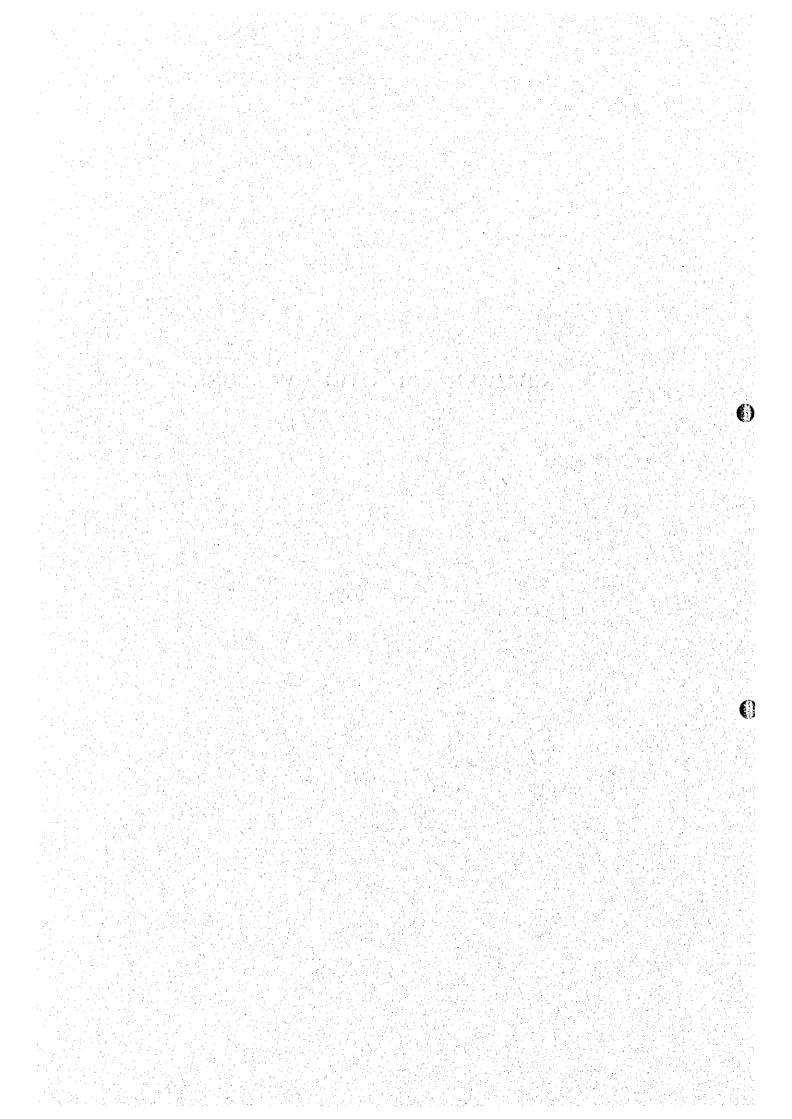
# **CHAPTER- VIII OTHER MEASURES**

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## **CHAPTER -- VIII**

## **OTHER MEASURES**

## 1. BOTTOM SEDIMENT DREDGING

#### 1.1 OUTLINE

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In this section, the dredging and disposal method of the accumulated organic sediment in the Interior Puno Bay is examined for the water quality improvement.

and a second	
Dredging Area	2,200,000m2
Dredging Volume	660,000m3
Dredging Elevation	1.3 m to 3.5m below water level
Thickness	0.3m
Discharge Length	1,500m maximum
Nature of the soil	organic silt and clay with fine sand
Disposal Method	
Primary	Desiccation at temporary disposal area
Finally	Dumping to final disposal area
<b>Construction Period</b>	After completion of the city sewage treatment system
	construction (2010 to 2021)

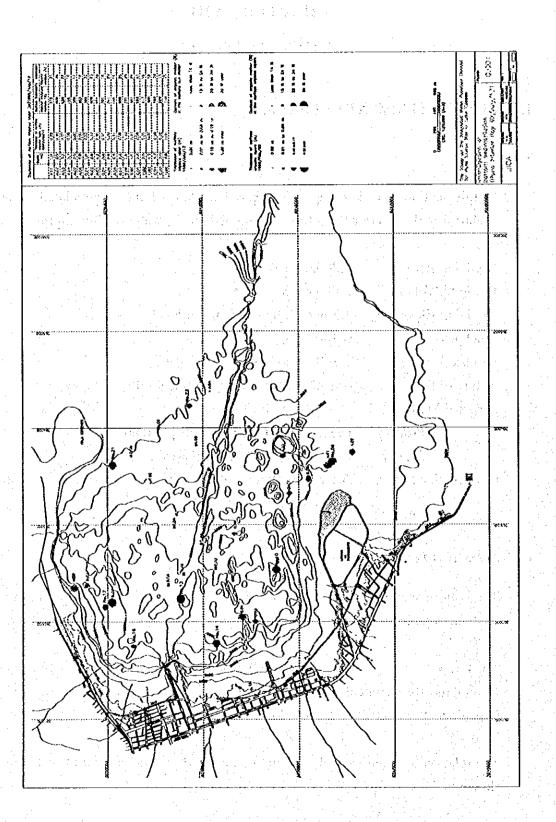
#### 1.2 EXAMINATION OF ACCUMULATED SEDIMENT

The bottom sediment was corrected in July 1999, the thickness, natural moisture content, organic matter content was measured at a site and the PELT laboratory.

Thickness	0.00m to 0.22 m
Natural moisture content	166% to 993 %
Organic matter content	10% to 41 %

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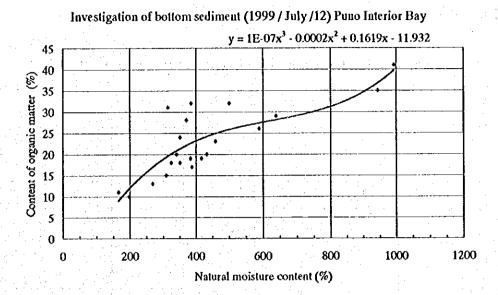
The relation between natural moisture content and organic content of materials is shown in the next figure.



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FigureVIII.1.1 Investigation of bottom sediment



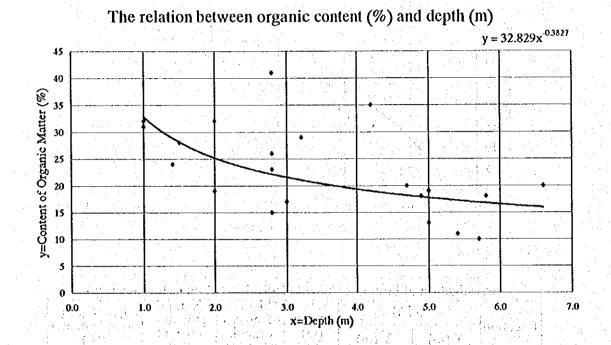
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Investigation of bottom sediment (1999/July/12 Puno Interior Bay)							
Location	UTM		Depth	Thickness of surface	Natural moisture	Content of organic matter	
Location	X (m)	<b>Y (m)</b>	(m)	organic layer (m)	content (%)	(%)	
A.01	393,620	8,247,691	1.0	0.22	315	31	
A.02	393,745	8,347,439	2.0	0.10	500	32	
A.03	393,702	8,248,161	3.2	0.07	638	29	
A.04	394,377	8,248,927	5.7	0.00	198	10	
A.05	393,816	8,249,070	3.0	0.00	388	17	
A.06	393,984	8,249,466	2.0	0.00	383	19	
B.01	392,354	8,250,354	1.0	0.22	385	32	
B.02	392,381	8,250,218	2.8	0.13	459	23	
B.03	392,194	8,249,953	4.2	0.20	944	35	
B.04	392,379	8,249,365	5.8	0.01	351	18	
B.05	392,488	8,249,203	6.6	0.05	341	20	
<b>B.06</b>	392,915	8,248,665	5.4	0.11	166	11	
B.07	393,311	8,248,097	2.8	0.08	589	26	
B.08	393,470	8,247,896	1.5	0.10	371	28	
C.00	392,006	8,248,448	1.4	0.10	351	24	
C.01	392,031	8,248,591	2.8	0.05	993	41	
C.02	392,547	8,248,867	5.0	0.01	417	19	
C.03	392,796	8,249,019	4.9	0.00	325	18	
C.04	392,964	8,249,301	4.7	0.00	433	20	
C.05	393,427	8,249,552	5.0	0.00	269	13	
C.06	393,706	8,249,754	2.8	0.00	310	15	

(The sampling points show it in Figure D. 001)

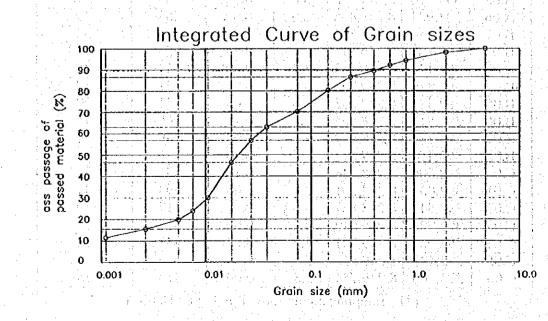
The next figure is expressing the relation between the water depth and organic matter content and there is an increase trend of organic matter content from the depth of 3.5m to shallower.



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The next figure shows the grain size distribution of organic sediment.



#### 1.3 THE TRANSPARENCY SURVEY OF INTERIOR BAY

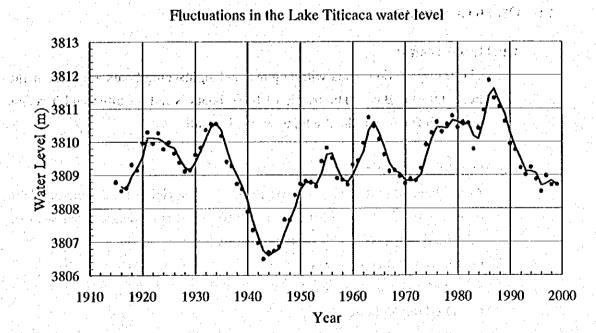
The transparency of the interior bay was investigated on the same day of bottom sediment sampling. The transparency was about 1.0m at the public pier neighborhood and 0.6 m to 0.8 m at the Espinar wastewater treatment plant neighborhood.

#### 1.4 NATURAL CONDITIONS OF THE PUNO INTERIOR BAY

#### 1.4.1 Water Level

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The fluctuations of water level of the Lake Titicaca after 1915 are as the next figure. The lowest water level is 3,806.17 m and the highest water level is 3,812.48 m.



### 1.4.2 Wind velocity and directions

According to the wind statistics data for the period June 1995 to May 1996,

- there is little strong wind that gives the bad influence to the dredging work.

#### 1.4.3 Current

There is very little flow in the Puno Interior Bay area except dredged channel.

#### 1.4.4 Wave

There is few occurrence of waves that give the bad influence to the dredging work in the Puno Interior Bay that the.

#### 1.4.5 Impact by altitude condition

The atmospheric pressure at Puno is 61.2% of the sea level, which causes the low oxygen density in the air. In the planning of the construction method and estimating of the construction cost, it shall be considered that the influence of the low oxygen density to the efficiency of an engine and an air compressor.

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#### **1.5 OTHER CONDITIONS**

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#### 1.5.1 Lake Traffic

The transportation boats with engines and sightseeing boats are main at the Puno Interior Bay. The traffic of these boats is not so often and it seems that the influence to the dredging works is small.

#### 1.5.2 Dredging License

At the Puno Bay the "Captania de Puno" has the right of dredging and lake transportation. The main items of the technical specification that shall be submitted to the "Captania de Puno" are as follows:

Proposed dredging area

Method of dredging work

Dredging volume

Proposed disposal area

Drawings (Scale=1:5,000 include UTM and geographical coordinate)

Drawings of dredging area (1:1,000)

Drawings of disposal area (1:1,000)

The environmental impact assessment according as DICAPI guideline.

#### 1.5.3 Local materials and equipment

The following material and equipment are available in the Peru.

Puno City or periphery area.

Cement, Fuel, Dumping truck, Trailer truck etc.

Lima city and the periphery area Large crane, Trailer truck etc.

#### 1.5.4 Temporary disposal area (Temporary sedimentation pond)

There is a development plan by PELT in the west and north coast of the Puno interior bay. In the coast area of Puno Interior Bay there is no suitable space except above-mentioned area to be used as the temporary sedimentation pond area. The topographic survey was performed in July 1999 at the proposed park and green zone of above. The elevations of these areas are between 3809m and 3811m and the total area is approximately 200,000 m2. JICA recommends that these proposed park and green zone should be used as the temporary sedimentation pond area.

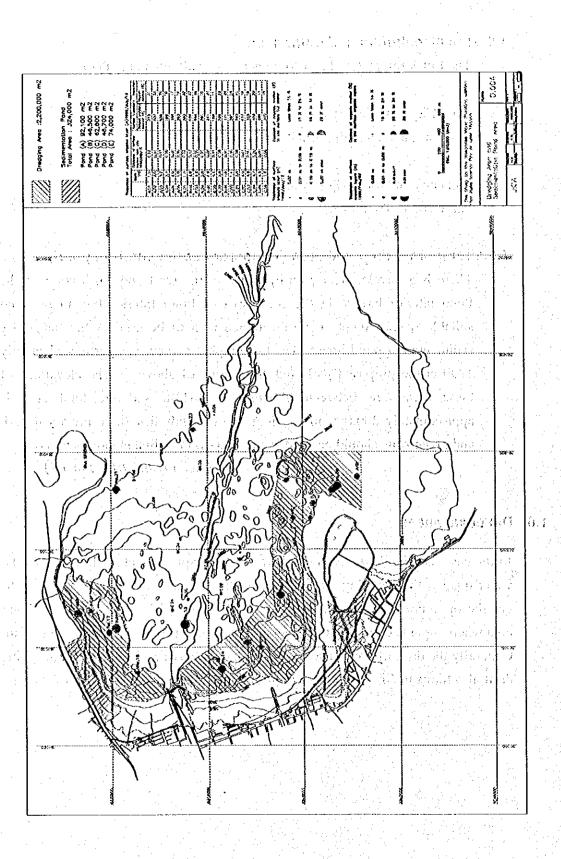
(See FigureVIII.1.3 and 4)

#### 1.6 DREDGING AREAS

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In the case that the dredging is employed as the improvement method of the lake water quality, the dredging area and the thickness must be selected attentively to get the optimum cost-effectiveness. In this study JICA selected a dredging area where organic content rate is over 20%. The depth of this area is over 3.5m. Generally the draft of bottom sediment dredger is between 1.2m and 1.5m. This draft also limits the dredging area. *FigureVIII.1.2* shows the dredging area.

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FigureVIII.1.2 Dredging area

#### **1.7 CONSTRUCTION PERIOD**

In this study, the wastewater treatment plant is planed to construct and the target year is around 2008. JICA considered that the dredging work shall be carried out after the completion of the sewage treatment system.

#### **1.8 DREDGING VOLUME**

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According to the measuring result carried out in July 1999, the thickness of the organic sediment was less than 0.3 m. The minimum dredging thickness is around 0.3 m even the updated bottom sediment dredging technology. For the cost estimation work, it is employed that the 2,200,000m2 of dredging area and the 660,000m3 of dredging volume.

#### **1.9 SELECTION OF THE DREDGER**

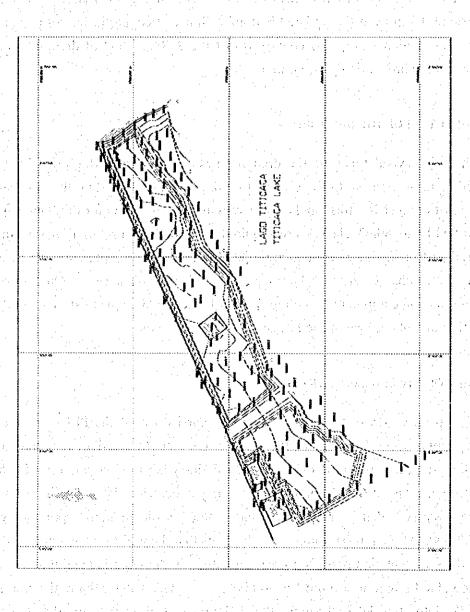
There is several types of the dredging system in portable high-density bottom sediment dredger. In the case that dredging thickness is thin, the most suitable type of dredger is a turn bucket type system dredger. As for dredging capacity, 100m3/hr to 80m3 classes are required. To the transportation system from dredger to temporary sedimentation pond it is required air pressure energy add to pump discharge energy because of discharge distance. Output of the construction equipment including dredger fleet should be planned as about 85% of rating output because of the low oxygen density atmosphere.

