1 General

1.1 Background

1.1.1 Government development strategy and project origin

Shanghai Municipality is located at the west coast of the Pacific Ocean and estuary of Yangtze River, the largest river in China, flows into the sea in Shanghai. The special location that connects the ocean and main land brings unique feature of Shanghai. In accordance with Shanghai Urban Master Plan (1999 to 2020), by 2020 Shanghai will become one of the international economic, finance, trade and shipping centers.

Currently, almost no water body can meet national water quality Class I and II standards in Shanghai due to heavy pollution of surface waters, except for Yangtze River estuary. Consequently, Shanghai has been classified as one of the 36 cities in China that suffer water shortage in terms of water quality. Shanghai has been making efforts for water quality improvement and water source development and upstream Huangpu River water diversion works and Chenhang Reservoir water diversion works were built since 1980s, but water supply demand keeps growing over time due to rapid economic development and urbanization, as well as improvement of living conditions. Gap between raw water supply and demand is becoming more significant in Shanghai and has severely impeded harmonious economic and social development. The statistics indicate that total raw water supply of Shanghai in 2004 was 10.64 million m$^3$/day. In updated Shanghai Urban Master Plan and plans of districts/counties total water supply of 14.28 million m$^3$/day is planned for 2020, which means big gap exists in raw water supply. In order to narrow gap between raw water supply capacity and demands in Shanghai, Qingcaosha water source has been included in Shanghai Urban Master Plan (1999 - 2020) approved by the State Council and Shanghai Water Supply Master Plan and Shanghai Aquatic Environmental Functional Zoning (Revision) approved by the Shanghai Municipal Government (SMG). Development of Qingcaosha water source was officially listed in Outline of the 11th Five-Year Plan for National Economic and Social Development of Shanghai on January 20 2006. Currently construction of this water source has been listed as one of the key projects of Shanghai for the 11th Five Year, and Qingcaosha Reservoir raw water transmission works will be completed and put into operation in the first half year of 2010.

Based on Qingcaosha Water Source Raw Water Project Plan, Nanhui Conveyor...
works will provide raw water from Yangtze River to Chuansha Water Treatment Plant (WTP), North Nanhu WTP, Hangtou WTP, Huinan WTP, and New Nanhu WTP, with total transmission capacity of 1.28 million m$^3$/day or 18% of the total water supply and the service area covering a portion of Shanghai Pudong New District and Nanhu District. Currently raw water of the above WTPs is from raw water system of upstream Huangpu River. However, raw water quality of upstream Huangpu River is poor and unstable, which cannot fully meet water source quality requirements in Surface Water Environment Quality Standard for centralized city and town drinking water source. Implementation of this project will have fundamental significances of many aspects in terms of: alleviating of raw water shortage of Shanghai, increasing water supply capacity in the city and towns, improving water supply quality, improving of urban environment quality, securing public health, promoting harmonious development of social economy, and maintaining social stability.

In accordance with the Law of Environmental Impact Assessment of People’s Republic of China and Regulations on the Administration of Construction Project Environmental Protection, environmental impact assessment is required for new, upgrade and expansion projects that have environmental impacts, and environmental impact assessment report or form shall be prepared to describe local environmental quality condition of the project location and environmental impacts associated with project construction and operation. In accordance with Notice of Strengthening EIA Management of Construction Project Financed by International Financing Organization issued by the SEPA and based on nature of this Project, EIA report shall be prepared. Therefore, this EIA report was prepared based on information collection and preliminary site reconnaissance, as trusted by Shanghai Qingcaoshua Investment and Construction Development Ltd.

1.1.2 Importance of project construction

This project will deliver raw water from Yangtze River to Pudong New District and Nanhu District by constructing new boost pumping station and water transmission pipelines, which will greatly improve the drinking water quality for residents (farmers), increase the percentage of drinking hygiene water, and help to improve the public health of local residents (farmer) in the project area. Secondly, increase of water supply capacity will help to improve investment environment and create a sound environment for
industrial and agriculture development in the project area. Moreover, this project will bring some indirect benefits, such as acceleration of urbanization, optimization of production structures and urban planning layout, and improvement of citizen diathesis.

1.1.3 Project objective

The purposes of this Project are to:

(1) Improve raw water quality of Shanghai so as to improve drinking water quality for Shanghai residents. Construction of this Project will further improve public health and life quality of the residents. After completion of Qingcaosha water source, Shanghai water supply system will connect with Chenhang Reservoir to the north and connect with Huangpu River transmission system to the south. These water systems will supplement to each other and will generally improve drinking water quality of Shanghai residents.

(2) Safeguard raw water supply to Shanghai and benefit local economic development. Implementation of this Project will eliminate the gap between raw water supply and water supply demand in project service area, improve investment environment of the affected areas, and benefit local economic development. Implementation of this Project will increase raw water transmission capacity in Pudong and Nanhui districts to achieve water supply objective of 14.28 million m³/d in Shanghai by 2020 so as to ensure sustainable development of Shanghai. Nanhui District is an agriculture protection area of Shanghai, and Pudong District has the most rapid population growth, therefore, increasing raw water supply capacity financed by the government in project areas will further encourage local industrial and agricultural development and benefit for achieving the objective of becoming modernized new style agriculture.

(3) Improve local planning and accelerate urbanization of Shanghai. Pollution control of Dazhi River in Nanhui District has been ongoing for many years, and currently embankment improvement is under construction. Implementation of this Project will coordinate with Dazhi River pollution control and other development projects to further improve water quality of Dazhi River and water environment and air quality in the surrounding areas.

1.1.4 Project organization

Led by Shanghai Development and Reform Committee, Shanghai Construction Committee, Shanghai Finance Bureau and Shanghai WB Loan (APL) PMO, and
supervised by Shanghai Water Authority, Shanghai Municipal Construction, Investment and Development Company (Shanghai Chengtou General) and Shanghai Qingcaosha Investment, Construction and Development Ltd. take responsibilities for project implementation.

1.2 Summary of environmental impact assessment report

1.2.1 Purpose of environmental impact assessment

In accordance with the Law of Environmental Impact Assessment of People’s Republic of China and Regulations on the Administration of Construction Project Environmental Protection, Notice of Strengthening EIA Management of Construction Project Financed by International Financing Organization, WB Safeguard Policies and domestic and WB environmental impact assessment procedures, an EIA report is prepared to evaluate positive environmental impacts introduced by project implementation, identify, screen, forecast and analyze potential negative environmental impacts, and recommend particular and effective mitigation measures and environmental management plan with respect to inevitable adverse environmental impacts, so as to provide basis for independent project evaluation by WB and for integrated government management and decision-making of environmental authorities.

1.2.2 Category of environmental assessment and evaluation classification

In accordance with Notice of Strengthening EIA Management of Construction Project Financed by International Financing Organization (Document [1993]324) issued by SEPA and other ministries/commissions and WB Safeguard Policies - Environmental Assessment (OP 4.01) and based on identification of environmental assessment parameters and screening results, this Project is identified as Category A, i.e., a project that may have significant adverse environmental impacts. Full EIA is required for this type of project as stipulated in Document (Huanjian [1993]324). Police OP 4.01 stipulates “a project will be identified as Category A project if the proposed project will have significant adverse environmental impacts and these impacts are sensitive, multiple or unprecedented and meantime may extend beyond project site or facility area”. Therefore, for this Project a full EIA report is prepared as required for Category A
In accordance with EIA Technical Guidelines – General (HJ/T2.1-93), EIA Technical Guidelines – Air Environment (HJ/T2.2-93), EIA Technical Guidelines – Surface Water Environment (HJ/T2.3-93), EIA Technical Guidelines – Acoustic Environment (HJ/T2.4-95), EIA Technical Guidelines – Non-Pollution Ecological Impact (HJ/T 19-1997), and relevant WB requirements, environmental impact assessment for this Project is classified as below:

(1) Surface Water

For this Project, water pollutant discharge concentrates in construction period, and mostly are sandy production wastewater and domestic sewage of the construction workers. Analogy investigation of similar projects shows that wastewater and sewage are discharged in a little amount during construction and has very simple composition in terms of wastewater quality. Discharge during operation is mostly domestic sewage of the workers, which is in small amount and simple in composition as well. In accordance with requirements in EIA Technical Guidelines – Surface Water Environment (HJ/T2.3-93) for EIA classification, the assessment will only include analysis of environmental impacts and contents of assessment will be appropriately simplified.

(2) Acoustic Environment

Noise impacts introduced by this Project are mostly traffic and construction activity noise during construction and are temporary. Noise during operation is noise from pump station operation, which is mitigated by sheltering of the pump house and distance and will have insignificant impact. As stipulated in EIA Technical Guidelines (HJ/T2.4-1995) for classification of acoustic EIA, EIA Class III is identified for this Project.

(3) Air Environment

Air pollutant emissions are mostly associated with construction period for this Project, and no production air pollutants will be emitted during operation. Air pollution during construction includes emission of construction machinery and vehicles, dust suspension during pipe jacking and pump station construction, amount of which is small. In accordance with classification of EIA in EIA Technical Guidelines (HJ/T2.2-93) for
air environment, assessment will only include analysis of the impacts, and contents of assessment will be properly simplified.

(4) Ecological Environment

Construction activities are mainly along pipelines and at pump station construction sites, so the affected scope is limited. Moreover, pipe jacking method is applied for all the transmission pipelines, most of which are under green belt along the road. Thus, generally only the planted vegetation will be affected and insignificant impacts will be introduced by this Project to regional ecological environment. In accordance with EIA Technical Guidelines (HJ/T19-1997) requirements for non-pollution ecological impact EIA classification, only analysis of impacts will be included and the contents of assessment will be properly simplified.

1.2.3 EIA report components and EIA institution

This EIA report includes:

(a) Qingcaosha Water Source Raw Water Project – Nanhui Conveyor Works EIA Report; and

(b) Environmental Management Plan (EMP), covering environmental impacts, mitigation measures, environmental monitoring plan, institutional arrangements, capacity building and training, and cost estimate, etc.

EIA Institution: Shanghai Investigation, Design & Research Institute

1.3 Scope and period of assessment and environmental protection targets

1.3.1 Scope of environmental assessment

Scope of EIA for this Project covers:

(1) Surface water

Environmental impact assessment of surface water involves rivers within project area, including rivers of Zhangjiabang, Chuanyang, Beixingou, Changjiegang, Qizaogang, Liuzaogang, Youlonggang, and Dazhi.

(2) Air environment
Ambient air impact assessment covers pipeline construction shafts and areas within 200 meters away from the shaft, and pump station construction sites and areas within 200 meters away from this site.

3) Acoustic environment

Acoustic environment impact assessment involves pipeline construction shafts and areas within 300 meters away from the shaft, and pump station construction sites and areas within 300 meters away from this site. Noise level is monitored at 1 meter away from the pump station boundary during operation.

4) Ecological environment

Ecological environmental impact assessment involves areas occupied by the Project and construction sites.

1.3.2 Periods for environmental impact assessment

This EIA assesses the environmental impacts associated with construction and operation periods.

1.3.3 Environmental protection targets (sensitive points)

In accordance with local EIA laws and regulations and WB safeguard policies, environmental protection targets (sensitive points) of this EIA include:

1) Special protected areas, ecologically sensitive areas, and natural habitats: areas that need special protection stipulated by the Government or approved by governments at county or higher levels, such as drinking water source protected area, natural reserve, scenic spots, important wetland, and areas that are necessary to be or may be listed as natural reserves or scenic spots.

2) Areas of social concerns: populated area, cultural and education area, centralized office area, and hospital.

3) Involuntary resettlement.

Identification of environmental protection targets (sensitive points) and screening results are shown in Table 1.3-1. The locations of sensitive points are showed in attached Figure 5.
### Table 1.3-1  Checklist of sensitive objects

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Sensitive Point</th>
<th>Location</th>
<th>Distance (m)</th>
<th>Type of Sensitive Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1#</td>
<td>Wujiazhai</td>
<td>North to working shaft</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>2#</td>
<td>Xidingjiazhai</td>
<td>Northeast to Working shaft</td>
<td>60</td>
<td>Densely inhabited areas</td>
</tr>
<tr>
<td>3#</td>
<td>Xijiazhai</td>
<td>West to Working shaft</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>4#</td>
<td>Zhangjiazhai</td>
<td>Northwest to Working shaft</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>5#</td>
<td>Jujiazhai</td>
<td>West to Working shaft</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>6#</td>
<td>Huangjiaxincun</td>
<td>East to Working shaft</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>7#</td>
<td>Gongjiazhai</td>
<td>South to Working shaft</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>8#</td>
<td>Dingfeixincun</td>
<td>South to Working shaft</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>9#</td>
<td>Dingfeibeizhai</td>
<td>North to Working shaft</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>10#</td>
<td>Nanhuangjiazhai</td>
<td>South to Working shaft</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>11#</td>
<td>Tangrenyuan</td>
<td>South to Working shaft</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>12#</td>
<td>Wangjiazhai</td>
<td>South to Working shaft</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>13#</td>
<td>Haojiazhai</td>
<td>South to Working shaft</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>14#</td>
<td>Pailouzhai</td>
<td>East to Working shaft</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>15#</td>
<td>Guanyinzhai</td>
<td>North to Working shaft</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>16#</td>
<td>Gejiazhai</td>
<td>East to Working shaft</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>17#</td>
<td>Lingjiazhai</td>
<td>South to Working shaft</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>18#</td>
<td>Dongnanyicun</td>
<td>South to Working shaft</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>19#</td>
<td>Kangjiazhai</td>
<td>West to Working shaft</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>20#</td>
<td>Panjiazhai</td>
<td>South to Working shaft</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>21#</td>
<td>Chujiazhai</td>
<td>Northeast to Working shaft</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>22#</td>
<td>Chenjiazhai</td>
<td>Southeast to Working shaft</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>23#</td>
<td>Caijiazhai</td>
<td>South to Working shaft</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>24#</td>
<td>Qigan Village, Dongnanyicun</td>
<td>South to Pump Station</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>25#</td>
<td>Qigan Village, Lingjiazhai</td>
<td>North to Pump Station</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>
附图5 本项目沿线环境敏感点位置示意图
1.4 Environmental impact factors and parameters for assessment

1.4.1 Identification of environmental impact factors

Implementation of this Project will help further mitigate issues with raw water supply in Shanghai, improve infrastructure condition of Pudong New District and Nanhui District, and will have significant importance to promoting sustainable urban environment and socioeconomic development. Meanwhile, implementation of this Project will introduce some adverse environmental impacts during construction and operation to social environment, ecological environment and environmental quality.

(1) Social environmental impacts: project implementation will definitely result to certain impacts on social economy, mostly from land acquisition. Project construction will occupy certain area of land, which will affect life of local residents and their possession of production resources, and additionally construction activities also will lead to access inconvenience and safety concerns.

(2) Ecological environmental impacts: land occupation of project construction will reduce local farmland area and vegetation, change land use, and consequently result to impacts to local agricultural ecology. Construction activities will destroy vegetation on the proposed site, and soil loss may occur for backfill or excavation of road without proper maintenance measures.

(3) Environmental quality impacts: the proposed project site is close to urban areas; so great attention should be paid to adverse impacts during construction and operation to urban environment. During construction, waste oil due to leakage or spill of construction machinery and domestic sewage from construction workers may pollute waters; construction material transportation and mixing process may introduce large amount of dust suspension and air pollution; machinery noise also will affect daily life of adjacent residents, and construction vehicles will interfere with traffic condition. During operation, pump station will generate noise and will affect surrounding acoustic environment to some extent. Since project works need improvement and vegetation restoration takes time, soil erosion loss may continue for a period of time after construction.

In general, major environmental impact aspects associated with construction and operations of this Project include:

(1) Social environment: land occupation, etc.
(2) Ecological environment: change of land use, vegetation damage, soil erosion;
(3) Water environment: impacts to water quality by construction wastewater and domestic sewage during operation;
(4) Acoustic environment: construction noise, pump station operation noise; and
(5) Ambient air: dust suspension and vehicle emission during construction.

**1.4.2 Selection of parameters for environmental assessment**

Based on the above analysis and considering project nature and characteristics, the environmental impact identification matrix is developed, as shown in Table 1.4-1.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Natural Environment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Air Environment</td>
</tr>
<tr>
<td>Construction</td>
<td>Selection of Construction Site</td>
<td>-S</td>
</tr>
<tr>
<td></td>
<td>Material Transportation</td>
<td>-S</td>
</tr>
<tr>
<td></td>
<td>Site Preparation</td>
<td>-S</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>-M</td>
</tr>
<tr>
<td>Operation</td>
<td>Facility Operation</td>
<td>+S</td>
</tr>
</tbody>
</table>

**Note:** S refers to in slight impact, M for medium impact, L for large impact; “+” for positive impact, “-” for negative impact.

In order to further select specific environmental assessment parameters, two categories are identified based on nature and characteristics of the project: (1) water transmission pipelines; and (2) booster pump station.

Based on identification of environmental impacts, environmental assessment parameters are selected, as listed in Table 1.4-2.
<table>
<thead>
<tr>
<th>Project Category</th>
<th>Environmental Parameters</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipelines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Use,</td>
<td>TSP, PM&lt;sub&gt;10&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>Vegetation</td>
<td>SS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chloride, Sulfate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Traffic Noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction Noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction Debris,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Waste Soil</td>
<td></td>
</tr>
<tr>
<td>Pump Station</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Use,</td>
<td>TSP, PM10</td>
<td></td>
</tr>
<tr>
<td>Vegetation</td>
<td>pH, COD, BOD, NH&lt;sub&gt;3&lt;/sub&gt;-N, TP, TN, Petroleum oil, SS, volatile phenol, fecal coliform</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Noise at Plant Boundary, Construction Noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction Debris,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Waste Soil</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** ★ Significant impact; ☆ General impact; ○ Insignificant impact; + Positive impact; − Negative impact
2 Laws, Regulations, Policies and Regulatory Frameworks

2.1 Environmental laws and regulations

2.1.1 Introduction

Considering project scale, site, environmental sensitivity, and characteristics and extents of the potential environmental impacts, EIA of this Project will base and involve the following laws, regulations, policies, and standards:

1. Environmental protection laws and regulations
2. Pollution prevention and control technical policies
3. Socioeconomic development and environmental protection plans
4. Urban master plan
5. EIA technical guidelines
6. Environmental quality standards
7. Pollutant discharge/emission control standards
8. WB safeguard policies

These laws, regulations and policies form legal and regulatory frameworks for providing guidance to environmental impact assessment. Additionally, this EIA also use the project feasibility study report, preliminary design report and approval documents from government authorities, which reflect and apply these laws, regulations and standards, as one of the basis for EIA.

2.1.2 Environmental protection laws and regulations

1. Law of Environmental Protection of PRC, December 1989
2. Law of Environmental Impact Assessment of PRC, October 2002
3. Law of Water Pollution Prevention and Control of PRC, February 2008
4. Law of Air Pollution Prevention and Control of PRC, April 2000
5. Law of Environmental Noise Pollution Prevention of PRC, October 1996
6. Law of Solid Waste Environmental Pollution Control of PRC, December 2004
7. Law of Water of PRC, January 1988

(9) Regulations on the Administration of Construction Project Environmental Protection, August 1992

(10) Interim Methods for Public Consultation of EIA, February 2006


(12) Implementation Method of Shanghai for the Law of EIA of PRC, May 2004

(13) Regulation of Environmental Protection of Shanghai, October 2005

(14) Management Methods for Construction Project Environmental Protection of Shanghai, December 1997

(15) Aquatic Environmental Functional Zoning of Shanghai

(16) Ambient Air Quality Functional Zoning of Shanghai

(17) Acoustic Environmental Quality Functional Zoning of Shanghai

(18) Management Methods of Dust Suspension Pollution Control of Shanghai, May 2004


(20) Notice of Stringent Control of Construction Activities during Night to Prevent Environmental Noise Pollution, August, 1995

(21) Requirements on Road and Pipeline Construction and Dust Suspension Prevention of Elevated Road Cleaning of Shanghai, September 2004

(22) Protection Methods for Raw Water Diversion Pipe and Canal of Shanghai, January 1995

2.1.3 Pollution prevention and control technical policies

Guidelines for Industrial Restructuring (2005 version), 2 December, 2005

2.1.4 Socioeconomic development and environmental protection plans

(1) Shanghai Urban Master Plan (1999 to 2020)

(2) Outline of the 11th Five-Year Plan for National Economic and Social
Development of Shanghai

(3) Shanghai Land Utilization Master Plan

(4) Shanghai Water Supply Master Plan

(5) Shanghai Environmental Protection and Development Three-Year Action Plan for 2006 to 2008

(6) Shanghai Environmental Protection 11th Five-Year Plan

2.1.5 EIA technical guidelines and criteria

(1) HJ/T2.1-93 EIA Technical Guidelines - General

(2) HJ/T2.2-93 EIA Technical Guidelines – Air Environment

(3) HJ/T2.3-93 EIA Technical Guidelines – Surface Water Environment

(4) HJ/T2.4-1995 EIA Technical Guidelines – Acoustic Environment

(5) HJ/T19-1997 EIA Technical Guidelines – Non-Pollution Ecological Impact

2.1.6 Environmental quality standards

(1) Water environment

In accordance with the Aquatic Environmental Functional Zoning of Shanghai issued by Shanghai EPB in 2004, water bodies to be affected by this Project are Category IV and V waters, and values of relevant standards are listed as in Table 2.1-1.

Table 2.1-1 Limits to general parameters in surface water environmental quality standard (Unit: mg/L)

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water Temperature (℃)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Man-made water temperature change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>should be limited to: weekly average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>increase ≤1 and decrease ≤2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>pH (No unit)</td>
<td>6~9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Dissolved Oxygen</td>
<td>≥7.5</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Permanganate Index (as CODMn)</td>
<td>≤2</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>BOD₅</td>
<td>≤3</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Ammonia Nitrogen (as NH₃-N)</td>
<td>≤0.15</td>
<td>0.5</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>7</td>
<td>Total Phosphorus (as P)</td>
<td>≤0.02</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
</tr>
</tbody>
</table>
Total Nitrogen (for reservoir and lake, as N) ≤ 0.2 0.5 1.0 1.5 2.0
Copper ≤ 0.01 1.0 1.0 1.0 1.0
Zinc ≤ 0.05 1.0 1.0 2.0 2.0
Mercury ≤ 0.00005 0.00005 0.0001 0.001 0.001
Lead ≤ 0.01 0.01 0.05 0.05 0.1
Volatile Phenol ≤ 0.002 0.002 0.005 0.01 0.1
Petroleum Oil ≤ 0.05 0.05 0.05 0.5 1.0
Fecal Corliform (Number/L) ≤ 200 2000 10000 20000 40000

(2) Air environment

In accordance with the Ambient Air Quality Functional Zoning of Shanghai, Class 2 of Ambient Air Quality Standard (GB3095-96) is applied, and the specific limits are given in Table 2.1-2.

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Class 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SO2</td>
<td>0.06, Annual Average</td>
</tr>
<tr>
<td>2</td>
<td>NO2</td>
<td>0.08, Annual Average</td>
</tr>
<tr>
<td>3</td>
<td>TSP</td>
<td>0.2, Annual Average</td>
</tr>
<tr>
<td>4</td>
<td>PM10</td>
<td>0.1, Annual Average</td>
</tr>
</tbody>
</table>

(3) Acoustic environment

In accordance with the regional acoustic environmental functional zoning, areas along pipelines are Category II areas, and which is applicable to the proposed Nanhui North pumping station site. Urban Regional Environmental Noise Zoning Technical Guidelines stipulates that Category IV standards are applied to 50m within road boundary and Category I standards are applied to 50m beyond road boundary when there is road or railway (including tramway) crossing Category I area; Category IV standards are applied to 35m within road boundary and Category II standards are applied to 35m beyond road boundary when there is road or railway (including tramway) crossing Category II area.
In accordance with the above regulations and regional acoustic environmental functional zoning, Category I, II, and IV standards of Urban Regional Environmental Noise Standards (GB3096-93) are applicable to project areas.

**Table 2.1-3 Standards for noise assessment (Unit: leq[dB(A)])**

<table>
<thead>
<tr>
<th>Category</th>
<th>Daytime</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>55</td>
</tr>
</tbody>
</table>

### 2.1.7 Pollutant discharge control standards

1. **Wastewater**

   Class 2 of Shanghai Integrated Wastewater Discharge Standard (DB31/199-1997) is applied to construction period, and Class 3 is applied to operational period.

   **Table 2.1-4 Wastewater discharge standards (Unit: mg/L)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SS</th>
<th>BOD5</th>
<th>COD</th>
<th>NH₃-N</th>
<th>Petroleum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 2</td>
<td>150</td>
<td>30</td>
<td>100</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Class 3</td>
<td>350</td>
<td>150</td>
<td>300</td>
<td>25</td>
<td>20</td>
</tr>
</tbody>
</table>

2. **Air**

   Limits to inorganized emission in Integrated Air Pollutant Emission Standard (GB16297-96) are enforced.

   **Table 2.1-5 Air pollutant emission limits for new pollution source (concentration limits to unorganized emission monitoring) Unit: mg/m³**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SO2</th>
<th>NOx</th>
<th>Particulates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Point with Concentration Boundary</td>
<td>Highest Concentration Boundary</td>
<td>Point with Highest Concentration Boundary</td>
</tr>
<tr>
<td>Concentration</td>
<td>0.4</td>
<td>0.12</td>
<td>1.0</td>
</tr>
</tbody>
</table>

3. **Noise**

   Limits to Noise Level at Construction Site Boundary (GB12523-90) and Standards for Noise Control at Industrial Plant Boundary (GB12348-90) are enforced.
Table 2.1-6 Limits to noise level at construction site boundary (Leq)  
(Unit: dB(A))

<table>
<thead>
<tr>
<th>Construction Time</th>
<th>Earthwork</th>
<th>Piling</th>
<th>Structural Engineering</th>
<th>Decoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limit</td>
<td>Daytime</td>
<td>75</td>
<td>85</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Night</td>
<td>55</td>
<td>Prohibited</td>
<td>55</td>
</tr>
</tbody>
</table>

Table 2.1-7 Standards for noise control at industrial plant boundary (Leq)  
(Unit: dB(A))

<table>
<thead>
<tr>
<th>Category</th>
<th>Daytime</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>II</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>III</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>IV</td>
<td>70</td>
<td>55</td>
</tr>
</tbody>
</table>

2.1.8 WB safeguard policies

(1) OP/BP 4.01 Environmental Assessment
(2) OP/BP 4.12 Involuntary Resettlement
(3) BP17.50 Information Disclosure
(4) OP 4.11 Physical Cultural Resources
(5) OP/BP 4.04 Natural Habitats
(6) OP 4.37 Safety of Dams

2.1.9 Project related documents

(1) Qingcaosha Water Source Raw Water Project Nanhui Conveyor Works Proposal or Feasibility Study Report, prepared by Shanghai Qingcaosha Raw Water Engineering Company Ltd. and Shanghai Municipal Engineering Design and Research Institute, August 2007
(2) Preliminary Design Report for WB Financed Shanghai APL Phase III Subproject Nanhui Conveyor Works, prepared by Shanghai Qingcaosha Raw Water Engineering Company Ltd. and Shanghai Municipal Engineering Design and Research Institute, April 2008; and
(3) Resettlement Action Plan (RAP) for WB Financed Shanghai Qingcaosha Water
Source Raw Water Project Nanhui Conveyor Works and Associated projects, prepared by Shanghai Qingcaosha Investment, Construction and Development Ltd. and Shanghai Institute of Social Sciences, February 2008.

2.2 Environmental agencies and responsibilities

In China the Central Government, provinces, cities and counties have legally established environmental agencies, which are performing relevant environmental regulatory responsibilities. Environmental authorities related to this Project include Ministry of Environmental Protection, Shanghai Environmental Protection Bureau, and EPBs of Districts.

In March 2008, the State Environmental Protection Administration (SEPA) was upgraded to the Ministry of Environmental Protection, responsible for country-wide environmental protection administration and regulatory enforcement. Major responsibilities of MEP include: developing national environmental protection guidelines, policies, regulations and planning, and administrative regulations; supervising on natural resource development and utilization activities that have ecological environmental impacts, major ecological environment building and ecological damage restoration; supervise and inspect environmental protection performance of various types of natural reserves and scenic spots, and forest park; monitor and inspect biodiversity protection, wild animal and plant life protection, wetland environment protection, and desert prevention; supervising over national-level natural reserves; guiding and coordinating to address major environmental issues involving multiple jurisdictions and river basins; developing and organizing implementation of various environmental regulations; reviewing and approving EIAs of construction projects; providing guidance to urban and rural environmental rehabilitation; taking responsibilities for rural ecological environmental protection; managing international cooperation and communication in environmental protection; participating and coordinating important international environmental protection activities; managing and coordinating performance in following
international environmental protection treaties, and liaising with external agencies; managing external economic cooperation of environmental protection system; coordinating foreign fund utilization associated with performing international treaties; taking responsibility for international environmental affairs as trusted by the State Council; and being responsible for liaison with international environmental organizations.

EIA Department is established under MEP, dedicatedly responsible for administration of environmental impact assessment. Major responsibilities of EIA Department include: developing environmental policies and regulations for EIA and “Three Synchronies” and organizing implementation; undertaking EIAs of major economic and technical policies, development planning and economic development plan; developing regulatory classification for EIA; and reviewing and approving EIA reports of major development and construction projects.

(2) Shanghai Environmental Protection Bureau (SEPB)

Shanghai EPB is responsible for environmental administration and regulatory enforcement. Major responsibilities of SEPB include: (a) enforcing environmental protection guidelines, policies, laws, and regulations; reviewing and developing relevant local environmental laws and regulations and policies, and organizing enforcement; (b) reviewing and developing environmental development strategy of the city; preparing medium and long term environmental protection planning and annual plan, and organizing implementation; participating in developing national economic and social development planning, land planning, regional/county planning, and urban master plan; organizing preparation of environmental functional zoning; preparing city-wide total pollutant mass control plan and abatement plan; coordinating settlement of major environmental issues; (c) supervising over prevention and control of air, water, soil, noise, radioactivity, solid waste, toxic chemical and vehicle pollution; assisting with improvement of energy utilization restructuring; and controlling of sea pollution from land pollutants and coastal construction projects; (d) supervising over natural resource development and utilization activities, major
ecological environmental building and damage restoration activities, which have impacts to ecological environment; monitoring environmental protection performance in natural reserves, scenic spots, and forest parks; monitoring protection of biodiversity, wild animal and plant, and wetland; managing environmental safety of biological technologies; responsible for rural ecological environmental protection, and providing guidance to ecological demonstration zone and ecological agriculture building; (e) investigating and settling major environmental pollution accidents and ecological damage incidents; assisting with settlement of trans-regional environmental pollution disputes and relevant external environmental disputes; environmental supervision and administrative inspection; work jointly with concerned agencies in management of pollution source treatment fund; organizing environmental regulatory inspection in the entire city; (f) developing city environmental quality standards, pollutant discharge standards, and total mass control standards; organizing preparation of city environmental quality report; issuing city environmental condition report and quality forecast of air environment; (g) organizing enforcement of pollutant discharge application and registration, industrial permitting, pollution charges and environmental impact assessment for supervision of various pollutant discharge; reviewing and approving EIAs, as authorized, of citywide development and construction project, technical innovation project, coastal construction project, and river-basin and regional development project; (h) in charge of environmental monitoring, statistics, and information; developing environmental monitoring requirements and criteria; organizing establishment and management of city environmental monitoring networks and environmental information networks; organizing environmental quality monitoring and pollution source monitoring for supervision purpose; reviewing of EIA qualification; (i) working together with other concerned agencies to organize environmental technology innovation, scientific research and technical demonstration project; working jointly with other concerned agencies in management of environmental certification implementation; guiding and promote development of environmental protection industry; (j) taking responsibility
for citywide international and regional cooperation and communication in environmental protection; organizing and coordinating compliance with international environmental treaties in the entire city; participating and coordinating international economic cooperation and foreign fund project in environmental protection; encouraging public and NGO to participate in environmental protection; handling international environmental protection affairs as trusted by the municipal government; (k) supervising and managing radiation environment, radioactive waste and nuclear radiation safety; emergency response to radiation environment and nuclear accident; integrated supervision and management of pollution prevention associated with electromagnetic radiation and nuclear technology application; and (l) settlement of administrative reconsideration and litigation.

