9.3.2 Basic Investigation and Research

The basic investigation and research necessary to make a plan for water quality conservation was partly executed in this study. But the study period was very limited, that was only one year, therefore some problems were left to make clear or to be solved hereafter. The concrete subjects are given in each supporting report.

9.3.3 Applicaton of Water Quality Conservation Techniques

Concerning the applicable techniques for water quality conservation in the Ypacarai basin, this has beeen explained previously in Chapter 8. The better part of these techniques require a great investment, including the use of some kind of facilities or equipment, which would be the most effective.

Regarding the application of these techniques to the non-point sources, the fundamental measure of improving water quality is planned land use, which requires a lot of time to implement becase of the necessary legal procedures and related water quality conservation measures. Normally, the improvement of facilities which serve non-point sources requires great investment, although the effect is minor. Thus, it would be desirable to improve the techniques for water quality conservation which serve the point sources.

It would be better to have as a first priority the application of these techniques to industrial sources according to the amount of generation, discharge and inflow of pollutants into the water body. The inflow pollutant load from demestic sources is small as compared to that of the industry sources. Nevertheless, as was mentioned above, the discharge itself from domestic sources is larger. In urban zones, where populatoin desity is high, and the social infrastructure is insufficient, it is expected that in the future, these zones will contribute much more pollution. Therefore, measures related to domestic sources should be implemented at this point. Likewise, in spite of the small contribution of pollution from tourism facilities, it would be logical to take measures now to control this pollution, so that the same people who use these facilities would benefit from its unpolluted state.

With respect to supporting the fundamental potential of natural purification, it is advisable to apply expanded measures of conservation in the following ways: to forest zones, in order to prevent the inflow of sediment and other contaminated matters; to marshes, which have a great capacity for water

purification. This form of conservation concerning the natural environment, is not only more desirable than the implementation of the measures which require artificial facilities, from an ecological point of view such as, the conservation of the countryside, but, in the long-term it would be more cost-effective.

All the technical details concerning the implementation of these measures have been given in Chapter 8.

9.3.4 Legislation Provision

It is necessary to make an effective code system in Paraguay in order to proceed in the prevention of water pollution. This is stated in the following: ① to decide on those responsible for monitoring the water quality, to identify the work required to be effectively carried out by those responsible, ② to indicate reliable data on water quality standards in public water areas and also on water quality standards of drainage, ③ to establish the system of investigation in advance, at a public gathering, of behavior which influences the environment such as the discharge of pollutants, ④ to introduce preferential measures in order to proceed in planned land use and in the establishment of water purification facilities.

According to these points, the present conditions and problems in Paraguay will be shown to be the following.

1) Those responsible for water quality monitoring

The water quality in aquatic areas which are affected by an unspecified number of persons, grows worse generally, unless a public organization takes control of the situation. In Japan, rivers, lakes, ports and the coastal area are regulated as public water areas, and the water quality requires continuous monitoring by the heads of local public bodies. The results are required to be publicized.

On the contrary, in Paraguay, the idea of "public aquatic areas" has not been established yet and those responsible for rivers and lakes are not clearly designated. Although, where facilities exist, people are designated to run them. However, there is no obligation to control the water quality nor other environments.

First of all, people responsible for the environment and for work to be undertaken have to be selected for the purpose of conservation of the whole environment, including the water quality in public aquatic areas.

Pollution sources also require people who can perform the function of monitoring the water quality. For factories and businesses which discharge at least 50m^3/day, a person to monitor and carry out proper drainage treatment is necessary. What is desired is to establish schools for qualified trainees in the area of drainage treatment performed by the governmental agencies.

2) Establishment of water quality standards

As for the establishment of standards for the lake and inflowing rivers as public aquatic areas, the fundamental concepts are shown in the preceding paragraphs. It is hoped that the standards well be established as soon as possible according to the results of future investigations.

Specific water quality regulations on discharge need to be established, depending on the type of industry, after considering the water quality standards in the public aquatic area and the situation of the discharge of pollutants, as mentioned above. In order to regulate the water quality of drainage, there are two methods: to regulate only the concentration; or to regulate the total amount of the polluted matters discharged. One or both of these methods could be applied depending on the nation and the district. However, for closed type water areas which promote easy accumulation of pollutants as compared to rivers and the sea, it is necessary to apply areawide total pollutant load control, as they would be the most effective.

