

**Advisory review of the master plan for the
rehabilitation of Lake Tai (first phase) in the
People's Republic of China**

14 januari 2002

039-099

**Advisory Review of the master plan for the rehabilitation of Lake
Tai (first phase) in the People's Republic of China**

**Advice submitted to the Minister for Development Co-operation, by a working
group of the Commission for Environmental Impact Assessment in the
Netherlands.**

the technical secretary



Arend Kolhoff

the chairman



Dick de Zeeuw

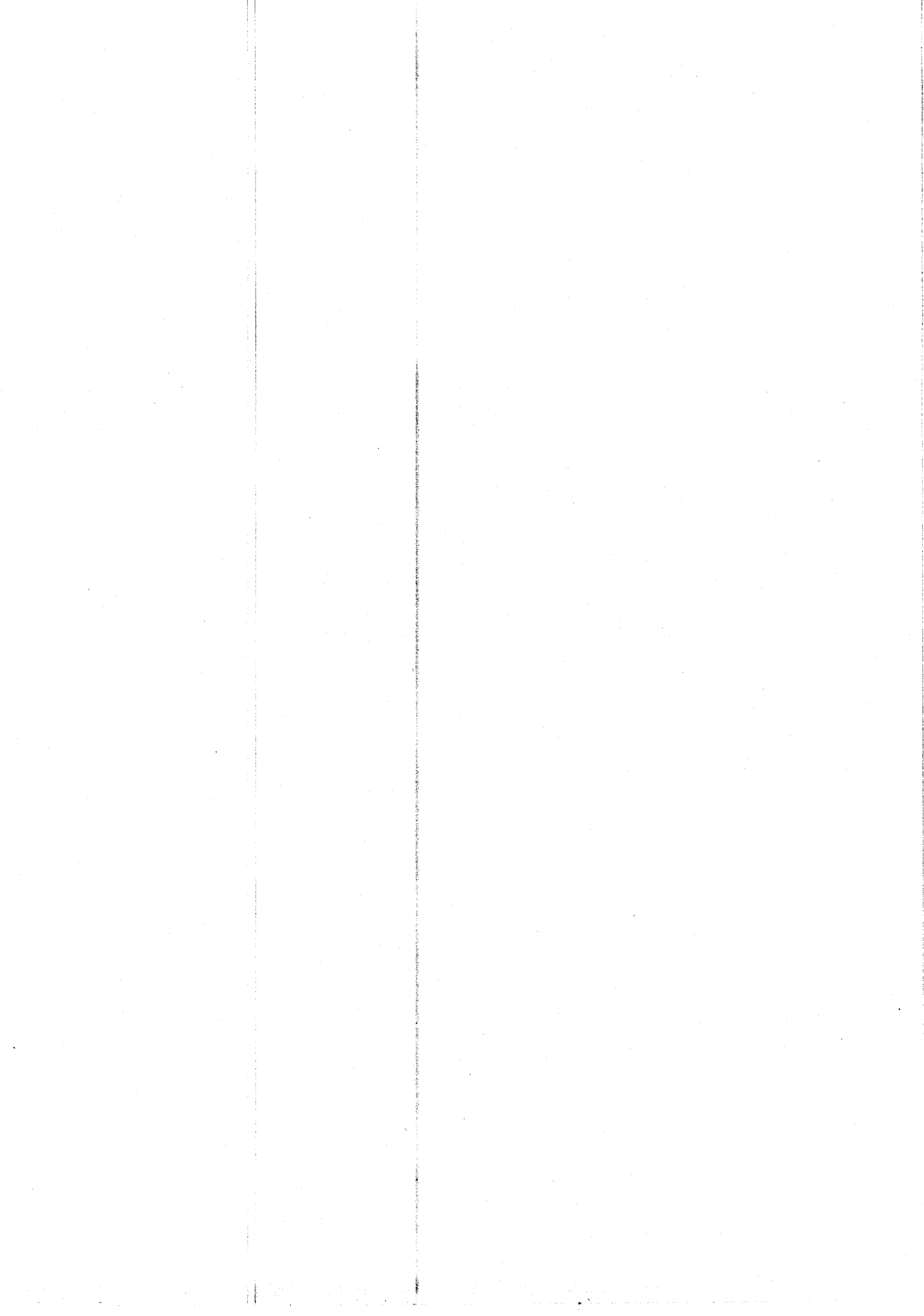
Utrecht, 14 januari 2002

CONTENTS

1. INTRODUCTION.....	1
1.1 The initiative: Master Plan for Rehabilitation of Lake Tai, China.....	1
1.2 Rationale and mandate for this review advice	2
1.3 Justification of the approach	2
2. MAIN CONCLUSIONS.....	3
3. ASSESSMENT AND RECOMMENDATIONS	4
3.1 Objectives and approach of the Master plan study.....	4
3.2 Data gathering & analysis.....	4
3.2.1 <i>Agriculture</i>	5
3.2.2 <i>Ecology and fisheries</i>	5
3.3 Measures	6
3.3.1 <i>Wetlands</i>	6
3.3.2 <i>Sediments</i>	7
3.4 Water quality and modelling aspects	7
3.5 Institutional aspects	8
3.6 Project implementation	9

APPENDICES

1. Letter of the Minister d.d. 1 May 2000 with request for advice
2. Composition of the working group
3. Programme of the site visit
4. Main findings of the joint Chinese – Dutch mission
5. Review framework
6. Map of Lake Tai area



1. INTRODUCTION

1.1 The initiative: Master Plan for Rehabilitation of Lake Tai, China

5 A Dutch firm applied for financing under the MILIEV programme¹ for an export transaction to the People's Republic of China (PRC). The application concerns the selection of priority projects for a short term cleaning-up programme (phase 1) and preparation of a master plan (phase 2) for the rehabilitation of Lake Tai, located in the provinces Jiangsu and Zhejiang and the municipality of Shanghai, in order to achieve sustainable use of the lake (see Appendix 6 for a map of Lake Tai area).

10 The lake is heavily polluted due to population growth (discharge of untreated domestic waste water), agricultural activities (use of fertilisers and pesticides) and industrial activities (discharge of industrial waste water) in the catchment area of the lake.