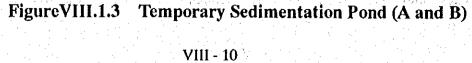
#### **1.10 TEMPORARY SEDIMENTATION POND**

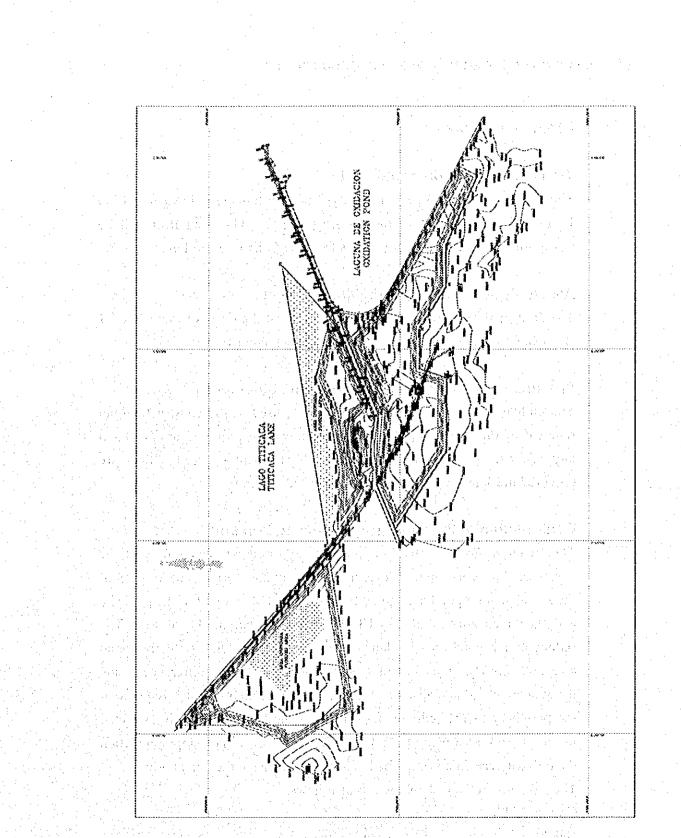
The specific gravity test of sediment was carried out at the PELT laboratory in September 1999. Supposing the moisture content of the sediment at lake floor as 500% and the apparent density of dredged slurry is supposed about 60% with the average. The moisture content of the slurry becomes 864%. The volumes of sedimentation into the pond 👘 become the ... slurry that are sent 660,000m3/0.6=1,100,000m3. It seems that the moisture content of sediment at the sedimentation pond is decreasing within dredging period and it assumes that the value became to around 550 to 600%. The water volume that can return back into the lake through the temporary spillway from the temporary

sedimentation pond during dredging work will be around 320,000m3 to 380,000m3. The volume of sediment that stays behind to temporary sedimentation pond is estimated 720,000 to 780,000m3. The total area of the temporary sedimentation pond is 200,000m2. The average height of the embankment required 4.3m according to the following calculation. 200,000m2\*(3.8m+0.5m)=760,000m3. In the cost estimation of final disposal work it is assumed that the moisture content of the sediment become to around 400% after 2 to 3 years later from completion of dredging work because of the high evaporation atmosphere of this site.

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FigureVIII.1.4 Temporary Sedimentation Pond (C, D and E)

#### 1.11 DREDGING CONSTRUCTION WORK EXECUTION PLAN

#### 1.11.1 Temporary works

#### Transportation of dredging fleet

The dredging fleet will be portable type and be transported as cargo from Japan or Europe including the discharge pipes. Dredging fleet will be transported on 13 tons capacity tracks from the Callao port to Puno.

#### Assembly, dismantling of the dredger fleet

The dredger fleet is assembled and dismantled at the coast of Puno Interior Bay using two numbers of 50 tons capacity track cranes. 60

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#### Procurement of a general construction equipment

The bulldozer, dumping truck, backhoe etc., used to the construction and removal of the temporary sedimentation pond, are procured around Puno city. While the crane, backhoe, used assembly dismantling dredger fleet, are procured in Lima periphery and be transported to Puno.

#### Construction of the temporary sedimentation pond

The temporary sedimentation pond(s) of dredged material will be constructed prior to commencement of the dredging work. The location of the sedimentation pond is planned to be constructed at a part of the park site and the green zone of the PELT development plan in the future. The sedimentation pond area is planed that area of 324,000m2 (effective pond area 200,000m2), embankment length of 6,000m, height difference inside the area about 3,0 m, capacity 760,000m3. The embankment is required at the periphery of the sedimentation pond. The bank material is extracted inside of bank area using 0.7m3 capacity backhoe. For slope protection the polyethylene film is stretched onto the slope inside the bank body. The structure of the embankment is as follows.

Crown Width 5m Height 1.5~5.3m Slope gradient 1:2

#### **Temporary Spill Way**

The temporary spillway is constructed to each sedimentation pond to discharge surplus water from pond into the lake. For control of the return water suspended solids concentration (SS) the temporary spillway should have the structure that is able to adjust the height of the accumulated water level. The weir for the water level adjustment is made by wooden material and polyethylene sheet. The drainpipe is constructed using steel pipe or synthetic resins pipes.

#### **Discharge Pipeline**

The dredged material from the dredger is conveyed to the sedimentation pond through the discharge pipeline. The constitution of the discharge pipeline is as follows.

#### **Floating Pipeline**

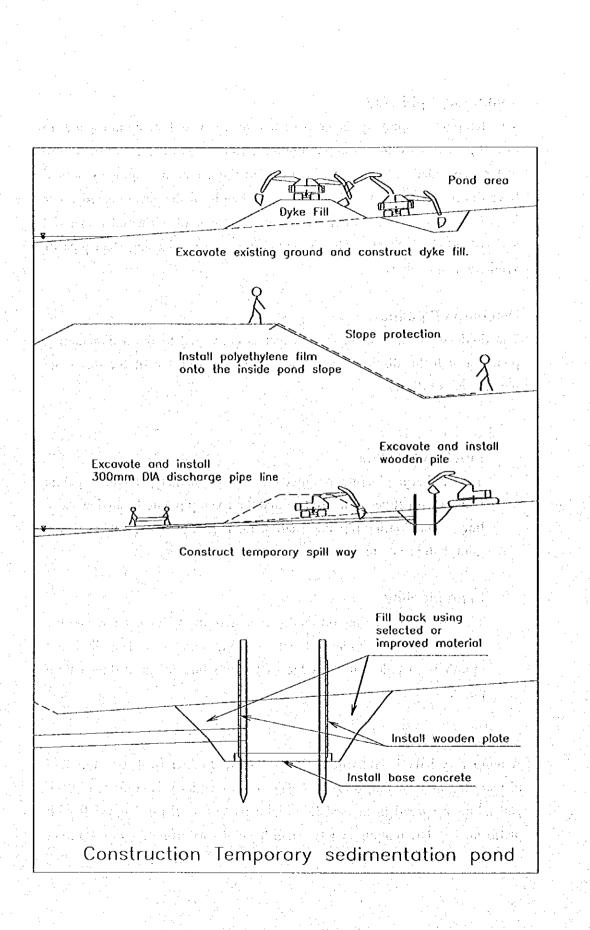
The discharge pipeline mounted on the float, namely, floating pipeline is installed between the dredger and the fixed pipeline located at shore line. The floating pipeline shall be made flexible using rubber sleeve joint, ball joint, etc.

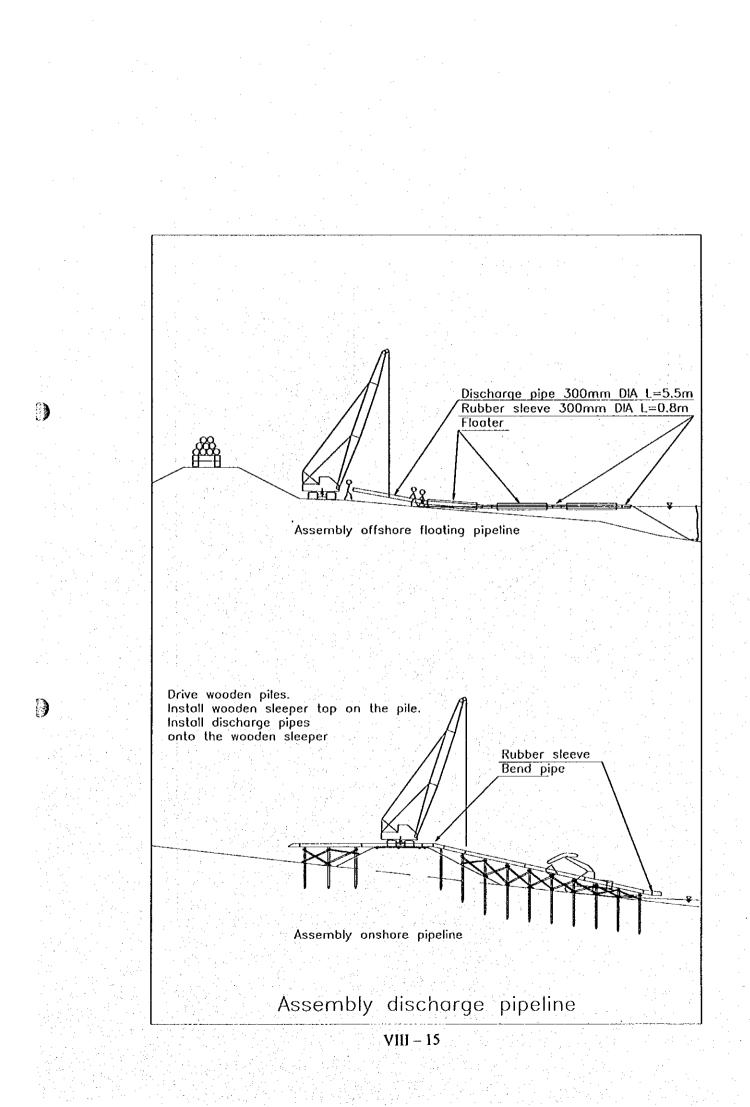
### Land pipeline

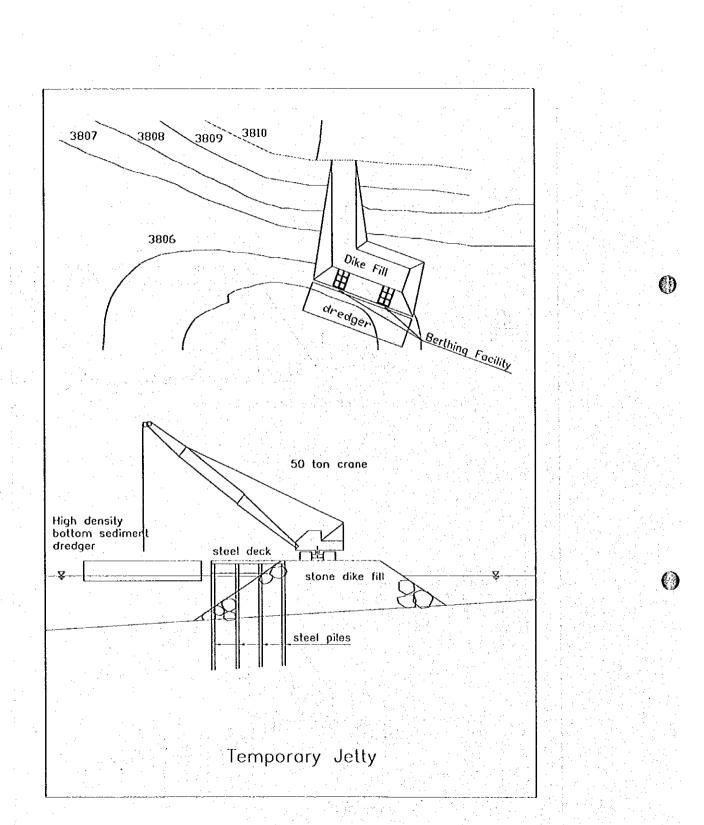
The discharge pipeline on land is mounted on the fixed flame and the lakeside edge is connected with floating pipeline. The discharge mouth is installed at the edge of the pipeline in the sedimentation pond.

#### **Temporary Jetty**

A temporary jetty is constructed to use of the dredger fleet assembly and dismantling and loading fuel etc. The temporary jetty is consisted of the embankment spread from landslide and a part of steel pile quaywall with platform. The temporary jetty shall have at least 10m\*30m of working space and the depth of minimum 2m in front of the working space.







#### 1.11.2 Main work

#### Dredging

The dredger will be employed the turn bucket type high density bottom sediment dredger. Operation hour is 18 hours/day and the dredger crew works in two shifts of nine hours.

#### Transportation of dredged material

The dredged material will be transported through the 300mm-diameter steel made discharge pipeline by the discharge pump and compressed air.

#### Maintenance of the temporary sedimentation pond

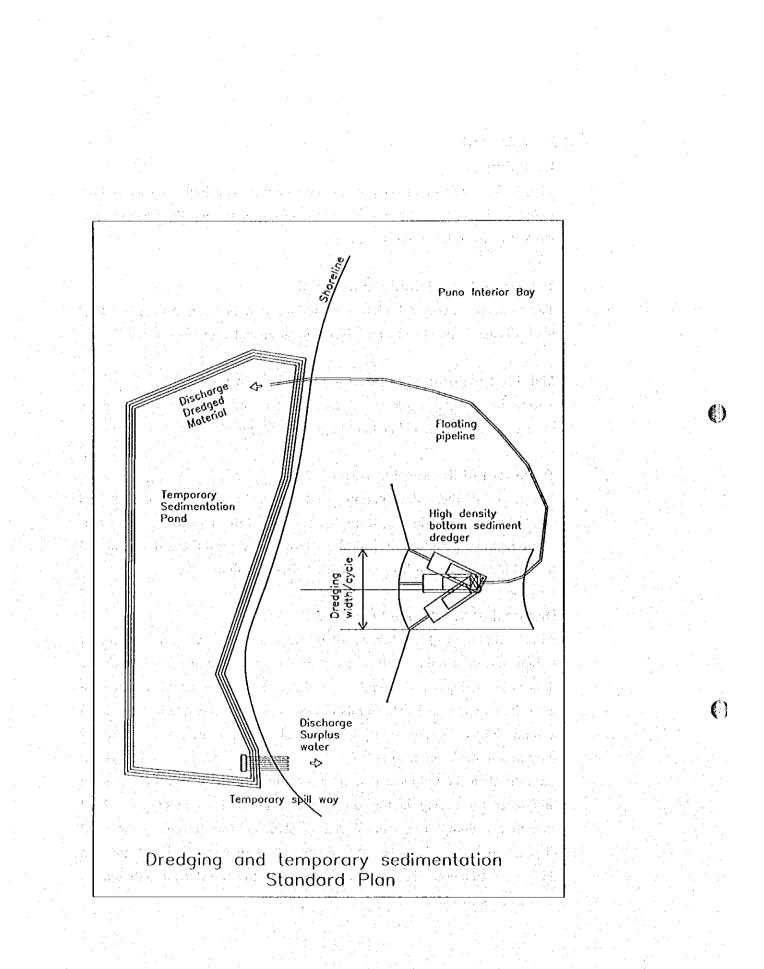
Within the dredging work period the temporary sedimentation pond and the discharge pipeline should be kept in good condition.

#### Treatment of the surplus water

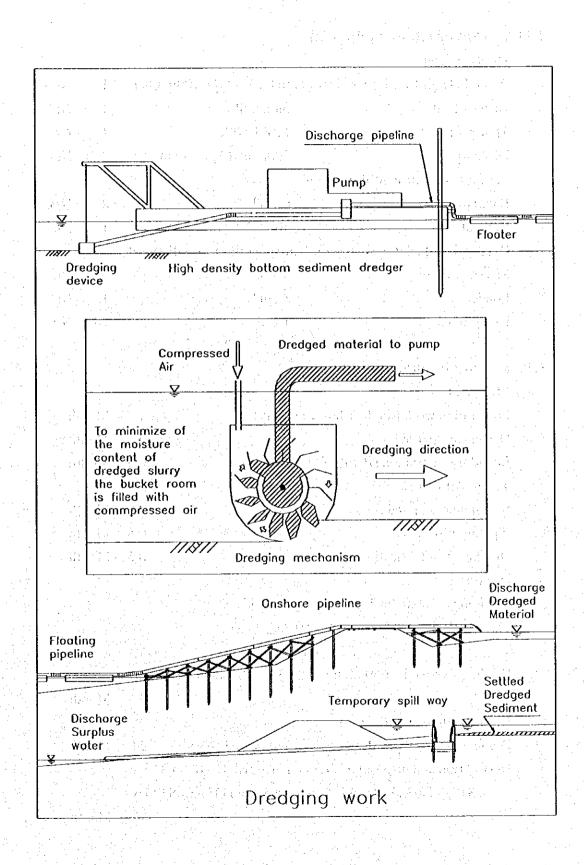
The slurry in the sedimentation pond is separated to the sediment and surplus water while flowing from discharge point to spill way. The weir of the temporary spillway should be adjusted to control the water level and the turbidity of the surplus water, which discharge to the lake.

