

TECHNICAL ARRANGEMENT

On

“Study on Beijing Water Ecological Environment Monitoring and Assessment
and Early Warning Systems”

Among

BEIJING MUNICIPAL ECOLOGY AND ENVIRONMENT BUREAU(BEE)

and

THE DIRECTORATE FOR SUSTAINABLE DEVELOPMENT,
ENVIRONMENTAL DAMAGE,EUROPEAN UNION AND
INTERNATIONAL AFFAIRS
OF THE MINISTRY FOR THE ENVIRONMENT, LAND AND SEA OF
THE ITALIAN REPUBLIC
(IMELS)

(Hereinafter referred to as the Parties)

Recalling that since 2002, IMELS has launched continued cooperation with the People’s Government of Beijing Municipality under the framework of Sino-Italian bilateral environmental protection cooperation. The cooperation has proved to be a win-win fruitful cooperation on supporting Beijing’s efforts to fulfill “Green Olympics Commitment” and improve environmental quality.

Taking into account the “Agreement IMELS-Beijing Municipality for the Establishment of a Sino-Italian Environmental Cooperation for Sustainable Beijing Fund (SIEC-SUB)” signed on the 14th of May 2005, between the IMELS and BEE, to financially contribute for projects’ implementation by the IMELS and BEE.

Recognising that the cooperation between IMELS and BEE is framed in a mutually beneficial partnership as an important opportunity to create value for a fruitful business exchange and *taking into account* that IMELS and BEE intend to define a working program based on the agreement signed on the 15th of November 2013.

Based on the existing cooperation, IMELS and BEE signed on 16th of June 2017 a Memorandum of Understanding (MOU), with the objective to strengthen their joint work for building a more sustainable Beijing through supporting Beijing to implement

strategic research and technical projects.

Taking into account that China has put in place, since 2002, a water quality monitoring system, mainly focusing on physical and chemical methods, in accordance with the Environmental Quality Standards for Surface Water (GB3838–2002), there is a need to improve the system including also biological parameters to assess the ecological state of the water bodies as well as enhance risk monitoring capabilities for drinking water sources and strengthen early warning capacities.

Considering the recent institutional reform in Beijing Municipality Governments that BEE integrated new responsibility of comprehensive water quality management with both ground and underground water pollution monitoring and pollution prevention and control, this study is of importance for BEE to upgrade the current water quality monitoring network from not only superficial water but also ground water within Beijing Municipality.

Considering the positive results of Tongzhou Water Environment Evaluation and Strategy TWEES project, aimed at supporting Chinese authorities in assessing the effectiveness of the Beijing Water pollution Prevention and Control Work Plan in reaching its targets and processing a methodological approach for water quality assessment protection restoration, monitoring and control, carried out by SOGESID Srl as the Technical Team Leader, in 2016-2017.

It is hereby agreed as follows

Art. 1 – General Provisions

IMEELS and BEE agree on developing the project “Study on Beijing Water Ecological Environment Monitoring and Assessment and Early Warning Systems” (“the Project”), in order to support the capabilities of BEE in water quality monitoring network management.

Art. 2 – Objectives and Activities

The Project aims at assisting BEE to improve Beijing's water environmental monitoring, evaluation system and early warning, based on European standards (EU Water Framework Directive).

The activities will be implemented according to the structure, content, and schedule described in the Annex 1 to this Technical Arrangement.

Flexibility will be given to the Parties of the service contract for future changes in the working plan. The Parties shall jointly agree upon modifications.

Art. 3 - Cooperation Method

BEE and IMELS will be responsible for project management and coordination.

In order to guarantee a productive and effective expertise, BEE identifies Beijing Municipal Environmental Monitoring Center(BMEMC) as Chinese technical supporting agency for the Project.

For the same reason, IMELS identifies SOGESID Srl as the Technical Team Leader and as the Project implementing entity, able in supporting and engaging relevant appropriate agencies such as environmental protection agencies at region level.