15 The main objective is to contribute to the improvement of the water quality of Lake Tai and maintaining/rehabilitating the different functions of the lake (drinking water supply, water for irrigation, wetlands, fish production, buffer area, navigation / transport, recreational value) through setting up a cleaning programme and development of a Master plan. Integrated water resources management (IWRM) is the guiding principle for the Master plan study. The project started in September 2000 and the duration of the project, which is actually a study, is 24 months. The main activities are as follows.

- 20
1. Phase 1, 10 months; preparation of a short term cleaning-up programme.
Goal: Selecting engineering projects in order to make a quick start in reducing water pollution.

25 Activities:

- 30
- to collect all relevant data and develop pollutant load inventory;
 - to define criteria to select pollution sources that need to be reduced in the short term;
 - to undertake an engineering feasibility study for pollution clean-up projects;
 - to identify, list and prioritise the selected engineering projects and their combinations, selecting and assessing proposed locations and technologies of proposed engineering projects;
 - to define functional district water pollution control zones.

- 35
2. Phase 2, 14 months; execution of a long term Master plan study.
Goal: Investigating the causes of the pollution problems and recommend control and prevention measures elaborated in scenarios to ensure sustainable development of the project area.

40 Activities:

¹ Programma Milieu en Economische Verzelfstandiging

- to determine water quality targets/objectives, with consideration of various water quality targets of local government in 1998, 2000 and 2010;
- to determine the overall hydrological and water quality regime;
- to develop a numerical water quality model as a management tool for water quality development scenarios which can be tested with this model in order to ensure sustainability. The model will be transferred to PRC for future management control;
- to determine total pollution reduction targets and the restoration of ecological ecosystem;
- to prepare a Master plan that will be developed through engineering planning, environmental planning, land use planning, economic incentives, institutional strengthening, capacity building, control and enforcement.