#### **Disposal of the dredged material**

After completion of discharges all of surplus water, the surface layer of sedimentation should be turn over and excavate drainage channel for desiccation using marsh backhoe. After 2 years of above desiccation work it is expected that the moisture content of sediment will became to around 400%. For transport to final disposal area it is required furthermore desiccation work. Some parts of the dyke fill will be opened carefully then the sediment that flew out from the pond shall be spread in thin layer for drying in the sun. The desiccated sediment after dried enough for dump truck transportation shall be transferred to the final disposal area where is supposed to be near the sedimentation pond site. In the cost estimation, the moisture content of the transferred sediment is estimated as around 200%.







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## 1.11.3 Construction equipment

Dredger fleet			
Portable High Density Dredger (1	`urn bucket type 100m3/hr)	1	Nr
Anchor boat	3ton 60PS	1	Nr.
Transport boat	FRP D50PS	1	Nr.
Discharge pipe	300mmDIA, L=5.5m	300	Nrs.
Temporary sedimentation pond			
Backhoe	0.7m3	2	Nrs.
Generator	50KVA	1	Nr.
Dredged material desiccation, t	ransportation and disposal		vill Nev System Nev System
Marsh backhoe	0.4m3	1	Nr.
Loader	3.3m3	1	Nr.
Dump track	10m3	10	Nrs.

#### 1.11.4 Construction period

Mobilization	
Preparation work (dredger home country) 1 M	onth
Ocean transportation 2 M	onth
Inland transportation (Peru) 0.5 M	onth
Temporary work	
Sedimentation pond 21 M	onth
Pipeline installation 0.5 M	onth
Dredger fleet fabrication 0.5 M	onth
Dredging	

Dredging 660,000m3/650m3/day=1,015days

1,015days/20days/month=50.75

#### 51 Month

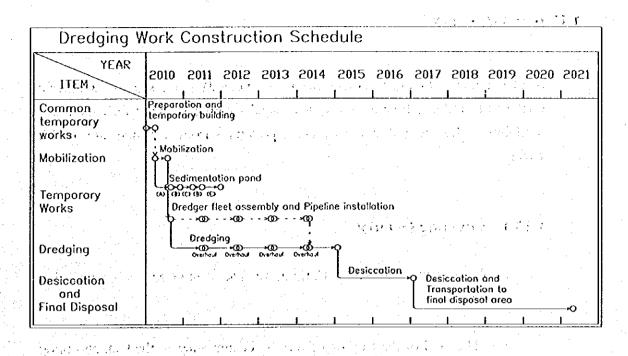
Deadage gugehoul	660 000 m 2/50 m 2/h = /2	OOOL A A A Lines	
Dreuger overnauf	660,000m3/50m3/hr/3	,000ms=4.4=4 nmcs	÷.,

3 Month

### Dredged material disposal

Dredged material pre-desiccation 540,000m3 24 Month Desiccation and disposal of dredged material 310,000m3 310,000m3/(10 tracks\*6 times/day\* 6m3/time)=847days

56 Month



## 1.12 COST ESTIMATION

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## 1.12.1 Condition of the estimation

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Construction period	2010 to 2016
Dredging volume	660,000m3
Discharge distance	Maximum 1,500m
Dredging depth	1.3m to 3.5m
Dredging thickness	0.3m
Shape of the dredging area	normal
Scattering of the dredging area Lake weather condition	normal normal
Obstruction Restrictions to the construction	normal non
Soil condition	Organic Silt Cray

## 1.12.2 Construction Cost

The construction cost of dredging work is as follows.Total in S/.120,436,000S/.

### **1.13 ALTERNATE PLAN**

Sand capping onto the sediment (covering method) is chosen as an alternate method of dredging because the cost of sand capping is lower than the one of dredging. This method aims to prevent pollutants from releasing into the lake water.

#### 1.13.1 Covering Material

As the covering material the Cotimbo river sand and Charcas beach sand are examined.

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The sand of the Cutimbo River is accumulating to the Cutimbo bridge periphery that locates 21 km (0.5 hrs drive) from Puno to the south. There is the place where the fine sand suitable as covering material is accumulating. But the quantity is being limited therefore it is required to use the sieved sand from gravel mixture material.

Charcas beach sand is fine sand and not necessary to sieve. It is suitable to extract by sand pump from the lake and the transport by the hopper barge.

Other than the above two points, it is available silty sand in the Puno Interior Bay.

## 1.13.2 Construction Method and construction equipment

a) Cutimbo River sand

In the case that the Cutimbo River sand is used, following method combination is appropriate.

Extraction

Tire shovel and 1/2 inch sieve

Onshore transportation

Dump track

- Floating pipeline and sand pump
- Offshore transportation Sprinkling
- Floating pipeline and sand pump

The maximum total length of offshore transportation by floating pipeline is

restricted due to total loss water head by frictional resistance in the pipeline, and in this case the 500m of total discharge length is the economical limits.

The proposed construction equipment is as follows;

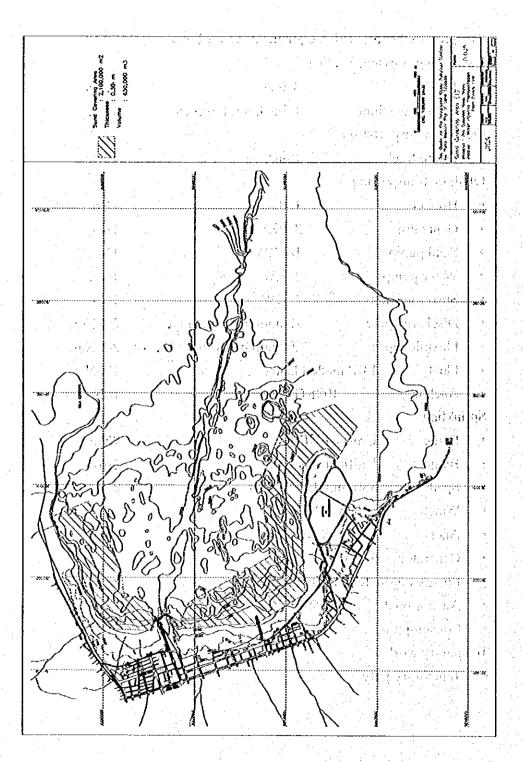
Excavating, sieving, loading

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•	Loader	3.3m3	2Nos.
•	Sorting machine	1/2inch mesh screen	1No.
On	shore transportation		
•	Dump track	15m3	10Nos.
Ōf	fshore transporting		
•	Hopper	100m3	1No.
•	Generator	300KVA	1No.
•	Sand pump	180KW	1No.
•	Water pump	22KW	1No.
•	Stirrer machine	22KW	1No.
•	Discharge pipe	200mmDIA steel pipe	200Nos.
•	Flexible pipes	200mmDIA Rubber Sleeve	200Nos.
•	Float FRP mad	le Floater	100Nos.
•	Anchor 100	)KG	10Nos.
Sp	rinkling		
•	Barge Unifloat	UF-1A	7Nos.
•	Barge Unifloat	UF-1AS	2Nos.
•	Spad 350mmD	0IA*10m	2Nos.
•	Winch 15KW*	1.8Ton	2Nos.
•	Anchor 500	)KG	2Nos.
•	Generator 50KVA		1No.
•	Energy dissipater, Ben	d pipe etc.	LS.
•	Anchor boat 1T	50PS	1No.
•	Consumption		LS
Tei	nporary work		
•	Temporary jetty		LS
$\mathcal{L}_{\mathcal{L}}$			

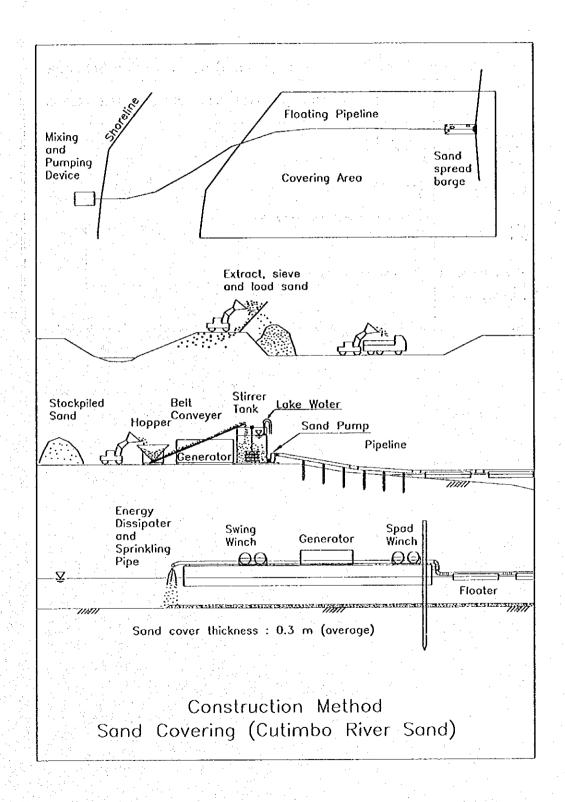
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Figure VIII.1.5 Sand Covering Area (Cutimbo River Sand)



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YEAR	S010	2011	2015	2013 I	2014	2015 I	2016	2017	2018	2019	1 5050	1 2051
Common temporary works Mobilization Temporary Works Extract, transport	tempor po Mobi	ation and ory build lization and sprii Extract,	ling nkling pl			ismantle y šond						
and sprinkling Sand			•		1	1		•		1	 _	

## b) Charcas Beach sand

In the case that the Charcas Beach sand is used, following method combination is appropriate.

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٠	Extraction	Sand Pump Barge
•	Offshore transportation	Hopper barge and tug boat
•	Sprinkling	Sand Pump Barge and another states and a

The proposed construction equipment is as follows; Extract and loading

		•	
•	Barge	Unifloat UF-1A	7Nos.
•	Barge	Unifloat UF-1AS	2 Nos.
•	Spad	350mmDIA* 1 0 m	2 Nos.
•	Winch	15KW*1.8Ton	er de la set <b>3 Nos.</b> El se
•	Anchor	500KG	2 Nos.
• ,	Generator	150KVA	1 Nos.
•	Sand pump	75KW	1 Nos.
•	Plumbing n	naterial	1 Nos.
•	Anchor boa	t 1T 50PS	and the <b>1 Nos.</b> The second
•	Consumptio	on Million (1996) - Alexandria (19	1 Nos.

#### Transport

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•.	Barge	Unifloat UF-1A	36 Nos.
•	Steel materi	al	20ton
•	Tug boat	200PS	1 Nos.
Sp	rinkling		4
•	Barge	Unifloat UF-1A	7 Nos.
: . ●	Barge	Unifloat UF-1AS	2Nos.
•	Spad	350mmDIA* 1 0 m	2 Nos.
•	Winch	15KW*1.8Ton	3 Nos.
•	Anchor	500KG	2 Nos.
•	Generator	150KVA	1 Nos.
•	Sand pump	22KW	1 Nos.
•	Water pump		1 Nos.
•	Energy diss	ipater, Bend pipe etc.	LS

<ul> <li>Anchor boat</li> </ul>	1T 50PS	1No.
Consumption		LS.
Temporary work		
• Temporary jetty		LS.

c) Puno Interior Bay sand

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In the case that the Puno Interior Bay sand is used, following method combination is appropriate.

- Extraction Portable pump dredger
- Offshore transportation
   Floating discharge pipeline
- Sprinkling Floating discharge pipeline

It is conceivable that there are two types of construction method, the first one is to employ portable pump dredger and the second one is to use combination of existing bucket dredger at Puno Bay, hopper barge, tug boat and sand pump. In this report, the cost estimate is done by the first method of pump dredger.

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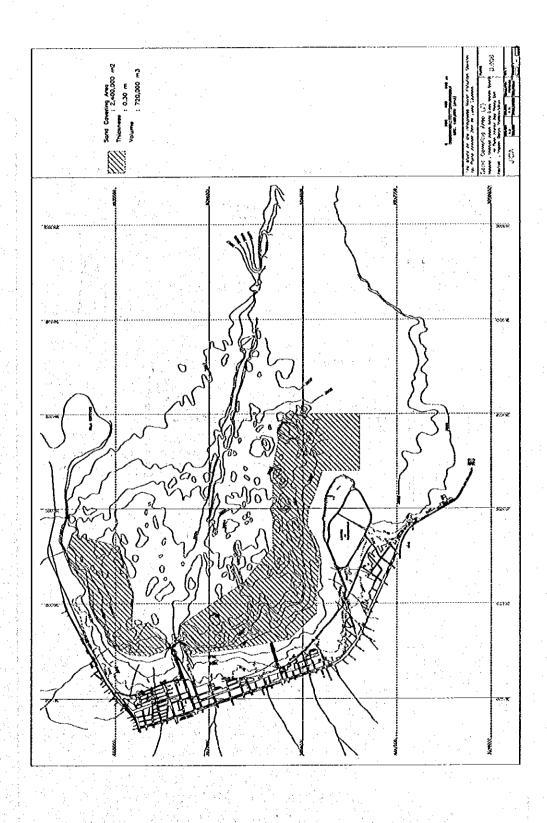
The proposed construction equipment is as follows; Dredging, transportation, sprinkling consistency work

• .	Portable pump di	edger D-600PS	- 1 No.
٠	Anchor boat	1T 50PS	1 No.
•	Discharge pipe	Steel made 300mmDIA	200 Nos.
٠	Flexible Pipe	300mmDIA Robber sleeve	200 Nos.
٠	Float states	FRP made Floater	200Nos.
• .	Anchor	100KG	10Nos.
•	Barge	Unifloat UF-1A	4 Nos.
•	Generator	50KVA	1 No.
•	Energy dissipate	, Bend pipe etc.	LS.
•	Winch	15KW*1.8Ton	2Nos.
	Anchor	100KG	4Nos.
*	Consumption		LS
•	Silt Fence		LS
Te	mporary work		
•	Temporary jetty		LS

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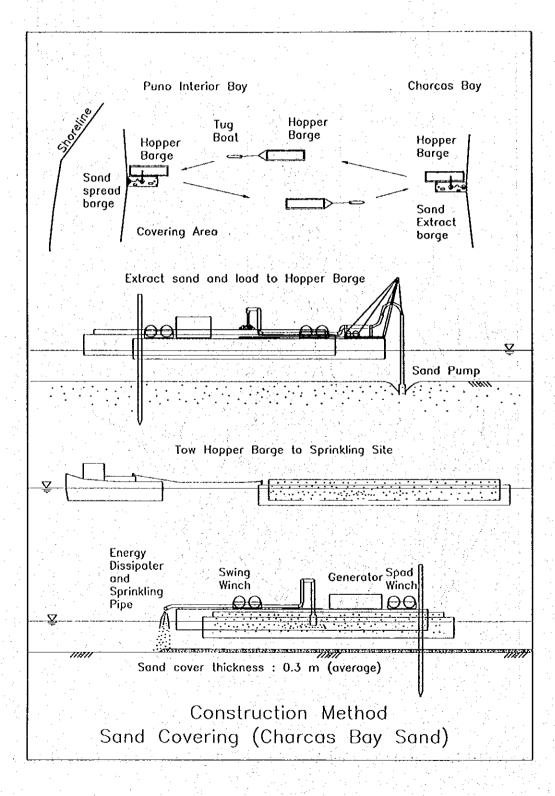
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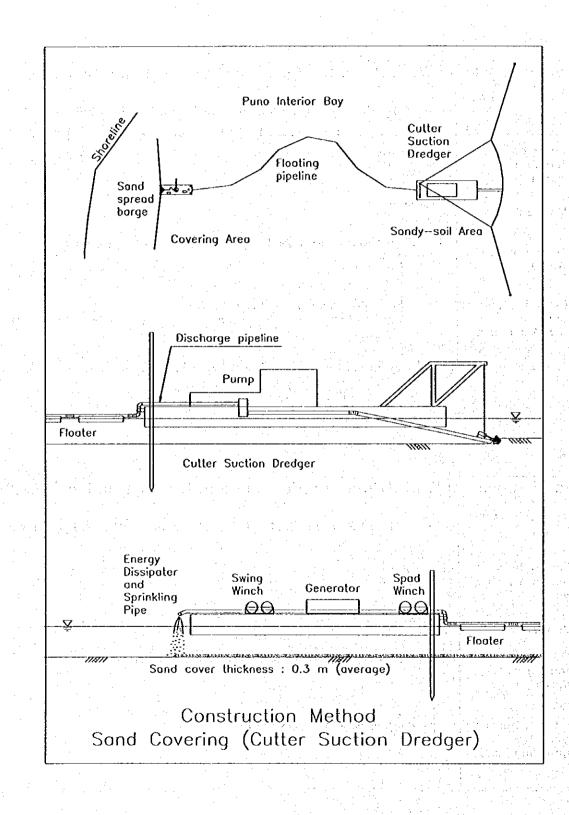
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YEAR ITEM	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Common temporary works Mobilization	tempor 9-0	ation and ory build lization		• • • •		· · ·	<b>,</b>	:	J			<b>I</b>
Temporary Works	F	oblicate	hopper	barges,	tugboat,	sprinktii	ng barge	e and so	nd pum	o barge		
Extract, transport and sprinkling Sand			Extra	ct, tran:	sport an	d sprinkl	ing sond				•	-0

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YEAR ITEM	2010	2011	2015	2013	2014	2015	2016	2017	2018	2019	2020	505
Common temporory works Mobilization	tempor	L ory build lization	<b>ling</b>	I iredger	sprinklin	g barge	ond pipe	I Sine insl	l			
Temporary Works Extract, transport and sprinkling Sand	9	Extract,	transpo	rt ond s	prinkling O	j sand						



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## 1.13.3 Construction cost

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* 	The construction cost of each method is as follows.
	a) Cutimbo river sand
	• Total in S/. 23,800,000 S/.
	فالمحمة والمحاورة فالمحال ومحاومتهم وتموج فالجاج فارتبع كالمحو ألحاجته
	b) Charcas Beach sand
	• Total in S/. 29,338,000 S/.
	·····································
	c) Puno Interior Bay SandySoil
	• Total in S/. 19,670,000 S/.