3) The pre- and post-inspection systems with regard to the behavior of pollutant emission

As for the drainage of pollutants into the aquatic areas, there is the development land use which enhances the drainage from non-point sources and the establishment of factories and offices which increases the drainage from point sources.

In Paraguay, there are no goverment or districts to regulate the use of land or the establishment of factories and offices. Therefore, in the Lake basin, development is going on at random in the form of the cutting

down of forests and creating housing sights, which is unfavorable with regard to water quality conservation.

In a way, with regard to the pollution discharge, items of prohibition were elaborated in 1980, to include hygiene laws. However , the cases where this applicability was accepted, and prohibited pollution discharge loads, are few.

In order to improve this situation, at land development and factory and business locations, a system of advanced investigation and a system of monitoring the protection of the conditions, from the time of the investigation, are necessary. Furthermore, especially in that which concerns large-scale development, it is necessary that, in advance, assessments are made of the possible effects on the environment and, from these results, that the nation and districts retain the jurisdiction to regulate their consequential development and establishment.

4) Introduction of various preferential items

In order to decrease the amount of drainage of polluted matters from the basins, it is necessary to use the land adequately, and also to establish various facilities for water purification and treatment. It is necessary to consolidate the preferential items concerning taxes and a system for the provision of assistance funds, before obliging factories and offices to construct those facilities, as the construction is costly.

Furthermore, to proceed with the land use plans according to water quality conservation, regulations are necessary; but in order for these regulations to be fully effective, a preferential tax system should be adopted which decreases the taxes on forests and marshlands which effectively purify the water.

9.3.5 Education and Enlightenment

A basic thought existing in many countries, which represents the difficulty which lies in general environmental conservation, including water quality, is that "investing in environmental conservation brings an economic growth slowdown, thus, in order to improve the standard of living, the degradation of the environment must be withstood. Which is to say, environmental conservation and economic progress cannot stand side by side".

However, if the economy is raised and the standard of living improved, demand for a pleasurable environment will increase. The irreversibility of damage to the environment is certainly possible. There are very few countries which have achieved a restoration of the environment after ignoring it for economic gains, without investing a large sum of money. Furthermore, before an improvement in the standard of living, human existence ruins the environment to an unforgivable extent, and in the case of some countries and regions, past land use also resulted in the remarkable degradation of neighboring countries and regions.

In order to avoid this kind of situation, all peoples and users must understand that, economic development and environmental conservation are not exclusive of one another, but that the environment is a great public resource whose use is not limitless. Finally, it must be understood that it is necessary for all users to contribute efforts to provide for the environment's long-term integrity.

Until recently, in Paraguay all factories and installations discharged their emissions directly into the rivers, causing eutrophication, despite the fact that by the 1970's, water quality in Asuncion's metropolitan area and its environs was frighteningly poor. Rivers had long since lost the ability to clean themselves.

The concern the people in Paraguay feel for water quality conservation is inadequate. Looking at this from anoter angle the guarantee, up to present, of a favorable water quality environment in this country is admirable; however there is a need to reform the up-to-now "throw it in the river and forget it" way of thinking, and to penetrate every level of the society with the above idea to bear the appropriate expenses and to carry out the maintenance of public property.

The concept of environmental and water quality conservation above must be disseminated among those responsible at factories and offices, the general populace in the basins, governmental officials and students in ways and means appropriate for the level of each group.

As for diffusion methods, the following are possible: preparation/ distribution of pamphlets, staging lectures and research seminars, airing of special TV programs, preparation of posters, designation of an environmental week, re-examination of education curriculum concerning environmental science, establishment of a water garden.

9.3.6 Administrative Organization Reinforcement

In order to formulate and implement a policy of conservation for a certain body of water, it is necesary to take measures at all stages, including the generation, discharge and introduction into the environment of waste, while considering the natural and socieconomic conditions of the environment. Therefore, it is desirable to create a body which administers and takes measures to protect basins, as England does, through the Water Authority.

To actually make an independent system and attempt to recommend measure operations entails problems: if there are overlapping projects and recommendations for various projects from differing sources, and conflict and contrast in existing governmental organizations, and no adjustment either of the budget or of the functioning of the administration, there will be little ensuing success for the measures. Accordingly, it is hoped that the environmental administration agency will possess the authority to take the initiative in other administrative agencies' coordination and execution of policies related to this project. This would include the support for personnel and budget, by its position within the government.