1.2 Rationale and mandate for this review advice

By letter dated 1 May 2000 (see Appendix 1) the Ministry of Foreign Affairs of the Netherlands (DOB) requested the Netherlands Commission for Environmental Impact Assessment (the Commission) to monitor the project. The objective of monitoring is to review the quality of the products of phase 1 (Engineering study) and phase 2 (Master plan) of the study. Reviewing of the two phases of the project will be executed sequentially and will result in two advisory reviews prepared by a working group of the Commission. The following expertise is represented in the working group: water quality, modelling, water management, waste water treatment, ecology and sociology/economy, see Appendix 2 for composition of the working group.

As agreed upon in the Grant Agreement China 2000.04, dated 19 May 2000, a joint Chinese-Dutch mission visited Lake Tai in order to review the first phase of the project: 'Master Plan for the Rehabilitation of Tai Lake'. The joint mission, consisting of the working group of the Netherlands Commission and two representatives of the State Environmental and Protection Administration (SEPA) did take place from 2-10 November 2001 and resulted in this first advisory review (see Appendix 3 for the programme of the visit). The main findings of the joint Chinese-Dutch mission have been prepared in China and are presented in Appendix 4.

The second advisory review of the project is planned to be executed when the draft Master plan is available (according to planning July / August 2002).

1.3 Justification of the approach

In this advisory review the findings of the review of the ongoing Engineering Study are presented. They are based upon the report of the September 2001 Nanjing Workshop and discussions with SEPA, institutions and authorities in Nanjing (a.o. National Institute for Environmental Sciences), Jiangsu and Zhejiang provinces (a.o. Environmental Protection Bureau - EBP, Renmin University, Taihu Basin Authority - TBA) and a visit to the Tai basin area. The product of the first phase, the Engineering Study report is not subject of this review due to the fact that this report was not yet available during the visit to

China. The Commission decided to visit China and not to wait for the report because the opportunities for steering are optimal in this stage of the project.

5 The Commission has prepared a project and site specific review framework, which is used for assessing the quality of the products of phase 1. This framework has been made and based upon the following reports: (i) Grontmij Consulting Engineers (supported by the Chinese Research Academy of Environmental Sciences (December 1998)) Feasibility study; Master plan for rehabilitation of Lake Tai, China, de Bilt: Grontmij Consulting Engineers and (ii) review frameworks prepared by the Commission for similar type of studies².

10 In Appendix 5 the (draft) review framework is presented. The review criteria have been agreed in the Terms of Reference of July 2000 stating that 'the joint review working group will review the products of the project based on the quality criteria completeness and correctness of the information'.

15 **2. MAIN CONCLUSIONS**

The working group of the Netherlands Commission for EIA is of the opinion that:

20 ***At this stage of the study (end of first phase) essential information is not yet available. Moreover, part of this information is not yet planned to be gathered in the second phase. Without this information the Master plan will be of insufficient quality to facilitate integrated water resources management. Recommendations in this advice are intended to remedy these shortcomings.***

25 In the next chapter this conclusion is substantiated and recommendations are provided.

30 In Appendix 4 the main findings of the joint Chinese-Dutch mission in China are presented. Due to the fact that additional information was gathered in the Netherlands after the visit to China the conclusions concerning modelling and institutional aspects presented (section 3.4 and 3.5) in this advice differ from the main findings of the joint mission. Therefore, this advice is an advice of the Commission only.

² Advices by the Commission on the following projects: Lac Sud, Tunisia; Laguna de Bay, Philippines, Tidal Inlet – Cartagena, Colombia.

3. ASSESSMENT AND RECOMMENDATIONS

3.1 Objectives and approach of the Master plan study

5 The water quality (according to SEPA it should meet class 3 in the long term) is the main objective in view of maintaining the lake's function as a source of drinking water supply. Other functions such as fish production, transport and recreational value have not been explicitly identified, although these are important contributors to the eventual cost benefit analysis of the different scenarios for water quality improvement that will be developed.

