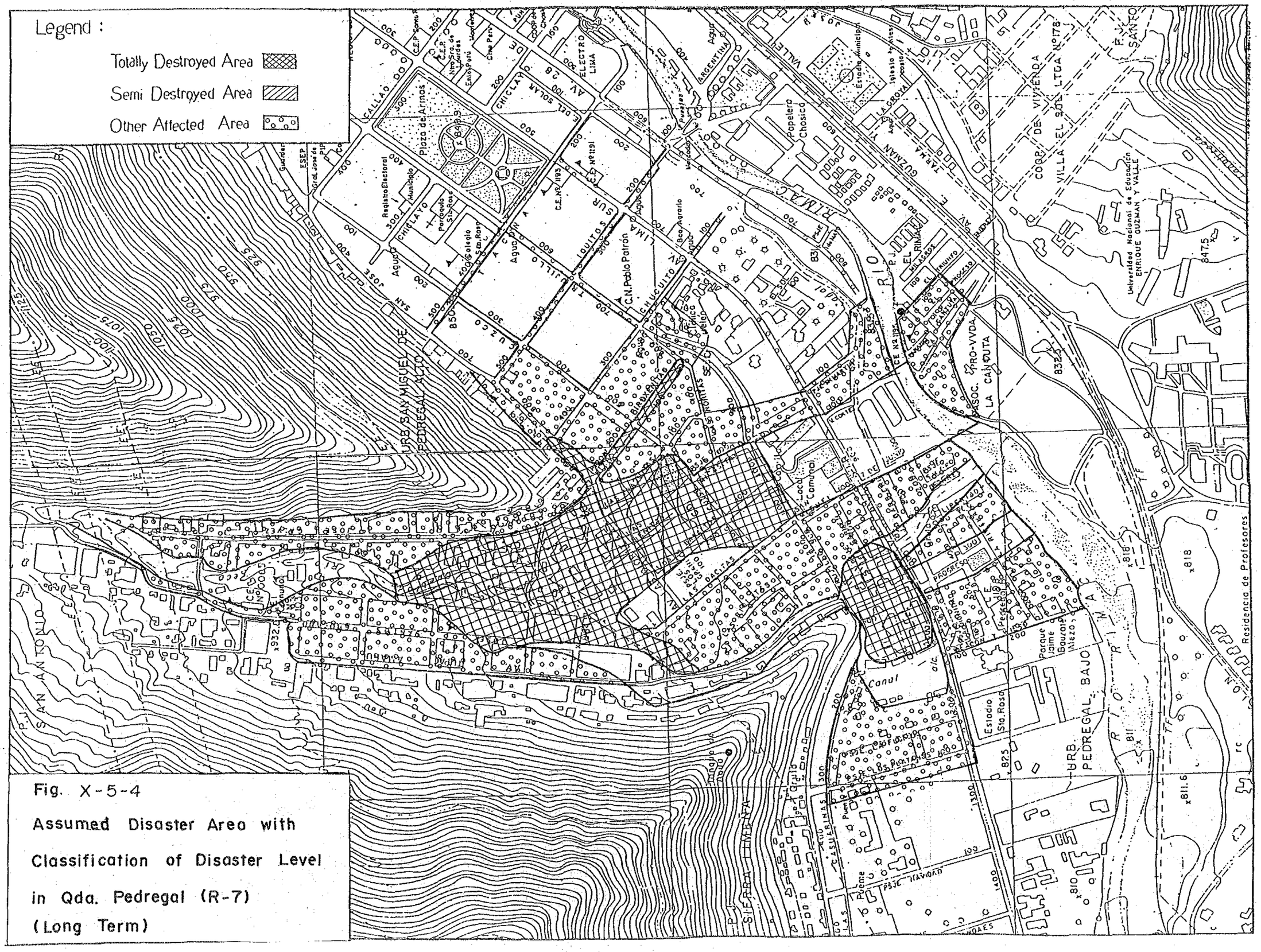


Fig. X-5-4
Assumed Disaster Area with Classification of Disaster Level in Qda. Pedregal (R-7)
(Long Term)