In Paraguay, there does not yet exist such a governmental agency for, as it shows in 2.4, various agencies individually effect work which links directly or indirectly to water quality conservation. Thus, in order to promote conservation measures for solely the Ypacarai basin, establishment of a new agency, "Lake Ypacarai Basin Management Authority", is proposed.

However, to construct a new agency immediately with these functions and jurisdiction does not seem possible from the viewpoint of funding and personnel, nor necessary as existing agencies could share the burden. Therefore, it is thought a good idea to name as nucleus for this the lake research team which was formed for this project. Desired is the assistance of an international specialist who is knowledgeable in environmental administration and water quality conservation techniques.

In the beginning, since it will be difficult to secure sufficient personnel and finances, it is desired to construct an agency which could assume only the duty of planning and coordination; and then, gradually, could transfer over functions and personnel from agencies closely related to water

quality/environmental conservation; and, finally, could assume the full capacity of actual operations and work execution.

Lake Ypacarai Basin Management Authority will be required to promote the followings: ① continuation of fundamental research, ② diffusion activities, ③ preparation of laws and regulations, ④ implementation of conservation measures, ⑤ development and application of relevant techniques, ⑥ guidance in monitoring for engineers and educational operations, ⑦ monitoring of water quality, ⑧ assurance of sufficient financial and human resources.

9.4 Socioeconomic Benefits Caused by Water Quality Conservation

In order for water conservation measures to have the support of the population, and effected without difficulty, it is imperative to demonstrate that the benefits of the measures will exceed the losses resulting if they are not implemented. However, this profit must include economic benefits not spread via the market (in other words, exterior effects).

Presently, not enough facts exist for a cost/benefit analysis; therefore, this report can only expound on the socioeconomic benefits that will derive from the conservation measures.

The socioeconomic value of a safe quantity, quality and flow of water from lakes and rivers can be divided as follows: ① useful function as a resource for potable, industrial and agricultural water, ② useful function as the resource for the pleasant existence of people and animals (Function as a resource for national territorial conservation without causing inundations and erosion and for the pleasant atmosphere at tourist and recreation spots).

Consequently, the benefits of conservation measures will come as a consequence of the maintenance of these two functions.

As concerns the Ypacarai basin, the following could be improved: decrease in cost of purification and treatment, decrease in health cost for inhabitants, decrease in health cost for animals, increase in farm income by using river water for irrigation, increase in recreational/tourist spots income, increase in land value, prevention of decrease in farm animal production, increase in fuel resources.

The Lake and its basins have not been fully used on a wide scale, but the basins' population is subject to the spread of abundant health hazards; and the vital changes which occur in the ecological system are not met at the same rate by degradation of the environment. Accordingly, present profit from water quality conservation measures do not exceed their expenses, however for the next generations, the potential for profit is quite remarkable.

9.5 Implementation of the Water Quality Conservation Plan

9.5.1 Yearly Planning

In order to implement the water conservation plan without losing time it is necessary to consider the many types of measures outlined in 9.3. For that very reason this report has examined the conditions in which these measures will be applied.

1) Application of the techniques of water treatment and purification

In order to establish water treatment and purification facilities, if the acquisition of land, the water quality standard for discharge and the cost sharing system legalities are not settled, the execution is bound to be quite problematic. Consequently, the establishment of legislations comes first, however, it is somewhat possible to eatablish the facilities, depending on the proper application of present legislation. For example, concerning operational suspension or existing drainage treatment facilities which require repair, the direction of the future funcions would be possible if the administrative agency possessed enough guidance potential.

In a sense, if legislation is not fixed for the establishment of environmental conservation which assures a large capacity for natural purification and of the public water body, for the determination of the necessary monitoring specialists and their related duties, and for the land use regulations, excution is going to be extremely difficult. However, before setting up legislation, selection must be made of the zones requiring conservation, and land use plans which would prove effective for water quality conservation must be designed. Furthermore, the prohibition of dumping garbage and polluted matters into the lake and rivers, and the campaign for forest and swamp protection can be effected without having to wait for the implementaion of legislation. Therefore, even the sense of the administrative agency's enthusiasm should be made apparent as early on as possible.

