Public Disclosure Authorized

Public Disclosure Authorized

World Bank Financed Project

E1399 v7

World Bank Financed Project - Guangdong Pearl River Delta Urban Environment Project (II)

Environmental Impact Assessment Report for the Foshan Nanzhuang Sludge Treatment Plant Project

PIU: Foshan Water Group Co. Ltd.

EIA Institute: Guangzhou Research Institute of Environmental Protection

Apr. 2011

Contents

Introduction

Project Background

“The Feasibility Study of Foshan Nanzhuang Sludge Treatment Plant” has passed the initiation approval in August, 2006. According to the Feasibility Study (FS) approved by the Guangdong Provincial Development and Reform Committee, this project is planned to build a centralized sludge treatment facility with 400t/day capacity (with 80% of water content). It will use “Thermal Drying Technology” to reach the purpose of “Volume Reduction, Decontamination and stabilization” so as to avoid secondary pollution from the sludge to the surrounding environment. The project is(was) planned to invest 131 million RMB, among which 10.7 million USD will be financed by the World Bank and the remaining will be from the company itself or bank loan. Based on the project design proposal and treatment process described in the FS, the Project Implementation Unit (PIU) completed the “Environment Impact Assessment Report” in 2006, and got approval from the Guangdong Provincial Environmental Protection Bureau. (GDEPB, 2006 No. 1011). The project has not yeat started construction.

Under the circumstances of a New Era, New Technology and New Environment, and its requirements on sludge treatment, Design Institut working on the Feasibility Study started to revise the original proposal giving reference to the sludge treatment trial and experiment around Foshan City, and various sludge treatment technologies being implemented. The purpose of revision is to discuss the feasibility of adopting new technologies and process in this project to select an affordable and suitable treatment process to achieve “Volume Reduction, Decontamination and stabilization” and “resource utilization” in sludge treatment. According to the recommendation of the research paper, the Nanzhuang sludge treatment project of Foshan city planned to use a new technology: the sludge will be lanfilled or utilized after being dewatered (water content is below 60%) inside each WWTPs (including Zhen’an, Shagang, Chengbei and Nanzhuang 4 WWTPs). Refer to figure 1.1-1 to see the project plants locations.

According to the “The Environment Protection Law of PRC”, “Law of PRC on Evaluation of Environmental Effects”, and “The Regulations on the Administration of Construction Project Environmental Protection”, any new building, expansion, rebuilding, moving, technical reconstruction project, and area development project, requires an environmental impact report. Authorized by PIU, Guangzhou Research Institute of Environmental Protection (GRIEP) is chosen to be in charge of the environmental impact assessment of the “Foshan Nanzhuang Sludge Treatment Project”. “Environmental Assessment Report of Foshan Nanzhuang Sludge Treatment Project” was completed, based on site investigation, review of engineering content, research of the pollutant discharge status and basic information such as project feasibility study etc., according to the requirement of “Technical Guideline for Environmental Impact Assessment”.

Figure 1.1-1 Project Construction site

Purpose of the Assessment

(1) Through site investigation and inspection, to understand the project environmental baseline and environmental sensitivity factors. To analyze and evaluate the environmental feasibility of the project from the view of environmental protection and cost-benefits of the technology.

(2) In addition to reviewing existing information about the area’s natural and social economic conditions and current discharge of main pollution sources, conduct site baseline monitoring to inspect and evaluate the environmental quality baseline of the project area.

(3) Through engineering pollution analysis and analogical investigation, to identify the magnitude of pollution source and discharge features of the project, and to identify main pollution factors and environmental impact factors.

(4) To predict and evaluate the level and scope of potential impact to the surrounding environment caused by putting into use of the plant.

(5) Using the principal of cleaner production, compliance discharge and total control of pollutant discharge, to evaluate the advanced treatment technology, and to evaluate the feasibility of the pollution prevention and mitigation measures of the project.

(6) To provide scientific evidence for the governmental department to make decisions, for the design institute to optimize the design, and for the PIU to implement environmental management.

Assessment Criteria

National Environmental Protection Laws and Regulations

（1） The Environment Protection Law of PRC, Dec., 1989

（2） Law of PRC on Evaluation of Environmental Effects, Sept. 1, 2003

（3） Law of PRC on the Prevention and Control of Water Pollution, June 1, 2008

（4） Law of PRC on the Prevention and Control of Atmospheric Pollution, Revised April,2000

（5） Law of PRC on the Prevention and Control of Environmental Noise Pollution, Oct., 1996

（6） Law of PRC on Prevention of Environmental Pollution Caused by Solid Waste, Revised Dec.,2004

（7） Law of Land Administration of PRC, Aug 28, 2004

（8） Cleaner Production Promotion Law of PRC, June, 2002

（9） Circular Economy Law of PRC, Jan. 1st, 2009

（10） Renewable Energy Law of PRC, Jan. 1st , 2006

（11） Energy Conservation Law of PRC, Revised Oct 28, 2007

（12） Law of PRC on Water and Soil Conservation, June 29, 1991

（13） Outline of the National Environmental Protection, issued by State Council in Dec.,2000

（14） Decision of the State Council on Several Issues Concerning Environmental Protection, Aug., 1996

（15） National Plan on Ecological Environmental Development, State Council, 1998 No. 36;

（16） Notice about Strengthening Management of Environmental Risk Assessment within the Scope of Environmental Impact Assessment, SEPA, 2005 No. 152;

Local Environmental Protection Laws and Regulations

（1） Regulations on Environmental Protection Management of Construction Projects in Guangdong, Jan. 1st, 2005

（2） Regulations on Environmental Protection in Guangdong, Sept. 24th, 2004

（3） Guangdong Clean Water Plan, GD Government, 1997 No, 29;

（4） Surface Water Functional Zoning of Guangdong Province, GD Governemnt, 2011 No. 29;

（5） Guangdong Surface Water Functional Zoning (draft proposal), GD Government, 1999 No. 553;

（6） Guangdong Clean Air Plan, GD Government, 2001 No. 7;

（7） Notice about Strengthen Water Pollution Control, GD Government, 1997 No. 74;

（8） Regulation of Solid Wastes Pollution Prevention in Guangdong, May 1st, 2004

（9） Outline of Guangdong Environmental Protection Planning (2006~2020);

（10） Regulation of Drinking Water Source Water Quality Protection in Guangdong, in the effect on July 1st, 2007;

（11） Notice on Issuing the Guidance on Standard Practice on Setup Pollution Discharge Point in Guangdong, GDEPB, 2008 No. 42;

（12） Regulation of Water Quality Protection in Pearl River Delta in Guangdong, No. 6 sub-meeting of No. 9 Guangdong People's Congress Meeting on Nov. 27th, 1998;

（13） Outline of the Pearl River Delta Environmental Protection Plan (2004-2020), Sept. 24th, 2004, No. 13 meeting of Guangdong 10th People's Congress General Committee Meeting;

（14） Implementation Plan for "Outline of the Pearl River Delta Environmental Protection Plan (2004-2010);

（15） Plan of Foshan Drinking Water Source Protection;

（16） Written Approval for Revising of the Foshan Beijiang River Drinking Water Source Protection Zone, GD Government, 2010 No. 75;

（17） Notice of Issuing Foshan Air Quality Functional Zoning, Foshan Government, 2007 No. 154, Dec. 19th, 2007;

（18） The Eleventh Five-Year Plan of Foshan Environmental Protection and Ecological Environment Development; Foshan Government, 2007 No. 17, Jan. 2007;

（19） Chancheng District Regional Acoustic Environment Functional Zoning;

Technical Guides and Standards

（1） Technical Guideline for Environmental Impact Assessment General Principles, （HJ/T2.1-93）

（2） Technical Guideline for Environmental Impact Assessment Environmental Air，（HJ2.2-2008）

（3） Technical Guideline for Environmental Impact Assessment Surface Water，（HJ/T2.3-93）

（4） Technical Guideline for Environmental Impact Assessment Sound Environment，（HJ2.4-2009）

（5） Temporary Measures on Public Consultation in Environmental Impact Assessment, SEPA, 2006 No. 28;

（6） Comments on Implementing Public Consultation in Environmental Impact Assessment on Construction Project in Guangdong, Guangdong Government, 2007 No. 99;

（7） Technical Guidance of Pollution Control Best Practice for Municipal WWTP Sludge Treatment and Disposal.

Related Laws, Regulations and Documents

（1） Temporary Regulation on Promoting Industrial Structure Reorganization, State Council, 2005 No. 40 (Dec. 2nd, 2005);

（2） Notice on Strengthen New Project Environmental Protection Approval, SEPA, 2006 No. 394;

（3） Notice on Strengthening Pollution Control of Sludge from Municipal Wastewater Treatment Plants, GDEPB, 2010 No. 157;

（4） Resolution of the State Council on Implementing Scientific Development and Strengthen Environmental Protection, State Council, 2005 No. 39;

（5） National Catalogue of Hazardous Wastes (Implemented in Aug. 2008)

（6） Regulation on Implementing “Hazardous Wastes Transportation Record Management” in Guangdong;

World Bank Related Regulations

（1） World Bank OP/BP4.01 and its Appendix (Environment Assessment), Jan., 1999

（2） World Bank GP4.01 (Environment Assessment), Jan., 1999

（3） World Bank Environmental Impact Assessment Information Data Pack (Vol. 1-3), (Revising)

（4） World Bank GP4.07 (Water Resource Management), Dec., 2000

（5） World Bank GP14.70 (Participation of NGOs in World Bank Financed Activities), Dec., 2000

Evaluation Factors

1、Atmospheric Environment

According to air pollution features of the proposed project, current air quality of the region and the requirement of “Technical Guideline for Environmental Impact Assessment Environmental Air”(HJ2.2-2008), PM_{10}, SO_2, NO_2, H_2S, NH_3, and odor concentration was adopted in air quality baseline monitoring and assessment. H_2S, NH_3, and odor concentration was adopted in air pollution impact assessment.

2、Aquatic Environment

Based on current water quality of the river bodies receiving discharge from each WWTP, in accordance with “Technical Guideline for Environmental Impact Assessment” （HJ/T2.3-93）, pH, SS, DO, BOD_5, CODcr, NH_4-N, Oil, TP etc. were identified as key parameters in water quality baseline evaluation. The additional wastewater generated by advanced dewatering facilities of each WWTP within the scope of this project ranged from only 21 to 71 m^3/d, and wastewater will be treated in municipal WWTPs and discharged in compliance with standards, therefore qualitative analysis on its impact to the water quality is adopted.

3、Acoustic Environment

The main noise source is from industrial equipment. According to the demand of “Technical Guideline for Environmental Impact Assessment Sound Environment”

（HJ2.4-2009）, equivalent continuous A sound level was adopted in baseline environment quality assessment, and in environmental impact assessment.

Assessment Grade

According to relevant documents from the World Bank, after screening the type, location, sensitivity, scope and feature and size of potential environmental impact of this project, it is confirmed that the EA of this project is Category A.

Based on “Technical Guideline for Environmental Impact Assessment” （HJ/T2.1-93，HJ/T2.3-93，HJ2.2-2008，HJ2.4-2009）, the assessment grades are as follows:

The assessment grade of environmental air quality impact

The assessment grades of ambient air quality impact of this project is based on the factors such as discharge volume of main pollutants, the complexity of surrounding terrain and the local ambient air quality standards.

After the project put into use, the main atmospheric pollutants are NH_3、H_2S and etc. Based on the “Technical Guideline for Environmental Impact Assessment (Environmental Air)”（HJ2.2-2008）, the assessment calculates separately the maximum ground concentration Pi (pollutant No. i) of each pollutant, and the corresponding maximum distance $D_{10\%}$ of pollutant No i, when the land concentration parameter reaches the 10% limit pollutant No i. Pi is defined as:

$$P_i = \frac{C_i}{C_{0i}} \times 100\%$$

In which: Pi—the maximum ground concentration of pollutant No i, %

C_i —the maximum ground concentration of pollutant No. i, calculated by projection model, mg/m^3

C_{0i} —ambient air quality standards of pollutant No.i, mg/m^3

The projection model used is city and flat terrain model, which considers the maximum ground concentration under all climate conditions (including under the most disadvantageous climate condition), but does not consider the smoke and buildings’ run off. By calculating the maximum ground concentration Pi and the corresponding maximum distance $D_{10\%}$ of ground concentration 10% limit of the main pollutants NH_3 and H_2S.The assessment grades of each pollutants can be confirmed based on table 1.5-1. Table 1.5-2 shows the assessment grade of the project.

Table 1.5-1 Categorization of Assessment Grade

Assessment Grade	Assessment Criterion
Grade 1	P_{max}≥80%， and $D_{10\%}$≥5 km
Grade 2	Others
Grade 3	P_{max}＜10% or $D_{10\%}$＜the minimum distance between the pollution source and the plant

Table 1.5-2 Air Pollutants Assessment Grade

Pollutants	NH_3				H_2S			
Location	Zhen’an	Shagang	Chengbei	Nanzhuang	Zhen’an	Shagang	Chengbei	Nanzhuang
Pollutant Source Area	45×35	69×24	40×30	42×24	45×35	69×24	40×30	42×24
Height of Pollutant Source	12	12	12	12	12	12	12	12
Emission Speed（g/s）	0.00017	0.00009	0.00004	0.00004	0.00031	0.00015	0.00008	0.00008
Environmental Air Quality Standards（mg/m^3）	0.20				0.01			
Maximum Ground-level concentration（mg/m^3）	0.0001	0.0001	0.00004	0.00004	0.0003	0.0001	0.0001	0.0001
The distance of downwind maximum ground-level concentration point to the source (m)	78	20	74	73	78	80	74	73

Maximum Grand-level concentration parameter *Pi*(%)	0.05%	0.05%	0.02%	0.02%	3.0%	1.0%	1.0%	1.0%
$D_{10\%}$ （m）	No							
Assessment Grade	Grade 3							

From Table 1.5-1, the impact assessment grade for air quality is Grade 3 according to “Technical Guideline for Environmental Impact Assessment (Environmental Air)” （HJ2.2-2008）.

The Impact Assessment Grade of the Surface Water Environmental Quality

After the project been implemented, the additional wastewater volume discharged from advanced dewatering engineering for each WWTP is 21m^3/d（Chengbei、Nanzhuang）, 34m^3/d（Shagang）and 71 m^3/d（Zhen’an）. All wastewater will be discharged into the river after being treated in the WWTPs. Jili Creek, the receiving river body of Nanzhuang WWTP should comply with class III water quality standard of “Environmental Quality Standard for Surface Water” （GB3838-2002）. Foshan Stream, the receiving river of Zhen’an WWTP and Shagang WWTP and Foshan channel, the receiving river of Chengbei WWTP should comply with Class IV water quality standard of “Environmental Quality Standard for Surface Water” （GB3838-2002）. According to the “Technical Guideline for Environmental Impact Assessment” （HJ/T2.3－93）, the water environmental impact assessment grade of the project is Grade 3.

Impact Assessment Grade of Acoustic Environment Quality

All the advanced dewatering workshops of each WWTP of this project are located within Class II acoustic environment functional zone. After the project being implemented, the noise levelof surrounding environment will not change significantly. According to the requirement of “Technical Guideline for Environmental Impact Assessment Environmental Air” （HJ2.2-2008）, the acoustic environment impact assessment grade of the project is Grade 2.

Risk Assessment Grade

During the operation period, no hazardous materials will be used. The treatment process will use electricity as its power, and will not use any kind of fuel. The main risky material is the dewatered sludge, which remains as low level risk. According to "Technical Guideline for Environmental Risk Assessment of Construction Project"□HJ/T169-2004□, the environmental risk assessment Grade of this project is Grade 2.

Focus of the Assessment

（1） Analyze and assess the environmental feasibility of the project implementation from the environmental and cost-benefit point of view based on factors such as the environmental sensibility, existing environmental capacity and etc.

（2） Consider the control of odor as thekey issue; emphasize pollution factors analysis, cost-benefit feasibility study of the pollution prevention and control measures and estimate cleaner production level after the project implementation.

（3） Environmental quality baseline and environmental impact projection and impact analysis of the plant before and after the project implementation.

（4） The environmental impact and risk during the sludge transportation.

（5） Analysis on how advance and clean the dewatering technology is.

Assessment Scope

Air Quality Assessment Scope

The percentage of maximum ground concentration compared to standard of the discharge pollutant is below 10% in this project, which determines the assessment Grade is Grade 3. According to the requirement in the Guidance, the scope of air quality assessment is a 5km width rectangular area which is centered with the WWPTs. Refer to figure 1.7-1 for the environmental air assessment scope.

Aquatic Environment Assessment Scope

The receiving river bodies of all the WWTPs mentioned in the dewatering project are:

Zhen'an: the treated wastewater is discharged to river body on the north, i.e. Foshan Stream;

Shagang: the treated wastewater is discharged to river body on the east, i.e. Lan Shi Da Stream, through Feng Shou Stream to Foshan Stream in the end;

Chengbei: the treated wastewater is discharged to river body on the northeast, i.e. Foshan channel;

Nanzhuang: the treated wastewater will be discharged through Nanzhuang floodgate to river body on the south, i.e. Jili Creek;

The assessment scope for water quality is Foshan Stream and Foshan Channel: three sections (4#, 5#, 2# in Figure 1.8-1) 800m downstream of Hong Jiao Sluice and Zhen'an WWTP discharge outlet; Jili River Area (see Figure 1.8-1): Luonan Section to the end of Jili River (1.5 km away from Tanjiang River shown as 6# and 7# in Figure 1.8-1).

Acoustic Environment Assessment Scope

According to the "Technical Guideline for Environmental Impact Assessment Sound Environment"□HJ2.4-2009□, the acoustic environment assessment scope of the project is the area 1 m outside of the project boundary and all environmental sensitive points within 200m from the sites.

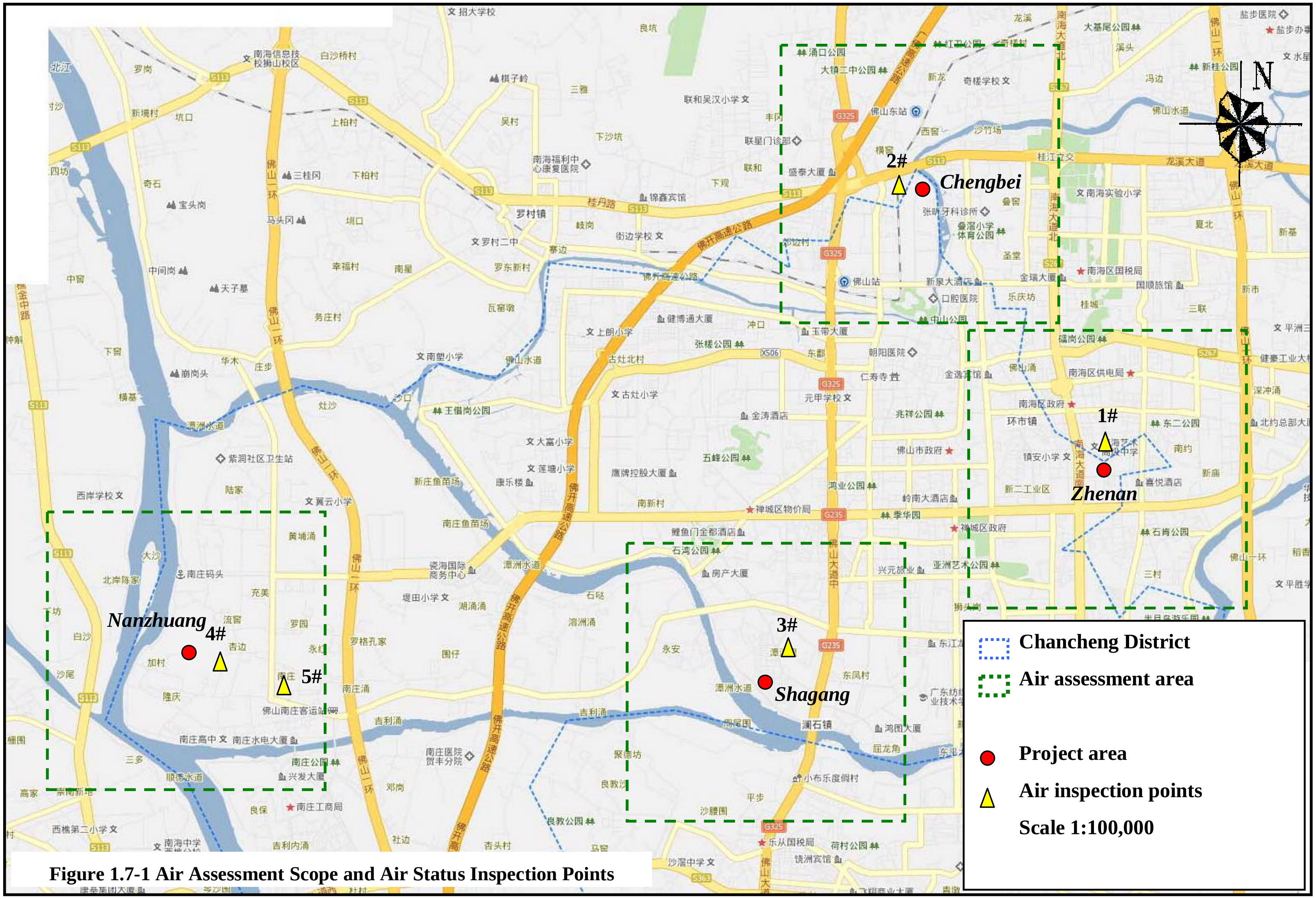


Figure 1.7-1 Air Assessment Scope and Air Status Inspection Points

Environmental Function Zone of the Assessment Scope and Applicable Standards

Water Environmental Function Area and Applicable Standards

According to Guangdong Surface Water Functional Zoning (GDEPB, 2011, No. 29), Jili Creek, the receiving river body of Nanzhuang WWTP will implement class III of Surface Water Quality Standards (GB3838-2002). Foshan stream, the receiving river body of Zhen’an WWTP and Shagang WWTP, and Foshan channel, the receiving river body of Chengbei WWTP will implement class IV water quality standards of Surface Water Quality Standards (GB3838-2002). According to the “Plan of Foshan Drinking Water Source Protection” and the “Written Approval for Revising of the Foshan Beijiang River Drinking Water Source Protection Zone, GD Government, 2010 No. 75” and the fact that all the project locations are not related to drinking water source protection area, the assessment scope of the water environmental function area is decided as table 1.8-1 and figure 1.8-1. As for the drinking water source protection area, refer to figure 1.8-2.

Environmental Air Quality Function Zone and Applicable Standards

According to “Foshan City Environmental Air Quality Function Zoning” (Dec. 2007), the project area and environmental air assessment scope is categorized as environmental air quality Class II function area (figure 1.8-3). The environmental air quality should comply with Class II standards of “Environmental Air Quality Standards (GB3095-1996)” and its 2000 revised version.

Sound Environmental Function Area and Applicable Standards

According to “Chancheng District Environmental Noise Function Zoning” and the environmental assessment approval documents of all the WWTPs, all the WWTPs of the project are located inside sound environmental Class II function zone (figure 1.8-4). Sound environmental quality should comply with Class II area standards of “Environmental Quality Standards for Noise” （GB3096-2008）（daytime：60dB（A），night：50dB（A））.

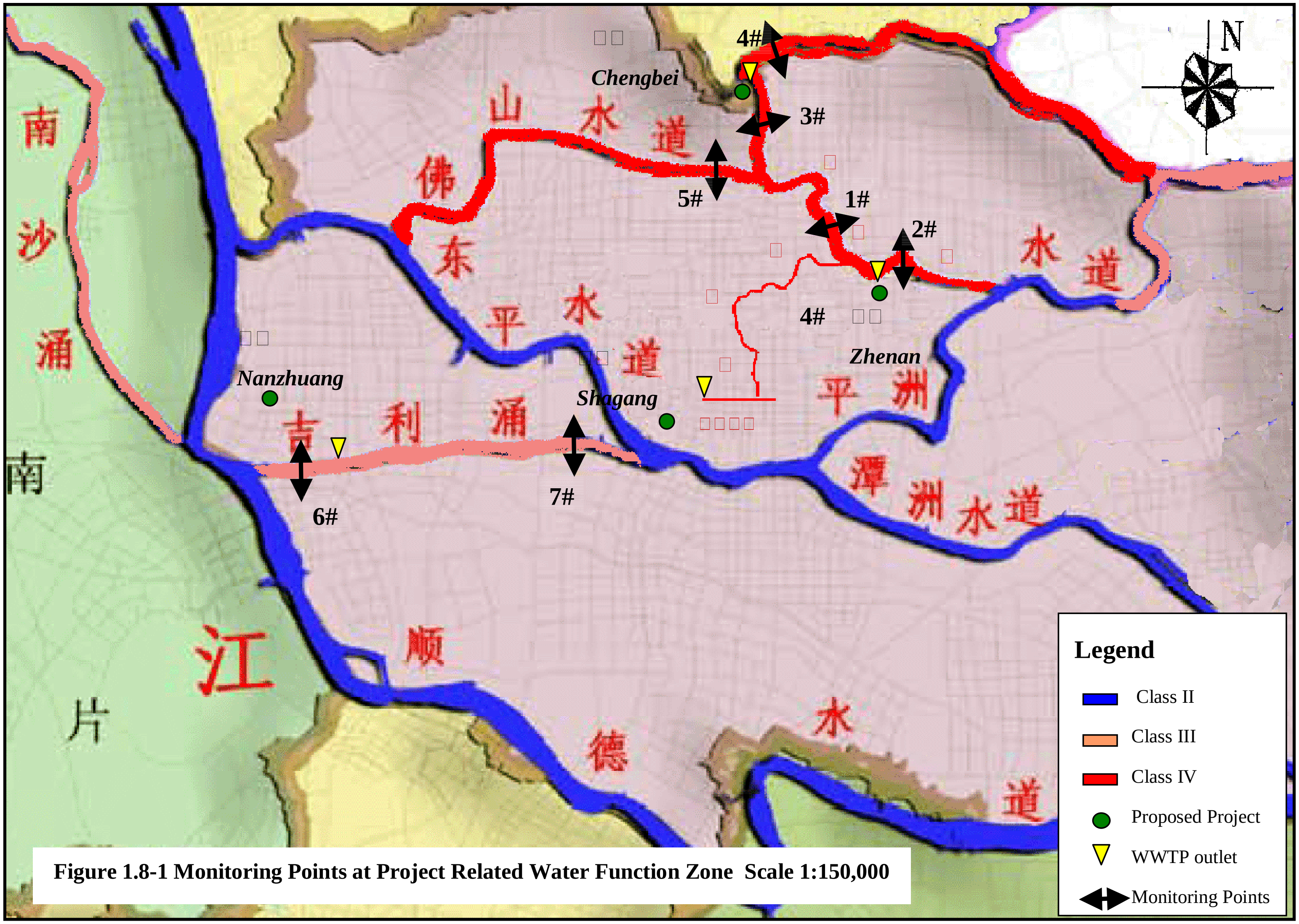


Figure 1.8-1 Monitoring Points at Project Related Water Function Zone Scale 1:150,000

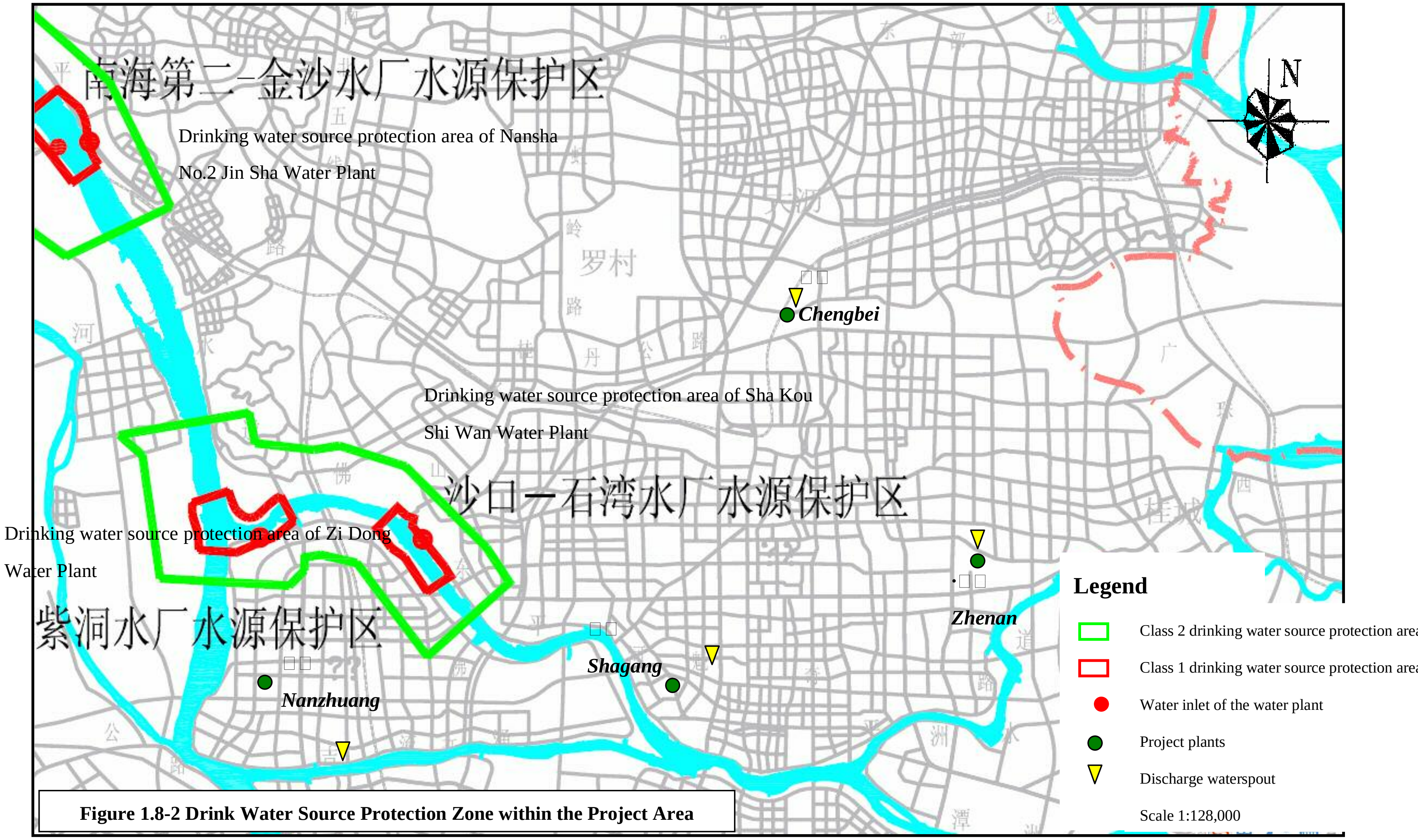


Figure 1.8-2 Drink Water Source Protection Zone within the Project Area

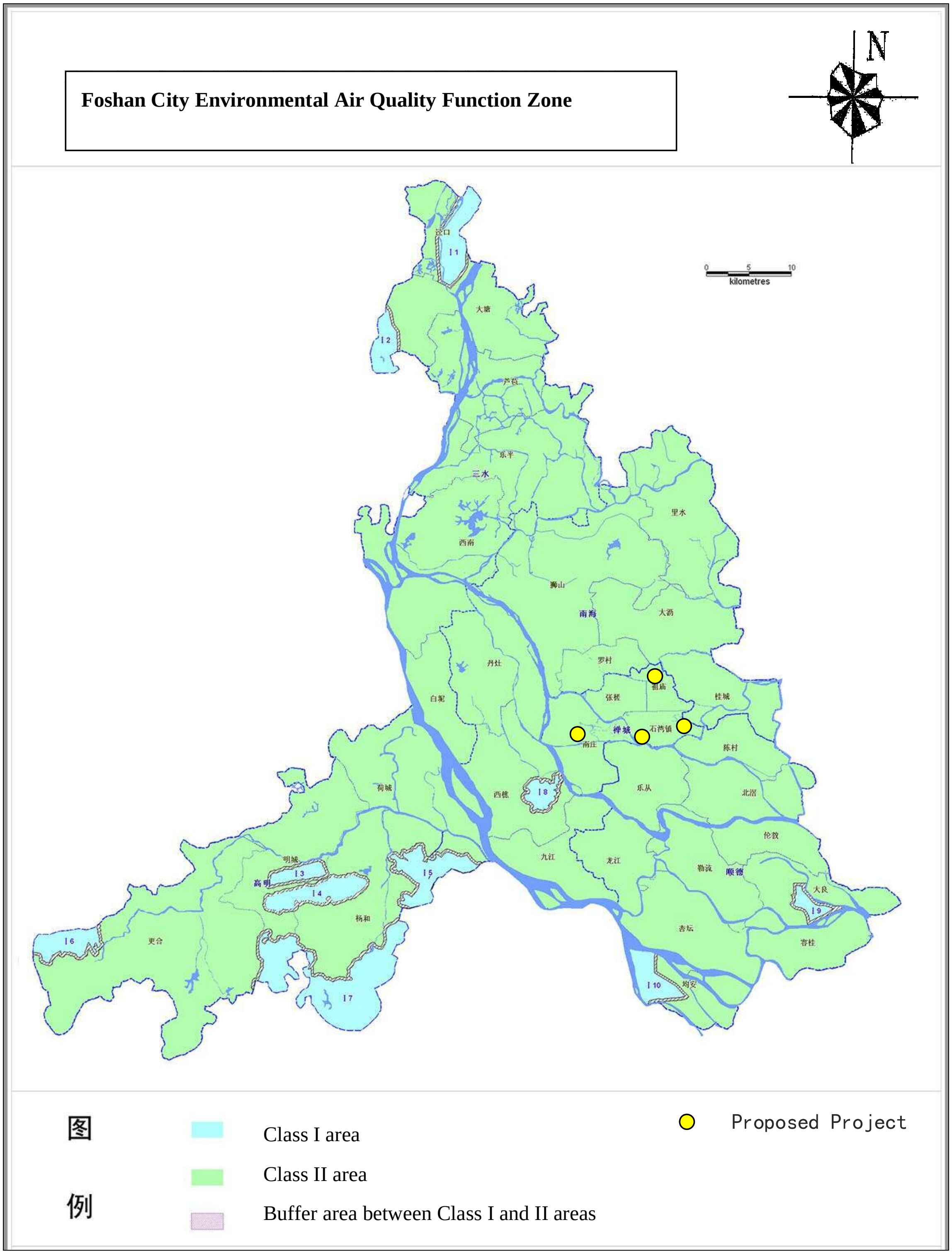


Figure 1.8-3 Air Environment Functional Zoning in the Project Area

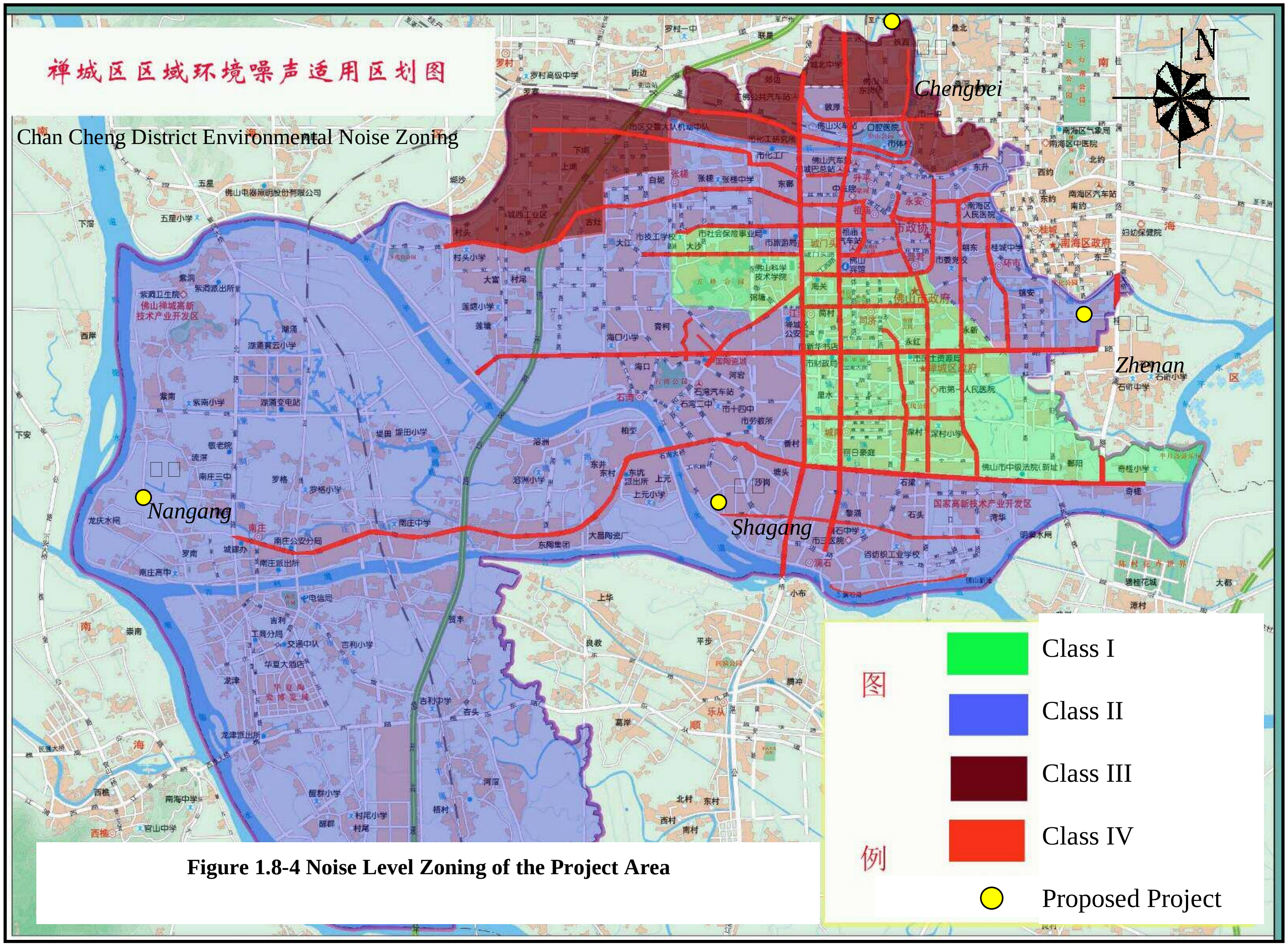


Figure 1.8-4 Noise Level Zoning of the Project Area

Applicable Standards Used in Assessment

Environmental Quality Standards

（1） Class II of “Environmental Air Quality Standards (GB3095-1996)” and its 2000 revision version

（2） Class III and IV of “Surface Water Environmental Quality Standards (GB3838-2002)”

（3） Class II of “Environmental Quality Standards for Noise (GB3096-2008)”

Pollutant Discharge Standards

（1） Class I B (Nanzhuang) and Class II (Zhen’an, Shagang and Chengbei) of “Municipal WWTP Pollutant Discharge Standards （GB18918-2002）”

（2） Municipal WWTP Class I (Nanzhuang) and Class II (Zhen’an, Shagang and Chengbei) of Guangdong Provincial “Water Pollutant Discharge Limit” （DB44/26-2001）

（3） Class II air pollutant discharge limit of the “Municipal WWTP Pollution Discharge Standards （GB18918-2002）”

（4） Class II of the revised edition of “Effluvial Pollutant Discharge Standards (GB14554-93)”

（5） Class II of “Noise Standards at Factory Boundary （GB12348-2008）”

（6） Noise limit of each construction phase respectively in the “Noise Limit for Construction Site Boundary (GB12523-90)

Reference Standards

“Industrial Enterprise Design Hygiene Standards (TJ36-79)”

Detailed limit value applied in this environmental assessment are summarized in Table 1.9-1~ Table 1.9-6.

Table 1.9-1 Environmental Air Quality Assessment Standards Unit: mg/m3

Items	Sampling time	Concentration Limit	Standards
SO_2	daily average	0.15	(GB3095-1996) and its class 2 revised version
	1-hour average	0.50	
NO_2	daily average	0.12	
	1-hour average	0.24	
PM_{10}	daily average	0.15	
H_2S	once	0.01	(TJ36-79) the maximum tolerance concentration of the hazardous
NH_3	once	0.20	

Table 1.9-2 Water Environmental Quality Standards (Unit：mg/L)

Water Quality Parameters	pH	DO	COD	BOD_5	Oil	NH_4-N	Total Phosphorus
Class III Value	6～9	□5	□20	□4	□0.05	□1.0	□0.2
Class IV Value	6～9	□3	□30	□6	□0.5	□1.5	□0.3

Table 1.9-3 Sound Environmental Quality Assessment Standards Unit: dB(A)

Sound Functional Area Zone	Applied zone scope	Standards (Environmental Quality Standards for Noise (GB3096-2008))	
		Daytime	Night
Class II Zone	Plant border and nearby residential area	60	50

Table 1.9-4 Water Pollutants Discharge Standards (Unit：mg/L, except pH)

Water Quality Parameter		CODcr	BOD_5	SS	NH_4-N
WWTP	Zhen’an, Shagang and Chengbei	60	30	30	25
	Nanzhuang	40	20	20	8

Table 1.9-5 Standard Limits of Fugitive Emission of Air Pollutants Unit: mg/m^3

No.	Pollutants	GB 18918□2002	GB14554-93	Discharge limit
1	H_2S	0.06	0.06	0.06
2	NH_3	1.5	1.5	1.5
3	Odor Concentration (None Dimensional)	20	20	20

Table 1.9-6 Noise Discharge Standards   Unit: dB(A)

<table>
<tr><td rowspan="2">haPse</td><td rowspan="2">Construction Phase</td><td rowspan="2">Main noise source</td><td colspan="2">Nose limit</td><td>Standards</td></tr>
<tr><td>Daytime</td><td>Night</td><td rowspan="5">Noise Limit for Construction Site Boundary (GB12523-90)</td></tr>
<tr><td rowspan="4">Constructio n</td><td>Foundation</td><td>Bulldozer, grab, loading etc.</td><td>75</td><td>55</td></tr>
<tr><td>Piling</td><td>All kinds of pile drivers</td><td>85</td><td>Construction Forbidden</td></tr>
<tr><td>Structuring</td><td>Vibrating tube, electrical saw etc.</td><td>70</td><td>55</td></tr>
<tr><td>Decorating</td><td>Crane, elevator etc.</td><td>65</td><td>55</td></tr>
<tr><td rowspan="3">Operation</td><td></td><td colspan="3">Noise limit</td><td rowspan="3">Noise Limit of Factory Boundary （GB12348-2008）</td></tr>
<tr><td>Time</td><td>Daytime</td><td colspan="2">Night</td></tr>
<tr><td>Class II</td><td>60</td><td colspan="2">50</td></tr>
</table>

Environmental Protection Areas of Concern

The odor impact scope of a normal WWTP is between 100~300m around the plant border. However the odor intensity of the pollutant discharge of the dewatering workshop of this project is significantly less than the odor intensity of the whole WWTP. Moreover, the difference between the odor intensity before and after the new project is minimal. Therefore, the main focus of the assessment is the sensitive points such as schools and residential areas around 500m range of the project locations (the nearest sensitive point of Shagang WWTP is 680m far). According to the site investigation, such sensitive points are mostly villages, residential buildings, and 2 schools and 1 park. Refer to Table 1.10-1 and Figure 1.10-1 to 1.10-4 for main environmental protection targets near the project locations.

Table 1.10-1 Sensitive Points and Environmental Protection Targets

Protection Targets		Category	Location	Distance (m)		Scale	Protection requirements
				WWTP Boundary	Proposed Project		
Zhen’an	Nanhai Art High School	School	N	110	115	1800 people	Class II environmental air quality Class II sound environmental quality
	Guihua High School	School	N	120	125	800 people	
	Northeast residence area	Residence	NEN	105	340	2000 people	Class II environmental air quality
	Hongxing Village	village	W	120	500	800 people	
	Culture Park	Park	NW	140	350	4ha	
	Foshan stream	Receiving river body	N	40	45	—	Class *IV* water environmental quality
Shagang	Shagang village	village	NW	580	680	800 people	Class II environmental air quality
	Foshan stream	Receiving river body	NE	3000	3100	—	Class *IV* water environmental quality
Chengbei	Gua Bu Xun village	village	W	200	210	800 people	Class II environmental air quality
	Fuxi village	village	S	15	450	460 people	
	Fuxi peasants apartment	Residence	S	10	390	320 people	
	Foshan channel	Receiving river body	NE	90	95	—	Class *IV*water environmental quality
Nanzhuang	Aochong village	village	ESE	150	390	480 people	Class II environmental air quality
	Gaotian village	village	NE	340	490	420 people	
	Jili Creek	Receiving river body	S	1500	1700	—	Class *III* water environmental quality

Surrounding Status of Selected Plant Sites and Current Land Usage Situation and Planning

The project will be implemented in 4 selected WWTPs. Zhen’an, Shagang, Chengbei WWTPs are all located in urban developed areas, where nearby buildings have already finished construction. Surrounding status of the three WWTPs and current land use are shown in Figure 1.10-1~1.10.3. Nanzhuang WWTP is situated in newly developing areas, which is surrounded by ponds and bare lands at the moment (see Figure 1.10-4). According to Urban Planning of Foshan City (2005~2020), a new road namely Guiqi Road (80m length) will be built on south side of Nanzhuang WWTP, across which is designed as Class II residential district. North and East to Nanzhuang WWTP, it is planned as Class II industrial area, and the land on its west side is for municipal usage. (See Figure 1.10-5)

Figure 1.10-1 Sensitive Points of Zhenan Project

Scale 1:10000

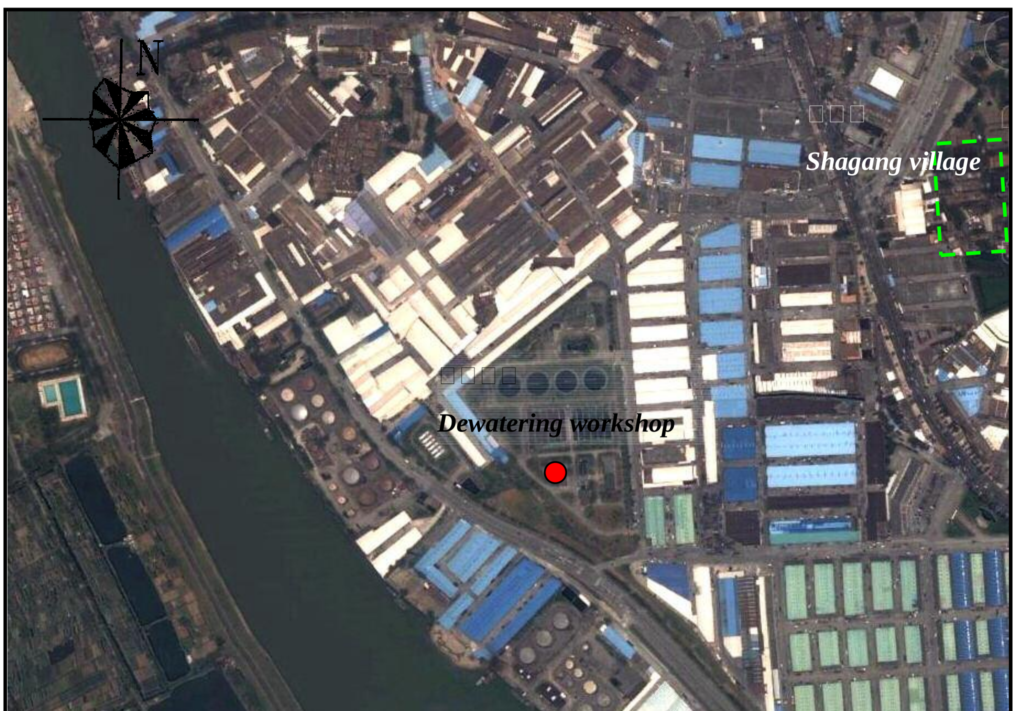


Figure 1.10-2 Sensitive Points of Shagang Project

Scale 1:10000

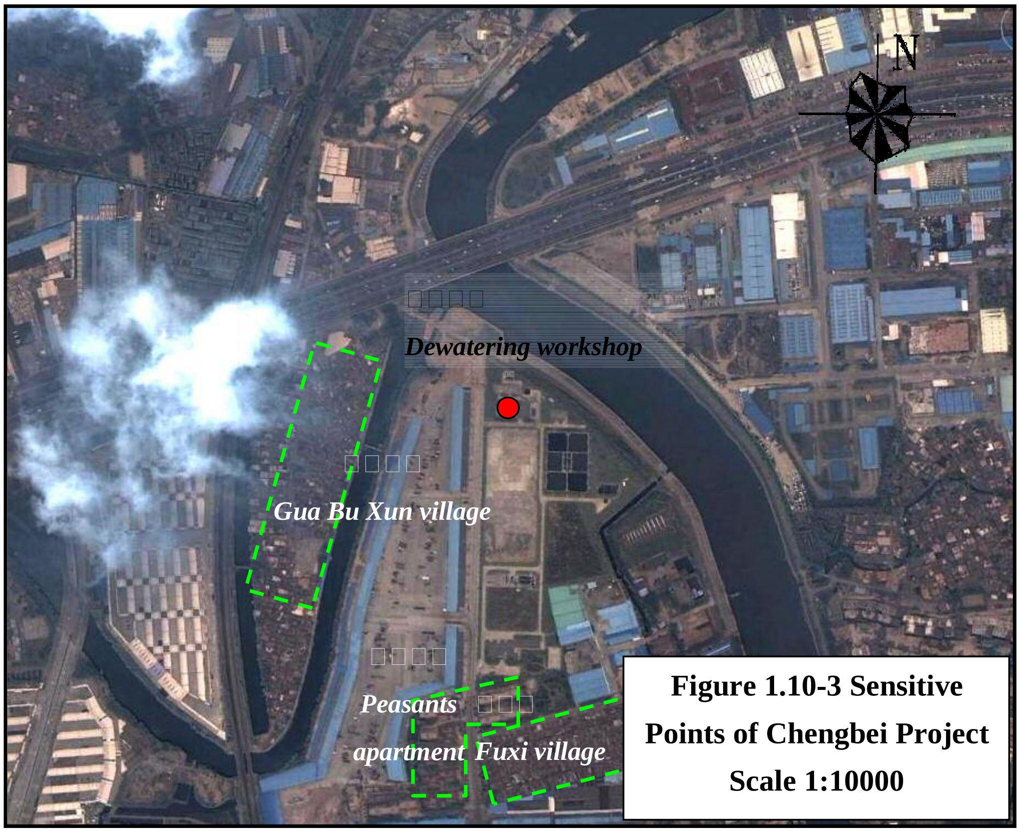


Figure 1.10-3 Sensitive Points of Chengbei Project
Scale 1:10000

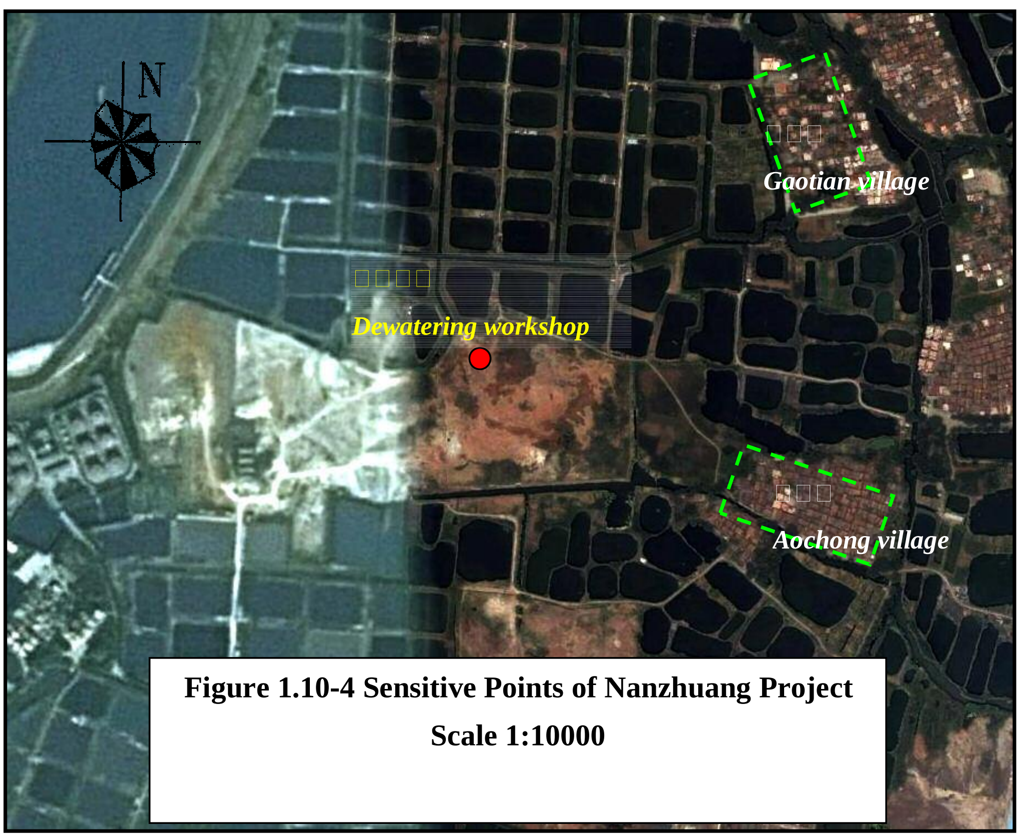


Figure 1.10-4 Sensitive Points of Nanzhuang Project
Scale 1:10000

Project Description and Analysis of Pollution Factors

Existing WWTP and Current Sludge Disposal Practice

Summary of Existing WWTPs

1、Summary of Zhen’an WWTP

Started construction in 1991 and put into operation in 1995, the WWTP applied A/O treatment process to treat wastewater from east part of the city with a catchment area of 22 km^2. Phase 2 of the project (100,000 m^3/d) adopted advanced A^2/O process and was put into operation in year 2005. Phase 3 (another 50,000 m^3/d) of the WWTP also adopted A^2/O process and started to accept wastewater from April 2010. According to the “Long-term WWTP Planning (2020) for Zhen’an”, the total treatment capacity of Zhen’an WWTP will reach 350,000 m^3/d.

Designed influent and effluent quality of Zhen’an WWTP is shown in the table below:

Table 2.1-1 Zhen’an WWTP design inlet and outlet water quality (unit: mg/L)

Parameter	CODcr□	BOD_5	SS	TN	NH_4^+-N	TP
Inlet	250	130	150	35	25	4
Outlet	60	20	30		15	1

2、Summary of Shagang WWTP

Currently, Phase 1 of the WWTP is in operation with a capacity of 100,000 m^3/d. Shagang WWTP phase 1 was put into use in Nov. 2004 and adopted A^2/O treatment process. According to the plan, total treatment capacity will reach 150,000 m^3/d by 2020.

Designed inlet and outlet water quality of Shagang WWTP is shown in the table below:

Table 2.1-1 Shagang WWTP design inlet and outlet water quality (unit: mg/L)

Parameter	CODcr□	BOD_5	SS	TN	NH_4^+-N	TP
Inlet	230	130	150	30	20	3
Outlet	60	20	25		10	1

3、Summary of Chengbei WWTP

Chengbei WWTP locates in north of Chancheng District close to wholesale market in City North. Phase 1 of 50,000 m^3/d used SBR process and was completed in 2006. Phase 2 of 50,000 m^3/d used SBR process and was put into use in 2009.

Designed inlet and outlet water quality of Chengbei WWTP is shown in the table below:

Table 2.1-3 Chengbei WWTP design inlet and outlet water quality (unit: mg/L)

Parameter	CODcr□	BOD_5	SS	TN	NH_4^+-N	TP
Inlet	250	130	150	30	25	3
Outlet	40	20	20		8	1.5

4、Summary of Nanzhuang WWTP

Nanzhuang WWTP, which is currently under construction, locates in Nanzhuang County in Chancheng District. Phase 1 of the WWTP adopted A2/O treatment process with 25,000 m^3/d and planned to be completed in end of 2011. Overall designed capacity of Nanzhuang WWTP is 250,000 m^3/d in the long term.

Designed inlet and outlet water quality of Nanzhuang WWTP is shown in the table below:

Table 2.1-4 Nanzhuang WWTP design inlet and outlet water quality (unit: mg/L)

Parameter	CODcr□	BOD_5	SS	TN	NH_4^+-N	TP
Inlet	250	140	150	30	25	4
Outlet	60	30	30		15	1

WWTP Sludge Disposal Proposals

1) Zhen'an WWTP

Phase 1: Belt thickening + belt filter press, treated sludge water content is around 80%.

Phase 2: integrated centrifuge thickening and dewatering unit, treated sludge water content is 75~80%;

Phase 3: integrated centrifuge thickening and dewatering unit, treated sludge water content is 75~80%.

Zhen'an WWTP (including 3 phases) can treat 110~120 t/d sludge (counted as 80% of water content). Treated sludge is transporting to Zhaoqing Yunan landfill (240 km away) for final disposal.

Current sludge dewatering workshop, locating in the northwest of the WWTP between phase 1 and phase 2 wastewater treatment lines, consists of office, control room, equipment room, dewatering workshop, and sludge storage room. Main equipments are shown in the table below.

Table 2.1-5 Main Equipments for Sludge Dewatering

No	Name	Specification	Quantity	Remark
1	Sludge Centrifuge	$Q=40m^3/h$	3	2 working 1 standby
2	Auto Chemical Dosing Station		1	
3	Sludge Pump	$Q=40m^3/h$	3	2 working 1 standby
4	Chemical Pump	$Q=0.2\sim0.8m^3/h$	3	2 working 1 standby
5	Backwash Pump	$Q=25m^3/h$	2	1 working 1 standby
6	Sludge Slicer	$Q=40m^3/h$	3	2 working 1 standby
7	Shaftless Screw Conveyors	$Q=3m^3/h$	3	
8	Dilution Unit		3	
9	Sludge Bucket	Steel	3	With electrical control valve

2) Shagang WWTP

Sludge Treatment Process: integrated centrifuge thickening and dewatering unit, treated sludge water content is 75~80%.

Shagang WWTP (including 3 phases) can treat 55~60 t/d sludge (counted as 80% of water content). Treated sludge is transporting to Zhaoqing Yunan landfill (240 km away) for final disposal.

Current sludge dewatering workshop, locating in the west of the WWTP, consists of electrical room, dewatering workshop, and sludge storage area. Main equipments are shown in the table below.

Table 2.1-6 Main Equipments for Sludge Dewatering

No	Name	Specification	Quantity	Remark
1	Sludge Centrifuge	Q=60m^3/h	2	2 working 1 standby
2	Flocculants Preparing Unit	N=7.5KW	1	
3	Screw Sludge Pump	Q=45-60m^3/h	3	2 working 1 standby
4	Dosing Pump	Q=0.4~1.6m^3/h	2	Fit for the centrifuge
5	Flat Screw Conveyor	L=12m	1	2 working 1 standby
6	Shaftless Screw Conveyors	L=6m	1	
7	Electrical Single Main Beam Hanged Crane	W=3t	1	

3□Chengbei WWTP

Phase 1: Belt thickening + belt filter press, treated sludge water content is around 80%.

Phase 2: Belt thickening + belt filter press, treated sludge water content is around 80%.

Chengbei WWTP (including 3 phases) can treat 25~30 t/d sludge (counted as 80% of water content). Treated sludge is transporting to Zhaoqing Yunan landfill (240 km away) for final disposal.

Current sludge dewatering workshop, locating in north of the WWTP, consists of control room, equipment room, dewatering workshop, and sludge storage room. Main equipments are shown in the table below.

Table 2.1-7 Main Equipments for Sludge Dewatering

No	Name	Specification	Quantity	Remark
1	Thickening and Dewatering System	Q=40~60m^3/h	2	1 working 1 standby
2	Sludge and Reagent Mixer	Q=40~60m^3/h	2	Fit for the dewatering system
3	Sludge Pump	Q=10~60m^3/h	2	1 working 1 standby
4	Dosing Pump	Q=0.3~1.0m^3/h	2	1 working 1 standby, with dilution system
5	Backwash Pump	Q=12m^3/h	2	1 working 1 standby
6	Flocculants Preparing System	Q=4m^3/h	1	
7	Belt Conveyor		2	
8	Compressor	Q=30L/min	2	1 working 1 standby
9	Sludge Bucket	Stainless Steel	2	

4□Nanzhuang WWTP and Sludge Treatment Proposal

Phase 1 of the WWTP plans to adopt belt filter press to treat sludge to water content of 80%. Phase 1 sludge treatment capacity is 30 t/d (counted as 80% of water content). Treated sludge is planned to transport to Zhaoqing Yunan landfill (240 km away) for final disposal.

Nanzhuang WWTP has not yet started construction. According to design documents, the sludge dewatering workshop, locating in the north of the WWTP, consists of electrical room, dewatering workshop, and sludge storage area. Main equipments are shown in the table below.