The Supervision and Management Department is established within SEPB, responsible for environmental management associated with citywide planning, plan, construction projects, and pollution treatment of industrial zone lower than city-level, supervision over EIA agencies, responsible for review and approval of EIA reports of construction projects within municipal jurisdiction and as trusted by the Central Government and “Three Synchronies” completion acceptance and review, investigation and settlement of radiation environment emergency response, and also responsible for provision of supervision and guidance to district/county EPBs in project review and approval.

International Cooperation Department is also set up under SEPB, responsibilities of which include preparation of international cooperation plan and implementation organization, coordination of international environmental cooperation projects, coordination of compliance with international environmental treaties in the entire city, international communication, and cooperation and communication with friendly cities in environmental protection.

(3) District EPBs

District (Pudong New District and Nanhui District) EPB is responsible for district environmental protection administration and administrative enforcement.
Qingcaosha Water Source Raw Water Project - EIA of Nanhui Conveyor Works

Major responsibilities of district EPB include: (a) enforcing national and city environmental guidelines, policies, laws and regulations; reviewing and developing internal environmental projection regulations and policies, developing district pollution control methodology and methods and organizing and supervising on implementation; (b) preparing medium and long term environmental protection planning and annual plan, and organizing implementation; management of environmental statistics and information within jurisdiction; participating in developing economic and social development planning, land development and rehabilitation planning, and regional economic development planning; participating in review of environmental protection associated with new urban area building, development zone and urban area improvement; (c) supervising on waste gas, wastewater, noise, radiation, solid waste, toxic and hazardous chemical and vehicle pollution control in jurisdiction; supervising on compliance with List of Prohibited (or strictly control) Polluting Project and List of Toxic and Hazardous Chemical for Priority Control issued by the Government; management of chemicals; environmental protection associated with wastewater collection and discharge to sea and pollution; (d) natural environment protection, supervision on resource development activities that have ecological environmental impacts; rural ecological environmental protection, and guidance to ecological demonstration zone and ecological agriculture building; (e) enforcement of pollutant discharge application and registration, discharge permitting, pollution charges, EIA, Three Synchronies, and time-bound pollution treatment; review of EIA reports or forms of district development and construction projects, technical innovation, and regional development and construction projects; (f) coordination of accountability for environmental protection targets and quantitative evaluation of urban environmental rehabilitation; (g) environmental monitoring; supervise on implementation of environmental monitoring regulations; providing guidance to environmental monitoring networks; providing guidance to quality certification of environmental monitoring station and quality assurance; (h) organizing regional environmental quality survey, investigating and settling major environmental
pollution accidents and ecological damage incidents; handling environmental protection proposal raised by district People’s Congress and Political Consultative Conference and relevant mails and visits of the public; organizing regulatory enforcement inspection of environmental protection in the district; (i) supervising over enforcement of national and local environmental standards and technical criteria; working with other concerned agencies in organizing environmental protection technical innovation and demonstration projects; guiding and promoting development of environmental industry; (j) cooperation and communication on environmental protection; participate in coordination of foreign fund projects; introduction of new environmental protection technologies and processes; organization of quality monitoring of environmental protection equipment; (k) environmental protection publication, education and training of environmental laws and regulations; assistance with concerned agencies in environmental education and dissemination; and (l) presence when there is administrative litigation.

A supervision department is also set in district EPB, dedicatedly responsible for environmental supervision on pollution control of reserved industrial zones within jurisdiction, review and approval of EIAs of construction projects within district jurisdiction and as trusted by the City, review and acceptance of “Three Synchronies” and participation in engineering acceptance of construction projects, and consultation of environmental laws, regulations and policies.
3 Project Description and Analysis

3.1 Project name

WB financed Nanhui Conveyor Project.

3.2 The proposed project location

The proposed Nanhui Conveyor Project will be located in Pudong New District and Nanhui District of Shanghai.

The proposed project works consist of water transmission pipelines and booster pumping stations. The water transmission pipelines are aligned along Jinhai pumping station – Huadong Road – Chuansha pumping station; Jinhai pumping station – Huadong Road – Longdong Road – Binzhou Road – A20 Road – A2 Highway – Zhouzhu Road – North Nanhui pumping station – Hangtou Water Treatment Plant (New Huinan WTP). The booster pumping station is North Nanhui pumping station.

The project location map is shown in Figure 3.2-1.
The following principles are followed in the Feasibility Study Report for project site selection:

(1) Compliance with local urban master plan and relevant special planning;

(2) Compliance with site selection regulations and criteria, for example, Environmental Protection Design Regulations on Construction Project, GB50014-2006 Outdoor Drainage Design Criteria; and

(3) Less capital and operational costs.

The proposed project sites are shown in Table 3.2-1 based on field survey and comprehensive comparison and analysis on technical, economic and environmental conditions. Analysis of rationality for project site selection is given in Section 8, Comparison and Analysis of Alternatives.
Table 3.2-1 Proposed pumping station sites

<table>
<thead>
<tr>
<th>Pumping station</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Nanhui Pumping station</td>
<td>Nanhui District Zhoupu Town, north to Zhouzhu Road, east to A2 Road, northeast of A2 Road and Zhouzhu Road intersect</td>
</tr>
</tbody>
</table>

3.3 Project implementation agency

Implementation Agency of this Project is Shanghai Qingcaosha Investment, Construction and Development Company Limited.

3.4 Project scale and objective

3.4.1 Scale and objective of the whole project

According to the approved Qingcaosha Raw Water Project Overall Plan, water supply capacity of this proposed project will be 7.19 million m³/d by 2020, of which 0.11 m³/d for Changxing WTP located at Changxing Island and 7.08 for several inland WTPs via Yangtze River crossing pipelines.

3.4.2 Scale and objective of Nanhui conveyor works

According to Inland System Plan for Qingchasha Water Source Raw Water Project and its approval, Nanhui Conveyor is located downstream of inland transmission system towards Jinhai, Chuansha and Nanhui transmission systems. Water supply capacity of Nanhui Conveyor is 1.28 million m³/d, and service scope covers Chuansha WTP in Pudong New District and all WTPs in Nanhui District and Lingang New Town. The raw water is conveyed from Wuhaogou pumping station to Jinhai pumping station and then 0.2 million m³/d is lifted to Chuansha WTP, and 1.08 million m³/d is pumped to downstream Nanhui North pumping station. 0.2 million m³/d is transferred from Nanhui North pumping station to Nanhui North New WTP, and the remaining 0.88 million m³/day to downstream Hangtou WTP, Huinan WTP, and Huinan New WTP.

Nanhui Conveyor is mostly utilized for water transmission to Chuansha and
Nanhui direction, and the receiving WTPs are Chuansha, Nanhui North, Hangtou, Huinan, and Huinan New WTPs. The targeted water supply is:

<table>
<thead>
<tr>
<th>Name of WTP</th>
<th>Design Capacity (10,000 m³/d)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuansha WTP</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Nanhui North New WTP</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Hangtou WTP</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Huinan WTP</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Huinan New WTP</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>128</strong></td>
<td></td>
</tr>
</tbody>
</table>

### 3.5 Proposed alignments

#### 3.5.1 Project scope and function

In accordance with Qingcaosha Water Source Raw Water Project Overall Plan and Qingcaosha Water Source Raw Water Project packaging approved by Shanghai Water Authority in August 2006, Nanhui Conveyor is a section of inland water transmission system, downstream of Jinhai, Chuansha and Nanhui sub-systems, starting from Jinhai pumping station at end of Jinhai Conveyor.

As one of the major components of Qingcaosha Water Source Raw Water works, Nanhui Conveyor undertakes raw water transmission to Chuansha, Nanhui North New, Huinan, Hangtou, and Huinan New WTPs. Project scope covers transmission pipelines and booster pumping stations from Jinhai pumping station to the existing Chuansha WTP, Hangtou WTP, Huinan WTP, and the proposed Nanhui North New WTP and Huinan New WTP.

The design life time of Nanhui Conveyor is 50 years.

The overall alignment plan of Qingcaosha Water Source Raw Water Works and the location and scope of Nanhui Conveyor are shown in Figure 3.5-1.
3.5.2 Recommended alignment plan

The recommended plan is to construct one pumping station in Nanhui Conveyor Plan, i.e., only Nanhui North pumping station is built without Nanhui booster...
pumping station, and two pipelines (DN2000, 18.3 km) are laid from Jinhai pumping station to Nanhui North pumping station and two pipelines (DN1800, 10.8 km) from Nanhui North pumping station to Nanhui pumping station. The diagram is shown in Figure 3.5-2.

![Diagram of recommended plan](image)

**Figure 3.5-2 Diagram of recommended plan**

### 3.6 Major project components

This project includes construction of water transmission pipelines and one booster pumping station.

#### 3.6.1 Water transmission pipelines

In the proposed project plan, there five parts of pipelines:

1. Jinhai pumping station to North Nanhui pumping station: two DN2000 steel pipelines (Nanhui Conveyor) and one DN1600 steel pipelines (Chuansha Conveyor); parallel pipelines are laid by applying pipe jacking method with 4 to 5 m space between pipe center; of the proposed pipelines, the two DN 2000 pipelines are laid in parallel to North Nanhui pumping station with total length of 18.35 km, and the DN 1600 pipeline is separated to two DN1000 ductile iron pipelines, from the point
3.56km away from Jinhai pumping station and 0.79km to the east (Chuansha Conveyor).

(2) East Gaoke Road to Chuansha WTP (Chuansha Conveyor): two ductile iron pipelines are laid in parallel for 1.43km by opening excavation method, and then changed to two parallel DN1000 steel pipelines laid by pipe-jacking method, 0.49km in length to Chuansha WTP, space between pipe center is 3.5m.

(3) North Nanhui pumping station to intersection of A2 Road and Dazhi River north bank: two parallel DN1800 steel pipelines to be laid by pipe-jacking method, 10.8km long and 5m for space between pipe center-line.

(4) Intersection of A2 Road and Dazhi River north bank to Huinan WTP: two parallel DN1800 steel pipelines, laid by pipe-jacking method, 7.34km long, and 4m for clearance between pipe center-line.

(5) Intersection of A2 Road and Dazhi River north bank to Hangtou WTP: one DN1600 steel pipeline, laid by pipe-jacking, 7.24km long.

Total length of the transmission route is 45.7km, and total pipeline length is 88.4km.

3.6.2 Pumping station

Nanhui North pumping station is located north to Zhouzhu Road, east to A2 Road, northeast to A2 Road and Zhouzhu Road intersection, covering an area of 2.42 ha. Booster-pump chamber (semi-underground, reinforced concrete structure), 35 kV transformer station and office building for administration, operation and domestic purpose will be built in the pumping station. Additionally, there will be auxiliary structures including warehouse and safeguard room, etc.

Nanhui North pumping station is a dual-functional booster pumping station. Major functions of this station include lifting of raw water to adjacent proposed Nanhui North New WTP and transfer of raw water to Nanhui pumping station. Total water transmission capacity of the station is 1.08 million m³/d, of which 0.2 million will be conveyed to Nanhui North New WTP. This pumping station is equipped with
three horizontal centrifugal pumps (one standby), lifting capacity of each pump is 4,458 m$^3$/h, head of the pump is 6.0m, and motor power is 180kW. The remaining 0.88 million m$^3$/day will be conveyed to Nanhui pumping station. This pumping station is equipped with five horizontal centrifugal pumps (one standby), lifting capacity of each pump is 9,808 m$^3$/h, head of the pump is 32.5m, and motor power is 1400kW.

Layout plan of North Nanhui pumping station is shown in Figure 3.6-1.

### 3.6.3 Quantities

Quantities of this Project are those for Nanhui Conveyor and pumping station.

#### (1) Water Transmission Pipelines

**Table 3.6-1 Quantities of water transmission pipelines**

<table>
<thead>
<tr>
<th>Section</th>
<th>Pipe Size (mm)</th>
<th>Material</th>
<th>Pipe-Jacking (km)</th>
<th>Manhole (Unit)</th>
<th>Collection Tank (Unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jinhai – North Nanhui</td>
<td>2000</td>
<td>Steel</td>
<td>18.35×2</td>
<td>26</td>
<td>17</td>
</tr>
<tr>
<td>North Nanhui-Huinan</td>
<td>1800</td>
<td>Steel</td>
<td>18.14×2</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>North Nanhui-Hangtou</td>
<td>1600</td>
<td>Steel</td>
<td></td>
<td>23</td>
<td>20</td>
</tr>
<tr>
<td>Chuansha Conveyor</td>
<td>1000</td>
<td>Steel</td>
<td>0.49×2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>Ductile Iron</td>
<td>1.43×2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>88.4</td>
<td>49</td>
<td>37</td>
</tr>
</tbody>
</table>
Figure 3.6-1 Nanhui North pumping station layout plan
(2) Booster pumping station

<table>
<thead>
<tr>
<th>Name</th>
<th>Capacity (10,000m³/d)</th>
<th>Land Area (ha)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Nanhui Pumping station</td>
<td>20</td>
<td>2.42</td>
<td>To North Nanhui New WTP</td>
</tr>
<tr>
<td></td>
<td>88</td>
<td></td>
<td>To Hangtou, Huinan, Huinan New WTP</td>
</tr>
</tbody>
</table>

3.6.4 Land occupation

Project land occupation includes permanent land acquisition for Nanhui North pumping station and permanent land acquisition for pipe-jacking shafts reserved for transmission pipelines and auxiliary facilities (valve manhole, drainage valve manhole, exhaust valve manhole and pressure compensation tower), and temporary land occupation during pipeline construction.

The proposed land acquisition plan is as below:

1. Permanent land acquisition of 2.42 ha for Nanhui North pumping station;
2. Permanent land acquisition of approximate 369 m² for auxiliary facilities along transmission pipelines;
3. Temporary land occupation of approximate 10.56ha during pipeline construction;
4. Reserved land of 2.2ha.

3.7 Major construction plans

3.7.1 Overall construction arrangements

This project involves a very long route for pipeline construction and there is little interference each other, thus construction activities at different sites can be implemented at the same time. Since construction sites are along pipelines and along urban roads with convenient transportation condition, construction material, such as sand and stone, and construction equipment can be directly hauled along the roads to construction sites.
3.7.2 Pipeline construction plan

Open excavation and pipe jacking methods are applied for pipeline laying of this Project.

(1) Open excavation

For Chuansha Conveyor section of this Project (East Gaoke Road to Chuansha WTP), construction along Huadong Road (south to East Gaoke Road) is ongoing and the green belt is remaining. Two parallel ductile iron pipelines (1.43km) will be laid by open excavation. In populated areas south to Beijie River, pipe jacking method is applied to lay two parallel DN1000 steel pipelines of 0.49km to Chuansha WTP.

(2) Pipe jacking

Open excavation is adopted only for 1.43km pipelines of Chuansha Conveyor, and pipe jacking is used for all the other pipelines.

3.7.3 Open excavation

About 1.4km of Jinhai pumping station to Chuansha WTP pipelines (East Zhonghua Road East Gaoke Road to south of Beijie River) will be laid by open excavation.

(1) Construction working face is at one side of the pipelines. Pipeline construction is conducted by segment construction. All excessive soil should be hauled outside the site. The soil for backfill purpose can be temporarily stored by the finished pipelines, but the earth pile should not be higher 2.0m, and the soil cannot be piled above the laid pipelines.

(2) Spigot and socket cast iron pipe is used.

(3) Pipe bottom is generally located in the 2nd silty clay blanket or 3rd slime and silty clay blanket.

(4) Where depth of open excavation is within 4m, sloping surface with gradient of 1:1.2 is adopted and well point dewatering is used. Where excavation depth ranges from 4m to 6m, combination of sloping surface, steel sheet pile and inside spider as supporting structure is adopted with well point dewatering. Where excavation depth
is more than 6m or environmental condition requires no use of steel sheet pile or outside dewatering, shaped steel Soil-cement Mixed Wall (SMW) retaining structure plus inside spider are adopted.

(5) The pipe size is DN1000 and the earth covering is 1.6 to 6.5 m. In considering the poor bearing capacity of the foundation and water and soil loss due to penetration and leakage of adjacent pipelines, reinforced concrete foundation is adopted to reduce uneven settlement of the pipelines.

(6) Generally foundation treatment is not considered. In case of local mud or blind ditch, graded sand is backfilled after mud or blind ditch is removed. Large area or thick soft soil should be treated by rubble filling to remove mud.

3.7.4 Pipe jacking

Generally pipe jacking is adopted for all the pipelines, and total pipe jacking length is approximately 44.3km.

(1) Pipe jacking methods

There are two pipe jacking methods, mud water impelling method, cutting-edge impelling method. Mud water impelling method is adopted for this project.

Mud water impelling method: cutting head and impelling speed is utilized to balance frontal soil pressure, and circulating water pressure is adjusted to balance groundwater pressure. Liquid is utilized to transport soil cut and loaded into silo. Continuous impelling process means high speed of construction. Territoriality improvement or dewatering treatment is not needed and there is little surface settlement after construction. The construction process is shown in Figure 3.7-1.
(2) Working shaft and receiving shaft

Exterior protected construction is adopted for working shaft and receiving shaft in pipe jacking. Shaped steel SMW retaining structure or drill caisson pile plus pressure injection pile is adopted based on depth of foundation ditch. Process manholes are built in the foundation ditch after pipe jacking is finished.

(3) Depth of pipe jacking

Usually soil covering for pipe jacking is not less than twice of the pipe size and not less than 1.5m; soil covering in case of river crossing should meet needs for anti-floatation, and generally not less than 1.25 times of pipe size and no less than 3m. The depth should be properly increased when pipe jacking crosses major structures. Depth of pipe jacking should be considered to avoid area with significant change of soil hardness.

(4) Pipe jacking spacing

The existing buildings and structures should be avoided for pipe jacking and the net distance with the existing structures should be not less than the pipe size (external diameter). Where more than one pipes are impelled in parallel, the longitudinal separation of the adjacent pipes should be more than 50m to eliminate interference during construction.
(5) Once impelling distance of pipe jacking

Once impelling distance of DN2000 steel pipe is controlled under 950m, DN1800 steel pipe under 800m, DN1600 steel pipe under 700m, and DN1000 under 180m. This requirement can be adjusted based on actual construction condition.

3.7.5 Crossing of large and major obstacles

Alignment plan of Nanhui Conveyor indicates that there will be many crossings of existing large and major obstacles, including magnetic suspension rail, A2 and A20 overpass, A2 Airport Road overpass, A2 Hunan Road overpass, flying bridge, and navigable river. Crossing methods include pipe jacking, pipe bridge, and inverted siphon. Pipe size in this Project ranges from DN1600 to DN2000. Since pipe jacking is adopted for all the pipelines, pipe-jacking crossing will be adopted for obstacle crossing.

(1) Crossing of navigable water course

Pipe jacking is applied for crossing of navigable river. Soil covering (raw-condition river bed) should be no less than 1.25 times of pipe size and not less than 3m. Meanwhile, soil covering should be in compliance with river planning requirements, and soil covering thickness from pipe top to river bottom should meet anti-floatation requirements.

(2) Crossing of flying bridge

Pipeline construction of this project will cross several flying bridges of highways through pipe jacking. Where elevated section is crossed, the pipeline crosses the flying bridge vertically between the two bridge piers, In this case pipeline is mostly located in 3rd and 4th grey muddy clay blanket, which have poor intensity and favorable to large size pipe jacking. Since this geological condition provides limited bearing capacity to bridge pile foundation, it has insignificant impact on settlement control of the pile foundation even if the soil layer is disturbed to some extent.

(3) Magnetic suspension rail

The pipelines will cross existing magnetic suspension rail north to A2 and A20
overpasses. Magnetic suspension rail is elevated simply-supported structure. High-speed moving has very stringent requirements for smoothness of rail beam and settlement control of pier, therefore, water transmission pipelines will cross the magnetic line from two spans respectively. The pipeline layout plan shows that pipeline center elevation here is about -5.00m. The pipeline is mostly located in muddy clay blanket, which have poor intensity and is favorable to large size pipe jacking. Since this geological condition provides limited bearing capacity to magnetic rail pile foundation, it has insignificant impact on settlement control of the pile foundation even if the soil layer is disturbed to some extent. Since off-lying pile foundation is racking pile and external pipe wall is close to pile foundation, multiple measures should be taken to ensure safe operation of magnetic suspension rail. First, the pipelines should be aligned orthogonal to the magnetic rail to minimize affected length. Second, two pipelines cross the magnetic rail from two spans, respectively. Third, appropriate measures should be taken to increase safety, for example, pre-reinforcement should be made prior to construction by injection to soil body next to pile foundation along pipeline and depth of injection is 3m from pipe bottom to bottom bed of magnetic rail. Monitoring locations should be set during pipe jacking to closely supervise over settlement of magnetic rail pile foundation and surrounding soil and timely injection is done to ensure safety of magnetic suspension rail.

(4) Crossing of overpass

Pipeline construction will cross several overpasses. When overpass cluster is crossed, vertical crossing should be selected as much as possible and multiple turn-overs are adopted to avoid pier columns so that impact of pipe jacking to overpass is minimized.

3.8 Project management

3.8.1 Implementation agency

Shanghai Qingcaosha Investment, Construction and Development Ltd. is the implementation agency for this Project. Preliminary institutional organization includes
five departments, responsible for project preparation, construction, supervision and management.

(1) Administrative affairs
Specific responsibilities include routine administration and liaison.

(2) Planning and finance
Responsibilities include development of project financial plan and associated implementation arrangements, coordination with the contractor in contract compliance, fund utilization arrangements and disbursement processing.

(3) Technical management
Responsibilities include management of technical documents and archives, organization of design review, addressing technical issues, organize technical communication, professional training for the staff and technical evaluation.

(4) Construction management
Duties include coordination of and guidance to construction and equipment installation, construction scheduling, monitoring of construction quality and safety, and project acceptance.

(5) Equipment and material management
Duties include procurement, keeping and allocation of project equipment and material.

3.8.2 Operational management agency and staffing plan

Since this Project is a component of Qingcaosha Water Source Raw Water Works Land Transmission System, it will be incorporated into the main project once completed, which will be operated by Qingcaosha Raw Water Treatment Plant affiliated with Shanghai Qingcaosha Investment, Construction and Development Ltd.

The proposed Nanhui North pumping station will have 18 staff. Considering long distance of transmission pipelines of this Project, additional nine persons are considered for pipeline inspection. Thus, twenty seven staff is included in the staffing plan.
3.9 Analysis of pollution sources

3.9.1 Analysis of pollution source during construction

Excavation for pipeline construction and pumping station construction will generate wastewater, noise, waste gas and dust suspension, which will have certain impacts on surrounding environment and residents. Pollutant discharge intensity during construction is identified by using analogical analysis method.

3.9.1.1 Construction process and pollution generation analysis

Construction processes that have environmental impacts are mostly excavation for pipeline construction, pipe jacking, and construction of pumping station.

(1) Excavation for pipeline construction

<table>
<thead>
<tr>
<th>Stage</th>
<th>Noise</th>
<th>Waste, Gas/Dust Suspension</th>
<th>Wastewater</th>
<th>Solid Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foundation Works</td>
<td>Noise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe Laying</td>
<td>Noise</td>
<td></td>
<td>Waste Gas</td>
<td></td>
</tr>
<tr>
<td>Soil Covering</td>
<td>Noise</td>
<td></td>
<td>Solid Waste</td>
<td>Waste Gas, Dust Suspension</td>
</tr>
<tr>
<td>Surface Restoration</td>
<td>Noise</td>
<td></td>
<td>Waste Gas, Dust Suspension</td>
<td>Solid Waste</td>
</tr>
</tbody>
</table>

(2) Pipe jacking process and pollution generation

<table>
<thead>
<tr>
<th>Stage</th>
<th>Noise</th>
<th>Solid Waste</th>
<th>Waste Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recoil Installation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jack Placing</td>
<td>Noise</td>
<td>Solid Waste</td>
<td>Waste Gas</td>
</tr>
<tr>
<td>Rail Laying</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casing Laying</td>
<td>Noise</td>
<td>Solid Waste</td>
<td>Waste Gas</td>
</tr>
<tr>
<td>Paying Out</td>
<td>Noise</td>
<td>Solid Waste</td>
<td>Waste Gas, Wastewater</td>
</tr>
</tbody>
</table>
3.9.1.2 Wastewater and sewage generation during construction

Usually excavation does not generate wastewater, but given relatively high groundwater level and deep excavation, construction will generate certain amount of groundwater seepage. Wastewater and sewage generation during construction include groundwater seepage during excavation, muddy water during pipe jacking and bucket washing, seepage during pipe jacking, oily wastewater generated by construction machinery and vehicles during maintenance and cleaning, pressure test wastewater and domestic sewage from construction workers.

(1) Construction wastewater

Based on quantities and construction method and analogical analysis, it is estimated that construction of this Project will generate approximately 2.36 million m³ wastewater. Construction wastewater is high concentration muddy wastewater, and the major pollutants are suspended solids and petroleum oil. Suspended solids and petroleum oil concentrations prior to treatment are 5,000mg/L and 40mg/L,

(2) Domestic sewage

There are about 400 workers on site during peak time. If per capita sewage discharge is 50L/person/day, sewage generation will be approximately 20m³ per day and total sewage discharge during construction will be 7,300m³. Major pollutants are COD₉, BOD₅ and NH₃-N, and concentrations of COD₉, BOD₅, NH₃-N and oil and grease are 350mg/L, 200mg/L, 30mg/L and 40mg/L, respectively.

(3) Pressure test wastewater

During construction, test, and maintenance and repair, large amount of
high-pressure water is required to flush away the silt in the pipe, therefore, discharge outlet is set at the pipe end in this Project. Wastewater from Hangtou WTP and Huinan WTP pipe-end outlets is discharged to Dazhi River, and wastewater from Chuansha WTP pipe-end is discharged to Chuanyang River.

Pressure test water is raw water from the proposed Qingcaosha Reservoir, without any additives. Since Qingcaosha Water Source has good water quality, silt in water will settle in the reservoir and subsequently water quality will be further improved and can meet Class II water quality standard. Based on monitoring information of Chenhang Reservoir and associated WTPs, after 5 to 6 days of retention in the reservoir, suspended solid concentration of raw water from Yangtze River can decrease to 70 to 80mg/L and will further decrease over time. Therefore, given operation performance of existing raw water works in Shanghai, it is estimated pressure test discharge will be approximately 400,000 m³, in which suspended solid content is 70 to 80mg/L.

3.9.1.3 Noise

Noise sources during construction are open excavation, pumping station construction, and pipe jacking. With reference to similar projects, levels of noise from construction machinery and vehicles and affected distances are shown in Table 3.8-1 and Table 3.8-2.

<table>
<thead>
<tr>
<th>Period</th>
<th>Distance (m)</th>
<th>Highest Level, Lmax, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthwork</td>
<td>20</td>
<td>74</td>
</tr>
<tr>
<td>Piling</td>
<td>20</td>
<td>74</td>
</tr>
<tr>
<td>Structure</td>
<td>20</td>
<td>79</td>
</tr>
<tr>
<td>Decoration</td>
<td>20</td>
<td>64</td>
</tr>
</tbody>
</table>

Table 3.8-2 Noise source and level during pipeline construction

<table>
<thead>
<tr>
<th>Machinery</th>
<th>Distance (m)</th>
<th>Highest Level, Lmax, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loader</td>
<td>5</td>
<td>90</td>
</tr>
<tr>
<td>Grader</td>
<td>5</td>
<td>90</td>
</tr>
</tbody>
</table>
3.9.1.4 Waste gas and dust suspension

Sources of dust are open excavation, loading and unloading, and transportation process, which will have adverse impacts on ambient air of the construction site. Dust suspension along transportation route is the major source of air pollution. Additionally, operation of construction machinery and vehicles will generate waste gas such as NO$_2$ and CO.

3.9.1.5 Solid waste

Solid wastes to be generated by this Project include waste soil from excavation and backfill, and construction of working shafts and pipe jacking, grits from temporary mud tank and construction debris. Considering construction characteristics of this Project, adequate attentions should be paid to earthwork balance, waste soil and construction debris from site clearance and pipe case excavation and construction for pumping station should be used as much as possible for site backfill, and excessive waste soil or debris should be hauled to designated site as required by solid waste administration.

It is estimated waste soil and construction debris is approximately 239,000 m$^3$, of which 236,000 from pipeline construction and the remaining 3,000 from pumping station construction.

There are about 400 workers on site during peak time. If per capita solid waste generation is 0.5kg/person/day, solid waste generation will be approximately 200kg per day and total solid waste generation during construction will be 73 tons.
3.9.2 Pollution source analysis during operation

Source of environmental impacts during operation is Nanhui North pumping station.

Operational staff of the pumping station will generate small amount of domestic sewage and solid waste. This pumping station has twenty seven staff. If sewage generation is 100L/person/day, the total wastewater generation will be 2.7m$^3$/day. If solid waste generation is 0.5kg/person/day, solid waste generation will be approximately 13.5kg per day. In addition, equipment cooling process will generate small amount of wastewater.

Based on engineering preliminary design report and similar pumping station in operation, bar screen will not be built in the pumping station. Therefore, no grit will be generated from bar screen.

Operation of similar pumping stations shows that noise of pumping station during operation is around 80dB(A) one meter outside the pump chamber.

3.10 Compatibility analysis of plans

3.10.1 Analysis of compatibility with Shanghai Urban Master Plan (1999-2020) and Outline of the 11th Five-Year Plan for National Economic and Social Development of Shanghai

Shanghai Urban Master Plan (1999-2020) indicates that trend of water source development for Shanghai core city and part of new urban areas is towards utilization of Yangtze River water. Expansion of Chenhang Reservoir is proposed near existing Chenhang Reservoir and subsequently raw water supply capacity of Chenhang Reservoir water source will reach 2.60 million m$^3$/day. Meanwhile, it is proposed Qingcaosha Reservoir west to Changxing Island located at Yangtze River estuary or other water sources be development so that real harmonized development of clean water and raw water for water supply of Shanghai can be achieved.

