

Henan Yellow River Ecological
Livestock Demonstration Project of
World Bank Loan Credit
Environmental Impact Assessment

(Final draft)

Hohai University

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Executive Summary

Yellow River basin is an integral part of stream of the river. The basin is used for diverting flood, holding flood and sand sedimentation, local communities also rely on it for livelihoods. To minimize environmental pollutions caused by medium and large livestock farms (farm/park), Henan province is taking US\$ 80 million World Bank Loan to support Henan Yellow River Ecology Livestock Project.

The project comprises existing and new 589 farms in 30 counties (city, district) in 8 prefectures. There are three components under the project: capacity building of public institution, environment management of existing and new farms, project management and monitoring & evaluation. The total cost of the project is estimated at RMB 1,273,238,600 (US\$ 160 million). The land area occupied by the project is 36,017.9 mu, out of which, 11,469 mu is newly acquired by lease. The acquired lands are not classified as prime farmland and none is included in the prime land protection program. None of the livestock farms are located at or in proximity of sources of water, nature reserves, or historical sites. Distance between new farms and residential area is longer than 500 m.

The project area has a continental monsoon climate between the subtropical zone and temperate zone. Its climate is characterized with transition from plain to hills running from east to west, thus the winter is cold and dry, spring is dry and windy, summer is hot and rainy. The project area is located in Yellow River basin and old course of Yellow River. Most of the basin is beach formed by sedimentation of sand, it is low lying, the basin has two narrow ends and a wide middle; the trench, depression and stream are pervasive there; the old course of Yellow River used to be the river bed of it, it is flat with slow hills and depressions.

Henan is a large livestock producer of the country. Livestock industry is one of the pillar industry of rural economy and one of important sources of incomes for farmers. In 2008, the total meat output of this province amounts to 5.8508 million tons, accounting for 10% of the total of the country. Currently, most livestock farms do not have adequate environmental protection facilities. Sewage and manure collection facilities are not well established, and the surrounding areas are polluted due to disposal of untreated manures and wash water. According to the survey, amount of COD, NH₃- and TP discharged by the existing farms amount to 7740.7 t/a, 2580.2 t/a, and 2222.1 t/a, respectively.

To address these issues, 7 livestock production models are developed in the Feasibility Study Report, which includes 500 dairy cows farm, 500 beef cattle farm, 5000 pig farm with bio-fermentation beds, 500 dairy cows farm with organic fertilizer production, expanding 100-head dairy cow farm, expanding 200-head dairy cow farm, expanding 200-head beef cattle. The manure of these farms will be transported manually to manure storage pads, where they will be treated or processed into organic fertilizer, then will be applied into crop land; the urea and sewage will be collected and discharged into the sewage tank, then will be treated and applied into the crop land.

This EIA report will comply with the environmental protection requirements of the World Bank and China. As the project is focus on the improvement of livestock farm infrastructures

and environment management, in accordance with the agreement reached by the Bank's pre-appraisal mission and Provincial Environment Protection Bureau, no full environment impact assessment will be undertaken, whereas the Bank is more interested in a comprehensive and practical environment management and monitoring plan (EMMP).

The findings of EIA indicate that implementation of the project will have positive impacts on environment and improve the environment. However, in case that location of livestock farms is not appropriate, or mitigation measures are not taken, project activities will have potential negative impacts and undermine the sustainability of the project.

The project will have short-term and partial impacts on the environment during the stage of construction. The potential environment impacts include: impact of land acquisition on vegetation, noise, dust and trash of construction sites. If the measures recommended by the EIA report are implemented, the negative impacts will be minimized.

The negative impacts of the project will have on environment and human health when it is in operation is the pollution of odour, sewage, solid waste, and the impacts on human health. When the mitigation measures recommended in 7.2.2 of the Report are taken, these negative impacts can be minimized or avoided.

Hui is the only ethnic minority that participate the project and are subject to the impacts of the project. Hui population is located in Yangzhuang village, Huizu town of Fengqiu county and Shuiyunzhuang village, Lilin town of Jiyuan county, the total of them are 2,283. Full consideration has been given to impacts on different ethnic nationalities by the project. The project will not have any impacts on the relations between different ethnic nationalities, religion, culture and norms.

The EIA report includes a detailed environment management and monitoring plan and an environment management institution and training plan. Meanwhile, in accordance with Chapter 7- nutrients balance, 10% of the livestock farms will be sampled for monitoring and evaluating pollution control of the project when it is in operation.

The report concludes that livestock farms' pollutions under the project can be minimized in an effective way, provided the waste treatment plans and mitigation measures recommended in the report can be implemented. The implementation of the project can improve rural living and production conditions and level of ecology conservation, and develop a harmonious relation between human being and the nature.

The findings of the EIA report concludes that the project, if fully implemented, while will have no significant negative impact, it will improve quality of life and environmental condition of the animal park and neighbouring areas through implementation of proposed animal park waste management activities. Due to significant potential positive environmental impact of the project, the EIA team recommends that the Bank and Chinese authorities at all level support the project and allow for its speedy implementation.

Preface

The floodplain of Yellow River in Henan province is an important agricultural and natural resource in Yellow River watershed. It is not only the areas for flood attenuation, drainage, discharge and desilting, but it is also the major and highly productive resource that is used by the local inhabitants in all aspects of agricultural production. In order to improve the aquatic environment of the floodplains of Yellow River, promote sustainable development of ecological livestock-raising, and to improve natural environment through reducing nutrient loading of surface and groundwater resources, Henan province encouraged the development of all forms of livestock development from piggy to poultry to beef and dairy cattle development. In 2002, “green dairy demonstration area construction plan in the floodplains of Yellow River in Henan province” was issued with great attention (No.75, 2002, the general office of Henan People’s Government) to support ecological and green development of dairy industry. According to the plan, Henan Animal Husbandry Bureau (AHB), Development and Reform Commission (DRC), and Department of Finance (DOF) requested for an 80 million US dollars loan from the World Bank to develop the unused areas along Yellow River floodplain and its old river course in 30 counties (city and district) in Zhengzhou, Kaifeng, Luoyang, Xinxiang, Jiaozuo, Jiyuan, Puyang and Shangqiu and build the program of ecological animal husbandry industrial zone which integrates seeding, stock keeping and processing. In 2005, this plan was approved by State Council and was listed in alternative project plan funded by World Bank loan. In the beginning of 2007, approved by Provincial Government, Provincial Development and Reform Commission, Department of Finance and Animal Husbandry Bureau issued project declaration guide and finished project organization declaration. In September, 2007, because of the policy material changes for World Bank to loan to Chinese agriculture, Provincial Development and Reform Commission, Department of Finance and Animal Husbandry Bureau put forward the project adjustment scheme according to the latest policy of World Bank and the requirement of national department concerned. The project after adjustment becomes the public welfare project mainly with public finance and public product and its target is to reduce the environment pollution caused by the large and medium animal husbandry production (farm and plot) in the floodplain of Yellow River in Henan province. The World Bank loan will be paid by government at all levels and at the same month, the project adjustment scheme was approved by Provincial Government (No.159, 2007, general office of Henan People’s Government).

In September, 2008, World Bank identification group made an investigation for “ecological animal husbandry demonstration project in the floodplain of Yellow River funded by World Bank loan” and discussed with relevant persons from government at all levels. They decided on the content of the project, prepared the work plan for the next steps and reached an agreement on the target of the project and the activities for loan from the World Bank. The name of the project was changed to “Henan Yellow River Ecological Livestock Demonstration Project of the World Bank loan Credit”.

Fully considering and preventing various influence to the environment when project is carried out, in order to reduce or lighten negative effect to the environment when project is designed, carried out and operated, according to relevant requirement of *the Environmental Impact*

Assessment Law of the PRC and Notice about Strengthen International Financial Organization Loan Construction Project Environmental Impact Assessment Management, Henan Animal Husbandry Bureaus entrusts Hehai University to undertake the task of environmental impact assessment of ecological animal husbandry demonstration project in the of Yellow River floodplain, funded by Henan World Bank loan. Hehai University was entrusted with preparation of the environmental impact assessment (EIA) for the project. This report was prepared as the first draft after detailed site investigation, research and information collection.

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1 INTRODUCTION

1.1 The Purpose of the Environmental Impact Assessment (EIA)

The objective of the proposed project is to strengthen the environmental management and infrastructure of the animal raising farms in the Yellow River Floodplain Areas and to change the animal husbandry production model, optimize the production structure in the proposed project areas, and then in the whole Henan Province afterwards. Specific measures will be taken and extend to realize this objective, such as, animal breed improvement, better feed, disease control and treatment of animal manure. The animal raising farms with in the proposed project areas will be standardized as energy saving, technology back-up and environmental friendly farms, based on that, a modern animal production chain, which will generate obvious economic, social and ecological impact will be formed with the following characteristics like, well served infrastructure and service system, modern technology applied, optimized production structure and pleasant farm environment. These will be the demonstration farms to nearby project counties or even the whole province so as to promote sustainable animal husbandry development.

The purposes of the EIA report are:

- Undertake qualitative analysis and evaluation on the natural environment and social-economic status in the proposed project areas and then confirm scope and depth of evaluation and review environmental protection implementation of the project;
- Undertake evaluations on the positive impact and identify, select and predicate the potential negative impact of the project; and
- Prepare mitigation means to inevitable negative impact of the project and prepare Environment Management and Monitoring Plan (EMMP).

1.2 Impact Assessment Methods

In order to make this EIA in accordance with the EIA Technological Guidance of China and the EIA Outlines of the Eco-Stockbreeding Model Projects on the Flood Plains in Henan Province.

(2) Combination of the overall evaluation of the project and the focused evaluation. Conduct overall environmental evaluation of the project in a whole and every sub-project through collecting the natural, social, economic and environmental information and analyzing the technology. And the projects do not share the same emphasis. Key analysis will be conducted on the projects with relatively profound influence and the typically representative projects. Pay special attention to the key controlling areas and sensitive areas.

(3) The situation-evaluation and the analysis on environmental influence are based on the full use of the current materials that are available. The merits as well as demerits of the construction project to the environment will be analyzed.

(4) The analysis of the project's environmental influence and environmental management are combined together, which means that the evaluation report needs to take its appearance in the environment management and controlling measures. Combine the analysis environmental influence and environmental management measures of the project and apply the analysis on environmental influence to practical environment management and control measures. Stipulate practical environment protection measures and environment management plans.

(5) In the EIA process, consideration is also given to the development and change of the projects (5-year construction period, participation method and adjustments and changes of the project plans) and the planned EIA is also introduced.

1.3 Relationship with Feasibility Study of the Project

Based on item 9 and 17 of the "Environmental Protection Regulation of the Construction Project", the project owner, the Animal Husbandry Bureau of Henan Province, should submit EIA during feasibility study period of the project. Environmental protection shall be one of the chapters in project preliminary design and the related prevention and mitigation measures to the potential negative impact, environmental protection investment cost should be included, too.

Based on the requirement of the World Bank, during the designing stage of the project, EIA should be prepared at the same time, during which, the staffs working on EIA shall keep a close contact with project office, social impact assessment group and use the feasibility study report as a reference, consult local government, farmers and households raising animals. The EIA group keeps a tight contact with the feasibility study group and it is viewed by the EIA group that the environmental impact assessment is an indivisible part of feasibility study. It is the recommendation from EIA group that one chapter in feasibility study should cover all the environmental problems mentioned in this EIA and the overall project budget shall include environmental management plan costs.

In order to eliminate or minimize the project negative impact during the design period, EIA group and feasibility study group had discussions on the balance of environmental protection and economic development and different animal raising modules in detail. The environmental management plan has put forward mitigation measures on the potential environmental problems. In a word, EIA is a result of cooperation between different technical groups of the proposed project.

1.4 The EIA Team

Members of the EIA Team and the Division of the Work are presented in Table 1-1.

Table 1-1 Members of the EIA Team and Work Distribution

| Name | Major | Registration Field | Assignment |
|----------------|---|--|---|
| Han Longxi | Hydraulics and River Dynamics | Agriculture, Forestry and Hydro-powers | Project Manager |
| Wang Wanjie | Hydrograph and Water Resources | Traffic & Transportation | Report Editor |
| Cao Jiashun | Environment Engineering | Social Areas | Pollution Prevention |
| Liu Xiaodong | Environment Engineering | Social Areas | EMMP |
| Zheng Xiaoyu | Environment Engineering | Social Areas | Environmental Impacts |
| Shao Xiaohou | Bio-Agricultural Environment & Energy Engineering | | Agriculture Pollution |
| Wang Chenglong | Veterinary | | Breeding Techniques & Pollution Control |
| Li Wanping | Veterinary | | Breeding Techniques & Pollution Control |
| Liang Jing | Veterinary | | Breeding Techniques & Pollution Control |
| Wang Yufeng | Veterinary | | Breeding Techniques & Pollution Control |
| Liu Xiuling | Veterinary | | Breeding Techniques & Pollution Control |
| Feng Ling | Veterinary | | Breeding Techniques & Pollution Control |

1.5 Classifications of the Evaluation

According to Note on the Strengthening of the Control and Management of Evaluation of International-Financial-Organizations-Funded Construction Projects' Environmental Influence (Environmental Inspection N. [1993]324), and the possible amount of influence, areas of influence and the sensitivity of the site of the construction, three levels are formulated, which are shown in table 1-2.

Table 1-2 Levels of the Influence of the Project Construction

| Levels | Environmental Influence | Content of Evaluation |
|---------------|---|--|
| A | Construction Projects with Possible Negative Influence | A full evaluation of the possible negative influence is to be done |
| B | The projects whose possible negative influence to the environment is limited. And the influence can be slowed down and reduced dramatically with the application of advanced techniques and mature prevention measures. | These projects need no full environmental evaluation. But special analysis or evaluation of the environmental influence will be carried out according to the characteristics of the project and the environmental factors. |
| C | Construction projects with very little environmental influence belong to this level. | These projects will go through no environmental influence evaluation or analysis and they need only to be on the record of environmental protection management. |

Since the potential project impacts on the surrounding environment appear to be short term, minor, and reversible, it is categorized as Category B according to the World Bank classification of development projects.

1.6 Factors of the Evaluation

1.6.1 Identification of the Factors of the Evaluation

The construction and operation of this project will promote the cooperative development of the economy of this county, strengthen the public service function of the stockbreeding, change the production method, perfect the structure of industries, optimize regional economic layout, improve the eco-environment of the stockbreeding, motivate the sustainable development and increase the farmers' income. This project is of great importance to the sustainable development of the society and economy. At the same time the construction and operation of this project will produce some negative influence to the society, ecological environment and the quality of the environment which appears mainly in the construction period and the operation period.

- Influence on the social environment: This project can introduce the separate stockbreeding farmers to the urban community, which will set an example for the project area and lead the stockbreeding's standardization and macro-production in this province. The living environment of the human beings can also be improved, with low rate of communication the animal diseases and infectious diseases in both human beings and animals, which will improve the public hygiene in the rural areas. And progress can be witnessed in not only the farmers' income but also the sustainable development of the district economy and the pace of the new-country-building;
- Influence on the ecological environment: in the construction process, the project may incur some damage to arable land and vegetation to a certain extent and easily lead to

water and soil erosion; after completion of this project, the green construction, the improvement of ecological environment and the reclamation of manure from the breeding farm into fields can effectively improve the soil structure of floodplain of the Yellow River and promote the virtuous cycle of farming and animal husbandry; and

- Influence on the environmental quality: In the construction process, the project may bring pollution to water environment, atmospheric environment, acoustic environment and ecological environment; the pollutants such as sewage, waste gas, noise and solid waste that are produced during the operating period may exert an influence on the surrounding environment.

Table 1-3 indicates the potential impact of the proposed project on the environment.

Table 1-3 Preliminary Identification Matrix for Main Environmental Impact Factors of the Project

| Project Components | Environmental Parameters | | | | | | | | | | | | | | |
|--|--------------------------|---------------|-------|--------------|-------------|-------------|------------------------|-----------------|--------------|----------------------|--------------------|-----------------------------|---------------|------------|------------------------|
| | Physical Environment | | | | | | Ecological Environment | | | | Social Environment | | | | |
| | Water hydrology | Water quality | Noise | Soil erosion | Ambient air | Solid waste | Flora and Fauna | Nature reserves | Biodiversity | Soil characteristics | Social-economy | Cultural & Natural Heritage | Public health | Employment | Downstream water users |
| Construction Phase | | | | | | | | | | | | | | | |
| 100 dairy expansion | 0 | -1 | -1 | 0 | -1 | -1 | 0 | 0 | 0 | 0 | +1 | 0 | 0 | +1 | 0 |
| 200 dairy expansion | 0 | -1 | -1 | 0 | -1 | -1 | 0 | 0 | 0 | 0 | +1 | 0 | 0 | +1 | 0 |
| 200 beef expansion | 0 | -1 | -1 | 0 | -1 | -1 | 0 | 0 | 0 | 0 | +1 | 0 | 0 | +1 | 0 |
| 500 dairy w/ organic fertilizer production | 0 | -1 | -1 | 0 | -1 | -1 | 0 | 0 | 0 | 0 | +1 | 0 | 0 | +1 | 0 |
| 5000 pigs with fermentation bed | 0 | -1 | -1 | -1 | -1 | -1 | 0 | 0 | 0 | 0 | +1 | 0 | 0 | +1 | 0 |
| New 500 dairy farm | 0 | -1 | -1 | -1 | -1 | -1 | 0 | 0 | 0 | 0 | +1 | 0 | 0 | +1 | 0 |
| New 500 beef farm | 0 | -1 | -1 | -1 | -1 | -1 | 0 | 0 | 0 | 0 | +1 | 0 | 0 | +1 | 0 |
| Operation Phase | | | | | | | | | | | | | | | |
| 100 dairy expansion | 0 | 0 | 0 | 0 | -1 | -1 | 0 | 0 | 0 | +1 | +1 | 0 | 0 | +1 | 0 |
| 200 dairy expansion | 0 | 0 | 0 | 0 | -1 | -1 | 0 | 0 | 0 | +1 | +1 | 0 | 0 | +1 | -1 |
| 200 beef expansion | 0 | 0 | 0 | 0 | -1 | -1 | 0 | 0 | 0 | +1 | +1 | 0 | 0 | +1 | -1 |
| 500 dairy w/organic fertilizer production | 0 | -1 | -1 | 0 | -1 | -1 | 0 | 0 | 0 | +1 | +1 | 0 | 0 | +1 | -1 |
| 5000 pigs with fermentation bed | 0 | -1 | -1 | 0 | -2 | -2 | 0 | 0 | 0 | +1 | +1 | 0 | 0 | +1 | -1 |
| New 500 dairy farm | 0 | -1 | -1 | 0 | -2 | -2 | 0 | 0 | 0 | +1 | +1 | 0 | 0 | +1 | -2 |
| New 500 beef farm | 0 | -1 | -1 | 0 | -2 | -2 | 0 | 0 | 0 | +1 | +1 | 0 | 0 | +1 | -2 |
| Training | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | +1 | 0 | 0 | 0 | 0 |

0= No Impact, 1 = Slight, 2 = Medium, 3 = Significant, += Positive impact, -= Negative impact

1.6.2 Selection of Factors of Environmental Evaluation

Selection of factors of environmental evaluation is based on the identification and analysis of the environmental influence factors.

1. Factors for the Current Environment Situation Evaluation
 - ✓ Ambient Air: TSP;
 - ✓ Surface Water: COD, BOD₅, pH, DO, SS, TP, NH₃-N;
 - ✓ Subsurface Water: pH, total hardness, total arsenic, total mercury, total lead, total large intestine bacterium group;
 - ✓ Sound Environment: Equivalent and Successive Sound Level A.
2. Factors for the Environment Evaluation in the Construction Period
 - ✓ Ambient Air: TSP, PM₁₀
 - ✓ Surface Water: COD, SS, Oil-like
 - ✓ Sound Environment: Noise in the Construction
 - ✓ Eco-Environment: Loss of Water and Soil, Vegetation and Crops
 - ✓ Solid Waste: Abandoned Dregs and Living Waste
3. Factors for the Environment Evaluation in the Operation Period
 - ✓ Ambient Air: TSP, H₂S, NH₃, stink;
 - ✓ Surface Water: TP, NH₃-N, manure, large intestine bacterium group, ascaris eggs;
 - ✓ Groundwater: pH, total hardness, total arsenic, total mercury, total lead, total large intestine bacterium group;
 - ✓ Acoustic Environment: Equivalent and Successive Sound Level A;
 - ✓ Solid Waste: Solid Waste from Production, Solid from Everyday Life;
 - ✓ Soil Environment: Cd, Cr, Pb, As, Hg, Cu;
 - ✓ Socioeconomics (including life quality): Agriculture Output Value, Income per Capita, Job Chances, Training Number and Proportion, etc.

Since the project impact relative to other activities within the Yellow River watershed is quite small and considering the mere size of the Yellow River, the above factors that are routinely used in environmental monitoring are not believed to be responsive. Therefore, it has been decided to use the farm nutrient balance methodology instead. The aforementioned methodology is described in detail in Chapters 7 and 8 and has been adopted by the environmental team to be used for environmental monitoring of the project activities.

1.7 Content and Focus for the Evaluation

1.7.1 Evaluation Content

In accordance with Environment Impacts Evaluation Technical Guideline of PRC and the Bank requirements, stipulated in the provided TOR, the content of evaluation will include:

- Collection, analysis, and evaluation of general social, economic and environmental information of the Project counties;
- Field visits and conducting surveys of the above parameters in selected sampled sites;
- Evaluation of project's potential impacts on environment and eco-system, identifying potential negative impacts and proposing prevention or mitigation measures;
- Undertaking public participation campaigns in project counties; and
- Preparation of environmental management and monitoring plan (EMMP) for the proposed project activities.

1.7.2 Evaluation Focus

The evaluation focuses mainly centre on identification of potential environmental impacts of the project activities compared to the current livestock development practices and to ensure that appropriate measures are implemented by the project proponents to prevent or minimize the potential environmental pollution due to project activities and to enhance the positive impacts, identified by the EIA team. The final outcome of this EIA report is an implementable and realistic environmental management and monitoring plan to ensure the environmental sustainability of the project and to ensure that the recommendations provided in the impact and mitigation section are fully implemented. The main aim of preparing this EIA report is to provide a good basis for decision makers including the World Bank, PEPB, AHB, and other relevant institutions in proper environmental management and to ensure that an integrated plan is presented to ensure the environmental sustainability of the proposed project.

1.8The Objective of the Environmental Protection

The project is designed with environmental protection as one of its pillars. If implemented according to the project design, the project impact on aquatic environment will be positive and pollution of water resources will be minimized. None of the places of historical interest or prime agricultural lands will be affected by the project. The residential areas in close proximity of the animal parks will be treated as sensitive target areas and a minimum distance of 500 m will be strictly adhered to minimize project impact on residential areas.

1.9Evaluation Range and Period

1.9.1 Evaluation Range

The following evaluation ranges are considered based on the evaluation levels described in previous sections:

- Physical- environment including soil, vegetation and landscape ecology, extended to 1 km radius around the animal park;
- Aquatic Environment covering surface and ground water;

- Atmospheric Environment considering the project effect on a 200 m radius of the animal parks;
- Acoustic Environment within the 200 m radius of project area;
- Social Economic Environment focusing on people that are directly or indirectly affected by the project activities

1.9.2 Evaluation Period

The evaluation period covers the construction period, lasting about 5 years and 5 years during project operation from completion of the first group of animal parks.

Project impact on surrounding environment is believed to be minimal and short lived during construction Project impact during operation varies between different farm models, but in general short be positive, assuming that proposed project waste management activities are fully operational. Most potentially negative environmental impact of the project is due to the environmental risk of proposed waste management activities. Since the potential environmental risks during operation period could be long term and irreversible, the main focus of the project EMMP activities are concentrated on project activities during operational period.

1.10 Evaluation Standard

The applicable environmental standards for emission and other relevant environmental factors are presented below in accordance with the environment regulations of Environmental Protection Bureau of the Henan Province (PEPB).

1.10.1 Environmental Quality Standard

The major environmental standards of the PEPB and Ministry of Environment that are relevant to project activities include:

1. *The Environmental Quality Standard for Surface Water* (GB3838-2002);
2. *Groundwater Environmental Quality Standards* (GB/T14848-93);
3. *Environment Air Quality Standard* (GB3095-1996, modified on 1, 6, 2000);
4. *Acoustic Environment Quality Standard* (GB3096-2008);
5. *Soil Environmental Quality Standards* (GB 15618-1995).

1.10.2 Emission Standards

The amount of large intestine bacterium and ascaris eggs concentration should below the day average emission of *Livestock Pollution Emission Standard* (GB18596-2001).

1. The Emission Standard Grade II of *Integrated Emission Standard of Air Pollutants* (GB16297-1996) and the *Emission Standard for Odour Pollutants* (GB14554-93) are implemented for the waste gas, in which the discharge standard of odour pollutants for livestock and poultry breeding in the *Discharge Standard of Pollutants for Livestock and*

Poultry Breeding (GB18596-2001) shall be implemented for the discharge of odour (odour concentration of 70).

2. Noise in the construction period should follow the limitation proposed by *Noise Standards of the Construction Site* (GB12523-1990).
3. Livestock and poultry manure odour should follow the *Pollution Emission Standard of the livestock and Poultry Breeding* (GB18596-2001): the death rate of the ascaris eggs $\geq 95\%$ and the large intestine group number (unit/kg) ≥ 105 Composting and settling ponds should follow the *Hygiene Standards of harmonization of Manure Treatment* (GB 7959-87).

1.11 Evaluation Procedures

The evaluation procedure is summarized and presented in Figure 1.1.

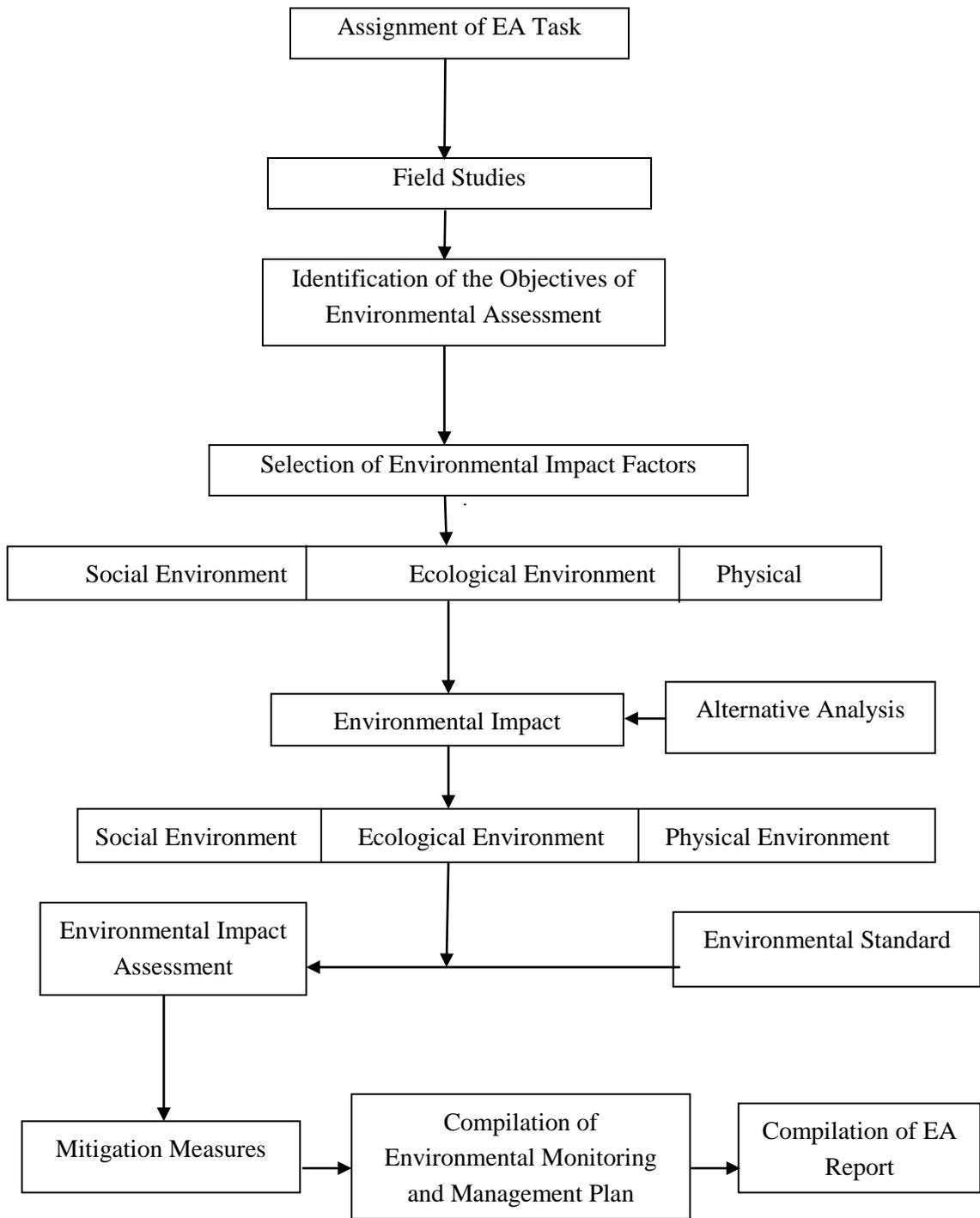


Figure 1-1 Assessment Procedures for the EIA

2 Policies, Laws and Management Framework

As requested in the Notice on Strengthening the EA work for Construction Project with Loans from International Financial Institutions (Document NO.324), the project has to implement the Chinese laws, regulations & standards on environmental protection (EP) and EA regulations and requirements. In addition to the relevant Chinese regulations on EA, the project should also follow the technical requirements of the World Bank. The EIA report is subjected to review and approval of the Provincial Environmental Protection Bureau (PEPB) and the World Bank Safeguard Group.

2.1 Organizations & Administrative Framework

At present, a system of uniform environmental supervision and management is in place in China that is practiced by Ministry of Environment (MOE) and Provincial environmental protection bureaus (PEPB) under the direction of the State Council. They are responsible to ensure all relevant environmental guidelines and regulations are enforced. The organizational structure of environmental administrative is presented in Fig. 2-1.

2.2 Environment Protection Law and Regulations

- (1) Environmental Protection Law of the People's Republic of China (December 1989),
- (2) Environmental Impact Assessment Law of the People's Republic of China (September 2003),
- (3) Cleaner Production Promotion Law of the People's Republic of China (January, 2003),
- (4) Circular Economy Promotion Law of the People's Republic of China (January, 2009)
- (5) Animal Husbandry Law of the People's Republic of China (July, 2006),
- (6) Agriculture Law of the People's Republic of China (December 2002),
- (7) Solid Waste Pollution Prevention Law of the People's Republic of China (June 2008),
- (8) Water Pollution Prevention Law of the People's Republic of China (April 2005),
- (9) Air Pollution Control Act of the People's Republic of China (April 2000),
- (10) Animal Epidemic Prevention Law of the People's Republic of China (January 2008),
- (11) Forestry Law of the People's Republic of China (October 1998),
- (12) Grassland Law of the People's Republic of China (March 2003),
- (13) People's Republic of China Land Administration Law of the People's Republic of China (May 2005),
- (14) Soil and Water Conservation Act of the People's Republic of China "(June 1991),
- (15) Desertification Control Act of the People's Republic of China (August 2001),
- (16) Water Act of the People's Republic of China (August 2002)

- (17) Protection of Wild Animals Act of the People's Republic of China (March 1998),
- (18) Protection of Cultural Relics Act of the People's Republic of China (October 2002),
- (19) Noise Pollution Control Act People's Republic of China (1997, march),
- (20) Law of the People's Republic of China on Quality and Safety of Agricultural Products (November 2006),
- (21) Species of Livestock and Poultry Management Regulations (July. 1994),
- (22) Major Animal Epidemic Emergency Regulations (November 2005),
- (23) Veterinary Drug Management regulations (March 2004),
- (24) Feed and Feed Additive Regulations (December 1998),
- (25) Regulations on the Protection of Basic Farmland of the People's Republic of China (December 1998)
- (26) Nature Reserve Ordinance of the People's Republic China (October 1994)
- (27) Construction Project Environmental Protection Management Regulations (November 1998)
- (28) People's Republic of China Regulations on the Protection of Wild Plants (January 1997)
- (29) People's Republic of China Regulations on the Protection of Wild Animals (1993)
- (30) Scenic Area Ordinance, People's Republic of China (State Council Order No. 474, 2006),
- (31) Town and Country Planning Act of the People's Republic of China (October 2007),
- (32) Management Ordinance in the Planning and Construction of Villages and Market Towns,
- (33) Historical and Cultural City, Town, village Protection Ordinance (April 2008),
- (34) Henan Construction Projects of Environmental Protection Ordinance (December 2006),
- (35) Provisional Regulations on Water Pollution Prevention and Control in Huaihe River Basin (April 2004).

2.3 Important Documents

- (1) Suggestions for the Making of the 11th Five-year Project of the Development of the National Economy and Society by the Central Committee of the Communist Party (October 11, 2005);
- (2) Suggestions for the Active Development of the Modern Agriculture and Strong Push to the New Rural Areas of Socialism by the Central Committee of the Communist Party and the State Council (Central Committee N.[2008]1);
- (3) Suggestions for the Sustainable and Healthy Development of the Stockbreeding by the State Council (State Council N. 2007]4);
- (4) Decision for the Execution of the Scientific Development and the Strengthening of the Environment Protection (State Council, N. [2005]39);

- (5) Suggestions for the Motivation of the Healthy Development of the Milk Industry (State Council, N.[2007]31);
- (6) Notice on the Strengthening of the Management of Environmental Influence Evaluation of the International Financial Organization Loaned Construction Project (National Environment Protection Bureau, National Planning Committee, Ministry of Finance, Chinese People's Bank, June 1993);
- (7) Naming List of Environment Protection of the Construction Projects (National Bureau of Environment Protection, January 2003);
- (8) Notice on the Strengthening of the Environmental Influence Evaluation Verification in Classes (National Environment Protection Bureau, December 2004);
- (9) Notice on the Temporary Method of Public Participation in the Environment Influence (National Bureau of Environment Protection, March 2006);
- (10) Management of the Signs of the Stockings and Poultry and the Breeding Files (Ministry of Agriculture, July 2006);
- (11) Regulations on the Classification of Verification of the Environmental Influence Evaluation Documents (89th order from Henan People's Government, April 2005);
- (12) Suggestions on the Stimulation of the Development of Industrialization of the Stockbreeding and Stockbreeding Development Speeding-up (Henan Communist N. [1997]19);
- (13) Decision on the Rapid Development of Stockbreeding by People's Government of Henan (Henan Gov. N. [2000]49);
- (14) Notice on the Distributing of Execution Plan for the National Important Stock Production and Handling Bases by People's Government of Henan (Henan Gov. N. [2000]33);
- (15) Suggestions on the Stimulation of the Modern Stockbreeding Industry by the Henan People's Government (Henan Gov. N. [2000]37);
- (16) Regulations on the Stockbreeding Industry in Henan (Standing Committee of People's Congress in HENAN, December 7th, 2001);
- (17) The Eco-Milk Industry Building Plan for the Flood Plain of the Yellow River in Henan ((Henan Gov. N. [2002]75))

2.4 Environment Protection and Pollution Prevention

- (1) Several Suggestions for the Strengthening of the Eco-environment Protection in the Rural Areas (National Environment Protection Bureau, November 2009);
- (2) Outline of National Eco-Environment Protection (State Council, December 2009);
- (3) Regulations on the Improvement Environment Protection of the Enterprises in Rural Areas (National Environmental Protection Bureau, Agriculture Ministry, National Planning Committee and National Economic and Trade Committee, March 1997);

- (4) Management and Prevention of the Stock and Poultry Breeding (National Environmental Protection Bureau, May 2001);
- (5) Name List of the National Treasured Wild Plants (State Council, August 1999)
- (6) Name List of National-Treasured Wild Animals (State Council, January 1989);
- (7) Guidance of the Adjustment of the Industry Structure (2005) (National Development and Reform Committee, December 2005);
- (8) The Management and Inspection of the Pollution Prevention Facilities in Henan, 52nd order of People's Government in Henan, November 11, 1999;
- (9) The Management of the Administration of the Source of Pollution in Henan, 24th order of the People's Government in Henan, issued on January 20, 1996;
- (10) Management of the Use and Collection of the Pollution Emission in Henan Province, People's Government in Henan, October 2003;
- (11) Notice on the Printing of the <The Planned Division of the Collection of Drinking Water Source of the City > Henan Government N. (2007)125, December 2007;
- (12) Plan for the Reduce of the Main Pollution in Henan in 2008
- (13) The Plan of the Reduce of the Main Pollution of the City of Project Area

2.5 Social, Economic, and Environmental Protection Plan

- (1) Chinese Develop Outlines in Undeveloped Rural Areas (2001-2010);
- (2) Outlines of National Eco-Protection (November 2000);
- (3) The “11th Five-Year Project” of the National Eco-Protection (October 2006);
- (4) National Region-Developing Plan for the Agricultural Products (2008-2015)
- (5) National Development Outlines of the Straw's Returning the Field through the Stomach of the Animals (1996-2000) ;
- (6) Construction Plan for the Central Areas in Henan of National Crop Strategy (HENAN Document N.[2008]120) ;
- (7) The “11th Five-Year Project” of the Development of the Stockbreeding of Henan Province (July 2006).

2.6 EIA Technology Guidelines

- (1) Environmental Influence Evaluation Technology Guidance (HJ/T2.1, 2.3, 2.4-93);
- (2) Environmental Influence Evaluation Technology Guidance Ambient Environment (HJ2.2-2008);
- (3) Environmental Influence Evaluation Technology Guidance Eco-Influence of Non-Pollution (HJ/T19-1997);

- (4) Environmental Influence Evaluation Technology Guidance of Construction Projects (HJ/T169-2004);
- (5) The Prevention of Pollution of Stockbreeding and Poultry Breeding (HJ/T81-2001) ;
- (6) The Management Regulation of the Poultry and Stockbreeding Community in Henan Province (trial)
- (7) Codes of Security Use of livestock and Poultry Breeding manure (NY/T1334-2007)
- (8) Hygiene Standards of the Deharmonization of the manure

2.7 Safeguard Policies of the World Bank

- (1) Environmental Assessment (OP/BP 4.01);
- (2) Natural Habitats (OP/BP 4.04);
- (3) Pest Management (OP 4.09);
- (4) Physical Cultural Resources (OP/BP 4.11);
- (5) Involuntary Resettlement (OP/BP 4.12);
- (6) Indigenous Peoples (OP/BP 4.10);
- (7) Forests (OP/BP 4.36); and
- (8) Projects on International Waterways (OP/BP 7.50).

In this project, only Environmental Assessment (OP 4.01) and Involuntary Resettlement have been triggered. This report is prepared in response to the OP 4.01 requirement.

2.8 Relevant Documents of this Project

- (1) The Preliminary Feasible Report of the World Bank-Loaned Stockbreeding Model Program in the Flood Plain of the Yellow River in Henan;
- (2) Guidance of the Environmental Evaluation of Eco-Stockbreeding Model Program in the Flood Plain of the Yellow River in Henan;
- (3) The Chinese Animal Waste Management Policies and Technological Research Report of the World Bank-Loaned Stockbreeding Model Program in the Flood Plain of the Yellow River in Henan;
- (4) The Verification Team's Memorandum of the World Bank-Loaned Stockbreeding Model Program in the Flood Plain of the Yellow River in Henan and memorandum of the preparation team and pre-evaluation team.