2) Formulating legislation

9.3.4 points out the legislation necessary for water conservation. To implement this legislation, information must be collected upon which a coherent legislative structure can be erected. That legislation, in turn,

will help to unify the population and the institutions, as well as establish systems of support and penalty.

3) Instruction and education

All sectors of society must understand and support the idea of water conservation for it to move ahead. Therefore, instruction and education of all proposed activities must remain a priority.

4) Bolster the administrative agency

As 9.3.6 explained, the central administrative agency should have the functions and powers to oversee water quality control throughout the basin. First, though, all existing organizations must be told of the need for this new agency, its functions and proposed powers.

Presently, there is no proposed length of time for water conservation measures to achieve their goals. However, if we take into account that after ten years palpable results will not be available, the most appropriate time frame is approximately 20 years. Considering that in the year 2011 (within 20 years) Paraguay will celebrate the bicentennial of its independence, this seems to be a good year to envision for success of the proposed goals.

Figure M9511 shows the yearly flow chart, and the diverse measures which establish, as a goal, the year 2011.

9.5.2 Financial Plan

Getting financing from the national budget in order to implement conservation measures for Lake Ypacarai and its basin as proposed in Figure M 9511 is difficult, as explained in Chapter 2. Implementing installations for water treatment and purification can be assisted by international economic aid. Nevertheless, resources to assist in compiling information, monitoring and carrying out activities of diffusion should be supported principally by internal resources.

Methods for the procurement of funding are the following: ① introduction of new tax regulations, ② using the profit from any operations, ③ introduction of tax breaks for those contributors who bear the cost of facility establishment.