#### **1.14 RECOMMENDATION**

JICA considered the dredging and disposal method is not recommendable plan because of its high construction cost.

In the three of alternate sand capping methods, the Puno Interior Bay Sandy Soil Method gives the lowest construction cost and the Cutimbo river sand method gives 33% higher cost. The dredger using in the cost estimation of sand covering method is expected from a foreign country because in this stage it is difficult to make sure of the operation schedule of the portable dredger belongs to the Peru government.

JICA recommends the sand covering method using Puno Interior Bay Sandy Soil as the Puno Interior-Bay water quality improvement method.

However the 19,670,000 S/. of construction cost is still a high amount. After completion of the sewage treatment system, the bottom sediment should be observed periodically. In the rainy season the muddy water is flowing in to the Puno interior bay and if it is observed the settlement of non-organic sediment on the existing organic matter this plan should be re-examined.

### 2. MONITORING PROGRAMME

### 2.1 PHYSICAL AND CHEMICAL CONDITIONS

The monitoring program obtains a basic data for the water environmental condition, and the final goal is improvement and preservation of water environmental condition in Lake Titicaca.

### **Practice of Monitoring**

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Practice of monitoring is summarized as below.

PELT conducted the monitoring in the lake by the simplified analysis methods from 1993 to 1997.

The PELT's new laboratory has been established in cooperation with JICA Study Team for monitoring of water environment since 1998.

DIGESA is planning to classify the water quality by water quality standards in Lake Titicaca.

The responsible organization for environmental condition in Lake Titicaca, namely, PELT, DIGESA and DASA, held a conference regarding cooperation system toward with improvement and preservation of water environmental condition in the Lake Titicaca on September 1999.

### Strategy of Monitoring Program

The following strategies should be considered for establishment of monitoring program

A monitoring program consists of two parts, one is monitoring for wastewater from workshops, industries and wastewater treatment plant, the other is for water bodies of the lake and drainages.

Water parameters of monitoring should follow the law regarding water quality standards.

to avoid redundant monitoring by assigning roles to the relevant department or project.

The PELT's laboratory should take initiative in sampling and water analysis in Puno. Some parameters that can not be analyzed by PELT's capacity should be analyzed in DIGESA's laboratory in Lima. (refer to Table VIII.2.1)

The method of analysis should be standardized by DIGESA. TABLE OF

The results of monitoring is managed in common by the responsible organization for environmental condition.

Based on the above-mentioned conditions, the monitoring program for Lake Titicaca is considered below.

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### (1) WATER POLLUTION SOURCES

Generally, wastewater from workshops and industries may occur hazardous contamination and organic pollution in water environment. For example, plating, chemical and tanning industries may cause hazardous contamination and food, papermaking, slaughterhouse and some kind of industries may cause organic pollution are listed.

According to the field survey in the Study area, no factories discharging hazardous contamination are found. However, slaughter house, alcohol products and food products (processing, bakery, sweetshop, etc) as organic pollution sources are found. However, these factories are small scale facilities except slaughterhouse. Consequently, the monitoring program for water pollution sources in the Study area is focused on organic pollution sources.

### **Contents of Monitoring Program**

In principle, the water environmental control of the Puno Interior Bay is the subject of this program. Consequently, minimum contents of monitoring which are enough to evaluate organic pollution or eutrophication. Outline of monitoring program is described as follows.

Monitoring target:	Food and processing industries (5 facilities)
	Wastewater treatment plant (WWTP)
Frequency of Monitoring:	Workshop / Industry: 2 times a year
	WWTP: 12 times a year (refer to Table VIII.2.2)
Monitoring parameter:	Flow measurement,
	Temperature, pH, DO, SS, BOD, COD, NH <sub>4</sub> -N
station of the second secon Second second	NO <sub>2</sub> +NO <sub>3</sub> -N, T-N, PO <sub>4</sub> -P, T-P, Total coliform

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### (2) WATER ENVIRONMENT

The previous monitoring program was conducted by PELT from 1993 to 1994. After 1995, this program became intermittently, and stopped in 1997. Consequently, no series of data on water quality in Puno Interior Bay was recorded. (refer to *Table VIII.3.4*) The new monitoring program is planned referring to the previous monitoring program.

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### Contents of Monitoring Program

Monitoring targets are proposed as follows.

- Lake water and its bottom sediment
- Drainage channels

### Monitoring point

### [Lake water]

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Monitoring points are the same points of the lake water quality survey in this Study. The monitoring points are classified into two categories. One is a main point which is selected to grasp the longitudinal water quality condition from the Interior Bay to the Exterior Bay. The other is a supplementary point which is selected to grasp a local distribution of water quality. (refer to *Figure VIII.2.1*)

### [Drainage channel]

Monitoring targets are the same drainage channels surveyed in this Study. Five drainage channels are selected based on the amount of discharged pollution load. It is necessary that the monitoring points should be reconsidered according to the improvement of water quality of the drainage channels. Based on the existing condition, the selected drainage channels are shown in *Figure VIII.2.2*.

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### Monitoring frequency

Basically, monitoring frequency is set up once a month, and these are summarized in *Table VIII.2.2*.

### Observed item and analysis parameter by PELT

Water quality parameters which were are observed and analyzed by PELT, have been selected to grasp the water quality condition as minimum requirement. And further, it is necessary that meteorology data and water level in the lake be collected. These items and parameters are shown in *Table VIII.2.3*.

Moreover, the additional study for the mechanism of water pollution in the lake is proposed as below. According to the capacity and the ability of the laboratory, the Study should be conducted.

**Biological research** 

Concentration of Chlorophyll-a in the lake

Release of nutrients from sediment

formation of sediment

### Organization

It is expected that two organizations are responsible for the monitoring program. The selected two organizations and its reason are described as follows.

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PELT (Special Bi-national Project for Lake Titicaca)

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The previous monitoring program from 1993 to 1997 was carried out by PELT.

PELT and JICA have established the laboratory in Puno.

PELT and JICA have conducted the water quality survey and biological research for this study.

DIGESA (The Ministry of Health)

DIGESA is responsible for establishment and superintendence of The Environmental Quality Standards.

However, the environmental quality standard for the interior Puno Bay is not established yet. Accordingly, it is desired that the monitoring program be conducted by the cooperation of PELT and DIGESA. In the future, on the occasion of the establishment of the environmental quality standard in the interior Puno Bay, it is desirable that a new organization to be reestablished by PELT and DIGESA.

### Personnel organization

Role	Required No. of personnel	remarks
Chief	1 person	
Analyst	3 persons	Chemist 2 persons, Biologist 1 person
Analysis Assistant	4 persons	
Labor	1 person	

The personnel organization is planned as follows.

### **Cost Estimation**

Additional capital investment and maintenance costs are calculated as below. The details are shown in *Table VIII.3.5*.

- Additional capital investment : 246 thousand soles
- Operation and maintenance cost : 184 thousand soles/year

### 2.2 BIOLOGICAL ASPECTS

These proposals are for an Environmental Monitoring Plan (EMP) to describe and assess biological changes occurring in Puno Interior Bay. The proposals cover submerged macrophytes, benthos and zooplankton.

### Submerged Macrophytes

At the moment, submerged macrophytes are mainly restricted to the shallow waters of the eastern side of the Interior Bay. Up to perhaps 40 years ago they occurred over most or all of the bay. The monitoring programme should assess both the distribution and abundance of submerged macrophytes and the species present.

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Thus, annually, all submerged macrophytes of Puno Interior Bay should be accurately mapped and species composition of each locality recorded. Abundance should be noted qualitatively as dense, moderate or sparse. Accurate mapping can only be done quickly and accurately with GPS. As ecosystem conditions improve, increases in the distribution, abundance and species diversity will occur. If conditions become worse, all of these characteristics will decrease. Improvements in submerged macrophyte communities will be a key indicator for improving ecological conditions in Puno Interior Bay.

### Benthos

Apart from the eastern side of Puno Interior Bay, benthos has virtually disappeared from the locality. Its reappearance will be a good indication of greatly improved ecosystem conditions. The monitoring programme should consist of the following:

### **Monitoring Sites**

- 4 locations close (about 50 m) to the western shore, two to the north and two to the south of the main jetty;
- 2 locations close (about 100 m) to Esteves Island;

- 2 locations close (about 100 m) to Espinar Island;
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- 4 locations in the centre of Puno Interior Bay;
- 4 locations in the eastern part of the bay, two to the north and 2 to the south of

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the main navigation channel.

### Monitoring Frequency

- 2 times in the wet season;
- 2 times in the dry season.

### Sampling Method

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- at each locality at each occasion, 3 Bkman samples with the sediment filtered through a 1 mm mesh sieve;
- samples examined separately to produce averages for each sampling occasion.

### Sample Analysis

- all species identified as far as possible;
- all species counted and numbers per square meter calculated, for each of the
  - 16 sites on each of the 4 sampling days per year.

Improved ecosystem conditions will be demonstrated by the occurrence of benthos from localities where it is now absent, by increasing densities and by more species being found.

### Zooplankton

Zooplankton occurs over all the Puno Interior Bay, but is extremely patchy being found in very high numbers in some areas and very low numbers in others. This is at least partly due to the greatly varying water conditions over the bay. The great dominance of cladocerans over copepods is a characteristic of highly eutrophic waters. Monitoring programmes should look for a more even distribution of zooplankton over the Interior Bay (as water conditions improve) and a reducing dominance of cladocerans.

The monitoring programme should therefore consist of the following:

### **Monitoring Sites**

- two locations close (about 50 m) to the western shore, one to the north and one to the south of the main jetty;

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- one location close (about 100 m) to Esteves Island
- one location close (about 100 m) to Espinar Island
- two locations in the centre of Puno Interior Bay;
- two locations in the eastern part of the bay, one to the north and one of the south of the main navigation channel.

### Monitoring Frequency

one time in the wet season;one time in the dry season.

### Sampling Method

- at each locality on each occasion, one sample obtained by hauling the plankton net (40 μ mesh) from the bottom (depth recorded) to the surface.

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### Sampling Analysis

- each sample stored in preservative and concentrated to 100 ml;

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- 5 x 1 ml subsamples taken and numbers of copepods and cladocerans counted in each to produce average numbers for each sample on each date;

- numbers per litre estimated.

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Improved ecosystem conditions will be shown by increasing numbers of zooplankton occurring in areas of previously poor water quality and an increasing proportion of copepods relative to cladocerans.

### Phytoplankton

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Phytoplankton occurs in very large numbers over all the Interior Bay, and is particularly abundant in the summer months. These high numbers are due principally to the high levels of nitrate and phosphate nutrients. As water quality improves, phytoplankton biomass and volume will decrease. The monitoring programme has been designed to show this.

The monitoring programme should therefore consist of the following:

- Monitoring Sites: The same as for zooplankton

- Monitoring Frequency: Every two months

- Sampling Method:

At each locality on each occasion, phytoplankton samples should be taken by hauling a 40 $\mu$  mesh plankton net just below the surface for a measured distance (say 100m or 200m). This will enable calculation of the volume of water filtered. The net should be hauled slowly. If insufficient phytoplankton is collected, the towing distance should be increased (by a known amount so that the volume of water filtered can always be calculated). The sample should be filtered, dried (at 105°C) and scraped into a measuring cylinder of small volume. To this is added an exactly known volume of water. The resulting additional volume as recorded on the measuring cylinder is the volume of the phytoplankton sample. This can be converted into volume of phytoplankton per unit volume of water eg /m<sup>3</sup> or /100m<sup>3</sup> of lake water.

The method gives an approximate measure of phytoplankton volume. More detailed methods are available (cg measuring chlorophyll *a* by spectrophotometry or fluoresence) but are costly to implement. If the method described above is not accurate enough (particularly as water quality improves and phytoplankton volumes decrease) the more detailed methods will need to used if the monitoring programme is to continue.

	Parameter	PELT	DIGESA
· · · · · · · · · · · · · · · · · · ·	Temperature	0	
	Transparency	0	
	pH	0	
	DO	0	
	SS	0	
General	BOD <sub>5</sub> (COD)	0	
and	NH <sub>4</sub> -N, NO <sub>2</sub> -N, NO <sub>3</sub> -N, T-N	0	
Organic	PO <sub>4</sub> -P, T-P	0	
Parameter	ORP	0	
	Moisture content	Ó	
	Ignition Loss	0	
	Total Coliform	0	1
	Total Coliform	0	
	Flow Rate Measurement	0	
	Selenium (Se)		0
	Mercury (Hg)		0
	РСВ		0
	Esters Escalates		0.
	Cadmium (Cd)		0
	Chromium (Cr)	<u></u>	0
	Nickel (Ni)	· · · · · · · · · · · · · · · · · · ·	0
	Copper (Cu)		0
Hazardous	Lead (Pb)		0
	Zinc (Zn)		0
Parameter	Cyanide (CN-)		0
	(Fe)		. 0
	Sulfurous		0
	Arsenic (As)		0
	Nitrogen (T-N)		0
	M.E.H.		0
	S.A.A.M.		0
	C.A.E.		0
	C.C.E.		0
	Biological Conditions (Benthos)	0	
Biological	Biological Conditions (Phyto/Zoo		
Biological Parameter		0	
	Plankton, Macrophytes) al in Hexane (mainly Grease)	<u> </u>	<u> </u>

# Table VIII.2.1 Assignment of Water Quality Analysis

1) Extractive material in Hexane (mainly Grease)

2) Active substances in Methylene Blue (mainly Detergent)

3) Extract of column of active carbon by alcohol (according to the Slow Flow Method)

4) Extract of column of active carbon by chloroform (according to the Slow Flow Method)

Frequency of Monitoring and Sampling for Monitoring Program Table VIII.2.2

		<b>p</b> -4	9		48	.
Biological Conditions	Lake Water / Sediment	16 (benthos), 8 (zoo/phyto plankton), (macrophytes)	4 (benthos), 2 (zooplankton), (phytoplankton), 1 (macrophytes)		64 (benthos), 16 (zooplankton), (phytoplankton)	
	Drainage Channel	S.	12	3	180	
Water Environment	Lake Sediment	12	2	<b>I</b>	24	
Wat	Lake Water Lake Sediment	7 (main). 5 (supplem.)	12 (main). 6 (supplem.)	I ( upper and lower layer)	228	
n Sources	Wastewater Treatment Plant		12		12	
Water Pollution Sources	Workshop / Slaughter House	1	2		01	
	ltem	Number of Monitoring Points	Frequency of Monitoring (time/vear)	Number of Sampling Times (time/survey)	Total Number of Samples	