11th Five-Year is the critical period for development of Shanghai. Municipal water supply is critical to urban development as important resource guarantee. With
respect to water supply of Shanghai, Outline of the 11th Five-Year Plan for National Economic and Social Development of Shanghai requires “water supply service be improved; development and utilization of Yangtze River water resources be expanded by construction of Qingcaosha water source and water diversion Phase III of Chenhang Reservoir; WTPs including Jinhai WTP be constructed to increase daily municipal water supply capacity to 12.60 million m³/day; efforts be made to improve water quality of the core urban area and to promote centralized water supply in suburban areas.”

Nanhui Conveyer Project, one of the major components of Qingcaosha water source construction, will supply water for Pudong District and Nanhui District, water supply for which will account for half of incremental water supply for Shanghai in 2020. Implementation of this Project has strategic importance to development of Shanghai during 11th Five-Year. Therefore, this Project is in compliance and well compatible with Shanghai Urban Master Plan and 11th Five-Year Plan Outline.

3.10.2 Analysis of compatibility with Shanghai Water Supply Plan

Shanghai Water Supply Plan clearly indicates that it is a necessary trend to use Yangtze River instead of Huangpu River to meet the incremental raw water demands of Shanghai to obtain quality raw water. It is appropriate to implement strategic transfer of raw water supply in Shanghai. Efforts should be made to develop Yangtze River water source to increase percentage of raw water and transfer from relying on Huangpu River to half versus half contribution from Yangtze River and Huangpu River. Even it is possible that water supply of Shanghai is mostly from Yangtze River and Yangtze River estuary is protected as future strategic water source of Shanghai to safeguard Shanghai water supply. With the purpose to optimize water source structure of Shanghai, the relatively ideal plan is construction of the third water source at Yangtze River estuary to shift the existing west to east water diversion status to water supply from local sources in west or eastern areas. This proposed water source, upstream Huangpu River and Yangtze River Chenhang water source will achieve
utilization of local source for raw water supply and will supplement to each other to improve economy and reliability of water sources.

Shanghai is becoming a modernized international metropolis, which will have more stringent requirements for water supply quantities and quality, especially for quality. In accordance with Shanghai Water Supply Plan, half of the incremental raw water demands of Shanghai in 2020 will be contributed by Pudong District and Nanhui District. This Project, one of the major components of Qingcaosha Water Source Construction Project, will supply raw water from Qingcaosha Reservoir to Pudong New District and Nanhui District. Completion of this Project will provide raw water to the proposed municipal WTPs in Pudong New District and Nanhui District to meet needs for incremental water supply, improved water supply quality, increased living standard and sustainable urban development, and comply with Shanghai Water Supply Plan approved by Shanghai Municipal Government.

3.11 Related project works

3.11.1 Qingcaosha water source raw water project

Qingcaosha Water Source Raw Water Project consists of Qingcaosha Reservoir and water extraction and transmission lifting and gate facilities, Yangtze River crossing pipelines, land transmission pipelines and booster pumping station. Water transmission system of Qingcaosha Water Source Raw Water Project includes transmission pipelines at Changxing Island, raw water Yangtze River crossing pipelines, and land transmission pipelines and booster pumping station.

Overall layout plan for the transmission system of Qingcaosha Reservoir Raw Water Project is described as below:

Qingcaosha Reservoir uses two DN5,500 gravity tunnel boring machines (TMB) for water transmission to Changxing Island working shaft on river crossing pipelines, and then uses two DN5,500 river-crossing raw water pipelines for transmission to Wuhaogou pumping station in Pudong District.

Wuhaogou pumping station is inland water transmission hub pumping station,
used for transmission of raw water from Qingcaosha water source to three directions:

One is towards Lingqiao. Single pipe is used to convey water from Wuhaogou pumping station to Lingqiao WTP. The receiving WTPs are Lingqiao WTP and Zhabei WTP during saltwater intrusion. Water supply capacity is 600,000 m$^3$/day in non-saltwater intrusion period and 704,000 m$^3$/day during saltwater intrusion.

The second is towards Yanqiao. Double pipelines will be laid from Wuhaogou pumping station to Yanqiao pumping station of the existing Huangpu River raw water system, then some existing water supply facilities of Huangpu River raw water system are utilized for water supply to Yangshupu WTP, Jujiqiao WTP, Nanshi WTP, Linjiang WTP, Changqiao WTP and Xujing WTP. The water supply capacity is 4.40 million m$^3$/day. Booster pumping station is built at Longdong Road on Yanqiao branch pipeline. Additionally, in order to ensure water supply of Jinhai WTP, Wenhua Park pumping station and connection to Jinhai WTP are built to supply upstream Huangpu River raw water to Jinhai WTP.

The third is towards Jinhai, Chuansha and Nanhui direction. Dual pipes are aligned from Wuhaogou pumping station to the proposed Jinhai WTP, and then aligned along Nanhui conveyor for water supply to Chuansha and Nanhui direction. The receiving WTPs include Jinhai, Chuansha, Nanhui North, Hangtou, Huinan and Huinan New WTPs, and water supply capacity is 2.08 million m$^3$/day. To ensure water transmission and ease allocation of raw water to WTPs, Jinhai, Chuansha and Nanhui North pumping stations will be built on Jinhai and Nanhui branch pipelines.

Except for the proposed water transmission pipelines and pumping station, Qingcaosha Water Source Raw Water Project will utilize some existing water supply facilities of Huangpu River raw water system from Yanqiao branch to the receiving WTPs, for which improvement is required. The facilities to be renovated include Yanqiao pumping station, Linjiang pumping station, Changqiao WTP pump chamber, and gate of Caohang junction point.
3.11.2 Associated receiving WTPs

Receiving water works closely related to this Project include the existing Huinan WTP and Hangtou WTP, and proposed Nanhui North New WTP and Huinan New WTP. Water supply capacity of Huinan and Hangtou WTPs is 240,000 m³/day, water supply capacity of Chuansha WTP is 200,000 m³/d, and water supply capacities of the proposed Huinan New WTP and North Nanhui New WTP are 400,000 m³/day and 200,000 m³/day, respectively.

Pollutant generated during operation of these WTPs is dewatered sludge cake. Tilted-plate thickening and frame filter dewatering are adopted for sludge treatment. Production wastewater is discharged to storage tank and then enters to tilted-plate tank for thickening. Thickened sludge is conveyed to equalization for storage and then lifted to dewatering chamber. Solid content of the sludge cake is 75%. Investigation shows that sludge cake quantities of Huinan WTP and Hangtou WTP are 40 tons each day, and sludge cake quantity of Chuansha WTP is 35 tons each day.

The sludge from water plants generally has no toxic substances mainly containing inorganic substances generated from coagulation to remove SS by adding coagulant. Based on analysis of heavy metal content in sludge of Nanshi WTP conducted by Shanghai Water Plant and Shanghai Architectural Science Research Institute, heavy metal content in sludge was lower than limits in national Concentration Control Parameters of Pollutants in Sludge for Agricultural Use (GB4284-84). The dewatered sludge cake is stored at sheltered site for a short period before hauled by the solid waste administration for landscape purpose or backfill of low-lying land, which does not have significant environmental impact.

3.12 Project cost estimate and implementation schedule

Based on preliminary design report, the total investment of this project is about 24.9015 billion RMB. This project will commence in October 2008, and complete in March 2010. Meanwhile, this project will move into commissioning and operation stage in coordination with overall progress of the Qingcaosha raw water works.
4 Regional Environmental Condition

4.1 Environmental condition of Shanghai

4.1.1 Physical condition

Shanghai is located 120°51′～122°12′ east longitude and 30°40′～31°53′ north latitude, west to the Pacific Ocean and east part of Asia continent. Shanghai is at middle of south and north coast of China and confluence of the Yangtze River and Qiantang River estuaries, with Yangtze River in the north, Donghai Sea in the east, Hangzhou Bay in the south and Jiangsu Province and Zhejiang Province in the west. Given location advantage, Shanghai has very convenient transportation condition.

Shanghai is part of Yangtze River Delta alluvial plain, with average elevation of 4 meters above sea level slightly sloping from east to west from an overall perspective. Dianliu lowland of Dianshan Lake area in the west has the lowest elevation at only 2 to 3 meters. Areas east to Sijing, Tinglin and Jinwei areas along Huangpu River are plate marginal highland with elevation around 4 meters. Areas east to Qingpu River of Pudong District is strand plain at an elevation of 4 to 5 meters. Monadnocks including Tianma Mountain, Xue Mountain and Fenghuang Mountain are located in the west, and Tianma Mountain has the highest elevation of 98.2 meters in Shanghai land area. Rock islands including Dajin Mountain, Xiaojin Mountain and Wugui Mountain are located in the sea area, and Dajin Mountain is the highest, at an elevation of 103.4 meters. Total area of Shanghai is 6340.5km². In north Shanghai, there are three islands, Chongming Island, Changxing Island and Hengsha Island, located at Yangtze River estuary to the sea. Chongming Island is the third largest island in China, formed by silt alluvion and with an area of 1,041.21km² and at an elevation of 3.5 to 4.5 meters. Areas of Changxing Island and Hengsha Island are 74.10km² and 49.26km² respectively.

Shanghai has north subtropical monsoon climate, temperate and humid, relatively short spring and autumn and long winter and summer, with sufficient
sunshine and abundant precipitation. Average annual air temperature is 16.2°C in urban area and 15.4 to 16.0°C in suburban area. The extremely highest air temperature in a year ranges from 37 to 39°C, and extremely lowest air temperature generally is −7 to −10°C. Shanghai has abundant precipitation. Total annual precipitation is 1,190mm in urban area and 1098 to 1175mm in suburban area. Number of rainy days is around 130. Average annual relative humidity is 77% to 82%. Shanghai is located in a region dominated by East Asia monsoon, and wind speed decreases from riverside and coastal areas to urban areas and highest in spring, lower in winter and summer and lowest in autumn. Wind direction apparently varies with seasons. Southeast wind direction dominates through the year, particularly southeast wind direction dominates during March to August, northeast during September to October and northwest during November to next February.

Shanghai has dense river and lake systems and rich water resources. Water area is approximately 697km², or 11% of the whole city area. Most of the River systems in Shanghai belong to Huangpu River water system, including Huangpu River and its tributaries Suzhou Creek, Chuanyang River and Dianpu River. Huangpu River sources from Taihu Lake flowing through Shanghai urban area, 113km long in total, 300 m to 770m wide and 360m wide in average. The average flow of Huangpu River is 321 m³/s.

Shanghai is located on estuary delta plain adjacent to river and sea, where there is widespread alluvial soil resulting from river and sea alluviation. Zonal soil types adaptive to north subtropical zone are only found in a few manodmocks including She Mountain. Major soil types in Shanghai area include saline soil, sandy muddy earth(沙泥土), mud with sand (夹沙泥), yellow mud head(黄泥头), dry ditches(沟干泥), and livid mud. Natural vegetation of Shanghai is characterized with evergreen deciduous and broad-leaved mixed forest dominated by deciduous and broad-leaved forest communities. Long time agricultural development and urbanization have resulted to extinction of natural vegetation of Shanghai. Now features of Shanghai natural vegetation can be only reflected by small quantities of zonal vegetation.
sparsely located in hilly areas, which are mostly middle-subtropical vegetation in Dajinshan Island and north subtropical vegetation in She Mountain area.

4.1.2 Social condition

Economy of Shanghai is growing very fast, and Shanghai is progressively taking lead in economic development of Yangtze River Delta area. In 2005, GDP of Shanghai was RMB 914.395 billion, increased by 11% compared to the previous year, and GDP keeps increasing by more than 10% over the previous continuous fourteen years. Per capita GDP in 2005 was RMB50,000. The secondary and tertiary industries work together to contribute to economic growth of the entire city, and contribution by the tertiary industry is about 50.2% of the total GDP of the city. In 2005, per capita disposable incomes of urban and rural households were RMB18,640 and RMB8,340, respectively, which keep rapid growing and gap of income increase is narrowing. The increase of income is fast and the difference of income increment reduces gradually.

Shanghai Urban Master Plan (1999-2020) specifies: by 2020 Shanghai will be preliminarily built one of the international economic, finance, trade and shipping centers, and role of Shanghai as an international economic central city will be generally identified. Function of Shanghai in connecting international and local radiation effect should be made full use to further promote co-development of Yangtze River Delta and Yangtze River economic zone.

4.1.3 Environmental functional zoning

(1) Air environmental functional zoning

In Shanghai air environment functional zones include Category I zone, Category II zone and buffer zone. Category I zone includes Chongming Ecological Island, Hengsha Island tourism and scenic zone, Jinshan Island marine ecological natural reserve, She Mountain national tourism zone, Taiyang Island natural scenic reserve, and Dianshan Lake scenic and water body feature reserve. Category II zone refers to areas except Category I areas. Transitional area between Category I and Category II areas is buffer zone, 300 meters wide. Shanghai air environment functional zoning is
shown in Figure 4.1-1.

![Figure 4.1-1 Shanghai air environment functional zoning](image)

(2) Surface water environment functional zoning

In accordance with Shanghai Water Environment Functional Zoning issued by Shanghai EPB in 2004, this Project involves Category IV and Category V water bodies. Shanghai surface water environment functional zoning is shown in Figure 4.1-2.
4.2 Environmental condition of Pudong District

4.2.1 Physical condition

(1) Geographical location

Pudong District is located east of Shanghai, a piece of sector land located eastern edge of Yangtze River Delta, with Yangtze River estuary to the east, Nanhui District and Minhang District to the south, and Xuhui, Luwan, Huangpu, Hongkou, Yangpu,
and Baoshan districts to the west and north at the other side of the Huangpu River.

(2) Topographic features

Pudong District is located in Yangtze River Delta alluvial plain, formed by accumulation of silts in Yangtze River under wave, tide, current velocity and man-induced effects approximately 500 to 1,000 years ago. The landform becomes wider from Wusongkou estuary to southeast in a shape of approximate triangle. This area is a part of low-lying and flat alluvial plain sloping from southeast to northwest. The surface elevation is around 3.5 to 4.5 meters and 4 meters in average, and the elevation is 5 meters in a few locations.

(3) Geology and earthquake

Geology of Pudong area is characterized with late Quaternary Pleistocene and Holocene stratum, where foundation soil 70m below from the surface is divided into seven layers from bottom to top, which are all Quaternary deposits composed of soft saturated clay and sandy loam. The level of each layer is stable and depth of top and bottom varies a little. Supporting course intensity of the natural foundation (R value) is 90～100kPa. In accordance with national Design Criteria for Earthquake Resistance of Structures (GB 50011-2001), the proposed project area is 7 degree zone in terms of earthquake-proof intensity and the designed basic speed acceleration value in case of earthquake is 0.10g.

(4) Climate and meteorology

Pudong District has north subtropical monsoon humid climate, characterized by apparent four seasons of relatively long winter and summer and short spring and autumn. It is wet and cold in winter, and the average air temperature in January is 3.9℃ and average relative humidity is 80%. It is humid and hot in summer with average air temperature of 27.5℃ in July and average relative humidity of 86%. Annual average air temperature is 15.5℃. Frost-free period throughout the year is around 230 days, and average annual sunshine time is 1,994.6 hours.
Average annual precipitation is 1,162.0 mm, and number of rainy days is 136.3. Rainfall concentrates in periods of March, June to July, and late August to mid September. Average rainfall in March is 102.8 mm. Period beginning from June 16 and ending on July 11 July is Meiyu rainy period, during which rainfall is 324.6 mm. Average length of Meiyu rainy period is 26 days. In autumn, rainfall concentrates from late August to mid September, with average precipitation of 209.9 mm. Number of days with rainfall more than 50 mm is 3.6 days each year. The most daily precipitation was 196.6 mm, and the most hourly rainfall was 75.2 mm.

Based on historical statistical information of Shanghai Meteorological Bureau, east-oriented southeast wind direction is dominating in summer in Pudong District, and northeast to northwest wind is prevailing in winter. Tropical cyclone often invades Pudong area during July to September when high temperature and storm usually come together, and this period is also a time when typhoon frequently occurs. During this period the extremely strongest wind power is higher than Class 11 and annual average wind speed is 3.1 m/s. Average wind direction frequency, wind velocity and pollution meteorology in Shanghai area during 1995 to 2000 are shown in Figure 4.2-1 and Figure 4.2-1.

(5) Hydrology
There are crisscrossed rivers in Pudong District. Water area accounts for 10 to
12% of the total district area. There are 6,400 large and small rivers, 2,900km long in total. There are seventeen major rivers in Pudong District including Chuanyang River, Bailianjing River, Gaoqiaogang River and Pudong Canal. Huangpu River is 80 kilometers long, approximately 400 meters wide and 7 to 9 meters deep. Chuanyang River is 28.7 kilometers long, 44 to 55 meters wide and about 3 meters deep. Currently water level of rivers in Pudong District is controlled by water gate. Tide is utilized for water diversion from water gates along Yangtze River estuary and discharge from water gates along Huangpu River in order for introduction of clean water and discharge of polluted water.

(6) Groundwater

Groundwater of Pudong District is mostly stored in loose rock pore space involving multiple aquifers and large width. Shallow aquifer is dominated by brackish water and the depth is generally 1.0m to 1.3m. Deep aquifer contains mostly plain water and is relatively more valuable for development. In addition, there are other five artesian aquifers, of which the fourth and fifth aquifers are located in project areas but deep and non-uniform distribution make it difficult for extraction.

Within this area, groundwater in shallow soil strata is shallow aquifer mostly replenished by atmospheric precipitation. Groundwater level in shallow aquifer varies from 0.3m to 1.2m and the elevation is 3.2 to 3.1m.

4.2.2 Social environmental conditions

(1) Social economy

During 11th five year period, economy of Pudong continued developing in a healthy and sustainable manner. Every main economic index increased greatly. Regional GDP broke 200 billion RMB and reached 210 billion RMB in 2005 with annual growth rate of 15%. The total amount of commodities in Pudong broke 40 billion RMB. The accumulative fixed asset investment in five years was about 295 billion RMB. The total amount of export-import goods trade value reached 90 billion USD with about 30% annual growth rate, which was 2.5 times of the value of 2000. In
accumulation, the total amounts of utilized foreign funds in contract value and practically invested foreign funds exceeded 16 billion RMB and 10 billion RMB respectively. The total amount of financial revenue reached 49 billion RMB with 36% annual growth rate; local financial revenue exceeded 15.5 billion RMB with annual comparable growth rate of 22%. At present, the GDP of Pudong New District accounts for one quarter of the GDP of Shanghai; total amount of export-import goods trade value accounts for half of the amount of Shanghai. The amount of five year accumulated foreign investment in contract value is about 30% of the amount of Shanghai. The amount of practically invested foreign funds is about 40% of the amount of Shanghai. Pudong New District is playing a very important positive role of promoting Shanghai to become one of the international economic, finance, trade and shipping centers.

In 2005, the urban household per capita disposable income exceeded 19,000 RMB; the suburban household per capita disposable income exceeded 9,700 RMB. The growth rates increased 50% and 70% respectively. The average per capital floor space of urban residential building reached 23.2 m² increasing about 5.1m² compared with the end of ninth five year period.

(2) Urban development planning

The inner ring road and outer ring road in Shanghai across Pudong divided Pudong into three areas, i.e. area within inner ring road; area between inner ring road and outer ring road, and outside of outer ring road. In accordance with the master plan of Shanghai and the distribution situation of “Three Areas” of existing industries, Pudong further optimized the composition of productivity and promoted harmonious economic development in the area.

a. Higher level service industry group in area within inner ring road

Area within inner ring road is the core area with highest modernization level of
Pudong. Amongst, “One Road and Three Areas) (Shiji Road, Lujiazui Financial Area, Zhuyuan Trade Area, and Flower and Tree Ecological and Cultural Area) and River Shore Area between Nanpu Bridge and Yangpu Bridge are landmarks of Shanghai urban development in 21st century, which exhibit the thrive and prosperousness of Shanghai. Development of higher level service industries, such as finance and insurance, trade, exhibition and tourism, modern residence, intermediary service, and etc. are concentrated in this area. Domestic and internationally financial institutions, regional headquarter, marketing headquarter, and investment decision center of national and international large scale enterprises (groups) are centralized in this area, which is becoming the core area of modern service center of Shanghai.

b. High technology industry zone between inner and outer ring roads.

The area connects four development parks and several key economic towns of Pudong, which concentrates many high and new-technology industries the pillar industries. The development focuses on the new-technology industries of information technology, biological medicine, and new type material as the core, as well as manufactures of car, ship, refine chemical engineering, top steel, light mechanical and electrical integration and industries of modern city agriculture, trade, house, and tourism. The high and new-technology zone of Zhangjiang as the core and extended to Qinqiao, Waigaoqiao, and round towns which focusing on microelectronic industry will become the important base and landmark of technology renovation and industrial highland

c. River shore and coastal development zone outside of outer ring road

The zone of river shore and coastal line is an area with integrated induction composition which presents the future development potential of Pudong. In the rural area between outer ring road and suburban ring road, modern city agriculture and ecological agriculture will be developed. Around Pudong International Airport and
Waigaoqiao Port, relying on the advantages of “One Town (Linkong New Town) and Two Ports”, outward-oriented airport-vicinity and Port-vicinity will be developed in priority, on one hand. On the other hand, take the chance of development of international first class big scale entertainment facilities and exhibition facilities, expedite to develop high quality and comprehensive entertainment tourism, exhibition industrial and supplementary services.

(3) Infrastructure development

During 10th five year period, Pudong New District further sped up the development of some functional pivot infrastructures. Total 68 billion RMB was invested important projects including Pudong International Airport, Waigaoqiao Port Area, and Shanghai Information Port and municipal infrastructures including cross river transportation, railway transportation, and highways. An infrastructure network covering whole city, world oriented and radiating Yangtze River Triangle Area is preliminarily established. Urban ecological environment has been further improved that per capita public green land is about 24.5m². The rate of green covering in urban area exceeded 37%. Pudong New District was awarded National Civil Urban District, National Garden Urban District, National Sanitation Urban District, and National Advance District with Development on Non-obstruction. Jiuduansha wetland was promoted as a national nature reserve. Process of urbanization is becoming faster and faster with the continuous development of infrastructure and improvement ecological environment. The constructed or constructing urban area reached about 270km².

4.2.3 Environmental quality condition

(1) Surface water environment condition

Based on the statistic analysis of regular monitoring data on water quality by Pudong New District Water Quality Monitoring Department in recent years, the results of water quality assessment on main river course from 2003 to 2005 are shown
It can be seen from Table 4.2-1 that water quality of assessed river courses is relatively poor. The pollution is organic type pollution. Most assessment indexes are lower than the water quality standard of corresponding functional zone (Category IV). Main pollutants are NH$_3$-N and TP.
<table>
<thead>
<tr>
<th>Rives</th>
<th>Year</th>
<th>DO</th>
<th>COD$_{\text{Mn}}$</th>
<th>COD$_{\text{Cr}}$</th>
<th>BOD$_5$</th>
<th>NH$_3$-N</th>
<th>TP</th>
<th>Type Function</th>
<th>Incompliant Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bailianjing</td>
<td>2003</td>
<td>Less V</td>
<td>IV</td>
<td>IV</td>
<td>V</td>
<td>Less V</td>
<td>III</td>
<td>IV</td>
<td>DO、NH$_3$-N、BOD$_5$</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>Less V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>Less V</td>
<td>Less V</td>
<td>IV</td>
<td>NH$<em>3$-N、TP、COD$</em>{\text{Mn}}$、COD$_{\text{Cr}}$、DO、BOD$_5$</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>V</td>
<td>Less V</td>
<td>Less V</td>
<td>IV</td>
<td>BOD$_5$、NH$_3$-N、TP</td>
</tr>
<tr>
<td>Sanba River</td>
<td>2003</td>
<td>V</td>
<td>IV</td>
<td>V</td>
<td>V</td>
<td>Less V</td>
<td>Less V</td>
<td>IV</td>
<td>NH$_3$-N、TP</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>V</td>
<td>Less V</td>
<td>Less V</td>
<td>IV</td>
<td>NH$_3$-N、TP</td>
</tr>
<tr>
<td>Zhangjiabang</td>
<td>2003</td>
<td>IV</td>
<td>IV</td>
<td>III</td>
<td>IV</td>
<td>Less V</td>
<td>V</td>
<td>IV</td>
<td>NH$_3$-N、TP</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>V</td>
<td>Less V</td>
<td>Less V</td>
<td>IV</td>
<td>NH$_3$-N、TP、BOD$_5$</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>III</td>
<td>III</td>
<td>I</td>
<td>IV</td>
<td>Less V</td>
<td>IV</td>
<td>NH$_3$-N</td>
<td></td>
</tr>
<tr>
<td>Majiabang</td>
<td>2003</td>
<td>V</td>
<td>IV</td>
<td>IV</td>
<td>V</td>
<td>Less V</td>
<td>Less V</td>
<td>IV</td>
<td>NH$_3$-N、TP、DO、BOD$_5$</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>V</td>
<td>IV</td>
<td>IV</td>
<td>V</td>
<td>Less V</td>
<td>Less V</td>
<td>IV</td>
<td>NH$_3$-N、TP、DO、BOD$_5$</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>IV</td>
<td>III</td>
<td>I</td>
<td>IV</td>
<td>Less V</td>
<td>Less V</td>
<td>IV</td>
<td>NH$_3$-N、TP</td>
</tr>
<tr>
<td>Caojiagou</td>
<td>2003</td>
<td>V</td>
<td>IV</td>
<td>IV</td>
<td>V</td>
<td>Less V</td>
<td>Less V</td>
<td>IV</td>
<td>NH$_3$-N、TP、DO、BOD$_5$</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>Less V</td>
<td>IV</td>
<td>IV</td>
<td>V</td>
<td>Less V</td>
<td>Less V</td>
<td>IV</td>
<td>DO、NH$_3$-N、TP、BOD$_5$</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>IV</td>
<td>IV</td>
<td>III</td>
<td>V</td>
<td>Less V</td>
<td>V</td>
<td></td>
<td>NH$_3$-N、TP、BOD$_5$</td>
</tr>
</tbody>
</table>
As shown in the above table, with the implementation of water environment integrated rehabilitation of Pudong New District from 2003 to 2005, the trend of deterioration of water body has been stopped in some degree. All water quality indexes present a trend of improvement. The concentration of pollutants decreased greatly in 2005 comparing with that of 2004.

(2) Air environment condition

There are six air quality monitoring point in jurisdiction of Pudong New District. Additionally, there are 66 regional dustfall monitoring points and 3 dustfall monitoring points on road, 15 sulfatization rate and 15 fluoride monitoring points. Air quality of Pudong New District is good and reaches national Class II standard based on the analysis of air quality monitoring data. Annual average values of SO2, NO2, PM10 of 6 regular monitoring points are better than air quality Class II standard. The average of dusfall in Pudong of 8.5t/km².m is better than Shanghai Dingshan Lake rolling value standard of 0.0t/km².m, which is decreased comparing with the value of 2004.

(3) Acoustic environment condition

One environment noise monitoring point is set every 2km² in Pudong New District. There are 34 monitoring points in total and monitoring area is about 68km², including 3, 27 and 4 points in areas of Category 1, 2, and 3 respectively. The monitoring data of regional environmental noise of 2005 is shown in Table 4.2-2.

<table>
<thead>
<tr>
<th>Type</th>
<th>Regional environment</th>
<th>Road</th>
<th>Category 1 area</th>
<th>Category 2 area</th>
<th>Category 3 area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td></td>
<td>Daytime</td>
<td>Night</td>
<td>Daytime</td>
<td>Night</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>57.4</td>
<td>49.2</td>
<td>69.5</td>
<td>64.6</td>
</tr>
</tbody>
</table>

It can be seen from Table 5.3-1 that regional acoustic environment quality of Pudong New District can meet Class 2 standard. Traffic noise on road in daytime met Class 4 standard; however, traffic noise during night time was serious and cannot meet the standard.
Noise during daytime and night in Category 1 functional zones was not in compliance. Noise during daytime and night in Category 2 and 3 functional zones met the corresponding standards.

The route of transmission pipeline of this Project is from Huadong Road to Gaoke East Road and to A20 with many residential areas along the both sides of roads. Currently, residential buildings near roads have been suffering serious traffic noise where the acoustic environment quality exceeded the standard greatly and far beyond the regional environment noise Class 2 standard for urban areas.

4.3 Environmental condition of Nanhui District

4.3.1 Natural environment condition

(1) Geographic condition

Nanhui District is located 30°53′–31°09′ north latitude and 121°35′–121°51′ east longitude, southeast end of Yangtze River Delta, east to the Pacific Ocean and south to Hangzhou Bay, west to Shanghai urban area on the other side of Huangpu River, and north next to Pudong New District. Nanhui is a typical water area in China with flat topography and crisscrossed rivers.

(2) Topographic features

Nanhui District is located at the end of the front and west edge Yangtze River Delta. It was called “Nanhui Mouth” in ancient time. This piece of land was formed by deposition of massive alluvia from Yangtze River under the interaction of tide and Yangtze River estuary. Topography of Nanhui District is flat with elevation of 2 to 3 meters (Yellow Sea Elevation). West part is a bit higher, while coastal area is lower.

(3) Climate and meteorology

Nanhui District has subtropical monsoon humid climate, characterized by apparent four seasons of relatively long winter and summer and short spring and autumn. It is wet and cold in winter. The average annual air temperature is 15.7°C with highest air temperature of 37.8°C and lowest air temperature of -8.4°C. Average annual precipitation is 1,072.2mm.
Precipitation from May to September accounts for 60% of whole year. Average annual evaporation is 1,264.4mm, and average annual relative humidity is 82%; number of hours of sunshine during is 1,931.7h. Nanhui District is affected by southeast monsoom and southeast wind direction dominates through the year. Nanhui is affected Typhoon of 2.94 time every year on average.

(4) Hydrology

Nanhui is located in Huangpu River system. It is an area of tidal plain river network with crisscrossed rivers. Fresh water is abundant. Based on years of monitoring, annual total amount of surface water on average is about 1.859 billion m$^3$ (including nature runoff 0.21 billion m$^3$ and amount of tide about 1.649 billion m$^3$). However, it varies greatly in years and distributes unevenly in seasons.

Water system in Nanhui District is divided into three water systems, i.e. Tangxi water system, Tangdong North water system and Dangdong South water system. Rivers are dense in southeast and sparse in northwest of Nanhui. There are 2942 main rivers courses of city, district, town and village levels with total length of 2944.56 km. The area of river course is about 58.17km$^2$. The main river courses include Dazhi River, Pudong Canal, Bailonggang River and Suitang River.