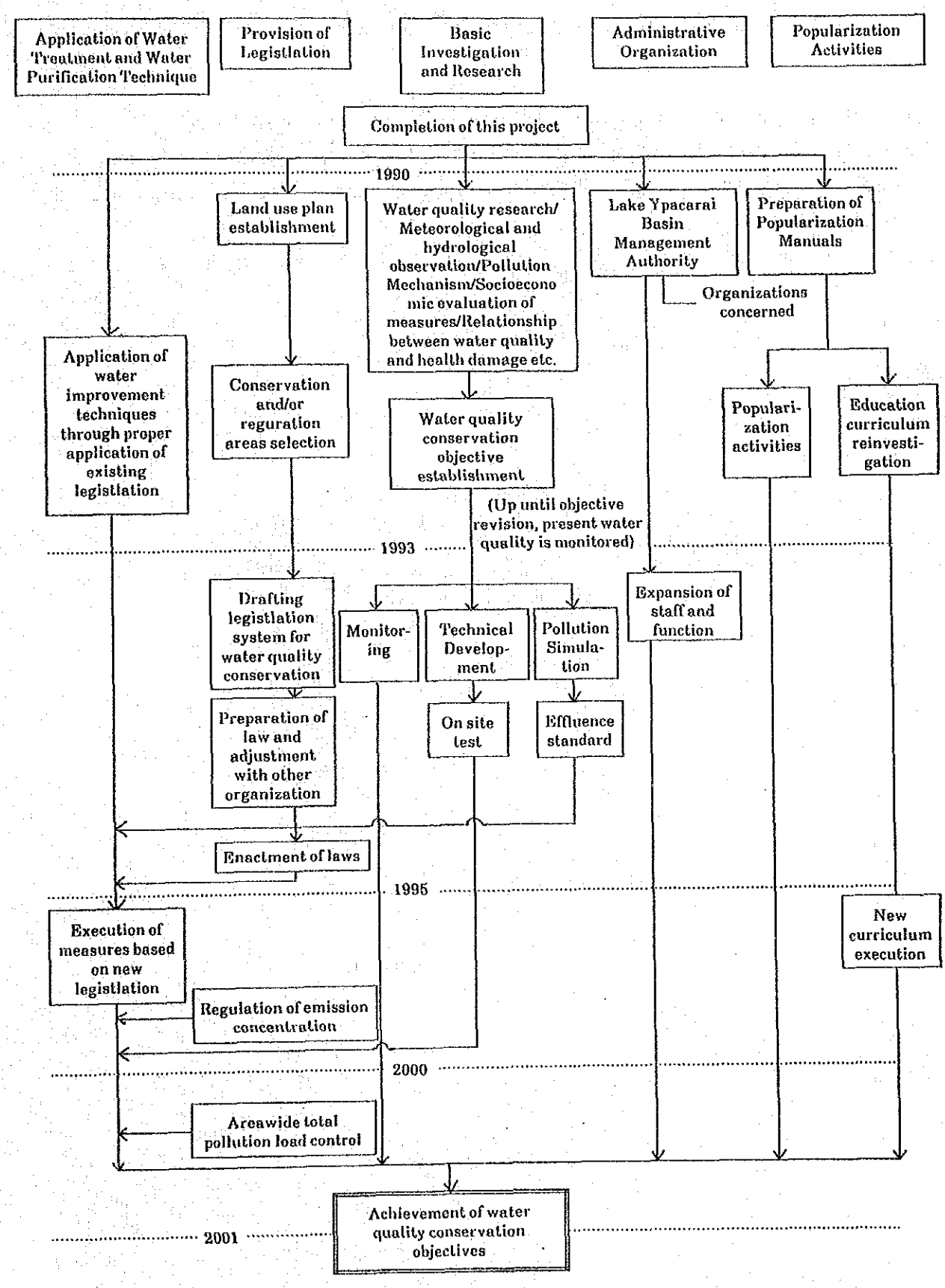

Fig. M9511 Yearly Plan for Water Quality Conservation

However, ① is found to be the most effective in assuring a long-term financial resource.

Today, in any country, it is common sense that the contributor to pollution bear his/her proper cost burden according to the contribution amount (pollution contributor burden principle). Therefore, new taxation regulations based on this principle would easily win the people's support and , it is thought, constitute the best method in finance procurement for the conservation operations.

CHAPTER X CONCLUSION AND RECOMMENDATION

CHAPTER X

CONCLUSION AND RECOMENDATION

10.1 Conclusion

1. From the results of survey, investigation and on-site observation, the following are made clear about the natural environment of the lake and its basin;

   1) It is judged that almost all the Yuquyry River water is running into Lake Ypacarai. Therefore, 892.6km^2 of the Lake Ypacarai basin is comprised by the Pirayu River system, Eastshore river system, Westshore river system and Yuquyry River system. Downstream of the Yuquyry River, a vast marshland exists.

   2) The Lake Ypacarai is 3m in maximum depth, and its bottom is flat and covered uniformly with black mud except near the shore.

   3) The strata/rocks found in the basin are dug out everywhere as raw materials of building stone, gravel and ceramics, which represent one of the runoff sources of earth and soil. The soil in the basin is sandy, lacking in organic substances and runoff is common.

   4) The annual precipitation during the study period was the average of normal year, but the temperature and precipitation of each month differed from those of a normal year. The precipitation differed in every district, even in the basin.

   5) The lake water level has low correlation with rainfall (river water level) and is greatly affected by egress to the Salado River. The lake water level recorded in January 1988 was 2.60m greater than the past's maximum, and produced clarity of the lake water.

   6) The runoff time of rainfall is 1.5 to 2 days at the Pirayu River, and 0.5 to 1 day at the Yuquyry River. This is due to the fact that the urban area ratio in the basin of the latter is high.

   7) In the Lake basin, mountain forest and riverside forest are being reduced, especially in the Yuquyry basin. This is important regarding earth and soil runoff prevention and water quality conservation.

   8) The lakeside is rich in vegetation, in particular, hydrophyte shows how its distribution is strongly controlled by wave and

wind. The phytoplankton and zooplankton in the lake show a particular composition in the eutrophic lake.

2. From the results of analyses of various statistical data and interviews, the socioeconomic issues which represent the background of water quality pollution can be summarized as follows:

   1) The pressure from the expansion of Asuncion metropolis on the basin is very large, and how to reduce this pressure is one key to solve the water pollution problem of the Lake basin.

   2) In the Yuquyry basin, adjacent to the Asuncion metropolis, the urban area has more than doubled during recent 23 years. On the contrary, in the Pirayu basin the area for pasture is large from long ago and remarkable change has not been found in the land use.