Table 2.1-8 Main Equipments for Sludge Dewatering

No	Name	Specification	Quantity	Remark
1	Belt Filter Press	Q=30m^3/h	2	1 working 1 standby
2	Integrated Chemical Dilution and Dosing System	Q=3-4Kg/h	1	
3	Pipe Mixer	L=942	2	1 working 1 standby
4	Sludge Screw Pump	Q=10-60m^3/h	2	1 working 1 standby
5	Backwash Pump	Q=18m^3/h	2	1 working 1 standby with auto backwash filter
6	Compressor	Q=50L/min	2	1 working 1 standby
7	Shaftless Screw Conveyors	L=16m	1	

Pollution from the Current Sludge Dewatering Practice and Control Measures

1、Wastewater

Currently in the WWTPs, wastewater is generated mainly from sludge dewatering process. Main pollutants include CODcr, BOD_5, SS and NH_4-N. Table 2.1-6 summarizes the wastewater volume generated from dewatering process in each WWTP.

Table 2.1-9 Wastewater Generation from Current Sludge Dewatering Facilities

WWTP		Zhen’an	Shagang	Chengbei	Nanzhuang	Total
Wastewater generated	Daily Discharge (m^3/d)	2280	1140	570	570	4560
	Annual Discharge (10,000 m^3/a)	83.220	41.610	20.805	20.805	166.44

Wastewater generated from sludge dewatering has all been sent to WWTP before discharging. In Zhen’an, Shagang and Chengbei WWTP, treated effluent applies Class II of “Municipal WWTP Pollution Discharge Standard” (GB18918-2002) and Class II (for municipal WWTP) of Guangdong Water Pollution Discharge Limit (DB44/26-2001). In Nanzhuang WWTP, the treated effluent applies Class IB of “Municipal WWTP Pollution

Discharge Standard” (GB18918-2002) and Class I (for municipal WWTP) of Guangdong Water Pollution Discharge Limit (DB44/26-2001). According to information given by the PIU, Table 2.1-7 summarizes the main water pollutants generated by current dewatering facilities.

Table 2.1-10 Pollutants Generated by Current Dewatering Facilities

Pollutants		CODcr	BOD_5	SS	NH_4-N
Discharge concentration mg/l		60	30	30	25
Annual Loading（t/a）	Zhen’an	49.93	24.97	24.97	20.81
	Shagang	24.97	12.48	12.48	10.40
	Chengbei	12.48	6.24	6.24	5.20
Discharge concentration mg/l		40	20	20	8
Annual Loading（t/a）	Nanzhuang	8.32	4.16	4.16	1.66
Total（t/a）			95.7	47.85	47.85

2、Exhausted Gas

Main air pollution caused by the sludge dewatering facility is odor released from sludge dewatering process. In order to reduce its impact to the environment, the four WWTPs have adopted or plan to adopt biological deodorants to control odor. EIA agency conducted onsite monitoring in sludge dewatering workshop in Zhen’an and Shagang WWTP. The results showed an odor level of Class 3.5. Detail pollutant concentration is shown in Table 2.1-11.

Table 2.1-11 Monitoring Results of Existing Sludge Dewatering Workshops

WWTP		Zhen’an	Shagang
Pollutant Concentration （mg/m^3）	NH_3	0.13	0.18
	H_2S	0.269	0.284

The research showed that ventilation rate in Zhen’an and Shagang WWTP is 8640 and 4460 respectively. As other sludge conveying storage facility release little odor, it is assumed to be 20% of the odor released from sludge dewatering workshop. Pollution loading can then be calculated and results as shown in Table 2.1-12. Chengbei WWTP’s sludge dewatering facilities were under maintenance during research period, therefore site monitoring was not conducted. Nanzhuang WWTP is not yet completed. Figures for these two WWTPs are resulted from analogy calculation based on relative treatment capacity.

Table 2.1-12 Odor Emission from the Existing Sludge Dewatering Workshops

Sludge Dewatering Workshop		Zhen'an	Shagang	Chengbei	Nanzhuang
Pollutant Emission Speed (g/h)	NH_4	1.348	1.008	0.393	0.393
	H_2S	2.819	1.590	0.735	0.735
Pollution Discharge Load (t/a)	NH_4	0.012	0.009	0.0034	0.0034
	H_2S	0.025	0.014	0.0064	0.0064

3、Noise

Major noise sources within the current sludge dewatering process include sludge pumps, water pumps, blowers, air compressors, dewatering equipments, mechanical gears, and transporting vehicles. Noise control measures include absorption at equipment base and insulation of compressor room. According to information provided by PIU, current noise level of the equipments is summarized in the table below:

Table 2.1-13 Current Sources of Noise

No.	Source of Noise	Location	Noise Level dB（A）
1	Sludge frame filter press	Sludge dewatering workshop	70～80
2	Centrifuge separator	Sludge dewatering workshop	75～85
3	Compressor	Compressor room	85～95
4	Sludge pump and water pump	Pump station	80～90
5	Blower	Sludge dewatering workshop and other locations that have blower	75～85
6	Vehicle		75～85

4、Solid Wastes

Dewatered sludge (with around 80% water content) is main solid waste generated from existing dewatering process in the WWTPs. Dewatered sludge is now transported to

Zhaoqing Yunan Landfill (240 km from Nanzhuang) for disposal. Domestic garbage is sent to local environmental sanitation department for disposal. According to information provided by PIU, current status of solid waste generation is summarized in the table below:

Table 2.1-14 Current Status of Solid Wastes Generation (unit, t/d)

WWTP		Zhen’an	Shagang	Chengbei	Nanzhuang	Total
Existing Filter Press Workshop	Sludge	120	60	30	30	240
	Domestic garbage	0.01	0.01	0.01	0.01	0.04
	Total	120.01	60.01	30.01	30.01	240.04

Main Issues with Existing Facilities

1、High energy consumption: integrated centrifuge thickening and dewatering equipments are used in Zhen’an Phase 2 and 3, Shagang WWTP and Nanzhuang WWTP. Those equipments consume large amount of energy which lead to high operation cost.

2、Dewatering results are not satisfactory: the WWTPs either use “belt thickening + belt filter press” or “integrated centrifuge thickening and dewatering equipments”, which can reduce the water content to only 80%. Such sludge is not accepted by most landfill sites. The Zhaoqing Yunan landfill accepting the sludge is 240 km away from the WWTPs, which leads to high transportation cost.

3、Sludge volume is relatively large: due to 80% of water content, the total volume of dewatered sludge is almost twice of advanced dewatered sludge with 60% of water content, and consequently doubles the transportation cost. The related odor and noise pollution brings negative impact to the environment during the sludge transportation process.

Summary of the Sludge Dewatering Project

（1） Project Name: Foshan Nanzhuang Sludge Treatment Plant

（2） Authorized Government Department: Land, Urban-Rural Development and Water Bureau of Foshan Chancheng District

（3） PIU: Foshan Water Group Co. Ltd.

（4）　Project Scope and Treatment Process: 220 t/d (80% of water content) treatment capacity, sludge conditioning + frame filter press dewatering process.

（5）　Project Location: within the boundary of Zhen’an, Shagang, Chengbei, Nanzhuuang WWTPs, next to the existing sludge dewatering workshops. Nanzhuang WWTP locates west of Chancheng District, north to Kuiqi Road and west to West Changang Road. Zhen’an WWTP locates at No. 58 Zhongyi Road. Shagang WWTP locates at Shiwan Shagang. Chengbei WWTP locates at South East area to Guabuxun Water Gate. Plant locates of this project can be found in Figure 1.1-1.

（6）　Service Area of the Project: sludge produced from Zhen’an, Shagang, Chengbei and Nanzhuang WWTPs.

（7）　Project Objective: to achieve “Volume Reduction, Decontamination and stabilization” so as to avoid secondary pollution from the sludge to the surrounding environment, and to promote “Resource Utilization”(Recycle & Reuse) when sludge quality allows.

（8）　Main Construction Enginerring: construction of advanced sludge dewatering facilities. Sludge final disposal proposals are only as a discussion topic in the EA report(不明白). Construction content of the project includes wet sludge storage, sludge treatment workshop, dewatered sludge storage, office and control center, power substation, and etc.

（9）　Project Investment: total investment of 100.9 million RMB, among which 10.7 million USD (equals to 69.55 million RMB) is financed by World Bank loan.

（10）　Working Hours: 365 days a year, 3 shifts a day, 8 hours each shift.

Advanced Sludge Dewatering Project Analysis

Necessity of the Project

1）Construction of the sludge treatment facility is necessary to ensure environmental and social value of municipal wastewater treatment in Foshan

Wastewater treatment capacity and rate of treatment increased dramatically in recent years. As a result, sludge produced largely increased. Sludge as a by-product of wastewater treatment is a compound which may contain organic matters, bacteria, pathogen, inorganic solids, colloid and heavy metals. Without proper treatment, it is harmful to human health and may cause secondary pollution to surrounding environment, which will offset the benefit brought by wastewater treatment, in another word discount the environmental and social value created by implementing wastewater treatment. Therefore, it is important to integratively manage sludge and to reduce secondary pollution caused by municipal sludge to the largest extent.

2）Construction of the sludge treatment facility is necessary to protect people’s livelihood in Foshan.

Sludge contains a lot of organic matter which will release odor during natural fermentation and evaporation which can affect people’s daily life. Filtrate from sludge dewatering contains also high concentration of pollutants which might pollute surface and ground water system.

3）Construction of the sludge treatment facility is necessary to protect the ecological environment.

Without proper treatment, pathogens, heavy metals and other hazardous components in the sludge may enter the food-chain then attack human body and break the balance of ecosystem.

In summary, construction of the sludge treatment facility is very necessary.

Advance Sludge Dewatering Process

1、Introduction of the Treatment Process

Sludge enhanced dewatering is the dewatering method that involve sludge conditioning, cell membrane break-through, releasing bound water, absorption water and internal cell water, which improve dewatering performance of sludge and reach sludge water content below 60%. At present, there are different domestic nomenclatures of the above technology; conditioning agents include inorganic substances, organic substances or microorganism; dewatering equipments include ordinary filter pressing equipments, high pressure or vaccum pressing equipments. To sum up, enhanced dewatering technology is consisted of the following 4 steps.

Step 1: sludge thickening. Sludge pre-thickening is needed by gravitythickening to reach water content of about 95%, as the water content of sludge in the sludge storage tank in the WWTP is about 99.3%, which will cost large consumption of agent by direct dosing to the high water content sludge; water content of the dewatered sludge is about 80%, and with dosing of polymeric flocculant; large amount of water is combined within the flocculant, therefore, it is needed to change the structure of the combined flocculant to be smaller and decentralized, so that the following dosing can be more homogenized. Generally speaking, technology of dosing of organic substance or inorganic substance use large sludge thickening tank for the sludge thickening; in some circumstance, moderate amount of agent (mainly inorganic flocculant) is used to accelerate the thickening and sedimentation, to reduce the volume of thickening tank; however, sludge need not to be pre-thickened by adopting technology of microorganism agent.

Step 2: sludge conditioning. It is the core of the entire process. For technology of inorganic or organic agent dosing, structure of cell is further destroyed to release the intercellular water and reduce the sludge water content by regulating the pH (normally about pH=12) of the sludge and dosing of substance of high hydrolyzation and oxidation (e.g. Fe^{3+}), with dosing amout of 1-4%; for technology of microorganism agent, organisms in the sludge is digested by the microorganism to reduce sludge amount by adding active microorganism (normally only one time adding is required, as microorganism can reproduce in the sludge and water mixture), aeration and continuous nutrient substance (nutramin, N, P, K, methanol) required by microorganism. Since some water is released from conditioned sludge, sludge and water mixture is then sedimented to reduce the consumption of agent; the supernatant is treated in the WWTP and the following inactivation and flocculation are conducted for the sediment.

Step 3: inactivation and flocculation of sludge. Inactivator and flocculant are added for sludge and water mixture inactivation, to sterilize and remove the odor, which control the emission of odor; porous grid framework is also formed in the sludge so as to improve the compressibility of sludge and improve the strength of the newly formed floccules. CaO is used as inactivator for the organic agent, inorganic agent and the microorganism agent technology, under some circumstances, polyacrylamide is also added to enhance the flocculation effect. The dosage is about 2% (97% water content slugde).

Step 4: Sludge dewatering: filter unit is consisted of filter plate, membrane plate and filter membrane; solid-liquid separation of sludge is done by feeding pump pressure when hydrocylinder compress tightly the filter plate; Membrane-type filter press technology is applied to press the filter cake to improve the dewatering efficiency of the filter press. Normally, traditional plate-and-frame filter press or box pressure filters can be used, more advanced variable high pressure filter press can be also used.

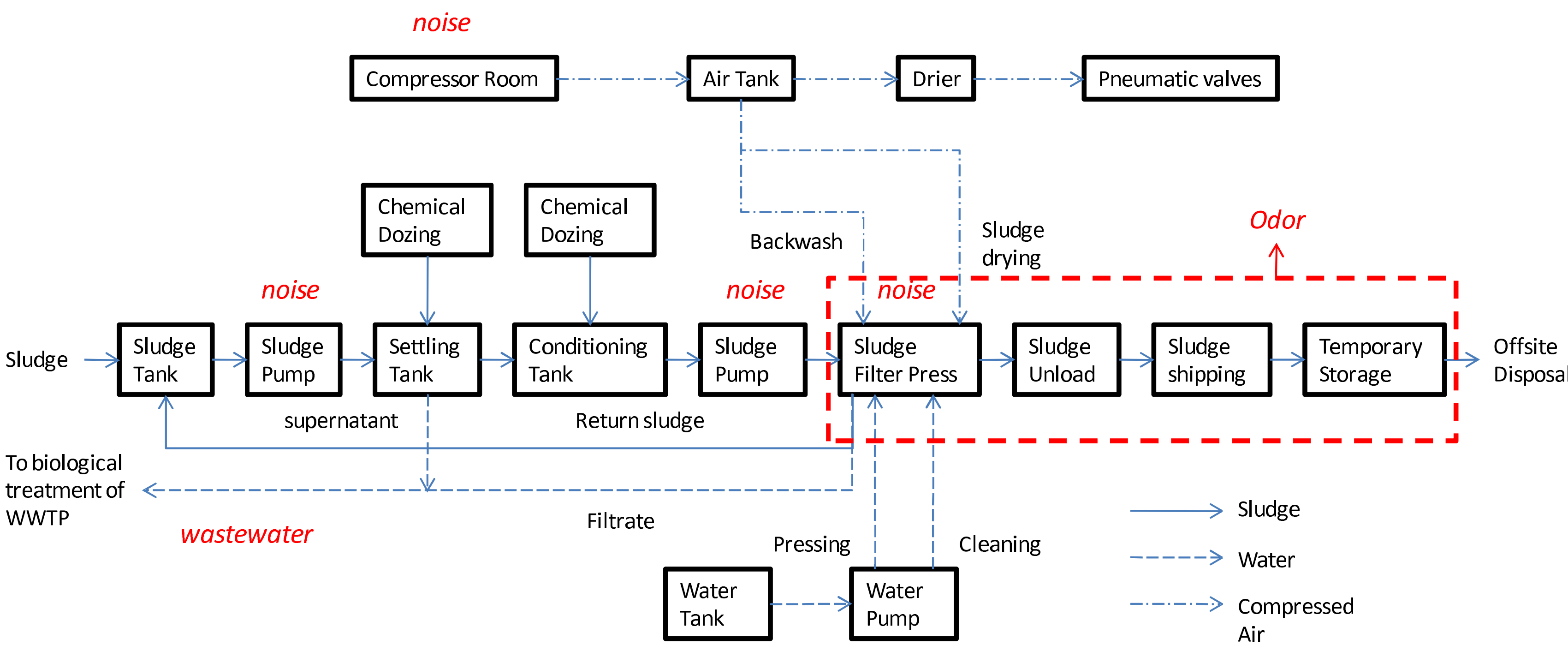
Sludge from municipal WWTP can be dewatered to water content of below 60% by sludge condintioning plate-and-frame filter press enhanced dewatering technology, which is higher in dewatering effectiveness than that of ordinary mechanical dewatering technology. Sludge of 99% water content is pumpd from sludge storage tank in WWTP to sludge conditioning tank; dewatering performance and bioactivity of sludge are improved by adding surface active agent, additives, dewatering auxiliaries and flocculants, etc; sludge is then pumped to plate-and-frame filter press for filter press dewatering, which is batch-type dewatering, with interval of about 2.5 hours. 2 t sludge of water content below 60% is produced by single set of machine in a operation process, which reduce sludge amount by more than half, further achieve sludge reduction, stabilization and harmlessness. “The Disposal of Sludge from Municipal Wastewater Treatment Plant-Quality of Sludge for Co-landfilling” (CJ/T249-2007) requires that sludge water content should be below 60% for co-landfilling, Mix ratio between garbage and sludge should be less than 8%, sludge used as mulchingsoil should be less than 45% in water content and for soil use the water content should be also below 60%. Sludge dewatered by enhanced dewatering can meet all the requirements above, and be landfilled, incinerated or reused. The agent dosage is about 3‰, which will not pose major impact on the sludge weight. Moreover, expensive natural gas is not used as fuel; the equipments are flexible and can make use of every single space in each plant, so as to save construction land use, and reduce the cost of wet sludge transport and reduce the impact of wet sludge transport on the environment.

2、Rationality of treatment process

This project is enhanced sludge dewatering. Chapter 2.2.1 of “Guideline on Best Available Technologies of Pollution Prevention and Control for Treatment and Disposal of Sludge from Municipal Wastewater Treatment Plant (on trial)” （HJ-BAT-002）issued by MEP in Feb 2010 indicates that, “sludge thickening and dewatering are classified as sludge pre-treatment technologies”, therefore, this project is sludge pre-treatment project.

Chapter 3.4.2 of Guideline indicates that, “sludge dewatering includes natural drying dewatering, thermal drying dewatering and mechanical dewatering, dewatering refer to mechanical dewatering in this Guideline. Common mechanical dewatering includes filter press and centrifugal dewatering, of which filter press mainly refer to plate-and-frame type and belt type”. In chapter 8.2 “Guideline on Best Available Technologies of Pollution Prevention and Control for sludge pre-treatment”, it is indicated that, “Best Available Technologies system of Pollution Prevention and Control for sludge pre-treatment include collection system, thickening system, digestion system, dewatering system, storage and transport system, metering system and auxiliary facilities, etc.”, “mechanical dewatering is applicable to medium-large municipal WWTPs”, “batch-type gravity thickening is applicable to small municipal WWTPs”. Dewatering technology adopted in this project is mechanical dewatering; Zhen’an, Shagang, Chengbei and Nanzhuang WWTPs belong to large scale WWTP, therefore, dewatering technology adopted by this project is in line with the recommended “best available technologies” in the “Guideline on Best Available Technologies of Pollution Prevention and Control for Treatment and Disposal of Sludge from Municipal Wastewater Treatment Plant”

Figure 2.3-1 Process Diagram of the Advanced Dewatering System



3、Temporary Storage of Dewatered Sludge

Dewatered sludge is temporarily stored in a sludge bucket inside the dewatering workshop and transported out regularly. Vehicle used to transport sludge is modified 5 t Dongfeng Truck. Depending on sludge volume, transportation frequency in each plant is: 12 trips/d in Zhen’an WWTP, 6 trips/d in Shagang WWTP, and 3 trips/d in Chengbei and Nanzhuang WWTPs, which is a total of 24 trips/d. Filter press is operated in batches with 2.5 hr per batch. Sludge will be sent offsite once it’s produced, and leftovers will be sent together with the next batch. Zhen’an, Shagang, Chengbei and Nanzhuang WWTPs will be equipped respectively 4, 3, 2, and 2 sets of dewatering equipments, which will produce 8t, 6t, 4t, and 4t of sludge every batch. Therefore, sludge can be sent offsite no longer than 2.5 hrs after dewatered.

Engineering Design of the Advanced Dewatering Proposal

1、Key Design Parameters

Water content before treatment: 99%;

Water content after treatment: below 60%;

Sludge volume before and after treatment is summarized in the table below:

Table 2.3-1 Sludge Volume Before and After Treatment

WWTP	Zhen’an	Shagang	Chengbei	Nanzhuang
Before Dewatering（t/d, water content 99%）	2400	1200	600	600
After Dewatering（t/d, water content 60%）	60	30	15	15
Design Treatment Capacity（t/d, water content 80%）	120	60	30	30

2、Proposed Equipment

Dewatering equipments of each plant mainly include: filter press equipment, air compressing equipment, agitator, sludge (water) pump, tanks and containers etc. Major equipements of each plant are listed in the tables below:

Table 2.3-2 List of major equipments of enhanced sludge dewatering project in Zhen'an WWTP

Id	Equipments	Specification	Power (kW)	Uint	Number	Material	Remark
1	sludge plate-and-frame filter press machine	LY1250	13	set	4	End product	
2	air compressor	2.48/10	18	/	2	End product	
3	sludge pump		15	/	4	End product	raw sludge
4	sludge pump		22	/	6	End product	sludge into dewatering machine
5	washing pump		18.5	/	1	End product	
6	extrusion pump		15	/	4	End product	
7	screwpropelle		7.5	/	4	End product	
8	screwpropeller		11	/	3	End product	
9	agitator		5.5	/	2	End product	agent
10	agitator		15	/	4	End product	conditionin g
11	sediment tank	$100m^3$		/	4	steeliness	
12	conditioning tank	$50m^3$		/	4	steeliness	
13	clean water tank	$12m^3$		/	2	steeliness	
14	agent agitator tank	$10m^3$		/	2	steeliness	
15	dosing pump		5.5	/	2	End product	

16	air tank	4m^3		/	6	steeliness	
17	crushing equipment		18.5	set	1	End product	
18	dryer		0.75	/	1	End product	
19	lime silo	75m^3		/	2	steeliness	
20	lime milk metering pump		1.5	/	4	End product	
21	lime milk equilibriumbox	1m^3		/	2	steeliness	
22	lime milk agitator tank	2m^3	5	/	2	steeliness	
23	volumetric screwfeeder	0,5~1m^3/h	0.75	/	2		
24	vibrating feeder	2.5 m^3	3	/	2		

Table 2.3-3 List of major equipments of enhanced sludge dewatering project in Shagang WWTP

Id	Equipment	Specification	Power kW	Unit	Number	Material	Remark
1	sludge plate-and-frame filter press machine	LY1250	13	set	3	End product	
2	air compressor	2.48/10	15	/	2	End product	
3	sludge pump		15	/	2	End product	raw sludge
4	sludge pump		22	/	5	End product	sludge into dewatering machine

5	washing pump		18.5	/	1	End product	
6	extrusion pump		15	/	3	End product	
7	screwpropelle		7.5	/	3	End product	
8	screwpropelle		11	/	3	End product	
9	agitator		5.5	/	2	End product	agent
10	agitator		15	/	4	End product	conditionin g
11	sediment tank	$100m^3$		/	2	steeliness	
12	conditioning tank	$50m^3$		/	2	steeliness	
13	clean water tank	$12m^3$		/	2	steeliness	
14	agent agitator tank	$10m^3$		/	2	steeliness	
15	dosing pump		5.5	/	2	End product	
16	air tank	$4m^3$		/	3	steeliness	
17	crushing equipment		18.5	set	1	End product	
18	dryer		0.75	/	1	End product	
19	lime silo	$75m^3$		/	1	steeliness	
20	lime milk metering pump		1.5	/	2	End product	
21	lime milk equilibriumbo x	$1m^3$		/	1	steeliness	

22	lime milk agitator tank	$2m^3$	5	/	1	steeliness	
23	volumetric screwfeede	$0,5\sim1m^3/h$	0.75	/	1		
24	vibrating feeder	$2.5\ m^3$	3	/	1		

Table 2.3-4 List of major equipments of enhanced sludge dewatering project in Chengbei WWTP

Id	Equipment	Specification	Power kW	Unit	Number	Material	Remark
1	sludge plate-and-frame filter press machine	LY1250	13	set	2	End product	
2	air compressor	2.48/10	15	/	2	End product	
3	sludge pump		15	/	2	End product	raw sludge
4	sludge pump		22	/	4	End product	sludge into dewatering machine
5	washing pump		18.5	/	1	End product	
6	extrusion pump		15	/	2	End product	
7	screwpropelle		7.5	/	2	End product	
8	screwpropelle		11	/	2	End product	
9	agitator		5.5	/	2	End product	agent
10	agitator		11	/	4	End product	conditionin g
11	sediment tank	$60m^3$		/	2	steeliness	
12	conditioning tank	$30m^3$		/	2	steeliness	
13	clean water tank	$12m^3$		/	2	steeliness	
14	agent agitator tank	$10m^3$		/	2	steeliness	

15	dosing pump		5.5	/	2	End product	
16	air tank	4m^3		/	3	steeliness	
17	crushing equipment		18.5	set	1	End product	
18	dryer		0.75	/	1	End product	
19	lime silo	40m^3		/	1	steeliness	
20	lime milk metering pump		1.1	/	2	End product	
21	lime milk equilibriumbox	1m^3		/	1	steeliness	
22	lime milk agitator tank	2m^3	3	/	1	steeliness	
23	volumetric screwfeede	0,15~0.3 m^3/h	0.55	/	1		
24	vibrating feeder	1.5 m^3	3	/	1		

Table 2.3-5 List of major equipments of enhanced sludge dewatering project in Nanzhuang WWTP

Id	Equipment	Specification	Power kW	Unit	Number	Material	Remark
1	sludge plate-and-frame filter press machine	2.48/10	15	/	2	End product	
2	air compressor		15	/	2	End product	
3	sludge pump		22	/	4	End product	raw sludge
4	sludge pump		18.5	/	1	End product	sludge into dewatering machine
5	washing pump		15	/	2	End product	
6	extrusion pump		7.5	/	2	End product	
7	screwpropelle		11	/	2	End product	
8	screwpropelle		5.5	/	2	End product	
9	agitator		11	/	4	End product	agent
10	agitator	$60m^3$		/	2	steeliness steely	conditionin g
11	sediment tank	$30m^3$		/	2	steeliness	
12	conditioning tank	$12m^3$		/	2	steeliness	
13	clean water tank	$10m^3$		/	2	steeliness	
14	agent agitator tank		5.5	/	2	End product	

15	dosing pump	$4m^3$		/	3	steeliness	
16	air tank		18.5	set	1	End product	
17	crushing equipment		0.75	/	1	End product	
18	dryer	$40m^3$		/	1	steeliness	
19	lime silo		1.1	/	2	End product	
20	lime milk metering pump	$1m^3$		/	1	steeliness	
21	lime milk equilibriumbo x	$2m^3$	3	/	1	steeliness	
22	lime milk agitator tank	0,15~$0.3m^3/h$	0.55	/	1		
23	volumetric screwfeede	1.5 m^3	3	/	1		
24	vibrating feeder	2.48/10	15	/	2	End product	

3、Plant Layout and Surrounding Areas

It is planned to built the advanced sludge dewatering facilities within or next to the existing dewatering workshop. According to the process design, it requires a storage area and a dewatering workshop. Within storage area, there are a pre-treatment workshop with chemical preparation, storage and dozing equipments. Within sludge dewatering workshop, there are filter press and pump sets. Detailed layout and surrounding areas of each WWTP is shown in Figure 2.3-2~9.

a、 Zhen’an WWTP

According to the current plant layout of Zhen’an WWTP, advanced sludge dewatering facilities are planned to be built in the area south to the existing dewatering workshop.

All facilities will be built in one workshop. According to process design, a 45*35 m workshop with light steel structure will be built. It will cover a total area of 2000 m^2.

b、 Shagang WWTP

The advanced sludge dewatering facilities are planned to be built next to the existing dewatering workshop. It will be divided into storage area and dewatering workshop. Storage area will be located around current sludge storage tank, with an area of 1017m^2. Existing dewatering workshop will be renovated to advanced dewatering workshop. It will cover a total area of 1800 m^2.

c、 Chengbei WWTP

Similar to Shagang WWTP, the area will be divided into storage area and dewatering workshop. The storage area (605 m^2) will locate next to existing dewatering workshop which is west to the power substation. Existing dewatering workshop will be renovated to advanced dewatering workshop. It will cover a total area of 1100 m^2.

d、Nanzhuang WWTP

Nanzhuang WWTP is currently under construction. The original sludge dewatering workshop will be upgraded to the advanced sludge dewatering workshop. All facilities will locate in a single workshop. According to process design, a 40*30m workshop with light steel structure will be built. It will cover a total area of 1500 m^2.

Total construction area of advanced dewatering workshop in each WWTP is summarized in the table below:

Table 2.3-3 Total Construction Area of the Dewatering Workshop in each WWTP

WWTP	Zhen’an	Shagang	Chengbei	Nanzhuang
Total Area Covered（m^2）	2000	1800	1100	1500
Workshop Area（m^2）	1575	Dewatering Workshop (existing): 440 Pump Station:112.5	Dewatering Workshop (existing): 484	1200

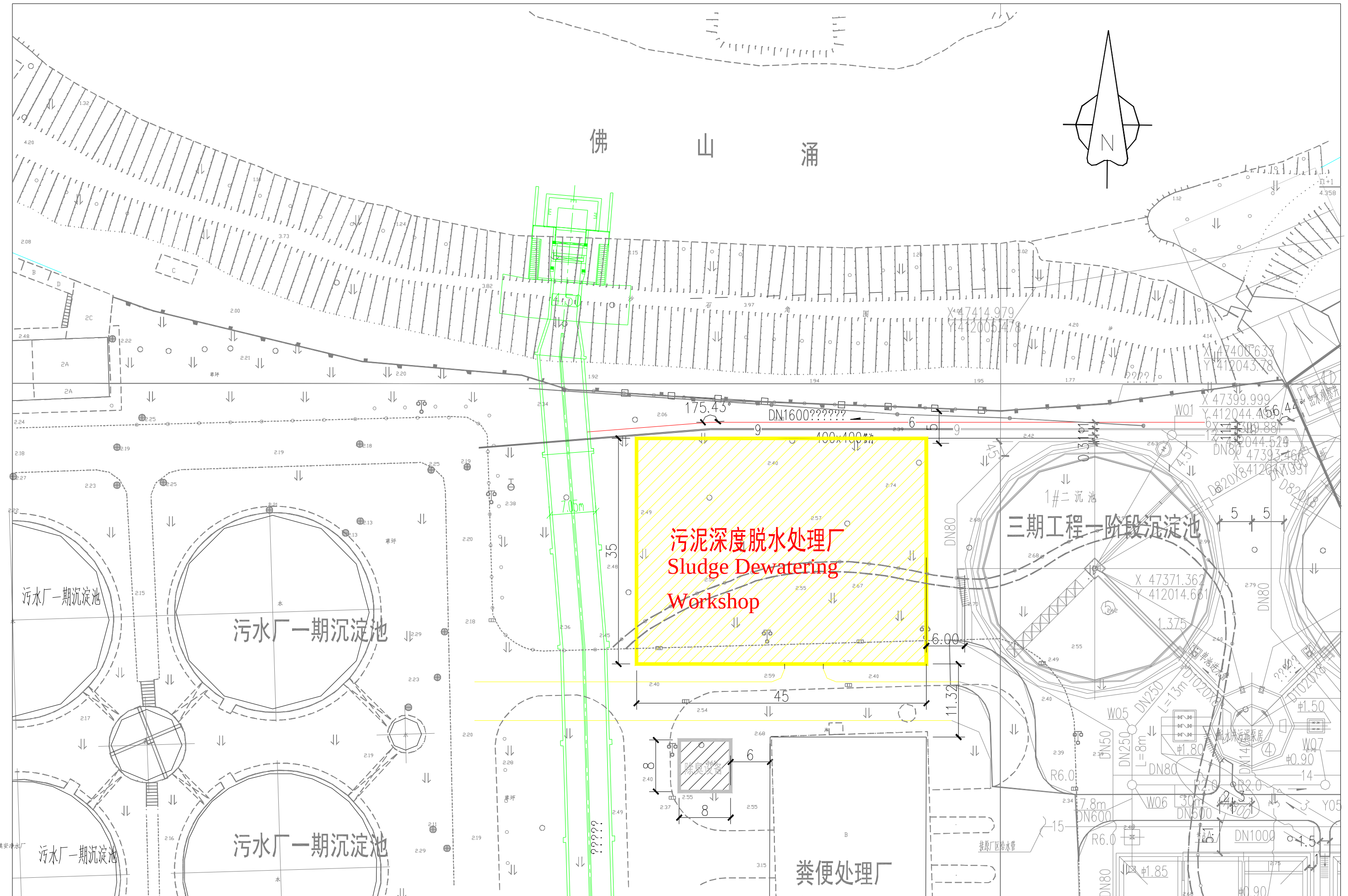


Figure 2.3-2 Site Location of the Zhen'an WWTP Sludge Dewatering Workshop (**Scale 1:960**)

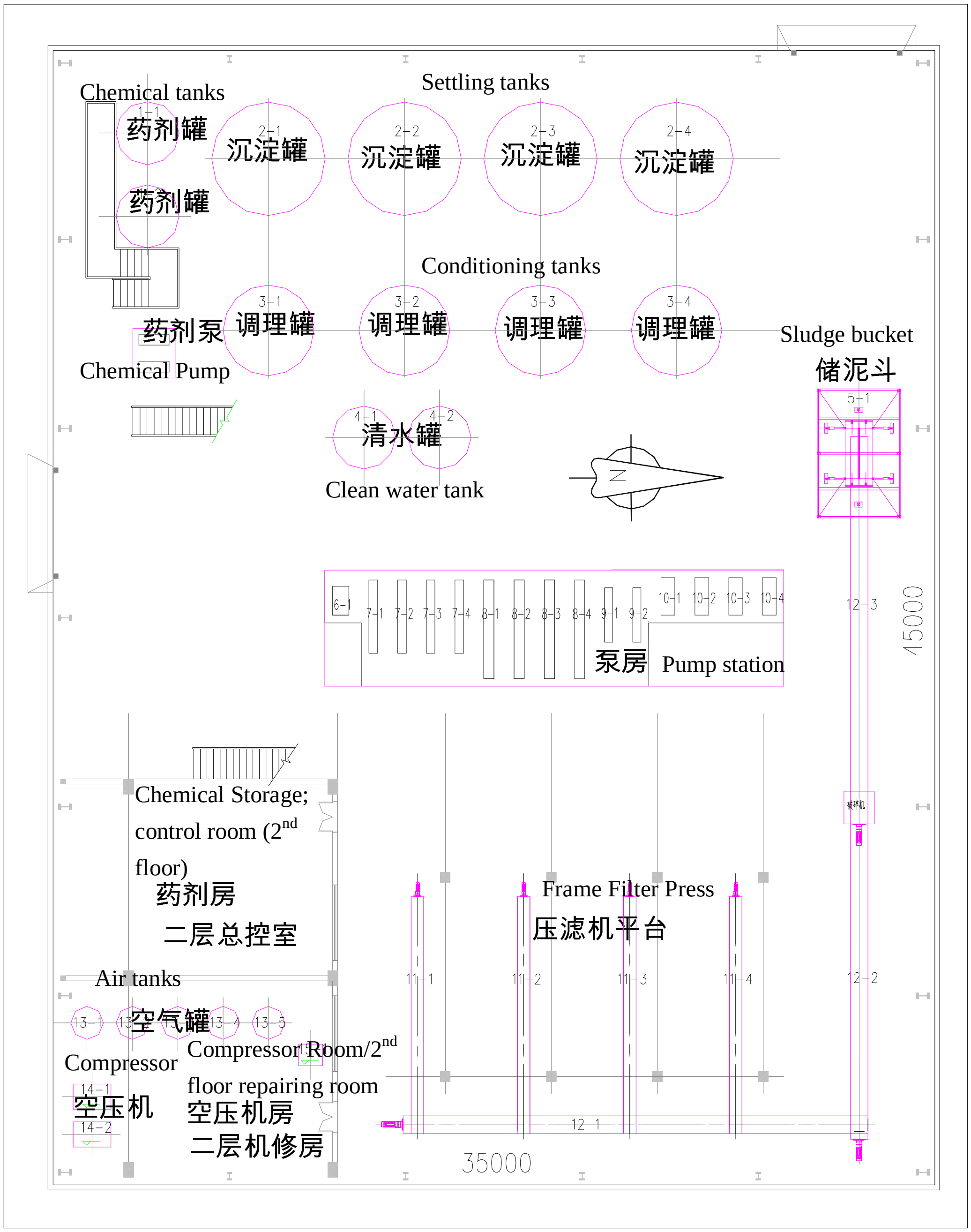


Figure 2.3-3 Layout of Zhen’an WWTP Sludge Dewatering Workshop **(Scale1:260)**

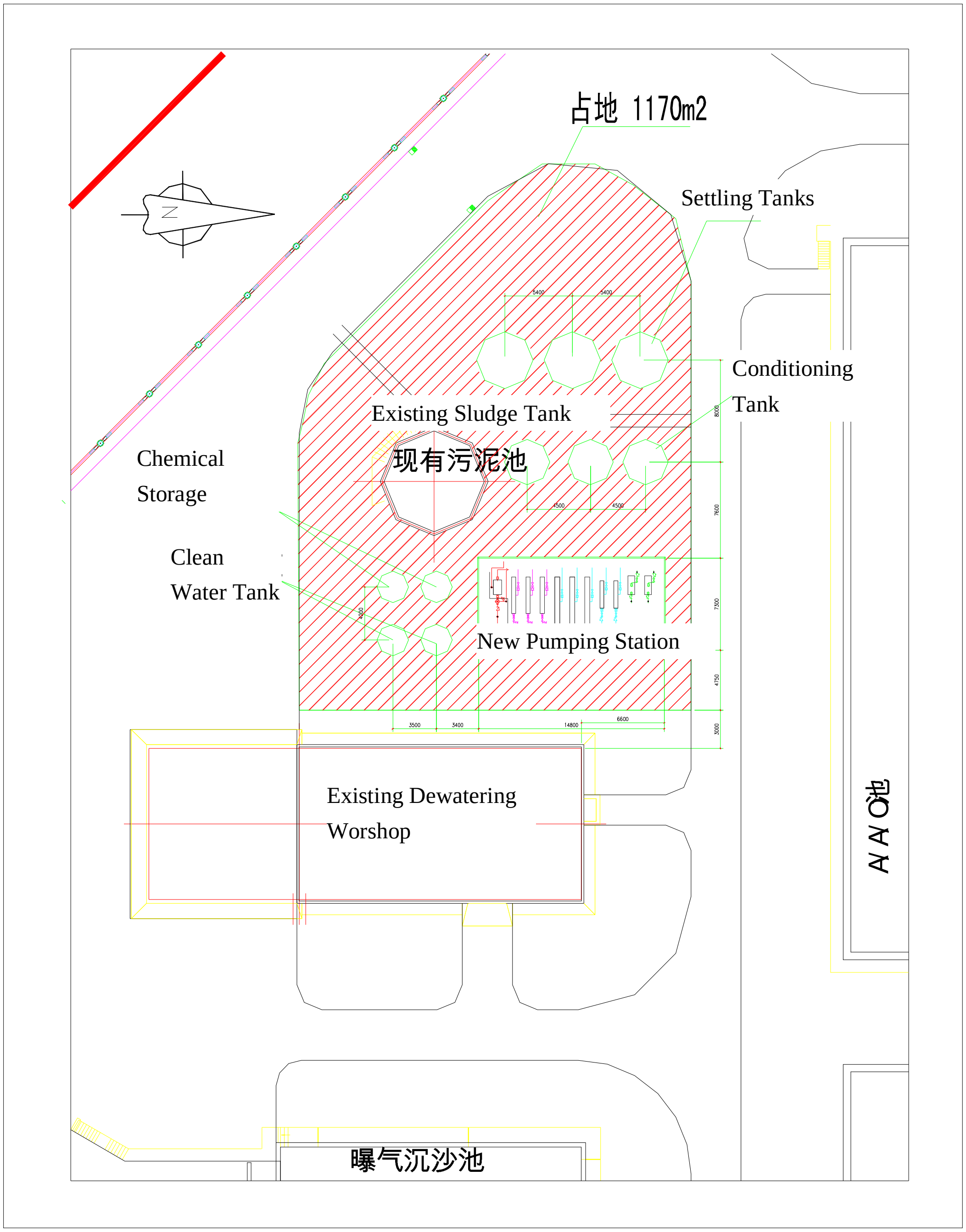


Figure 2.3-4 Layout of Shagang WWTP Sludge Dewatering Workshop **Scale1:500**

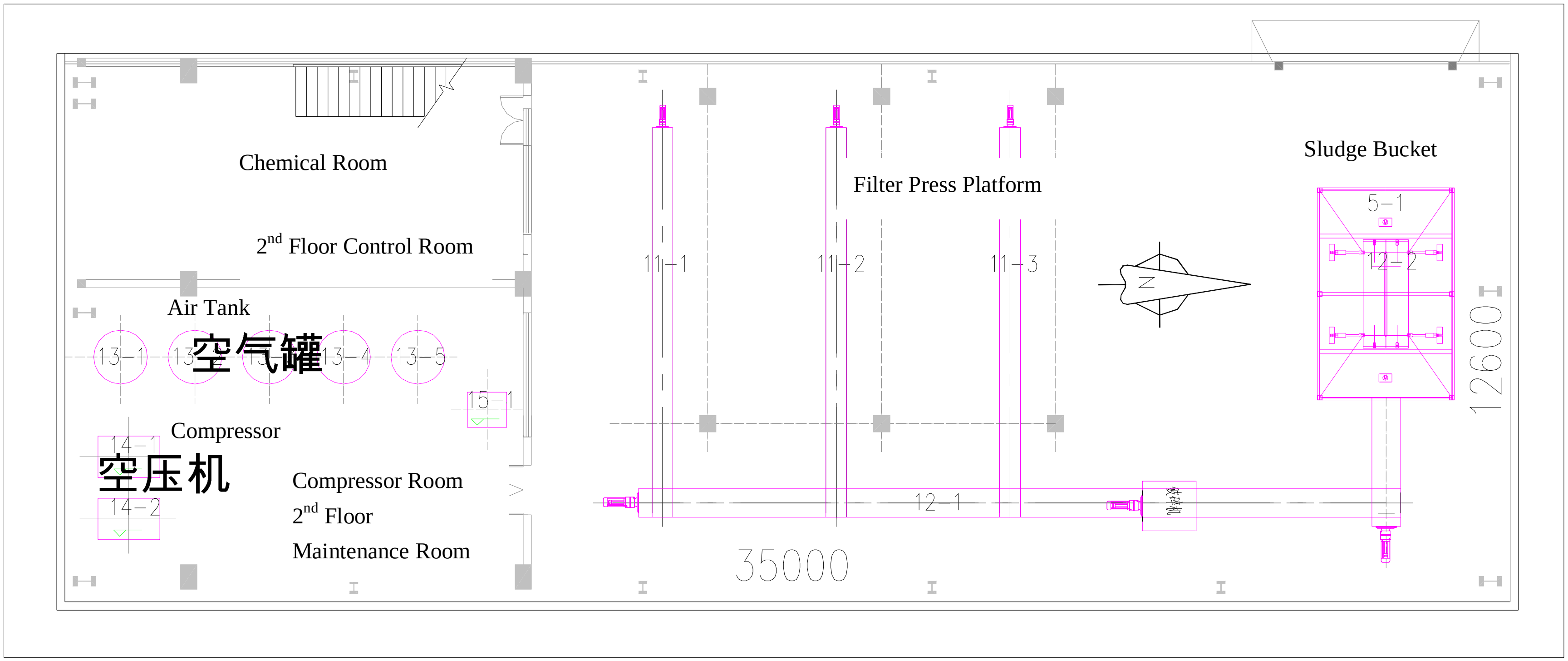


Figure 2.3-5 Layout of Shagang WWTP Advanced Sludge Dewatering Workshop

Scale 1:230□□ 1:150

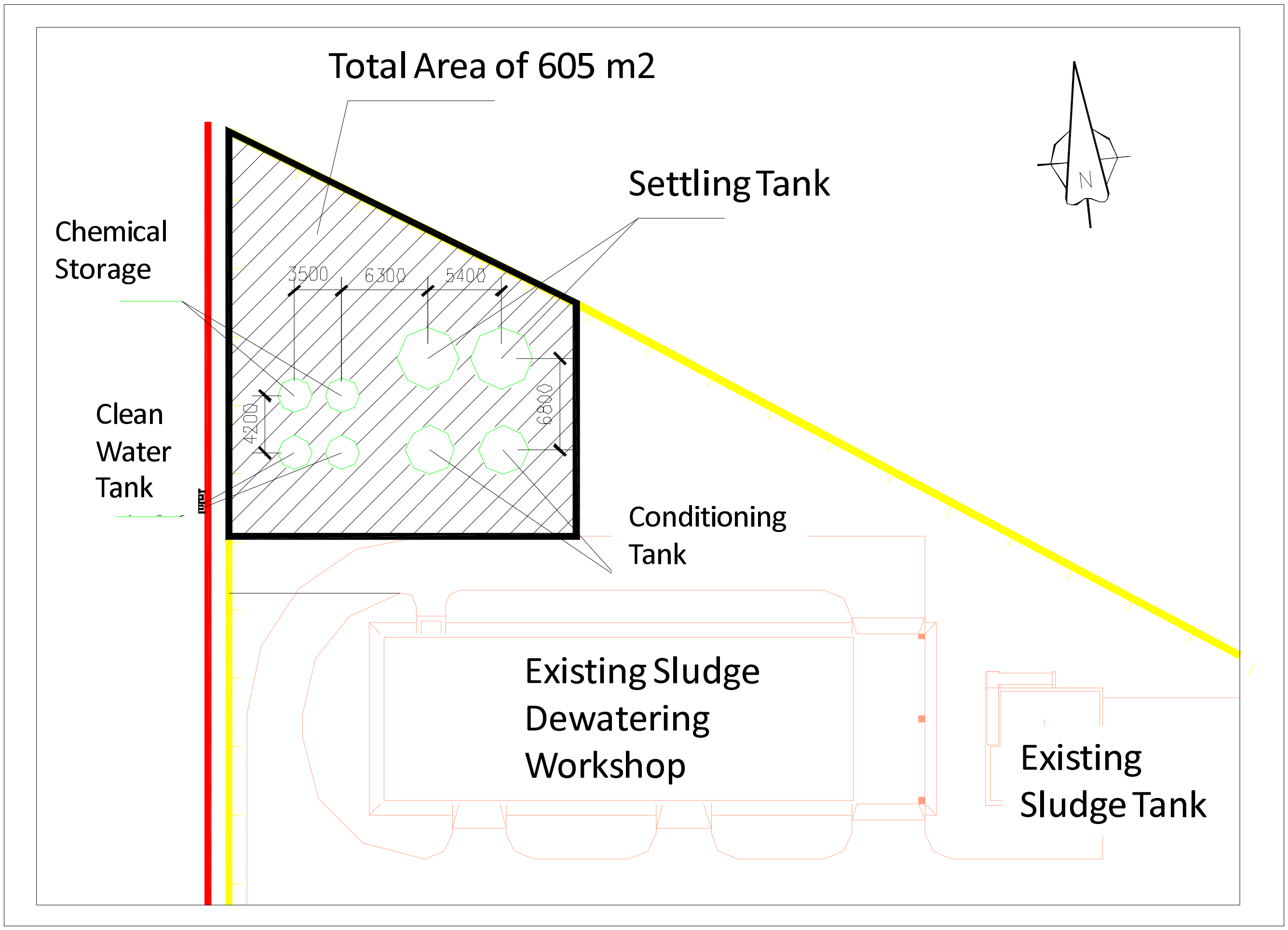


Figure 2.3-6 Layout of Chengbei WWTP Sludge Dewatering Workshop **Scale 1:500**

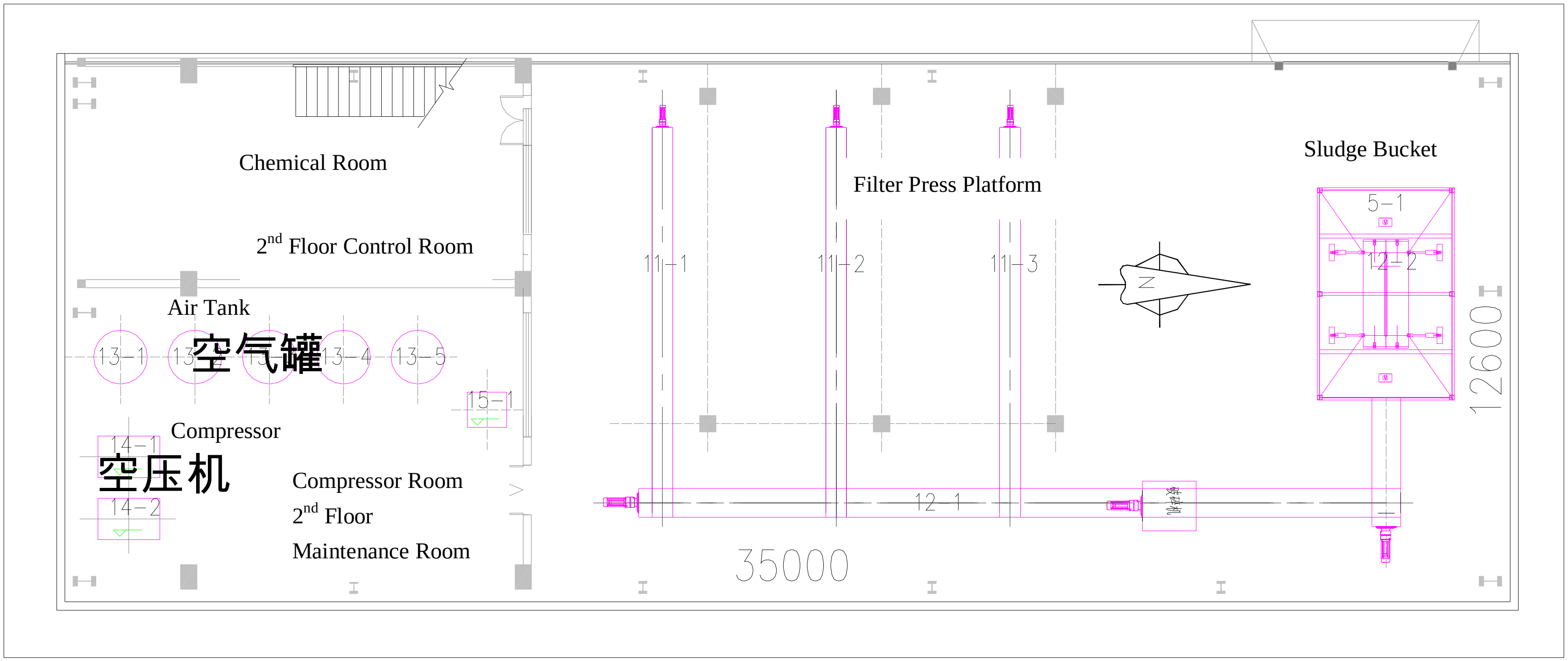


Figure 2.3-7 Layout of Chengbei WWTP Advanced Sludge Dewatering Workshop

Scale 1:230□□ 1:150

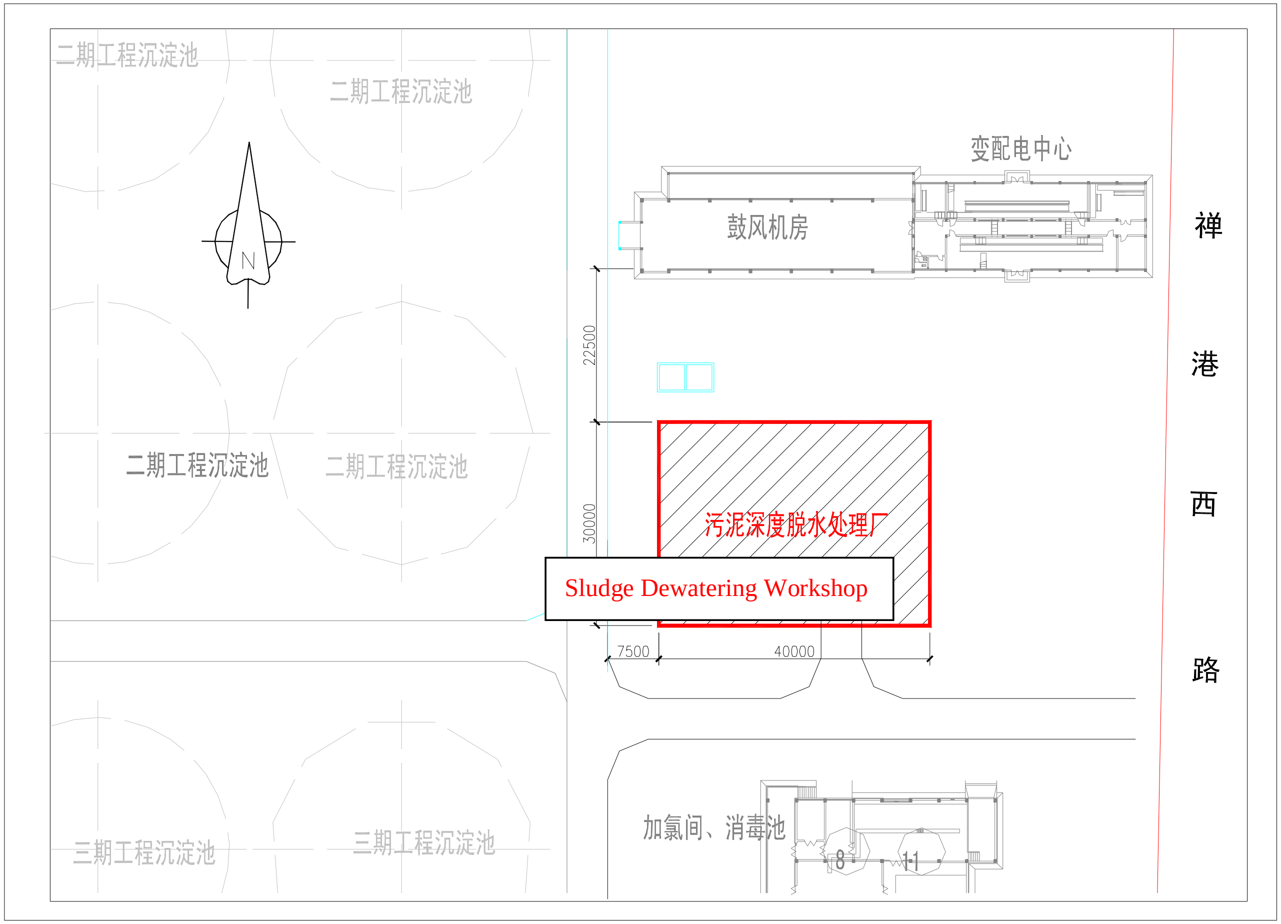


Figure 2.3-8 Site Location of Nanzhuang WWTP Sludge Dewatering Workshop **Scale 1:900**

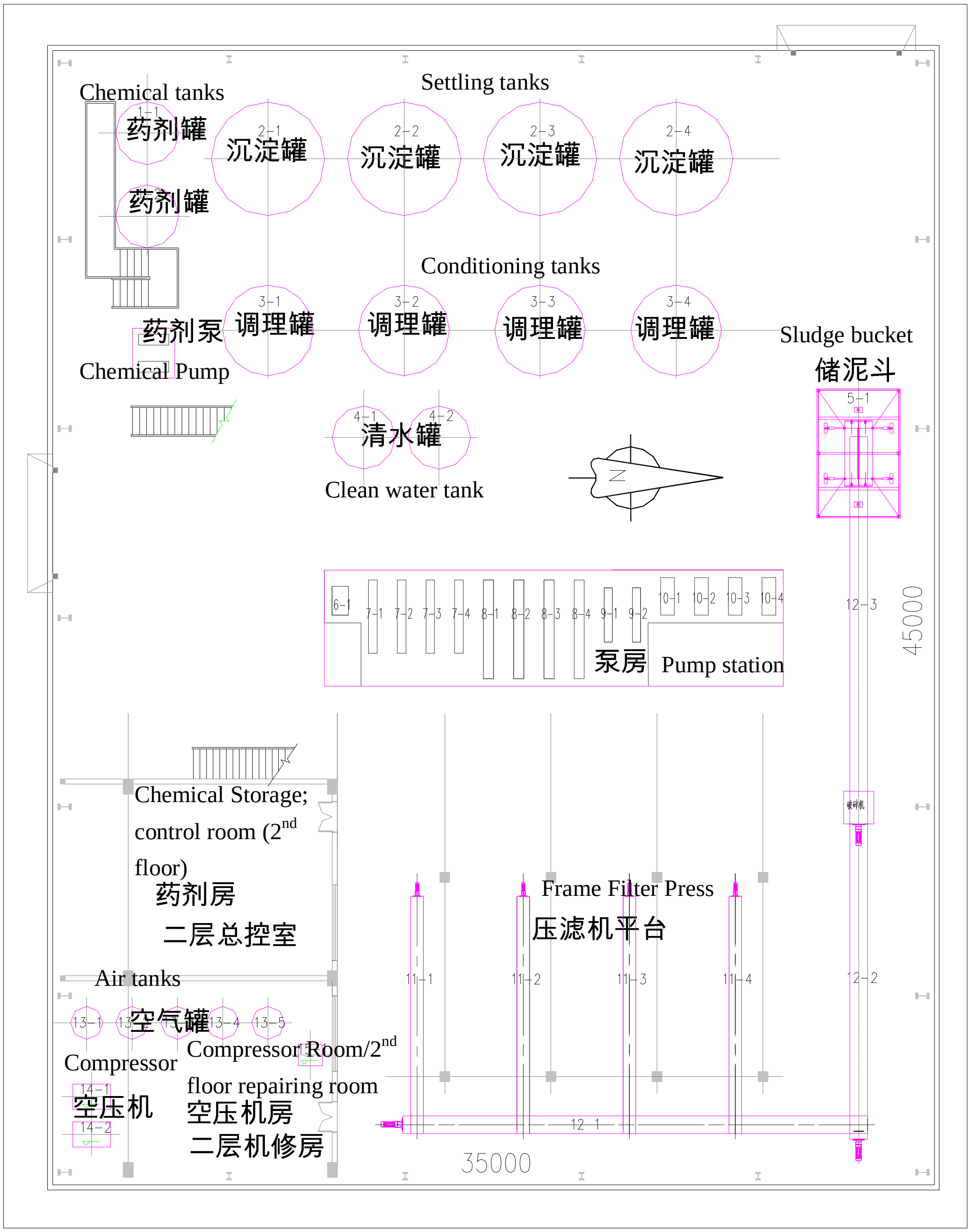


Figure 2.3-9 Layout of Nanzhuang WWTP Sludge Dewatering Workshop **Scale 1:230**

2.3.4 Public Utility and Staff Arrangement

1、Water Supply and Sewage System

Water will be supplied by WWTP.

Drainage system is designed consistent with existing drain which is a separate system. Production and domestic wastewater will be discharged directly into the drainage system in the plant and sent to WWTP for treatment.

Table 2.3-7 Project Water Usage, unit: m^3/d

WWTP	Zhen'an	Shagang	Chengbei	Nanzhuang
Domestic water usage (from municipal water supply)	1	1	1	1
Industrial water usage (from municipal water supply)	10	8	5	5
Industrial recycle water (from treated wastewater)	50	30	20	20

2、Power Supply System

Power will be supplied through a separate electrical control cabinet from the WWTP power substation. Most equipments are 380/220V low voltage installations. Electricity supply to firefighting equipment, firefighting control room, anti-smoke facility, fire-alarm system, network system, emergency lighting system and evacuation signal is categorized as Class II. Other usage is categorized as Class III. According to the feature of electrical load and use requirement, two lines of 10kV power will be provided from substation to ensure Class II usage. Power supply circuit will be connected to the closest 2 10kV switch.

Lighting of the project includes routine lighting and emergency lighting.

Evacuation lighting will be settled at entrance, evacuation routes and emergency exits.

3、Lightening Protection Design

According to relevant design criterion, buildings of the project should have protection from lightning strikes, lightning sensor and lightning invasion. In top of buildings, lightning network connected to flash device and form a grounding ring with reinforced concrete roof slab, beam-column and reinforced concrete base is recommended. Protective grounding of electric equipment should be connected to the grounding ring nearby. Outlet of the cable, metal skin and steel pipe should also be connected to the grounding ring and the ground-resistance should less than one Ω.

Lightning guard should be set additional around buildings to protect person on the path or green open space. Coordination with the environment should also be considered when setting the lighting guard.

Electric instrument and test equipment in the network center according to its type should be equipped with various computer signal electronics arrester, DC power surge absorption device and over-voltage protection device distribution system etc.

4、Ventilation System

Ventilation system setup in electric room and equipment room is shown in Table 4-1.

Table 2.3-8 Ventilation System in Electric and Equipment Rooms

Name of rooms	System form	Input volume	Output volume	remarks
transformer substation	Mechanical blowing-in and exhaust	（20）	（20）	
Pump house	Mechanical blowing-in and exhaust	（6）	（6）	
Garage	Mechanical blowing-in and exhaust	（6）	（6）	
Public toilets	Mechanical exhaust and natural blowing-in	（15）	（15）	
Sludge dewatering workshop	Mechanical exhaust and natural blowing-in	(6)	(6)	

5、Firefighting System

This project locates in the WWTP, and all fire water will be supplied by the WWTP.

