E4792 V2

China/Global Environment Facility Project
Project Number：QT2014-30

# Landscape Approach to Wildlife Conservation in Northeast China Project

# Environmental Management Plan

Heilongjiang Province · Jilin Province · China
Siberian Tiger Habitat Protection Project Executive Office of Jilin Province
Siberian Tiger Habitat Protection Project Executive Office of Heilongjiang Province
Siberian Tiger Protection Project Executive Office of the General Bureau of Heilongjiang Forest Industry
Planning and Design Institute of Forest Products Industry of the State Forestry Administration

March, 2015

# CONTENTS



**Attachment：**

**Attachment** 1-- *Pest Management Plan*

**Attachment** 2-- *Environmental Protection Guidelines for Plantation*

**Attachment** 3-- *Environmental Codes of Practice of Small Civil Engineering and Architecture Projects*

# 1 Project Overview

## 1.1 Project Background

In order to promote the protection and management of the Siberian tiger（*Panthera tigris altaica*), also known as Amur tiger, and its habitat, the State Forestry Administration and World Bank jointly applied for the GEF "Landscape Approach to Wildlife Conservation in Northeast China Project", and got approval in principle on Feb 29th, 2012. This project is implemented in Northeast China, at the junction area of Heilongjiang Province and Jilin Province, close to the Primorsky Region of Russia and Hamgyong Province of North Korea. It involves Hunchun City, Wangqing County, Dongning County, and Muling County, with a total area of 15337.08 square kilometers. The aggregate amount of the project is 18 million US dollars. The undertaking units of the project include Jilin Forestry Department, Heilongjiang Forestry Department and the General Bureau of Heilongjiang Forest Industry.

This project aims to recover the threatened biological diversity in prior reserves of northeast China through improving the regional ecological environment; to support policies and planning frameworks in biodiversity-friendly areas by taking coordinative planning measures in target areas; to raise the management effectiveness of the reserves or the protection network; to improve the carrying capacity of wild animals through the recovery, expansion, and connection of important habitats, and to increase biodiversity-friendly areas which are adjacent to the reserves; to take effective law enforcement and regulatory measures in the reserves or greater regions to reduce the mortality of some key species; to buffer human-animal conflicts through increasing the income of local people and providing subsidies in wildlife protection process.

## 1.2 Project Content

The project consists of the following subprojects: to mainstream the wildlife protection through coordination and cooperation among various departments; to improve the protection effectiveness of habitats in Northeast ecological areas through ecosystem protection methods in priority areas; to reduce human-animal conflicts in the ecological areas (capacity building, law enforcement strengthening, environmental education, and incentive mechanism to promote community participation in protection); and project management. Contents of each subproject are listed in the Table 1.2-1.

**Table 1.2-1 Table of Project Contents**

| Project Name | Subproject Name | Project Contents |
|---|---|---|
| Mainstream the wildlife protection through coordination and cooperation among various departments. | Strengthen the enforcement and management of policy framework in priority ecological regions, so as to better protect tiger habitats in forest regions of the General Bureau of Heilongjiang Forest Industry. | Recommend priority regions of tiger habitats conservation |
| | | Strengthen legal norms of nature reserves |
| | | Update protection and restoration plans of Jilin province; draw up protection and restoration plans in forest regions of the General Bureau of Heilongjiang Forest Industry |
| | | Set up the Siberian tiger regional conservation consultative committee |
| | | Discuss how to make tiger habitats conservation part of economic activities/engineering construction |
| | | Establish/update policies to reduce human-tiger conflicts (eg: compensation mechanism) |
| | | Establish China-Russia trans-boundary conservation coordination mechanism |

| Project Name | Subproject Name | Project Contents |
|---|---|---|
| Improve the habitat protection effectiveness in Northeast ecological areas through ecosystem protection methods in priority areas. | Improve the management effectiveness of five current reserves | Legislate/update rules/plans of each nature reserve |
| | | Strengthen the capability construction of 47 conservation stations |
| | Expand reserve area | Expand the two existing reserves; specify the legal status and implementation arrangements; legislate rules/plans of each region; build 3 new conservation stations |
| | Conduct staff training of nature reserve and local forestry bureaus | Conduct conservation management team training in reserves and local forestry bureaus |
| | Increase prey population and improve tiger habitats | Set up supplementary feeding stations, release domesticated spotted deer, red deer, wild boar to nature; increase prey population quantity |
| | Restore vegetation to improve tiger habitats | Restore vegetation, improve habitat quality |
| | Patrol up mountains and clear up the hunting tools (measurable indicators are demanded) | Conduct mountain patrol activities, take over hunting sets, fight against poaching activities, set up trial reward system |
| Reduce human-animal conflicts in the ecological areas (capacity building, law enforcement strengthening, environmental education, and incentive mechanism to promote community participation in protection). | Strengthen monitoring and law enforcement efforts outside reserves | Build 28 new conservation stations |
| | | Improve the capability construction of 14 conservation stations |
| | | Conduct training for staff and leader (include staff leaders of each station) in conservative stations |
| | Enhance publicity and education in community | Conduct publicity through television, broadcast, journal, slogan, leaflet to improve people's awareness of the Siberian tiger protection |
| | Conduct trials on updating dissipation compensation method | Compensate the loss caused by the Siberian tiger and its prey to buffer human tiger conflict |
| | Conduct environmental friendly practice on improving tiger habitats and farmers livelihood | Conduct tiger-friendly activities to create good habitats for the Siberian tiger meanwhile guarantee workers' livelihood |
| | Project monitoring evaluation | Monitor project progress and periodical results according to project monitoring objectives |
| Project management. | Monitor and control tiger and prey population quantity | Conduct surveys on the Siberian tiger and prey population quantity, master their distribution and number, which provides scientific evidence for conservation management and project implementation effectiveness evaluation |
| | Establish effective coordination mechanism between the country and different provinces | Set up project office in the General Bureau of Heilongjiang Forest Industry, Heilongjiang Forestry Department, Jilin Forestry Department to coordinate the project implementation |
| | Effective implementation | Put the project into practice through establishing institutions, staff training and effective management |

## 1.3 Security Policies of the World Bank

Security Policies of the World Bank that are applicable in this project include:
OP 4.01—Environmental Assessment
OP 4.04—Natural Habitats
OP 4.09—Pest Management
OP 4.10—Indigenous Peoples
OP 4.12—Involuntary Resettlement
OP 4.36—Forestry

# 2 Implementation Plan of Mitigation Measures

Implementation plan of mitigation measures for ecological environment impacts in this project is shown in Table 2.1-1.

**Table 2.1-1 Implementation Plan of Mitigation Measures for Environment Impacts**

| Environment Category | Environment Factor | Mitigation Measures | Implementing Unit | Supervision Unit |
|---|---|---|---|---|
| Nature Environment | Atmospheric Environment | Spray water and clean construction sites in time. Measures of shelter, enclosure or sprinkling should be taken in dust-flying areas of construction sites. Granular materials with fine particles piled in construction sites should be sealed or covered. Sprinkling on the surface of material piles accordingly can effectively reduce the dust amount. Use concrete mixed at sites, which is easy to apply sealing measures. The clearance and transport of construction waste should be conducted in airtight containers. Aloft throwing is prohibited. The construction waste should be stored by categories and disposed in time according to relative regulations for urban garbage classification; a certain amount of water should be sprayed before the transport and disposal. Strengthen the management of transport vehicles, and cover tarps over vehicles that will produce dust easily. Consecutive and enclosed fences should be set up around the construction site. | Construction unit of protection stations | Local environmental protection unit |
| | | Choose construction machines and vehicles in good operating conditions. Fuel construction machines and vehicles must be operated in normal conditions to make sure the exhaust emission is within the standard amount. Utilize equipment properly and strengthen the maintenance and repair of equipment. | Construction unit of protection stations | Local environmental protection unit |

| Environment Category | Environment Factor | Mitigation Measures | Implementing Unit | Supervision Unit |
|---|---|---|---|---|
| | Ground Water Environment | Waste water caused by vehicle washing, construction materials washing, concrete curing, and sandstone materials washing in construction sites should be collected together. Mix and dilute the waste water to lower the PH, then lead it into temporary sedimentation tank, the size of which is at the standard where the waste water can stay for at least 12 hours. The processed waste water will be reused for construction sites cleaning, construction materials washing, concrete curing and sandstone materials washing. Strengthen the construction management and strictly control the running, emitting, dripping and leaking of construction machines; manage well the drainage system of temporary soil piles and take soil conservation measures to prevent the soil erosion from affecting the water environment.<br>Each construction unit must implement every treatment measures regarding construction waste water and domestic sewage, and makes sure that the waste water is properly handled; Strengthen the environment conservation education of constructors and improve their environmental awareness. Constructors cannot litter or dump waste and waste water. | Construction unit of protection stations | Local environmental protection unit |
| | Sound Environment | Select advanced and reliable equipment with low noise. The construction time is from 8:00am to 20:00pm. During 12:00am-14:00pm, construction activity is not allowed. Meanwhile, construction at night is forbidden. For these that must be operated continuously at night, it's demanded to show certificates issued by local construction administrative departments, approved by environmental conservation administrative departments, and announce it to nearby residents. Reasonably arrange the construction time and avoid operations of many large noise-making machines at the same construction site and at the same time. Speed up the construction to reduce the noise affecting time. Try to minimize impacts of the construction noise on constructors; Shock-absorbing and vibration-attenuating support shall be done for machines producing loud noise, and wrap up damping materials. | Construction unit of protection stations | Local environmental protection unit |
| | Solid Waste | The clearance and transport of construction waste should be conducted in airtight containers. Aloft throwing is prohibited. The construction waste should be stored by categories and disposed in time according to relative regulations for urban garbage classification. Domestic garbage collected in bags from dustbins in construction sites should be transported to and processed in local domestic garbage landfill. Waste soil can be used to level and backfill convex and concaves in water and soil conservation project, and used as padding material for nearby road subgrade on the other as well. No spoil disposal area will be set. | Construction unit | Local environmental protection unit |

| Environment Category | Environment Factor | Mitigation Measures | Implementing Unit | Supervision Unit |
|---|---|---|---|---|
| Ecological Environment | Wildlife | To improve law enforcement capacity and carry out unremitting anti-poaching measures. | Forestry department of each county and city and nature reserves | Local government |
| | | To strictly control the intensity of prey introduction. | Jilin academy of forestry | Project office in Jilin province |
| | | To scientifically set the timing and number of reintroduced prey and the individual prey introduced need to be quarantined in case that the pathogens and epidemic diseases are brought and transmitted with them. | Jilin Academy of Forestry | Project office in Jilin province |
| | | To protect and improve the habitats of Ungulata, monitor the national key protected animal species like Ungulata, sika deer and Siberian musk deer, and properly take measures, such as supplementary feeding, to guarantee the food sources of reintroduced prey. | Forestry department of each county and city and nature reserves | Provincial project office |
| | Vegetation and biodiversity conservation | We should to carry out environmental education for participants in the project, especially forest tending and plantation workers, raise their awareness and quality, and strictly prohibit hunting, transacting of wild animals and randomly picking wild plants. | Construction unit of plantation and forest tending | Forestry department of each county and city |
| | | Cave-shaped soil preparation can be helpful to reduce disturbance of natural vegetation; to protect the miscellaneous shrubs under the gullies and ridges during soil preparations and plantation, and try to maintain the under forest vegetation and vegetation on forest edge during the operation. | Construction unit of plantation | Dongning county forestry department |
| | | To adopt the mixed plantation method in plantation process. The varieties of trees include spruce, larch, pinus sylvestris, pinus koraiensis, etc. | Construction unit of plantation | Dongning county forestry department |
| | | During the operation process of light-transmitting tending, ecological thinning, pruning and miscellaneous bushes clearing, equipment with low noise should be utilized. Operation hours in the same area should be relatively centralized so as to reduce disturbance brought to surrounding wildlife. | Construction unit of forest tending | Forestry department of each county and city |

| Environment Category | Environment Factor | Mitigation Measures | Implementing Unit | Supervision Unit |
|---|---|---|---|---|
| | Pest Management | During plantation, to select nursery stocks which are resistant to pests, and quarantine seeds and stocks. | Construction unit of plantation | Dongning county forestry department |
| | | To promote integrated pest management and strengthen forest protection, take mixed measures of biological and chemical prevention and control, protect the natural enemies, and control pests through the species balance of the nature. | Construction unit of plantation | Dongning county forestry department |
| | | The project will only recommend use of the WHO Ⅲ and U types of pesticides. Pesticide with high effectiveness, low toxicity and residual should be selected and used. We should improve pesticide efficiency and increase the total amount of pesticide, avoid pesticide abuse and repeated usage of one pesticide in large amount to avoid the pests' resistance to pesticides. | Construction unit of plantation | Dongning county forestry department |
| | | To reasonably arrange the pesticide applying time. To apply pesticides at proper time could improve the efficiency. | Construction unit of plantation | Dongning county forestry department |
| | | To utilize the pesticide according to the regulation, control the pesticide amount and frequency, and do not increase the amount and concentration of pesticide. The project will only recommend use of the WHO Ⅲ and U types of pesticides. | Construction unit of plantation | Dongning county forestry department |
| | | Package material like the package bags, pesticides bottles will be recycled. | Construction unit of plantation | Dongning county forestry department |
| Social Environment | Livelihood | To conduct alternative livelihoods for staffs in the forest farms, i.e., tiger-friendly forest management, and attract the forest farm staffs to actively participant in the protection activities of this project. Provide training on wildlife protection and management and create relevant jobs for forest farm staffs; provide training on forest tending and create relevant jobs for forest farm staffs; provide training on farming and breeding industry and improve the livelihood for forest farm staffs; compensate for the prohibition of deforestation to affected forest farms, and this can be implemented through the natural forest protection project. | Forestry department of each county and city and nature reserves | Provincial project office |

| Environment Category | Environment Factor | Mitigation Measures | Implementing Unit | Supervision Unit |
|---|---|---|---|---|
| | | To encourage and attract residents in the peripheral communities of the project area to participate in nature reserve management, including patrolling, monitoring and other protection activities so as to increase their sources of income and enhance their initiative to involve themselves in the project. The implementation of this project and the introduction of *Notice on Implementing Pilot Work of Completely Stopping Commercial Deforestation* in 2014 would have interactive influences on the resettlement of state-owned forest farm workers in Jilin and Heilongjiang Province. Thus the Resettlement Plan is needed to transform their job from logging to management and protection, and to develop under-forest economy. | Forestry department of each county and city and nature reserves | Provincial project office |
| | | To develop pilot alternative livelihood, train the residents in the peripheral communities of the project area on some professional skills including planting bagged fungus, flue-curing tobacco and beekeeping, thus providing more jobs and sources of income for them, and making them less dependent on grazing and picking. Provide training on wildlife protection and management and create relevant jobs for farmers; provide training on forest tending and create relevant jobs for farmers; provide training on farming and husbandry and improve the livelihood for farmers. | Forestry department of each county and city and nature reserves | Provincial project office |
| | | For households in poverty, to provide training on wildlife protection and management, forest tending, planting and breeding, and create relevant jobs to improve their livelihood. | Forestry department of each county and city and nature reserves | Provincial project office |
| | | Buy sawdust from wood processing units and introduce the new technique of using leaves, corncob and bean straw to grow black fungus, which is adopted by the black fungus association in Mudanjiang City, Heilongjiang Province. We shall compile the Plans for the Development of Ethnic Minorities, mainly to solve the problem of ethnic minorities' relying on sawdust when cultivating agaric in Hunchun City. | Forestry department of each county and city and nature reserves | Provincial project office |

| Environment Category | Environment Factor | Mitigation Measures | Implementing Unit | Supervision Unit |
|---|---|---|---|---|
| | | Trace and monitor the units that sell hunting tools like sticky nets and traps and as well as their sales status and co-manage the reserve with the nearby communities and employ the residents to clear away the hunting tools. Establish a mechanism to co-manage the peripheral communities and the reserves, and set up a benefit-sharing mechanism of the nearby communities and villagers based on the co-management mechanism. Some peasants would still collect forest products in state-owned forest farms and the experimental areas of the reserves. They will be allowed to still collect forest products in the experimental areas of the reserves after the project is implemented. Establish a pressure mechanism for the nearby communities, to give financial incentives to communities with less hunting tools. Encourage experienced hunters to participate in reserve protection, to transform their job from hunting to protecting. | Forestry department of each county and city and nature reserves | Provincial project office |
| | Human and livestock safety assurance | To strengthen security publicizing, and install protective fences, etc. | Forestry department of each county and city and nature reserves | Provincial project office |
| | | To develop pilot dry-lot feeding and captive breeding to advocate and guide residents in the peripheral communities of the project area to raise livestock in pens, and gradually replace their traditional mode of production by raising free-range livestock. | Forestry department of each county and city and nature reserves | Provincial project office |
| | | Active efforts should be made to facilitate the issue of related regulations and policies in Heilongjiang Province by reference to Jilin Province. Besides, it is necessary to develop pilot projects to compensate for damages caused by wildlife, establish a mechanism for appealing against the wildlife accidents, and found an appeal committee of the wildlife-caused accidents to properly solve the problems in compensating for the damages that wildlife like boars cause to human and livestock. Laws about compensating for animal-caused loss shell be started; and a special fund for compensation shall be set. The State Forestry Administration will include Heilongjiang Province into the special support program of compensation for animal-caused accidents. Set warning signs at places where tigers and leopards regularly appear; warn the risks of under-forest activities to villagers. | Provincial project office | Project office of the central government |

| Environment Category | Environment Factor | Mitigation Measures | Implementing Unit | Supervision Unit |
|---|---|---|---|---|
| Environmental protection units and staff training | | Training for managerial staffs of nature reserves and the government staffs. | Provincial project office | Project office of the central government |
| | | Training for staffs of protection stations. | Forestry department of each county and city and nature reserves | Provincial project office |

# 3 Environmental Management and Supervision

## 3.1 Environmental Management Institutions

The Environmental Management Plan (EMP) aims to formulate a series of technologically practicable, financially sustainable and operable environmental countermeasures, to specify the responsibilities and duties of environment management of each project participant, the planned environmental mitigation measures, environmental management and institution construction arrangement, and the expenditure of environmental management, so as to eliminate or compensate for the negative effects of the project on the society and the environment and to lower the negative effects to an acceptable level.