Recommendation:

10 *In order to assess and develop the potential of these functions (and benefits) it is necessary to assume and develop a holistic approach³ to the management of the lake for which fisheries management based on food transfer (algae – filtrators – fish) efficiencies could be a good starting point.*

15 *The basic analytical part should include calculation of the hydrological budget and recording of the present ecological status (Sven Björk, 1996⁴) involving investigations on environmental conditions, communities of organisms and ecological interrelationships (work already partly done by existing working groups).*

20 The project consists of two phases. It is stated that in the first phase (engineering) projects are selected in order to make a quick start in reducing water pollution.

Recommendation:

25 *It should be justified that the projects selected in the first phase pose no constraints or induce irreversible effects with respect to possible clean-up strategies to be developed under the Master plan.*

3.2 Data gathering & analysis

30 A significant part of the required data has been gathered and partly analysed. These data are regarded as data from existing and routine monitoring activities and from the Statistical Yearbooks. Part of the necessary additional data collection through field surveys needs to be continued. The available information has resulted in a considerable amount of knowledge of the functioning of the Tai Lake basin system. A shift in the relative contributions from the point source pollution to the non-point source pollution has been observed. The Chinese government decided to pay more attention to the non-point sources and ecological conservation in the 10th 5-Year Plan.

³ "Holism is a philosophical biological concept saying that the whole is more than the sum of the parts. Holistic in the framework of integrated water resources management means that the lake should be assessed from a watershed perspective and should include a comprehensive array of water management issues such as hydrology, ecology, economy, land use, industrial and urban pollution.

⁴ Sven Björk 1994: "The evolution of lakes and wetlands" in Restoration of Lake Ecosystems - a holistic approach, Eiseltova M. (ed.) 1996, IWRB Publ. 32. 182 pp.

3.2.1 Agriculture

Agriculture production in the catchment area of Lake Tai is considerable. At the end of the nineteen eighties the following production figures were reported: grain (11.5 million t/yr), cotton (125,000 t/yr), rape seed (290,000 t/yr), fruits (60,000 t/yr), pig (10 million head) and silkworm cocoon (50,000 pieces)⁵.

Based on the available reports of the Grontmij task groups it is concluded that the agricultural sector is the main contributor to the total nutrient waste load entering Tai Lake (Nitrogen some 70% and Phosphorus some 80%). This implies that strategies to improve the water quality of Tai Lake must include measures to reduce this non-point sources load.

Recommendation:

It has been observed that significant qualitative knowledge in the field of non-point sources (agricultural waste loads) is still lacking and has to be made available in time in order to be able to prepare the decision framework of the Master Plan. In order to select the most (cost) effective combination of measures, predominantly qualitative knowledge on the agricultural production system and the resulting waste (water) production is required.

3.2.2 Ecology and fisheries

The present eutrophication of Tai Lake has reportedly (Environmental Protection Bureau, TBA) resulted in considerable algae blooms, which hamper the self-purification, fish production, recreational value and reduce biological diversity. Based on the available reports of the task groups it was concluded that insufficient information and analysis on the cause-effect relations with regard to algae growth and food transfer (algae – filtrators – fish) efficiencies in Tai Lake has been made available through the project. As seems to be the case with the Tai Lake project, lake and reservoir management usually does not include fish management, although the condition of fish, especially predatory types, is considered a very good indicator of adequate management of water quality for human use (Jaroslav Hrbáček 1994⁶).

Part of this information is planned to be provided by the water quality model. Information on cause-effect relations must be made available in time in order to be able to prepare the decision framework of the Master Plan. Information on the occurrence of natural vegetation, fish and other animal species in and around Tai Lake has not yet been made available through the project. A quantitative description of this aspect might turn out to be difficult to obtain within the timeframe of this project.

⁵ International Lakes Environment Committee, World Lakes Database, Tokyo, Japan 2000, www.ilec.org

⁶ Jaroslav Hrbacek 1994: "Food web relations" in Restoration of Lake Ecosystems - a holistic approach, Eiseltova M. (ed.) 1996, IWRB Publ. 32. 182 pp.