Outdoor fire water system will be used for fire water supply in the sludge dewatering system.

Indoor fire water system will be used for indoor fire water supply in sludge dewatering workshop.

In the transformer room and power substation, gas fire extinguishing system should be equipped to put out an electrical fire.

According to nature of the building, grade of fire risk, quantity of inflammable material, rate of fire spread, difficulty of fighting and the type of fire, moderate portable extinguisher should be equipped to put out an initial fire.

6、Sludge Test

For the purpose of analyzing and monitoring pollutant emissions data, a chemical laboratory equipped with necessary analysis and test equipment is required for the project. Main items of analysis are:

Water: CODcr, BOD_5, pH, DO, SS, LAS, oil, Volatile Phenol, sulfide, cyanide, Cr^{6+}, benzene, NH_4-N, TP;

Sludge: heat value, Hg, Pb, Cd, Cr, Cu, Zn, Be, Ba, Ni, As

Mainly instruments include: analyzer, COD Analyzer, heating effect indicator, high-performance tester, high-performance desktop chromatography, mass spectrometer, atomic absorption spectrophotometer, microwave absorption moisture gage, dust analyzer, thermal flowmeter, precision incubator etc.

7、Electrical and Mechanical Maintenance

Tasks of electrical and mechanical maintenance room include mechanical maintenance, electrical maintenance, instrument maintenance and daily maintenance, minor repair and emergencies handling of process units, vehicle and other equipments in the plant. A electrical and mechanical maintenance room has been set up in the plant and its maintenance capacity satisfy the need of the project.

8、Staff Organization

The plant is operating 24 hrs a day, with 3 shifts a day and 8 hrs per shift. Each plant has 19 operating staff including 17 operators, 1 manager and 1 driver.

Environmental Impact Factor

Wastewater

1、Wastewater generated from the sludge dewatering project

The dewatering project will not build dormitory and canteen. Wastewater from the project includes filtrate from sludge dewatering and domestic wastewater. Wasted liquid and rinsing water of specific containers generated from lab will contain heavy metal, strong acid and basic solutions, which need to be assigned to licensed entity for harmless treatment. Normal rinsing water from the lab can be discharged into the WWTP for treatment.

Table 2.4-1 summarizes wastewater generated from sludge dewatering. Such wastewater contains COD_{cr}, BOD_5, SS, NH_4-N, consulting other similar project quality of the wastewater can be found in table 2.4-2.

Table 2.4-1 Wastewater Generated from the Sludge Dewatering Project (unit m^3/d)

WWTP	Zhen'an	Shagang	Chengbei	Nanzhuang	Total
Domestic Wastewater*	0.9	0.9	0.9	0.9	3.6
Lab rinsing wastewater	0.1	0.1	0.1	0.1	0.4
Filtrate from Sludge Filter Press	2350	1178	590	590	4708ı
Total	2351	1179	591	591	4712ı

*counted as 90% of water usage, see Table 2.3-4

Major pollutants above are CODcr, BOD5, SS,NH3-N etc. according to the data in "Technologies of Sludge Enhanced Dewatering Treatment and Reuse Disposal in Xiamen" (Xie Xiaoqing, Water Industry Market, 2010.7), concentration of CODcr in wastewater from sludge enhanced dewatering is about 1200mg/l, BOD5 about 800mg/l, NH3-N about 120mg/l and SS about 100mg/l. According to the data collected from study tours to 9 similar sludge enhanced dewatering projects in Guangzhou, Xiamen, Hangzhou and Wuxi in October 2010 (CODcr concentration is 250~1200mg/l); the water quality is shown in Table 2.4-2.

Table 2.4-2 Water Quality of Wastewater Generated from the Project (unit m^3/d)

Pollutant		CODcr	BOD_5	SS	NH_4-N
Concentration（mg/l）		1100	400	100	75
Pollution Load（t/a）	Zhen' an	943.93	343.25	85.81	64.36
	Shagang	473.37	172.13	43.03	32.28
	Chengbei	237.29	86.29	21.57	16.18
	Nanzhuang	237.29	86.29	21.57	16.18

	Total	2991.88	1087.96	271.98	204.00

Those wastewater streams will be treated in the WWTPs. Water quality after treatment is shown in Table 2.4-3.

Table 2.4-3 Designed Treated Wastewater Quality

Pollutant		CODcr	BOD_5	SS	NH_4-N
Concentration (mg/l)		60	30	30	25
Pollution loading（t/a）	Zhen’an	51.49	25.75	25.75	21.45
	Shagang	25.82	12.91	12.91	10.76
	Chengbei	12.94	6.47	6.47	5.39
Concentration (mg/l)		40	20	20	8
Pollution loading（t/a）	Nanzhuang	8.63	4.31	4.31	1.73
Total□t/a□		98.88	49.44	49.44	39.33

According to routine monitoring data from Foshan Environmental Monitoring Centre, treated effluent water quality is significantly lower than discharge limits. Therefore, the actual water pollution of the project would probably be much lower than estimated in Table 2.4-3. Some of the monitoring data is summarized in the table below:

Table 2.4-4 Water Quality Monitoring Data of WWTP Treated Effluent (unit: mg/L)

Pollutant		CODcr	BOD_5	SS	NH_4-N
Zhen’an	2010.05	10	1.0	8	0.132
	2009.11	17	2	9	0.202
	2009.08	15	4.8	9	1.171
Shagang	2009.11	13	2	6	0.108
Chengbei	2010.05	18	1.7	10	0.543
	2009.11	23	2	7	0.618
Discharge Standard		60	30	30	25
Actual measurement range		10□23	1.0□4.8	6□10	0.108□1.171
Max recorded value / standard value (%)		38.3%	16.0%	33.3%	4.7%

3□Water Balance

Water balance of each WWTP is summarized in Figure 2.4-1~3.

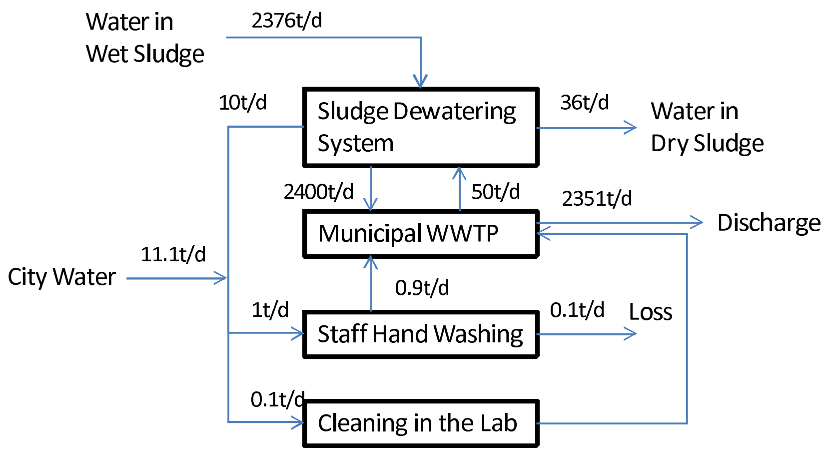


Figure 2.4-1 Water Balance of Zhen'an WWTP Sludge Dewatering Project

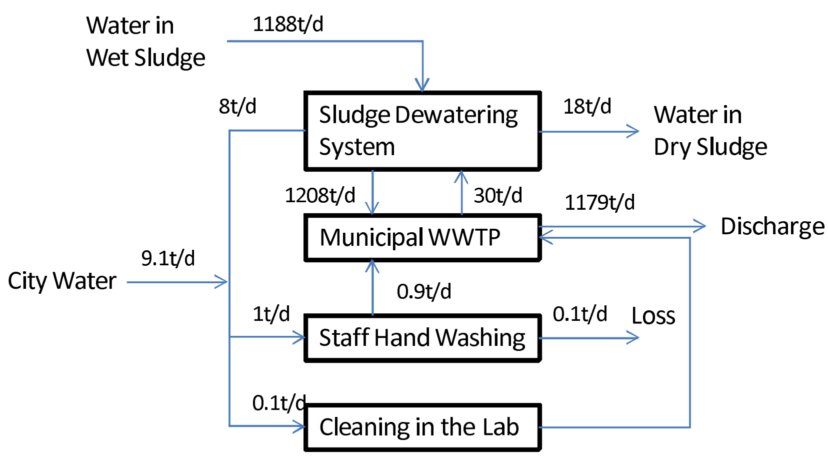


Figure 2.4-2 Water Balance of Shagang WWTP Sludge Dewatering Project

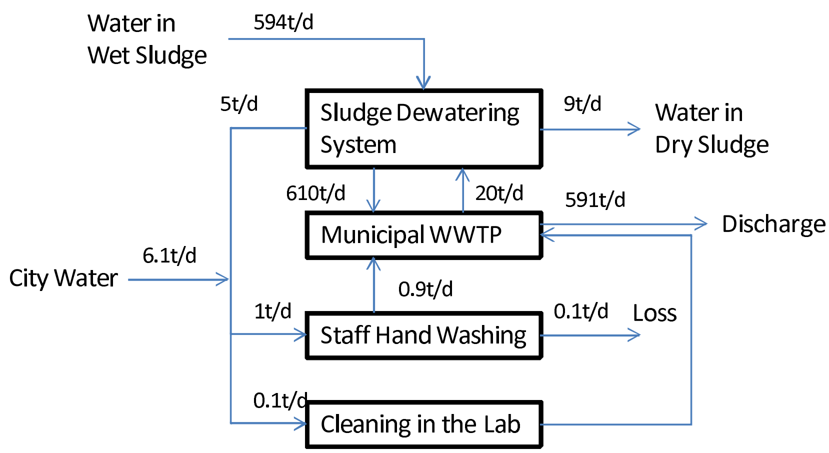


Figure 2.4-3 Water Balance of Cheng'an and Nanzhuang WWTP Sludge Dewatering Project

2□Wastewater Volume Increase in Each WWTP

After implementation of the sludge dewatering project, wastewater discharge generated will change due to higher dewatering efficiency. Such increase ranges from 21 to 71 m^3/d in each WWTP, and details are showed in table below.

Table 2.4-5 Wastewater Volume Increase Caused by the Project (unit: m^3/d)

WWTP			Zhen'an	Shagang	Chengbei	Nanzhuang	Total
Advanced sludge dewatering project	Wastewater volume (10,000 m^3/a)		85.812	43.034	21.572	21.572	171.99
	Pollution loading (t/a)	CODcr	51.49	25.82	12.94	8.63	98.88[1]
		NH_4-N	21.45	10.76	5.39	1.73	39.33[1]
Existing workshop	Wastewater volume (10,000 m^3/a)		83.220	41.610	20.805	20.805	166.44
	Pollution loading (t/a)	CODcr	49.93	24.97	12.48	8.32	95.70[1]
		NH_4-N	20.81	10.40	5.20	1.66	38.07[1]
Variation	Wastewater volume (10,000 m^3/a)		2.592	1.424	0.767	0.767	5.55
	Pollution loading (t/a)	CODcr	1.56	0.85	0.46	0.31	3.18[1]
		NH_4-N	0.64	0.36	0.19	0.07	1.26[1]

Exhausted Gas

Main air pollution generated from proposed project is the odor from the sludge dewatering. The sewage contains obvious odor and foul smell, during the sludge treatment process, the odor is mainly generated from the microorganism aerobic/anaerobic fermentation process. The process adopted in this project includes two parts: sludge conditioning and mechanical dewatering. The sludge is transmitted into the sealed conditioning tank from the sludge storage tank and delivered to the dewatering workshop by pipelines. The whole process is well insulated. Therefore odor is mainly generated from the filter press.

The "Emission Standards for Odor Pollutants" (GB 14554-93) lists 8 indicators for odor pollution assessment, namely NH_3, trimethylamine, H_2S, methyl mercaptan, dimethyl sulfide, carbon disulfide and styrene. According to research, NH_3 and H_2S are the key indicators of odor from municipal WWTP.

As odor concentration is a result of combination of different exhausted gas, it is difficult to test concentration and composition of each component. This report uses analogy method to identify odor concentration and then discharge intensity. According to the monitoring in dewatering rooms in Zhen'an and Shagang WWTPs (Table 2.1-11), concentration of H_2S is 1.8 times than NH_3 in dewatering room; accordin to the comparison between odor and pollutant concentration, H_2S contributes far more than NH_3 to the odor. This report is to define the discharge situation of H_2S in enhanced dewatering project by analogy, and then calculate the discharge amount of H_2S by analogy of monitoring results in sludge dewatering rooms in Zhen'an and Shagang WWTPs.

1□Comparison with Limits in the "Emission Standards for Odor Pollutants" (GB 14554-93)

According to monitoring data of the sludge dewatering workshop in Dashadi WWTP, odor level at different locations ranged from 40~56 (non-dimensional), an average of 48.5. Interpolating calculation based on data in Table 2.4-6 shows corresponding NH_3 concentration of 3.23 mg/m^3, and H2S concentration of 0.24 mg/m3.

Table 2.4-6 Odor Limit at Plant Boundary (quoted)

No.	Parameter	Unit	Class I	Class II		Class III	
				New	Existing	New	Existing

1	NH_3	mg/m^3	1	1.5	2	4	5
2	H_2S	mg/m^3	0.03	0.06	0.1	0.32	0.6
3	Odor Concentration	Non-dimensional	10	20	30	60	70

Odor is generated from filter press platform in Dashadi WWTP. The platform is 144 m^2 large and 12m high equipped with fans. Net capacity of the platform is 1700 m^3. Ventilation rate is 10200 m^3/h with exhaustion every 6-hour. Therefore corresponding pollution emission speed is 32.95g/h for NH4 and 2.45g/h for H2S.

2□Estimation Using Odor Level Detected Onsite

Relationship between odor pollutant concentration and odor level is showed in Table 2.4-7. Odor level is categorized as 6 Classes as showed in Table 2.4-8.

Table 2.4-7 Relationship between Odor Pollutant Concentration (ppm) and Odor Level*

Odor Pollutant	Odor Level						
	1	2	2.5	3	3.5	4	5
NH_3	0.1	0.6	1.0	2.0	5.0	10.0	40.0
H_2S	0.0005	0.006	0.002	0.06	0.2	0.7	8.0

* “Summary of Odor Research in Japan”, translated by Shi Lei

Table 2.4-8 Categorization of Odor Level

Class	Indicator
0	No smell
1	Hardly be smelled (smell threshold)
2	Weak smell, but can be recognized (cognition threshold)
3	Easily be recognized smell
4	Strong smell
5	Unendurable strong smell

* “Public Hazard Guide”, Japan Analytical Chemistry Committee, Guangdong Editorial

Take Dashadi WWTP sludge filter press workshop for example, odor can be recognized during site visit, but the smell is not strong, odor level is around Class 3. Moreover, project owner has visited all together 9 sites with similar sludge dewatering process in Guangzhou, Xiamen, Hangzhou, Wuxi and etc., among which 8 sites are categorized as Class 3 odor level. According to ventilation rate calculated before, the corresponding emission speed is 15.50g/h for NH_3 and 0.92g/h for H_2S.

3□Esimiation Based on Actual Monitoring Data from Zhen'an and Shagang WWTP

Onsite monitoring showed that odor level was Class 3.5 at Zhen'an and Shagang WWTP. Actual H_2S concentration is 0.29 mg/m^3 in average. Onsite monitoring showed that odor level was Class 3.5 at Zhen'an and Shagang WWTP. Actual H_2S concentration is 0.29 mg/m^3 in average. Odor level in Dashadi WWTP is Class 3. According to Table 2.4-7, corresponding H_2S concentration is 0.08 mg/m^3.

4□Odor Estimation Using Monitoring Data from Datansha WWTP

According to "Current Environment Status Report of Guangzhou Datansha WWTP (Phase 1, 2)", the monitoring result of H2S in the sludge dewatering room is 0.075□0.130 mg/m3, with average of 0.085mg/m3.

5□Calculation of Odor Emission from Sludge Dewatering Process

Take sludge filter press room in Dashadi WWTP as example, the pollutants discharge rate is estimated by analogy as Table 2.4-9. Of the 3 analogy results, the corresponding value analogized to standard value of Odor Pollutants Emission Standard is higher, as the standard value provides the concentration limit of single odor gas, while actual odor is the result of effect of various gas, therefore, the estimated value is remarkably higher. Estmated values of other 3 methods are very near. Actually the relation between odor concentration and odor gas concentration is obtained on the basis of various monitored results, therefore, it is approximate to the actual situation.

Table 2.4-9 Odor Pollutant Emission Speed from Dewatering Workshop in Dashadi WWTP

Analogy Method	H_2S Concentration（mg/m^3）
Comparison with the "Emission Standard for Odor Pollutant"	0.24
Estimation Using Odor Level Detected Onsite	0.09
Estimation Using Monitoring Data from Zhen'an and Shagang WWTP	0.08
Estimation Using Monitoring Data from Datansha WWTP	0.85

Value used in this Report	0.09

Odor in the sludge filter press room of Dashadi WWTP is mainly from filter press platform, which is 144m2 in area and 12m high. The platform is equipped with fan to strengthen the local ventilation. Effective room of the platform is about 1700 m3□air volume is calculated as 10200 m3/h considering 6 air exchange in 1 hour, the concentration of H_2S is 0.09 mg/m3 and corresponding discharge rate of H_2S is 0.92 g/h.

6□Calculation of Emission from other Odor Pollutants

During sludge dewatering, sludge delivery between storage tanks and filter press is through pipelines. Because the whole process is covered, odor emission is minimal. Sludge bucket for dewatered sludge might release some odor, however dewatered sludge cake release very little odor. It is estimated that emission from the above process counts 20% of the overall odor emission, i.e. discharge rates of H2S is 0.10g/h and 0.18 g/h.

7□Odor Pollution Emission Calculation for the Proposed Project

Enhanced sludge dewatering process is used in this project; Major equipements are basically the same as that used in Dashadi WWTP, and the major equipments of the dewatering room and the layout plan of the dewatering room is basically the same as that in Dashadi WWTP. Furthermore, odor concentration during dewatering process in enhanced sludge dewatering projects in Xiamen, Hangzhou and Wuxi, etc. is about class 3. It can be seen that there are no big difference of odor emission between similar enhanced sludge dewatering projects. Odor fugitive emission has been calculated for Dashadi WWTP by analogy with monitoring results of Zhen’an and Shagang WWTPs. Therefore, odor pollutants emission can be calculated by analogy with situation with enhanced sludge dewatering project in Dashadi WWTP.

Sludge treatment capacity is 120t/d (sludge of 80% water content) in Dashadi enhanced sludge dewatering project, which has 4 sludge filter press machines. By analogy analysis, discharge rate of H2S during dewatering, sludge conditioning and temporary dry sludge storage is about 1.1 g/h. By analogy with monitoring result of Zhen’an and Shagang WWTPs (see Table 2.1-11), ratio of discharge rate between NH3 and H2S is 1/1.8.

According to the sludge treatment capacity of each plant in this project, odor emission can be calculated by analogy with the above data. Since the odor emission is mainly from the sludge filter press process, number of filter press machine is mainly considered during analogy. The calculation is shown in the table below.

Table 2.4-10 Estimation of Odor Emission from the Proposed Project

Advance Sludge Dewatering Project		Zhen'an	Shagang	Chengbei	Nanzhuang
Sludge Volume (80% water content)		120	60	30	30
Number of Sludge Dewatering Cycles		4	3	2	2
Pollutant Emission Speed (g/h)	NH_4	18.0	13.5	9.0	9.0
	H_2S	1.2	0.9	0.6	0.6
Pollution Discharge Load (t/a)	NH_4	0.158	0.119	0.079	0.079
	H_2S	0.021	0.016	0.011	0.011

8. Change of Odor Pollution Loading after Implementation of the Proposed Project

According to the calculation result in Table 2.1-12 and Table 2.4-10, odor emission before and after project construction is shown in Table 2.4-11. NH3 emission and H2S emission in the sludge dewatering room of the 4 WTTPs are reduced by 61.2% and 62.5% respectively.

Table 2.4-11 Odor emission before and after project construction

Enhanced sludge dewatering project		Zhen'an	Shagang	Chengbei	Nanzhuang	Total
Rate of pollution emission(g/h)	NH_3	0.012	0.009	0.0034	0.0034	0.0278
	H_2S	0.025	0.014	0.0064	0.0064	0.0518
Amount of pollution emission (t/a)	NH_3	0.0053	0.0027	0.0014	0.0014	0.0108
	H_2S	0.0096	0.0048	0.0025	0.0025	0.0194

2.4.3 Noise

Noise is generated from sludge pumps, water pumps, blowers, air compressors, sludge dewatering equipments, operation gearings and working vehicles. Most of the equipments locate in dewatering workshop and pumping station, which is similar to the current situation. Noise level will have very little change after implementation of the project.

Table 2.4-12 Main Noise Sources Before and After Project Implementation

No.	Source of Noise	Location of the Source	Sound Level dB□A□	
			Existing	Proposed Project
1	Sludge frame filter press	Sludge dewatering workshop	70□80	70□80
2	Centrifuge separator	Sludge dewatering workshop	75□85	None
3	Agitator	Sludge conditioning tank	None	70□80
4	Compressor	Compressor room	85□95	85□95
5	Sludge pump and water pump	Pump station	80□90	80□90
6	Blower	Sludge dewatering workshop and other locations that have blower	75□85	75□85
7	Vehicle		75□85	75□85

2.4.4 Solid Wastes

Solid wastes generated from this project are dewatered sludge, domestic garbage and lab wasted liquid. The laboratory liquid waste may contain hazardous elements such as heavy metal, strong acid and strong basic solutions?; the corresponding rinsing water also contains the above elements, therefore, the dedicated container shall be collected and sent to qualified entities to conduct hazard-free treatment. Treated sludge in each WWTP will contain 60% of water content. According to the "List of Strictly Control Waste in Guangdong Province" (updated in 2009), it is considered as strict control waste of Guangdong Province (HY06), its treatment and disposal should be handled by qualified entity. Management account and the transfer manifest system should be established for sludge transfer. Solid wastes generated by each WWTP are summarized in the table below.

Table 2.4-13 Solid Wastes Generation Before and After Project Implementation (unit, t/d)

WWTP		Zhen’an	Shagang	Chengbei	Nanzhuang	Total
Existing Dewatering Workshop	Sludge	120	60	30	30	240
	Domestic Garbage	0.01	0.01	0.01	0.01	0.04
	Total	120.01	60.01	30.01	30.01	240.04
Advance	Sludge	60	30	15	15	120

Sludge Dewatering Workshop	Domestic Garbage	0.01	0.01	0.01	0.01	0.04
	Wastes Liquid from Lab	0.001	0.001	0.001	0.001	0.004
	Total	60.011	30.011	15.011	15.011	120.044
Variation		-89.999	-26.999	-14.999	-14.999	-119.966

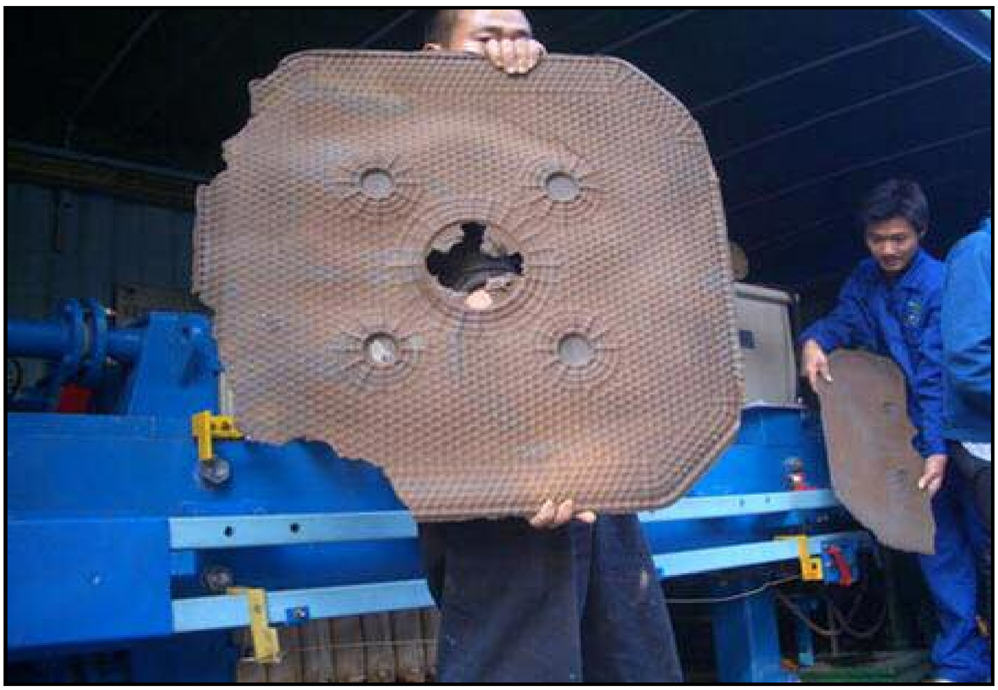


Figure 2.4-4 Sludge Cake after Advanced Dewatering

2.4.5 Pollution Factor Analysis during Transportation

Treated sludge forms firm solid sludge cake as shown in Figure 2.4-4, which contains as low as 60% water content. Due to its low water content, original odor from untreated sludge is largely reduced. There is no problem of spillage or leakage during transportation of sludge cake. Main pollution factors during transportation are odor emission from sludge cake; impacts on sanitation caused by sludge falling from the trucks when overloading or uncovered transportation; and odor emission and impacts on sanitation caused by sludge falling during severe car accidents.

It is planned to use vehicles with insulation to transport sludge cake to reduce odor emission during transportation and falling off. Probability of occurring car accident is low, but such accident will cause large amount of sludge falling off. Odor from the sludge will affect the near areas, and have negative impact on the nearby sanitation.

2.4.6 Summary of Water, Air and Solid Wastes Pollution Generated from the Proposed Project

Table 2.4-14 Pollution Load Before and After Proposed Project Implementation

<table>
<tr><th colspan="2">Main Pollutant</th><th>Unit</th><th>Existing Facility</th><th>Advanced Sludge Dewatering</th><th>Variation</th><th>Ratio</th></tr>
<tr><td rowspan="3">Wastewater</td><td>Volume</td><td>10,000 m³/a</td><td>166.44</td><td>171.99</td><td>+5.55</td><td>+3.3%</td></tr>
<tr><td>COD</td><td>t/a</td><td>95.70</td><td>98.88</td><td>+3.18</td><td>+3.3%</td></tr>
<tr><td>NH_4-N</td><td>t/a</td><td>38.07</td><td>39.33</td><td>+1.26</td><td>+3.3%</td></tr>
<tr><td rowspan="2">Exhausted Gas</td><td>H_2S</td><td>t/a</td><td>0.0278</td><td>0.0108</td><td>-0.0170</td><td>-61.2%</td></tr>
<tr><td>NH_3</td><td>t/a</td><td>0.0518</td><td>0.0194</td><td>-0.0324</td><td>-62.5%</td></tr>
<tr><td rowspan="3">Solid Wastes</td><td>Sludge</td><td>10,000 t/a</td><td>8.76</td><td>4.38</td><td>-4.38</td><td>-50%</td></tr>
<tr><td>Domestic Garbage</td><td>t/a</td><td>14.6</td><td>14.6</td><td>0</td><td>0</td></tr>
<tr><td>Wasted Liquid from Lab</td><td>t/a</td><td>—</td><td>1.46</td><td>+1.46</td><td>+100%</td></tr>
<tr><td>Noise</td><td colspan="6">In the existing facilities, noise is mainly generated from sludge pumps, water pumps, blowers, compressor and centrifuge. Noise level is generally around 70~95dB(A). In the proposed project, noise will be mainly generated from sludge pumps, water pumps, blowers, compressor and frame filter press. Noise level is generally around 70~95dB(A). The difference between before and after is minimal.</td></tr>
</table>

Analysis of Alternatives

Analysis of Final Sludge Disposal Alternative

Sludge Quality Analysis

According to the data from construction unit, the leach monitoring data of sludge from each WWTP of Chancheng District by a specialized monitoring department indicate that monitoring value of all parameters are lower than the limit set in The Hazardous Waste Identification Standard-Leaching-out Toxicity Identification (GB50810.3-2007). The sludge could not be identified as hazardous waste.

Table 3.1-1 Sludge Leaching Data of WWTPs of Chancheng District

Parameters	Monitoring value（mg/L)			GB50810.3-2007 limit（mg/L)
	Zhen’an	Dongpo	Shagang	
Hg	0.00043	0.00151	0.01381	0.1
Pb	0.047	0.0028	0.008	5
Cd	0.0405	0.03942	0.0352	1
Cr	0.0084	0.0205	0.02503	5
Cu	0.0079	0.00492	0.000065	100
Zn	0.79	0.81	0.92	100

WWTPs of Chancheng District have assigned qualified monitoring units to conduct 1 to 2 component analysis of sludge annually. The results are shown in Table 3.1-2; Nanzhuang WWTP will be put in use in 2011. Since there are ceramic factories in Nanzhuang, it is estimated that the component of Nanzhuang WWTP sludge is similar to that of Shagang WWTP.

Overall, WWTPs of Chancheng District receive industrial wastewater (mainly industrial wastewater from ceramics), so heavy metal content is higher, organic matter content is low.

Table 3.1-2 Analysis of Sludge Component (mg/kg)

Parameters	Zhen'an								Shagang					Chengbei	
	2006	2006	2007	2007	2008	2008	2009	2010	2006	2007	2008	2009	2010	2009	2010
Cd	5.88	3.69	1.79	2.47	3.57	4.62	3.21	3.1	6.05	4.89	4.11	7.64	2.4	12.5	43.6
Hg	8.24	16.35	4.26	2.29	3.71	2.23	1.78	1.96	7.39	15.32	2.46	6.72	2.47	19.6	1.93
Pb	248.17	68.7	52.9	79.7	125	218	164	120	507.97	266	2.22	535	166	178	101
Cr	76.85	55.87	73.8	163	125	294	526	156	146.5	161	193	873	509	291	66
As	43.98	45.86	36.9	64.69	23.1	38.9	32.9	64.5	23.12	82.46	19	62.6	53.8	44.6	50.4
Cu	666.43	762.7	1200	846	893	756	555	399	183.04	672	251	535	182	344	130
Zn	1420.5	868.1	1910	2250	1850	2690	1110	664	2692	5140	3990	4370	1610	1390	640
Ni	48.93	45.22	165	254	41.7	113	61.3	44	60.64	265	69.8	186	91	212	55
B	/	/	126	256	51.8	173	16.9	/	/	234	456	116	/	30.4	/
CN-	/	/	5	4	0.51	0.17	0.114	/	/	3.2	0.15	1.28	/	0.766	/
TOC (g/kg)	/	/	353.2	311.8	302	293	370	445.4	/	320.1	310	468	177.8	526	280.8
K	/	/	1070	1360	7140	12200	9640	/	/	1680	7810	20700	/	8590	/
T-N (g/kg)	40.1	/	27.3	30.1	27.3	31.5	28.6	/	6.42	0.28	18.3	27.4	/	/	18.1
T-P (g/kg)	13.22	/	1.2	1.8	21.3	24.9	15.6	/	1.41	2	8.6	10.5	/	13.8	8.15
Fe	/	/	/	/	0.4	0.3	/	/	/	/	0.8	/	/	/	/
Cl-	/	/	/	/	256	315	/	/	/	/	231	/	/	/	/
F-	/	/	/	/	7.4	4.6	/	/	/	/	9.9	/	/	/	/

Analysis of Final Sludge Disposal Method

After advanced dewatering, potential sludge disposal methods include sanitary landfill, agricultural use, soil condition, incineration, brick making and additive of cement clinker production.

1□Sanitary landfill

Sanitary landfill is the way of landfill that takes measures to control gas emission and leachate. It is different to the traditional landfill way that it takes bottom and slope liner systems, treats or recovers the landfill gas and leachate, takes measures of compaction and covering with soil, so as to avoid secondary pollution by traditional landfill method.

Sludge sanitary landfill is the engineeringed method with consideration of environment protection, scientific site selection, strict design, construction and operation management. It has become a relatively widely used sludge disposal technology. Facilities and operation of sanitary landfill have the advantages of simple equipment, large capcity, and relatively less capital investment. It also has disadvantages of large land occupation, long-distance transport, and difficulty of site selection. As the environmental protection requirements are becoming stricter and stricter, the standard of design and construction of landfill is becoming higher, corresponding construction investment and operation cost has accordingly increased. Usually sludge is landfilled mixing with municipal solid waste to avoid specific site selection and construction and fully utilize the pollution control facilities of the municipal waste landfill.

The Disposal of Sludge from Municipal WWTP Sludge Quality for Co-landfillin □GB/T23485-2009□was issued in 2009.

Table 3.1-3 The Disposal of Sludge From Municipal WWTP Sludge Quality for Co-Landfilling□GB/T23485-2009□

No.	Control Parameters	Limit value（mg/kg dried sludge）
1	Cd	20
2	Hg	25
3	Pb	1000
4	Cr	1000
5	As	75
6	Ni	200
7	Zn	4000
8	Cu	1500
9	Mineral oil	3000
10	Phenol	40
11	CN-	10
12	Water content (%)	60%
13	pH	5～10
14	mixture ratio	8%

2□Agricultural Application and Soil Conditioning

Land use and agricultural use of sludge include application in soil conditioning, gardening, fertilizer. In terms of components of sludge of WWTPs from various places, WWTP sludge is richer in the content of organic matters, nitrogen and phosphorus and so on than that in the barnyard manure. The WWTP sludge is also rich in potassium and other trace elements. Physical, chemical and biological properties of soil can be improved by using sludge as fertilizer. China is a country in great need of fertilizer. It will be a broad development prospect in WWTP sludge application in the combined fertilizer. Therefore, the State Council has promoted the application of organic combined fertilizer in the “Fertile Soil Project”.

If carcinogenic substances and heavy metals contained in sludge exceed standards, it will lead to chronic poisoning of animal and plants after long-time contact. Therefore, least heavy metal concentration and large amount reduction in pathogen is a prerequisite of land use and agricultural use of sludge. Currently, national pollutant control standard for land use and agricultural use of sludge are: Pollutant Control Standard Limit Value for Agricultural Use of Sludge（GB4284-84）, Pollution Control Limit for Agricultural Use of Sludge（GB18918-2002）, Disposal of Sludge of Municipal Wastewater Treatment Plant – Sludge Quality of Agricultural （CJ/T309-2009）, etc.

Table 3.1-4: Pollutant Control Standard Limit Value for Agricultural Use of Sludge（GB4284-84）

No.	Parameters	Maximum permissible Concentration（mg/kg dried sludge）	
		in Acid soil（PH<6.5）	in natural and alkali soil（PH≥6.5）
1	Cd and its compound（in Cd）	5	20
2	Hg and its compound（in Hg）	5	15
3	Pb and its compound（in Pb）	300	1000
4	Cr and its compound（in Cr）	600	1000
5	As and its compound（in As）	75	75
6	Ni and its compound（in Ni）	100	200
7	Zn and its compound（in Zn）	500	1000
8	Cu and its compound（in Cu）	250	500
9	B and its compound（in B of water-	150	150

	solubility）		
10	Mineral Oil	3000	3000
11	Benzo(a) pyrene	3	3

Table 3.1-5 Pollution Control Limit for Agricultural Use of Sludge□GB18918-2002□

No.	Control Parameters	Maximum permissible Concentration（mg/kg dried sludge）	
		in Acid soil（pH＜6.5）	in natural and alkali soil（pH□6.5）
1	(Cd)	5	20
2	Hg	5	15
3	Pb	300	1000
4	Cr	600	1000
5	As	75	75
6	Ni	100	200
7	Zn	2000	3000
8	Cu	800	1500
9	B	150	150
10	Mineral Oil	3000	3000
11	Benzo(a) pyrene	3	3
12	PCDD/PCDF	100	100
13	adsorbable organic halides adsorbable organic halides（AOX）（in CL）	500	500
14	PCB	0.2	0.2

Table 3.1-6 Disposal of Sludge of Municipal Wastewater Treatment Plant – Sludge Quality of Agriculture□CJ/T309-2009□

No.	Control Parameters	Limit（mg/kg dried sludge）	
		A level sludge	B level sludge
1	As	75	75
2	Cd	3	15
3	Cr	500	1000
4	Cu	500	1500
5	Hg	3	15
6	Ni	100	200
7	Pb	300	1000
8	Zn	1500	3000
9	Benzo(a) pyrene	3	3
10	Mineral Oil	3000	3000
11	PAH(polycyclic aromatic hydrocarbon)	5	6
12	Water content（%）	60%	
13	Partical size (mm)	10mm	
14	Impurity	harmful substance such as metal, ceramics, tile glass, and etc. sundries≦3% in quality	
15	mortality of roundworm	□95%	
16	Fecal coliform	□0.01	
17	TOC (g/kg)	200	
18	NPK concentration(g/kg)	30	
19	PH	5.5～9	

3□Incineration

Incineration is the most thorough method for sludge treatment, by which carbohydrate in sludge is turned into CO_2 and water. Volume of sludge is reduced by 80□90%, which can reduce cost of residue landfill and transportation. Furthermore, virus and bacteria are killed in high temperature, and heat can be recovered during incineration. However, gas emission during sludge incineration contain pollutants such as dust, dioxin, heavy metals etc, which requires good leakproofness of the incineration system and strict treatment of the exhausted gas, to avoid negative impact on the surrounding environment. More width of sanitary protection zone is required for incineration system. According to the Disposal of Sludge of

Municipal Wastewater Treatment Plant – Sludge Quality of Incineration □CJ/T290-2008□, it is required that the sludge quality for incineration meets the standard below:

Table 3.1-7 Physical and Chemical Parameters of sludge incineration□CJ/T290-2008□

Catergory	Control Parameters			
	PH	Water content	QDW (KJ/kg)	Content of Organic matters（%）
self sustained incineration	5～10	□50	□5000	□50
combustion-supporting - incineration	5～10	□80	□3500	□50
Drying-incineration	5～10	□80	□3500	□50

4、Brick and Cement Additives

Brick making and usage in cement clinker production are the common solutions of treatment of sludge from municipal wastewater treatment plant. This secondary usage of sludge can recover material and energy. Pollution control facilities in brick factories and cement plants can also significantly reduce secondary pollution during treatment of sludge. The standard for sludge use of brick making and cement additive is Disposal of Sludge from Municipal Wastewater Treatment Plant – Sludge Quality for Brick Making□CJ/T314-2009□, Disposal of Sludge from Municipal Wastewater Treatment Plant – Sludge Quality for Cement Clinker Production□CJ/T314-2009□.

Table 3.1-8 Pollution Parameter and Limit for Sludge Use in Cement Clinker Production□CJ/T314-2009□

No.	Control Parameters	Limit（mg/kg dry sludge）
1	Cd	20
2	Hg	25
3	Pb	1000
4	Cr	1000

5	As	75
6	Ni	200
7	Zn	4000
8	Cu	1500

Table 3.1-9 Disposal of Sludge from Municipal Wastewater Treatment Plant – Sludge Quality for Brick Making（CJ/T314-2009）

No.	Control Parameters	Limit（mg/kg dry sludge）
1	Cd	20
2	Hg	5
3	Pb	300
4	Cr	1000
5	As	75
6	Ni	200
7	Zn	4000
8	Cu	1500
9	mineral oil	3000
10	volatile phenol	40
11	cyanide	10
12	pH	5～10
13	water content	40%
14	mixing ration	10%

3.1.3 Selection of Sludge Final Disposal Alternatives

1、Sanitary landfill

Historical data show that, some parameters (mainly Zn、Ni) in Shagang WWTP exceed the standard (see table 3.1-10 black italic part). Recent 3 years data indicates that only Zn of Shagang WWTP in 2009 and Cd of Chengbei WWTP in 2010 exceed the standard, but the mixed sludge of each WWTP does not exceed the standard; water content of sludge after advanced dewatering is below 60%, which meet the requirement of landfill standard. Sludge sanitation landfill after advanced dewatering is viable for this project.

FWGC and ONXY company have reached a preliminary agreement that Baishiao Sanitation Landfill will accept sludge from WWTPs. Sludge can be accepted and landfilled when water content is below 60% and other major parameters meet the standard of sanitation landfill requirement.

Table 3.1-10 Comparison between Component of Sludge and Landfill Standard (mg/kg)

Parameters	Monitoring value															Landfill standard
	Zhen’an								Shagang					Chengbei		
	2006	2006	2007	2007	2008	2008	2009	2010	2006	2007	2008	2009	2010	2009	2010	
Cd	5.88	3.69	1.79	2.47	3.57	4.62	3.21	3.1	6.05	4.89	4.11	7.64	2.4	12.5	***43.6***	20
Hg	8.24	16.35	4.26	2.29	3.71	2.23	1.78	1.96	7.39	15.32	2.46	6.72	2.47	19.6	1.93	25
Pb	248.2	68.7	52.9	79.7	125	218	164	120	507.97	266	2.22	535	166	178	101	1000
Cr	76.85	55.87	73.8	163	125	294	526	156	146.5	161	193	873	509	291	66	1000
As	43.98	45.86	36.9	64.69	23.1	38.9	32.9	64.5	23.12	82.46	19	62.6	53.8	44.6	50.4	75
Cu	666.43	762.7	1200	846	893	756	555	399	183.04	672	251	535	182	344	130	1500
Zn	1420.5	868.1	1910	2250	1850	2690	1110	664	2692	***5140***	3990	***4370***	1610	1390	640	4000
Ni	48.93	45.22	165	***254***	41.7	113	61.3	44	60.64	***265***	69.8	186	91	212	55	200
CN-	/	/	5	4	0.51	0.17	0.114	/	6.05	4.89	4.11	7.64	/	0.766	/	10

2□Agricultural Use and Soil Rehabilitation

Compared with the A standard of agricultural use (applicable to acid soil), monitoring data indicate that Cd, Cu, Zn all exceed the standard and Ni, Hg exceed the standard to a serious extent (see table 3.1-11); compared with B standard of agricultural use (applicable to non-acid soil), Cu and Zn in sludge from Zhen’an WWTP and Shagang WWTP all exceed the standard, and a few other parameters also exceed the standard (see table 3.1-12). Hg records high concentration in Chengbei sludge, while other parameters meet the B standard of agricultural use. Due to impact of acid rain, soil in PRD is normally acid, and not applicable to B standard of agricultural use, therefore the market is limited. Generally speaking, sludge of this project is not suitable for agricultural or soil improvement use due to high heavy metal concentration.

Table 3.1-11 Comparison between Component of Sludge and Standard of Agricultural Use (mg/kg)

Parameters	Monitoring value															A Standard of Agricultural Use
	Zhen'an								Shagang					Chengbei		
	2006	2006	2007	2007	2008	2008	2009	2010	2006	2007	2008	2009	2010	2009	2010	
Cd	***5.88***	***3.69***	1.79	2.47	***3.57***	***4.62***	***3.21***	***3.1***	***6.05***	***4.89***	***4.11***	***7.64***	2.4	***12.5***	***43.6***	3
Hg	***8.24***	***16.35***	***4.26***	2.29	***3.71***	2.23	1.78	1.96	***7.39***	***15.32***	2.46	***6.72***	2.47	***19.6***	1.93	3
Pb	248.17	68.7	52.9	79.7	125	218	164	120	***507.97***	266	2.22	***535***	166	178	101	300
Cr	76.85	55.87	73.8	163	125	294	526	156	146.5	161	193	***873***	***509***	291	66	500
As	43.98	45.86	36.9	64.69	23.1	38.9	32.9	64.5	23.12	82.46	19	62.6	53.8	44.6	50.4	75
Cu	***666.43***	***762.7***	***1200***	***846***	***893***	***756***	***555***	***399***	183.04	***672***	***251***	***535***	182	***344***	130	250
Zn	***1420.5***	***868.1***	***1910***	***2250***	***1850***	***2690***	***1110***	***664***	***2692***	***5140***	***3990***	***4370***	***1610***	***1390***	***640***	500
Ni	48.93	45.22	***165***	***254***	41.7	***113***	61.3	44	60.64	***265***	69.8	***186***	91	***212***	55	100
B	/	/	126	***256***	51.8	173	16.9	/	/	***234***	***456***	116	/	30.4	/	150
TOC (g/kg)	/	/	353.2	311.8	302	293	370	/	/	320.1	310	468	/	526	/	≥200

Table 3.1-12 Comparison between Component of Sludge and B Standard of Agricultural Use (mg/kg)

Parameters	Monitoring value															B Standard of Agricultural Use
	Zhen'an								Zhen'an					Zhen'an		
	2006	2006	2007	2007	2008	2008	2009	2010	2006	2007	2008	2009	2010	2009	2010	
Cd	5.88	3.69	1.79	2.47	3.57	4.62	3.21	3.1	6.05	4.89	4.11	7.64	2.4	12.5	***43.6***	20
Hg	8.24	***16.35***	4.26	2.29	3.71	2.23	1.78	1.96	7.39	***15.3***2	2.46	6.72	2.47	***19.6***	1.93	15
Pb	248.17	68.7	52.9	79.7	125	218	164	120	507.97	266	2.22	535	166	178	101	1000
Cr	76.85	55.87	73.8	163	125	294	526	156	146.5	161	193	873	509	291	66	1000
As	43.98	45.86	36.9	64.69	23.1	38.9	32.9	64.5	23.12	82.46	19	62.6	53.8	44.6	50.4	75
Cu	***666.43***	***762.7***	***1200***	***846***	***893***	***756***	***555***	399	183.04	***672***	251	***535***	182	344	130	500
Zn	1420.5	868.1	1910	2250	1850	2690	1110	664	2692	***5140***	***3990***	***4370***	1610	1390	640	3000
Ni	48.93	45.22	165	***254***	41.7	113	61.3	44	60.64	***265***	69.8	186	91	***212***	55	200
B	/	/	126	***256***	51.8	173	16.9	/	/	***234***	***456***	116	/	30.4	/	150
TOC (g/kg)	/	/	353.2	311.8	302	293	370	/	/	320.1	310	468	/	526	/	≥200

3. Incineration

Historical monitoring data indicate that sludge from each WWTP from Chancheng District are different in heat value, which partly meet the Physical and Chemical Parameter for Sludge Incineration □CJ/T290-2008□; the organic matters in each WWTP is too low for incineration (see Table 3.1-13 to Table 3.1-15). Furthermore, 1000m of width of sanitary protection zone is required for sludge incineration plant, while it is hard to find a suitable plant location in Chancheng District at present. Therefore, incineration is not suitable for sludge treatment and disposal of this project.

Table 3.1-13 Comparison between Component of Sludge and Sludge Incineration Standard (mg/kg)

Parameters	Monitoring value															Incineration Standard
	Zhen'an								Zhen'an					Zhen'an		
	2006	2006	2007	2007	2008	2008	2009	2010	2006	2007	2008	2009	2010	2009	2010	
TOC (g/kg)	/	/	***353.2***	***311.8***	***302***	***293***	***370***	***445.4***	*/*	***320.1***	***310***	***468***	***177.8***	526	***280.8***	□500

Table 3.1-14 Heat Value Analysis of Sludge from WWTPs of Chancheng District

WWTP	Water content	Gross heat value□MJ/kg□	Gross heat value□kilocalorie /kg□	Certificate No.
Sludge of Zhen'an	10%	9.36	2238	NM-050800537
	20%	5.92	1415	NM-050800538
	40%	5.63	1346	NM-050800539
Sludge of Shagang	10%	1.51	361	NM-050800540
	20%	1.27	303	NM-050800541
	40%	1.13	270	NM-050800542

Table 3.1-15 Physical and Chemical Parameters for Sludge Incineration□CJ/T290-2008□

Category	Control Parameters			
	PH	Water content	QDW (KJ/kg)	Concentration of organic matters（%）
self sustained-incineration	5～10	□50	□5000	□50

combustion-supporting -incineration	5～10	□80	□3500	□50
Drying-incineration	5～10	□80	□3500	□50

4□Brick Making

Historical data indicates that Hg exceed standard in each WWTP, Cd exceed standard in Chengbei WWTP in 2010 (see Table 3.1-16). The water content of sludge after advanced dewatering is 60%, which does not meet the requirement of brick making (water content below 40%). Furthermore, brick making is not permitted by local policy. Therefore, sludge use of brick making is not suitable for treatment and disposal in this project.

Table 3.1-16 Comparison between Component of Sludge and Brick Making Standard (mg/kg)

Parameters	Monitoring value															Brick Making Standard
	Zhen’an								Shagang					Chengbei		
	2006	2006	2007	2007	2008	2008	2009	2010	2006	2007	2008	2009	2010	2009	2010	
Cd	5.88	3.69	1.79	2.47	3.57	4.62	3.21	3.1	6.05	4.89	4.11	7.64	2.4	12.5	***43.6***	20
Hg	***8.24***	***16.35***	***4.26***	2.29	***3.71***	2.23	1.78	1.96	***7.39***	***15.32***	2.46	***6.72***	2.47	***19.6***	1.93	5
Pb	248.17	68.7	52.9	79.7	125	218	164	120	***507.97***	266	2.22	***535***	166	178	101	300
Cr	76.85	55.87	73.8	163	125	294	526	156	146.5	161	193	873	509	291	66	1000
As	43.98	45.86	36.9	64.69	23.1	38.9	32.9	64.5	23.12	82.46	19	62.6	53.8	44.6	50.4	75
Cu	666.43	762.7	1200	846	893	756	555	399	183.04	672	251	535	182	344	130	1500
Zn	1420.5	868.1	1910	2250	1850	2690	1110	664	2692	***5140***	3990	4370	1610	1390	640	4000
Ni	48.93	45.22	165	***254***	41.7	113	61.3	44	60.64	***265***	69.8	186	91	***212***	55	200

5□Additive to Cement Manufacturing

Historical monitoring data show that Zn, Ni and Cd exceed the standard. Recent 3 years data shows that Cd of Chengbei WWTP exceeds the standard in 2010, but the mixed sludge of each WWTP does not exceed the standard. Generally speaking, sludge from each WWTP is suitable for additive of cement clinker production. However there is no cement plant in Foshan, it is suitable for sludge use as cement additive if accepted by neighboring districts.

Table 3.1-17 Comparison between Component of Sludge and Standard of Additive of Cement Clinker Production (mg/kg)

Parameters	Monitoring value															Standard
	Zhen'an								Shagang					Chengbei		
	2006	2006	2007	2007	2008	2008	2009	2010	2006	2007	2008	2009	2010	2009	2010	
Cd	5.88	3.69	1.79	2.47	3.57	4.62	3.21	3.1	6.05	4.89	4.11	7.64	2.4	12.5	***43.6***	20
Hg	8.24	16.35	4.26	2.29	3.71	2.23	1.78	1.96	7.39	15.32	2.46	6.72	2.47	19.6	1.93	25
Pb	248.17	68.7	52.9	79.7	125	218	164	120	507.97	266	2.22	535	166	178	101	1000
Cr	76.85	55.87	73.8	163	125	294	526	156	146.5	161	193	873	509	291	66	1000
As	43.98	45.86	36.9	64.69	23.1	38.9	32.9	64.5	23.12	82.46	19	62.6	53.8	44.6	50.4	75
Cu	666.43	762.7	1200	846	893	756	555	399	183.04	672	251	535	182	344	130	1500
Zn	1420.5	868.1	1910	2250	1850	2690	1110	664	2692	***5140***	3990	4370	1610	1390	640	4000
Ni	48.93	45.22	165	***254***	41.7	113	61.3	44	60.64	***265***	69.8	186	91	***212***	55	200

6）Conclusion

Generally speaking, due to high heavy metal concentration, low organic matter content and taking into account of the environment impact factors, sludge after advanced dewatering from WWTPs of Chancheng District is not suitable for agricultural, incineration or bricking making use. The viable way of sludge treatment and disposal way is landfill. If sludge can be accepted by cement plants from neighboring districts, use for cement clinker production additive is also a way of sludge treatment and disposal for Chancheng District.

All large-scale factories have been shut down or moved out from Chancheng District except Nanzhuang. Large-scale factories of Nanzhuang are planned to be shut down or moved out when Nanzhuang WWTP is put into use. Therefore, WWTPs from Chancheng District will not accept industrial wastewater. According to monitoring data, sludge quality of each WWTP has improved in 2010. Although the sediment of pipeline network still contains certain pollutants such as heavy metals, it will reduce gradually. Therefore, treatment and disposal methods such as soil improvement, incineration and etc. will be further discussed when sludge quality of each WWTP further improves.

Alternative Analysis

Other Sludge Dewatering Process

As shown above, limited by the sludge quality, the treatment and disposal alternative is sanitation landfill with municipal solid waste in accordance with sludge landfill standards. Two common used treatment alternatives are as follow:

1□Advanced Dewatering Alternative□ Conditioner is added to the sludge to improve its dewatering performance, then water is squeezed out from sludge by high pressure frame dewatering equipments to obtain sludge of about 60% water content, reducing half of the sludge volume. The operational cost is lower than thermal drying alternative because it does not need external heat source.

2□Thermal Drying Proposal□ Water is evaporated from wet sludge by external heat source, to increase dryness of sludge and reduce the sludge volume and kill the harmful matters such as pathogenic bacteria. Dryness of sludge can reach 50~95% and the sludge volume is significantly reduced.

"**No Project Option (Business As Usual?)**" :Situation without new project implementation and remaining the current sludge dewatering process of the WWTPs is also discussed.

The comparison of alternatives is as table below□

Table 3.2-1 Comparison of sludge treatment alternatives

Parameters	Advanced dewatering alternative	Thermal Drying alternative	No Project
Process	Conditioner is added to the sludge to improve its dewatering performance, water is squeezed out from sludge by high pressure frame dewatering equipments	Water is evaporated from wet sludge by external heat source, to increase dryness of sludge and reduce the sludge volume and kill the harmful matters such as pathogenic bacteria.	Sludge dewatering by board frame dewatering equipment and centrifugal dehydrator
water content of sludge(%)	60%	20%	80%
sludge quantity (t/d)	120	55	220
Final disposal way	Landfill	Landfill	Landfill
acceptance site	Baishiao Waste Sanitation Landfill in Gaoming Miaocun	Baishiao Waste Sanitation Landfill in Gaoming Miaocun	Yunan Waste Landfill in Zhaoqing

distance of transportation (km)		83	83	240
operational cost* (10,000 RMB/d)	gas	0	4.7	0
	transportation	1.00	0.46	5.28
	landfill	1.12	0.52	1.76
	Total	**2.12**	**5.68**	**7.04**
New land acquisition		Current dewatering room and land within WWTP is used, no new land acquisition	2 ha of new land acquisition	Current dewatering room and land within WWTP is used, no new land acquisition
New investment (10,000 RMB)		8155	10487	0
Environment Impact area		Controlled within WWTP	100-200m away from plant boundary	Controlled within WWTP

* Transportation cost:1RMB/ t.km, landfill cost of Baishiao Landfill : 93RMB/t, landfill cost of Yunan Landfill: 80RMB/t,

In terms of operational cost, thermal drying alternative has remarkable advantage that it can reduce cost of transport and landfill to a great extent, but its cost of gas is high; Operational cost of “No project” is the highest because of the largest sludge volume; the operational cost of the advanced dewatering alternative is the lowest.

In terms of new investment, cost of “No project” is the lowest, investments of thermal drying and advanced dewatering are relatively high. Compared with the cost reducing of “No project”, new investment of thermal drying alternative can be recovered in 21.12 years, new investment of advanced dewatering alternative can be recovered in 4.54 years.

From perspective of environment impact, impact area of thermal drying alternative is larger than other alternative because centralized sludge drying. Furthermore, thermal drying alternative involved new land acquisition.

Generally speaking, thermal drying alternative can reduce water content of sludge to a great extent, reduce cost of transport and landfill, but its cost of gas and new investment is the highest and involve land acquisition; “No project” alternative involve no new investment or new land acquisition, its environment impact area is relatively small, but its cost of transport and landfill is the highest; Advanced dewatering alternative can significantly reduce the water content of sludge, its cost of transport and landfill is the lowest and no new land acquisition is involved, investment is high but it can be recovered in short term. Therefore, advanced dewatering is the optimal alternative of the three alternatives.

Comparison between this alternative and the approved alternative in 2006

Construction unit had proposed thermal drying process for the sludge drying in the sludge treatment plant, and the EIA has been approved by the EPB. Hereafter, this alternative is compared with the approved alternation in 2006.

Table 3.2-2 Technical and economic comparison of sludge treatment and disposal technologies

Alternatives	This alternative（enhanced dewatering technology）	Approved alternative in 2006（thermal drying technology）
Site selection	Exsisting dewatering room and nearby areas of Zhen'an, Shagang, Chengbei, Nanzhuang WWTPs	Special land for Nanzhuang Sludge Treatment Plant
Process	sludge thickening tank——sludge condintioning——plate-and-frame filter press——sanitation landfill	WWTP：sludge thickening tank——centrifugal dewatering / belt filter Drying plant：sludge——sludge thermal drying——sanitation landfill
Major equipments	plate-and-frame filter press machine, air compressor, sludge pump, water pump, conditioning tank、sediment tank、dosing equipment, conveyor, sludgehopper	wet sludge storage, dry sludge storage, sludge mix tank, cyclone separator, biogas cabinet, conveyor, drying burner, fluid-bed, condenser, biological odor control device
Daily Treatment capacity（t/d）	220（water content of 80％）	400（water content of 80％）
Total investment（10,000 RMB）	10090	13164
Unit treatment cost（RMB/t）	272.5（low）	477（high）
Sludge reduction after treatment	50％	≥75％
Construction period	6 months	More than 15 months
Personnel requirement	Ordinary operation	Specialized technical personnel（high

	personnel（general requirement）	requirement）
Safety requirement	no special requirement	anti-explosion requirement in special area
Odor	Low odor level during sludge treatment	Low odor level during sludge treatment
objective of “minimum, steady and innocuous” sludge	Achieve the objective of “minimum, steady and innocuous” sludge	Fully Achieved
recycling objective	Dewatered sludge has been made into soil, brick etc.	Dry sludge is used as auxiliary fuel
Water content after treatment	Below 60%	Below 20%, full drying can be reached
requirement of clean fuel	no requirement	Need to use natural gas
Major equipment and parts	All domestic equipments	Major equipment are import equipment, and the Lead-time is at least 6 months
Environmental and social impact	Small impact on nearby environment because the water content being below 60% and sludge in dry solid state; in line with environment protection policy of energy saving, pollution reduction and efficiency improvement	Small impact on environment after sludge drying; high energy consumption for thermal drying process; odor can not be avoided during transport, load and unload and treatment for the 80% water content wet sludge
Recommendation	**Recommended**	**Not recommended**

According to the comparison, Thermal drying alternative proposed in 2006 is 75% higher in unit treatment cost than this project, and it has problems of long construction period, high requirement of operation and safety, and consumption of fuel. Correspondingly, thermal drying alternative proposed in 2006 has the advantages of high drying efficiency, significant reduction effectiveness. Sludge enhanced dewatering alternative is recommended after comparison between two alternatives

Legality and Rationality Analysis of the Project

Legality Analysis of Project

(1) In accordance with Water Pollution Prevention Law of PRC and its implementation regulations and Management Regulation of Pollution Prevention for Drinking Water Protection Zone.

Clause 57 of Water Pollution Prevention Law of PRC(amended in No.32 meeting of 10th NPC on Feb 28th 2008) provides that pollutant discharge point setting is prohibited within Drinking Water Protection Zone. The clause 60 says that construction, extension construction of projects that seriously pollute the water body is prohibited; the reconstruction of project is not allowed to increase pollutant discharge amount.

None of the WWTPs involved in this project is located within the drinking water protection zone, none of the discharge points of each WWTP is located within the drinking water protection zone.

This project is advanced dewatering of WWTP sludge. Wastewater is mainly from domestic wastewater of staff, cleaning water from laboratory and wastewater from advanced dewatering process. Wastewater of each WWTP is treated by secondary biological treatment system in each WWTP and discharged in line with discharging limit. According to regular monitoring data of Foshan Environment Monitoring Center, pollutant concentration of treated wastewater from each WWTP is lower than standard and the treated wastewater can be discharged meeting the requirements. Therefore, it will not post negative impact on water quality of receiving water body. Therefore, this project could not be identified as the project that seriously pollute the water body or the project that increase the pollutants. This project is not in the list of the projects that prohibited by the Clause 57 and Clause 60 and other clauses in the Water Pollution Prevention Law of PRC (amended in No.32 meeting of 10th NPC on Feb 28th 2008).

(2) In accordance with Water Quality Protection Regulation of PRD in Guangdong Province.

According to Clause 18 in Water Quality Protection Regulation of PRD of Guangdong Province, “small scale chemical pulp and paper production, leather, electroplating, printing and dyeing, dyestuff, refining, pesticide, and other projects with serious pollution are prohibited” in PRD. This project is advanced dewatering of sludge from WWTPs and environment protection project, which is not in the prohibited list of this regulation.

Clause 23 of this regulation provides that, “solid waste is prohibited to dump into the water body by any unit or individual. Measures should be taken for storage, transport and disposal of solid waste to avoid environment pollution”

Sludge will be dewatered to below 60% water content and trucked by enclosed which have seepage proof and anti-leakage function; sludge treatment rooms are equipped with anti-leakage, seepage proof and anti-spill facilities, which is in compliance with Clause 23 of this regulation.