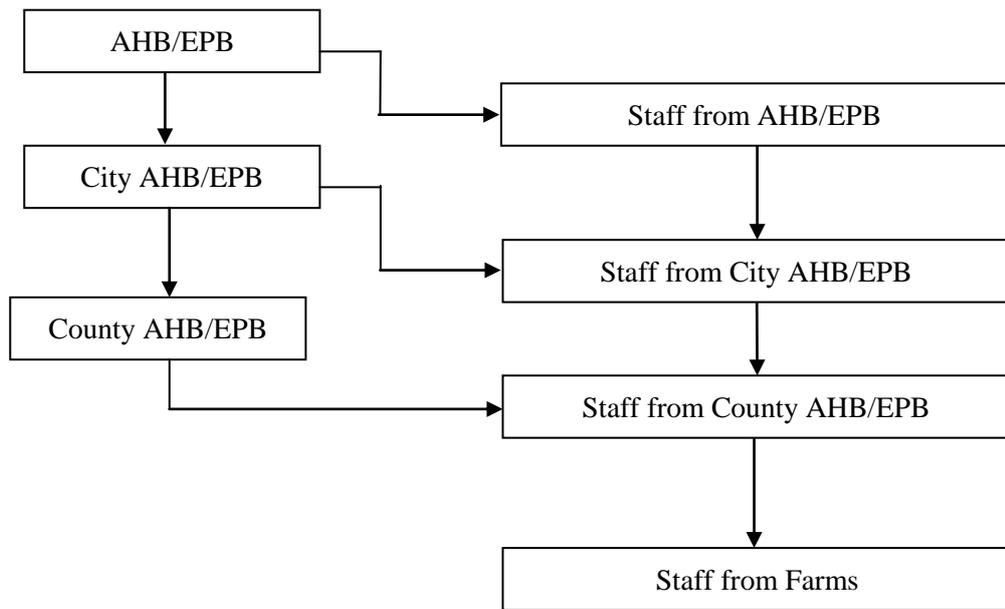


Figure 2-1 Organizational Structure of Environmental Administrative Framework

3 Project Overview

3.1 Project Background and the Status of Animal Raising

Farms

3.1.1 Project Background

The Yellow River flood plain in Henan Province is an important part of the course of Yellow River. The flood plain is the flood discharge area, flood detention area and the settling basin in flood season; at the same time, it is the essential land on which people and crowds of the flood plain rely on for production and life. In order to improve the cultivation environment in Yellow River flood plain and boost the sustainable development between the ecological stock-raising and the surrounding environment, Henan Province put forward that they will actively develop the production hog and poultry industry, accelerate the development of cattle and sheep industry and highlight the development of dairy industry. In 2002, Henan Province launched the *Construction Program of the Green Dairy Industry Demonstration Site in Yellow River flood plain of Henan Province* (Henan General Office (2002) No.75 document) to support the ecological and green cultivation of dairy cow. According to the construction program, Henan Animal Husbandry Bureau, Develop and Reform Commission and Provincial Finance Department proposed to develop the unused lands along the Yellow River flood plain and the ancient course of Yellow River to build an ecological livestock industrial zone, which integrates all aspects of grass planting, stock keeping and processing, in 30 counties (city & district) of 8 provincially administered municipality: Zhengzhou, Kaifeng, Luoyang, Xinxiang, Jiaozuo, Jiyuan, Puyang and Shangqiu, with the loan of 80 million U.S. dollars from the World Bank. The proposal was approved by the State Council in 2005 and recognized in alternative item list for the World Bank loan. Early in 2007, after being approved by provincial government, the Henan Develop and Reform Commission, Provincial Financial Depart and Animal Husbandry Bureau jointly issued the project application guidelines and finished the project organization and declaration work. In September 2007, as a result of the significant changes of the World Bank's loan policy to the agricultural development in China, Henan Develop and Reform Commission, Provincial Financial Department and Animal Husbandry Bureau adjusted their project proposal based on the latest World Bank policies and requirements from relevant state departments. After adjustment of the project proposal,, the proposed project aims at reducing the environmental pollution due to livestock animal husbandry projects due to the large and medium-scale Livestock production such as animal raising parks. As a result, the project has become a public interest project where the public financing and public goods will be the major components. The World Bank loan will be repaid by the government at all levels. In the same month, the adjusted project obtained approval from provincial government (Henan Government document (2007) No.159).

In September 2008, the World Bank identification mission visited the proposed project site. Discussions were held with related personnel from government at all levels. The project activities were confirmed and the major work plan for the next step was developed. The

identification mission reached agreements with the Henan Province about the project targets and the project title has been revised to “Henan Yellow River Ecological Livestock Project of World Bank Credit”.

3.1.2 The Status of Animal Raising Farms in the proposed Project Areas

3.1.2.1 Scales of the Farms

The total number of project expansion and rehabilitation farms is 472. Table 3.1-1 shows the number of animals at present.

Table 3.1-1 Current number of Livestock in Project Cities

| Project Cities | Number of Animals Before the Project | | | |
|----------------|--------------------------------------|--------------|--------------|------------|
| | Dairy | Beef | Pigs | Bulls |
| Zhengzhou | 14835 | 2170 | | 120 |
| Kaifeng | 8052 | 34083 | 4500 | |
| Luoyang | 7107 | | 10000 | |
| Liaozhuo | 15063 | 3436 | 23000 | |
| Xinxiang | 14841 | 13684 | | |
| Puyang | 3438 | 11153 | | |
| Shangqui | 16482 | 23453 | 30000 | |
| Liyuan | 3562 | | 2200 | |
| Total | 83380 | 87979 | 69700 | 120 |

3.1.2.2 Survey of Pollutants

Table 3.1-2 illustrates the current environmental pollution from the 472 farms.

Table 3.1-2 Survey of Pollutants

| Pollutants | Total Amount | Amount Used | Discharge Amount | Pollutants Discharge Amount | | |
|---------------|-------------------|-------------------|------------------|-----------------------------|---------------|---------------|
| | | | | COD | NH3-N | TP |
| | | | | (t/a) | | |
| Cattle Manure | 1171204.70 | 1048782.50 | 122422.70 | 3795.1 | 208.1 | 144.5 |
| Cattle Urine | 585602.35 | | 585602.35 | 3513.6 | 2342.4 | 2049.6 |
| Pig Manure | 134834.65 | 122759.50 | 12075.15 | 432.0 | 29.7 | 28.0 |
| Total | 1891642.00 | 1171542.00 | 720100.20 | 7740.7 | 2580.2 | 2222.1 |

3.1.2.3 Existing Problems

The infrastructures on the farms are not complete. The ratio of animals raising by households are high and technologies are backward with animals and people living together. The feed

utilization rate is low and animal manure are barely treated. This production model is not a sustainable way for animal husbandry development.

- Lack of environmental protection facilities is a cause for concern. Animal manure and urine discharge imposes aquatic and atmospheric pollution to the areas around the farms. Diseases spreading occurred easily.
- Improper utilization of pollutants pollutes environment and over applying of animal manure to crop land also causes loss of nitrogen and phosphorus and pollution to aquatic environment.
- Currently, animal farms have no one as the responsible person for animal manure collection, treatment and utilization, as a result, environment is getting polluted.
- Some of the livestock farms are too close to the residential areas and potentially affect daily lives of the residents.
- The existing farms are not standardized and cannot satisfy the needs of speeding up the animal husbandry development.

3.2 Project Objectives

Using the World Bank loan, this project plans to optimize industrial structure by improving infrastructure and integrated service system of farms (parks) in the beach area of Yellow River and bring along the transformation of production mode of animal husbandry in the project area and even the whole province; Assemble and apply advanced practical techniques such as breed improvement, feed preparation, total mixed ration feeding, disease prevention and control, pollution comprehensive treatment and non-polluted livestock product development; construct specialized, intensive and standardized farms (parks) of resource-saving, technique intensive and ecological and environmental protection; Form a development pattern and a virtuous circle industrial chain with perfect infrastructure, advanced technique, optimized structure, perfect service system and elegant ecological environment, and to change animal husbandry to a modern industry with notable economic benefit, social benefit and ecological benefit to bring along the sustainable development of cities and counties nearby the farm and even the farms in the whole province.

3.3 Project Components (sub-project)

This project strives to expand the farming scale, strengthen pollutant control and enhance environmental management through reconstruction and improving the existing farm infrastructure. Additionally, a group of standardized model farms will be built to consolidate the public abilities in developing animal husbandry and promoting sustainable development of breeding industry. As a part of the project a number of new normalized demonstration breeding farms will be built to strengthen the public capacity building of livestock industry and promote the sustainable development of animal husbandry.

This project involves 30 counties (city, district) of 8 provincially administered municipalities in Henan province and plans to expand or newly build plants (area), including:

- 472 reconstructed and expanded livestock farms (parks) comprising:
 - ✓ 179 dairy cows expanded farms (parks);
 - ✓ 272 beef cattle breeding farms (parks);
 - ✓ One egg-laying hen breeding farm (park);
 - ✓ 18 ecological pig farms (parks);
 - ✓ 2 breeding cow stations reconstruction and upgrading; and
 - ✓ One dairy cow breeding farm (park).
- 117 newly-built livestock farms (parks) comprising:
 - ✓ 66 dairy cow breeding farms (parks); and
 - ✓ 51 beef cattle breeding farms (parks).

After the implementation of the project, 483,269 heads breeding scale will be realized, including 181,703 dairy cows in stock, 196,546 stalls of beef cattle, and 108,400 live pig in stock.

The project will include three sub-components: (1) the capacity-building of public institutions; (2) the environmental management of the existing or new farm (district), and (3) the management, testing and evaluation of the project.

This project includes 7 models that include 500 dairy cows standardized farm, 500 beef cattle standardized farm, 5000 ecological pigs fermentation bed, pelletized organic fertilizer of 500 dairy cows, expansion of 100 dairy cow farms, transforming or expansion of 200 dairy cows farms and transforming or expansion of 200 beef cattle farms.

3.3.1 Module 1: 500 Dairy cows standardized Animal Park sub-project

3.3.1.1 Construction scale

A new 500 dairy cow scale cultivation plant is to be built, with 500 cows at hand annually. This plant mainly supplies fresh milk to the market.

3.3.1.2 Feeding technology and feeding stuff

➤ Feeding process

Depending on the purpose of cow production model, cow rearing can be divided into four phases: calves, yearlings, heifers, and cows. The production flow diagram is presented in Figure 3.3-1.

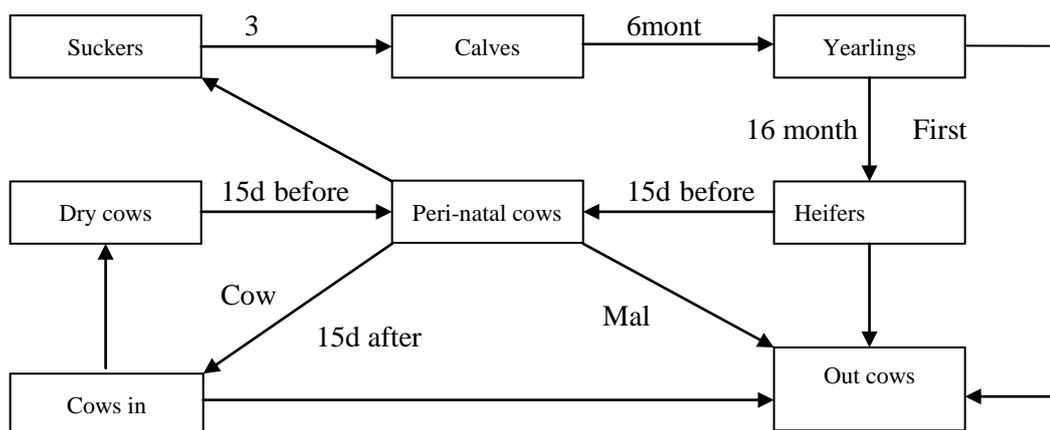


Figure 3.3-1 Dairy cow feeding technology flow diagram

➤ Feed requirements

Table 3.3-1 presents the feed material that is proposed for feeding dairy cows

Table 3.3-1 Dairy cow feeding stuff

| No. | Name of the feeding stuff |
|-----|---|
| 1 | Qualified hay (20% legume) |
| 2 | Silage corn |
| 3 | Fresh green, chopped |
| 4 | Root (carrot, beet) |
| 5 | Residue and by-product (grain silage, soybean curd residue) |
| 6 | Soybean meal |
| 7 | Corn flour |
| 8 | Wheat bran |
| 9 | Bone meal |
| 10 | Salt |

3.3.1.3 Overall layout for a dairy farm

Climate of Yellow River Basin of Henan is under category II, the outdoor temperature in winter -5°C, the mean temperature in July is higher than 28 °C. The dominant wind direction of the year is south-east; dominant wind direction in winter is north-west. The shed will face east west, 15° south to south east. The detailed design and layout will be modified based on local topography and landscape.

The general plan can be divided into (1) general office; (2) production support; (3) production; (4) waste management; and (5) quarantine areas. The boundaries between each function area should be well demarcated, but it should be easy to walk from one to the other area. All dairy cows will be milked mechanically in dairy parks. The cows will be fed and managed together. The major areas work areas in the dairy park are described below:

- General office area includes buildings for administration and operation. They should be located in the up wind of production area and stand in the higher terrain. This area should be strictly separated from production area, minimum distance is 50 meters.
- Production support area includes water, power, heat facilities, repair and fodder storage, which is attached to production area. Fodder storage, feed storage, feed preparation plant and silage pit should be built downwind of production area and stand in higher terrain.
- Production area includes shed/barn, milking hall, veterinary office and other production facilities. The facilities should be built in the downwind of general office area. At the entrance of the area, disinfection room for staff, lockers and disinfection pool for vehicles should be built. The sheds/barns should be planned well to meet needs of rearing cows by phases and flocks. Sheds for cows in lactation should be closed to milking hall, appropriately spaced to ensure construction activities meet the fire control requirements.
- Waste management and quarantine area where the quarantine shed, dead cows treatment and waste management facilities located. They should be located downwind of production area, minimum distance of 100 meters between them should be kept and stay in lower terrain. Separate passage should be built for waste treatment and quarantine shed, this will facilitate the quarantine, disinfection and waste treatment.

Key economic indicators of overall plan refer to the Table 3.3-2.

Table 3.3-2 Key economic indicators of overall plan

| Number | Items | Unit | Amount |
|--------|---|--------------------------|---------|
| 1 | Farm areal coverage | m ² (187*257) | 33350.0 |
| 2 | Total building area | m ² | 9623.4 |
| 3 | Land occupied by buildings | m ² | 13811.4 |
| 4 | Building index | % | 17.6 |
| 5 | Floor area ratio | % | 29.0 |
| 6 | area of plantation | m ² | 6670.0 |
| 7 | Plantation index | % | 20.0 |
| 8 | New roads | m ² | 2668.0 |
| 9 | Fence | m | 880.0 |
| 10 | Sewage collection system (45 by 50 open bricked sewage) | m | 983.5 |
| 11 | Rainwater collection system (45 by 50 open bricked sewage) | m | 800.0 |
| 12 | Water pipeline (DN100) | m | 500.0 |
| 13 | Power cable | m | 500.0 |

3.3.1.4 List of buildings and structure

The civil works and equipment should be provided for newly-built cow farm. Table 3.3-3 presents the list of propose buildings and structures.

Table 3.3-3 Dairy cow farm building and structure list

| No | Items | Unit | Quantity | Area |
|----|--------------------------------------|------|----------|-----------------------|
| 1 | Shed for lactating cows | set | 2 | 1320 m ² |
| 2 | Shed for heifers and dry cows | set | 1 | 720 m ² |
| 3 | Shed for yearlings and weaned calves | set | 1 | 420 m ² |
| 4 | Calving pen | set | 1 | 324 m ² |
| 5 | Separate stall for suckers | pc | 40 | 124.8 m ² |
| 6 | Quarantine shed | seat | 1 | 100.0 m ² |
| 7 | Milking parlor/hall | seat | 1 | 460.8 m ² |
| 8 | Corrals | seat | 6 | 6906.9 m ² |
| 9 | Veterinary office | seat | 1 | 60.0 m ² |
| 10 | Disinfection room | seat | 1 | 106.0 m ² |
| 11 | Office | set | 1 | 288.0 m ² |
| 12 | Staffs quarters | set | 2 | 384.0 m ² |
| 13 | Canteen | set | 1 | 288.0 m ² |
| 14 | Pump house | set | 1 | 10.8 m ² |
| 15 | Doorman's house | set | 1 | 25.0 m ² |
| 16 | Hay storage | seat | 1 | 648.0 m ³ |
| 17 | Concentrate storage | seat | 1 | 504.0 m ³ |
| 18 | Tool house | seat | 1 | 300.0 m ² |
| 19 | Silage pit | seat | 6 | 6480.0 m ³ |
| 20 | Disinfection pool | seat | 4 | 108.0 m ² |
| 21 | Scale | seat | 1 | 45.0 m ² |
| 22 | Cow ramp | seat | 1 | 45.0 m ² |
| 23 | Sewage collection pond | Pond | 1 | 450.0 m ³ |
| 24 | Manure composting pad | Pad | 1 | 600.0 m ² |

3.3.1.5 Manure treatment plan options

Manure will be treated manually. Animal solid and liquid manure will be separated manually. Manure will be loaded on trucks and transported to the composting area; wash water for milking hall and urea will be collected and drained into urea treatment pond. The treatment process follows the processes reported below:

➤ Manure treatment

Manure treatment process includes fermentation, rough treatment, and finishing treatment. The details of the process include:

- ✓ Fermentation: solid manure composting, Liquid manure fermentation in lagoon, and application to cropland;
- ✓ Rough treatment: Bacteria spraying of manure to reduce odour, fly and mosquito population, followed by drying. Add organic matter plus bacteria followed by composting, fermentation, plowing and composting. Ground the treated manure, add supplements and mix. Then pack for sale; and

- ✓ Finishing treatment: Take the rough products. Add organic matter, following by second composting, drying, pelletizing, and packaging.

➤ Sewage of washing the milking hall

Liquid from washing of the milking hall will be collected and drained into liquid manure treatment pond, after treatment and allowing for adequate retention time to reduce level of zoonotics, it will be discharged into cropland or orchard. The proposed technology includes collection of urea and sewage in sedimentation tank followed by moving to fermentation tank, filtration tank and then application to farmland. Liquid manure and sewage will be treated through sedimentation, fermentation and filtration and will be discharged into farmland or orchard

➤ Solid, liquid manure and sewage

Solid, liquid manure and sewage mix will be treated using an integrated approach.

Manure will be diluted by water and drained into the pre-treatment pond, then solid and liquid will be separated. The sewage will be purified by tandem fermentation tanks, the purified sewage (liquid) will be used to dilute the manure; the solid manure will be sent to fermentation tank in the organic fertilizer plant, it will be ploughed, ground, sieved and mixed into organic fertilizer.

3.3.1.6 Excrements

Proposed project activities will minimize pathogenic microorganism, parasitic ovum and weed seeds. It also can significantly reduce the number mosquitoes, flies and level of emission of poisonous gases such as free ammonia and hydrogen sulfide. The project feasibility team believes that the proposed treatment activities can also reduce the COD level by 70%.

Project implementation should reduce pollution of soil, surface and groundwater due to discharge of untreated cattle excrements.

3.3.2 Module 2: 500 Beef cattle standardized Animal Park sub-project

3.3.2.1 Construction scale

In this module, a new standardized farm (area) for 500 beef cattle is designed, adopting composting technology and natural sedimentation methods to deal with farmyard manure and sewage from the farm. Construction plan includes building a sewage sedimentation tank and organic fertilizer production workshop with investment of 3,693,100 Yuan.

3.3.2.2 Feeding process and feeding stuff

➤ Feeding process

In commercial beef breeding plant, cattle feeding and preparation of finished cattle process can be divided into 3 major phases:

- ✓ Transition phase (20 days). During this period parasites control and stomach toning will be carried out so that cattle can adapt to the new feeding environment. At early stages, the cattle are allowed to eat fodder freely. Fodder will not be chopped to

minimum size of 5 cm in length. At later stages, when cattle are tied to stall and are fed through the trough, most of the feed material will be fodder and can be chopped into 1 cm long pieces. Each cattle will be fed 0.5 kg of grain per day. Grain will be mixed evenly with fodder, and the grain amount will gradually increase to 1.5 kg per day by the end of this phase. Cattle is fed twice a day, while water is provided 3 times a day;

- ✓ Early fattening phase (40 days). During this phase dry matter intake will be increased to 8 kg, crude protein to 12% of ration, and grain to 50% to 60% of the feed. During this period, cattle should gain weight about 1.0 to 1.2 kg per day; and
- ✓ End of fattening phase. Dry matter intake will be increased to 10 kg, crude protein to 11% of ration, and grain to 70% to 80% of the ratio. During this stage, cattle should gain weight about 1.2 to 1.4 kg per day. Animals will be fed 3 to 4 times a day, while water will be provided 4 times a day.

➤ Feeding stuff

- ✓ **Hay:** It is mainly made up of wheat straw, sweet potato stem, groundnut stem and other hay. It also may include high-quality, improved pasture material such as *Zea Mexicana*, Lucerne and ryegrass.
- ✓ **Fine fodder:** It is mainly dividedly into energy feed, protein feed, and other feed. The energy feed includes corn, sorghum, bran, rice bran, etc; protein feed includes bean cake, cottonseed cake and rapeseed cake, etc; other feed material includes shell powder, salt, non-protein nitrogen, vitamin additives, etc.

Specific feed provision that is proposed is presented in Table 3.3-4.

Table 3.3-4 Daily feed provision for each beef cattle

| Item | Unit | Total daily grain | Soy meal | corn | Cotton seed meal | Corn Silage (with ear) | distilled spirit lees | CaCO ₃ | Salt |
|---------------------|------|-------------------|----------|------|------------------|------------------------|-----------------------|-------------------|------|
| 300-500kg Yearlings | kg | 50 | 0.5 | 2.5 | 1.5 | 28.5 | 16 | 1 | 0.05 |

3.3.2.3 Overall layout for a beef cattle farm

Climate of Yellow River Basin of Henan is under category II, the outdoor temperature in winter -5°C, the mean temperature in July is higher than 28°C; the dominant wind direction of the year is south-east, dominant wind direction in winter is north-west. The shed will face east west, 15° south to south east. The detailed design and layout will be modified based on local topography and landscape. The General technical indexes of the animal park layout are presented in Table 3.3-5.

Table 3.3-5 Major technical indexes

| No | Item | Unit | Quantity |
|----|---|----------------|----------|
| 1 | Land area | m ² | 6667 |
| 2 | Total construction area | m ² | 4818 |
| 3 | Area occupied by buildings | m ² | 4818 |
| 4 | Coefficient of building occupation | % | 72.27 |
| 5 | Plot ratio | | 0.72 |
| 6 | Plantation | m ² | 1333 |
| 7 | Coefficient of plantation | % | 20 |
| 8 | New roads | m ² | 533 |
| 9 | Enclosure wall | m | 700 |
| 10 | Waste water collection system (45 by 50 brick open canal) | m | 800 |
| 11 | Water supply pipelines on the farm (DN100) | m | 500 |
| 12 | Power lines | m | 500 |

3.3.2.4 Constructions and structures in the dairy cow plant

The list of constructions and structures for dairy cow plant is presented in Table 3.3-6.

Table 3.3.-6 Beef cattle construction layout and structure list

| No | Project name | Unit | Quantity |
|----|-------------------------|----------------|----------|
| 1 | Sterilizing room | m ² | 40 |
| 2 | Silage pit | m ³ | 3000 |
| 3 | Pumping house | m ² | 10.8 |
| 4 | House for the fattening | m ² | 2000 |
| 5 | Veterinarian room | m ² | 60 |
| 6 | Manure storage | m ² | 300 |
| 7 | Sewage processing tank | m ³ | 450 |

3.3.2.5 Expected effect

- Upon project completion, the total number of cattle to be delivered to the animal park is estimate to as high as 1,000 heads with an annual organic fertilizer output of 400 tons and direct benefit of 9.8 million.
- Upon project implementation, the wash water and cattle liquid manure should be fully collected from the shed as well as solid manure.

- Upon project implementation, the pathogenic microbes, parasitic eggs and weed seeds in the cattle manure will be destroyed through provision of adequate retention time and the processes of composting/fermentation. This should significantly reduce mosquitoes and flies population and should decrease the emission of harmful gases such as NH₃, and H₂S to the atmospheric environment. The objective of harmless processing is achieved. The COD in the cattle manure can be cut by 70% after treatment.

3.3.3 Module 3: 5000 Ecological Hog Bio-fermentation Bed Module

3.3.3.1 Scale of construction

The project plans to annually stock 5000 hogs (standard weight of a hog is 95 kg) .

3.3.3.2 Process design

The production design is diagrammatically presented in 3.3-2.

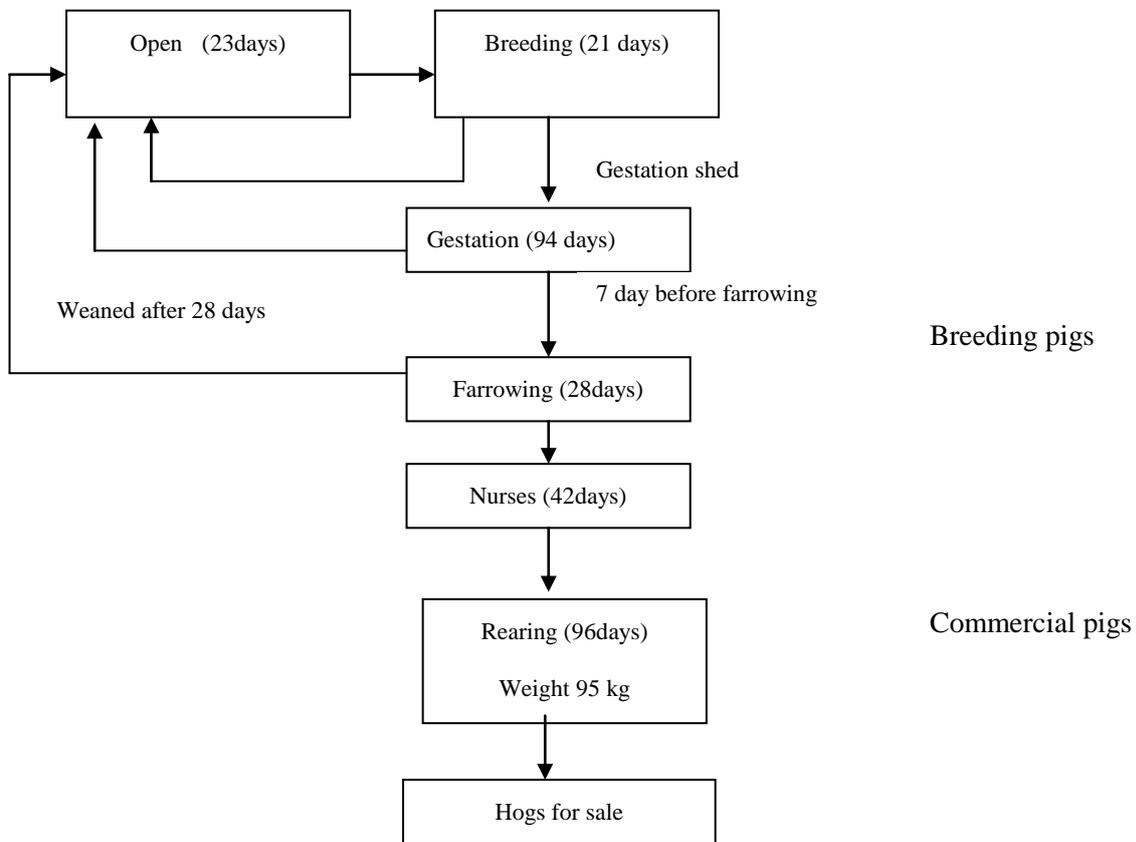


Figure 3.3-2 Process design

3.3.3.3 Feed

Pig feed nutrient characteristics at different phases of operation is presented in Table3.3-7.

Table 3.3-7 P Nutrients for feed of different phases

| No | Period | Early Piglet | Late piglet | Early fattening | Late fattening |
|----|----------------------------------|--------------|--------------|-----------------|----------------|
| | Nutrients | | | | |
| 1 | Digestible energy (MJ/kg) \geq | 13.8 | 13.39 | 12.97 | 12.25 |
| 2 | Crude protein (%) \geq | 20 | 18 | 17 | 16 |
| 3 | Crude fat (%) \geq | 3 | 2.5 | 2.5 | 2.5 |
| 4 | Crude ash (%) \leq | 7 | 7 | 8 | 8 |
| 5 | Crude fiber (%) \leq | 4 | 5 | 7 | 7 |
| 6 | Calcium (%) | 0.70 to 1.20 | 0.50 to 1.00 | 0.40 to 0.80 | 0.40 to 0.80 |
| 7 | Total P (%) \geq | 0.6 | 0.5 | 0.5 | 0.4 |
| 8 | Lysine (%) \geq | 1.3 | 1 | 0.85 | 0.75 |
| 9 | Sulfur amino acids (%) \geq | 0.78 | 0.6 | 0.55 | 0.5 |
| 10 | Water (%) \leq | 13 | 13 | 13.01 | 3 |
| 11 | Salt (%) | 0.30 to 0.80 | 0.30 to 0.80 | 0.30 to 0.80 | 0.30 to 0.80 |

3.3.3.4 Fermentation bed

➤ Scale

The size of commercial pig herds is 5000 per year, covering an area of 10,336 square meters, in the original pig-bed 7396 square meters within the set fermentation, fermentation bed litter 5845 cubic meters of domestic demand. Table 3.3-8 presents the number of animals and types and required fermentation bed.

Table 3.3-8 Fermentation bed characteristics by animal type

| No | Pig Type | Number (Head) | Existing Area per pig (m ²) | Fermentation Bedding (m ²) | Fermentation bed height (m) | Volume (m ³) |
|-----|-------------------------|---------------|---|--|-----------------------------|--------------------------|
| 1 | Production boar | 13 | 317.15 | 156 | 0.9 | 140.00 |
| 2 | Production sows | 531 | | | | |
| 2.1 | Left with breeding sows | 140 | 402.85 | 350 | 0.9 | 320.00 |
| 2.2 | Pregnant sows | 278 | 600 | 417 | 0.9 | 375 |
| 2.3 | Sow delivery | 112 | 570.48 | 448 | 0.8 | 360 |
| 3 | Piglet | 824 | 259.52 | 206 | 0.8 | 165 |
| 4 | Conservation Piglet | 1174 | 930 | 704 | 0.5 | 350 |
| 5 | Growing Pigs | 2630 | 6700 | 4734 | 0.8 | 3790 |
| 6 | Sow reserve | 133 | 481.41 | 333 | 0.9 | 299 |
| 7 | Boar reserve | 4 | 68.59 | 48 | 0.9 | 46 |

➤ **Fermentation production process bed**

The main constituents (raw material) of fermentation litter bed are sawdust, rice husk, bran, and bacteria. The main function of sawdust is to provide carbon and to keep the moisture (provide water) for assisting the bacterial fermentation process. Rice husk's primary role is keep the material loose, breathable, and to provide oxygen for the bacterial fermentation. Other material such as crushed peanut shells, corn cob, corn stalks and other crops could also be used as replacement of rice husk. Bran's primary role is to provide nutrients for the bacteria to assist in fermentation process. Other materials that can be used instead of bran include corn flour and rice bran.

➤ **Litter production**

Litter production of either concentration of production in the pig outside the venue, you can also ferment within the bed. Bacteria did not grow, its production of fermentation-bed method is different.

Common litter production methods are:

- Using raw materials at ratio of 1 m³ per litter (saw dust materials to rice husk is 50: 50), wheat bran or rice bran 2 kg, 0.2-0.3 kg of solid bacteria, appropriate amount of water.
- Bacteria propagation: Bacteria is uniformly mixed in the wheat bran or rice bran for bacteria multiplication.
- Three in one litter production methods (raw material, mixed bacteria inoculation and humidity adjustment): In this method wheat bran or rice bran is used in the mixture and

the diluted bacteria sawdust, rice husk mixture is evenly used. Water should be sprayed during mixing process to control the moisture content at around 50% to 60% to be able to press by hand into litter clump, loosely pressed to allow for easy spreading of the bedding.

- Litter accumulation ripening: In this method humidity is adjusted in small piles to allow for good fermentation. It can be accumulated to more than 1.5 meters high and total volume of not less than 10 m³ per reactor. Litter should be covered with breathable woven sacks and other coverage to allow for heat energy to be collected. In the litter of about 30-40 cm deep, it is desirable to have temperature of 40°C or above during the first two days, the next 4 to 5 days the temperature should reach around 70°C. After 7-5 days of fermentation, the temperature will drop by about 70°C to around 45°C. That indicates that the fermentation has matured. Fermented litter should be spread out evenly with 10 cm of saw dust.

3.3.4 Module 4: Producing pelleted organic fertilizer from 500 dairy cow

3.3.4.1 Construction content

Design the pelleted organic fertilizer module for cattle manure with standardized Breeding Parks containing 500 dairy cows as a basic unit using the organic fertilizer technology. The construction includes pre-treatment tank, organic fertilizer work and purchase of various equipments. The amount of investment is 520,700 Yuan.

3.3.4.2 The process

The process flowchart is presented in Figure 3.3-3.

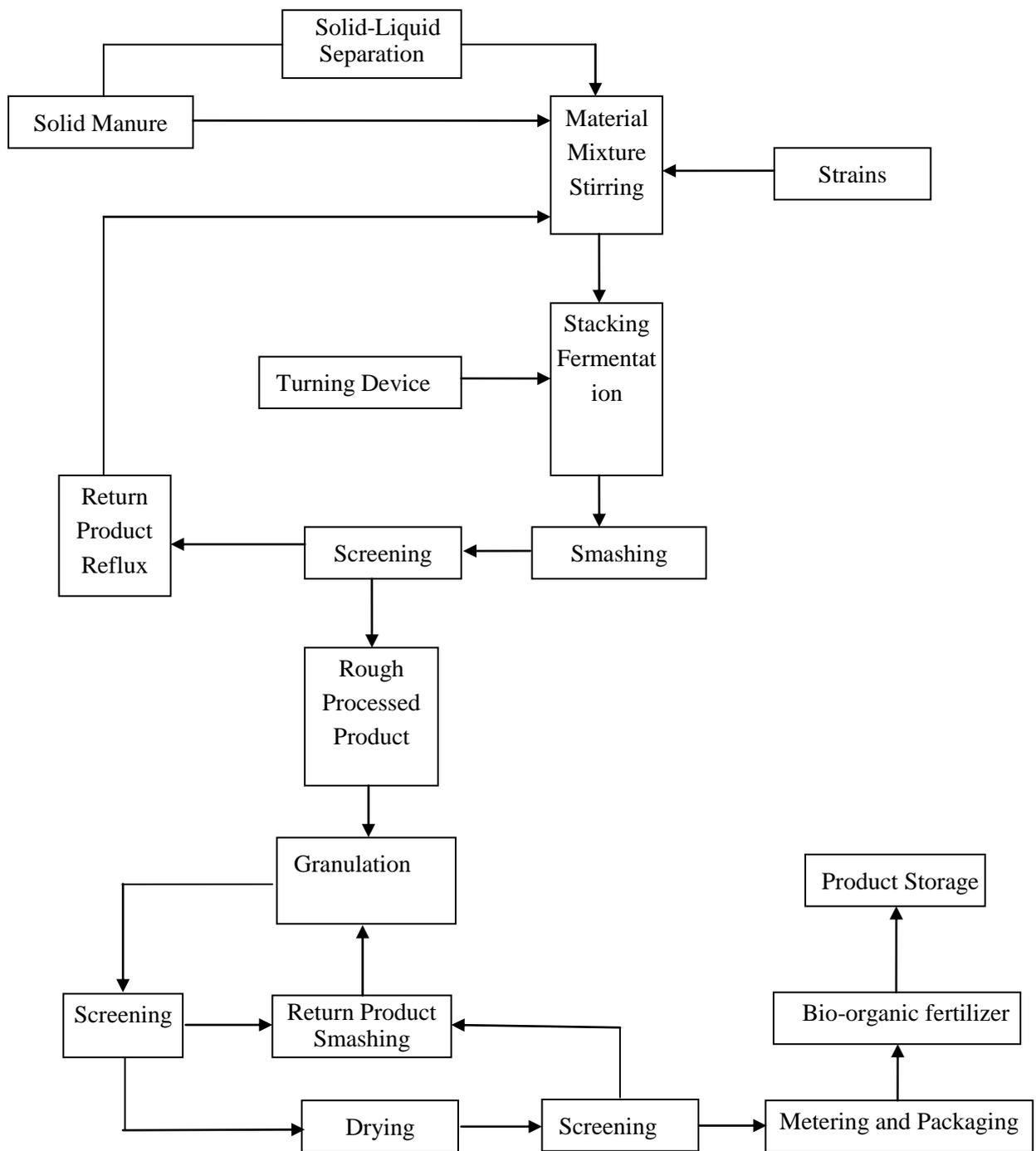


Figure 3.3-3 Production process

3.3.4.3 Equipment

The requirement equipment for the pelleted fertilizer production is summarized in the Table 3.3-9.

Table 3.3-9 Fertilizer manufacturing equipment list

| Device Name | Type | Qty | Technical parameter |
|------------------------|-------------|-------|---|
| Agitator | JBJ-2.2 | 1 set | Axial length: L = 2.50m; Rotation speed = 60rpm, N = 2.2Kw |
| Solid-liquid separator | LJ180 | 1 set | Q = 3m ³ /h, N = 4Kw |
| Micro-strainer | RBWL1 | 1 set | Q = 5t/h, N = 2.5Kw |
| Pump | WQ10-20-1.5 | 1 set | Q = 3m ³ /h, H = 20m, N = 1.5Kw |
| Chain pulverizer | LP800 | 1 set | Q = 3m ³ /h, N = 30Kw |
| Granulator | ZG1818 | 1 set | Q = 1t/h, N = 4.8Kw |
| Screener | HZS20 | 1 set | Q = 2t/h, N = 1.5Kw |

3.3.5 Module 5: Reconstructed and expanded 100 dairy cows standardized livestock Park

The management mode of the original farm (area) is generally poor. Pollution treatment process is minimal, farm environment is poor, and the rate of resources utilization is low. Following to the principle of strengthening capability construction, the project should adopt ecological breeding model to maximize resources utilization, lower wastage and reduce production cost by using ecologically appropriate technical measures to improve breed quality, water quality, and the ecological environment. This module is designed to extend standardized farm for 100 dairy cows. After extension is implemented, breeding farm scale can reach up to 500 cows and standardized breeding parks can be established. Taking expansion farm as target objective, this project will reconstruct and extend feed ration, animal raising management, cowshed reconstruction design, sanitation & epidemic prevention, and solid and liquid waste disposal.

3.3.5.1 Design scheme

Building structure and equipment configuration of this model will follow the module 1. The design of scheme for manure treatment is also similar to the contents in module 1.

3.3.5.2 Construction contents and investment estimate

Construction requirement of this module includes building cowshed and cow farm, etc and purchasing of equipment, with investment of 834,600 Yuan. The total investment cost and the breakdown is presented in Table 3.3-10.

Table 3.3-10 Investments cost estimate

| No | Item | Unit | Quantity | Unit cost (RMB) | Construction works (RMB 1,000) | Equipment (RMB 1,000) | Total (RMB 1,000) |
|-----|--|----------------|----------|-----------------|--------------------------------|-----------------------|-------------------|
| 1 | Environmental management of existing and new livestock parks | | | | 97.1 | | 97.1 |
| 1.1 | Pollution minimization infrastructure | | | | | | |
| | Disinfection room | m ² | | 528.65 | | | |
| | Silage pit | m ³ | 1296 | 59.69 | 77.4 | | 77.4 |
| | Disinfection pool | m ³ | | 86.94 | | | |
| | Well | Pce | | 15000 | | | |
| | Pump house | m ² | | 450 | | | |
| | Pump | Set | 1 | 10000 | 10.0 | | 10.0 |
| | Quarantine shed | m ² | 20 | 486 | 9.7 | | 9.7 |
| | Plantation | m ² | | 3.48 | | | |
| | Wall | m | | 166.62 | | | |
| | Road | m ² | | 90 | | | |
| | Food processing equipment | Set | | 35000 | | | |
| | Feed choppers / hay cutter | Set | | 10000 | | | |
| | TMR mixer vehicle | | | 150000 | | | |
| | Water supply pipeline (DN100) | m | | 150 | | | |
| 1.2 | Waste management infrastructure | | | | 132.5 | 256.3 | 388.8 |
| | Shed for lactating cows | m ² | | 295 | | | |
| | shed for heifers and dry cows | m ² | | 295 | | | |
| | shed for yearlings and weaned calves | m ² | | 295 | | | |
| | Calving pen | m ² | | 374.29 | | | |
| | separate stall for suckers | Pce | | 1500 | | | |
| | Lactating cow shed floor reconstruction | m ² | 1056 | 35.00 | 37.0 | | 37.0 |
| | Heifers and dry cow shed floor reconstruction | m ² | 576 | 35.00 | 20.2 | | 20.2 |

| No | Item | Unit | Quantity | Unit cost (RMB) | Construction works (RMB 1,000) | Equipment (RMB 1,000) | Total (RMB 1,000) |
|-------|---|----------------|----------|-----------------|--------------------------------|-----------------------|-------------------|
| | Yearlings and weaned calves shed floor construction | m ² | 336 | 35.00 | 11.8 | | 11.8 |
| | Corrals | m ² | 1381.38 | 46.03 | 63.6 | | 63.6 |
| | Fence for corrals | m | 131.544 | 20.00 | | 2.6 | 2.6 |
| | Cow bed | Pce | 96 | 160 | | 15.4 | 15.4 |
| | Barrow | Pce | 4 | 200 | | 0.8 | 0.8 |
| | Forklift | Pce | 1 | 90000 | | 90.0 | 90.0 |
| | Waste water collection system | m | 983.5 | 150 | | 147.5 | 147.5 |
| 1.3 | Waste treatment system | | | | 249 | 100 | 349 |
| | Manure and urea treatment pond | m ³ | 450 | 230 | 103.5 | | 103.5 |
| | Liquid waste tank car | set | 2 | 10000 | | 20.0 | 20.0 |
| | Manure pad | m ² | 600 | 242 | 145.2 | | 145.2 |
| | Plough | Set | 1 | 80000 | | 80 | 80.0 |
| 1.4 | Training, technical and farm management support | | | | | | |
| 1.4.1 | Training | | | | | | |
| | Training material | Set | | | | | |
| | Farmer training | Person day | | | | | |
| | Domestic study tour for technician | Person day | | | | | |
| 1.4.2 | Technical supporting system | | | 20000 | | | |
| | Veterinary tools | Set | | | | | |
| 1.4.3 | Livestock farm management supports | | | | | | |
| | Training on livestock farm management | Person day | | | | | |
| | Farmer association management training | Person day | | | | | |
| 1.5 | Production facility | | | | | | |
| | Milking parlour/hall | m ² | | 355 | | | |
| | Fishbone milking pump | | | 250000 | | | |

| No | Item | Unit | Quantity | Unit cost (RMB) | Construction works (RMB 1,000) | Equipment (RMB 1,000) | Total (RMB 1,000) |
|----|---|----------------|----------|-----------------|--------------------------------|-----------------------|-------------------|
| | Milk storage | | | 40000 | | | |
| | Sampler | | | 800 | | | |
| | Mobile milking pumping (serve 2 at the same time) | | | 10000 | | | |
| | Veterinary office | m ² | | 355 | | | |
| | Lab equipment (animal health) | Qty | | 250000 | | | |
| | Veterinary/animal health management equipment | Qty | | 40000 | | | |
| | Total | | | | 478.2 | 356.3 | 834.6 |

3.3.5.3 Effects Expected

- After the expansion, the annual milk production of this breeding park should reach 1358.85 tons; the annual organic fertilizer production is estimated at 1212.20 tons. Thus, the direct economic benefit of the project is about 4.89 million Yuan per annum.
- Through the implementation of this project, 100% of the wash water and manure (solid and liquid) should be collected.
- After project implementation, the manure treatment should eliminate the pathogenic microorganism, parasitic ovum and weed seeds. It should also significantly reduce the mosquitoes and flies population and emission of hazardous gases such as free ammonia (NH₃), and hydrogen sulphide (H₂S). It is also estimated that the process can reduce as much as 70% of COD by the proposed manure treatment processes.