Recommendations:

5 *Qualitative retrospective investigations (e.g. last 10 years) to include investigation of plankton, macrophytic vegetation, water bottom animals, fish and other vertebrates, ornithological conditions including rare and threatened species should fill the data gap on ecological base line data. Data on productivity should be obtained to enable both qualitative as well as quantitative comparisons as the system is improving. In this respect especially data on fish and aquatic production in general need to be updated. Sources used can be fisheries and aquaculture statistics (fish landings, fishing population, area under aquaculture for different species, production figures, economic revenues, exports and local consumption figures) and additional surveys to map the present state of fisheries and aquaculture in and around the lake.*

15 *An ecological chapter as part of the water quality assessment report should explain the present conditions of the lake including the cause-effect relations related to water quality and productivity, relationships between the catchment and the lake ecosystem (sediment and pollution loads and their effects), functional aspects and relationships within the system (trophic relations, production and reduction of organic matter), relations between phytoplankton, zooplankton, algae growth and fish stock development (year class) research as well as a statement on the future development of the lake in case no measures are taken. This analysis can be supported with data and results of the water quality model.*

3.3 **Measures**

25 **3.3.1 Wetlands**

30 *A special topic should be the present occurrence and effectiveness of wetlands around the lake and their importance to water purification (halophyte filter function), fish production (ponds) and fish reproduction (nursery grounds) and fisheries. The inception report mentions the rehabilitation of wetlands as one of the measures to be taken and the 10th 5-Year Plan and the Year 2010 Taihu Basin Pollution Control and Prevention Plan have adopted this approach. However, there seems to be a difference in interpretations and definition of what constitute wetlands in and around the lake: SEPA wants to implement wetlands inside Tai Lake, while Grontmij has planned them outside the lake.*

35 *The importance of wetlands to contribute to water purification should not be overestimated and properly assessed including post harvest disposal of vegetation in which pollutants have accumulated.*

Recommendations:

40 *An inventory of existing wetlands locations and potential areas for wetlands restoration should be made available together with a qualitative and quantitative assessment of their (potential) functions in Lake Tai.*

The proposed and potential measures for wetlands protection and restoration should be assessed during the second phase of the project in

order to judge its effectiveness for the rehabilitation of (potential) functions of Lake Tai.

3.3.2 Sediments

5 Present monitoring results do not indicate severe problems regarding polluted sediments. However, it is likely that polluted sediments exist and that possibly large amounts may have to be deposited as a result of dredging operations in the future. Another problem may be caused by sludge released from waste water treatment plants. It will be necessary to consider and analyse options for re-use, such as burning or use as soil suppletion for agriculture purposes, including the related risks of accumulation of non-organic pollution.

Recommendations:

15 *The quality of dredged material and the quality of the sludge of the waste water treatment plants should be assessed as a part of the present data collection effort. The environmental impacts of the various options for disposal of these sediments should be assessed.*

3.4 Water quality and modelling aspects

20 With respect to the water quality model it is very important to make a clear distinction between software development (and acceptance) and the application of the software at the situation in Tai Lake (model application). The joint working group observed that the 3D Water Quality Model named OOMAS will be used for this purpose. According to chapter 4.1.2 of the contract, Grontmij is responsible for the software development. NIES is responsible for the application of the OOMAS software to Tai Lake, assisted and supervised by Grontmij. It is of the utmost importance that the software are delivered as soon as possible to make NIES familiar with the set up and processes included and to start the calibration. However, delivery of the software is said to be waiting for the results of the data collection by NIES, in order to implement the most appropriate set of quality parameters (nutrients, fish, etc.). Development of a water quality model including a description of ecology requires considerable effort, time and training. A thorough calibration, validation and documentation of a new model development and application within the remaining budget and time is therefore regarded as unlikely.