Environmental management institutions related to this project mainly include provincial project offices, forestry department of each city and county and each reserve.

(1) Provincial project offices.

Provincial project offices include the Executive Office of Siberian Tiger Habitat Protection Project in Jilin Province, the Executive Office of Siberian Tiger Habitat Protection Project in Heilongjiang Province and the Executive Office of Siberian Tiger Protection Project of the General Bureau of Heilongjiang Forest Industry. They are responsible for supervising and checking the implementation of mitigation measures and monitoring tasks; compiling and handing in monitoring reports.

(2) Forestry department of each city and county and each reserve.

Forestry department of each city and county and each reserve include Wangqing Forestry Bureau, Hunchun Forestry Bureau, Wangqing County Forestry Bureau, Hunchun City Forestry Bureau, Tianqiaoling Forestry Bureau, Wangqing Siberian Tiger Nature Reserve, Hunchun Siberian Tiger Nature Reserve, Dongning Countty Forestry Bureau, Suiyang Forestry Bureau, Muling Forestry Bureau, Heilongjiang Laoyeling Siberian Tiger Nature Reserve and Heilongjiang Muling Northeast Taxus Chinensis Nature Reserve. Responsibilities of these forestry bureaus and relevant reserves are: to implement and supervise the mitigation measures and monitoring tasks; to report the problems, reasons, and countermeasures in time; and to compile and hand in monitoring reports.

## 3.2 Environmental Supervision

Supervision work of environmental protection will be conducted during the implementation of this project. See Table 3.2-1 for details of environmental supervision plan at each stage:

**Table 3.2-1 Environmental Supervision Plan**

| Stage | Agency | Monitoring Items | Monitoring Requirements |
|---|---|---|---|
| Construction stage | Provincial project offices | Verify the documents of environmental mitigation measures and monitoring plans of each forestry department and county and each nature reserve. | Ensure the documents of environmental mitigation measures and monitoring plans conform to the requirements of environmental impact assessment report and national laws and regulations. |
| | Forestry department of each city and county and each nature reserve. | Supervise the implementation of environmental mitigation measures and monitoring tasks. | Ensure the implementation of environmental mitigation measures and monitoring plans conform to the requirements of the documents of environmental mitigation |

| Stage | Agency | Monitoring Items | Monitoring Requirements |
|---|---|---|---|
| | | | measures and monitoring plans. |
| Operation stage | Provincial project offices | Verify the environmental monitoring plan | Ensure the environmental monitoring reports meet the requirements of the documents of environmental mitigation measures and monitoring plans. |
| | Forestry department of each city and county and each nature reserve. | Check the effects of environmental mitigation measures. | Find problems in time and put forward improvement measures and recommendations. |

## 3.3 Environmental Impact Assessment Management

This project is an environmental and ecological protection project in nature. Its main tasks are technical assistance and capacity cultivating. Constructions involved in this project are small in scale and quantity. This EIA shall conduct classification management of environmental impacts in accordance with domestic standards of China. According to corresponding scientific researches and design, as well as the content and scale of construction projects, corresponding reports or registration forms shall be completed before each sub-project is implemented. The need of report shall depend on the scale and content of the construction project. Reports or registration forms shall be compiled according to the requirements of domestic EIA. Measures proposed in the report should be carried out strictly to minimize the impacts of the sub-projects on the environment.

(1) Forestry protection projects: reports can be filed to propose corresponding complementary mitigation measures of biodiversity conservation and social environment impacts based on the scale and impact scope of each construction in the implementation plan.

(2) Nature reserve protection projects: departments in charge of nature reserves shall offer review opinions on projects within the reserve or on peripheral areas of the reserve.

(3) Tiger-friendly forest management projects: make clear the detailed workflow arrangement of project implementation, measures to reduce impacts of the project on environment and society, to coordinate related areas and reduce tiger-human conflicts.

(4) The Environmental Impact Registration Form can be filed and verified by related administrative authority as for other projects of small scale, such as the construction of single monitoring room and patrol management rooms, the installing of small and medium monitoring equipment, and the allocation of facilities and equipment used in scientific research and monitoring.

# 4 Environmental Monitoring

## 4.1 Monitoring Targets

Environmental monitoring is an important basic work of environmental protection and management. It provides scientific bases for the prevention of environment pollution and ecology destruction. The director in charge of environmental protection shall coordinate with local departments (environmental monitoring stations, forestry bureaus, agricultural bureaus, etc.) and fully utilize current institutions, technology and equipment to form an integrated monitoring system of engineering environment. All departments shall undertake the task of environmental monitoring.

Three types of monitoring shall be considered in the Landscape Approach to Wildlife Conservation in Northeast China Project:

(1) Monitoring of the implementation, i.e., to check if the implementation progress of the project is in accordance with the determined bases;

(2) Monitoring of the consistency, i.e., to compare the implementation of the project with determined environmental standards, regulations, permissive conditions, and commitments made in the project plan;

(3) Monitoring of the validity, i.e., to specify the connection between the impacts of the project on the environment and its long-term objectives. The main objectives of this plan are: to ensure that all mitigation measures in the EIA are implemented; to evaluate the monitored data and estimate whether the anti-pollution measures work; to ensure the sustainable utilization of natural resources.

## 4.2 Monitoring Content

The monitoring area includes the project area and communities and villages nearby. The monitoring contents are determined through the analysis of project layout and its environmental and ecological impacts. The monitoring in this project includes monitoring of the Siberian tiger and its prey, monitoring of pests and diseases and quarantine inspection of reintroduced prey.

**1. Monitoring of the Siberian tiger and its prey.**

(1) Monitoring contents.

To investigate animal entities (including animal species, quantity, etc.), footprints (including the amount of individuals, moving direction, etc.), and record the geographical coordinates, vegetation types, canopy density, altitude, slope position, slope aspect and depth of snow, etc.

(2) Monitoring methods.

Based on the existing monitoring methods and technology, one separate investigation and monitoring area of 10km$^2$ (5km long and 2km wide) shall be set in each county or city. When investigating, we shall start from one side of the investigation and monitoring area, select one transect line every other 500m within the width of 2km, and select 5 transect lines in total.

Research tools include stock map, satellite imagery, investigation form, GPS, camera, video camera, telescope, intercom, protective equipment, etc.

(3) Monitoring frequency.

Monitoring will be carried out one time in each winter from 2015 to 2018.

(4) Monitoring institutions.

Each forestry department and nature reserve in the project area.

(5) Supervising institutions.

The Research Center of Felidae and provincial project offices.

**2. Monitoring of pests and diseases.**

(1) Monitoring contents

Types of pests, number of plants damaged by pests (rate), average pest intensity of single plant, injury of stand, etc.

(2) Monitoring sites

Each pest monitoring site will be set up in the 3 project regions involved in this project. The monitoring area of each monitoring site is 1 hectare. See the Table 4.2-1 for general information of the monitoring sites.

**Table 4.2-1. Table of Pest Monitoring Sites**

| No. | County /City | Forestry farm | Forest compartment | Sub-compartment | Area of the sub-compartment | Tree variety | Age group |
|---|---|---|---|---|---|---|---|
| 1 | Wangqing County | Dahuanggou | 3 | 1-21 | 256 | Korean pine | Young forest |
| 5 | Dongning County | Tuanjie | 3 | 14 | 17 | Larch | Middle-aged forest |
| 8 | Muling City | Shuangning | 2 | 8 | 71 | White birch | Young forest |

Setting up sample monitoring sites and standard trees: to set up fixed sample monitoring areas in woodland with flat slopes, convenient transportation conditions, representative site conditions and stand types; to determine 20 to 30 standard trees through appropriate mechanical sampling on each fixed sample monitoring area according to the site types, and mark them as fixed standard monitoring trees.

Annual pest investigation of the fixed standard trees in sample monitoring areas shall be carried out regularly. Pest types and the amount of infected plants shall be recorded. Field monitoring and identification of diseases and pests shall be carried out in accordance with technical requirements and procedures.

Means of transportation and communication include special vehicles and motor vehicles used for forest quarantine, microcomputers, fax machines and direct-dial telephones. Equipment include microscopes, anatomical lens, cameras, constant temperature and humidity boxes, autoclaves, Temperature and humidity recording devices, balances, breeding cage, moth-killing lamp, refrigerator, drying oven, soft X-ray machine and mobile pesticide appliances.

(3) Monitoring frequency.

Monitoring will be carried out one time in each winter from 2015 to 2018.

(4) Monitoring institutions.

Each forestry department and nature reserve in the project area.

(5) Supervising institutions.

Provincial stations of forest pest management and quarantine, and provincial project offices.

**3. Quarantine inspection of reintroduced animals**

(1) Contents of quarantine inspection

Infectious disease pathogens, parasites and health condition of reintroduced prey.

(2) Methods of quarantine inspection

Methods of quarantine inspection include isolated observation and diagnosis in laboratory. Quarantine inspection includes inspection in export place before the animals are transported and inspection in import place. Meanwhile, individual ID chip is needed to implant. Usually the chip can be implanted behind the left ear. And the ear card need to be reserved. A basic record of reintroduced deer need to be set up for individual recognition among the population, which includes type, gender, ear card number, chip number. Different colors of ear cards can be selected according to the

year of reintroduction.

Problems can be found and solved in time through quarantine inspection, and loss caused by potential disease spreading and death can be avoided during the long-distance transport. Due to the long-distance transport and pressure of new environment, some potential disease may appear after the animals are transported to the destination. Thus the isolated breeding and quarantine are necessary for the reintroduced animals. They can be released only when it's ensured that they have no disease.

Quarantine inspection in export place are operated when the local population provider draws up the transport license of wild animals. The animals are needed to be isolated and bred for 1 month, and sampling quarantined is needed before release. Population physiological and biochemical indexes should be in normal condition on the quarantine results. Besides, it should be guaranteed that no tuberculosis, abortus fever, or foot-and-mouth disease are affected; no abnormal Intestinal parasites are found before these animals are released to the wild.

(3) Frequency of quarantine inspection

Quarantine inspection should be conducted once in export place and once before the animals are released.

(4) Institution in charge of quarantine inspection

Jilin Forestry Academy

(5) Supervisory institition

The project executive office of Jilin Province.

**Table 4.2-2. Table of Monitoring Items Information (unit: 10,000 USD)**

| Monitoring items | Monitoring contents | Monitoring methods | Monitoring frequency | Monitoring institutions | M |
|---|---|---|---|---|---|
| Monitoring of the Siberian tiger and its prey | Animal entities (including animal species, quantity, etc.), footprints (including the amount of individuals, moving direction, etc.) | Each forestry department and nature reserve shall set up investigation and monitoring area respectively, and adopt line transect method. | one time in each winter from 2015 to 2018 | Each forestry department and nature reserve in the project area | |
| Monitoring of pests and diseases | Types of pests, number of plants damaged by pests (rate), average pest intensity of single plant, injury of stand, etc. | Setting up monitoring sites, sample monitoring sites and standard trees | one time in each winter from 2015 to 2018 | Each forestry department and nature reserve in the project area | |
| Quarantine inspection of reintroduced animals | Infectious disease pathogens, parasites and health condition of reintroduced animals | Isolated observation and diagnosis in laboratory | once in export place, once before the animals are released | Jilin Forestry Academy | |

## 4.3 Monitoring Expenditure

Based on preliminary estimates, the total expense of monitoring in this project is 1,158,800 US dollars. Detailed information about the fund sources and usage plan is shown in the following table

**4.3-1 Table of Monitoring Projects**

| Monitoring Items | Monitoring Fund | Sources of Monitoring Fund | | | | | Use Plan | |
|---|---|---|---|---|---|---|---|---|
| | | The GEF | The WWF | Jilin Forestry Department | Heilongjiang Forestry Department | The General Bureau of Heilongjiang Forest Industry | 2015 | 2 |
| In total | 115.88 | 50.15 | 43.21 | 17.32 | 1.60 | 3.60 | 34.72 | |
| Monitoring of the Siberian Tiger and its prey | 110.76 | 50.15 | 43.21 | 15.40 | 0 | 2.00 | 33.20 | |
| Monitoring of Pest and Diseases | 4.80 | 0 | 0 | 1.60 | 1.60 | 1.60 | 1.20 | |
| Quarantine inspection of reintroduced animals | 0.32 | 0 | 0 | 0.32 | 0 | 0 | 0.32 | |

# 5 Staff Training

## 5.1 Training Objectives

The purpose of the training on environmental monitoring is to improve the abilities of the officials in charge of implementing environmental management and monitoring plans, to ensure they can successfully implement the mitigation and monitoring plans determined in the Environmental Impact Assessment during project implementation and operation periods. Relevant staffs in the forest farms and the reserves also need to attend the training.

To ensure the successful completion of training courses, the staffs in charge of supervising environmental protection and these who attend the training courses shall get a high school diploma at least. And it is preferred if their majors or jobs are related to forestry or animal protection (for example, Forestry Management, Zoology, Environmental Ecology, Botany, etc.).

This project combines project implementation and professional training, that is to say, during the implementation of the project, technology promotion and professional training are arranged. First, through combined methods of classes and on-site instructions, training will be given to forestry technicians and administrators from relevant departments of each city, county and town to improve their quality and operating skills. Second, international and domestic investigations and training will be will arranged to learn advanced management modes and techniques especially from related animal protection units of Russia where most Siberian tiger inhabit. Abilities and experience of staffs involved in the project will be further enhanced. Third, we will consult and learn techniques from domestic and foreign experts, and arrange relevant staffs to go to Russia for investigation to reinforce capacity building at the same time.

## 5.2 Training Contents

The Jilin Forestry Department, the Heilongjiang Forestry Department and the General Bureau of Heilongjiang Forest Industry shall make overall training arrangement based on their own needs. According to the training content and objects, the training includes basic staff training, domestic reserves training, international training, etc. International exchange and relevant surveys and investigation at home and abroad will be arranged. Each unit will organize four or five terms of training in turn. In each term 20 to 30 people will attend to the training. The contents include the training on protection and management for protection station staffs and relevant leadership. Reports of training on protection and management team of reserves and local governments will be finished as well.

Under the leadership of each project office, the environmental training courses includes:

(1) Understanding and application of the laws, regulations, standards and specifications of the World Bank and the Chinese government;

(2) The environmental management standard applied by the World Bank;

(3) Techniques of environmental protection and environmental monitoring, including:

1. Basic knowledge of environmental monitoring;

2. Basic methods of sampling and handling determined in the Environmental Management and Monitoring Plan (EMP);

3. Prevention and control techniques of pests and the principle of Integrated Pest Management (IPM);

4. Compiling Environmental Monitoring Report.

See Table 5.3-1 for detailed training plan of environmental protection.

**Table 5.3-1 Table of Training Plan**

| Level | Training content | Sponsor | Training object | Training method | Training material |
|---|---|---|---|---|---|
| Province-level | ①Understanding and application of the laws, regulations, standards and specifications regarding environment of the World Bank and the Chinese government; | Provincial project office | Managerial persons of each nature reserve and government staffs | Training class | Regulations of Environmental Management and Environmental Protection , the Environmental Management and Monitoring Plan, the Pest Management Plan, Manual/Guidance of Environmental Impact |
| | ②Regulations of environmental management and environmental protection, including environmental impact of the project, regulations of environmental protection and implementation of and supervision on environmental management; | | | | |
| | ③The principle, plan and implementation of the Integrated Pest Management (IPM); | | | | |
| | ④The plan and implementation of environmental monitoring, including selecting and setting up of environmental monitoring sites, field monitoring of environmental factors, method of analysis and report of monitoring results. | | | | |
| County-level | ①Basic knowledge of environmental monitoring, and basic understanding of dynamic of forest resources, vegetation types and the ecosystem; | Forestry bureaus of each county and city | Staffs of protection stations | Training classes, training courses and on-site instruction | |
| | ②Monitoring techniques/methods of biodiversity; | | | | |
| | ③Pests' identification, life history and biological characteristics; | | | | |
| | ④Techniques of controlling pests and relevant knowledge. | | | | |

## 5.3 Training Expense

Based on preliminary estimates, the total expense of staffing training in this project is 569,000 US dollars. The detailed information is shown in the following table.

**Table 5.3-1 Table of Training Expense (unit: 10,000 US dollars)**

| Training Items | Training cost | Sources of Training cost | | | | | Use Plan of Training cost | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | The GEF | The WWF | Jilin Forestry Department | Heilongjiang Forestry Department | The General Bureau of Heilongjiang Forest Industry | 2015 | 2016 | 2017 | 2018 |
| In total | 56.90 | 27.15 | 23.05 | 2.70 | 0 | 4.00 | 12.96 | 16.16 | 16.40 | 11.38 |
| Training for Managerial Staffs of Nature Reserves and Government Staffs | 35.27 | 11.52 | 19.05 | 2.70 | 0 | 2.00 | 7.00 | 10.34 | 11.15 | 6.78 |
| Training for Protection Stations Staffs | 21.63 | 15.63 | 4.00 | 0 | 0 | 2.00 | 5.96 | 5.82 | 5.25 | 4.60 |

# 6 Estimate of Environmental Protection Investment

As an ecological and environmental protection project, this project's relevant contents can be integrated into the environmental protection investment of the whole project. The budget of environmental protection activities during the implementation of the project consists of the environmental protection budget of the Jilin Forestry Department, the Heilongjiang Forestry Department and the General Bureau of Heilongjiang Forest Industry. The budget of the environmental protection investment of the Jilin Forestry Department is 1,409,000 US dollars. As for Heilongjiang Forestry Department, it is 669,000 US dollars. And for the General Bureau of Heilongjiang Forest Industry, it is 696,000 US dollars. The total investment of this project on environmental protection is 2,774,000 US dollars. Detailed information is shown in Table 6.1-1.

Based on the actual conditions in each project area, this budget of the environmental protection investment is made in accordance with relevant regulations in the *Announcement on the Release of Administrative Charge Items and Charge Standards of Environmental Protection System* issued by the State Administration for Commodity Prices and the National Finance Ministry, and relevant regulations in the charge standard of professional service concerning environmental monitoring issued by the price bureaus and finance bureaus of Jilin Province and of Heilongjiang Province. The expenditure of experimental materials and equipment is counted in.