3. The treatment of waste water from the pollution source found in the Lake basin was understood through the on-site survey and by information gathered by questionnaires. The generation/discharge of pollution was estimated by referring to existing data. The main results are as follows:

   1) Most of the domestic/industry/public facilities pollution sources are located in the Yuquyry basin, and the tourism pollution sources are concentrated in the Eastshore basin.

   2) Most of the domestic waste water is treated by infiltration tanks at every house, and only a small portion is sent to a public sewage treatment plant through sewerage.

   3) The tourism pollution sources are treated by septic tanks and storage tanks, but many of them are not properly maintained and managed.

   4) The waste water from public facilities is comparatively well treated.

   5) As regards industry pollution sources, vegetable oil refineries discharging large amounts of high concentration waste water is the largest problem. As to the middle- to small-scale factories of other industry, only a few are equipped with

lagoons and most discharge waste water into river without treatment.

6) Among the load generated by point sources, that from domestic is the largest, followed by that from industry. However, as the runoff coefficient of domestic waste water seems to be low, waste water from industry has a great influence on the water quality of the lake and the rivers.

7) The pollutant produced by non-point sources is mainly due to organic substances from pasture/farmland and earth and soil discharged form uncovered areas of the forest.

4. The following points became clear about the pollution of the rivers and the lake, through the study on water and bottom material quality.

1) In the Yuquyry River system, there are many sections polluted by organic substances, but in the Pirayu River system, the degree of such pollution is low.

2) The pollutant concentration level in flood time does not increase in the Yuquyry River, but it increases to several times that of normal water level in the Pirayu River. Therefore transportation load per unit time of the two rivers become almost equal in flood time. This may be due to the fact that the ratio of pollution produced by point sources is high in the former and the ratio of that produced by non-point sources is high in the latter.

3) The contributions to the yearly load into the lake including the marshland were estimated at around 50% from the Yuquyry basin, and around 30% from the Pirayu basin. However, as the purification capacity of the marshland downstream of the Yuquyry River is large, the actual load flowing into the lake is not supposed to differ too much between both drainage basins.

4) Judging from Chl-a concentration, 20~30% of organic substances in the lake water is of phytoplankton origin. And 60~70% of the lake water TCOD is DCOD, which concentration is not too much different from that of the inflow river water. Moreover, BOD/COD is low both in the river water and the lake water. Therefore, it seems that a considerable portion of the organic substances are dissolvable

and difficult-to-decompose carried in by rivers; but this is not entirely clear.

5) The nutrient salt concentration in the lake water is extremely high, but the phytoplankton breeding is usually suppressed as the turbidity is high. However, as the transparency was high during the study period, internal production was stimulated and water blooms were generated, too.

6) Causative substance of extreme high turbidity of the lake water is probably present as the dissolvable and difficult-to-decompose organic substances which are carried in from the drainage basin; but this has not yet been proved.

7) The lake water contamination level by bacteria and toxic substances is low. However, at the downstream of the Yuquyry River, the number of fecal coliform group is always at high levels, and it seems that these are brought on by butchery and domestic waste water.

8) Ninety-nine percent of the lake bottom material is clay/silt and contains much organic substances. At the center of the lake, the portion rich in organic substance is down 15cm from the bottom surface.

5. The pollution mechanism of the lake was investigated through the results of water quality analysis and several experiments. A prediction of lake water quality on several cases was tried by the numerical simulation model based on the above results. The important results are as follows:

1) The retention time of the lake is estimated at around 150 days.

2) The lake water is well mixed both horizontally and vertically, and the water quality difference from point to point is small.

3) The main factors which control the lake water quality are three: ① residue of the inflow river load, ② phytoplankton breeding inside the lake, ③ elution from bottom mud and stir-up of bottom mud by wind and/or wave, and each ratio varies in many ways depending on the meteorological and hydrological conditions.

4) According to the pollution simulation, it is predicted that even though the inflow pollutant is reduced to half the present

value, water quality is scarcely improved, but if it is left to take its own course then pollution will increase very rapidly.

10.2 Recommendations

1. Keeping in mind the future usage demands of Lake Ypacarai and its basin, the present pollution status, water improvement techniques applicable to the Lake basin, and the present system and organization concerning the environmental conservation, it is desirable to base the promotion of the water quality conservation plan on the following five items : ①basic investigation and research, ②application of water quality improvement techniques including natural environmental conservation, ③establishment of legislation on water quality conservation, ④educational/ instructional activities related to water quality conservation concept, ⑤reinforcement of the water quality administration.

