FINAL REPORT
ENVIRONMENTAL INFORMATION SERVICE'S CONSULTATION TO ASSIST THE PERUVIAN NATIONAL OFFICE FOR THE EVALUATION OF NATURAL RESOURCES (ONERN) LIMA, PERU

Prepared by
Hira Biswas and German Reyes
Environmental Information Service
The Conservation Foundation

July 21 to August 4, 1989

The Conservation Foundation

March 19, 1990

Claudio Saito
Environmental Officer
USAID/Lima, Peru
APO Miami 34031

Dear Mr. Saito

Per your request, delivered to the EIS on 03/06/90, via Mr. John Wilson LAC/DR, enclosed you will find a copy of the final report of the consultation conducted by The Conservation Foundation to assist the Peruvian National Office for the Evaluation of Natural Resources (ONERN).

This final report incorporates Dr. Biswas' comments on the consultation and the results of introducing a low flow estimating technique. Three staff engineers were engaged to develop some hands-on experience of the Log-Pearson III technique. This kind of analysis was intended as a pilot project using a methodology that can be replicated for the analysis of other rivers in Peru. Unlike the the USA, Peru has not adopted any low flow estimating technique or standards for environmental quality control purpose.

According to my conversations today with Mr. Reyes and Dr. Biswas, they feel satisfied that this report adequately responds to the consultancy's objectives. In addition, this final report has been reviewed by Bill Eichbaum, Head of the Environmental Quality Program of the The Conservation Foundation. Dr. Eichbaum has 20 years of experience in Water Resources Management.

We are sorry for the delay in sending you the final report. Since Dr. Eichbaum and I recently jopined the Conservation Foundation, we were unaware that this was a pending issue. We regret the inconvenience this may have caused you.

Sincerely,-

Carlos Linares
Director Environmental
Information Service

CC: John Wilson
With enclosure: Final Report

1250 Twenty-Fourth Street, NW Washington, DC 20037 USA 202/293-4800 Telex: 64505 PANDA

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PREFACE

This report presents the results of a consultation conducted by the Environmental Information Service of The Conservation Foundation, to assist the Office of Evaluation of Natural Resources (ONERN) of the Peruvian Government with their surface water data needs; assess existing water quality problems; and, identify project areas for water quality improvement.

The authors wish to thank all the persons who contributed their time and knowledge to the preparation of this report. Special thanks to Ing. Raul Gutierrez Yrigoyen, Director General de Estudios Integrados, and Mr. Claudio Saito, Environmental Officer of the UISAID Mission/Peru, for their guidance and support.

This report was prepared by Dr. Himanmay Biswas, water quality expert at USEPA's Watershed Protection Office and German Reyes, Junior Associate of The Conservation Foundation. The in-country consultation was carried out between July 24th and August 4th of 1989.

EXECUTIVE SUMMARY

During the two-week consultation, the authors were impressed by the genuine interest of ONERN researchers for learning about how to solve their water quality management needs. Several problems regarding water quality and institutional arrangements designed for managing water resources were identified.

The data-related technical problems include among others:

- The lack of a national low flow standard to which water quality standards of individual pollutants could be tied;
- Deficient water sampling design, mostly with respect to sampling locations and parameters;
- No data exists on the extent of bacteriological pollution;
- Loading targets can not be determined since standards are promulgated without river flow considerations; and,
- Unpublished relevant data for water quality management. No serious efforts are being made to disseminate valuable information.

The problems regarding institutional arrangements include:

- Lack of a centralized mechanism for pollution control;
- Little or no compliance with the enforcement of penalties and fines to polluters;
- Lack of interagency coordination for natural resources management and pollution control activities.

Principal Conclusions and Recommendations:

1. Promote greater collaboration among ONERN, Ministry of Health, and Other Government agencies: All agencies dealing with water resources should convene to explore a common agenda. Three areas of importance that should be included in that agenda are, the determination of bacteriologic pollution in the rivers of Peru; inventorying the major polluters along their courses; and the enforcement of penalties and remedial actions.

2. Train Key Staff Scientists and Introduce New Skills: ONERN staff needs training in some of the latest techniques in: a) low flow estimation; b) monitoring; and c) water quality analyses. Communication skills and techniques should be introduced to

enhance ONERN's role in the provision of the information necessary for the management of water resources.