The project construction is also in compliance with the Clause 27 which is related to requirements of drinking water protection zone.

(3) In accordance with Guangdong Provincial Drinking Water Resources Protection Regulation.

□ This project is not in the list of prohibited construction projects in Clause 15 of Guangdong Provincial Drinking Water Resources Protection Regulation.

Clause 15 of Guangdong Province Drinking Water resources Quality Protection Regulation provides that: following projects are prohibited to be constructed in the surface drinking water resources protection zone:

□1□construction, reconstruction projects with discharge of persistent organic pollutants or pollutants containing Hg, Cd, Pb, As and Cr etc.□

□2□set up discharge points;

□3□storage tanks, storage, storehouse, oil gas pipeline for oil and other toxic and harmful substance, and the recover site and workshop for the waste;

□4□catering and entertainment facilities that occupy the surface of drinking water resources such as river and lake or discharge pollutants to the water body such as river and lake.

□5□construction of Livestock and poultry farms, breeding area;

（6）Other projects that pollute the water resources.

This project is advanced dewatering of WWTP sludge. Wastewater is mainly from domestic wastewater of staff, cleaning water from laboratory and wastewater from advanced dewatering process. Wastewater of each WWTP is treated by secondary biological treatment system in each WWTP and discharged compliant with standards. Therefore, this project will not discharge persistent organic pollutants or pollutants containing Hg, Cd, Pb, As and Cr etc. No wastewater discharge point is set up in this project. This project is not in the list of the projects in Clause1 and Clause 2.

This project is advanced dewatering of WWTP sludge. Advanced sludge dewatering facilities are planned to be set up within or beside the current dewatering rooms , which aims to improve the current dewatering facilities of low efficiency. It is not the setting of storage of toxic and harmful substance, waste recovering site of buying, sorting, classification and transport, or waste workshop of waste disassembling, substance refining.

This project is not in the list of projects provided in the Clause 3 above.

This project is not in the list of projects provided in the Clause 4, Clause 5 or Clause 6 either.

Therefore, this project is not in the list of prohibited projects provided in the Clause 15 of Guangdong Province Drinking Water resources Quality Protection Regulation.

□ No activity is prohibited by the Clause 16 of the Guangdong Province Drinking Water resources Quality Protection Regulation：

This project is environment protection project of advanced sludge dewatering, which does not involve activities that prohibited by the Clause 16 of Guangdong Province Drinking Water resources Quality Protection Regulation: “discharging, dumping, piling, landfilling, burning of poisonous materials, radioactive substances and oil, acid and alkali kind of materials, industrial waste, domestic waste, medical wastes, feces and other waste” .

To sum up, this project conforms to the provision and requirement of Water Pollution Prevention Law of PRC and its implementation regulations, Management Regulation of Pollution Prevention for Drinking Water Protection Zone, Guangdong Province

Drinking Water resources Quality Protection Regulation, and Water Quality Protection Regulation of PRD in Guangdong Province. Therefore, the advanced sludge dewatering project construction in the WWTPs is in accordance with the requirements of current laws and regulations of environment protection.

Compliance Analysis of Industrial Policy

According to No.40 order of National Development and Reform Commission (NDRC) Guidance Catalog of the Industrial Structure Adjustment (2005) and Guangdong Industrial Structure Adjustment Guidance Catalogue (2007 version), sludge of each WWTP (including Zhen'an, Shagang, Chengbei and Nanzhuang WWTPs)in this project is treated by advanced dewatering (water content below 60%) and landfilled, which will achieve sludge stabilization, reduction, and harmlessness, avoiding secondary pollution, resources/energy/landfill space saving, and ecological environment protection. This project is on the encouraged project list in the Item 23(reduction, recycling and harmlessness treatment and comprehensive utilization project of city and town waste and other solid waste) of the Category 26 (environment protection, resources saving and comprehensive utilization). Industry of this project is supported by Guangdong Province, and in compliance with state and local industrial policy requirement.

In order to strengthen the pollution prevention and control of municipal WWTP sludge, protect and improve the environment quality, A series of requirements have been put forward by state and province.

Notice on Strengthening of Pollution Prevention and Control of Municipal WWTP Sludge (Huanban [2010]157) require that, "For construction, reconstruction and extension of WWTP, sludge treatment facilities(sludge stabilization and dewatering facilities) and the wastewater treatment facilities should be planned, constructed and put into use at the same time. For the existing WWTPs without sludge treatment, sludge treatment facilities should be constructed and put into use within 2 years since date this notice is issued"

The Notice on Issue of "Comments on Further Strengthening of Sludge Treatment and Disposal of Municipal WWTPs of Our Province" (Yuehuanfa[2010]113) require that, "by end of 2012, rate of sludge innocent treatment should be above 80□ in the cities of city level", "positively draw on the merits and apply the sludge enhanced dewatering, anaerobic digestion, aerobic fermentation, waste heat drying technologies, treat the sludge according to corresponding standards", "sludge treatment and disposal site should be clearly defined when construting, reconstructing and extending WWTPs; if construction of sludge treatment facilities is needed, sludge treatment and disposal facilities and the main WWTP project should be designed, constructed and accepted at the same time".

According to the requirement of Huanban[2010]157 and Yuehuanfa[2010]113, this project is to construct sludge treatment facilities in existing WWTPs (Zhen'an, Shagang and Chengbei) and newly constructed WWTP (Nanzhuang), to ensure that Foshan will reach the sludge innocent treatment rate of above 80% by end of 2012; moreover, the sludge enhanced dewatering technology adopted in this project is a widely used and mature process, therefore, this project construction meet the requirements of national and local industrial policies.

Compliance Analysis of Project with Corresponding Planning

(1) Compliance Analysis of Project Construction with Relating Guangdong Environment Protection Planning

Guangdong Province Outline of Environment Protection Plan (2006-2020) (No. 24 session of the 10th Standing Committee of the NPC, 2006) indicated to improve management of solid waste treatment: "**encourage enterprises to strengthen technology improvement, reduce comsuption of energy and materials and the production of solid waste**".

According to the requirement of ecological protection requirements of the Pearl Rriver Delta Environmental Protection Plan (2004 ~ 2020), PRD is divided into strict protection zone, important ecological function protection area, ecological function conservation area, resource development and utilization zones, urban construction and development area, ecological buffer area between city clusters (see figure 8.3-1), as basis of regional ecological protection and management. As shown by Figure 8.3-1, project construction site is located in the urban construction and development zone, does not belong to strict protection zone, important ecological function protection area or ecological function conservation area, which is compliant with the Pearl Rriver Delta Environmental Protection Plan (2004 ~ 2020).

This project is in compliance with the requirement of the Guangdong and PRD environment protection plans.

(2) "11th five-year" Foshan Environmental Protection and Ecological Construction Plan

The "11th five-year" Foshan Environmental Protection and Ecological Construction Plan (Foshan [2007] 17, January 2007) proposes to " **properly treat and dispose sludge for municipal wastewater treatment plants and plan to construct WWTP sludge treatment plant.**".

Sludge of each WWTP (including Zhen’an, Shagang, Chengbei and Nanzhuang WWTPs) in this project is properly treated by advanced sludge dewatering (water content below 60%) and landfilled, which will achieve sludge stabilization, reduction, and harmlessness, avoiding secondary pollution and protect the ecological environment.

Therefore, this project meets the requirement of 11th five-year" Foshan Environmental Protection and Ecological Construction Plan.

(3) Outline of the “11th five year” Plan of Foshan National Economic and Social Development

Outline of the “11th five year” Plan of Foshan National Economic and Social Development proposes to invest 9.7 billion RMB for the construction of ecological environmental protection projects, speed up the construction and improve a series of water environment and comprehensive urban environment improvement infrastructures, including six aspects of 20 projects such as WWTP construction, waste treatment and disposal, hazardous waste disposal, air pollution abatement, environmental management capacity building and ecological environment protection construction. It is planned to construct Foshan Industrial Solid Waste Treatment Centers and Medical Waste Treatment Center. Pay special attention to the follow-up projects of Foshan Pearl River Water Environment Improvement Project, continue to strengthen renovation basins and inner creeks improvement works, **concentrate on projects of Zhen’an WWTP, Foshan Waterway**

Dredging, Sludge Treatment, to speed up to achieve the objective of comprehensive environmental improvement.

This project is advanced sludge dewatering for each WWTP (including Zhen’ an, Shagang, Chengbei and Nanzhuang WWTPs). Therefore construction of this project is in accordance with the requirement of the Outline of Eleventh Five-year National Economic and Social Development Plan of Foshan City.

4 Drainage Planning of Foshan Central Region

According to the Drainage Planning of Foshan Central region, in the medium term, **“sludge is required to be condensed and dewatered to reduce the sludge amount, and the water content should be below 75. Sludge disposal methods such as sanitary landfill, land use and incineration are studied by experiment.”**

This technologies applied in proposed projects are advanced sludge dewatering (water content below 60%) for each WWTP (including Zhen’ an, Shagang, Chengbei and Nanzhuang WWTPs) and landfill. Therefore construction of this project is in accordance with the requirement of Drainage Planning of Foshan Central region.

To sum up, the construction of sludge advanced dewatering project is in accordance with requirement of environment protection plan of Guangdong and Pearl River Delta, 11th five-year" Environmental Protection and Ecological Construction Plan of Foshan, National Economic and Social Development Plan of Foshan, and Drainage Planning of Foshan Central region.

Analysis of Compliance of Project with Environment Functional Zoning

According to the Ambient Air Quality Functional Zoning of Foshan, location of each WWTP belongs to class 2 of air quality zone. Class 2 standard of Ambient Air Quality Standard and GB3095-1996 amended version in 2000 is applied. (see Figure 1.8-3).

According to the Yue Huan Han [1999] No.553 Surface Water Environment Zoning of Guangdong Province (Trial Implementation), Class *III* standard of Surface Water Quality Standard （GB3838-2002）is applied to Jili Creek (receiving water body of

Nanzhuang WWTP), class *IV* standard is applied to the Foshan Creek (receiving water body of Zhen’an WWTP and Shagang WWTP) and Foshan Waterway (receiving water body of Chengbei WWTP). According to Drinking Water Resources Protection Plan of Foshan and Approval and Reply on Adjustment of Drinking Water Resources Protection Plan of Beijiang Water System of Foshan (Yuefu Han [2010] No.75), no drinking water resources protection area is involved in the project areas of each project. The ambient water functional zoning is detailed in Table 1.8-1 and Figure 1.8-1, the drinking water resources protection zoning is shown in Figure 1.8-2.

According to the Regional Ambient Noise Functional Zoning of Chancheng District, each plant location of this project belong to class 2 of ambient noise functional zone (See Figure 1.8-4), class 2 standard of Ambient Noise Quality Standard （GB3096-2008）(daytime：60dB（A），nighttime：50dB（A））is applied.

Location of this project belong to class 2 zone of ambient air quality, class III and *IV* of ambient water functional zone. No drinking water resources protection area is involved in project location. Project location is in accordance with environment functional zoning of Foshan.

Environmental Feasibility Analysis of Project Site Selection

Location of WWTPs (Zhen’an, Shagang, Chengbei and Nanzhuang) in this project belong to the class 2 area of ambient air quality, class 2 area of acoustic environment and class *III* and *IV* area of water environment; location of WWTPs do not involve drinking water protection zone, which meet the environmental functional zoning of Foshan City.

Furthermore, project construction is within each WWTP (Zhen’an, Shagang, Chengbei and Nanzhuang), does not involve new land acquisition; the land within the WWTPs belong to the city construction land use, which is in accordance with the land use planning of Foshan City.

According to environment impact analysis during operation in Chapter 7, increase of wastewater and pollutant discharge is very small after sludge enhanced dewatering project construction, the wastewater is treated by WWTP, there is no significant impact on the receiving water body under normal operation condition of WWTPs.

NH_3 and H_2S emission of the sludge dewatering rooms in 4 WWTPs are reduced by 61.2% and 62.5% respectively to reduce impact of odor of WWTPs on the nearby sensitive points after enhanced sludge treatment project construction in each WWTP. Besides, sludge is quickly trucked away after dewatering, the temporal storage time is normally less than 2.5 hours. In the 4 projects, when any sludge transport vehicle does work, vehicle within the WWTP can be deployed, therefore, the sludge will not be retained in the treatment site for long time, so to avoid odor pollution due to the fermentation from the long time stock of sludge.

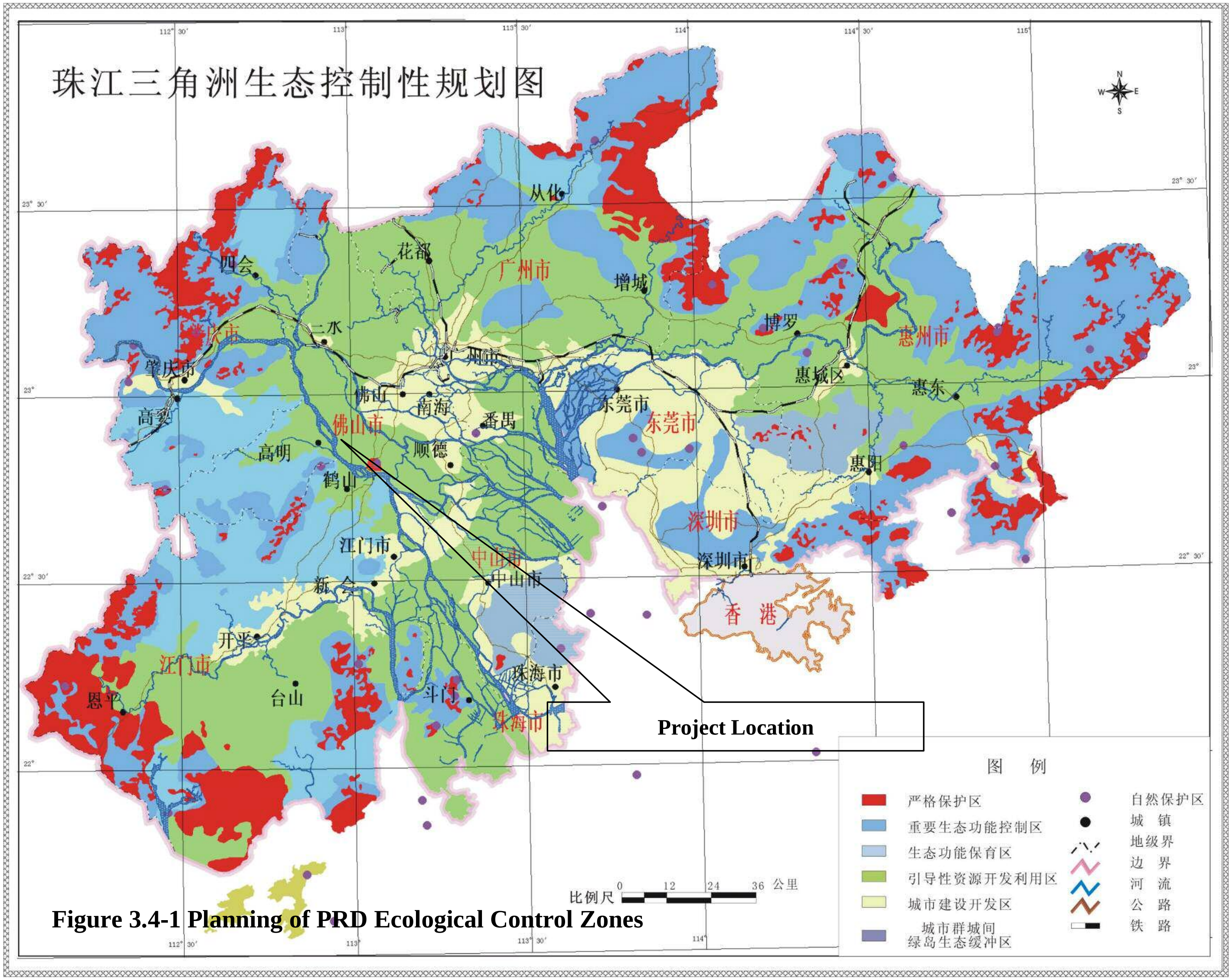


Figure 3.4-1 Planning of PRD Ecological Control Zones

Major equipments of enhanced sludge dewatering are in the dewatering room and pump house, which is similar to the existing sludge dewatering project. The noise level varies little before and after project construction; taking into account the worst case that all noise sources impact at the same time, the boundary noise level estimation value of day time and night time meet the class 2 standard of the Emission Standard for Industrial Enterprises Noise at Boundary (GB 12348 － 2008), which is basically similar to the change of current situation; therefore, noise from equipments in the sludge dewatering room has little impact on the nearby acoustic environment.

In conclusion, construction of enhanced sludge treatment projects in each WWTP (Zhen’an, Shagang, Chengbei and Nanzhuang) is in line with the environmental functional zoning of Foshan City and corresponding land use planning; furthermore, construction of enhanced sludge dewatering project has little impact on the nearby water environment and acoustic environment, and reduce the odor emission in the WWTPs, thus reduce the impact on the ambient air of the nearby sensitive points.

Necessity and Rationality Analysis of Project

（1）Rationality and Necessity Analysis of Sludge Advanced Dewatering Process

Along with the rapid development of economic and urban construction, urban population increase, the wastewater amount has increased accordingly. Wastewater treatment of 1 ton will result in 0.2～0.3% of sludge. There are 3 WWTPs in Chancheng District with total capacity of 400,000 m^3/d and sludge output 237t/d (80% water content). Sludge amount will increase along with the implementation of extension project of Zhen’an WWTP, Shagang WWTP and Chengbei WWTP and the construction of Nanzhuang WWTP.

Municipal wastewater sludge belongs to hazardous wastes. It will pose threat on the ecological environment if it is directly disposed without treatment. Municipal wastewater sludge treatment is important for the healthy development of municipal wastewater treatment. Sludge reduction, stabilization and harmlessness are urgent and necessary for the treatment way of the increasing amount of wastewater sludge in Foshan.

The traditional sludge dewatering facilities are mainly: frame press filter, belt press filter and centrifugal dewatering machine; normally these dewatering equipment can only achieve 80％ of sludge water content. For frame press filter, belt press filter, the automation level is low and cost of reagent is high, with odor in dewatering room. Although odor of sludge can be control to some extent by using centrifugal dewatering machine, the electricity consumption is high, the capacity is hard to increase and the cost of maintenance is high.

Compared with the above dewatering equipment, the sludge conditioning + frame press advanced dewatering technology adopted in this project can dewater the WWTP sludge to the water content of less than 60%, reduce the water content as well as the sludge output. Dewatered sludge is in the cake shape without leachate or odor. Odor is better controlled in the sludge dewatering room. Cost of reagent, water and electricity and so on is relatively low. Cost of dewatering cost of one ton is reduced by 40 RMB.

Furthermore, for the following sludge disposal, sludge below 60% water content has significant advantages of the following disposal; half of the fermentation cycle can be reduced for sludge composting; it can be directly added into the incineration facilities if it is disposed by incineration.

Similar “sludge conditioning and frame press advanced dewatering technology” has been successfully implemented in the sludge treatment and disposal in Shunde Lunjiao Municipal WWTP of 30,000t/d, Panyu Dongchong Textile Printing WWTP of 30,000t/d and Guangzhou Dashadi Municipal WWTP of 200,000t/d. Treatment and disposal effectiveness is good and anticipated objective has been achieved during 3 to 8 month operation.

Therefore, construction of this project will contribute to the reduction, stabilization and harmlessness of wastewater sludge of Foshan and enhance the sludge treatment level of this area. It is of significance of improving ecological construction and pollution control of PRD and construction of Green Guangdong.

（2）Requirement of Demonstration Project of Sludge Reduction and Harmlessness

Sludge disposal ways are various without a clear main technical route. Standardizing the sludge treatment and disposal and reducing pollution of sludge treatment and disposal to the environment have become an urgent need of pollution control and treatment.

Advanced sludge dewatering project with premise of amount reduction, stabilization and harmlessness will help to protect ecological environment, reduce disposal cost and boost the development of recycling economy. Reducing sludge water content is the premise for sludge landfill, incineration and recycling reuse. Objective of harmlessness and amount reduction can be achieved by using supplementary energy for sludge dry, but its cost and investment are high. Sludge conditioning and frame press filter advanced dewatering technique has the characteristics of stable operation, less secondary pollution and wide scope of usage; it has become a developing direction of resolving the difficulty of sludge treatment.

Rapid development of economy has posed great pressure on the ecological environment protection work. Wastewater sludge amount is increasing along with the increasing scale of WWTPs. Volume reduction, stabilization and harmlessness treatment in the source of WWTP will effectively resolve the way of sludge disposal. Therefore, implementation of this project will provide a new pattern for harmless sludge treatment of Foshan, and serve as a positive example in improving harmless sludge treatment level of Guangdong Province.

（3） Rationality of Constructing Advanced Sludge Dewatering Project in WWTPs

Sludge conditioning frame press filter advanced dewatering technique can be considered as upgrading of existing sludge dewatering facilities in each WWTP. To the largest extent, it can utilize existing facilities and workshops, and will not require new land therefore save a lot of cost.

Traditional dewatering facilities in WWTPs normally can only achieve 80□ sludge water content. It has shortcomings of low automation level, high cost of reagent and electricity, difficulty in sludge odor control and etc. Sludge conditioning frame press filter advanced dewatering technique has the advantages of high dewatering effectiveness, low operational cost, odorless sludge cake and avoiding secondary pollution. These problems will be resolved after improvement of existing dewatering facilities of WWTPs.

Furthermore, advanced sludge dewatering in WWTPs is virtually sludge reduction from the source of sludge production to avoid secondary pollution during sludge transportation. Sludge is dewatered directly to below 60□ water content; the shape and property of sludge is stable, with no leachate or odor, which facilitate the following sludge disposal.

All in all, constructing advanced sludge dewatering project in each WWTP is good for volume reduction from the sludge production source, stabilization, harmlessness, improvement of sludge dewatering effectiveness, reduction of dewatering cost. Furthermore, existing dewatering rooms in WWTPs are utilized so that it can save cost of new construction of advanced sludge dewatering facilities elsewhere.

Conclusion

The analysis indicates that this project is in accordance with Guangdong industry development policy, requirements of environmental protection regulations of state and provincial level, requirements of Guangdong Province, PRD and Foshan City and Foshan environmental functional zoning.

Project construction can effectively resolve the problem of sludge disposal, and boost the sustainable development of city. This project will utilize the existing facilities of WWTP. The sludge conditioning frame press filter advanced dewatering technique has the advantages of less investment and operational cost, large treatment capacity, stable operation, less secondary pollution and full utilization of land of the WWTP. Therefore, advanced sludge dewatering project construction in the WWTP is in accordance with laws and regulations and reasonable.

Regional Environmental Status and Due Diligence

The natural environment and social environment situation

Natural environment

1、The geographical location

Foshan city is located in central south of Guangdong Province , covering areas from north latitude 22 ° 38 throughout 23 ° 34 and from east longitude 112°22′ to 113°23′, with Guangzhou adjacent in the east, Jiangmen and Zhongshan in the south, Zhaoqing in the west and Qingyuan in the north. Distance from east to west and south to north are both about 103km, 3848.49 km^2 in area, including Chancheng, Nanhai, Shunde, Sanshui and Gaoming districts,. Foshan is located in the middle of the pearl river delta, within 50km distance from Guangzhou, Zhongshan, Jiangmen, Zhuhai, Dongguan, Qingyuan and Zhaoqing, and within about 100km distance from Hong Kong and Macau, which is convenient for foreign economic communication. Air and land transportation lines have provided good condition for economic development. Guangmao railway travels through from east to west, and main roads such as Guanghai, Guangzhu highways and Guangfo and Fokai highways and etc travel through Foshan, Foshan airport is located within Foshan with 10 airlines for direct flight to many cities; there are 50 major waterways with nearly 1000km navigation mileage and more than 20 ports that make water transport extend in all directions.

The project is located in Nanzhuang Town southwest of Foshan Chancheng District (see Figure 3-1), 25 kilometers away from Guangzhou. The town area is 76.7 km^2, with one urban district administrative office, 18 villagers' committees, and total number of 7.5 million permanent residents.

2、Climate and meteorology

Foshan city is located in the south of the tropic of cancer and belongs to the south tropical and subtropical monsoon climate region, its main characteristic is: pluvial heat in the same season, wet cold spring, long summer without extremely hot, warm fall and winter and sunny drought.

Annual average temperature is 22.2 ºC. January is the coldest month with average temperature of 13.5ºC; July is the hottest month, with average temperature of 29.1ºC; Normally, the most extreme minimum temperature is above 3ºC, lowest recorded is □1.9ºC (January 17, 1967). Extreme highest temperature is 39.2ºC (July 18, 2005).

Average annual rainfall of this region is 1653.0 millimeter, total annual rainfall is 1400 ~ 2000 millimeters, maximum record in 2008 is 2343.8 mm and the minimum record is 1075.7 mm (1991). Rainy season is from April to September, accounting for 80% of year total. Rainfall from May to June is over 250 millimeter for it is the intensive rainy period of a year.

Annual average sunshine duration is 1739.6 hours, between 1500 ~ 2100 hours. Rainy weather occurs often from Feb to April, with monthly sunshine duration of only 60 ~ 90 hours. Sunshine is abundant from July to December. Sunshine is most abundant in July of a year.

Monsoon climate’s characteristics are: predominant northeast wind in fall and winter, predominant southeast wind in spring and summer. Average wind speed is 2.2m/s.

3□Geology and Geomorphology

In terms of tectonic unit, Foshan is part of Huanan bow area. Caledon tectonosphere exists to the east of the Guangzhou - Foshan – Jiujiang line, is consisted of all sorts of gneiss, quartzite, schist, and shallow metamorphic sandstone. Hercynian-Indochina tectonosphere exists to the north of the Foshan – Guangzhou- Jiujiang, consisted of sand shale, limestone, etc. There are conglomerate, sandstone volcanic rock mass in Shunde urban area, which belong to Yanshan tectonosphere. A few of granite exist in Shunde, which is the product of magma intrusion in the Yanshan period. Complex fracture during the Himalayan movement period resulted in graben basin in Sanshui, trachyte in Dazhugang, basalt in Zoumaying and Wangjiegang, and tufa in Huachong.

The geological structures can be divided into 5 groups: deposit underwent of NNE strike direction in Sanshui Heshengkeng; Sanshui fracture, Langshi fracture, west to east fracture near Rongqi of west to east strike direction; Luoke fracture, Hecheng-Jinji fracture; Sanzhou-Xiqiao Mountain fracture, Tanbu-Dali fracture of northwest strike direction.

The geological structure dominates the development of geomorphology, result in the geomorphic characteristics of scattered hills and cross river network. The terrain in northwest is high and southeast low. The highest point is in Gaoming Zaomushan with altitude of 805m. the lowest point is in Sanshui Dadawo, with altitude of - 1.7 m; Beijiang is connected in Sanshui Sixianjiao, which is the peak of Xibeijiang Delta. 2 third of the city area is Xibeijiang Delta Plain and is valley alluvial plainor of its tributaries, which is distributed over most part of Shunde and Nanhai and northeast part of Gaoming. Old delta is gradually transit into new delta from northwest to southeast. Except sporadic residual hills, the terrain is flat. The altitude is about 0.7 ~ 2.5m in the cross river network alluvial plain. In addition, sporadic trachyte hills, basalt, limestone caves, conglomerate and paleocoast remain line of 5000 years ago resulted by earth crust risen result in the unique geomorphologic landscape.

Chancheng District, Nanhai District and Shunde District belong to □ degree seismic protection area, Sanshui and Gaoming belong to □ degree seismic protection area.

4□Hydrological Features of Surface Water

Beijiang river, the second main stream of Pearl River is the biggest river flowing through Foshan from northwest to southeast. Beijiang originated in Jiangxi, flows southwards through Yingde, Qingyuan into Sanshui of Foshan, and is connected with Xijiang in Sixianjiao of Sanshui. The main stream turns its flowing direction southeastwards through Sanshui Xinan and is connected with Shunde Waterway at Chancheng Zidong, and then flow into sea via Hongqili, Shawan Waterway and Jiaomen. The mainstream flow into Lubaochong, Xinanchong and into Pearl River after converge, the main stream flow into Tanzhou Waterway in Chancheng Zidong, and converge with Shunde Waterway in Xihaikou. The length of Beijiang mainstream is 468km, with 100.2km within Foshan, and 13 tributaries, catchment area of 46,700 km2. Its water resource is abundant with average daily discharge of 49 billion m3. there is big difference between wet season and dry season in flow. According to data of Hengshi hydrological monitoring station, the annual average flow is 1106m3 / s, and the assurance P = 95% flow is 193 m3 / s.

According to monitoring data from 1959 to 2001 of Sanshui Station, average daily flow in the driest month is 203m3/s, average daily flow in the driest consecutive 10 days is 168 m3/s, average annual driest daily flow is 115 m3/s. the flood peak of 20 year return flood in Sanshui Station is 13100 m3/s, 14800 m3/s for 50 year return flood. The width of river is 700-2000m. According to monitoring of hydrological monitoring station, the average annual flow is 7764 m3/s, and the total annual runoff is 254 million m^3.

Shunde waterway is a major river of Beijiang traverses Foshan City. It flows from Beijiang mainstream, via Nanzhuang Town of Chancheng, Shatou Town of Nanhai, Lecong of Shunde, Beijiao and into Zhongshan City, and finally into South Sea via Hongqili and Shiziyang. Its length is 50 km, and width 300-500m. it is the major water resources of Nanhai District, Shunde District of Foshan City. Water intake of Nanzhou Water Supply Plant in located in the Huangchong Section in Beijiao Town with capacity of 1 million t/d. the average runoff with 90% guarantee rate in the driest month is 61.47 m3 / s, and 96.1 m3/s for the average runoff with 50% guaranteed rate.

Dongping Waterway is also a major river of Beijiang that traverses Foshan City. It is available for ships of 1000 ton. It flows from Beijiang mainstream, via Nanzhuang Town, Shiwan Town of Chancheng District and Chencun Town of Shunde District, and then into Panyu District of Guangzhou, and into South Sea via Hongqili and Shiziyang. The catchment area is over 100 square kilometers, and the total length is about 80 km. From 1959 to 2001, the average annual minimum daily flow, minimum daily flow in consecutive driest 10 days and minimum average daily in driest month are 110 m^3/s□58 m^3/s□186 m3/s respectively. It shows that, the Dongping Waterway is abundant in water resources. There are Xiaotang, Foshan, Shiwan, Lanshi and Pingzhou Harbors along the Dongping Waterway. Tanzhou Waterway is wide and deep and Pingzhou Waterway is narrow, deep and of high flow velocity and many bends. (such as Dadaowan, Baishexuan, etc.).

Jili Creek is an inner river that traverses Nanzhuang Town. It is connected with Dongping Waterway in the east and with Shunde Waterway in the west. It is the major pollution receiving water body in Nanzhuang. The river is 30-50m wide and about 10 km long.

5□Soil and Vegetation

Ecological environment quality is good in project areas, vegetation coverage is high. The soil is fertile, abundant resources, plain and low terrain, numerous fish ponds and waterfowl breeding, it is a beautiful and of good environment area in Pearl River Delta (PRD).

The project location belongs to subtropical plains in the Pearl River Delta (PRD) region, of which fish ponds and rivers accounted for most part. The zonal vegetation was formerly the south tropical rainforests, wet birth, marshy raw water pine, mangrove. Due to human activities, primeval forest have already been destroyed completely, leaving only scattered species such as Aporusa dioica, Ficus microcarpa, etc. Currently most vegetations are grassiness community, bamboo grove community, melons and vegetables composite community, small area of ecological forest of with Ficus microcarpa communities and Eucalyptus urophylia community, the ecological community village residence, town and village ecological garden landscape communities, mud flat and grass, etc.

Social Economic Overview

16.7%□Overview: Chancheng district is one of five Districts of Foshan, only 6 Km from east Guangzhou, 96 kilometers from southeast Hong Kong, 135 kilometers from south Macao; Guangzhou-zhuhai, Guang Zhan highway and Guangmao railway traverses through its territory; the transportation is convenient. Chancheng has jurisdiction over a town and three street agencies; it is the capital of Foshan People's Government and the center urban area of Foshan. Foshan city "originated from Jin dynasty and famous in Tang dynasty", has long history and the famous name of home town of Yue opera, home town of ceramic art, home town of martial arts, home town of folk arts and home town of Qiuse arts. As of North Song dynasty, it was called as one of the "Four famous towns" with Hubei Hankou, Jiangxi Jingdezheng, and Henan Zhuxian. There is a Zumiao called by foreign friends as museum of fork art, Liang Garden, and Huangfeihong Museum. Chancheng District Committee and the district government conscientiously implement the scientific outlook of development, focusing on the comprehensive competitiveness of strategic objectives, adhere to the concept of developing "high-quality goods economy", "high-quality goods city". Politics, economy, culture and other social undertakings of various fields has achieved great progress. In 2008, Chancheng's realization in GDP is 82.45 billion RMB, up 16.5 %; Industrial output fulfilled is 187.045 billion RMB, up 16.9%; Total retail sales amount of consumer goods is 26.279 billion RMB, up 25%; Export amount is 6.749 million US dollars, up 1.4%, Fixed asset investment is 24.007 billion RMB, up 14.3%; The actually utilized foreign capital is 304 million US dollars, up 20.4 %; General budget income of Chancheng is 2.31 billion RMB, up 16.7%.

Industry: the 2008 Chancheng has achieved 187.045 billion RMB total industrial output in 2008, up by 16.9%., of which above-scale industrial output value is 166.917 billion RMB, up by 17.8 percent. Key features Industrial operation is: first, the heavy industrial production growth continues to lead, with 19.8 percent higher in growth rate han light industry. Light and heavy industry have reached respectively 50.352 billion and 116.565 billion RMB, with growth rate of 4.9% and 24.7% respectively; second, state-owned enterprises is the major force that promotes rapid growth of Chancheng industrial enterprise production. State-owned enterprises have reached output of 44. 25 billion RMB, up 43%, 26.1 percent more than the district overall data; third, pillar industry’s supporting role has been further strengthened. Above-scale industrial output value has achieved 143.913 billion RMB, up 28.7% , 10.9 percent more than above-scale industrial growth, percentage weight has increased from 73.8□ to 86.2%; forth, sales situation of industrial products is good, sales-output ratio reach 98%, up 0.3 percent year-on-year. Large leading enterprises continue to play a leading role. 10 leading enterprises have reached about more than 30 percent of the total industrial output.

Business tourism: Services development in 2008 has speeded up, and become the major force of increasing employment, promoting high-quality goods economy. Year-round service value added is 34.472 billion RMB, up 16.5%. Total amount of retail sales of consumer goods is 26.279 billion RMB, up by 25%, year-on-year increase up 1.7 percent. In 2008, Chancheng has achieved total tourist income of 5.164 billion RMB, up 10.23%, of which tourist foreign exchange income is 185 million USD, up by 9.5%; overnight guests reception is nearly 2.025 million person-time, up by 1.91%. Tourist quality safety supervising is effectively implemented, the tourism industry is of integrity self-discipline, there is no major tourist safety and quality accident during a year.

Agriculture: in 2008, rural economic income of Chancheng amounted to 38.332 billion RMB, with an increase of 15.3%; distributable income of farmers is 3.181 billion RMB, an increase of 13.9%; The per capita income of farmer is 10258.9 RMB, an increase of 6.2%. Further establishing and improving rural financial management system, to formulate the

Financial Management System of Chancheng Rural Collective Economic Organizations and Accounting System of Chancheng Rural Collective Economic Organizations to ensure normalization and standardization of rural financial publication. Promulgated and implemented Social Endowment Insurance Implementation Plan of Chancheng Rural Cadres and Further Deepening Joint-stock System Reform Plan of Rural Chancheng. The rural comprehensive reform is deepening.

Education: by the end of 2008, the kindergarten fulfillment rate reached 57.9% and high grade rate reached 32.77%, with year on year increase by 13.89% and 11.51% respectively. For compulsory education, 96 school have 100% reached the standard of “Standardization Schools of Guangdong Compulsory Education". 62 primary or high schools are of high quality, accounting for 64.58% of the total. Teacher team building is advancing smoothly. First 9 brand schools, 15 brand famous headmasters, and 59 famous school teachers were chosen in September. Same Salary Within Same City policy has been implemented since January 1st.

Healthcare: infectious disease condition in 2008 is stable without substantial infectious disease outbreak; Medical units of district level have achieved 5.098 million person-time outpatient services, 39400 discharges from hospital, which have increased year-on-year by 10.03%□11.13% respectively; Maternal and child health care work have further been strengthened, with zero maternal mortality rate and 1.88 ‰ infant mortality, and 98.17□ healthcare management of children under 7, 95.48% of maternal health care system management rate, 99.98% of hospital parturition rate. The health system has invested an overall research fund of 1.826 Million RMB, obtained 25 scientific research projects. Since July 1st, Fundamental healthcare insurance system of Chancheng Residents Outpatient Service has been established, which include all urban or rural residents in the scope of outpatient medical insurance system to achieve fundamental objective that everyone has fundamental medical safeguard. Since October 1, fundamental outpatient insurance system for employees has been implemented to signify that Chancheng District has entered the era of comprehensive medical insurance. As of December 31, number of resident basic outpatient insured has reached 176,000 and insured employees reached 348,000.

Due Diligence

Relevant WWTP Due Diligence

EIA Approval for All WWTPs and Current Implementation Status

Zhen’an WWTP was constructed as early as 1991. Environmental management by that time required only an “EA form” to be filled for Zhen’an WWTP project. The completed form was approved and officially sealed by Foshan EPB, which said it was agreed on the site selection of Zhen’an WWTP (March 5th, 1992), however a separate approval document wasn’t issued. Except that, all WWTPs has conducted EIA and obtained approval from EPB. Relevant approval and implementation status of the WWTPs is summarized in Table 5.2-1. The summary of approval documents (in table below) focus on environmental management measures instead of quoting applied pollution discharge standards.

Table 5.2-1 EIA Approval and Status of Implementation of the WWTPs

WWTP		Authorized Government Department	Document No.	Time of Approval	Key Points in the Approval Document	Status of Implementation	Project Acceptance Investigation
Zhen'an	Phase 2	Foshan EPB	F2004-004	2004.02.13	Adopt sufficient control measures at odor sources; set up at least 100 m of safety distance; select low noise equipment and adopt effective noise mitigation measures; carry out sludge disposal measures;	Spreading of deodorant was adopted to control odor; 100 m safety distance was set up; low noise equipment was selected and insulation and absorption measures were adopted; sludge was sent to sanitary landfill;	Accepted by FoShan EPB
	Phase 3	Guangdong EPB	GDEPB [2006] No. 1008	2006.07.10	Implement water recycle facility; online monitoring on final outlet; implement odor treatment for all phases; set up at least 100 m of safety distance; select low noise equipment and adopt effective noise mitigation measures; send sludge to Bai Shi Ao landfill for disposal	Water recycle facility was constructed in phase 3; online monitoring was installed at outlet; biological odor treatment was installed at main odor source, reaction tank and aeration tank were covered and implemented odor treatment; sludge is planned to be dewatered and send to Bai Shi Ao Landfill for disposal	Not yet conducted

Chengbei	Phase 1	Foshan EPB	F2005-005	2005.01.31	Adopt effective measures to mitigate odor emission; set up 300 m of safety distance; choose low noise equipment; and adopt noise mitigation measures; improve site greening	biological odor treatment was adopted; 300 m safety distance was set up; low noise equipment was selected and insulation and absorption measures were adopted; sludge is sent to sanitary landfill; over 40% of green coverage	Accepted by FoShan EPB
	Phase 2	Chancheng District EPB	CB-2009-C10	2009.05.04	Apply cover to main facilities and treat odor; set up greening buffer zone in between with Fuxi Village; set up safety distance according to the EA report	Covers to main facilities were applied and biological treatment of odor was implemented; greening buffer zone in between with Fuxi Village was set up; 100 m of safety distance was set up	Accepted by FoShan EPB
Shagang	Phase 1	Guangdong EPB	GDEPB [2003] No. 156	2003.03.06	Install online monitoring at outlet; set up minimal 300 m of safety distance; apply effective measures to mitigate environmental impact of odor and exhausted gas carrying bacteria; chose low noise equipments and adopt effective noise reduction measures; carry out sludge disposal	Online monitoring was installed at outlet; 300 m of safety distance was set up; biological odor treatment was implemented; low noise equipments were selected and insulation and adsorption measures were taken; sludge is sent to sanitary landfill	Accepted by Guangdong EPB
Nanzhuang	Phase 1	Foshan EPB	F2006-14	2006.04.03	Install online monitoring at outlet; set up minimal of 150m safety distance; select low noise equipment and apply noise	The project is currently under construction, and environmental protection measures are to be taken;	Not yet conducted

					mitigation measures; carry out sludge disposal		

Summary of WWTPs Operation and Management

1) Operation and Management of WWTPs and Relevant Standard Procedures

All the 4 WWTPs in the scope of this project are currently operated by Foshan Water Group and implementing a same set of management procedures. In daily operation, WWTP operation company focus on the control of inlet and outlet water quality and sludge quality, and implements emergency response measures to different breakdowns and accidents.

Foshan Water Group has established a set of management procedures and emergency response plan, main documentations include:

1) Standard Procedure on Control Parameters and Frequency of Wastewater, Sludge Monitoring (FSX/WI033)
2) WWTP Discharge Standard (FSX/WI055)
3) Standard Working Procedure of the Central Laboratory (FSX/WI057)
4) Standard Procedure of Sampling and Sample Management (FSX/WI058)
5) Standard Procedure of Data Statistical Analysis and Control (FSX/WI061)
6) Emergency Plan on Inlet Water Quality Exceeding Design Maximum Allowed Loading (FSX/WI024)
7) Emergency Plan on Non-compliance Discharge (FSX/WI143)
8) Reporting System (FSX/WI032)

2) Data Recording

WWTP operater keeps original data recording daily monitoring and equipment maintenance records, and carry out statistical analysis of the data. Relevant documentations include:

1）Daily Testing Form of Central Lab

2）Monthly Testing Form of WWTP

3）Quarterly Testing Form of WWTP

4）Original Record of COD

5) Original Record of MLSS and SV

6) Original Record of SS

7) Original Record of Sludge Microscopic Check

8) Original Record of TDS and TS

9) Original Record of NH4-N

10) Original Record of BOD_5

11) Original Record of Sludge Water content

12) Original Record of TN

13) Original Record of TP

14) Original Record of Cl^-

15) Original Record of MLVSS

16) Original Record of pH, DO, color

17) Original Record of NO_2-N

18) Original Record of NO_3-N

19) Original Record of Fecal Coliform

20) Calibration and Maintenance Record of Testing Instruments

21) Equipment Repair Record

22) Wastewater and Sludge Testing Parameters and Frequency

3) Water quality, Sludge quality monitoring frequency and main testing parameters

WWTP Operation Company's central lab is responsible for testing inlet and outlet water quality. Major control parameters include COD, SS, NH_4-N, BOD_5, TN, TP, Cl^-, pH, DO, Color, Fecal Coliform. Testing frequency is 4 times a day.

Foshan EPB has installed online monitoring instruments at each WWTP outlet to monitor volume and quality of the treated wastewater. The monitoring parameters are COD and flow rate.

Foshan EPB has assigned Guangzhou Drainage Monitoring Station to carry out regular test on sludge quality. Testing items include Cd、Hg、Pb、Cr、As、Cu、Zn、Ni、B、CN^-、TOC、K、T-P. The test is carried out 1~2 times a year.

4) Monitoring on Ambient Environmental Quality

Water quality of the receiving water body, ambient air quality and acoustic environment monitoring is carried out by Foshan EPB in line with routine environmental quality monitoring activities.

Pollution Emission Monitoring Data from Existing WWTPs

1□Water Pollution

According to government EIA approval, Zhen'an, Shagang and Chengbei WWTP should comply with Municipal WWTP Pollution Discharge Standard (GB18918-2002) Class II and Guangdong Water Pollution Discharge Limit (DB44/26-2001) Class II for Municipal WWTP.

Table 5.2-2 Water Pollution Discharge Standard□Unit□mg/L□

Limits		CODcr	BOD_5	SS	NH_4-N
WWTP	Zhen'an, Shagang, Chengbei	60	30	30	25

Table 5.2-3 WWTP Treated Effluent Water Quality Monitoring Data (Unit:mg/l)

Pollutant		CODcr	BOD_5	SS	NH4-N
Zhen'an	2010.05	10	1.0	8	0.132
	2009.11	17	2	9	0.202
	2009.08	15	4.8	9	1.171
Shagang	2009.11	13	2	6	0.108
Chengbei	2010.05	18	1.7	10	0.543
	2009.11	23	2	7	0.618
Standard		60	30	30	25
Range of Actual Monitoring Figure		10□23	1.0□4.8	6□10	0.108□1.171
Percentage of Max Concentration Compared to Standard		38.3%	16.0%	33.3%	4.7%

2□Air Pollution

According to government EIA approval, Zhen'an, Shagang and Chengbei WWTP should comply with Municipal WWTP Pollution Discharge Standard (GB18918-2002) Class II and Odor Pollution Discharge Standard (GB14554-93) Class II for newly built and expanded plants. The limit values are shown in the Table below:

Table 5.2-4 Non-point Source Air Pollution Discharge Limits (Unit: mg/m^3)

No.	Pollutant	GB 18918□2002	GB14554-93	Discharge Limits
1	H_2S	0.06	0.06	0.06
2	NH_3	1.5	1.5	1.5
3	Odor Intensity (Nondimensional Parameter)	20	20	20

Historical data shows that air pollution at the boundary of Zhen'an Shagang and Chengbei WWTPs all complied with discharge standards. Historical data is summarized in the table below.

Table 5.2-5 Monitoring of Air Pollution at WWTPs' Boundary (Unit: mg/l)

Pollutants		NH_3	H_2S	Odor Intensity (Nondimensional Parameter)
2005.12	Zhen'an North Side Boundary	0.79	Not detected	<10
	Zhen'an South Side Boundary	0.13	0.03	<10
	Shagang East Side Boundary	0.80	Not detected	<10
2007.07	Chengbei South Side Boundary	0.015~0.020	Not detected	<10
2007.09	Chengbei South Side Boundary	Not detected~0.018	Not detected~0.014	<10
Standards		1.5	0.06	20
Range of Actual Monitoring Figure		Not detected~0.79	Not detected~0.014	<10
Percentage of Max Concentration Compared to Standard		52.7%	23.3%	<50%

3□Noise

According to government EIA approval, Zhen'an, Shagang and Chengbei WWTP should comply with Noise Standards at Factory Boundary □GB12348-2008□ Class II, i.e. <=60 dB(A) during daytime, and <=50 dB(A) during nights. Monitoring data during this research shows that noise level at the boundary of Zhen'an, Shagang and Chengbei WWTPs all complied with standards. Monitoring figures are shown in the table below.

Table 5.2-6 Current Noise Level (Unit: dB(A))

Time and Value / Monitoring Points	2010.11.23		2010.11.24	
	Daytime	Night-time	Daytime	Night-time
East side boundary of Zhen’an	53.1	46.4	53.9	47.1
South side boundary of Zhen’an	52.6	45.5	53.1	45.5
West side boundary of Zhen’an	52.6	46.7	52.7	46.5
North side boundary of Zhen’an	54.6	48.5	56.5	47.5
Northeast side boundary of Shagang	57.4	47.5	57.1	48.3
South side boundary of Shagang	57.1	47.2	56.9	47.7
Northwest side boundary of Shagang	57.9	48.9	56.3	47.1
Southeast side boundary of Chengbei	49.8	43.5	51.2	44.2
South side boundary of Shagang	52.1	44.6	52.5	43.7
West side boundary of Shagang	57.1	49.1	56.3	47.2
Northeast side boundary of Shagang	56.3	47.6	57.4	46.3
□GB3096-2008□Class II	**60**	**50**	**60**	**50**

4□Sludge

Zhen’an, Shagang and Chengbei WWTPs generate around 220t/d (counted as 80% water content) sludge. Currently, belt filter press or sludge centrifuge are used to dewater the sludge to water content of 75~80%. Treated sludge is sent to Zhaoqing Yunan Landfill (240 km away) for final disposal.

According to historical record from 2006~2010, sludge from Zhen’an, Shagang and Chengbei WWTP contains farely high level of heavy metal, but it still complied with quality standard for mixed landfill. Moreover, project owner assigned professional agency to conduct leaching test for sludge from Chancheng district WWTP. Relevant parameters all comply with standards in Hazardous Wastes Identification Test – Leaching Toxicity Test (GB50810.3-2007), i.e. it isn’t categoried as hazardous wastes (see Chapter 3.1 for details).

Governmental Approval and Implementation Status of “Foshan Nanzhuang Sludge Treatment Plant Project”

1、Governmental Approval

“Foshan Nanzhuang Sludge Treatment Plant Project” is a sub-project of the “World Bank Financed Guangdong Pearl River Delta Urban Environment Project (II)”.

According to the Feasibility Study, the project consists of building a centralized sludge treatment plant with 400 t/d of capacity (calculated based on 80% moisture content) in

Nanzhuang WWTP in Chancheng District. The project aims to use "Thermal Drying Technology" to reach the purpose of "Volume Reduction, Decontamination and stabilization" so as to avoid secondary pollution from the sludge to the surrounding environment. The project was planned to invest 131 million RMB, among which 10.7 million USD would be financed by the World Bank and the remaining would be from the company itself or bank loan.

The PIU assigned Zhongshan University in 2006 to develop the EA report for "PRD(II) Foshan Nanzhuang Sludge Treatment Plant Project", and obtained Guangdong EPB approval on July 10th, 2006 (GDEPB [2006] No. 1011). The approval document agreed that the project would be built in Luonan Village in East South of Chancheng District using "fluid-bed drying process" to treat municipal WWTP sludge from Zhen'an, Dongpu, Shagang, Chengbei, Nanzhuang WWTPs and some from WWTPs outside of Chancheng District. The total treatment capacity is 400 t/d (with 80% moisture content), and production rate of dry sludge (10% moisture content) is 87 t/d of. Dried sludge will be sent to Bai Shi Ao landfill in Gaoming Miao Village. Feasibility Study Report of this project has also obtained approval from Guangdong Development and Reform Commission on August 28th, 2006.

2□Requirements and Cotnrol Measures for Environmental Protection

According to "Environmental Impact Assessment for the Foshan Nanzhuang Sludge Treatment Plant Project (PRD Urban Environment Project II)" and No 1011 government notice issued by GDEPB in 2006, the requirements for environmental protection include:

1) Discharge wastewater into Nanzhuang WWTP for treatment and compliant discharge into river body; total wastewater volume is 7455.7t/d;
2) Use natural gas as fuel source; adopt odor control measures; conduct insulation during sludge storage and transporation; and conduct waste treatment before final waste disposal;
3) Adopt vibration reduction, noise isolation, noise absorpotion, muffling and etc. to mitigate noise pollution; adopt vibration reduction device at pump base, insulate pumping station, select low noise level compressor and adopt vibration reduction and muffler;
4) Properly arrange equipment layout and apply greening to reduce noise;
5) Apply deodorization and detoxification treatment to dry sludge then ship by insulated trucks to Bai Shi Ao Landfill in Gaoming for final landfill disposal;

6) Clean and ship out domestic garbage in time to Bai Shi Ao Landfill in Gaoming, conduct disinfection and apply pesticides in garbage onsite piling area;
7) Apply 100 m safety distance.

3、Project Implementation Status

The project site is within the boundary of Nanzhuang WWTP phase 1 site. Currently, Nanzhuang WWTP has started construction. But this project hasn't yet conducted in detailed engineering design, and no actual construction taken place.

Large Industrial Enterprises within the Wastewater Collection Areas of each WWTP

According to research data, many large industrial enterprises have already been closed or relocated from Chancheng District to the suburban areas. Information from Chancheng District EPB shows that there were 31 large industrial enterprises in Chancheng District in 2009 (see Table 2.2-10), which all are located in Nanzhuang catchment area and will be closed or relocated within 1~2 years. Therefore, by year 2009 there were no more large industries within the catchment area of Zhen'an, Shagang and Chengbei WWTPs. It is estimated that by 2012 when Nanzhuang WWTP is put into use there will be no more large industries operating in the catchment area.

According to information from Chancheng District EPB, the 8 enterprises discharged industrial wastewater compliant with discharge standards, and the rest of companies all realized "Zero Liquid Discharge". Named companies above had no record of violations of environmental protection laws and regulations during year 2009.

Table 5.2-2 Wastewater Discharge from Large Industries in Chancheng District

Name of the Company	Industrial Wastewater (10,000 t/a)			Wastewater Pollution Loading (t/a)				
	Treated Wastewater Volume	Wastewater Discharge Volume	Compliance Discharge Volume	COD	NH4-N	Oil	Volatile Phenolic compounds	CN^-
Foshan Rongmei Industry Ltd.	43000	43000	43000	6259	742.7			

Foshan Xingfa Innovation Co., Ltd.	650800	605000	605000	18816	10698	680.6	60.5	2.4
Foshan Shenfang (United) Ltd.	9360	9360	9360	6664	0.9	28.1		
Huaxin (Foshan) Color Printing Ltd.	21682	21682	21682	787.1	1.3		2.2	
Foshan Hualian Xiwa Ltd.	28178	28178	28178	619.9	140.9			
Foshan Nanzhuang Heng’an Textile Ltd.	223000	223000	223000	11936	16.7			
Foshan Xinmingzhu Sanitary Appliance Ltd.	15000	3800	3800	117.8	0.2			
Foshan Chancheng Guangyu Aluminum Ltd.	21682	21682	21682	604.9	0.2	8.7	2.2	0.7
Foshan Chancheng Xingtou Qunxing Ceramic Factory	265000	—	—	—	—	—	—	—
Foshan Huisheng Ceramic Ltd.	157371	—	—	—	—	—	—	—
Foshan Liangjian Ceramic Ltd.	104208	—	—	—	—	—	—	—
Guangdong Qianghui Ceramic Ltd.	60000	—	—	—	—	—	—	—
Foshan Yingji Ceramic Ltd.	211608	—	—	—	—	—	—	—
Foshan Jintuo Ceramic Ltd.	3240000	—	—	—	—	—	—	—
Foshan Baoshima Ceramic Ltd.	150000	—	—	—	—	—	—	—
Foshan Guangzhu Ceramic Ltd.	285000	—	—	—	—	—	—	—
Guangdong Nengqiang Ceramic Ltd.	256570	—	—	—	—	—	—	—
Foshan Xinjiaxiang Ceramic Ltd.	144000	—	—	—	—	—	—	—
Guangdong Junshi Ceramic Ltd.	152000	—	—	—	—	—	—	—
Foshan Jiataomei Ceramic Ltd.	10256	—	—	—	—	—	—	—
Foshan Xinhengyue Ceramic Ltd.	50000	—	—	—	—	—	—	—
Foshan Juzhimei Ceramic Ltd.	247593	—	—	—	—	—	—	—
Foshan Ouyu Ceramic Ltd.	93000	—	—	—	—	—	—	—
Foshan Wei’erda Ceramic Ltd.	36000	—	—	—	—	—	—	—
Foshan Jianxing Ceramic Ltd.	143200	—	—	—	—	—	—	—
Foshan Dengke Ceramic Ltd.	156789	—	—	—	—	—	—	—
Foshan Shuangxi Ceramic Ltd.	94650	—	—	—	—	—	—	—
No. 2 Plant of Foshan Rongzhou Construction Ceramic Ltd.	90000	—	—	—	—	—	—	—
Foshan Yuexiang Ceramic Ltd.	16154	—	—	—	—	—	—	—
Foshan Samite Ceramic Ltd.	128432	—	—	—	—	—	—	—
Foshan Hengnuo Ceramic Ltd.	135000	—	—	—	—	—	—	—

Sludge Sanitary Landfill Site Due Diligence

1、Summary

Bai Shi Ao Sanitary Landfill in Gaoming Miao Village is a licensed garbage detoxification disposal facility. This project was approved by Guangdong EPB (GDEPB, 2002 No. 658 Notice) and Guangdong DRC (GDDRC, 2002 No. 1221 Notice), and started operation in 2005. According to information provided by the design institute, the project covers 1433 MU land with a design capacity of 24 million m^3 and design service life of 30 years. By 2010, the landfill treated 3000 t/d of garbage, and had total treatment of 3 million t occupying 2.4 million m^3 of capacity. It can continue to operate for another 27 years with a daily treatment volume of 3000 t. The landfill is operated by ONXY. As described in the BOT contract of Gaoming Bai Shi Ao Sanitary Landfill, the site has to accept and treat municipal WWTP sludge in Foshan city. Foshan Water Group has come to a preliminiary agreement with ONXY regarding treatment of sludge in Bai Shi Ao Landfill. Sludge will be accepted by the landfill when sludge quality meets key control limit of the landfill, especially water content under 60%.

On March 10th 2011, Foshan Water Group signed MOU with ONXY regarding sludge landfill disposal. ONXY agreed to accept 100~150 t/d of sludge from this project with water content under 60%.

2、Environment Protection Facilities and Corresponding Management Measures

According data from construction unit, EIA of Gaoming Baishiao Sanitation Landfill was approved by Guangdong Provincial Environment Protection Bureau （GD Env. Letter No.[2002]658）. Environment management requirement of environment approval and the implementation by Baishiao Landfill are listed below:

Table 5.2-3 Environment Protection Facilities in Baishiao Sanitation Landfill

No.	Major requirement（GD Env. Letter No.[2002]658）	Implementation
1	10^{-7}cm/s double layer liner system should be adopted for the landfill bottom, with permeability coefficient less than 10^{-7}cm/s	Implemented in the design and construction
2	Construction of leachate treatment facilities with capacity no less than 700m^3/d and with capacity of regulating reservoir no less than 9000 m^3	Implemented in the design and construction of wastewater treatment plant

3	gas collection, recover and reuse; gas should be treated before discharge if it is not suitable for recover or reuse	gas collection network has been installed and burned
4	Low noise level equipments should be selected and measures such as sound insulation, vibration reduction and noise elimination adopted	Low noise level equipments are selected and measures such as sound insulation, vibration reduction and noise elimination and adopted
5	implementation of specialization management to avoid environment pollution during transportation	special trucks are adopted for waste transport and transport regulation has been established
6	accident prevention and emergency plan should be established and implemented	accident emergency plan has been established and emergency facilities have been equipped.
7	online monitoring equipments should be set up for the wastewater discharge point	installed
8	More than 500m of width of sanitation safety distance should be set up	500m width of sanitation safety distance is set up, there is no village, residential community and other sensitive objects within.

3□Statistical Analysis of Environmental Monitoring Records

At Bai Shi Ao Landfill, 4 times a year of environmental monitoring including air quality, water and ground water quality, leachate, soil and noise, are conducted on landfill site and surrounding sensitive areas.

According record during Sept. 2010 provided by Bai Shi Ao Landfill, air quality at all sensitive points complied with standards; landfill leachate was treated and compliant discharge; noise level at site boundaries was compliant with standards; soil quality at landfill site and sensitive points all met standards; 2 out of 8 parameters (H_2S, odor) measured within landfill and 2 monitoring points at site boundary exceeded standards for air quality; water quality within landfill site met standards except NH_4-N, although it didn't' affect surface water environment since such water was all used in greening onsite; ground water quality monitored at 8 well mostly met standards except pH, color and Coliform.

Statistical analysis of monitoring data is shown below:

1□Ambient Air Quality Monitoring Result

The results show that all parameters at sensitive points (2#, 3#) were compliant. H_2S and odor level at gas collection in landfill site (1#) and Zone 1 boundary (4#)

exceeded standards. It is concluded that odor released from landfill has caused some impact to air quality on site and at site boundary but very little to sensitive points in surrounding areas.

Table 5.2-4 Landfill Site Air Quality Monitoring Data (unit: mg/m^3)

Monitoring Point	Parameter	Number of Sample	Range of Concentration	Limits	No. of Non-compliance
1# Landfill Site Gas Collection Inlet	NH_3	20	0.241~0.493	1.5	0
	H_2S	20	0.041~0.102	0.06	**14**
	Odor	5	70~83	20	**5**
	SO_2	20	0.043~0.116	0.5	0
	NO_2	20	0.055~0.102	0.24	0
	CO	20	1.688~4.500	10	0
	TSP	5	0.205~0.238	0.3	0
2# Lu Dong Mountain Forestry Park	NH_3	20	0.046~0.150	1.0	0
	H_2S	20	Not dectected	0.03	0
	Odor	5	Not dectected	20	0
	SO_2	20	0.023~0.93	0.15	0
	NO_2	20	0.025~0.098	0.12	0
	CO	20	0.650~1.388	10	0
	TSP	5	0.095~0.116	0.12	0
3# Miao Village	NH_3	20	0.047~0.152	1.5	0
	H_2S	20	Not dectected	0.06	0
	Odor	5	Not dectected	20	0
	SO_2	20	0.025~0.096	0.5	0
	NO_2	20	0.041~0.106	0.24	0
	CO	20	0.725~1.313	10	0
	TSP	5	0.096~0.133	0.3	0
4# Landfill Zone 1 Boundary	NH_3	20	0.342~0.558	1.5	0
	H_2S	20	0.027~0.087	0.06	**6**
	Odor	5	32~41	20	**5**
	SO_2	20	0.041~0.108	0.5	0
	NO_2	20	0.045~0.115	0.24	0
	CO	20	1.063~2.538	10	0
	TSP	5	0.169~0.195	0.3	0

2. Treated Leachate Quality Monitoring Results

Monitoring point for treated leachate is located at outlet of the leachate treatment platn. Discharge limit for pH is quoted from "Guangdong Water Pollution Discharge Standard" (DB44/26-2001) Table 4: Maximum Allowed Concentration Class I for 2nd Category of Pollutant. Limits for other parameters are quoted from "Domestic

Garbage Landfill Pollution Control Standard" (BG16889-2008) Table 2: Maximum Allowed Water Pollutant Concentration from Existing and New Domestic Landfill. Monitoring data shows that treated leachate complied with relevant standards.