2. Judging from the results of pollution simulation and the effects of water quality conservation measures executed for other lakes, establishment of a long-range plan will be necessary for the Lake Ypacarai Basin. There is some hope for temporary improvement in the lake water quality itself, however, permanent improvement can only come about if measures are carried out for pollution sources within the Lake basin based on the water quality conservation plan.

3. In light of the fact that a large share of the pollution load discharge originates from industrial sources, measure priority should be given to the completion of the waste water treatment facilities at these factories. It is desired that lagoons as well as chemical treatment facilities for high pollutant concentration waste water will be installed at the vegetable oil refineries, and that at least lagoons will be installed at middle- and small-scale factories. As for the factories where treatment facilities exist but are not in operation or are not maintained sufficiently, an administrative authority should intervene to ensure the resumption of their functioning as soon as possible.

4. The completion of a sewerage and sewage treatment plant is the most desirable countermeasure for domestic pollution sources in the urban area, however, it is necessary to introduce temporary measures for those districts where sewerage construction will be retarded. (It has been ascertained by on-site testing that soil absorption treatment shows a low removal rate for nutrient salts, whereas a very high one for organic substances.). In addition to this fact, this method has a lower possibility of contaminating the underground water as compared to that employing an infiltration tank. Therefore, the soil absorption treatment is a suitable temporary countermeasure in the urban area. In those districts where the soil conditions do not allow for this method, the

possibility of using cesspit emptiers to collect raw sewage should be further studied.

5. The basis of the measures for non-point pollution sources is the execution of planned land use, the nuclei of which is to conserve and expand forests and to prevent the expansion of urban areas lacking in complete basic living facilities. It is desired that the prevention operations are executed for those areas where sand and soil run-off is remarkable.

6. One method of preventing the inflow load from large rivers entering the lake would be to build a diversion dam-type drainage canal between the Yuquyry River and the Salado River so as to divert the excess water in flood time. However, a possible drawback to this is the detrimental effect on the ecosystem of the downstream marsh around the Salado River. Thus, before such a project be carried out, adequate research should be undertaken.

7. As a measure to directly purify the lake water, the installation of a water gate at the egress to the Salado River is considered. If the lake water is flushed out following the controlled rise in water level by manual periodical closing of the gate, it would be possible to render the water to its lucid state at the beginning of 1988. However, the suitability of this measure should be determined only following sufficient basic research on the phytoplankton increase conditions.

8. Although development progresses, there is still a flourishing natural environment in the basin, consequently, along with the implementation of the above-mentioned water quality improvement techniques concerning the facility establishment, adequate consideration must be given to the conservation and the purification potential of the natural environment. The conservation of the Yuquyry and Pirayu downstream marshes and the conservation and expansion of the stream source and riverside forests are important here.

9. In order to promote water quality conservation measures, new legislation incorporating the following should be provided: ①water quality monitoring officials and their related duties, ②well-grounded numerical values for water quality standards concerning public waters and various kind of effluent, ③systems for prior investigation and post inspection for pollutant dischange, ④various proposals effective to promote the systematic land use and water purification facilities establishment.

10. In order to smoothly execute water quality conservation measures, it is necessary that the significance of water quality conservation penetrate the public strata at every level. Therefore, with this objective, education and instruction by various means should be initiated as early as possible.

11. In order to promote the above-mentioned general planning for water quality conservation, "Lake Ypacarai Basin Management Authority" requires to be established. This organization would concern itself initially, for the first 2-3 years, with planning and coordination, however, the ultimate goal would be, with a continuous increase in staff and function, the realization of an agency with the capacity of planning the comprehensive measure by basin and having the competence of promoting the countermeasure operations.

12. The responsibilities of Lake Ypacarai Basin Management Authority will be promotion of the followings: ①basic survey and research necessary for the drafting of water quality conservation plan, ②educational/instructional activities related to water quality conservation concepts, ③establishment of laws and regulations necessary for the execution of the water quality conservation plan, ④water quality conservation measure operations, ⑤developoment and guidance of water treatment and purification techniques, ⑥guidance and training for water quality control specialists, ⑦water quality monitoring at public waters and pollution sources, ⑧securing of funds and personnel necessary for the realization of these operations.

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