**Table 6.1-1 Estimate of Environmental Protection Investment（Unit：10,000 USD）**

| Agency | Project evaluation | Office management | Equipment purchase | Environmental monitoring | Staff training | Total |
|---|---|---|---|---|---|---|
| Jilin Forestry Department | 4.8 | 16 | 12 | 90.4 | 17.7 | 140.9 |
| Heilongjiang Forestry Department | 2.3 | 16.5 | 7 | 13.6 | 27.5 | 66.9 |
| The General Bureau of Heilongjiang Forest Industry | 2 | 18 | 26 | 11.9 | 11.7 | 69.6 |
| In Total | 9.1 | 50.5 | 45 | 115.9 | 56.9 | 277.4 |

# 7 Social Management Plan

## 7.1 Mitigation Plan for Social Impacts

1. To mitigate impacts on forest farm staffs

Due to the reserve construction, forest farm staff will face job alteration. The mitigation measures include:

--to provide training on wildlife protection and management and create relevant jobs for forest farm staffs;

--to provide training on forest tending and create relevant jobs for forest farm staffs;

--to provide training on farming and breeding industry and improve the livelihood for forest farm staffs;

--to compensate for the prohibition of deforestation to affected forest farms, and this can be implemented through the natural forest protection project.

2. To mitigate impacts on farmers in surrounding regions

The project will have impacts on farmers in terms of resources in state-owned forest farms. The mitigation measures include:

--to provide training on wildlife protection and management and create relevant jobs for farmers;

--to provide training on forest tending and create relevant jobs for farmers;

--to provide training on farming and husbandry and improve the livelihood for farmers;

3. To mitigate impacts on poverty-stricken families

Poverty-stricken families in the project area include forest farm staffs and farmers in surrounding regions. The mitigation measures include:

--to provide training on wildlife protection and management and create relevant jobs;

--to provide training on forest tending and create relevant jobs;

--to provide training on farming and husbandry and improve their livelihood.

## 7.2 Risk Mitigation Plan

1. Mitigation measures for wildlife accidents risks

The perfection and expansion of reserves will inevitably increase wildlife accident risks. Jilin Province has promulgated the *Compensation Methods for the Personal Injury and Property Damage Caused by Specially Protected Terrestrial Wildlife in Jilin Province* and the *Implementation Regulations of Compensation Methods for the Personal Injury and Property Damage Caused by Specially Protected Terrestrial Wildlife in Jilin Province*. However, there is still no official measures of such case in Heilongjiang Province. Mitigation measures of wildlife accident risks include:

--to advance legislation on wildlife-caused loss;

--to establish special fund of wildlife accidents in counties and cities involved in the project; the State Forestry Administration will include Heilongjiang Province into the special support program of compensation for animal-caused accidents.

--to recommend that Heilongjiang Province establish mechanisms of recognition compensation for wildlife accidents with reference to these of Jilin Province;

--to set warning signs at places where tigers and leopards regularly appear; warn the risks of under-forest activities to villagers.

2. Mitigation measures for forestry resources utilization conflicts

Mitigation measures to prevent farmers of the surrounding regions from entering the reserves and gathering forest products include:

--to establish a mechanism to co-manage the peripheral communities and the reserves, and set up a benefit-sharing mechanism of the nearby communities and villagers based on the co-management mechanism. Some peasants would still collect forest products in state-owned forest farms and the experimental areas of the reserves. They will be allowed to still collect forest products in the experimental areas of the reserves after the project is implemented.

--to provide training on farming and breeding techniques in surrounding communities, and reduce their dependence on the reserves by improving their income.

3. Mitigation measures for Poaching

Mitigation measures for adverse impacts of poaching include:

--to trace and monitor shops that sell hunting tools like sticky nets and traps and as well as their sales status;

--to co-manage the reserve with the nearby communities and employ residents in nearby communities to clear away the hunting tools;

--to establish a pressure mechanism for the nearby communities, to give financial incentives to communities with less hunting tools;

--to encourage experienced hunters to participate in reserve protection, to transform their job from hunting to protecting;

--to provide them with relevant training on understory planting techniques.

4. Mitigation measures for material shortage risks of fungus planting

Though the material shortage of fungus planting is due to adjustment of national and provincial forestry policies, mitigation measures are also put forward in this project:

--to provide training on mushroom and herb planting for local farmers;

--to encourage farmers of surrounding communities to participate in reserve construction and management.

5. Mitigation measures for environmental impacts

Main measures of environmental impact include:

--For exhaust gas, noise, dust, polluted water, sludge, and impacts on water and soil conservation and traffic, the construction unit shall decrease the adverse impacts of the project construction on residents of surrounding regions and wildlife on the base of designing requirements and abovementioned risk aversion measures.

--In the implementation period, environmental laws, regulations and industrial technical standards shall be strictly conducted. Household waste in the reserve area shall be reasonably disposed to decrease the adverse environmental impacts.

6. Mitigation measures for impacts on ethnic minorities

We shall compile the *Ethnic Minority Development Plan*, mainly to solve the problem of ethnic minorities' relying on sawdust when cultivating agaric in Hunchun City.

7. Mitigation measures for involuntary resettlement

The implementation of this project and the introduction of *Notice on Implementing Pilot Work of Completely Stopping Commercial Deforestation* in 2014

would have interactive influences on the resettlement of state-owned forest farm workers in Jilin and Heilongjiang Province. Thus the Resettlement Plan is needed to transform their job from logging to management and protection, and to develop under-forest economy.

## 7.3 Benefit Strengthening Plan

The positive impacts of this project include the environmental, economic and social benefits. By related social management measures, the positive impacts shall be enlarged and the objectives of the project could be better achieved.

**1. Environmental Management System Construction**

In this project, we shall improve the ecological environment and carry out forest management which is friendly to the Siberian tiger and its prey. This will promote the protection and restoration of wildlife resources in Northeast China. Meantime, this project involves some engineering construction, including maintenance and construction of protection stations, tiger-friendly forest management (afforestation, forest tending and livelihood alteration), construction or expansion of Nature Reserves and supplementary feeding stations. All these will have some positive impacts on local community, ecological environment and wildlife species, and meet the requirement of protecting the ecological environment in the project area.

Environmental management system construction include: to strengthen legal norms of Nature Reserves; to update protection and restoration plans of Jilin province; to draw up protection and restoration plans in forest regions of the General Bureau of Heilongjiang Forest Industry; to set up the Siberian tiger regional conservation consultative committee; to establish China-Russia trans-boundary conservation coordination mechanism; to legislate/update rules/plans of each Nature Reserve; to expand the two existing reserves; to specify the legal status and implementation arrangements; to set up supplementary feeding stations, release domesticated wild boar into nature and increase prey population; to conduct publicity through television, broadcast, journal, slogan, leaflet and improve people's awareness of the Siberian tiger protection, etc.

**2. Measures to Improve Social Benefits**

The project will promote economic development and social stability in peripheral regions. It has obvious social benefits.

To enhance the social benefits, the following measures are put forward in this report:

- Farmers and laid-off workers should be allowed to set up mobile stalls to sell forest specialties and fruits, on the condition that they do not affect normal defensive functions of wildlife protection in Nature Reserves. Meanwhile, management of these mobile stalls should also be standardized and strengthened.

-Contracts can be signed with schools to build teaching and research centers, which can be used to popularize science knowledge and publicity education among students. Meanwhile, they can improve the social influences of these Nature Reserves.

3. Measures to Improve Economic Benefits

The environmental and social benefits of this project, though cannot be measured directly by economic indicators, could generate great economic values from indirect benefits which are immeasurable and much more than the direct economic benefits.

--After the eco-tourism is developed, periphery area outside of the nature reserves can be used as ecological landscape for visiting. A co-management mechanism can be established to promote tourism and stimulate development in other

industries.

--Develop the livelihood methods of nearby community and the protection of nature reserves by means of co-management. For example, to connect the under-forest products collecting and pasturing with the patrolling and management of nature reserves; give full play to nearby peasants' monitoring and protection towards the nature reserves (such as clearing hunting tools). This will not only decrease the workflow of reserves in terms of monitoring and protection, but also guarantee the income of households that live on forestry products collecting. It's recommended to conduct tests at 2-3 communities and reserves.

--Besides, the training on panting north medicine in forest farms can include nearby peasants. Scale merit can be obtained through develop agricultural orders and fully utilize the local resources.

## 7.4 Participation, Appeal and Complaint Mechanisms for Forest Farm Staffs and Rural Households in Peripheral Areas

During the planning, design, preparation, implementation, monitoring and assessment of the project, it will be favorable to select proper stakeholders to participate in the program, mainly including the participation and appeal mechanisms. The participation mechanism includes participation goals, means, conditions and contents, and participating institutions, personnel, time, place and budget as well. The appeal and complaint mechanism means that stakeholders can complain or appeal to concerned institutions if they still have not got satisfactory solutions after their participation.

**1. Means to Collect Discontents and Complaints**

(1) To collect and analyze problems existing in complaints of the masses, progress and measures of the work through the reports of the project office.

(2) Coordination problems found in the on-site investigation of construction sites of owner units.

(3) Relevant information reflected by external inspection institutions.

(4) Letters and visits from affected people.

(5) Reflections from agencies of the project executive units.

**2. Procedures of Appeal and Complaint**

Forest farm works and rural households in peripheral areas are always encouraged to participate in the project. But more or less, problems will still arise in practice. In addition to the ongoing petition and compliant channels at all levels of forestry departments, the project also establishes transparent and effective channels and mechanisms of appeal for affected people to ensure timely and effective resolving of these problems and smooth progress of the project.

**3. Principles to Handle Appeals and Complaints**

Complaints from the masses must be investigated through field researches, their opinions must be heard and consulted patiently. Objective and justified counter-measures must be put forward in the light of principles and standards stipulated in national regulations or the project. As for complaints which they are not able to solve, the concerned units must report to upper-level departments and assist the upper-level departments to complete the investigation.

If decision-making institutions at the former stage do not reply to the appeal before the specified date, the declarant has right to continue the appeal.

**4. Contents and Means to Reply to Appeals**

(1). Contents of the reply

- Brief introduction of the complainer' discontents;

- Investigation results;
- Relevant national regulations, principles and standards of the project implementation;
- Counter-measures and specific base.

(2). Means of reply

- For particular individual complaints, replies in written materials can be directly sent to complainers.
- For frequently reflected complaints, staff meetings or village committee can be hold and documents can be sent to notify the concerned forest farms or communities.

Whichever means of reply is adopted, the reply materials must be sent to forest farms or communities to which the complainers belong.

**5. Records and tracking feedbacks of appeals and complaints**

In the design and implementation period of the project, the monitoring team should cooperate with respective department in the registration and management of the complaint materials and the handling results, and regularly report to the project management office by means of written materials. The project management office will regularly check the handling and registration of the complaints.

To completely record the complaints handling situation and relevant problems of affected people, the project management office has worked out related registration chart as follows.

**Table7.4-1 Registration Chart for Complaints and Appeals of Landscape Approach to Wildlife Conservation in Northeast China Project**

| | | | | | |
|---|---|---|---|---|---|
| Complaint Receiving Unit | | Date | | Place | |
| Name of the Complainer | Contents of the Complain | Required Solution | | Proposed Solution | Actual Situation of Handling |
| | | | | | |
| Signature of the Complainer | | | | Signature of the Recorder | |
| Note:<br>1. The recorder should correctly put down the contents and requirements of the complainer.<br>2. Any disturbance and obstacle should be avoided in the process of the appeal.<br>3. The proposed means of solution should be communicated to the complainer within specified time. | | | | | |

In addition, channels relevant to appeals and complaints will be publicly released to affected groups, and will be sent to each affected forest farms and community in the form of publicity materials before the implementation of this project.

See the *Social Impact Assessment Report* for detailed information.

# 8 Other Items

## 8.1 Information Exchange

A project database system to collect and collate the information regarding the forest growth, climatic variation and hydrology dynamic status will be established. Meanwhile, information about monitored tigers and other rare wild animals and significant dynamic information of ecological environment change shall be collected, collated and analyzed through a uniform database and develop into a uniform network system.

## 8.2 Record

Each project implementing unit shall make and release a proposed plan according to the overall plan of the project. Undertaking units at each level shall prepare for the key work according to the proposed plan and then release the official plan. Detailed regulations of environmental protection shall be enacted and environmental protection groups at corresponding levels shall be formed. Environmental impact monitoring sites regarding to air index, hydrology dynamic, soil fertility and pests shall be set up to record the environment index in key areas of the whole project.

## 8.3 Report

The *Environmental Monitoring Plan* of this project shall be implemented under the supervision of provincial environmental protection authorities and local environmental protection authorities in the project area. The project shall be monitored through close cooperation and clear division of labor between environmental monitoring stations and environmental protection bureaus of each province, city and county. When each monitoring task is finished, the monitoring station shall submit a monitoring report in which the monitoring data should reflect the comment on the implementation of environmental protection measures. The report shall be analyzed for recommendations on corresponding environmental protection measures and then be submitted to provincial project offices and superior environmental protection administrative departments. After the provincial project offices and competent departments get the monitoring report, they shall propose improvement measures regarding the problems reflected in the report. During the implementation of the project, each provincial project office shall submit the annual report of environmental management and monitoring to the World Bank.

# Attachment 1. Pest Management Plan

**Content**

According to requirements of *Regulations on Forest Pest Control* issued by the State Council on December 18, 1989 and the World Bank's operation policy "Pest Management"(4.09), the project prepares a special report on "Pest Management Plan" so as to promote application of the biological method in controlling pests and diseases and reduce reliance on chemical synthetic reagents as well as reduce risks of diseases and pests, thus ensuring that environmental pollution caused by chemical pesticides can be diminished as much as possible while pests and diseases can be effectively prevented and controlled. In this article, pests and diseases refer to injurious pests, mites, plant nematodes and diseases. This plan puts forward some methods to prevent and control major possible diseases and pests in this project, recommendatory pesticides, organization and implementation systems, training, monitoring and evaluation, etc. according to the disease and pest prevention and control policy of "Prevention-centered, Scientific control, Legal treatment, Promotion of health".

# 1. Overview of Disease and Pest Management

## 1.1 Disease and Pest Management of World Health Organization

IPM is a kind of disease and pest control strategy modified in 1972 from Integrated Pest Control (IPC) put forward by Food and Agriculture Organization of the United Nations in 1966. IPM is a branch of science related to diseases and pests, which emphasizes that natural control comes first while other prevention and control methods coordinate with it organically. Based on different biological characteristics and habits of diseases and pests, IPM places emphasis on monitoring firstly and considers adopting quarantine method, forest management method, physical, mechanical and biological methods to prevent and control diseases and pests. Only when the above methods are invalid can chemical methods be adopted to prevent and control diseases and pests by using chemical pesticides with high efficiency and low toxicity.

The grading standard of pesticide hazards recommended by World Health Organization (WHO) was passed by the 28$^{th}$ Legislation Meeting of WHO in 1975. In order to meet the requirements of new situations for environment, the WHO revised the grading standard of pesticide hazards in 2009 (Table 3). Classification of pesticides' toxicity is primarily based on acute oral and dermal toxicity, which has become a standard method for classification of toxicity in toxicology.

The grading standard of pesticide hazards recommended by the WHO is specifically shown in the table below.

**Table 1.1-1 WHO's Grading Standard of Pesticide Hazards (2009)**

| Grade | Symbolic meaning of each grade | The oral median lethal dose（mg/kg) | The dermal median lethal dose（mg/kg) |
|---|---|---|---|
| Ia | Extreme toxicity | <5 | <50 |
| Ib | High toxicity | 5-50 | 50-200 |
| II | Middling toxicity | 50-2000 | 200-2000 |
| III | Low toxicity | >2000 | >2000 |
| U | No toxicity | ≥5000 | ≥5000 |

## 1.2 Disease and Pest Management of China

In order to reinforce control and quarantine of diseases and pests, the Chinese government published a series of laws and regulations, including *Forest Law*, *Regulations on Forest Pest Control*, *Regulations on Plant Quarantine*, *Technical Specifications of Forest Plant Quarantine*, *Control on Diseases and Pests of Forest*

*Plant, Management Measures on Objectives of Forest Pest Control, Standards for Safe Application of Pesticides and Regulations on Pesticides Management,* etc.

The Chinese government attaches much importance to prevention and control of diseases and pests, focus on adopting the prevention and control policy of "Prevention-centered, Scientific control, Legal treatment, Promotion of health" and in the future a method which mainly focuses on biological control and prevention will gradually be employed. The policy of the Chinese government is aimed at controlling the density of diseases and pests (namely, damage degree) at a low level, improving the forestry quality and promoting the sustainable utilization of forestry resources. In other word, the government's purpose is to protect forestry resources and ecological environment. When serious diseases and pests happens and cannot be effectively prevented and controlled by means of other methods, application of chemical pesticides is a necessary method to prevent and control them by using pollution-free chemical pesticides with high efficiency and low toxicity.

Prevention and control of forest diseases and pests observes the principle of "The person who runs forests shall take charge of prevention and control". It is owners of forests who shall be responsible for prevention and control of diseases and pests of commercial forests. Meanwhile, forest disease and pest prevention and control institutions can provide supervision and technical guidance for them. Disease and pest prevention and control of non-commercial ecological forests shall be in the charge of local governments, but specific procedures should be organized and implemented by Forest Disease and Pest Control and Quarantine Station. China formulates subsidy policy for crucial forest disease and pest control as well as provides national central forecasting sites with subsidies for the operating cost.

The Chinese government formulates the following specific regulations on application of pesticides:

- Which pesticides are suitable for disease and pest prevention and control;
- Which pesticides with high efficiency, low toxicity and low residue can be recommended when non-pesticide methods are ineffective;
- Farm products with excessive pesticide residues are forbidden to enter market for sale;
- Methods of safe application of pesticides.