3.3.6 Module 6: 200 dairy cows expansion livestock parks

3.3.6.1 Design scheme

Building structures and equipment configuration for this module also follow module 1. The design of scheme for manure treatment is also the same as module 1.

3.3.6.2 Construction contents and investment estimate

Construction contents of this module include building cowshed and cow farm, etc and purchasing of necessary equipment, with investment of 1,644,500 Yuan. Table 3.3-11 presents the cost estimate for the investment for this module.

Table 3.3-11 Investments cost estimate

| No | Item | Unit | Quantity | Unit cost (RMB) | construction works (RMB 1,000) | Equipment (RMB 1,000) | Installation (RMB 1,000) | Others (RMB 1,000) | Total (RMB 1,000) |
|-----|--|----------------|----------|-----------------|--------------------------------|-----------------------|--------------------------|--------------------|-------------------|
| 1 | Environment management of existing and new livestock farm and livestock park | | | | 332.6 | 235.0 | | | 567.6 |
| 1.1 | Pollution minimization infrastructure | | | | | | | | |
| | Disinfection room | m ² | | 528.65 | | | | | |
| | Silage pit | m ³ | 2592 | 59.69 | 154.7 | | | | 154.7 |
| | Disinfection pool | m ³ | | 86.94 | | | | | |
| | Well | unit | | 15000 | | | | | |
| | Pump house | m ² | | 450 | | | | | |
| | Pump | set | 1 | 10000 | 10.0 | | | | 10.0 |
| | Quarantine shed | m ² | 100 | 486 | 48.6 | | | | 48.6 |
| | Plantation | m ² | 6670 | 3.48 | 23.2 | | | | 23.2 |
| | Wall | m | | 166.62 | | | | | |
| | Road | m ² | 1067.2 | 90 | 96.0 | | | | 96.0 |
| | Food processing equipment | Set | 1 | 35000 | | 35.0 | | | 35.0 |
| | Feed choppers/hay cutter | set | 2 | 10000 | | 20 | | | 20.0 |
| | TMR mixer vehicle | | 1 | 150000 | | 150 | | | 150.0 |
| | Water supply pipeline (DN100) | m | 200 | 150 | | 30 | | | 30.0 |
| | Waste management infrastructure | | | | 541.6 | 186.6 | | | 728.2 |
| | Shed for lactating cows | m ² | 528 | 295 | 155.8 | | | | 155.8 |
| | shed for heifers and dry cows | m ² | 288 | 295 | 85.0 | | | | 85.0 |
| | shed for yearlings and weaned calves | m ² | 168 | 295 | 49.6 | | | | 49.6 |
| | Calving pen | m ² | 129.6 | 374.29 | 48.5 | | | | 48.5 |
| | separate stall for suckers | unit | 16 | 1500 | 24.0 | | | | 24.0 |
| | Lactating cow shed | m ² | 792 | 35.00 | 27.7 | | | | 27.7 |

| No | Item | Unit | Quantity | Unit cost (RMB) | construction works (RMB 1,000) | Equipment (RMB 1,000) | Installation (RMB 1,000) | Others (RMB 1,000) | Total (RMB 1,000) |
|-------|---|----------------|----------|-----------------|--------------------------------|-----------------------|--------------------------|--------------------|-------------------|
| | floor reconstruction | | | | | | | | |
| | Heifers and dry cow shed floor reconstruction | m ² | 432 | 35.00 | 15.1 | | | | 15.1 |
| | Yearlings and weaned calves shed floor construction | m ² | 252 | 35.00 | 8.8 | | | | 8.8 |
| | Corrals | m ² | 2762.76 | 46.03 | 127.2 | | | | 127.2 |
| | Fence for corrals | m | 263.088 | 20.00 | | 5.3 | | | 5.3 |
| | Cow bed | Unit | 192.0 | 160 | | 30.72 | | | 30.7 |
| | Barrow | Unit | 8 | 200 | | 1.6 | | | 1.6 |
| | | Unit | 1 | 90000 | | 90.0 | | | 90.0 |
| | Waste water collection system | m | 393.4 | 150 | | 59.0 | | | 59.0 |
| | Waste treatment system | Unit | | | 248.7 | 100.0 | | | 348.7 |
| | Manure and urea treatment pond | m ³ | 450 | 230 | 103.5 | | | | 103.5 |
| | Liquid waste tank car | Set | 2 | 10000 | | 20.0 | | | 20.0 |
| | Manure pad | m ² | 600 | 242 | 145.2 | | | | 145.2 |
| | Plough | Set | 1 | 80000 | | 80 | | | 80.0 |
| 1.4 | Training, technical and farm management support | | | | | | | | |
| 1.4.1 | Technical supporting system | | | | | | | | |
| | Veterinary tools | Set | | 520 | | | | | |
| | Lab equipment (animal health) | QTY | | | | | | | |
| | Veterinary/animal health management equipment | QTY | | | | | | | |
| | Veterinary tools | Set | | 20000 | | | | | |
| 1.5 | Production facility | | | | | | | | |
| | Milking parlor/hall | m ² | | | | | | | |
| | Fishbone milking pump | | | 250000 | | | | | |
| | Milk storage | | | 40000 | | | | | |

| No | Item | Unit | Quantity | Unit cost (RMB) | construction works (RMB 1,000) | Equipment (RMB 1,000) | Installation (RMB 1,000) | Others (RMB 1,000) | Total (RMB 1,000) |
|----|---|------|----------|-----------------|--------------------------------|-----------------------|--------------------------|--------------------|-------------------|
| | Sampler | | | 800 | | | | | |
| | Mobile milking pumping (serve 2 at the same time) | | | 10000 | | | | | |
| | Total | | | | 1122.9 | 521.6 | | | 1644.5 |

Total cost of this project is RMB 1,644,500, of which civil works amount to RMB 1,122,900 and equipment cost is RMB 521, 600.

3.3.6.3 *Effects Expected*

- After project implementation, the annual milk production of this breeding park should reach 1,358.85 tons and the annual organic fertilizer production should reach 1,212.20 tons. Therefore, the direct economic benefit of the project is estimated at 4.89 million Yuan per annum.
- Through the implementation of this project, 100% of the wash water and manure (solid and liquid) should be collected, reducing environmental pollution.
- After project implementation, majority of pathogenic microorganism, parasitic ovum and weed seeds should be eliminated from the manure. The project implementation should also significantly reduce mosquitoes and flies population and hazardous gas emission such as free NH₃ and H₂S. It is also estimated that project implementation can potentially reduce up to 70% of COD due to manure treatment.

3.3.7 *Module 7: Reconstructed and expanded 200 beef cattle livestock parks*

This module is designed to extend standardized farm to 200 beef cattle. After expansion is completed, breeding scale will reach 500 cows. Taking expansion of the animal parks as model, the project should reconstruct and extend feed ration, animal raising management, cowshed reconstruction design, sanitation & epidemic prevention, manure & waste disposal.

3.3.7.1 *Design scheme*

Building structure and equipment configuration of this project follow the designs presented for module 2. The design of scheme for manure treatment also is the same as module 2.

3.3.7.2 *Construction contents and investment estimate*

Construction contents of this module include building cowshed, cow farm, etc and purchase of required equipment, with investment of 1,037,200 Yuan.

Table 3.3-12 presents the investment requirement of implementing Module 7.

Table 3.3-12 Investments cost estimate

| No | Item | Unit | Quantity | Unit cost (RMB) | construction works (RMB 1,000) | Equipment (RMB 1,000) | Installation (RMB 1,000) | Others (RMB 1,000) | Total (RMB 1,000) |
|----|--|----------------|----------|-----------------|--------------------------------|-----------------------|--------------------------|--------------------|-------------------|
| 1 | Environment management of existing and new livestock farm and livestock park | | | | | | | | |
| 2 | Pollution minimization infrastructure | | | | 72.3 | 55.0 | | | 127.3 |
| | Disinfection room | m ² | | 528.65 | | | | | |
| | Silage pit | m ³ | | 59.69 | | | | | |
| | Disinfection pool | m ³ | 1 | 15000 | 15 | | | | 15 |
| | Well | Pce | 10.8 | 493.83 | 5.3 | | | | 5.3 |
| | Pump house | m ² | 1 | 10000 | 10 | | | | 10 |
| | Yearlings shed floor construction | m ² | 1200 | 35 | 42 | | | | 42.0 |
| | Plantation | m ² | | 3.48 | | | | | |
| | Road | | | 90 | | | | | |
| | Wall | m | | 166.62 | | | | | |
| | Water supply pipeline (DN100) | m | | 150 | | | | | |
| | Food processing equipment | Set | 1 | 35000 | | 35 | | | 35.0 |
| | Feed choppers, hay cutter | set | 2 | 10000 | | 20 | | | 20.0 |
| 3 | Waste management infrastructure | | | | | 211.6 | | | 211.6 |
| | shed for yearlings | m ² | | 305.51 | | | | | |
| | Waste water collection system | m | 800 | 150 | | 120 | | | 120 |
| | Forklift | unit | 1 | 90000 | | 90 | | | 90.0 |
| | Barrow | unit | 8 | 200 | | 1.6 | | | 1.6 |
| 4 | Waste treatment system | | | | 176.1 | 100 | | | 276.1 |
| | Manure and urea treatment pond | m ³ | 450 | 230 | 103.5 | | | | 103.5 |
| | Liquid waste tank car | set | 2 | 10000 | | 20 | | | 20.0 |
| | Manure pad | m ² | 300 | 242 | 72.6 | | | | 72.6 |
| | Plough | Set | 1 | 80000 | | 80 | | | 80.0 |

| No | Item | Unit | Quantity | Unit cost (RMB) | construction works (RMB 1,000) | Equipment (RMB 1,000) | Installation (RMB 1,000) | Others (RMB 1,000) | Total (RMB 1,000) |
|----|--|----------------|----------|-----------------|--------------------------------|-----------------------|--------------------------|--------------------|-------------------|
| | Veterinary office | m ² | | 520 | | | | | |
| | Veterinary tools | Set | | 20000 | | | | | |
| | Lab equipment (animal health) | QTY | | | | | | | |
| | Veterinary /animal health management equipment | QTY | | | | | | | |
| | Total | | | | 640.6 | 396.6 | | | 1037.2 |

3.3.7.3 Effects Expected

- After project implementation, the annual output of livestock from this breeding park can reach 1000 heads; the annual organic fertilizer production can reach 400 tons. Therefore, the direct economic benefit is estimated at 9.80 million Yuan per annum.
- After project implementation, it should significantly reduce soil, groundwater and surface water pollution due to cattle manure.

3.4 Project Investment

Total investment cost of this project consists of construction investment, interests during the construction period, pre-collection fees and the circulating funds. It is estimated that the total investment cost will be 1,273.2386 million Yuan (187.241 million US dollars), among which: the construction investment is estimated as 1,076.3703 million Yuan (158.2896 million US dollars), the interests during the construction period are estimated as 39.1984 million Yuan (5.7645 million US dollars) and the pre-collected fee is estimated as 1.36 million Yuan (200,000 US dollars) while the circulating fund is estimated as 156.31 million Yuan (7.5376 million US dollars).

3.5 Project Performance Indicators

- Whether this project can accelerate the increase in productivity, organization, and economic development in the area; whether it can improve the quality safety of the livestock products, public sanitary safety and ecological safety, and lead to the development of the standardized animal husbandry in project area and the whole province through scaling up.
- Whether it can strengthen the quarantine management at the animal parks, increase the feed conversion rate, improve beef quality, and improve the quality of the dairy produced by the to improve food safety.

- Whether it can effectively use the waste produced by the farm industry to produce mash gas or power so as to optimize the energy structure and provide clean energy for the farmers. Meanwhile, to decrease the pollution brought about by the carbon dioxide.
 - Whether it can make comprehensive use of the straws, muck water to produce the compost so as to reduce the discharge of the COD, SO₂, and other pollutants, improve the quality of soils of Yellow River floodplain. Soil quality improvement, if materialized, will not only provide fertile soil for the local farmers but will also provide for multi-level use of the biological energy and thus realization of ecological agriculture and sustainable agricultural development.
- (5) Whether it can realize the completely treatment of the droppings or urines and return them to the land.

3.6 Project Area

The project is planned to be carried out in 30 counties of Henan Province including Huiji District, Xingyang City, Zhongmou County, Xinzheng City, Kaifeng County of Kaifeng City, Weishi County, Qi County, Tongxu County, Lankao County, Mengjin County of Luoyang City, Yanshi City, Mengzhou City, Wen County, Wuzhi County, Qinyang City and Bo'ai County of Jiaozuo City, Changyuan County, Fengqiu County, Yuanyang County, Yanjin County of Xinxiang City, Puyang County, Fan County, Taiqian County, Qingfeng County of Puyang City, Liangyuan District, Suiyang District, Yucheng County, Minquan County, Ningling County, Sui County, and Jiyuan City, to sum up, the project involves 8 provincially administrated municipalities and 30 county (city, district).

3.7 Time Arrangement and Implementation Schedule of the Project

The construction period is estimated as 5 years. The beef cattle, dairy cows and other demonstration projects (infrastructure) and the technical support system are to be finished within the first 3 years after project initiation. Construction of public facilities and improvement of project management and monitoring system should be completed within the first 5 years. Table 3.7-1 provide the details of project implementation time schedule.

Table 3.7-1 Schedule for project implementation

| NO | Year Item | First Year | | | | Second Year | | | | Third Year | | | | Fourth Year | | | | Fifth Year | | | |
|----|-------------------------------|------------|---|---|---|-------------|---|---|---|------------|---|---|---|-------------|---|---|---|------------|---|---|---|
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 1 | Preliminary Design & Drawings | — | | | | | | | | | | | | | | | | | | | |
| 2 | Material Purchase | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 3 | Civil Works | | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 4 | Equipment Installation | | | | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 5 | Equipment Testing | | | | | | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 6 | Inspection | | | | | | | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 7 | Training | | | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 8 | Supporting System | | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 9 | Management System | | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

3.8 Economic Benefits of the Project

3.8.1 Indirect Benefits

- Upon project implementation, the environmental management of the cropped areas should be improved and the composted animal manure should be utilized effectively to not only reduce and regulate surface and groundwater pollution, but to also optimize the energy structure, reduce emissions, improve rural environmental condition, and improve environmental protection status.
- The implementation of the project can effectively drive the surrounding farmers to enter the cultivation farms (sections), enhance the comprehensive management of breeding industry, provide several local posts, improve the economic income of the surrounding farmers and maintain the sustainable development of local economy and animal husbandry.

3.8.2 Direct Benefits

The total number of farmers directly participating in this project is up to 11,233 and the annual revenue of each household can be increased by 20,000 Yuan on the existing basis upon the implementation of the project. Besides, the newly-added revenue of the raising households can be increased by nearly 233 million Yuan. The implementation of the project can further strengthen the industrial advantage of milk, optimize the regional distribution, enhance the driving force, effectively drive the related industry development such as feeding stuff, veterinary drugs, transportation, processing, etc, promote the local economic development, increase tax revenue, expand the channels to get rich for farmers, increase employment opportunities and farmers' income, gradually narrow the gap between the rural and urban areas to make positive contributions for the comprehensive construction of a well-off society.

4 Current Environmental Conditions

4.1 Current Environmental Conditions

4.1.1 Environmental Overview of Zhengzhou City

| Project City | Project County /City | Environmental Overview |
|--------------|----------------------|---|
| | Zhongmou County | <p><u>Natural Environment:</u> Zhongmou County is located between the east longitude 113°58' to 113°59' and north latitude 34°42' to 34°43', east to Kaifeng and west to Zhengzhou.</p> <p>Weather and Climate Conditions: It belongs to typical mid-latitude warm-temperate continental monsoon climate, with four distinct seasons, mild climate, rain hot over the same period; the annual average temperature in Zhongmou County is 14.2°C, the frost-free period is 240 days, and the annual average precipitation is 616 millimeters.</p> <p>Soil: Moisture soil, which consists of 3 soil layers (sandy soil, two-combined soil and warp soil), is the main soil in the county and it belongs to sandy loam soil and silty clay soil.</p> <p>Water System: There are more than 40 rivers and streams in Zhongmou County. The surface water mainly comes from the Yellow River and Jialu River. The annually diverted water volume from the Yellow River is 301 million m³.</p> <p><u>Social Economy:</u></p> <p>Zhongmou County governs 11 towns, 6 townships and 431 administrative villages, with the total areas of 1,416.6 km²; at the end of 2008, the total population of the county is 675,785, among which, 219,630 are urban population and 456,155 are rural population; the gross production value of the whole year reached 15.56 billion yuan. In 2007, the per capita disposable income reached 10,003 yuan for urban dwellers, the per capita net income of rural residents rose to 5,836 yuan. The agricultural industry of Zhongmou County has a very solid foundation and forms the industrial pattern of “forestry, fruit industry and animal husbandry at South county; growing melon, garlic and vegetable at middle county; the water surface planting and aquaculture at north county”. The vegetable land covers the areas of 203,400 mu, and there are 134 fresh-preserved storehouses; by utilizing these resources, more than 700,000 tons of fresh vegetables of various kinds</p> |

| Project City | Project County /City | Environmental Overview |
|--------------|----------------------|---|
| | | <p>are produced. The total output of meat is 83,500 tons, eggs 31,400 tons, dairy products 134,600 tons; number of pig for sale is 675,200, cow 78,700, sheep 704,200 and poultry 8.8174 million; water areas for aquaculture are up to 45,000 mu, in which products known all over the country are raised, such as steamed crab, Yellow River carp and South America prawn. The output of green vegetable, fresh milk and farm products ranks the first place of the whole city.</p> |
| | Huiji District | <p><u>Natural Environment:</u> Huiji District is located at the north part of Zhengzhou and the south bank of Yellow River, 113°37' east longitude and 34°52' north latitude.</p> <p>Weather and Climate Conditions: It belongs to north temperate zone semi-arid sub-humid continental monsoon climate, with four distinct seasons; the temperature is moderate but with big variation every year; the annual average temperature is 14.2°C and the range of variation each year is between 13°C to 16°C.</p> <p><u>Social Economy:</u></p> <p>Huiji District governs 2 towns and 6 sub-district offices, with the total areas of 232.8 km². At the end of 2008, the total population of the district is 198,171, among which, 124,848 are urban population and 73,323 rural population. The gross production value of 2008 reached 4,815.11 million yuan, among which, the annual gross output value of agriculture of this district is 718.19 million yuan. The per capita disposable income reaches 12,032 yuan for urban dwellers, and the average per capita net income of rural residents is 8,971 yuan. The annual total grain output are 26,208 tons, vegetables 233,100 tons. The annual cultivation areas of crops are 11,740 hectares, among which, 4,580 hectares for planting grain crops and 7,160 hectares for economic crops (6,140 hectares for vegetables). The annual total output of meat is 6,000 tons, poultries and eggs 5,589 tons, milk 27,043 tons, and aquatic products 21,489 tons. The infrastructures for water supply and sewage, power and communication pipe network are completely facilitated.</p> |
| | Yingyang City | <p><u>Natural Environment:</u> Yingyang City is located between east longitude of 113°22'~113°23' and north latitude of 34°46'~34°47', west to Luoyang, south to Songshan Mountain, north to Yellow River and East to Zhengzhou. Yingyang City is rich in mineral resources, mainly including coal, bauxite, dolomite, limestone, pyrite, iron ore,</p> |

| Project City | Project County /City | Environmental Overview |
|--------------|----------------------|---|
| | | <p>loess ore, marble, granite and etc. The Yellow River flows through the northwest areas of Yingyang City with the strand lines of 45 km long; the surface and ground water resources are rich and the soil structure is good.</p> <p><u>Social Economy:</u></p> <p>The city governs 2 sub-districts, 9 towns, 3 townships, with the total areas of 908 km² and the total population of 620,000 (among which, 9,395 are rural population); the natural population growth rate is 3.18%. The per capita disposable income reaches 13,232 yuan for urban dwellers, the average per capita net income of rural residents is 7,455 yuan and the per capita GDP is 49,412 yuan. The areas of arable land are 42,000 hectares, on which mainly grows wheat, corn, cotton, peanut, winter peach, honeysuckle, pomegranate, persimmon and etc. Yingyang City is rich in water resources and two water plants have been constructed, with the daily capacity of water supply attaining 32,000 tons.</p> |
| | Xinzheng City | <p><u>Natural Environment:</u> Xinzheng City is located at the middle part of Henan Province, north to Zhengzhou City, east to Weishi County, south to Changge County, west to Xinmi City. It is situated between the north latitude of 34°16' to 34°39' and the east longitude of 113°30' to 113°54', with 42 km from south to north and 36 km from east to west.</p> <p>Landform: Situating at the transition zones of Yuxi mountain areas to the east areas, Xinzheng City is with various terrains of mountain, mound and plain, high in the west and lower in the east, high in the middle and lower in the north and south; the mountains mainly located at this area are Juci Mountain, Jingshan Mountain, Zhangshan Mountain, Taishan Mountain, Meishan Mountain and etc.</p> <p>Weather and Climate Conditions: It is belongs to Warm temperate continental monsoon climate, with moderate temperature and four distinct seasons. The annual average temperature is 14.4°C.</p> <p>Water System: The total volume of water resources are 138.66 million m³ and the owning amount per capita is 236 m³. There are more than 14 rivers in this city, viz. Shuangji River, Huangshui River, Yishui River, Meihe River, Lianhe River, Luanquan River, Gaolu River. The total channel length is 223.82 km. There are 24 registered reservoirs, mainly including Wangjinglou Reservoir,</p> |

| Project City | Project County /City | Environmental Overview |
|--------------|----------------------|---|
| | | <p>Luodong Reservoir, Houhu Reservoir and Yangzhuang Reservoir. The total volume of available water resources in this area are 196 million m³, among which, 68 million m³ are surface water runoff, 95 million m³ are transit water and 47.1 million m³ are shallow seated ground water allowed to be developed.</p> <p><u>Social Economy:</u></p> <p>Xinzheng City governs 9 towns, 3 townships and 3 sub-district offices, with the total areas of 873 km² and total population of 766,982. The areas of already built district are 20 km² and the urban population is 180,000. The gross production value of 2008 reaches 32.10271 billion yuan and the total grain output is 205,937 tons. The annual grain cultivation areas are 54,670 hectares, the output of meat is 17,164 tons, the output of poultries and eggs are 23,465 tons, the output of milk is 17,800 tons. Xinzheng City has abundant agricultural resources and has built various farm products production bases, such as cherry production base, grape production base and production base for various fruits; there are 200,000 mu areas for growing Chinese date, on which 6 million date trees are planted and 30 million tons of good quality date are produced each year; thus, Xinzheng City has been named as the “Home of Chinese Date” by China's Ministry of Forestry.</p> |

4.1.2 Environmental Overview of Kaifeng City

| III | Kaifeng City | Environmental Overview |
|-----|----------------|--|
| 1 | Kaifeng County | <p><u>Natural Environment:</u></p> <p>Geographic Features: Kaifeng County is located at the east part of Henan Province, the south bank of Yellow River, with three sides being surrounded. It is situated between the east longitude of 113°52' to 115°15' and the north latitude of 34°11' to 35°01', with 40.8 km from south to north and 55 km from east to west.</p> <p>Landform: The county areas belong to alluvial plains of Yellow River; it is high in the northwest and lower in the southeast; the north areas of Yellow River is high bottomland and the south is swale; the western and the southern part of the county are swale, while the terrain of middle and eastern part is flat; the altitude is between 89.3 to 62.5 meters. The county has four types of landform, viz. accumulated bottomland of Yellow River, wind-deposition alluvial sandy dune land, alluvial flat land of Yellow River and alluvial</p> |

| III | Kaifeng City | Environmental Overview |
|-----|---------------|---|
| | | <p>bottomland of Yellow River.</p> <p>Soil: The soil particles are small and the soil mechanical composition is mainly loam; the soil bulk density is small and the pore space is comparatively large; the variation range of pH value of soil is large; the soil nutrient has the tendency of enriching.</p> <p>Weather and Climate Conditions: Kaifeng County belongs to the warm temperate continental monsoon climate, with the annual average temperature of 14°C, the annual precipitation of 628 millimeters, and the frost-free period of 214 days.</p> <p>Water System: Kaifeng County is abundant in water resources and has large volume of ground water. There are 32 rivers in this area; the water quality of Yellow River is good and its water source is sufficient; in addition, there are Huiji River, Wahe River and Yuni River. The average burial depth of phreatic water is 3 m and the thickness of water layer is about 15 m; the areas of fresh water accounts for 98.6% of total water areas.</p> <p><u>Social Economy:</u></p> <p>Kaifeng County governs 6 towns and 9 townships, with the total population of 700,000 and the total areas of 1,449.9 km². The county has abundant farm and sideline products, mainly producing wheat, rice, corn, cotton, peanut, watermelon and vegetables. So far, production bases with the areas of 900,000 mu for growing high yield wheat, of 500,000 mu for good quality peanut, of 200,000 mu for good quality Bianliang watermelon, of 150,000 mu for vegetables and 80,000 mu for rice have been established. In 2008, the per capita net income of peasants reached 4,355.43 yuan.</p> |
| 2 | Weishi County | <p><u>Natural Environment:</u></p> <p>Geographic Features: Weishi County is located at the Yudong Plain and between the north latitude of 34°121' to 34°37' and the east longitude of 113°52' to 114°27', east to Tongxu and Fugou County, south to Yanling County and Changge City, west to Xinzheng City and north to Kaifeng County and Zhongmou County, with 40.77 km from north to south and 43.76 km from east to west.</p> <p>Landform: The terrain is high at the northwestern part and lower at the southeastern part; the southwestern part is high flat land and the eastern part is wash plain of Yellow River.</p> <p>Soil: There are mainly three types of soil, viz. moisture soil, aeolian sandy soil and cinnamon soil, among which, the moisture soil is mainly utilized for the cultivation in Weishi County, with two-combined soil accounting for more</p> |

| III | Kaifeng City | Environmental Overview |
|-----|---------------|---|
| | | <p>than 60%.</p> <p><u>Weather and Climate</u> Conditions: It belongs to warm temperate sub-humid monsoon climate, with four distinct seasons. The annual average temperature is 14.1°C, the annual average frost-free period is 215 days, the annual average precipitation is 692.3 millimeters and the annual average sunshine time is 2,481.9 hours.</p> <p>Water System: There are Shuangji River and Dugong River in the south, Jalu River in the east, Kanggou River in the middle; these river flow in convergence early and late, and finally flows into Huaihe River.</p> <p><u>Social Economy:</u></p> <p>Weishi County governs 8 towns, 9 townships and 512 administrative villages, with the total areas of 1,307.7 km² (1.205257 million mu of arable land and 1.78 mu per capita) and the total population of 675,581 (649,232 of agricultural population, accounting for 96.1% of the total). As for forestry, black locust and Chinese date are planted in the west areas, and paulownia and willow are generally planted in the east areas. The main crops are wheat, cotton, corn, oil-bearing crops, melons and vegetables, among which, wheat and cotton are largely produced.</p> |
| 3 | Qixian County | <p><u>Natural Environment:</u></p> <p>Geographic Features: Qixian County is located at the Yudong Plain and between the east longitude 114°44' to 114°48' of and north latitude of 34°30' to 35°35', with 55 km from north to south and 32 km from east to west.</p> <p>Landform: It is a part of Yellow River Alluvial Plain, the terrain is flat with just a little relief surface and there is little slope from northwest to southeast; the altitude is between 53~64 meters and the ground gradient is between 1/4500-1/5000.</p> <p>Soil: There are 2 soil types in this areas, viz. moisture soil and aeolian sandy soil, and there are 3 subtypes of soil, 5 soil genus and 24 soil species; moisture soil accounts for 99.93%, and the left 0.07% are aeolian sandy soil.</p> <p>Weather and Climate Conditions: It belongs to temperate continental monsoon climate with four distinct seasons, abundant sunshine and sufficient precipitation. The annual average temperature is 14.1°C, the annual precipitation is 722 millimeters and the frost-free period is 210~214 days.</p> <p>Water System: Mainly Yuni River, Huiji River and Tiedi River flow through the county areas.</p> <p><u>Social Economy:</u></p> |

| III | Kaifeng City | Environmental Overview |
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| | | <p>Qixian County governs 21 towns and townships, 546 administrative villages, with the total areas of 1,243 km² (125 mu of arable land) and the total population of 1.04 million (0.942 million of agricultural population). Several production bases of farm products have been established, such as garlic, chili, peanut, cotton, wheat, cauliflower and edible mushroom production bases. Qixian County produces a lot of livestock products; so far, more than 1,300 large scale farms for raising livestock have been established and the output value of stockbreeding accounts for more than 40% of the gross output value of agriculture.</p> |
| 4 | Tongxu County | <p><u>Natural Environment:</u></p> <p>Geographic Features: Tongxu County is located on the Yudong Plain, north to Yellow River and west to Songshan Shaolin Temple, between the east longitude of 114°27' to 114°28' and north latitude of 34°28' to 34°29', with 30.5 km from east to west and 34.8 km from south to north.</p> <p>Landform: It is situated in the middle of the huge alluvial fan created by Yellow River flowing from Mengjin to the east, and located on the west of Yudong Plain. Generally, Tongxu County is high in the west and the north, lower in the east and south, and the northwestern part inclines a little to the southeastern part. The terrain is flat. The altitude is between 57.5-66.5 meters and the ground gradient is 1/4000-1/5000. There are 3 types of landforms, viz. mound, flat land and swale.</p> <p>Soil: Moisture soil is the main soil type, among which, sandy soil accounts for 9.7% of the arable land areas of the whole county, light sandy soil for 47.8%, two-combined soil for 24.9%, silt soil for 13.3%, saline soil for 4.3%, and all these soils are scattered in the county.</p> <p>Weather and Climate Conditions: It belongs to warm temperate continental monsoon climate with four distinct seasons and moderate temperature; the annual mean sunshine time is 2,500 hours, annual average temperature 14.9°C, frost-free period 222 days and annual precipitation 775 millimeters.</p> <p>Water System: There are Wahe River and its old channel in the county.</p> <p>Social and Economy:</p> <p>It governs 6 towns, 6 townships and 304 administrative villages, with the total areas of 767 km² and the total population of 0.59 million. With the flat terrain and sufficient resources, a lot of crops are planted, such as wheat, cotton, corn, peanut, watermelon and garlic, thus, Tongxu County is known as the grain production base county, good quality wheat production base county, seedless watermelon production base county and labor service export base of Henan Province.</p> |

| III | Kaifeng City | Environmental Overview |
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| | | <p>Existing Water Supply and Utilization Facilities: There is a water station in the industrial zone, the ground water supply network is 20 km, the diameter of the main pipeline is 310 mm, and the capacity of water supply is 200~2000 t/h.</p> <p>Water Drainage: The drainage pipeline network is 18 km, 7 km of Φ1000mm pipe, 11 km of Φ800mm pipe; the distance between sanitary sewer manholes is 50 m.</p> |
| 5 | Lankao County | <p><u>Natural Environment:</u></p> <p>Geographic Features: Lankao County is located at the downstream areas of Yellow River, northwest to Yellow River, bordering the Shandong Province at the northeast, between the east longitude of 114°47' to 114°50' and north latitude of 34°48' to 35°50'.</p> <p>Landform: It slopes down from northwest to southeast; to the north of Yellow River, there is bottom land; to the south of Yellow River and north of its old channel, there are mound, hills and inland inundation areas of swale; to the south of old channel of Yellow River, there are sandy waste land, inland inundation areas and saline-alkaline fields.</p> <p>Soil: Sandy soil and two-combined soil, which belongs to moisture soil type, are two main soil kinds in this area and these kinds of soil are lack of organic matters; in addition, there are a few saline soil and Aeolian sandy soil, with thick soil layer and alkaline nature.</p> <p>Weather and Climate Conditions: It belongs to warm temperate sub-humid continental monsoon climate with four distinct seasons, dry, cold and windy in winter, hot and rainy in summer, cool and with long daytime in autumn. The annual average temperature is 14°C, annual mean sunshine time 2,529.7 hours, annual average precipitation 678.2 millimeters and frost-free period 219 days.</p> <p>Water System: There are Heli River, Siming River and Huangcai River.</p> <p><u>Social and Economy:</u></p> <p>The areas of administrative district: Lankao County governs 11 townships and 5 towns, with the total population of 0.76 million and the total areas of 1,116 km² (0.9746 million mu of arable land). The county has abundant farm products of good quality, and it mainly produces wheat, corn, soy bean, peanut, cotton, paulownia, apple, grape, Chinese date and etc. Lankao County is a national production base of commodity grain with the production of grain, cotton and oil ranking the national's top hundred. In 2006, the gross production value of the whole county reached 5.74 billion yuan, the per capita disposable income reached 6,620 yuan for urban dwellers, and the per capita net income of rural residents rose to 2,494 yuan.</p> |

4.1.3 Environmental Overview of Luoyang City

| IV | Luoyang City | Environmental Overview |
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| 1 | Mengjin County | <p><u>Natural Environment:</u></p> <p>Geographical characteristics: It is located on the border of middle and lower reaches of Yellow River, 110 km from Zhengzhou in the east, 90km from Sanmen Gorge in the west, adjacent to Luoyang in the south and facing Yellow River in the north, adjoining the Jiyuan City. It lies between east longitude 112°12' to 112°49', north latitude 34°43' to 34°57', and runs 55.5km from east to west, 26.9km from south to north. Landform: High in the west and low in the east as well as high in the middle and low in the south and north. In addition, the south and north sides of its east part are the terraces of the Luohe River and Yellow River, which are considerably flat; the average altitude of the whole county is 262m. Soil: The soil includes 2 soil types, 6 subtypes, 17 soil genera, and 50 soil species, of which, the brown soil and moisture soil classes occupy 93% and 7%, respectively. Weather and climate: It belongs to the transitional belt from the subtropical zone to the temperate zone, which is featured by the average temperature of 13.7°C, average rainfall of 650.2mm, average frost-free period of 235 days, and annual average rainfall of 650.2mm.</p> <p>Water system: (hydrological characteristics of the surface water and underground water) It belongs to the water system of Yellow River, with the main rivers including Yellow River, Jinshui River, and Chanhe River. The Yellow River within its borders and the county borders is with the flow of 59km and 6.5km, and with the catchment area of 62.7km².</p> <p><u>Social economy:</u></p> <p>There are 9 towns, 1 township, and 227 administrative villages under the jurisdiction of Mengjin County, which is with the total population of 0.45 million, total area of 758.7km², cultivated land area of 0.5667 million mu, and the per capita agricultural cultivated land area of 1.43mu. In 2006, it hit the total output value of 5611 million yuan, with the urban per capita disposable income and the rural per capita net income of 7711 yuan and 2990 yuan. Besides, in the whole county, the high-quality and special wheat of 0.23 million mu, high-quality corn of 0.25 million mu, vegetable of 65000 mu, flower and plant of more than 9000 mu, fine tobacco leaf of 20000 mu had been planted, with 20000 milk cows on hand. Moreover, there are also plentiful economic forest resources, which mainly include the apple, pear,</p> |

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| IV | Luoyang City | Environmental Overview |
| | | peach, grape, hawthorn, cherry, plum, Chinese date, apricot, pomegranate, walnut, and persimmon. |
| 2 | Yanshi City | <p><u>Natural environment:</u></p> <p>Geographical characteristics: It faces Songyue in the south, and adjacent to Yellow River in the north, which lies between east longitude 112°26' and 113°00', north latitude 34°27' to 34°50', and runs 44km from east to west, about 34km from south to north. Landform: It is the low mountain and hill area, which is high in the south and north and low in the middle, of which, the plain, hill, and mountain area occupy 31.4%, 51.9%, and 16.7%. With regard to the north hill and ravine areas, middle Yishui River and Luoshui River areas, and sloping field to the south of Yishui River, the average altitude is 300-900m. Soil: Within its borders, the main part is the brown soil class, yellow and brown soil, and moisture soil classes, which are of wide distribution area; and there are also few clay and lithosol. Weather and climate: It has the continental climate of the warm temperate zone, which is featured by the annual average temperature of 14.2oC, annual average rainfall of 535mm, average frost-free period of 211 days, and 2248.3 annual average sunshine hours. Water system: (hydrological characteristics of the surface water and underground water) Its water systems includes the Yellow River, Yihe River, and Luohe River. The length of Yellow River within its borders is 1.4km; Yihe River and Luohe River flow through 11 town(ships) from west to east, and they join together as the Yiluo River in Yuetang; finally, it flows into Yellow River, which is regarded as the primary tributary of Yellow River. Additionally, Majian River, Liujian River, Tiejiao River, and Shahe River at its south borders are also the important tributaries of Yihe River and Luohe River.</p> <p><u>Social economy:</u></p> <p>Area of the administrative villages: There are 16 town(ships) and 332 administrative villages under its jurisdiction, which is with the total population of 0.85 million, agricultural population of 735485, accounting for 87.67%, and total area of 960 km². In 2007, it hit the total output value of 27 billion yuan; in 2006, the rural per capita net income was 5201 yuan. Besides, its main crops include the wheat, corn, cotton, sesame, and sweet potatoes. In addition to above, with the well-known wheat planting experience throughout the country, it is not only the domestic wheat planting origin with the high-yielding, stable yield, high quality, and low costs, but also the main wheat production area and the basic grain production county (city) of Henan Province.</p> |