# Table VIII.2.3 Parameters for Monitoring Program

	Winhan	Worksworkse			Drainage	
Parameter	vorksnop / Slaughter House	w astewater Treatment Plant	Lake Water	Lake Sediment	Channel	1 .
Temperature	0	0	0		•	
Transparency			0			
	0	0	0		0	1
ORP				0		e Mer N
OQ.	0	0	0		•	
SS	•	Q	0		0	
BCD,	o	0	0		0	
CODMIN	0	0	0		0	- - -
Moisture content			a share and a share a share a share a share a share a share a s	0		•
Ignition Loss			*** *** ********	0		
T-N(Kj-N)	0	0	0	0	•	
N- HN	0	0	٥		0	
NO2+NO3 - N	0	0	•		0	
PO4 - P	0	0	0		0	· .
	•	0	•	•	•	
Total Coliform	0	0	0		0	
Flow Rate Measurement	0	0			0	
Biological Conditions (Benthos)	and the second	the state of the second se		•		
Biological Conditions (Phyto/Zoo			c			
Plankton, Macrophytes)						

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Table VII.3,4

# Table VIII.2.4 The Execution of the Previous Monitoring in Puno Interior Bay

		1993					1994					1995		lÌ			1 ł			L		Š,			
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x Parameter : Temperature, Conductivity, TDS, pH, Transparency, Turbidity