3. **Present Vital Information in a Non-technical Manner:** Attempts should be made to present all vital information about each river in a non-technical language. The national planning office needs to explain this information to other government agencies and the public who are unfamiliar with the scientific language used in water quality analysis.

4. **Establish Low Flow Standards:** Establish a low flow standard for the purpose of pollution control and then translate all the monitoring data for that low flow standard.

5. **Select Sampling Locations and Sampling Parameters Using Site-Specific Water Use as a Primary Guide:** In any future diagnostic monitoring work, sampling locations and sampling parameters should be consistent with the site-specific use conditions.

6. **Permit No River to Dry up in Agricultural Lands:** Rivers with high agricultural demand down stream and heavy mining activities in the upper reaches should not be allowed to become completely dry before they reach the ocean to avoid future contamination of agricultural lands with heavy metals.

7. **Establish Mobile Labs for Bacteriological Tests:** Determination of on-site parameters (e.g., bacteria counts) are very important, but within the given constraints of resources, bacteriological tests in those remote locations are possible only with mobile labs.

I. Introduction

The Office of Evaluation of Natural Resources (ONERN) is a cabinet level agency responsible for inventorying the natural resources of Peru, as well as, for formulating planning strategies to assure the sound socio-economic and environmental development of the country. Unfortunately in recent years, little --if any-- planning guidance developed by ONERN reaches the other major government and/or private institutions charged with developing natural resources.

Unfortunately, the weakening of the process designed to plan and coordinate development strategies for controlling industrial, agricultural, and residential pollution is resulting in the indiscriminate disposal of contaminants throughout Peru, especially in surface waters. This, in combination with the excessive use of water resources, has changed the natural characteristics of many areas. Moreover, economic difficulties, combined with the limitations of the current administration to devise constructive economic programs, provides little hope for solving pollution problems without external funding.

II. Objectives

Prior to the consultant's departure from Washington, D.C., the objective of the consultation was to conduct data analysis and interpretation to help ONERN determine pollution loadings from natural and man-made processes, and evaluate the reliability of test results obtained from private laboratories. After meeting with U.S.AID/Lima representatives, however, these objectives were placed in a framework that entailed the following:

- Evaluate the data on physical and chemical parameters from the 70 rivers sampled by ONERN since 1982;
- Provide a broad assessment of existing water quality problems, especially in Lima's metropolitan area, where the quantity and quality of the river waters are being increasingly threatened;
- Assess the natural resources/pollution control areas where ONERN's professionals seriously lack professional training; and,
- Identify possible natural resources/pollution control areas where ONERN could play a leadership role with the financial assistance of the Peruvian government, USAID, or other donors.

III. Assessment of Existing Water Quality Problems

The monitoring data collected by ONERN for diagnostic purposes involves 70 major rivers of Peru and their tributaries. Seventeen of the 70 rivers are on the east side of the Andes leading to the Amazon River and emptying in the Atlantic Ocean, and the remaining 53 rivers are on the western side emptying in the Pacific Ocean. The Pacific side of Peru is arid, only 2 percent of Peru's surface water runs through this side but nearly 65 percent of population live here. The eastern side is wet, covered with dense forest and is relatively under populated. Mountainous terrain make sample collection and transportation very difficult; sampling locations were in many cases adjusted for ease of access and sample transportation.

A. Water Quality Use and Standards

Irrigation, industrial, and municipal are some of the major water uses. Mining is the most important industrial use and mining activities are located mostly at the upper reaches of the Andes. Most irrigation and agricultural activities are conducted down in the valleys, near the ocean in the western side or near the border in the eastern side.

Ninety percent of the flows in the Pacific side are used for irrigation, and the rest is used to meet mining and municipal needs. Water shortage in the pacific side is severe. Irrigation demands are so heavy that many rivers in this area run dry before they reach the ocean. So the potential of contamination of agricultural lands with mining wastes, heavy metals and salt is significant. Peru has national maximum permissible limits for BOD-DO, heavy metals and pesticides. Peru does not have a national low flow standard to which water quality standards of individual pollutants could be tied.

B. Sampling Locations, Timing, Frequency and Parameters

Sample collection and analyses were done in the year 1983. Three of four sampling locations were selected on each river sampled. The first sampling location was generally 5 Kms. from the ocean outfall, and the other two or three sampling points are about 25 Kms. apart. All sampling was done during low flow months. Samples were collected on three or four separate months. Each time grab samples were collected for 3-5 days. Analyses of DO, PH, heavy metals and pesticides were done for all samples collected for all locations.