(5) Hydrogeology

The hydrogeological unit of Nanhui is part of estuary - coastal plain sub-region of Yangtze River Dela Plain Hydrogeology Parent Zone. Based on ground water occurrence condition and its distribution, the ground water of Nanhui district can be divided into three basic types: pore-space water in loose rock, fissured water of bedrock, and fissured cavern water of carbonate rock (assumed to exist).

The top stratum covering Nanhui is Holocene Epoch Late Stage Littoral Facies phreatic aquifer. Depth of the aquifer top is about 3 to 4 meters. Because there is no imperviousness stratum above the aquifer, it is affected by many natural and human factors, such as ground rainfall, evaporation, tide water level, man-made irrigation and drainage, etc.

(6) Soil and vegetation
The topography of Nanhui is flat with a little land wave. Development of soil in different parts is of big variance. From the physical and chemical characters of soil, the soil is getting better towards west. There are 6 main types of soil in Nanhui, i.e. moist soil, Well drained paddy soil, half drained paddy soil, sandy soil, loamy sandy soil, and marine saline soil.

Natural vegetation of Nanhui is classified as Medium Sub-tropical Area evergreen broad-leaved forest. Nanhui is located at the edge of north sub-tropical area, the vegetation is characterized with evergreen deciduous and broad-leaved mixed forest. The terrestrial deposit of Nanhui is short. The history of vegetation in Nanhui is only about thousand years, where southeast coastal area is about only hundred years. Therefore, the type of vegetation is simple. Histories of vegetation and human activity basically occurred at the same period. Human activity has great impacts on the nature occurrence and development of vegetation. Currently, the natural vegetation in Nanhui is planted by human expect the survivals on the newly formed silting-up type tidal flat. Most are crops, such as food, cotton, cole, and etc.

4.3.2 Social environment condition

Nanhui is located at the intersection of Yangtze River estuary and Hangzhou Bay, east to Donghai Sea, south to Huangzhou Bay, north adjacent to Pudong New District, southwest connected with Fengxian and Minhang districts. The total area is about 688km² with coastal line 45km.

There are 14 towns, coastal tourism resorts, Kangqiao industrial park of municipal level, and Nanhui industrial parks under the jurisdiction of Nanhui District. There are 185 adminitrative villages, 60 residential communities, 813,000 million permanent residents, 269,000 households and 694,000 registered residents in Nanhui District.

GDP of Nanhui District in 2005 was about 27.49 billion RMB. Total social fixed asset investment was about 31.87 billion RMB. The completed financial revenue was about 63.33 billion RMB and industrial profit was about 2.6 billion RMB. The increase of the tertiary industry was about 9.74 billion RMB. Industries of real estate, tourism, trade, etc. are becoming the points of growth of tertiary industry. The total sales of industrial products
reached 24.68 billion RMB, and the total retail amount of commodities reached 12.47 billion RMB. The total agricultural output value was about 3.92 billion RMB. The average salary of urban employee was about 26,093 RMB and annual net income of farmer was about 7,773 RMB.

4.3.3 Environmental quality condition

(1) Surface water environment condition

According to Environment Quality Report of Shanghai (2006), the main pollutants of surface water in Nanhui District are NH$_3$-N, TP, BOD$_5$, and COD$_{Cr}$. Part of water quality monitoring data of Nanhui, 2006 is listed in Table 4.3-1.

<table>
<thead>
<tr>
<th>Rivers</th>
<th>Pollution factors</th>
<th>Xiantanggang</th>
<th>Liuzaogang</th>
<th>Lujiabang</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xiantanggang</td>
<td>DO</td>
<td>1.58</td>
<td>3.65</td>
<td>1.17</td>
</tr>
<tr>
<td></td>
<td>COD$_{Cr}$</td>
<td>39.53</td>
<td>27.95</td>
<td>60.38</td>
</tr>
<tr>
<td></td>
<td>BOD$_5$</td>
<td>13.54</td>
<td>8.59</td>
<td>19.17</td>
</tr>
<tr>
<td></td>
<td>NH$_3$-N</td>
<td>6.60</td>
<td>3.33</td>
<td>8.37</td>
</tr>
<tr>
<td></td>
<td>TP</td>
<td>0.634</td>
<td>0.469</td>
<td>0.727</td>
</tr>
<tr>
<td></td>
<td>Oils</td>
<td>0.06</td>
<td>0.05</td>
<td>0.07</td>
</tr>
</tbody>
</table>

(2) Air quality condition

According to Environment Quality Report of Shanghai (2006), the daily average value of the main air pollutants of Nanhui District as follows: SO$_2$ 0.052mg/m$^3$, NO$_2$ 0.050mg/m$^3$, inhalable particle matter PM$_{10}$ 0.075mg/m$^3$, the total suspended particle TSP0.146mg/m$^3$, which all meet the national air quality Class 2 standard. In 2006, the regional dustfall in Nanhui District in 2006 was 5.5t/(km$^2$·month), which was lower than the average 8.0t/(km$^2$·month) of the city. The all-year rate of fineness of environment air quality in Nanhui was 91.2%, which is better than Shanghai average of 88%.

(3) Acoustic environment condition

The route of transmission pipeline of this Project is along A2 Road with many residential areas along the both sides of roads. Currently, residential buildings near roads have been suffering serious traffic noise, where the acoustic environmental quality exceeded the
standard greatly and was far beyond the regional environment noise Class 2 standard for urban areas.

In general, the regional acoustic environment quality of Nanhui District met Class 2 standard in 2006. Traffic noise on road in daytime met Class 4 standard; however, traffic noise during night time was serious and cannot meet the standard. Noise during daytime and night in Category 1 functional zones was not in compliance. Noise during daytime and night in Category 2 and 3 functional zones met the corresponding standards.

4.4 Main environmental protection targets

The main concerned environmental protection targets (sensitive points) are residential areas, as listed in Table 4.4-1. The locations of sensitive points are shown in attached Figure 5. The proposed site for pumping station and area round pipeline route of this Project are not involved environmental sensitive areas, such as special protection areas, ecological sensitive area, natural habitat, and physical culture resources.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of sensitive targets</th>
<th>Location</th>
<th>Distance (m)</th>
<th>Type of regional noise standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1#</td>
<td>Wujiazhai</td>
<td>North to working shaft</td>
<td>30</td>
<td>2, 4</td>
</tr>
<tr>
<td>2#</td>
<td>West Dingjiazhai</td>
<td>Northeast to working shaft</td>
<td>60</td>
<td>2, 4</td>
</tr>
<tr>
<td>3#</td>
<td>Xijiazhai</td>
<td>West to working shaft</td>
<td>20</td>
<td>2, 4</td>
</tr>
<tr>
<td>4#</td>
<td>Zhangjiazhai</td>
<td>Northwest to working shaft</td>
<td>60</td>
<td>2, 4</td>
</tr>
<tr>
<td>5#</td>
<td>Jujiazhai</td>
<td>West to working shaft</td>
<td>60</td>
<td>2, 4</td>
</tr>
<tr>
<td>6#</td>
<td>Huangjia New Village</td>
<td>East to working shaft</td>
<td>70</td>
<td>2, 4</td>
</tr>
<tr>
<td>7#</td>
<td>Gongjiazhai</td>
<td>South to working shaft</td>
<td>40</td>
<td>2, 4</td>
</tr>
<tr>
<td>8#</td>
<td>Dingfei New Village</td>
<td>South to working shaft</td>
<td>20</td>
<td>2, 4</td>
</tr>
<tr>
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<td>DingfeiBeizhai</td>
<td>North to working shaft</td>
<td>30</td>
<td>2, 4</td>
</tr>
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<td>South Huangjiazhai</td>
<td>South to working shaft</td>
<td>30</td>
<td>2, 4</td>
</tr>
<tr>
<td>11#</td>
<td>Tangrenyuan</td>
<td>South to working shaft</td>
<td>20</td>
<td>2, 4</td>
</tr>
<tr>
<td>12#</td>
<td>Wangjiazhai</td>
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<td>40</td>
<td>2, 4</td>
</tr>
<tr>
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<td>Haojiazhai</td>
<td>South to working shaft</td>
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<td>2, 4</td>
</tr>
<tr>
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</tr>
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<td>Guanyizhai</td>
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<td>2, 4</td>
</tr>
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<td>East to working shaft</td>
<td>30</td>
<td>2</td>
</tr>
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<td>80</td>
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</tr>
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<td>South to working shaft</td>
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</tr>
<tr>
<td>#</td>
<td>Location</td>
<td>Direction to Shaft</td>
<td>Distance</td>
<td>Route</td>
</tr>
<tr>
<td>----</td>
<td>------------------------------------</td>
<td>-------------------</td>
<td>----------</td>
<td>-------</td>
</tr>
<tr>
<td>19#</td>
<td>Tangjiazhai West</td>
<td>West to shaft</td>
<td>30</td>
<td>2, 4</td>
</tr>
<tr>
<td>20#</td>
<td>Paijiazhai South</td>
<td>South to shaft</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>21#</td>
<td>Chujiazhai Northeast</td>
<td>Northeast to shaft</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td>22#</td>
<td>Chenjiazhai Southeast</td>
<td>Southeast to shaft</td>
<td>70</td>
<td>2</td>
</tr>
<tr>
<td>23#</td>
<td>Caijiazhi South</td>
<td>South to shaft</td>
<td>80</td>
<td>2, 4</td>
</tr>
<tr>
<td>24#</td>
<td>Dongnanyicun of Qigan Village</td>
<td>South to pump</td>
<td>60</td>
<td>2, 4</td>
</tr>
<tr>
<td>25#</td>
<td>Lingjiazhai of Qigan Village</td>
<td>North to pump</td>
<td>30</td>
<td>2</td>
</tr>
</tbody>
</table>
5 Integrated Environmental Impact Assessment

5.1 Analysis of environmental impact during construction

5.1.1 Analysis of acoustic environmental impact

(1) Pipeline construction

Noise sources during pipeline construction are open excavation, pipe jacking machinery and transportation vehicles. Construction noise is temporary and mobile, and varies with construction equipment. Noise levels at the major sources and construction equipment noise decreasing with distance are shown in Table 5.1-1.

<table>
<thead>
<tr>
<th>Source</th>
<th>Noise Level, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5m</td>
</tr>
<tr>
<td>Loader</td>
<td>90</td>
</tr>
<tr>
<td>Grader</td>
<td>90</td>
</tr>
<tr>
<td>Roller</td>
<td>81</td>
</tr>
<tr>
<td>Dozer</td>
<td>86</td>
</tr>
<tr>
<td>Excavator</td>
<td>84</td>
</tr>
<tr>
<td>Spreader</td>
<td>85</td>
</tr>
<tr>
<td>Air Compressor</td>
<td>90</td>
</tr>
<tr>
<td>Air Pick</td>
<td>95</td>
</tr>
<tr>
<td>Concrete Mixer</td>
<td>66</td>
</tr>
<tr>
<td>Pipe Hanger</td>
<td>89</td>
</tr>
</tbody>
</table>

As shown in Table 5.1-1, in order to meet limits to noise level dB(A) specified in Limits to Noise Level at Construction Site Boundary (GB12523-90), 100m away from construction equipment is acceptable during daytime for all the equipment, while 300m is required between construction equipment and the site boundary to meet standard limit.

(2) Pump station construction

With reference to similar projects, noise level of major construction equipment and affected distance by using point noise source decrease formula are shown in Table 5.1-2.
### Table 5.1-2 Noise level of pump station construction machinery

<table>
<thead>
<tr>
<th>Period</th>
<th>Noise Level, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20m</td>
</tr>
<tr>
<td>Earthwork</td>
<td>74</td>
</tr>
<tr>
<td>Piling</td>
<td>74</td>
</tr>
<tr>
<td>Structure</td>
<td>79</td>
</tr>
<tr>
<td>Decoration</td>
<td>64</td>
</tr>
</tbody>
</table>

As shown in Table 5.1-2, distance of 60 meters away from construction equipment is needed during daytime to meet noise level limit (dB (A)) specified in Limits to Noise Level at Construction Site Boundary (GB12523-90), and 300 meters between construction equipment and site boundary is needed to meet noise limit during night. The proposed Nanhui North pumping station is located at Qigan Village of Zhoupu Town in Nanhui District, acoustic sensitive points around which are residential areas east and north to the pumping station, a primary school opposite to the station in the west, residential buildings in the south of the station opposite to Zhouzhu Road. These points are close to the construction site, so construction activities during daytime and night will have certain impacts to acoustic environment of this area and life of the residents.

Impact associated with construction is short term and only exists in construction period. Noise during construction will be reduced to an acceptable level after mitigation measures are taken, for example, no construction activities during night.

(3) Analysis of impacts on acoustic sensitive points

Acoustical environmental sensitive points in project area are mostly residential areas along the pipelines and around pump station. Since these sensitive points are close to the construction site, noise during construction will have significant impacts to these points because the noise level exceeds local environmental noise standard. Currently, due to impacts of traffic noise to these sensitive points, local acoustical environmental quality cannot meet Urban Local Environmental Noise Standard for Class II area. Given impact of traffic noise, incremental noise level contributed by pipeline construction during daytime is insignificant. However, impact of construction noise is significant during night due to reduction of traffic, therefore, effective mitigation measures should be taken to decrease construction noise. Thus,
reasonable scheduling of various machinery is required during construction to avoid use of many noisy equipment at the same time, avoid sensitive period of surrounding environment to noise, and use of noisy equipment is arranged during daytime as much as possible. Additionally, transportation during night should be reduced and construction activities during night (22:00 to 6:00) should be prohibited. Approval of local EPB is required to inevitable construction activities during night and temporary sound barrier should be set between noise source and sensitive points.

Field investigation and analogical analysis indicate that the front row buildings of sensitive point is affected most by construction noise, while impact of construction noise to other buildings will be significantly reduced after blocking by the front row buildings and decrease with the distance. Based on Shanghai Acoustic Environment Function Zoning, Class 2 and Class 4 standards will be applied to the sensitive points. Extents of construction noise impact to environmental sensitive points are given in Table 5.1-3.

<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
<th>Nearest Distance (m)</th>
<th>Noise Forecast, dB(A)</th>
<th>Noise Limit, dB(A)</th>
<th>Gap during Daytime, dB(A)</th>
<th>Gap during Night, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1#</td>
<td>Wujiazhai</td>
<td>30</td>
<td>69.4</td>
<td>70 for Daytime, 55 during Night</td>
<td>—</td>
<td>14.4</td>
</tr>
<tr>
<td>2#</td>
<td>Xidingjiashai</td>
<td>60</td>
<td>63.4</td>
<td>—</td>
<td>—</td>
<td>8.4</td>
</tr>
<tr>
<td>3#</td>
<td>Xijiazhai</td>
<td>20</td>
<td>73.0</td>
<td>3.0</td>
<td>—</td>
<td>18.0</td>
</tr>
<tr>
<td>4#</td>
<td>Zhangjiashai</td>
<td>60</td>
<td>63.4</td>
<td>—</td>
<td>—</td>
<td>8.4</td>
</tr>
<tr>
<td>5#</td>
<td>Jujiashai</td>
<td>60</td>
<td>63.4</td>
<td>—</td>
<td>—</td>
<td>8.4</td>
</tr>
<tr>
<td>6#</td>
<td>Huangjia New Village</td>
<td>70</td>
<td>62.1</td>
<td>—</td>
<td>—</td>
<td>7.1</td>
</tr>
<tr>
<td>7#</td>
<td>Gongjiashai</td>
<td>40</td>
<td>66.9</td>
<td>—</td>
<td>—</td>
<td>11.9</td>
</tr>
<tr>
<td>8#</td>
<td>New Dingfei Village</td>
<td>20</td>
<td>73.0</td>
<td>70 for Daytime, 55 during Night</td>
<td>3.0</td>
<td>18.0</td>
</tr>
<tr>
<td>9#</td>
<td>Dingfeibaihui</td>
<td>30</td>
<td>69.4</td>
<td>—</td>
<td>—</td>
<td>14.4</td>
</tr>
<tr>
<td>10#</td>
<td>Nanhuangjiashai</td>
<td>30</td>
<td>69.4</td>
<td>—</td>
<td>—</td>
<td>14.4</td>
</tr>
<tr>
<td>11#</td>
<td>Tangnyuan</td>
<td>20</td>
<td>73.0</td>
<td>3.0</td>
<td>—</td>
<td>18.0</td>
</tr>
<tr>
<td>12#</td>
<td>Wangjiashai</td>
<td>40</td>
<td>66.9</td>
<td>—</td>
<td>—</td>
<td>11.9</td>
</tr>
<tr>
<td>13#</td>
<td>Haojiashai</td>
<td>20</td>
<td>73.0</td>
<td>3.0</td>
<td>—</td>
<td>18.0</td>
</tr>
<tr>
<td>14#</td>
<td>Pallouzhai</td>
<td>30</td>
<td>69.4</td>
<td>—</td>
<td>—</td>
<td>14.4</td>
</tr>
<tr>
<td>15#</td>
<td>Guangyinzhai</td>
<td>40</td>
<td>66.9</td>
<td>—</td>
<td>—</td>
<td>11.9</td>
</tr>
<tr>
<td>16#</td>
<td>Gejiashai</td>
<td>30</td>
<td>69.4</td>
<td>60 for Daytime, 50 for Night</td>
<td>9.4</td>
<td>19.4</td>
</tr>
<tr>
<td>17#</td>
<td>Lingjiashai</td>
<td>80</td>
<td>60.9</td>
<td>—</td>
<td>0.9</td>
<td>10.9</td>
</tr>
</tbody>
</table>
5.1.2 Analysis of water environmental impact

(1) Pipeline construction

Since most of construction activities will occur in built urban area, construction workers can utilize existing domestic facilities around the construction site and temporary domestic facilities are not necessary. Therefore, discharge generated during construction will be mostly production wastewater.

Pipe jacking is adopted through the pipeline route. Wet impelling method is used for pipe jacking, which will generate large amount of muddy wastewater with high SS concentration. Uncontrolled discharge of untreated wastewater to water body or nearby municipal sewers will pollute water body or block municipal sewers and consequently affect function of other parts of municipal sewers.

During pipe jacking, lubricating media is injected into the space between pipe and soil to decrease resistance. Major components of the lubricating media are bentonite and small quantities of additives (CMC), which are non-toxic and non-hazardous and will not result in pollution to water or soil.

(2) Pumping station construction

During construction, site cleaning, concrete mixing and installation will generate certain amount of wastewater. Additionally, large amount construction workers during construction
will generate domestic sewage.

- Discharge of construction wastewater is small in quantities and major pollutants are suspended solids and oil. Wastewater sedimentation tank will be built at the construction site to collect various production discharges. Wastewater will be reused for cleaning purpose after treatment. No wastewater will be discharged to surface water body.

- Major pollutants in domestic sewage are COD\(_{Cr}\), BOD\(_5\), NH\(_3\)-N and oil & grease, concentrations of which prior to treatment are 350mg/L, 200mg/L, 30mg/L and 40mg/L, respectively. Uncontrolled wastewater and sewage discharge will pollute water body around construction site to different extents.

(3) Pressure test and pipe cleaning

Based on operation performance of existing Shanghai raw water works, it is estimated that wastewater from pressure test and pipe cleaning will be approximately 400,000m\(^3\). Raw water of the proposed Qingcaosha Reservoir will be used for pressure test and pipe cleaning without use of any additives. After completion of Qingcaosha Reservoir, the hydraulic model indicates that retention time in the reservoir during normal operation will be around 16 to 20 days. After natural sedimentation of the silts, water quality will be further improved and can meet Category II standard. Monitoring information of Chenhang Reservoir and associated WTPs indicates that SS concentration of Yangtze River raw water can decrease to 70 to 80mg/L after 5 to 6 days of retention in the reservoir, and can further decrease over time. Given large quantities of pressure test and pipe cleaning water, generally the remaining soil on the pipe wall will not have significant impact to pipe cleaning water due to dilution, therefore, direct discharge of pressure test and pipe cleaning wastewater will not have significant impact to water environment of the receiving waters, Chuanyang River and Dazhi River.

5.1.3 Air environment impact

Investigation shows that dust suspension on construction site is mostly from transportation vehicles, which approximately contributes 60% of the total dust suspension. Dust suspension is also associated with road surface condition and driving speed. Generally,
affected scope of dust suspension caused by natural wind on construction site and along construction road is within 100 meters. The quantity of dust will increase and scope affected will expand to some extend in windy days. Improper covering of wasted soil, sand and lime on the storage site or spill during loading, unloading and transportation will also cause dust suspension, affected scope of which is within 100 meters.

Another case for dust suspension is open storage of excavated earth, characteristics of which is that dust suspension is affected by wind speed. Additionally, since dust suspension of road varies with driving speed of the vehicles, higher speed will definitely cause more dust suspension.

Analogical analysis indicates that four to five times of water spraying per day on the road will reduce dust suspension by 70%. Table 5.1-4 shows actual test results of dust reduction by water spraying on construction site.

### Table 5.1-4 Test result of dust reduction by watering

<table>
<thead>
<tr>
<th>Distance from Construction Source, m</th>
<th>5</th>
<th>20</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Hourly TSP, mg·m⁻³</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Watering</td>
<td>10.14</td>
<td>2.89</td>
<td>1.15</td>
<td>0.86</td>
</tr>
<tr>
<td>Watering</td>
<td>2.01</td>
<td>1.40</td>
<td>0.67</td>
<td>0.60</td>
</tr>
<tr>
<td>Ambient Air Quality Standard GB3095-1996, Class 2</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It can be seen from the table that water spraying (four to five times per day) can substantially reduce dust suspension (as TSP) and the affected scope decreases from 5 -100 m to 5 - 50m. Within 50 to 100 meters, TSP concentration in ambient air meets Class 2 of Ambient Air Quality Standard (GB3095-1996), which is applicable to residential area and combined commercial and residential area.

Transmission pipelines of this Project are aligned along existing urban roads. Based on identification of environmental protection targets and screening results, distance between the proposed construction site and residential area is 10 to 100 meters. Therefore, dust suspension during construction will have environmental impact. Although such impact is temporary and will come to end when construction period is over, effective measures should be taken during construction to mitigate adverse impact of dust suspension on surrounding sensitive points.
5.1.4 Environmental impact of solid wastes

Solid wastes generated during construction include soil and crushed stone from excavation, settled grits of muddy water generated during pipe jacking, spill of sand and stone and concrete during transportation. Excavation and pipe jacking will generate wasted soil of about 239,000m³, which may have environmental impacts during transportation and disposal.

Impacts of solid wastes during construction include:

(a) Overloaded vehicles may cause soil spill along transportation route. Dirty wheels may pollute transportation road. Dust suspension in clear days and muddy road in rainy days will affect access of people and vehicles and environmental quality.

(b) Lack of designated waste soil disposal site or uncontrolled dumping will affect land use and river flow and will damage natural and ecological environment.

(c) Waste soil transportation requires lots of vehicles, so transportation during daytime will affect local traffic and result in traffic congestion.

Shipping the waste soil from this Project by closed soil truck can effectively control the environmental impact from waste soil during transportation. Waste soil from pipeline construction is general solid waste that does not include toxic or hazardous component. Priority utilization of such solid wastes is backfill to the proposed site foundation. Other options include transportation to site designated by municipal administration and planning agency for foundation filling, low-lying area filling, or use for landscaping purpose. Therefore, generally disposal of waste soil will not have adverse environmental impacts.

5.1.5 Impacts on ecological environment

5.1.5.1 Analysis of soil erosion impact

(1) Pipeline construction

Open excavation, construction of pipe-jacking working shaft and receiving shaft will have adverse impacts to existing vegetation in construction area. Inevitable vegetation damage during construction will lead to exposure of surface soil in construction areas. Excavation and piling of waste soil will change original landform and topographical features
and cause soil erosion, and consequently will increase water and soil loss in project area in rainy days. Therefore, it is required contractor strictly implement various water and soil conservation measures including timely compaction of the exposed surface soil to avoid soil loss. Attention should be paid to reasonable storage of soil on construction site. Certain distance should be maintained between the storage site and municipal sewers and rivers. Construction material and waste soil that are temporarily stored on site should be properly covered during windy and rainy days.

Waste soil from excavation should be stored on proper sites and appropriate management measures for backfill should be developed. Water and soil loss impact during pipeline construction will be under control if water and soil conservation management measures tailored for this project are strictly followed.

(2) Pump Station Construction

Water and soil loss caused by pump station construction includes soil erosion in rainy days because of vegetation damage due to open excavation, and soil erosion due to vegetation damage caused by temporary land occupation. For example in raw material storage site, improper management of temporary storage of waste soil may cause water and soil loss in forms of sheet erosion and shallow ditch erosion.

In areas without obvious erosion, empirical formula is used to estimate potential water and soil loss during construction:

\[ Q = m \times A \times a \]

Where: 
- \( Q \) - soil loss, ton;
- \( m \) - erosion modulus, t/km²·a ;
- \( A \) – interfered surface area, km²;
- \( a \) – time period, year

Soil loss during pumping station construction is estimated as shown in Table 5.1-5.

<table>
<thead>
<tr>
<th>Area</th>
<th>Interfered Area, m²</th>
<th>Surface Erosion, t/km²·a</th>
<th>Modulus,</th>
<th>Period, Year</th>
<th>Soil Loss, Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Nanhui Pump Station</td>
<td>24200</td>
<td>3000</td>
<td>0.5</td>
<td>36.3</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.1-5 Estimate of soil loss at pumping station
Project construction may damage original vegetation, change hydraulic condition of existing surface water, weaken erosion-resisting capacity of surface soil, and increase surface runoff and flushing intensity. Soil erosion due to construction will cause certain damage if no timely and reasonable prevention and protection measures are taken.

5.1.5.2 Analysis of land occupation impact

(1) Impact of temporary land occupation

Pipeline construction will need temporary land acquisition. Stringent measures should be taken during construction on temporarily occupied land to protect surface soil and avoid irrecoverable impact. During excavation of pipe trench and working well, surface soil (within depth of 30 to 50 cm as recommended) should be separately collected and stored and soil erosion prevention measures should be taken. When construction is completed, underground soil will be backfilled first, and then the top will be covered with surface soil in uniform manner, after that the site will be leveled to mitigate impacts to land quality. The adverse impacts can be effectively controlled if appropriate plan is developed during construction and timely site clearance and planting are implemented after construction.

(2) Impact of permanent land acquisition

Pumping station construction requires permanent land acquisition. First, removing of crops and sod will decrease vegetation coverage, which may cause small quantities of soil loss. Second, excavation and backfill will change soil structure, decrease soil curing degree, affect soil productivity in secondary reclamation, but will not affect land use pattern. Since the land permanently acquired for pump station construction is mostly farmland, farmland allocated to farmers will be reduced. Local government has developed compensation plan, including adjustment of farmland allocation and economic compensation given to the affected farmers as stipulated by the national regulations. Land acquisition area and compensation methods are shown in Table 5.1-6.
5.1.6 Social impact

During pipe jacking, improper pipe impelling may cause local surface lift and consequently damage underground pipelines and some buildings, affect water supply, gas supply and mail service for nearby residents, which will cause inconvenience to daily life of the residents.

Resettlement will involve residential buildings in Qigan Village of Zhoupu town within scope of Nanhui North pumping station. Appropriate compensation will be provided to farmers affected by land acquisition in accordance with national and local relevant policies and standards. Since this Project is located in highly commercialized Shanghai area, where there are various options for livelihood and there are mature laws and regulations as guarantee, therefore, this project will not have significant impacts to people affected by land acquisition after reasonable compensation is provided.

5.1.7 Analysis of other environmental impacts during construction

5.1.7.1 Health and safety impacts

Large quantities of works require lots of construction workers from different places, and these workers have a nature of mobility. Scattered construction sites, poor living and health condition, and high work load will possibly cause occurrence of epidemics. In order to ensure construction safety, health check should be done for the construction workers prior to construction commencement and patients with epidemics are prohibited to enter the construction site. Periodic health check should be done for canteen workers, and workers found with epidemics shall be sent to health center to prevent epidemics. Centralized water supply facilities should be built on construction site and health facilities and doctors and
nurses should be in place in order to ensure health and safety of construction workers for successful implementation of the project.

In addition, dust pollution during construction will have impacts on health. Inhalation of suspended particulates by construction workers and surrounding residents will cause various respiratory diseases and pathogenic bacteria carried by particulates will spread various diseases and consequently affect health of construction workers and nearby residents.

5.1.7.2 Analysis of impacts on urban landscape

Land acquisition and demolition and excavation will damage roads and green belts along the roads, and consequently affect urban landscaping. Spill during waste soil transportation will pollute road surface, cause dust suspension and have adverse visual impacts on surrounding environment. Temporary storage of excavated soil on site will result in muddy road in rainy days in case of improper protection and will affect urban visual. Pollution of dust during construction to various buildings and trees will also have visual impacts. Therefore, cleaning of the construction site seems particularly important. Adverse visual impacts associated with construction are temporary and are recoverable.

5.1.7.3 Traffic impact during construction

Compared to open excavation, pipe jacking for road crossing in this project can significantly reduce impacts of construction activities to traffic on the road. In this project, generally traffic impacts will be very little. However, working shafts of pipe jacking may also require temporary road occupation, which will cause traffic impacts along pipelines. Pipe size in this project ranges from DN2000 to DN1000. Large pipe size requires more transportation vehicles due to load limit of each vehicle, thus, transportation of raw material (sand, stone, and concrete) and waste soil during construction will result in traffic increase during a short time period, which will pose traffic pressure to surrounding roads, generate impacts to overall regional traffic and cause inconvenience to the public. Therefore, transportation should be scheduled to avoid rush hours, especially before and after office hours. Signs should be placed on construction site and dedicated persons should be arranged for traffic guidance. Additionally, management during construction should be further strengthened to prevent
traffic congestion, such as shortened construction period.

Transmission line of this Project will cross many existing large and major obstacles, mainly including magnetic suspension rail, A2 and A20 overpass, A2 Airport Road overpass, A2 Hunan Road overpass, flying bridges, and navigable rivers. Pipe jacking is used for this Project to cross these obstacles. Any inappropriate construction method may penetrate bed of navigable river, cause settlement of pile foundation of bridges and overpasses, cause settlement of pile platform of magnetic suspension rail, which may have impact on safe operation. The design institute has prepared a complete construction plan to reduce the impacts on large and major obstacles from pipe jacking to minimum. Due to the requirements of high speed operation of magnetic suspension rail, the rail beam has a very strict control on pile platform. Therefore, measures should be taken to enforce construction management and improve construction safety. Monitoring points may be set during construction to closely watch the pile foundation and the settlement. Consolidation with grouting shall be taken in time to ensure safety of magnetic suspension rail.

5.1.7.4 Construction impact to physical cultural resources

Since construction sites of pipeline construction are located along urban highway and main roads that are highly developed areas, there is a very low possibility for existence of cultural relics. Additionally, no cultural or historical relics were found during preliminary reconnaissance and physical detection along the proposed pipeline route. Affected scope of pipe jacking construction method is relatively small and applicable laws and regulations including the Law of Cultural and Historical Relics Protection of PRC will be strictly enforced, therefore, construction activities will not cause adverse impacts to cultural or historical relics.