4.1.4 Environmental Overview of Jiaozuo City

| V. | Jiaozuo City | Environmental Overview |
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| 1 | Mengzhou City | <p><u>Natural Environment:</u></p> <p>Geographical Features: Situated in the Southeast direction of Jiaozuo City, neighboring Lingwen County in East, and with Qiyuan connected in the West, Yellow River adjoined in the South, also next to Qinyang city in the North, Mengzhou City is lied between longitude 112°33' to 112°55' East and latitude 34°02' to 34°50' North, with the whole length of 32 km from east to west and the whole width of 25.75km from south to north.</p> <p>Topography: within the boundary of the city, there are some obvious transitive features of low mountain—rolling country—plains, which are the western boundary area of North China Plain, with the height of 305.9 to 108.5m above sea level.</p> <p>Soil: mainly composed of cinnamon and tidal land, while cinnamon is distributed amongst the western hill area, tidal land in the eastern plains and Yellow River floodplains.</p> <p><u>Weather& Climate:</u> it belongs to warm temperature zone and continental climate with distinctive four seasons each year, an average temperature of 14.4° C, an annual average rainfall of 640.9mm, frost-free period for 220 days, and annual sunshine hours of approximately 2400hrs. Water system: the system within the city is connected to the Yellow River Basin, and its main rivers include Yellow River and Mang River, amongst which the full length of Yellow River within the city amounts up to 26km.</p> <p><u>Social Economy:</u></p> <p>With a total area of 541.65 km², the city governs 7 townships (town), and 4 designated offices. In 2008, the city's year-end total population is 377425, amongst which nonagricultural population takes up 58268, with the year's net income of RMB6266 per capita for the urban residents, and dispensable income of RMB 12105 per capita for the residents living in the towns. The city's grain growing area is 39657 hectares, amongst which, the cultivated area for grains sowing in the summer amounts to 20793hectares, and that for grains sowing in the Autumn occupies 18864 hectares, and the cottons 1951 hectares, grains 3665 hectares, and vegetables 5008 hectares.</p> |
| 2 | Wen County | <p><u>Natural Environment:</u></p> <p>Geographical Features: Situated in the western part of Yudong Plains, neighboring Yellow River in the South, and with Taihang Mountains connected in the North, Wen Country lies between the longitude 113°03' to 113°05' east and latitude 34°55' to 34°57' north. Topography: the northern and central regions are rolling fields of Qin River, with plain</p> |

| V. | Jiaozuo City | Environmental Overview |
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| | | <p>terrains; while the southern regions are characterized by abrupt slopes, connected to the Yellow River and bottomland of Mang River, with the height of 75-120m above sea level throughout the region. Weather & Climate: warm temperature zone and continental monsoon climate featuring annual average temperature about 14.3°C, with annual rainfall of 552.4mm, and the frost-free periods of 210 days.</p> <p>Water System: with the length of 26km within the Yellow River, of more than 10km within Qin River, and of 27km within Mang River.</p> <p><u>Social Economy:</u></p> <p>Wen County governs 7 towns and 3 townships, altogether 262 administrative villages. The total area of 5 communities is 462sq km, amongst which, 360 thousand mu are arable lands, and there are state-owned non-cultivated land of bottomland of Yellow River amounting up to 190 thousand mu, with the total population of 419 thousand living there. the county is rich in producing grain and oil crops including wheat, corn, peanut, soy bean etc, as well as “Four Great Bei Herbs”, i.e., Chinese common Yam, rehmanniae, chrysanthemum, and achyranthes. In 2007, the disposable income per capita of the urban residents of Wen County is RMB 5181.79 , and wage income per capita of urban residents is RMB 3729.85.</p> |
| 3 | Wuzhi County | <p><u>Natural Environment:</u></p> <p>Geographic Features: Wuzhi County locates in the middle reaches of Yellow River, neighboring Taihang Mountains to the North, and Yellow Rivers in the South, with the longitude 113°11’ to 113°11’ east, and latitude 34°57’ to 35°10’ north. Topography: it’s the fluvial plains of Yellow River and Qin River with plain terrains. Soil: mainly cinnamon soil, loess and meadow cinnamon soil. <u>Weather & Climate:</u> continental monsoon climate with distinctive four seasons, sufficient sunshine and abundant rainfall. It has an annual rainfall of 700mm, and annual average temperature 14.2°C, as well as a frost-free period of 240 days throughout the year with annual average relative humidity of 60%. Water System: the rivers floating through the county are mainly Qin River, Communism Channel, Qi River and Laomang River.</p> <p><u>Social Economy:</u></p> <p>Wuzhi County governs 7 towns and 7 townships, altogether 3 residents' committees and 367 administrative villages, with a total area of 860 sq km. The total population of the whole county is 701,424 in 2006, in which, the agricultural population takes up 640,371 and nonagricultural population amounts up to 61,053.</p> |

| V. | Jiaozuo City | Environmental Overview |
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| | | <p>The total GDP achieved in 2006 is RMB 10.16 billion, with the rural per capita net income of RMB 4499, and urban per capita disposable income of RMB 8096 Yuan. The year's total grain output is 488,000 tons, amongst which, summer grain crops takes up 269 thousand tons, and autumn grain crops of 219 tons.</p> <p>The animal husbandry has experienced one smooth development, with the total output of meat of 670,000 tons and that of poultry and egg of 790 tons, reaching the output value of husbandry of RMB 1.4 billion. Existing water supply and consumption situation: Wuzhi county has detected and found out the groundwater storage of 3.54 billion cubic meters, and the ecological project of utilizing water from Yellow River could provide Yellow River water of 180 million m³. The on-going construction of middle route project of south-north water diversion passes through this area. Wuzhi enjoys the rich region of extremely valuable water resources that could hardly be found in any other parts of central and western regions of China. The daily water supply of running water (meeting national standards for drinking water) reaches 100,000 tons.</p> |
| 4 | Qinyang City | <p><u>Natural Environment:</u></p> <p>Geographical Features: Qinyang City is situated in the lower reaches of Qinyang River, neighboring Boai to the East, and Jiyang City in the West, with Wen County and Mengzhou City connected in the South, and sharing common boundary with Jincheng of Shanxi Province to the North. It locates between longitude 112°42' to 113°02' east, and latitude 34°59' to 35°18' north, with the length of 28.8km from east to west, and that of 36.8km from north to south. Topography: fluvial plain of Yellow River and Qin River, with flat terrains. Soil: the shallow hill regions in the north are mainly covered with black stone soil of cinnamon category, and red oil and brown forest soil; the southern plains are loams and lianghe soil, while the both sides of Qin River are covered with primarily sandy soils and sandy loams.</p> <p><u>Weather & Climate:</u> warm temperature zone and continental climate, with an annual average temperature of 14.3°C, and an annual average frost-free period of 210 days, as well as ample sunshine. Water System: the rivers are mainly Qin River, Mang River, Dan River, Qi River and Cheng River.</p> <p><u>Ecological Environment:</u></p> <p>Plants: the city has achieved annual forest planting of 250,000 mu in 2008, amongst which, artificial reforestation takes up 250,000 mu. The forest coverage reaches 15.72%.</p> <p><u>Social Economy:</u></p> |

| V. | Jiaozuo City | Environmental Overview |
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| | | <p>The city has 6 towns, 3 townships, and 4 designated offices as well as 329 administrative villages, with a total area of 623.5 km². And the total urban population reaches 489 thousand by the end of 2008, amongst which, nonagricultural population occupies 940,000, and agricultural population takes up 395,000. The GDP achieved throughout the city is RMB 192.5 Yuan, with the urban per capita disposable income of RMB 12,359 and rural per capita net income of RMB 6,392 for the whole year respectively. The grain acreage of the city is 430,000 hectares for the whole year, in which, the planting area of summer grain crops is 210,000 hectares, and that of autumn grain crops 222,000 hectares. The whole year's total grain output is 324,000 tons, amongst which, summer grain crops take up 164,000 tons, and autumn grain crops amount up to 164,000 tons. The main crops are including wheat, corn, rice, cotton, sesame, soybean, bast fire plants and tobacco.</p> |
| 5 | Boai County | <p><u>Natural Environment:</u></p> <p>Geographical Features: Boai County locates at the southern foot of Taihang Mountains, the juncture of Henan and Jinzhong provinces, neighboring Qin River in the South, and Danshui in the West, with Dasha River bordered in the East, and Taihang Mountains backed to the North. It lies between longitude 112° 58' to 113°12' east, and latitude 35°02' to 35°21' north. Topography: two basic units of mountains and plains, the northern mountainous regions are parts of Taihang Mountain ranges, with the terrains of ladder drop from the high in the north to the low in the south, about 105-170m above sea level. Soil: the soil mainly constitutes limestone soil, Li loess, red oil, tidal clay soil, lianghe soil, stasis cinnamon soil, alluvial soil, tenacious clay etc. Weather & Climate: warm temperature zone and continental monsoon climate, with annual average sunshine hours of 2484hrs, an annual average temperature of 14.1℃, and a frost-free period of 216 days, as well as an annual average rainfall of 597.1mm. Water System: the main rivers within the boundary of the county are Dongda River, Yindan Main Canal, Xiaqing River, Xinfu River, Lema River, Yunliang River, Xinjiang Trench and Qin River, besides; there is one storage reservoir to the northwestern region.</p> <p><u>Social Economy:</u></p> <p>Boai County governs 13 towns and villages (7 towns&6 villages), altogether 234 administrative villages, with a total area of 492 km², and an total population of 430 thousand. The total output value achieved throughout the county is RMB 9.78 billion, amongst which, urban per capita disposable income of RMB 8362, and rural per capita net income of</p> |

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| V. | Jiaozuo City | Environmental Overview |
| | | RMB 4,285. The total arable land of the county is 330 thousand mu, with the main economic crops including wheat, corn, soybean, peanut, ginger, fresh peach, grape and various vegetables. Existing Water Supply and Water Consumption Situation: the running water company of Boai County has the daily water supply capacity of $1.3 \times 10^4 \text{ m}^3/\text{d}$, and the company shall be eventually expanded, one part is to build one water treatment plant with the daily water supply capacity of 50 thousand cubic meters, the other party is to expand the water supply networks of the county in accordance with the expected water supply capacity of 50 thousand m^3/day . |

4.1.5 Environmental Overview of Xinxiang City

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| VI | Xinxiang City | Environmental Overview |
| 1 | Yuanyang County | <p><u>Natural Environment:</u></p> <p>Geographical Features: Yuanyang County, located in the plains of northern Hunan Province, and coast of Yellow River, lies between longitude $113^{\circ} 36'$ to $114^{\circ} 15'$ east and latitude $34^{\circ} 55'$ to $35^{\circ} 11''$ north. Topography: the terrains lean from northwest to northeast. To the south of great dam of Yellow River, there are mainly high beaches and dry fields, in the central, they are mainly low-lying water logged lowland, while to the south of Wenya Channel, and there are mainly hillocks. Soil: there includes 8 types of soil, i.e., Brunisolic soil, Cinnamonic soil, skeleton soil, rocky soil, moisture soil, sand oil, and paddy soil etc, amongst which, moisture soil takes up 72.33%, and Brunisolic soil occupies 13.76%, the two types of soil are the mainly agricultural soil of the region. Weather & Climate: continental and warm temperature monsoon climate, with distinctive four seasons, sufficient sunshine, and an annual average temperature of 14.4°C, annual average rainfall of 549.9mm, as well as a frost-free period of 227days. Water System: Yuanyang County stretches across the two water systems, Yellow River and Huaihe River, with plentiful water resources. Three large-scale irrigated areas through introducing water from Yellow River have been established, with an annual water supply capacity of 100 million cubic meters. The quality of underground water is nice; furthermore, several underground springs are widely distributed around the county.</p> <p><u>Social Economy:</u></p> <p>Yuanyang County governs 3 towns, 14 villages, with a total area of 1339 sq</p> |

| VI | Xinxiang City | Environmental Overview |
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| | | <p>km, in which, the area of arable land takes up 65.8 hectares, with a total population of 680.2 thousand, the rural population taking up 536 thousand. Up to 2006, the area of arable land is 80180 hectares. There mainly produces great amount of high-quality paddy rice, wheat, cotton, corn, peanut, soybean, and mung bean etc. In 2007, the county's rural per capita of net income reaches RMB 3189.31 Yuan. Ever since having introducing water of Yellow River for irrigation in 1961, 6 sluice gates for introducing water of Yellow River have been inconsecutively built up, eventually forming the 3 great sluice gates, i.e., Tinan, Han Dongzhuang and Xiang Fuzhu, with an annual average water volume introduced from the Yellow River of 450 million cubic meters, and the irrigated area covers about 60 thousand sq meters.</p> |
| 2 | Changyuan County | <p><u>Natural Environment:</u></p> <p>Geographical Features: the county is located in the northwest part of Henan province, neighboring Yellow River in the East, and Fengqiu in the west, adjoining Hua County, and Puyang city. in the North, between longitude 114°39' to 114°40' east, and latitude 35°11' to 35°12' south. Topography: no mountains within the county, with flat low-lying terrains, at about 58-67m above the sea level. The great dam of Yellow River divides the county into two parts naturally: to the east of the dam, is the beach region of Yellow River with a terrain of high in the west to low in the east, and high in the south to the low in the north. The fluvial plains of Yellow River are to the west of great dam, with flat terrains, and slight slopes. Soil: it has deep layers of soil, with nice soil quality, and high agricultural values, mainly two types of soil, i.e., moisture soil and aeolian sandy soil; and three sub-types of soil, i.e., moisture soil from Yellow River, Salinized moisture soil, and solonetz etc. Weather & Climate: warm temperature zone and continental monsoon climate, with distinctive four seasons, and an annual average temperature of 13.6°C, an annual average frost-free period of 208 days. Average annual rainfall is 644.4 mm, and the daily average sunshine of 2455 hours. Water System: the rivers within the boundary are mainly Yellow River, Natural Wenyan Channel and Wenming Channel etc.</p> <p><u>Social Economy:</u></p> <p>Changyuan County governs 6 towns, 8 villages and 4 designated offices, with a total area of 1051 sq km, amongst which, the arable land takes up 860 thousand mu, with a total population of 800 thousand. The five industries including lifting machinery, medical apparatus and instruments, and heath materials, anti-corrosion construction and anti-corrosion materials, cooking</p> |

| VI | Xinxiang City | Environmental Overview |
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| | | culture, and food processing within the country have been well boosted. In 2008, urban per capital disposable income is RMB 9985 Yuan, and urban per capita net income of RMB 5965 Yuan. |
| 3 | Yanjin County | <p><u>Natural Environment:</u></p> <p>Geographic Features: Yanjin County locates in the eastern part of Xinxiang Regions, neighboring Ji County to the North, and Hua County in the South, adjoining Yuanyang in the South, and connecting Xinxiang County in the west, with the longitude 113°07' to 114°26' east, and latitude 35°07' to 35°29' north. Topography: it's the fluvial plains of Yellow River of North China with flat terrains. Soil: mainly yellow moisture soil and aeolian sandy soil, in which, yellow moisture soil takes up 56.9% of arable land, while aeolian sandy soil occupies 43.1% of arable land. <u>Weather & Climate:</u> warm temperature zone and continental monsoon climate with distinctive four seasons, and more wind, less rain & snow in the Winter and Summer, more rains in Autumn. It has an annual rainfall of 600.4mm, and annual average temperature 14°C, with the highest temperature 42.6°C, the lowest temperature -5.2°C as well as a non-frost period of 285 days throughout the year. Water System: the rivers floating through the county are mainly Wenyan Channel, Liuqing River, Longtan Channel, Chengsha pool and Dasha River.</p> <p><u>Social Economy:</u></p> <p>Yanjin County governs 4 towns, 14 villages and 375 administrative villages, with a total area of 947.5 km², and a total population of 450 thousand, as well as 625 mu of arable land. The county is rich in growing agricultural crops including wheat, corn, cotton, peanut etc., serving as the production base county of national commodity grains. In 2006, rural per capita net income is RMB 3265 Yuan.</p> |
| 4 | Fengqiu County | <p><u>Natural Environment:</u></p> <p>Geographical Features: the county is located in the eastern part of Xinxiang Region, neighboring Yuanyang County and Yanjin County in the west, adjoining Hua County, and Changyuan County in the North, as well as Eastern part and Southern part being divided from Lankao County, Kaifeng County and Kaifeng City by one river, between longitude 114°14' to 114°46' east, and latitude 34°53' to 35°14' south. The length of county boundary stretches 38.2km from south to north and the width of county boundary from east to west is 48.7km. Topography: the terrains are quite complex, with sandy hills, plains and low-lying lands. at about 65-72.5m above the sea level. To the south of the dam of Yellow River, is the beach region of Yellow River with an terrain of high in the southwest to low in the</p> |

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| VI | Xinxiang City | Environmental Overview |
| | | <p>northeast, and other parts are mainly low-lying. Soil: its main soils include lianghe soil, little lianghe soil, lianghe soil with light salt, sandy loam soil, cinnamon lianghe soil, alluvial soil, anthropogenic alluvial soil, sand soil for fixing fine sands of sand flood, and sand soil for half fixing fine sands of sand flood etc. <u>Weather & Climate:</u> warm temperature zone and continental monsoon climate, with an annual average temperature of 13.9°C, an annual average frost-free period of 214 days. And an annual average rainfall of 615.1mm, as well as daily average sunshine of 2310.4 hours. Water System: the main rivers floating within the boundary of Yellow River are 60km, the length of Tianran Channel within the boundary is 46km, and that of Wenyan Channel 40km. Tianran Channel, Wenyan Channel, the water resources of the two channels reach 113 million cubic meters, Yellow River and Huaihe River also provide lavish water resource supply.</p> <p><u>Social Environment:</u></p> <p>Fengqiu County governs 6 towns, 13 villages, with an total area of 1220.5 sq km, in which, the area of arable land takes up 926 thousand mu, with a total population of 719,510, amongst which the rural population takes up 5683 thousand, while urban population amounts up to 450 thousand. There mainly produces great amount of high-quality wheat, rice, cotton, corn, peanut, soybean, and mung bean, foxtail millet, canola plant, sesame etc. Honeysuckle flower planted here serves as the national production bas, while celery, mushrooms, pomegranates, honeysuckle flowers also nationally renowned. The GDP is RMB 1245750 thousand Yuan, amongst which the county's GDP per capita reaches RMB 1826 Yuan. There are arable lands available about 924.8 thousand mu, the grain crops give priority to wheat, corn and soybean, the commercial crops include bast fiber plants, sugar, tobacco and medical herbs. The rural per capita of net income is RMB 2552 Yuan in 2006.</p> |

4.1.6 Environmental Overview of Puyang City

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| VII | Puyang City | Environmental Overview |
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| VII | Puyang City | Environmental Overview |
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| 1 | Puyang County | <p><u>Natural Environment:</u></p> <p>Geographical Features: Puanyang County, located North China Plains, lies at the juncture of both Hebei, Shandong and Henan Provinces, between longitude 114° 52' to 116° 05' east and latitude 35° 41' to 36° 12' north, with the length of 125km from east to west, and width of 100km from south to north. Topography: it's situated in the fluvial plains of Yellow River, with flat terrains leaning from southwest to northeast. To the south of Jinti River and to the north of great dam of Yellow River, there are mainly inland inundation area, and to the south of the dam of Yellow River, there are mainly bench lands, about 48-58m above the sea level generally. Soil: there are 3 types of soil including moisture soil, sand soil and Solonetz, 9 sub-types of soil, 15 soil genus and 62 soil species.</p> <p><u>Weather & Climate:</u> warm temperature zone and sub-humid continental monsoon climate, with an annual average temperature of 13.4°C, an annual average rainfall of 621.1mm, as well as a frost-free period of 213days. Water System: it belongs to Haihe River system, and it's the main rivers, Yellow River, with a length of 50km within the boundary, and Jinti River, tributary of Yellow River, with a length of 50km within the boundary, then Majia River</p> <p><u>Social Economy:</u></p> <p>Puyang County governs 15 villages, 7 towns and 1026 administrative villages, with an total land area of 1455 sq km, agricultural acreage of 1315.6 thousand mu, and total population of 1092.7 thousand throughout the county. Grain crops are mainly wheat, soybean, potatoes, and corns, while commercial crops give priority to cotton, peanuts etc. the GDP per capita is about RMB 13340 Yuan for the first half of 2009.</p> |
| 2 | Fan County | <p><u>Natural Environment:</u></p> <p>Geographical Features: Situated in the lower reaches of Yellow River, and in the northeast part of Henan Province, with one river opposite to the Juancheng County of Shandong Province in the south, and Xin County of Shandong province bordered with Jinti River in the North, neighboring Puyang River in the west, and Taiqian County in the east. Fan Country lies between the longitude 115°29' to 115°31' east and latitude 34°51' to 35° 52' north, with the length of 20km from south to north, and width of 42km from east to west. Topography: part of fluvial plains of Yellow River, with plain & low-lying terrains and some slight sectional ups and downs, leaning from southwest to northeast, the greatest height difference within the boundary is</p> |

| VII | Puyang City | Environmental Overview |
|-----|----------------|---|
| | | <p>9.8m, with a gradient of 1/6000 to 1/7500. Weather & Climate: warm temperature zone and continental monsoon climate featuring annual average temperature about 13.4°C with an annual rainfall of 626mm, and the frost-free periods of 205 days. Water System: the rivers within the boundary of the county include: Yellow River, Jinti River, Menglou River, amongst which, Yellow River and Jinti River flows through the whole area of Fan County, the river trench of Yellow River within the county boundary reaches 43.5km.</p> <p><u>Social Economy:</u></p> <p>Area of Administrative Regions</p> <p>Fan County covers 2 towns, 11 villages, 681 administrative villages and 5225 villager groups with the land area of 625 sq km, arable land of 510 mu, and total population of 3491.7 thousand by the end of 2005 for the whole county, the county's permanent population is 487.8 thousand. Grain crops are mainly focused on wheat, corn, paddy rice, soybean, foxtail millet; and commercial crops are cotton, peanut, water melon, sesame; the total output value achieved by the county is RMB 3.07 billion Yuan; and total grain output of whole year attains 267 thousand tons in 2005, amongst which total output of summer grain is 125 thousand tons, while that of autumn grain 142 thousand tons, cotton 47 9 tons, oil-bearing crops 6265 tons. Animal husbandry develops rapidly. The whole county's total meat output is 24745 tons, and the total output of poultry and eggs reached 30502 tons, total dairy output attains 1000 tons. The urban per capita disposable income is RMB 4647 Yuan, and rural per capita net income reaches RMB 2078 for the whole year.</p> |
| 3 | Taiqian County | <p><u>Natural Environment:</u></p> <p>Geographic Features: Taiqian County locates at the juncture of Henan and Shandong Provinces with the longitude 115° 50' to 115° 52' east, and latitude 35°59' to 36° 00' north. Topography: it's the fluvial plains of Yellow River with plain terrains. Weather & Climate: warm temperature zone with continental monsoon climate with distinctive four seasons, sufficient sunshine and moderate rainfall. It has an annual average temperature 13.5°C, and an annual average relative humidity of 68.3%.</p> <p>Water System: Yellow River and Jinti River floats through the country, with the amount usable of underground water reaching 102 million cubic meters.</p> <p><u>Social Economy:</u></p> |

| VII | Puyang City | Environmental Overview |
|-----|-----------------|---|
| | | <p>Taiqian County governs 7 villages, 2 towns, and 370 administrative villages, with a total population of 350 thousand, and is rich in growing wheat, corn, soybeans and garlic etc. In 2006, the county's total grain output reached 118.6 thousand tons, amongst which, total output of summer grains is 79 thousand tons, in increase by 31.2%; and that of autumn grains 40 thousand tons. The county's total outputs of meat, poultry & eggs and dairy have been increased by 13.2%, 8.2%, and 124%, respectively. And the people working in outside of county reach 690 thousand, achieving service income of RMB 350 million Yuan.</p> |
| 4 | Qingfeng County | <p><u>Natural Environment:</u></p> <p>Geographical Features: Situated at the juncture of Hebei, Shandong and Henan Provinces, Qingfeng County lies between the longitude 115°07' east and latitude 35°54' north. Topography: the eastern regions are plain terrains, with sand hill distributed from south to north, the highest sea level elevation being 55m and the general sea level elevation being 49m. <u>Weather&Climate:</u> warm temperature zone and continental monsoon climate featuring distinctive four seasons, an annual average temperature 13.4°C, and an annual rainfall of 700mm, and the frost-free periods of 215 days throughout the year. Water System: the main rivers are Majia River, with the length of 26km within the county boundary, Zhulong River, with the length of 30km within the county boundary, also Weihe River which floats through the northwest of boundary.</p> <p><u>Social Economy:</u></p> <p>Qingfeng County governs 3 towns, 14 villages, and 520 administrative villages, with an total area of 834 sq km, arable land area of 820 thousand mu, and the year's total population of 666.5 thousand, amongst which, agricultural population occupies 596.2 thousand, and nonagricultural population takes up 70.3 thousand. The grain corps is mainly wheat, corn, and the commercial crops include cotton, peanut, sesame, and canola plants. The GDP achieved throughout the city is RMB 7953356 Yuan in 2008. The grain acreage of the city is 72904 hectares for the whole year, in which, the planting area of wheat is 47191 hectares, that of high-quality special wheat is 46349 hectares, and that of cotton, oil-bearing crops, and gourds & vegetables are 1244 hectares, 11341 hectares and 22769 hectares respectively. The year's total grain output is 514.7 thousand tons, that of meat 40.2 thousand tons, that of poultry & eggs 54.9 thousand tons, that of dairy 11.6 thousand tons, that of cotton 1082 tons and that of oil-bearing crops 53.9 tons.</p> |

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| VII | Puyang City | Environmental Overview |
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4.1.7 Environmental Overview of Shangqiu City

| VIII | Shangqiu City | Environmental Overview |
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| 1 | Liangyuan District | <p><u>Natural Environment:</u></p> <p>Geological Features: Liangyuan District locates at the joint portion of Henan, Shandong, Jiangsu, and Anhui Provinces, and is the political, economic, cultural and information center of Shangqiu City. Topography: Liangyuan District falls into the geomorphic types of alluvial plains of Yellow River, being situated in the northern part of East Henan Plains, with the flat terrains at an average sea level elevation of 49-51 meters. Weather& Climate: located in typical warm temperature zone and continental monsoon climate, with the basic characteristics of distinctive four seasons, rain& heat, complexity & diversity, and frequent meteorological disasters. The annual average rainfall is relatively less, about 700mm and distributed unevenly. Water System: the rivers within the boundary belong to the three water systems, i.e., the water system of Wohe River; water systems to the east of Wohe River, and water system of four lakes in the south. Besides the city's Haihe River watershed and those trunk rivers with the watershed coverage of more than 1000 sq km within the city boundary are Wohe River, Huiji River, and Tuohe River, ancient riverbed of the Yellow River, Dasha River and Wangyin River etc.</p> <p>Social Economy:</p> <p>The whole district governs 11 villages (towns) and 8 subdistrict offices, with a total area of 960 km², and a total population of 730 thousand.</p> |
| 2 | Suiyang District | <p><u>Natural Environment:</u></p> <p>Geographical Features: Suiyang District stands in the southern part of Shangqiu City, Henan Province, at exactly the joint portion of Henan, Shandong, Jiangsu and Auhui Provinces, and Municipal Government of Shangqiu City establishes there.. Weather&Climate: located in warm temperature zone with distinctive four seasons, an average temperature of 13.9 °C, a frost-free period of 206 days and 4430.8</p> |

| VIII | Shangqiu City | Environmental Overview |
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| | | <p>hours of the duration of sunshine throughout the year. Water System:</p> <p><u>Social Economy:</u></p> <p>Suiyang district governs 18 towns& villages(designated offices), and 357 administrative villages(communities), with an total area of 9.6 million sq km, in which, the arable land takes up 63440 hectares. The district has a total population of 810 thousand, amongst which, rural resident's amount to 6.08 million. The agricultural area: the arable area is 10799535.8 mu in 2007, taking up 67.28% of the city's total land area. The district is rich in growing wheat, corn, cotton, canola plant, soybean, tobacco and gourd& vegetables etc., serving as the base for national commodity grains an high-quality cotton; also the agricultural development zone of the plains of both Yellow River and Huaihe River.</p> |
| 3 | Yucheng County | <p><u>Natural Environment:</u></p> <p>Geographical Features: located in the eastern part of Henan Province, adjoining Shandong and Anhui Provinces, between longitude 115°50'—115°53' east and latitude 34°22'—34°24' north.</p> <p><u>Weather & Climate:</u> the region is located in the warm temperature zone and continental monsoon climate, with an annual average temperature of 14°C and an annual rainfall of 726.5mm, as well as a frost-free period of 271 days.</p> <p><u>Social Economy:</u></p> <p>Yucheng County governs 9 towns, 21 villages, and 658 administrative villages, with a total area of 1558 sq km, and with a total population of 1.08 million, in which, agricultural residents takes up 986 thousand. The whole county has arable land of 1.32 million mu, amongst which grains area occupies 1.10 million mu, with an annual grain output of 600 million kg; planting area for cotton takes up 300 million mu, with an annual output of high-quality cotton of 455 thousand dans; and the planting area for orchard amounts up to more than 300 thousand mu, with an annual yield of high-quality fruits of 200 million kg.</p> |
| 4 | Minquan County | <p><u>Natural Environment:</u></p> <p>Geographical Features: Situated in the lower reaches of Yellow River, neighboring Shangqiu City in the east, and Kaifeng City in the west,, with Zhoukou Town in the opposite direction to the south, and Heze connected in the north, Fan Country lies between the longitude 115°07' to 115°10' east and latitude 34° 49' to 115° 28' north, with the length of 57.8km from east to west, and width of 36.9km from south to north. Topography: it's bordered via the</p> |

| VIII | Shangqiu City | Environmental Overview |
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| | | <p>ancient embankment of Yellow River, to the north of embankment, there are mainly high beach fields and to the south of embankment, there are mainly green sands and sand base. Weather& Climate: influenced by the winter and summer monsoons, it shows the characteristics of warm temperature zone and continental monsoon climate featuring an annual average temperature of 14.1°C, with an annual rainfall of 674mm, and the frost-free periods of 213 days. Water System: the rivers within the boundary of the county include: Yellow River, with the length of 32km within the county boundary, and Tonghui Channel, reaching 43.5km.within the county boundary.</p> <p><u>Social Economy:</u></p> <p>Mingquan County governs 6 towns, 12 villages, with a total area of 1222 sq km, in which, the arable land area takes up 1.17 million mu.</p> <p>Minquan County’s arable land is 1.13 million mu, with a total population of 852 thousand, and an area of 1222 km² within the sphere of town. The control region planned by the county town is 104 km², and the built-up area is 28 km². The county has been well conferred the nice reputation of both “ hometown of paulownia” and “kingdom of grapes”, and is one of 4 county grape planting bases.</p> |
| 5 | Ningling County | <p><u>Natural Environment:</u></p> <p>Geographical Features: Situated in the East Henan Plains, neighboring Shangqiu City in the east, and Zhecheng County in the south, with Xuxian County adjoined in the west and Mingquan County in the north, Ningling County lies between the longitude 115 °18’ to 115° 20’ east and latitude 34°26’ to 34° 27’ north. Topography: it belongs to the fluvial plains of the lower reaches of Yellow River, with plain & low-lying terrains and some slight sectional ups and downs, leaning from southwest to northeast, with a gradient of 1/-60 to 1/7500, the sea level elevation is generally 50.5 to 60.3m. There are altogether 4 types of topographical features throughout the county, i.e., high beach fields of ancient riverbed of the Yellow River, approximately taking up 5.2%; downbend of Beihe River, taking up about 5.5%; groove-shape and butterfly-shape downbend, takes up around 3.4%; and moderate slanting flow flat terrain, taking up about 85.9%. Soil: the soil of the whole county could be roughly divided into 3 types: sandy soil, Lianghe soil, and alluvial soil. <u>Weather&Climate:</u> warm temperature zone and continental monsoon climate featuring distinctive four seasons,</p> |

| VIII | Shangqiu City | Environmental Overview |
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| | | <p>and an annual average temperature about 14.2°C, and an annual rainfall of 647mm, and the frost-free periods of 216 days, as well as duration of sunshine 4430.7 hours throughout the year. Water System: the total amount of water resources around the county is about 180 million cubic meters, some 400 cubic meters per capita, and more than 200 cubic meters averagely for per mu.</p> <p><u>Social Economy:</u></p> <p>The county governs 4 towns, 11 villages, and 365 administrative villages, with a total area of 785.7 sq km, and a total population of 580 thousand , as well as arable land of 684 thousand mu. The GDP achieved is RMB 1331720 thousand Yuan, and GDP per capital is RMB 2371 Yuan. The existing arable land is 683.8 thousand mu, and the grain crops are mainly wheat, corn, potatoes, and soybeans. And main traditional Chinese medical herbs are <i>paeonia lactiflora pallas</i> and dried rhizome of <i>rehmannia</i>.</p> <p>The peasants' income situation: the county mainly produced wheat, peanut, cotton, .zhanggong wine, animal furs& leathers, balsam, textiles& handicrafts and other agricultural special local products.</p> |
| 6 | Suixian County | <p><u>Natural Environment:</u></p> <p>Geographical Features: Suixian County, located in the northern and central part of Henan Province, neighboring Ningling County in the east, and zhecheng, Taikang Counties in the south, adjoining Piqu County in the west and with Minquan County backed in the north, lies at the longitude 114°50' to 115°12' east and latitude 34°12' to 34°34' north, with the length of about 33 km from east to west, and width of around 41 km from south to north. Topography: it's situated in the backland of Plains of Huanghuai Area, and belongs to part of Huaihe River Basin with flat terrains and fertile soils. Weather & Climate: HVAC sub-humid temperate continental monsoon climate with distinctive four seasons, and an annual average temperature of 14.0°C, an annual average rainfall of 700.6mm, annual duration of sunshine 2236.0 hours, as well as a frost-free period of 207 to 214 days. Water System: it's the main rivers including Huiji River, Tonghui River, Jianghe River, Qihe River, Little Wen River, Jiangan Trench, and Shenjiagan Trench etc. and the main lakes including Chenghu Lake, with an area of 266.7 hectares.</p> <p><u>Social Economy:</u></p> <p>The county governs 8 towns, 12 villages, and 545 administrative villages, with a total area of 924 sq km, and a population of 800</p> |

| VIII | Shangqiu City | Environmental Overview |
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| | | <p>thousand, as well as an area of arable land of 870 mu. Land use(including the currently main crops and the crops cultivation methods):</p> <p>Peasants' income Situation: the town is superabundant with wheat, peanut, cotton, soybean, canola plant, tobacco and fresh gourd & vegetable, and is renowned as base county for national commodity grains, base county for high-quality cotton, county base for raw goat skins, and advanced country for high rate of reaching the standards for plain afforestation; meanwhile, the base county for production of improved wheat varieties of Henan Province, county base for forestry and county base for corn exports. It enjoys abundant labor powers. In 2002, the main agricultural products include wheat, corn, cotton, peanut, canola plant and various vegetables, medical herbs, woods, various fruits and other livestock products such as pig, cattle, sheep, chickens, ducks, rabbits etc.</p> |

4.1.8 Environmental Overview of Jiyuan City

| Jiyuan City | Environmental Overview |
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| Jiyuan City | <p><u>Natural Environment:</u></p> <p>Geographic Features: Jiyuan County locates in the northwest of Henan Province, neighboring Taihang Mountains and Wangwu Mountain to the North, the two mountains and the city being separated by the Yellow River in the South, adjoining Yuanqu city, Shanxi Province in the West and Menzhou City in the east, between the longitude 112°01' to 112° 46' east, and latitude 35 ° 17' to 34 ° 53' north. Topography: it has the geographical features of carst phenomena, with the northern part being high rise and southern part being low. Soil: mainly cinnamon soil, loess and meadow cinnamon soil. Weather& Climate: continental monsoon climate with distinctive four seasons, sufficient sunshine and abundant rainfall. It has an annual rainfall of 600.3mm, and annual average temperature 14.9°C. Soil: the soil in the Taihang Mountains region are mostly taupe brown forest soil and sandy clay, with its soil layer extremely thin and unevenly distributed; and the terraced fields over the foot of mountains are primarily red, brown or grey loamy soil. The soil parent materials of the northern shallow mountain regions are mostly amaranth clay shale, over which, are covered with the quaternary loess and red clay parent materials. And the soil parent materials over the southeastern hilly regions of yellow soil are clay shale and sandstones, with its quaternary yellow soil unevenly covered. The soil layer over the northern part of hilly regions are relatively thinner, and the soil layer over the eastern part of hilly regions are relatively heavier, and could be divided into yellow soil and white soil etc. The slanting plain regions in front of the mountain are mostly covered</p> |

| Jiyuan City | Environmental Overview |
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| | <p>with clay loam, and mainly distributed on both sides of Jihe River, in the south of Fei Village and Xixu, in the north of Yaqiao and Matou as well as Daoqi distributed at the bottom of trench of the hilly regions.</p> <p>Water System: (hydrological characteristics of surface water and underground water), the main rivers in the city are Qinhe River and Manghe River. The total area of Qinhe River is 13532 m², with an area of 3023 m² within the province, about the length of 135km within the province. Qinhe River floats into the fluvial plains at the Wulong Kou of Jiyuan, with the channel aggradations of 2-4 m above the ground of the outside of dam, forming one hanging river. Manghe River has a full length of 130km, and catchments area of 1328 m².</p> <p><u>Social Economy:</u></p> <p>The city area is 1931.26 hectares, and the county governs 8 towns, 4 villages, 4 sub-district offices, and 521 administrative villages. According to statistics made by the end of 2005, the city's total population is about 666.1 thousand, amongst which, nonagricultural residents take up 195. 3 thousand and urban residents reach 220 thousand. According to the statistical figures, the land transferable into arable land throughout the city amounts up to 430 thousand mu, up to the end of May, 2008, the land transferred into arable land reaches 520 thousand mu, taking about 12.1% of transferable land area.</p> <p>Agriculture: the grain planting area in 2008 is 41360 hectares, in which, the wheat planting area is 19270 hectares, the planting area for high-quality special wheat seeds is 11000 hectares, and that for cotton is 360 hectares, that for oil-bearing materials is 2020 hectares, that for vegetables is 7980 hectares. The whole year's grain yield is 214036 tons that of cured tobacco is 1844 tons that of vegetable is 290078 tons that of cotton is 330 tons that of oil-bearing materials is 3351 tons. There are 589 large-scale breeding farms, and 20349 hectares of effective irrigation area, and new 623 hectares of water-saving irrigation area. The total power of agricultural machinery at the end of the year is 100.24 kilowatts; and there are 19969 tractors, 38556 agricultural carriers, and 20969 tons of fertilizer application amounts (pure).</p> <p>Water Supply and Water Consumption Situation: the total amount of water resources throughout the city in 2008 is 310 million cubic meters. The Budai Trench Project relies on the water sources of Budai storage reservoir, the designed daily water supply capacity is 3500 cubic meters, and providing water to 320 thousand residents living in the 37 administrative villages of Shaoyuan Town, and to meet the drinking water demand of 16 breeding plants, and 50 thousand live stocks. Meanwhile, the project shall provide water to the 7 schools, 14 enterprises and 3 contract sections of Ji-Shao Super highway of Shaoyuan Town, and still solve the agricultural water-saving irrigation of 5000 mu along the way.</p> |

4.2 Environmental Quality

4.2.1 Environmental Quality in Zhengzhou City

The number of days which the atmospheric environmental quality is good is 325 in Zhengzhou urban areas in 2008 and the rate of reaching the standard is 88.8%. The rate of reaching the standard for drinking water quality is 100% according to the survey result of Jialu River of Huai River; Yellow River and its branches. The total 16 section in 11 rivers are in the survey and the category V water section is 81.25%. The amount of drinking water taken from the water resource for urban district is 240 million tons. The average urban acoustic level is around 55.6 db (A), which is classified as light pollution; the average traffic noise level is around 67.7 db (A), which is classified as good.

4.2.2 The Environmental Quality in Kaifeng City

The atmospheric environmental quality in Kaifeng in 2008 is good, slightly polluted. The annual contain of PM₁₀, SO₂, NO₂ in the air is respectively 0.089 mg/m³, 0.038 mg/m³, and 0.038 mg/m³. The rate of reaching the standard for drinking water quality is 100%. Based on the “Environmental Quality Criteria for Surface Water” (GB3838-2002), the quality of ground water is under the criteria, which is classified as III out of V. The average annual acoustic level is 51.0 db (A), classified as grade 1, considering as good. The average traffic noise level is around 67.7 db (A).

4.2.3 The Environmental Quality in Luoyang City

The atmospheric environmental quality in Luoyang has reached the second criteria of the state in 2008. The surface water in the areas of Luoyang has reached III grade. The water quality of Yi River and Ru River are considered good. Luo River is considered slightly polluted, while Yi River is considered severely polluted. Yiluog River is turning from heavily polluted to slightly polluted. The average annual acoustic level in the area is measured at 54.64 db (A), being classified as grade 1. The average traffic noise level is estimated at around 68.5 db(A) that is considered to be good.

4.2.4 The Environmental Quality in Jiaozuo City

The number of days which the atmospheric environmental quality is good is over 317 in Jiaozuo urban areas in 2008 and the rate of reaching the standard is 86.85%. The rate of reaching the standard for COD is 91.68% and the rate for ammonia is 99.0%. The rate for drinking water is 100%.

4.2.5 The Environmental Quality in Xinxiang City

The number of days which the atmospheric environmental quality is good is 335 in Xinxiang urban areas in 2008 and the rate of reaching the standard is 91.8%. Of the 542 km of river in monitoring, 38 km is classified as IV, 12 km as V, and 410 km as worse than V. The atmospheric index during day time is 51.7 db and 40.3 db at night, which is considered to reach the standard “Acoustic Standard in Urban Areas” (GB3096-93). The rate of reaching the standard for noise is 100%. The average traffic noise level is around 64.2 db (A).

4.2.6 The Environmental Quality in Puyang City

The atmospheric environmental quality is rated as good; the ratio of number of good days is 92.3%. The major pollutants of Puyang are COD, five-day BOD, permanganate index, volatile phenol and ammonia. 50% of the river is classified as grade III and 50% less than grade V. The water from two rivers under monitoring are the main branch of Yellow River with good quality, and Jingti River that is heavily polluted.

4.2.7 The Environmental Quality in Shangqiu City

The atmospheric pollution index in Shangqiu is 76 and the major pollutants are PM₁₀. The rate of reaching the standard for COD is 95.8% and for ammonia is 93.9. The rate of reaching the standard for drinking water is 100%. The rate for fine atmospheric ion is 92%. The average urban acoustic level is around 55.2 db (A). The average traffic noise level is around 66.2 db (A).

4.2.8 The Environmental Quality in Jiyuan City

The atmospheric environmental rate for reaching standard is 86.3% with 315 good days in 2007. The annual index for SO₂ is 0.066 mg/m³ and the annual index for NO₂ is 0.043 mg/m³, the annual respiratory particle is 0.110 mg/m³. According to the "Ground Water Standard" (GB/T14848-93), the ground water is classified as grade IV with good quality. The average urban acoustic level is around 50.9 db (A), the rate of reaching the standard is 89.6%; the average traffic noise level is around 65.7 db (A), which is classified as good.