In 2011, the Chinese government published some kinds of pesticides banned and restricted to be used, including: (1) Pesticides banned to be used (23 kinds): benzene hexachloride (BHC), dichlorodiphenyl trichloroethane (DDT), camphechlor, Dibromochloropropane, Chlorodimeform, Ethylene dibromide (EDB), nitrofen, aldrin, dieldrin, melrcury compounds, arsena and plumbum compounds, Bis-ADTA, fluoroacetamide, gliftor, Tetramine, sodium monofluo fluoroacetate, silatrane, methamidophos, parathion-methyl, parathion, moncrotophos, phosphamidon. (2) Pesticides forbidden and restricted to be used in forestry (16 kinds): dicofol, fenvalerate, phorate, isofenphos-methyl, terbufos, phosfolan-methyl, sulfotep, demeton, carbofuran, aldicarb, ethoprophos, phosfolan, coumaphos, fonofos, isazofos, fenamiphos, etc.

# 2. Status of Disease and Pest Prevention and Control in the Project Area

## 2.1 Occurrence of Diseases and Pests

This project is located in the east part of Jilin Province and Heilongjiang Province in the northeast of China, and mainly covers counties (cities) including Hunchun City and Wangqing County of Jilin Province as well as Dongning County and Mulin County of Heilongjiang Province. The major standing forests in the project area contain Korean pine, dahurian larch, acer mono, picea asperata, Mongolian Scotch Pine and the major diseases and pests include:

Korean pine: Rhizoctonia solani, Cronartium ribicola J.C. Frischer et Rabenhorst, Cenangium abietis (Pers.) Duby and Pineus cembrae pinikoreanus Zhang et Fang.

Dahurian larch: Mycosphaerella larici-leptolepis Ito et al., Dendrolimus superans (Butler), Coleophora dahurica Falkovitsh, Adelges laricis Vallot, Dioryctria abietella Schiff, Ips subelongatus Motschulsky.

Acer mono: Uncinula aceris (DC.) Sacc., slugs, bagworms, aphids and long-horned beetles.

Picea asperata: Ips typographus Linnaeus, Dioryctria schuetzella Fuchs and Pests in cones of Picea asperata.

Mongolian Scotch Pine: Shoot blight of pine

The major diseases and pests and their damages are as follows:

1. Rhizoctonia solani of Korean pine

This is a common disease in the seedling stage of Korean pine and it occurs after seeds are sawn, before and after seedlings come up as well as in the nursery plant stage. The pathogenic microorganisms of this disease are rhizoctonia and fusarium, which will infect Korean pine in their germinal and seedling stages. If the disease cannot be prevented in time, it will bring damage to more areas and make plantlet small and sick plants spread widely.

2. Cronartium ribicola J.C. Frischer et Rabenhorst

This disease tends to occur on trunks of Korean pine under 20 years of age and Korean pine trees about 10 years old are most likely to gets this disease. Each year, the period from the middle ten days of September to the middle ten days of November is the early stage of infection of this disease, during which barks in trunks will swell and yellowish dense drops will appear on the surface of barks attacked by this disease and these drops contain spores of large seedlings. Next year from the last ten days of April to the last ten days of June, there are a lot of apricot bubbles at the beginning and hoary or white bubbles in the later period on diseased parts, which are called rust sporangia. After these sporangia become mature and beak, yellow powdery aecidiospores are produced. Crowns of Korean pine trees attacked by this disease take on the broom-like shape. In general, Korean pine trees which have been infected with this disease for 2 to 3 consecutive years will die soon. In addition, those yellow powdery aecidiospores can be transmitted via wind and it is easier for the Korean pine trees in low-lying areas with high humidity to get this disease.

3. Cenangium abietis (Pers.) Duby

This disease mainly attacks weak Korean pine trees and is the most common in seed production stands. The viruses of Cenangium abietis (Pers.) Duby often invade from the wounds of trunks and treetops and finally make infected branches and trunks wither and die. The surface of barks on the diseased parts is black and rough while the diseased lateral branches are withered and down bent and needle-point leaves turn reddish-brown from green, gradually become withered and yellow and finally fall

down.

4. Pineus cembrae pinikoreanus Zhang et Fang

The kind of pests mainly harms new leaves and tender tips and influences the height growth. May, June and August are three booming periods of Pineus cembrae pinikoreanus Zhang et Fang. This kind of pests will eat the newly-sprouted tips and leaves of Korean pine trees, which impedes their metabolism and growth.

5. Ips typographus Linnaeus

Larvae and imagoes of Ips typographus Linnaeus will eat the relatively soft barks of spruces and pines and then produce very long and deep trenches on tress, which will harm life and growth of tress, makes them no longer secrete resins, and make leaves yellow and trees wither. If the quantity of this kind of pests reaches a certain point, vast stretches of spruces will wither and die.

6. Shoot blight of Mongolian Scotch Pine

This is a kind of host leading disease. Its pathogenic bacteria are a kind of facultative parasites with the saprophytic feature, which widely lurk and invade in healthy Mongolian Scotch Pine trees. Only when the host of these bacteria declines can this disease occurs due to invasion of viruses. The pathogenic bacteria can not only live through the winter in needle-point leaves, sprouts, tips, branches and fruits of sick trees of last year, but also can lurk and invade in needle-point leaves, sprouts, tips, branches and fruits of healthy trees. Shoot blight of Mongolian Scotch Pine mainly occurs among nursery plants and trees at middle and old ages. Older the tree age is, more serious the disease will be. The primary source of infection is conidiophores that fly off from germ substances in sick trees of last year and seeds don not carry disease germs. The pathogen spores can spread and transmit throughout the growing season, and duration and amount of rainfall directly influence the diffusion period, the peak period and quantity of spores. In years with high rainfall, more spores will diffuse and the disease will be more serious.

## 2.2 Disease and Pest Management

### 2.2.1 Establishment of Institutions

In the project area, the provincial General Station of Forest Pest Management and Quarantine is responsible for organization and management as well as instruction and supervision of disease and pest prevention and control throughout the whole province, and also takes charge of technology promotion. The Forestry Bureau of every city (state) and county sets up Forest Disease and Pest Control and Quarantine Stations, and Forest Disease and Pest Control and Quarantine Station at each level is responsible for organization and management as well as instruction and supervision of disease and pest prevention and control within its jurisdiction. The establishment of institutions is shown in Chart 1.2-1.

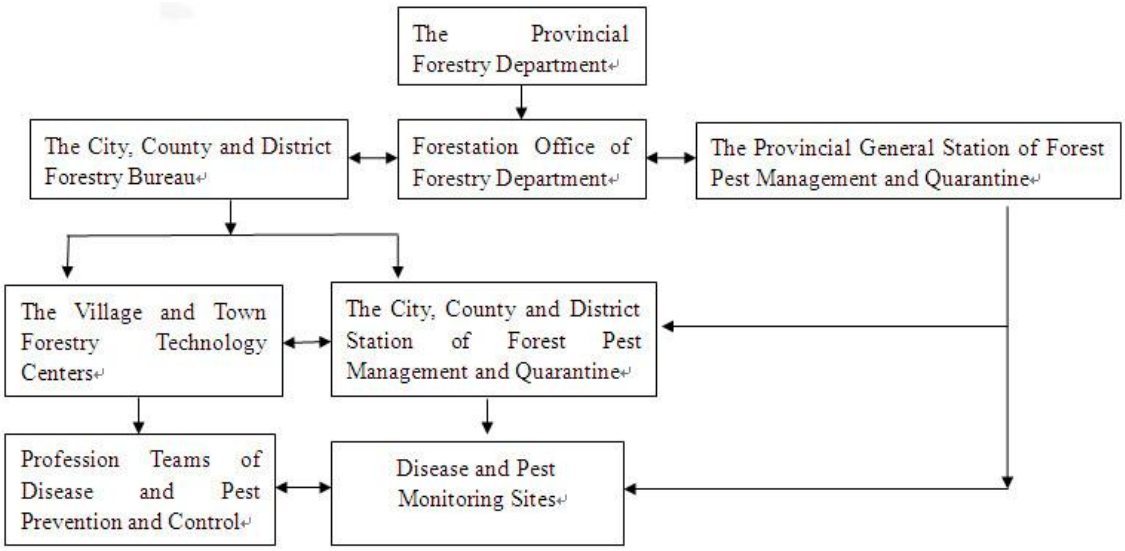



**Chart 1.2-1 The Sketch Map of Management Institutions of Disease and Pest Prevention and Control**

### 2.2.2 Responsibilities of Institutions

The Provincial Forestry Department: being responsible for forestry affairs of the whole province.

Forestation Office of the Provincial Forestry Department: being responsible for management of the project's forestation technology.

The General Station of Forest Pest Management and Quarantine: being responsible for organization and management as well as instruction and supervision of the project's disease and pest prevention and control, and also taking charge of technology promotion.

The City and County (District) Forestry Bureau: being responsible for forestry affairs within its jurisdiction; taking charge of organization, planning, coordination, supervision, decision-making of forest disease and pest prevention and control, as well as formulation of the work management systems.

The City and County (District) Station of Forest Pest Management and Quarantine: being responsible for organization and management as well as instruction and supervision of disease and pest prevention and control within its jurisdiction; assisting and coordinating with relevant law enforcement departments and technology departments to carry out promotion, training and guidance of pesticide management technology as well as disease and pest integrated management technology.

Disease and Pest Monitoring Sites: being responsible for investigation and monitoring of disease and pest occurrence tendency; regularly issuing long-term, medium-term and short-term forest disease and pest forecasting.

Profession Teams of Disease and Pest Prevention and Control: being responsible for timely eradication of diseases and pests within its jurisdiction.

### 2.2.3 Current Situations of Management

Presently, the task of disease and pest prevention and control in the project area has made great progress, which is shown as follows:

1. Strengthening monitoring and forecasting in an all-round way. We have fully fulfilled the radiation influence of the national central monitoring sites of forestry pests, used observation and forecast networks at the state, province, city and county levels as well as town and village forestry working stations so as to comprehensively improve monitoring coverage, spot diseases and pests in time, issue forecasting and eradication notices and ask relevant responsible persons to deal well with prevention and control.

2. Seriously coping with prevention and control of dangerous forestry pests which severely damage forestry resources, arouse much attention of society and have great international influence such as Rhizoctonia solani, Cronartium ribicola J.C. Frischer et Rabenhorst, Cenangium abietis (Pers.) Duby and Pineus cembrae pinikoreanus Zhang et Fang as well as Dendrolimus superans, Coleophora dahurica Falkovitsh. According to *Regulations on Forest Pest Control*, we adopt integrated prevention and control measures like forestry method, biological method, physical method and chemical method, etc. to reduce losses and influenced areas and realize sustainable prevention and control of harmful forestry pests. Especially when using chemical pesticides, we strictly observe requirements of WHO and generally used pesticides of Category Ⅲ and Category U.

3. Strictly carrying out quarantine and enforcing various laws. We conscientiously implement regulations of *Regulations on Plant Quarantine*, strengthen inspection and quarantine, and strictly control diffusion and spread of quarantine pests. Meanwhile, we scientifically conduct risk assessment of exotic harmful forestry pests and are extremely strict in examination and approval as well as quarantine and supervision of introduction, and deal well with quarantine of origin area and dispatching so as to prevent invasion of exotic harmful organisms.

4. Focusing on strengthening the emergency mechanism construction of unexpected forestry pest disasters. According to requirements of *Treatment with Unexpected Forestry Pests* and *Contingency Plan for Crucial Exotic Forestry Pest Disasters*, we have made good preparation for emergency in terms of organization, technology, capital and supplies, formulated plans for emergency and strengthened infrastructure construction of coping with emergencies and improved material reserves.

5. Constantly improving technology. As for difficulties of prevention and control, we earnestly study and summarize advanced prevention and control technology at home and abroad, strengthen international cooperation and coordination of multiple departments, improve applied technology and promote use of advanced, environment-friendly and applicable prevention and control technology as soon as possible.

### 2.2.4 Major Problems

In the project area, there are still some problems in prevention and control of diseases and pests at present, mainly shown in the following aspects:

1. Concept of prevention shall be improved. In part of the project area, the theory of forest healthcare was not thoroughly combined with practice of forestry pest prevention and control and there lacked effective measures of adopting forestation technology and enhancing the adversity tolerance of standing forest according to ideas of ecosystem.

2. Methods of predication and forecasting methods need to be improved. So far, we mainly adopt the traditional way of ground investigation to monitor forestry pests, which is labor- and time-consuming. Advanced monitoring technology should be vigorously promoted.

3. The capacity building system shall be improved. The training of integrated forestry pest prevention and control technology needs to be strengthened. Introduction of advanced monitoring as well as prevention and control technologies, promotion of demonstration effect and relevant organization and training measures remains to be improved.

4. Reliance on chemical pesticide is relatively excessive. In part of the project area, due to cultivation of a large area of artificial pure forests such as masson pine, moso bamboo, poplar, fruit trees, etc., generally chemical pesticides is used for prevention and control when pest disasters occurs in large scale.

# 3 Plans for Disease and Pest Management

## 3.1 Guiding Thought

Adhering to the principle of “Prevention-centered, Scientific treatment, Legal supervision and management, Strengthened responsibility”, we set up the concept of forest health, reinforce it as "two services" including decision-making and production, boost “three changes” from eradication-centered to prevention-centered, from chemical control to pollution-free control, from treatment with the problem’s symptoms to treatment with the root cause, and improve "four systems" including the monitoring and warning system, the quarantine and disaster- resistance system, the prevention and disaster-reduction system, and the support and insurance system.

## 3.2 Principles

When formulating disease and pest prevention and control strategies, we not only consider the economic benefit, but also consider the ecological balance and the social security. Based on this theory, the principles of forest disease and pest prevention and control in the project area are as follow: based on forestation strategies, we give priority to prevention, make full use of the nature’ control over diseases and create conditions to the disadvantage of occurrence and development of diseases and pests. In addition, we adopt measures suiting local conditions and reasonably use the biological, physical, chemical and other methods which are supplementary and complementary to and coordinate with each other so as to avoid killing natural enemies of diseases and pests and polluting environment as well as to control diseases and pests on tolerable levels.

## 3.3 Objectives of Disease and Pest Management

The objectives of forestry pest management in the project area is: the rate of disasters caused shall be controlled below 30%; the accuracy rate of prediction and forecasting shall reach at 87%; the rate of pollution-free prevention shall reach at 87%; and the quarantine rate of seedlings’ origin areas shall be above 99%.

## 3.4 Strategies of Disease and Pest Management

We earnestly observe the guideline of “Prevention-centered, Scientific prevention and control, Legal treatment, Promotion of health” and thoroughly apply prevention and control of diseases and pests to the whole process of forestry production. Firstly, as for forestation and cultivation of seedlings, we should choose strong seedlings able to resist diseases and pests, strengthen inspection and quarantine of trees and seedlings, put an end to transport and planting of sick trees and seedlings, take effective methods of forestation control to strengthen pest and disease resistance ability of trees and make forests keep healthy, strengthen monitoring and forecasting of diseases and pests so as to provide a basis for decision-making, prevention and control, and combine the quarantine method and the forestation method, the physical, mechanical, biological and chemical methods together to prevent and control diseases and pests. In the course of prevention and control of diseases and pests, we should firstly prefer the physical and biological control and prevention measures; only when other methods is invalid and disease and pest monitoring results show that the harm degree of diseases and pests is above the economic threshold can the chemical pesticides be used; When using pesticides, we should select pollution-free pesticides and reduce the drug-resistant ability of diseases and pests and avoid damage to environment.

1. Monitoring and forecasting refers to monitoring occurrence of diseases and

pests, predicting occurrence dynamics, diffusion and spread tendency of diseases and pests, which is the premise and guarantee for scientific implementation of disease and pest prevention and control. As for monitoring and forecasting of diseases and pests, we adhere to the principle of combining the monitoring of masses with the professional monitoring. As for monitoring and forecasting in the project area, the existing forest disease and pest control and quarantine institutions at all levels should be made full use of. The Forest Disease and Pest Control and Quarantine Station at the county level should make timely prediction and forecasting for occurrence and damage of forest diseases and pests in the project area through fixed-site monitoring, field tread and investigation, and other methods, and accordingly work out measures of disease and pest prevention and control. In addition, we should use the platform of geographic information system, give full play to the monitoring function of the forecasting network, use fixed persons to conduct observation in fixed sites on time, issue forecasting information in time so as to exactly obtain changes of forestry diseases, pests and rats and improve the quality and level of forest monitoring.

2. We should reinforce quarantine and law enforcement, select nursery plants in strict accordance with the system of plant quarantine, and prevent spread of quarantine objects.

3. We should actively adopt new technologies and tools, resolutely forbid to use five categories of drugs banned by national regulations, and cope well with application of various medicants.

4. We should actively promote application of biotechnology. For example, beauveria bassiana has successively prevented Aphrophora flavipes Uhler and Pristiphora erichsonii (Htg).

5. We should well finish all preparatory work before prevention, prepare abundant drugs, devices, funds of prevention and control, etc.

## 3.5 Measures of Disease and Pest Prevention and Control

### 3.5.1 Prevention and Control of Diseases and Pests of Korean pine

Rhizoctonia solani, Cronartium ribicola J.C. Frischer et Rabenhorst, Cenangium abietis (Pers.) Duby and Pineus cembrae pinikoreanus Zhang et Fang are not only common diseases and pests of Korean pine, but also key targets of forestry disease and pest prevention and control. We should put forward effective methods and improve technology of preventing and controlling diseases and pests of Korean pine, based on getting good knowledge of production mechanism, transmission methods and damages of these diseases and pests.

1. Rhizoctonia solani of Korean pine

First, we should avoid choosing low-lying and damp areas with poor drainage for the seedling cultivation fields of Korean pine trees, and the rotation of Korean pine trees with corns, vegetables and potatoes is forbidden. Second, we should use clean earth and turfy earth to process seedbeds of Korean pine, improve soils and isolate harmful microorganisms so as to prevent and control diseases and pests. Three, we must carry out the bud forcing treatment with seeds of Korean pine before sawing so as to shorten the time of seeds lying in soils and contribute to improvement of disease resistance ability of seedlings of Korean pine. Fourth, we should pay attention to collocation of various fertilizers. We can’t only use excessive nitrogen fertilizer when applying fertilizers in the seedling cultivation fields of Korean pine trees. Five, we should timely remove sick seedlings found in the seedling cultivation fields by bringing them off from seedbeds and burning them down. Six, when seedlings of Korean pine are infected with rhizoctonia solani, we can spray 1:1:200 bordeaux mixture, and also can use 65% of wettable powdery Zineb to prevent and control rhizoctonia solani of

Korean pine in the seedling period.