5.2 Analysis of environmental impact during operation
5.2.1 Analysis of acoustic environmental impact

After operation of this project, booster pumping station will be the major noise source. With reference to other similar pump stations, noise level generated by booster pump station will be around 80dB, one meter from the pump chamber. If booster pump is regarded as point noise source, noise level at pumping station boundary is forecasted based point sound source decaying pattern and sound level nestification pattern, as shown in Table 5.2-1.

<table>
<thead>
<tr>
<th>Location</th>
<th>Distance from the PS, m</th>
<th>East</th>
<th>South</th>
<th>West</th>
<th>North</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nanhui North Pumping Station</td>
<td></td>
<td>44.5</td>
<td>121.5</td>
<td>55.2</td>
<td>38.7</td>
</tr>
<tr>
<td>Noise Contribution, dBA</td>
<td></td>
<td>47</td>
<td>38.3</td>
<td>45.2</td>
<td>48.2</td>
</tr>
<tr>
<td>Applicable Standards, dBA</td>
<td></td>
<td>60/50</td>
<td>60/50</td>
<td>60/50</td>
<td>60/50</td>
</tr>
<tr>
<td>Compliance</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Forecast results indicate noise level at Nanhui North pumping station to all the directions can meet Category II of Standard for Noise Control at Industrial Plant Boundary (GB12348-90), which means insignificant noise impacts to surrounding acoustic environment.

5.2.2 Analysis of impact to water environment

This project will generate certain quantities of domestic sewage, most of which is generated by staff of the pumping station. Given small amount of staff, quantities of domestic sewage is small. Major pollutants of domestic sewage are CODCr, BOD5, NH3-N and oil & grease. Pollutant concentrations of domestic sewage are quite high prior to treatment, so improperly treated or direct discharge to water body will pollute surrounding water environment although the discharge is in small quantities.

5.2.3 Analysis of solid waste impact

Solid wastes generated during operation are mostly domestic solid wastes from working staff and grits from the screens. Although generation of domestic solid waste is not much given small amount of staff, littering or uncontrolled dumping will contaminate water body
and soil and affect health. Centralized collection of domestic solid wastes and timely transportation will eliminate potential environmental pollution caused by solid wastes. Domestic solid wastes will be separately collected and stored and will be transported by Environmental Sanitation Administration of Nanhui District, thus, there will be no environmental impacts.

Based on engineering preliminary design report and other pumping stations in operation, bar screen will not be built in the pumping station. Therefore, no grit will be generated from bar screen.

### 5.2.4 Analysis of socioeconomic impacts

Water resources are irreplaceable basic natural resources, and are also public resources and economic resources. Safe and reasonable municipal water supply system plays a decisive role in harmonious urban economic, social and environmental development and improvement of life quality of residents. Meanwhile, it is fundamental guarantee for sustainable urban development and increase of integrated urban capacity.

In recent years, rapid urban and economic development in Pudong New District and Nanhui District has resulted in increasing industrial and domestic water consumption and increasing demand for water resources, therefore, need for increased raw water supply is very urgent. Once completed, this project will improve transmission and distribution networks in Pudong New District and Nanhui District, increase flexibility and reliability of local municipal water supply services for effective utilization of water resources, provide strong support for sustainable economic and social development of Pudong New District and Nanhui District. Thus, this Project has positive economic and social benefits.

### 5.2.5 Environmental Impact of Related Works

Among the works related to this Project, the existing Huinan WTP and Hangtou WTP, and proposed Nanhui North WTP and Huinan New WTP are closely related to this Project. Pollutant generated during WTP operation is sludge cake.

Investigation shows that quantities of sludge cake generated in Changxing Hengsha No.2 Island Phase I WTP (daily water supply capacity is 40,000 m$^3$ and water source is the
Yangtze River) is 9.6 tons each day with solid content of 35%. Additionally, based on overyear operational statistics of Chenhang Reservoir, SS content in water of Chenhang Reservoir is less than that of Yangtze River by 60 to 80%. Based on analogical analysis, if it is assumed SS content in Qingcaosha Reservoir is 40% of that of Yangtze River, total sludge cake quantities (solid content of 35%) generated by WTPs associated with this Project will be approximately 125 tons each day.

Components of sludge cake are mostly suspended solids and coagulants, with relatively small percentage of organic component and high solid content. Based on analysis of heavy metal content in sludge of Nanshi WTP conducted by Shanghai Water Plant and Shanghai Architectural Science Research Institute, heavy metal content in sludge was lower than limits in national Concentration Control Parameters of Pollutants in Sludge for Agricultural Use (GB4284-84). The dewatered sludge has various and valuable uses, including backfill of low-lying land, covering of landfill and for direct landscaping purpose, which will not cause secondary environmental pollution. Currently, as stipulated by Shanghai Government, dewatered sludge generated by WTPs associated with this Project will be under supervision of Solid Waste Administration and relevant agencies will be consulted based on purposes of sludge utilization to effectively reuse dewatered sludge and avoid adverse impacts to the environment.
6 Mitigation Measures

6.1 Mitigation measures during construction

6.1.1 Mitigation measures for air environment impact

Dust suspension and waste gas are major impacts to surrounding environment and environmental sensitive points during construction, which will cause some local adverse impacts to nearby areas and life of residents. In order to reduce impacts to environmental sensitive points and regional ambient air quality during construction, the following measures should be taken to meet Shanghai Management Methods for Dust Suspension Pollution Control and Requirements for Dust Control during Pipeline Construction and Elevated Road Cleaning in Shanghai.

(1) As stipulated in items 8, 9, 10 and 11 of Shanghai Management Methods for Dust Suspension Pollution Control, the contractor shall develop dust suspension control plan, establish responsibility allocation system and records, assign dedicated persons for management of construction site dust suspension control. Dust suspension pollution control plan should be submitted to Pudong District Municipal Administration for record three days before construction commencement and this plan should be posted on a place that can be easily seen before construction commencement until end of the construction.

(2) In conjunction with noise prevention measures, simple sound barriers should be installed around construction site to separate construction site and surrounding environment so as to reduce adverse impacts of waste gas to surrounding environment. Usually height of the barrier is 2.5 to 3 meters.

(3) Management of construction site should be strengthened by the contractor. Construction material (mostly yellow sand and crushed stone) should be stored on designated location and appropriate dust prevention measures should be taken. Excavated soil should be stored together to minimize affected scope, and should be backfilled or transported in a timely manner to shorten period affected. Soil generated during construction should be hauled
for disposal in a timely manner. In case soil storage on site is longer than 48 hours or stored for later backfill purpose, temporary storage site should be built within construction site, for which barrier should be set and other dust control measures, such as water spraying and covering, should be taken to reduce water loss and soil erosion.

(4) Full time workers should be assigned at construction site for site cleaning. One person should be arranged for each shift to spray water to clean the construction site and surface of transportation road. Times of water spraying should be determined based on weather condition. Usually one time should be done for rush hours of 7:30am - 9:00am and 16:30 - 19:00, and noon time 12:00-13:00, and once every two hours should be done in clear summer days and when wind speed is higher than Class 5. Measures such as water spraying should be taken during earth excavation, loading and dumping to prevent dust suspension. The contractor should spray water to surface of backfilled working shaft and implement planting shortly after construction to prevent dust pollution.

(5) Construction management should be strengthened. Transportation route should be appropriately arranged to avoid residential area, and speed of transportation vehicles should be controlled, especially in residential area. Solid waste, wasted soil, and sand and stone transportation vehicles should obtain Shanghai Wasted Soil and Sand/Stone Transportation Permit, and should be closed to prevent spill and leakage along the transportation route. Good transportation management and loading/unloading practices should be adopted.

(6) Vehicle cleaning facilities and associated wastewater and muddy water sedimentation facilities should be built on construction site. Transportation vehicles should be cleaned before leave construction site. After unloading, carriage of transportation vehicle should be washed. Tyres of transportation and other kinds of vehicles should be washed before leave the construction site. Loading quality of transportation vehicles should be checked.

(7) Maintenance of construction machines and transportation vehicles should be improved. Construction machinery and vehicles that are not in compliance with national
waste gas emission standard are prohibited to enter the construction site and overloaded operation of construction machines that use diesel fuel is forbidden to reduce fume intensity and particulate emission. Assistance with concerned agencies should be provided for traffic management of surrounding roads during construction to avoid traffic congestion caused by construction activities and reduce resulting idling waste gas emission.

(8) Dust and pollutants from fuel oil combustion are harmful to health, therefore, labor protection measures should be taken for affected construction workers, for example wearing dust prevention mask and helmet.

(9) Environmental education for construction workers should be strengthened to increase environmental awareness of all construction staff to reduce air pollution during construction by good construction performance.

6.1.2 Mitigation measures for water environment impact

Raw water transmission pipelines are generally aligned along roads. There are complete municipal service facilities in project areas and there are municipal sewers along the transmission route. Wastewater generated in this Project will be treated to meet Class 2 standard before discharged to nearby municipal sewers or rivers.

6.1.2.1 Production wastewater from pipe jacking

(1) Treatment process

Wastewater generated during pipe jacking is muddy water, and major pollutant is suspended solid. Such wastewater cannot be directly discharged to river or municipal sewers before treated. Additionally, pipe-jacking will also generate small quantities of oily construction wastewater. This project will adopt traditional coagulation sedimentation treatment process, which has relatively low capital cost and low operational cost. Preliminary sedimentation tanks are built near pipe-jacking sites to remove large-size particulates that can readily settle. Preliminary sedimentation tank will decrease high SS concentration to around 1,000mg/L. Preliminarily treated wastewater will be collected and treated in centralized
wastewater treatment station set in appropriate location by addition of coagulant to remove fine particulates. In case oily wastewater is included, oil separation process will be adopted first, and then treated oily wastewater is mixed with preliminarily treated muddy wastewater for further coagulation sedimentation treatment. Final effluent shall meet Class 2 discharge standard and be discharged to nearby river or municipal sewers. Construction discharge will have insignificant impact to water environment after the above measures are taken. Process chart for wastewater treatment is shown in Figure 6.1-1.

**Figure 6.1-1 Process chart for production wastewater treatment**

(2) Analysis of treatment performance

Muddy wastewater generated during pipe jacking is piped into preliminary sedimentation tank and grit removal tank to remove large-sized particulates and particulates that can readily settle. Although SS can be removed by about 80%, SS concentration of wastewater entering reaction tank is still as high as around 1,000 mg/L. PAC coagulation sedimentation process will be adopted to ensure SS removing rate of more than 90% in order to meet Shanghai Integrated Wastewater Discharge Standard (DB31/199-1997) Class 2, i.e., SS concentration not higher than 100 mg/L.

(3) Location plan of treatment systems

Based on locations of construction sites and wastewater discharges, 86 wastewater
collection and treatment systems will be built near pipe-jacking construction sites. Treated wastewater will be conveyed to nearby rivers or municipal sewers.

6.1.2.2 Wastewater from pump station construction

Major pollutants of wastewater generated during pump station construction are suspended solids and petroleum oil. Such wastewater cannot be discharged to river course or municipal sewers before treated. Process for pump station construction wastewater treatment is the same as that for pipe-jacking wastewater treatment. One on-site wastewater treatment facility is built for each pump station construction site. Wastewater is collected through pipes or ditches and discharged to nearby rivers or municipal sewers after treated.

6.1.2.3 Domestic sewage from construction workers

Usually construction workers rent local residential buildings to live and their domestic sewage is collected by existing facilities and discharged to municipal sewers. Workers for pipeline construction should use existing domestic facilities near the construction site as much as possible. In places without sanitary facilities, mobile toilets or closed toilets are used to collect domestic sewage and transported periodically by environmental sanitation department. Mobile toilets or closed toilets about 30 for this Project will be provided by contractors. Oil separation tank is necessary for treatment of oily wastewater from construction worker canteen, and the treated wastewater will be discharged to municipal sewers.

6.1.2.4 Management measures

(1) Muddy water or other kinds of wastewater cannot be discharged without sedimentation treatment. Management requirements should be specified for control of large amount of muddy water generated during construction, and direct discharge to water body is prohibited. Washing water and storm water runoff should be collected in open ditches and
discharged after treated.

(2) Groundwater seepage caused by excavation should be collected and discharged in a timely manner to avoid impacts to construction activities and surrounding environment.

(3) In order to avoid loss of temporarily stored construction material due to storm water flushing, 50cm high retaining wall shall be built with bricks around the storage site as temporary protection measures.

(4) Attentions should be paid to site cleaning, timely maintenance and repair of construction machines to avoid leakage of engine oil. In case of leakage, measures should be taken in a timely manner for collection in separate container and proper treatment.

(5) Construction material, such as oil and chemicals, are not allowed to be stored adjacent to river. Storage of such material should be far away from rivers and canvas should be available for temporary covering to avoid entering into water body caused by heavy rain.

(6) More stringent management of wastewater treatment system is required to periodically monitor wastewater quality at the outlet. Sediments and oil from separation tank should be transported for disposal and cannot be dumped.

(7) Education of construction staff should be strengthened to ensure implementation of operation procedures so as to avoid or reduce pollution accidents.

6.1.3 Mitigation measures for acoustic environmental impact

In accordance with the Law of Environmental Noise Pollution Prevention of PRC, this Project shall meet Limits to Noise Level at Construction Site Boundary. Information including project name, construction location and period, potential environmental noise level and prevention and mitigation measures to be taken should be reported to Pudong District and Nanhui District EPBs five days before construction commencement.

Construction noise is the major impact to surrounding environment during construction, therefore, attention should be paid during construction. Since this Project has many acoustically sensitive points that are adjacent to construction site, the following measures
shall be taken to minimize potential impacts:

(1) During construction, noisy machines like excavator, air pick and churn drill should be located far away from residential areas and should be well maintained periodically and properly operated. In sensitive residential areas such as No. 3 Xijiazhai, No.8 Dingfei New Village, No.11 Tangrenyuan, No. 13 Haojiazhai, No. 16 Gejiazhai, No. 17 Lingjiazhai, No.20 Panjiazhai, No. 21 Chujiashai, No. 22 Chenjiazhai, No.25 Qigancun Lingjiazai, enclosures must be used for closed construction. When construction is carried out at No. 16 Gejiazhai, No. 20 Panjiazhai and No. 25 Qigancun Lingjiazai, temporary sound insulated screen barriers should be used around noisy machines like excavator, air pick and churn drill. Construction activities during night should be prohibited at above noise sensitive points to mitigate impacts of construction to residential areas.

(2) Construction time should be reasonably scheduled and scientific construction plan should be developed. Use of lots of noisy machines near sensitive points like residential area at the same time should be avoided, and use of equipment that has high noise level, strong impact and vibration should be arranged in daytime. Around all 25 noise sensitive points, construction activities that generate noise pollution should be strictly prohibited during night. Construction activities during 22:00pm-6:00am should be applied to local EPB and get prior approval, meanwhile public notice should be made to nearby residents to strengthen consultation and communication with these residents and mitigate noise impact to residents.

(3) Contractor should strictly follow requirements specified in Limits to Noise Level at Construction Site Boundary (GB12523-90) and Regulations on Construction Machinery Management of Shanghai to ensure proper maintenance of construction equipment, timely repair in case of failure, proper lubrication and fastening of parts in order to reduce operational vibration and noise. Construction machinery should be improved. Whole equipment should be firmly placed and well fit to the ground, and damping stand should be used where available. Construction management should be strengthened and proper construction procedures should be followed to avoid other noises caused by improper
maintenance of construction machines during operation.

(4) Construction vehicle noise is one of the major environmental impacts introduced by this Project. Transportation route and schedule should be reasonably arranged for construction vehicles. Vehicles in compliance with Allowable Noise Standard for Vehicles (GB1495-79) should be selected and machinery and vehicles that are not in compliance with national noise control standards should not be allowed to enter construction site. Construction vehicles should be strictly controlled including prohibition of horn, driving within speed limit and following of good practice to reduce traffic during night (22:00 to 6:00) so as to reduce local traffic noise.

(5) Construction plan should be optimized to develop reasonable implementation schedule to minimize impacts of construction noise. During tendering process, measures for environmental noise pollution reduction should be included in design documents and should be specified in the contract.

(6) Use of commercial concrete is recommended and concrete mixer is not installed on construction site.

(7) Personal protection should be strengthened. Noise protection equipment like earplug, earpiece and helmet can be provided to construction workers working by noisy equipment.

(8) In accordance with Notice of Environmental Noise Pollution Supervision and Management during University Entrance Exam issued by SEPA on 26 April 1998, construction noise sources should be under stringent control during exam period and half month before the entrance exam in accordance with relevant national environmental noise standards to prohibit construction activities that violate noise standards and have impacts to residents.

(9) Construction supervisor should enhance daily supervision and monitoring on construction site. Contractor should equip with acoustic meters (about 4 sets) to monitor the acoustic environmental quality in residential sensitive points. If the construction noise still
have great impact on environmental sensitive points like residential areas, investigations should be carried out and relevant measures should be taken accordingly. Temporary sound insulated screen barriers should be installed when necessary to ensure construction noise to meet standards.

After the above measures are taken, construction noise will meet Limits to Noise Level at Construction Site Boundary (GB12523-90) and Urban Regional Environmental Noise Standard.

6.1.4 Mitigation measures for solid waste impact

Shanghai Management Regulations on Construction Solid Wastes and Waste Soil Disposal (Amended) stipulates “implementation agency or contractor that generates construction solid wastes and/or debris should, five days before construction commencement, submit information of generation of construction solid waste and debris and disposal plan to municipal solid waste administration or district/county environmental sanitation agency. This plan should include actual categories of construction solid wastes, quantities, transportation routes and disposal location. Implementation agency or contractor should sign performance agreement with solid waste administration”. Considering construction characteristics of this Project, the following control measures are recommended:

(1) Once the contractor is determined, the contractor will sign agreement with the solid waste administration. Information of solid waste generation and disposal plan should be submitted to Pudong District and Nanhui District solid waste administrations, five days before construction starts. This information should include categories of construction solid wastes, quantities, transportation routes and disposal location. The contractor should sign performance agreement with solid waste administration.

(2) Wasted soil should be reused as much as possible and properly treated to be reduced in quantity and/or volume and non-hazardous. If there are other construction sites in the city, municipal construction agency and environmental sanitation agency should be consulted for
priority reuse of the wasted soil for foundation backfill on other municipal infrastructure sites. When on-site disposal is inadequate for all the wasted soil, the excessive wasted soil should be hauled outside the urban area for proper storage.

(3) The implementation agency and contractor should obtain disposal permit issued by solid waste administration and then trust solid waste transportation to professional service provider.

(4) Solid wastes on construction site should be collected in a timely manner by the contractor or transportation service provider. It is not allowed to occupy the road for storage of wasted soil and construction debris. Timely collection and transportation of sludge generated by construction wastewater treatment system is also required. Construction site cleaning and solid waste treatment and disposal should be well done and it is required no solid wastes be left on construction site before end of construction.

(5) When construction site is close to river course, dumping of various solid wastes to river should be prohibited, and meanwhile uncontrolled entering of various solid wastes into the river should be avoided. For solid wastes entered into the river, especially floating material that cannot settle in short period, the contractor should do their best to collect.

(6) With respect to domestic solid waste management, garbage bins should be placed in different units of the construction site, and solid wastes should be collected by category to avoid mixture of garbage and construction solid wastes. Domestic garbage should be periodically transported by environmental sanitation agency to prevent entering into nearby river with surface runoff caused by storm water flushing.

(7) Education and management for temporarily employed workers should be strengthened to avoid littering of garbage and ensure centralized disposal of night soil and domestic garbage.

6.1.5 Measures for ecological environmental protection

(1) Principles of focusing on prevention and priority of protection will be used to guide
design, construction and environmental management and to incorporate ecological environmental protection to project design, in order to minimize adverse impacts of project construction to vegetation and ecological environment along the pipelines.

(2) Project design and alignment of pipelines should be optimized for least temporary land acquisition and for less damage to vegetation. Sod or trees on the occupied land should be transplanted to other places and damage should be avoided.

(3) Greenbelt and vegetation damaged by project construction should be recovered in a timely manner in accordance with road and regional planting plan. Importance should be given to combination of tree, bush and grass planting to form a complete compound ecological system. Planting area should be no less than original area.

6.1.6 Mitigation measures for social impacts

(1) In order to ensure orderly construction and minimize impacts to local traffic, it is proposed construction period be shortened with the prerequisite of eligible construction quality. Additionally, based on construction progress the contractor should work with traffic administration and transportation agency in developing appropriate detailed transportation plan including categories of vehicles, number of vehicles, transportation routes, scheduling of transportation, and dedicated persons should be assigned to assist with traffic management to minimize impacts of project construction on road traffic.

(2) Construction will involve large quantities of power and water consumption, therefore the contractor should communicate with relevant power and water agencies prior to construction to prepare connection plan and construct temporary connection. In areas with inadequate power or water capacity, prior pipeline improvement should be done to avoid temporary power or water supply suspension or impacts to normal water and power supply for nearby areas.

(3) Various preparations should be made prior to construction including detailed investigation of roads and underground power and communication cables and sewage
pipelines in construction area. Preparations also include prior consultation with concerned agencies to prepare resettlement and relocation plan and prepare emergency responsive plan to avoid normal water, power, and gas supply and communication service along the pipelines in case of cable or pipeline cutting off to maintain normal living condition.

(4) Reasonable compensation should be provided to affected units and residents in accordance with national and Shanghai local laws, regulations and management methods. Transparency of resettlement plan should be improved. During land acquisition and resettlement, public consultation should be emphasized to allow affected people to have understanding of land acquisition, compensation rate for resettlement and implementation schedule. Agreements should be signed with affected units and residents, and project construction cannot begin until agreements have been reached.

(5) Prior notice should be provided to residents along pipeline route and around pump station before construction. Notice of vehicle diversion due to pipeline construction also should request for approval of concerned agencies and be given to affected residents in advance.

(6) Complaints from the public should be properly handled. Project construction will affect a large scope of area and will inevitably cause inconveniences to life of nearby residents, therefore, appropriate settlement of public complaints will help successfully solve issues with construction impacts. When the contractor receives complaints from the public, persons should be assigned to coordinate with the public and solve the issues in a specified time limit, and efforts should be made to disseminate and explain project detail to the public to obtain their understanding and support.

(7) In order to ensure efficient municipal drainage during construction, water diversion and use of pumps will be necessary. Where site condition allows, diversion can be used, and pumping will be used in places where drainage diversion cannot be adopted given site condition.
(8) Road sections, along which there are environmental sensitive targets including schools, should be given priority protection during construction and measures including water spraying to reduce dust suspension, noise control and traffic diversion and control should be taken.

(9) When pipe jacking of this Project crosses magnetic suspension rail, A2 and A20 overpass, A2 Airport Road overpass, A2 Hunan Road overpass, flying bridges, and navigable rivers, construction plan prepared by design institute shall be implemented strictly, construction management and construction safety shall be enhanced and improved. Especially when pipe jacking crosses magnetic suspension rail, monitoring points will be set up during construction to closely observe settlement of pile foundation and around environment. Measures shall be taken in time to ensure safety of magnetic suspension rail.

6.1.7 Measures for health protection

In order to protect health of construction workers and nearby residents and prevent epidemics, the following preventive measures will be taken:

(1) Attentions should be paid to epidemic prevention on construction site. Health check should be done by professional health agency for construction workers before construction and periodical health check for construction workers and health supervision should be ensured during construction to ensure health of construction workers.

(2) Supply of clean drinking water should be ensured on construction site, which should meet health standard for drinking water. Management of food sanitation should be strengthened to prevent unclean food in order to prevent breakout and spreading of epidemics.

(3) Education and training on disease prevention and good health practice should be implemented on construction site to protect health of construction workers. Sanitation management guidelines should be developed and inspection on sanitation status of construction site should be strengthened.
(4) Management and disposal of domestic sewage and garbage on construction site should be strengthened to maintain environmental sanitation.

6.1.8 Measures for physical cultural resource protection

Before construction, the implementation agency should inform local cultural and historical relic protection agency of alignment plan of the proposed project and consult with them about possibility of existence of cultural or historical relics. If there is possibility that cultural or historical relics may be found, the local administration should be consulted whether the construction is allowed, if yes, relevant permission documents and recommended protective measures should be requested from the administration.

Although there is little possibility that there are cultural or historical relics along the pipeline route, education on relic protection should be conducted for construction workers. Once cultural or historical relics are found during construction, construction activities should be suspended immediately and the site should be closed to avoid man-made damage. Existence of cultural or historical relics should be reported to local relic protection agency in time, and then the local relic protection agency will decide protection measures after field investigation, rescue or excavation.

6.2 Mitigation measures during operation

6.2.1 Measures for noise pollution control

(1) With respect to pump station design, semi-underground pump chamber is used. Pump chambers should be built separately, far away from office and residential areas, and soundproof double-glazing windows should be installed for office buildings to reduce noise impact on office staff.

(2) Since pumps generate strong noise during operation, the following control measures should be taken to abate noise impact: (a) sound insulation and sound absorption treatment should be adopted for pump chamber, for example, acoustic shield is installed for pump and sound absorption material is used for inner wall of pump chamber to reduce noise escape; (b)
low-vibration and less noisy pumps should be selected, damping treatment should be done to
pump foundation, and flexible rubber joints should be equipped for inlet and outlet of the
pump to reduce noise; (c) machinery should be well maintained to keep low noise level.

(3) Based on pump station layout and needs for landscaping and planting, planting should
be done as much as possible outside pump chamber and at pump station boundary to reduce
noise impact by vegetation absorption.

After the above measures are taken, noise generated by pump station will meet Category
II of Standard for Noise Control at Industrial Plant Boundary.

6.2.2 Measures for ecological environmental protection

(1) Planting percentages of trees, bush and grass should be paid attention to maintain
reasonable hierarchical structure.

(2) Local species should be used as much as possible as priority selection to reduce
introduction of external species.

(3) Dedicated persons should be assigned for planting and management of the pump
station. Regulations should be made to protect green area and ecological environment.

(4) Vegetation should be recovered as much as possible on exposed surface caused by
temporary land occupation. Dominating grass species in local area should be selected for
planting. Meanwhile timely protection should be provided in major areas to prevent damages
caused by various factors.

6.2.3 Domestic sewage and garbage treatment during operation

Domestic sewage generated by pump station workers during operation will be collected
in sewers and conveyed to municipal sewer mains, which will have little impact to surface
water environment.

Garbage bins are provided in pumping station and garbage is collected by category to
maintain clean environment of pump station. Garbage should be stored separately on
designated sites and should be collected in a timely manner. Nanhui District Environmental
Sanitation Agency is trusted for garbage transportation.

6.2.4 **Protective measures for pipeline safety**

During operation, Shanghai Raw Water Transmission Pipelines and Canal Protection Method should be strictly enforced. Scope for transmission pipeline protection should be specified, which is 8 meter wide areas along both sides of pipeline center, and permanent identification marks should be set. Piling, well digging, pit digging and soil excavation are not allowed within protection area in accordance with Shanghai Raw Water Transmission Pipelines and Canal Protection Method.
7 Environmental risk analysis and mitigation measures

7.1 Environmental risk analysis

Environmental risk may occur during construction and operation. Because environmental risk is the risk borne by environment from little probability accidents, the following risks may occur by analysis on series activities of construction and equipment operation.

7.1.1 Construction period

(1) During pipe jacking, improper pipe impelling may cause local surface lift and consequently damage some buildings.

(2) During pipeline alignment, improper construction may damage water supply pipes, communication cable, gas pipes, or electricity cables and consequently affect utilities on surrounding resident, such as water supply, power supply, gas supply, or communication.

(3) When pipe jacking across river, due to failure of some construction technologies, water pollution or soil erosion may happen. Especially during flood season, flood may flow back into city and seriously impact on society.

(4) Big stratum loss and uneven sedimentation due to construction may cause cracking of above-ground buildings, even collapse, trigger unexpected resettlement, and have certain impacts on residential life, transportation, air quality, etc.

(5) Muddy water from pipe jacking is discharged directly to rivers or municipal sewers without treatment.

7.1.2 Operation period

(1) Water hammer effect

As a result of long distance and big scale of water transmission, many receiving WTPs and booster pumping station, when some hydraulic transitions happen during operation, such as pipe inspection, stop of pumping station, the upstream and downstream valves may be
closed quickly and the water flow may generate a pressure on valves and pipes and reach to maximum because of slippery pipe and inertia of subsequent water flow. The water hammer is generated thereof and may cause damage on the safety of valves and transmission pipelines.

(2) Risk on pipe safety

After pipeline constructed, some activities may damage the raw water transmission pipelines and raw water quality, such as piling, well drilling, pitting, soil excavation (dig and turn over the soil for planting), pouring toxic and dangerous solid waste or liquor, or passing or parking big coaches and cargo vehicles in the protection zone of the transmission pipeline without taking reinforcement measures.

7.2 Mitigation measures

7.2.1 Construction period

The following prevention measures may be taken during construction:

(1) Measures to prevent accidents of pipe jacking

The project developer should entrust an experienced contractor to implement pipe jacking so that the location and precision of pipe jacking can be precisely determined. The constructors will be trained before construction to prepare scientific pipe jacking plan and improve operation quality.

Meanwhile, all preparation works should be completed before construction, for example, site investigation on roads and underground facilities of power supply, communication cables, and drainage pipes, etc., coordination with relevant agencies to determine the resettlement plan, preparation of emergency response. If damages on power, communication, drainage, and buildings happen during construction, the contractor should contact with relevant departments in time and take remediation measures to ensure that cutoff of pipes during contraction won’t impact operation of facilities of water supply, power supply, gas supply and communication along pipelines. The normal living conditions will be ensured.
(2) Measures to prevent wastewater discharge without treatment

Enhance collection and management of construction wastewater and stop construction wastewater discharging without treatment.

(3) Maintain or renew the damaged roads and buildings due to construction in time.

7.2.2 Operation period

(1) In order to eliminate water hammer effect, install PLC automatic control system on raw water transmission pipelines and pump system, install pressure relief valves on pipelines, install fast-closing check valves and hydraulic control valves at the outlet of pumping station, and build on-line one way pressure regulating towers in the pumping station or in the middle of pipelines.

(2) Raw water pipe protection

Define raw water pipe protection zone by strictly implementing Methods of Raw Water Transmission Pipes and Cannels of Shanghai. The protection zone is 8 meters wide from the outer edge of both sides of pipe. Establish permanent identification marks in the protection zone.

The land in the protection zone can only be used for landscape, besides road constructions parallel to or cross the pipes or underground pipe constructions are really needed. These constructions should be consulted with and consented by the water authority in advance. Reinforcement measures should be taken. Otherwise engineering clearance procedures cannot be started.

If deep layer foundation construction is conducted in the pipeline protection zone, the project developer should inform water authority before application of the planning permit of engineering project.