1. **Number of Samples:** Adequate for the diagnostic purpose.

2. **Sampling Period:** All sample collections were done during the appropriate low flow period of each river.

3. **Sampling locations:** Not appropriate for diagnostic purpose. Instead of setting sampling locations 25Kms. apart, sampling locations for diagnostic purpose should have been located before and after the major designated water uses. For example, sampling should be done before and after an area of ore and mining activities in order to find out how these activities impact the quality of the receiving water. The same would apply to the major agricultural and other activities.

4. **Sampling Parameters:** Sampling parameters could have been more selective for diagnostic purpose. For example, there may not be sound reasons to analyze all samples for the same parameters. For diagnostic monitoring of a mining activity in the upper reaches of the river in the Andes, analyses of pesticides may not be useful. On the other hand, a river with a lot of agricultural activities and no mining and/or other industrial activities may not be monitored for heavy metals. Although some of the data that have been generated may not be directly used to meet diagnostic needs, they may be used as background concentration for future use. These rivers are rarely monitored and therefore, any information generated on these rivers could be potentially useful in the future.

Also, information from our trip to the national lab and review of bacteriological data for some of the monitoring stations around Lima led us to believe that bacteria counts for many of the sampling sites should have been done. Our discussion with senior managers revealed that the upper management is acutely aware of this need. But since there is no Regional Lab for such tests, and since transportation of samples through the mountainous terrain to the Lab in Lima, was time consuming and prohibitively costly, the planning office had to go without it.

5. **Sample Analyses:** Although there were a number of questions about sample analysis in the planning office, our review of data, consistency tests, visit to the lab and discussion with lab professional led us to believe that by and large sample analyses were good.

6. **Data Use:** The use of data is spotty. The planning office sends only those sampling data to the relevant ministry for follow up actions where data showed actual exceedence of national maximum permissible pollutant standards. A file has been maintained for each of the 70 rivers sampled. Although the information are filed in an

orderly fashion, their use by upper management will be limited unless attempts are made to surface and present critical information in a non-technical manner.

In summary, despite the extensive amount of data collected by ONERN, we found that pollutant levels were not related to the existing river flow characteristics during the time of sampling; points of sampling completely ignored the geographic location of major river water users (mining, agricultural, and domestic); and that, the data remained hidden in files despite the crucial role they play in designing natural resources development programs.

IV. Major Findings

A. Institutional and Policy Issues

There are four major government agencies responsible for determining the type and extent of surface water uses. They are:

- ONERN - provides the information necessary for the management of water resources;
- Ministry of Agriculture's Office of Water - designates water uses;
- Ministry of Health's Technical Directorate of Environmental Health - establishes pollution control guidelines to all users of surface waters; and,
- Ministry of Mines - oversees mining activities.

Several problem areas were identified within this institutional framework. The effective implementation of existing water pollution control programs is difficult due to the following reasons:

- The water-use designations promulgated by the Office of Water of the Ministry of Agriculture favor agricultural-related activities over other equally important uses of the river water (recreation, wildlife protection, residential, etc.);

- The high-altitude location of mining activities reduces the competition for land and water resources with farming practices and other downstream uses. The polluting of agricultural lands and river surface waters by mining waste, however, is seriously impairing the future of agricultural production and farming in general.

- Cadmium, Lead, Copper and Zinc are few of the heavy metals found to be exceeding the permissible levels or

standards. Even in instances where control measures and fines are imposed on miners by the Technical Directorate for Environmental Health, little compliance results since it is the Ministry of Mines who enforces them.

- Industrial use is generally small and concentrated in or near populated centers. The scanty information on the amount of pollutants discharged, as well as their impact on water quality, precludes the Directorate from establishing realistic and enforceable pollution control targets.

- Although, the Directorate has adopted several WHO-recommended standards for the control of municipal discharges into river waters, their enforceability is negligible since there are no data on the extent of the bacteriological pollution.

- Despite the large number of standards adopted in Peru for controlling point and non-point sources of pollution, none are based on low river flow characteristics, making the promulgation of pollution control measures worthless since it is impossible to determine loading targets (amount of pollutant that can be discharged in a specific time interval) for each use along the rivers.