Table 5.2-5 Treated Leachate Water Quality Monitoring Data (unit: mg/l, except pH and color, Coliform: count/l)

Item	pH	Color	SS	CODcr	BOD_5	HN_4-N	Coliform
Monitoring Data	7.52	4	6	78	18.8	5.86	<100
Standard Limit	6~9	40	30	100	30	25	10000

3□Surface Water Quality Monitoring Results

Monitoring point for surface water is located at outlet of the oxidization ditch in the landfill site. "National Surface Water Quality Standard" (GB3838-2002) Class II standard is applied. Monitoring figures show that all parameters except NH_4-N are compliant with the standard.

Table 5.2-5 Surface Water Quality Monitoring Data (Unit: mg/l, exept pH, Coliform: counts/l)

Item	**pH**	**CODcr**	**BOD_5**	**HN_4-N**	**TN**	**TP**
Monitoring Figure	7.52	20	1.4	1.753	2.57	0.07
Standard Limits	6~9	20	4	1.0	1.0	0.2
Item	**Pb**	**Cr^{6+}**	**Cd**	**Hg**	**As**	**Coliform**
Monitoring Figure	0.00012	Not detected	Not detected	Not detected	0.0020	5200
Standard Limits	0.05	0.05	0.005	0.0001	0.05	10000

4□Gound Water Monitoring Results

10 well were drilled in the landfill site, among which 2 didn't meet requirements for water quality monitoring. Therefore ground water quality monitoring was conducted at 8 points. "National Gound Water Quality Standard" (GB 14848-1993) Class III Standard was adopted. All parameters except pH, color and coliform were compliant with the standard.

Table 5.2-5 Ground Water Quality Monitoring Data (Unit: mg/l, exept pH, color, coliform: counts/l)

Item	**Monitoring Data**	**Limits**	**Percentage of actual measurement in the samples**	**Rate of non-compliance**
pH	5.82~7.65	6.5~8.5	100%	25%
Color	2~40	15	100%	50%
Pb	0.00018~0.00595	0.05	100%	0
Cd	Not detected~0.00104	0.01	50%	0
Cr^{6+}	Not detected ~0.010	0.05	12.5%	0
As	0.0009~0.0023	0.05	100%	0
Hg	Not detected	0.001	0	0
Coliform	2.8×10^4 ~ 4.4×10^6	3	100%	100%

5□Soil Monitoring Results

"Soil Environmental Quality Standard" (GB 15618-1995) Class II was applied. Samples taken at sensitive points around landfill site were all compliant with the standards.

Table 5.2-6 Soil Monitoring Data (unit: mg/Kg)

Monitoring Points	Soil Type	Item				
		Hg	**As**	**Cd**	**Cr**	**Pb**
Downstream of oxidation ditch	Sand Soil (reddish brown)	0.020	10.2	0.14	37	80
West side of Lu Dong Forestry Park		0.041	12.3	0.11	45	97
Side of leachate adjustment tank		0.081	10.0	0.11	12	90
Limits		0.5	30	0.30	200	300

6□Site Boundary Noise Level Monitoring Results

Noise level monitoring point was set at boundary of landfill Zone 1. "Emission Standard for Industrial Enterprises Noise at Boundary" (GB 12348-2008) Class II standard was applied. The monitoring results show noise levels during daytime and nighttime at site boundary were all compliant with the standard.

Table 5.2-7 Noise Level at Site Boundary (Unit: dB)

Monitoring Point	Date	Daytime Leq	Night-time Leq
Landfill Zone 1	2010.9.15	52.8	48.5

boundary			
Limit Value		60	50

Environmental Baseline Assessment

Water Environment Status Monitoring and Assessment

Water Environment Status Monitoring

□1□Monitoring and assessment scope

According to requirements in the Technical Guidelines for Environmental Impact Assessment – Surface Water Environment□HJ/T2.3-93□, water environment assessment scope of pollution receiving water bodies from WWTPs such as Foshan Creek, Foshan Waterway, Jili Creek is selected as the water(aquatic?) environment baseline assessment scope.

□2□Setting of monitoring sections

According to requirements in the Technical Guidelines for Environmental Impact Assessment – Surface Water Environment□HJ/T2.3-93□, monitoring sections are set up in pollution receiving water bodies such as Foshan Creek, Foshan Waterway, Jili Creek, Fengshou Creek. Since Nanzhuang WWTP is under construction, and recent quality of Jili Creek does not have big change, historical monitoring data is collected instead. Setting of monitoring sections is shown in Table 6.1-1 and Figure1.8-1.

Table 6.1-1 Ambient water status monitoring section setting

Section number	Section location	River	Remark
1#	1500m upstream of discharge point of Zhen’an WWTP	Foshan Creek	monitoring result in November 2010
2#	800m downstream of discharge point of Zhen’an WWTP		
3#	Zhongshan Bridge	Foshan Waterway	Monitoring data collection of 2010
4#	Hongjiao Water Gate		
5#	Wensha Bridge		
6#	Luonan	Jili Creek	Monitoring data

7#	1.5km before Jili Creek influx into Tanzhou Waterway		collection of 2009

□3□Monitoring time, frequency

First phase of site monitoring (when was the second phase?) was conducted in November 2010 in Foshan Creek and Fengshou Creek with continuous 3 day sampling and 2 sample a day(tide and ebb). Water quality monitoring data of Foshan Waterway and Jili Creek in 2009 is also collected for analysis.

Sampling, sample preservation and analysis is conducted according to the method specified in Environmental Quality Standards for Surface Water (GB 3838-88-2002) and Monitoring and Analysis Method of Water and Wastewater (4th edition). Specific analysis method and minimum detection limit of each water quality monitoring parameter are shown in Table 4.1-2.

□4□Monitoring parameters

9 analysis parameters of monitoring sections of Foshan Creek in 2010 are water temperature, pH, SS, DO, BOD_5, COD, NH_4-N, oil, TP.

4 monitoring parameters of Foshan Waterway in 2010 are COD, DO, NH_4-N and TP; 13 monitoring parameters of Jili Creek are water temperature, pH, DO, COD, BOD_5, LAS, NH_4-N, TP, volatile phenol, oil, sulfide, copper, hexavalent chromium.

□5□Statistics of monitoring results

Monitoring result is shown in Table 6.1-2.

Table 6.1-2 Water quality analysis method and minimum detection limit

No.	Parameters	Analysis method	Detection threshhold (mg□L)
1	water temperature	The thermometer measurement	——
2	pH	Glass electrode method	0.01pH
3	DO	iodometry	0.2
4	SS	gravimetric method	4

5	COD_{Cr}	Dichromate method	5
6	BOD_5	dilution and seeding method	0.5
7	Oil	infrared spectrophotometry	0.1
8	NH4-N	Nessler's reagent colorimetric method	0.03
9	TP	Ammonium molybdate spectrophotometric method	0.01
10	Volatile phenol	After distillation by means of 4-AAP spectro-photometric method	0.005

Table 6.1-3 Statistics of monitoring results (Foshan Creek) unit: mg/L

Time	Section	Water temperature (℃)	pH	SS	DO	BOD_5	COD_{Cr}	NH_3-N	Oil	TP
11.22	1#—tide	22.0	6.87	23	5.4	2.7	<10	0.20	0.02	0.12
	1#—ebb	22.5	6.93	25	5.3	2.4	<10	0.18	0.03	0.14
	2#—tide	22.1	7.12	20	5.3	2.6	<10	0.13	0.02	0.13
	2#—ebb	22.5	7.03	22	5.2	2.8	<10	0.13	0.04	0.14
11.23	1#—tide	21.5	6.93	24	5.2	2.7	<10	0.28	0.03	0.10
	1#—ebb	22.0	6.95	22	5.5	2.6	<10	0.33	0.03	0.13
	2#—tide	21.5	7.20	26	5.7	2.8	<10	0.12	Not detected	0.14
	2#—ebb	22.0	7.14	24	5.6	2.9	<10	0.11	0.02	0.15
11.24	1#—tide	20.8	7.01	23	5.7	3.2	<10	0.15	Not detected	0.16
	1#—ebb	21.5	7.03	25	5.5	2.7	<10	0.21	0.03	0.15
	2#—tide	20.8	7.14	24	5.8	2.7	<10	0.10	0.02	0.14
	2#—ebb	21.5	7.21	23	5.6	2.5	<10	0.16	0.04	0.15

Table 6.1-4 Statistics of monitoring results (Foshan Waterway) unit: mg/L

Time	Section	DO	COD_{Cr}	NH_3-N	TP
2010.8.4	3#—tide	4.9	14.5	0.51	0.18
	4#—tide	3.7	16.7	0.91	0.22
	5#—tide	2.8	33.3	2.34	0.31
	3#—ebb	4.4	12.9	1.04	0.25
	4#—ebb	3.1	12.3	1.39	0.27
	5#—ebb	2.2	17.5	1.72	0.28

Table 6.1-5 Statistics of monitoring results (Jili Creek) unit: mg/L

No.		Monitoring result (mg/L, except pH and otherwise specified)								
Time	Sampling point	pH	CODcr	BOD_5	SS	DO	NH_4-N	Oil	TP	Volatile phenol
2009.5.16	6#—tide	7.31	25.4	12.0	70	2.32	0.40	0.05	0.10	0.002L
	6#—ebb	7.33	29.0	13.8	68	2.00	0.56	0.09	0.11	0.002L
	7#—tide	7.73	16.5	5.1	61	3.37	0.23	0.12	0.04	0.002L
	7#—ebb	7.62	17.8	6.8	70	3.09	0.35	0.15	0.04	0.002L
2009.5.17	6#—tide	7.24	25.0	11.2	67	2.30	0.35	0.04	0.10	0.002L
	6#—ebb	7.30	28.5	14.3	62	2.01	0.50	0.08	0.11	0.002L
	7#—tide	7.83	17.1	5.5	68	3.56	0.27	0.13	0.04	0.002L
	7#—ebb	7.72	18.4	7.2	76	3.20	0.39	0.16	0.05	0.002L
2009.5.16	6#—tide	7.34	25.7	12.0	72	2.20	0.42	0.06	0.16	0.002L
	6#—ebb	7.38	29.3	15.1	68	1.95	0.57	0.09	0.12	0.002L
	7#—tide	7.84	17.5	5.7	69	3.44	0.28	0.14	0.04	0.002L
	7#—ebb	7.75	18.6	7.5	78	3.14	0.41	0.18	0.05	0.002L

Water Quality Baseline Assessment

□1□Assessment Criteria

According to the “Guangdong Province Surface Water Environment Functional Zoning” (Guangdong EPB [1999] No. 553)□Class III water quality standard of Environmental Quality Standards for Surface Water (GB 3838-88-2002) is applied to Jili Creek, class IV water quality standard of Environmental Quality Standards for Surface Water (GB 3838-88-2002) is applied to Xiebian Creek, Foshan Creek, Fengshou Creek and Foshan Waterway. Surface water quality standards for this project are shown in Table 6.1-6.

Table 6.1-6 Environmental Quality Standards for Surface Water (GB 3838-88-2002) (mg/L, except pH)

Parameters	Class IV standard of （GB3838-2002）	Class III standard of（GB3838-2002）
pH	6—9	6—9

DO	3	6
SS	150	150
BOD_5	6	4
COD_{Cr}	30	20
NH4-N	1.5	1.0
Oil	0.5	0.05
Volatile phenol	0.01	0.005
Sulfide	0.5	0.05
TP	0.3	0.2

（2）Assessment method

According to the monitoring results, Single water quality index assessment method recommended in Technical Guidelines for Environmental Impact Assessment （HJ/T2.3-93）is adopted. By using standard index method, standard index of single water quality index at j point is:

$$S_{i,j} = C_{i,j} / C_{S,i}$$

Standard index for DO：

$$S_{\mathrm{DO_j}} = \frac{|DO_f - DO_j|}{DO_f - DO_s} \qquad DO_j \geq DO_S$$

$$S_{DO_J} = 10 - 9\frac{DO_j}{DO_s} \qquad DO_j < DO_S$$

Standard index for pH：

$$S_{pH,j} = \frac{7.0 - pH_j}{7.0 - pH_{sd}} \qquad \text{pHj ≤7.0}$$

$$S_{pH,j} = \frac{PH_j - 7.0}{PH_{su} - 7.0} \qquad \text{pHj >7.0}$$

where：Ci， j — monitoring concentration value of assessment parameter i at j point（mg/L）

$Cs，i$ — standard limit value of assessment parameter i, mg/L；

DO_j — DO at j point（mg/L）

DO_f —saturated dissolved oxygen concentration, mg/L；

$DO_f = 468/(31.6+T)$，T: water temperature（℃）

pH_j —pH at j point；

pH_{sd} — lower limit of pH in surface water quality standard；

pH_{su}—upper limit of pH in surface water quality standard.

Water quality index > 1 means the water quality index exceed the standard limits, the bigger the water quality index is, the more seriously the indicator exceed the standard.

（3）Assessment result

Surface water quality monitoring result is shown in Table 6.1-7 ~ Table 6.1-9, with baseline monitoring results and surface water quality standard.

Table 6.1-7 Statistics of monitoring results (Foshan Creek) unit: mg/L

Time	Section	pH	SS	DO	BOD_5	COD_{Cr}	NH_3-N	Oil	TP
11.22	1#—tide	0.13	0.15	0.61	0.45	0.33	0.13	0.04	0.40
	1#—ebb	0.07	0.17	0.62	0.40	0.33	0.12	0.06	0.47
	2#—tide	0.06	0.13	0.62	0.43	0.33	0.09	0.04	0.43
	2#—ebb	0.02	0.15	0.64	0.47	0.33	0.09	0.08	0.47
11.23	1#—tide	0.07	0.16	0.64	0.45	0.33	0.19	0.06	0.33
	1#—ebb	0.05	0.15	0.59	0.43	0.33	0.22	0.06	0.43
	2#—tide	0.10	0.17	0.56	0.47	0.33	0.08	Not Detected	0.47
	2#—ebb	0.07	0.16	0.57	0.48	0.33	0.07	0.04	0.50
11.24	1#—tide	0.01	0.15	0.56	0.53	0.33	0.10	Not Detcted	0.53
	1#—ebb	0.02	0.17	0.59	0.45	0.33	0.14	0.06	0.50
	2#—tide	0.07	0.16	0.54	0.45	0.33	0.07	0.04	0.47
	2#—ebb	0.11	0.15	0.57	0.42	0.33	0.11	0.08	0.50

Table 6.1-8 Statistics of monitoring results (Foshan Waterway) unit: mg/L

Time	Section	DO	COD_{Cr}	NH_3-N	TP
2010.8.4	3#—tide	0.69	0.48	0.34	0.60
	4#—tide	0.88	0.56	0.61	0.73
	5#—tide	***1.60***	***1.11***	***1.56***	***1.03***
	3#—ebb	0.77	0.43	0.69	0.83
	4#—ebb	0.98	0.41	0.93	0.90
	5#—ebb	3.40	0.58	1.15	0.93

Table 6.1-9 Statistics of monitoring results (Jili Creek) (unit: mg/L)

No.		Monitoring result (mg/L, except pH or otherwise specified)								
Time	Sampling point	pH	CODcr	BOD_5	SS	DO	NH4-N	Oil	TP	Volatile phenol
2009.5.16	6#—tide	0.16	***1.27***	***3.00***	0.47	***3.04***	0.40	1.00	0.50	Not detected
	6#—ebb	0.17	***1.45***	***3.45***	0.45	***4.00***	0.56	***1.80***	0.55	Not detected
	7#—tide	0.37	0.83	***1.28***	0.41	0.94	0.23	***2.40***	0.20	Not detected
	7#—ebb	0.31	0.89	***1.70***	0.47	0.98	0.35	***3.00***	0.20	Not detected
2009.5.17	6#—tide	0.12	***1.25***	***2.80***	0.45	***3.10***	0.35	0.80	0.50	Not detected
	6#—ebb	0.15	***1.43***	***3.58***	0.41	***3.97***	0.50	***1.60***	0.55	Not detected
	7#—tide	0.42	0.86	***1.38***	0.45	0.91	0.27	***2.60***	0.20	Not detected
	7#—ebb	0.36	0.92	***1.80***	0.51	0.97	0.39	***3.20***	0.25	Not detected
2009.5.16	6#—tide	0.17	***1.29***	***3.00***	0.48	***3.40***	0.42	***1.20***	0.80	Not detected
	6#—ebb	0.19	***1.47***	***3.78***	0.45	***4.15***	0.57	***1.80***	0.60	Not detected
	7#—tide	0.42	0.88	***1.43***	0.46	0.93	0.28	***2.80***	0.20	Not detected
	7#—ebb	0.38	0.93	***1.88***	0.52	0.97	0.41	***3.60***	0.25	Not detected

As shown in Table 6.1-7, each monitoring parameter of Foshan Creek meets the class IV standard of Environmental Quality Standards for Surface Water (GB3838-88-2002).

As shown in Table 6.1-8, only parameters in 5 # section exceed the class IVstandard of Environmental Quality Standards for Surface Water (GB3838-88-2002) during flood tide and ebb tide. The water quality of other sections is good.

As shown in Table 6.1-9, of all the monitoring parameters, COD, BOD5, DO and oil in Jili Creek monitoring section exceed the standard, can not meet the class III water quality standard of Environmental Quality Standards for Surface Water (GB3838-88-2002). It is because that Nanzhuang WWTP has not been put into use and the domestic and industrial wastewater is directly discharged into the Creek. Water quality of Jili Creek will improve when Nanzhuang WWTP is constructed and put into operation.

Ambient Air Quality Baseline Monitoring and Assessment

Ambient Air Quality Baseline Monitoring

□1□Assessment monitoring scope

According to the characteristics of air pollution emission, dilution and diffusion of this project and the requirement of Technical Guidelines for Environmental Impact Assessment – Ambient Air□HJ2.2-2008□, rectangular area with proposed project as the center and side length of 6km is selected as the assessment scope of air quality baseline.

□2□Location of monitoring points

Monitoring point location setting mainly follows the following principles□

a. According to the meteorological characteristic during sampling, monitoring points should be located in the downwind direction of the prevailing wind direction.

b. Monitoring location in the nearest sensitive points for air pollution

c. According to Technical Guidelines for Environmental Impact Assessment – Ambient Air□HJ2.2-2008□, ambient air quality monitoring setting should mainly follow the environment functional area principles and take into account of uniform distribution principles.

According to the principles above, and taking into account of full use of historical monitoring data, 6 air quality baseline monitoring points are set up in the nearest sensitive points of each WWTP. Characteristics pollutants of this project are monitored. Regular monitoring data and historical monitoring data of Chancheng District are also collected to reflect situation of regular parameters such as SO_2, NO_2 and PM10. Monitoring points are shown in Table 6.2-1 and Figure 1.7-1.

Table 6.2-1 Setting of Air Quality Baseline Monitoring Points

No.	Location of monitoring point	Parameters	Remark
1#	1# Nanhai Art High School	NH_3□H_2S□Odor	monitoring data
2#	2# Guabuxun Village	NH_3□H_2S	
3#	3# Shagang Village Committee		
4#	4# Aochong Village		
5#	5# Nanzhuang	SO_2 □NO_2 and PM_{10}	EIA report of Shuixiang New Town in Chancheng – ecological greening project in east district (2009)
Other	regular monitoring data of Chancheng District		Data collection of regular air monitoring data of 2009

□3□Monitoring and analysis method

Technical Specification of Environmental Monitoring, Environmental Monitoring and Analysis Method and Ambient Air Quality Standard (GB3095-1996) are adopted as the monitoring and analysis method. See table 6.2-2.

Table 6.2-2 Analysis method for air quality baseline monitoring

Parameters	Analysis method	detection threshhold
Odor	triangle odor bag method	10□non-dimensional□

H_2S	Methylene blue spectrophotometric method	0.001mg/m^3
NH_3	Nessler reagent spectrophotometric method	0.01mg/m^3
NO_2	N□(1□naphthyl)□□ethylenediamine dihydrochloride colorimetric method method	0.015
SO_2	pararosaniline hydrochloride spectrophotometric method	0.007
PM10	flow sampling, gravimetric method	0.001

□4□Monitoring time and frequency

According to the Technical Guideline of requirement of Environmental Impact Assessment - Air Environment (HJ2.2-2008), first phase monitoring was conducted in November 2010. Except for WWTPs itself, there are no other enterprises around with NH_3, H_2S as characteristic pollutant. WWTPs are running smoothly, with stable emission of characteristic pollutant. According to the guideline requirement that " monitoring days can be reduced if there is no project around in the assessment area with the same characteristic pollutants", the monitoring arrangements for each characteristic pollutant, ie NH3, H2S and odor is: continuous sampling for 3 days with 4 samplings each day (Beijing time 02, 08, 14, 20). Meteorological observation was conducted to record temperature, atmospheric pressure, wind direction, wind speed and rain etc during sampling. WWTPs were in normal production condition during monitoring.

For monitoring data collection of regular parameters such as SO_2, NO_2 and PM10, monitoring time should not be less than 7 days.

□5□Statistics of Monitoring Results

Monitoring data is shown in Table 6.2-3, meteorological data in Table 6.2-4.

Table 6.2-3 Current Air Quality Monitoring Results (units: mg/m^3)

No.	Sampling time		SO_2	NO_2	PM_{10}	NH_3	H_2S	Odor
1# Nanhai Art High School	November 22	02:00	/	/	/	/	/	/
		08:00	/	/		/	/	/
		14:00	/	/		0.06	0.001	Not Detected
		20:00	/	/		0.05	0.001	11
	November 23	02:00	/	/	/	0.06	0.001	Not Detected
		08:00	/	/		0.06	0.001	10
		14:00	/	/		0.05	0.001	10
		20:00	/	/		0.08	0.002	11
	November 24	02:00	/	/	/	0.06	0.002	Not Detected
		08:00	/	/		0.04	0.001	11
		14:00	/	/		0.05	0.001	10
		20:00	/	/		0.07	0.002	12
	November 25	02:00	/	/	/	0.09	0.001	Not Detected
		08:00	/	/		0.06	0.001	Not Detected
		14:00	/	/		/	/	/
		20:00	/	/		/	/	/
2# Guabuxun Village	November 22	02:00	/	/	/	/	/	/
		08:00	/	/		/	/	/
		14:00	/	/		0.04	0.001	/
		20:00	/	/		0.04	0.002	/
	November 23	02:00	/	/	/	0.03	0.001	/
		08:00	/	/		0.02	0.001	/
		14:00	/	/		0.01	0.001	/
		20:00	/	/		0.06	0.002	/
	November 24	02:00	/	/	/	0.02	0.001	/
		08:00	/	/		Not Detected	0.002	/
		14:00	/	/		0.01	0.002	/
		20:00	/	/		0.05	0.002	/

No.	Sampling time		SO_2	NO_2	PM_{10}	NH_3	H_2S	Odor
	November 25	02:00	/	/	/	0.05	0.001	/
		08:00	/	/		0.05	0.002	/
		14:00	/	/		/	/	/
		20:00	/	/		/	/	/

No.	Sampling time		SO_2	NO_2	PM_{10}	NH_3	H_2S	Odor
3# Shagang village committ ee	November 22	02:00	/	/	/	/	/	/
		08:00	/	/		/	/	/
		14:00	/	/		0.05	0.001	/
		20:00	/	/		0.03	0.002	/
	November 23	02:00	/	/	/	0.04	0.001	/
		08:00	/	/		0.03	0.001	/
		14:00	/	/		0.03	0.001	/
		20:00	/	/		0.06	0.001	/
	November 24	02:00	/	/	/	0.03	Not Detected	/
		08:00	/	/		0.03	0.002	/
		14:00	/	/		0.02	0.001	/
		20:00	/	/		0.04	0.001	/
	November 25	02:00	/	/	/	0.05	0.001	/
		08:00	/	/		0.06	0.002	/
		14:00	/	/		/	/	/
		20:00	/	/		/	/	/
4# Aochong village	November 22	02:00	/	/	/	/	/	/
		08:00	/	/		/	/	/
		14:00	/	/		0.03	0.001	/
		20:00	/	/		0.03	0.001	/
	November 23	02:00	/	/	/	0.03	0.001	/
		08:00	/	/		0.03	0.001	/
		14:00	/	/		0.04	0.001	/
		20:00	/	/		0.05	0.004	/
	November 24	02:00	/	/	/	0.03	0.001	/
		08:00	/	/		0.02	0.001	/
		14:00	/	/		0.04	0.001	/
		20:00	/	/		0.05	0.003	/

	November 25	02:00	/	/	/	0.03	0.002	/
		08:00	/	/		0.04	0.002	/
		14:00	/	/		/	/	/
		20:00	/	/		/	/	/
5# Nanzhuang	May 14, 2009		0.091	0.066	0.118	/	/	/
	May 15, 2009		0.084	0.094	0.113	/	/	/
	May 16, 2009		0.081	0.078	0.107	/	/	/
	May 17, 2009		0.089	0.053	0.104	/	/	/
	May 18, 2009		0.089	0.081	0.109	/	/	/
	May 19, 2009		0.089	0.09	0.114			
	May 20, 2009		0.086	0.079	0.102	/	/	/
Average value of Chancheng District in 2009			0.039	0.052	0.066	/	/	/

Table 6.2-4 Meteorological data summary during sampling

Monitoring time	environment parameters	Air temperature (℃)	Air pressure (kPa)	Wind direction	Wind speed (m/s)	Weather condition
November 22	2:00~3:00	——	——	——	——	——
	8:00~9:00	——	——	——	——	——
	14:00~15:00	25	100.2	NE	1.5	sunny
	20:00~21:00	22	100.3	N	1.6	sunny
November 23	2:00~3:00	20	100.4	NE	0.5	sunny
	8:00~9:00	23.5	100.5	N	0.8	sunny
	14:00~15:00	26	100.2	NE	1.2	sunny
	20:00~21:00	22	100.3	NE	1	sunny
November 24	2:00~3:00	20.5	100.5	NE	1.2	sunny
	8:00~9:00	23	100.3	NE	0.8	overcast
	14:00~15:00	26	100.2	NE	0.6	sunny
	20:00~21:00	22	100.4	C	C	overcast
November 25	2:00~3:00	20	100.4	N	1.6	overcast
	8:00~9:00	23	100.3	NE	1.3	sunny
	14:00~15:00	——	——	——	——	——
	20:00~21:00	——	——	——	——	——

(6) Monitoring results for air pollutants at boundaries

Based upon previous data, analysis on concentrations of air pollutants at boundaries of WWTPs was performed as detailed in table 6.2-5.

Table 6.2-5 Monitoring data on concentrations of air pollutants at boundaries of WWTPs Unit: mg/l

Type of Air Pollutants		NH_3	H_2S	Odor Concentration
2005.12	North boundary of Zhen’an WWTP	0.79	not detected	<10
	South boundary of Zhen’an WWTP	0.13	0.03	<10
	East boundary of Shagang WWTP	0.80	not detected	<10
2007.07	South boundary of Chengbei WWTP	0.015~0.020	not detected	<10
2007.09	South boundary of Chengbei WWTP	not detected ~0.018	not detected ~0.014	<10
Standard applied		1.5	0.06	20
Concentration test range		not detected ~0.79	not detected~0.014	<10
Maximum compliance percentage		52.7%	23.3%	<50%

Air Quality Baseline Assessment

(1) **Assessment standard**

Air quality assessment standards is shown in table 6.2-5.

Table 6.2-5 Ambient Air Quality Standard (unit mg/m^3)

Pollutant	Time span	Concentration limit	Standards
SO_2	1 Hour average	0.50	class 2 standard of Ambient Air Quality Standard (GB30912.1-1996)
	daily average	0.15	
NO_2	1 Hour average	0.24	
	daily average	0.12	
PM_{10}	daily average	0.15	

NH_3	once	0.20	Hygiene Standards for Industrial Enterprises Design (TJ36-79)
H_2S	once	0.01	
Odor	--	20	class 2 of boundary standard of the Odor Pollutant Emission Standard

□2□Assessment result

According to current status monitoring data and historical monitoring data, monitoring result of SO_2, NO_2 and PM_{10} in the assessment area meet the class 2 standard of Ambient Air Quality Standard (GB30912.1-1996) and its amendment list; Ammonia, hydrogen sulphide meet the standard of Hygiene Standards for Industrial Enterprises Design (TJ36-79); Concentration of odor meet the class 2 of boundary standard of the Odor Pollutant Emission Standard. As indicated by previous monitoring data, concentrations of air pollutants at boundaries of Zhen'an, Shagang and Chengbei WWTPs could meet the requirements of relevant standards.

Acoustic Environmental Quality baseline Monitoring and Assessment

Acoustic Environmental Quality baseline Monitoring

□1□Setting of Monitoring Points

According to noise sources distribution and location of sensitive points around the plants, according to the requirement of Technical Guideline for Environmental Impact Assessment of Acoustic Environment (HJ2.4-2009), monitoring points are set up at boundary of each WWTP nearby the location of sludge dewatering project.

□2□Monitoring time and frequency

First phase monitoring was conducted in November 2010, continuously lasting for 2 days and 2 times each day; monitoring time is: 8:00□17:00 (daytime), 22:00 ~ 0:00 next day (nighttime).

□3□Measuring Method and Norms

According to corresponding requirements of the Technical Guideline for Environmental Impact Assessment of Acoustic Environment (HJ2.4-2009), Standards for Acoustic Environmental Quality (GB3096-2008), Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008), weather condition is good, with no rain and wind speed less than 5.5 m/s during monitoring. Microphone is installed outdoor one meter away from the boundary, with height of 1.2 ~ 1.5 meters.

□4□Monitoring instruments

Model HY105 of type 2 integrating sound level meter is used for monitoring. Acoustic and electrical performance of this monitoring instruments is in accordance with requirements of international standards IE [651 (1979)]. The type of microphone is capacitor microphone. Sound level calibrator B&K 4230G type (1000Hz, 94dB) is used for calibration before each monitoring.

□5□Monitoring value

According to the requirement of Technical Guideline for Environmental Impact Assessment of Acoustic Environment (HJ2.4-2009), equivalent continuous A sound level is selected for sound level monitoring.

□6□Assessment value

According to the characteristics of noise source, equivalent continuous A sound level is selected for the sound level monitoring. Following formula is adopted for the culculation of equivalent continuous A sound level.

$$\mathrm{Leq} = 10\log\left(\frac{1}{\mathrm{T}}\int_0^T 10^{0.1Lp(t)}dt\right)$$

□□□T——monitoring time□s□

Lp(t)——dB□A□Instantaneous sound level, dB (A)□

Li——dB□A□sound level value of i^th sampling, dB (A)□

n——number of sound level samples in monitoring point□

samples in equal time intervals, formula above can be simplified as:

$$\mathrm{Leq} = 10\log\left(\frac{1}{\mathrm{n}}\sum_{i=1}^{n} 10^{0.1Li}dt\right)$$

□7□Monitoring Result

Acoustic environmental monitoring result is shown in Table 6.3-1.

Table 6.3-1 Acoustic Environmental Monitoring Result (unit: dB (A))

date and monitoring value / monitoring point	11.23		11.24	
	Daytime	nighttime	daytime	nighttime
1# east boundary of Zhen’an dewatering room	53.1	46.4	53.9	47.1
2# south boundary of Zhen’an dewatering room	52.6	45.5	53.1	45.5
3# west boundary of Zhen’an dewatering room	52.6	46.7	52.7	46.5
4# north boundary of Zhen’an dewatering room	54.6	48.5	56.5	47.5
5# north east boundary of Shagang dewatering room	57.4	47.5	57.1	48.3
6# south boundary of Shagang dewatering room	57.1	47.2	56.9	47.7
7# north west boundary of Shagang dewatering room	57.9	48.9	56.3	47.1
8# south east boundary of Chengbei dewatering room	49.8	43.5	51.2	44.2
9#south boundary of Chengbei dewatering room	52.1	44.6	52.5	43.7
10# west boundary of Chengbei dewatering room	57.1	49.1	56.3	47.2
11# north east boundary of Chengbei dewatering room	56.3	47.6	57.4	46.3
12# east boundary of Nanzhuang dewatering room	42.6	40.9	41.9	38.9
12# south boundary of Nanzhuang dewatering room	43.7	39.2	42.6	39.5
14# west boundary of Nanzhuang dewatering room	41.2	40.1	41.5	39.5
15# north boundary of Nanzhuang dewatering room	39.6	38.1	41.0	37.5

GB3096-2008class 2 standard	60	50	60	50

Environmental Noise Quality Baseline Assessment

Project location is of the class 2 environmental noise functional area, where the class 2 standard of Acoustic Environmental Quality (GB3096-2008) is applicable [daytime 60dB (A), nighttime 50dB (A)].

As shown in Table 6.3-1 acoustic environmental quality monitoring results can be seen that, acoustic environmental monitoring values of all boundaries can meet the standards of class 2 of Acoustic Environmental Quality (GB3096-2008). Acoustic environmental quality in the project areas is good.

Environmental Impact Projection and Assessment during Operation Period

Ambient Air Quality Impact Analysis

Ground Meteorological Characteristics

The project area is located in the south of Tropic of Cancer, a subtropical and subtropical monsoon climate zone, the main characters are: with hot rainy season, more cold and wet in spring, longer summer without extremely hot, warm and sunny autumn with drought. The ground meteorological data collected statistical information on weather data in Foshan Nanhai Meteorological Station. Its latitude and longitude is: N23 ° 03 ', E113 ° 08', 3km (Zhen'an) to 16.5 km (Nanzhuang) far from four sewage treatment plants.

According to the weather statistics of Nanhai Meteorological Station in Nanhai District of Foshan City from Jan 1st 1957 to Dec 31st 2008, the annual average temperature of this area is 22.2ºC. January the coldest, with and average temperature of 13.5 º C; July the hottest, with an average temperature of 29.1 º C; From June to September, the average temperature is above 27 ºC. In terms of average temperature in each ten days: the first ten days in Jan and Feb are the coldest days with an average temperature of 13.3□13.7 ºC; the temperature will gradually rise from last ten days of Feb. The highest temperature reaches 29.2 ºC in the second ten days of July while the last ten days in July and 1st ten days in Aug will reach 29.1 ºC, and then the temperature will go down. Seasons differentiated by climate: average temperature in ten days □10ºC defines winter, average temperature in ten days □22ºC defines summer, while the temperature between the above two scopes defining spring or autumn. There is no winter in most of past years in this area, the summer lasts from mid-April to October. Most of the annual lowest temperature is above 3ºC while the lowest recorded as □1.9ºC (on 17th Jan, 1967). The annual highest temperature is 39.2ºC (18th July 2005), while the days with a temperature above 39 ºC all appeared after 2004. The historical records of annual average temperature show that the temperature rise obviously since 1986, and it is higher than the average level after 1997, the annual average temperature keeps above 23ºC from 1998 to 2007.

The annual average rainfall in this area is 1653.0mm, the annual total rainfall is between 1400~2000mm, while the heaviest recorded as 2342.8mm(in 2008), the smallest recorded as 1075.7mm(in 1991). From April to September it is rainy season (flood season), the total rainfall amounts 80% of the whole year. The rainfall in May and June is all above 250mm and it is the centralized rainy period. The biggest monthly rainfall is 909.2 mm(in June 2008), the biggest daily rainfall is 279,8mm (on 23rd Aug 1999, due to the impact of No.9908 typhoon which caused the huge storm).

The average sunshine duration in this area is 1739.6 hours yearly, and the annual sunshine duration is between 1500~2100 hrs, there are more rain and cloudy days from Feb to April, monthly 60~90 hrs sunshine duration. There is abundant sunshine from July to December, and the longest sunshine duration is in July all the year around. Total hours of sunshine over the past years show: the annual sunshine hours are less than the past since 1992.

The annual average relative humidity of this area is 80%, in April it is the moistest month all the year around while in November and December it is the driest months. The relative humidity decreases gradually from mid-1980s, from 1995 till now the relative humidity is all under the past year, while in 2007 and 2008 the relative humidity is lowest which is just 71%.

Monsoon climate manifested in this area: northerly wind prevails in autumn and winter, southeasterly wind prevails in spring and summer. The annual average wind speed is 2.2 ms/sec.

Evaluation Factors and Source Strength Forecast

The main content of this project is to build sludge dewatering facilities in each WWTP, without sludge disposal facility afterwards. The main construction components include sludge conditioning tank, pump area, dewatering treatment platform, administrative and control room, power substation and etc.

Main air pollutant to be generated from proposed advanced sludge dewatering project will be unpleasant odor during sludge dewatering. Meanwhile, operation of deodorization process associated with wastewater treatment facility is now ongoing for Phase III Zhen'an WWTP project. And reconstruction of associated deodorization process for Phase I and II Zhen'an WWTP projects is proposed. Therefore, analysis on Phase III Zhen'an WWTP project as an example was performed for projection of variations in air quality at sensitive receptors after implementation of proposed WWTPs. Calculation parameters in Table 7.1-2, 3, 4 and 5 were cited from EA Report for Phase II Urban Environment Project for Pearl River Basin - Reconstruction of Phase III Zhen'an WWTP in Foshan Municipality and relevant test data.

Table 7.1-1 Calculation Parameters Used for Sludge Workshops

Type of pollutant	NH_3				H_2S			
Location	Zhen'an	Shagang	Chengbei	Nanzhuang	Zhen'an	Shagang	Chengbei	Nanzhuang
Area of pollution sources (m^2)	45×35	69×24	40×30	42×24	45×35	69×24	40×30	42×24
Height of pollution source (m)	12	12	12	12	12	12	12	12
Emission rate（g/s）	0.00017	0.00009	0.00004	0.00004	0.00031	0.00015	0.00008	0.00008

7.1-2 Calculation Parameters Used for Existing Pollution Sources from Phase I Zhen'an WWTP

Type of pollutant	NH_3			H_2S		
Pollution source	Biological tank	Sedimentation tank	Thickening tank	Biological tank	Sedimentation tank	Thickening tank
Area of pollution sources (m^2)	85×76	84×84	10×10	85×76	84×84	10×10
Height of pollution source (m)	3	3	3	3	3	3
Emission rate（g/s）	472.25	34.97	0.4	1.19	0.15	0.0019

7.1-3 Calculation Parameters Used for Existing Pollution Sources from Phase II Zhen'an WWTP

Type of pollutant	NH_3			H_2S		
Pollution source	Biological tank	Sedimentation tank	Thickening tank	Biological tank	Sedimentation tank	Thickening tank
Area of pollution sources (m^2)	90×73	70×70	9×8	90×73	70×70	9×8
Height of pollution source (m)	3	3	3	3	3	3

Emission rate（g/s）	676.5	35.17	0.36	1.70	0.15	0.0017

7.1-4 Calculation Parameters Used for Existing Pollution Sources from Phase III Zhen’an WWTP

Type of pollutant	NH_3			H_2S		
Pollution source	Biological tank	Sedimentation tank	Thickening tank	Biological tank	Sedimentation tank	Thickening tank
Area of pollution sources (m^2)	80×40	50×50	10×10	80×40	50×50	10×10
Height of pollution source (m)	3	3	3	3	3	3
Emission rate（g/s）	318.89	17.58	0.37	0.804	0.074	0.0018

7.1-5 Calculation Parameters Used for Zhen’an WWTP after Implementation of Deodorization Process

Item		Unit	Data		
Name of Point source			Phase I Zhen’an WWTP	Phase II Zhen’an WWTP	Phase III Zhen’an WWTP
Altitude of chimney bottom		m	0		
Height of chimney		m	10		
Inner diameter of chimney		m	0.4		
Outlet velocity of flue gas		m/s	19.2		
Ambient temperature		K	293		
Outlet temperature of flue gas		K	293		
Intensity of assessment parameters at pollution sources	Ammonia	Kg/h	0.030	0.037	0.018
	H2S	Kg/h	0.0007	0.0005	0.0003

Projection Results and Impact Analysis for Ambient Air

(1) Air pollution projection results for Zhen’an WWTP

The projection results for emissions from sludge dewatering workshop of Zhen’an WWTP are listed in Table7.1-6.

As indicated in Table 7.1-6, after reconstruction of sludge dewatering process in Zhen’an WWTP, maximum ground concentration of NH3 emission from dewatering workshop was 0.0001mg/m^3 with concentration percentage compared to standard of 0.05% (limit value of assessment standard is 0.2mg/m^3). And the ground maximum concentration occurred at 78m away from the workshop, thus its impact on the ambient air quality in project area will be minimal. And maximum ground concentration of H_2S emission from point source was 0.0003mg/m^3 with concentration percentage compared to standard of 3.0% (limit value of assessment standard was 0.01mg/m^3). And the ground maximum concentration occurred at 78m away from the workshop, thus its impact on the ambient air quality in project area will be minimal.

The projection results for air emissions after implementation of deodorization process in Zhen’an WWTP are shown in Table 7.1-7 and Table 7.1-8.

As indicated in Table 7.1-7, after implementation of deodorization process, under most unfavourable meteorological condition maximum ground concentrations of NH3 emissions at all of sensitive receptors would greatly decrease. After addition with effects from sludge dewatering project, maximum ground concentrations of NH3 emissions at sensitive receptors could meet the requirements of assessment standard, which is 0.20 mg/m^3. Among these, the maximum ground concentration of NH3 was 0.006 mg/m^3 with concentration percentage compared to standard of 3.0%, which was located in Culture Park. Therefore, the impact of Zhen’an WWTP on ambient air at regional sensitive receptors was rather little.

Table 7.1-6 Calculation results for contributions of non-point pollution sources from sludge workshops of Zhen’an WWTP

Pollution source	Sludge Dewatering Workshop			
Type of pollutant	NH3		H_2S	
Distance to leeward side of pollution source D(m)	Projected downwind concentration C(mg/m^3)	Concentration percentage compared to standard P(%)	Projected downwind concentration C(mg/m^3)	Concentration percentage compared to standard P(%)
50	0.0001	0.05	0.0003	3.0
100	0.0001	0.05	0.0002	2.0
200	0.0001	0.05	0.0002	2.0
500	0.0000	0	0.0001	1.0
Maximum concentration on leeward side (mg/m^3)	0.0001 (distance to pollution source: 78m)	0.05	0.0003(distance to pollution source: 78m)	3.0
Assessment standard	0.20mg/m^3		0.01mg/m^3	

Table 7.1-7 Impacts of air pollutants on sensitive receptors before/after implementation of deodorization process in Zhen'an WWTP (NH_3)

Sensitive receptors	Concentration for existing project				Concentration after implementation of deodorization process					Concentration Variation
	Phase I	Phase II	Phase III	subtotal	Phase I	Phase II	Phase III	Proposed project	subtotal	
Nanhai Art High School	0.0931	0.1264	0.1027	0.3222	0.0018	0.0022	0.0011	0.0001	0.0051	-0.3171
Guihua High School	0.0896	0.1217	0.0976	0.3089	0.0018	0.0022	0.0011	0.0001	0.0051	-0.3038
Residential area in the northeast	0.1006	0.1369	0.1139	0.3514	0.0018	0.0022	0.0011	0.0001	0.0051	-0.3463
Hongxing Village	0.0896	0.1217	0.0976	0.3089	0.0018	0.0022	0.0011	0.0000	0.0051	-0.3038
Culture Park	0.0778	0.1052	0.0801	0.2631	0.0021	0.0026	0.0013	0.0000	0.006	-0.2571

Tabel 7.1-8 Impacts of air pollutants on sensitive receptors before/after implementation of deodorization process in Zhen'an WWTP（H_2S）

Sensitive receptors	Concentration for existing project				Concentration after implementation of deodorization process					Concentration Variation
	Phase I	Phase II	Phase III	subtotal	Phase I	Phase II	Phase III	Proposed project	subtotal	
Nanhai Art High School	0.0017	0.0022	0.0000	0.0018	0.0000	0.0000	0.0000	0.0002	0.0002	-0.0016
Guihua High School	0.0016	0.0021	0.0000	0.0017	0.0000	0.0000	0.0000	0.0002	0.0002	-0.0015
Residential area in the northeast	0.0018	0.0024	0.0000	0.0020	0.0000	0.0000	0.0000	0.0001	0.0001	-0.0019
Hongxing Village	0.0016	0.0021	0.0000	0.0017	0.0000	0.0000	0.0000	0.0001	0.0001	-0.0016
Culture Park	0.0014	0.0019	0.0000	0.0014	0.0001	0.0000	0.0000	0.0001	0.0002	-0.0012

(2) Air pollution projection results for Shagang WWTP

The projection results for emissions from sludge dewatering workshop of Shagang WWTP are listed in Table7.1-3.

As indicated in Table 7.1-3, after reconstruction of sludge dewatering process in Shagang WWTP, maximum ground concentration of NH3 emission from dewatering workshop was 0.0001mg/m^3 with concentration percentage compared to standard of 0.05% (limit value of assessment standard is 0.2mg/m^3). And the ground maximum concentration occurred at 80m away from the workshop. The ground concentration of NH3 in Shagang Village was 0 mg/m^3 with concentration percentage compared to standard of 0% (limit value of assessment standard is 0.2mg/m^3), thus its impact on the ambient air quality in project area will be minimal. And maximum ground concentration of H_2S emission from point source was 0.0001mg/m^3 with concentration percentage compared to standard of 1.0% (limit value of assessment standard was 0.01mg/m^3). And the ground maximum concentration occurred at 80m away from the workshop. The ground concentration of H_2S in Shagang Village was 0 mg/m^3. Thus its impact on the ambient air quality in project area will be minimal.

Table 7.1-3 Calculation results for contributions of non-point pollution sources from sludge workshops of Shagang WWTP

Pollution Source	Sludge Dewatering Workshop			
Pollutant	NH3		H_2S	
Distance to leeward side of pollution source D(m)	Projected downwind concentration C(mg/m^3)	Concentration percentage compared to standard P(%)	Projected downwind concentration C(mg/m^3)	Concentration percentage compared to standard P(%)
50	0.0001	0.05	0.0001	1.0
100	0.0001	0.05	0.0001	1.0
200	0.0001	0.05	0.0001	1.0
500	0.0000	0	0.0000	0
680（Shagang Village）	0.0000	0	0.0000	0
Maximum concentration on leeward side (mg/m^3)	0.0001 (distance to pollution source: 80m)	0.05	0.0001 (distance to pollution source: 80m)	1.0
Assessment standard	0.20mg/m^3		0.01mg/m^3	

(3) Air pollution projection results for Chengbei WWTP

The projection results for emissions from sludge dewatering workshop of Chengbei WWTP are listed in Table 7.1-4.

As indicated in Table 7.1-4, after reconstruction of sludge dewatering process in Chengbei WWTP, maximum ground concentration of NH3 emission from dewatering workshop was 0.0004mg/m^3 with concentration percentage compared to standard of 0.02% (limit value of assessment standard is 0.2mg/m^3). And the ground maximum concentration occurred at 74m away from the workshop. The sensitive receptor with maximum ground concentration of 0.0002mg/m3 and concentration percentage compared to standard of 0.01% was located in Guabuxun Village. Thus its impact on the ambient air quality in project area will be minimal. And maximum ground concentration of H_2S emission from point source was 0.0001mg/m^3 with concentration percentage compared to standard of 1.0% (limit value of assessment standard was 0.01mg/m^3). And the ground maximum concentration of H_2S occurred at 74m away from the workshop. The sensitive receptor with maximum ground concentration of 0.0001mg/m3 and concentration percentage compared to standard of 1.0% was located in Guabuxun Village. Thus its impact on the ambient air quality in project area will be minimal.

Table 7.1-4 Calculation results for contributions of non-point pollution sources from sludge workshops of Chengbei WWTP

Pollution Source	Sludge Dewatering Workshop			
Pollutant	NH3		H_2S	
Distance to leeward side of pollution source D(m)	Projected downwind concentration C(mg/m^3)	Concentration percentage compared to standard P(%)	Projected downwind concentration C(mg/m^3)	Concentration percentage compared to standard P(%)
50	0.00004	0.02	0.0001	1.0
100	0.00004	0.02	0.0001	1.0
200	0.00003	0.02	0.0001	1.0
500	0.00001	0.01	0.0000	0
Guabuxun Village（210）	0.00002	0.01	0.0001	1.0
Fuxi	0.00008	0.04	0.0000	0

Village（450）				
Farmer lodging house in Fuxi Village（390）	0.00001	0.01	0.0000	0
Maximum concentration on leeward side (mg/m^3)	0.00004 (distance to pollution source: 74m)	0.02	0.0001 (distance to pollution source: 74m)	1.0
Assessment standard	$0.20mg/m^3$		$0.01mg/m^3$	

(4) Air pollution projection results for Nanzhuang WWTP

The projection results for emissions from sludge dewatering workshop of Nanzhuang WWTP are listed in Table 10.2-5.

As indicated in Table 10.2-5, after reconstruction of sludge dewatering process in Nanzhuang WWTP, maximum ground concentration of NH3 emission from dewatering workshop was $0.0013mg/m^3$ with concentration percentage compared to standard of 0.65% (limit value of assessment standard is $0.2mg/m^3$). And the ground maximum concentration occurred at 73m away from the workshop.

The sensitive receptor with maximum ground concentration of 0.0003mg/m3 and concentration percentage compared to standard of 0.15% was located in Aoyong Village. Thus, its impact on the ambient air quality in project area will be minimal. And maximum ground concentration of H_2S emission from point source was $0.0001mg/m^3$ with concentration percentage compared to standard of 1.0% (limit value of assessment standard was $0.01mg/m^3$). And the ground maximum concentration of H_2S occurred at 73m away from the workshop. The sensitive receptor with maximum ground concentration of 0.0001mg/m3 and concentration percentage compared to standard of 1.0% was located in Aoyong Village. Thus, its impact on the ambient air quality in project area will be minimal.

Table 7.1-5 Calculation results for contributions of non-point pollution sources from sludge workshops of Nanzhuang WWTP

Pollution Source	Sludge Dewatering Workshop			
Pollutant	NH3		NH3	
Distance to leeward side of pollution source D(m)	Projected downwind concentration C(mg/m^3)	Concentration percentage compared to standard P(%)	Projected downwind concentration C(mg/m^3)	Concentration percentage compared to standard P(%)
50	0.00004	0.02	0.0001	1.00
100	0.00003	0.02	0.0001	1.00
200	0.00002	0.01	0.0001	1.00
500	0.00000	0.00	0.0000	0.00
Aoyong Village（390）	0.00001	0.01	0.0000	0.00
Gaotian Village（490）	0.00001	0.01	0.0000	0.00
Planned plot for residence in the south of Nanzhuang WWTP（100）	0.00003	0.02	0.0001	1.00
Maximum concentration on leeward side (mg/m^3)	0.00004(distance to pollution source: 73m)	0.02	0.0001 (distance to pollution source: 73m)	1.0
Assessment standard	0.20mg/m^3		0.01mg/m^3	

Distribution of pollutants ground concentration under all meteorological conditions including unfavorable conditions were taken into account in the estimation model. As indicated in projection results, implementation of proposed project will not pose any distinct negative impact on air quality at sensitive receptors, even under unfavorable conditions.

(5) Analysis of environmental impacts due to odor pollution

Based upon ground concentrations of odorous pollutants at key sensitive receptors around the proposed WWTPs and comparisons in Table 7.1-6, odor intensities at sensitive receptors around Zhen'an, Shagang, Chengbei and Nanzhuang WWTP were much lower than those of Class 1, which were much lower than olfactory threshold. Therefore, project implementation will not pose any distinct impact of unpleasant odor on surrounding areas of the proposed WWTPs.

Table 7.1-6 Relation between concentration of odorous pollutants and odor intensity *

Odorous Pollutant	Classification of Odor Intensity						
	1	2	2.5	3	3.5	4	5
NH_3	0.1	0.6	1.0	2.0	5.0	10.0	40.0
H_2S	0.0005	0.006	0.002	0.06	0.2	0.7	8.0

*"Research Overview on Public Nuisance due to Odor Pollution in Japan" Shi Lei edited;

In general, present concentrations of odorous pollutants at boundaries of Shagang and Chengbei WWTPs could comply with relevant standards. As indicated baseline monitoring and field investigations, no distinct impacts of odorous pollutants will be caused in sensitive receptors. And odor intensities at sensitive receptors around proposed WWTPs were much lower than those of Class I. Therefore, project implementation will not pose any distinct impact of unpleasant odor on surrounding areas of the proposed WWTPs. The environmental quality of proposed project areas is generally good. After construction of advanced sludge dewatering workshops, sludge amount will greatly decrease. The emission of odor pollutants will not appear to increase if sludge to be generated can be transported on a timely basis. And the concentrations of odorous pollutants at boundaries will be compliant with relevant standards which will not lead to deterioration in air quality at sensitive receptors. Meanwhile, implementation of deodorizaion process for wastewater treatment facilities is ongoing in all WWTPs concerned. As shown in projection results for Zhen'an WWTP, impacts of air pollutants by existing WWTPs on surrounding sensitive receptors will be greatly lessened after construction of deodorization facilities. And regional air quality will be consequently improved in some degrees, ompared to current one.

Safety Distance for Atmospheric Environment

The safety distance from air pollution is calculated in accordance with guidance, and in line with the calculation results, the ground concentration of NH_3 and H_2S emission from the WWTPs are below of the environmental and quality standards which is 0.2mg/m^3 and 0.01mg/m^3, none of the points were found exceeding the standards within the assessment scope, thus the safety distance for atmospheric environment is unnecessarily to be set up.

Safety Distance for Health Protection

It is applicable to non-point source emission in this case. NH_3 and H_2S are used as factors to calculate the Safety Distance for Health Protection in sludge workshop in the WWTPs.

① Calculation method

Qc/Cm□[□BL^C+0.25r^2□$^{0.50}$L^D]/A

Qc——Achievable level of emission control of non-point harmful gas pollution in industries, kg/hr□

Cm——Standard Concentration Limit□mg/m^3□

L——safety distance required for industries and enterprises□m□

R——Equivalent radius of the project in which pollutant emission occurs , m. Use land area of the project S (m^2) to calculate, r=□S/□□$^{0.5}$;

A, B, C, D -- safety distance calculation coefficient, dimensionless, select from table 10.2-6 according to recent five-year average wind speed of the area and type of pollution from the industry.

When result of safety distance for two or more of pollutants are at the same protection level, the protection level of such project should be upgraded to the higher level. When safety distance is within 100 meters, the differential of each protection level is 50 meters; more than 100 meters but less than or equal to 1000 meters, the differential of each protection level is 100 meters, when it is above 1000 meters , the differential of each protection level is 200 meters.

②The Selection of Calculation Parameters

1) Wind speed: In recent years, the annual average wind speed is between 2□4m/s;

2) Level of atmospheric pollution sources from industrial enterprises

Level of atmospheric pollution of industrial enterprises is Class □.

3□Calculation of coefficient: A = 350, B = 0.021, C = 1.85, D = 0.84.

4□Equivalent radius: the equivalent radius of non-point source emission is approximately 1.13m.

Table 7.1-6 Calculation of coefficient of safety distance

Coefficient	5-year average wind speed	Safety Distance L,m								
		L□1000			1000<L□2000			L>2000		
		Industrial enterprises constitute a category of atmospheric pollution sources								
		I	II	III	I	II	III	I	II	III
A	<2	400	400	400	400	400	400	80	80	80
	2□4	400	400	400	400	400	400	80	80	80
	>4	700	470	350	700	470	350	380	250	190
B	<2	0.01			0.015			0.015		
	>2	0.021			0.036			0.036		
C	<2	1.85			1.79			1.79		
	>2	1.85			1.77			1.77		
D	<2	0.78			0.78			0.57		
	>2	0.84			0.84			0.76		

□Result

The calculation result is detailed in table 7.1-6.

Table 7.1-6 The calculation results of various safety distance in sludge dewatering workshops

WWTP	Result of safety distance calculation□m□		determination of safety value□m□	Sensitive points within the safety distance
	NH_3	H_2S		
Zhen'an	3.5	4.8	50	None
Shagang	1.5	2.1	50	None
Chengbei	1.8	2.5	50	None
Nanzhuang	1.0	1.3	50	None

According to the concept of Safety distance, it means the minimum distance from border of units which generate pollutant, to the boundary of residential area. Currently the main entities within the Safety distance are buildings within WWTPs, rivers and lands used for municipal roads, while there is no sensitive point such as residential area. It seems not repulsive to proposed project; therefore, it is feasible to set up 50m as safety distance.

Considering the safety distance of this project, residential buildings shall not be built within this distance. The sensitive points of this project are all located beyond the safety distance, there is no sensitive point within, therefore, there is no residential area to be relocated.

Conclusion

Environmental impact projection and evaluation of air quality show that in normal operation condition, the project emissions of NH_3 and H_2S will not impose significant negative impact on air quality in the surrounding areas. In order to effectively control on the air pollution, the project should further improve the level of cleaner production, enhance efforts on air pollution control to reduce emissions of air pollutants, in particular, to strictly prevent accidental emissions.

It is suggested that 50m safety distance shall be set up in different sludge dewatering workshops.

Water Environment Impact Analysis

Sewage Discharge Status

（1）Sewage discharge volume

After sludge advanced dewatering in the WWTP, the sludge water content will drop from current 80% to under 60%, the sludge volume will be greatly reduced. Reduction of sludge water content will result in change of wastewater volume, which can be seen from Table 7.2-1.

Table 7.2-1 Effluent volume change after implementation of sludge advanced dewatering

WWTP		Zhen'an	Shgang	Chengbei	Nanzhuang	Total
Existing Project	Daily discharge (m^3/d)	2280	1140	570	570	4560
	Annual discharge (10000 m^3/a)	83.220	41.610	20.805	20.805	166.44
After implementation of this project	Daily discharge (m^3/d)	2351	1179	591	591	4712
	Annual discharge (10000 m^3/a)	85.812	43.034	21.572	21.572	171.99
Volume increase or reduction	Daily load (m^3/d)	71	39	21	21	152
	Annual load (10000 m^3/a)	2.592	1.424	0.767	0.767	5.55
Treatment Capacity	(10000 m^3/d)	35	15	20	25	95

(2) Change in discharge pollution loading

After the completion of sludge advanced dewatering in WWTP, the major pollutant emission changes is detailed in Table 7.2-2.

Table 7.2-2 Pollutant Discharge Variation Unit: m^3/d

WWTP			Zhen'an	Shagang	Chengbei	Nanzhuang	Total
Sludge dewatering project	Sewage discharge (10,000 m^3/a)		85.812	43.034	21.572	21.572	171.99
	Pollution load (t/a)	CODcr	51.49	25.82	12.94	8.63	98.88
		NH_4-N	21.45	10.76	5.39	1.73	39.33
Existing project	Sewage discharge (10,000 m^3/a)		83.220	41.610	20.805	20.805	166.44
	Pollution load (t/a)	CODcr	49.93	24.97	12.48	8.32	95.70
		NH_4-N	20.81	10.40	5.20	1.66	38.07
Variations	Sewage discharge (10,000 m^3/a)		2.592	1.424	0.767	0.767	5.55
	Pollution load (t/a)	CODcr	1.56	0.85	0.46	0.31	3.18
		NH_4-N	0.64	0.36	0.19	0.07	1.26

Water Environment Impact Analysis

According to the Table 7.2-1, the increasing volume from the sewage discharge after the sludge dewatering is very little, while the sewage increasing volume in Zhen'an, Shagang, Chengbei and Nanzhuang are respectively 71 m^3/d□39 m^3/d□21 m^3/d and 21 m^3/d, which counts to 0.036%□0.04%□0.02% and 0.04% of its discharge volume (daily treatment capacity). The sludge advanced dewatering will not cause large increase in the treated sewage discharge volume in the WWTP.

From Table 7.2-2 we can see that the increments of major pollutant discharge after the advanced sludge dewatering is very small, the increment of COD in Zhen'an, Shagang, Chengbei and Nanzhuang WWTP is respectively 1.56t / a, 0.85t / a, 0.46t / a and 0.31t / a, NH4-N increase is 0.64t / a, 0.36t / a, 0.19t / a and 0.07t / a, which counts for 0.036%, 0.04 %, 0.02% and 0.04% of their total emissions. There will not be significant increase in the pollutant emission due to the sludge advanced dewatering project in WWTP.