 Table VIII.2.5
 Cost Estimation for Monitoring Program

Information         1 art         1,500 obtelor         0 antoler         1,500         0           Total         Total         -         1,500         0         -         1,500         0           Total         -         -         1,1,37         -         -         1,500         0         -         1,500         0           Finance         -         -         -         -         -         -         1,500         0         -         1,500         0         0         -         1,500         0         0         -         1,500         0         0         -         1,500         0         0         -         1,500         0         0         0         -         1,500         0         0         -         1,500         0	High presure steam retrified         1 set         1 s 000 soleciet.         0 soleciet.         1 s 000         0           Free         Tool         -         -         1 s 000 soleciet.         0 soleciet.         1 s 000         0           Free         Tool         -         <	Interpresence caterin retrition: Troil         1 art         1,5,000 obtector:         0 solucion:         1,5,000         0           Free         Tool         F         F         1,5,000 obtector:         0 solucion:         15,000         0           Free         Tool         F	nnital investment				(Foreign currency)	LOCAL CULTERCY	10001		(enine)
Total         Total         15.000         0           Image: Second Seco	Total         Total <th< td=""><td>Treat         Treat         Second currency         Local currency</td><td></td><td></td><td></td><td>1 set</td><td>15,000 soles/set</td><td>0 soles/set</td><td>15,000</td><td>-0,</td><td>15.0</td></th<>	Treat         Treat         Second currency         Local currency				1 set	15,000 soles/set	0 soles/set	15,000	-0,	15.0
For 10.17 period     Second       Item     International expension     Everyptic outricroy     Local currency     Local currency       Item     International expension     2,400 sets/man-month.     2,400 sets/man-month.     2,400 sets/man-month.       Expended expension     13 anon-month.     2,400 sets/man-month.     2,400 sets/man-month.     2,400 sets/man-month.       Expended expension     13 anon-month.     2,400 sets/man-month.     2,400 sets/man-month.     2,400 sets/man-month.       Expended expension     13 anon-month.     2,400 sets/man-month.     2,400 sets/man-month.     9,450       Expended expension     13 anon-month.     2,400 sets/man-month.     2,400 sets/man-month.     9,450       Expended expension     13 anon-month.     2,400 sets/man-month.     9,450     0       Expended expension     13 anon-month.     2,000 sets/man-month.     9,450     0       Expended expension     13 anon-month.     2,000 sets/man-month.     9,450     0       Expended expension     13 anon-month.     2,000 sets/man-month.     9,450     0       Expended expension     14 any/set     2,000 sets/man-month.     10,000 sets/man-month.     10,000 sets/man-month.       Expended expension     14 any/set     2,000 sets/man-month.     2,000 sets/man-month.     2,000       Expende     14 any/	Free II (a) Free     Decision       Intern     Internation       Internation     Events       Internation     Events <td>Se         31.5 sole           Bin         Local currery         Local currery         Local currery         Local currery         Local currery         Local currery         Color           Bin         Bin         Correge currery         Se monech.         Se monech</td> <td></td> <td>Total</td> <td></td> <td></td> <td></td> <td></td> <td>15.000</td> <td></td> <td>15.000</td>	Se         31.5 sole           Bin         Local currery         Local currery         Local currery         Local currery         Local currery         Local currery         Color           Bin         Bin         Correge currery         Se monech.         Se monech		Total					15.000		15.000
Tennal         Total         Cueal currancy         Foregrit C         Load Currancy         Foregrit C         Currance         State	Image: International Prevention Preventional Preventional Preventional Preventional Pr	Terrage currency         Local currency         Local currency         Local currency         Local currency         Local currency         Clencence         Prevence         Clencence				<b>J J</b>	soles and the second	<ul> <li>A second s</li></ul>			
Personnel expenses         Chref         21         mannonth         2         306/mannonth         2         300           Personnel expenses         Chref         56         mannonth         10         95         560           Analysis         Scientimentionth         100         Selectiman-month         100         56         56           Analysis         Subrotal         13         mannonth         100         Selectiman-month         100         56           Remail fee         Boxt         103         Sterotal         103         Selectiman-month         100         56           Remail fee         Boxt         24         40         115         Selectimon         9450         0         9560           Expendables         Stendable         1         selectimon         150         Selectimon         0         7600           Remail         1         set         2700         0         1560         0         1560           Repair         Stendable         1         set         200         Selectimon         2550         0         0         1560           Repair         Stendable         1         set         200         1560         0	Personnel caperacia         Chard         12 annomenth         - solec/mammennith         2 (500 solec/mammennith)	Personnel expenses         Churd         12 amm-month         2 sole           Personnel expenses         Analysis         3 simmonth         1600 soles/mammonth         0         73.800           Analysis         Asalysis         4 simmonth         1000 soles/mammonth         1000 soles/mammonth         0         73.000           Nanyosis         Kansin         8 min-month,         1000 soles/mammonth         1000 soles/mammonth         0         73.000           Nanyosis         Kansin         11 ammonth,         1000 soles/mammonth         1000 soles/mammonth         0         75.000           Romai         Expendiables         Chansin         11 advysta         soles/mammonth         1000 soles/mammonth         0         11.000           Romai         Expendiables         Stablooti         11 advysta         soles/mammonth         9.600         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0         9.500         0<			÷	sector and the sector sector	Foreign currency	Local currency	Foreign C. (soles/vear)	Local C. (soles/year)	Total (soles/year)
Analysis     Analysis     Sensimination     1,000 selection     0,000 selection       Analysis     Analysis     Sensimination     1,200 selection     0     7,600       Randi fee     Box     1,300 selection     0     7,600       Randi fee     Box     1,300 selection     0     1,400       Rendi fee     Box     1,300 selection     0     7,800       Rendi fee     Box     2,800 selection     0     7,800       Rendi fee     Box     2,800 selection     0     7,800       Rendi fee     Box     2,800 selection     0     7,800       Rendi fee     2,800     3068/bar     - solection     0     7,800       Rendi fee     2,800     1,841     1,841     - 3,800     0     1,800       Chemalis     1,841     - solection     - 3,600     0     1,500       Others     9,800     - 1,800     - 3,000     0     1,500       Chemalis     1,841     - solection     - 3,500     0     1,500       Others     - 1,800     - 1,800     - 2,500     0     1,500       Chemalis     - 1,800     - 1,800     - 2,800     0     1,500       Others     - 1,810     - 1,810     - 2,800 <td>Analysis Assistant     Se main-monicity     Job Solechman-monicity     Job Solechman-monicity&lt;</td> <td>Analysis     Sol minimizer     Sol minimizer     Sol minimizer     Sol Sol setsimization     Sol Sol Sol Sol Sol Sol Sol Sol Sol Sol</td> <td>Anintenance Costs</td> <td></td> <td>Chief</td> <td>12 man-month.</td> <td>- soles/man-month.</td> <td>2,400 soles/man-month.</td> <td>0.</td> <td>28,800</td> <td>28,8</td>	Analysis Assistant     Se main-monicity     Job Solechman-monicity     Job Solechman-monicity<	Analysis     Sol minimizer     Sol minimizer     Sol minimizer     Sol Sol setsimization     Sol	Anintenance Costs		Chief	12 man-month.	- soles/man-month.	2,400 soles/man-month.	0.	28,800	28,8
Naniysis Assistant     45 man-month, aniysis Assistant     56 man-month, stam-month, Expondables     500 soles/man-month, sub-toral     500 soles/man- sub-toral       Repart     2 sub- sub-toral     1 set     2,700 soles/year     100 soles/man- soles/mon,     9,450     0       Repart     2 sub- sub-toral     1 set     2,700 soles/year     5 soles/mon,     2,700     0       Repart     2 sub- sub-toral     1 set     - soles/mon,     7,600 soles/year     0     7,800       Others-     5 sub-toral     1 set     - soles/mon,     - soles/mon,     2,700     0       (1% for fersoned expenses)     1 set     - soles/mon,     - soles/mon,     - soles/mon,     - soles/mon,     0       (1% for fersoned expenses)     1 set     - soles/mon,     - soles/mon,     - soles/mon,     - soles/mon,       Total     - roul     - soles/mon,     - soles/mon,     - soles/mon,     - soles/mon,     0       (1% for fersoned expenses)     - roul     - soles/mon,     - soles/mon,     - soles/mon,     0       - roul     - roul     - soles/mon,     - soles/mon,	Analysis Assistant     4: man-month, labor     Selectman-month, labor     Selectman-month, lab	Analysis Assistant     Came-month     Stekman-month     1200 soles/man-month     0     95/600       Remail de     Stexends     101     man-month     800 soles/man-month     800 soles/man-month     9       Remail de     Stexends     103     man-month     800 soles/man-month     800 soles/man-month     9       Remail de     Cars     24 day/vart     104     9     9     9     9       Expendibles     Carnet     1 set     9     9     9     9     9       Expendibles     Carnet     1 set     2.700 soles/man     9     9     9       Expendibles     Stehonal     1 set     2.700 soles/man     9     9     9       Obreas     Stehonal     1 set     - soles/man     7.600 soles/man     0     7.800       Obreas     Stehonal     1 set     - soles/man     7.600 soles/man     0     0     0       Constraint     Stehonal     1 set     - soles/man     1 set     - soles/man     0     1 set       Obreas     Stehonal     1 set     - soles/man     - soles/mon     0     7.800       Marinifertum     1 set     - soles/mon     - soles/mon     0     7.800       Marinifertum     1 set     - soles/m			Analyst	36 man-month.	- soles/man-month.	1,600 soles/man-month.	0	57,600	57.6
Nachonal     12     materimeter     800 soles/materimorith     0     9,600       Remail fee     Boor     100 sectors     -     -     0     1,400       Remail fee     Boor     100 sectors     -     -     0     1,400       Remail fee     Boor     100 sectors     -     -     0     1,400       Remail fee     Boor     25 day/year     -     -     0     1,400       Subronal     1     set     2.700     0     -     2.800       Repair     25%     1     set     2.700     0     -     2.600       Repair     25%     1     set     2.700     0     -     2.600       Others*     5%     1     set     2.700     0     -     2.600       Noticell     1     set     -     soles/mon.     2.700     0     -       Noticell     1     set     -     soles/mon.     2.700     0     -       Natistrution     1     set     -     soles/mon.     2.700     0     -       Numeration     1     set     -     soles/mon.     2.700     0     -       Numeration     1     set     - <td< td=""><td>New     12     manimentih     soles/manimentih     800 soles/manimentih     0     9,600       Remail (se     Boxi     10 percents     -     0     1,400       Remail (se     Boxi     14 day/year     -     -     0     1,400       Remail (se     Boxi     14 day/year     -     -     0     1,400       Strendables     Chemicals     1 set     -     -     9,450     0       Strendables     Chemicals     1 set     -     -     -     -       Strendables     Chemicals     1 set     -     -     -     -       Onters*     5%     1 set     -     -     -     -     -       Onters*     5%     1 set     -     -     -     -     -       Concers*     5%     1 set     -     -     -     -     -       Onters*     5%     1 set     -     -     -     -     -       Sub-total     1 set     -     -     -     -     -     -       Onters*     5%     -     -     -     -     -     -       Onters*     -     -     -     -     -     -     -</td><td>Jaker     Jaker     12 manmonth.     500 soles/day     0     2500       Remail Ge     Bost     14 and Sub-roted     14 and Sub-roted     10 anterday     100 anterday     0     1,400       Remail Ge     Bost     14 and Sub-roted     12 and Sub-roted     14 and Sub-roted     9,450     0     27,800       Expendables     Chemicals     1 set     9,450     0     27,800     0     27,800       Rapair     Sub-roted     1 set     2,700     0 station     9,450     0     27,800       Rapair     Sub-roted     1 set     2,800     1 set     2,800     0     27,800       Obsend     Sub-roted     1 set     2,800     0     0     7,800       Obsend     Sub-roted     1 set     2,800     0     0     1,500       Obsend     Noted     1 set     2,800     0     0     1,500       Total     Total     1 set     2,800     0     0     1,50</td><td></td><td></td><td>Analysis Assistant</td><td>48 man-month</td><td>- soles/man-month.</td><td>1,200 soles/man-month,</td><td>0</td><td>57,600</td><td>57,6</td></td<>	New     12     manimentih     soles/manimentih     800 soles/manimentih     0     9,600       Remail (se     Boxi     10 percents     -     0     1,400       Remail (se     Boxi     14 day/year     -     -     0     1,400       Remail (se     Boxi     14 day/year     -     -     0     1,400       Strendables     Chemicals     1 set     -     -     9,450     0       Strendables     Chemicals     1 set     -     -     -     -       Strendables     Chemicals     1 set     -     -     -     -       Onters*     5%     1 set     -     -     -     -     -       Onters*     5%     1 set     -     -     -     -     -       Concers*     5%     1 set     -     -     -     -     -       Onters*     5%     1 set     -     -     -     -     -       Sub-total     1 set     -     -     -     -     -     -       Onters*     5%     -     -     -     -     -     -       Onters*     -     -     -     -     -     -     -	Jaker     Jaker     12 manmonth.     500 soles/day     0     2500       Remail Ge     Bost     14 and Sub-roted     14 and Sub-roted     10 anterday     100 anterday     0     1,400       Remail Ge     Bost     14 and Sub-roted     12 and Sub-roted     14 and Sub-roted     9,450     0     27,800       Expendables     Chemicals     1 set     9,450     0     27,800     0     27,800       Rapair     Sub-roted     1 set     2,700     0 station     9,450     0     27,800       Rapair     Sub-roted     1 set     2,800     1 set     2,800     0     27,800       Obsend     Sub-roted     1 set     2,800     0     0     7,800       Obsend     Sub-roted     1 set     2,800     0     0     1,500       Obsend     Noted     1 set     2,800     0     0     1,500       Total     Total     1 set     2,800     0     0     1,50			Analysis Assistant	48 man-month	- soles/man-month.	1,200 soles/man-month,	0	57,600	57,6
Renail (se         Subsent         108 persent         500 bits         153,600 bits         154,600 bits         153,600 bits	Remail (se         Bout         100 percens         solsaday         100 solsaday         0         155 600         155           Remail (se         Bout         14 dayyear         solsaday         100 solsaday         0         1500         1<00	Remail (co         Boar         100 species         135 600         135           Remail (co         Boar         14 dayyear         0         135 600         136           Stehenoli         2 dayyear         2 dayyear         0         136 000         0         136 000           Stehenoli         2 dayyear         2 dayyear         0         136 000         0         1400           Stehenoli         2 dayyear         1 set         2 dayyear         9 450         9 200         0         9 350         0         9 350         0         9 350         0         9 350         0         9 350         0         9 350         0         9 350         0         9 350         0         9 350         0         9 350         0         9 350         0         9 350         0         0         1 360         1 36         0         1 36         0         1 36         0         1 36         0         1 36         0         1 36         0         1 36         0         1 36         0         1 36         0         1 36         0         1 36         0         1 36         0         1 36         0         1 36         0         1 35         0         0			Inhor	12 man-month	- soles/man-month.	800 soles/man-month.	0	009 6	9'6
Remail (see         Description         Constraint (see         Description         Constraint (see         Description         Constraint (see         Cons         Constraint(see         Const	Remark fee     Boart     14 daylywar     soles/day     100 soles/day	Remart fee     Boot     14 daylywar     soles/day     100 soles/day	· Contractor and a second second		Cub total	108 APPEARS			0	153 600	153.6
Memalation     Description     2 dayyet     Selection     150 solection     0     7,000       Expendables     Stebenoli     2 dayyet     5 450 solection     9 450     0     9 200       Expendables     Stebenoli     2 dayyet     9 450     0     9 450       Repair     3 stebenoli     1 set     2.000 soles/year     9 450     0     9 450       Repair     3 sub-noni     1 set     2.000 soles/year     7 680 soles/mon.     2.000     0       Others     5 sub-noni     1 set     2.000 soles/year     7 680 soles/mon.     2.000     0       Others     Sub-noni     1 set     2.000 soles/year     - soles/mon.     2.000     0       Others     Sub-noni     1 set     - soles/mon.     7.680     0     1.550       Others     Sub-noni     1 set     - soles/mon.     2.600     0     0       It     Administration     - soles/mon.     7.680     0     0     1.556       Others     - soles/mon.     - soles/mon.     - 0     0     1.556       Total     - res     - soles/mon.     - 1.556     0     0       Total     - res     - soles/mon.     - 1.556     0     0       Total     - res<	Memalation     Control of the control     Conteon     Contro     Control <th< td=""><td>Kental fee     Car     St daylyear     soles/day     150 soles/day     150 soles/day     150 soles/day     150 soles/day       Stependables     Subrotals     1 set     2.450 soles/day     1 set     2.450 soles/day     0     2.00       Superdables     Subrotals     1 set     2.700 soles/day     1 set     2.700 soles/day     0     2.00       Reput     2.86     1 set     2.700 soles/day     1 set     2.700 soles/mon.     2.700 soles/mon.     2.700 old       Onters*     2%     1 set     2.700 soles/mon.     7.680 soles/mon.     2.700 old     0       Onters*     2%     1 set     - soles/mon.     7.680 soles/mon.     0     1.56       Onters*     2%     1 set     - soles/mon.     0     1.56     0       Onters*     2%     1 set     - soles/mon.     0     1.56       Total     1 set     - soles/mon.     0     1.56       Total     1 set     - soles/mon.     0     1.56       Total</td><td>and the second sec</td><td></td><td>040-044</td><td></td><td>solar (date</td><td>100 001-001</td><td>G</td><td>1 400</td><td>4</td></th<>	Kental fee     Car     St daylyear     soles/day     150 soles/day     150 soles/day     150 soles/day     150 soles/day       Stependables     Subrotals     1 set     2.450 soles/day     1 set     2.450 soles/day     0     2.00       Superdables     Subrotals     1 set     2.700 soles/day     1 set     2.700 soles/day     0     2.00       Reput     2.86     1 set     2.700 soles/day     1 set     2.700 soles/mon.     2.700 soles/mon.     2.700 old       Onters*     2%     1 set     2.700 soles/mon.     7.680 soles/mon.     2.700 old     0       Onters*     2%     1 set     - soles/mon.     7.680 soles/mon.     0     1.56       Onters*     2%     1 set     - soles/mon.     0     1.56     0       Onters*     2%     1 set     - soles/mon.     0     1.56       Total     1 set     - soles/mon.     0     1.56       Total     1 set     - soles/mon.     0     1.56       Total	and the second sec		040-044		solar (date	100 001-001	G	1 400	4
Curr     Subrotal     1 set     9.450 soles/year     104 soles/advy     0     7000       Subrotal     1 set     2.700 soles/year     soles/mon.     9.450     0     9.200       Repair     Subrotal     1 set     2.700 soles/year     soles/mon.     9.450     0       Repair     Subrotal     1 set     2.700 soles/year     soles/mon.     2.700     0       Others     Subrotal     1 set     2.700 soles/year     soles/mon.     2.700     0       Others     Subrotal     1 set     2.700 soles/mon.     7.680 soles/mon.     2.700     0       Others     Subrotal     1 set     2.700 soles/mon.     7.680 soles/mon.     2.700     0       Administration     Subrotal     1 set     2.700 soles/mon.     7.680 soles/mon.     2.700     0       Administration     Subrotal     1 set     2.700 soles/mon.     7.680 soles/mon.     0     1.560       Administration     I set     Soles/mon.     7.680 soles/mon.     0     1.560       Total     Total     I set     Soles/mon.     0     1.556       Total     Total     I set     Soles/mon.     0     1.556       Total     Total     I set     Soles/mon.     0     1.556 </td <td>Car         Statistical         Car         Statistical         100 soles/ort         9 450         0         200           Expendables         Chemicals         1 set         3.450 soles/year         5 450 soles/year         9 450         0         9.200         0         9.200         0         9.200         0         7.000         9.200         0         9.200         0         9.200         0         9.200         0         7.000         9.200         0         7.000         9.200         0         9.200         0         9.200         0         7.000         9.200         0         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         1.000         9.200         0         1.000         1.200         1.000         1.200         1.000         1.200         1.000         1.200         1.000</td> <td>Curr     Statylyser     Soles/mon.     1.00 soles/mon.     0     2.00       Expendables     Chemicals     1 set     9.450     0     9.200       Expendables     Chemicals     1 set     2.700 soles/year     9.450     0     2.00       Repair     28.     1 set     2.700 soles/mon.     7.680 soles/mon.     2.700     0     7.800       Others*     5%     1 set     2.700 soles/mon.     7.680 soles/mon.     2.700     0       Others*     5%     1 set     2.700 soles/mon.     2.700     0     1.550       Others*     5%     1 set     - soles/mon.     2.700     0     1.560       Others*     5%     1 set     - soles/mon.     2.700     0     1.560       Total     1 set     - soles/mon.     7.680     0     1.560       Total     1 set     - soles/mon.     2.700     0     1.560       Total     1 set     - soles/mon.     - 2.700     0     1.560       Total     1 set     - soles/mon.     - 2.600     0     1.560       Total     - resultation     soles/mon.     7.680     0     1.560       Total     - resultation    </td> <td>and the second second</td> <td>Rental lee</td> <td>Roat</td> <td>14 day/year</td> <td>with the second</td> <td></td> <td>&gt; &lt;</td> <td></td> <td></td>	Car         Statistical         Car         Statistical         100 soles/ort         9 450         0         200           Expendables         Chemicals         1 set         3.450 soles/year         5 450 soles/year         9 450         0         9.200         0         9.200         0         9.200         0         7.000         9.200         0         9.200         0         9.200         0         9.200         0         7.000         9.200         0         7.000         9.200         0         9.200         0         9.200         0         7.000         9.200         0         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         7.000         9.200         0         1.000         9.200         0         1.000         1.200         1.000         1.200         1.000         1.200         1.000         1.200         1.000	Curr     Statylyser     Soles/mon.     1.00 soles/mon.     0     2.00       Expendables     Chemicals     1 set     9.450     0     9.200       Expendables     Chemicals     1 set     2.700 soles/year     9.450     0     2.00       Repair     28.     1 set     2.700 soles/mon.     7.680 soles/mon.     2.700     0     7.800       Others*     5%     1 set     2.700 soles/mon.     7.680 soles/mon.     2.700     0       Others*     5%     1 set     2.700 soles/mon.     2.700     0     1.550       Others*     5%     1 set     - soles/mon.     2.700     0     1.560       Others*     5%     1 set     - soles/mon.     2.700     0     1.560       Total     1 set     - soles/mon.     7.680     0     1.560       Total     1 set     - soles/mon.     2.700     0     1.560       Total     1 set     - soles/mon.     - 2.700     0     1.560       Total     1 set     - soles/mon.     - 2.600     0     1.560       Total     - resultation     soles/mon.     7.680     0     1.560       Total     - resultation	and the second	Rental lee	Roat	14 day/year	with the second		> <		
Expendabits     State-foreit     1 set     9,450 soles/year     0     9,200 olimitation       Repair     Sub-foreit     1 set     2,700 soles/year     9,450 soles/year     0     9,450 olimitation       Repair     2,0%     1 set     2,700 soles/year     2,700 olimitation     0     7,680 olimitation       Others     5%     1 set     2,700 soles/year     2,700 olimitation     0     7,680 olimitation       Others     5%     1 set     2,700 olimitation     7,680 olimitation     0     7,680 olimitation       Others     5%     1 set     soles/year     - soles/mon.     7,680 olimitation     0     7,680 olimitation       Total     1 set     - soles/mon.     7,680 soles/year     - soles/mon.     2,700 olimitation     0       Total     1 set     - soles/mon.     7,680 soles/mon.     0     1,550 olimitation     0       Total     1 set     - soles/mon.     - soles/mon.     0     1,550 olimitation     0       Total     1 set     - soles/mon.     - soles/mon.     0     1,550 olimitation     0       Total     1 set     - soles/mon.     - soles/mon.     - 1,560 olimitation     0     1,550 olimitation       Total     1 set     - soles/mon.     - 1 set     -	Stependables     Stependables     Stependables       Expendables     Schendal     1 set     9.450 soles/year     9.450 soles/year       Repair     2%     1 set     2.700 soles/year     9.450 soles/year       Others*     5%     1 set     2.700 soles/year     9.450 soles/year       Others*     5%     1 set     2.700 soles/year     9.450 soles/mon.       Others*     5%     1 set     2.700 soles/year     0       Others*     5%     1 set     2.700 soles/mon.     7.680       Ministrution     Sub-lead     1 set     3.054/year     0       Total     I set     soles/year     1 set     7.680       Total     Total     1 set     1 set     7.680       Total     I field (year)     0     1.556       Sub-lead     1 set     soles/year     1 set       Total     I field (year)     0     1.556       Sub-lead     1 set     soles/year     1 set       note * it is equal to 5% of the personnel expenses.     0     1.556       Line (stant)     1 set     2 solys/set     0       Total     1 set     2 solys/set     0       Total     1 set     2 solys/set     0       Total     1 set	Supportabilities     Selection     9.450     9.200       Expendables     Chemicals     1 set     9.450     0       Repair     2%     1 set     2.00     0       Repair     2%     1 set     2.00     0       Repair     2%     1 set     2.00     0       Others     5%     1 set     2.00     0       Administration     7.680 soles/mon.     7.680     2.00       Others     Sub-local     1 set     -     2.00       Others     Sub-local     1 set     -     2.00       Others     Sub-local     1 set     -     30les/mon.     -       Others     Sub-local     1 set     -     -     -       Total     1 set     -     -     -     -       Total     -     -     -     -     -       Total     -     -     -     -     -       Total     -	a na ana ana ana ana ana ana ana ana an		Car	52 day/year	- soles/day	150. soles/day	0	008 /	x /
Expendables     Chemicals     1 set     9,450     0       Sub-total     2,450     0       Repair     2,500     0       Sub-total     1 set     2,700     0       Rubit     Sub-total     1 set     2,700     0       Obters     5%     1 set     2,700     0       Obters     5%     1 set     2,700     0       Other     5%     1 set     2,700     0       Other     5%     1 set     - soles/mon.     2,700       Other     5%     1 set     - soles/mon.     0     1,550       Other     5%     1 set     - soles/mon.     0     1,556       Other     1 set     - soles/mon.     0     1,556       Total     Total     - soles/mon.     - 0     0     1,556       Other     - file (year)     - 1 sole     - 1,556     1,56       Total     12     dati/year     - 2 dati/year     - 1 sole       Featurent samplin	Expendables     Chemicalis     1 set     9,450     0       Repair     2%     1 set     2,700 soles/year     9,450     0       Repair     2%     1 set     2,700 soles/year     0     7,660       Repair     2%     1 set     2,700 soles/year     0     7,660       Numbered     5%     1 set     2,700 soles/mon.     0     7,660       Ohners     5%     1 set     - soles/mon.     2,700     0       Sub-tend     1 set     - soles/mon.     2,700     0     1,566       Others     5%     1 set     - soles/mon.     0     1,566       Administration     1 set     - soles/mon.     0     1,566       Total     1 set     - soles/mon.     0     1,556       Total     1 set     - soles/mon.     0     1,556       Total     - resumpting     2 day/year     0     1,556       Ecter sampling     12 day/year     - resumpting     1     1,556       Descriptions     2 day/year     - resumpting     - ros     0     1,556       Total     12 day/year     - ros     - ros     - ros     0     1,556       Total     12 day/year     - ros     - ros     - ros <td>Expendables     Chemicals     1 set     9,450     00       Repair     25,05     31,450     0       Repair     25,05     31,450     0       Name     31,450     1 set     2,705 soles/year     - soles/mon.     2,700     0       Obtoos*     5%     1 set     2,705 soles/year     - soles/mon.     2,700     0       Obtoos*     5%     1 set     - soles/mon.     7,680 soles/mon.     2,700     0       Obtoos*     5%     1 set     - soles/mon.     7,680 soles/mon.     0     1,580       Obtoos*     5%     1 set     - soles/mon.     7,680 soles/mon.     0     1,580       Total     1 set     - soles/mon.     7,680 soles/mon.     0     1,580       Total     1 set     - soles/mon.     7,680 soles/mon.     0     1,560       Total     - soles/mon.     - soles/mon.     0     1,556       Total     - ret     - soles/mon.     0</td> <td></td> <td></td> <td>Sub-total</td> <td>and the second second</td> <td>of the state of th</td> <td></td> <td>0</td> <td>9,200</td> <td>9,2</td>	Expendables     Chemicals     1 set     9,450     00       Repair     25,05     31,450     0       Repair     25,05     31,450     0       Name     31,450     1 set     2,705 soles/year     - soles/mon.     2,700     0       Obtoos*     5%     1 set     2,705 soles/year     - soles/mon.     2,700     0       Obtoos*     5%     1 set     - soles/mon.     7,680 soles/mon.     2,700     0       Obtoos*     5%     1 set     - soles/mon.     7,680 soles/mon.     0     1,580       Obtoos*     5%     1 set     - soles/mon.     7,680 soles/mon.     0     1,580       Total     1 set     - soles/mon.     7,680 soles/mon.     0     1,580       Total     1 set     - soles/mon.     7,680 soles/mon.     0     1,560       Total     - soles/mon.     - soles/mon.     0     1,556       Total     - ret     - soles/mon.     0			Sub-total	and the second	of the state of th		0	9,200	9,2