Art. 4 - Financial Resources

The Parties will all make necessary financial contribution for a successful implementation of the Project. The share of IMELS contribution and Beijing Municipality contributions on the Project total investment would be around 45% and 55% respectively.

The Project total budget is estimated at 819.400,00 Euro.

The breakdown of Project budget is described in Annex 2 to this Technical Arrangement

Any financial resources regarding project's activities under this Technical Arrangement will be borne by the available budgeted resources of the Parties and will not, in any event, create additional expenditures for the State budgets of the Italian Republic and of the People's Republic of China.

IMELS will contribute with 369.400,00Euro, to cover activities of Italian implementing agency and logistics costs in Italy for Beijing participates.. The above mentioned amount has been already transferred by IMELS to SIEC-SUB fund according to the agreement signed on the 15th of November 2013.

BEE will contribute with 450.000,00Euro to cover the activities of Chinese implementing agency and local logistics costs in Beijing for Italian implementing agencies.

Art. 5 - Accounts and auditing

Accounts, directly comparable to the budget, shall be submitted to the Steering Committee, established under the MOU between IMELS and BEE signed on 16th of June 2017, along with the relative report for approval.

The accounts shall be endorsed by a qualified accountant and the person responsible for the projects, who, by their endorsement, confirm that the accounts are presented in accordance to the agreement. Notwithstanding, IMELS reserves the right to demand

third party auditing.

Art.6 - Law in force

This arrangement will be implemented in conformity with international law principles, international Conventions and Protocols signed by the Parties, national legislation of China and Italy, as well as, as for Italy, with any other obligations arising from the membership of the Italian Republic in the European Union.

Art. 7- Settlement of Disputes

Any dispute arising from the interpretation and implementation of this Technical Arrangement shall be settled through consultation among the Parties.

Art. 8 - Duration

This Technical Arrangement shall enter into force on the date of Signature and it will remain effective until the end of April 2021, in accordance with the provision of article 1 of the present Technical Arrangement, unless one of the Parties notifies the other in writing, at least three(3) months in advance, of its intention to terminate it.

The Technical Arrangement may be extended by written agreement between the Parties at least three (3) months in advance.

The following annexes are integral part of this Technical Arrangement:

- Annex 1 - Project Proposal
- Annex 2 - Break down of project budget.

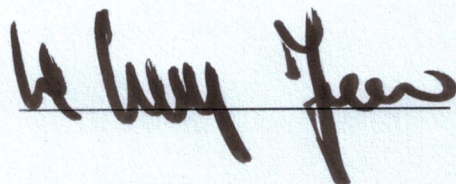
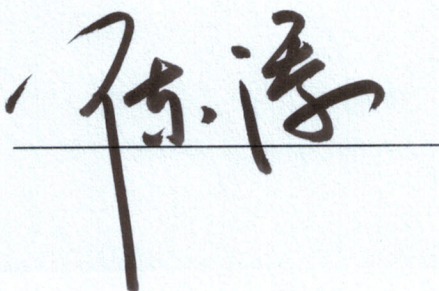
Signed for acknowledgement and acceptance on 19 March 2019 in Beijing in 2 copies of English.

For Beijing Municipal Ecology and
Environment Bureau(BEE)

For the Directorate for Sustainable
Development, Environmental Damage and
European Union and International Affairs
of the Ministry for the Environment, Land
and Sea of The Italian Republic
(IMELS)

Mr. Chen Tian
Director General

Mr. Francesco La Camera
Director General



ANNEX 1: Project Proposal

Study on Beijing Water Ecological Environment Monitoring and Assessment and Early Warning Systems

I. Project Background

1.1 Basic situation of water environmental quality monitoring in Beijing

Figure 1 shows Beijing's current status monitoring network for water environment. The four-tiered monitoring network covers the river basin level, district and county level, township level, and grassroots water management organizations.