Currently at Jili Creek, monitoring fdata shows non-compliance of COD、BOD_5、DO and oil to "Surface Water Environmental Quality

Standard"(GB3838-2002) Class III water quality standard. This is because the Nanzhuang WWTP haven’t been put into operation and domestic sewage and partial industrial sewage are directly discharged into the river. With the completion of Nanzhuang WWTP, water quality of Jili Creek will be improved.

In general, sludge dewatering project will bring very little additional pollution, the addition wastewater will be treated in the WWTP and under the normal operation of WWTP, it will not cause significant impact on the receiving river bodies.

Acoustic Environment Impact Projection and Assessment

Sources of noise

The noises of the sludge advanced dewatering process are generated from mud pump, water pump, blower, air compressor and sludge dewatering equipment as well as operation of gears. The main equipments of the sludge advanced dewatering engineering are located mainly in sludge dewatering workshop and pump station which is similar to the existing sludge dewatering facilities. The noise intensity from equipment changed little before and after the construction of proposed projects.

Table 7.3-1 The sources of noise before and after the project implementation

SN	Name	Unit	Quantity					Noise concentration dB□A□
			Zhen’an	Shagang	Chengbei	Nanzhuang	Total	
1	Sludge frame filter press	set	4	3	2	2	11	70□80
2	Air compressor	set	3	3	2	2	10	85□95
3	Mud pump	set	14	11	7	7	39	80□90
4	Backwash pump	set	1	1	1	1	4	80□90
5	Agitator	set	6	6	6	6	24	70□80

Projection Model

According to the noise source emission characteristics, combined with the requirements of guidelines, point source projection model is chosen to simulate the noise attenuation with distance from the pollution sources.

a) Noise level caused by point sources at assessed area is calculated using the geometric divergence noise attenuation formula:

$$L_A(r) = L_{WA} - 20\lg r - 8$$

in the formula: LA(r)—A Sound level (dB) at r meters away from the source

LWA- A sound power level (dB) of the point source;

r- distance from the point source (m);

b) Estimation method of theoretical multiple-sources sound pressure level:

$$L_{A总} = 10\lg\sum_{i=1}^{n}10^{0.1L_{Ai}}$$

In the formula: LA is the total sound pressure level of n point sources at a particular location, dB (A);

LAi is equivalent sound level of a particular location caused by No. i point source, dB (A).

Contents of the Projection and Analysis

The analysis is choosing the worst scenario, in which all noise sources are operating at the same time, to predict its impact on acoustic environment in the plant, and compare it to the regulated limits therefore evaluate and conclude the potential impact of the operation to surrounding environment.

Projection Results Analysis

By using the above models, noise level at all WWTP boundaries was projected and resulted the boundary noise estimation. The results are detailed in Table 7.3-2~Table 7.3-5.

Table 7.3-2 The Projection Results of Impact of Equipment on Acoustic Environment (Zhen'an)

Location	Day		Night	
	Projection value	Standard limit	Projection value	Standard limit
East border	53.9	60	47.1	50
South border	53.1		46.5	
West border	52.7		46.7	
North border	56.5		48.5	

Table 7.3-3 The Projection Results of Impact of Equipment on Acoustic Environment (Shagang)

Location	Day		Night	
	Projection value	Standard limit	Projection value	Standard limit
Northeast border	57.4	60	48.3	50
South border	57.1		47.7	
Northwest border	57.9		48.9	

Table 7.3-4 The Projection Results from Equipment Impacted on Acoustic Environment (Chengbei)

Location	Day		Night	
	Projection value	Standard limit	Projection value	Standard limit
Northeast border	51.2	60	44.2	50
South border	52.5		44.6	

Northwest border	57.1		49.1	

Table 7.3-4 The Projection Results of Impact of Equipment on Acoustic Environment (Nanzhuang)

Location	Day		Night	
	Projection value	Standard limit		Projection value
East border	42.6	60	40.9	50
South border	43.7		39.5	
West border	41.5		40.1	
North border	41.0		38.1	

All WWTP should comply with Class II of "Emission Standard for Industrial Enterprises Noise at Boundary" (GB 12348-2008). As shown in Table 7.3-2 ~ Table 7.3-5, taking in to account of all noise sources in the worst scenario, the projected night and day time noise level meets the requirement of Class II. Moreover, noise level is almost the same as current status, the impact of sludge dewatering project on the acoustic environment is minimal.

Solid Waste Impact Analysis

Solid Waste means solid or semi-solid wastes generated from production, construction, daily life and other activities that generates pollution. It can be divided into hazardous waste and general waste according its toxic and harmful level.

Solid waste pollution prevention and control should follow principal described in the "Law of PRC on the Prevention and Control of Environmental Pollution Caused by Solid Wastes" Article III: "The main principal for solid waste pollution control in China is to reduce production of solid wastes and hazards, fully recycle of solid wastes and safely treat and dispose solid wastes, therefore to promote cleaner production and circular economy" Firstly, it should start from reform of production process to eliminate or reduce production of solid waste; secondly, it should promote recycle and utilize of valuable waste, and finally, it should apply hazard-free treatment of those wastes that can not yet be utilized to prevent and mitigate its negative impact. In addition, during the collection, storage, transportation and disposal of solid waste, a comprehensive management system should be adopted to prevent flying up, flowing away and leakage of the wastes. At the same time, implementation of solid waste registration (respecting the “Law on the Prevention and Control of Environmental Pollution Caused by Solid Wastes”) is necessary to avoid secondary pollution to air, water and soil.

This chapter focuses on summarizing the sources, type, quantity, nature and final disposal of solid wastes generated from the proposed project, and analyzing the waste treatment and disposal proposals.

The Production of Solid Waste

The solid waste generated from advanced sludge dewatering process mainly includes the filter-pressed sludge and staff domestic garbage. In addition, various laboratory wasted liquid may contain hazardous elements such as heavy metal, strong acid and strong alkaline solutions; the corresponding rinsing water also contains the above elements; therefore, the dedicated container shall be provided for collection and sent to qualified entity to conduct the hazard-free treatment. The sludge water content is approximately 60% after filter press.

7.4.1.1 Type, Source and Nature of Solid Waste

(1) Domestic garbage

The garbage generated by the project staff is mainly from daily life, work and canteen leftovers, which is categorized as general solid waste.

(2) Sludge

Sludge is generated from the WWTP. According to the "List of Strictly Control Waste in Guangdong Province" (updated in 2009), it is considered as strict control waste of Guangdong Province (HY06), its treatment and disposal should be handled by qualified entity. A management account book as well as transfer manifest system should be established for sludge transfer.

(3) Laboratory Liquid Waste

The laboratory liquid waste may contain hazardous elements such as heavy metal, strong acid and strong basic solutions; the corresponding rinsing water also contains the above elements, therefore, the dedicated container shall be collected and sent to qualified entities to conduct hazard-free treatment. PIU should comply with "Article on Implementing (Hazardous Waste Management Practices) in Guangdong Province" and delivered the waste to qualified units for treatment. Temporary storage of such waste should strictly follow the relevant requirements in "Standard for Pollution Control on Hazardous Waste Storage"(GB18597-2001).

7.4.1.2 Volume of Solid Wastes Generated

Domestic wastes: according to former calculation, domestic wastes generated by sludge dewatering in each WWTP is 0.01t/a. The domestic wastes should be collected timely and treated by the sanitation sector.

After advanced dewatering, the sludge generated by Zhen’an WWTP, Shagang WWTP, Chengbei WWTP, Nanzhuang WWTP are 60t/a、30 t/a、15 t/a and15 t/a respectively, will be disposed in landfill.

The liquid waste from chemical laboratory is 0.001t/a in average, and will be treated by qualified entities.

The quantity and quality of the solid wastes is shown in table 7.4-1.

Table 7.4-1 The Quantity and Quality of the Solid Wastes (t/a)

WWTP		Zhen’an	Shagang	Chengbei	Nanzhuang	Summation
Current	Sludge	150	57	30	30	267

filter press room	Domestic wastes	0.01	0.01	0.01	0.01	0.04
	Subtotal	120.01	60.01	30.01	30.01	267.04
Advanced dewatering project	Sludge	60	30	15	15	120
	Domestic wastes	0.01	0.01	0.01	0.01	0.04
	Laboratory liquid waste	0.001	0.001	0.001	0.001	0.004
	Subtotal	60.011	30.011	15.011	15.011	120.044
Variation		-89.999	-26.999	-14.999	-14.999	-146.966

Analysis of Environmental Impact from Solid Wastes

Hazardous elements in the solid wastes can reach the environment through water, soil and air, the impact depends on the quantity and concentration of the pollutant during emission. Based on the types and composition of the solid wastes generated from this project, the pollution will be multilateral if not controlled properly, these impacts will include:

(1) Analysis of impact on soil

The solid wastes from this project can't be used directly in agriculture or common storage. If used directly in agriculture, the harmful elements will penetrate into soil easily by weathering, rainwater or runoff, they will kill the microorganism in soil, destroy the system balance created by microorganism and surrounding environment, it will cause that the vegetation cannot grow, the soil will be polluted. The common storage needs area, it is estimated that every 10,000 tons of wastes stored needs one acreage of area, the more stored the more area needed. This will even worsen the situation of limited arable lands per capita.

(2) Analysis of impact on water

Once the solid wastes encounter with the water and surface runoff, the harmful elements in solid wastes will be leached out and enter and pollute the surface water, if leaching into the soil, it will pollute ground water, which could cause secondary pollution on surface water and ground water. If the solid wastes are discharged into the river directly then they will make greater water pollution, not only causesedimentation, but also interrupt existing acqutic eco-system and use value ofthe water.

(3) Analysis of impacts on air quality

Generally the solid wastes pollute the air by following ways: fine grained waste residue and wastes spread to the air by the wind, harmful gas and dust generated during transportation and odor during disposing solid wastes. If the solid wastes cannot be disposed properly, such as being stored outdoors randomly, it will make an impact on the air.

(4) Impact on sanitation

If the solid wastes such as domestic wastes stored too long, it will have an impact on the sanitary condition of working and living environment, the health of people will be threatened.

To sum up, if the solid wastes generated from this project were not disposed properly, it would make a secondary pollution on water, air quality, soil and sanitation, harm the ecological environment and health of people. Therefore, the national and local laws and regulations must be strictly implemented to severely manage and safely handle the solid waste generated from this project, in particular for the disposal of the hazardous wastes.

Treatment and Disposal Requirements of Solid Waste

The staff domestic garbage shall be timely collected and disposed by the Sanitation Sector.

The sludge generated from waste water treatment in this project shall be delivered to Gao Ming Bai Shi Ao Landfill for disposal.

Laboratory wastes produced by each WWTP shall be safely disposed by qualified entity, while random piling is prohibited. Special storage place must be set up with proper storage and management complying with the "Standard for Pollution Control on Hazardous Waste Storage"(GB18596-2001) and "Technical Guidance on Hazardous Waste Pollution Control”; measures to should be taken to prevent scattering, run-off, leakage; operation should be conducted by professionals, and ensure separate collection and storage. In summary, by implementing appropriate solid waste storage, treatment and disposal measures proposed in this report, the solid wastes generated by this project could be effectively treatment and disposal and will not cause secondary pollution to the surrounding environment.

Brief Summary

The solid wastes generated from the WWTP mainly include lab liquid waste (hazardous waste), sludge from waste water treatment and domestic garbage. If the solid waste is not collected and treated it may impact on the followings: □occupation of land□□soil pollution□□water pollution□□air pollution□□impact on environmental sanitation. In particular for the hazard waste, as it contains toxic and hazardous elements, all the treatment process shall be strictly monitored and delivered to qualified units for safe disposal.

Transportation Impact Analysis

The sludge transportation routine is shown in Figure 5.5-1.

□1□Chengbei WWTP: Chenbei WWTP→Huochang Road→Wenchang Road West→Foshan Av.→Jili Av.→Qiaogao Road→S113→Bai Shi Ao Landfill in Gaoming Miao Village

（2）Zhen’an WWTP: Zhen’an WWTP→Chaoan Road South→Jihua Road→Foshan Av.→Jili Av.→Qiaogao Road→S113→ Bai Shi Ao Landfill in Gaoming Miao Village

（3）Shagang WWTP: Shagang WWTP→Shagang New Road→Foshan Av.→Jili Av.→Qiaogao Road→S113→ Bai Shi Ao Landfill in Gaoming Miao Village

（4）Nanzhuang WWTP: Nanzhuang WWTP→Nanzhuang Av.→Foshan 1st Ring Road→Jili Av.→Qiaogao Road→S113→ Bai Shi Ao Landfill in Gaoming Miao Village

At present the sludge transport vehicles used is the Dongfeng trucks with 5 tons capacity, special vehicles converted, with good insulation (enclosing or sealing?). According to the capacity of each sludge treatment plant, its transport frequency is: Zhen'an WWTP 12 trips / day, Shagang WWTP 6 trips / day, Chengbei WWTP and Nanzhuang WWTP are all 3 trips / day, for a total of 24 trips / day.

After the advanced dewatering workshops built in WWTPs, the sludge after the advanced dewatering will be delivered to Bai Shi Ao Landfill in Gaoming Miao Village for sanitary landfill. The sludge transportation condition is same as current in the WWTPs, i.e. using vehicle with insulated cover. When the sludge water content decrease to 60%, the sludge will become hard solids, with intense structure, not loose, not brittle, and less odor compared to current sample (water content 80%), while transport trips will be reduced by 50%, the overall transport frequency will become only 24 vehicle trips / day. To maintain good condition during transport, trucks are sealed, so the odor emission during the transport will not cause significant negative impact on air quality.

Based on measurement for sludge vehicles for Dashadi WWTP, odor intensity on both sides of vehicles was approximately classified as Class 2, and that away from 10m was approximately Class 1. The distance between neighboring sensitive receptors and transportation route is over 20m. Hence, no impact of unpleasant odor will be caused during transportation.

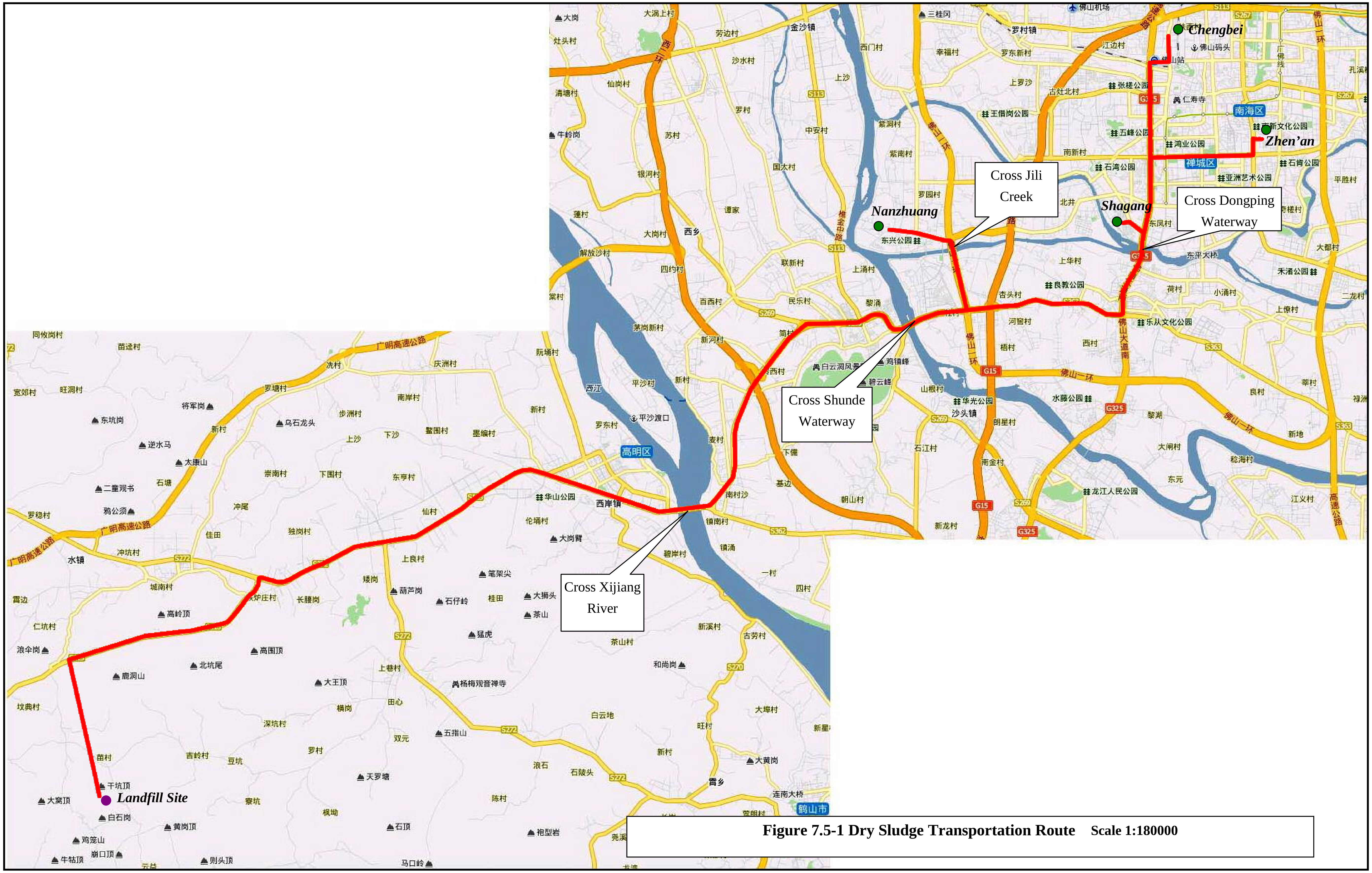


Figure 7.5-1 Dry Sludge Transportation Route **Scale 1:180000**

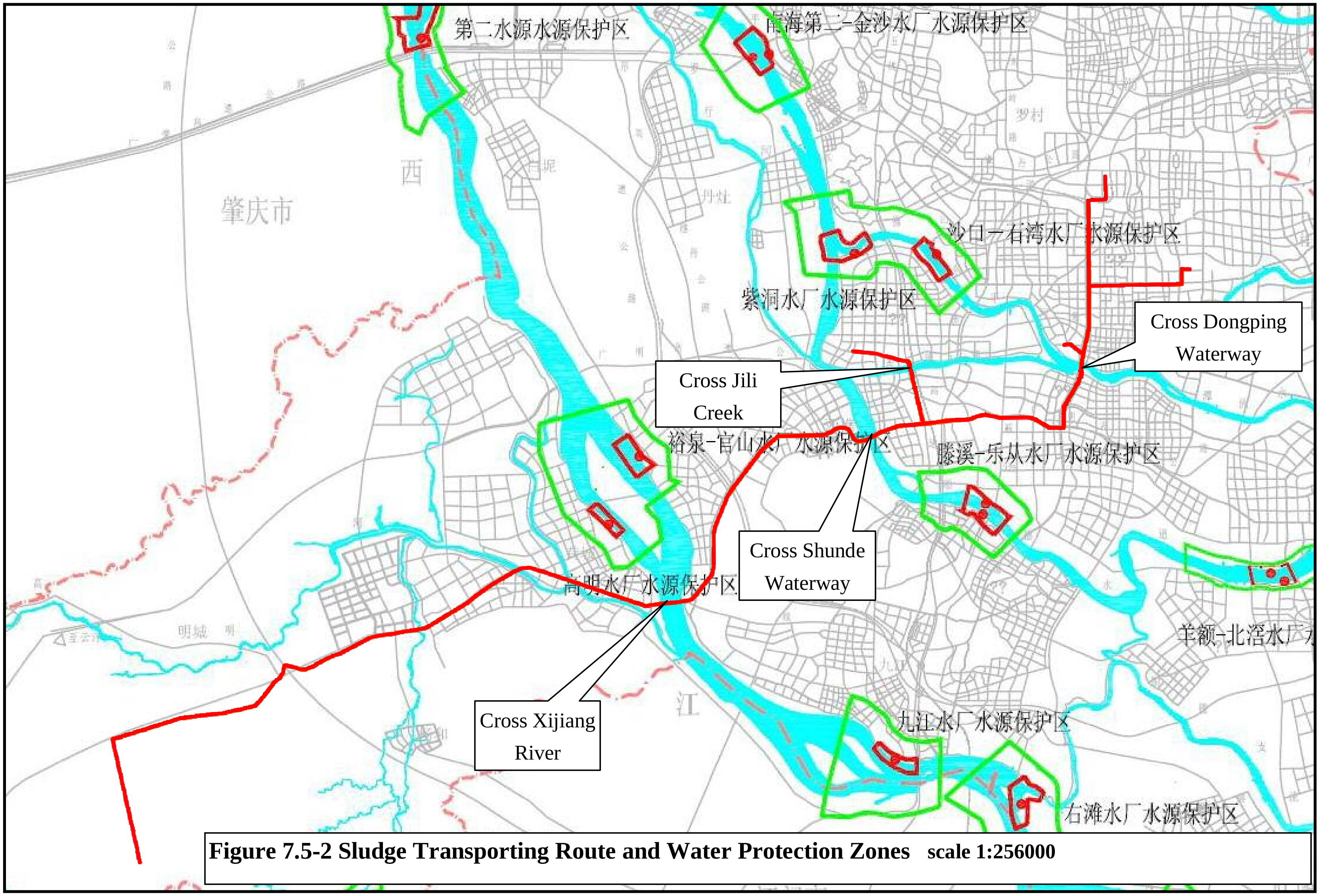


Figure 7.5-2 Sludge Transporting Route and Water Protection Zones **scale 1:256000**

Environmental Impact Assessment during Construction

Analysis and Assessment of Impacts on Air Quality during Construction

Main Air Pollutants to be generated during Construction

The proposed project construction sites are relatively small. Number of construction workers on site is not more than 20, and no specific canteens will be constructed on site. The following air pollutants will be generated during construction:

1) Dust

2) Exhausted gas to be generated from construction machinery and vehicles

During construction dust is mainly generated from transportation of construction materials, loading and transportation of spoils, and the exposed surface due to excavation at construction site in windy conditions. The fuel combustion during operation of the construction machinery and vehicles will generate exhausted gas. And diesel-engine generators used at construction sites will also generate exhausted gas. Temporary canteens will be constructed on site. Exhausted gas will be generated from the fuel and natural gas used by stoves in canteens.

Analysis of Main Impacts on Air Quality during Construction

1. Impacts of Dust Generation

Dust generation differs from types, scopes of construction activities and weather conditions. Dust will mainly be generated from the following construction activities:

1) Construction dust to be generated by vehicles on dirty roads

2) Loading and unloading of construction materials and waste

3) Excavation at construction sites

Dust emission caused by material transportation will compose the greatest impacts within a long time. The impacts of construction dust will be deteriorated with road status and exposure of soil at construction sites. In general, the dust generation, is proportional to the velocity, weight of vehicles and dust accumulation for each type of surface. According to EA Report for Chengde Gas Project loaned by ADB the dust concentration from both sides of the road could reach 8-10 mg/m^3 during spoil transportation at construction sites. Similarly, the dust concentration from both sides of the road at construction sites is estimated to be 8 mg/m^3.

As described in EA Report for Phase I LNG Transfer Stations and Transmission Trunk Project prepared by Guangzhou Research Institute of Environmental Protection in Dec, 2002 and approved by SEPA, USAEPA's FDM was applied to project the impacts of fugitive dust on construction sites. The projection results indicated that dust from general construction sites had distinct impacts on surrounding area within 150m. As for larger sites, dust from construction operations had distinct impacts on surrounding area within 500m. And maximum dust concentration was 1.6mg/m^3 which appeared in the area within 100m.

Dust generation can be greatly reduced if control measures are carried out during construction, including spraying water on site and reducing wind speed by installation of fences. As estimated, dust generation will be reduced by 70% if two measures described above are implemented and at the same time applying low driving speed, cleaning wheels and car bodies, and using canvas to cover dust-generating materials. As estimated, TSP concentration at points of 100m away from plant boundaries will be reduced to 0.45mg/m3. And TSP concentration at points of 250m away from plant boundaries is approximately 0.30mg/m3, which equals to daily average TSP concentration. TSP concentration at points far away from 300m will be lower than the daily average, which will greatly lessen impacts of dust nuisance on surrounding air quality.

2. Impacts of exhausted gas **to be generated by construction machinery and vehicles**

Diesel is usually used as fuel for construction machinery. Exhausted gas will be generated during start-up. Transport vehicles are usually large-sized diesel-driven vehicles, which will generate exhausted gas. Air pollutants to be generated from construction machinery and vehicles include CO, NO_X and PM_{10}. Hence, operation of construction machinery should be far away from residential area. And transport routes should be planned to avoid sensitive points to lessen adverse impacts on air quality as much as possible.

Mitigation Measures for Air Pollution during Construction

(1) Mitigation measures for dust reduction

1) Spray water to maintain the humidity of construction sites and dust-generating materials;

2) Spray water on main access and areas with construction activities on a timely basis, namely every 2 hours, at poor weather conditions and dry seasons.

3) Slow down while driving on dust-generating roads

4) Set up cleaning equipment for wheel and car body at proposed site gates, clean public roads if necessary.

5) Use canvas as cover during transportation of dust-generating materials.

6) Reduce heap(pile?) height during loading and unloading, strictly control driving speed as vehicles enter into loading areas, clean loading areas on a timely basis.

(2) Mitigation measures for reduction of exhausted gas form construction machinery and vehicles.

Operation of construction machinery should be far away from residence. And transport routes should also avoid passing through villages.

Analysis and Assessment of Impacts on Aquatic Environment during Construction

Main Water Pollutants during Construction

Wastewater to be generated during construction of proposed project mainly includes slurry to be generated during excavation and drilling, petroleum-containing washing water to be generated during operation of construction machinery and equipment, and domestic wastewater etc.

Analysis of Impacts of Wastewater Pollutants during Construction

During construction, the amount of domestic wastewater is calculated for 20 construction workers for each WWTP. Daily generation of domestic wastewater will be 0.1 ton per person per day. Thus, daily generation of domestic wastewater for each WWTP will be approximately 2 tons. In addition, a small amount of wash water will be generated from construction equipment and vehicles. In accordance with relevant regulations for construction site, 3 phased septic tanks should be built to treat the wastewater. The wash water will be discharged into local WWTPs through pipeline network after oil removal. The wastewater amount is very limited. Therefore, the treated wastewater will not bring any adverse impacts on local water quality.

Analysis and Assessment of Impacts of Noise during Construction

This chapter specifies analysis of impacts of noise from vehicles and construction machinery on surrounding environment.

Assessment Criteria

Class 2 Environmental Quality Standard for Noise GB3096-2008, namely 60dB(A) at daytime and 50dB(A) at night, is applicable to assessment area. The noise levels at plant boundaries will comply with Class 2 Emission Standard for Industrial Enterprises Noise at Boundary GB12348-2008, which includes 60dB(A) at daytime and 50dB(A) at night. Noise Limit for Boundaries of Construction Site GB12523-90 is applicable during Construction, as detailed in Table 8.3-1.

Table 8.3-1 Noise Limit for Construction Work

Construction conducted	Noise Limit (dB(A))	
	Daytime	Night
Site preparation	75	55
Piling	85	Not Allowed
Structuring	70	55
Construction and decoration	65	55

Noise Levels of the Main Construction Machinery

The various construction machinery used for proposed project during construction are detailed in Table 8.3-2.

Table 8.3-2 Noise Levels of Various Construction Machinery Unit: dB(A)

No.	Type	Distance of testing pointed to construction machinery (m?)	Lmax
1	Blender	5	90
2	Loader	5	90
3	Bulldozer	5	86
4	Excavator	5	84
5	Lorry	5	89
6	Mobile Crane	5	86

Projection Model

Point Source Distance Attenuation Model:

$$Loct(r) = Loct(r_0)-20lg(r/r_0)-\square L$$

in which,

Loct(r) is sound pressure level when distance equals to r; dB(A)

Loct(r0) is sound pressure level when distance equals to r0; dB(A)

△ L: Attenuation during transmission

Projection Results and Analysis of Noise

Projection results are shown in Table 8.3-3

Table 8.3-3 Projection Results for Impacts of Noise from Construction Machinery

Activities	Distance (m)									
	1	10	20	50	100	150	200	250	300	500
Earthwork	90	70	63	55	50	47	44	42	40	38
Ground construction	86	65	59	51	45	41	39	37	35	33

As indicated above, construction noise is attenuated when distance increases. Noise levels at projection points 100m away from noise source could reach 50dB(A) and 45 dB(A) during excavation and ground construction. As the coverage of construction area is large, the noise level outside of site boundaries will be lower than 55 dB(A), which can comply with Noise Limit for Boundaries of Construction Site GB12523-90.

There will be no sensitive points within the distance of 100m away from construction site. However, special attention should be paid in order to avoid construction activities by equipment with high noise emission. The construction noise will terminate with completion of construction. Thus, the duration of noise nuisance will be short.

Environmental Protection Measures for Acoustic Environment during Construction

The impact analysis indicated that the construction noise will pose a certain impacts on acoustic environment. To lessen the potential impacts, the PIU should take the following control and mitigation measures in compliance with Law of Noise Pollution Control and Prevention.

(1) Use of various pile drivers is forbidden. As intensity of noise source from pile drivers are enormous, use of pile drivers should be avoided, especially at night.

(2) Select machinery devices with low noise emission or devices with noise insulation and attenuation as much as possible, enhance equipment maintenance;

(3) Arrange construction time and construction areas in a proper way. Construction activities with high noise emission should be away from noise sensitive receptors. If necessary, temporary noise insulation barriers should be set up around high noise sources to lessen the impacts of noise nuisance;

(4) Avoid use of diesel-driven generators if power supply is available;

(5) Stipulate construction progress and schedule in a proper way and control the operation time of equipment with high noise emission;

(6) Avoid the operation of equipment with high noise emission at rest period, such as at noon or night;

(7) Manage the access of vehicles to construction sites in a proper way and reduce the noise to be generated by horning.

Analysis of Impacts of Solid Waste during Construction

Main types of solid waste during construction include domestic waste from staff of the site, spoil from excavation when building WWTP, waste bricks and construction materials during pipeline construction.

Analysis of Impacts of Solid Wastes during Construction

As analyzed above, solid waste for proposed project will not be defined as hazardous waste, according to National Catalogue of Hazardous Wastes and Guangdong Provincial Catalogue of Hazardous Wastes. However, solid waste without proper treatment will affect traffic and pollute environment. During transportation, spilling caused by dirty vehicles will pollute the streets and roads, affect city landscape and traffic, and pose serious impact on aquatic and terrestrial environment.

After construction, construction sites will be messy if construction wastes, such as waste metal, wood and bamboo etc. are not collected and treated. And soil erosion will take place without treatment of sludge to be generated during construction.

During operation, domestic waste without collection and treatment will cause river pollution and pose serious impacts on landscape and sanitation. Besides, river sediments will be polluted if solid waste sinks to the river bottom. And diffusion of solid waste in the water bodies will generate hazardous substances, which can destroy the aquatic ecosystem.

As for treatment and disposal of solid wastes, the spoil to be generated from pipeline construction should be backfilled as much as possible. During excavation the topsoil and subsoil should be piled separately, during backfilling, subsoil should be backfilled prior to backfilling of topsoil, which can retain soil fertility.

If sludge and spoil that cannot be backfilled are stored on-site, serious soil erosion would take place. Therefore, according to rules specified by local sludge management offices, sludge and spoil should be landfilled or transported to the nearby quarry to restore ecological environment, which avoids soil erosion. Therefore, the impacts on surrounding environment will be very little.

Domestic wastes should be cleaned and collected by sanitation companies and then transported to municipal landfill sites for disposal.

Once management is enhanced and feasible measures are implemented, potential solid wastes will not cause hazard to the environment.

Mitigation Measures for Impacts of Solid Wastes during Construction

During construction, domestic wastes in living and working areas should be collected on a timely basis and be transported to the designated place for storage. One sanitary team together with one vehicle and some metal waste bins should be assigned for each construction area. The waste bins should be placed in locations with raining sheltering, good ventilation and convenient traffics. Solid wastes should be categorized for storage and collection according to waste characteristics. Recyclable waste should be sent to qualified waste recycling companies.

The construction contractors is required to strictly follow the relevant regulations regarding management of sludge and spoil disposal, handle the formalities and dispose of sludge and spoil at designated places after approval. Particle materials and solid waste must be sealed, packed and covered during transportation. No spilling is allowed. The vehicles should operate along specified routes at the specified time.

Mixing of construction waste with domestic waste and mixing of hazardous waste with construction waste are forbidden, strictly following the Management Rules for Municipal Construction Waste.

As for solid management, a waste management plan is required, which includes implementation plan of waste disposal, reporting procedures for waste control, report formats and maintenance procedures etc..

Environmental Risk Analysis

Environmental Risk Identification

Risk Material Identification

During the operation of the project, no poisonous, hazardous, flammable or explosive materials are used as raw material, additive or fuel. The main material mentioned in the project production process is the sludge treated from the city WWTPs.

According to the appendix A1 of "Technical Guideline for Environmental Risk Assessment of Construction Project" HJ/T169-2004, the municipal wastewater, sludge and domestic waste are not categorized as the poisonous, flammable or explosive materials mentioned in the Appendix A1. They are not categorized as hazardous wastes listed inside the "National Catalogue of Hazardous Wastes".

Municipal wastewater and sludge contain all kinds of colloid, organic matters, solid granule and floccule curdy such as mud, sand, fibre, and animal and plants residuals and etc.. Its heavy metal content level is quite high. The organic matters in the sludge mainly consists of primary organic matters such as amino acid, humus acid, bacteria and its metabolite, PAH, compound of heterocyclic ring, organic sulfide, and volatile odorous compound etc.. Their structure is quite simple and has been oxidized in biological treatment. They are easy to be decomposed in high temperature. If sludge is leaked directly into the water body or leaks indirectly into the water body accompanied with rainwater, the pollutants in the sludge (such as heavy metal pollutant) may enter directly into water body and cause water body contamination.

Types of Environmental Risk

Environmental risks of sludge treatment mainly are accidents of sludge trucks during the transportation, in which the container is damaged and the sludge leaks out. Environmental risk impact is the impact of organic matter and heavy metal in the sludge to the surface water quality. If the sludge leaks into the drinking water source protection area, it may cause contamination to the drinking water source. Possible leak-out situations are:

（1） Accidents during transportation: When the sludge container is broken, which causes the sludge leaks into the water body. The sludge in the water body will release organic matter and heavy metal and may affect the water quality of river body. According to the analysis of sludge transportation route, the sludge transportation will keep away from drinking water source protection area, which means there will be no direct impact to the drinking water source protection area.

（2） Sludge leakage caused by accidents during dewatering and loading / unloading process in the plant: The possibility of this situation is quite low. Besides, the leaks inside the plant can be treated properly so that the sludge cannot leak into the surrounding surface water body. Therefore, it will not cause significant negative consequences.

Impact Analysis of Environmental Risk Accident

Accident Source Analysis

Refer to figure 5.5-1 for the sludge transportation routes. The sludge transportation route for each WWTP is:

□1□Chengbei Plant: Chengbei Plant→Huochang Road→West Wenchang Road→Foshan Road→Foshan Road→Jili Road→Qiaogao Road→S113→Bai Shi Ao Landfill of Gao Ming Miao village

（2）

Zhengan Plant：Zhengan Plant→South Chaoan Road→Jihua Road→Foshan Road→Jili Road→Qiaogao Road→S113→Bai Shi Ao Landfill of Gao Ming Miao village

（3）Shagang Plant：Shagang Plant→New Shagang Road→Foshan Road→Jili Road→Qiaogao Road→S113→Bai Shi Ao Landfill of Gao Ming Miao village

（4）Nanzhuang Plant：Nanzhuang Plant→Nanzhuang Road→Foshan Yi Huan→ili Road→Qiaogao Road→S113→Bai Shi Ao Landfill of Gao Ming Miao village

The main water bodies that will be passed over during the transportation are Dongping water channel crossed over by Foshan Road, Jili Creek crossed over by Foshan Yi Huan, Shunde channel crossed over by Jili Road, and Xijiang River crossed over by S113（figure 5.5-1）. The water bodies mentioned above are not connected with Grade 1 and 2 drinking water source protection area. If transportation trucks accounter accidents when they are passing through the above 4 water bodies, and the sludge leaking out, it will affect the water quality of the above 4 water bodies.

Accident Probability Analysis

（1）Calculation formula of accident probability

The following formula can be used to calculate the probability of the water environmental impact accident when passing through the water body during the sludge transportation of the project:

$$P = Q_0 \times Q_1 \times Q_2 \times Q_3$$

P ——risk probability of water contamination accident may happen during transportation sludge through important section of river；

Q0——present probability of major traffic accident in the area such as trucks crash into each other and run over.　time / million × kilometers）

Q1——absolute trips of sludge transportation trucks.　million / year）

Q2——distance of important section of river.　kilometers）

Q3——ratio of P Vs. probability of normal road accident.

（2）Major parameters

Q_0：the average probability of traffic accident is 0.1323 time /（million×kilometer×year）, referring to probability of traffic accident of Foshan city.

Q_1：traffic loads that cross over Dongping channel, Jili Creek, Shunde channel and Xijiang river are 0.0077 million / year, 0.0011million / year and 0.0088 million / year respectively.

Q_2：The distance of the roads that cross over Dongping channel, Jili Creek, and Shunde channel are 350m, 210m, 500m, and 1000m respectively.

Q_3：1.0, considering the average situation.

（3）Calculation Result

After calculation, the accident probabilities of sludge transportation trucks passing over west Pearl River fairway section and Liuxi River section are:

Table 9.2-1 Probability of water body pollution caused by traffic accident of sludge transportation

No.	Water body	Q_0 (Time / million × kilometer × year)	Q_1 (Million / year)	Q_2 (kilometer)	Q_3	P (Time / thousand years)
1	Dongping channel (Foshan Road)	0.1323	0.0077	0.35	1.0	0.36
2	Jili Creek (Foshan Yi Huan)	0.1323	0.0011	0.20	1.0	0.03
3	Shunde channel (Jili road)	0.1323	0.0088	0.50	1.0	0.58
4	Xijiang river (S113)	0.1323	0.0029	1.00	1.0	1.16

From the prediction result in table 9.2-2, the probabilities of water contamination that will happen during the sludge transportation trucks crossing over Dongping channel, Jili Creek, Shunde channel and Xijiang river of the project are 0.36 time / thousand years, 0.03 time / thousand years, 0.58 time / thousand years, and 1.16 time / thousand years respectively. Assume that the project is going to operate 10 years, then the number of the water contamination accidents might happen during the 10 years is from 0.0003 time～0.0116 time, which is quite low.

Accident Consequence Analysis

The main water bodies that will be crossed over during the transportation are Dongping channel crossed over by Jihuang road, Jili Creek crossed over by Foshan Yi Huan, and Shunde channel crossed over by Jili Road. The above river bodies being crossed over are not connected to Grade 1 and 2 drinking water source protection area. If transportation trucks occer traffic accidents when passing over the above water bodies, sludge on the trucks may drop to the ground and leak into the water bodies, which will cause instant negative consequence to part of the water bodies. The main consequence is the increase of the concentration of organic matter and heavy metal. However this consequence will not affect directly the water quality of the water source. Since the sluge transportation trucks are insulated, accident will not cause large spilt of sludge. Therefore, accidents will not greatly affect the water quality.

Summary

Analysis indicates that the probability of traffic accident when passing over Dongping channel, Jili Creek, and Shunde channel, and water contamination caused by it is very limited. If an accident happens, the main impact will be the increase of concentration of organic matter and heavy metal. To avoid or reduce the accident probability and the negative consequences to the surface water quality caused by the accident, it is necessary to adopt pertinent risk prevention and emergency response measures. As a whole, the environmental risk of the project is acceptable, therefore, from the environmental risk point of view, the implementation of the project is feasible.

Prevention and Emergency Measures for Environmental Risk Accident

In order to strengthen the management, to ensure an effective control of the sludge transportation trucks, and to reduce the sludge leak-out incident and its negative consequence to the environment to the minimum, PIU should establish a “Sludge Transportation Management Procedure” to bring out an effective management scheme. The management procedure should identify each department’s duty during the transportation and procedures of whole process of sludge transportation and loading/unloading, strictly implement in accordance with the “Sludge Transportation Management Procedure” to minimize the sludge leak-out incidents.

Prevention measures t include:

（1）Select safe vehicle model forsludge transportation;

（2）Require sludge transportation truck supplier to provide a type of vehicle with excellent insulation which does not drop or leak;

（3）Rinse the wheels and truck bodies, the sludge transportation trucks before going on the road;

（4）Sludge transportation trucks have to install GPS system;

（5）Vehicles need a regular maintenance to keep them in a good condition;

（6）Check insulation of the transportation trucks before loading to ensure no leaking of sludge;

（7）Transportation trucks must have obvious safety warning signs;

（8）Specify the travelling route, and do not voluntarily change it;

（9）Obey the traffic rules, and enhance the safety awareness, especially when cross through the bridges crossing over water bodies under bad weather conditions such as the rainy day.

□10□Transportation trucks must have water-proof covering cloth, which can prevent the rain water to dissolve heavy metal and organic matter inside the sludge and leak into the water body.

□11□Strengthen the environmental protection awareness and professional training of dealing with emergencies of transportation truck drivers and its escort.

Emergency Response Plan of Environmental Risk

In order to deal with the incident in time when it happens, and to minimize the consequences, PIU should establish a “Emergency Response Plan of Environmental Risk Accident”. The act should arrange the emergency management commanding organization, duties and responsibilities and emergency management procedures in details, so as to deal with the environmental risk accident and to adopt effective measures. Related risk emergency response plan should include the following contents:

1、Specify the hazardous targets of environmental risk and environmental protection targets

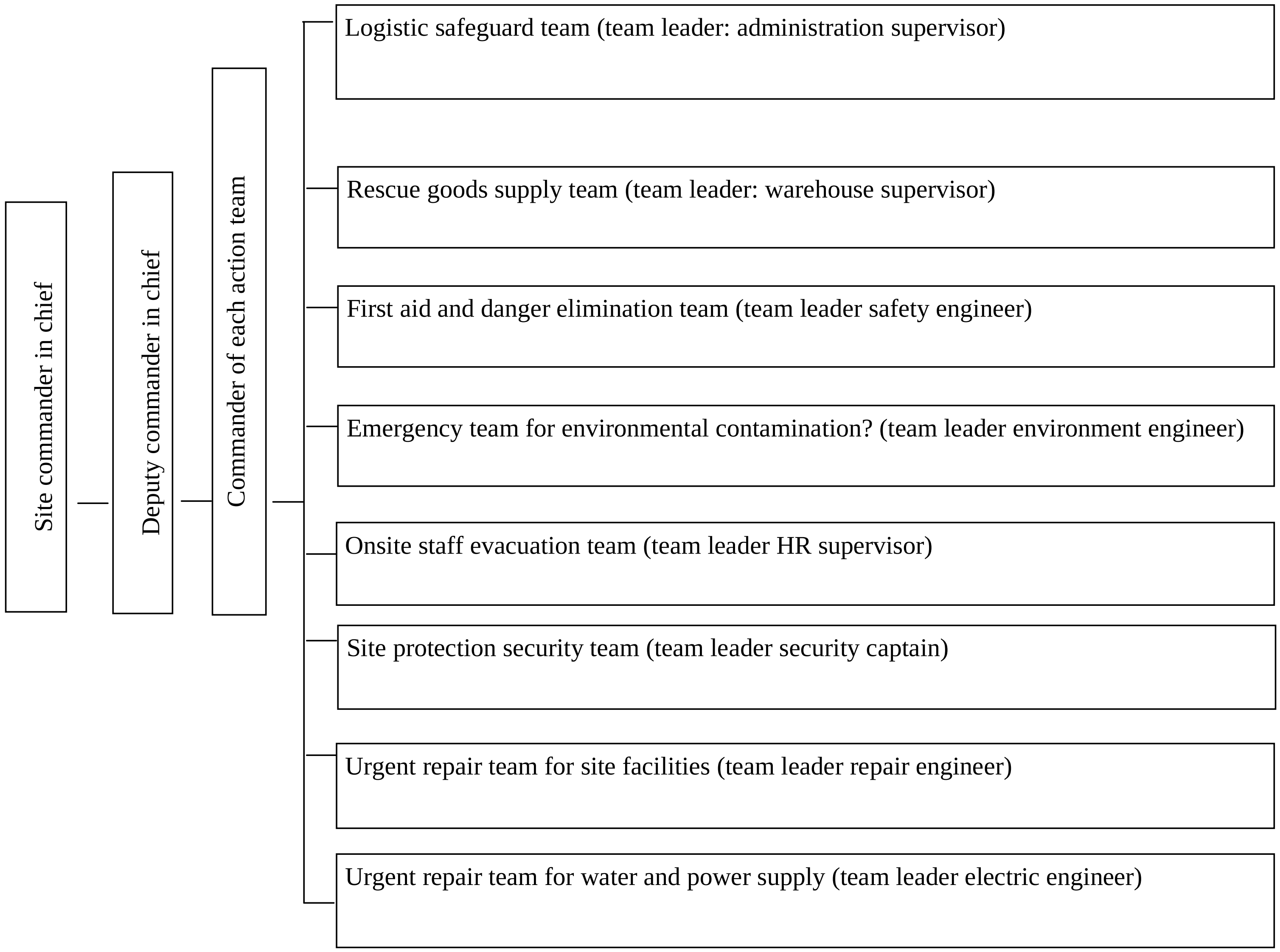
Environmental risk source: sludge loading facilities and sludge transportation trucks.

Environmental protection targets: mainly include water bodies when crossing over Dongping channel, Jili Creek and Shunde channel.

2、Establish emergency management organization of environmental accident. Specify related responsible person and accident management procedure.

（1） Emergency management commanding organization

The recommended emergency management commanding organization of environmental accident is as follows:


Site commander in chief
Deputy commander in chief
Commander of each action team
Logistic safeguard team (team leader: administration supervisor)
Rescue goods supply team (team leader: warehouse supervisor)
First aid and danger elimination team (team leader safety engineer)
Emergency team for environmental contamination? (team leader environment engineer)
Onsite staff evacuation team (team leader HR supervisor)
Site protection security team (team leader security captain)
Urgent repair team for site facilities (team leader repair engineer)
Urgent repair team for water and power supply (team leader electric engineer)

（2）Emergency management procedure of environmental risk accident

Accident emergency management procedure figure 9.4-1

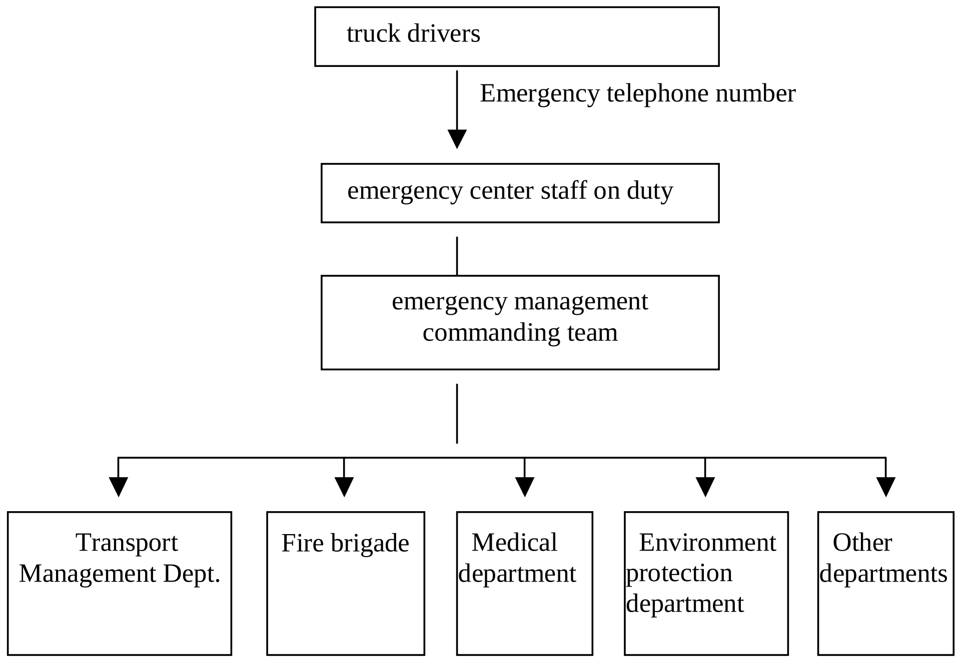


Figure 9.4-1 Flow Chart of Accident Emergency Procedure

3、Warning and Contact Information

（1） Communication equipment and communication network

Equip each department and functional department with special-line telephones in order them to connect with functional departments at any time. Establish broadcasting system inside the plant to communicate the information in time.

（2） Signal standard

During the accident, use site alarm, broadcasting, walkie-talkie, alarm telephone exchange and telephone to report the information.

（3） Emergency contact numbers for usable resources

Specify the contact list of emergency management commanding team members and department emergency management responsible person, including name and contact numbers etc..

Specify external (public) contact number for emergency aid.

4□Accident countermeasures

1□Sludge leaks onto the road or highway: immediately dispatch vehicles to move away the sludge and clean the site.

2□In the rainy day, cover the leak-out sludge with the water proof cloth to minimize the pollutants being washed away, and move away the sludge as soon as possible.

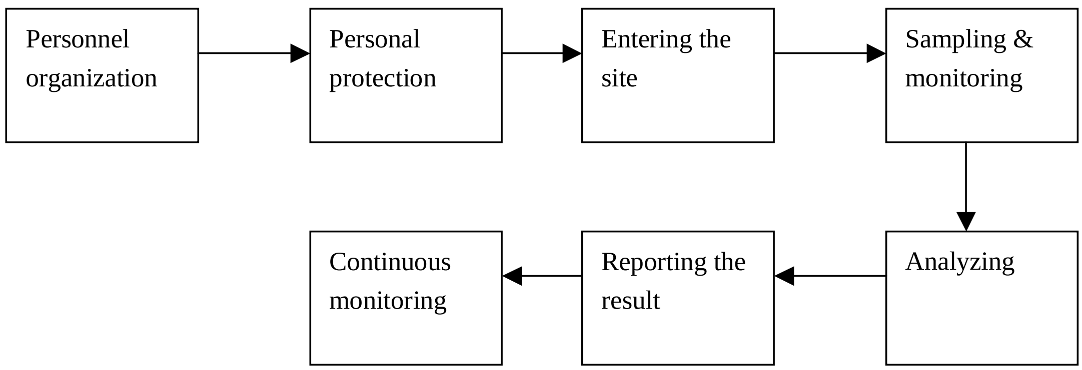
3□Inform the emergency management commanding team and environmental protection bureau and also inform the water supply department of the Foshan Water Group to prepare for the anti-pollution activities.

4□Take a close monitoring on the flow direction of the polluted water body. Take corresponding measures to minimize the scope of the pollution area.

5□Emergency environmental monitoring, site treatment, first aid, and control measures

If the accident happens, it should organize an environmental monitoring team as soon as possible to monitor the accident site and its surrounding environment. Take samples of pollutants in the environment and put them under monitoring so as to know the accident characteristics, risk type, pollutant concentration, risk level and number of affected people, which will provide scientific evidence for taking the site treatment, first aid and anti-toxin, anti-explosion, and non-proliferation measures.

(1) Flow chart of the procedure:



(2) Before conducting environmental monitoring, adopt a reliable anti-toxic and anti-explosion measure based on the known information.

(3) During the monitoring, keep in touch with the commanding headquarter and report to it in time.

(4) Take both fixed and mobile monitoring methods for the site monitoring. Items that need to be monitored are discharged waste water and air pollutants during the accident. Monitoring work should take place through out the whole emergency management process. Take dynamic monitoring and report the result to the site commander in chief in time. Monitoring items should be selected in accordance with the type of the accident. Parameters of environmental risk monitoring are: waste water COD, Oil, Hg, Pb, Cd, As and Ni.

(5) Keep the samples during the monitoring so as to use in further studies.

(6) Assess the causes of the accident, casualties and environmental impact. Learn from the experience so as to avoid such kind of accident to happen again and to provide scientific evidence for the future emergency aid work of the HQ.

6、Closing procedure of emergency aid of environmental accident

（1） Preconditions of terminating the emergency aid

① Accident site has been controlled and causes of the accidents have been eliminated.

② The leakage or emission of pollution source has been minimized below the limit.

③ Hazard of the accident has been eliminated and there is no possibility of secondary accident.

④ All kinds of professional emergency response activities for the accident site are no longer necessary to continue.

⑤ Take necessary measures to protect the environment from receiving another harm.

⑥ Take necessary collection and protection measures to avoid sludge, waste water or other pollutants entering into the environment. Environmental impact has basically been eliminated.

（2） Closing procedure of emergency response

① Emergency response measures are closed. Inspectors go into the site to inspect the site.

② When the site inspectors inform that the hazard has been controlled effectively, the commanding team announces the closing instruction.

③ Commanding team announces to end the emergency status. Release the accident alarm in the surrounding area. Evacuation team then gathers the staff back to its post. Resume the production and report to the commander in chief.

（3） Activities after the termination of emergency response actions

① Arrange personnel to clean the site. Initiate the accident investigation, aftermath management, insurance claim and rebuilding work. Report to the component authority in charge, environmental protection bureau, bureau of work safety, police, fire brigade, communication and public health department of the local government.

② Investigate the causes of the accident to prevent such accident to happen again.

③ Make records of the accident. Organize professional department to assess the emergency response measures based on the practical experience. Revise the emergency response measures timely.

7□Training program

（1） Training for the emergency response team

Carry out a training program to the staff about knowledge of environmental accident. Put environmental accident prevention, emergency deployment, and comprehensive coordination as main training content, in order to improve the capability of emergency response team to deal with the environmental accident.

（2） Staff training for the emergency response

Train the staff with environmental safety education program and conduct examination. Moreover, take regular environmental safety education and periodical practice so as to promote the emergency response awareness.

（3） Publicity of emergency response knowledge of the environmental accident to the surrounding unit and personnel

Dispatch publicity materials about the company’s emergency response to the environmental accident to the surrounding units and personnel. Take periodical practice together with surrounding units.

8□Drilling program and revision of emergency countermeasures act

In order to act promptly and ordely after the environmental accident, and to minimize the loss caused, it is necessary to prepare the emergency response plan. Detailed actions are:

1□Every year, adjust the organization based on personnel reassignement to ensure the emergency response teams are functional.

2□Prepare the material and equipment based on the job duty and responsibility. Assign specific staff to take in charge of the equipment storage and maintenance in order to ensure the equipments are in good condition.

3□Monthly check of the emergency response recordss and equipment maintenance.

4□Carry out emergency response practice regularly.

5□Revise and update the emergency response plan regularly and timely.

Analysis of Mitigation Measures and Technical and Economic Feasibility

Analysis of Air Pollution Prevention Measures and Technical and Economic Feasibility

（1）Exhausted Gas Emission

Exhausted gas pollution from WWTPs is mainly unpleasant odor during advanced dewatering process. The sludge has distinct unpleasant odor. During sludge treatment, odorous gas is mainly generated from aerobic/anaerobic fermentation of microbes in wet conditions.

Processes adopted for proposed project include sludge conditioning and mechanical dewatering. The sludge from storage will be delivered to sealed conditioning tanks and then sent to dewatering workshop. The entire treatment process will be performed in a closed environment. Therefore, no odor emissions will be generated in the ambient air.

The odor emissions from WWTPs concerned can be calculated in accordance with the sludge treatment capacity. As odor emissions will be mainly generated from filter press, the number of press filters should be taken into account. Calculation results are shown in the table below.

Table 10.1-1 Estimation of Odors Emissions for Proposed Project

Project		Zhen’an WWTP	Shagang WWTP	Chengbei WWTP	Nanzhuang WWTP
Sludge treatment capacity (water content of 80%)		120	60	30	30
Amount of filter press		4	3	2	2
Emission rate (g/h)	NH_3	18.0	13.5	9.0	9.0
	H_2S	1.2	0.9	0.6	0.6
Pollution emission (t/a)	NH_3	0.158	0.119	0.079	0.079
	H_2S	0.021	0.016	0.011	0.011

(2) Exhausted gas control and prevention measures

Sludge treatment capability after project implementation is the same as that of current situation in WWTPs concerned.

Prior to project implementation, sludge from WWTPs concerned was treated by frame press filters or centrifugal compressors after being conditioned. After project implementation, sludge will be conditioned to reduce generation of odor emissions and the decrease of water content and volume after dewatering will also cause reduction of odor emissions.

In addition, biological deodorant was applied in existing dewatering workshop in WWTP concerned to reduce odor concentration. The organics will be decomposed by biological deodorant through microorganisms and probiotics. And generation of ammonia and H_2S as odor sources together with production and reproduction of detrimental bacteria will be treated by the biological deodorant.

(3) Selection of Deodorization Technology

① Biological Oxidation

End products of biological oxidation include CO_2 and H_2O, which will not cause secondary pollution. It can be divided into 4 categories in terms of filtration methods, including biofiltration tank, biofilter (soil, composting and bog muck), and packed column for deodorization (absorption and adsorption), biological scrubber (aeration and biological scrubbing).

② Natural Plant Deodorization

The basic principle of this technology is to use special plant extract as deodorant together with advanced spraying or atomizing technologies. The atomized molecules are equably dispersed in the air to adsorb odor-generating molecule, as well as have reactions such as decomposition, polymerization, substitution and displacement, which facilitate the change in structures of odor-generating molecules. The end products are harmless molecules such as water, oxygen, nitrogen etc. The types of odor-generating molecules depend on odor generation sources. Therefore, it is proposed to select specific plant extracts for deodorization.

③Activated Oxidation

Activated oxidation is to employ static electricity with high frequency and high voltage (activated oxygen generators can emit hundreds of billions ions with high energy) to generate high density activated oxygen with high energy for deodorization, which is a transition from between oxygen molecule and ozone. The process is conducted in normal temperature. Therefore, it is also called microtherm combustion. The products are chalcogen aggregates, such as O_2, O_2^-, O_2^+, ·OH□ HO_2, ·O, which have intensive oxidation ability.

④High Energy Ion Purification

The technology is based upon principles of electric field ionization. Lots of α particle was generated from ion generators. The collision of α particle with oxygen molecules forms positive and negative oxygen-ions. The positive oxygen-ions have very strong oxidability to decompose pollutants such as methyl, ammonia and hydrogen sulfide and to produce small-sized harmless molecules of carbon dioxide and water. At the same time, oxygen ions can destroy the living conditions of bacteria and also reduce the indoor bacteria concentration. The charged ions can absorb suspended particles which is several times heavier than themselves. The ions with particles fall down by gravity. Consequently, suspended colloids in air can be eliminated.

As indicated by practice, efficiencies of 4 aforesaid technologies are high.

Among those, biological oxidation technology has the advantages of stable effect with low operation expenses and investment, easy operation and maintenance, and low energy consumption. Like other projects, proposed project will apply biological deodorant to oxidize odorous gas in a biological way.

As a result of visits to existing dewatering workshop, the odor intensity in existing dewatering workshop exceeded Class 3. Based upon the visit to sludge advanced dewatering workshop in Dashachi WWTP of Guangzhou, the odor intensity was nearly Class 3 which was lower than that of existing project sites. It is considered that odor emissions will be reduced and local air quality will be improved after project implementation. Therefore, the odor control measure by biological oxidation after sludge conditioning is feasible.

At present, WWTPs in large cities, such as Datansha WWTP in Guangzhou, concentrated odor treatment alternatives for sludge dewatering workshops were implemented for control of odor from sludge dewatering process in an effective way. The operation efficiencies of those odor control alternatives were relatively good, which were higher than 90%. Well-organized collection and treatment measures can be also taken into account for further reduction of odorous offgas emissions if feasible.

Analysis of Water Pollution Prevention Measures and Technical and Economic Feasibility

□1□Wastewater generation

For proposed project, there will be no new construction of dorms and canteens. The staff will handle accommodation and meals by themselves. The wastewater mainly includes domestic waste and industrial wastewater to be generated from advanced dewatering. As for site laboratories, all types of waster liquid and wash water may contain hazardous and toxic components, such as heavy metal, strong acid and strong base. Therefore, the wastewater should be collected in specific containers and then sent to qualified company from hazard-free treatment. General wash water from laboratories should be discharged into municipal WWTP for centralized treatment.

The sludge generation from dewatering in WWTPs concerned is detailed in Table 10.2-1. Main water pollutants include CODcr, BOD_5, SS and NH_3-N. The comparisons of wastewater quality in WWTPs concerned are shown in Table 10.2-2 below.