5 Public Consultation and Information Disclosure

5.1 Consultation Methods and Contents

5.1.1 Consultation Methods

Main methods used to consult the concerned citizens include:

- Formal meetings with concerned citizens in project areas;
- Interviews with farmers/beneficiaries within project areas;
- Survey public opinions through the use of formal questionnaires; and
- Formal discussions and/or telephone interviews with Non-governmental organizations (NGOs) such as Women's Federation in each county.

5.1.2 Consultation Content

5.1.2.1 Content of formal meetings and interviews

Meetings were held in project areas and with Women's Federation to introduce the public with proposed project activities and the issues that will be covered by the environmental team (TOR). After introduction of the main content of proposed activities to be covered by the EIA team, suggestions were sought from participants and considered in finalizing the activities of the group. (2) Content of provided questionnaire. In total 30 questionnaires were distributed to project counties. Main content of the questionnaire is presented in Table 5.1-1.

Table 5.1-1 Public Participation Questionnaire

| | | | | | | | |
|--|--------------------|----------------|--|------------------------------------|--|-----------------------|--|
| <p>Introduction to the project: With a total investment of 1,273,238,600 yuan, <i>World Bank Loan Project of Ecological Animal Husbandry Demonstration in Yellow River Floodplain of Henan Province</i> involves 30 countries (cities, districts) of 8 provincially administered municipalities in Henan. The project plans to reconstruct, expand and newly build 590 breeding farms (zones). Among them, the number of reconstructed and expanded breeding farms (zones) is 473, including 272 beef cattle breeding farms (zones), 179 dairy cow breeding farms (zones), 1 laying hen breeding farm (zone), 18 ecological pig breeding farms (zones), 2 reconstructed and upgraded bull breeding stations. The number of newly-built breeding farms (zones) is 117, including 66 dairy cow breeding farms (zones) and 51 beef cattle breeding farms (zones). After the completion of the project, the breeding farms (zones) will achieve the cultivation scale of 483,269, including 196,546 beef cattle, 181,703 dairy cows, and 108,400 live pigs.</p> | | | | | | | |
| Situation of respondents | | | | Situation of surveyed units | | | |
| Name | | Age | | Unit name | | | |
| Gender | | Occupation | | Telephone | | | |
| Educational level | | Telephone | | Nature | | Management department | |
| Home address | Country Village | Township(Town) | | Unit address | | | |
| <p>Do you know that the local will implement the demonstration project of ecological animal husbandry in Yellow River floodplain?</p> <p><input type="checkbox"/>Know <input type="checkbox"/>Don't know <input type="checkbox"/>Can't remember clearly <input type="checkbox"/>Other</p> | | | | | | | |
| <p>If you know, where did you learn the information of the project?</p> <p><input type="checkbox"/>Released by the government <input type="checkbox"/>Television broadcast and newspaper <input type="checkbox"/>Network <input type="checkbox"/>Other</p> | | | | | | | |
| <p>How do you like to learn the information?</p> <p><input type="checkbox"/> Released by the government <input type="checkbox"/>Television broadcast and newspaper <input type="checkbox"/>Network <input type="checkbox"/>Other</p> | | | | | | | |
| <p>Do you care about the project?</p> <p><input type="checkbox"/>Care a lot <input type="checkbox"/>General <input type="checkbox"/>Don't care</p> | | | | | | | |
| <p>According to the information you have learnt, how do you think the hazard/impact of the project on the environment?</p> <p><input type="checkbox"/>Serious <input type="checkbox"/>Larger <input type="checkbox"/>General <input type="checkbox"/>Smaller <input type="checkbox"/>Have no idea</p> | | | | | | | |
| <p>What do you think is the largest impact of the project on environment?</p> <p><input type="checkbox"/>Water environment <input type="checkbox"/>Atmospheric environment <input type="checkbox"/>Ecological environment <input type="checkbox"/>Noise</p> | | | | | | | |
| <p>What impact do you think the project will have on the development of local economy?</p> <p><input type="checkbox"/>Very favorable <input type="checkbox"/>General <input type="checkbox"/>Smaller <input type="checkbox"/>Unfavorable</p> | | | | | | | |
| <p>What impact do you think the project will have on your personal and family lives?</p> <p><input type="checkbox"/>Very favorable <input type="checkbox"/>General <input type="checkbox"/>Smaller <input type="checkbox"/>Unfavorable</p> | | | | | | | |
| <p>If you are required to remove in the construction process, do you support?</p> <p><input type="checkbox"/>Strongly support <input type="checkbox"/>Conditional support <input type="checkbox"/>It doesn't matter <input type="checkbox"/>Oppose</p> | | | | | | | |

| |
|---|
| What's your attitude to the project? <input type="checkbox"/> Strongly support <input type="checkbox"/> Conditional support <input type="checkbox"/> It doesn't matter <input type="checkbox"/> Oppose |
| By which way do you hope to participate in the environmental protection of the ecological animal husbandry demonstration project? <input type="checkbox"/> Answer questionnaire <input type="checkbox"/> Interview <input type="checkbox"/> Forum <input type="checkbox"/> Other |
| What suggestions do you have for the project construction and environmental protection work? |

5.2 Public Comments and Suggestions

5.2.1 Survey Results of Public Participation

5.2.1.1 Survey results

A total of 950 questionnaires were distributed to the counties; 941 questionnaires were returned (99.1%). Tables 5.2-1, 5.2-2, and 5.2-3 represent the summary of the findings.

Table 5.2-1 Opinion Consultation Results

| Project county | Number of people (Male/Female) | Form of opinion consultation |
|---------------------------|--------------------------------|---|
| Jiyuan | 29 (18/8) | Distribute questionnaire |
| Wen | 34 (27/7) | Distribute questionnaire |
| Qinyang | 30 (24/6) | Distribute questionnaire |
| Yucheng | 38 (32/16) | Distribute questionnaire |
| Minquan | 30 (23/7) | Distribute questionnaire |
| Mengjin | 30 (26/4) | Distribute questionnaire |
| Yanshi | 30 (25/5) | Distribute questionnaire |
| Liangyuan district | 30 (23/7) | Distribute questionnaire |
| Zhongmou | 30 (19/11) | Distribute questionnaire |
| Fengqiu | 30 (28/2) | Distribute questionnaire |
| Yuanyang | 30 (28/2) | Visit, hold forums and distribute questionnaire |
| Changyuan | 30 (20/10) | Distribute questionnaire |
| Yanjin | 30 (23/7) | Distribute questionnaire |
| Huiji district, Zhengzhou | 30 (18/12) | Visit, hold forums and distribute questionnaire |
| Xinzheng | 30 (17/13) | Distribute questionnaire |

| Project county | Number of people (Male/Female) | Form of opinion consultation |
|-----------------------|---|--|
| Mengzhou | 30 (26/4) | Distribute questionnaire |
| Wuzhi | 30 (28/2) | Distribute questionnaire |
| Bo'ai | 30 (22/8) | Distribute questionnaire |
| Taiqian | 30 (23/7) | Distribute questionnaire |
| Puyang | 30 (27/3) | Distribute questionnaire |
| Qingfeng | 30 (19/11) | Distribute questionnaire |
| Fan | 30 (28/2) | Distribute questionnaire |
| Suiyang | 30 (25/5) | Distribute questionnaire |
| Sui | 30 (23/7) | Distribute questionnaire |
| Ningling | 30 (19/11) | Distribute questionnaire |
| Xingyang | 30 (24/6) | Distribute questionnaire |
| Tongxu | 30 (24/6) | Distribute questionnaire |
| Lankao | 30 (24/6) | Distribute questionnaire |
| Kaifeng | 30 (25/5) | Visit, hold forums and distribute questionnaire |
| Weishi | 30 (29/1) | Distribute questionnaire |
| Qi | 30 (24/6) | Distribute questionnaire |
| Total | 941 (700/241) | |

Table 5.2-2 Statistical Table for Structure Level of Respondents in Public Participation Questionnaire Survey

| Structure of respondents | Gender | Educational level | | | | | Occupation | | | | | Age | | | |
|--------------------------|--------|-------------------|--------|------------------|--------------------|--------------------|------------|--------|---------|---------|-------|-----|-------|-------|------|
| | Male | Female | middle | junior technical | school and college | Bachelor and above | Cadre | Worker | Peasant | Teacher | Other | <20 | 20-30 | 30-40 | >40 |
| Statistical result | 741 | 200 | 289 | 352 | 200 | 96 | 160 | 87 | 387 | 18 | 289 | 93 | 247 | 410 | 447 |
| Percentage (%) | 78.7 | 21.3 | 30.7 | 37.4 | 21.3 | 10.2 | 10.6 | 9.2 | 41.1 | 1.9 | 30.7 | 10 | 26.2 | 43.6 | 47.5 |

Table 5.2-3 Statistical Results of Public Participation Questionnaire Survey

| Survey contents | Statistics of survey results | | | | |
|---|---|---|--|--------------------------------|-------------------------------------|
| Do you know that it is planned to develop ecological animal husbandry in Yellow River floodplain? | Know 904 people (96.1%) | Don't know 24 people (2.6%) | Can't remember 7 people (0.7%) | Other 6 people (0.6%) | |
| If you know, where did you learn about the project? | Government release 534 people (56.7%) | Television/ newspaper 261 people (27.7%) | Internet 110 people (11.7%) | Other 97 people (3.9%) | |
| How do you like to learn the information? | Government release 324 people (34.4%) | Television/ newspaper 430 people (45.7%) | Internet 232 people (24.7%) | Other 22 people (2.3%) | |
| Do you care about the project? | Care a lot 722 people (76.7%) | Neutral 201 people (21.4%) | Don't care 17 people (1.9%) | | |
| How do you think the hazard/impact of the project on the environment? | Significant 12 people (1.3%) | Large 25 people (2.7%) | Neutral 176 people (18.7%) | Small 694 people (73.8%) | Have no idea 32 people (3.4%) |
| What do you think is the largest impact of the project on environment? | Aquatic environment 249 people (26.5%) | Atmospheric environment 267 people (28.4%) | Ecological environment 351 people (37.3%) | Noise 79 people (8.4%) | |
| What impact do you think the | Very favorable | General | Smaller | Unfavorable | |

| Survey contents | Statistics of survey results | | | |
|--|---|--|--|--------------------------------|
| project will have on the development of local economy? | 822 people (87.4%) | 57 people (6.1%) | 61 people (6.5%) | 1 people (0.1%) |
| What impact do you think the project will have on your personal and family lives? | Very favorable 609 people (64.7%) | General 220 people (23.4%) | Smaller 123 people (13.1%) | Unfavorable |
| If you are required to remove in the construction process, do you support? | Strongly support 622 people (66.1%) | Conditional support 242 people (25.7%) | It doesn't matter 63 people (6.7%) | Oppose 0 (0.0%) |
| What's your attitude to the project? | Strongly support 753 people (80.0%) | Conditional support 136 people (14.5%) | It doesn't matter 42 people (4.5%) | Oppose 0 (0.0%) |
| By which way do you hope to participate in environmental protection of the project? | Answer questionnaire 476 people (50.6%) | Interview 175 people (18.6%) | Forum 211 people (22.4%) | Other 100 people (10.6%) |
| What suggestions do you have for the project construction and environmental protection work? | 1. The public hopes that the project is implemented as soon as possible; 2. It is suggested to increase the input in Biogas; 3. To use feces and sewage as fertilizer and try to reduce the usage amount of fertilizer; 4. To increase the government support; 5. To strengthen environmental protection and expand scale on the pre 6. To carry out innocent treatment to manure, thus realizing the reutilization of resources; 7. Environmental protection measures have large input and high quality; 8. To increase the input in infrastructure of farms and achieve standardized management; | | | |

5.1.2.2 Public Recommendations

The main recommendations received from the public included: (1) to attempt strengthening environmental protection activities during construction and operation of the animal parks to reduce the project negative impact on the surrounding environment; (2) apply manure as fertilizer to farmland to improve soil fertility; (3) enhance the environmental monitoring and management of the animal parks to ensure sustainable operation of pollution control facilities.

5.1.2.3 Analysis of survey results

The received questionnaires were analyzed. The major findings include:

A: Are you aware of the Yellow River Ecological Livestock Project?

- Questionnaires finding indicate that 96.1% of the public were aware of the project, indicating that the lined agencies in the project area have had adequate discussions with inhabitants and fully informed the public about the project;

B: How do you assess the impact of the project?

- Only 2.7% of the public believe that the project implementation will have negative impact on the environment while majority (73.8%) believe that the project impact is highly positive.

C: What is the biggest impact of the project?

- Public opinion indicates that 37.3% believe that the project will have impact on ecology, 28.4% believe that it will impact on atmospheric environment and 26.5% believe that it will have impact on aquatic environment.

D: What do you assess the project impact on the social-economic development?

- Public opinion indicates that 87.4% believe that the project construction is very favorable to the local economic development;

E: What do you think of the project impact on personal and family lives?

- Public opinion indicates that 64.7% believe that the project construction will have favorable impact on personal and family lives, while 36.5% believe that the impact will be minor; and

F: What is your attitude towards the project?

- Public opinion indicates strong support for the implementation of the project (80%), while 14.5% support the project implementation with some conditionality. There is no objection to the project.

G: What are the recommendations and suggestions from public?

- The vast majority of the participants requested to speed up the project development process to ensure early implementation. Therefore, the project can play its role in improving social, environmental and economic benefits to the participating communities.

As is presented in Table 5.2-3, about 80% of the respondents have a very supportive attitude towards the project, believing that the project will form a good social foundation for an environmentally sustainable and smooth development of the animal parks in the participating counties. Full attention should be made by the Project management office to ensure views of the public are considered in project design and implementation.

5.2.2 Survey Results of Women's Federation at Country Level

Table 5.2-4 presents the result of the survey of the women's federation in each country.

Table 5.2-4 Statistical Table for Survey Information of Women's Federation at Country (City) Level

| Prefecture level city | Consultation time | Place and object | Number of people (M/F) | Consultation form | Consultation results and main suggestions |
|-----------------------|-------------------|----------------------------------|------------------------|----------------------|---|
| Zhengzhou | July 23, 2009 | Huiji district | 0/5 | Visit | <p>1. To strengthen the cultivation of cattle, sheep, pigs and fowls, build moderate farms, do a good job in environmental protection, reduce atmospheric noise and water pollution, construct supporting facilities of biogas and achieve the comprehensive utilization of pollutants;</p> <p>2. Hope to allocate some advanced supporting facilities and instruments etc for cultivation, strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; the project construction site doesn't occupy basic farmland, far away from residential areas.</p> |
| | July 23, 2009 | Xinzheng City Women's Federation | 0/5 | Visit | <p>1. To strengthen the construction of supporting facilities of farms and try not to occupy farmland;</p> <p>2. It is suggested to achieve the comprehensive utilization of pollutants;</p> <p>3. To strengthen the sewage treatment of farms;</p> <p>4. To increase the scale of cultivation and it is suggested that farms should be far away from residential areas.</p> |
| | July 23, 2009 | Zhongmou country | 0/10 | Visit and phone call | <p>1. Project content suggestions: to strengthen the construction of cow and beef cattle breeding industries, build new cow and beef cattle farms with 500 cows and beef cattle in stock, including 300 adult cows;</p> <p>2. Environmental protection suggestions: to strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; the project construction site doesn't occupy or occupies a little farmland and woodland; farms should be far away from residential areas; to strengthen the sewage treatment of farms, construct achieve the comprehensive utilization of pollutants.</p> |
| | July 23, 2009 | Xinyang city | 0/10 | Visit | <p>1. To strengthen modern and large-scale environmental protection livestock breeding industry and enhance the infrastructure supporting construction of farms;</p> <p>2. To strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; the project construction site doesn't occupy or occupies a little farmland and woodland; farms should be far away from residential areas; to strengthen the sewage treatment of farms.</p> |
| Peifeng | July 23, 2009 | Weishi country | 0/5 | Visit | <p>1. To strengthen the large-scale farming and scientific breeding management of beef cattle;</p> <p>2. To enhance the large-scale farming of beef cattle, keeping more than 500 beef cattle in stock and carry out standardized</p> |

| Prefecture level city | Consultation time | Place and object | Number of people (M/F) | Consultation form | Consultation results and main suggestions |
|-----------------------|-------------------|------------------|------------------------|----------------------|---|
| | | | | | <p>construction and scientific management to ensure safe animal products;</p> <p>3. The construction site should be far away from villages without occupying basic farmland; feces and sewage should be well handled;</p> <p>4. To pay attention to environmental protection during the project construction; the site should be in line with provisions of the epidemic law.</p> |
| | July 23, 2009 | Tongxu country | 0/5 | Visit | <p>1. Project content suggestions: to strengthen the development of pig, beef cattle and cow breeding industry, keeping more than 10,000 pigs, more than 500 beef cattle and over 300 cows in stock yearly; to strengthen the construction of supporting facilities for epidemic prevention and monitoring facilities for epidemic diseases etc;</p> <p>2. Environmental protection suggestions: to strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; the project construction site doesn't occupy or occupies a little farmland and woodland; farms should be far away from residential areas; to strengthen the sewage treatment of farms.</p> |
| | July 23, 2009 | Qi country | 0/10 | Visit and phone call | <p>1. Project content suggestions: to strengthen the fund input in beef cattle breeding, expand the scale of beef cattle farm and enhance the construction of supporting facilities of beef cattle farm;</p> <p>2. Environmental protection suggestions: to strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; the project construction site doesn't occupy or occupies a little farmland and woodland; farms should be far away from residential areas; to strengthen the sewage treatment of farms.</p> |
| | July 27, 2009 | Kaifeng country | 0/6 | Visit | <p>1. To strengthen the support dynamics to herbivorous livestock;</p> <p>2. To promote large-scale farming and achieve environment-friendly development;</p> <p>3. Fowl and livestock farms should be far away from residential areas to prevent from affecting the life of residents;</p> <p>4. To increase investment to dispose manure of fowl and livestock and treat sewage; input equipment for the processing and utilization of manure.</p> |
| | July 23, 2009 | Lankao country | 0/6 | Visit and phone call | <p>1. Project content suggestions: to vigorously develop ecological cattle breeding by using Yellow River floodplain; the scale of investment in farms should be more than 1 million yuan; construction of supporting facilities of farms should be enhanced;</p> <p>2. Environmental protection suggestions: to strengthen the environmental management in construction period to reduce</p> |

| Prefecture level city | Consultation time | Place and object | Number of people (M/F) | Consultation form | Consultation results and main suggestions |
|-----------------------|-------------------|--------------------------------------|------------------------|-------------------|---|
| | | | | | atmospheric, noise and water pollution; the project construction site doesn't occupy or occupies a little farmland and woodland; farms should be far away from residential areas; to strengthen the sewage treatment of farms |
| Luoyang | July 29, 2009 | Women's Federation of Mengjin county | 0/5 | Visit | <ol style="list-style-type: none"> 1. Loan policy inclines towards women; interest rate and period should be taken into account; 2. To strengthen training and technical guidance; it is suggested to set up a permanent mechanism for technical service of ecological development; 3. Able to absorb and spur more women to participate in the project, realizing entrepreneurship to create more employment opportunities and common prosperity. |
| | July 27, 2009 | Women's Federation of Yanshi city | 0/7 | Forum | <ol style="list-style-type: none"> 1. To focus on doing well in infrastructure construction and reconstruction of large-scale farms so as to realize standardized production of breeding enterprises; 2. To give full consideration to environmental protection factors, select the places far away from residential areas and industrial and mining establishments, standardize feces and sewage treatment facilities of breeding enterprises, do well in sewage treatment of farms. |
| Jiaozuo | July 23, 2009 | Mengzhou city | 0/4 | Visit | <ol style="list-style-type: none"> 1. To increase the development of beef cattle and pig breeding industries, control moderate scale, strengthen the supporting facilities for disinfection, enhance sewage treatment and protect environment; 2. To strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; the project construction site doesn't occupy or occupies a little farmland and woodland; farms should be far away from residential areas. |
| | July 27, 2009 | Bo'ai county | 0/5 | Visit | Livestock breeding industry should have certain scale, quantity and supporting facilities. First of all, it shouldn't destroy human being and environment. It should be especially in broad places, far away from living areas so as to reduce atmospheric, noise and water pollution. Water quality pollution should be well handled. The application for development scale shouldn't become the reason for money. It is necessary to do it well and conscientiously serve the people. |
| | July 27, 2009 | Wen county | 0/6 | Visit | <ol style="list-style-type: none"> 1. Project content suggestions: to actively develop cow farming, expand the scale of cow farms; it is suitable for cow farms to have a scale of 400 cows; to increase the monitoring of epidemic diseases, coordinate the construction of laboratory, prevent the development and prevalent of zoonosis, strengthen the construction of environmental protection facilities in farms, rationally use manure to change the waste to valuable; |

| Prefecture level city | Consultation time | Place and object | Number of people (M/F) | Consultation form | Consultation results and main suggestions |
|-----------------------|-------------------|---------------------------------------|------------------------|-------------------|---|
| | | | | | 2. Environmental protection suggestions: to strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; the project construction site doesn't occupy or occupies a little farmland and woodland; farms should be far away from residential areas; to achieve the comprehensive utilization of manure; |
| | July 28, 2009 | Wuzhi country | 0/5 | Visit | 1. Farms shouldn't occupy or occupy a little farmland; 2. To pay attention to environmental protection, strengthen the control of feces and sewage and achieve the comprehensive utilization of resources; 3. To take note of the balanced nutrition of farms and reduce nutrient loss; 4. Farms should be away from residential areas as far as possible. |
| | July 29, 2009 | Qinyang city | 0/5 | Meeting | 1. The project construction should try not to occupy farmland; 2. To strengthen the sewage treatment of farms; 3. Farms should be away from residential areas as far as possible. |
| Xinxiang | July 23, 2009 | Women's Federation of Fengqiu country | 0/5 | Visit | 1. To strengthen the farming of herbivorous animals including cows and beef cattle etc; 2. To enhance the standardized construction of farms; 3. The project construction doesn't occupy or tries to occupy a little farmland and farms should be far away from residential areas; 4. To strengthen the pollution control of farms and construct manure treatment facilities. |
| | July 23, 2009 | Yanjin country | 0/5 | Meeting | 1. Making full use of the superior condition of rich forage grass and feed resources in our country, to vigorously develop the production of herbivorous livestock and advocate moderate scale, such as, 300 to 500 cows, 500 to 1,000 beef cattle, and 1,000 to 2,000 mutton sheep. At the same time of developing production, attention must be paid to environmental protection and the innocent treatment work for feces and sewage should be well done; 2. The project construction should try not to occupy or occupy a little farmland; farms should be far away from residential areas and artery traffic; to strengthen pollution control and achieve the resource utilization of wastes. |

| Prefecture level city | Consultation time | Place and object | Number of people (M/F) | Consultation form | Consultation results and main suggestions |
|-----------------------|-------------------|-------------------|------------------------|----------------------|--|
| | July 24, 2009 | Changyuan country | 0/7 | Visit | <p>1. Project content suggestions: to strengthen the development of goose and duck breeding industries, improve the living structure of residents, enhance the production of beef cattle breeding industry which has a scale of 200 to 300 beef cattle, and strengthen the construction of supporting facilities;</p> <p>2. Environmental protection suggestions: to strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; the project construction site doesn't occupy or occupies a little farmland and woodland; to strengthen the construction of innocent supporting facilities and achieve the comprehensive utilization of pollutants;</p> |
| | July 23, 2009 | Yuanyang country | 0/8 | Visit | <p>1. To increase cow and beef cattle farming and construct standardized farms;</p> <p>2. To realize large-scale farming and construct farms with 10,000 cow and 10,000 beef cattle;</p> <p>3. To strengthen the construction of supporting facilities of farms, achieve standardized water and electricity engineering construction, construct isolated barns and innocent treatment facilities for feces and sewage;</p> <p>4. To strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution;</p> <p>5. It is suggested that the project construction site doesn't occupy or occupies a little farmland and woodland;</p> <p>6. Project farms should be far away from residential areas, having no impact on the production and life of residents;</p> <p>7. To enhance the feces and sewage treatment of farms so as not to pollute the atmosphere and water resource and ensure the living safety of residents;</p> |
| Puyang | July 30, 2009 | Taiqian country | 0/6 | Visit and phone call | <p>1. In project content, the emphasis should be put on the development of herbivorous livestock, cows or beef cattle, mainly embodied in expanding the large-scale infrastructure construction of farms to achieve normalization and standardization. The cow breeding scale should be more than 300 at least and the beef cattle breeding scale should be more than 100;</p> <p>2. In environment protection, try not to occupy basic farmland or woodland. Farms should be far away from residential areas. To strengthen the control of environmental pollution, construct pollutant treatment facilities.</p> |
| | July 31, 2009 | Puayng country | 0/5 | Visit | <p>1. Project construction suggestions: cow and beef cattle breeding industries should be strengthened. It is suitable for farms to have a scale of 300 to 500 cows or beef cattle. Innocent treatment facilities.</p> <p>2. Environmental protection suggestions: to strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; the project construction site doesn't occupy or occupies a little farmland and woodland;</p> |

| Prefecture level city | Consultation time | Place and object | Number of people (M/F) | Consultation form | Consultation results and main suggestions |
|-----------------------|--------------------|--------------------|------------------------|-------------------|--|
| | | | | | to strengthen the treatment for manure of farms, construct treatment facilities including sedimentation tank etc, achieve the comprehensive utilization of pollutants and economize on resources. |
| | July 31, 2009 | Qingfeng country | 0/8 | Forum | 1. It is necessary to enhance the support for cow breeding industry in our country because it is backward. The emphasis should be put on the construction of standardized and large-scale farms or culture areas; 2. The heavy stress should be laid on the transformation of existing farms, especially on the increase of input power in pollutant treatment |
| | July 31, 2009 | Fan country | 0/8 | Visit | 1. Project content suggestions: to strengthen the development of beef cattle and cow breeding industries. Quantity: the cow breeding scale should be 500 to 10,000 and the beef cattle breeding scale should be 300 to 500. The construction for feces and sewage treatment facilities of farms should be enhanced; 2. Environmental protection suggestions: the project construction should be far away from residential areas, without occupying basic farmland. Feces and sewage treatment facilities. |
| Shangqiu | July 20, 2009 | Liangyuan district | 0/5 | Visit | 1. Farms of different scales should construct such environmental protection measures to reduce environmental pollution; 2. It is prohibited to occupy basic farmland. Farms should be far away from residential areas. |
| | July 23, 2009 | Suiyang district | 0/5 | Visit | 1. To strengthen beef cattle and cow farming; 2. To enhance feed processing and supporting facilities for epidemic prevention; 3. To reinforce the control of feces and sewage, achieve the comprehensive utilization of feces and sewage; 4. To improve the ecological benefits of animal husbandry and pay attention to environmental protection; 5. Farms should be built at the place more than 500m away from residential areas, without occupying or occupying a little farmland. |
| | July 23 & 24, 2009 | Sui country | 0/6 | Forum and visit | 1. To strengthen the construction of large-scale farms so as to expand the scale and improve benefits; 2. To enhance environmental management and carry out comprehensive management of feces and sewage to reduce pollution' 3. The extension of farms should occupy farmland as little as possible; |

| Prefecture level city | Consultation time | Place and object | Number of people (M/F) | Consultation form | Consultation results and main suggestions |
|-----------------------|-------------------|------------------|------------------------|----------------------|---|
| | | | | | <p>4. To strengthen ecological culture;</p> <p>5. To strengthen environmental protection construction.</p> |
| | July 23, 2009 | Ningling country | 0/5 | Visit | <p>1. To strengthen beef cattle and cow farming; it is suggested that the beef cattle and cows on hand should be more than 300</p> <p>2. To enhance infrastructure construction, pay attention to environmental protection and reduce atmospheric, noise and water pollution;</p> <p>3. Farms should be built at the place more than 500m away from residential areas, without occupying or occupying a little farmland;</p> <p>4. To improve the ecological benefits of animal husbandry.</p> |
| | July 23, 2009 | Minquan country | 0/5 | Visit | <p>1. To strengthen beef cattle and cow farming and enhance the construction of supporting facilities in the farms;</p> <p>2. To strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; the project construction site doesn't occupy or occupies a little farmland and woodland; farms should be far away from residential areas; to strengthen the sewage treatment of farms, construct supporting facilities of achieve the comprehensive utilization of pollutants;</p> |
| | July 22, 2009 | Yucheng country | 0/6 | Visit and phone call | <p>1. For World Bank loan project, full support should be given to cow and beef cattle breeding industries. The beef cattle and cow breeding scale should be more than 300. In supporting facilities of farms, the construction of facilities for epidemic prevention, breed improvement, forage grass and feed processing etc should be reinforced to provide society with good-quality beef and milk.</p> <p>2. To strengthen the environmental management in construction period to reduce atmospheric, noise and water pollution; rubbish produced during the project construction should be promptly cleared and handled; farms should be more than 500m away from residential areas; feces and sewage should be treated through such measures as heap fermentation, to achieve the comprehensive utilization of pollutants; farms should become the local beef cattle and cow demonstration site and spur peasants in surrounding areas to vigorously develop beef cattle and cow breeding industry, thus promoting the development of local rural economy and increase the income of peasants.</p> |

| Prefecture level city | Consultation time | Place and object | Number of people (M/F) | Consultation form | Consultation results and main suggestions |
|-----------------------|-------------------|------------------|------------------------|-------------------|--|
| Jiyuan | July 24, 2009 | Jiyuan city | 0/5 | Visit | <p>1. To strengthen the support for three major industries of cows, pigs and laying hens, develop large-scale farming. The scale of 500 cows, 20,000 laying hens and 3,000 pigs is suitable. Farms should construct standardized supporting facilities for disinfection and treatment facilities for feces and sewage. Feces and sewage should be discharged after innocent treatment for reaching the standard. Innocent treatment should be carried out for livestock and poultry died of diseases and covers should be provided for sewers. Production area, living area and innocent treatment area of feces and sewage should be separated. The control emphasis must be put on the pollution caused by cultivation. It is inadvisable to cause new polluted sites because of the construction of farms. It is required to achieve standardized management and scientific operation;</p> <p>2. To implement the strategy of “withdrawing from the plain and entering the mountain as well as large-scale development”; guide livestock breeding industry to transfer from plain area to mountain area by using policy lever; try not to occupy or occupy a little farmland and arable land; promote the scale standard and construction standard of new farms; carry out examination, verification and record-keeping mechanism in new farms. Farming projects with feces and sewage control failure shouldn't be examined, approved and kept into records so as to ensure that the pollution control of farms is in place;</p> <p>3. The new project must conform to town and village planning, land use policies and site selection requirements of <i>Animal Husbandry Law</i>, avoiding industrial agglomeration areas, water source region and tourist districts etc. It should be carried out environmental assessment at environmental protection department. Only projects in line with project requirements can be allowed for construction;</p> <p>4. To increase pollution control in accordance with the law. Coordinating with environmental administration, to increase the pollution discharge monitoring of farms. Culture areas (farms) which have been seriously polluted but haven't actively taken measures to control pollution must be imposed punishment in accordance with the law. It is required to promote the process of pollution control of livestock breeding industry according to the law.</p> |

5.3 Information Disclosure and Feedback

Animal Husbandry Bureau of Henan Province provided information on the project and the terms of reference on the bureau's web site and by posting on public notice boards before the environmental impact assessment was carried out.

The first public disclosure activity covered the following areas::

- Project overview;
- Working procedures and main content of the EIA;
- Request for suggestion on project scope and major issues ;
- Request for recommended options to ask for suggestions from the public;
- Publicize the process and the timing for reviewing and commenting on the summary EIA report; and
- Methods to contact the bureau with comments, including the mailing addresses, postal codes, contact telephone numbers, fax numbers, contacts and electronic mailboxes, etc of the construction unit and environmental impact assessment organization;

To this date, no comments or feedback had been received from the local public on the environmental assessment procedure or project design.

The second round of public disclosure will be made on bureau's web site and at county libraries/PMOs after the project's first draft has been submitted for review and comments by the PEPB and the World Bank safeguard group, requested revisions have been made, and approvals have been received. Main contents of the second round of public disclosures include:

- Summary EIA report in Chinese;
- Deadline for the public to give suggestions; and
- Methods of contacting the bureau and the EIA team, including mailing addresses, postal codes, contact telephone numbers, fax numbers, contacts and electronic mailboxes etc.
- Website for information disclosure:

<http://www.hnxmy.gov.cn/more.asp?classid=25&typeid=25&typename=>



河南省世行贷款黄河滩区生态畜牧业示范项目环境影响评价第一次公示

发布时间: 2009-9-2 责任编辑: z1

为切实做好建设项目环境影响评价公众参与工作,按照《环境影响评价公众参与暂行办法》要求,现将河南省世行贷款黄河滩区生态畜牧业示范项目信息公示如下。

1、项目概要

本项目旨在减少河南省黄河滩区大中型畜牧业生产(养殖场和养殖小区)所造成的环境污染,通过项目建设,推动畜牧业可持续发展、增加农民收入。

本项目拟利用世行贷款8000万美元,项目承建单位包括500多个养殖场区,建设内容包括公共机构能力建设、对现有和新建养殖场(区)环境的改造和升级、项目管理和技术支持体系等三个部分。项目区涉及郑州市的惠济区、荥阳市、中牟县、新郑市,开封市的开封县、尉氏县、杞县、通许县、兰考县,洛阳市的孟津县、偃师市,焦作市的孟州市、温县、武陟县、沁阳市、博爱县,新乡市的长垣县、封丘县、原阳县、延津县,濮阳市的濮阳县、范县、台前县、清丰县,商丘市的梁园区、睢阳区、虞城县、民权县、宁陵县、睢县,济源市等8个省辖市的30个县(市、区)。

项目实施后,将改善黄河滩区养殖场(区)环保基础设施,提高其环保水平,促进畜牧业可持续发展。

2、项目建设单位的名称和联系方式

项目建设单位:河南省世行贷款黄河滩区生态畜牧业示范项目领导小组办公室

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3、承担评价工作的环境影响评价机构的名称和联系方式

本项目环境影响评价工作由河海大学环境水利研究所承担,联系方式如下:



河南省世界银行贷款黄河滩区生态畜牧业示范项目环境影响评价第二次公示

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1 项目概况

1.1 建设内容

本项目涉及河南省8个省辖市的30个县(市、区),计划改扩建、新建589个养殖场(区)。其中:改扩建养殖场(区)472个;包括肉牛养殖场(区)272个,奶牛养殖场(区)179个,奶牛养殖场区改造(区)1个,生态养殖场(区)18个,2个种公牛站改造升级。新建养殖场(区)117个;包括奶牛养殖场(区)66个,肉牛养殖场(区)51个。

建设内容包括公共机构能力建设、现有或新建养殖场(区)环境管理、项目管理、检测和评价三大部分。

本项目包括500头奶牛标准养殖场、500头肉牛标准养殖场、存栏5000头生态猪生物发酵床、500头奶牛颗粒有机肥项目、改扩建100头奶牛养殖场、改扩建200头奶牛养殖场和改扩建200头肉牛养殖场等七个模块。

1.2 项目建设的必要性

畜牧业经过多年发展,已经成为农村经济的重要支柱产业和农民增收的重要途径。但是在畜牧业发展进程中,还存在着标准化规模化程度低、产业结构不尽合理、生产方式相对落后、服务体系脆弱等问题,畜牧业发展还面临着市场约束、资源约束、体制约束等深层次矛盾,畜牧业生产对环境造成的负面影响日益彰显,畜产品安全保障和质量提升任务艰巨,庭院、散养、小规模养殖模式已经成为影响新农村建设的和谐因素。突破畜牧业发展的制约瓶颈,必须以优势区域为突破口,紧紧抓住生产方式转变、着力提高畜牧业综合生产能力和核心竞争力,积极推进畜牧业现代化。

项目建设是大力发展生态畜牧业,促进经济、社会、环境和谐发展的有效途径,完善畜牧业循环经济的重要保障,是推进畜牧业现代化、实现又好又快发展的重要措施,是优化畜牧业产业结构、增强畜产品竞争力的迫切要求,是优化区域布局的需要,是转变生产方式的必要,是贯彻落实公共财政政策的需要,是拉动内需、保障供给的需要。

1.3 项目实施的环境可行性

(1) 河南省畜牧业生产发展快速,一些庭院、散养、小规模养殖给周围环境造成了污染。本项目以协会、合作社等形式的畜牧业合作组织,为规模、规范养殖提供了有利条件,得有利于污染物的综合治理。

5.4 Summary of Public Consultation

The public recommendation and comments have been collected during the first phase of public disclosure through meetings, interviews, questioners, posters, and internet. The information collected clearly indicate that the public have a much better understanding of the project components and proposed activities. The results indicate that the majority is in favor of project implementation and no one has any objections to the project development. The collected information also indicates that the public perceives the project activities to positively impact the social, environmental, and economic development of the project counties. The collected information also indicates that the beneficiaries are in favor of early project implementation in an environmentally sustainable manner.

6 Analysis of Alternatives

Since the propose project is mainly an rehabilitation and expansion project, aiming at improving the management of waste from animal parks, the project study team considered to only review the "with" and "without" project scenarios and no other alternatives were considered. This chapter will only discuss the "with project" and "without project" alternatives.

6.1 Analysis of "With Project" Alternative

Currently, there are a number of major constraints for livestock production systems in the project areas that limit the livestock farmer's income, production efficiency, and effectiveness of livestock waste management activities. Lack of appropriate feed mix, proper animal waste treatment and storage, and low efficiency of animal feeding are some of the major constraints that the project is trying to address.

6.1.1 Current Status of Livestock Development and Fodder Production

A major factor restricting livestock farmers' income increase and improvement of livestock development in agricultural areas is inadequate supply of nutritious feed material and poor feed quality. Field visits to a number of project counties and review of feed and silage mix quality revealed the poor quality of some forage material available at project farms. One of the main ingredients of the available feed material was maize stover (silage material), wheat straw and in a few sites, maize grain. Use of the poor quality feed and improper feed ration not only prevent the timely fattening of the animals or high production of milk, in case of dairy farms that reduces the potential income of the livestock farmers, but it also increase livestock waste due to inefficient absorption of feed material by the animals. The current status of livestock farms appear to be suboptimal, poor quality shed, lack or inadequate exercise ground, poor farm management practices are all affecting the animal welfare, health status, and quality and quantity of production (milk or meat).

Currently, the visited farms lack any waste management facilities. The animal waste (fresh manure) is generally either wasted or sold to farmers in fresh status (without any composting) for use in agricultural fields. Rain and wash water. Mixed with liquid and solid manure is directly discharged to the surface waters, causing significant eutrophication and pollution of water resources with Yellow River watershed.

In addition many households are keeping the animals within the homestead that could potentially cause the occurrence of zoonotic diseases and epidemics, as well as surface and groundwater pollution due to poor management and lack of waste management facilities.

Implementation of proposed project' components should not only improve feed quality and efficiency of feed digestion, but should also significantly reduce loss of nutrients from animal manure to the environment through appropriate methods of manure composting and treatment of liquid manure and wash waters in the project constructed anaerobic ponds.

6.1.2 Present status of applied research, extension and training

At present the infrastructure for conducting applied research and technological development in Henan province and project prefectures/cities exist. However, the level of training is not up to standards and adequacy of research budget in areas of beef cattle, piggery, poultry, and dairy cattle development are questionable.

Another major constraint within project areas is the lack of well-developed and assertive extension department to disseminate the results of applied research in areas of animal husbandry and livestock waste management to the livestock farmers. There is a large gap between the available scientific knowledge and what is available to the livestock farmers in the areas of feeding technology and breed improvement and animal waste management. The inadequate number of well trained and experienced extension personnel makes it difficult to launch regular farmer training, and a lot of new technologies and new research results cannot be disseminated to farmers, limiting animal farm production improvement.

During field visits of the EIA team, strong desire for training was expressed by both extension personnel and the livestock farmers.

6.2 Analysis of “With Project” Alternative

The project’s objective is to improve the livelihood of the livestock farmers in the project areas and reduce nutrient loading of surface and groundwater resources within Yellow River watershed through establishment of appropriate manure management facilities in animal parks. The achievement of this objective would not only lead to improved livelihood within project affected communities and greater social stability in the project area, but it would also enhance environmental condition and quality of water resources.

Although the impact of the project on pollution reduction appears to be small relative to the sheer size of the Yellow River watershed and considering the size and magnitude of the livestock and other agricultural and industrial activities within the watershed, the project will have a positive impact on the immediate surrounding environment of animal park and the findings of the monitoring activities should establish the potential of scaling up of the project activities and incremental impact of the project activities on reducing pollution levels from the animal parks. Project activities, if successfully implemented could have significant impacts on improving beef and milk yield per animal from the animal parks. As was mentioned under section 6.1.1, currently the smallholders are keeping the animals within the homestead, increasing the risk of transmission of zoonotic diseases between human and the livestock and the risk of epidemics. The implementation of the project should eliminate animal and human health issues and not only provide a better environment for both human and livestock, but also improve the animal welfare by improving the living condition and feed quality.