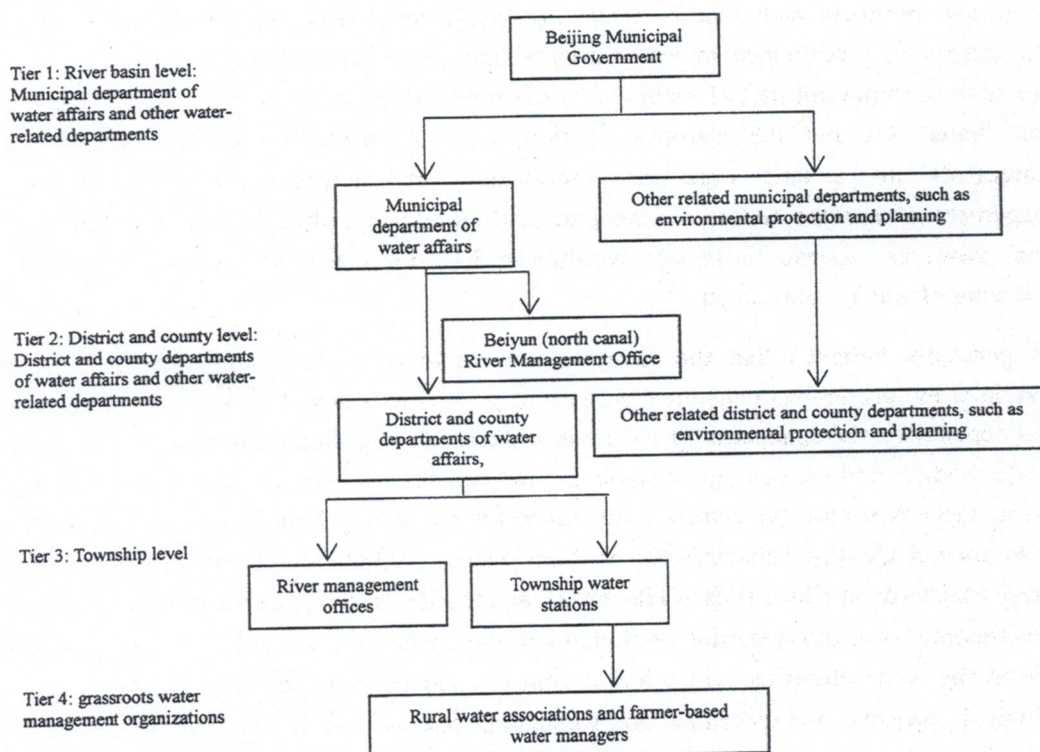


Figure 1 Beijing's water environment monitoring network

1.2 Water environment monitoring situation at home and abroad

China has carried out water environment monitoring since 2002, mainly using physical and chemical methods, in accordance with the *Environmental Quality Standards for Surface Water (GB3838-2002)*. However, the current monitoring network does not match the current water environment situation or meet environmental management needs. The existing monitoring system faces such major problems as imperfect system of aquatic ecological assessment and weak capacity in risk monitoring and early warning for drinking water sources and in emergency response for surface water environment.

Reasonable deployment of monitoring sites should provide guarantee for scientific and

authoritative monitoring data. The European Union Water Framework Directive stipulated surveillance monitoring, operational monitoring and investigative monitoring to meet different environmental management needs. In the United States, the deployment of monitoring sites takes into account factors such as historical continuity and local economic development, including historically fixed monitoring sites, monitoring sites determined by probabilistic design methods, and monitoring sites that are selected by the people and periodically sampled. In China, the deployment of monitoring sites for water environment mainly follows the Technical Specifications for Monitoring of Surface Water and Waste Water (HJ/T 91-2002). The monitoring sites are mainly found in the main streams and tributaries of important water systems and in water bodies that embrace large water conservancy facilities, but a hierarchical network has not yet taken shape.