Sub-total     Sub-total     1 set     2.700 soles/yaar     9,450     0       Repar     2%     1 set     2.700 soles/yaar     50,500     0       Others*     5%     1 set     2.700 soles/yaar     2,000 oley/saar     0     7,680 soles/mon.     2,700 0     0       Others*     5%     1 set     2.700 soles/mon.     7,680 soles/mon.     2,700 0     0       (1% for Personnel expenses)     Sub-total     1 set     - soles/mon.     2,700 0     0     1,556       Total     Total     1 set     - soles/mon.     - 0     0     1,556       Total     Total     1 set     - soles/mon.     - 0     0     1,556       Total     Total     1 set     - soles/mon.     - 0     0     1,566       Total     1 set     - soles/mon.     - 1,560     0     0     0     1,566       Frencin     1 set     - soles/mon.     - 1,560     0     0     1,566       Frencin     1 set     - 3 soles/mon.     - 1,560     0     0     1,566       Frencin     1 set     - 3 soles/mon.     - 1,560     0     0     1,556       Frencin     1 set     - 3 soles/mon.     - 1,560     0     0     1,566 </td <td>Sub-neurl         Sub-neurl         1 set         2.700 soles/year         9,450         0           Zepar         2%         1 set         2.700 soles/year         - soles/mon.         7,680 soles/mon.         2,700         0           Zepar         2%         1 set         - soles/mon.         7,680 soles/mon.         2,700         0           Others*         S%         1 set         - soles/mon.         7,680 soles/mon.         2,700         0           Report         Sub-toni         1 set         - soles/mon.         7,680 soles/mon.         0         1,336           Administration         Sub-toni         1 set         - soles/mon.         7,680 soles/mon.         0         1,336           Administration         I set         - soles/mon.         7,680 soles/mon.         0         0         1,336           Totai         I set         - soles/mon.         - soles/mon.         - soles/mon.         0         0         1,336           Totai         - real         - soles/mon.         - soles/mon.         - soles/mon.         0         0         1,336           Totai         - real         - soles/mon.         - soles/mon.         - soles/mon.         0         0         0         0</td> <td>Sub-rotati         2%         1 set         2.700 soles/year         9,450         0           Repair         2%         1 set         2.700 soles/year         2.700         0           Sub-rotati         1 set         - soles/mon.         7.650 soles/mon.         2.700         0           Others*         5%         1 set         - soles/mon.         7.650 soles/mon.         2.700         0           Others*         1 set         - soles/mon.         7.650 soles/mon.         7.650         0         2.500           Administration         1 set         - soles/mon.         7.650 soles/mon.         0         7.550           Administration         1 set         - soles/mon.         7.650 soles/mon.         0         1.556           Administration         1 set         - soles/mon.         7.650 soles/mon.         0         1.556           Administration         1 set         - soles/mon.         - soles/mon.         0         1.556           Total         1 set         - soles/mon.         - soles/mon.         0         1.556           Total         1 set         - soles/mon.         - soles/mon.         0         1.556           Total         1 set         - soles/mon.         - so</td> <td></td> <td>Fruendahler</td> <td>Chemicals</td> <td>- Set Contraction</td> <td>9,450 soles/year</td> <td>soles/mon,</td> <td>9,450</td> <td>0</td> <td>7'6</td>	Sub-neurl         Sub-neurl         1 set         2.700 soles/year         9,450         0           Zepar         2%         1 set         2.700 soles/year         - soles/mon.         7,680 soles/mon.         2,700         0           Zepar         2%         1 set         - soles/mon.         7,680 soles/mon.         2,700         0           Others*         S%         1 set         - soles/mon.         7,680 soles/mon.         2,700         0           Report         Sub-toni         1 set         - soles/mon.         7,680 soles/mon.         0         1,336           Administration         Sub-toni         1 set         - soles/mon.         7,680 soles/mon.         0         1,336           Administration         I set         - soles/mon.         7,680 soles/mon.         0         0         1,336           Totai         I set         - soles/mon.         - soles/mon.         - soles/mon.         0         0         1,336           Totai         - real         - soles/mon.         - soles/mon.         - soles/mon.         0         0         1,336           Totai         - real         - soles/mon.         - soles/mon.         - soles/mon.         0         0         0         0	Sub-rotati         2%         1 set         2.700 soles/year         9,450         0           Repair         2%         1 set         2.700 soles/year         2.700         0           Sub-rotati         1 set         - soles/mon.         7.650 soles/mon.         2.700         0           Others*         5%         1 set         - soles/mon.         7.650 soles/mon.         2.700         0           Others*         1 set         - soles/mon.         7.650 soles/mon.         7.650         0         2.500           Administration         1 set         - soles/mon.         7.650 soles/mon.         0         7.550           Administration         1 set         - soles/mon.         7.650 soles/mon.         0         1.556           Administration         1 set         - soles/mon.         7.650 soles/mon.         0         1.556           Administration         1 set         - soles/mon.         - soles/mon.         0         1.556           Total         1 set         - soles/mon.         - soles/mon.         0         1.556           Total         1 set         - soles/mon.         - soles/mon.         0         1.556           Total         1 set         - soles/mon.         - so		Fruendahler	Chemicals	- Set Contraction	9,450 soles/year	soles/mon,	9,450	0	7'6
Repair         2%         1 set         2,700 soles/year         1 set         2,700 of 0         0           Sub-total         1 set         - 2,700 soles/mon.         7.680 soles/mon.         2,700 of 0         0         7.680 soles/mon.         7.680 soles/mon.         2,700 of 0         0         7.680 of 0         0         7.680 soles/mon.         0         0         7.680 soles/mon.         0         0         1.336 soles/mon.	Repair     2%     1 set     2,700 soles/year     soles/mon.     2,700     0       Sub-total     1 set     2,700     0     7,680 soles/mon.     2,700     0       Others     Sub-total     1 set     - soles/mon.     7,680 soles/mon.     2,680       Administration     Sub-total     1 set     - soles/mon.     7,680 soles/mon.     0     7,680       (1% for Personnel expenses)     Sub-total     1 set     - soles/mon.     7,680 soles/mon.     0     1,336       (1% for Personnel expenses)     Sub-total     1 set     - soles/mon.     7,680 soles/mon.     0     1,336       Obtical     Total     1 set     - soles/mon.     - soles/mon.     - 3,680     0     1,336       Octical     1 set     - soles/mon.     - soles/mon.     - 3,680     0     1,336       Octical     - total     - soles/mon.	Repair         2%         1 set         2,700 soles/year         2,700         0           Sub-total         1 set         2,700 soles/year         3,600 soles/mon.         2,700         0         7,650         0           Others         Sub-total         1 set         - soles/mon.         7,660 soles/mon.         2,700         0         7,650         0         1,556           Others         Sub-total         1 set         - soles/mon.         7,650         0         1,556         0         1,556         0         1,556         0         1,556         0         1,556         1,55			Sub-tom		a the same is seen as a second s		9.450	0	4.0
Kepair         2780         700         7.680           Others         5%         1 set         - soles/mon.         7.680         7.680           Others         5%         1 set         - soles/mon.         7.680         7.680           Nuministration         Sub-total         1 set         - soles/mon.         7.680         7.680           Nuministration         Sub-total         1 set         - soles/mon.         7.680         7.680           Nuministration         Sub-total         1 set         - soles/mon.         7.680         7.680           Total         Total         1 set         - soles/mon.         7.680         1.536           Total         Total         1 set         - soles/mon.         7.680         1.536           Total         note1 k is equal to 5% of the personnel expenses.         - 1 soles/mon.         0         1.536           Total         note1 k is equal to 5% of the personnel expenses.         - 2 day/year         - 1 soles/mon.         0           Freat linets sampling         1 2 day/year         - 2 day/year         - 1 soles/mon.         - 1 soles/mon.           Proteinons source         - 2 day/year         - 2 day/year	Keptif     278       Others*     5%       Others*     5%       Others*     5%       Sub-total     1 set       Administration     7.680 soles/mon.       Others*     5%       Sub-total     1 set       Total     1 set       Sub-total     2 soles/mon.       Total     2 soles/mon.       Total     2 soles/mon.       Total     2 soles/mon.       Sub-total     2 soles/mon.       Total     2 soles/mon.	Keptif     278       Others*     5%       Its     1       Administration     7680 soles/mon.       Total     1 set       Total     2 soles/mon.       Total     1 set       Total     1 set       Total     1 set       Total     2 soles/mon.       Total     1 set       Total     1 set       Total     2 soles/mon.       Total     1 set       Total     2 soles/mon.       Total     2 soles/mon. <td>ta da ante a sere a sere a sere a</td> <td>ſ</td> <td>200-004</td> <td></td> <td>2 200 colar/unar</td> <td>, soles(mon</td> <td>2,200</td> <td>0</td> <td>27</td>	ta da ante a sere a sere a sere a	ſ	200-004		2 200 colar/unar	, soles(mon	2,200	0	27
Others*     5%     I set     soles/mon.     7.680 soles/mon.     0     7.680       Nub-total     I set     soles/mon.     0     7.680 soles/mon.     0     7.680 soles/mon.       Nub-total     I set     soles/mon.     0     1.536       Nub-total     I set     soles/mon.     0     1.536       Nub-total     I set     soles/mon.     0     0       Nub-total     I set     soles/mon.     0     1.536       Total     Total     I set     soles/mon.     0     1.536       Total     Total     I set     soles/mon.     0     1.536       Total     I set     soles/mon.     0     1.536       Total     I set     soles/ment     motion     0     1.536       Total     I set     soles/ment     motion     0     1.536       Total     I set     I set     soles/ment     motion     0     1.536       Total     I set     I set     soles/ment     motion     0     1.536       Total     I set     I soles/ment     motion     0     1.536       Total     I set     I set     I set     1.5     1.5       Treat plant sampling     I set <td< td=""><td>Others*     Switchold     Sub-total     T 680 soles/mon.     0     7.680       Sub-total     Sub-total     1 set     - soles/mon.     0     7.680       Administration     Sub-total     1 set     - soles/mon.     0     7.680       Mainistration     Sub-total     1 set     - soles/mon.     0     1.556       Mainistration     I set     - soles/mon.     0     1.536       Mainistration     Sub-total     1 set     - soles/mon.     0     1.536       Total     Total     - soles/mon.     0     1.536       Total     Total     - soles/mon.     0     1.536       Remain     - concertinent sampling     12     day/year       Recentert sampling     12     day/year       Property (soles)     - fife (year)     - 7.000       Property     - fife (year)     - 7.000       Property     - fife (year)     - 7.000       Property     - fife (year)     - 7.000       Property    </td><td>Others     Sub-total     1 set     - soles/mon.     7.680 soles/mon.     0     7.680       Administration     Sub-total     1 set     - soles/mon.     0     7.680       Administration     Sub-total     1 set     - soles/man.     0     7.680       (1% for Personnel expenses)     Sub-total     1 set     - soles/man.     0     1.536       (1% for Personnel expenses)     Sub-total     1 set     - soles/man.     0     1.536       Total     Total     1 set     - soles/man.     0     1.536       Total     1 set     - soles/man.     - soles/man.     0     1.536       Total     1 set     - soles/man.     - soles/man.     0     1.536       Total     1 set     - soles/man.     - soles/man.     0     1.536       Total     - soles/man.     -</td><td></td><td>Kcpair</td><td>%7</td><td>in set in the set of t</td><td></td><td></td><td></td><td>2 · · · · · · · · · · ·</td><td>i c i c</td></td<>	Others*     Switchold     Sub-total     T 680 soles/mon.     0     7.680       Sub-total     Sub-total     1 set     - soles/mon.     0     7.680       Administration     Sub-total     1 set     - soles/mon.     0     7.680       Mainistration     Sub-total     1 set     - soles/mon.     0     1.556       Mainistration     I set     - soles/mon.     0     1.536       Mainistration     Sub-total     1 set     - soles/mon.     0     1.536       Total     Total     - soles/mon.     0     1.536       Total     Total     - soles/mon.     0     1.536       Remain     - concertinent sampling     12     day/year       Recentert sampling     12     day/year       Property (soles)     - fife (year)     - 7.000       Property	Others     Sub-total     1 set     - soles/mon.     7.680 soles/mon.     0     7.680       Administration     Sub-total     1 set     - soles/mon.     0     7.680       Administration     Sub-total     1 set     - soles/man.     0     7.680       (1% for Personnel expenses)     Sub-total     1 set     - soles/man.     0     1.536       (1% for Personnel expenses)     Sub-total     1 set     - soles/man.     0     1.536       Total     Total     1 set     - soles/man.     0     1.536       Total     1 set     - soles/man.     - soles/man.     0     1.536       Total     1 set     - soles/man.     - soles/man.     0     1.536       Total     1 set     - soles/man.     - soles/man.     0     1.536       Total     - soles/man.     -		Kcpair	%7	in set in the set of t				2 · · · · · · · · · · ·	i c i c
Others*     5%     1 set     solestmon.     7.000 solestmon.     0     7.000       (1% for Personnel expenses)     Sub-otal     1 set     solestytear     solestmon.     0     1.556       Total     Total     1 set     solestytear     solestmon.     0     1.556       note     1 is set     solestytear     solestmon.     0     1.556       Total     Total     12     day/year     0     1.556       Sediment sampling     12     day/year     126     0     1556       Property (soles)     12     day/year     166     0     155       Pollution source     2     day/year     10%     166       Pollution source     2     day/year     0%     0%	Others*     5%     1 set     solestmon.     7.680 soresmon.       Administration     Iset     solestyear     0     7.680 soresmon.       (1% for Personnel expenses)     Sub-total     1 set     solestyear     0     1.536       Total     I t is equal to 5% of the personnel expenses.     0     1.536     0     1.536       nooc     I t is equal to 5% of the personnel expenses.     0     1.536     0     1.536       rotal     I t is equal to 5% of the personnel expenses.     0     1.536     0     1.536       nooc     I t is equal to 5% of the personnel expenses.     Property (soles)     1.536     0     1.536       faintage s. sampling     I     daty/year     2     daty/year     1.645/year     0     1.536       footenty     Notestration     1     daty/year     1.645/year     1.656     1.556       footenty     1     2     daty/year     1.645/year     1.656       footenty     1     2     daty/year     1.656     1.656       footenty     1     2     daty/year     1.656       footenty     1     2     daty/year     1.656       footenty     1     2     daty/year     1.656       footenty     1	Others*     9%     set     solestmon.     7.000 solestmon.       Administration     Sub-total     1 set     solestmon.     0     7.680       11% for Personnel expenses.     Sub-total     1 set     solestration     0     7.680       11% for Personnel expenses.     Sub-total     1 set     solestration     0     1.556       11% for Personnel expenses.     Note:     0     1.556     0     1.556       11% for express.     Note:     0     1.556     0     1.556       11% for express.     Editer sampling     1     2     230/vear     1.556       11     Feat.     2     230/vear     1.556     1.066       11     12     230/vear     1.157     1.066       11     12     230/vear     1.156     1.066       11     12     230/vear     1.15     1.066       11     12     230/vear     1.15     1.066       11     12     12     1.066     1.066       11     12     1.066     1.166       11     12     1.066     1.166       11     12     1.010     1.135.000       12     12     12     1.066       13     12     1.			Sub-total	· · · · · · · · · · · · · · · · · · ·			20.17		it
Administration     Sub-total     1 set.     soles/mon.     0     7.680       (1% for Personnel expenses)     Sub-total     1 set.     soles/mon.     0     1.536       Total     Total     I set.     soles/mon.     0     1.536       Total     Total     I set.     soles/mon.     0     1.536       Total     Total     I set.     soles/mon.     0     0     1.536       Total     Total     I set.     soles/mon.     0     1.536       Total     I set.     soles/mon.     0     1.536       Sectiment sampling     12     day/year     12     day/year       Freat. plant sampling     12     day/year     15     1.15       Property (soles)     12     day/year     15       Dollution source     2     day/year     15       Pollution source     2     day/year     15       Dollution source     2     day/year     10%       Dollution source     2     day/year     10%	(1% for Personnel expenses)     Sub-total     1 set.     soles/year     0     7,680       (1% for Personnel expenses)     Sub-total     1 set.     soles/year     0     1,556       Total     Total     I     1 set.     soles/men.     0     1,556       Total     Total     I     soles/men.     0     1,556       Ferampling     12     day/year     Early     27,000     135,000       Ferampling     12     day/year     Early     7     1,156       Poliution source     2     day/year     12     day/year       Presonnel     12     day/year     13     10%       Ferminge     2     day/year     13     10%       Poliution source     2     day/year     7     15       Fermine     2     day/year     10%     10%	Nuministration     Sub-total     1 set.     soles/year     0     7.680       (1% for Personnel expenses)     Sub-total     1 set.     soles/year     0     1.536       Total     Total     I set.     soles/year     0     1.536       note     1 ti sequal to 5% of the personnel expenses.     0     1.536       note     1 ti sequal to 5% of the personnel expenses.     0     1.536       note     1 ti sequal to 5% of the personnel expenses.     0     1.536       note     1 ti sequal to 5% of the personnel expenses.     10%     135,000       note     1 ti sequal to 5% of the personnel expenses.     10%     16%       note     2 day/year     1 day/year     15     day/year       Personator     2 day/year     1 day/year     7     15       Personator     2 day/year     1 day/year     7     16%       Personator     2 day/year     1 day/year     7     10%       Maining     1 day/year     1 day/year     10%     10%       Personator     2 day/year     1 day/year     10%       Potalinge     2 day/year     1 day/year     1 day/year		Others•	5%		solcs/mon	7,680 soics/mon.	•	0.80.7	
Administration     Sub-total     I set     soles/year     soles/year       (1% for Personnel expenses)     Sub-total     1 set     - soles/year       Total     Total     0     0       Total     Total     I set     - soles/year       Total     Total     - soles/year     0       Total     Total     - soles/year     0       note     - It is equal to 5% of the personnel expenses.     0       note     - It is equal to 5% of the personnel expenses.     - soles/year       note     - It is equal to 5% of the personnel expenses.     - 10%       Personaling     12     day/year     - 10%       Prepriator     12     day/year     - 10%       Prepriator     - 2     day/year     - 10%	Administration     Sub-total     I set.     soles/year     olimitstration       (1% för Personnel expenses)     Sub-total     I set.     soles/year     0     1,556       Total     Total     Total     I set.     soles/year     0     1,556       note: * 1 is equal to 5% of the personnel expenses.     Note: * 1 is equal to 5% of the personnel expenses.     0     1,556       note: * 1 is equal to 5% of the personnel expenses.     Property (soles)     12     4ay/year       reatinge c. sampling     12     day/year     135,000     135,000       Property (soles)     12     day/year     10%       Property (soles)     12     day/year       Property (soles)     12     day/year       Property (soles)     12     day/year       Property (soles)     12     day/year       Property cource     2     day/year       Pollutions source     2     day/year       Pollutions source     2     day/year       Pollution source     2     day/year	Administration     Sub-total     1 set.     soles/mon.     0     1.536       (1% for Personnel expenses)     Sub-total     1 set.     soles/mon.     0     1.536       Total     Total     Instrument     0     0     1.536       Total     Total     Instrument     0     1.536       Total     Note.*It is equal to 5% of the personnel expenses.     0     1.536       Note.*It is equal to 5% of the personnel expenses.     0     1.536       Note.*It is equal to 5% of the personnel expenses.     0     1.536       Note.*It is equal to 5% of the personnel expenses.     0     0     1.536       Note.*It is equal to 5% of the personnel expenses.     0     0     1.536       Note.*It is equal to 5% of the personnel expenses.     0     0     1.536       Note.*It is equal to 5% of the personnel expenses.     0     0     1.536       Note.*It is equal to 5% of the personnel expenses.     0     0     1.536       Note.*It is equal to 5% of the personnel expenses.     0     0     1.536       Note.*It     12     day/sear     12     day/sear       Pollution source     2     day/sear     0     0       Pollution source     2     day/sear     0     0       Pollution source <t< td=""><td>e e e de departe de e e en</td><td><ul> <li>The second s</li></ul></td><td></td><td></td><td></td><td><ul> <li>A second sec second second sec</li></ul></td><td>&lt;</td><td>V07 #</td><td>Y F</td></t<>	e e e de departe de e e en	<ul> <li>The second s</li></ul>				<ul> <li>A second sec second second sec</li></ul>	<	V07 #	Y F
Administration     1 set.     soles/wat     soles/mon.     0     1,330       Toul     Toul     Toul     0     1,530     1       Toul     note:     It is equal to 5% of the personnel expenses.     0     1,530       note:     It is equal to 5% of the personnel expenses.     0     1,530       note:     It is equal to 5% of the personnel expenses.     1     1       note:     It is equal to 5% of the personnel expenses.     1     1       note:     It is equal to 5% of the personnel expenses.     1     1       note:     It is equal to 5% of the personnel expenses.     1     1       note:     It is equal to 5% of the personnel expenses.     1     1       note:     It is equal to 5% of the personnel expenses.     1     1       note:     It is equal to 5% of the personnel expenses.     1     1       note:     It is equal to 5% of the personnel expenses.     1     1       real:     It is equal to 5% of the personnel expenses.     1     1       real:     It is equal to 5% of the personnel expenses.     1     1       real:     It is equal to 5% of the personnel expenses.     1     1       real:     It is equal to 5% of the personnel expenses.     1     1       real:     It is is equal	Administration     Administration     0     1.330       (1% for Personicl expenses)     Sub-total     0     1.530       Total     Total     Total     0     1.530       Total     Total     Property (soles mon.)     0     1.530       Total     Total     Total     1.530     1.530       Total     Property (soles mon.)     0     1.530       Total     Property (soles mone)     27,000     135,000       Eake sampling     1.2     day/year     1.166 (year)     7       Freat, plant sampling     1.2     day/year     1.166 (year)     7       Property (soles mone)     2.1     day/year     1.6       Property (soles mone)     1.2     day/year     1.6       Presentator     1.2     day/year     1.6       Presentator     2.2     day/year     1.6       Presentator     2.2     day/year     1.6       Presentator     2.2     day/year     1.6       Presentator     2.2     day/year     1.16       Presentator     2.2     day/year     1.16       Presentator     2.2     day/year     1.16       Presentator     2.2     day/year     1.16       Presentator <td< td=""><td>Administration     I set.     soles/veat     soles/veat     soles/veat       (1% for Personnel expenses)     Sub-total     0     1,530       Total     Total     0     0     1,536       Total     Total     0     0     1,536       Total     Total     0     0     1,536       Total     Total     12     day/vear     0     1,536       Sediment sampling     12     day/vear     12     day/vear       Property (soles)     12     day/vear     0     16       Pollution source     2     day/vear     10%       Sediment sampling     12     day/vear     10%       Property (soles)     12     day/vear     0       Pollution source     2     day/vear     0       Sediment sampling     12     day/vear     0       Pacetation     22     day/vear     0</td><td></td><td></td><td>Sub-total</td><td></td><td></td><td></td><td></td><td>10001</td><td></td></td<>	Administration     I set.     soles/veat     soles/veat     soles/veat       (1% for Personnel expenses)     Sub-total     0     1,530       Total     Total     0     0     1,536       Total     Total     0     0     1,536       Total     Total     0     0     1,536       Total     Total     12     day/vear     0     1,536       Sediment sampling     12     day/vear     12     day/vear       Property (soles)     12     day/vear     0     16       Pollution source     2     day/vear     10%       Sediment sampling     12     day/vear     10%       Property (soles)     12     day/vear     0       Pollution source     2     day/vear     0       Sediment sampling     12     day/vear     0       Pacetation     22     day/vear     0			Sub-total					10001	
(1% for Personnel expenses)       Sub-total       0       1.536       1.536         Total       Total       note: •. It is equal to 5% of the personnel expenses.       Nachinery.       1.536         note: •. It is equal to 5% of the personnel expenses.       Nachinery.       1.536       1.536         Eaker sampling       1.2       daylycar       1.2       daylycar         Treat, plant sampling       1.2       daylycar       1.5       1.15         Definition source       2       daylycar       0%       1.0%         Action 1.35       1.2       daylycar       0%       1.6         Property (soles)       1.2       daylycar       0%       0%       1.6%         Action 1.3       2       daylycar       0%       0%       0%       0%       0%         Propertor       1.2       daylycar       1.2       daylycar       0%       0%       0%       0%       0%         Action 5       2       daylycar       1.2       daylycar       0%	(1% for Personnel expenses)     Sub-total     0     1.536     1       Total     Total     0     1.536     1       Total     note: *. It is equal to 5% of the personnel expenses.     0     1.536     1       Note: *. It is equal to 5% of the personnel expenses.     0     1.536     1       Note: *. It is equal to 5% of the personnel expenses.     0     1.536     1       Note: *. It is equal to 5% of the personnel expenses.     0     1.536     1       Note: *. It is equal to 5% of the personnel expenses.     0     1.55     1       Sediment sampling     1.2     day/year     2     day/year       Treat. plant sampling     1.2     day/year     1     1       property isole     1.2     day/year     1     10%       Property isole     1.2     day/year     1     1       Property isole     2     day/year     1     1       Property isole     2     day/year     1     1       Property isole     2     day/year     1     1	(1% for Personnel expenses)       Sub-total       0       1,536       1         Total       Total       0       1,536       1         Total       Total       Note. * It is equal to 5% of the personnel expenses.       Note. * It is equal to 5% of the personnel expenses.       184         note. * It is equal to 5% of the personnel expenses.       Note. * It is equal to 5% of the personnel expenses.       135         note. * It is equal to 5% of the personnel expenses.       Its for the personnel expenses.       12       day/year         Externangling       2       day/year       12       day/year       10%         Property (soles)       12       day/year       12       day/year         Presentencov       12       day/year       10%         Presentencov       12       day/year       10%         Presentencov       12       day/year       10%         Presentencov       12       day/year       10%         Flakt sampling       12       day/year       10%         Flakt sampling       12       day/year       10%         Flakt sampling       12       day/year       10%		Administration	an strand to say that is a strand	I set.	soles/year	- soles/mon.		070	<u>_</u>
Total     Total       note     It is equal to 5% of the personnel expenses.       note     It is equal to 5% of the personnel expenses.       Eaker sampling     12       Carr >     Property (soles)       Sectiment sampling     12       Teat, plant sampling     12       day/year     16       preparatory     12       pollution source     2       odd/vear     0%       Property     0%	Total       note: • It is equal to 5% of the personnel expenses.       note: • It is equal to 5% of the personnel expenses.       CEar >       Car >       Sediment sampling       12       day/year       property (soles)       135,000	Toul     Toul       note     It is equal to 5% of the personnel expenses.       note     It is equal to 5% of the personnel expenses.       Car>     Car>       For exampling     12       datainage     2       datainage     2       perpenatory     12       daty/year     15       daty/year     15       daty/year     10%       preparatory     12       daty/year     0%       preparatory     12       daty/year     10%			Sub-total			and the second	0	1,536	
oce .* It is equal to 5% of the personnel expenses.           Action         Cur>         Action         Instrument         Machinery           Laste sampling         12         day/year         7         7         135,000           Treat, plant sampling         12         day/year         7         7         7         10%           Treat, plant sampling         12         day/year         12         day/year         7         10%           preparatory         12         day/year         12         day/year         7         10%           preparatory         12         day/year         12         day/year         7         10%           preparatory         12         day/year         2         day/year         0%         10%	octe: - It is equal to 5% of the personnel expenses.         Car>       Car>         Lake sampling       12         Sediment sampling       2         Treat, plant sampling       12         day/year       27,000         property (soles)       135,000         freat, plant sampling       12         day/year       23,000         preparatory       12         pollution source       2         day/year       10%         Property (soles)       12         day/year       10%         pollution source       2         day/year       10%	ote .* It is equal to 5% of the personnel expenses. <ul> <li>Cur&gt;</li> <li>Cur&gt;</li> <li>Cur&gt;</li> <li>Cur&gt;</li> <li>Cur&gt;</li> <li>Lake sampling</li> <li>12 day/year</li> </ul>									
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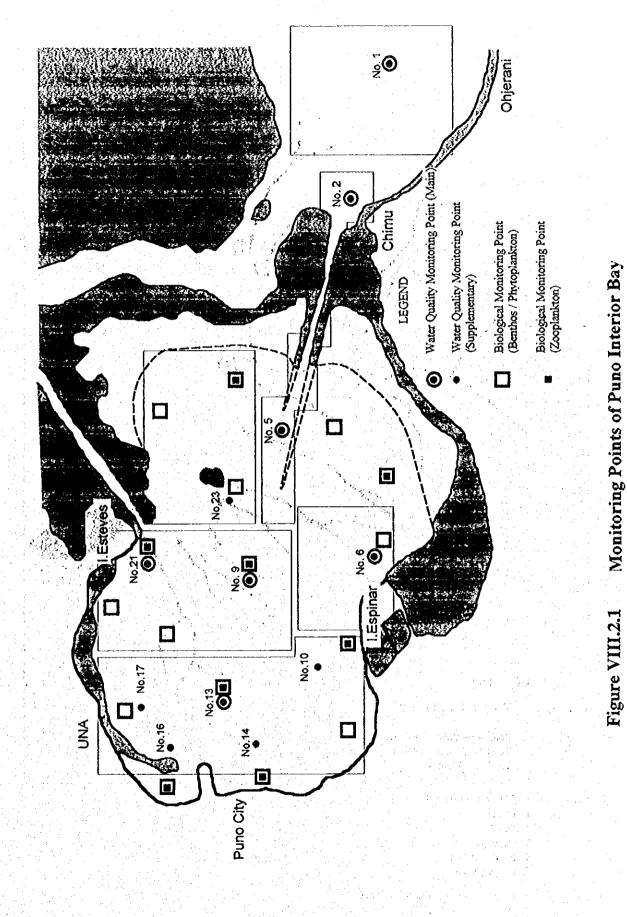
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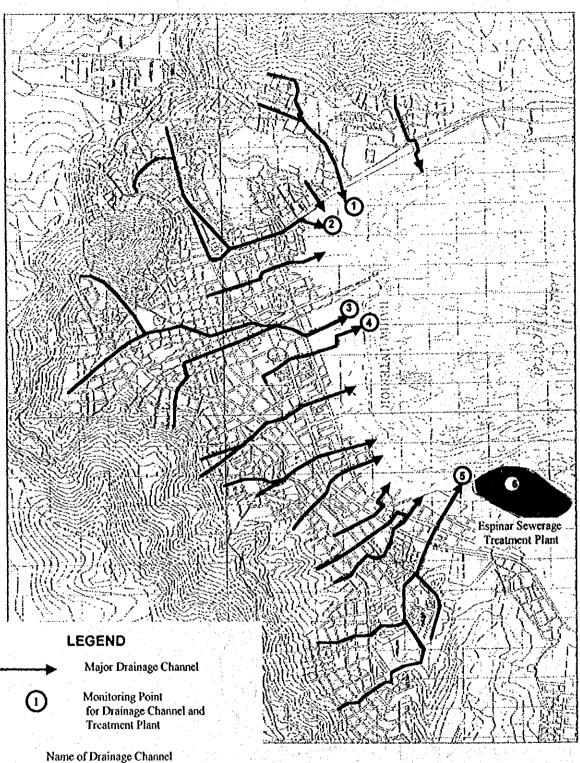
1<u>2</u> 6