Table 10.2-1 Statistics on Wastewater Discharge for Proposed Project Unit: m^3/d

WWTP	Zhen' an WWTP	Shagang WWTP	Chengbei WWTP	Nanzhuang WWTP	Subtotal
Domestic	0.9	0.9	0.9	0.9	3.6

wastewater *					
General wash water in labs	0.1	0.1	0.1	0.1	0.4
Wastewater from sludge dewatering	2350	1178	590	590	4708
Subtotal	2351	1179	591	591	4712

Table 10.2-2 Parameters of Water Quality for Proposed Project Unit: m^3/d

Pollutant		CODcr	BOD_5	SS	NH_3-N
Concentration（mg/l）		1100	400	100	75
generation（t/a）	Zhen’ an WWTP	943.93	343.25	85.81	64.36
	Shagang WWTP	473.37	172.13	43.03	32.28
	Chengbei WWTP	237.29	86.29	21.57	16.18
	Nanzhuang WWTP	237.29	86.29	21.57	16.18
	Subtotal	2991.88	1087.96	271.98	204.00ı

After project implementation, effluent discharge will correspondingly change due to increase of dewatering efficiency. The increase of effluent discharge ranges from 21 to 71 m^3/d as detailed in Table 10.2-3.

Table 10.2-3 Variation Situation of Sludge Discharge in this Project □ m^3/d□

WWTP			Zhen'an WWTP	Shagang WWTP	Chengbei WWTP	Nanzhuang WWTP	Subtotal
Proposed project	Wastewater discharge (10000 m^3/a)		85.812	43.034	21.572	21.572	171.99
	Pollutant discharge (t/a)	CODcr	51.49	25.82	12.94	8.63	98.88
		NH_3-N	21.45	10.76	5.39	1.73	39.33
Existing Project	Wastewater discharge (10000 m^3/a)		83.220	41.610	20.805	20.805	166.44
	Pollutant discharge (t/a)	CODcr	49.93	24.97	12.48	8.32	95.70
		NH_3-N	20.81	10.40	5.20	1.66	38.07
Variation	Wastewater discharge (10000 m^3/a)		2.592	1.424	0.767	0.767	5.55
	Pollutant discharge (t/a)	CODcr	1.56	0.85	0.46	0.31	3.18
		NH_3-N	0.64	0.36	0.19	0.07	1.26

□2□Mitigation Measures for Wastewater

Total capacity of Zhen'an WWTP is 350000 m^3/d . A/O treatment process was adopted at Phase I; improved A^2/O treatment process was adopted at Phase II and III. Designed water quality at inlets and outfalls of Zhen'an WWTP is detailed below.

Table 10.2-4 Designed water quality at inlets and outfalls of Zhen'an WWTP (mg/L)

Parameter	CODcr□	BOD_5	SS	TN	NH_4^+-N	TP
Inlet	250	130	150	35	25	4
Outfall	60	20	30		15	1

Phase I Shagang WWTP is currently put into operation with a capacity of 100000 m^3/d, and A^2/O treatment process. Designed water quality at inlets and outfalls of Shagang WWTP is detailed in following table.

Table 10.2-5 Designed water quality at inlets and outfalls of Shagang WWTP (mg/L)

Parameter	CODcr□	BOD_5	SS	TN	NH_4^+-N	TP
Inlet	230	130	150	30	20	3
Outfall	60	20	25		10	1

Phase I Chengbei WWTP has a treatment capacity of 50000 m^3/d with improved activated sludge treatment process. And Phase II Project of Chengbei WWTP will increase the treatment capacity of 50000 m^3/d with the same treatment process. Designed water quality at inlets and outfalls of Chengbei WWTP is detailed in following table.

Table 10.2-6 Designed water quality at inlets and outfalls of Chengbei WWTP (mg/L)

Parameter	CODcr□	BOD_5	SS	TN	NH_4^+-N	TP
Inlet	250	130	150	30	25	3
Outfall	40	20	20		8	1.5

Phase I Nanzhuang WWTP is still under construction with a capacity of 25000 m^3/d and modified A^2/O treatment process. Designed water quality at inlets and outfalls of Nanzhuang WWTP is detailed in following Table.

Table 10.2-7 Designed water quality at inlets and outfalls of Nanzhuang WWTP (mg/L)

Parameter	COD_{cr}□	BOD_5	SS	TN	NH_4^+-N	TP
Inlet	250	140	150	30	25	4
Outfall	60	30	30		15	1

Class II Pollutant Discharge Standard for WWTP GB18918-2002 and Class II Discharge Limit for Water Pollutant in Guangdong Province DB44/26-2001 are applicable to Zhen’an, Shagang and Chengbei WWTPs. Class IB Pollutant Discharge Standard for WWTP GB18918-2002 and Class I Discharge Limit for Water Pollutant in Guangdong Province DB44/26-2001 are applicable to Nanzhuang WWTP.

The wastewater after dewatering will be treated in existing treatment facilities of WWTPs in compliance with relevant standards prior to being discharged. The increase of wastewater generation from proposed dewatering house will be very little and ranges from 0.01 to 0.03% with maximum increase in Shagang WWTP, which will not exceed the capacity of WWTPs concerned. The increase of pollutants discharge at outfalls will also be very little, which will not cause significant changes in local aquatic environment quality. Therefore, a tiny increase of wastewater generation from proposed project is feasible.

Analysis of Noise Pollution Prevention Measures and Technical and Economic Feasibility

Major Noise Sources

Major noise sources for advanced dewatering in WWTPs concerned mainly include sludge pumps, water pumps, blowers, air compressors, sludge dewatering device and conveying system. Main devices for proposed project are mainly placed in dewatering workshop and pump rooms. Compared to existing projects, there will no distinct changes in noise intensity after project implementation.

Table 10.3-1 Major Noise Sources before and after project implementation

No.	Name	Unit	Number					Noise Level dB(A)
			Zhen'an WWTP	Shagang WWTP	Chengbei WWTP	Nanzhuang WWTP	Subtotal	
1	Frame press filter	Set	4	3	2	2	11	70□80
2	Air compressor	Set	3	3	2	2	10	85□95
3	Sludge pump	Set	14	11	7	7	39	80□90
4	Water pump	Set	1	1	1	1	4	80□90
5	Blender	Set	6	6	6	6	24	70□80

Noise Pollution Control Measures

To lessen impacts of noise nuisance caused by dewatering devices in WWTP concerned on surrounding environment, the following measures are proposed:

(1) For large noise sources, during installation, sheltering, noise insulation, vibration prevention and attenuation should be implemented for noises sources. Mitigation measures such as insulated rooms, walls and noise damp, should be taken to lessen noise radiation and transmission. And noise prevention measures for fans, air compressors and water pumps should be implemented.

(2) Devices should be placed in closed rooms with noise insulation meausres. Vibration attenuation should be performed at pump inlets and outlets. Noise damping should be implemented at blower inlet and outlet. Sound absorption should be implemented in dewatering rooms. And noise damping should be implemented for ventilation system of closed dewatering rooms.

(3) Device maintenance should be carried out on a regular basis, such as use of lubricant to keep devices in good conditions and reduce noise generation.

(4) Place equipment with high noise emission in a proper way according to the general layout to keep the equipment away from sensitive areas, place equipment with high noise emission at low elevation as much as possible to reduce further noise transmission.

(5) Use geographic condition, e.g. fences between noise source and sensitive areas to mitigate noise transmission. Equipment with high noise emission should not be placed at plant boundaries.

As indicated by projection and analysis results, noise from dewatering devices in WWTPs concerned will not bring distinct adverse impacts on regional acoustic environment. The proposed noise mitigation measures are feasible.

Analysis of Solid Waste Pollution Prevention Measures and Technical and Economic Feasibility

Sources and Category of Solid Waste

Solid waste generated during advanced dewatering includes sludge cake after press filtration and domestic wastes. Besides, liquid wastes from laboratories and wash water may contain hazardous and toxic components such as heavy metal, strong acid and alkali, which should be collected in specific containers and then sent to qualified company for hazard-free treatment. Water content of sludge after dewatering in WWTPs concerned will be approximately 60%.

Generation and characters of solid waste are shown in Table 10.4-1.

Table 10.4-1 Generation and Characters of Solid Waste (t/a)

WWTP		Zhen’an WWTP	Shagang WWTP	Chengbei WWTP	Nanzhuang WWTP	Subtotal
Existing dewatering workshop	Sludge	150	57	30	30	267
	Domestic waste	0.01	0.01	0.01	0.01	0.04
	Subtotal	120.01	60.01	30.01	30.01	267.04
Proposed Project	Sludge	60	30	15	15	120
	Domestic waste	0.01	0.01	0.01	0.01	0.04
	Waste liquid from laboratories	0.001	0.001	0.001	0.001	0.004
	Subtotal	60.011	30.011	15.011	15.011	120.044
Variations		-89.999	-26.999	-14.999	-14.999	-146.966

Treatment and Disposal of Solid Waste

(1) Domestic Waste

Domestic waste and waste packages are considered as general waste which will be stored in compliance with rules specified by sanitation authorities, and collected and treated by sanitation authories in charge.

(2) Hazardous Waste

Hazardous waste, e.g. waste liquid from laboratories, will be sent to qualified company for safe disposal.

(3) WWTP Sludge

WWTP sludge will be landfilled after advanced dewatering.

Based upon monitoring data on sludge, certain data (mainly Zn and Ni concentrations) for Shagang WWTP were not compliant with relevant standards as shown in bold and italic in Table 10.4-2. In recent three years, Zn concentration for Shagang WWTP in 2009 and Cd concentration for Chengbei WWTP in 2010 were beyond the limit values of relevant standards. However, sludge from WWTPs after mixing will be compliant with relevant standards. The proposed water content after advanced dewatering will be lower than 60%, which can meet the requirements for landfilling.

Initial Agreement between Foshan Water Group and ONXY Company was signed for acceptance of sludge from WWTPs in Baishiao Sanitary Landfill Site. After advanced dewatering, water content of municipal sludge should be not higher than 60%. And it is also required that other key parameters should meet the requirements of relevant standards. Thus, sludge from WWTPs can be disposed of in the landfill sites.

Table 10.4-2 Analysis and Comparision of Sludge Components and Standards for Sludge Landfilling (mg/kg)

Item	Test data															Landfill Standard
	Zhen’an WWTP								Shagang WWTP					Chengbei WWTP		
	2006	2006	2007	2007	2008	2008	2009	2010	2006	2007	2008	2009	2010	2009	2010	
Cd	5.88	3.69	1.79	2.47	3.57	4.62	3.21	3.1	6.05	4.89	4.11	7.64	2.4	12.5	***43.6***	20
Hg	8.24	16.35	4.26	2.29	3.71	2.23	1.78	1.96	7.39	15.32	2.46	6.72	2.47	19.6	1.93	25
Pb	248.2	68.7	52.9	79.7	125	218	164	120	507.97	266	2.22	535	166	178	101	1000
Cr	76.85	55.87	73.8	163	125	294	526	156	146.5	161	193	873	509	291	66	1000
As	43.98	45.86	36.9	64.69	23.1	38.9	32.9	64.5	23.12	82.46	19	62.6	53.8	44.6	50.4	75
Cu	666.43	762.7	1200	846	893	756	555	399	183.04	672	251	535	182	344	130	1500
Zn	1420.5	868.1	1910	2250	1850	2690	1110	664	2692	***5140***	3990	***4370***	1610	1390	640	4000
Ni	48.93	45.22	165	***254***	41.7	113	61.3	44	60.64	***265***	69.8	186	91	212	55	200
CN-	/	/	5	4	0.51	0.17	0.114	/	6.05	4.89	4.11	7.64	/	0.766	/	10

The aforesaid sludge treatment and disposal alternatives are technically feasible.

The proposed treatment and disposal of solid waste are technically feasible.

Mitigation Measures for Transportation Routes

Sludge Transportation Routes and Methods

After dewatering total amount of sludge from WWTPs concerned will be 120t/d. The frequency for sludge transportation will be 24 times (trips?)/d, namely sludge transportation by 24 vehicles from Chancheng District to Gaoming every day.

The proposed transportation routes for each WWTP are shown in Figures 5.5-1.

(1) Chengbei WWTP: Chenbei WWTP→Huochang Road→Wenchangxi Road→Foshan Avenue→Jili Avenue→Qiaogao Road→S113→Baishiao Sanitary Landfill Site in Miao Village of Gaoming

(2) Zhen’an WWTP: Zhen’an WWTP→Chaoannan Road→Jihua Road→Foshan Avenue→Jili Avenue→Qiaogao Road→S113→Baishiao Sanitary Landfill Site in Miao Village of Gaoming

(3) Shagang WWTP: Shagang WWTP→Shagangxin Road→Foshan Avenue→Jili Avenue→Qiaogao Road→S113→Baishiao Sanitary Landfill Site in Miao Village of Gaoming

(4) Nanzhuang WWTP: Nanzhuang WWTP→Nanzhuang Avenue→Foshan 1st Ring Road→Jili Avenue→Qiaogao Road→S113→Baishiao Sanitary Landfill Site in Miao Village of Gaoming

Due to location of WWTPs concerned, transport through urban areas is inevitable. Pollution receptors along routes include residence, enterprises and institutions on both sides of the roads. The generation of odor pollutants after advanced dewatering will be very little. And closed vehicles are used for transportation, which will control impacts of noise nuisance in greatest degrees. The PIU should improve vehicle insulation and conduct careful inspection and maintenance of vehicles to avoid sludge spillages. The unqualified vehicles should be discarded to protect local air quality and sanitation along transportation routes.

Mitigation Measures for Impacts of Transportation Routes

To lessen impacts of waste transportation, the following measures are proposed.

① Use sealed vehicles to transport sludge, enhance maintenance of vehicles and update vehicles on a timely basis to ensure sealing performance of vehicles.

② Clean vehicles on a regular basis, carry out cleaning work along the routes and road sides in a proper way.

③ Avoid transportation in rush hour as much as possible.

④ Equip each vehicle with communication tools in case of emergency. Once accidents occur, transport staff should notify relevant administrative department to respond as soon as possible.

⑤ Strengthen education and technical training for drivers to avoid traffic accidents

Environmental Risks and Countermeasures during Operation

Environmental risk during operation of proposed project mainly is sludge leakage due to traffic accidents during sludge transportation. Therefore, corresponding prevention measures and emergency schedules should be implemented for control the occurrence of environmental risk to the utmost and control of risk influence to the utmost in case of emergency.

Summary of Environmental Protection Measures.

Negative impacts and proposed mitigation measures during construction are summarized in Table 10.7-1 and Table 10.7-2. Negative impacts and proposed mitigation measures during operation are summarized in Table 10.6-3. Risk prevention measures and emergency schedules for proposed project are listed in Table

10.7-4. Pollution Mitigation and environmental management measures for associated projects are shown in Table 10.7-5.

10.7-1 List of Environmental Impacts during Construction

Nr.	Pollution Source	Adverse Environmental Impacts
1	Fly dust	Fly dust will be generated during drilling, construction, material transportation and treatment. Impact scope can be controlled within 100m of construction sites after implementation of appropriate measures.
2	Industrial and domestic wastewater during construction	Industrial and domestic wastewater to be generated during construction may affect quality of surface water and clog sewers if being discharged into surface water or municipal sewerage network without treatment.
3	Noise	Construction machinery and transport devices will pose potential impacts on surrounding residential areas or other sensitive receptors. Impact scope ranges from 0 to 100m.
4	On-site solid waste	A certain amount of construction waste, spoil and domestic waste to be generated at construction sites needs to be disposed of.
5	Vegetation deterioration	Proposed project will be implemented in existing sludge dewatering workshops in WWTPs and surrounding empty land. Therefore, no distinct vegetation deterioration will be caused.
6	Soil erosion	Proposed project will be implemented in existing sludge dewatering workshops in WWTPs and surrounding empty land. Therefore, no distinct soil erosion will be caused.

10.7-2 List of Mitigation Measures for Environmental Impacts during Construction

Environmental Element	Pollution Prevention Measures
Ambient air	— Spaying at construction sites and on dust generation sources to keep humid; — Under dry weather, spay water on roads with high transport frequency and high work load on a regular basis (every two hours); — Slow down while driving on the road with dust; — Equip wheels and car body rinsing devices at outlet of construction sites. Clean up public roads if necessary; — Cover the vehicles with convas during transportation of dust-generated materials; — reduce the height variation as much as possible during loading. Control driving velocity into loading areas in a strict way and clean the loading areas on a regularly basis. — remove construction machinery as well material transport routes from villages
Aquatic environment	— install septic tank for advanced treatment of dung-containing wastewater; — treat on-site washing water through screening grids; — discharge all types of wastewater after treating wastewater in compliance with relevant standards.
Acoustic environment	— Forbid using all types of pile drivers. Avoid operation of pile drivers if possible, especially at night, due to high noise intensity and serious impacts, — Select construction machinery with low noise emission or devices with noise insulation and damping if possible. Enhance equipment maintenance;

	— Arrange construction time and sites in a proper way. Remove construction sites with high noise levels from noise sensitive receptors if possible. Set up temporary sound barriers around pollution sources with high noise level if required, so as to lessen noise nuisance; — No use of diesel generators if possible when municipal power supply is available. — Arrange construction schedule and plan in a rational way and limit the construction period for operation of device with high noise level; — Avoid use of devices with high noise intensity at noon break and night if possible; — evacuate vehicles into construction sits in a rational way and mitigate noise due to car horn.
Soild waste	— Refill the spoil as much as possible during pipeline construction; — Pile up topsoil and bottom soil in a separate way during excavation. And refill bottom soil prior to topsoil refilling so as to maintain topsoil fertility; — Pile up remaining sludge and spoil in designated areas in compliance with regulations by local sludge management offices if the sludge and spoil cannot be refilled. And transportation of the sludge and spoil to abandon quarry is also feasible for ecological rehabilitation; — transport domestic wastes to municipal sanitary landfill sites for disposal after collection by qualified cleaning companies.

10.7-3 List of Mitigation Measures for Environmental Impacts during Operation

Pollution Source	Adverse Impact	Mitigation Measures
Air pollution and odor nuisance	Unpleasant odor will be generated from sludge dewatering workshop during operation. However, odor generation will decrease due to process improvement.	1 Condition sludge to reduce water content of sludge to be treated; 2 Spray biological deodorant to reduce emission of odorous gas. Installation of concentrated deodorization facility will be also taken into account; 3 Enhance routine environmental monitoring, entrust environmental monitoring authorities to monitor odor concentrations in surrounding areas.
Water pollution	During advanced sludge dewatering, sludge generation will slightly increase compared to current level. However, no distinct changes will be caused for the WWTP.	1 Discharge the wastewater after treatment in the WWTPs in compliance with relevant standards; 2 Monitor effluent quality by operators and monitor water quality of surrounding water bodies by relevant EPBs.
Noise	Machinery noise to be generated by wastewater treatment facilities	1 Implement noise insulation, shielding, shockproof and damping measures, such as rooms with insulation equipment, noise barriers and mufflers, so as to attenuate sound radiation and transmission during installation of devices with high noise levels. And implement corresponding noise prevention measures for blowers, press filters and water pumps, etc. 2 Install devices in closed areas with sound insulation, implement vibration attenuation at inlet and outlet of water pumps, damping measures at inlet and outlet of blowers, sound adsorption in service rooms, and also damping measures for ventilation of closed service rooms.

		3 Maintain devices on a regular basis and apply lubricant to maintain devices in good conditions and reduce noise levels during operation. 4 Place devices with high noise intensities according to general layout, remove these devices from noise sensitive areas if possible and install these devices in low altitude to lessen long distance transmission if possible. 5 Take advantage of natural landform to lessen noise transmission, e.g. setup of fences between sound sources and sensitive receptor. Installation of devices with high noise levels at plant boundaries is not allowed.
Solid waste	Water content of advanced dewatered sludge will be 60% which includes domestic wastes and a small amount of waste liquid from labs	1 Transport sludge to Gaoming Baishiao Landfill Site through closed vehicles after thickening and dewatering. Establish mangenement account list and transfer form systems for sludge transportation. 2 Domestic wastes will be treated by sanitation and hygience authorities. 3 Collect a small amount of waste liquid from labs in a proper way and delivery the waste liquid to a qualified company for hazard-free treatment.
Sludge transportation	Odor nuisance will be generated during sludge transportation and sludge leakage may occur and cause environmental risks to surface water.	1 Use vehicles with sealing measures to transport sludge and enhance maintenance and upgrade vehicles on a timely basis to ensure good sealing of vehicles for sludge transportation. 2 Clean up vehicles on a regular basis and implement road cleaning. 3 Avoid rush hours if possible. 4 Equip every vehicle with required communication tools for emergency. Report relevant authorities for proper handling as soon as possible in case of accidents during sludge transportation. 5 Enhance education and technical training for drivers to avoid occurrence of traffic accidents.

10.7-4 Prevention Measures and Contingent Plan for Environmental Risks

Type of Measure	Specific Measures
Prevention measures for environmental risks	− Set priority in use of vehicles of high safety performance. — Require vehicle suppliers to provide vehicles of good sealing performance without leakage. — Clean wheels and car bodies after sludge loading. — Equip vehicles with real-time positioning monitoring system. — Maintain vehicles on a regular basis to ensure the good driving performance. − Examine sealing performance of vehicles prior to loading to ensure sludge transportation without spillage and leakage. − Label vehicles with remarkable safety signs. − Stipulate transport route without random adjustment. − Obey traffic rules, enhance awareness of driving safety, especial in rainy days and bridge construction crossing water bodies, more caustions need to be exercised for occurrence of traffic accidents. − Equip vehicles with waterproof cover. Cover the vehicles in case of spillage and leakage during sludge transportation on a timely basis to stop pollutants such as heavey metal and organics in sludge together with storm water from entering into water bodies. − Enhance professtional training of awareness of environmental protection and contingent plan for drivers and persons concerned.
Contigent plan for environmental risks	— Establish emergency organization for environmental accidents and identify persons in charge and accidents response procedures − In case of sludge spillage and leakage on roads and highways, arrange vechiles to remove sludge immediately and clean the sites as well. − Cover the spilled sludge in waterproof cloth in rainy days to reduce pollution discharge if possible, and remove the sludge as soon as possible. − At the same time, report emergency management team and EPBs immediately and report water supply divisions of Foshan Water Group on a timely basis to ensure the preparation for pollution prevention − Strictly monitor flow direction of polluted water bodies and implement corresponding contingent plan to control pollution coverage within a small region. − Implement reliable antitoxin and explosion-proof measures based opon knowledge of project progress prior to environmental monitoring. − Keep in touch with headquarters at any time and report the headquarters on a timely basis during monitoring. − Monitor in fixed and flexible way for accident prevention. The monitoring items should include accident effluents and air pollutants. The monitoring should cover the whole process with active monitoring. And monitoring results should be reported to site manager on a timely basis. − Attentions should be paid to sample storage during monitoring to facilitate further verification. − Assessment should be made for accident origin, casualties and hazard to environment causes. Lessons should be learnt to avoid the re-occurrence of accidents and provide scientific basis for further emergency relief.

10.7-5 Enviromental Protection Measures for Associated Projects

Associated Project	Adverse Impact	Mitigation Measures

Zhen'an, Chengbei, Shagang WWTPs	Air pollution and odor nuisance	Zhen'an WWTP	1 Deodorization by means of biological deodorant and setup of green belts in the plant and at plant boundary. 2 Cover the main odor generation sources prior to collection for deodorization. The implementation of aforesaid deodorization methods was completed for phase III project. 3 Set up sanitary protection zone in the width of 100m.
		Chengbei WWTP	1 Cover main devices, spray biological deodorant and build up green belts in the plant and at plant boundary. 2 Set up sanitary protection zone in the width of 100m.
		Shagang WWTP	1 Deodorization by means of biological deodorant and setup of green belts in the plant and at plant boundary. 2 Set up sanitary protection zone in the width of 300m.
	Wastewater		1 Treat wastewater in WWTPs through A/O, A^2/O or improved A^2/O process prior to discharge in compliance with relevant standards; 2 Monitor effluent quality by operators and setup on-line monitoring devoces at outfalls by EPBs to monitoring flow rate and COD.
	Noise		1 Implement environmental protection measures such as construction of rooms with sound insulation, sound-proof wall and mufflers during installation of pollution sources with high noise intensity. 2 maintain devices on a regular basis, apply lubricant to keep devices in a good condition and reduce noise to be generated during operation.
	Solid waste		1 Deliver sludge into Yunan Sanitary Landfill Site in Zhaoqing after thickening and dewatering. After project implementation, deliever dewatered sludge into Baishiao Sanitary Landfill Site in Gaoming Miao Village for disposal 2 Domestic wastes will be treated by sanitation and hygiene authorities.
	Others		Foshan Water Group will be in charge of operation management of WWTPs involved in the proposed project. The operation models for WWTps are unified. During routine operation, operators will exercise cautions to monitoring of water quality at inlet and outlet as well sludge quality. And a complete recording system will be established together with contingent plans for various breakdown and accidents.
Baishiao Sanitary Landfill Site in Gaoming Miao Village	Air pollution and odor nuisance		1 Build up collection pipeline and explosion-proof systems for flammable offgas. The offgas to be generated from the landfill site will be collected and incinerated by torch. 2 Set up sanitary protection zone in the width of 500m.
	Leachate		1 Employ bilayer anti-seepage process with anti-seepage coefficient less than 10^{-7}cm/s 2 transfer leachate from retention tank for greening as reuse after on-site leachate treatment.
	Noise		Select devices with low noise emission and implementation of specific sound insulation, vibration attenuation and damping meaures.
	Pollution during transportation		Use specific vehicles for waste transportation and establish transport manuals.
	Others		Set up 10 groundwater monitoring wells and monitoring points for air quality in neighboring Miao Village Ludongshan Forest Park. Conduct environmental monitoring for landfill site and surrounding sensitive receptors for 3-4 times. The monitoring covers air quality, surface water, ground water, leachate, soil, noise and etc.

Public Consultation

According to the “Law of Environmental Impact Assessment of PRC”, the “Temporary Method for Public Consultation during EIA (SEPA 2006 No.26)” and the “Notifications on Printing and Distribution of Opinions on Implementing Public Consultation related to Environmental Management of Construction Projects in Guangdong Province (GDEPB 2007 No.99)”, public consultation and information disclosure of this project has been performed by PIU with the technical assistance and support of the EA agency so as to improve rationality and fairness of EIA work and get a full understanding of public opinions and expert suggestions on project implementation.

Public Consultation Procedure

Integrated with EIA work, public consultation during the preparation of EIA documents was performed as described in Figure 11.1-1.

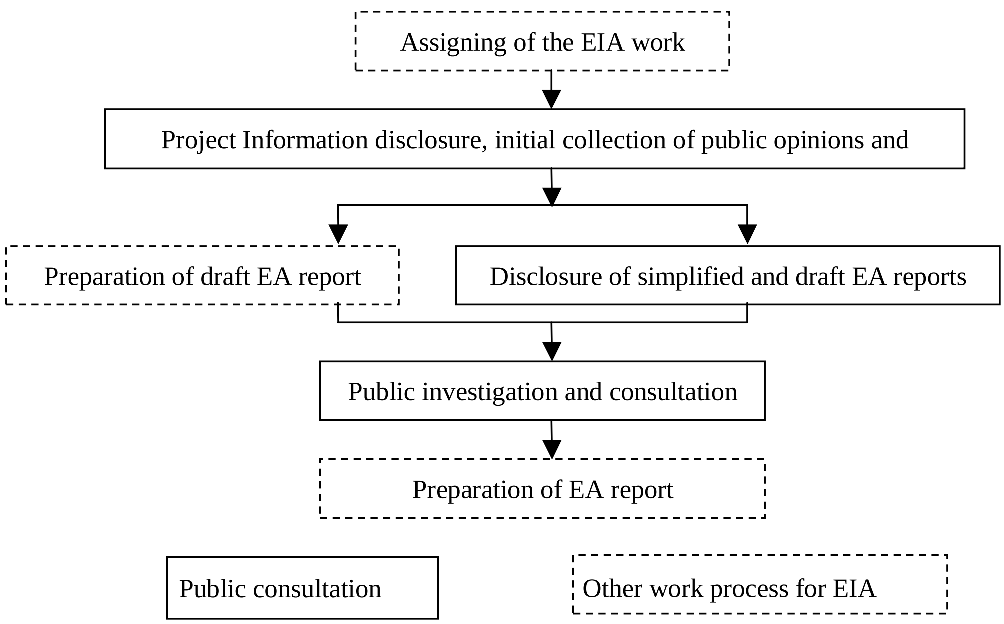


Figure 11.1-1: Public Consultation Procedure during EIA

Information Disclosure

（1）Entrusted by Guangzhou Research Institute of Environmental Protection (GRIEP), the PIU carried out project information disclosure on the local website of Foshan Water Group (http://www.fswater.com/) as well as at neighboring pollution receptors for 10 working days. The details were disclosed of as follows.

Notification on Public Consultation for Potential Environmental Impacts related to Foshan Nanzhuang Sludge Treatment Plant Project

1. Project Overview: The proposed Foshan Nanzhuang Sludge Treatment Plant project is located within the boundaries of Nanzhuang WWTP, Zhen'an WWTP, Shagang WWTP and Chengbei WWTP. The proposed treatment capacity is 240 t/d dewatered sludge with 80% water content. The goal of sludge treatment is to dewater WWTP sludge by employing sludge conditioning and frame filter press advanced dewatering techniques to achieve water content lower than 60% so as to realize reduction and hazard-free treatment of sludge from municipal WWTPs and to minimize negative impacts of sludge on the local ecological environment.

The implementation of proposed project will greatly reduce sludge treatment and disposal costs. No expensive natural gas is used as fuel and the treatment facility is quite flexible which requires less land, reduces wet sludge transportation cost and minimize potential negative impacts on environment during transportation. As a whole, the proposed project will bring great economic, environmental, social benefits and energy efficiency.

2. PIU: Foshan Water Group Company Ltd. Address: Foshan Municipality Chancheng District Tongjixi Road 16 Water Supply Mansion; e-mail: liuyanhui□gz@126.com; Tel: 0757-83808173; Fax: 0757-83808173; Contact person: Ms Liu.

3. EA agency: Guangzhou Research Institute of Environmental Protection Address: Guangzhou Municipality Tianhenan Road 24; e-mail: hkszhoulin@126.com; Tel: 020-85515283; Fax: 020-87540073; Contact person: Ms Zhou.

4. EIA work procedure and Terms of Reference (TOR): analysis of environmental impacts of on-site sludge treatment, survey on environmental baselines in project sites, projection and assessment of impacts on environmental elements and protection zones, collection of public opinions and suggestions, identification of mitigation measures for potential environmental pollution, and prevention, control and management measures for ecological environment protection.

5. Scope of public consultation and key issues of concern: collection of public opinions and suggestions on environmental protection issues, such as environmental impacts, mitigation measures, and selection of project sites.

6. Main methods for public consultation: contact with PIU or EA agency can be available via mail, fax, telephone, correspondence and visit.

Foshan Water Group Company Ltd.
Oct. 2010

The details of first round of public consultation on the website are presented in Figure 11.2-1. And the details of information disclosure at neighboring pollution receptors are presented in Figure 11.2-2.

Figure 11.2-1 Information Disclosure for proposed project on the website (first round)

Notice in Chengbei WWTP

Notice in Shagang WWTP

Notice in Zhen’an WWTP

Bulletin board in Guabaxun Village

Bulletin board in Fuxi Village

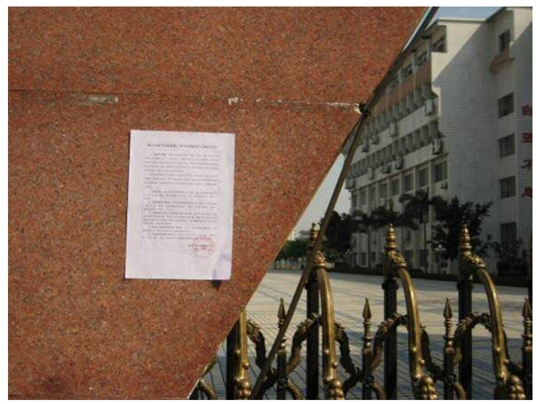
Notice in Aochong Village

Figure 11.2-**2a Sites of Information Disclosure**

Notice in Gaotian Village

Bulletin board in Shagang Village

Notice in Guihua High School



Notice in Nanhai Art High School

Bulletin board in Xinger Community of Zhen’an Village

Bulletin board in Guihua Community

Figure 11.2-**2b Sites of Information Disclosure (first round) **

（2）Second round of information disclosure

After completion of draft and summary of EA reports, on Dec. 6th 2010, preparation of EA report was disclosed on the local website of Foshan Water Group (http://www.fswater.com/) as well as at neighboring pollution receptors for 10 working days. The information disclosed of included:

- Project overview;
- Description of potential impacts of the proposed project on the environment;
- Key points of prevention and mitigation measures for potential negative environmental impacts;
- Key points of EIA conclusions made in EA report;
- Methods and deadline for public access to EA Summary, and methods and deadline for public request for supplemental information from PIU or EA agency entrusted by PIU;
- Scope of public consultation and main issues;
- Forms of public consultation;
- Time frame for the public to express their opinions

The details of second round of information disclosure on the website are presented in Figure 11.2-3. And the details of information disclosure at neighboring pollution receptors are presented in Figure 11.2-4.

Figure 11.2-3 Information Disclosure for proposed project on the website (second round)

Bulletin board in Shagang Village Commission

Notice in Shagang WWTP

Notice in Zhen' an WWTP

Notice in Guihua High School

Notice in Chengbei WWTP

Bulletin board in Guabaxun Village

Figure 11.2-**4a Sites of Information Disclosure (second round)**

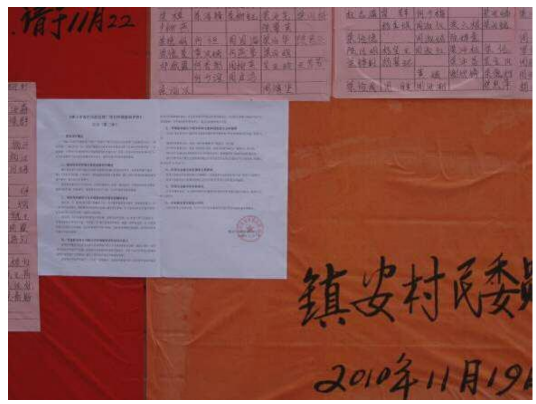
 Bulletin board in Aochong Village	 Notice in Nanhai Art High School
 Notice in Gaotian Village	 Bulletin board in Zhen’an Village
 Bulletin board in Fuxi Village	 Bulletin board in Guihua Community

Figure 11.2-**4b Sites of Information Disclosure (second round)**

Form of Survey

After first round of information disclosure, EA agency made visits to sensitive areas close to advanced dewatering workshops of WWTPs to get an initial understanding of public opinion and suggestions on project implementation. During initial survey, neither specific opinions nor suggestions were made by the public as the public had no idea about the proposed project. Some of surveyed persons consulted the EA agency to understand the project progress, and the EA agency provided information on proposed project and informed the public of second round of public consultation and disclosure of EA summary to raise public awareness.

After completion of draft EA report and second round of public consultation and disclosure of EA summary, consultation with residents and relevant entities close to proposed project sites was carried out by the EA agency and PIU in the form of questionnaire survey,.

The main form of public survey in villages/communities close to proposed project sites was questionnaire survey to individual residents. The main targets included representatives of villages/communities and schools, cadres, teachers and students at different ages of different occupations, religions, ethnic groups, education levels and genders.

The main form of survey on government and relevant entities was direct consultation. The comments were provided by surveyed entities with official chop.

The sites of public consultation in neighboring villages/communities are shown in Figure 11.3-1.

Survey in Gaotian Village

Survey in Shagang Village

Survey in Guihua High School

Survey in Fuxi Village

Survey in Aochong Village

Survey in Guabuxun Village

Figure 11.3-**1 Sites of Public Consultation**

Contents of Public Consultation

□1□Public Survey in villages/communities

Main contents of public survey included public attitude, opinion and suggestion on the proposed project. The survey questionnaire distributed is shown in Table 11.4-1.

Table 11.4-1 Public Survey Questionnaire for Foshan Nanzhuang Sludge Treatment Plant Project

1□Project Introduction
Project Overview The proposed Foshan Nanzhuang Sludge Treatment Plant project locates within the boundary of Nanzhuang WWTP, Zhen’ an WWTP, Shagang WWTP and Chengbei WWTP. The proposed treatment capacity is 240 t/d dewatered sludge with 80% water content. The goal of sludge treatment is to dewater WWTP sludge by employing sludge conditioning and frame filter press advanced dewatering techniques to achieve water content lower than 60% so as to realize reduction and hazard-free treatment of sludge from municipal WWTPs and to minimize negative impacts of sludge on the local ecological environment. Implementation of the proposed project will greatly reduce sludge treatment and disposal costs. No expensive natural gas is used as fuel and the treatment facility is quite flexible which requires less land, reduces wet sludge transportation cost and minimize potential negative impacts on environment during transportation. As a whole, the proposed project will bring great economic, environmental, social benefits and energy efficiency. **Main Pollution Sources** Construction period: industrial wastewater, C&D waste, noise, dust, etc. Operation period: domestic wastewater, wastewater to be generated by sludge filtering, washing water, odorous gas from advanced dewatering process, noise, dry sludge, solid waste and laboratory wastewater. **Main Mitigation Measures** Construction period: ① select construction machinery and process with low noise emission; ② noise insulation and control of construction at night; ③ sprinkle the sites on a regular basis, load raw materials with sealing measures to reduce dust pollution; ④ recycle and reuse treated wastewater, discharge residual wastewater into WWTP and discharge in compliance with standards.

Operation period: ① discharge wastewater into receiving water bodies after treatment in WWTPs; ② build up green areas to lessen odor nuisance due to small amount of odorous gas; ③ take insulation, vibration attenuation and noise elimination measures; ④ dispose of sludge in sanitary landfill after advanced dewatering process, transport domestic waste to local sanitation agency for treatment, entrust qualified waste treatment company to treat laboratory wastewater as hazardous waste.

2□Contact Information

PIU: oshan Water Group Company Ltd.；

Foshan Municipality Chancheng District Tongjixi Road 16 Water Supply Mansion； Contact Person□ Ms Liu□ Tel□0757-83808173

EA Agency□ Guangzhou Research Institute of Environmental Protection

Address□ **Guangzhou Municipality Tianhenan Road 24**□ Contact Person□ Ms Zhou□

Tel□020-85515283 Fax□020-87540073

2□Public Questionnaire Survey

Personal Information

Name：_____ Gender：___ Occupation：

Education：______Age：

Tel:

Impacts of proposed project □① Residence□ □ ②Work□ □ ③Neither□ □

Residence/Work location：

Question 1 Do you know about the proposed project□

Well( ) a little（ ） no( )

Question 2 What do you consider as current main environmental issues during sludge dewatering in proposed WWTPs ?

Noise( ) Air Pollution ( ) Water Pollution ( )

No idea( ) Others(please specify)

Question 3 What do you consider as main potential environmental impacts caused by the proposed project□ Construction period□ Exhausted gas( ) Noise( ) Wastewater( ) Solid waste( ) No idea( ) Others(please specify) Operation period□ Exhausted gas( ) Noise( ) Wastewater( ) Solid waste( ) No idea( ) Others(Please specify)
Question 4 How will regional environmental quality change after project completion, compared to current quality□ Better( ) No significant change( ) Worse( ) No idea( )
Question 5 What do you think of impacts on your daily life and work caused by project implementation□ Positive impacts( ) No significant impacts( ) No idea ( ) Negative impacts( ) Negative impacts□(please specify)
Question 6 Are you concerned about potential environmental issues caused by proposed project □ Construction period□ yes( ) It doesn't matter to me. ( ) no( ) No idea( ) Operation period□ yes( ) It doesn't matter to me. ( ) no( ) No idea( )
Question 7 As a whole, do you favor implementing the proposed project? yes ( ) It doesn't matter to me.□ □ no( )□ if no, please specify□
Question 8 In view of environmental protection, what are your suggestions and opinions on the project implementation□□ Attached sheets are available.□

□2□Government and Relevant Entity survey

Main contents of government and relevant entities consultation included attitudes, opinions and suggestion on the proposed project. The survey questionnaire distributed is shown in Table 11.4-2.

Table 11.4-2 Survey Questionnaire for Relevant entities within Environmental Sensitive Areas

Name of Company：________ （Seal） Date：

Contact Person：________ Tel：

Question	Comments
1. Comments on wastewater, exhausted gas, solid waste and noise emission caused by proposed project：	
2. The potential negative impacts on the environment is considered limited after implementation of corresponding environmental protection measures. In view of environmental protection, what is altitude towards proposed project：	favor ok oppose if oppose, please specify your concern： □In view of environmental protection □Others
3. Requirements and suggestions on other environmental issues	

Statistics and Analysis of Survey Results

Statistics for Information Disclosure

Duration of first round of information disclosure: from October 25th to November 8th 2010;

Duration of second round of information disclosure: from December 6th to December 21st 2010.

During information disclosure, a resident from Gaotian Village made a phone call to express their opinions on project implementation. The person thought that the project will bring sludge from WWTPs to Nanzhuang WWTP for treatment and it would pose serious negative impacts on neighboring villages.

Statistics of Public Opinions

1、Analysis of survey representation

On the principle of being universal and focusing on key points, public survey was performed after the completion of draft EA repot in form of questionnaires. The questionnaires were distributed on a selective basis to residents and related personnel in surrounding areas of proposed project, which covered Nanhai Art High School, Guihua High School, Shagang, Guabuxun, Fuxi, Aochong and Gaotian Villages.
In total, 70 questionnaires were distributed and returned with 100% return rate, 67 surveyed individuals lived or worked in sensitive receptors within 2000m of assessment area. It is required that over 70% of surveyed individuals live or work in project-affected area including areas with environmental risks. In this case, 95.7% of surveyed individuls was directly or indirectly affected by proposed project. The factors, such as occupation, education and age, were taken into account during public survey. And the surveyed samples are representative.
The surveyed units included Zhen’an, Nanzhuang, Zinan, Shagang, Guabuxun, Fuxi Village Committees and Foshan Nanhai Art High School. It is also required that over 70% of surveyed units should be located in project-affected area including areas with environmental risks. In this case, 100% of surveyed units might be affected in the assessment area.

2、Statistics on Survey Results

Specific distribution scopes and number of survey questionnaires are shown in Table 13.5-1.

Personal data on surveyed public is shown in Table 11.5-2.

Statistical results on survey questionnaires are shown in Table 11.5-2.

Table 11.5-1 Distribution of Survey Questionnaires

Location		Relative Bearing	Distance (m)	Number of Questionnaire distributed	Number of Questionnaire returned
Zhen’an	Nanhai Art High School	NW	180	5	5
	Guihua High School	N	120	3	3
	Zhen’an	W	500	7	7
	Nanhai and Chancheng			3	3
Shagang	Shagang Village	NW	690	15	15
Chengbei	Guabuxun Village	W	200	10	10
	Fuxi Village	S	450	8	8
Nanzhuang	Aochong Village	ESE	390	5	5
	Gaotian Village	NE	490	7	7
	Nanzhuang			7	7
Subtotal				70	70

As indicated in Table 11.5-1, over 70% of surveyed public was living/working within project affected areas, which met the requirement of “Notification on Printing of Implementation Opinions on Public Consultation for Environmental Management regarding Construction Project in Guangdong Province” (GDEPB 2007 No.99). The detailed information on surveyed public is shown in Table 11.5-2.

Table 11.5-**2 Personal Information of Surveyed Public**

WWTP	No.	Name	Gender	Occupation	Education	Age	Tel	Residence/Work Place
Chengbei	1	Zhou Ronghua	Male	Worker	Primary school	43	82413093	Fuxi Village
	2	Zhou Shan	Female	Worker	University	23	82834230	
	3	Lin Yujia	Male	Farmer	Secondary school	22	□	
	4	Zhou Zhuansheng	Female	Worker	Junior high school	50	82820455	
	5	Li Shuang	Female	Farmer	Junior high school	19	13543614252	
	6	Huo Xinyun	Male	Farmer	Junior high school	54	84484782	
	7	Lin Yongqian	Male	□	Junior high school	50	13702561474	
	8	Huang Xiaoxia	Female	Worker	Junior high school	43	1370256811	
	9	Liang Huandai	Female	—	—	50	85536616	Guabuxun Village
	10	Lu Weiji	Male	Security guard	Primary school	62	15302869853	
	11	Yang Yiping	Female	—	—	—	13794005273	
	12	Ye Zhenhua	Male	—	—	—	13927739426	
	13	Fan Botian	Male	Worker	Junior high school	39	—	
	14	Ye Qiucun	Male	Worker	Junior high school	28	13923200773	
	15	Zhou Zhulin	Male	—	Senior high school	35	—	
	16	Yang Bingjing	Male	—	—	—	13902813394	
	17	Ye Zhihui	Male	—	—	—	85566337	
	18	Xu Hongxia	Female	—	—	—	13679878668	
Zhen'an	1	He Zhaocui	Female	□	□	40	13802633166	Zhen'an Village
	2	Chen Ruinan	Male	laborer	Junior high school	65	13600301307	
	3	Liang Qiong	Female	□	□	40	13727341153	
	4	Chen Yuhui	Male	Worker	□	40	13923141416	
	5	Yang Zhihong	Male	laborer	Senior high school	50	13702553792	
	6	Lu Rungen	Male	□	College	40	13923110433	
	7	He Lankang	Male	laborer	College	35	13695177555	
	8	Liu Guangwen	Female	Teacher	University		86221112	Nanhai Art High School
	9	Lu Xiaolin	Female	Teacher	University	42	18923151946	

WWTP	No.	Name	Gender	Occupation	Education	Age	Tel	Residence/Work Place
	10	Chen Zhongping	Male	Student	Secondary school	20	—	
	11	Chen Yahong	Female	Student	Secondary school	18	—	
	12	Huang Weishao	Male	Student	Secondary school	19	—	
	13	Yongquan	Male	Teacher	□		86329295	
	14	Wu Yihua	Male	Student	High school	17	—	Guihua High School
	15	Luo Zhiwei	Male	Student	High school	17	—	
	16	Liang Zhiyun	Female	Employee	Bachelor	29		Guicheng Nanxing’er Road Yulan Village
	17	Lu Riming	Male	Technician	Master	30	1376060633	Chancheng District Guicheng
	18	Wu Yaoguang	Male	Technician	Bachelor	30	—	Chancheng District

WWTP	No.	Name	Gender	Occupation	Education	Age	Tel	Residence/Work Place
Shagang	1	Liang Zhuosong	Male	—	Senior high school	53	13923149832	Lanshixi District
	2	Mo Manjiang	Male	Driver	Senior high school	34	13622711713	water conservation agency of Shiwan Community
	3	Liang Chengjian	Male	Driver	Bachelor	27	13827766839	Power station of Shagang
	4	Liang Ruiguang	Male	—	—	26	13889922008	Shiwan Shagang
	5	Zhang Hui	Male	Farmer	Primary school	57	13006720968	Power station of Shagang
	6	He Yanshan	Female	□	Junior high school	36	13420603663	Shiwan Shagang
	7	Li Binghuang	Male	—	Secondary school	26	13929991951	
	8	Mr Zhong	Male	Driver	□		13827772746	
	9	Zhou Pingchu	Male	Security	Junior high school	47	13528903337	
	10	Mr Chen	Male	—	—	32	—	
	11	Guan Chengqi	Male	—	Junior high school	30	13798697189	
	12	Mrs Li	Female	—	—	—	13420651390	
	13	Mrs Wen	Female	—	—	—	23690626553	
	14	Li Yunxin	Male	laborer	Senior high school	44	15813419919	

WWTP	No.	Name	Gender	Occupation	Education	Age	Tel	Residence/Work Place
	15	Zhang Nuo	Male	laborer	Secondary school	22	—	
Nanzhuang	1	Liao Xueyi	Male	—	Junior high school	27	82074210	Aochong Village
	2	Xie Xiaoqun	Female	Farmer	—	50	—	
	3	Mr Luo	Male	Farmer	Junior high school	65	—	
	4	Mr Luo	Male	Farmer	Junior high school	60	13809702237	
	5	Mrs Luo	Female	—	—	36	—	
	6	Mr Luo	Male	Accountant	College	33	85332227	Nanzhuang Village Commission
	7	Mr Luo	Male	Accountant	College	35	85332227	Nanzhuang Zitong Road 100
	8	Mr Liang	Male	Worker	Junior high school	45	□	Gaotian Village
	9	Lan Yinghuang	Male	Worker	Junior high school	30	□	
	10	Cui Wenxiang	Male	laborer	Junior high school	43	13528903337	
	11	Huang Xiaolan	Female	laborer	□	45	85325835	
	12	Xiang Xinlian	Female	□	College	32	□	
	13	Pan Sheng	Male	Farmer	Senior high school	45	□	
	14	Mrs Lu	Female	farmer	□	□	□	
	15	Luo Huanying	Female	Civil servant	Bachelor	25	85332218	Nanzhuang
	16	Mrs Feng	Female	□	□	50	85315285	
	17	Fu Linglin	Male	□	College	24	1502424730	
	18	He Changping	Male	resident	Junior high school	40	15918130986	
	19	Mr. Jin	Male	□	□	□	13542643573	

2□Statistics of Questionnaire return rate

70 questionnaires were distributed and returned which amounted to return rate of 100%. The details are shown in Table 11.5-3.

Table 11.5-**3 Statistical Result of Public Survey**

No.	Question	Answer	Subtotal	Percent□□
1	Question 1	know well	27	39
		know a little	33	47
		no idea	10	14

No.	Question	Answer		Subtotal	Percent□□
2	Question 2	Noise		20	29
		Air pollution		36	51
		Water pollution		8	11
		No idea		12	17
		Other		0	0
3	Question 3	Construction Period	Exhausted gas	23	33
			Noise	40	57
			Wastewater	10	14
			Solid waste	5	7
			No idea	5	7
		Operation period	Exhausted gas	48	69
			Noise	12	17
			Wastewater	12	17
			Solid waste	7	10
			No idea	2	3
4	Question 4	Better		41	59
		No significant changes		18	26
		Worse		8	11
		No idea		2	3
5	Question 5	Positive impacts		21	30
		No significant impacts		46	66
		No idea		2	3
		Negative impacts		1	1
6	Question 6	Construction period	Concerned	22	31
			It does not matter	10	14
			No concern	23	33
			No idea	6	9
		Operation period	Concerned	15	21
			It does not matter	12	17
			No concern	36	57
			No idea	3	4
7	Question 7	favor		61	88
		It does not matter		7	10

No.	Question	Answer	Subtotal	Percent□□
		Oppose	1	1
		Other	1	1
8	Question 8	They hoped that they would see blue sky, green water an natural oxygen bar.		

3□Analysis of survey results

□1□Do you know about the proposed project□

39% of surveyed public knew about proposed project well, 47% knew a little and 14% did not know. The PIU should enhance the propaganda to improve public knowledge of the project.

□2□What do you consider as current main environmental issues during sludge dewatering in proposed WWTPs?

Over 50% of surveyed public considered air pollution as current main environmental issue during sludge dewatering in proposed WWTPs. Most public thought odor was main environmental issue in proposed WWTPs.

□3□What do you consider as main potential environmental impacts caused by the proposed project□

Construction period: 57%of surveyed public considered noise as main potential environmental impact and most public were concerned about noise during construction.

Operation period: 69% of surveyed public considered air pollution as main potential environmental impact, and most public thought that unpleasant odor would be generated from proposed WWTPs.

□4□How will regional environmental quality change after project completion, compared to current quality□

59 % of surveyed public thought that the environmental quality would be better, 26% thought that no significant changes would be found and 11% thought that it would be worse than current situation. As a matter of fact, the odor from WWTPs can be mitigated if all of pollution prevention and control measures are well implementation.

（5）What do you think of impacts on your daily life and work caused by project implementation？

30% of surveyed public thought proposed project would bring positive impacts, 66% thought proposed project would bring negative impacts and 3% had no idea. Most public thought that the proposed project would not pose significant impacts on their own life and work.

（6）Are you concerned about potential environmental issues caused by proposed project？

Construction period: 33% of surveyed public were not concerned about environmental issues caused by proposed project, 14% thought it would not matter to them and 31% showed their concerns.

Operation period: 57% of surveyed public were not concerned about environmental issues caused by proposed project, 17% thought it would not matter to them and 21% showed their concerns.

（7）As a whole, do you favor implementing the proposed project?

88% of surveyed public favored project implementation, 10% thought it would not matter to them; one person did not express his opinion and one person opposed project implementation, he did not favor the construction of Nanzhuang WWTP close to the village.

Meanwhile, during information disclosure, a resident from Gaotian Village made a phone call to express their opinions on project implementation. The person thought that the project will bring sludge from WWTPs to Nanzhuang WWTP for treatment and it would pose serious negative impacts on neighboring villages.

（8）In view of environmental protection, what are your suggestions and opinions on the project implementation？

The public hoped that they could see blue sky and green water after implementation of pollution prevention and control measures.

（9）Survey on impacts of existing wastewater treatment facilities

In addition, the surveyed public explained the environmental issues for existing WWTPs, which included odor nuisance to Guihua High School close to Zhen'an

WWTP, especially some impacts on the school when south wind is prevailing. Except Zhen’an WWTP, no specific comments were made on sensitive receptors due to operation of existing facilities of other three WWTPs.

Statistics of Survey on Relevant Entities

The survey involved 19 entities including Zhen’an, Nanzhuang, Zinan and Shagang, Guabuxun and Fuxi Village Commissions and Foshan Nanhai District Art High School. Among those, Zhen’an Village Commission refused to express their opinions and Zinan Village Commission could not fill out the questionnaire without approval from government agencies in charge. The rest 17 entities filled in the questionnaire, as detailed in Table 11.5-1.

Table 11.5-**1 Distribution of Survey Questionnaire to Neighboring Entities**

No.	Name of Entities	Contact Person	Tel
1	Xiebian and Guabuxun Village Commission of Dali Town, Nanhai District	Yang Xi’en	13802633809
2	Fuxi Village Commission of Zumiao Community, Chancheng District	Zhou Runqiang	82832537
3	Nanzhuang Village Commission	Luo Lixian	85332329
4	Nanhai Art High School of Foshan Municipality (Nanhai Normal School)	Liu Guangwen	86221112
5	Shagang Village Commission	Zhang Ruchao	13702913165
6	Guihua High School	Liang Yongquan	13728551197
7	Foshan Huabiao Ceramics Co.,Ltd	Pan Xulong	13690186779
8	Foshan Chancheng District Deyi Ceramics Wholesale Department	Wu Jinqi	13929963359
9	Foshan Chancheng District Faquan Ceramics Wholesale Department	Li Senzhi	13528982877
10	Foshan Chancheng District Transport Department	Xiao Haifeng	13798667802
11	Foshan Xinjie Transport Department	Liao Dingquan	89913628
12	Foshan Zhanhua Logistics Center	Feng Zhixiao	13929998580
13	Foshan Changtong Transport Department	Mao Guanghui	13539333888
14	Foshan Chancheng District Zhihong Hardware Plant	Chen Yuhui	13923141416

No.	Name of Entities	Contact Person	Tel
15	Foshan Chancheng District Chuangyite Printwork	He Lankang	13695177555
16	Foshan Chancheng District Guicheng Tianjia Electromechanical Installation Department	Zhou Rushu	13902813371
17	Foshan Chancheng District Shengdalong Hardware Machinery	Mr Liang	13702927907

The main opinions of the 17 entities included ①implementation of environmental protection measures to ensure discharge compliance and limited impacts on surrounding environment during operation;② enforcement of the national discharge standards；③ Unpleasant odor would be generated from Zhen’an WWTP, which could pose negative impacts on neighboring schools, especially when south wind was prevailing.

As for project implementation, one entity, namely Guihua High School, expressed disagreement; 6 entities favored with preconditions, including Fuxi Village Commission, Foshan Nanhai District Art High School, Foshan Chancheng District Transport Department, Foshan Xinjie Transport Department, Foshan Zhanhua Logistics Center and Foshan Changtong Transport Department. And the rest 10 surveyed entities expressed their agreement. In summary, 94.1% of surveyed entities favored project implementation.

The other suggestions and opinions on environmental protection regarding proposed project are summarized as follows.

□It is suggested that the project could take into account protection of the surrounding environment, prepare emergency response measures. Environmental protection should be set as priority;

② Exhausted gas emission should be reduced as much as possible and noise should be avoided at school time;

③Pollution should be strictly prevented and controlled.

Feedbacks from the Public

During public consultation, one person surveyed and Guihua High School opposed project implementation. Meanwhile, during EIA information disclosure, objection of one villager from Gaotian Village was received. After further communication, the EA agency learned about the main reasons of those objections as listed below.

（1）The villager from Gaotian Village opposed construction of Nanzhuang WWTP close to the Gaotian Village;

（2）The other villager from Gaotian Village who made a phone call thought that treatment of sludge from other WWTPs at Nanzhuang would bring serious negative on the surrounding villages.

（3）The contact person of Guihua High School expressed that unpleasant odor would be generated when south wind was prevailing, which could pose negative impacts caused by Zhen’an WWTP on the school.

In response to aforesaid objections, the EA agency made explanations to the villagers from Gaotian Village and communicated with Guihua High School and the villager. The explanations and responses were as follows.

①The proposed project content was not construction of WWTP but construction of advanced sludge dewatering facility. Therefore, it was suggested that the villagers give opinions and suggestion on the advanced sludge dewatering facility.

② The proposed sludge treatment plant project would be constructed in Shagang, Zhen’an, Chengbei and Nanzhuang Villages simultaneously. The sludge from WWTPs would not be transported to and treated in Nanzhuang.

③ During operation there would be no significant change in the total load of air pollutants, such as ammonia and hydrogen sulfide, from proposed dewatering workshops and would eventually be reduced. Meanwhile, as for odor from Zhen’an WWTP, the odor control measures in the WWTP were taken by the PIU, which included sealing of on-site odor sources, namely all types of tanks, installation of biological deodorization unit on those equipment and facilities, and setup of green areas to lessen the odor to be generated from WWTPs.

After communication and explanation, two villagers with objections still opposed construction of Nanzhuang WWTP and doubted that sludge from other WWTPs would be transported to Nanzhuang for treatment. The contact person of Guihua High School thought that the deodorization measures for Zhen’an WWTP had not been taken yet. They still disagreed prior to the implementation of those measures.

The aforesaid objections mainly focused on construction of WWTPs instead of project implementation. The EA agency had explained to the public. Therefore, those objections were not acceptable.

In the chapter related to environmental impacts of this EA report, calculation and analysis on impact on ambient air before / after implementation of deodorization project of Zhen’an WWPT were performed. As indicated by calculation, under most unfavourable meteorological condition, maximum ground concentrations of H2S and NH4 at sensitive receptors would greatly decrease, compared to current ones.

After addition with impacts caused by sludge dewatering project, concentration percentage compared to standard of maximum ground concentration of H2S was 4.85% and that of NH4 was 8%. And maximum ground concentrations of H2S and NH4 could meet the requirements of relevant assessment standards.

To dispel these concerns and worries about proposed project implementation, the PIU should enhance project propaganda and explanation to improve the public understanding of proposed project. At the same time, environmental protection should be set as priority during construction and operation and all of pollution prevention and control measures should be strictly implemented to gain the public support.

Meanwhile, the PIU expressed that implementation of odor control measures for Zhen’an WWTP would be accelerated. And after construction the PIU would make visits to pollution receptors, e.g. Guihua High School to know about efficiency of odor control on a timely basis so as to gain long-term support from the public.

Conclusion of Public Consultation

In conclusion, most public showed their agreement for the proposed project in existing sites. Meanwhile, some affected persons showed worries about potential environmental impacts caused by project implementation, expressed their concerns about the nearby environment quality and their own vital interests and also strong environmental awareness to which attention should be paid by the PIU.

To dispel the public misgivings, PIU should enhance project introduction and propaganda and also improve public knowledge and understanding of project implementation. At the meantime, environmental protection should be considered as key issue by the PIU during construction and operation. The PIU should strictly implement pollution prevention and control measures to gain public supports

Cleaner Production and Total Load Control

Analysis of Cleaner Production

Cleaner production is referred to as environmental protection initiative throughout production procedure and product life cycle. As for production procedure, cleaner production includes saving of raw materials and energy, elimination of toxic and hazardous raw material and minimization of waste and emissions and reduction of their toxicity prior to discharge. As for products, it is intended to minimize impacts on human beings and environment throughout life cycle, namely from raw material extraction to product disposal.

During cleaner production it is required to update design, use clean energy and raw materials, employ advanced technologies and devices, improve management and comprehensive use so as to prevent pollution through source reduction strategy, improve resources utilization efficiency, reduce or avoid pollution generation and discharge during production, procurement and consumption.

The comprehensive environmental protection strategies are applied to production procedure and products, which mitigates or eliminate hazard to human health and environment.

Production Process

（1）Sludge Dewatering

During operation, sludge conditioning with surfactants, dehydrants and flocculants will improve sludge dewatering performance and biological activity. And afterwards the sludge will be transported to the frame filter press though sludge pumps for advanced dewatering. After advanced dewatering, the water content of sludge from WWTPs can reach lower than 60% which is much higher than that of traditional machinery dewatering. Therefore, advanced dewatering can replace multi-stage sludge dewatering, which greatly decrease sludge treatment and disposal fees. The dose of chemicals is approximately 3‰, which will not influence the sludge weight. During advanced dewatering, no expensive natural gas is used as fuel and on-site sludge treatment also decreases delivery expenses for wet sludge and lessen potential negative impacts on environment during transportation. As a whole, the proposed project will bring great economic, environmental, social benefits and energy efficiency.