In the range of raw water protection zone, the following activities which jeopardize water pipes or water transmission safety and water quality are strictly prohibited:

a, Constructing buildings or structures; b, pile up sand and stone, bricks, metals, woods;
c, piling, well drilling, pitting, soil excavation (except digging and turning over the soil for planting, or depth is less than 0.7m); d, pouring toxic or harmful solid waste or waste liquor; e, passing or parking big coaches or cargo vehicle without taking reinforcement measures; f, covering, chipping out, erasing or changing, or damaging the identification mark of transmission pipelines.

### 7.3 Suggestions

Aiming at the environmental risks during construction and operation, it is recommended that the project developer and contractors should prepare an emergency responsive plan on environmental risks.
8 Alternative Analysis

Alternative analysis of this project is carried out in two aspects: one is no-action alternative analysis and the other is technical alternative analysis.

The general principles of alternative analysis are:

1. Quantity analysis: quantifying environmental impact of each alternative as much as possible;
2. Integrated analysis: integrated analysis on environmental, technical, economy and social aspects;
3. Consistent analysis: the selected alternative shall be consistent with relevant development plans and criteria and be accordance with local conditions.

8.1 Analysis of no-action alternative

This EIA analyzes the no-action alternative (without implementation of the Project) from the points of view of profit and loss of environment and social economy, as shown in Table 8.1-1.

<table>
<thead>
<tr>
<th>Item</th>
<th>Implementing this Project</th>
<th>Without this Project (No-action alternative)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main advantages</strong></td>
<td>(1) in accordance with Shanghai Urban Mater Plan (1999-2020), Shanghai Water Supply Plan, Shanghai Aquatic Environment Zoning (Revision), and the Outline of the 11th Five-Year Plan for National Economic and Social Development of Shanghai; (2) in favor of improving water supply capacity and quality for urban area, safeguarding public health (3) establish a more perfect water transmission system</td>
<td>(1) maintain current situation, for example, the vegetation will not be damaged (2) will not change the value of land (no land occupation, etc.) (3) will not damage the vegetation during construction and will not have environmental impacts, such as dust suspension.</td>
</tr>
<tr>
<td><strong>Main disadvantages</strong></td>
<td>(1) land occupation: land acquisition: 2.42ha, and temporary borrow land 10.56ha; (2) damage vegetation and cause dust suspension during construction (3) noise of equipment during operation may impact the environment</td>
<td>(1) water supply capacity of Nanhui District is not enough; (2) Water quality of Pudong New District and Nanhui District is not good.</td>
</tr>
<tr>
<td><strong>Integrated analysis</strong></td>
<td>From points of view of social and environmental aspects, the alternative of implementing this Project is better than the alternative of no-action</td>
<td></td>
</tr>
</tbody>
</table>

It can be seen from Table 8.1-1 that the no-action alternative will not bring environmental impacts. However, the water supply capacity of Pudong New District and
Nanhui District cannot meet the needs of sustainable social economic development and continuous increase of living conditions. And the water quality in the region is also poor. Implementation of this Project will cause some environmental impacts. However, only the impact of permanent land acquisition 2.5 ha is not irreversible. The other impacts can be avoided or eliminated (details in Chapter 6) by taking corresponding environmental protection measures. Meanwhile, the impacts during construction are temporary. However, the social and environmental profits of project implementation and operation are long term. Therefore, it is necessary to implement this Project from point views of promoting social economic development and environmental protection. The alternative of implementing this Project is better than the one of no-action.

8.2 Technical alternative analysis

8.2.1 Optimizing design of pipe routes

Based on determined plan of inland water transmission system, Shanghai Urban Planning and Design Institute conducted a plan of route and site selection in July 2007 which was approved by the Shanghai Planning Bureau in August 2007 (see attachment for details). This plan of route and site selection provided the direction and location of Nanhui Conveyors. Based on the plan of route and site selection, the Nanhui Conveyor works are divided into four parts of Nanhui branch, Chuansha branch, Hangtou branch, and Huinan branch. The direction of Nanhui branch is from Jinhai pumping station, along Huadong Road towards south – Gaoke East Road towards East - A20 Road towards south – Nanhui North pumping station – A20 Road towards south again, to intersection of A20 road and Dazhi River; the direction of Chuansha branch is from Jinhai pumping station along Huadong Road towards south to Chuansha WTP; the direction of Hangtou branch is from intersection along Dazhi River north bank towards west to Hangtou WTP; the direction of Huinan branch is from the intersection along Dazhi River north bank towards west to Huinan WTP.

The design institute optimized the design of locations of pipeline based on the following design principles and working objectives:

a. Adjustment of design locations: in principle, the pipe is designed based on the
location provided in the plan of route and site selection. If the planned pipe route encounters existing underground barriers and cannot pass through, then part of the pipe route can be adjusted slightly based on on-site situation considering reasonability of design and economical efficiency. The adjustment principles: close the planned pipe location as much as possible, reasonable avoidance of exiting barriers, bilateral protection lines 9 meters wide from pipe center should be in the green line of planned road.

b. The route of pipeline should be reasonable and construction should be feasible; the reasons for adjustment should be reasonable and adequate; reduce the prophase engineering cost and coordination difficulty as much as possible; avoid resettlement as much as possible;

c. Determining location of pipe jacking shafts should consider distance of pipe jacking, avoidance underground barriers, reasonable pipe location, saving engineering works, reduce resettlement and moving of existing aboveground and underground facilities as much as possible, as well as feasibility and convenience of construction (machinery in and out, pipe material storage, impacts of construction on surrounding buildings, power utilization during construction).

8.2.2 Construction alternative comparison and selection

The alternative analysis of pipe materials and construction plans are shown in Table 8.2-1.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Alternative analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction methodology</td>
<td>Open excavation</td>
<td>The technology is mature and applied widely. Investment is relative low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Great impacts on green belts and vegetation of main traffic roads;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inconvenient for crossing buildings, roads, flyers, and rivers;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>earth surface may sink during construction;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vibration and noise is serious</td>
</tr>
<tr>
<td>Method</td>
<td>No excavation, relative safe, will not affect above ground engineering projects and traffic; Vibration and noise is little; The impacts on surrounding protection targets (sensitive points) are small; Convenient for crossing buildings, roads, flyers and rivers.</td>
<td>Technical requirement is high. Need a professional contractor. Have requirements on pipeline materials. Investment is high</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pipe jacking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tunnel Boring Machine</td>
<td>No excavation needed, relative safe, will not impact on traffic and project, low vibration and noise, small impact on residents along the transmission line, easy to cross obstacles, fewer working shafts needed.</td>
<td>High technical requirements, slow construction, high investment</td>
</tr>
<tr>
<td>Steel pipe</td>
<td>Long history of application, Broad application, good adaptability; Capacity of bearing high internal pressure, Construction and maintenance are flexible High safety for water supply, especially acceptable for pipe jacking</td>
<td>Price is relative high</td>
</tr>
<tr>
<td>Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ductile iron pipe</td>
<td>Capacity to bear pressure is high; Good erosion protection; Good tightness Pipe interface is flexible, Anti vibration is good.</td>
<td>Price is high; Can only be used in open excavation; Cannot be used in pipe jacking</td>
</tr>
<tr>
<td>Pre-stressed reinforced concrete</td>
<td>mechanical behavior is good, good capacity of bearing internal and external pressure, no anti-corrosion measures needed.</td>
<td>Pipeline is heavy; Construction intensity is great, and; Cannot be used in pipe jacking</td>
</tr>
</tbody>
</table>
Through above integrated analysis of technical, economic and environmental impacts, pipe jacking for Nanhui conveyor is adopted. Part of transmission pipeline can be constructed by open excavation at sites without green belt. Steel pipes will be used for pipe jacking, and ductile iron pipes will be used for open excavation.

8.3 Alternative analysis for raw water transmission system

8.3.1 Introduction of alternatives

Alternative No. 1: construct two pumping stations in Nanhui Conveyor system, i.e. Nanhui North booster pumping station and Nanhui booster pumping station, parallel DN2000 transmission pipes between Jinhai pumping station and Nanhui North pumping station (18.3km), and parallel DN1800 transmission pipes between Nanhui North pumping station to Nanhui pumping station (10.8km). The detail scheme is shown in Figure 8.3-1;

Alternative No. 2: construct one pumping station in Nanhui Conveyor system, i.e. only Nanhui North pumping station and without Nanhui pumping station, parallel DN2000 transmission pipes between Jinhai pumping station and Nanhui North pumping station (18.3km); and parallel DN1800 transmission pipes between Nanhui North pumping station to Nanhui pumping station (10.8km). The detailed scheme is shown in Figure 8.2-2.

Alternative No. 3: construct one pumping station in Nanhui Conveyor system, i.e. only Nanhui pumping station and without Nanhui North pumping station, parallel DN2200 transmission pipes between Jinhai pumping station and Nanhui North pumping station (29.1km). The detailed scheme is shown in Figure 8.2-3.
Figure 8.3-1 Diagram of alternative No. 1

Figure 8.3-2 Diagram of alternative No. 2
8.3.2 Alternative analysis and recommended option

(1) Advantages and disadvantages of alternatives

In Alternative No.1 Nanhui pumping station is dedicated to supply raw water to Hangtou WTP and Huinan WTP without fall of water head. The hydraulic balance of the system is good. However, one more pumping station means more water loss of whole system, more booster pumps (13 sets), more land occupation (2.1ha more land), more working staff (9 more staff), as well as maintenance.

In Alternative No.2 pumps are shared to supply raw water by Nanhui North pumping station with fall of water head. After precise hydraulic calculation, Hangtou WTP is the control point in short term. There is a fall of water head in Huinan direction (during non salt intrusion, water head at Hangtou WTP is about 25.32meters, while water head at Huinan WTP is only about 18.34meters. There is 6.98 meter fall of water head; during salt intrusion, water head at Hangtou WTP is about 17.69, while, water head at Huinan WTP is only about 13.05 meters with 4.64 meter fall of water head). In long term, Huinan is the control point. There is a fall of water head at Hangtou direction (during non salt intrusion, water head at Huinan is about 40.99 meters, while, water head at Hangtou is about 33.67 meters with 7.32
meter fall of water head; during salt intrusion, water head at Huinan is about 25.52 meters, while, water head at Hangtou is only about 21.01 meters with fall of water head 4.51 meters). However, cutting down one pumping station will reduce 2.77 meter water loss. Only five pumps are needed if without Nanhui pumping station. 2.1ha of land can be saved, as well as 9 working staff. Work of maintenance is also reduced.

Alternative No. 3 without Nanhui North pumping station, then the water head at Jinhai pumping station should be increased. In order to reduce the high water head at Jinhai pumping station, then increase the diameter of transmission pipeline from Jinhai pumping station to Nanhui pumping station to DN2200. In Nanhui pumping station, dedicated pumps are supply water for Hangtou WTP and Huinan WTP respectively. There is no water fall at Hangzhou WTP and Huinan WTP with dedicated pumps. And water head can meet the long term need of Nanhui North WTP. However, during transition period, short term period or non-maximum day of long term period, there is a water fall at Nanhui pumping station in order to meet the influent requirements of Nanhui North WTP. Without Nanhui North pumping station will reduce 3.45 meter water loss. Nine pumps are needed. 2.42 ha of land can be saved, as well as 9 working staff. Work of maintenance is also reduced.

(2) Economic analysis of alternatives

Economic analysis of alternatives is shown in Table 8.3-1.

<table>
<thead>
<tr>
<th>alternatives</th>
<th>Engineering const (10,000 RMB)</th>
<th>Operation cost</th>
<th>NPV of power cost (10,000 RMB)</th>
<th>Net present value (10,000 RMB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td>117,855</td>
<td>Short term: 17,818,300 RMB; Long term: 48,957,300 RMB</td>
<td>27,172.49</td>
<td>145,027.5</td>
</tr>
<tr>
<td>No. 2</td>
<td>109,769</td>
<td>Short term: 17,818,300 RMB; Long term: 48,170,800 RMB</td>
<td>26,927.96</td>
<td>136,697.0</td>
</tr>
<tr>
<td>No. 3</td>
<td>125,189</td>
<td>Short term: 10,215,300 RMB; Long term: 27,745,600 RMB</td>
<td>15,478.03</td>
<td>140,667.0</td>
</tr>
</tbody>
</table>
(3) Recommended design option

Through above technical and economic analysis, Alternative No. 2 has many advantages, such as saving land, less equipment and staff, as well as maintenance works. Comparing with Alternative No. 1 and 3, the engineering cost of Alternative No. 2 is less. Even the electricity cost of Alternative No. 2 for short term and long term is greater than Alternative No. 3, the net present value of engineering cost and electricity cost of Alternative No. 2 is least.

Alternative No. 2 is more reasonable in term of environmental impact and technical and economic aspects. Therefore, Alternative No. 2 is recommended as the option for engineering design.

(4) Optimization of recommended design option

Based on recommended design option, Sogreah proposed an alternative option. The main contents of this alternative option include laying dual DN3000 pipes between Jinhai Pumping Station and T joints, canceling Nanhu North Pumping station, adopting TMB method. After comparison analysis, the recommended design option and this alternative option proposed by Sogreah both can be effectively carried out during normal and emergent conditions. However, the investment cost and net present value of the recommended option are much lower than the alternative option. In addition, considering factor of engineering construction and progress of implementation, the recommended design option is still the optimal option.

In order to ensure that Qingcaoshan Reservoir can be effectively operated during emergency, a 4km long, DN5000 transmission line will be needed to connect Yanqiao Conveyor and Jinhai/Nanhui Conveyor. During emergency, water supply in the areas which originally provided by Nanhu Conveyor, the emergency water supply will be provided by Daqiao intake jointly.
9 Environmental and Economic Profit and Loss Analysis

9.1 Cost estimates of environmental protection during construction

The investment of environmental protection of this Project is about 3,875,000 RMB excluding green belt restoration which is included in engineering cost. The detail is shown in Table 9.1-1.

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Cost (10,000RMB)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Environmental monitoring measures</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Monitoring on construction wastewater</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Monitoring on noise and air</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Monitoring on hygiene and disease control</td>
<td>6.0</td>
<td>150RMB/person</td>
</tr>
<tr>
<td>2</td>
<td>Temporary measures of environmental protection</td>
<td>242.0</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Production wastewater and sewerage treatment</td>
<td>152.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Production wastewater treatment facility</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operation cost of wastewater treatment</td>
<td>72.0</td>
<td>Including labor cost and electricity cost</td>
</tr>
<tr>
<td></td>
<td>Sewerage collection</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>Mitigation measures of air impacts</td>
<td>16.0</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Mitigation measures of noise impacts</td>
<td>50.0</td>
<td>Including enclosures, temporary sound barriers, and acoustnic meters</td>
</tr>
<tr>
<td>2.4</td>
<td>Solid waste disposal</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Protection measures of public health</td>
<td>4.0</td>
<td>100RMB/person</td>
</tr>
<tr>
<td>2.6</td>
<td>Other temporary engineering projects</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Independent cost</td>
<td>101.8</td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Construction management fee</td>
<td>55.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental management fee</td>
<td>27.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental supervision fee</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>Dissemination and education</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and technical training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 Fees of research,</td>
<td>46.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>investigation, design and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>consulting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fee of EIA</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigation and design of</td>
<td>6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>environmental protection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 Engineering quality</td>
<td>0.4</td>
<td>0.25% of Item 1 and 2</td>
<td></td>
</tr>
<tr>
<td>supervision fee</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic contingency fee</td>
<td>28.7</td>
<td>8% of Item 1, 2 and 3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>387.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 9.2 Social economic benefit

Water resources are irreplaceable basic natural resources, and are also public resources and economic resources. Safe and reasonable municipal water supply system plays a decisive role in harmonious urban economic, social and environmental development and improvement of life quality of residents. Meanwhile, it is fundamental guarantee for sustainable urban development and increase of integrated urban capacity.

Through implementation of this project, good quality Yangtze raw water from Qingcaoshia reservoir will be transfer by booster pumping station and long distance transmission pipeline to Chuasha WTP, Huinan WTP, Hangtou WTP, and proposed Nanhui New WTP. The drinking water quality will be improved in the above regions. The problem of drinking water of emerging industrial parks in suburban areas will be settled. Furthermore, it is of far reaching importance to urban sustainable economic development.

### 9.3 Environmental profit and loss

Based on Shanghai Aquatic Function Zoning and Shanghai Water Supply Plan, the raw water for Shanghai drinking water must be taken from designated water sources of upper Huangpu River and estuary of Yangtze River. This Project is accordance with Shanghai Aquatic Function Zoning and Shanghai Water Supply Plan and improves water quality in Nanhui District. Nanhui Conveyor works is one important component of inland transmission system of Qingcaoshia Water Source Raw Water Project. Currently, Dazhi River is the water source for Nanhui District. Replacement of water of Dazhi River with water from upper
Huangpu River and Yangtze River will effectively project Dazhi water resource. And water environment of Dazhi River will be further improved.

The environmental loss of this Project will be happen during construction, for example, wastewater discharge from excavation, waste disposal, site leveling, concrete mixing and filling. Moreover, sewerage from a large amount of construction workers may pollute water of surrounding rivers; exhaust gas from machinery and dust suspension from naked soil and storage areas may cause air pollution; noise from transportation of raw material and machinery may impact surrounding residents; solid waste from construction workers and construction may pollute the site. However, the above impacts are temporary and partial and are not serious which can be controlled in a short period of time, limited scope and slight degree by strictly implementing all relevant regulation. The impact will not be significant and therefore will not influence permanent residents. The pollutions on other environmental factors during construction are also temporary and partial and not serious. The construction impact can be minimized by enhanced construction management and civil construction which will not create accumulative damage on surrounding environment.

9.4 Analysis of environmental profit and loss

This Project is an important water supply works in Shanghai. The environment losses of this Project occur during construction in terms of decline of air environment quality and acoustic environment quality in areas of construction sites, traffic congestion of part roads, damages on green belts. Most of the environmental loss can be restored by taking environment protection measures.

This Project is one important component of inland transmission system of Qingcaosha Water Source Raw Water Project. The economic, social and environmental benefits during operation are visible. Implementation of environmental protection measures can reduce and avoid project impacts and ensure environmental benefits.

This project will solve the problem of gap between water supply and demand in Pudong New District, Nanhui District and Lingang New Town which will provide great support to fast economic development and sustainable social development of Pudong New District and
Hanhui District.
10 Public participation

10.1 Purposes of public participation

(1) Requirements of laws and regulations

The fifth and twenty first articles of Laws of Environment Impact Assessment of People’s Republic of China clearly specify that the State encourage relevant units, experts and public to participate in environment impact assessment in an appropriate manner and the project implementing agency shall organize justification meeting and hearing or other manners to consult with relevant units, experts and public for comments before submit EIA report for approval. An explanation about why the comments from relevant units, experts or public are adopted or not adopted shall be attached with the EIA which is submitted by the project implementing agency. The public participation of EIA for this project is carried out based on the provisions of Tentative Method of Environment Impact Assessment Public Participation (Huanfa 2006[28]).

(2) Right to Know of Public

Public has the right to know the construction of this project. Therefore, public participation embodies the principles of fairness, open, science and democracy on one hand, and on the other hand ensures the right to know of public.

(3) Ways to raise comments and suggestions of public

Public in the areas of this project including social groups, social organizations, units, individuals may raise their comments and suggestions by public participation based on some understanding of the project to protect environment interest of public. Therewith, the communication and contact among project implementing agency, EIA unit and public can be enhanced by public participation.

(4) make the measures and environment management more comprehensive and reasonable

The public can know the potential environment issues may be caused by the project by public participation. The reasonability and acceptability of EIA of this project could be improved by extensive consultation. And public participation could also facilitate engineering
construction of the project and furthest improve the integrative social benefits of the project.

10.2 Implementation

Base on the laws and regulations of environmental protection of China and the requirements of safeguard polices of the World Bank (OP4.01), this project conducted two rounds of public participation. The first round was conducted during project preparation when EIA guideline was prepared. The second round was conducted when draft EIA report was completed. The first round public participation was to collect the information that public was concerned about the project construction. The second round public participation was to communicate on the public concerned environmental issues which were raised during the first round public participation and the relevant mitigation measures and help the public to understand the project construction and the adopted mitigation measures.

The first round public participation was conducted during EIA guideline was prepared. In March 2008, the project implementing agency and EA institute organized a public announcement on site and distributed questionnaires to the public along the area of construction. The participants were mainly affected residents, as well as some organizations related to the project. During the survey, the EA institute clearly briefed the information about the project including the key environmental impacts due the project construction in the questionnaire. The main participants are people affected by the projects or people reside in the project area. Moreover, the participants covered peoples with different ages, sexes, education backgrounds and careers. The investigation questionnaire not only focused on the general attitude of the public to the project, but also concentrated on the attitude of public to some specific environmental issues, such as the benefits that the project may bring in, negative impacts in terms of noise, dust suspension, etc. during construction, inconvenience to the community and residents that caused by the projects, resettlement and compensation of residents in the area of land acquired by the project, etc.

The second round public participation was conducted when the draft EIA report was completed. In May 2008, the project implementing agency and EIA institute organized a public announcement on EIA of Nanhui Conveyor project on the media. The main
participants were still affected public and organizations. The second round public participation focused on EIA report and mitigation measures and answered the questions raised during the first public participation in EIA report. And the draft EIA brief was provided on a website for public consultation.

The second round public participation also adopted combination of department consultation and expert consultation. During preparation of engineering preliminary design report and this EIA report, the implementing agency, design institute and EIA institute had interviews with relevant departments and experts in terms of consultation meetings. Representatives from relevant departments and experts were invited to give their comments and suggestion on the design and EIA of this Project.

10.3 Methodology and target population of survey

The methods of public participation applied for this project were on-site public announcement, public announcement on the media, and on-site survey. The contents of on-site public announcement and public announcement on the media are attached in Annex 2 and 3. The EIA institute prepared specific survey questionnaires on environmental impact of Nanhui Conveyor for organization and individual respectively, which are attached in Annex 4 and 5.

In March 2008, the project implementing agency and EIA institute carried out on-site public announcements covering project introduction, potential environmental impacts might be brought by the project, and environmental protection measures that will be adopted by the project in several locations, i.e. Huinan WTP in Huinan district, Tangrenyuan of Tangzhen Town in Pudong area, Tuanxin Village of Datuan Town in Nanhui District, Qigan Village of Zhoupu Town in Nanhui District, Yaoshi Village of Chuansha Town of Pudong District, and etc.

In March 2008, the EIA institute carried out on-site surveys of public participation by methods of interviewing with questionnaires and interviewing organizations. The selected survey sites were affected representative residential communities and organizations along both sides of the conveyor. The survey objects were randomly and proportionally selected.
from the affected population. The selected participants completed the questionnaires by clicking the answers. During the public participation survey, the EIA institute interviewed Huinan WTP of Huinan District, the resident committees of Tanrenyuan, Tuanxin Village, Qigan Village, and Yaoshi Village and asked the relevant units and committees to cooperate with the project implementing agency and EIA institute on the public participation survey.

In May 2008, EIA institute announced Nanhui Conveyor EIA on the media. On May 20, 2008, EIA institute publicized the information of Nanhui Conveyor EIA on websites of Shanghai Environment Hotline (www.envir.gov.cn) and Shanghai Investigation, Design & Research Institute (www.sidir.com) and also provided electronic version of EIA brief. The information about EIA of the project was publicized on the Jiefang Daily on May 22, 2008.

The second round public participation also adopted combination of department consultation and expert consultation. During preparation of engineering preliminary design report and this EIA report, the implementing agency, design institute and EIA institute had interviews with relevant departments and experts in terms of consultation meetings. Representatives from relevant departments and experts were invited to give their comments and suggestion on the design and EIA of this Project. Main consultation targets include Shanghai Urban Construction Design Institute, Shanghai Municipal Design Institute, Sogreah Consulting Company, Shanghai Yangzi Estuary Chinese Sturgeon nature Reserve Administrative Department, and experts of WB Beijing office.
10.4 Analysis of public participation survey

10.4.1 Constitution of survey objects

A hundred questionnaires were sent to individuals and 97 effective questionnaires were retuned. The rate of return was about 97%. Seven questionnaires were sent to organizations and all of them were returned. The rate of return was 100%.

Among the participants, 67% are males and 33% are females. In terms of ages, 5.1% of participants are from 18 to 29 years old, 18.6% from 30 to 39, 29.9% from 40 to 49, 26.8% from 50 to 60, and 19.6% above 60 years old. In terms of education, 6.2% of participants are elementary school level, 54.3% primary high school level, 17.5% high school or technical secondary school level, 10.3% college level, and 7.2% undergraduate and above level. In terms of careers, 21.6% of participants are farmers, 13.4% administrative staff, 9.2% workers, 8.2% retired staff, 5.1% financial staff, 4% professionals, and 6% others. And 31% of participants did not answer their careers. The constitution of participants in terms of sexes, ages, educations, and careers are listed in Table 10.3-1 and Figure 10.3-1, Figure 10.3-2, and Figure 10.3-3.
Table 10.3-1 Statistic Table of Public Participation Survey

<table>
<thead>
<tr>
<th>Items</th>
<th>Result of Survey</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>65</td>
<td>67%</td>
</tr>
<tr>
<td>Female</td>
<td>32</td>
<td>33%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 18 years old</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>from 18 to 29</td>
<td>5</td>
<td>5.1%</td>
</tr>
<tr>
<td>from 30 to 39</td>
<td>18</td>
<td>18.6%</td>
</tr>
<tr>
<td>from 40 to 49</td>
<td>29</td>
<td>29.9%</td>
</tr>
<tr>
<td>from 50 to 60</td>
<td>26</td>
<td>26.8%</td>
</tr>
<tr>
<td>Above 60 years old</td>
<td>19</td>
<td>19.6%</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary school</td>
<td>6</td>
<td>6.2%</td>
</tr>
<tr>
<td>Primary high school</td>
<td>53</td>
<td>54.3%</td>
</tr>
<tr>
<td>Secondary high school or technical secondary high school</td>
<td>17</td>
<td>17.5%</td>
</tr>
<tr>
<td>College</td>
<td>10</td>
<td>10.3%</td>
</tr>
<tr>
<td>Undergraduate and above</td>
<td>7</td>
<td>7.2%</td>
</tr>
<tr>
<td>Unfilled</td>
<td>4</td>
<td>4.1%</td>
</tr>
<tr>
<td>careers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer</td>
<td>21</td>
<td>21.6%</td>
</tr>
<tr>
<td>Administration staff</td>
<td>13</td>
<td>13.4%</td>
</tr>
<tr>
<td>Unfilled</td>
<td>31</td>
<td>31%</td>
</tr>
<tr>
<td>Worker</td>
<td>9</td>
<td>9.2%</td>
</tr>
<tr>
<td>Financial staff</td>
<td>5</td>
<td>5.1%</td>
</tr>
<tr>
<td>Professionals</td>
<td>4</td>
<td>4.1%</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
<td>6.1%</td>
</tr>
<tr>
<td>Retired staff</td>
<td>8</td>
<td>8.2%</td>
</tr>
<tr>
<td>Total number</td>
<td>97</td>
<td>100%</td>
</tr>
</tbody>
</table>
Figure 10.3-1 Sex constitution of investigation objects

Female 33%
Male 67%

Figure 10.3-2 Age constitution of investigation objects

50-60 years old 27%
40-49 years old 29%
30-39 years old 19%
18-29 years old 5%
above 60 years old 20%

Figure 10.3-3 Education levels of investigation objects

primary high school 55%
secondary and technical high school 3%
secondary high school 6%
elementary school 4%
unfilled 7%
undergraduate and above 10%
10.4.2 Analysis on results of individual questionnaires

Ten questions were included in the questionnaires. The statistic analysis on the questionnaires is seen in Table 10.3-2. The results show:

1. 94.8% of participants knew or heard about this project and 5.2% never heard about this project.

2. 97.9% of participants think the water supply will be improved in the urban area by the project; and 2.1% think it will not be changed.

3. 94.8% of participants think the local economy development will be benefit from the implementation of this project; and 5.2% think it will not.

4. The participants think the key environmental qualities should be improved in the areas which they are living are water environment (51.6%), ecological environment (36.3%), air quality (6.5%), acoustic environment (4.0%), and others (1.6%) in turn.

5. 50.5% of participants think the site for the pumping station is reasonable, 33% of participants have no comments on the site for the pumping station. And 16.5% of participants think the site for the pumping station is not reasonable.
(6) The participants think the key environmental issues during construction are water pollution (33.3%), inconvenience for transportation (25.4%), noise (18.1%), solid waste debris (11.6%), damage to ecological system (8.0%), and air pollution (3.6%) in turn.

(7) 41% of participants think the construction of this project has no much influence on their living and working. And they can overcome the inconveniences. 36.1% of participants think the construction of this project has no influence on their living and working. Moreover, 22.7% of participants think the construction of this project has big impact on their living and working.

(8) 60.8% of participants are willing to be resettled for the needs of construction of this project and 14.4% are not willing to. And 24.7% of participants don’t care about the resettlement.

(9) 60.8% of participants are willing to support the project without conditions, 24.7% of participants are willing to support the project with some conditions. 24.7% of participants don’t care. 59.8% of participants explain the following main reasons why they would like to support the project. a. This project is a national important project which should be supported; b. The water quality and living condition will be improved; c. The project will be in favor of local economic development; and d. The project will beautify the ambient environment.

(10) 59.8% of participants give comments and suggestions for this project. Almost half of the suggestions focused on reduction of noise during construction. The other suggestions are related to reduction of local environment pollution as much as possible, enhancement of construction quality, civil construction, etc.

**Table 10.3-2 Analytic table of individual questionnaires of public participation survey**

<table>
<thead>
<tr>
<th>Questions</th>
<th>Options</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Did you know or hear about this project?</td>
<td>(1) Yes</td>
<td>92</td>
<td>94.8%</td>
</tr>
<tr>
<td></td>
<td>(2) No</td>
<td>5</td>
<td>5.2%</td>
</tr>
<tr>
<td>2. Do you think this project will</td>
<td>(1) Yes</td>
<td>95</td>
<td>97.9%</td>
</tr>
<tr>
<td>Question</td>
<td>Option</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>3. Do you think implementation of this project will help the local economic development?</td>
<td>Yes</td>
<td>92</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4. Which environment quality do you think should be improved mostly?</td>
<td>acoustic environment</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>air</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>water</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ecologic system</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td></td>
<td>others</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5. Do you think if the site for the pumping station and routing for pipes are reasonable?</td>
<td>Reasonable</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relatively reasonable</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not reasonable</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>6. Which main environmental impact of this project do you think should be paid attention to?</td>
<td>Water pollution</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Air pollution</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Noise</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solid Waste Debris</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inconvenience of transportation</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Damage on ecologic system</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7. How do you fill the influence on your living and working by this project:</td>
<td>No</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A little influence</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Great influence</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>8. Are you willing to be relocated for the needs of this project?</td>
<td>Yes</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t care</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>9. What is your attitude towards this project in the environmental protection point of view?</td>
<td>Support resolutely</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Support with conditions</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Object</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t care</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>10. What are your comments and suggestions on environmental projects of this project?</td>
<td>Answered</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not answered</td>
<td>39</td>
<td></td>
</tr>
</tbody>
</table>
10.4.3 Analysis on results of organization questionnaires

Ten questions were included in the questionnaires. The statistic analysis on the questionnaires is seen in Table 10.3-3. The results show:

(1) 100% of participants knew or heard about this project.
(2) 100% of participants think the water supply will be improved in the urban area by the project.
(3) 100% of participants think the local economy development will be benefit from the implementation of this project.
(4) The participants think the key environmental qualities should be improved in the areas which they are living are water environment (62.5%), ecological environment (25%), air quality (12.5%) in turn.
(5) 71.4% of participants think the site for the pumping station is reasonable, 28.6% of participants have no comments on the site for the pumping station.
(6) The participants think the key environmental issues during construction should be paid attention to are noise (30%), water pollution (20%), solid waste debris (20%), damage to ecological system (20%), and inconvenience for transportation (10%) in turn.
(7) 71.4% of participants think the construction of this project has no much influence on their living and working. And they can overcome the inconveniences. 28.6% of participants think the construction of this project has no influence on their living and working.
(8) 85.7% of participants are willing to be resettled for the needs of construction of this project. And 14.3% of participants don’t care about the resettlement.
(9) 100% of participants are willing to support the project without conditions, 57.1% of participants explain the following main reasons why they would like to support the project. ① This project is a national important project which should be supported; ② The water quality and living condition will be improved; ③ The project will be in
favor of local economic development; and ④ The project will beautify the ambient
environment.