2. Cronartium ribicola J.C. Frischer et Rabenhorst

First, we should nurse and cultivate seedlings and trees in time after forestation, remove weeds and host plants such as ribes and pedicularis. Second, we should smear coking wax diesel emulsion on wounds of trees, which has positive treatment effect on slightly sick trees. Third, as for diseased trees, we should remove sick seedlings and trees in time. If there is 40% or more of sick trees, we should decidedly adopt the measure of regeneration under clear cutting system and replant Korean pine trees. Four, we should carry out strict quarantine systems for Cronartium ribicola Frischer ex Rabenhorst so as to prevent its diffusion and spread.

3. Cenangium abietis (Pers.) Duby

First, we should reinforce nurturance and cultivation of young forests, boost growth of trees and strengthen their ability of resisting diseases. Second, we should cut withered, suppressed and sick trees so as to keep woodland clean. Third, at the beginning of May, we should carry out the spray-drying process and smear wounds with 2-degree lime sulphur and emulsion of 50% anthracene oil in the concentration of 1:5.

4. Pineus cembrae pinikoreanus Zhang et Fang

According to the reproduction law of Pineus cembrae pinikoreanus Zhang et Fang, when the first generation of nymphs began to converge on new tips in the first and second ten days of May each year, we can use Chlorbenzuron and Fenoxycarb to kill numphs. In the dense and flourish young forests of Korean pine, we can use Chlorothalonil fumigant to kill imagoes and nymphs of Pineus cembrae pinikoreanus Zhang et Fang.

**3.5.2 Prevention and Control of Diseases and Pests of Dahurian larch**

1. Mycosphaerella larici-leptolepis Ito et al.

1) Measures of Forestation

a. In terms of forestation, we should plant and cultivate disease-resistant tree seeds such as Japanese larch trees.

b. We should plant appropriate trees in right places and vigorously cultivate mixed forests.

c. We should nurse, trim and thin trees properly, and keep them well-ventilated after forests become flourish and dense.

2) Measures of Artificial Prevention and Control

We should collect fallen leaves of trees in time, bury them deeply and burn them down.

3) Measures of Chemical Prevention and Control

a. Sprays：During the booming period of diffusion of germ ascospores (from the end of June to the beginning of July), we should adopt 75% Chlorothalonil (500 times diluted) or mixed liquids (600 times diluted) of 65% Mancozeb and 50% Carbendazim to spray on crowns of immature forests. The dosage is 2kg per hectare. 7 days later, we should spray pesticides for the second time.

b. Smokes：During the booming period of diffusion of germ ascospores (from the end of June to the beginning of July), we should use half-mature forests and young forests. The dosage is 10-15kg per hectare. 7 days later, we should spray pesticides for the second time.

2. Dendrolimus superans

1) Measures of Artificial Prevention and Control

a. Surrounding with plastic rings: During the first and second ten days of April, we should surround forests with plastic rings to prevent larvae before they get up on tress.

The width of rings is 20cm and the height is about 1.5cm. If we prevent larvae from climbing trees, they will starve to death and the pest density will decline.

b. Artificially picking cocoon: During the pupal period of pests (in the last ten days of June), we can prevent pests by picking their cocoon by hand.

2) Measures of Biological Prevention and Control

a. Releasing trichogramma: In the first and second ten days of July, we should hang trichogramma cards, release trichogramma and make them parasitic on eggs of Dendrolimus superans so as to make them unable to breed and reduce pest density. We should hang 25 pieces of trichogramma cards above 1.5cm high in leeward places and there is 20mx20cm distance among them.

b. Preventing pests via birds: we should hang boxes of bird nests so as to attract beneficial birds such as great tits. There should be 5 boxes per hectare.

3) Measures of Physical Prevention and Control

Light-trap: From the last ten days of June to the first ten days of July, during the booming period of imagoes' emergence, based on the phototaxis of imagoes we can hang black-light lamps to trap and kill imagoes and control their reproduction and reduce the population density of pests.

4) Measures of Chemical Prevention and Control

a. Poisonous rings: In the first and second ten days of April, before larvae get up on trees, we should prevent and control pests by brushing poisonous rings (lime: dichlorvos: diesel oil: water) which are about 1.5cm high and 20cm wide. Also, we can make poisonous ropes, poisonous glues and others with pyrethroid pesticides and make them surrounded tree trunks so as to separate larvae from climbing trees and reduce pest density.

b. Sprays: In the stage of larvae, we can use missible oil of 1.2% matrine and as well as 3% high permeation fenoxycarb (500-800 times diluted) to spray and kill pests, which is an effective method to prevent and control pests and larvae.

c. Plant-based smokes: During the second ten days of May and the last ten days of August, we can spray matrine and nicotine on enclosed mature forests to prevent and control pests with dosage of 20kg/$hm^2$. We should use these smokes before sunrise in the morning or after sunset in the evening on windless days or days with the wind speed of 1m/s in places where the ground cover should be removed in case of fire disasters. On rainy or foggy days or days with strong wind, we should not use them. In addition, there should be 20mx20m among smoke sites.

3. Coleophora dahurica Falkovitsh

1) Measures of Forestation

We should build mixed forests, enrich natural enemies of pests and strengthen the ability of "natural prevention and control". Based on the phototaxis of Coleophora dahurica Falkovitsh, we should prefer the rational close planting, avoid cultivating and cutting down trees excessively, keep proper canopy density, and replant trees timely in forest clearings. In addition, based on the vertical distribution on tree crowns of Coleophora dahurica Falkovitsh (overwintering larvae generally exist in the middle and lower part), while nursing forests with high pest density we should lop tree branches in winter and early spring so as to greatly reduce sources of pests.

2) Measures of Biological Prevention and Control

Preventing pests via birds: In spring, we should hang bird boxes in larch forests to attract beneficial birds such as finches and white-eye, etc. who can prey on and kill a lot of larvae and pupas.

3) Measures of Physical Prevention and Control

Light-trap: From the last ten days of May to the first ten days of June, based on the

phototaxis of imagoes we can hang black-light lamps to trap and kill imagoes and reduce the amount of eggs and control the population density of pests.

4) Measures of Chemical Prevention and Control

a. Sprays: As for artificial young forests, during the last ten days of April when larvae began to move, we can use missible oil of 1.2% matrine as well as 3% high permeation fenoxycarb (500-800 times diluted) to spray on leaves, which can reduce the population density of pests and its damage.

b. Plant-based smokes: During the last ten days of May and the first ten days of June, when the emergence rate of imagoes reach the peak, we can use matrine and nicotine to prevent and control pests in enclosed mature forests with dosage of 20kg per hectare. We should use these smokes before sunrise in the morning or after sunset in the evening on windless days or days with the wind speed of 1m/s in places where the ground cover should be removed in case of fire disasters. On rainy or foggy days or days with strong wind, we should not use them. In addition, there should be 20mx20m among smoke sites.

4. Adelges laricis Vallot

1) Measures of Forestation

Since the first and second hosts of Adelges laricis Vallot are respectively Picea asperata and Dahurian larch, we should avoid planting Picea asperata and Dahurian larch together and cultivating their seedlings in the same places seedbeds so as to reduce conditions of heteroecism and damages. While cultivating young forests, we should remove weeds in forests and keep proper canopy density so as to create a good ventilation and health conditions for forests. As for seedbeds, we should pay attention to the density degree of trees and the humidity of soils. Meanwhile, we should build mixed broadleaf-conifer forests so as to reduce the parasitic rate and damage of Adelges laricis Vallot.

2) Measures of Artificial Prevention and Control

Picking insect galls: Before insect galls break, we should pick and remove insect galls of Larch casebearer in time during the second ten days of June and the first ten days of July, and then burn them down, immerse them or bury them deeply.

3) Measures of Chemical Prevention and Control

Sprays: From the last ten days of April to the first ten days of May, which is the newly-hatched nymph stage of the first generation of Adelges laricis Vallot, we should use ***aphid-killer*** or 25% imidaclorprid (500 times diluted) to prevent and control disease of artificial young forests. From the second ten days of May to the last ten days of June, when some of the winged aphids will fly back to spruce trees for laying eggs and breeding, we should spray ***aphid-killer*** or 25% imidaclorprid (500 times diluted) onto artificial young forests once every 10 days.

5. Dioryctria abietella Schiff

1) Measures of Forestation

We should actively build mixed forests, and preserve or grow bee plants among them so as to increase of natural enemies of pests (macrocentrus and trichogramma) and reduce pest density.

2) Measures of Artificial Prevention and Control

Trimming branches (fruits): In the places where pests of Dioryctria abietella Schiff are densely distributed and serious, and when fruits of Korean pine trees are harvested (at the end of September), we should trim sick fruits and branches by hand and burn them down so as to eliminate pests in them, reduce trees with pests, control population density of pests and improve quality of standing forests.

3) Measures of Physical Prevention and Control

Light-trap: The first booming period of imagoes of Dioryctria abietella Schiff is during the second ten days of June while from the last ten days of August to the first ten days of September is the second booming period when is the best time for preventing imagoes. And then we can use black-light lamps to trap and kill imagoes.

4) Measures of Biological Prevention and Control

Releasing trichogramma: Dioryctria abietella Schiff begin to lay the first generation of eggs at the beginning of June and the second generation eggs in the second ten days of August. At this moment, we can release trichogramma by hanging 25 pieces of trichogramma cards above 1.5cm high in leeward places and with 20mx20cm distance between each other so as to make them parasitic on eggs of Dioryctria abietella Schiff and control the hatching rate of these eggs.

6. Ips subelongatus Motschulsky

1) Measures of Forestation

Before March, we must eliminate trees with pests and weak, withered or downed trees and trees broken by wind. Meanwhile, we should pay attention to health of forests and clean up breeding sites of Ips subelongatus Motschulsky, which is the fundamental method to prevent and control this kind of pests.

2) Measures of Artificial Prevention and Control

Setting up baited woods: From March to May, we can set up baited woods in places where Ips subelongatus Motschulsky appear. These baited woods should be 1-2cm long and piled up at the edge of forests or forest clearings. There are 3-4 woods per stack while there are 5-6 stacks per hectare. In spring, when young pests of Ips subelongatus Motschulsky begin to fly, we can attract them to lay eggs on baited-woods. And then we need to peel skins of these woods before larvae pupate so that larvae will die without any treatment. After peeled, these baited woods can be recycled.

3) Harm-elimination Treatment of Woods with Pests:

Fumigation with medicants: We should carry diseased logged woods to timber depots before emergence of imagoes, and then peel skins of these woods or use the method of fumigation with medicants. The method of fumigation with medicants is as follows: we can choose agriculture plastic films with the thickness of 1.2mm, and glue them together via adhesives to form tabernacles with the similar size as stacks of diseased woods, and then cover these woods with tabernacles. Besides, we need to dig trenches around wood stacks and compact all edges of plastic films hard and create enclosed spaces in tabernacles so as to prevent vaporized medicants from flow away. In addition, we need to open pores on tabernacles and inject pesticides. On the condition that the temperate keep 22 degrees centigrade, if we enclose the tabernacles for 2 or 3 days, bark beetles in peels can be killed completely. The dosage per cubic meter is as follows: methyl bromide is 15g, or aluminium phosphide is 3g, or sulfuryl fluoride is 30g. Through harm-elimination treatment, we can kill some of pests and effectively reduce the quantity of pests.

4) Application of biomimetic preparations

Pheromone traps: Before the last ten days of May, we can place aggregation pheromone traps of bark beetles in forests with 3 traps in the severely-damaged areas, 2 traps in the moderately-damaged areas and 1 trap in the mildly-damaged areas. During the emergence peak period of bark beetles, we can collect imagoes in traps once two days and then kill them.

5) Biological Prevention and Control

Protecting natural enemies of pests: The natural enemies of this kind of pests include Thanasimus substriatus, Coeliodes sp. and parasitic microbes, etc. The killing rates can reach 30%-40%. At the same time, we should protect these natural enemies

well while preventing and controlling pests.

### 3.5.3 Prevention and Control of Diseases and Pests of Acer mono

1. Uncinula aceris (DC.) Sacc.

We can treat this disease with Bordeaux mixture. In the early stage of the disease, we can spray Bordeaux mixture for 1-2 times, and also can use chlorothalonil, thiophanate methyl, triadimefon to prevent and control disease. Moreover, in autumn, when Acer mono trees are attacked by this disease, we must collect sick fruits and leaves together. And then burn them down or bury them deeply.

2. Pests of Acer mono

The major pests of Acer mono trees include slugs, bagworms, aphids and long-horned beetles, etc. and aphids mainly damage new branches and leaves of Acer mono trees. We can use Chlorbenzuron, triflumuron, diflubenzuron and other insecticides to kill various pests. Also, we can inject 3% high penetrable fenoxycarb EC (500-800 times diluted) into holes on trunks of Acer mono trees and then use yellow mud seal holes.

### 3.5.4 Prevention and Control of Diseases and Pests of Picea asperata

1. Ips typographus Linnaeus

1) It is extremely important to pay attention to prevention and control of diseases and pests of Acer mono trees among landscape trees as well as control and manage daily jobs. As for Ips typographus Linnaeus that parasitize Picea asperata, we should take effective measures in time to prevent and control them so as to ensure effect and economic benefit of landscaping and reduce investment in greening.

2) We can restrain growth and reproduction of Ips typographus Linnaeus via its natural enemies, mainly including parasitic wasps, mites and some predatory creatures of ***colydiidae. We*** can introduce these natural enemies into landscaping belts, which can effectively prevent and control reproduction and outbreak.

3) Baited woods can be adopted. When Ips typographus Linnaeus begin to lay eggs, we can use standing forest stocks of picea asperata to make woods 1-2 meters high, and place them in susceptible landscaping areas so as to attack Ips typographus Linnaeus to lay eggs on these woods. After a period of treatment, we need to burn these baited woods down or kill pests with insecticides, etc.

4) The chemical method can be used. ①Sprays: In the last ten days of April, we can spray 3% high penetrable fenoxycarb EC (500-800 times diluted) onto trees in landscaping areas where diseases have appeared or possibly appear so as to control increase in the quantity of Ips typographus Linnaeus during their emergence. In addition, we can regularly spray this pesticide based on the retention term of pesticide efficacy. ②Poisonous rings: In the last ten days of April, we can weave some straw or paper strips and place them to the areas attacked by pests. Because these strips has been immersed in emulsion of 40% omethoate, missible oil of 80% dichlorphos or oil of 80% ammonium phosphate, if we wrap them around trunks of Picea asperata, Ips typographus Linnaeus will be killed when they creep along trunks.

5) We can adopt other methods. Every year, during the breeding period of Ips typographus Linnaeus, we can place some hormones to affect their copulation. Also, we can plant some poplars and birches to strengthen resistance of Picea asperata to pests.

2. Pests in cones of Picea asperata

1) We can dilute wettable powders of bacillus thuringiensis and spray the solution onto cones of Picea asperata when pests in cones begin to breed.

2) In the first ten days of June, we can spray the reagent mentioned above onto tender tips of Picea asperata to prevent Dioryctria schuetzellatrella from transferring to

cones.

3) We can prevent pests via their natural enemies. From the first ten days of May to the second ten days of June, we can use yarn nets to collect parasitic wasps in cones of Picea asperata that has experienced the stage of emergence, and release them into greening seed production stands, and then conduct survey on the pest density and the parasitic rate of natural enemies, etc. Through such a method, we have achieved some progress in prevention and control of Dioryctria schuetzellatrella and various pests in cones of Picea asperata. But, the decrease in the quantity of Dioryctria schuetzellatrella is more than that of pests in cones. The reason is as follows: Dioryctria schuetzellatrella go into seminiferous scales in the stage of larvae and accordingly absorb a lot of pesticides while pests in cones just absorb some drops of pesticides. Moreover, such prevention and control methods tend to be influenced by weather. When preventing and controlling pests in cones, we must begin to spray pesticides before cones close. So, there are strict requirements for the time of spraying pesticides and the method of spraying pesticides can only be used in relatively flat green areas.

5) As for Dioryctria schuetzellatrella that parasitize Picea asperata, after hibernant larvae in tree tips and needle-point leaves come out, they will begin to eat seminiferous scales after eating cones, which will lead to abnormal growth of seedlings and tress. Therefore, from the last ten days of May to the first ten days of June, we need to prevent and control larvae that have emerged from leaves so as to lower the pest density and reduce damages of pests in tree tips and cones of Picea asperata. Moreover, in order to strengthen the efficacy of pesticides, we can add chlorothalonil and Chlorbenzuron, etc. to them. In the gardens where it is not convenient to fetch water, we can spray powders when dews do not disappear in the early morning.

6) Pests tend to inhabit the core of cones for living through winter, and next years will come out from cones after emergence, but some pests need to parasitize for 2 or 3 years before their emergence. Therefore, we can preserve threshed cones of Picea asperata well and use yarn nets to cover greening forests in the spring of the third year. Also, we can collect winged insects to kill pests in forests and place parasitic wasps into greening forests, which can protect natural enemies. Though such a method, we can effectively prevent and control pests. If we use this method for a long time, the parasitic rate of natural enemies will increase and regeneration of pests can be effectively restrained so as to stop pests from damaging growth of seedlings and trees.

### 3.5.5 Prevention and Control of Diseases and Pests of Mongolian Scotch Pine

1. Shoot blight of pine

First, we need to cultivate strong seedlings, match species with sites and plant mixed forests and avoid planting vast stretches of Mongolian Scotch Pine trees. Second, we need to operate and manage forests reasonably, promote growth of trees, carry out the tending cutting as well as the release cutting of trees in time and reduce occurrence of pests. Third, we need to loose soils and fertilize for trees. Since occurrence of shoot blight of pine relates to lack of boron elements, if we scatter borax on roots of Mongolian Scotch Pine, we can prevent and control this disease. Four, we also can adopt the chemical method. In general, this disease burst out during the period between the last ten days of May and the second ten days of June. Before spores fly apart, we can use 40% carbendazim (400-600 times diluted), 75% chlorothalonil (1000 times diluted), 70% thiophanate-methyl (1000 times diluted), or 65% Zineb (500 times diluted), which all can effectively prevent and control this disease.