As urban water environmental pollution shows regional specificity and complexity with social and economic development, the existing monitoring indicators of water environment become less pertinent and reliable, while biological benchmark and biological monitoring gains increasing prominence in water quality and safety assessment. Ensuring biological integrity is an important part of maintaining the functions of water bodies. The United States Clean Water Act and the European Union Water Framework Directive all set clear requirements for aquatic organisms monitoring, and Italy's current regulations on management of surface water environment also stipulated Indice Biotico Esteso(IBE). In China, however, aquatic biological monitoring has not yet been included in the daily monitoring of water environment.

It is generally believed that the environmental state of surface water bodies is jointly determined by physical and chemical status and ecological status. The physical and chemical status depends on the concentrations of toxic and hazardous pollutants that must be controlled in water bodies, and the ecological status depends on the diversity of aquatic ecosystems. At present, the environmental quality assessment for water in China is mainly based on the Environmental Quality Standards for Surface Water (GB3838-2002) and the Groundwater Quality Standards of China (GB14848-2017), and the single-factor evaluation method is used for evaluating toxic and hazardous pollutants in the water environment. But slow progress is made in the comprehensive evaluation system for aquatic ecosystems as the assessment of ecological integrity and potential environmental risk is insufficient due to the lack of monitoring indicators. In addition, the existing standards for water quality assessment do not support the rating and classification of different water functional zones.

At present, unexpected accidents of water pollution have occurred frequently in China. Given this, the following moves are important to appropriately handle such accidents, including quickly and scientifically assessing the hazards of accidents to ecosystems and human health, setting emergency control thresholds for characteristic pollutants for purpose of the protection of ecosystems and drinking water safety, and adopting scientific and effective emergency disposal technologies. Italy employs MIVIS (Multispectral Infrared and Visible Imaging Spectrometer) airborne hyper spectral sensors to achieve early warning of environmental pollution emergencies, and integrates the CHRIS (Compact High Resolution Imaging Spectrometer) data into the quantitative research on water chlorophyll, colored dissolved organic pollutants (CDOM) and total suspended solids (TSS). The practice offers good

references for conducting drinking water monitoring and early warning and resolving cross-border water pollution disputes in China.

China's relevant departments have raised a boom in the construction of automatic monitoring stations for water quality, which corresponds to manual monitoring. However, the necessity of automatic monitoring stations remains controversial internationally. In the United States, for example, water quality monitoring still relies on field sampling and laboratory analysis because automatic monitoring stations are believed to entail high costs of construction and operation and hardly adapt to various environments and meet the requirements of tests at different levels. In China, water quality automatic monitoring techniques are immature and have limited application. The promotion on large scale first needs to perform complementary monitoring that takes advantage of both manual monitoring and automatic monitoring.

II. Project Purpose and Significance

The European Union (Italy) as an early starter has established a relatively mature monitoring technology and management system for water environment, which provides good references for the refinement and improvement of China's current system. In comparison, China's monitoring and evaluation system for water environment cannot fully adapt to the current situation in terms of monitoring network deployment, monitoring and evaluation indicators, and ecological evaluation methods. China remains at the stage of exploration in risk monitoring and early warning for drinking water sources and surface water resources and in emergency response for water environment. Given this, refining the existing water environment monitoring system, through the exchanges of monitoring methods and concepts, will be of vital significance for optimizing China's environmental monitoring network.

Environmental monitoring is essential to environmental protection that under pins the development of ecological civilization. China has raised the requirements and specified the instructions for water environment monitoring by releasing the national and municipal programs for building the environmental monitoring network. While major opportunities are brought by these programs, it is very challenging to optimize the monitoring site deployment and improve the indicator and method system based on the existing monitoring and evaluation system, and further to "build an environmental monitoring network that covers air, land and sea, coordinates departments at all levels and facilities information sharing". Therefore, the Sino-Italian cooperative research on water environment monitoring programs will help optimize China's water environment monitoring strategies by drawing on the successful practices and experiences of the European Union (Italy). It is not only important for promoting Sino-Italian exchanges and cooperation in the field of environmental protection, but also meets the inevitable requirement of accelerating the progress towards ecological civilization in China.