As long-term difficult problem for technicians, viscous phase is the key point for breakthrough of sludge dewatering. The advanced sludge dewatering has solved the viscous phase issue and is considered as a significant breakthrough in WWTP sludge dewatering technology.

As analyzed above, considering the sludge characters, sanitary landfilling of treated WWTP sludge together with municipal waste is identified as final sludge disposal alternative. The proposed sludge treatment will be compliant with relevant standards regarding sludge landfilling.

At present, the two common sludge treatment alternatives are advanced dewatering and thermal drying

Table 12.1**-1 Comparison of Advanced Dewatering and Thermal Drying**

Process / Parameter	Advanced Dewatering	Thermal Drying
Investment	low	high
Operation expenses	low	high
Facility	National facility	Main devices are imported
Operation	Easy	Relatively complicated
Water content	60%	20%
Secondary pollution	Light	Serious

As indicated in Table 12.1-1, thermal drying can minimize water content of sludge, which decreases subsequent disposal costs. However, compared to advanced dewatering, the incineration cost and investment for thermal drying are relatively higher with larger coverage of environmental impacts. The advanced dewatering can greatly reduce water content of sludge with lower investment and operation expenses as well as smaller coverage of environmental impacts. Therefore, advanced dewatering is preferable.

□2□Sludge transportation

The following measures will be taken during sludge transportation□

① Use sealed vehicles to transport sludge cake to lessen odor nuisance during transportation in an efficient way and avoid material scattering；

② Clean the wheels and car bodies after loading and prior to setting off;

③ Equip the sludge vehicles with real time monitoring system;

④ Check the tightness of vehicle prior to loading to ensure that neither spill nor leak will happen during transportation;

④ Label the sludge vehicles with remarkable safety signs;

⑤ Stipulate delivery route and avoid the transport in pollution receptors, e.g. source water protection zones; Alteration as one pleases is forbidden；

 Equip the vehicles with water-proof cover; Stop the falling sludge with heavy metal and organics together with storm water from discharging into water bodies on a timely basis.

The implementation of aforesaid measures can avoid spill and leak during collection and transportation which will mitigate negative impacts on the environment during collection and transportation.

In summary, the proposed mitigation measures during sludge transportation are environmentally sound.

Dewatering Devices

The frame filter press selected for proposed project is flexible enough to operate in limited spaces in proposed project sites, which can save construction areas. Meanwhile, compared to common frame filter press, the filter press has the following advantages.

The feeding system will be equipped with spiral distributors, which improves sludge distribution, thickness of sludge cake as well as water content.

 Raised granular filter bed can improve sludge dynamics and homogeneity which avoid cracking due to pressure increase and greatly improve the pressure on the filter press;

 Filter fabrics with taper filtration pores can greatly reduce the resistance of filter media and improve the hydrophobicity of filter fabrics;

□ During dewatering through the frame filter press, the pressure is increasing at an interval of 2 bars, which reduces the resistance during formation of sludge cake and greatly improve the dewatering ability of frame filter press.

The dewatering applied in proposed project can produce sludge with water content lower than 60%, which reaches sludge reduction, stability and hazard-free. The sludge treatment system from feeding to outlet of filter press is constantly closed. Compared to other types of sludge treatment systems, this system has better performance, in terms of energy saving, automation and safety, as detailed in Table 12.1-2.

Table 12.1-**2 Comparison of Different Types of Sludge Dewatering Systems**

Dewatering Devices	Traditional Filter press			Dewatering Device applied for this project
	frame filter press	belt filter press	centrifugal dehydrator	
Water content□	75□80	75□83	75□80	Lower than 60
treatment capacity□t□	60□75	60□88	60□75	Lower than 33
Consumption□kwh/t DS□	5□15	5□20	30□60	6□15
Ratio for Chemicals Expenses	1	1	0.7	0.7
Use of Wash Water	Medium	Large	Small	Small
Site Conditions	Ordinary (Odor generation during unloading)	Poor (Odor nuisance)	Good (closed)	Good (no odor from sludge cake)
Scaling	Available	Not available	Not available	Available
Automation	Ordinary	Ordinary	Good	Good
Safety	Ordinary	Poor	Ordinary	Good
Maintenance Charges	Medium	High	High	Medium

As indicated in Table 12.1-2, the advanced frame filter press has lower power consumption and larger amount of washing water, compared to conventional filter press. The power consumption of advanced frame filter press ranges from 6 to 15 kwh/t DS, which is approximately 75% of that of centrifugal dehydrator. The chemical dose and amount of wash water is almost same as that of centrifugal dehydrator. And maintenance charges of advanced frame filter press are the lowest among dewatering devices.

In summary, the advanced frame filter press for proposed project have high performance in water and energy saving.

Pollution Prevention and Control Measures

The main sludge treatment process includes sludge conditioning and mechanical dewatering.

The sludge from stores from WWTPs will be delivered to closed conditioning tank through ducts. And afterwards the sludge will be delivered to dewatering workshop. The entire process takes place in a closed condition so as to avoid liquid and gas leaks.

After being conditioned and dewatered, the treated sludge has good performance in stability, which includes:

① volume decrease of 50%;

② loss of organics □3□□

③ heat loss □5□□

④ increase in solid content＜ 3‰□

Correspondingly, the odor emissions to be generated from sludge cake will decrease after sludge dewatering.

In addition, biological deodorants were applied in existing dewatering workshop to decrease odor concentration. After implementation of advanced dewatering, biological deodorants will still be fed to decrease odor concentration.

Meanwhile, sealing measures will be implemented during sludge transportation to avoid spillage and leakage and transportation time will be stipulated in a proper way to avoid rush hour during operation. Random inspection of sludge vehicles will be carried out to ensure the tightness and operation performance of these vehicles.

Comparison and Analysis of Cleaner Production

The comparisons of operation of existing sludge dewatering systems in proposed WWTPs and operation after project implementation are shown in Table 12.1-3.

Table 12.1-**3 Comparisons of Sludge Dewatering Systems**

Item	Zhen'an WWTP	Shagang WWTP	Chengbei WWTP	Nanzhuang WWTP	System after reconstruction
Existing sludge treatment process	Phase 1: Belt thickening and dewatering system Phase 2 and 3: Centrifugal thickening and dewatering complex	Centrifugal thickening and dewatering complex	Belt thickening and dewatering system	Centrifugal thickening and dewatering complex	Automatic frame filter press
Water content of sludge	75%-80%	78%-80%	78%-80%	78%-80%	<60％
Sludge generation m^3/d	150	57	120	15	Volume decrease 55％
Cost for sludge dewatering	200	200	200	200	160
Odor control	Poor (exposures to the air, strong unpleasant odor)	Ordinary (closed conditions)	Poor (exposures to the air, strong unpleasant odor)	Ordinary (closed conditions)	Good (no odor to be generated from sludge cake)
Character of sludge	Sand-shaped, leachate generation with odor after long time retention	Sand-like, leachate generation with odor after long time retention	Sand-like, leachate generation with odor after long time retention	Sand-like, leachate generation with odor after long time retention	Cake-shaped, neither leachate nor odor

Note: Cost for sludge dewatering□power consumption □ water consumption□chemical expenses□ maintenance charges

As indicated in Table 12.1-3, water content of treated sludge will significantly decrease after implementation of reconstruction of proposed sludge dewatering system. And odor from dewatering workshop will be controlled in a proper way. The cost for sludge will decrease CNY 40/t.

In addition, concerning sludge disposal, the water content lower than 60% will be advantageous. If the treated sludge is used for composting, the fermentation period will be halved. And the treated sludge can be fed into incinerators without further treatment in case of incineration.

The advanced dewatering technology by sludge frame filter press was applied in Shunde Lunjiao Municipal WWTP with a capacity of 30000t/d, Panyu Doyong Printing and Dyeing WWTP with a capacity of 30000t/d and Guangzhou Dashadi Municipal WWTP with a capacity of 0.2 million t/d in June 2009, respectively. After operation for 3-8 months, treatment and disposal efficiencies were proved to be good and completely met the expected requirements.

Among those applications, the Dashadi WWTP Sludge Treatment and Disposal Project was completed on October 9^{th} 2009 in Guangzhou Dashadi WWTP. The treatment capacity of Dashadi WWTP (phase 1) was 0.2 million t/d. To meet the requirements of sludge treatment in Dashadi WWTP, automatic frame filter press with a capacity of 150 t sludge (counted as water content of 80%) was constructed. The construction of new sludge treatment facility in Dashadi WWTP ensured productivity as well as sludge treatment capacity, which realized pollution sources prevention, reduction of carbon emission and energy saving. The odor concentration after advanced dewatering treatment was approximately 3, which is generally acceptable. The dewatered sludge was stabilized in hardness. The COD concentration in leachate was approximately 250mg/L, which can be treated by WWTP with no subsequent influence on the wastewater treatment process. The personnel arrangement was determined to be 5 persons/shift, which indicates high level of automation.

Hence, after implementation of advanced sludge dewatering project in Zhen’an, Shagang, Chengbei and Nanzhuang WWTPs, the WWTP concerned can realize energy saving and discharge reduction. Besides, the project implementation will contribute to regional sludge reduction, stabilization and hazard-free treatment, which can improve regional sludge treatment ability.

Suggestions

To ensure the implementation of cleaner production, it is suggested that complete environmental protection and health safety management systems should be established, such as ISO14000 Environmental Management System and EHS Management System and Cleaner Production Audit.

Conclusions on Cleaner Production

The proposed sludge dewatering through frame filter press will realize sludge reduction, stabilization and hazard-free treatment, which is one of cleaner production projects with energy saving and discharge reduction.

Besides, no leachate will be generated with low odor concentration after formation of sludge cakes, which can control secondary pollution in an efficient way.

To ensure the implementation of cleaner production, it is suggested that complete environmental protection and health safety management systems should be established, such as ISO14000 Environmental Management System and EHS Management System and Cleaner Production Audit.

Total Load Control of Pollution Discharge

According to “Notification on Implementation of Pre-approval of total Discharge Amount of Key Pollutants for Construction Project” (GZEPB No. [2008]69), attention should be paid to requirements of cleaner production together with discharge compliance and requirements of relevant codes. Based upon technical and economic feasibility justifications for environmental protection measures, Total Load control target for pollutants discharge caused by proposed project should be specified in connection with regional Total Load control of pollutants discharge in a rational way. The effluents to be generated will be treated by municipal WWTP and the exhausted gas emissions from proposed project sites will be generally the same as those before project implementation. Therefore, there will be no distinct changes in discharge and emissions from WWTPs concerned after project implementation. No extra discharge/emission quota is required from the regional target.

Analysis of Economic Benefits

Analysis of Project-related Direct Economic Benefits

(1)Analysis of key parameters for economic benefits

The total investment for proposed project is CNY 81.55 million. The average operation revenue after project implementation is estimated to be CNY 33.73 million and total profits is estimated to be CNY 7.64 million per year. The key indicators for economic benefits are detailed in Table 13.1-1.

Table 13.1-**1 Key Indicators for Economic Benefits after Project Implementation**

No	Item	Unit	Indicator
1	Total project investment	CNY 10000	8155
2	Annual operation revenue		3373
3	Annual operation tax and added values		0
4	Annual Value Added Tax (VAT)		0
5	Annual total profits		764
6	Annual income tax		191
7	Annual after-tax profits		573
8	Payback period	year	9.74
9	financial internal rate of return (FIRR)	%	10.87
10	Breakeven point	%	60

(2)Comprehensive evaluation

As one of public utility projects, the proposed project requires a certain amount of investment during construction and operation. As indicated in Table 13.1-1, total profits is estimated to be CNY 7.64 million per year with profit rate o 9.37%, following the principles of breakeven with meager profits. The results also indicate that the FIRR is estimated to be 10.87%, which is higher than sector-based discount rate (4%). And the payback period is estimated to be 9.74 years, which is shorter than sector-based value (18 years). Therefore, the proposed project is economically sound. In general, the project implementation will bring many economic benefits.

Analysis of Project-related Indirect Economic Benefits

In addition to economic benefits above, the proposed project with advanced dewatering will bring indirect economic benefits, including energy saving and decrease of economic losses caused by sludge pollution.

(1) Energy saving

Multi-stage treatment of sludge is required to reach water content lower than 60% for further landfilling or reuse as construction material as water content after thickening and dewatering is approximately 80% in common WWTPs. The advanced dewatering processes applied for proposed project can reach water content lower than 60% at one step, which saves a large amount of energy for drying.

(2) Saving of sludge treatment fees

At present, sludge treatment fee is approximately CNY 200/t. After advanced dewatering process, the sludge amount will decrease from 87600t/a to 43800t/a with reduction rate of 50%, which can save CNY10.74 million/a.

(3) Land appreciation

The proposed project will solve the problem of municipal sludge treatment, which prolongs the service life of landfill sites, upgrade use value of municipal land and avoid secondary pollution. Therefore, the proposed project will improve investment climate and attract investment of foreign fund.

Hence the project implementation will bring enormous indirect economic benefits.

Analysis of Social Benefits

The proposed project is not only a public utility project but also an environmental protection project. The project implementation can solve the problem of municipal sludge treatment and disposal in Foshan Municipality, which will reconstruct and improve sludge treatment system in WWTPs of Foshan Municipality. The project implementation will realize reduction, stabilization and hazard-free treatment of sludge, which can greatly mitigate environmental pollution and improve public living conditions, control and prevent all types of epidemics and public hazard, improve public health and facilitate sustainable development of municipal economy.

Investment for Environmental Protection

The proposed project is an environmental protection project which is related to pollution prevention. The investment for environmental protection is CNY5.91 million, which is 5.9 % of total investment (CNY 100.90 million). The details are shown in Table 13.4-1.

Table 13.4-**1 List of Environmental Investment after Project Construction**

Environmental Protection Facility		Investment (CNY 10,000)
Sludge testing device		250
Prevention and control of wastewater pollution	Waste collection facility and ducts	261
Exhausted gas treatment	Biological deodorant spraying facility	20
Noise control facility	vibration damping and noise insulation devices	40
Subtotal		571
Percentage on total investment		

Cost Benefit Analysis of the Project Environmental Impacts

During project construction and operation, environmental impacts such as generation of air and water pollutants, noise and solid waste will affect local environmental quality in some degrees. However, after environmental protection investment is paid, the project implementation will not pose distinct adverse impacts on local environment if environmental management is enhanced to strictly control all parameters related to environmental impacts in an effective way.

Environmental benefits are the most significant benefits during and after project implementation, which include the following aspects.

The advanced dewatering technology employed in proposed project will realize water content lower than 60% at one phase, which can reduce the difficulties in subsequent treatment and disposal as well as disposal cost. No additional heat is required, which can reduce energy consumption for sludge drying and also land use due to sludge landfilling.

Meanwhile, the project implementation will facilitate the mitigation of sludge pollution in Chancheng District of Foshan Municipality.

The proposed project is an environmental protection project which will follow the principles of reduction, stabilization and hazard-free treatment, and wastewater, exhausted gas, noise and solid waste during project operation will be treated in compliance with relevant environmental protection standards. However, it is still possible to generate secondary pollution, which will bring a certain adverse impacts on the surrounding environment and life of local residents.

（1）Wastewater

Main types of wastewater to be generated include domestic waste, washing water from laboratory and wastewater to be generated from advanced dewatering process. The wastewater from WWTPs concerned will be treated through existing on-site biological and chemical processes prior to being discharged in compliance with relevant discharge standards.

As described in Chapter 2, the increase of COD is estimated to be 3.18 tons/a and the increase of NH_3-N is estimated to be 1.26 tons/a after project completion, compared to existing situation.

The environmental losses due to pollutants discharge can be measured by codes of discharge fees. According to the 8th Term of “Management Methods for Levying and Use of Discharge Fees in Guangzhou Province” No.116 Document issued by Guangdong Provincial Government, which came into effect on August 1st 2007, the discharge fees shall be levied according to national “Levy Standard and Calculation Methods for Discharge Fees”..

According to “Levy Standard and Calculation Methods for Discharge Fees”, levying of discharge fees depends on types and amount of pollutants discharged, which is CNY0.7 every pollution equivalent. The calculation of discharge fees for water pollutants is as follows.

Calculation of pollution equivalent of water pollutants:

Pollution equivalent of one type of pollutant□pollutant discharge□kg□/pollution equivalent weight of this pollutant□kg□

Calculation of discharge fees:

Levying of exhausted gas emission□CNY0.7× sum of the pollution equivalents of 3 types of pollutants

□The number of pollutant types are ranked depending on pollution equivalents, and can not exceed 3.□

13.5-1□

The pollution equivalents of all types of pollutants are shown in 13.5-1.

Table 13.5-**1 Pollution Equivalents of Water Pollutants to be discharged in this Project**

Pollutant	Discharge□t/a)	Pollution Equivalent Weight□Kg□	Pollution Equivalent
COD	3.18	1	3180
NH_3-N	1.26	0.8	1575

Correspondingly, the annual economic loss due to water pollution during operation is calculated as follows:

Economic loss due to water pollution = Wastewater discharge fees

=0.7×(3180+1575)=3328.5 RMB

Hence, the economic loss due to water pollution is CNY3328.5/a.

□2□Exhausted gas

The main impact on air quality caused by proposed project is odor to be generated during sludge dewatering. Based upon information provided by the PIU, sludge conditioning during project operation can decrease odor emissions. Meanwhile, water content and volume will decrease after dewatering, which leads to decrease of odorous gas. In addition, biological deodorant was sprayed in existing dewatering workshop of WWTPs to decrease odor concentration. As a result of site visit, the odor intensity in existing dewatering workshop was 3 which is similar to that of proposed project.

Therefore, it is projected to be no distinct changes in odor emissions from dewatering workshop of WWTPs after project implementation which will cause no economic losses due to exhausted gas pollution.

（3）Noise

Main potential sources of noise nuisance for proposed project include sludge and water pumps, fan, air compressor, sludge dewatering devices, conveying facility and vehicles. The intensity of noise sources ranges from 70 to 95 dB(A). The main devices will be placed at sludge dewatering workshops and pump houses, which will be similar to the current situation. Therefore, there will be no distinct changes in noise intensity after project implementation.

（4）Solid Waste

After advanced dewatering, the treated sludge with water content of 60% will form solid sludge cake, which is proposed to be transported by closed vehicles to reduce odor generation and avoid material spilling during transportation. After project completion, the sludge generation will decrease from 87600 tons/a to 43800 tons/a, which is approximately 50% of sludge volume.

The project implementation will bring a certain adverse impacts on the local environment. However, these impacts can be lessened to an acceptable level after implementation of corresponding pollution prevention and control measures. Comparably, the economic losses due to negative environmental impacts will be far less than economic and social benefits after project implementation, that is, the project implementation will bring economic benefits due to positive environmental impacts.

Conclusions

The analysis results indicate that the economic and social benefits will be far more than economic losses due to environmental impacts during project operation. The project implementation can facilitate sustainable development of both environment and economy in some degrees. Therefore, the project implementation is feasible.

Environmental Management and Environmental Monitoring Plan(EMP)

Objectives

As shown in EIA results, the project will have a certain impact on environment during the construction and operation period. The EMP will specify environmental mitigation measure, environmental management, supervision and monitoring. The EMP will be used as operation manual for the activities above, which includes:

(1) operation manual for environmental protection. After being reviewed by World Bank, this version of EMP will be used as operation manual regarding environmental protection to be distributed to construction supervision entity, environmental monitoring agency and other relevant entities during construction and operation.

(2) identification of responsibilities and rules of relevant entities. The responsibilities and rules of relevant authorities and management agencies will be specified. And communication channels and methods for all parties concerned will be identified.

(3) identification of environmental mitigation measures and environmental monitoring plan during construction and operation.

Organizational Framework

Organizational Framework for Environmental Management Institutions

The organization framework for environmental management institutions during project construction and operation is shown in Figure 14.2-1 and Figure 14.2-2.

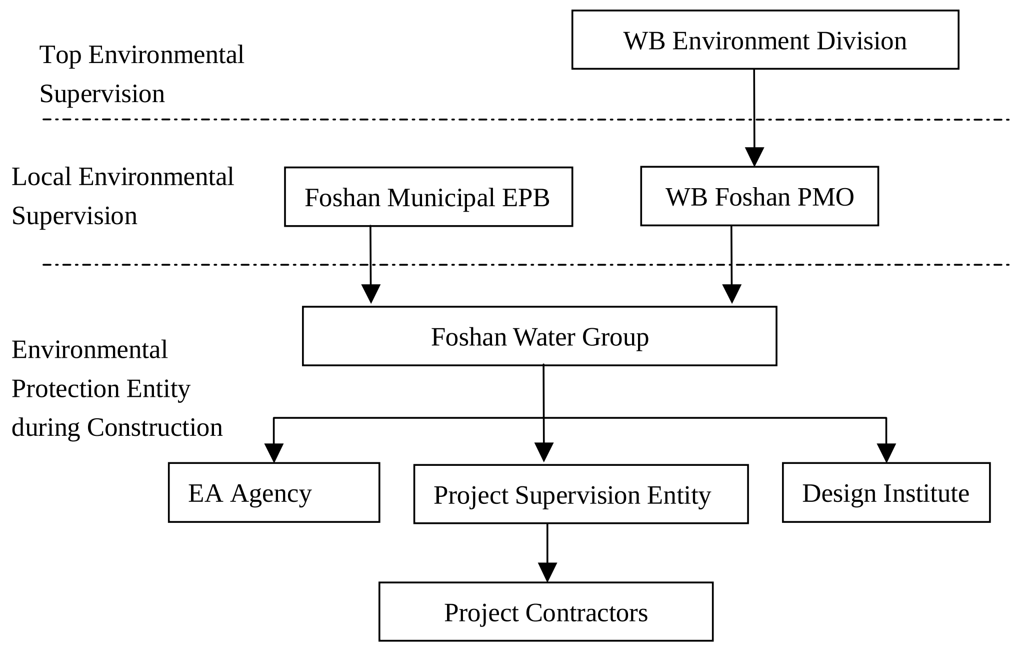


Figure 14.2-1 Organizational Framework for Environmental Management during Construction

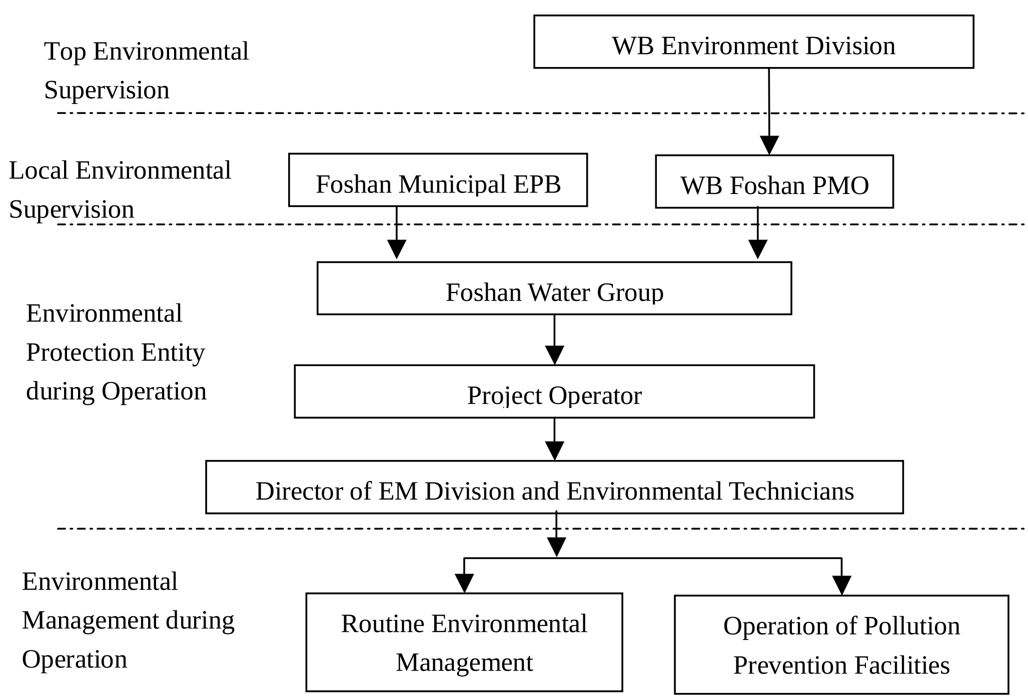


Figure 14.2-2 Organizational Framework for Environmental Management during Operation

Responsibilities and Rules and Environmental Management Institutions

Based upon project characters, the implementation of project-related environmental protection measures needs to be supervised by relevant entities of WB and local environmental protection authorities of Foshan Municipality. During construction, specific environmental supervisors should be assigned to assist the PIU to conduct site supervision.

The responsibilities and rules of all environmental management institutions are as follows.

WB Environment Division is in charge of supervision of whole project and addressing the requirements of environmental protection.

Foshan WB PMO is in charge of assisting WB Environment Division to conduct environmental supervision.

Foshan Municipal EPB is in charge of environmental supervision throughout the project implementation according to requirements of WB Environment Division and relevant laws and regulations regarding environmental protection.

Foshan Water Group Company Ltd is in charge of comprehensive project planning, making arrangement and coordination of project preparation, implementation, and supervision and management. During construction and operation, Foshan Water Group Company Ltd will perform environmental supervision and supervise the implementation of Three Synchronies Policy for construction of environmental protection facilities to ensure the project operation. Foshan Water Group Company Ltd will ensure the implementation of environmental management measures specified by environmental protection authorities and WB, and also assist the environmental management authorities to perform routine supervision.

Environmental Supervision Entity is in charge of assisting the PIU to supervise the implementation of on-site environmental protection measures and also assisting the environmental management authorities to conduct routine environmental supervision

The main responsibilities of environmental supervision engineer include:

□1□ensuring the handling of all project-related approvals and implementation of EMP prior to commencement of project construction.

□2□verification of implementation of environmental protection measures by the PIU and all staff of project operator in compliance with the contract signed.

□3□communication with construction teams to inform them of on-site environmental requirements, make recommendations on remediation measures, notify formal operation manual to the PIU and project operator as required.

□4□communication with the PIU, project operator and construction consultants to enhance communication among them; understanding of opinions on some special issues to rapidly inform construction management engineer of urgent issues during project implementation.

□5□supervision of implementation of environmental monitoring plan during construction and construction progress of environmental protection facilities following Three Synchronies Policies to ensure the success in environmental protection acceptance prior to the deadlines.

Director of Environmental Protection and Environmental Technicians are in charge of implementing laws and regulations regarding environmental protection, understanding of environmental status measured by monitoring(□□) center, making statistics and analysis of pollutants discharge, organizing the preparation and implementation of overall environmental protection planning and annual plan. The director and environmental technicians are responsible for overall environmental management, propaganda on environmental protection knowledge and promotion of new technologies concerned, and routine inspection of operation of environmental protection facilities and troubleshooting on a timely basis. They are also in charge of knowledge of operation of environmental protection facilities, filing of pollution sources and operation status of environmental protection facilities to make statistics on environmental protection work, filing and preserving testing documentation. The testing documentation will report testing activities, status of testing devices and equipment, and hazard-free treatment, disposal and testing of wastewater, exhausted gas and hazardous waste accurately. The director and environmental technicians are in charge of preparation, coordination and implementation of environmental monitoring plan meeting the requirements of environmental protection authorities in charge. They are also in charge of handling relevant pollution accidents and disputes, supervision and inspection of implementation of Three Synchronies Policy for construction, reconstruction and extension projects, and participating in completion acceptance of environmental protection facilities, etc.

Responsibilities of Project Contractors

The qualified contractors should be selected for project implementation. The mitigation measures during construction should be included in contractors' bidding documents and also included in final construction contracts as contractual requirements for project contractors to ensure the EMP implementation in an efficient way. The responsibilities of project contractors are as follows.

(1) It is required that contractors and construction supervisors should take relevant training on environmental protection and environmental management. The contractors need to assign one full-time environmental technician. Those environmental technicians are required to take training to be qualified for their jobs, based upon training program.

(2) During construction. Contractors should communicate and coordinate with local public, put up bulletin boards in each construction areas to notify the specific construction activities and schedule. Meanwhile, the contractors need to disclose contact person and telephone number for the public to make complaints and provide suggestions on construction activities.

(3) As on-site environmental protection and management measures, at the same time of implementation of wastewater, exhausted gas, noise and solid waste prevention and control measures, professional environmental technicians should be assigned by contractors to be in charge of environmental management during construction. Besides, the project sites should be equipped with noise detection devices to test noise levels at surrounding pollution receptors so as to ensure the compliance with environmental standard for noise.

(4) Construction schedule should be stipulated in a proper way. The transportation of construction material should avoid rush hour. The vehicles should drive along specific routes. The construction with high noise emissions during demolition or decoration should be carried out at daytime. Construction at night is forbidden.

(5) Occupational EHS for construction teams should be carried out in a proper way.

Training Program

It is required that PIU, construction contractors and supervisors should participate in compulsory EHS training prior to construction commencement.

Training Program during Construction

A qualified entity to be entrusted by the PIU will provide trainings for full-time and part-time environmental technicians of construction contractors and supervision entity.

The trainees also include technical directors and specific administers from relevant contractors and supervision entity.

The training contents include

1□national, Guangdong provincial and Foshan municipal laws and regulations regarding environmental protection in project management and relevant documents and codes;

2□environmental protection measures and requirements of environmental protection during construction specified during project design;

3□operation manual for environmental protection during project construction.

Environmental protection directors of EPB and design institute and relevant specalists from EA and monitoring agencies can be invited as training lecturers.

Training Program during Operation

The proposed training program for environmental personnel during operation will be organized by EPB. Training courses can be taught by relevant environmental protection specialists from universities, research academies and project operator or short-term training program. The cost for training of environmental protection knowledge during construction and operation sums to CNY 72,000.

Table 14.3-1 Training Program for Environmental Protection Personnel

Phase	Category	Number of	Period	Cost

		trainees		(CNY10,000)
Design and planning	Training tour for national good project practices and pollution prevention control projects	1	Design and planning	3.0
Construction	Environmental technicians from PIU and contractors	1 person for each entity	After identification of contractors and prior to construction	0.6
	Environmental supervision engineer	PIU:4 persons Operator:4 persons		0.8
	All construction personnel	80		0.8
After construction and prior to operation	Environmental managers from operator	4	After construction and prior to operation	0.4
	Environmental technicians from operator	4		0.8
	All personnel	76		0.8
subtotal				7.2

Table 14.3-2 Training Contents during Construction

Training Contents		Training Duration
Common Environmental knowledge for construction workers	Introduction of environmental impacts elements and environmental protection measures; Introduction of pollution receptors and concerning environmental issues at construction sites, and introduction of surrounding areas for construction sites.; Responsibilities and rules of environmental management engineers, environmental supervisors and construction supervisors, and key reporting points of those environmental issues; ; Waste management for construction camps and sites; Pollution control measures for construction sites; Codes of non-compliance and penalties specified in relevant laws and regulations;	Half-day on －site training
Common health and safety knowledge of	Route of transmission and prevention methods for HIV/AIDS and STD; Alcohol and drug prohibition;	Half-day on －site training

construction workers	Access to medical care and other medical assistance in case of emergency and normal situation, such as STD testing and consultation; Common sense of health and safety, including basic processes of traffic safety and management of explosion, fire and hazardous waste; Use of personal protection equipment (PPE); Non-compliance penalties;	

Table 14.3-3 Training for Environmental Management Personnel for Operator

Trainees	Tranining Contents	Training Duration
Environmental management personnel	WB project management procedures; Filling, disclosure, communication and reporting mechanisms of environmental data; Environmental risk and contingency management; Inspection and approval procedures for health and safety.	1 day
	Training tour for advanced technologies and environmental management practices	Training tour for national good projet practices and pollution prevention control projects
Environmental technicians	Operation manual of devices including standards, testing, methods, sample delivery, data monitoring and reporting; Environmental risk and contingency management; Potential spills and leaks and impacts on environment and human health, contingence plan including priority response, location and use of emergent equipment.	2 days
All staff	WB project management procedures; Considerations of treatment and disposal of wastewater. Exhausted gas and spoil to be generated during operation; Operation manual of environmental protection facilities; Environmental risk and contingency management.	1 day proir to operation

Environmental Management Plan

The project implementation will comply with relevant national laws and regulations regarding environmental protection to ensure the synchronies of design, construction and operation of environmental protection facilities with main project contents. At different phases, environmental management, mitigation measures and specific implementation entities concerned are shown in Table 14.4-1.

Table 14.4-1 Summary of Project-related EMP

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
Design Period				
Wastewater	Treat storm water and sewage separately	Design institute	Foshan Water Group Company Ltd.	Not included in design expense and calculated separately
Exhausted gas	Select appropriate mechanical ventilation system and equip workshops with deodorant devices			
Noise	Select devices with low noise emission, consider vibration attenuation for foundation, place air compressors, pumps with high noise emission in closed separate rooms, consider environmental protection measures, such as insulation			
Construction Period				
General impacts of construction activities on the environment	- Set up effective organization framework to perform supervision and monitoring of project-related environment, specify personnel responsibilities and operation procedures to handle non-compliance in a rapid and efficient way. - Rules of environmental issues should be specified in the bidding documents for contractors. And the responsibilities of contractors in view of environmental protection should be included in contractual documents.	Foshan Water Group Company Ltd. / Contractor		3
Impacts on	- Prepare on-site management measures to avoid pollution;	Contractor	Foshan Municipal	4

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
water quality	- install septic tank for advanced treatment of dung-containing wastewater; - treat on-site washing water through screening grids; - discharge all types of wastewater after treating wastewater in compliance with relevant standards.		EPB	
Impacts on air quality	- Spaying at construction sites and on dust generation sources to keep humid; - Under dry weather, spay water on roads with high transport frequency and high work load on a regular basis (every two hours); - Slow down while driving on the road with dust; - Equip wheels and car body rinsing devices at outlet of construction sites. Clean up public roads if necessary; - Cover the vehicles with canvas during transportation of dust-generated materials; - reduce the height variation as much as possible during loading. Control driving velocity into loading areas in a strict way and clean the loading areas on a regularly basis. - remove construction machinery as well material transport routes from villages	Contractor	Foshan Municipal EPB	2
Impacts on acoustic environment	- Construction noise should comply with Noise Limits for Construction Site GB12523-90. - Forbid using all types of pile drivers. Avoid operation of pile drivers if possible, especially at night, due to high noise intensity and serious impacts, - Select construction machinery with low noise emission or devices with noise insulation and damping if possible. Enhance equipment maintenance; - Arrange construction time and sites in a proper way. Remove construction sites with high noise levels from noise sensitive receptors if possible. Set up temporary sound barriers	Contractor	Foshan Municipal EPB	1.2

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
	around pollution sources with high noise level if required, so as to lessen noise nuisance; - No use of diesel generators if possible when municipal power supply is available. - Arrange construction schedule and plan in a rational way and limit the construction period for operation of device with high noise level; - Avoid use of devices with high noise intensity at noon break and night if possible; - evacuate vehicles into construction sits in a rational way and mitigate noise due to car horn.			
Impacts of Solid Wastes	- Refill the spoil as much as possible during pipeline construction; - Pile up topsoil and bottom soil in a separate way during excavation. And refill bottom soil prior to topsoil refilling so as to maintain topsoil fertility; - Pile up remaining sludge and spoil in designated areas in compliance with regulations by local sludge management offices if the sludge and spoil cannot be refilled. And transportation of the sludge and spoil to abandon quarry is also feasible for ecological rehabilitation; - transport domestic wastes to municipal sanitary landfill sites for disposal after collection by qualified cleaning companies.	Contractor	Foshan Municipal EPB	2
Impacts on public health	- Establish strict rules of operation workers and construction site management for contractors - On-site EMP should be established by contractors, and be reported to the PIU. The PIU together with Foshan health authorities will perform supervision and inspection for construction site management and health conditions	Contractor	Foshan Water Group Company Ltd./ Foshan Municipal EPB / Foshan	1.2

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
	- Establish strict hygiene and epidemic prevention systems		Municipal Board of Health	
Impacts on site personnel safety	-Design construction sites in a proper way -Establish strict on-site security system	Contractor	Environmental Supervision Team/Foshan Municipal Supervisory Bureau for Work Safety	Included in site management fee and not calculated separately
Impacts on offsite personnel safety	- The contractors are required to implement relevant on-site safety rules, including installation of fences, notification to the public concerned, construction of main access and temporary path for construction, and establishment of contingence plan for transport accidents - Establish specific on-site and offsite traffic rules	Contractor	Foshan Water Group Company Ltd./Foshan Municipal Supervisory Bureau for Work Safety	Included in site management fee and not calculated separately
Operation Period				

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
Impacts on water quality	- Discharge all the wastewater after treatment in the WWTPs in compliance with relevant standards; - Monitor effluent quality by operators and monitor water quality of surrounding water bodies by relevant EPBs.	Contractor	Foshan Water Group Company Ltd / Foshan Municipal EPB	5.2/a (monitoring cost is not included)
Impacts on air quality	- Odor concentration at boundaries will comply with Class II Odorous Pollutants Emission Standards (GB14554-93). - Condition sludge to reduce water content of sludge to be treated; - Spray biological deodorant to reduce emission of odorous gas. Installation of concentrated deodorization facility will be also taken into account; - Enhance routine environmental monitoring, entrust environmental monitoring authorities to monitor odor concentrations in surrounding areas.			2.5/a (monitoring cost is not included)

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
Impacts on acoustic environment	- Implement noise insulation, shielding, shockproof and damping measures, such as rooms with insulation equipment, noise barriers and mufflers, so as to attenuate sound radiation and transmission during installation of devices with high noise levels. And implement corresponding noise prevention measures for blowers, press filters and water pumps, etc. - Install devices in closed areas with sound insulation, implement vibration attenuation at inlet and outlet of water pumps, damping measures at inlet and outlet of blowers, sound adsorption in service rooms, and also damping measures for ventilation of closed service rooms. - Maintain devices on a regular basis and apply lubricant to maintain devices in good conditions and reduce noise levels during operation. - Place devices with high noise intensities according to general layout, remove these devices from noise sensitive areas if possible and install these devices in low altitude to lessen long distance transmission if possible. - Take advantage of natural landform to lessen noise transmission, e.g. setup of fences between sound sources and sensitive receptor. Installation of devices with high noise levels at plant boundaries is not allowed.			Included in operation cost, not calculated separately

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
Solid waste	- Transport sludge to Gaoming Baishiao Landfill Site through closed vehicles after thickening and dewatering. Establish management account list and transfer form systems for sludge transportation. - Domestic wastes will be treated by sanitation and hygiene authorities. - Collect a small amount of waste liquid from labs in a proper way and delivery the waste liquid to a qualified company for hazard-free treatment.			Included in operation cost, not calculated separately
Sludge transportation	- Use vehicles with sealing measures to transport sludge and enhance maintenance and upgrade vehicles on a timely basis to ensure good sealing of vehicles for sludge transportation. - Clean up vehicles on a regular basis and implement road cleaning. - Avoid rush hours if possible. - Equip every vehicle with required communication tools for emergency. Report relevant authorities for proper handling as soon as possible in case of accidents during sludge transportation. - Enhance education and technical training for drivers to avoid occurrence of traffic accidents.	Contractor	Foshan Water Group Company Ltd / Foshan Municipal EPB	Included in operation cost, not calculated separately
Prevention measures for environmental risks	- Set priority in use of vehicles of high safety performance. - Require vehicle suppliers to provide vehicles of good sealing performance without leakage. - Clean wheels and car bodies after sludge loading. Equip vehicles with real-time positioning monitoring system.	Contractor	Foshan Water Group Company Ltd / Foshan Municipal EPB	Included in operation cost, not calculated separately

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
	Maintain vehicles on a regular basis to ensure the good driving performance. - Examine sealing performance of vehicles prior to loading to ensure sludge transportation without spillage and leakage. - Label vehicles with remarkable safety signs. Stipulate transport route without random adjustment. - Obey traffic rules, enhance awareness of driving safety, especial in rainy days and bridge construction crossing water bodies, more cautions need to be exercised for occurrence of traffic accidents. - Equip vehicles with waterproof cover. Cover the vehicles in case of spillage and leakage during sludge transportation on a timely basis to stop pollutants such as heavy metal and organics in sludge together with storm water from entering into water bodies. - Enhance professional training of awareness of environmental protection and contingent plan for drivers and persons concerned.			
Contingent plan for environmental risks	- Establish emergency organization for environmental accidents and identify persons in charge and accidents response procedures - In case of sludge spillage and leakage on roads and highways, arrange vehicles to remove sludge immediately and clean the sites as well. - Cover the spilled sludge in waterproof cloth in rainy days to reduce pollution discharge if possible, and remove the sludge as soon as possible. - At the same time, report emergency management team and EPBs immediately and report water supply divisions of Foshan Water Group on a timely basis to ensure the preparation	Contractor	Foshan Water Group Company Ltd / Foshan Municipal EPB	Included in operation cost, not calculated separately

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
	for pollution prevention - Strictly monitor flow direction of polluted water bodies and implement corresponding contingent plan to control pollution coverage within a small region. - Implement reliable antitoxin and explosion-proof measures based upon knowledge of project progress prior to environmental monitoring. - Keep in touch with headquarters at any time and report the headquarters on a timely basis during monitoring. - Monitor in fixed and flexible way for accident prevention. The monitoring items should include accident effluents and air pollutants. The monitoring should cover the whole process with active monitoring. And monitoring results should be reported to site manager on a timely basis. - Attentions should be paid to sample storage during monitoring to facilitate further verification. - Assessment should be made for accident origin, casualties and hazard to environment causes. Lessons should be learnt to avoid the re-occurrence of accidents and provide scientific basis for further emergency relief.			
Environmental impacts related to Baishiao Sanitary	- Build up collection pipeline and explosion-proof systems for flammable offgas. The offgas to be generated from the landfill site will be collected and incinerated by torch. - Set up sanitary protection zone in the width of 500m. - Employ bilayer anti-seepage process with anti-seepage coefficient less than 10-7cm/s。 - transfer leachate from retention tank for greening as reuse after on-site leachate treatment.	Baishiao Sanitary Landfill Site	Foshan EPB	Included in WWTP operation cost, not calculated in this project

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
Landfill Site	- Select devices with low noise emission and implementation of specific sound insulation, vibration attenuation and damping measures. - Use specific vehicles for waste transportation and establish transport manuals. - Set up 10 groundwater monitoring wells and monitoring points for air quality in neighboring Miao Village Ludongshan Forest Park. Conduct environmental monitoring for landfill site and surrounding sensitive receptors for 3-4 times. The monitoring covers air quality, surface water, ground water, leachate, soil, noise and etc.			
Environmental Impacts on Zhen'an, Shagang, Chengbei, Nanzhuang WWTPs	- Treat wastewater in WWTPs through A/O, A2/O or improved A2/O process prior to discharge in compliance with relevant standards; - Monitor effluent quality by operators and setup on-line monitoring devices at outfalls by EPBs to monitoring flow rate and COD. - Spray biological deodorant at key odor generation sources and setup of green belts in the plant and at plant boundary to adsorb odorous pollutants to be generated. And main odor generation sources were covered prior to collection for deodorization for Phase III Zhen'an WWTP Project, which have been proposed for Phase I and II Zhen'an WWTP Project. - Implement environmental protection measures such as construction of rooms with sound insulation, sound-proof wall and mufflers during installation of pollution sources with high noise intensity. - Maintain devices on a regular basis, apply lubricant to keep devices in a good condition and reduce noise to be generated during operation. - Deliver sludge into Baishiao Sanitary Landfill Site in Gaoming Miao Village after	Zhen'an, Shagang, Chengbei, Nanzhuang WWTPs	Foshan Water Group/ Foshan EPB	Included in WWTP operation cost, not calculated in this project

Item	Recommended Mitigation Measures	Implementation Agency	Supervision Agency	EMP Budget (CNY10000)
	advanced dewatering. - Operators will exercise cautions to monitoring of water quality at inlet and outlet as well sludge quality. And a complete recording system will be established together with contingent plans for various breakdown and accidents.			

Environmental Monitoring Plan

The environmental monitoring during construction and operation aims at full understanding of pollution updates of proposed project, changes in local environmental quality, impact coverage and updates of environmental quality during operation on a timely basis, reporting those updates to authorities concerned, which provides a scientific basis for project-related environmental management.

Monitoring plan is mainly prepared for advanced sludge dewatering project. However, monitoring program during operation needs to cover monitoring activities for advanced sludge dewatering project and associated project. During operation monitoring activities include monitoring of wastewater to be generated from advanced sludge dewatering project (monitoring of WWTP outfalls), monitoring of concentration of odorous pollutants and odor intensity at plant boundaries, and noise at boundaries. These activities are not separately listed in monitoring program for WWTP concerned.

The environmental management and monitoring programs for various phases are shown in Table 5.2-1. The monitoring cost during construction is CNY 30,500 and monitoring cost during operation is CNY 22,400.

Table 14.5-1 Project-related Environmental Monitoring Plan

Environmental Element		Monitoring Point	Monitoring Parameters	Monitoring Frequency	Unit Price (CNY)	Total Budget (CNY10000/a)	Monitoring Agency	PIU	Supervision Agency
Construction period									
Water quality	Industrial wastewater	Outfalls	pH, petroleum, COD and SS	Once at commencement, once at mid-term and once at final phase	500/time	0.81	Qualified and independent environmental monitoring entity	Foshan Water Group Company Ltd.	Foshan Municipal EPB
		Outfalls of construction sites and machinery maintenance areas	pH, petroleum, and SS		400/time				
	WWTPs	Outfalls of WWTPs	pH, petroleum, COD and SS	4 times/day (analysis of routine monitoring data of WWTPs)	0	0			
Air quality		North plant boundary towards dewatering houses of Zhen'an WWTPs	TSP	Once for excavation and structuring at commencement, once for construction at mid-term	400/time	1.28	Qualified and independent environmental monitoring entity	Foshan Water Group Company Ltd.	Foshan Municipal EPB
		West plant boundary towards dewatering houses of Chengbei WWTPs			400/time				

Environmental Element	Monitoring Point	Monitoring Parameters	Monitoring Frequency	Unit Price (CNY)	Total Budget (CNY10000/a)	Monitoring Agency	PIU	Supervision Agency
	Southwest plant boundary towards dewatering houses of Shagang WWTPs			400/time				
	North plant boundary towards dewatering houses of Nanzhuang WWTPs			400/time				
Acoustic environment	16 monitoring points at plant boundaries of WWTPs	L_{Aeq}(dB)	Once at commencement, once at mid-term and once at final phase; And twice for each day (daytime and night)	100/time for each monitoring point	0.96	Qualified and independent environmental monitoring entity	Foshan Water Group Company Ltd.	Foshan Municipal EPB

Environmental Element	Monitoring Point	Monitoring Parameters	Monitoring Frequency	Unit Price (CNY)	Total Budget (CNY10000/a)	Monitoring Agency	PIU	Supervision Agency

Operation								
Water quality	Outfalls of WWTPs	pH, COD, BOD_5, SS, NH3-N	Analysis of WWTP routine monitoring data 4 times every day	Included in operation cost of WWTPs, not calculated separately	0	Monitoring department of WWTPs	Foshan Water Group Company Ltd.	Foshan Municipal EPB
		COD, flow rate	Online monitoring			WWTPs		
		pH, COD, BOD_5, SS, NH3-N	Twice every year			Independent qualified monitoring entity		
Air quality	Plant boundaries of Zhen'an WWTP	Concentrations of H_2S, NH_3, odor and CH_4	Twice every year	2400/time	1.92	Qualified and independent environmental monitoring entity		
	Plant boundaries of Chengbei WWTP			2400/time				
	Plant boundaries of Shagang WWTP			2400/time				
	Plant boundaries of Nanzhuang WWTP			2400/time				

Environmental Element	Monitoring Point	Monitoring Parameters	Monitoring Frequency	Unit Price (CNY)	Total Budget (CNY10000/ a)	Monitoring Agency	PIU	Supervision Agency
Operation								
Acoustic environment	16 monitoring points at plant boundaries of WWTPs	L_{Aeq}(dB)	Twice every year; for each monitoring, once at daytime and once at night	50/time at each monitoring point	0.32			
Solid waste	Sludge stores in WWTPs	Hg, Pb, Cd, Cr, Cu, Zn, Ni, As, petroleum, volatile phenol, sulfides, cyanides, water content of sludge	Once every month	Included in operation expenses, no extra budgets	0	Laboratories at project sites	WWTP operators	Foshan Water Group Company Ltd./ Foshan Municipal EPB
	Sludge landfill sites		Spot check for each batch		0	Laboratories of sludge landfill sites	Baishiao Landfill Site	Foshan Municipal EPB
Operation (Baishiao Landfill Site)								

Environmental Element	Monitoring Point	Monitoring Parameters	Monitoring Frequency	Unit Price (CNY)	Total Budget (CNY10000/ a)	Monitoring Agency	PIU	Supervision Agency
Operation								
Wastewater	Outfall of leachate treatment facility	pH, color, SS, CODcr, BOD_5, HN4-N, fecal coliform	4 times every year	Included in operation cost of Baishiao Sanitary Landfill Site, not calculated separately	0	Independent qualified monitoring agency	Baishiao Landfill Site	Foshan Municipal EPB
Surface water	Surface water in the landfill site	pH, CODcr, BOD_5, TN, HN4-N, TP, Pb, Cr^{6+}, Cd Hg, As, fecal coliform	4 times every year					
Groundwater	10 groundwater monitoring wells	pH, COD, HN4-N, Hg, Cd, Cr^{6+}, Pb, As	4 times every year					
Air quality	Boundaries of landfill site	H_2S, NH_3, odor concentration, SO_2, NO_2, CO, TSP	4 times every year					
	Neighboring sensitive receptors such as Miao Village and Ludong Forest Park							

Environmental Element	Monitoring Point	Monitoring Parameters	Monitoring Frequency	Unit Price (CNY)	Total Budget (CNY10000/a)	Monitoring Agency	PIU	Supervision Agency
Operation								
Acoustic environment	Boundaries of landfill site	L_{Aeq}(dB)						
Soil	Downstream of oxidation pond West of Ludong Forest Park Neighboring area of regulating container for leachate	Hg, As, Cd, Cr, Pb						
Soild waste	Sludge stores in WWTPs	Hg, Pb, Cd, Cr, Cu, Zn, Ni, As, petroleum, volatile phenol, sulfides, cyanides	Once every month	Included in operation expenses, no extra budgets	0	Laboratories at project sites	WWTP operators	Foshan Water Group Company Ltd./ Foshan Municipal EPB
	Sludge landfill sites		Spot check for each batch		0	Laboratories of sludge landfill sites	Baishiao Landfill Site	Foshan Municipal EPB

Information Management

Information Exchange

It is required that environmental management should cover required information exchange among different departments of project owner, contractors and operators. Meanwhile, external information exchange for relevant entities and puble should be carried out.

Internal information exchange should be performed in form of meeting and internal brief reports. However, official meeting is required once every month. All information to be exchanged should be recorded and filed. External information exchange will be performed once every half year or every year. The information to be exchanged with other parties needs to be summarized and filed.

Recording

For an effective operation of the environmental management system, a complete recording system should be established and following records should be maintained:

1. Stipulations of laws and regulations;
2. Permits;
3. Environmental factors and impacts;
4. Training;
5. Check, calibration and maintenance activities;
6. Monitoring data;
7. Effectiveness of rectifications and prevention measures;
8. Information of parties involved;
9. Auditing;
10. Evaluation.

In addition, control for various aforesaid records is required, including tagging, collection, listing, filing, keeping, management, maintenance, query, term of keeping, disposal, etc.

Report Mechanism

During the implementation of the project, the contractors, monitoring agency and Project Management Office should keep a record of items including project progress, implementation of Environmental Management Plan (EMP), environmental quality monitoring results, etc., and report to relative authorities. The main contents consist of the following 6 parts:

(1) Project environmental supervision engineer will made detailed monthly records on EMP implementation, submit monthly reports to the PIU and municipal PMO on a timely basis. The monthly report includes implementation of environmental protection measures, progress in environmental monitoring and monitoring data.

(2) The contractors and operator will make detailed quarterly records on project progress and EMP implementation, report quarterly reports to PMO on a timely basis, and also forward the quarterly reports to municipal EPB.

(3) After completion of environmental monitoring, monitoring agency will submit monitoring reports to operators and environmental supervision engineer on a timely basis.

(4) Municipal PMO will submit project progress reports to provincial PMO on a timely basis, and forward the reports to the provincial EPB. The semiyearly project progress reports prepared by PMOs include EMP implementation, such as progress of EMP implementation and especially environmental monitoring results.

(5) In case of serious non-compliance regarding environmental protection, environmental supervision engineers and PMO will report the non-compliance to local environmental protection authorities, and further report to authorities at different levels if required.

(6) The EMP implementation reports should be completed prior to the deadlines set by WB and be submitted to WB. The EMP implementation reports will include the following contents.

1) Project progress;

2) Implementation of EMP including implementation of training program and project-related environmental protection measures, progress in environmental monitoring and also key monitoring data;

3) Possible public complaints: Records of key points of complaints, solutions and public satisfaction in case of complaints;

4) EMP implementation plan for the following year.

Conclusions and Suggestions

Project Overview

Foshan Water Group Company Ltd is in charge of construction of proposed Foshan Nanzhuang Sludge Treatment Plant Project. The proposed project content covers reconstruction of existing sludge treatment process Zhen'an, Shagang, Chengbei and Nanzhuang WWTPs in Chancheng District. The proposed advanced dewatering will reach water content lower than 60% in sludge from aforesaid WWTPs. The proposed project sites are located at vacant land close to existing sludge dewatering workshops in Zhen'an, Shagang, Chengbei and Nanzhuang WWTPs. The existing dewatering devices will be used and new land acquisition is not required. The proposed project involves construction of wet sludge store, sludge treatment workshop, dewatered sludge store, control cabinet, high and low voltage power supply room, etc. The proposed treatment capacity is 220d/t (counted as water content of 80%). The proposed treatment processes are sludge conditioning and plate and frame press advanced dewatering(□□□□□□). The total investment is approximately CNY 100.9 million including USD 10.7 million, approximately CNY 69.55 million.

Project Rationality and Compliance

The analysis results indicate that the proposed project implementation complies with national and Guangdong provincial sector development policies, national and Guangdong provincial laws and regulations regarding environmental protection, codes of environmental protection of Guangdong Province, Pearl Delta Area and Foshan Municipality, and Environmental Function Zoning of Foshan Municipality.

The proposed project implementation will solve the problem of sludge treatment and disposal in Foshan Municipality in an efficient way, which facilitates the sustainable development of Foshan Municipality. The proposed project with advanced dewatering technology in existing WWTPs has many advantages, such as low investment and operation expenses, large treatment capacity, stable operation and little secondary pollution. And the vacant areas in existing WWTPs will be fully used as proposed project sites. Therefore, the project implementation in existing WWTPs is rational and sound.

Environmental Baselines

1. Baselines of Surface Water Quality

The environmental monitoring data indicated that all of monitoring parameters in Foshan Stream as proposed receiving water body could meet the requirements of Class IV Environmental Quality Standard for Surface Water GB3838-2002. The concentrations of COD, DO, NH_3-N and total phosphorus at Wensha Bridge Section of Foshan Watercourse exceeded Class IV Environmental Quality Standard for Surface Water GB3838-2002. Except the non-compliance at Wensha Bridge Section, all of monitoring parameters at other sections of Foshan Watercourse could meet the requirements of Class IV Environmental Quality Standard for Surface Water. The concentrations of COD, BOD, DO and petroleum at Jili Creek Section exceeded Class III Environmental Quality Standard for Surface Water GB3838-2002 because the Nanzhuang WWTP has not been put into operation yet and domestic wastewater and part of industrial wastewater from surrounding areas were discharged into the Jiliyong Section without treatment. As the completion and operation of Nanzhuang WWTP, the water quality of Jiliyong Section will be improved.

2. Baselines of Air Quality

As indicated in baseline monitoring and historical monitoring data, the concentration of SO_2, NO_2 and PM_{10} in assessment areas could meet the requirements of Class II Environmental Quality Standard for Ambient Air GB30912.1-1996 and its amendment. The concentration of ammonia and hydrogen sulfide in assessment areas could meet the requirements of Hygiene Standard for Design of Industrial Enterprises TJ36-79. And the odor concentration could comply with concentrations at plant boundary of Class II Odorous Pollutants Emission Standards.

3. Baselines of Acoustic Environment

The results of baseline monitoring indicated that noise levels at WWTP boundaries could meet the requirements of Class II Environmental Quality Standard for Noise. Therefore, the quality of local acoustic environment was good.

Assessment of Environmental Impacts

The projection and assessment of air quality indicated that ammonia and hydrogen sulfide generated would not pose distinct adverse impact on local air quality during normal operation of proposed dewatering workshop? in WWTPs. To prevent and control air pollution in an efficient way, cleaner production should be further enhanced to reduce amount of air pollutants emissions, especially to prevent accidental emission. It is suggested that the safety distance to dewatering workshop in WWTPs should be identified to be 50 meters wide.

The addition of wastewater discharge after advanced dewatering process is estimated to be very little. The additions of wastewater discharge of Zhen'an, Shagang, Chengbei and Nanzhuang WWTP are estimated to be $71m^3/d$, $39m^3/d$, $21m^3/d$ and $21m^3/d$, respectively, which are 0.036%, 0.04%, 0.02% and 0.04% of treatment capacities of corresponding WWTPs, respectively. Therefore, the proposed advanced dewatering will not cause a significant increase in wastewater discharge of WWTPs. Therefore, the proposed project will not pose distinct adverse impacts on receiving water bodies of these WWTPs.

The noise projection showed after completion of dewatering workshop, noise levels projected at plant boundaries at daytime and night would comply with Class II2 Emission Standard for Industrial Enterprises Noise at Boundary which would be similar to the current status. Therefore, noise nuisance to be generated from devices in dewatering workshop will not bring serious impacts on surrounding acoustic environment.

As indicated by the anaylsis, lab waste liquid to be generated is classified as hazardous waste which needs to be strictly managed during the whole process and disposed of in a safe way by a qualified company. In Guangdong Province, sludge dewatering is controlled in a strict way, which includes sanitary landfilling, establishment of management account lists and transfer form systems for sludge transportation and implementation of covering and anti-seepage and anti-leakage measures during transportation. Thus, solid wastes to be generated from proposed project will not pose any negative impact on surrounding environment. Meanwhile, no negative impacts will be generated along transport routes during sludge transportation.

Risk Assessment

The analysis results indicated that the probability of water pollution due to accidents during transportation through Dongping Watercource, Jili Creek Section and Shunde Watercource would be very low. Once the accident happens, the concentrations of organics and heavy metal will increase a bit, which is the main impact on local water quality. To avoid or reduce accident occurrence as well as potential adverse impacts on quality of surface water after accidents, specific risk prevention measures as well as emergency response plans should be implemented. As a whole, the environmental risks of proposed project are acceptable. Therefore, in view of environmental risks, the project implementation is feasible.

Cleaner Production and Total Pollution Load Control

The proposed sludge dewatering through board-frame press filter will realize sludge reduction, stabilization and hazard-free treatment. In addition to good performance in water and energy saving, no leachate will be generated with low odor emission after formation of sludge cakes, which can control secondary pollution in an efficient way. The proposed project is a cleaner production project with energy saving and discharge reduction.

The effluents to be generated will be treated by municipal WWTP and the exhausted gas emissions from proposed project sites will be generally the same as those before project implementation. Therefore, there will be no distinct changes in discharge and emissions from WWTPs concerned after project implementation. No extra discharge/emission quota is required from the regional target.

Public Consultation

Most public favored project construction in existing sites. Meanwhile, some public concerned about potential negative impacts of project implementaion on the environment and also expressed their worries on surrounding environmental quality and their own vital interests, which showed strong awareness of environmental protection. Great attention should be paid to those concerns by the PIU

To dispel these concerns and worries about proposed project implementation, the PIU should enhance project propaganda and introduction to improve the public understanding of proposed project. At the same time, environmental protection should be set as priority during construction and operation and all of pollution prevention and control measures should be strictly implemented to gain the public support.

Conclusions

In summary, the proposed project implementation will comply with relevent national and provincial sector policies, laws and regulations regarding environmental protection, and planning of environmental protection. The main goal is to improve existing sludge drying processes in WWTPs concerned. After project implementation, generation and discharge of all type of pollutants will generally be the same as current status. After effective prevention and control, all pollution parameters will not bring distinct adverse impacts on surroundingenvironmental and pollution receptors. The project constrution, capacity and treatment processes to be applied are feasible. The PIU should strictly follow the management rules of Three Synchronies Policy, complete all application and approval procedure, and also ensure the implementation of all of environmental protection measures specified in this EA report. During operation, device maintenance should be enhanced to ensure the normal operation of environmental protection facility. Thus, the proposed project will not pose distinct adverse impacts on the surrounding environment. The project implementation is environmentally feasible.