## 3.6 Selection and Application of Pesticides

### 3.6.1 Selection of Pesticides

The recommended pesticides that can be selected and used for prevention and

control of pests in the project area are all listed in Table 3.6-1.

**Table 3.6-1 The List of Pesticides Suitable for this Project Area**

| Category of trees | Category of diseases and pests | Category of pesticides | Grading of pesticides (WHO) |
|---|---|---|---|
| Korean pine | Rhizoctonia solani | Bordeaux mixture | III |
| | Cronartium ribicola Frischer ex Rabenhorst | Coking wax diesel emulsion | III |
| | Cenangium abietis (Pers.) Duby | 2-degree lime sulphur and 1:5 emulsion of 50% anthracene oil | III |
| | Pineus cembrae pinikoreanus Zhang et Fang | Chlorbenzuron<br>Fenoxycarb<br>Chlorothalonil (smokes) | III<br>U<br>U |
| Dahurian larch | Mycosphaerella larici-leptolepis Ito et al. | Chlorothalonil<br>Mancozeb<br>Carbendazim | U<br>III<br>III |
| | Dendrolimus superans (Butler) | missible oil of 1.2% matrine<br>Fenoxycarb | III<br>U |
| | Coleophora dahurica Falkovitsh | missible oil of 1.2% matrine<br>Fenoxycarb | III<br>U |
| | Adelges laricis Vallot | Aphid killer<br>Imidaclorprid | III<br>III |
| Acer mono | Uncinula aceris (DC.) Sacc. | Bordeaux mixture<br>Chlorothalonil<br>Thiophanate-methyl<br>Triadimefon | III<br>U<br>U<br>III |
| | Slugs, bagworms and long-horned beetles | Chlorbenzuron<br>Triflumuron<br>Diflubenzuron<br>Fenoxycarb | III<br>III<br>III<br>U |
| Picea asperata | Ips typographus Linnaeus | Fenoxycarb | U |
| | Pests in cones of Picea asperata | Wettable powder of bacillus thuringiensis<br>Chlorothalonil<br>Chlorbenzuron | III<br>U<br>III |
| Mongolian Scotch Pine | Shoot blight of pine | Chlorothalonil<br>Carbendazim<br>Thiophanate-methyl<br>Mancozeb | U<br>III<br>U<br>III |

If diseases and pests that are not listed in Table 4 burst out in forests of the project area, or pesticides that are not listed in the Table are needed, we also can use pesticides that are not recommended in Table 4 to prevent and control diseases and pests. However, only after the newly-adopted pesticides are put forward by experts in institutions of forest disease and pest control and quarantine at the provincial and above levels and approved by the provincial project management office as well as reported to the World Bank for recordation can they be identified as new categories of pesticides allowed to be used in the project. All the adopted pesticides must be in conformity with

requirements of the World Bank (as for the grading standard, the standard of 2009 of WHO is applicable) and policies and regulations of China.

**3.6.2 Pesticide Application**

Pesticide usage in pest management will easily lead to non-point source pollution of soil. The pesticide will get into the water through overland runoff, interflow and underground leakage when there are rainfalls, and cause pollution. Applying pesticide in large areas and the plane spraying of pesticide will affect the air environment quality. The solid waste produced in pest management process, such as package bags and pesticide bottles, will affect the growth of under forest vegetation and forest landscape as well if they are not properly handled.

In order to use pesticide safely, biological agents, vegetant agents,biomimetic agents and environment-friendly chemical agents should be primary choices. Pesticide application will bring negative influences on the health of human and the livestock, as well as the ecological environment. Therefore, effective measures should be taken to avoid or reduce the risks of pesticides on health and environment. In the implementation process of the project, the potential risks and safe application measures of pesticides are shown in Table 3.6-2.

**Table 3.6-2 Potential Risks and Safe Application Measures of Pesticides**

| Environmental risks | Health risks | Safe Application Measures of Pesticide |
|---|---|---|
| 1. Pesticide residue result in water degradation and reduce the number of aquatic organisms.<br>2. Spraying Pesticide near the source of drinking water will pollute the water source.<br>3. Possible riskiest pesticides will bring impacts on non-target species (predators, etc.).<br>4. Long-term overuse of pesticide will result in pests' resistance to pesticides.<br>5. Pesticide residue in soil will result in the soil pollution. | 1. Breathe in pesticide spray in preparing chemical agents.<br>2. Discomfort caused by pesticide spray inhalation when spraying pesticide without protective equipment.<br>3. Skin burns caused by the spraying or leakage of pesticides when spraying pesticide without protective clothing.<br>4. Pesticide spraying or chemical agents leakage near the source of drinking water will result in drinking water pollution.<br>5. The livestock and subsidiary agricultural products may bring harms to human health due to the pesticide-polluted water. | 1. Strictly control the purchase, transport and storage of agents.<br>2. Apply pesticides in the right way. Popularize and apply pesticide application techniques which will cause less toxicity to human body, livestock and plants and less pollution to environment.<br>3. Strengthen the training of agents and instruments application. Improve the protection awareness of agents applying persons.<br>4. Emphasize the importance of wearing protective clothing when applying pesticides (including proper working clothes, protective hats, face masks, gloves and shoes, etc.)<br>5. Strengthen the confirmation and management of pesticides applying areas. Avoid the pollution of pesticide to water sources and ecological environment.<br>6. Strengthen technology cooperation, improve the applying efficiency of agents and instrument, and reduce the dosage.<br>7. Regulate the management of agents and instruments. Wasted chemicals and used chemical containers and agent instruments are not allowed to wash in natural waters. They should be disposed in safe places (for example, deeply buried). Remanent pesticides should be reasonably restored or safely disposed. |

Mitigation measures of pesticide pollution are as follows:

（1) Pesticide with high effectiveness, low toxicity and residual should be selected and used. We should improve pesticide efficiency and increase the total

amount of pesticide, avoid pesticide abuse and repeated usage of one pesticide in large amount to avoid the pests' resistance to pesticides.

（2) We should reasonably arrange the pesticide applying time. To apply pesticides at proper time could improve the efficiency, yield twice the result with half the effort, and kill pests at young stage. Due to the little damage and low pesticide-resistance of pests at young stage, the pesticide will be very effective in pest prevention and control.

（3) We should utilize the pesticide according to the regulation, control the pesticide amount and frequency, and do not increase the amount and concentration of pesticide. With over high pesticide concentration, it will result in phytotoxicity. The interval time of pesticide applying should not be too short.

（4) We will notice the environment condition when applying pesticides. When it is hot (over 30 degrees Celsius) in summer, with strong sunshine, relative humidity under 50%, wind speed over level 3 (over 5 m/s), and big rainfall or dew, pesticides can not be used in case it would cause phytotoxicity.

（5) The fertilizer which is not used the very day should bu stored in the canopy, around which there should be drainage ditches.

（6) Package materials like the package bags, pesticides bottles should be recycled.

# 4 Implementation and Management

## 4.1 Implementation Units and Division of Work

This *Pest Management Plan* will be the guide to the integrated pest management of this project.

Project offices of the province, city and county are responsible for implementing the pest management plan. The responsibilities include guiding each project unit to implement the *Pest Management Plan*, train the forestry technologists of each level and peasants, and supervise the training and the implementation of IPM measures.

Through negotiation with the World Bank, the provincial project offices will approve the list of prescribed pesticides. Project offices of each county take charge of the purchase, or organize and guide the peasants to purchase the pesticides. The project fund can be used to buy pesticides on the list only. The provincial project offices should strictly supervise and check the purchase list, allocation, and application of pesticides, as well as the usage of the fund. Project offices of each level should keep detailed record to supervise the purchase.

Project offices of province and city level will supervise the training of county project offices, and the application of IPM measures. The county project offices will take the charge of training on forestry technologists (of county and town level) and peasants, and the application of IPM measures.

Forestry technologists of county forestry bureaus and town forestry stations will be in charge of pest diagnose, and offer peasants advice of pest management through prescribed pesticides. According to actual needs, forestry technologists of county forestry bureau will consult with experts of relative institutions of city and province level, which include quarantine stations of forest pest prevention and control, plant protection departments of agricultural and forestry universities, etc.

## 4.2 Purchase, Transport and Storage of Pesticide

### 4.2.1 Purchase of Pesticide

The purchase of pesticide should be in accordance with the pesticide list recommended in the IPM plan and the supporting fund. Each afforestation entity should draw up the names and dosages of needed pesticides according to the prediction of pests, and report to the county project offices. County project offices report them to the city project offices. City project offices, together with provincial project offices will arrange the purchase list according to related regulations. If a town has a small purchase amount, it can purchase them at supply and marketing stations of pesticides in the town. If a town has a large purchase amount, the county project office will take charge of the purchase.

### 4.2.2 Transport of Pesticide

Technologists should be entrusted to transport the pesticides purchased in batches to ensure that they arrive timely and safely in target areas. Once the pesticide containers are broken, effective remedy measures should be taken to avoid environment pollution. County project offices will keep the original records of transport and delivery.

### 4.2.3 Storage of Pesticide

According to the regulation, county forestry bureaus in the project area should store pesticides with special facilities. Units and retailing shops which provide services for afforestation entities should regulate maintain the storage facilities. Residual pesticides of each afforestation entity should be sent back to appointed pesticide repositories. According to related laws and regulations, empty pesticide containers should be sent back to appointed repositories to be reused or disposed (deeply buried).

## 4.3 Supervisory and Management Units of Pesticide

Responsibilities of each unit:

Agriculture administration: take charge of pesticide registration, application and supervision in the province, and other related agricultural affairs including form or participate in forming the national or industry standards of safe application, product quality and residue of pesticides.

Bureau of industry and commerce: responsible for marketing management of pesticides.

Bureau of quality supervision: responsible for production management of pesticides.

Agricultural law enforcement agency: responsible for quality supervision of agricultural chemicals.

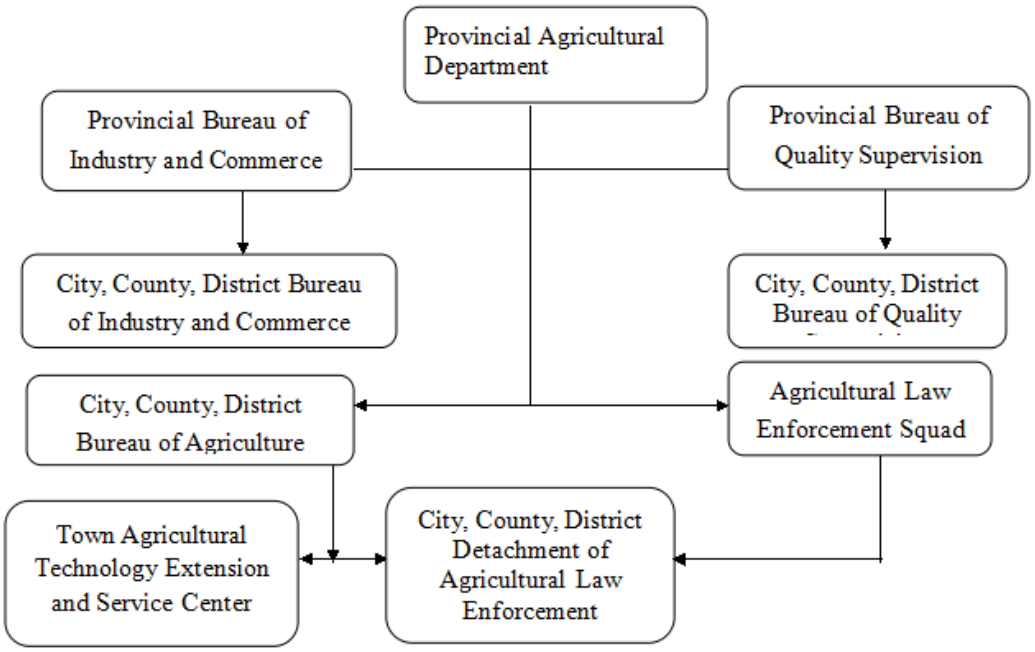



**Figure 4.3-1** Institution Framework of Pesticide Supervision and Management

## 4.4 Pesticide Residues Detection Unit

Responsibilities of each unit:

Quality inspection center (station) of agricultural and forestry products in each city, county and district: take charge of the supervision and management of local agricultural products quality safety.

Quality inspection station of agricultural and forestry products in wholesale markets and supermarkets: take charge of the quality inspection of agricultural products entrance in markets (supermarkets).

Quality inspection station of agricultural and forestry products in production bases: take charge of the quality inspection of agricultural products exit in production bases.

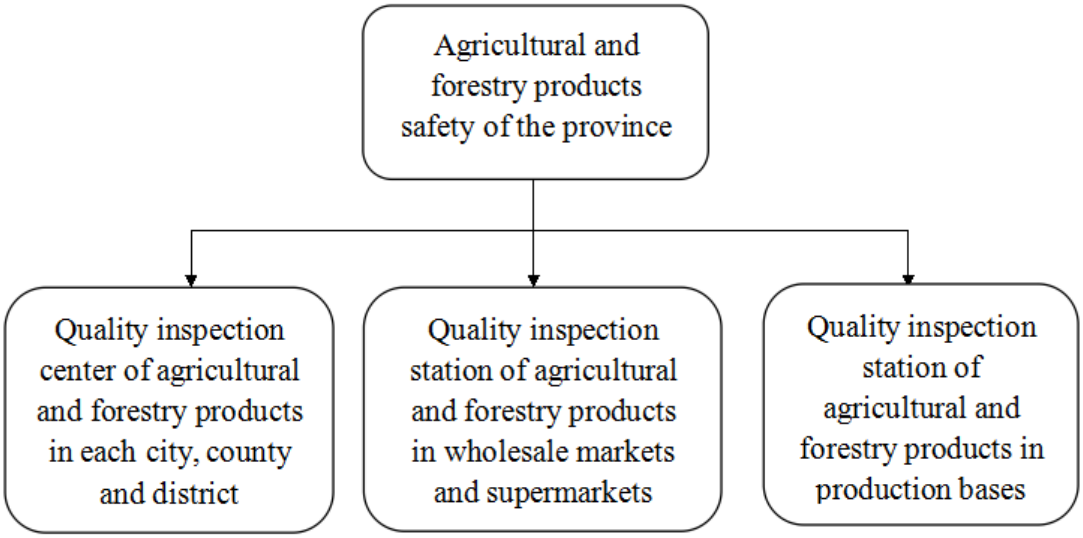



**Figure 4.4-1 Framework of Pesticide Residue Testing Institutions**

## 5 Training Plan

### 5.1 Training Methods and Objects

The provincial project office should make technical training plans of each level in the project area according to the IPM methods. The training will be conducted at provincial level and county level. Provincial training is organized by the provincial project office, and the training objects are managerial personnel and technicians of each county. County training is organized by the county project office, and the training objects are forestry technicians of each town and these of forest farms in each town and county. Training organizing units must carefully compile proper training textbooks, and conduct training through combined method of training class and on-site training.

### 5.2 Training Content

The training content should include:

（1）Related national and local laws and regulations

（2）The *Pest Management Plan* of the project and key points in the implementation

（3）Identification, prevention and integrated management techniques of main forest pests in the project area.

（4）Knowledge and operation skills of pesticide purchase, transport, safe application and storage.

For project management personnel and technicians of each level, integrated training of theoretical knowledge and practical techniques should be emphasized. For project entities and peasant representatives, training of knowledge popularization and operation skills should be emphasized.

### 5.3 Training Plan and Budget

The training plan is made according to the training content and requirements. The total project budget of pest management training is 36000 US dollars. The detailed information is shown in table 5.3-1

Table 5.3-1 Table of Training Plan and Fund Budget

| Training Level | Training Content | Organizer | Training object | Person-time | Training fee（US dollars） | Remarks |
|---|---|---|---|---|---|---|
| Provincial | （1）laws and regulations, the *Pest Management Plan* | Provincial project office | project management personnel and technicians of each county | 40 | 2400 | 60US dollars/person-time |
| | （2）forest pest prevention and control techniques | Provincial project office | project management personnel and technicians of each county | 80 | 4800 | 60US dollars/person-time |
| | （3）pesticide purchase, management and safe application | Provincial project office | project management personnel and technicians of each county | 80 | 4800 | 60US dollars/person-time |
| | Subtotal | | | 200 | 12000 | |
| County | （1）pest Identification, prevention and integrated | County project office | Technicians of forest farms | 400 | 12000 | 30US dollars/person-time |

| Training Level | Training Content | Organizer | Training object | Person-time | Training fee（US dollars） | Remarks |
|---|---|---|---|---|---|---|
| | management techniques | | | | | |
| | （2）Safe application techniques of pesticides | County project office | Technicians of forest farms | 400 | 12000 | 30US dollars/person-time |
| | Subtotal | | | 800 | 24000 | |
| | Total | | | 1000 | 36000 | |

## 6. Monitoring and Assessment

### 6.1 Monitoring of Pest Prevention and Control

#### 6.1.1 Monitoring Workflow

Monitoring work should be conducted in the integrated method of located monitoring and routine monitoring. Under the guidance of provincial and city quarantine stations of forest pest prevention and control, each county (city) quarantine station of forest pest prevention and control is responsible for conducting located monitoring two or three times a year, and generally in peak periods of pest and disease of the year. Besides, entities and peasants participating in the project need to take charge of the daily monitoring under the guidance forestry technicists of the county or town in the project forest of which they undertake the construction. Once any pest disease is found, they must report it to the county project office. Monitoring workflow of pest management is shown in Table 6.1-1.