The project can be considered as a series of pilot schemes for dissemination of information and form a basis (nucleus) for further development of an integrated livestock industry improvement outside the project areas. If successfully implemented the project should provide for strengthening the capacity of the Animal Husbandry Bureau at all levels in

application of new findings in applied research, improved feeding, and manure management technologies within the project areas.

The project, if successfully implemented, should also provide better forage and fodder crops and silage feed by improving farm management and introduction of better living condition for the livestock within animal parks. The project implementation would improve the livestock farmers' knowledge of livestock production and increase their income.

The project implementation may bring a number of negative impacts such as the land occupancy for expansion of animal parks and the proposed manure management facilities. In addition there is a potential for environmental pollution due to disposal of dead animals, especially dairy cattle, if appropriate measures for disposal of carcass is not established. Regarding the possible increase of non-point source pollution, the project has developed and is going to promote monitoring of the nutrient loading through calculation of animal park nutrient balance (accounting) on an annual basis to ensure that the project activities will reduce nutrient pollution to the environment. Better watershed management and incorporation of best cattle and dairy cow management practices in livestock development based on the available and future findings of applied research will be built-in the project development. In addition, the EIA team has developed an environmental management and monitoring plan that includes effective mitigation measures and environmental monitoring program, which will be carried out by the PPMO and project implementation teams to reduce the other possible negative impacts to minimum.

To sum up, if successfully implemented, the proposed project would not only promote the local social and economic development, but would also increase the living standards of the framers and reduce nutrient loading of water resources within Yellow River watershed through the use of appropriate manure management technologies. In the "with project" scenario, the impacts of the project on the natural environment are believed to be significantly positive due to reduction in nutrient loading, while the social and economic impacts appear to be positive. Please add any other project related information to support the "with Project" scenario.

7 Environment impacts assessment and mitigation measures

7.1 Environmental impacts and mitigation measures during design stage

7.1.1 Location of project activities

The location of project activities shall comply with Livestock Industry Waste Pollution Prevention and Control Technical Guideline (HJ/T81-2001) and Livestock Industry Waste Pollution Prevention and Control Regulation and Management Measures (No.9 Order, State Environment Protection Bureau, May 2001). It is not allowed to build new livestock farms, or renovate or expand any livestock farms within areas that are banned by the above orders and guidelines. An example of areas that animal parks cannot be built are in situations where the proposed farm is located downwind and side wind of dominant wind direction. The minimum allowable distance between boundary of the livestock farm and residential areas is 500 m. Other areas where development/expansion of livestock farms is not allowed by the above regulations include:

- Source of drinking water, resorts, historical sites, core and buffer zone of nature reserve, residential areas, major cultural sites, education facilities, hospitals, commercial buildings, industrial sites, and sites identified as scenic area; and
- Areas designated by county government as banned area for livestock farming as well as any other areas stipulated by the national and sub-national laws and regulations.

Environmental investigations indicate that some of the existing farms in the project area are close to the residential area, the distance between the farm and major residential areas being less than 500 m. Such animal parks cannot be included in the project and should theoretically be relocated. Table 7.1-1 presents the livestock farms that were included in the original project design and must be removed from the project since they do not meet the minimum distance from residential areas requirement.

Table 7.1-1 Proposed livestock farms that do not meet the minimum distance requirement

| No | Name of the farms | Distance to residential area | Solution |
|----|---|------------------------------|----------|
| 1 | Haoyuan Co-op of Lankao | 100m | Relocate |
| 2 | Hanjia farm, Liuta of Qingfeng | 50m | Relocate |
| 3 | Quanyuan Dairy Co-op of Huiji District | 50m | Relocate |
| 4 | Baiwan Dairy Co-op of Huji District of Huiji District | 200m | Relocate |
| 5 | Jingshui Dairy Co-op of Zhengzhou | 50m | Relocate |
| 6 | Zhongren Dairy Co-op of Huiji District | 200m | Relocate |
| 7 | Livestock Development Company of Huji District | 30m | Relocate |
| 8 | Nanyuedi Dairy Co-op of Huiji District | 400m | Relocate |
| 9 | Xuegang Dairy Co-op of Huiji District | 400m | Relocate |
| 10 | Hongyuan Beef Cattle Co-op of Huiji District | 400m | Relocate |

Additionally, the following issues should be considered for new farms by the planning team during finalization of the project design :

- Potential loss of farmland and/or change of land use of the farm:
 - ✓ Land acquisition for new farms might change the intended use of the farm. The change of land use could have impact on agricultural resources and can cause damage to natural vegetation. Crop lands that could potentially be impacted include rain-fed crop such as wheat, corn and irrigated/rainfed vegetables.
 - ✓ Afforestation should be included in project design to replace/increase vegetative cover and rehabilitate the local ecology after project implementation.
 - ✓ Project implementation should increase job opportunities for rural population and enhance competitiveness of products. Attempt should be made to hire less advantaged people, minorities, and women for newly opened positions.
 - ✓ Solid and liquid manure will be applied to crop lands that should assist in reducing the need for use of chemical fertilizers, mitigate environmental pressures and generate economic, social and environment benefits. However, it is important to consider the loading capacity of agricultural land to prevent over application of composted manure and contamination of soil, surface and groundwater within project area.
- Potential impacts on sources of drinking water;

Most project area inhabitants use groundwater as drinking water source. Over-application of manure and inorganic fertilizer could potentially outweigh the carrying capacity of the soils, especially within sandy, low exchange capacity soils of the project area. In a long term, the surplus N could potentially infiltrate the sandy soils and affect the groundwater quality, causing major disease epidemic in local population using the resource as drinking water. The manure storage facilities should also be located outside the protection areas for surface water sources.

- Potential impacts on historical and cultural sites;

The odour, harmful gases (ammonia, skatole, and H₂S) and dust carrying pathogenic microorganisms originated from the livestock farms could potentially have adverse impacts on population and visitors to historical and cultural sites. Minimum distance (MDS), as per regulation, should be kept between livestock farms and these sites.

- Impacts on rare and endangered flora and fauna;

Since there are very few wild animals and rare plants within project areas, the project impact on rare and endangered flora and fauna is not believed to be significant.

7.1.2 Project design

- Solid and liquid manure and waste water treatment system.

The collection, storage, transportation and treatment of manure and waste water of livestock farms have been a major issue that needs to be addressed urgently. Most intensive livestock farm operations in China are located in city suburbs and rural areas. Waste water from such operations is high in nutrient load and potentially carries harmful pathogens. Therefore, it is not permitted to drain them without prior treatment to surface waters or the city waste water system. If untreated manure is discharged, it can result in loss of nutrients and environmental pollution, undermining the sustainable development of livestock industry. Therefore, it is imperative that waste treatment technology and methodologies to collect, store, treat, and transport the solid and liquid waste should be a major part of any livestock development project in Henan Province. The design and implementation of such technologies should not only reduce environmental impact of livestock farms, but should also generate economic, social, and environmental benefits to project affected people.

Technologies for treatment and application of treated farms' solid and liquid wastes should be included in project plans for not only new farms, but also the ones to be renovated or expanded. Agricultural lands with adequate carrying capacity should be identified within close proximity of the animal parks for marketing and sale of treated animal waste as organic fertilizer.

Construction of appropriately sized concrete manure pads should be included in the project design of each animal park with allowance for covering the manure or installing interceptor drains to direct the washout due to rain into appropriately sized treatment lagoon for liquid waste so that farm effluent do not pollute the natural environment and water bodies in the proximity of the farm and minimize infiltration, spillage, leakage and odour from farm produced animal waste. The farm drainage system should be designed to separate rain and waste water and collect the waste water in the collection pond for further treatment.

- Design of animal shed

Air within the animal shed has a different quality than the outside air. Animals' daily activities, such as walking, eating, drinking, transpiration, excretion, sleeping, as well as production process, human activities, and running of equipments, all produce heat and raise the indoor temperature of the shed. At the same normal animals' daily activities emit vapour, noxious gases such as methane, dust, and noise. Lighting and ventilation should be incorporated into the design of shed to provide for a better living environment.

- Duration of composting

The scientific communities agrees that the minimum acceptable fermentation cycle to allow for most pathogens and weed seeds to be destroyed in Henan province is 20 days. This is the minimum period required for both composted and liquid manure to be allowed to ferment (retention time) before the material can be used/sold as fertilizer or be discharged be included for curing and storage of the treated manure. The special microorganism for composting such as E M Reagents might be needed to be applied to the solid and liquid waste to increase composting efficiency and to reduce excessive odour and mildew that can cause secondary environmental pollution.

➤ **Design of silage pit**

To minimize groundwater pollution from silage pits, the pit should have a concrete floor and, preferably, should be built above ground to prevent the silage from saturated due to accumulation of rainfall at the bottom of silage pit that can cause fermentation and spoilage of silage, reducing its quality as feed material.

7.2 Environment impacts and mitigation measures during project construction

Construction activities could potentially have short term, but significant impact on soil, air, water, and acoustic environment that can affect the surrounding communities. The impacts are short-term and reversible and if appropriate mitigation measures are applied the potential impact can be minimized to insignificant levels.

7.2.1 Dust

➤ **Environment impacts:**

Most of the project farms are located in rural area where potential impact due to dust is normally insignificant. The construction activities such as civil works and installation of equipment could produce some dust and noise pollution on the surrounding area, especially if large communities are living relatively close to the project area. Since most of the construction sites are in open areas and surrounded by farmland, are relatively far from residential area, and take a relatively short period of time, the perceived negative impacts are believed to be minimal and short-term. When the construction is carried out in a reasonable way, the building materials are piled and covered in an appropriate way, and water is sprayed on the construction site, then these negative impacts can be mitigated.

➤ **Mitigation measures:**

To ensure that dust does not cause any negative impact during construction period, earthwork and excavation, transportation, loading and unloading of building materials, transportation and stacking of building material, piling of garbage, and vehicle operation, especially when residential areas are in close proximity, the following mitigation measures should be applied:

- ✓ The construction site should be managed to reduce dust levels. Sand, cement, and other construction material should be stacked and handled carefully during transportation. Every effort should be made to minimize the time needed for stacking

the construction material to reduce potential dust pollution and minimize incremental air pollution.

- ✓ Work surface area should be sprayed, especially if construction activities are made during dry periods to maintain soil moisture and minimize dust production.
- ✓ Transport vehicles should be covered to minimize possibility of spillage of construction material along the road. Any building material left on the roads due to spillage or any other reasons should be cleaned. In dry periods, dirt roads should be sprayed at fixed intervals to control the dust.
- ✓ Construction site should be fenced to reduce dust impact on surrounding area.
- ✓ Dust pollution from cement mixing could be significant. However, the construction activities at project sites are generally minor and quantity of concrete to be used and mixed is quite small and the impact of concrete mixing, as long as it is done on site, is believed to be insignificant.

Incorporation of above recommendation as a part of the good construction management protocol should minimize or eliminate any possibility of significant dust pollution due to project activities.

7.2.2 Noise

Majority of proposed livestock farms are located away from the residential areas. Therefore, noise pollution due to construction activities is not considered as a significant issue.

In areas where the animal park is relatively close to residential areas, practical noise control measures can be considered as a part of a good construction management practice. In such circumstances, the contractor should incorporate practical management measures and comply with relevant environment protection regulations to minimize noise disturbance such as:

- ✓ Noise limits for Construction Site (GB12523-90) should strictly be followed, especially if construction is undertaken during the night. Application should be made to the local environment protection bureaus to obtain the approval for night construction before any activity can be commenced. Construction must be carried out within the specified and approved time.
- ✓ The construction machinery should be well maintained to ensure minimum noise disturbance. Such equipment with high noise levels should use sound insulation measures to minimize noise pollution, especially if project is close to residential areas or night construction is approved by the EPB.

Noise limits for Construction Sites have been reported in MOE guidelines (GB12523-90). It specifies the noise limits for various construction machineries at construction sites. The project is not using any equipment that produce high noise levels such as piling machine, therefore, taking into account that there are no large residential areas in surrounding areas, noise should not be considered as a major environmental issue during construction.

7.2.3 Solid wastes

Trash and waste that could be generated due to construction activities should be collected and disposed at nearby dump sites to ensure sanitary status of the construction site and

neighbouring areas. The reusable refuse, generated during project construction should be collected, and when possible, utilized. In general, construction crew should ensure that:

- ✓ With the exception of material to be used for backfill, all excavated earth should be collected and disposed to prevent dust or pollution of water bodies by runoff from the construction site.
- ✓ Refuse from construction site should be cleaned and/or disposed to minimize pollution to the surrounding areas.

7.2.4 Wastewater

Waste water generated during construction period includes industrial and domestic waste water. As the overall amount of waste water generated is minimal, as long as it is disposed in sanitary manner, potential impacts on environment will be minimal. To ensure disposal in a sanitary manner, the construction crew should ensure that:

- ✓ Sedimentation tank is built at the onset of construction activities for waste water from construction activities. The supernatant can be discharged, but the sludge should be disposed in landfill.
- ✓ Domestic waste water should be disposed of in settling pond and applied to crop land.

7.2.5 Natural environment

➤ Impact assessment:

The development of livestock farms will potentially change the current land use of some farm areas, resulting reduction of cropland or treed areas and lowering the physical capacity of the ecosystem, changing soil physical and chemical properties and changing the vegetative cover assemblage. Potential impacts of construction activities on natural environment include:

- ✓ Construction activities, such as making concrete pads or constructing sheds and farm buildings potentially can destroy the natural vegetation and cause an indirect impact on bio-diversity and ecological carrying capacity.
- ✓ Development activities will alter the soil condition, especially in areas that are not currently used for livestock production. Before commencement of construction activities, soil ecosystem is normally in stable state. Construction activities could significantly alter soil structure, physical and chemical properties, causing significant changes in natural ecosystem and population of soil microorganisms. Organic matter content might be lowered, making it more difficult to embark on afforestation of the area.
- ✓ According to the project feasibility study report, close to 36,000 mu of land will be occupied by new or expansion livestock farms. Although not a major impact, this could potentially have direct impacts on availability of prime agricultural land for growing grain and food crops such as wheat, corn, sweet potato and vegetables.

➤ Mitigation measures:

- ✓ Prime farmland acquisition should be minimized to reduce project impact on change in land use. As much as possible, excavated material should be piled within construction zone to minimize impact on areas that are not planned to be used for sheds, farm house, or other farm buildings. Maximum care should be taken by the

construction crew to minimize project impact natural vegetation along the canals and roads. Construction refuse should not be dumped on the vegetation along the road and canals.

- ✓ Vegetation should be rehabilitated in areas used for excavation or as the staging area in a timely manner.
- ✓ Areas used for stacking construction materials should be fenced to minimize soil erosion.
- ✓ During rainy season, appropriate measures such as use of silt fence, hay bale, etc should be used to minimize soil erosion and increase in sediment load of water bodies in proximity of construction site.

Since the scale of construction envisaged is relatively small and the period of construction is short, these impacts are believed to be minor and short-term. It is believed that by using good construction practices and following the recommended mitigation measures, project impacts on surrounding natural environment will be minimal.

7.3 Environment impacts and mitigation measures during operation.

During operation phase, waste generated and discharged by individual farm and all of the farms are showed in Table 7.2-1.

Table 7.2-1 Waste generated and discharged by individual farm and all of the farms

| Farm type | # of farms | # of animals | Solid Manure | Liquid Manure | Wash water | Evaporated Liquid manure | Amount lost |
|-------------|------------|--------------|--------------|---------------|------------|--------------------------|-------------|
| | | | (t/a) | | | | |
| Dairy | 1 | 500 | 3650 | 1825 | 1460 | 876 | 876 |
| Beef cattle | 1 | 500 | 3650 | 1825 | 1825 | 0 | 0 |
| Pig | 1 | 5000 | 3650 | 6022.5 | 0 | 0 | 0 |
| Dairy | 257 | 128500 | 938050 | 469025 | 375220 | 225132 | 225132 |
| Beef cattle | 323 | 161500 | 1178950 | 589475 | 589475 | 0 | 0 |
| Pig | 18 | 90000 | 65700 | 108405 | 0 | 0 | 0 |

7.3.1 Positive impacts

- Manure is currently used as organic fertilizer in crop lands. Incorporating appropriate manure composting measures and treating liquid manure in collection ponds, as is proposed in project plan, should reduce potential environmental hazards of applying untreated manure that could cause zoonotic diseases and weed seeds in agricultural fields. By applying manure on crop land, nutrients that can potentially pollute the surface and groundwater resources will be recycled in the ecosystem, increasing crop yield, improving soil physical properties, water holding capacity, and soil organic matter content, and reducing agricultural pollution.

- Project implementation should reduce the number of animals raised in backyard, reducing the incidence of zoonotic diseases and improve public health status in rural areas.
- During project operation, feed requirement at animal parks will increase, requiring more feed material as silage, and filler. The extra feed requirement should increase the demand for crop residue, reducing the need for burning the crop residues in the field, having an indirect impact on reducing air pollution.
- Project activities, in both new and expansion farms include incorporation of improved farms infrastructure and waste management facilities. Project activities also include improvement in environmental management capacity at animal parks and use of appropriate methodologies for converting livestock waste into high quality organic fertilizer. If properly implemented, project will be produce minimum waste at farm level, reducing environmental pollution from the animal parks. Proposed waste management processes will recycle both solid and liquid waste. Project implementation will reduce environmental pollution, develop a sustainable animal production system, improve agricultural soil properties and environment, and improve overall environmental condition of the surrounding area.
- Project implementation will reduce the amount of farm produced COD, N and P that is normally discharged, untreated to the environment, and contaminate soil, surface and groundwater resources. Manure treatment should significantly reduce population of flies and mosquitoes, significantly improving the animal parks environmental condition.
- Project approach to production, feeding, organization and economic development in the project area should improve livelihood and environmental condition of local inhabitants. Better quality and higher quantity of beef, pork, and dairy product should improve status of project units in local industries, geographical location and brands development. It will improve livestock product safety, public health and ecological environment. Animal parks will indirectly play demonstration role in “standardized livestock production” in project area and the whole province.

7.3.2 Negative impacts and mitigation measures

7.3.2.1 Surface water

➤ Impacts assessment:

During project’s normal operation, assuming that animal parks fully implement proposed waste management instrumentation, there should be no discharge of untreated solid or liquid manure to the surface waters. Therefore, no negative impact on surface waters is envisaged. However, if the proposed manure treatment facilities are under designed or underutilized, and/or if animal park management team does not fully implement the proposed waste management activities, there is a potential (environmental hazard) of surface water nutrient loading due to solid and liquid manure discharge.

The project promotes manure composting/treatment and its use as organic fertilizer in crop fields and in normal farm operation there should be no impact on surface waters. However, if over application of manure on agricultural crops is practiced, especially in Yellow River floodplain soils that are inherently coarse texture with low effective cation exchange capacity (CEC), there is possibility of overloading the soil reserve (exceeding soil’s carrying

capacity), causing surface water pollution due to runoff and P contamination of surface waters. This environmental hazard can also occur if farmers do not consider weather predictions and apply treated manure when soil is almost saturated and/or just before onset of rainfall.

Field investigations and review of project maps indicate that project farms are not located in areas demarcated as sources of surface waters. Therefore, project farms will not have any potential to pollute sources of surface waters in the project area.

➤ **Mitigation measures:**

Wash water and liquid manure should be collected by interceptor drains and collected (drained) into collection ponds, designed as a part of project development. Wash water and liquid manure should be kept in collection pond, at least for three weeks (more during winter months) to allow adequate retention time to remove pathogens and sources of zoonotic diseases.

Treated manure (solid and liquid) should be applied at appropriate rates and correct timing to ensure the applied manure is below carrying capacity of agricultural soils.

7.3.2.2 *Ground water*

➤ **Impacts analysis:**

Solid wastes generated by the livestock farms comprise solid manure, liquid manure, wash water, dead animals, and combination of manure and dirt mix in corrals and domestic garbage.

When animal manure is over applied in the crop land, it will outweigh the carrying capacity of land, the surplus N and P will be infiltrated into ground water and result in high concentration of nitrate and nitrite. Long-term drinking of this contaminated water can cause cancer. The combination of manure and dirt on the corrals can be infiltrated into ground water if it is not properly managed.

Dead animal carcass is degradable organic matter and its decay is exothermic, releasing substantial heat. If buried in soil, produced heat due to its degradation can potentially kill crop shoots and reduce crop yield. Rainwater can potentially leach degraded material to shallow ground water, polluting the groundwater resource. In addition, if the animal has died due to epidemic or contagious diseases, the carcass, if buried and is not appropriately discarded by burning or cremation, could not only cause groundwater contamination, but could also potentially cause health issues.

Liquid manure and wash water, if not collected in collection ponds or if the collection pond is too small for the amount of liquid manure produced at the farm, contain high levels of nitrogen (nitrates, nitrites, and ammonia). Allowing liquid manure/wash water mixture to end up in the field could potentially cause nitrogen contamination of groundwater resources.

Mitigation measures:

All efforts should be made to ensure that sizing of the collection pond fully consider every potential source of liquid waste in the farm. The sizing should also consider potential rainstorm, using 10 to 25 year rainfall event and size the collection pond accordingly to

ensure the pond does not fill immaturely. The pond and collection pipe/drain should be well maintained to prevent leakage and contamination of land, surface and ground water.

Waste water treatment facilities of livestock farms must receive anti-leakage treatment.

Corrals must be packed with lime and clay soil to prevent manure leakage. Solid manure should be collected in a timely manner, and liquid manure should be drained into collection pond.

If animal dies of epidemic or contagious diseases, the animal should be burnt/cremated, and then be covered with lime. If animal dies of normal causes, the body can be buried in an appropriate site, away from water bodies or shallow groundwater.

Domestic garbage should be disposed at local garbage collection areas.

7.3.2.3 *Atmospheric*

➤ **Impacts analysis:**

The manure-related sources of air pollution include manure inside and outside the animal sheds, manure piling, collection pond, and corrals. The major air pollutants include foul odour and harmful gases (H₂S, urea, and ammonia) generated from decomposition of organic matter. Livestock farm odour is generated from carbohydrates and nitrogen-containing organic compound. These foul-smelling substances not only can affect human health, but can also directly or indirectly decrease animal productivity, leading to degradation of ecosystem in surrounding areas. It is also one of the major animal produced sources of greenhouse effect and acid rain.

If animal waste is not treated in a timely manner, it can produce a number of other harmful gases such as dimethyl sulfide, methyl mercaptan, dimethyl amine and volatile fatty acids that can significantly impact air oxygen level, causing discomfort for both human and animals. The high concentration of these gases negatively impacts immune functions and cause serious effects on human and animal health status.

➤ **Mitigation measures:**

- ✓ Timely collection and treatment of solid and liquid manure to prevent development of noxious gases and reduce foul odour;
- ✓ Introduction and promotion of the use of bio-fermentation bedding in the pig farms to reduce generation of foul odour and noxious gases; and
- ✓ Use of electric heaters instead of coal fired boilers to reduce development of noxious gases that not only affect human health, but also cause global warming.

7.3.2.4 *Soils*

➤ **Impacts analysis:**

Livestock manures include large amount of sodium salts. If applied directly to crop land without adequate treatment, the excessive sodium salts can injure the plant and reduce available water holding capacity. Using untreated manure on agricultural land can potentially impact soil physical properties, destroy soil structure and increase soil compaction, causing significant negative impact on soil physical property and effective root zone.

➤ **Mitigation measures:**

Solid and liquid manure should be treated by composting and keeping in collection ponds, respectively before release for application to agricultural land.

7.3.2.5 Human and animal health

➤ **Impacts analysis:**

Animal manure contains large amount of pathogenic microorganisms, parasites eggs and new born flies and mosquitoes that can cause animal diseases and zoonotic diseases, harmful to both animal and human health.

➤ **Mitigation measures:**

The project design includes construction of facilities for treating both solid and liquid manure. If manure management facilities, proposed in project design are constructed and the farm waste management plan is fully managed as per project design, the proposed treatment plans should significantly reduce the level of microorganism, parasites ovum and flies and mosquitoes to levels well to mitigate this issue. It is important for the project management, especially during project monitoring to ensure that animal park management team has fully adhered to waste management activities as presented in project design.

7.3.2.6 Natural environment

After project implementation, some of the crop lands will be converted to livestock farms, resulting reduction in physical production capacity of the ecosystem, changing of soil physical and chemical properties, and causing loss of natural vegetation. Crops that would potentially be directly affected include wheat, corn, sweet potato and vegetables. Since the size of each individual animal park is relatively small, the regional ecological integrity will not be significantly affected by the conversion of farm lands to animal parks.

During project construction, afforestation of animal parks farms should be encouraged, including planting trees, lawn and flowers in the production and administration areas of the farms.

The proposed mitigation measures to prevent environmental impact due to animal park establishment during project operation are summarized in Table 7.2-2.

Table 7.2-2 Potential pollutants and proposed mitigation measures during operation

| Type of pollutants | | Mitigation measures | Residual impacts on environment |
|--------------------|--|--|---|
| Waste gas | Water Heater | Coal fired boiler should be replaced by electric or solar heater. | No |
| | Odour | Use Biological deodourizing systems: bio-fermentation bed in pig farms, manure composting in dairy and beef cattle farms. | Low |
| Waste water | Domestic waste water | Treat waste water in septic tanks for 20 days, then apply to crop land. | Low (Meet the requirements of EPB, minimal impact on surrounding surface & groundwater) |
| | Urine and water for cleaning | Should be collected and drained in collection pond, after appropriate retention time, should be applied in cropland as fertilizer; Collection pond and drains/pipes should be maintained to prevent leakage that can cause soil, surface and ground water contamination; The waste water treatment facilities must receive anti-infiltration treatment. Corrals should be packed with lime soil. Solid manure should be collected and treated in a timely manner. Treated sewage should be applied to the crop land with adequate carrying capacity. | |
| Solid waste | Animal manure & feed residues | Use environment-friendly feed, separate solid and liquid wastes; Fresh manure should not be piled in the farm on soil for composting. It should be composted on appropriately designed concrete slabs; The solid and liquid manure should be separated and composted, treated slurry should be applied to crop land with adequate carrying capacity The composted manure should be sold/applied as organic fertilizer. | Low (All will be treated and used. None will be drained before treatment) |
| | Dead animal due to disease | If the animal dies of severe diseases, its body should be incinerated or burned, covered with lime, and then buried. | |
| | Domestic garbage | It should be transported and disposed by local garbage unit. | |
| Noise | Pump for waste water, grounder and fan | Low-noise machine should be selected; Submersible pump should be used for sewage system; Vibration and noise-reduction measures should be taken; Noise levels at farm boundary should meet | Low |

| | | | |
|----------------|--|--|-----|
| | | GB12348-90 standards. | |
| Landscape | Landscape Change & impacts on vegetation | Landscaping should be done in farms, including planting trees, lawn and flowers in production and administration areas; Excavated areas should be used as landfill to reduce soil erosion. | Low |
| Transportation | Animal transport | Transport routes should be selected to reduce travel through residential areas; Animals should be washed before being loaded on the vehicles; Vehicles should be disinfected and kept clean; Vehicles should be covered to reduce odours disturbance; Vehicles should not be overloaded with live animals (Consider animal welfare). | Low |
| Health | Human and animal health | Production and administration areas should be separated; Manure should be collected and treated periodically; Special attention should be given to disease control and health of livestock. | Low |

7.3.3 Analysis of impacts on women and ethnic minority policy

7.3.3.1 Impacts on women

Women are involved in all project activities, from selection, planning, fund management, implementation, and technology dissemination to monitoring project performance. Some of the women will receive training on farm management and production in modern livestock farms. Women are believed to become more enthusiastic about livestock production after receiving training, awareness raising, and technical assistance. In addition, development of farmers co-operatives and livestock producers associations should allow women to have more learning opportunities, have wider knowledge, and improve quality of family life.

7.3.3.2 Impacts on ethnic minority policy

In Henan province, there are 3 ethnic minority autonomous districts, 21 ethnic minority townships, and 526 ethnic minority villages. They are located in 18 prefectures of the Henan province; most of them belong to Hui minority. The provincial CPC committee and Henan Provincial government have formulated a series of policies in favour of ethnic minorities, centering on national economic and ethnic minority policies democratic development, and securing equal rights for all nationalities.

Members of Hui ethnic minority are living in project counties in the 8 prefectures, but their number is small. The project implementation plans to fully consider its potential impacts on ethnic minority policies. Conflicts with ethnic minorities are minimized in term of relations between nationalities, religions, cultures and habits. It is important to ensure that ethnic minorities are fully involved in project activities and have a chance to getting involved in the project activities. It is important to respect the minority communities' beliefs, religion and cultural habits in design of the project activities to ensure project plans within Hui communities aim at securing unity of all nationalities and achieving a harmonious development.

The project proposed activities are consistent with the beliefs of ethnic minority people. The project will create more job opportunities in the community. It should give preferential treatment to ethnic minorities to allow for poverty reduction within the minority families and facilitate implementation of national ethnic minority policies. The project will not have impacts on their habits, religion and beliefs.

Under the project, a few pig farms will be renovated. However, these farms are not located within ethnic minority (Hui) communities and should not have any impact on their beliefs. The project activities will improve the environment, develop an integrated cropping-livestock production economy, and foster development of relevant industries that potentially can create more jobs for ethnic minority people, improve their environment and quality of life.

7.4 Environment risk assessment

7.4.1 Over or inadequate application of manure

7.4.1.1 Risk identification

Manure will be treated and applied to the crop land as organic fertilizer. This will not only improve nutrient status in soil, but it will also improve soil physical conditions, porosity, and available water holding capacity.

One of the potential risks of applying manure in agricultural field is over-application of manure beyond soil carrying capacity, causing excessive accumulation of N and P that can cause leaching and loss of mobile nutrients such as nitrogen to groundwater and loss of larger elements such as P by runoff to surface waters, causing contamination of surface and groundwater resources and causing afforestation of surface water bodies.

Another potential environmental risk of manure application is untimely application of manure; either when the soil is saturated or just before onset of major rainfall. In such instances, manure could runoff to water bodies, causing pollution of water bodies.

7.4.1.2 Risk management measures

To avoid such environmental risks, timing of manure application should be considered by the farmers to ensure manure is applied when soil is not saturated and ensure that weather forecast is not predicting major rainfall within 24 hours of manure application to minimize chance of manure loss to runoff.

To reduce potential over application of manure, it is recommended that soil samples should be collected by the farmers, and/or MOA experts and analyzed for total nitrogen and phosphorous to determine soil carrying capacity and avoid over application. In addition, better soil nutrient management, especially in coarse textures, low CEC soils of the Yellow River floodplain, could reduce potential loss of nutrients to leaching and runoff. In such soils, splitting the manure application should reduce the environmental hazards.

In summary, to manage the risks of over applying or inadequate application of manure in crop land, the amount and frequency of applying manure should be based on climate, soil moisture, soil N and P load and crop needs for N and P.

7.4.2 Storm water runoff

7.4.2.1 Risk identification

Although most livestock farms are built on relatively flat areas, during rainstorms, runoff takes place after soil is saturated, causing topsoil and manure to be moved by rainwater and drain into the surface water bodies, contaminating water bodies, causing eutrophication and depleting the stagnant water bodies from oxygen that potentially can cause fish kill.

7.4.2.2 Risk management measures

In sloping areas, special attention should be given to construct interceptor/collector drains to minimize mixing of rain water and solid and liquid manure at the farm. Rain water from rooftops can either be collected for irrigation or can be directly drained to nearby water bodies/drainage system.

Collection ponds, constructed for treating liquid manure and wash water, should be designed to have allowance for major rainfall events.

7.4.3 Risk of Drug and additives residuals

7.4.3.1 Risk identification

The use of additives and anti-biotic fosters livestock production and increase livestock output. However, the residuals staying in the animal and manure undermine food safety and the environment.

Potential reasons for residual drug risk include:

- Non-compliance of animal farms with withdrawal period regulation: The prominent problem lies in feed additives, most of them having known withdraw period. However, most livestock farmers do not comply with the regulations. Some farmers stop adding animal medications just before the animal is out of stock, resulting excessive drug residues in the animal.
- Over dosage of drugs: Over dosage of drugs in feed is one of the leading causes for excessive drug residues in animals and manure.

7.4.3.2 Risk management measures

- Medications and additives are included in animal ration for disease treatment and control, and/or promoting animal growth. To minimize drug residues the management in

animal parks should strictly adhere to the regulation in use of drugs and should routinely monitor drug residues.

- The farm management team should adhere to the principle of “Prevention first, treatment next”. Extension staff and veterinarian should follow scientifically-based vaccination procedures, drug management procedures, and treatment procedure of sick animals.
- Special attention should be given to the synergy between drugs and additives to avoid repeated medication prescription. When therapy is required, drugs should be prescribed at optimum and based on the needs of each individual animal and type of disease to minimize overdose.

7.4.4 Risk of diseases

7.4.4.1 Risk identification

If the livestock farm is not well managed, the operation can induce common diseases. In addition, body of dead animal is a significant source of infection and contamination of not only other animals, but also staff and surrounding population.

7.3.4.2 Risk management measures

Gain the principle of “Prevention first, and treatment next” should be followed in livestock farms to prevent and eradicate animal diseases, specially infectious and pandemic diseases, to allow the animals to grow to full potential and increase farmers economic revenues.

- Everyday preventive measures
 - ✓ Production and administration areas in a livestock farm should be separated, disinfection pool and chamber (with ultraviolet light and other disinfection facility), should be in place at the entrance of production area; disinfection pool should be filled with 2% - 4% Sodium Hydroxide solution all the time.
 - ✓ Unauthorized staffs should not be allowed to enter the production area. Whenever a visit is necessary, they should wear overalls, shoe cover and hats, should pass through the disinfection chamber, before being allowed to enter the facility.
 - ✓ Workers should have as a minimum, an annual physical exam. If anyone was diagnosed of having a zoonotic disease, he/she should be removed from the production area immediately to prevent infection of animals and other staff.
 - ✓ Animal shed, bed, corrals, and animals should be kept clean at all times. Shed, bedding, and corrals should be kept dry and clean.
 - ✓ Feed ingredients should be checked periodically. Nutrients in animal rations should be checked, adjusted and balanced.
- The emergency measures against infectious diseases.
 - ✓ Disease control team should be established at the farm and every effort should be made to diagnose the diseases as soon as possible and report to the county disease control authority.

- ✓ The infected animals should be isolated quickly, especially in case of hazardous infectious diseases. A quarantine zone should be established, vehicles and people entering and leaving the infection zone should be disinfected. The contaminated areas where animals use to stay should also be disinfected. Quarantine can only be lifted after last infected animal is recovered. After complete disinfection of the quarantine area and receipt of clearance from local disease control authority, the quarantine can be lifted.
- ✓ When an animal dies of disease, the body of the dead animal should be treated to the instruction provided by local disease control authority.

8 Environment Management and Monitoring Plan (EMMP)

8.1 Introduction

International experiences in environment assessments have shown that without an effective and strong monitoring and enforcement process to ensure their implementation, mitigation and monitoring plans would be neglected even though they have been clearly specified in the Environment Assessment Reports. In order to eradicate or compensate for the negative environment and social impacts during the implementation, and minimize the impacts to the acceptable level, a set of mitigation plan, monitoring plan, institutional development and the implementation plan (the Environment Management Plan) should be formulated. They must be technically reliable, economically feasible, and appropriate for the project design, construction and operation. They should be an integral part of the overall project management actions.

In the 1990s, the structure of environment assessment report was modified. A separate chapter is devoted to environment management plan (EMP). The environment management plan includes all the mitigation and monitoring requirements specified in the environment impact assessment. Once the feasibility study and the environment assessment report have been approved, an organization responsible for undertaking project mitigation and monitoring actions should be set up immediately, as an integral part of the overall project management organizations.

The project affects the environment mainly during the construction and operation period. All the environment issues have been identified and clarified in chapter 7, and the corresponding mitigation measures have been proposed. In this chapter, the environment monitoring plan and the corresponding responsibilities have been clarified as well. The orderly verification, review and propose of the mitigation measures assure no significant issues have been neglected, prevent the occurrence of negative impacts or minimize the impacts.

Many environment issues may arise as a result of the project. But if the major environment issues mentioned below have been effectively monitored and controlled, the project's impacts on local environment can be controlled effectively.

The environment management and monitoring plan comprises four parts: brief of environment management organizations and their responsibilities, environment management participants plan, environment training plan/ institution capacity building plan, and environment monitoring plan.

8.2 Environment management organizations and their responsibilities

8.2.1 Environment management enforcement organizations

This project comprises 30 counties in 8 cities (prefectures) in Henan province. It will support 590 existing and new farms/parks. In order to minimize the project's environment impacts, the environment management should be undertaken during the project construction and operation period. The environment management plan must be considered as an integral part of the project.

The organization structure for environment management is as follows: the provincial project leading team will be formed for Henan Yellow River Ecology Livestock Project, there will be an office under the project leading group (PPMO), project leading group and PMO will also establish at county level. Under the leadership of province project leading group and PPMO, they will be responsible for project implementation and management.

During the feasibility study stage, the environmental impact assessment team has been given the responsibility for preparing the EIA and EMP report, and submitting it to the provincial environment protection bureau and the World Bank for approval. During this period, provincial environment protection bureau may consult with city (county) environment protection bureaus and seek advice on the validity of EIA findings.

During project design, construction, and operation phases, PMOs at various levels are responsible for implementing the Environment Management and monitoring Plan; Provincial environment protection bureau is responsible for collecting essential data, monitoring the implementation of the Environment Management Plan and mitigation measures. However, city and county PMOs, under the direction of PPMO are responsible to request city (county) environment protection bureaus or other certified experts to conduct monitoring and inspection according to the requirements of environment management and monitoring plan as an integral part of the project development activities.

To ensure the implementation of the environment management plan and its compatibility with relevant national environment protection regulations, PPMO and all city PMOs should use staff with environmental monitoring training to be responsible for smooth implementation of the mitigation measure identified in Chapter 7, and the EMMP as is detailed in this chapter. Furthermore, each county PMO should appoint one of their staff as responsible for ensuring all livestock farms in the county fully implement the EMMP requirement and to report any unforeseen environment issues to the PPMO. The assigned staffs should receive trainings on environmental inspection and implementation of EMMP that should be provided by the project. The environment staffs designated by the PPMO and city PMOs should compile annual reports to detail the finding of EMMP activities at all project farms. Upon request, the reports should be availed to the environment protection bureaus at city and province levels, and the World Bank. During the operation period, each county PMO should assist the PMO at higher level to implement the environment monitoring plan detailed in this chapter, and ensure that the reports are submitted to the city and provincial PMOs. The environment management organizational charts during the construction and operation phases are presented in Figures 8-1 and 8-2.

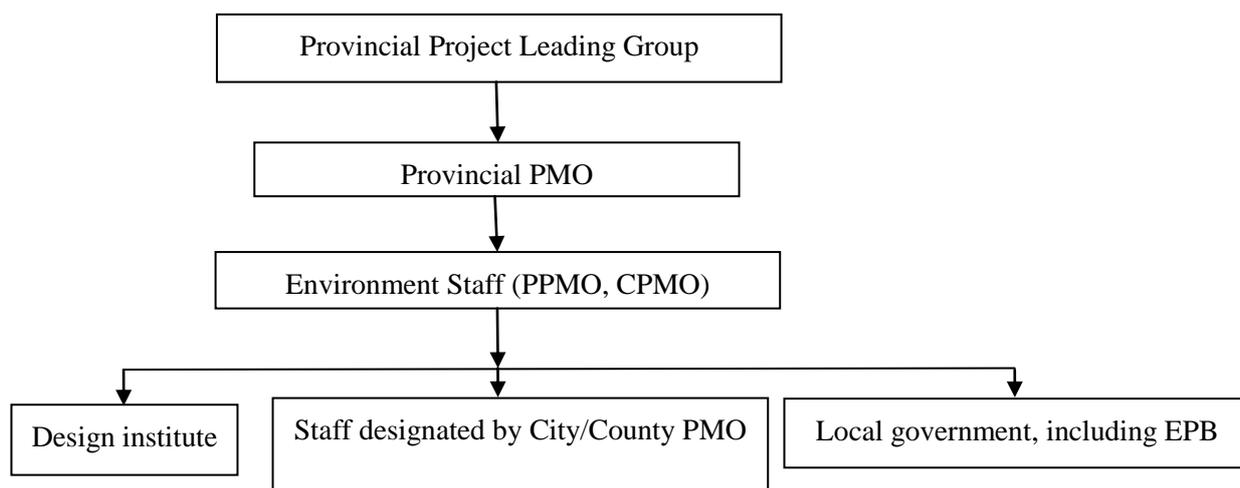


Figure 8-1. Environment Management organizational chart during the construction period.