(10) 57.1% of participants give comments and suggestions for this project. Almost
half of the suggestions focused on reduction of noise during construction. The other
suggestions are mainly related to reduction of local environment pollution as much
as possible, enhancement of construction quality, civil construction, etc.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Options</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Did you know or hear about this project?</td>
<td>(1) Yes</td>
<td>3</td>
<td>42.9%</td>
</tr>
<tr>
<td></td>
<td>(2) Heard</td>
<td>4</td>
<td>57.1%</td>
</tr>
<tr>
<td></td>
<td>(3) Never heard</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>2. Do you think this project will improve the water supply in the urban area?</td>
<td>(1) Yes</td>
<td>7</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>(2) No</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>3. Do you think implementation of this project will help the local economic development</td>
<td>(1) Yes</td>
<td>7</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>(2) No</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>4. Which environment quality do you think should be improved mostly?</td>
<td>(1) Acoustic environment</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>(2) Air</td>
<td>1</td>
<td>12.5%</td>
</tr>
<tr>
<td></td>
<td>(3) Water</td>
<td>5</td>
<td>62.5%</td>
</tr>
<tr>
<td></td>
<td>(4) Ecological system</td>
<td>2</td>
<td>25%</td>
</tr>
<tr>
<td>5. Do you think if the site for the pumping station and routing for pipes are reasonable?</td>
<td>(1) Reasonable</td>
<td>5</td>
<td>71.4%</td>
</tr>
<tr>
<td></td>
<td>(2) Relatively reasonable</td>
<td>2</td>
<td>28.6%</td>
</tr>
<tr>
<td></td>
<td>(3) Not reasonable</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>6. Which main environmental impact of this project do you think should be paid attention to?</td>
<td>(1) Water pollution</td>
<td>2</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>(2) Air pollution</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>(3) Noise</td>
<td>3</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>(4) Solid waste debris</td>
<td>2</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>(5) Inconvenience of transportation</td>
<td>1</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>(6) Damage on ecological system</td>
<td>2</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>(7) Others</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>7. How do you fill the influence on your living and working by this project:</td>
<td>(1) No influence</td>
<td>2</td>
<td>28.6%</td>
</tr>
<tr>
<td></td>
<td>(2) A little influence</td>
<td>5</td>
<td>71.4%</td>
</tr>
<tr>
<td>8. Are you willing to be relocated for the needs of this project?</td>
<td>(3) Great influence</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>(1) Yes</td>
<td>6</td>
<td>85.7%</td>
<td></td>
</tr>
<tr>
<td>(2) No</td>
<td>0</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>(3) Don’t care</td>
<td>1</td>
<td>14.3%</td>
<td></td>
</tr>
<tr>
<td>9. What is your attitude towards this project in the environmental protection point of view?</td>
<td>(1) Support Resolutly</td>
<td>7</td>
<td>100%</td>
</tr>
<tr>
<td>(2) Support with conditions</td>
<td>0</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>(3) Object</td>
<td>0</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>(4) Don’t care</td>
<td>0</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>10. What are your comments and suggestions on environmental projects of this project?</td>
<td>(1) Answered</td>
<td>4</td>
<td>57.1%</td>
</tr>
<tr>
<td>(2) Not answered</td>
<td>3</td>
<td>42.9%</td>
<td></td>
</tr>
</tbody>
</table>

10.4.4 Public announcement and the analysis of expert consultation

The duration of on-site and on media announcements are more than 10 days. The EIA brief report publicized on the media analyzed the environmental issues concerned by the public during the first round public participation, proposed feasible and effective mitigation measures, and adopted the suggestions from the public. Till the end of public announcement, the project implementing agency and EIA institute have not received any comments on the project construction from public, which means that the public agree with Nanhui Conveyor project or are careless about the project. No significant comments are against the project.

During second round public participation, several relevant department and expert consultation were held by the implementing agency, design institute and EIA institute. Representatives from relevant departments and experts give their comments and suggestions on engineering design and EIA report of this Project, such as alternative operations, engineering plan optimization, physical culture resource protection, environmental impacts of relevant engineering projects. Base on the consultation, design institute and EIA institute further optimized the design and EIA report.

10.5 Brief conclusion on public participation survey

It can be seen from the first round public participation survey by organizations and individuals that the participants all answered the questions seriously, which reflects the cares,
understandings and supports from the public to this project. Most participants knew about the basic information of the project through public announcements and the process of public participation. However, almost all participants come out in support of the construction of this project. The participants are relatively sensitive about noise, dust suspension, waste water and sludge during construction. However, most participants have tolerance on the potential impacts during construction. Most participants have no comments on the selected site of pumping station; however, a few of participants worry about the noise during operation of the pumping station. In order to mitigate the impacts on ambient environment and residents during construction, the public give some comments and suggestions, such as reducing noise of construction, adopting dust control measures, constructing the road and pipeline together, avoiding construction during night, properly dealing with resettlement issues, and shortening construction period, etc.

This EIA report analyzed the environmental issues concerned by the public during the first round public participation, proposed feasible and effective mitigation measures, and adopted the suggestions from the public to ensure the impacts on environment to be reduced to an acceptable degree. The EIA brief report issued during the second public participation listed the environment impacts concerned by the public and mitigation measures.

It can be seen from the two rounds of public participation survey that the degree of public participation in this area is high. The comments and suggestion raised the public are relatively objective and reasonable. The survey results are valuable for construction of this project. In order to solve the environmental issues raised by the public and reduce environment impacts, the project implementing agency and contractors should carry out the measures of environmental protection during periods of construction and operation.
11 Resettlement and Social Impact

11.1 General introduction

This project is a sub project of Qingcaosha Water Source Raw Water Project and is a new-built raw water conveyor in mainland area of Qiangcaosha Raw Water System. Part investment of Nanhui Conveyor is proposed to apply for the World Bank loan. The Nanhui conveyor starts from Jinhai Pumping Station in Tangzhen Town of Pudong New District (belong to Jinhai conveyor), southwardly passes though Tangzhen Town and Chuansha Town of Pudong New District along Huadong Road, then turns to Gaoke East Road from Huadong Road and westwards passed through Tangzhen Town of Pudong New District, then along A20 Road and east side of A2 Road passes through Zhangjiang Town of Pudong New District, Zhoupu Town, Xinchang Town, Xuanqiao Town and Datuan Town of Nanhui District to the Dazhihe north bank, then split towards east and west in the grassland of Dazhihe north bank respectively to Huinan WTP in Huinan Town and Hangtou WTP in Hangtou Town of Nanhui district. Some population will be affected due to land acquisition for this project.

This EIA report referred the results from the Resettlement Action Plan for the World Bank Loan Project: Shanghai Qingcaosha Water Source Raw Water Project Nanhui Conveyor Component and Relevant Projects (Shanghai Social Science Institute, February, 2008) to evaluate the resettlement and social impact of this project.

11.2 Project impact

With the participations of local governments, administrative villages, villager teams, and design institutes, the project implementing agency conducted an item by item investigation on material object indexes in terms of impacted population, houses and appurtenant works, lands, specific facilities based on primarily proposed scope of land acquisition. Based on the investigation results, the consulting unit and design institute communicated with the project implementing agency to take the social and economical impact of the project into consideration as much as possible. In order to reduce land acquisition and resettlement, the design institute and project implementing agency take some effective measures when decide
the plan and design the layout of other supporting facilities, such as avoiding residential areas, reducing resettlement and agriculture land. The taken measures should be in line with the local master plan and local government comments.

Total 68.409 Chinese Mu lands need to be acquired for new Nanhui North pumping station and vent wells of Nanhui conveyor including collective owned land 67.806 Chinese Mu (agriculture land 32.254 Chinese Mu). Total 13.717 Chinese Mu lands need to be borrowed including collective owned land of 7.048 Chinese Mu. Nanhui North pumping station is located in Qigan Village in Zhoupu Town of Nanhui District. The lands acquired for Nanhui North pumping station mainly are irrigated fields, vegetable lands, county roads, water surface of pits and ponds, water conservancy of agriculture land, rural house sites, and unused river surfaces. Total 13.717 Chinese Mu lands need to be borrowed for pipe-jacking including 7.048 Chinese Mu collective owned lands. Most of borrowed lands are grassland along sides of roads.

11.3 Policy framework and deserved rights

According to the requirements of the Law of Administration of People’s Republic of China (effective on January 1, 1999), the Law of the People"s Republic of China on Urban Real Estate Administration (effective on January 1, 1995), Regulations on the Administration of the Demolition and Removal of Urban Houses (effective on November 1, 2001), the Measures of Shanghai Implementing the Law of Administration of People’s Republic of China (approved by Shanghai 10th People’s Congress standing committee of No. 7 meeting on February 4, 1994, revised by Shanghai 10th People’s Congress standing committee of No. 36 meeting on May 28, 1997 based on the decision on the revision of the Measures of Shanghai Implementing the Law of Administration of People’s Republic of China, revised again by Shanghai 11th People’s Congress standing committee of No. 23 meeting on November 17, 2000), the World Bank Operational Policy OP 4.12: Involuntary Resettlement, the resettlement objective of this project is to reduce the negative impacts of land acquisition and resettlement as much as possible. The compensation for affected population and assets should be based on replacement price. And the compensation could provide enough chances
for them to recover or exceed their original standard of living.

11.4 Compensation standards of land and house

In order to get the land acquisition and resettlement of this project well done, to ensure the World Bank loan project APL to be implemented smoothly, and to protect the lawful rights and interests of land users, acquired land units, and relevant citizens, this policy is stipulated combined with the situation of Shanghai and this project and based on relevant laws and regulations, such as the Law of Administration of People’s Republic of China, Regulations on the Administration of the Demolition and Removal of Urban Houses, the World Bank Operational Policy OP 4.12: Involuntary Resettlement, and etc. The aim of this policy is to ensure that no single person permanently will lose his job because of this project. The following polices shall be applied when house demolition and land acquisition of state owned and collective owned land are carried out in the planning area of this project and compensation and resettlement to displaced persons or units are needed thereof.

11.4.1 Compensation policy for permanent land acquisition

(1) Compensation for land acquisition includes land compensation, relocation grants, and compensation for other structures and young on the land. Land compensation is owned by rural collective economic organizations. The compensation for other structures and young on the land is owned by the owners of the structure and the young. Relocation grants must be specifically used to arrange acquired land labor force and cannot be appropriated for other purposes.

(2) Standards of land acquisition compensation. The agriculture land is classified into three categories based on the purposes: cotton and grain land, vegetable land and fish pond. The compensation standards for cotton and grain land, vegetable land and fish pond are 14,400RMB/Chinese Mu, 24,000RMB/Chinese Mu, and 7,300RMB/Chinese Mu respectively.

(3) Relocation grants for agriculture land acquisition should be calculated based on the number of displaced farm population, which is counted according to the number of
acquired agriculture land dividing the average agriculture land occupied per person before land is acquired. Labor force relocation grants are paid from 90,000RMB/person to 120,000RMB/person based on different ages and sexes.

11.4.2 Compensation policy of temporary land acquisition

The compensation for temporary uses of rural collective owned lands is paid according to the purposes and losses of the acquired land including young compensation and land restoration compensation. The compensation for temporary uses of state owned lands is paid to affected units based on the size of and duration of land occupation. The project implementing agency will be responsible for demolishing temporary structures and cleaning the sites after construction completed. Temporarily occupation of state owned lands for pipeline alignment doesn’t need to pay land occupation compensation. Compensation for demolition of structures on lands should be paid on replacement price. The project implementing agency is responsible for restoring the structures based on original standard and size after construction completed. The restoration cost can be included in engineering construction cost.

11.4.3 State owned land transfer policy

A transfer contact is needed when the right to use of state owned land is transferred. The transfer price can be decided by transferor and transferee. However, the city government and county government have the priority to purchase the right to use of land if the transfer price is obviously lower than the market price. The city government and county government can take necessary measured to control the price when the market price of right to use of land increases unreasonably. The state owned land acquired for this project is transferred from government. Therefore, compensations only are paid for the structures on land when the land is transferred.

11.4.4 Temporary building compensation policy

To alleviate the adverse impacts on displaced persons of this project, according to the World Bank Operational Policy of Involuntary Resettlement, the replacement cost of
temporary buildings should be compensated based on its structure. However, the land for temporary buildings will not be compensated. The compensation for affected infrastructures and structures on lands will be made by the project implementing agency to the owners. The owners will be responsible for restoration. If the restoration cost is paid from this project, the project implementing agency will be responsible for restoration.

11.5 Income and house restoration measures

The objectives of this resettlement plan are to make the displaced persons benefit from this project, to support the displaced persons to improve or at least restore their living standard, ability to earn income and production scales, to particularly pay attention to the needs of very poor persons who are affected by this project. In order to follow the World Bank Operational Policy of Involuntary Resettlement OP4.12 and relevant policies and regulations of China and to realize the objectives of this resettlement, the project implementing agency specifically stipulate the following income restoration plan. Based on site investigation and listening to the requirements of affected persons and opinions of village committees, the project implementing agency will make compensations to affected persons in terms of paying land compensation and relocation grants and including the labor force from land acquisition into the social security system of small towns according to the land laws and relevant. Moreover, the project implementing agency will positively arrange affected fish pond contractors and vegetable farmers by different measures. With the principle of voluntary, the project implementing agency will offer appropriate arrangements on affected persons cooperating with village committees to ensure that they have enough income after land acquisition, to ensure their future life will not be affected or at least will not be lower than their original life.

Some villager’s houses will be demolished for Nanhui North pumping station which is located in Qigan Village, Zhoupu Town, Nanhui District. Total 26 households will be relocated due to this project. The houses of affected villagers mainly are brick-concrete structure and brick-wood structure. There are two story brick-concrete houses and brick-wood single story houses. Some two story brick-concrete houses are newly built, of
which the supporting facilities are simple. Brick-wood single story houses are relatively rough, of which the supporting facilities are bad.

There are two resettlement options. The first is relocation compensation with market price (i.e. cash compensation). The second is relocation with property right house in a different location (i.e. physical housing distribution). Complete property right houses in two or three different locations will be provided for the displaced persons to choose. The displaced persons will distribute new houses according to standards after they get the corresponding compensation for their original houses. If the displaced persons choose to receive compensation with market price, the displaced persons can buy houses themselves after they receive the compensation cash. In general, the displaced persons are free to choose not only different compensation options, but also the location and size of house. (According to the area grading subsidy rates of different locations, the displaced person only needs to pay the price difference if exceeding area grading subsidy rate; the displaced person can get corresponding compensation if below the area grading subsidy rate)

Two resettlement locations are selected by consultation with displaced persons and combine with general situations of all displaced persons. The first resettlement location is Fanrong Resettlement Residential community which is located in the east-south area of Zhoupu Town government, north of Fanrong East Road, south of Zhujiagang Road, west of Zhoudong Road. The other is a resettlement residential community which is close to Shanghai Medical Park of Zhoupu Town, west of A3 Road, south of Zhouzhu Road, east of Zhoudong South Road. (So called Four High Resettlement Community with low and medium price is a community with high levels of planning, design, construction and management.)

11.6 Organization

Shanghai World Bank Loan Project Management Office (SH PMO) will coordinate with the Pudong New District PMO and Nanhui District PMO to obligate the project implementing agency to carry out the land acquisition, resettlement strictly. The project implementing agency takes the main responsibilities of resettlement consulting, implementation and dispense of deserved interests in time. Relevant towns and villages will
provide assistance.

11.7 Vulnerable group

Vulnerable group is indentified by census. The project implementing agency will work with local government and relevant poverty relief organizations together to take feasible and effective measures to help vulnerable group in the aspects of daily life and working, such as psychological counseling, providing employment instruction for unemployed persons or career trainings. Through these positive and effective measures, the vulnerable group will get through the difficulties during relocation.

There are two affected households in the acquired land area of Nanhui North pumping station whose monthly income per person is below 290 RMB. The project implementing agency will provide minimum living security to the low income households through Shanghai Nanhui District Zhoupu Town Poor Family Social Security Center to ensure that their basic life will not be affected. There are three seniors living alone and one household has handicapped person. These people will have trouble in moving and they are vulnerable for self-servicing and living. The project implementing agency will give them to the ground floor especially the household with handicapped person. Shanghai currently has social security institutions at residential committee, street, district and county, and city levels which provide living security for poor families. After the displaced persons are relocated in the new places, the project implementing agencies will find out the specific social security institutions for them. At the same time, the project implementing agency will provide employment trainings and employment opportunities to the persons who are able to work through all levels of social security institutions and further improve their life.

11.8 Dispute settle mechanism

The persons who lose their house will have an opportunity to select house site. The persons who lose agriculture land will have an opportunity to select an appropriate income alternative. All villagers have to the right to decide how to use the compensation to collectives. The affected persons can firstly raise disputes to village committee or township
resettlement office orally or in writing. If the complain is not settled in two weeks, they can raise their complains for administrative reconsideration to county resettlement office in one month. If the complain is not settled in two weeks, the leading group office of the Shanghai World Bank Loan Project will coordinate to settle the disputes.

11.9 Monitoring and Evaluation

The details of internal and external monitoring are included in RAP. SH PMO will recruit an independent monitoring institute to carry out external monitoring. This monitoring institute will determine if the affected persons receive the deserved interests in time and if they completely restore their living, income and life standard. The monitoring institute will also carry out a baseline investigation before resettlement, carry out investigation every half a year during resettlement, carry out follow up investigation in two years after resettlement completes, and select representative samples (displaced households/villages).

SH PMO is preparing a quarterly reporting system to report the World Bank about the progress of land acquisition and resettlement. SH PMO will also provide the World Bank with independent monitoring report once or twice during resettlement implementation.

11.10 Financing and implementation plan

Part of investment for this project is applying for the World Bank loan. The rest will be self financed. According to the compensation policies and standards listed in RAP, Shanghai Qingcaosha Investment, Construction and Development Ltd. will entrust relevant resettlement departments to sign compensation agreements with all collaborating units, enterprises and public service institutions and to pay for the compensation based on the agreements and progress of project implementation.

The period of resettlement and construction of Shanghai Qingcaosha Water Source Raw Water Project is from August 2007 to March 2010 including Nanhui Conveyor projects and other relevant constructions.
12 Summary of Environment Management Plan

12.1 System of environment management

The Ministry of Environmental Protection (MEP) as the main body for administrative management and law execution of environmental protection will supervise the implementation of this project. The EIA report will be approved by Shanghai Environmental Protection Bureau (EPB) according to provisions of supervisor privilege of the Law of Environmental Protection of the People’s Republic of China and the Regulations on the Administration of Construction Project Environmental Protection. Being the environment administrative agency of this project, the main responsibilities of Shanghai EPB are to bring up requirements on environmental protection based on EIA report, to coordinate management of environmental protection among different agencies, and to organize the check and acceptance of environmental protection facilities. Under the organization framework, SH PMO is responsible for management of project implementation under the leadership of Shanghai Municipal Government (SMG). In order to ensure smooth implementation of project environmental management activities, the project office, the project implementing agency, contractors or operators shall recruit several fulltime or part time environmental management staff to carry out EMP. SH PMO is responsible for project planning and design, supervision of environmental protection, and technical trainings on environmental management staff in Shanghai. The district PMO and district EPBs are mainly responsible for executing project implementation plan, implementing technical standards of this project, and supervising daily environmental management. The city (district) environmental monitoring station entrusted by the project implementing agency is responsible for monitoring on environment quality in project area during construction and operation. The environmental supervision engineer entrusted by the project implementing agency is responsible for environment supervision during construction.

The project implementing agency is planning to recruit special environmental management staff to be responsible for the environmental management of different phases, to carry out and implement laws and regulations of environmental protect and EMP, to inspect
implementation of environmental protection measures, to promote advanced technology and experience of environmental protection, to organize trainings on environmental technologies for relevant staff, and to improve personnel qualifications. The scopes of environmental management during construction and operation are different. One is temporary, the other is permanent. Therefore the corresponding organizations for construction and operation are separate and different. The organization for construction will be cancelled after construction completed. Then the organization for operation will start playing its functions. However, the two organizations may cross for a period of time based on specific situations. The organization chart is showed in Figure 12.1-1.

Project environmental protection supervision plan is seen in Table 12.1-1.

**Table 12.1-1 Supervision plan of environmental protection of the project**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Institutes</th>
<th>Contents of supervision</th>
<th>Purposes of supervision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility study</td>
<td>WB</td>
<td>1. Review EIA report&lt;br&gt;2. Review EMP</td>
<td>1. Ensure EA contents are comprehensive, specific topics are well set, and key points are clear&lt;br&gt;2. Ensure the significant potential issues of this Project have been discussed&lt;br&gt;3. Ensure a feasible implementation plan for mitigation measures</td>
</tr>
<tr>
<td>Design and construction</td>
<td>MEP&lt;br&gt;SMG&lt;br&gt;District governments&lt;br&gt;City (district) EPB&lt;br&gt;City (district) Cultural Relics Bureau</td>
<td>1. Review preliminary design of environmental protection and EMP&lt;br&gt;2. Inspect restorations of temporarily occupied land for construction, vegetation, and environment&lt;br&gt;3. Inspect implementation of dust suspension and noise control and determine construction time&lt;br&gt;4. Inspect air pollutant discharge&lt;br&gt;5. Inspect sewerage and waste engine oil discharge and treatment on construction site&lt;br&gt;6. Restoration and treatment of earth taking and dumping sites&lt;br&gt;7. Inspect bottom mud disposal&lt;br&gt;8. Inspect if antique antiquities underground exist</td>
<td>1. Seriously carry out the Three Synchronies&lt;br&gt;2. Ensure all sites meet environmental protection requirements&lt;br&gt;3. Reduce the impacts on ambient environment from construction, enforce relevant laws and regulations of environmental protection&lt;br&gt;4. Prevent inland river from pollution&lt;br&gt;5. Prevent the scenic and land source from damage, avoid soil erosion&lt;br&gt;6. Ensure bottom mud is disposed appropriately&lt;br&gt;7. Protect antique antiquities from damage</td>
</tr>
</tbody>
</table>
| Operation                          | City (district) EPB | 1. Inspect EMP implementation during operation  
2. Inspect monitoring plan implementation  
3. Check sensitive point (any unanticipated environment issues might happen) which needs further environmental protection measures  
4. Inspect if environment quality of sensitive points meets corresponding quality standards  
5. Enhance supervision, prevent abrupt accidents, prepare emergency responsive plan, eliminate dangers in time once accident happens | 1. Carry out EMP  
2. Carry out monitoring plan  
3. Protect environment seriously  
4. Enhance environment management and protect human health seriously  
5. Ensure pollutants discharge meet the discharge standards |
|-----------------------------------|---------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
**Figure 12.1-1 Organization chart of environmental protection of the project**

### 12.1.1 Environmental protection organization during construction

#### 12.1.1.1 Organization

Technology: on the technical aspect of environmental management, the city project
office will recruit 3 or 4 experts to assist the project management.

Project office: the city project office will appoint a project environmental manager to supervise the implementation of EMP, who will be responsible for all issues related to environment of the World Bank project. The district project office sets one environmental manager to be in charge of the implementation of EMP in its jurisdiction and coordination with the city project office on environmental issues.

Contractors: contractors will appoint one or two environment coordinators to be responsible for supervision of EMP implementation, liaison with residents to solve environmental issues, and communication with the project office and environmental supervision institutions.

Operator: operator will set up an environmental management division consisting of two environmental protection professionals. They will be responsible for environmental management during operation period with the help of other employees. The company will equip them with internet, telephone, etc. to keep in touch with environmental supervision institutions.

Environmental supervision engineer (ESE): the project implementing agency will recruit an environmental supervision engineer for this Project who will be responsible for environmental management supervision on construction site during construction.

Environmental Monitoring Agency: entrusted by contractor or operator to monitor their environmental activities and provide environmental monitoring report.

12.1.2 Positions and responsibilities

A. Environmental specialist

Environmental specialist will provide technical supports to the project office. He will ensure all obligatory requirements to be satisfied at the beginning of the projects, and make sure EMP to be effectively carried out in accordance with requirements of relevant laws and regulations and the World Bank safeguard polices.

(1) Provide necessary trainings for the environmental management managers of project office, environmental management persons of contractor and operator, and ESE.
(2) Provide expert consulting service to the project office, the project implementing agency, contractors, and operators.

(3) Assist environmental management persons of enterprise to organize monitoring activities.

B. Project office: environmental manager

The SH PMO, Pudong PMO and Nanhui PMO each will appoint an environmental manager. The environmental manager in SH PMO is an expert to report to the World Bank and supervise the environment of this Project. Environmental managers in district PMOs are responsible for supervising local project and reporting to SH PMO. Environmental managers will assist the land administrative institution, the resettlement institution to ensure the implementation of this Project. The main responsibilities include:

(1) With the assistant’s support, provide trainings to environmental management directors (EMD);

(2) With the assistant’s support, prepare monitoring plan;

(3) Communicate with EMDs and construction workers. The ways are as follows:
- Submit monthly monitoring report to the project office and the World Bank
- Submit special report on non-compliance if the second or third cases occur.
- Communicate with contractor and operator to come up a final plan if a solution is available.
- Come up a corrective measure jointly with environmental management engineers and EMDs if a non-compliance appears

(4) Attend meeting jointly attended by project office environmental engineer, EMDs, contractors, and operators.

(5) Coordinate with environmental specialists to report to the World Bank

C. Project implementing agency: Specific environmental staff

The project implementing agency will appoint a specific environmental staff to be
responsible for environmental monitoring and reporting the city (district) project offices and government agencies about the implementation of environmental protection carried out by contractor and operator. The main responsibilities include:

At the project beginning phase, with technical assistant’s support, prepare detailed rules of environmental protection, monitoring and environmental protection procedures for contractors and operators, and collect outlines for project management and designers.

(1) Consign the monitoring items for which special equipment are required, such as air, acoustic, etc.

(2) Provide the project office with monthly monitoring report, implementation progress and remediation measures, etc. Hold a meeting every month with the project office to report monitoring status and compliance of this project.

(3) Select specialists or consultants from universities or institutions to consult trainings methods and technology. Determine according to needs of the reality of the project.

(4) Organize special studies or common investigations on special architectural requirements or obligatory alterations needed by this project.

(5) Report solutions of noncompliance situations and measures for emergencies to the project office environment manager and environment monitoring agencies.

(6) Disclose information though meeting and local media

D. Environmental supervision engineer (ESE)

Environmental supervision engineer mainly takes charge of supervising engineering construction on site and other activities, such as land occupation, resettlement, etc., ensuring the activities accord with the requirements, investments, and objectives of environmental protection, and coordinating with land administrative department, resettlement department, and environment monitoring department on site. The main responsibilities of ESE include:

(1) Ensure all permits, requirements, and EMP of this project to be in place before construction.

(2) Verify that all members of contractors and operators to carry out environmental protection measures according to provisions of contact.
(3) Prepare a standard qualification based table of monthly remuneration of contractors and operators according to the efforts and contributions that they make for environmental protection.

(4) Compile consolidated monitoring report of environmental protection.

(5) Identify the situations which need a special study or activity. Communicate with EMC and implement special measures regularly and effectively.

(6) Communicate with construction persons to help them understand environmental requirements on sites. Give suggestions on remediation measures and provide remediation measures for noncompliance of original intention of the project. Provide special formal guidelines to contractors and operators according to requirements.

(7) Communicate with contractors, operators, and consultants to collect other views on some special issues. Through communications, report the problems during implementation to construction supervision engineers (CSE) quickly and help to solve the problems. If the project has potential impacts on sensitive objectives or the project implementation is seriously unconformable with design, then he should apply for stop.

(8) Communicate with CSE and construction workers; prepare regular monitoring weekly report, record noncompliance and suggest remediation measures with project designer if necessary.

(9) Contractor: environmental manager coordinator (EMC)

Implement environmental protection according to bidding documents, contract, EIA report and design of environmental protect during construction. Accept the guidance and supervision of specific environmental staff of implementing agency, environmental supervision engineer and administrative governmental agencies, receive technical support of specialist.

12.1.3 Environmental protection organization during operation

During operation, the World Bank offices are responsible for supervision and initial
evaluation on investment.

Project operator will set up an environment management department to be responsible for EMP implementation. The main responsibilities of environment management department include:

1. Manage the execution of environmental protection measures.
2. Coordinate with environmental monitoring agency and residents to settle environmental issues.
3. Entrust the city/district environmental monitoring stations to carry out regular monitoring on three discharges and regional environment quality.
4. Deal with environmental emergencies when environment accident occurs.
5. Report information of environmental management of the company to Shanghai EPB and project office.
6. Record and file up the documents of environmental management of the company.