  Take for instance, the Rimac River which flows through Metropolitan Lima. Along this river there are over 400 major discharges, including: domestic (154); agricultural (150); industrial (43), mining (26); power plants (14); and, cattle grazing (12). Because these uses are not clearly coordinated among government agencies and/or controlled in terms of low flow characteristics, the loadings generated by the 50 major discharges alone create a demand for oxygen of nearly 230,000 kg/day. As a consequence, treating the water for drinking purposes in Lima is a continuing priority [and a very expensive one].

Some of the institutional problems identified within ONERN include: lack of communication between high-level officers and water quality research staff; lack of funds for promoting research activities and increasing staff; and lack of training opportunities on water quality management.

V. Conclusions and Recommendations

1. **Establish Low Flow Standards:** Establish a low flow standard for the purpose of pollution controls and then translate all the

monitoring data for that low flow standard. This will identify potential water quality violations at times when stream flows were lower than flows of the sampling periods. Follow up waste load control actions should be taken based on those potential violations.

By taking into consideration low flow values and recalculating its water quality figures, ONERN will be able to determine the exact number of rivers where the standards were violated. Once completed, these data should be displayed in an easy-to-understand format and distributed among key government officials.

2. **Select Sampling Locations and Sampling Parameters Using Site-Specific Water Use as a Primary Guide:** In any future diagnostic monitoring work, sampling locations and sampling parameters should be consistent with the sire-specific use conditions.

Better design for water quality sampling can be achieved by: organizing rivers to be sampled by river size; identifying uses along the rivers; and, selecting sampling sites where such activities are located. For example, if an active mine is identified, sampling should be done right before and right after the mining area so as to determine its pollutant loading.

3. **Permit No River to Dry up in Agricultural Lands:** Rivers with high agricultural demand down stream and heavy mining activities in the upper reaches should not be allowed to become completely dry before they reach the ocean to avoid future contamination of agricultural lands with heavy metals. For these rivers, a minimum flow at the national low flow standards may be maintained during the extreme drought events.

Water-use designation systems must be improved to accommodate all uses - The favoring of some river uses over others provides only temporary economic benefits to some at the expense of the entire ecosystem. For example, the effect of diverting surface waters for irrigation purposes is nothing else but converting agricultural lands into sanitary landfills for mining wastes, thus, increasing the risks to human and environmental health. In other cases, the favoring of agricultural activities also limits most recreational uses since rivers disappear before reaching the ocean. Not only does this undermine the ecological importance of the river, but also impedes the dilution process of pollutants.

4. **Establish Two Mobile Labs for Bacteriological Tests:** Bacteria counts are very important, but within the given

constraints of resources, bacteriological tests in those remote locations are possible only with mobile labs.

At least two mobile laboratories are needed (we recommend one mobile lab for the east side and one mobile lab on the west side of the Andes), for enabling ONERN staff to determine on-site parameters. On-site inventorying of microorganisms would help water quality surveyors obtain a preliminary idea of the pollution conditions in the area to be sampled in a matter of minutes, avoiding extensive --and expensive-- sampling.

5. **Surface and Present Vital Information in a Non-technical Manner:** Attempts may be made to present all vital information about each river in a non-technical language. The national planning office needs to explain this information to other government agencies and the public.

Better information dissemination can lead to public support of the issues, interagency coordination and the improvement of water quality in most rivers. This requires informing Peruvian business and public officials (unfamiliar with the scientific language used in water quality analysis).

6. **Train Key Staff Scientists and Introduce New Skills:** ONERN is staffed by some very bright scientists and engineers. But they are not well acquaint with some of the latest techniques in low flow estimation, monitoring, and water quality analyses.

The government of Peru will benefit by providing them training in these areas. In addition, communication skills and techniques should be introduced and developed to enhance ONERN's role in the provision of the information necessary for the management of water resources.

7. **Promote greater collaboration among ONERN, Ministry of Health, and Other Government agencies:** Rather than continuing with their respective agendas without regard to coordinated efforts, all agencies dealing with water resources should convene to explore more effective ways of utilizing their available financial and human resources. Three areas of importance that should be included in that agenda are, the determination of bacteriologic pollution in the rivers of Peru; inventorying the major polluters along their courses; and the enforcement of penalties and remedial actions.

This is a particular area where ONERN could play a leadership role with the financial assistance of the Peruvian government, USAID or other donors.