III. Project Objectives

1. Improving Beijing's water environmental quality monitoring and evaluation system

The project aims to establish a scientific, reasonable and effective monitoring and evaluation system for water environment by drawing on the European Union (Italy)'s mature system of monitoring network and evaluation indicators. It specifically includes optimizing the

monitoring network, improving monitoring and evaluation indicators (health risk indicators and ecological risk indicators), and building an ecological evaluation system applicable to different water functional zones.

2. Improving the capacity of water environmental quality monitoring and early warning

The project intends to introduce, through exchanges, a stable and efficient information system for risk assessment, monitoring and early warning of water environmental quality, so as to improve Beijing's capabilities of water environment monitoring and early warning. This includes water environment monitoring and catastrophic warning, and nitrogen and phosphorus reduction measures for drinking water sources; and experiences in risk assessment, early warning and emergency response for surface water environment.

III. Project Implementation Plan

1. Basic data collection

1.1 Investigation into the study area

Technical personnel from the Chinese side will collect historical monitoring data from the authorities concerned about water environmental monitoring, i.e. environmental protection and water conservancy; integrate natural profile data, including hydrology and water quality, topography and landforms, meteorology and climate; collect data about economic and social profile, such as administrative divisions, population distribution and density, industrial structure, economic indicators and land use features.

1.2 Analysis of current water environmental quality monitoring situation

Technical personnel from the Chinese side will systematically analyze the current situation and composition of Beijing's water environment monitoring through data collection and departmental discussions.

Based on the analysis of historical monitoring data, the overall trend of changes in water environment in Beijing will be summarized. Combined with the existing regulations, standards and target responsibility documents, the deficiencies of water environment monitoring and evaluation system will be investigated in the current water environment and policy context, such as monitoring site deployment, monitoring and evaluation indicators, and aquatic ecological assessment. Further, problems that urgently need to be solved will be identified, and technical requirements will be proposed for addressing these pressing problems.

2. Sino-European technical research and exchanges

According to the needs of the Chinese side, the Italian side will organize experts to provide technical training to relevant Chinese personnel in China. The training will specifically cover:

- a) the preparation of the EU Water Framework Directive, the evolution of Italy's water environment monitoring network and the current operation of Italy's water environment monitoring system;
- b) Italy's current technical system for water environment monitoring, including the selection of monitoring indicators for aquatic organisms and plankton in water bodies of different functions, indicator selection criteria, monitoring frequency, toxicity

analysis methods and etc.; c) Italy's experience in aquatic ecological assessment, and comparison of multi-indicator comprehensive evaluation system for water bodies in different functional areas; and d) Italy's successful experience in risk monitoring and early warning information system for water environment, including monitoring and early warning, and nitrogen and phosphorus reduction measures for drinking water sources, and success stories of risk assessment, early warning and emergency response for surface water environment.

The Chinese side will organize technical and management personnel of departments concerned to participate in the training, such as Beijing Municipal Ecological Environment Bureau, Beijing Municipal Environmental Protection Monitoring Center, and Beijing Municipal Research Institute of Environmental Protection. Based on the training, China's deficiencies in water environment monitoring, evaluation and early warning will be summarized.

3. Application research and demonstration of water environment monitoring and early warning system

The European Union (Italy) has mature experience in risk assessment for water environment and early warning of emergencies. Based on the pilot and basic data supplied by the Chinese side, technical personnel from the Italian side will prepare a proposal on monitoring and early warning, and nitrogen and phosphorus reduction measures for drinking water sources, design and develop a stable and efficient system of risk assessment, early warning and emergency response dedicated to water environment, and provide training to the Chinese personnel on technical methods and operational procedures, so as to improve Beijing's capabilities of water environment monitoring and early warning.