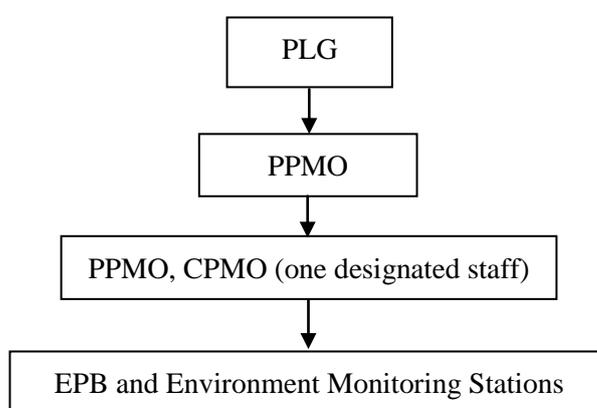


Figure 8-2 Environment Management Organizational Chart during the Operation Period

8.2.2 PMOs and the environment monitoring responsibilities

As discussed in section 8.2.1, PMOs at various levels are responsible for implementing the EMP to ensure smooth implementation of all identified mitigation measure and monitoring plan specified in the Environment Assessment Report. The PMO's main responsibilities include:

- a. to revise and implement environment mitigation measures to minimize the environment impacts during the whole project process;
- b. to inspect the implementation of pollution control measures, and to report the farms which discharge by violating the regulation, discharge by mistake and discharge by not following EPB standards;
- c. project implementation units should closely coordinate with project design unit, to ensure the relevant mitigation measures in the environment management plan be incorporated into the final project plan; project monitoring should be carried out effectively;

- d. to provide project management staff and project implementation staff at various levels with necessary trainings regarding environment issues and environment inspection, and enhance the organization's capacity;
- e. to monitor the implementation of the environment management plan, and to inspect whether the implementation of project mitigation measures is successful;
- f. to prepare correction measure manuals to deal with the biases (errors) in the environment performance;
- g. to implement environment contingency plan, and to report environment accidents to PPMO;
- h. to implement environmental monitoring plan, including participating and monitoring the monitoring agencies, and to ensure all the activities specified in the sampling and monitoring plan be carried out as scheduled;
- i. Use the data collected to prepare nutrient balance for feed and manure for selected representative animal parks;
- j. to prepare environment performance reports of project implementation and operation regularly for the environment protection bureaus and the World Bank;
- k. to receive complains regarding environment, and to respond to any monitoring and evaluation queries by the EPB or the World Bank;
- l. to host visit of the World Bank officials;
- m. to supervise the environment issues aroused during the project implementation, and to urge the implementation organizations to comply with relevant regulations;
- n. to implement the other activities that are necessary for implementing the EMMP.

8.2.3 Monitoring organizations

Henan provincial Environment Protection Bureau (PEPB) is the authority responsible for environment protection. It is responsible for environment management and monitoring of the province. City (County) EPBs are responsible for environment monitoring and supervision within their jurisdictions. Environment monitoring plan is shown in Table 8.2-1.

Table 8.2-1 Environment monitoring plan for Henan Yellow River Ecology Livestock Project

| Stage | Organization | Monitoring Items | Monitoring Objective |
|-------------------------|---------------------|---|--|
| Feasibility Study | PEPB, World Bank | Review EIA Report. | <ol style="list-style-type: none"> 1. To ensure the integrity of assessment, to identify appropriate stakeholders, and to emphasize the priorities; 2. To ensure the potential significant issues that may arise as a result of the project have been incorporated; 3. To ensure the action plan for mitigation measures are practical. |
| Design and Construction | PEPB, World Bank | 1 Review the initial design for environment protection & management. | <ol style="list-style-type: none"> 1. To strictly implement the Environment Management Plan; 2. To ensure project design and construction comply with all the relevant national laws and regulations. |
| | PEPB, World Bank | 2. Check whether the funds for environment protection and management plan have been made available. | <ol style="list-style-type: none"> 3. To ensure that funds for environment protection have been allocated and made available. |
| | City/county EPB | 3. Check the location of the project (farms). | <ol style="list-style-type: none"> 4. To ensure that construction sites are located in designated areas, assigned by the government. |
| | | 4. Monitor noise and dust pollution. | <ol style="list-style-type: none"> 5. To ensure measures for mitigating dust and noise pollution, recommended in the impact mitigation, is followed; 6. To ensure that contractors strictly follow the EMMP, and relevant local environmental laws and regulations. |
| | | 5. Check whether there is any cultural/ heritage site in the area. | <ol style="list-style-type: none"> 7. To protect heritage sites, if any. |

| Stage | Organization | Monitoring Items | Monitoring Objective |
|-----------|--------------------------|---|---|
| | | 6. Check drainage, and disposal and treatment of solid wastes and domestic sewage at construction sites (dairy, beef cattle, and pig farms). | 8. To ensure the treatment of solid waste and sewage comply with the national and local laws and regulations, and to ensure surface and groundwater are not contaminated. |
| Operation | Province/City/County EPB | <ol style="list-style-type: none"> 1. Supervise the implementation of EMMP during operation; 2. Take corrective actions to deal with unexpected environment issues; 3. Ensure implementation of the project waste management plan. | <ol style="list-style-type: none"> 1. To protect environment, and mitigate impacts on environment during the period of operation; 2. To review and revise the EMMP, if necessary; 3. To ensure integrated use of treated livestock waste |

8.3 Environment Management Plan

The details of the EMMP are summarized in Table 8.3-1.

Table 8.3-1 EMMP for the Henan Yellow River Ecology Livestock Project

| Environment Issue | Potential impacts | Recommended mitigation measures | Implementer | Responsible agency |
|------------------------|--|--|-------------------|--------------------|
| A: Design | | | | |
| Location | The inappropriate location of the sheds can have (negative) impacts on people's live | Sheds should be located downwind of residential areas. The minimum distance between sheds and residential areas should be 500m. They should stay away from water source areas tour sites, and heritage buildings. They should not occupy prime agricultural land. | Design institute | PPMO |
| Drainage | Inappropriate drainage could lead to pollution of surface and groundwater | They should stay away from water source areas. They should not be located in areas with shallow water table that is drained to surface water bodies (rivers, lakes, wetlands). | | |
| Composting | May cause odour, mildew, and secondary pollution | The minimum fermentation period of 21 days should be strictly followed. During cooler months (October to March), the fermentation time should increase to a minimum of 30 days. The pre-fermentation and fermentation of two-stage fermentation treatment should be at least 10 days each. In addition, the time for curing and storage should also be added to the fermentation period. | | |
| B: Construction | | | | |
| Air quality | Dust | Excavated soil, construction waste, and unused construction materials (sand and concrete) should be covered during transportation. Construction site should be kept clean. Area should be sprayed during dry months to reduce dust. | Construction unit | PPMO and CPMO |
| Water quality | construction and domestic sewage | Domestic waste water should be treated in septic tank. After treatment, waste water can be discharged or applied to crop land. Use erosion prevention measure such as | | |

| Environment Issue | Potential impacts | Recommended mitigation measures | Implementer | Responsible agency |
|---------------------|---|--|---------------------------------|--------------------|
| | | silt fence or hay bale to minimize water pollution due to sediment loading. | | |
| Noise | Construction noises | Use low noise equipments and machinery. High noise construction should be stopped at night or use silencers to reduce noise pollution. | | |
| Solid wastes | Construction trash, soil and domestic waste | Except for soil materials used for backfill, all other excavated soil and construction waste should be moved to appropriate dumping sites. | | |
| C: Operation | | | | |
| Water quality | Waste water of sheds may pollute ground water, and surface water. | <p>Collect and store waste water in collection pond. After treatment, waste water can be applied to agricultural fields as liquid fertilizer. Strictly monitor the status of collection pond and drainage (conveyance) pipes to prevent leakage that can cause soil, surface, and groundwater pollution.</p> <p>Sewage treatment facilities should receive anti-infiltration treatment before use;</p> <p>Corrals should be packed with lime soil. Solid manure should be cleaned routinely. Liquid manure should be drained to collection pond. The sewage from livestock farm should be applied in the cropland after treatment as organic fertilizer.</p> | City (County) PMOs, County EPBs | City (county) PMOs |
| Air quality | odour | Biological deodorization facilities should be used such as bio-fermentation beds for pig farms. | City (County) PMOs, County EPBs | City (County) PMOs |
| Solid wastes | Animal manure, silage and other feed | Environmentally-friendly feeds should be used. Solid and liquid manure separation technology should be adopted. Animal manure should be composted on concrete slabs as per project design. After solid and liquid manure are separated, manure should be composted, and sold for application as organic fertilizer for crop | City (County) PMOs, County EPBs | City (County) PMOs |

| Environment Issue | Potential impacts | Recommended mitigation measures | Implementer | Responsible agency |
|-------------------------|---|---|---------------------------------|--------------------|
| | | production. | | |
| Noise | Waste water pump, grounder, fan | Use of low noise equipments should be encouraged. Use of submersible wastewater pump should be promoted. Measures should be adopted to reduce noise and vibration. | City (County) PMOs, County EPBs | City (county) PMOs |
| Ecology and environment | Change of landscape | Afforestation should be undertaken to improve animal park aesthetic and ecological balance. | City (County) PMOs, County EPBs | City (County) PMOs |
| Animal health | Residua feed additives and anti-biotic in animals | Extension staff and veterinarian should follow scientifically-based vaccination procedures, drug management procedures, and treatment procedure of sick animals. Over prescription of drugs should be prohibited. | City (County) PMOs | City (County) PMOs |
| Human health | pathogens in shed have impacts on human health | Vaccination should be conducted regularly. Sheds should be disinfected regularly to prevent medical emergencies and spread of pathogens and infectious diseases. Drinking water facilities should be inspected regularly. Separate drinking water systems should be available for human and animal use. | City (County) PMOs | City (County) PMOs |

D: Monitoring plan

| | | | | |
|-----------------|----------------------|---|--|------|
| Baseline survey | wastes volume survey | Collect baseline data at feasibility stage of the project and before project implementation. Record the available information on current status of manure utilization, farm feed balance, and waste management in existing farms, including the amount of treated manure that has been used or discharged/lost (not collected). | PMOs, Environment Assessment team | PPMO |
| | monitor feeds | Items to be monitored include feed volume, crude protein, total N, total P; Monitoring frequency: twice per year; Monitoring time: before the project is implemented. Implementation period: one year; Monitoring spots: see table 8.5-1. | PMO, provincial academy of agricultural sciences | PPMO |

| Environment Issue | Potential impacts | Recommended mitigation measures | Implementer | Responsible agency |
|-------------------|--|---|---|--------------------|
| Operation Phase | Feed | Amount of feeds: report annual use of feed; period of implementation: 5 years; Number of farms: 62. | Animal Park management team | PMOs |
| | | Items to be monitored: crude protein, total N, total P, amount and feed type used in the ration, number of animals added/sold, amount of manure produced; Monitoring frequency: twice per year; Monitoring time: July and December of each year; period of implementation: 5 years; Monitoring spot: see table 8.5-1. | PMO, provincial academic of agricultural sciences | PMOs |
| | Meat (milk) | Production of meat (milk): report annual meat (milk) production ;Period of implementation: Number of farms: 62. | Animal Park management team | PMOs |
| | Solid wastes | Weight wastes: wastes volume transported off farm, amount of each transportation report once per year period of implementation: 5 years Number of farms: 62. | Animal Park management team | PMOs |
| | | Monitoring items: Crude protein, total N, total P; Frequency: twice per year Time: July and December each year Period of implementation: 5 years; Monitoring spot: 62 farms, See table 8.5-1. | PMO, provincial academic of agricultural sciences | PMOs |
| | Preparation of Environment Monitoring Report | frequency: once per year | Animal Park management team, PMOs | PMOs |

8.4 Environment Training Plan/Institutional Capacity Building Plan

8.4.1 Objectives of environment training

Training in environment management theories and skills will be provided to PMO staffs and project beneficiaries, aiming at:

- Enabling PMO staffs at all levels to have adequate understanding of national and provincial environmental laws and regulations, prediction of positive and negative environmental impacts of the project, implementation of EMMP, and relevant mitigation measures.
- Enabling (awareness raising) of project beneficiaries including animal park staff and representatives of livestock households, to better understand the benefits of implementing project EMMP, including the mitigation measures. Train on how to carry out the construction activities following the requirements of “Environment Protection Guideline”.

Environment management training will be carried at Provincial, City and County levels to assure the intended goal of the training programs are fully achieved.

8.4.2 Contents of environment trainings

The proposed environmental training topics include:

- The World Bank’ Safeguard policies, National and Provincial environment laws and regulations;
- Environment management model of projects financed by the World Bank;
- Potential environment impacts of the project and mitigation measures, the proposed organization and monitoring process for implementation of environmental safeguards;
- Environmental monitoring plan and implementation methods;
- Preparation of environment review reports;
- Ecological production technologies for beef cattle, dairy cows and pigs;
- Animal feed, health, and wastes management and emergency measures for risk prevention;
- Data collection and preparation of farm nutrient balance report;
- Working as environmental inspector (EI) during animal parks’ construction and operation phases; and
- Livestock waste treatment technologies at animal park level.

8.4.3 Environment Training Plan

The environment trainings will be concentrated toward the project commencement to ensure that all participants are well aware of their responsibilities with regard to implantation of environment related activities and to better appreciate the reasons for implementing the EMMP, how it can help the project and their long term economic and health status.

Training will be given mainly to staff of PPMO, City and County PMOs that are going to be responsible for implementation of EMMP. In addition training will be given to animal park staff on collection of required information for environmental monitoring and appropriate use and care of waste management facilities. Different awareness raising workshops/training programs will be prepared with appropriate contents responsive to the needs of senior staff of

the PMOs and animal parks, and livestock farmers involved in project activities to develop a better understanding of EIA, EMMP, and how their implementation can positively affect their livelihood.

It is recommended to front load some of the training programs that will affect the implementation of environmental activities proposed in this report. These training activities include (1) training of county PMO staff on working as environmental inspector during animal park construction and operation; (2) farm nutrient balance study and report preparation, especially for the staff of animal parks selected for environmental monitoring (10% of each farm model) involved in data collection and the county PMO staff assigned as EIs in counties where selected animal parks are located; (3) Training on implementation of EMMP and proposed mitigation measures, and (4) preparation of environmental reports, especially for the PPMO staff.

8.5 Environmental Monitoring Plan

The objective of this section is to summarize the monitoring requirement and prepare a sound environment monitoring plan. After being treated, waste product will be treated to produce low well decomposed and low in pathogens organic fertilizer to be applied to agricultural land instead of being discharged and causing soil and water pollution. The reduction in nutrient loss from animal parks through use of more efficient feeding program and improved waste management practices, promoted by the animal farm production cycle are the main focus of the proposed environmental monitoring. Through proposed monitoring plan, the projects' environment impacts and efficiency of proposed production process at the animal park level can be evaluated that should provide a solid foundation for evaluating different development models and their effectiveness in improving environmental, social, and economic condition in the project areas.

8.5.1 Environment Monitoring Plan

8.5.1.1 Monitoring items

➤ **Feasibility study (baseline data)**

Manure utilization data will be collected from the animal parks including the amount of manure that has been sold, manure that was not sold. The total amount of manure produced in the farm should be estimated based on the number and type of animals in the park and their average daily excrement. This activity should be carried out during the feasibility study period and during the first year before animal park construction.

➤ **Project design**

Before project implementation, feed quantity and ration formula (quality) at the selected 62 representative farms should be recorded. The monitoring plan is presented below:

- ✓ Items to be monitored: quantity of feed, Crude protein, total N, and total P;
- ✓ Monitoring frequency: twice in the first year before project operation (July, December);
- ✓ Monitoring time: Before or during project implementation;

- ✓ Period of Implementation: one year; and
- ✓ Monitoring locations: At the selected representative farms (Table 8.5-1).

➤ **Project operation**

A. Feed quality/quantity

Amount of feed by obtained by the farm should be weighed and recorded by type (both purchased and self-produced). The ration formula (average percentage of different feed material used in the feed) should also be recorded at the selected 62 farms on an annual basis. The statistical data should be collected by PMOs and send to PPMO staff for statistical analysis, preparation of farm nutrient balance, and recording the data in the annual environmental monitoring report.

- ✓ Items to be monitored: Crude protein, total N and total P;
- ✓ Monitoring frequency: twice per year.
- ✓ Monitoring time: Mid-July and mid-December;
- ✓ Period of operation: 5 years; and
- ✓ Monitoring spots: At the selected representative farms (Table 8.5-1).

B. Meat (milk)

Amount of meat produced at cattle/pig farms and milk in dairy farms should be weighed and recorded at the selected 62 farms on a twice per year basis. The statistical data should be collected by PMOs and send to PPMO staff for statistical analysis and use in preparation of farm nutrient balance studies. The final data should be recorded in the annual environmental monitoring report.

- ✓ Items to be monitored: Purchased animals and produced meat/milk;
- ✓ Monitoring frequency: twice per year.
- ✓ Monitoring time: Mid-July and mid-December;
- ✓ Period of operation: 5 years; and
- ✓ Monitoring spots: At the selected representative farms (Table 8.5-1).

C. Manure/ wash water

- ✓ Manure transported off farm or processed into organic fertilizer should be weighed and recorded. Yearly statistics should be prepared;
- ✓ Items to be monitored: Crude protein, total N and total P;
- ✓ monitoring frequency: Twice per year;
- ✓ monitoring time: Mid-July and mid-December;
- ✓ implementation period: 5 years; and
- ✓ Monitoring spots: At the selected representative farms (Table 8.5-1).

8.5.1.2 Monitoring locations

In order to ensure the results of environmental monitoring is statistically significant, it was decided to select 10% of the animal parks within each livestock farm model as the farms to be used for monitoring the impact of project activities on the soil and aquatic environment, using farm nutrient balance methodologies described in detail in Annex 3 of this report. All

attempts will be made to select the farms for monitoring within the ones constructed during the first year to allow the data to be analyzed during the same time period to minimize climatic variation and other natural variations. Current development plans, described in the project feasibility report, indicate that at least 10% of each farm model is planned to be constructed during the first year with the exception of the new 500 beef cattle animal park model where only 3 farms are planned to be developed during the first year. In order to allow for a significantly significant monitoring plan, it is recommended that the feasibility study team review and, if practicable, to increase the number of new 500 beef cattle livestock animal parks instead of new 500 dairy cows animal parks in the first year. The animal parks to be monitored, within each model, should be scattered throughout the project area to ensure that selected farms are representative of geographic and physiographic variation of project areas. In total, 62 farms are proposed to be monitored under the project. The sampled farms will be monitored for 5 consecutive years during operation to ensure representativeness of monitoring data.

Table 8.5-1 presents the distribution of animal parks to be selected under each model.

Table 8.5-1 Distribution and number of livestock farms to be monitored in each model

| Model | # of farms | Sample size (10%) | Constructed farms in Year 1 | Monitoring farms distribution |
|--|------------|-------------------|-----------------------------|--|
| New 500 dairy cows animal parks | 66 | 7 | 10 | Monitored farms in each model should be scattered throughout the project to represent their physiographic & geographic distribution. |
| New 500 beef cattle animal parks | 51 | 5 | 3 | |
| Expansion of 100 dairy cow animal parks | 7 | 1 | 1 | |
| Expansion of 200 dairy cow animal parks | 184 | 18 | 34 | |
| Expansion of 200 beef cattle farm / park | 272 | 27 | 40 | |
| Dairy cows granulated organic fertilizer | 20 | 2 | 5 | |
| 5,000 pigs bio-fermentation bed | 18 | 2 | 3 | |
| Total | 618 | 62 | 96 | |

8.5.1.3 Monitoring organizations

PMOs at various levels are responsible for implementing the environmental monitoring plan. Each PMO is responsible for undertaking environmental monitoring in its jurisdiction. During the operation period, livestock farm technicians at Animal parks, under the direction and supervision of PMO staff, are responsible for monitoring feed quality and quantity, meat (milk) production and wastes treatment and sales records to be submitted to respective PMO staff for further analysis and reporting in the annual EMMP report.

8.5.2 Environment monitoring and reporting system

Environment monitoring data should be collected by city (county) environment monitoring stations. Animal parks are responsible to record and submit the required information to the county PMOs. County PMOs should collate and compile the data to the respective city (prefecture) PMO. City PMOs should summarize the obtained data from all counties in their jurisdiction, aggregated the data in tabular form and submit the report to PPMO. PPMO is responsible for preparation of annual environmental monitoring report, including farm nutrient balance data for each individual monitored animal park (62 parks) based on the supplied data by each city and submit to provincial project leading group and the World Bank. The environment monitoring process flow diagram is summarized in Figure 8-3.

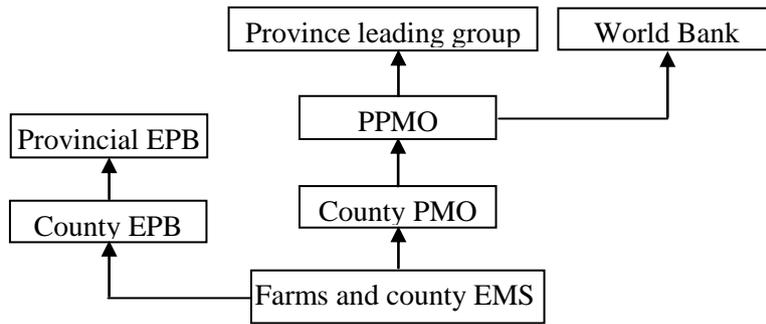


Figure 8-3 Environment Monitoring System

8.6 Cost Estimates

8.6.1 Environment Management Cost

At each project stage, 40 PMO staff at various levels (province, Prefecture and County) will be responsible, at part-time basis, for environment management of the project. The opportunity cost of their involvement in EMP is estimated at RMB 29,000 during the feasibility study, RMB 84,000 during construction phase, and RMB 182,000 during 5 year operation phase. The total environment management cost is estimated at RMB 295,000. Cost estimates at different phases of project are presented in detail in Table 8.6-1.

Table 8.6-1 Cost Estimate for Environmental Management

| Staff | Feasibility study | | Construction | | Operation | |
|--------------|--------------------------|------------|--------------------------|------------|--------------------------|------------|
| | Number of staff (person) | Cost (RMB) | Number of staff (person) | Cost (RMB) | Number of staff (person) | Cost (RMB) |
| PPMO | 2 | 6000 | 2 | 8000 | 2 | 8000 |
| City PMO | 8 | 8000 | 8 | 16000 | 8 | 24000 |
| County PMO | 30 | 15000 | 30 | 60000 | 30 | 150000 |
| Subtotal | 40 | 29000 | 40 | 84000 | 40 | 182000 |
| Total | RMB 295,000 | | | | | |

8.6.2 Environment training costs

Training cost on a yearly basis is estimated in Table 8.6-2. The details of training program are identified in Section 8.4.3 of this report.

Table 8.6-2 Environmental training cost estimate

| Year | Trainees | No of Trainees | Duration of training (day) | Unit cost (RMB) | Total (RMB 1,000) |
|-------------|--|---------------------|----------------------------|-----------------|-------------------|
| First Year | PMOs staffs at provincial , city and county levels, and county environment management staffs | 178 ^[1] | 11 | 300 | 587.4 |
| | Management of farms and livestock producer households | 2945 ^[2] | 3 | 200 | 1767.0 |
| Second Year | Environment management staffs | 658 ^[3] | 2 | 200 | 263.2 |
| Forth Year | Environment management staffs | 658 ^[4] | 2 | 200 | 263.2 |
| Total | | 4439 | | | 2880.8 |

Note: [1] 4 for PPMO, 3 for each city PMO, and 5 for each county PMO.

[2] 5 for each farm.

[3][4] 1 for PPMO, 1 for each city PMO, 2 for each county PMO and 1 for each farm.

8.6.3 Costs of environment monitoring

Total environmental monitoring cost, including the monitoring cost incurred during the design and operation phases, is estimated at RMB 386,880. Table 8.6-3 provides the breakdown of the estimated cost of the environmental monitoring plan.

Table 8.6-3 Cost Estimate of Environmental Monitoring

| Monitoring items | Unit cost (RMB per time, per farm) | | | Number of samples per year | Annual monitoring costs (RMB/yr) | Total monitoring costs during the design stage (RMB) | Total monitoring cost during the operation stage (RMB) |
|------------------|------------------------------------|---------|---------------|----------------------------|----------------------------------|--|--|
| | Total N | Total P | Crude protein | | | | |
| Wastes | 140 | 140 | 60 | 124 | 42160 | 42160 | 210800 |
| Feeds | 60 | 60 | 60 | 124 | 22320 | 22320 | 111600 |
| Total | | | | | | 64480 | 322400 |

Note: the environment baseline survey has been completed. Therefore, its costs are not included in these environment monitoring costs.

8.6.4 Cost summary

Table 8.6-4 summarizes the total cost of EMMP, including the environmental management, training, monitoring, and supervision. Additional 5% is included as contingencies. The total costs are RMB 3,918,068.

Table 8.6-4 Cost Summary of Environmental Management, Training, & Monitoring

| Item | References | Feasibility study (RMB) | Design/ Construction | Operation (RMB) | Subtotal (RMB) |
|--------------------------|-------------------|------------------------------------|---------------------------------|----------------------------|---------------------------|
| Environmental management | Table 8.6-1 | 29,000 | 84,000 | 182,000 | 295,000 |
| Environmental training | Table 8.6-2 | 0 | 0 | 2,880,000 | 2,880,800 |
| Environmental monitoring | Table 8.6-3 | 0 | 64,480 | 322,400 | 386,880 |
| Subtotal | | 29,000 | 148,480 | 3,384,400 | 3,562,680 |
| 12% contingencies | | 3,480 | 17,818 | 406,128 | 427,522 |
| Total | | 32,480 | 166,298 | 3,790,528 | 3,990,202 |

The information presented in Table 8.6-4 is arrived from the budget items presented in the feasibility study and has already been included in project cost. Therefore, As long as the relevant budget items in the feasibility study have not been changed, there will be no need for inclusion of additional budget for the environmental training activities.

9 Summary and conclusion

9.1 Summary

9.1.1 Project description

The proposed project is planned to be implemented in 30 counties/districts and 1 city of 8 prefectures in Henan province. Under the project, 589 animal parks will be built, renovated, or expanded. Support will be provided to approximately 472 existing farms. These will comprise 272 beef cattle farms, 179 dairy farms (parks), one renovated dairy farm, 18 pig farms, and two renovated bull breeding stations. There will also be 117 new livestock farms (parks) under the project. These will comprise 66 dairy farms (parks), and 51 beef cattle farms (parks).

Project comprises three components: (1) Institutional Strengthening, training and technical Support, (2) Environmental Management in Existing and New Farms and Livestock Parks, and (3) Project Management, and Monitoring and Evaluation.

The project will support 7 livestock production models: (1) 500-head new dairy farm, (2) 500-head beef cattle farm, (3) 5000-head pig bio-fermentation treatment, (4) 500 dairy cow organic fertilizer, (5) dairy cow farm expansion by 100 head, (6) dairy cow farm expansion by 200 head, and (7) beef cattle farm expansion by 200 head.

9.1.2 Project rationale

After years of development, livestock industry has become one of the pillar industries for rural economy and one of the most important sources of income for local farmers in Henan Province. However, during the development process, livestock industry development has been restrained by not becoming standardized and mainly being based on small operation scale, less than optimal industry structure, poor production and marketing plans, and poorly developed support service system. The major barriers for livestock industry development in Henan province are identified as lack of well developed marketing infrastructure, resources and institutions. The adverse impacts of livestock industry on environment have been significantly increasing in the recent years. The livestock product safety and quality control is another challenging issue. The backyard, small scale, and dispersed livestock production models are in conflict with the New Socialist Countryside Construction approach. Entry point for breaking through the bottleneck for livestock industry development is resting on the will of the region. The focus should be on transformation of production organization, enhancing comprehensive livestock production capacity and core competitiveness, and fostering modernization of livestock industry.

Interventions proposed by the current project are believed to be effective in development of: (1) ecologically sensitive livestock industry, (2) fostering a balanced economic, social, and environmental development, (3) safeguarding recycling livestock industry, (4) promoting livestock industry modernization, (5) optimizing livestock industry structure, (6) enhancing livestock products competitiveness, (7) transforming production organization, (8)

implementing public finance policy, (9) stimulating home demands, and (10) securing livestock product supply.

9.1.3 Environmental viability of the project

1. Henan Province is one of the leading livestock producers in the country. Its total production is quite significant, but most of the production is by small producers, with poor sanitation and difficulties in incorporating sound environmental management practices. Under the project, establishment of livestock producers' associations and co-operatives should allow for enlarging the scale of operation, introducing standardized operation and incorporating animal waste management into daily operation of animal farms.
2. There are numerous studies undertaken on livestock waste management in China that should lay the foundation for effective management of livestock waste generated by the project farms.
3. All the 30 project counties (city) are designated as grain production base by the national government. Therefore, substantial quantities of feed and forage are available as feed for animal production. Therefore, it is not foreseen that livestock production will have any significant adverse impact on local food supply or the surrounding vegetation cover, or ecological environment. Crop stalks will be used to feed animals, reducing the air pollution by minimizing the need for burning the residues at agricultural farm level.
4. None of the proposed animal parks are planned to be build in or in close proximity of nature reserves, sources of drinking water, or historical sites. The minimum distance allowed between animal parks and the residential areas is set at 500m that should minimize potential noise and foul smell impact on local residents.
5. Generally, livestock farms are surrounded by crop land. It is believed that sufficient crop land area will be available within reasonable distance for incorporation of park produced treated manure as organic fertilizer. However, availability of crop land with adequate carrying capacity for park produced treated manure should be reviewed on a farm by farm basis before implementation of the sub-project to ensure manure spreading on crop land will not cause contamination of soil, surface and groundwater resources.
6. Animal waste will be treated to reduce levels of pathogens and weed seeds to be sold for application in the neighbouring crop land as organic fertilizer rather than being drained off farm that should minimize its impacts on the environment.

The discharge or use of untreated livestock waste should be minimized through proposed waste treatment and utilization. Rural livestock production should increase, allowing for improvement in living condition, allowing for environment protection enhancement and development of a harmonious relationship between people and nature. Therefore, the project, if fully implemented, is believed to be environmentally sound and viable.

9.1.4 Project's impacts on environment and mitigation measures

9.1.4.1 Potential environment impacts

1. **Surface water:** If project is fully implemented, all solid and liquid manure, generated by the project farms will be treated according to principle of integration of livestock and crop production for use as organic fertilizer. Treated manure will then be sold for application in crop lands. Soil surface in corrals within animal parks will be compacted and limed and the manure will be routinely collected to minimize potential leaching or loss due to surface runoff. Therefore, the project activities should not have any significant negative impact on surface water resources. In fact, if project is fully implemented, the impact of the project on surface water resources, compared to current livestock development practices, should be positive.

Field and literature review indicate that the source of drinking water within project area is deep groundwater and surface water is not known to be used for drinking purposes.

2. **Groundwater:** Animal park solid wastes compose of solid manure, dead animals, manure- corral soil mix, and domestic trash. In agricultural farms, over-application of manure (above soil carrying capacity) can also cause surface and groundwater pollution due to excessive application of N and P sources that could infiltrate to groundwater (mainly N), or carried by surface off to neighbouring water bodies (mainly P), potentially causing elevated levels of N compounds (nitrate and nitrite) in groundwater. Long-term drinking of such water sources is known as potential cause of cancer. In corrals, if soils are not limed and compacted and manure is not managed as per project requirements, there is a potential for water resources pollution through infiltration of N-sources to the groundwater and contamination of neighbouring water bodies b N and P sources, causing water eutrophication. If proposed project activities are fully implemented, the project activities should not have any significant impact on groundwater pollution. In fact, if project is fully implemented, the impact of the project on groundwater resources, compared to current livestock development practices, should be positive.
3. **Atmosphere:** Manure-related sources of air pollution include manure inside and outside animal sheds, manure piling, collection ponds, and corrals. The major pollutants include odour, dust carrying pathogenic microorganisms, and harmful gases such as H₂S, NH₃, and skatole that are normally generated from decomposition of organic matter. Odour from animal parks is generated from decomposition of carbohydrates and nitrogen-containing organic compound in solid and liquid manure. These foul-smelling substance, not only can affect human physiology, but they also can decrease animal productivity and environment degradation.

If project does not fully implement the waste management related activities, there will be a potential for large amount of manures to be left untreated, allowing for generation of harmful gases such as dimethylsulfide, methyl mercaptan, dimethyl amine and volatile fatty acids that can reduce oxygen content of air in neighbouring areas and cause a decline in both human and animal immune function.

4. **Human and animal health:** Animal manure contains large amount of pathogenic microorganisms, parasites ovum and flies and mosquitoes larva that can cause pathogenic and zoonotic diseases, harmful to both animal and human health. Treatment of solid and liquid manure, as is proposed as one of the project activities, should minimize or prevent such impact on human health. Therefore, project should not only have no negative impact on human and animal health, but should also assist in reducing such problems compared to the current status quo.

9.1.4.2 *Mitigation measures*

- Air pollutants
 - ✓ The coal fired boiler should be replaced by electric wall-mounted heater;
 - ✓ Bio-fermentation bed should be introduced in pig farm; and
 - ✓ Afforestation in animal parks and surrounding areas should be encouraged to improve air quality and aesthetics.
- Water pollutants
 - ✓ Domestic sewage should be collected and treated in septic tank for a minimum of 20 days in warm months and 30 days during winter months (November to March). The treated waste can then applied in crop land as liquid fertilizer;
 - ✓ Liquid manure and wash water should be collected and drained into collection ponds. After adequate retention time (20 days in warm months and 30 days during winter), the treated waste can be applied to cropland as liquid fertilizer;
 - ✓ The collection pond and drainage/ conveyance pipes should be maintained to prevent leakage that can potentially contaminate soil, surface and groundwater;
 - ✓ Waste water treatment facilities must receive anti-infiltration treatment;
 - ✓ The corrals should be packed with limed soil. Solid manure should be removed and treated as compost, while liquid manure should be sent to the collection pond for treatment; and
 - ✓ Treated sewage should be applied to the crop land with adequate nutrient carrying capacity as fertilizer.
- Solid wastes

Solid and liquid waste should be separated;
No animal waste should be stacked on bare soil in the farm. They should be collected and composted on concrete slabs;

 - ✓ Solid and liquid manure should be separated and treated, the slurry, after appropriate retention time, should be applied to crop land with adequate carrying capacity as organic fertilizer;
 - ✓ If any animal dies due to infectious diseases, the body should be burned and lime before burial, or preferably incinerated; and
 - ✓ Domestic trash should be disposed at local garbage unit.
- Noise

As much as possible, low-noise machinery should be used during construction and operation;

Submersible pumps should be used at sewage system; and

As much as possible, every effort should be made by animal park management to employ vibration and noise-reduction measures.

- Ecology and environment: Afforestation and improvement of surrounding vegetative cover should be seriously considered as part of animal park activities, including tree planting, lawn and flower bed establishment at production and administration areas.

9.1.5 Establishment of environmental management and monitoring system as part of project activities

- Environment management institution

Project leading group for the project is already established at province and city level. PPMO and City/County PMOs are also established. Under the leadership of provincial project leading group and PPMO, city/prefecture and county PMOs are responsible, not only for project implementation, but also the implementation of the EMMP as is presented in this report (Chapter 8) in their respective jurisdictions;

- Environment monitoring system

During the project feasibility study, design, construction and operation phases of the project, PMOs at different levels should work closely with EPB offices and management of animal parks to ensure every aspect of environmental monitoring and farm nutrient balance study is fully adhered to and completed annually.

PMOs at all levels are responsible for routine environment monitoring. If appropriate expertise is not available at the PMO offices, the monitoring activities identified in this report can be contracted to other institutions such as local Academy of Agricultural Science or environment monitoring stations within their jurisdiction. However, PMOs have the final responsibility of ensuring environmental monitoring is conducted and must prepare the annual environmental monitoring report(s).

9.1.6 Significant economic, environmental and social benefits of the project

The proposed project, after completion, should be able to generate significant economic, environmental and social benefits. The potential benefits include:

- Economic benefits

By the end of the project implementation, it is estimated that some 11,233 households will participate in the project. According to project feasibility study, each household should make an incremental annual income of RMB 20,000. The total incremental income generated by the project will to RMB 233 million.

- Environmental benefits

- ✓ Livestock waste will be treated and applied to crop lands as organic fertilizer, reducing the need for chemical fertilizers. The activity will also reduce water pollution due to discharge of untreated solid and liquid manure to surface waters

that can cause significant water pollution and eutrophication of water bodies in the project areas;

- ✓ Application of treated manure to crop lands not only improve soil nutrient content, but it will also improve soil physical properties such as soil structure, humus content, porosity, and available water holding capacity that should have positive impact on quality and quantity of agricultural products;
- ✓ Standardized livestock production should provide a suitable environment for better and more efficient management of livestock waste, minimizing atmospheric, soil, surface, and groundwater pollution; and
- ✓ Due to animal need for feed material, crop stalks will be bought and used as animal feed. This should reduce the need for burning of crop residues at the farm, a practice that is normally used in the area, causing reduction in air pollution and indirectly reducing impact of crop production activities on global warming..

➤ **Social benefits**

The proposed project is designed to assist small livestock producers by providing the opportunity of moving to livestock parks. The standardized and scaled livestock operation in the project area is expected to improve living condition, improve animal health, and reduce incidences of zoonotic and infectious diseases that should also improve public health in rural areas.

9.1.7 Project support by general public

The project has fully adhered to the principles of public participation and putting people first during feasibility, environmental and social assessment processes. Opinions and advice were solicited through group meeting, interviews, questionnaires, on-site public disclosures, and web-based public disclosures. The information collected by the EIA team indicates that the public is well aware of the project and are generally supporting the project. They believe the project will improve environment in neighbouring areas of animal farms, reduce water pollution due to discharged of untreated farm sewage, and reduce the negative impacts of livestock production.

9.1.8 Environment issues that require special attention

Under the project, special attention should be given to certain issues to ensure project will not have any significant negative environmental impact such as:

1. Increasing the environmental protection campaign through training and awareness raising programs aimed at livestock producers in the project area. Such campaign should allow the local farmers to realize the importance of environment protection and encourages them to participate in the project proposed environment protection activities;
2. Strengthening capacity of PMOs and animal park staffs in environment monitoring of animal parks and to assure that manure generated by the animal parks are appropriately treated and applied to crop lands in quantities that do not cause soil and water pollution (consider soil carrying capacity); and

3. Attention should be given to disease control at animal parks to reduce incidence of infectious and zoonotic diseases.

9.2 Key conclusion

Based on the results of EIA report and the of above evaluation, it is concluded that if all mitigation measures cited in the report are implemented by the project team and the waste management schemes detailed in the project feasibility study report are implemented, the project will not only have no significant long-term environmental impact, but it should also improve the soil, atmospheric, and water environment by effectively reducing level of environmental pollution due to livestock farms activities. The project, if fully implemented, should significantly improve meat and dairy production, better the living conditions in project areas, and improve ecology and level of environmental protection within project areas that should assist in achieving a harmonious development of human and nature. The project is believed to be environmentally positive and is highly recommended for implementation.

10 List of references

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Appendixes

Appendix 1: List of EIA Team Members

List of EIA Experts

| Full Name | Specialized Field | The registered sectors of EIA engineers | The division of work |
|------------------|-------------------------------|--|--|
| Han Longxi | Hydraulics and river dynamics | Agriculture, Forestry and Water Conservancy | Project Leader |
| Wang Wanjie | Hydrology and Water Resources | Transportation | The preparation of the report |
| Cao Jiashun | Environmental Engineering | Social area | The preparation of sections of pollutant mitigation measures |
| Liu Xiaodong | Environmental Engineering | Social area | The preparation of environmental management and monitoring plan |
| Zheng Xiaoyu | Environmental Engineering | Social area | The preparation of sections of the environmental impact assessment |
| Shao Xiaohou | Agri- Biological Environment | | The part of agricultural pollution |
| Wang Cheng-long | veterinary | | Breeding technology and agricultural pollution |
| Li Wanping | veterinary | | Breeding technology and agricultural pollution |
| Liang Jing | veterinary | | Breeding technology and agricultural pollution |
| Wang Yufeng | veterinary | | Breeding technology and agricultural pollution |
| Liu Xiuling | veterinary | | Breeding technology and agricultural pollution |
| Feng Ling | veterinary | | Breeding technology and agricultural pollution |

Appendix 2: Minutes of Meetings, Public Consultation

Tongxu County Environmental Impact Assessment Forum Minutes

Time: July 14th, 2009

Address: Tongxu county Chengguan town Mao zhuang forest

Moderator: Qiao Liangjun (Company CEOs)

Contents:

Participants: Liu Haiyi (staff representative), Sun Tao (deputy director of Tongxu county projects), Sun Guode (person in charge of the project in Kaifeng City), Li Huaqin (staff representative), Qin Jiang (Provincial Animal Husbandry Bureau of Foreign Office responsible person)

Mr. Qiao Liangjun: First of all, welcome you to visit our forest for interviews. We have just seen the notice and have a better understanding of this World Bank Loan Project which is an opportunity for us. We will actively cooperate with the work to speed up the pace of the project started.

EIA Unit: Everyone who has any suggestions for improvement can be put forward according to physical on-field area present circumstances, so that our work can be considered more fully.