Recommendation:

35 *The implementation of the most appropriate set of quality parameters (nutrients, fish, etc.) should be finalised as soon as possible, in order to deliver the OOMAS software to NIES, to make NIES familiar with the set-up, to prepare the schematisation and to start the calibration.*

40 In the Inception Report it is stated that the River Network Model of Taihu Basin Water Resources Protection Bureau (TBWRPB) will be used to relate the actual waste water production to the resulting waste water discharges that finally enter Tai Lake, because 'without this quantitative basis, the results of water quality modelling would be far less reliable. Also during scenario

calculations the output from the TBA model will be needed as an input to the lake water quality model'. It is not clear whether the Master Plan study will use the output of various scenario calculations with the TBWRPB's River Network Model as input for the new water quality model of Tai Lake (as is stated at page 23 and 27 of the Inception Report). Furthermore, it should be clear how these scenario's and/or control measures will be connected to the clean-up of industrial and municipal waste water production, changing agricultural practices, the construction of sewer systems, and the implementation of secondary/tertiary treatment plants - which is the overall aim of the project. Finally, IWRM should comprise hydrological control measures, such as the increased water intake from the river Yangtse, which is by far the cleanest source.

Recommendation:

This pilot-project on IWRM should be used to enhance the co-operation between ministries and institutes (especially the Ministry of Agriculture and the Ministry of Water Resources).

IWRM requires combined water system information regarding the existing and future management practices in the basin. This project offers a unique opportunity to gain experience with the application of the principles of IWRM through the exchange of data and information, and the effective co-operation between the ministries and institutes involved.

Recommendations:

Knowledge and information regarding the present and future water quality and water quantity in the river basin network must be made available to judge the effect of Master plan scenarios at the water quality of Tai Lake.

3.5 Institutional aspects

Improvement of the eco-hydrological situation in Tai Lake requires an integrated approach towards water quantity, water quality and environmental management. IWRM requires effective co-operation between the institutes responsible for water quality, water quantity and natural resources management. In the Tai Lake case this implies co-operation between the main national level institutional stakeholders who hold responsibilities in the water sector which are the Ministry of Agriculture, the Ministry of Water Resources (MWR), the State Environmental Protection Agency (SEPA), the Ministry of Construction (MoC), the Ministry of Finance (MoF) and the Ministry of Sanitation (MoS) as well as main stakeholders on the river basin and provincial levels (Tai River Basin Authority, Water Resources Agencies, Environmental Protection Agencies and Construction Agencies). In addition to these institutions different research and monitoring agencies and institutions contribute and play a role (e.g. Nanjing Institute for Environmental Sciences, Universities, Environmental Protection Bureaus and Environmental Monitoring Centres).

In view of the complex technical and managerial requirements and institutional (mandatory) complexities new approaches towards IWRM are needed in China. SEPA reports that it has already made the first steps

5 towards this by proposing that the “Masterplan for the Rehabilitation of Lake Tai” could be a pilot project for IWRM in China. What is most likely needed is an independent river basin management agency co-ordinating water quality, water quantity and environmental issues of water resources management on the basis of well defined tasks and mandates such as;

- co-ordinate and solve water quality management problems;
- evaluate and monitor implementation of engineering projects;
- develop and monitor pollution control measures with stakeholders;
- co-ordinate and solve natural resources management and usage problems.

10 **Recommendation:**

15 *The role and status of such an institution would be similar to regional (or river basin based) water management institutions that exist elsewhere in the world. It would require far reaching institutional (laws, regulations, etc.) as well as capacity development (planning and decision making, communication and management, administration) efforts before it would become effective. In view of the ongoing institutional reforms in China however, the target for Task group III (socio-economic and institutional aspects) should most likely include an assessment of the requirements of this pilot project.*

3.6 Project implementation

25 Delays due to insufficient capacity and delayed disbursement of funds of the project in phase 1 have resulted in changes to the internal organisation and management of the project. The Commission is of the opinion that these changes will enhance the quality of the results of the project and contribute to its timely and effective implementation.

Recommendation:

30 *In view of the noted delays in implementation of certain parts of the project (ecological data collection, engineering report, water quality model) there is a need to revise the planning of the project and assess what can be finished within the planned 24 months of the original proposal.*