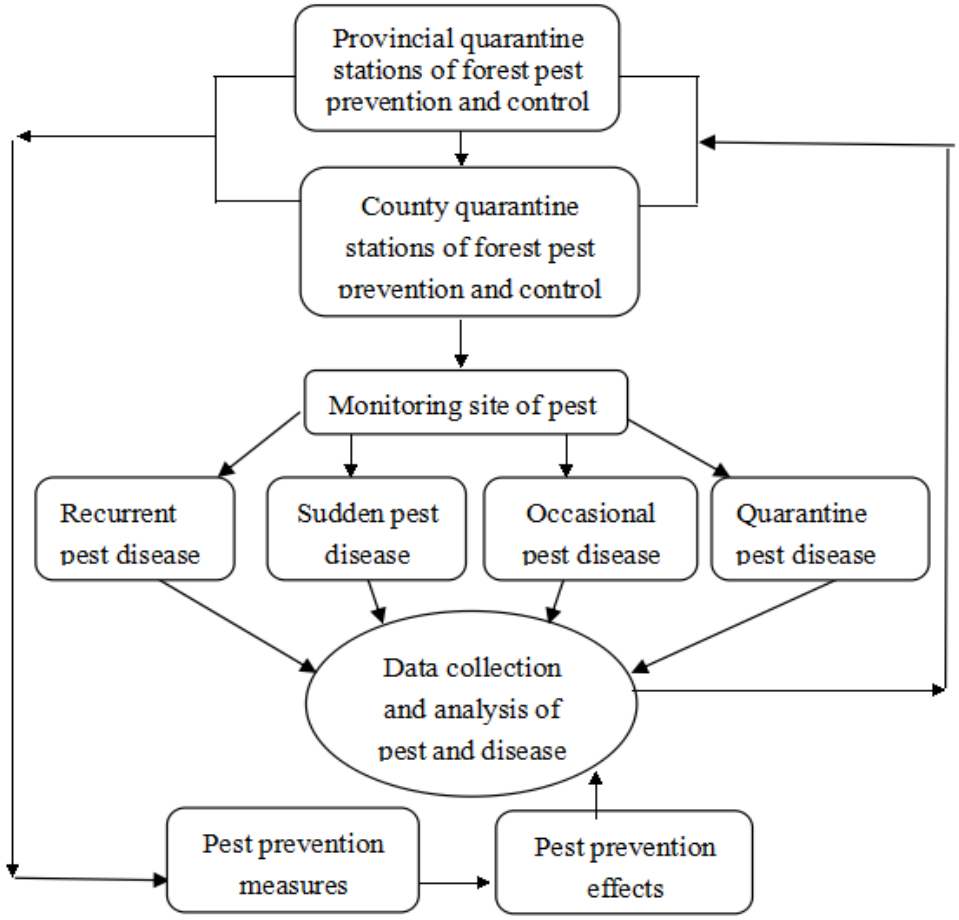



**Figure6.1-1 Workflow of Pest Management and Monitoring**

6.1.2 Pest Monitoring

(1) Monitoring sites

Two pest monitoring will be set up in the 4 counties and cities involved in this project. See the following table for general information of the monitoring sites and see the attached figure for their distribution.

**Table 4.2-3. Table of Pest Monitoring Sites**

| No. | County /City | Forestry farm | Forest block | Small block | Area of the small block | Tree variety | Age group |
|---|---|---|---|---|---|---|---|

| No. | County /City | Forestry farm | Forest block | Small block | Area of the small block | Tree variety | Age group |
|---|---|---|---|---|---|---|---|
| 1 | Wangqing County | Dahuanggou | 3 | 1-21 | 256 | Korean pine | Young forest |
| 2 | Wangqing County | Duhuangzi | 65 | 1-31 | 308 | Larch | Middle-aged forest |
| 3 | Hunchun City | Lanjia | 16 | 1-6 | 182 | Korean pine | Middle-aged forest |
| 4 | Hunchun City | Chunhua | 8 | 1-15 | 98 | Oak tree | Young forest |
| 5 | Dongning County | Tuanjie Reservoir | 3 | 14 | 17 | Larch | Middle-aged forest |
| 6 | Dongning County | Hancong River | 8 | 15 | 6.8 | Korean pine | Young forest |
| 7 | Muling City | Huashu River | 6 | 11 | 36 | Oak tree | Young forest |
| 8 | Muling City | Shuangning | 2 | 8 | 71 | White birch | Young forest |

(2) Monitoring content

Types of pests, number of plants damaged by pests (rate), average pest intensity of single plant, injury of stand, etc.

(3) Monitoring method

Setting up of sample monitoring sites and standard trees: set up fixed sample monitoring area in woodland with flat slopes and convenient transportations under conditions of representative site conditions and stand types. Determine 20 to 30 standard trees through appropriate mechanical sampling on each fixed sample monitoring area according to the site types, and mark them as fixed standard monitoring trees.

Annual investigation of the fixed standard trees on sample monitoring areas for pests shall be carried out, and pest types and the amount of infected plants shall be recorded. Field monitoring and identification of diseases and pests shall be carried out in accordance with technical requirements and procedures.

(4) Monitoring frequency

The monitoring will be carried out three times in 2015, respectively in early May, early July and early September.

**6.2 Effectiveness Evaluation of Pest Management**

Under the guidance of provincial and city project offices, each county project office need to supervise and evaluate the quality of integrated pest management in project forests through measures like regular inspection and random inspection. Provincial and city project office need to supervise and inspect the supervision and assessment of integrated pest management quality of each county in the project area.

Main contents of supervision and assessment are:

(1) monitoring the type, area of pests in project forests each year, prevention and control measures and the effects; evaluating whether it is in accordance with requirements of the integrated pest management.

(2) monitoring type and amount of pesticides purchased in batches, and these

purchased by project-participating entities and peasants; evaluating whether it is in accordance with pesticides recommended by the World Health Organization which are class II and above, and the pesticide list recommended by the project.

(3) monitoring the training content and person-times on city, county, town (forest farm) technicians and project-participating entities and peasants about pest management knowledge and techniques; evaluating the implementation progress and effects of training plans.

(4) monitoring the pesticide application status of project-participating entities and peasants, including whether they have mastered the right way to spray and use pesticides, whether they have taken protective measures when using pesticides, and the disposal status of wasted pesticides and wrap bags; evaluating whether project-participating entities and peasants have applied pesticides in the right way.

**6.3 Monitoring Fee**

According to the pest monitoring plan, the monitoring cost of each monitoring site is 5 000US dollars，and the total cost of 8 pest monitoring sites is 40 000 US dollars each year.

# Attachment 2. Environmental Protection Guidelines for Plantation

## Contents

# 1 Overview

## 1.1 Purpose and Significance

This *Environmental Protection Guidelines for Plantation* is formulated in particular to further enhance the ecological and environmental benefits of this project, to minimize or eliminate the negative impacts of plantation on the natural environment, and thus to achieve various environmental benefit targets in an all-round way.

The significance of this regulation lies in the following aspects:

(1) The operable *Codes of Environmental Protection* can effectively guide the implementation of the project. Scientific and practical environmental protection requirements and measures can help to realize the environmental targets of the World Bank.

(2) We will develop and implement the special *Pest Management Plan* to monitor and control the pest and disease in afforested forest timely and effectively based on the concepts and methods of integrated pest management;

(3) We will carry out the environmental monitoring carefully during the project, especially the long-term located monitoring of soil erosion, soil fertility and pests in the afforested forest.

(4) The *Codes of Environmental Protection* should be developed as one standard of construction quality inspection and acceptance in the project. We should set a target rate of environmental protection as one indicator of inspection and acceptance of sub-compartments, thus to ensure the *Codes of Environmental Protection* will be implemented effectively and good results will be achieved.

(5) We will strictly manage the quality supervision of environmental protection. The management model of “to offer training beforehand, guidance in the meantime, inspection and acceptance afterwards” will be applied, and the quality supervision approach of "inspection and acceptance according to the working procedure and level" will be adopted to strictly confirm to the environmental monitoring program and to strengthen the environmental quality supervision.

(6) We will emphasize the training of technical teams. Six kinds of environmental management training forms will be adopted, that is, “going out and bringing in”, centralized training, conference to replace training, on-site teaching, bringing science and technology to the countryside, and distributing technical leaflets. These measures will improve the personnel quality in environmental management and operation, and ensure that the target rate of environmental protection will meet the objectives and requirements of the project.

## 1.2 Relevant Laws

(1) Environmental Protection Law of the People's Republic of China (Dec, 26th, 1989);
(2) Forestry Law of the People's Republic of China (Jan, 1st, 1985);
(3) Land Administration Law of the People's Republic of China (Jan, 1st, 1999);
(4) Water and Soil Conservation Law of the People's Republic of China (Mar, 1st, 2011);
(5) Environmental Impact Assessment Law of the People's Republic of China (Oct, 28th, 2002);
(6) Regulations on Forest Pest Management (Dec,18th ,1989);
(7) Regulations on Plant Quarantine of People's Republic of China (May 13th ,1992);
(8) Forest Fire Prevention Ordinance (Jan, 1st ,2001);
(9) Regulations on the Implementation of Water and Soil Conservation Law of the People's Republic of China (Aug,1st ,1993);

(10) Regulations of the People's Republic of China on Nature Reserves (Dec 1st, 1994);
(11) Regulations on Restoring Farmland to Forest (Jan, 20th, 2003);
(12) Interim Measures for the Plantation Quality Management (July, 28th ,2010);
(13) World Bank OP4.01 Environmental Assessment;
(14) World Bank OP4.09 Pest Management;
(15) World Bank OP4.36 Forestry;
(16) World Health Organization (WHO) Pesticide Assignment Guidelines (2009).

## 1.3 Construction Contents of this Plantation Project

This plantation project is located in Shimenzi forest farm, Dongning County, Heilongjiang Province. It covers a total area of 500 hectares. Information about the sub-compartments in the plantation forest is shown in the table as below.

**Table 1.1-1 Sub-compartment Information in the Plantation Forest**

| Geographical location | Forest compartment | Sub-compartment | Area (hectare) | Scope and coordinates |
|---|---|---|---|---|
| Jifanggou | 2 | 15 | 40 | 670232 4868673、669790 4868167　669515 4868721、669904 4870080 |
| Tuanjie Reservoir | 3 | 3 | 61 | 669970 4870434、669642 4869489　669055 4869862、669932 4870985 |
| Cilaoyadi | 3 | 27 | 20 | 669155 4868601、669533 4867565　669035 4868502、668766 4869314 |
| Tuanjie Reservoir | 5 | 6 | 24 | 6668533 4868912、668497 4868466　667873 4868832、668759 4869553 |
| Daduchuan Ridge | 5 | 26 | 36 | 668468 4867283、668197 4866733　667739 4867097、668438 4867600 |
| Xiaomeikuang | 7 | 15 | 54 | 671476 4868215、670897 4867745　669705 4868104、671275 4868317 |
| LinchangXishan | 12 | 8 | 16 | 669664 4865489、669249 4865103　669111 4865645、669176 4865696 |
| LinchangXishan | 12 | 11 | 36 | 670148 4865301、669702 4864689　669412 4865056、669798 4865475 |
| LinchangXishan | 13 | 7 | 24 | 670931 4865223、670526 4864791　670345 4865397、670644 4865595 |
| LinchangXishan | 13 | 15 | 15 | 670440 4864548、669974 4864276　669798 4864457、670298 4865055 |
| LinchangXishan | 13 | 16 | 24 | 671623 4865949、670269 4863866　670575 4865837、670683 4866005 |
| Paotai | 13 | 33 | 39 | 670646 4863886、669738 4863618　669358 4863926、669967 4864253 |
| Caiying Ridge | 19 | 21 | 20 | 669300 4861575、669213 4860939　668852 4860805、668858 4861595 |
| Caiying Ridge | 20 | 18 | 40 | 670403 4861404、669762 4861123　669493 4861736、669923、4862141 |
| Erpaichanggou | 21 | 18 | 20 | 671950 4862019、671394 4861776　670726 4861102、670818 4862180 |
| Erpaichanggou | 21 | 23 | 22 | 672443 4861910、672183 4861618　671518 4861751、672184 4862059 |
| Sirenban | 33 | 14 | 9 | 668006 4856297、667901 4856234　667684 4856480、667778 4856881 |

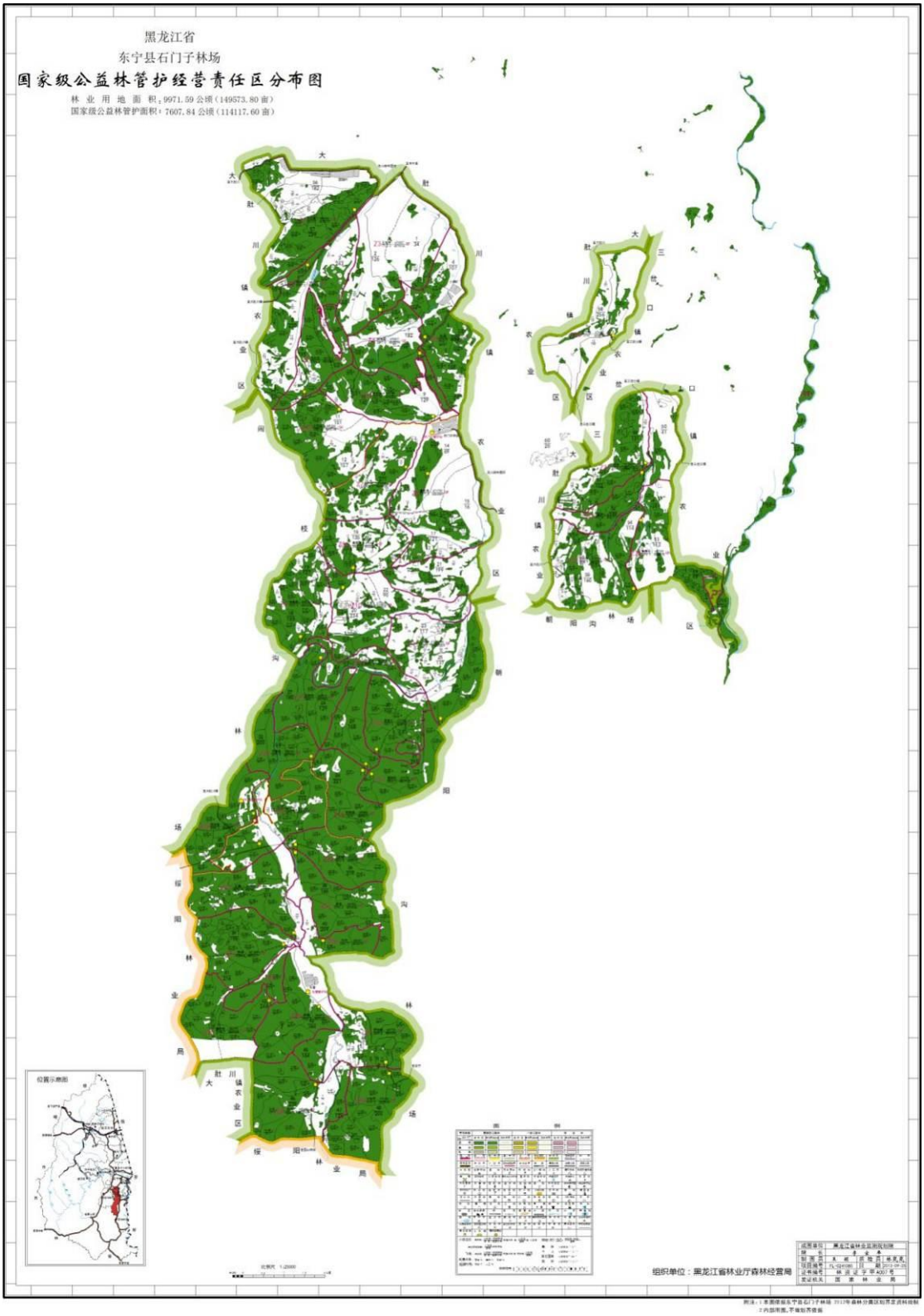



**Figure 1.1-1 Map of Sub-compartments in Plantation Area**

# 2 Environment Status in Plantation Project Area

## 2.1 Terrain

Shimenzi forest farm is located in sub-region of the Laoyeling which belongs to the Changbai Mountain system. The terrain is high in the south and low in the north. The highest altitude is 684 meters, the lowest altitude is 204 meters, and the average altitude is 450 meters. The average slope is 15 degrees.

## 2.2 Climate

The plantation project is located in the temperate continental monsoon zone and is close to the Sea of Japan. Its southernmost district is only 50 kilometers away from the estuary of Suifen River (Vladivostok), thus it also has some features of the continental marine climate. It is cold and dry in winter, wet and rainy in summer. The highest temperature is 35.7 ℃, the lowest is 37.5 ℃ and the average annual temperature is 2.3 ℃. The effective accumulated temperature is 2720 ℃. The average annual rainfall is 530 mm, and the frost-free period is about 119 days.

## 2.3 River

In addition to the boundary river (Hubutu River is a Level I tributary of the Suifen River) in Shimenzi forest farm, there are another two rivers which are more than 10 kilometers in length. One is Ganhezi River, a level I tributary of Hubutu River, which originates from the southwest part of the working zone and flows into the mainstream via the south of Miaoling. The other one is Quezigou River, which originates from the upper side of the ranger station and flows from Taoshigou into Xiaowushegou River. Hubutu River, the boundary river, is winding and zigzagging. Mountains on the west bank which belong to our country are steep. Slopes on both sides of Ganhezi River and Quezigou River are short and steep, while the middle and upper parts of the mountains are flat and open.

## 2.4 Soil

The soil in Shimenzi forest farm can be divided into three types, namely dark brown soil, meadow soil and swamp soil. Among them, the dark brown soil accounts for 97.5%, followed by meadow soil which accounts for 2.2%, while the swamp soil only accounts for 0.3%. Dark brown soil is the major soil type in this forest farm, which distributes in different slope aspects and positions.

## 2.5 Vegetation

Shimenzi forest farm is located in the northern part of the floristic zone of Changbai Mountain, and the sub-region of the Laoyeling in floristic regionalization. The forest coverage rate is 92.8%. Mountains above 600 meters are distributed with mixed forest (needle leaf and broad leaf), mainly including birch, larch, aspen, and oak tree. The undergrowth in this area mainly includes lespedeza, honeysuckle and mock orange, with an average coverage of 7%. The ground cover mainly includes *Carex ussuriensis, Convallaria majalis and Radix polygonati officinalis*, with an average coverage of 85%. Mountains below 600 meters are mainly distributed with oak and black birch. The undergrowth mainly includes lespedeza, azalea and honeysuckle, with an average coverage of 5%. The ground cover is mainly composed of *Carex ussuriensis, Rhizoma atractylodis, Artemisia stolonifera* and quinoa bean, with an average coverage of 50%. As for the horizontal distribution, artificial larch and *Mongolian scotch pine* are distributed from Quezigou, the north part of the forest farm, to the northern Miaoling. To the south of compartment No.68 and No. 70, the vegetation mainly includes soft broadleaf mixed forest, oak forest and natural larch. In the central part, it is mainly oak woods. In this region there are Chinese herbal medicines such as acanthopanax,

schisandra and astragalus; wild potherbs such as fiddlehead, osmunda and lily; berries such as hazelnuts, walnuts and *Vitis amurensi*; fungus such as armillaria, yellow mushroom, hedgehog, agaric, matsutake and so on.