Staff representative: Site problems now is the farm in the off season cow dung treatment. Now everyone saw it, cow dung anywhere-piled on or piled directly to the surrounding forest sometimes, and led to some trees died due to excess nutrients. There are farmers who came over to cope with in busy quarter. At present how to deal with cow dung is still a big problem.

Foreign Investment Officers of Animal Husbandry Bureau: Yes, the aim of the World Bank loan project is to cope with these problems. I hope you can put forward the difficulties and problems thoroughly in order to make recommendations at relevant for EIA units.

Staff representatives: Cattle feed store now is also a problem, there is not enough storage site. Sewage can be utilized as resource, but the destination is still a bit blind

EIA Unit: Is the income of feeding cows much better than cultivating the soil?

Staff representative: Of course. We all prefer-this scale than the old backyard-model, raising high security, and its acceptable management. This way is very good, and the benefits are higher than in the past. We all very much hope that can be built on a large scale farms.

Kaifeng livestock husbandry leadership: Loan project is a very good opportunity to local farmers. Provincial Bureau takes it seriously. Kaifeng is of the sand texture, livestock breeding could greatly improve local land. We all want to have a feed conversion rate can be improved and manure handling efficiency to improve the promotion of industries on a large scale.

Province of livestock husbandry leadership: This project makes our enthusiasm. That is good in this point. However, because the funds limited we had to take into account the limited places, this time it is a restricted and new conversion, so hoping that members will actively show their strengths in order to take advantage of this opportunity.

Time: July 14th, 2009

Location: Yuhuang Temple Town of Wazhuang Village in Tongxu County

Participants: Mr. Sun Tao (Vice Chief of project management of TongXu County)

Mr. Sun Guode (the responsible person of project management of Kai Feng City)

Mr. Qin Jiang (leader of foreign capital office of He Nan province)

Mr. Zhang GuoLi (general manager of farm area)

Mr. Chen Shuya (representative of culturist)

Mr. Sun Yajun (representative of culturist)

Mr. Wang Juntao (representative of culturist)

Moderator: EIA Unit

Contents:

Council for Environmental Accreditation: This time's investigation is processed with the aim of evaluation the environment of project areas and how to handle with the pollutants in farm, The leaders of He Nan Environmental bureau have paid much attention to it. Mr. Qin has introduced the workflow of the project. Everyone must have fully understanding. Now we will have a discussion on this farm, everyone can express his opinion freely.

Mr. Zhang Guo Li: There aren't all measurements in the farm now as my farm is moved to this area recently. It's for sure that we hope to have a better farm environment, more beautiful and comfortable. When I raised the cows in village before moving to this farm, it gave out an awful odour and the neighborhoods often complained. I chose the location of the farm carefully this time in case to not influence others, and you can see that it is not in the living area.

Mr. Sun Guode: I am afraid the capacity of the material storage tank is not big enough.

Mr. Zhang Guo Li: As for the straw storage pool, I have a good idea. We think it can save more room when we pack the smashed straw in big plastic bags. It can store enough feed staff for winter during harvest season, furthermore it can keep out. It is not afraid even if the rain

Mr. Sun Tao: Is there farm used machine allowance for crusher-machine?

Mr. Zhang GuoLi: Yes! Thanks to the good policy! There are certain grants each year! While the crusher-machine are not used often.

Council for Environmental Accreditation: Since it is a new farm, not all facilities are available, right?

Mr. Zhang GuoLi: The usage of water and electricity is temporarily as they are not opened officially. Some new facilities are not completed as it is a new farm. The handling of dung should be improved also. It's necessary for us to standard all these aspects with other projects.

Mr. Qinjiang: We will apply for reimbursement for this project, so it is better not operating the project too fast. It will cause the loan used abusive and you can not get your first investment refund when the loan is approved.

Meeting Minutes of Environment Evaluation of Wuzhi County

Time: July 13th, 2009

Location: Wuzhi County Lv Kang cattle industry professionals' Cooperative society.

Participants: Representative of farming bureau of Jiaozuo City

Representative of farming bureau of Wuzhi County

Representative of culturist

Content:

Mr. Qinjiang: Today the Environment Evaluation Unit, Hehai University come to us, they want to know your opinion on this environment protection project, please everyone express his opinion freely.

Representative of livestock husbandry of Jiaozuo City: Our city pays much attention to the project of handling pollutants of farm. While as the shortage of capital, many issues are not solved. We hope to solve these problems with the World Bank's capital.

Representative of livestock husbandry of Wuzhi County: Many cow farmers are scattered in our county at present, as they are all in rural area, they have polluted the common people's living area. We hope more farmers can raise the cow centralized in the farm through this project.

Representative of culturist: The leaders of livestock husbandry of our county think much of handling pollutants of farm, they often come to inspect our jobs. But as the shortage of managing environment knowledge, we don't know how to do it. So we hope to have more training on environment protection. Now we handle with the cow dung with drying them in the sun outside the farm after collecting. Drying the cow dung will occupy a big area. When it rains, some cow dung will be lost and pollute the surrounding area. We hope this project can be brought into effect asap.

Yuanyang County Environmental Impact Assessment Forum Minutes

Time: July 12th , 2009

Venue: Yuanyang Yu Ao milk cows breeding cooperative

Participants: livestock husbandry representatives of Xinxiang city, Yuanyang County's livestock husbandry Bureau representative, customers of milk cows breeding

Content:

The Director of the Qin Jiang: In order to do well the project for environmental protection, environmental impact assessment unit-- He Hai University come to us and want to hear the suggestions in environmental protection, I hope everyone will speak your minds.

Representative of livestock husbandry of Xinxiang city: This project is environmental governance and reconstruction project, leaders at all levels, attaches great importance to pick on this project. I believe, this project can improve the present state of our environment.

Yuanyang County animal husbandry Bureau representative: At present, states of the environment of most farms are poor and pollution is serious, hoping that the project be implemented as soon as possible.

Customers of milk cows breeding: Because lack of funds, at present farm infrastructure is poor no sewerage system; there is no hardening in the ground where urine infiltrate into the earth, causing water environment pollution. I hope that this project be implemented as soon as possible.

Appendix 3: Details of Nutrient Balance Study

Nutrients Balance Study

As was discussed in Chapter 1, since the project size relative to the size of the watershed is quite small, measurement of routine environmental monitoring indicators such TN, TO, COD, BOD, etc will not provide any significant change, positive or negative due to project activities on soil, surface and groundwater resources. Therefore, it has been agreed to use nutrient farm balance methodology to determine the environmental effects of the project activities. After review of different methodologies available for estimating farm nutrient balance, it was decided to adapt the AWMF methodology, recommend by USDA to provide for farm nutrients balance study and nutrient accounting.

Estimation the nutrients content in livestock manure at livestock farms

Intake of nutrient

Taking into account the average nutrients content in the recommended feed ration, the amount of nutrients in feed has been calculated. Food intake of cattle and pig are assumed to be 15kg/d and 3kg/d, respectively. Crude protein and total P contents are estimated based on the average nutrient content of feed material in China. The recorded numbers are calculated based on provided ration. The N content is derived from content of crude protein divided by 6.25.

$$\text{N intake} = \text{food intake of cattle (pig)} \times \text{N contents in feed} / 100.$$

$$\text{P intake} = \text{food intake of cattle (pig)} \times \text{P contents in feed} / 100.$$

Results of above calculations are presented in Table 1.

Table 1 Intake of Nutrients

| (a) Scale of farm operation (animal head) | (b) Food intake (Kg/day) | Feed Nutrient Content | | | Feed Nutrient contents | |
|--|--------------------------------|-----------------------|-----------------------|----------|------------------------|-----------------|
| | | (%) | | | (kg/day) | |
| | | (c) Crude protein | (d) N ¹ | (e) P | (f) N intake | (g) P intake |
| 500 beef cattle | | 9.5 | 1.52 | 0.12 | 98.80 | 7.80 |
| 500 dairy cows | | 10.7 | 1.71 | 0.19 | 111.28 | 12.35 |
| 5000 pig | 15000 | 17.3 | 2.77 | 0.50 | 415.20 | 75.00 |

Amount of nutrients retained in animal

Amount of nutrients retained in animals

$$(\text{Amount of N retained} = \text{scale of operation} * \text{average daily gain} * \text{N concentration})$$

$$(\text{Amount of P retained} = \text{scale of operation} * \text{average daily gain} * \text{P concentration})$$

The results of calculation are shown in Table 2.

Table 2 Amount of nutrients retained in animals

| (a) Type of animals | (h) Scale of operation (animal head) | (i) Average daily gain (kg/head/day) | Gross nutrients concentration | | Amount of nutrients retained in animals (kg/day) | |
|------------------------|--|--|-------------------------------|----------|---|----------|
| | | | (j) N | (k) P | (l) N | (m) P |
| Beef cattle | 500 | 0.800 | 0.026 | 0.0070 | 10 | 3 |
| Dairy cow | 500 | 0.800 | 0.027 | 0.0075 | 11 | 3 |
| Pig | 5000 | 0.600 | 0.024 | 0.0050 | 72 | 15 |

Note: h is derived from Feasibility Study of Henan Yellow River Ecology Livestock Project; i, j, and k are derived from Integrating Animal Feeding Decisions into CNMP Processes.

Amount of nutrients retained in products

In accordance with milk production and nutrients contents of milk, the amount of nutrients retained in milk is calculated.

(Amount of nutrients retained in milk = milk production * Nutrients contents retained in milk)

Results of calculation are shown in Table 3.

Table 3 Amount of nutrients retained in animal products

| Animal type | (a) Product | (n) Daily production (kg/day) | Nutrients contents in milk (Kg N/Kg product) | | Amount of nutrients retained in milk (Kg/d) | |
|---------------------|-------------------|-------------------------------------|---|----------|--|----------|
| | | | (o) N | (p) P | (q) N | (r) P |
| 500 head dairy cows | Milk ¹ | 12500 | 0.005 | 0.001 | 63 | 13 |

Note: n, o, and p are from Integrating Animal Feeding Decisions into CNMP Processes.

Amount of nutrients excreted.

Formula for calculating amount of nutrients excreted are:

$$(t = s \times (f-1) \text{ for beef cattle and pig, } t = s \times (f-q) \text{ for dairy cow})$$

$$(u = s \times (g-m) \text{ for beef cattle and pig, } u = s \times (g-r) \text{ for dairy cow})$$

$$(v = u \times 2.3)$$

where:

(t: N excreted, s: feeding period, f: Intake of N from Table1, l: N retained in animal from Table 2, q: N retained in milk from Table 3, u: P excreted, g: Intake of P from Table 1, m: P retained in animal from Table 2, r: P retained in milk from Table 3 and v: P₂O₅ excreted)

Results of calculations on annual basis are summarized in Table 4.

Table 4 Nutrients Excreted

| (a) Scale of operation (animal heads) | (s) Feeding period (days/year) | Nutrients excreted (kg/year) | | |
|---|---------------------------------------|------------------------------|----------|--------------------------------------|
| | | (t) N | (u) P | (v) P ₂ O ₅ |
| 500 beef cattle | 350 | 31080 | 5775 | 13283 |
| 500 dairy cow | 305 | 27535.4 | 2257 | 5191 |
| 5000 pigs | 150 | 51480 | 9000 | 20700 |

Note: feeding period for beef cattle is from Integrating Animal Feeding Decisions into CNMP Processes, feeding period for dairy cow is from Agricultural Waste Management Field Handbook (210-AWMFH,4/92) .

Nutrient available to crops after volatilization, denitrification, leaching and other losses

After considering how much nutrient is available in animal manure and amount remained after losses, the amount that is available to crops is derived. The results of calculation are presented in Table 5. The formulas used to derive to the results are:

($J_2 = t \times (1 - C_2)$, where J_2 is N available to land, t is N in animal manure at livestock farm level, and C_2 is the loss coefficient for N storage)

($K_2 = v \times (1 - D_2)$, where K_2 is P available to land, t is P in animal manure at livestock farm level, and C_2 is the loss coefficient for P storage)

($L_2 = J_2 \times (1 - E_2) \times (1 - F_2) \times (1 - G_2) \times H_2$, where L_2 is N available to crop, E_2 is denitrification coefficient, F_2 is leaching coefficient, G_2 is N volatilization factor, and H_2 is crop utilization co-efficiency)

($M_2 = K_2 \times I_2$ where M_2 is N available to crop, I_2 is crop utilization coefficient)

Table 5 Amount available to crop after volatilization, denitrification and other losses (kg/year)

| Farm | Total manure at farm level | | Factors | | | | | | | Soil available nutrients | | Crop available nutrients | |
|---------------------|----------------------------|-------------------------------|--------------------------|-------------------------------|------------------------|----------------------|-------------------------|------------------------------|-------------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|
| | (Kg/year) | | Storage loss coefficient | | Denitrification factor | Leaching coefficient | N volatilization factor | Crop utilization coefficient | | (Kg/Yr) | | (Kg/Yr) | |
| Nutrient accounting | t | v | C2 | D2 | E2 | F2 | G2 | H2 | I2 | J2 | K2 | L2 | M2 |
| | N | P ₂ O ₅ | N | P ₂ O ₅ | N | N | N | N | P ₂ O ₅ | N | P ₂ O ₅ | N | P ₂ O ₅ |
| 500 beef cattle | 31080 | 13283 | 0.35 | 0.2 | 0.26 | 0.1 | 0.05 | 0.55 | 0.4 | 20202 | 10626.4 | 7030.0 | 4250.6 |
| 500 dairy cows | 27535.4 | 5191 | 0.35 | 0.2 | 0.26 | 0.1 | 0.05 | 0.55 | 0.4 | 17898 | 4152.8 | 6228.2 | 1661.1 |
| 5000 pigs | 51480 | 20700 | 0.35 | 0.2 | 0.26 | 0.1 | 0.05 | 0.55 | 0.4 | 33462 | 16560 | 11644.3 | 6624 |

Note: C2, D2, E2, F2, G2, H2, I2 are from Agricultural Waste Management Field Handbook (210-AWMFH,4/92)

Crop demands for N and P

According to the available soils report for Yellow River floodplain, the major soil types in project area include Cinnamon, Yellow Cinnamon, Chao Soil, Aeolian sandy soil and Sha Jiang Black soil (Chinese soil classification nomenclature). Average organic matter, N and P content of the above soils are presented in Table 6.

Table 6 Contents of organic matter, N and P in soil

| No | Soil type | pH | Organic matter (%) | Total N (%) | Total P (%) |
|----|----------------------|------|--------------------|-------------|-------------|
| 1 | Cinnamon | 7.90 | 1.4 | 0.087 | 0.056 |
| 2 | Yellow Cinnamon | 7.05 | 1.4 | 0.085 | 0.049 |
| 3 | Chao Soil | 8.02 | 1.1 | 0.069 | 0.059 |
| 4 | Aeolian Sandy soil | 8.48 | 0.48 | 0.032 | 0.045 |
| 5 | Sha Jiang Black soil | 7.75 | 1.5 | 0.087 | 0.054 |
| 6 | Average | 7.84 | 1.2 | 0.072 | 0.053 |

The Chinese classification of soil nutrient availability in soil, the surplus and shortage status are categorized into high, relatively high, average, somewhat low, low, and very low. According to this classification, the organic matter levels of the above soils, being between 1 and 2%, is considered to be somewhat low. According to the same characterization N levels between 0.05-0.075% is considered as low. Using the above data, the amount of fertilizer that can be applied in the project area is calculated and is presented in Table 7. It is important to note that the data provided is based on average characteristics of these soils and cannot substitute for field measurement of these nutrients. The data should be used only as an indication of potential nutrient needs.

Table 7 Amount of fertilizer applied in the project area

| Crops | N (kg/mu.Yr) | P ₂ O ₅ (kg/mu.Yr) |
|------------|--------------|--|
| Wheat-corn | 29 | 18 |
| Vegetables | 45 | 12 |

Note : Wheat-corn rotation, wheat and corn is grown back to back followed by vegetables as the third crop.

Crop land area which is suitable for livestock farm

Normally Crops are fertilized with organic and chemical fertilizers. Assuming that half of N and P will be from organic and the other half will be from chemical fertilizers, crop land area required is estimated for application of manure from project's animal parks.

$$\text{N from organic fertilizer} = \text{N applied in crop land (See Table 7)/2}$$

$$\text{P from organic fertilizer} = \text{P applied in crop land (see Table 7)/2}$$

$$\text{N balance crop land} = \text{N available to crop /N available}$$

P_2O_5 balance crop land = P_2O_5 available to crop/ammonia available

The results of above calculation are presented in Table 8.

Considering the rough assumptions made in this exercise, there appears to be enough crop land within 10km of project livestock farms, allowing for efficient use of livestock manure. However, it is necessary to revisit this issue at each animal park to ensure adequate agricultural land with enough carrying capacity is available within appropriate distance from the park to allow for transport of treated manure to the agricultural farm land.

Table 8 Area of crop land suitable to livestock farm

| Scale of operation (animal head) | Available to crop | | Wheat -corn | | | | Vegetables | | | |
|-------------------------------------|-------------------|-------------------------------|--------------------------------------|------------------------|--------------------------------------|---|--------------------------------------|------------------------|--------------------------------------|---|
| | N | P ₂ O ₅ | Available N organic fertilizer | N balance crop land | Available P organic fertilizer | P ₂ O ₅ balance crop land | Available N organic fertilizer | N balance crop land | Available P organic fertilizer | P ₂ O ₅ balance crop land |
| | Kg/yr | | Kg/mu-Yr | mu | Kg/mu-Yr | mu | Kg/mu-Yr | mu | Kg/mu-Yr | mu |
| 500beef cattle | 7030.0 | 4250.6 | 14.5 | 484.8 | 9 | 472.3 | 22.5 | 312.4 | 6 | 708.4 |
| 500 dairy cows | 6228.2 | 1661.1 | 14.5 | 429.5 | 9 | 184.6 | 22.5 | 276.8 | 6 | 276.9 |
| 5000 pigs | 11644.3 | 6624.0 | 14.5 | 803.1 | 9 | 736.0 | 22.5 | 517.5 | 6 | 1104.0 |

Appendix 4: Terms of Reference for EIA

Henan Yellow River Livestock Ecological Livestock Development Project

Terms of Reference for Environmental Assessment

March 23, 2009

INTRODUCTION

Background. The Henan Provincial Government (represented by the Provincial Livestock Bureau) and the World Bank has initiated the preparation of a proposed Yellow River Ecologic Livestock Development Project.

It is anticipated that the project would be implemented over a five year period in about 750 medium size cattle (beef and dairy) farms of about 300 heads each, under private or cooperative ownership. The exact number of farms will be determined during preparation. Similarly, selection criteria and selection methodology for farmer participation in the project will be determined during preparation. It is anticipated that a large part of the newly built farms would function as livestock parks which would receive relocated surrounding small livestock farmers mainly under cooperative ownership (farmers' associations). It is also envisaged that each participating farm would function as a demonstration farm through structured outreach programs for surrounding farms so that the technologies introduced indeed can be spread.

Currently, Henan is proposing to implement the project in eight prefectures in about 29 counties along the Yellow River Belt in order to start reducing agriculture's contribution to the pollution of the Yellow River which is heavily polluted by point- and non-point source pollution.

Project Objective. The proposed project would aim to reduce the quantity of environmental pollution from livestock production in the Yellow River Belt in Henan Province. This project objective shall be seen in the context of Henan's overall objective of supporting a sustainable development of animal husbandry and increasing farmers' incomes by establishing and steering production to ecologically standardized livestock farms. Henan Province expects the proposed project to have a demonstration effect enabling scaling up of these ecologically standardized farms if successful.

Project Description. It is anticipated that the project objective will be achieved through design and implementation of the following three components:

- A. Strengthening of Public Institutions. This could include financing of activities to enhance the various government levels' ability to manage sustainable development of the livestock industry in terms of spatial planning and resource optimization: (a) development of local policies and procedures for monitoring effluents on and off farm; (b) monitoring, sampling and testing methodology of soil, water, and effluents; (c) establishment of a Geographic Information System (GIS) based

planning and management tool and related technical assistance and training; (d) intra-provincial and inter-provincial information sharing about innovations and management of public programs, enforcement and compliance strategies; and (e) communication planning and execution.

B. Environmental Management in Existing and New Farms and Livestock Parks

ensuring “ecological standardization.” This would include funding for:

- i Waste minimization infrastructure (silage pits, feed choppers, etc.) and technical assistance and training in nutrition and feed management¹
- ii Waste management infrastructure (sheds that would allow for proper waste collection, waste removal equipment, etc.)
- iii Waste disposal (drainage systems, waste and urine collection tanks, manure basins, composting facilities, dry manure packaging facilities, biogas infrastructure – including generators, etc.). Waste disposal strategies need to take into consideration specific risks related to antibiotic residues and disease risks.
- iv Investments that would ensure farmers moving into the newly established parks (e.g. investments in milking stations). For such investments, transparency and governance in the ownership structures would be carefully considered and monitored. In this context, funding is anticipated for animal health management related infrastructure, equipment, and technical assistance and training. Other activities to be financed could technical and assistance and training programs to support on-farm HACCP² principles.
- v Farm management support, including technical assistance and training for farmer’s organizations.

C. Project Management, and Monitoring and Evaluation. Activities to be financed would include project management costs, office equipment and vehicles, training, and progress and impact monitoring and evaluation.

¹ This is particularly important to reduce environmental contamination from feed additives and pesticide contaminated feeds from heavy metals, *Cu* (copper), *As* (arsenic), etc.

² “Hazard Analysis and Critical Control Point” – HACCP is a systematic preventive approach to food safety that addresses physical, chemical, and biological hazards as a means of prevention rather than finished product inspection. HACCP systems establish process control through identifying critical control points in the production process that are most important to monitor and control.

ENVIRONMENTAL ASSESSMENT

Background. The Environmental Assessment (EA) of the Project as described in these terms of references (TOR) shall be prepared to meet the requirements of the World Bank, the Government of China, and Henan Provincial Government in terms of an EA. The EA will assess the environmental impact and plan environmental mitigation and monitoring for the Project. More importantly, the EA will prepare guidelines and a framework for farm based environmental impact assessments (EIA) to be carried out during Project implementation.

The Project aims at promoting ecological animal husbandry and sustainable development in the areas along the Yellow River, to improve environmental quality and increase the benefit of animal husbandry activities. The Project aims at facilitating the use of high efficiency conversion and multi-level utilization of animal husbandry, reducing waste and environmental pollution; and improving the technical and ecological level of animal husbandry in Henan

Scope and Objective of the EA. The scope of the EA work would encompass an environmental impact assessment, an environmental mitigation and monitoring plan, and guidelines for farm based EIAs. The EA would be prepared in parallel to the preparation of the Project so as to inform the project in its final design.

More generally, the EA would: (i) screen the project to the most appropriate review and approval option; (ii) establish a reliable environmental baseline against which to measure future change; (iii) establish environmental objectives, standards and performance indicators; (iv) promote avoiding or reducing negative environmental impacts through early consideration in planning and design; (v) identify and quantify benefits and residual impacts or risks (i.e. those that cannot be avoided or mitigated); (vi) design an environmental monitoring and mitigation plan with a schedule, triggers, and cost estimates for action; (vii) prepare a framework and guidelines for how to carry out farm level environmental impact assessments; (viii) consult with and inform involved communities and convey information to decision-makers; and (ix) provide guidance to more detailed planning and implementation.

In addition to consisting of a “scientific impact analysis, the EA should focus on planning and design to avoid or minimize environmental impacts through: (i) community consultation; (ii) limiting site disturbance; (iii) minimizing disturbance and contamination of watersheds and watercourses; (iv) promote public health and safety, especially with relation to manure management technologies proposed under the project; and (v) well-conceived environmental monitoring.

Environmental Assessment Requirements. The following regulations and guidelines will govern the conduct of the assessment:

- (i) The EA and the process for its review and approval, shall conform to the laws and regulations of the People's Republic of China; in particular:
 - The Law on Environmental Protection (December 1989): specifically Articles 13 (preparation of environmental impact statements), 17 (protection of natural ecosystems), and 20 (rational application of chemical fertilizers and pesticides);
 - Regulations on the Management of Environmental Protection in Construction Projects (State Council Decree No. 253 of 1998): specifically Articles 7 (classification of projects), 8 (contents of an EIA report), 9 (the relationship between EIA and feasibility design), and 10 (submission of the EIA to the competent environmental administration for examination and approval);
 - Circular on Strengthening EIA Management in Construction projects Financed by International Financial Organizations (NEPA, June 21, 1993): specifically Articles I (projects subject to PRC laws, regulations and standards), II (subject to PRC environmental review and approval procedures), III (categorization of development projects), VI (synchronization of the PRC's and the international organization's project design and EIA procedures), VII (public participation), VIII (involuntary resettlement), IX (procedures for submitting EIA reports), XII (preparation of EIA reports by an organization with a Class A certification), and Annexes A, B and C (Annotated formats for EIA Terms of Reference, EIA Reports and EIA Summary Reports).
- (ii) All project activities must conform to the World Bank's safeguard policies. The EA report will therefore address the requirements of the following:
 - Operational Policy 4.01. Environmental Assessment: specifically Sections 1-3 (definitions of the environment and environmental assessment), 4-6 (responsibilities for EA on World Bank projects), 8 (environmental screening and project categories), 15 (public consultation), 16-19 (disclosure), and 20 (compliance with environmental prescriptions during implementation);
 - Operational Policy 4.04. Natural Habitats: specifically Sections 3-8 (project design and implementation to avoid conversion of natural habitats);
 - Operational Policy 4.09. Pest Management: specifically Sections 1-2 (pest management strategies must be considered in EA), 3-4 (pest management activities must be justified within an Integrated Pest Management Program), and 6-7 (criteria for pesticide selection and use);
 - Operational Policy 4.11. Cultural Property: specifically Sections 1 (definition of cultural property), 2 (policy on preservation and protection of cultural property) and 3 (procedures for protection of cultural property);
 - Operational Directive 4.30. Involuntary Resettlement: specifically Sections 3 (policy objectives for resettlement of people displaced by a project), and 4-22 (resettlement planning);
 - Bank Procedures 17.50. Disclosure of Operational Information: specifically Sections 11-14 (disclosure of environment-related documents).

Study Area. The study areas should be the same as the anticipated Project areas: It is anticipated that the project will be implemented in 29 counties (or county level cities or districts) in 8 municipalities (prefectures) as follows: Zhengzhou (Huiji District, Yingyang City, Zhongmu County, and Jinshui District); Kaifeng (Kaifeng County, Weishi County, Qi County, Tongxu County, and Lankao County); Luoyang (Mengjin County and Yanshi City); Jiaozuo (Mengzhou City, Wen County, Wuzhi County, Qinyang County and Bo'ai County); Xinxiang (Changhuan County, Fengqiu County, Yuanyang County); Puyang (Puyang County, Fan County, Taiqian County, and Qingfeng County); Shangqiu (Liangyuan District, Yucheng County, Minquan County, Ningling County, and Sui County; and Jiyuan. Representative farms/animal parks shall be identified with the Project Management Office.

Detailed Scope of Work. The detailed scope of work will consist of the following nine tasks:

Task 1. Description of the Project. General design and extent of construction and infrastructure/waste treatment facility development activities, extension and training services, and operation, maintenance, and health & safety components of animal waste treatment works; general design and extent of animal farm production improvement component. Based on this information identify, the key variables of interest on which the project activities may have an impact such as potential land and water contamination and use changes due to project activities; animal manure treatment, and potential conflicts between beneficiaries and affected people. It is noted that not all farms/livestock parks will have been firmly identified at the time of preparation of the feasibility study and the EA. Similarly to the feasibility study, the EA can use "sample" farm/livestock park designs and extrapolate from there.

Task 2. Description of the Environment. Collect, evaluate and present baseline data on the relevant environmental characteristics of the study area based on the key variables identified in Task 1. Only data relevant to the project and key impact variables should be collected. Existing (secondary) information sources should be given priority over primary data collection. All secondary data sources should be well referenced. It is critical that the EIA study team cooperates closely with other Project teams (especially the social assessment team) in order to avoid duplication in the collection of baseline information about project sites. Primary data collection should be undertaken only if there are serious data gaps, which prevent evaluation of significant project impacts. Include information on any changes anticipated before the project commences, including other development activities in the project area. The use of maps (with coordinates), photographs, tables, graphs, etc. is strongly encouraged to make the description as easily understandable and as transparent as possible.

- a) *Physical Environment:* Provide an indication of the geographical distribution of the proposed livestock farms/animal park areas included in the project, the size ranges and whether or not there will be any expansion of livestock farm area. Other information of potential interest includes geology; topography; soils; climate and meteorology; surface and ground-water hydrology; and receiving water quality.
- b) *Biological Environment:* Flora; fauna; rare or endangered species; sensitive habitats, including parks or reserves, significant natural sites, etc.; species of

commercial importance; possible competition between wildlife species and domestic animals; and species with potential to become nuisances, vectors or dangerous.

- c) *Socio-Cultural Environment*: Land use (including current crops and cropping patterns, grazing patterns); land tenure and land titling; present water supply and water uses (including current distribution of water resources if irrigation systems already exist in area); control over allocation of resource use rights.

Task 3. Legislative and Regulatory Considerations. Describe the pertinent regulations and standards governing environmental quality, health and safety, protection of sensitive areas, protection of endangered species, siting, land use control, etc., at international, national, regional and local levels. The analysis should focus on legislative and regulatory issues which have direct relevance to key impact variables identified in Task 1 such as land and water use changes; manure treatment and use/disposal of effluents, and potential conflicts between land and water users.

Task 4. Determination of the Potential Impacts of the Proposed Project. The analysis should focus on key variables on which the project can potentially have an impact. The use of maps (with coordinates) and other graphic medium is requested for illustration purposes. Examples of potential impacts to be assessed might include:

- a) *Project Location*: Resettlement of people; loss/changes in agricultural land and land use pattern; impact on flora and fauna; impact on historic and cultural sites; effects on water resources outside and inside command area. Particular attention should be paid to any impact on surrounding wetlands of significance.
- b) *Project Design*: Disruption of hydrology; drainage problems; design of manure treatment structures, animal sheds, impact of intensified fodder production including higher fertilizer and pesticide use, traffic increase, etc.
- c) *Construction Works*: Soil erosion; noise; etc.
- d) *Project Operation*: Impacts on soils (water logging, salinization, etc.); changes in ground water levels inside and outside immediate project area; changes in surface and ground water quality and risks of eutrophication of surface waters; noise and air pollution from increased traffic and animal production/manure treatment activities, etc.

When describing the project impacts, indicate which are irreversible or unavoidable which can be mitigated, how they can be mitigated, and the extent, magnitude, and significance of impact (temporal and spatial distribution of impacts).

Task 5. Discuss the environmental assessment undertaken by the project's feasibility studies, for example, the assessment of feed material, use of heavy metal additives, and antibiotics, pesticide use and management, including weaknesses and risks. Recommendation on retention time for treated manure before application as fertilizer or disposal, etc.

Task 6. Analysis of Alternatives to the Proposed Project. Describe alternatives were examined in the course of developing the proposed project and identify other alternatives, if any, that would achieve the same objectives with less significant environmental/social impact. The concept of alternatives might extend to siting, design, technology selection (i.e. selection of appropriate technical packages for

livestock production/manure treatment), construction techniques and phasing, and operating and maintenance procedures of structures. Compare alternatives in terms of potential environmental impacts; capital and operating costs; suitability under local conditions; and institutional, training, and monitoring requirements. To the extent possible, quantify the costs and benefits of each alternative, incorporating the estimated costs of any associated mitigating measures. This should be done based on the information collected and provided by the relevant feasibility study teams.

Task 7. Development of an Environmental Management and Monitoring Plan, with a focus on three generic areas: Mitigation measures, institutional strengthening and training, and monitoring. The emphasis on each of these areas depends on the needs in the specific project context, as identified by the environmental impact assessment.

- a) *Mitigation of Environmental Impact*: Identify potential significant environmental impacts and recommend feasible and cost-effective measures to prevent or reduce such negative impacts, if any, to acceptable levels and enhance potential positive impacts. This work should be carried out in close cooperation of other members of feasibility study team; the environmental consultant team should make sure that mitigation measures are worked out by technical agencies. For example, provincial or county Agricultural and/or Animal Husbandry Bureaus may have already developed acceptable standardized designs for animal production sheds or manure treatment plans. Estimate the impacts and costs of those measures and provide a mechanism for ensuring that adoption of such designs is promoted under the project. If relevant, consider compensation to affected parties for impacts which cannot be mitigated as the last resort. The plan should include proposed work programs, budget estimates, schedules, staffing and training requirements, and other necessary support services to implement the mitigating measures. Training activities should be developed in cooperation with other project feasibility study teams.
- b) *Institutional Strengthening and Training*: Identification of institutional needs to implement environmental assessment recommendations. Assess the strengths and weaknesses of institutions potentially involved in the project at local, provincial, and national levels, including their staffing, authority and capability, organization and management and knowledge and experience on environmental issues. Recommend steps to strengthen these institutions so that the management and monitoring plans in the environmental assessment can be implemented. The recommendations may extend to new agency functions, inter-sectoral arrangements, management procedures and training, staffing, operation and maintenance training, budgeting, and financial support.
- c) *Monitoring*: Prepare detailed arrangements for monitoring implementation of mitigating measures and the impacts of the project during implementation and operation. Include in the plan an estimate of capital and operating costs and a description of other inputs (such as training and institutional strengthening) needed to carry it out.

Task 8. *Farm Level EIA Framework*. It is likely that not all farms and livestock parks that will participate in the project will be identified until a later stage of the

project. The EA should develop a framework and guidelines for carrying out farm level environmental impact analysis.

Task 9. Assist in Inter-Agency Coordination and Public/Non Governmental Organization Participation. Provide inputs for Social Assessment and Participatory Rural Appraisal to obtain views of farmers and local authorities on key environmental management issues. Assist in coordinating the environmental assessment activities between different line agencies. Consult affected groups using stakeholder workshops and keep records of meetings, communications, and comments. Outmost effort should be made to work very closely in these areas with the social assessment team members to ensure avoidance of duplication of efforts.

Outputs: Reporting and Documentation. The EA report should be concise and limit itself to significant environmental issues. It should consist of an executive summary and a main text. The main text should focus on findings, conclusions and recommended actions, supported by summaries of the data collected and citations for any references used in interpreting those data. Detailed or un-interpreted data are not appropriate in the main text and should be presented in appendices or a separate volume. The use of tables, graphs, photographs, maps and other visual aids is crucial to present the findings in a condensed but easily understandable way. Unpublished documents used in the assessment that may not be readily available should be assembled in an appendix. All information has to be well referenced. The report should be organized according to the general outline below (a more detailed example of an outline is provided in Attachment 1 for reference.

Executive Summary

Policy, Legal and Administrative Framework (Chinese and World Bank)

Description of the Proposed Project (project objectives, project area and beneficiaries, costs and benefits, project components, monitoring)

Methodology and Baseline Data (techniques used for EA, source and description of data used for EA)

Analysis of Alternatives (description of alternative project designs; analysis of their potential environmental costs and benefits, environmental impacts, suitability, and institutional, training, and monitoring requirements)

Significant Environmental Impacts (project location, project design, construction works, and project operation)

Proposed Mitigation Measures (description of proposed mitigation measures for all identified significant environmental impacts)

Environmental Management and Monitoring Plan (environmental mitigation plan; institutional strengthening and training; monitoring)

Farm Level EIA Framework and Guidelines

Summary and Conclusion Provide a summary of all identified significant impacts of the project and provide a concluding remarks on environmental feasibility of the proposed project, and the need for any additional studies.

List of References

Appendices:

- List of Authors/Consultants for Environmental Assessment
- Record of Interagency/Forum/Consultation Meetings
- Background information including data, maps, graphs, documents, etc.
- Details of data and information used to justify the findings of the report

Under these terms of reference, the consultant is expected to carry out the assignment in three stages and complete the work as agreed with the Project Management Office. The report shall be prepared in both Chinese and English and presented in eight (8) copies for both Chinese and English version as well as electronic format.

- (i) Inception report, to be submitted by **xxxxx** to the Project Management Office: This includes, first, the description proposed work to be carried out and the proposed approach of the EA study, which should be approved by relevant national and/or provincial authority.
- (ii) Draft EA report, to be submitted by **xxxxxxxxx**. The full report includes all analytical and technical documentation, tables, plans and maps as described in these TORs. The Project Management Office and the World Bank will comment on this draft report within 3 weeks of receipt.
- (iii) Final EA report, to be submitted by **xxxxxxxxx** to the Project Management Office. The final report would be based on the draft report and reflect the comments received from the the Project Management Office, approving Chinese authority, and the World Bank.

Skills and Qualifications. The EA shall be carried out by an independent institute certified by the Ministry of Environmental Protection to carry out EAs. The Project Management Office will contract such an institute to carry out this assignment. The consultant team should include a proper mix of skills for carrying out the assignment according to the terms of reference. Members of the team should consist of people with the following qualifications and specializations at the minimum:

- Degrees in social sciences, environmental sciences, natural resources management, and animal husbandry (team needs to include expertise in rural sociology, natural resources management, livestock waste management, and animal husbandry).
- Minimum of eight years of experience with environmental impact assessments preferably related to the World Bank or other international agencies supported projects.
- Knowledgeable of China's related laws and regulations in rural and livestock sectors, and the Bank's safeguard policies and their requirements.
- Excellent oral and written communication skills in Chinese. Team needs to include at least one member with excellent oral and written skills in English.

Timeframe: Preliminary Schedule of the EA Process

| Stage | Activities | Timetable | Responsible Party |
|--------------------------|---|------------------|--------------------------|
| EA preparation | Identification and contracting of Environmental Impact Assessment Consultant; Environmental Impact Assessment Training | | PPMO with WB clearance |
| Initial Round of EA | Carrying out EIA exercise according to TOR and work plan, and complete fieldwork | | Consultant team |
| First Draft of EA report | Data analysis, writing, drafting, translation of EIA report in Chinese and English | | Consultant team |
| Revision of EA Report | Following Bank review and comments, rewriting and retranslating of EIA report | | Consultant team |
| Final EA report | Finalization of EIA report for project preparation | | Consultant team |

Materials Provided to the Consultants. The Project Management Office will provide the EA team the following background materials. Additional information may be available upon request:

- World Bank Project Concept Document
- World Bank regulations related to the preparation of an EA (consultants are to be aware of and be able to access all related national and local guidelines and regulations.
- TOR for Social Assessment
- TOR for Feasibility Study
- Lists of data sources, project background reports and studies, relevant publications, and other items to which the consultant's attention should be directed.

Example Outline of an EIA Report

Preface

Executive Summary

1. Introduction

- 1.1 Purpose and Basis of Report
- 1.2 EA Methodology
- 1.3 Relationship to Project Feasibility Study
- 1.4 EA Team
- 1.5 Assessment Categorization and Focus
- 1.6 Assessment Scope and Periods Covered
- 1.7 Assessment Factors and Assessment Classification
- 1.8 Assessment Standard
- 1.9 Assessment Procedures

2. Project Description

- 2.1 Project Background
- 2.2 Project Objective
- 2.2 Project Components
- 2.3 Project Investment
- 2.4 Indicators of Project Success
- 2.5 Project Areas
- 2.6 Project Time Frame and Implementation Schedule
- 2.7 Project Economics

3. Existing Environmental Setting

- 3.1 Natural/Physical Environment
- 3.2 Ecological Environment
- 3.3 Socioeconomic Conditions

4. Public Participation

- 4.1 Consultation Method and Subject
- 4.2 Public Opinion and Suggestion
- 4.3 Information Disclosure and Feedback
- 4.4 Beneficial Participation Plan
- 4.5 Summary of Public participation

5. Analysis of Alternatives

- 5.1 Project Alternatives
- 5.2 'Do-nothing' Alternative Analysis

- 5.3 Alternative Analysis in Preliminary Feasibility Study
- 5.4 Basis for the Selection of the Alternative Proposed for the Project Design

6. Environmental Impact Assessment and Mitigation Measures

- 6.1 Analysis of Significant Environmental Impact & Proposed Mitigation Measures in implementation & Construction Phase
- 6.2 Analysis of Significant Environmental Impact & Proposed Mitigation Measures During Operation Phase
- 6.3 Environmental Risk Assessment

7. Environmental Management and Monitoring Plan (EMMP)

- 7.1 Introduction
- 7.2 Environmental Management Organization and Responsibilities
- 7.3 Environmental Management Participants
- 7.4 Environmental Monitoring Plan
- 7.5 Environmental Training/Institutional Strengthening Plan
- 7.6 Monitoring Budget

8. EIA Framework and Guidelines for Farms/Livestock Parks)

- 8.1 Introduction
- 8.2 Framework and Methodology
- 8.3 Guidelines
- 8.4 Training Plan
- 8.5 Budget

9. Summary and Conclusion

- 9.1 Summary of Findings
- 9.2 Major Conclusions
- 9.3 Recommendations

10. List of References

Annexes

Annex A: TOR for EIA

Annex B: List of EIA Compilers (individuals and organizations)

Annex C: List of Authors

Annex D: References Record of Inter-agency/Forum/Consultation Meetings

Annex E: Background information including data, maps, graphs, documents, etc.