4. Investigation and exchanges on water environment evaluation system

The single-factor evaluation method for water environment prevalent in China fails to fully meet the requirements of China's environmental monitoring network construction. China's current aquatic ecological assessment system is deficient due to the lack of health risk indicators and ecological risk indicators. At the same time, China's existing standards for water quality evaluation do not support the rating and classification of water functional zones. In light of this, technical personnel from the Italian side will put forward the technical guidelines for aquatic ecological assessment applicable to different water functional zones, which reflect China's context of water quality, water resources and national development while drawing on the European Union (Italy)'s mature system of aquatic ecological assessment. Technical personnel from the Chinese side will study the evaluation methods and verify the applicability of the evaluation system.

5. Research on optimization of Beijing's water environment monitoring network

Technical and management personnel from relevant Chinese departments, such as Beijing Municipal Environmental Protection Monitoring Center, China National Environmental Monitoring Center, and Beijing Municipal Ecological Environment Bureau, will conduct more in-depth technical exchanges in Italy to draw on the experiences in monitoring network construction, covering monitoring site deployment, monitoring and evaluation indicators, monitoring frequency, and staffing. They will also carry outfield investigation and learn

related technical methods.

5.1 Optimization of water environment monitoring network

The Chinese side will provide the basic information about water environment monitoring in Beijing, including principle for deploying monitoring sites, number of monitoring sites, local water environment, and local economic, social and natural profiles. Drawing on the experience of the European Union (Italy), Italian technical personnel will conduct an empirical analysis of the advantages and disadvantages of the current monitoring site deployment and monitoring frequency, and put forward suggestions for improvement and the references. Finally, an economically feasible proposal for optimizing the monitoring site deployment will be formed, which reflects the local water environment and economic development and meets the requirements of ecological civilization construction.

5.2 Refinement of aquatic ecological monitoring techniques

In China, water environment monitoring mainly adopts physical and chemical methods and hardly integrates biological monitoring. As biological benchmark and biological monitoring gains prominence in water environment monitoring and evaluation, it is urgent for China to improve its biological monitoring system.

Through visits and investigations into Italian biological monitoring laboratories, Chinese technical personnel will learn from the Italian biological monitoring system, and analyze and screen information that is suitable for constructing China's biological monitoring and evaluation system while considering China's current water environment and economic, social and natural profiles. Italian technical personnel will provide technical guidelines for water environment monitoring based on the practical work experience and the information provided by the Chinese side. In addition, the Italian side will assist in developing a list of methods and instruments for tests, such as aquatic biological toxicity test, microbiological test, fish tissue contamination analysis, and aquatic bio-community survey.

5.3 Investigation and exchanges on automatic monitoring equipment

Through visit to Italian water quality automatic monitoring stations, Chinese technical personnel will learn about advanced automatic monitoring equipment at home and abroad, understand the differences between domestic and foreign automatic monitoring stations in monitoring site deployment and monitoring item design, and sum up China's strengths and weaknesses.

Chinese technical personnel will discuss with the Italian counterparts the deployment of water quality automatic monitoring stations at home and abroad and the necessity of large-scale deployment of such stations. While listening to the opinions and suggestions of the Italian side, they will explore solutions to problems such as high operation cost, technical immaturity and limited application.

IV. Project Outputs and Outcomes

1. Proposal for Nitrogen and Phosphorus Monitoring, Early Warning and Reduction Measures for Drinking Water Sources;

2. Technical Guidelines for Aquatic Ecological Monitoring;
3. Proposal for Optimization of Surface Water Environmental Monitoring Network.

V. Project Schedule

The project will span from March 2019 to April 2021, with the schedule as shown in Table 1.