12.2 Implementation of EMP

12.2.1 Detailed activities of EMP implementation

This project has impacts on environment during construction and operation. Aiming at different characters of environment impacts during construction and operation, the project will take corresponding measures to minimize the impacts to an acceptable degree. The project also prepared an environmental management and monitoring procedures in order to ensure the measures of environmental protection can effectively play functions. SH PMO will follow and report the monitoring of these environment measures, as well as play its administrative functions. General environmental protection measures and responsibilities of relevant units are introduced in this chapter. The project office will follow and report the implementation of environment measures. Table 12.2-1 listed the activities of implementation and monitoring of environment measures.
## Table 12.2-1 Detailed activities of environment management organizations

<table>
<thead>
<tr>
<th>Plan</th>
<th>Activity</th>
<th>Responsibilities</th>
<th>Implementation</th>
<th>Supervision</th>
<th>Resource</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Prophase of construction</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Responsibilities</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>Plan</strong>  <strong>Activity</strong> <strong>Implementation</strong> <strong>Supervision</strong> <strong>Resource</strong> <strong>Remarks</strong></td>
</tr>
<tr>
<td>One year</td>
<td>Set up environmental management team and recruit team members</td>
<td>Company (Qingcaoshasha Company)</td>
<td>PMO</td>
<td>PMO/company</td>
<td>PMO/company</td>
<td>Recruit members, select office, purchase transportation facility, finance for operation cost</td>
</tr>
<tr>
<td>One year</td>
<td>Every CSE choose or appoints one ESE</td>
<td>EMD (Environmental Management Director)</td>
<td>CSE</td>
<td>CSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One year</td>
<td>Every CSE implements environmental supervision trainings</td>
<td>EMD</td>
<td>CSE</td>
<td>CSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One year</td>
<td>Prepare and implement trainings for environmental managers of EMD and PMD</td>
<td>Technical assistance(TA)</td>
<td>PMO</td>
<td>PMO/company</td>
<td>PMO/company</td>
<td>Make global trainings for part of the project</td>
</tr>
<tr>
<td>One year</td>
<td>Prepare working plans for EMD and ESE</td>
<td>TA</td>
<td>PMO/company</td>
<td>PMO/company</td>
<td></td>
<td>Including clearly define roles and responsibilities of EMD and ESE</td>
</tr>
<tr>
<td>One year</td>
<td>Prepare working documents: standard, on-site inspection table, reporting format for different activities</td>
<td>EMD</td>
<td>PMO</td>
<td>PMO/company</td>
<td></td>
<td>Make adjustment on original document format if necessary when use the document on site</td>
</tr>
<tr>
<td>One year</td>
<td>Prepare detailed procedures of non-compliance discovered by supervision and reporting for EMD</td>
<td>TA</td>
<td>PMO</td>
<td>PMO/company</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One year</td>
<td>Make appropriate assessment on environmental factors to contract</td>
<td>TA helps EMD</td>
<td>PMO/WB</td>
<td>PMO/company</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One year</td>
<td>Prepare consign contract on monitoring activities (special equipment is required, for example, water and air quality monitoring) for EMD</td>
<td>EMD</td>
<td>Company</td>
<td>PMO/company</td>
<td></td>
<td>Make sure implementation and working plan is accordance with the land utilization</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Construction period</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>Plan</strong>  <strong>Activities</strong> <strong>Responsibilities</strong> <strong>Implementation</strong> <strong>Supervision</strong> <strong>Resource</strong> <strong>Remarks</strong></td>
</tr>
<tr>
<td>One year (0-3 month)</td>
<td>ESE discusses with EMD about project adjustment and improvement</td>
<td>EMD/ESE</td>
<td>PMO</td>
<td></td>
<td></td>
<td>Adjust the process in order to improve efficiency</td>
</tr>
<tr>
<td>One year (0-3 month)</td>
<td>Each contractor shall appoint an environmental professional to work with ESE and EMD</td>
<td>Contractor</td>
<td>PMO</td>
<td>Contractor</td>
<td></td>
<td>With admission of the company</td>
</tr>
<tr>
<td>One year</td>
<td>Each implementing agency and operator shall organize trainings on</td>
<td>Contractor</td>
<td>EMD/ESE</td>
<td>Contractor</td>
<td></td>
<td>Introduce site management and environmental problems by EMD</td>
</tr>
</tbody>
</table>
12.2.2 Requirements of environmental management in contract

During construction, the contractor will play a key role in environmental management, pollution control and implementation of prevention and mitigation measures etc. Therefore, the contractor is required to meet the following requirements:

(1) Contractors should be capable of making sure that the EMP be carried out effectively.

(2) Contractors and CSE are required to be trained on environmental protection and management before construction.

(3) The environmental impact mitigation measures mentioned above should be included in the bidding documents submitted by contractor and finally included in the contract as the requirements for contractor.

(4) Contractor is required to monitor his environmental activities and submit records of environmental performance every day or weekly. The project office and construction supervision team will inspect and review these records.

(5) Contractor should designate at least one full-time staff, who should be trained according training plan so that they are able to do their work.
(6) During construction, contractors must communicate and negotiate with local residents in project area, and establish a board on each construction site, inform people of the specific activities and time of construction, while providing contactor’s name and telephone, so as to make people appeal or give suggestion conveniently.

(7) Contractor should preserve a deposit for completion of environmental management according to annual budget and include the deposit in contract price.

12.2.3 Information communication and solutions of non-compliance

Information about environment monitoring needs be open to the on-site environment supervision engineers, enterprise environment management directors and the project office. In order to focus attention on the most important issues, the project’s non-compliance situations are divided into 3 levels.

Level 1: Definition: the non-compliance situation doesn’t match the original requirements, but it will not have a short-time impact on the important resources. It may turn into level 2 if level 1 happens several times without attention. Measures: it can be resolved through suitable cooperation and regular communication. For example, discuss with contractors and operators, the remedy measures can be implemented quickly. The typical formal way is ESE report to company’s EMD and on-site CSE through weekly meetings.

Level 2: Definition: the non-compliance situation hasn’t brought obvious damage or irreversible impact on sensitive and important resources. But it must be remedied at once to prevent the above influences. It may turn into level 3 if level 2 happens several times without attention. Measures: the enterprise EMD should report to the environment manager of the project office and on-site construction manager on the date when level 2 situation is discovered. Reach an agreement on the remedy measures ASAP. Usually, the remedy measures should be determined within one week.

Level 3: Definition: this level of non-compliance situation includes damages on specially focused sensitive targets or foreseeable and immediate damages. Internationally prohibited special activities are classified in Level 3. Measures: once the situation is discovered, the EMD should immediately report to the environment manager of the project
office and on-site construction manager and reach an agreement on the remediation measures ASAP. Usually, the remedy should be determined within 3 days unless longer time needed under special conditions. If necessary, the enterprise EMD can ask construction manager to stop some special projects for resource-protections before implementing remediation measures.

12.2.4 Training- necessary capacity building and means building

12.2.4.1 Training requirements

Main target audiences of environment capacity building are environment management persons and environmental supervision persons. The training for them is a part of the technical support of this project. Contractors and workers will also receive training during the implement process. Before project construction, all contractors, operators and construction supervision persons are required to take the compulsory trainings of environment, health and safety.

12.2.4.2 Training contents

(1) Environmental management persons and EMD

The trainings for environmental manager of the city and district project offices, EMCs of project and ESEs will be organized by SH PMO. The environmental specialists will conduct the trainings. Table 6.4-1 listed the training contents.

<table>
<thead>
<tr>
<th>Areas</th>
<th>Contents of training</th>
<th>Duration</th>
</tr>
</thead>
</table>
| Operational capacity (environmental manager and ESE) | Browse and recognize the functions of hot keys of Word, Excel and PowerPoint  
  Study the World Bank Safeguards policy  
  Study detailed rules of environmental protection prescribed for contractors. Every detailed specification of environmental protection should have monitoring plans  
  Study the environmental impacts of this project and environmental items need monitoring. | 4 days   |
<p>| Compliance monitoring (environmental manager and ESE) | Trainings on on-site supervision process, including organization, communication, roles and responsibilities, reporting, and standardized observation procedures. | 1 day    |
| Emergency                                   | Knowledge of on-site dangerous materials                                                                               | 1/2 day  |</p>
<table>
<thead>
<tr>
<th>Responsive Team (Environmental Manager and ESE)</th>
<th>Potential Leakage and Spill Impacts on Environment and Human of Leakage and Spill Emergency Responsive Process Including Priority Response Location and Use of Responsive Equipment Communication and Reporting Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Aid and Medical Rescue (Environmental Manager and ESE)</td>
<td>Procedures of Searching Medical Rescue Under Emergency Condition and Non-Emergency Condition, and Other Relevant Methods of Searching Medical Rescue (Long Distance Call, Medical Consulting)</td>
</tr>
<tr>
<td>Declaration Procedures of Health and Safety Inspection (EMD and ESE)</td>
<td>Health and Safety Problems Health and Safety Requirements How to Implement Health and Safety Inspection Process of Reporting and Solving Problems</td>
</tr>
<tr>
<td>Monitoring and Analysis on Water Quality, Air Quality and Noise (EMD and ESE)</td>
<td>Use of the Equipment Including Standards, Testing, Methods, Sample Transfer, Data Quality Control Monitoring and Reporting Requirements</td>
</tr>
</tbody>
</table>

(2) Contractor and construction workers

The trainings can be carried out by environmental specialist and enterprise EMD through the city (district) project offices and the project implementing agency in the location of this project before project construction starts. The detailed contents and duration are listed in Table 12.2-3.
### Table 12.2-3 Trainings for construction persons

<table>
<thead>
<tr>
<th>Model</th>
<th>Contents of training</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>General knowledge of environment</td>
<td>Introduce factors of environment impact and protection measures; Introduce the sensitive areas and problems of the construction site and around areas of the construction site; Roles and responsibilities of the environment management &amp; design engineer, ESE and CSE, and the key points of reporting of environment problems; Waste management in construction camp and site. Pollution control measures in construction site. Cultural heritage issues. Penalty for the violation of laws and regulations</td>
<td>Half day on every construction site</td>
</tr>
<tr>
<td>for construction workers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General health and safety for</td>
<td>The ways of spreading and protecting, prevent HIV/AIDS and STD. Prohibition of liquor and drugs. Procedures of searching medical rescue under emergency condition and non-emergency condition, and other relevant methods of searching medical rescue (such as STD test and advisory). General knowledge of health and safety including some basic process: traffic safety, electricity safety, explosion, fires, hazardous waste management. Personal protection equipment. Penalty for the violation of laws and regulations.</td>
<td>Half day on every construction site</td>
</tr>
<tr>
<td>construction workers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(3) Operators

### Table 12.2-4 Training for environmental management persons of operators

<table>
<thead>
<tr>
<th>Audience</th>
<th>Contents of training</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental management persons</td>
<td>World Bank project management procedures. Environment information publishing, open, communication and reporting mechanism. Environment emergency response. Health and safety inspection and declaration process. Study tour on advanced technologies and environmental management.</td>
<td>1 day study</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental management persons</td>
<td>Use of the equipment including standards, testing, methods, sample transfer, data quality control. Monitoring and reporting requirements. Environmental emergency response: potential leakage and spill, impacts on environment and human of leakage and spill, emergency responsive process including priority response, location and use of responsive equipment.</td>
<td>2 day study</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12.2.4.3 Budget for trainings

Table 12.2-5 listed the budget for project capacity building.

**Table 12.2-5 Training plan for project environmental protection persons**

<table>
<thead>
<tr>
<th>Period</th>
<th>Type</th>
<th>Number of persons (person)</th>
<th>Time</th>
<th>Budget (10,000RMB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Environmental manager</td>
<td>2</td>
<td>2008</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>EMC</td>
<td>4</td>
<td>2008</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>ESE</td>
<td>4</td>
<td>Before construction</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Construction workers</td>
<td>All worker of contractors</td>
<td>Before construction</td>
<td>6</td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Training for environmental management professionals of operator</td>
<td>2</td>
<td>Before operation</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Training for environmental emergency responsive person of operator</td>
<td>4</td>
<td>Before operation</td>
<td>4</td>
</tr>
<tr>
<td>Operation</td>
<td>Training on skills of environment persons of operator</td>
<td>20</td>
<td>Before operation</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>36</td>
</tr>
</tbody>
</table>

12.3 Environmental monitoring plan

12.3.1 Purpose of monitoring

Environment monitoring consisting of project construction period and operation period aims to comprehensively understand the dynamic status of pollutions of the project in time, understand the change of environment quality of project area, coverage of influence and the environment quality during the operation, report to the administrative department, and provide scientific foundations to environment management of the project.

12.3.2 Environmental monitoring organizations

Environmental monitoring during construction and operation will be entrusted to the environmental monitoring station of the city by contractors and operators. The environmental monitoring station should be a certificated unit of national environmental quality monitoring with complete equipment and strong technologies. According to the environmental impact forecast results, select those locations where pollution may be obvious as the monitoring points, track the pollution during construction period and operation period. The main
monitoring items include noise, air quality, and surface water quality. The monitoring factors will be determined based on pollution characters. The monitoring methods adopt the relevant methods listed in the Standard of Environment Monitoring Technology which is issued by the MEP. The detailed key procedures in the construction sites and activities are listed in Table 12.3-1:

**Table 12.3-1 Monitoring during construction and operation**

<table>
<thead>
<tr>
<th>Plan</th>
<th>Activity</th>
<th>Responsibilities</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Implementation</td>
<td>Supervision</td>
</tr>
<tr>
<td><strong>Prophase of construction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One year</td>
<td>Set up environmental management team and recruit team members</td>
<td>Company</td>
<td>PMO</td>
</tr>
<tr>
<td>One year</td>
<td>Every CSE chooses or appoints one ESE</td>
<td>EMD (Environmental Management Director)</td>
<td>CSE</td>
</tr>
<tr>
<td>One year</td>
<td>Every CSE implements environmental supervision trainings</td>
<td>EMD</td>
<td>CSE</td>
</tr>
<tr>
<td>One year</td>
<td>Prepare and implement trainings for environmental managers of EMD and PMD</td>
<td>Technical assistance(TA)</td>
<td>PMO</td>
</tr>
<tr>
<td>One year</td>
<td>Prepare working plans for EMD and ESE</td>
<td>TA</td>
<td>PMO/company</td>
</tr>
<tr>
<td>One year</td>
<td>Prepare working documents: standard, on-site inspection table, reporting format for different activities</td>
<td>EMD</td>
<td>PMO</td>
</tr>
<tr>
<td>One year</td>
<td>Prepare detailed procedures of non-compliance discovered by supervision and reporting for EMD</td>
<td>TA</td>
<td>PMO</td>
</tr>
<tr>
<td>One year</td>
<td>Make appropriate assessment on environmental factors to contract</td>
<td>TA helps EMD</td>
<td>PMO/WB</td>
</tr>
<tr>
<td>One year</td>
<td>Prepare consign contract on monitoring activities (special equipment is required, for example, water and air quality monitoring) for EMD</td>
<td>EMD</td>
<td>Company</td>
</tr>
</tbody>
</table>

**Construction period**
<table>
<thead>
<tr>
<th>One year (0-3 month)</th>
<th>ESE discusses with EMD about project adjustment and improvement</th>
<th>EMD/ESE</th>
<th>PMO</th>
<th>Contractor</th>
<th>Adjust the process in order to improve efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>One year (0-3 month)</td>
<td>Each contractor shall appoint an environmental professional to work with ESE and EMD</td>
<td>Contractor</td>
<td>PMO</td>
<td>Contractor</td>
<td>With admission of the company</td>
</tr>
<tr>
<td>One year</td>
<td>Each implementing agency and operator shall organize trainings on environmental common sense and measures for the employees</td>
<td>Contractor</td>
<td>EMD/ESE</td>
<td>Contractor</td>
<td>Introduce site management and environmental problems by EMD</td>
</tr>
<tr>
<td>One year</td>
<td>Organize public communication and provide supporting documents</td>
<td>TA helps EMD</td>
<td>Company</td>
<td>PMO/company</td>
<td>Establish rules and procedures of communication, prepare a safety notices of on-site and out-site</td>
</tr>
<tr>
<td>One year</td>
<td>Standardize the cooperation with other provinces and cities</td>
<td>EMD</td>
<td>Company</td>
<td>PMO/company</td>
<td>Cooperate with all projects</td>
</tr>
<tr>
<td>Operation period</td>
<td>Implement environmental monitoring during construction</td>
<td>Environmental monitoring station</td>
<td>EMD/ESE</td>
<td>Contractor</td>
<td></td>
</tr>
<tr>
<td>Operation period</td>
<td>Implement environmental monitoring during operation</td>
<td>Environmental monitoring station</td>
<td>Shanghai EPB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation period</td>
<td>Environmental monitoring during operation</td>
<td>Environmental monitoring station</td>
<td>Shanghai EPB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation period</td>
<td>Confirm solid waste generated by the project are centralized and disposed safely</td>
<td>Project implementing agency, environment and sanitation department</td>
<td>Shanghai EPB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12.3.3 Detailed requirements on environmental monitoring

12.3.3.1 Atmosphere monitoring during construction

(1) Locations of monitoring points

Set one monitoring point at construction site of Nanhui North Pumping Station. Set one monitoring point at each 25 working shafts close to residential sensitive points along pipeline. The total number is 26.

(2) Items of monitoring

TSP

(3) Time and frequency of monitoring
At pumping station construction site, monitoring will be conducted one term per quarter, continuous two days per term and three times per day. Samples will be taken for one hour continuously or four samples will be taken at same intervals in one hour. At every sensitive point, monitoring will be conducted two terms during construction of working shaft (in general it takes 3 months to construct a working shaft), continuous two days per term and three times per day. Samples will be taken for one hour continuously or four samples will be taken at same intervals in one hour.

12.3.3.2 Noise monitoring during construction

(1) Locations of monitoring points
Set one monitoring point each at east and north boundaries of Nanhui North Pumping Station construction site. Set one monitoring point each at 25 residential sensitive points along pipeline. The total number is 27.

(2) Items of monitoring
Equivalent continuous A sound level, LAeq.

(3) Time and frequency of monitoring
Monitoring will be conducted one term every month during construction of pumping station and working shafts, one day per term, twice for daytime and twice for night. Period of Sampling for each time should not be less than 20 minutes.

12.3.3.3 Wastewater monitoring during construction

(1) Locations of monitoring points
Set one water quality monitoring station each at pumping station construction site and outfall of construction wastewater treatment facilities. The total number is 87.

(2) Items of monitoring
SS, oils

(3) Time and frequency of monitoring
Monitoring will be conducted one term per quarter during construction period, two days
per term, and three times per day.

<table>
<thead>
<tr>
<th>Monitoring period</th>
<th>Environmental factors</th>
<th>Location of monitoring points (numbers)</th>
<th>Monitoring items</th>
<th>Monitoring frequency</th>
<th>Unit price (RMB)</th>
<th>Annual cost (RMB/year)</th>
<th>Phase cost (RMB)</th>
<th>Total (RMB)</th>
<th>Monitoring institution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 at construction site of Nanhui North pumping station;</td>
<td>TSP</td>
<td>1 term/quarter, 2 days/term, 3 times/day</td>
<td>60/sample</td>
<td>1,440</td>
<td>2,160</td>
<td>20,160</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 sensitive points along pipeline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ambient air</td>
<td>East and north boundary of Nanhui North Pumping Station</td>
<td>Leq dB (A)</td>
<td>1 term/month, 1 day/term; twice at daytime and twice night</td>
<td>50/point/time</td>
<td>4,800</td>
<td>7,200</td>
<td>22,200</td>
<td>City (district) environmental monitoring stations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 sensitive points along pipeline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Noise</td>
<td>Outfall of waste water treatment facility of pumping station construction site</td>
<td>SS, oil</td>
<td>1 term/quarter, 2 days/term, 3 times/day</td>
<td>85/sample</td>
<td>2,040</td>
<td>3,060</td>
<td>46,920</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wastewater from construction</td>
<td>Outfalls of 86 construction wastewater treatment facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operation (3 years)</td>
<td>Noise</td>
<td>Leq dB(A)</td>
<td>1 term/quarter, 2 days/term, 2 times at daytime and 2 times at night</td>
<td>50/point/time</td>
<td>6,400</td>
<td>19,200</td>
<td>19,200</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>108,480</td>
<td></td>
</tr>
</tbody>
</table>
12.3.3.4 Noise monitoring during operation

(1) Locations of monitoring points

Set one monitoring point at one meter away from four boundaries of Nanhui North pumping station. The total number is 4.

(2) Items of monitoring items

Equivalent continuous A sound level, $L_{Aeq}$.

(3) Time and frequency of monitoring

Monitoring will be conducted one term per quarter during operation period, two days per term, and twice for daytime and twice for night. Period of Sampling for each time should not be less than 20 minutes.

Considering the actual situation of this Project and referring to the Adjustment Notice of Part Environmental Protection Administrative Items and Standards of Charge (Shanghai Price Bureau, December 2005), detailed environmental monitoring plan and budget of the Project is listed in Table 12.3-2.

Table 12.3-2 Environmental monitoring plan and budget

12.4 Cost estimation of environmental management and funding resources

12.4.1 Budget allocation

The implement of the EMP measures involved in many units, thus the sources of funding are different. And most environment protection activities are engineering measures. Therefore, the fund should be included into engineering cost and offered by project contractors and operators. The costs should be nailed down and listed in their tendering documents. The fund of EMP is mainly used in the environment management during construction period and operation period including environment monitoring, environment supervision, personnel training and operation of environment management organizations, as well as some the risk prevention cost. Activities of EMC will be covered by the international
project management fee of SH PMO, air and noise monitoring. Monitoring and supervision activities of ESE are a part of activities of construction and supervision. Local monitoring stations are entrusted by the project implementing agency to monitor the water, air, and noise and are paid by the project implementing agency. If the regular monitoring of the local environmental protection department overlaps with this project, the data of the regular monitoring can be used.

12.4.2 Source of funding and EMP budget

Table 12.4-1 listed the EMP expenses during construction and operation.

<table>
<thead>
<tr>
<th>Table 12.4-1 Summary of EMP budget of this project</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average annual cost during construction</strong></td>
</tr>
<tr>
<td>(10,000RMB)</td>
</tr>
<tr>
<td>PMU(project management unit) operation</td>
</tr>
<tr>
<td>Salary</td>
</tr>
<tr>
<td>Office expense</td>
</tr>
<tr>
<td>Transportation cost</td>
</tr>
<tr>
<td>Environmental monitoring</td>
</tr>
<tr>
<td>Environmental supervision</td>
</tr>
<tr>
<td>Duration Of construction</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Cost during operation</td>
</tr>
<tr>
<td>Salary</td>
</tr>
<tr>
<td>Office expense</td>
</tr>
<tr>
<td>Transportation cost</td>
</tr>
<tr>
<td>Environmental supervision</td>
</tr>
<tr>
<td>PMU operation</td>
</tr>
<tr>
<td>3 year operation period</td>
</tr>
<tr>
<td>Cost</td>
</tr>
<tr>
<td>Environmental monitoring</td>
</tr>
<tr>
<td>Environmental supervision</td>
</tr>
<tr>
<td>Duration Of construction</td>
</tr>
<tr>
<td>Environmental supervision</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

According to the project implement term, annual budget must be guaranteed as for every construction period. A deposit should be included in the construction contract value (CCV) for completion of requested environment management of contractors and operators. Table 12.4-2 listed different deposit percentages of CCV of different activities.

<table>
<thead>
<tr>
<th>Table 12.4-2 Deposit percentage of CCV for environmental management</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Requirements</td>
</tr>
<tr>
<td>1 Environmental protection management</td>
</tr>
<tr>
<td>2 Labor organization and occupation health management</td>
</tr>
<tr>
<td>3 Public safety management</td>
</tr>
<tr>
<td>4 Social management</td>
</tr>
</tbody>
</table>
12.5 Information management of EMP

12.5.1 Information communication

Environmental management requires a necessary internal communication among different departments and positions of the project office, project implementing agencies, contractors and operators and also requires disclose relative information to outsiders (relevant stakeholders and public). The internal information communication can use many ways like meeting, internal newsletter, etc. A formal meeting should be held every month. All documents of information communication should be recorded and kept in archives. External information communication should be held once every year. The information communication with the cooperation units should be recorded and kept in archives.

12.5.2 Mechanism for recording

In order to guarantee effective implementation of environment management system, the organization shall establish a perfect recording system and keep following records:

(1) Requirements of laws and regulations
(2) Permits
(3) Environment factors and relevant impacts
(4) Training
(5) Inspection, check and maintenance activities
(6) Monitoring data
(7) Effectiveness of remediation and prevention measures
(8) Information of relevant parties
(9) Examination and verification
(10) Evaluation and appraisal

Moreover, it must make necessary controls on the above records including the recognition of the record, collection, catalogue, kept in archives, storage, management,
maintenance, inquire, storage life and disposition.

### 12.5.3 Reporting mechanism

Contractors, operators, monitoring units, ESE and project office should record and report to the relevant departments about the project process, the implementation of EMP, record of the environment quality monitoring in time, including the following six parts:

1. ESE of this project should record the implementation of EMP by month and submit weekly and monthly report to the project implementing agency and the city project office in time. The weekly and monthly report should include implementation of environmental protection measures, progress of environmental monitoring, monitoring data, and etc.
2. Contractors and operators should make detailed record on progress of the project and the implementation of EMP by quarter, report the project office in time, and copy the quarterly report to Shanghai EPB.
3. Monitoring units shall submit monitoring report to contractors (operators) and ESE in time after complete their assignments.
4. The city project office shall make a copy of project progress reports to Shanghai EPB. The project progress reports (monthly, quarterly, and annual) should include the information of EMP implementation, such as implementation progress and effectiveness of EMP, especially environmental monitoring results.
5. ESE and the project office shall inform the local environmental protection administrative department or up level government department if necessary if non-compliance of environmental protection happens.
6. EMP implementation report shall be finished and submitted to the World Bank before March 31 of the following year.

EMP implementation report should include:

(a) The implementation of training plan

(b) The process of the project, such as the construction of pumping station, progress
of pipe-jacking, and green land restoration, etc.

(c) The implementation of environmental protection measures, environmental monitoring, and main monitoring results

(d) Record the main content of complain, the solutions and satisfaction degree if there are complains.

(e) The implementation plan of EMP for the next year
13 Conclusions of Environmental Assessment

The following conclusions can be made through this environmental impact assessment:

(1) Nanhui conveyor project is a part of water main in inland of Qingcaosha Water Source Raw Water project and is located at the downstream of water main of Jinhai, Chuansha and Nanhui direction. One booster pumping station will be built. The total length of the transmission route is about 45.7 km and the total length of pipeline is about 88.4 km. The capacity of water supply is 1.28 million m$^3$/day. The service area will cover Chuansha WTP in Pudong New District, Nanhui District, and all WTPs in Lingang New Town.

This project will deliver raw water from Yangtze River to Pudong New District and Nanhui District by constructing new booster pumping station and water transmission pipelines, which will greatly improve the drinking water quality for residents (farmers), increase the percentage of drinking hygiene water, and help to improve the public health of local residents (farmer) in the project area. Secondly, increase of water supply capacity will help to improve investment environment and create a sound environment for industrial and agriculture development in the project area. Moreover, this project will bring some indirect benefits, such as acceleration of urbanization, optimization of production structures and urban planning layout, and improvement of citizen diathesis. In general, implementation of this project has fundamental significances of many aspects in terms of: alleviating of raw water shortage of Shanghai, increasing water supply capacity in the city and towns, improving water supply quality, improving of urban environment quality, securing health of urban residents, promoting harmonious development of social economy, and maintaining social stability.

(2) Construction of this project is accordance with national laws and regulations, Shanghai Urban Master Plan (1999-2020), Outline of the 11th Five-Year Plan for National Economic and Social Development of Shanghai, Shanghai Water Supply Master Plan, and plans of environmental protection. Implementation of this project
has solid bases of policies, laws and regulations.

(3) Implementation of this project may involve some environmental protection targets (sensitive points), which mainly are residential communities along the pipeline and around the pumping station. During project design, carefully select the sites away from the targets as much as possible. During environmental assessment, further reduce or eliminate adverse impacts on the sensitive targets of this project by means of alternative comparison, adoption of mitigation measures, stipulation and preparation of EMP, public participation, and involuntary resettlement measures, etc. Make the possible potential impacts be accordance with national laws, regulations, and standards of environmental protection.

(4) Implementation of this project may bring in some adverse impacts on ambient environment during project construction and project operation.

1) Adverse impacts during construction: construction dust suspension impacts on air quality, noise from vehicles and construction machinery impact on ambient environment, sewerage from construction impacts on surface water, soil erosion from taking soil, disposing soil, excavation, fill, temporary storage of earth material, damage on vegetation.

2) Adverse impacts during operation: noise of booster pumping station

(5) The adverse impacts of this project may be reduced or eliminated by means of alternative comparison, adoption of mitigation measures, stipulation and preparation of EMP, public participation, and involuntary resettlement measures. The degree and range of impacts will be accordance with national laws, regulations, and standards of environmental protection.

In conclusion, implementation of this project is environmentally feasible by adoption of proposed alternatives, mitigation measures, EMP, public participation, involuntary resettlement measures.
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<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>BOD</td>
<td>Biological Oxygen Demand</td>
</tr>
<tr>
<td>BOD₅</td>
<td>Five Day Biological Oxygen Demand</td>
</tr>
<tr>
<td>CCV</td>
<td>Construction Contract Value</td>
</tr>
<tr>
<td>COD</td>
<td>Chemical Oxygen Demand</td>
</tr>
<tr>
<td>CSE</td>
<td>Construction Supervision Engineer</td>
</tr>
<tr>
<td>DO</td>
<td>Dissolved Oxygen</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EMC</td>
<td>Environmental Management Coordinator</td>
</tr>
<tr>
<td>EMD</td>
<td>Environmental Management Director</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>EPB</td>
<td>Environmental Protection Bureau</td>
</tr>
<tr>
<td>ESE</td>
<td>Environmental Supervision Engineer</td>
</tr>
<tr>
<td>MEP</td>
<td>Ministry of Environmental Protection</td>
</tr>
<tr>
<td>NH₃-N</td>
<td>Ammonia Nitrogen</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-governmental organization</td>
</tr>
<tr>
<td>PMO</td>
<td>Project Management Office</td>
</tr>
<tr>
<td>PRC</td>
<td>People’s Republic of China</td>
</tr>
<tr>
<td>RAP</td>
<td>Resettlement Action Plan</td>
</tr>
<tr>
<td>RMB</td>
<td>Renminbi</td>
</tr>
<tr>
<td>SEPA</td>
<td>State Environmental Protection Administration</td>
</tr>
<tr>
<td>SEPB</td>
<td>Shanghai Environmental Protection Bureau</td>
</tr>
<tr>
<td>SH PMO</td>
<td>Shanghai World Bank Loan Project Management Office</td>
</tr>
<tr>
<td>SMG</td>
<td>Shanghai Municipal Government</td>
</tr>
<tr>
<td>SS</td>
<td>Suspended Solid</td>
</tr>
<tr>
<td>TA</td>
<td>Technical Assistance</td>
</tr>
<tr>
<td>TP</td>
<td>Total Phosphorous</td>
</tr>
<tr>
<td>WB</td>
<td>the World Bank</td>
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<td>WTP</td>
<td>Water Treatment Plant</td>
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Qingcaosha Water Source Raw Water Project-Nanhui Conveyor Works

Environmental Impact Assessment Report

Project Implementing Agency:

Shanghai Qingcaosha Investment, Construction and Development Ltd.

EIA Institute:

Shanghai Investigation, Design & Research Institute

Sept. 2008
Qingcaosha Water Source Raw Water Project-Nanhui Conveyor Works

Environmental Impact Assessment Report

Project Name: Qingcaosha Water Source Raw Water Project-Nanhui Conveyor works

Project Implementing Agency: Shanghai Qingcaosha Investment, Construction and Development Ltd.

EIA Institute: Shanghai Investigation, Design & Research Institute (Guohuanpingjiazi No. 1812)

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