Sediment sampling

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- 1 : Llavini
- 2 : Floral
- 3 : Carabaya
- 4 : Ricardo Palma
- 5 : Chanu Chanu
- 6 Espinar Sewerage Treatment Plant

## Figure VIII.2.2

# Monitoring Points of Drainage Channels and Espinar Wastewater Treatment Plant

# CHAPTER- IX NON-STRUCTURAL MEASURES

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### CHAPTER - IX

### NON-STRUCTURAL MEASURES

### 1. TARGET AND STRATEGY

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The non-structural measures described in this chapter are proposed as supplement to the structural measures (the sewerage development and the solid waste management) mentioned in the previous chapters of this Study, for the integrated pollution control of the Lake Titicaca.

These non-structural measures have the targets aiming at: (1) the development and sustainment of the organizational functions of the entities involving in the conservation of the Puno Bay's environment; (2) the motivation of public participation into the activities developed for the conservation of the Puno Bay's environment.

The following strategies are suggested to achieve these targets:

- Development of an institutional consolidation plan for strengthening the Puno Province Municipality's institutional capacity, the Multisectorial Committee, and the coordination between these entities involving in the conservation of Puno Bay's environment;
- (2) Development of a public educational program to promote and motivate the public participation into the tasks for the conservation of the Puno Bay's environment.

### 2. POSSIBLE MEASURES

In other chapters of this report, several specified measures had been discussed for strengthening the managerial capacity of the Puno Municipal Enterprise for Potable Water and Sewerage (EMSAPUNO) and the Division of Public Cleaning of the Puno Province Municipality. To supplement to these measures, the following four non-structural measures are proposed:

(1) The institutional consolidation plan;

(2) The public education program;

(3) The installation of the Clean Day;

(4) The enforcement of environmental regulations.

2.1 INSTITUTIONAL CONSOLIDATION PLAN

The institutional consolidation plan proposed here aims at the strengthening of the Puno Province Municipality's institutional capacity, and the Multisectorial Committee, as well as the strengthening of the coordination between the entities involving in the conservation of the Puno Bay's environment, by identifying the roles of the most important entities.

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(1) Identification of roles of the main relevant entities

There are many entities involving in the conservation of Puno Bay's environment as shown in *Figure VIII.2.1*. This figure also presents the inter-relationships between these entities, as observed by the Study Team. Each of these entities has a specified characteristic, and has some channels to access to some groups of the Puno City's resident.

At this present time, it is observed that the following three entities are taking the most important role in the conservation of the Puno Bay's environment: (1) the Puno Province Municipality, (2) the Multisectorial Committee of Ecology and Environment (Multisectorial de Ecología y Medio Ambiente, or "the Multisectorial Committee" in short), and (3) the PELT (Binational Special Project of Lake Titicaca).

The institutional capacity of each entity should be strengthened to effectively carry out the tasks aiming at the conservation of the Puno Bay's environment. Besides, the role of each entity in the framework of conservation of the Puno Bay's environment should also be identified, and the coordinational relationship between these three entities should be improved.

The roles that these three main entities should take can be identified as following:

(1) The Puno Province Municipality is responsible for the administrative management of all activities for the socio-economic development and the conservation of natural environment of the Puno Province. Taking this responsibility, the Municipality should develop the projects for improving the services of water, urban sanitation, urban sewerage, etc. oriented to the Puno City's residents, organize the programs or campaigns for motivating the residents into the conservation of the environment, formulate and execute the regulations and the plans necessary for the sanitary services, environmental management, etc.

(2) The Multisectorial Committee takes the role as a coordinator between the PELT, the Municipality, the mass media, and other relevant entities. Through these entities, the Multisectorial Committee shall access to as many residents as possible, to promote the educational programs, and to motivate the residents into the events, campaigns, and other activities which are performed for the conservation of the Puno Bay's environment.

(3) The PELT takes the role as a technical adviser, responsible for monitoring the changes in environment, advising the relevant entities on the environmental conservation technology, conducting the projects to utilize the new technology for the conservation of the Puno Bay's environment, etc. The projects' conducted by the PELT should not be duplicated with the ones conducted by the Puno Province Municipality.

The three above-mentioned entities should concentrate its efforts in performing its function respectively, in order to avoid duplicate efforts, and to effectively push forward the programs and campaigns aiming at the common purposes.