Table 1 Project schedule

Year	Month	Description
2019	3-4	Technical personnel from the Chinese side will conduct research on the trend of changes in the local water environment, analyze the deficiencies in water environment monitoring network in the current water environment and policy context, identify problems that urgently need to be solved, and make clear technical requirements for addressing these pressing problems
	5-6	According to the needs of the Chinese side, the Italian side will provide technical training on Italian water environment monitoring, evaluation and early warning to Chinese technical personnel.
	7-9	The Chinese side will provide the relevant information, and the Italian side will prepare the Proposal for Nitrogen and Phosphorus Monitoring, Early Warning and Reduction Measures for Drinking Water Sources, the Technical Guidelines for Aquatic Ecological Monitoring, and the Proposal for Optimization of Surface Water Environment Monitoring Network.
	10-11	Chinese technical personnel will conduct visits and field investigations into the nitrogen and phosphorus reduction projects and aquatic ecological assessment systems of drinking water sources in Italy and other European Union member states. Combined with the actual situation in Beijing, they will analyze the feasibility of the Proposal for Nitrogen and Phosphorus Monitoring, Early Warning and Reduction Measures for Drinking Water Sources provided by the Italian side.
2019-2020	12-8	The Chinese side will develop a research and exchange plan based on the training materials provided by the Italian side and the actual needs of monitoring and management. The exchanges will mainly cover the construction of manual and automatic monitoring networks for water environment in the European Union (Italy), the application of water environment monitoring techniques, regional aquatic ecological assessment system, and the construction of risk monitoring and early warning system for water environment. The Chinese side will organize technical and management personnel to conduct rounds of in-depth

Year	Month	Description
		technical exchanges, field investigations and case studies in Italy and other European Union member states. After returning to China, the Chinese team will refine the optimization plans based on research and study.
2020-2021	9-1	Project outputs will be summarized and reports prepared.
	2	The project will be completed.

ANNEX 2: Breakdown of project's budget

Tasks	Leader	Assistant	IMELS	Beijing Municipality	In total
1. Basic data collection			€ 16.000	€ 50.000	€ 66.000
1.1 Investigation about area under study	Chinese Side	Italian Side			
1.2 Analysis of current water environmental quality monitoring situation	Chinese Side	Italian Side			
2. Sino-European technical research and exchanges			€ 44.000	€ 50.000	€ 94.000
Provide training to the Chinese personnel on technical methods and operational procedures, so as to improve Beijing's capabilities of water environment monitoring and early warning.	Italian Side	Chinese Side			
3. Application research and demonstration of water environmental quality monitoring and early warning system			€ 44.000	€ 80.000	€ 124.000
Development of a proposal on monitoring and early warning, and nitrogen and phosphorus reduction measures for drinking water sources, design and develop a stable and efficient system of risk assessment, early warning and emergency response dedicated to water environment	Italian Side	Chinese Side			
4. Investigation and exchanges on water environmental quality evaluation system			€ 56.000	€ 120.000	€ 176.000

4.1 Development of technical guidelines for aquatic ecological assessment applicable to different water functional zones	Italian Side	Chinese Side			
4.2 Study the evaluation methods and verify the applicability of the evaluation system.	Chinese Side	Italian Side			
5. Research on optimization of Beijing's water environmental quality monitoring network			€ 75.000	€ 125.000	€ 200.000
5.1 Optimization of water environmental quality monitoring network	Chinese Side	Italian Side			
5.2 Refinement of aquatic ecological monitoring techniques	Italian Side	Chinese Side			
5.3 Investigation and exchanges on automatic monitoring equipment	Italian Side	Chinese Side			
Subtotal			€ 235.000	€ 425.000	€ 660.000
Project management fee			€ 14.400		€ 14.400
Travels and translations			€ 60.000	€ 10.000	€ 70.000
Chinese Study tour in Italy			€ 60.000	€ 15.000	€ 75.000
		TOTAL	€369.400 (45%)	€ 450.000 (55%)	€ 819.400