Figure 2.1-1 Plantation Site Photos - Shimenzi forest farm

## 2.6 Animals

Rich forest vegetation resources and suitable climate conditions provide a good living environment for many wildlife animals to live and breed. There are more than 20 kinds of wild animals in the operation area, mainly including leopard, deer, roe deer, bear, wild boars, fox , badger, rabbit and so on.

# 3 Project Implementation Plan

## 3.1 Implementation Requirements

1. Time requirement

Construction period: 2014-2015.

2. Quality requirement

The survival rate of nursery plant should be more than 90% in the same year.

3. Environmental requirement

We must prevent the water sources in the plantation from being polluted. Plastic bags and other chemical products are not allowed to be thrown about.

4. Other requirements

We should improve the quality and cognition of plantation staffs and pay attention to fire prevention.

## 3.2 Implementation Guarantee

1. Leadership Strengthening

An plantation leading group needs to be established, which consists of the farm head, branch secretary, team leader and and technicians of the plantation project. This group will be responsible for the preparation and implementation of plantation, strict quality inspection, management and protection work afterwards.

2. Technical training

We will organize plantation workers for technical training, and carry out each working procedure strictly in accordance with technical regulations.

3. Inspection and guidance

After the plantation is finished, the plantation leading group must carry out the inspection of each plantation plot to verify the area, species, density, and planting quality.

4. Accountability system establishment

We will set up leadership responsibility system and link this project with the annual evaluation. We will sign responsibility documents with staffs on site, develop incentive measures, and conduct them at the end of the year.

5. Scientific and technological achievements promotion

In the survey and design period, the application of GPS satellite positioning system can greatly reduce the outside work amount. Transplantone can be used during seedling planting to ensure the survival rate.

## 3.3 Plantation Project Selection Process

The site selection requirements in the plantation project include: plantation is not allowed to be conducted in valuable natural habitats and natural or cultural heritage protection areas; areas 2000m within the buffer zone of each reserve; areas within the regulated protection distance of material or cultural resources; areas within 50m from both sides of the main river and 20m from both sides of the tributaries. In addition, slope areas with the gradient above 25° should not be selected for plantation.

Selection process of the plantation project is as follows:

1. Are there any cultural relic or other protected resource on the proposed plantation land, or if the distance between the plantation land and the protected resource is less than the regulated one of the local authorities?

2. Is the proposed plantation land totally or partly located in the natural habitats, natural and cultural heritage sites, the buffer zones, or less than 2000m away from the bounder of the buffer zone?

3. Is the gradient of the proposed plantation land greater than 35 ℃?

4. Is the proposed plantation land within the area which is 50m from both sides of

the main river and 20m from both sides of the tributary?

5. Is the proposed plantation land natural forest or artificial forest the canopy density of which is greater than 0.5?

If any answer to the above five questions is "yes", then the land cannot be used for plantation. We should reconsider other places. If all the answers to these five questions are "No", then the land can be considered for the plantation project.

# 4 Plantation Technique Scheme of Korean Pine

## 4.1 Site Selection

Loose, ventilated and well-drained soil is suitable for Korean pines to grow. Therefore gentle slopes with loose and well-drained soil should be selected. Inappropriate places to plant Korean pines, such as the dry slopes, places with excess acid or alkali soil and imperfect drainage.

## 4.2 Plantation Density

Planting density should be taken into consideration based on the soil thickness and the forest usage. Land with thin and dry soil is mainly used to cultivate small-diameter timbers and protect forest, so it can be densely planted. On the contrary, land with fertile soil is suitable for large-diameter timbers with great economic benefits, thus it can be sparsely planted.

## 4.3 Arrangement of Tree Species

Mixed forests of Korean pine can protect the soil and reduce pests. Land with moist soil can be planted mixed forests of *Fraxinus mandshurica.* As for shady slopes and half-sunny slopes, it is suitable to plant mixed forests of linden and yellow pineapple. The proportions of coniferous trees and broad-leaved trees are generally 9/2，6/2，4/2.

## 4.4 Soil Preparation

Soil preparation **should be conducted one year in advance, usually in autumn**. **Firstly,** w**eeds and shrubs** should be eliminated in strips with a **width of 50 to 70 cm**. This method **of afforesting** while p**reparing the soil should be used in new water**-saving **cutover lands with fewer weeds,** f**ertile and soft soil**.

## 4.5 Seedling Selection

It’s preferred to choose 4 year-old seedlings with good root system, ground stem of above 0.5cm, taproot of above 18cm, and more than 10 lateral roots; plump buds, strong and straight stems, and high lignifications.

## 4.6 Plantation

Korean pines are preferred to be planted in spring. Seedling planting is a general method. Dibble planting method gains the highest survival rate. In order to ensure the survival rate, we should use this method: first dug the topsoil for planting seedlings; put the stretched roots into the hole to make the stems upright and then fill in the topsoil. When it reaches the two-thirds of the hole, we should pull up the seedlings to prevent curled roots or deep-planting; step on the soil tightly, and fill the rest up; step on the surface and finally cover it with regolith or dry branches and fallen leaves to prevent water evaporation.

## 4.7 Young Forest Tending

**The tending** of young forest **includes** weeding, bush cutting, erecting, treading, etc. Bush cutting, weeding and tending in **ribbons or bulks is usually adopted. Bandwidth** of the **tending ribbon should be about 50cm (50cm × 50cm** is **preferred). Tending time and frequency** should be **based on the growth of young trees** and weeds **intensity. Generally, the tending** should be conducted continuously for **3 to 7 years**, and **1 or 2 times per year**. **In the first year, the tending should be combined with brush cutting** to **erect and** solidly **tread** the **stock**.

# 5 Plantation Technique Scheme of Mongolian scotch pin

## 5.1 Site Selection

It's suitable for Mongolian scotch pine to grow in mountainous sand, gravel land, middle or upper part of sunny slopes, and areas with thin soil. The plantation would gain good results on well-drained, moist and rich soil. But they will fail to thrive and will become small old trees in wetland, impeded sticky soil, and soil containing more than 0.12% soluble salts. They should not be planted under crown canopy.

## 5.2 Plantation Density

The plantation density of protection forest should be 6660 plants/$hm^2$, while the commercial forest should be 3300 plants/$hm^2$ generally, and also can be 4400 plants/$hm^2$ on some occasion.

## 5.3 Soil Preparation

Soil preparation should be done one year in advance. Small scale-hole soil preparation should be made on steep slopes with barren soil and mountainous land with soil erosion. Soil dressing can be used on rocky mountain. The method of afforesting while preparing the soil can be used in the new deforested land and new derelict land with fewer weeds and loose soil. Wind erosion land can be used for plantation without soil preparation. Site preparation can be conducted in spring, summer and autumn, among which summer is the best choice. Because in summer, the grass seeds are not mature yet, and they can easily corrupt with high temperature and enough rain, which can increase the fertility of the soil.

## 5.4 Planting Season

Spring is the best season to plant Mongolian scotch pine. Because in spring the seedling root has strong ability to grow with less soil moisture. Thus we should quickly carry out the plantation when the soil is still moist. In dry years with strong wind, we should avoid plantation in wind period.

## 5.5 Seedling Section

It will cost 2 years for the seedlings to grow. The specifications for seedling to be brought on mountain is 12 ~ 15 cm high, 0.4 cm in ground diameter. Roots of the seedling should be cut in the original nursery bed 2 weeks ago. They can be lifted when the new roots differentiate. The slender seedling roots are easy to dry and not easy to form a new root once broken. Therefore, the protection of the seedling root is very important to improve the survival rate. We should shorten the exposure time of root in the air; and put the seedlings in water tanks, or wet grass, plastic bags, so as to avoid root damage. The one-year-old seedlings have weak resistance to the outside and the roots are easily to be damaged, which also have high death rate through the winter.

## 5.6 Plantation Methods

Hole-planting and narrow gap planting can gain good effect: the pit is always filled with wet soil to keep moisture, which reduces the digging and backfill soil processes with high efficiency. This area should not be using the method of the small pit leaning wall or machinery plantation method.

## 5.7 Tending of Young Forest

The forest tending may last 3 years. The tending contents of plantation in mountains mainly includes scarification, weeding and ridging. In the dry sand, we should earth up for Mongolian scotch pine seedlings to prevent the harm of physiological drought and animals in the winter of $1^{st}$, $2^{nd}$ and $3^{rd}$ year. The soil will be removed clearly in the spring of the $2^{nd}$ year before the stocks sprout to avoid damages of the terminal bud. 5 or 6 years later after the plantation, light-transmitting tending

must be adopted if the non-targeted species invade the planting area. The non-targeted trees and shrubs need to be cut down.

# 6. Plantation Technique Scheme of Larch

## 6.1 Site Selection

Larch grows well in areas with an annual average temperature of 2 ℃ ~ 4 ℃, daily temperature of 10 ℃, accumulated temperature of 2000 ℃ ~ 2800 ℃, annual rainfall of 600 ~ 900mm, and humidity degree of above 0.6. Low survival rate and poor growth have been seen in areas facing wind, dry slopes, peat moss swamps, and wet clay areas.

It's preferred to choose well-structured, moist and fertile soil, loose clay loam or valley alluvium and bottomland for plantation. In addition, the well-drained meadow, and mountainous brown forest soil can also be considered.

## 6.2 Mixed Forest Methods

Small areas of pure forest can be considered. When conducting plantation in a large scale, mixed forests is a better choice, because they could improve forest conditions and the stand stability. Species suitable for creating mixed forests include *Fraxinus mandshurica*, linden, white birch, and acer mono maxim. The mixed forests can be in ribbon pattern or blocky pattern, the mixture of which can help to balance the relationship between different species.

## 6.3 Plantation Density

Since Xing'an larch grow fast and prefer light, the planting should not be so dense. In ordinary barren areas where site conditions are rather poor, and there is a demand for thinning small-diameter timber and convenient transportation, the available planting density should be 4400 ~ 6600 plants per hectare. Thus canopy can be achieved early to improve forest conditions, help timely thinning and provide economic benefits as soon as possible. In the forest and the peripheral area, there are better site conditions and less labor. Thus large-diameter timber will be cultivated sparsely: 2500～3300 plants per hectare.

## 6.4 Soil Preparation Methods

Cave-shaped soil preparation method can be used in areas with less weeds and shrubs: the hole is 50cm in width and 30cm in depth. When preparing the soil, we should remove grass roots and gravels, put the fertile topsoil aside and the subsoil on the other side. In the gentle slopes with better soil fertility and moisture, ribbon pattern can be used for soil preparation, which is helpful for the growth of young forest and forest productivity. In the marshland and wet meadows, we must first build a high bed and a stereobate, then dig ditches for the drainage system, and conduct plantation finally.

## 6.5 Planting Season

Spring is the best choice. Due to the early foliation, the plantation should also begin as soon as possible. In the northeastern region, it may start in early or middle April when soil thaw depth is 15 ~ 20cm. Plantation in the fall is generally carried out in middle or late October to early and middle November. However, frost heaving is likely to occur, so we will put withered grasses, leaves or mosses of 6 ~ 7cm in depth on the planting hole in order to prevent frost heaving. Narrow planting is a perfect choice.

## 6.6 Plantation methods

Plantation by seedlings is a general method. In spring, the soil thawing is not deep, thus we should avoid planting in shallow pits, bare roots or curling taproots, and tangling of lateral roots. The seedlings should be put upright and the roots stretch. We should smash casingsoil, put the fertile topsoil around the roots and put subsoil on the surface. The casingsoil should be higher than the original surface in case of soil surface

subsidence in the future, and 1 ~ 2cm deep than the nursery time. A layer of loose soil will be put on the surface to prevent soil cracking.

In areas with great rainfall, low temperature (average annual temperature of 4℃), short growing season of plants (100~ 110 days), dramatic climate changes in spring and autumn, severe frost damage, relatively flat deforested land, great soil moisture and thin soil (humus horizon of 5~ 10cm), frost heaving is prone to occur after trenching and forestation. Based on the observations in Changbai Mountain, in some flat places with poor drainage, great temperature changes (ground temperature and air temperature) and excessive soil moisture (over 80%), thin layers of the surface soil would be frozen in spring (sometimes happens in late autumn) when the temperature difference becomes large (daytime ground temperature rises to above 10℃, while in the evening it drops below freezing point). When the temperature continues to drop (a minimum of minus 8℃ ~ 10℃), soil moisture would form to crystals of frozen blocks (up to 10cm thick) in the vertical direction at the bottom of the frozen soil layer. At this time, the roots of seedlings were solidly frozen. When the volume of frozen block expand to a large extent, the fibrous root seedlings are often pulled off and the taproots will be lifted. On the next day, when the temperature rises and the ice melts, the soil will fall off but the seedling roots cannot be restored and will be suspended in the soil. After a few rounds of freezing and thawing, the seedlings will be lifted higher and higher; and they may be pulled on the ground and become dead in severe situation. In areas where frost heaving happens, we can adopt the narrow slit planting method, which is also known as the soil conservation and antifreeze method. Characterized by planting without soil preparation, it can both save labor and prevent frost heaving. This method is most suitable for the new deforested land where soil is rich in organic matter, more dry branches and fallen leaves, good soil structure, less weeds and thickets. This method can maintain the original soil structure and physicochemical properties without soil preparation. When updating them, based on the spacing requirements, first wipe out dry branches and fallen leaves with hoes. The planting point will be 40cm × 40cm to make the topsoil exposed. Then plant trees with a shovel (spade) according to the requirement of “no curled roots, no bare roots; tread solidly and plant the seedlings upright”. The specific operation will be “three times spading, four times treading and then lift the seedlings”. It usually takes two years for seedlings to grow. In order to maintain moist of roots, it is needed to put the seedlings on a dedicated barrel in which all the roots can be soaked in the water when we begin to undertake mountain reforestation. We should pick them when we plant them, which is also an effective measure to improve the survival rate.

## 6.7 Tending of Young Forest

General speaking, the plantation needs weeding and cultivation for two or three times in the very year and the second year, and twice in the third year. In the first two years, it is required to weed and earth up around the roots to prevent the seedlings from being exposed, thus affecting their survival. As for the new deforested land, abandoned farmland and areas with fewer weeds, weeding and cultivation should be done once in the current year. Twice tending and weeding in the second year is needed and then tending once in the third year. In the process of weeding and bush cutting, we should pay attention to the protection of saplings. The pruning of young trees depends on the development of crown, and the pruning height should be at a quarter to a third of the tree height.

# 7 Technical Scheme of Tiger-friendly Forest Tending

## 7.1 Light-transmitting Tending

Targets of light-transmitting tending: the canopy density of young forest ≥0.8; trees are evenly distributed. As for forest lands where the undergrowth vegetation is sparsely distributed, measures like light-transmitting tending and felling of rotten, diseased, nontarget and over dense trees will be taken.

Technical requirements: the plant intensity is (15-30) %; the accumulation intensity is(10-20) %; the canopy density should be kept at 0.6-0.7 after felling. For pure forests, we should prune dense trees to make it even, cut down trees of low quality, trees with no cultivating meaning, and auxiliary trees that are too dense, and clear miscellaneous bushes that prevent forest growing. For mixed forests, we should adjust the forest stand and cut down trees that are in poor growing condition and prevent the target trees.

## 7.2 Ecological Thinning

Targets of ecological thinning: the canopy density of half-mature forest ≥0.7, slope<25°. As for trees in areas with deep soil and good site conditions, we shall adopt ecological thinning. To make the crown canopy form a stepped closure, and trees in main storey and sub storey can both receive straight sunlight, we shall classify trees into superior trees, useful trees and harmful trees, cut down harmful trees, and maintain superior trees, useful trees and a balanced amount of grass, bushes and vines.

Technical requirements: strains intensity and accumulation intensity in ecological thinning≤20%, canopy density should remain≥0.6 after felling.

## 7.3 Pruning

Targets of pruning: half-mature and young forests in which trees need to be pruned account for more than 60% of the total.

Technical requirements: according to the principle of pruning “slight pruning branches, retaining big crowns, controlling the competition and utilizing auxiliary trees”, the notch should be smooth and the bark should not be torn. We should prune branches closely from the stem base, and the section and trunk should be leveling without stubbles. Branch pruning should be done before the trees begin to bud. Cut off the dead arms or one of the twinning branches. The pruning height cannot exceed the longest green level branches. Generally, for young forests, the pruning height should not exceed 1/3 of the height of the tree; for half-mature forests, it should not exceed 1/2 of the height of the tree. After the pruning, preservatives should be put applied the cutting end.

## 7.4 Bushes cutting

Targets of bushes cutting: bushes that prevent trees from growing.

Technical requirements: First, bushes that do not compete for nutritions with target tress should be protected to preserve the biodiversity. Second, plants, endangered species, beneficial fungus and their hosts which have high economic values and important ecological status should be protected. Bushes in glade space, water wetlands and ponds should be well protected. Third, the height of cut bushes should be under 10cm.

## 7.5 Residuum disposal

Technical requirements: Residuum like harmful trees and dead trees should be disposed as the operation is conducted. Useful things in light-transmitting tending, ecological thinning and bushes cutting process should be utilized. Pruned branches should be removed or stacked together.

# 8 Environmental impacts and mitigation measures

## 8.1Environmental Impacts

Some activities in this plantation project, such as soil preparation, planting, tending of young forest and cleanup of supplementary feeding sites will remove local vegetation, so the total area of vegetation and vegetation coverage rate will be reduced in the short term. As the trees grow, the total area of vegetation and vegetation coverage will be gradually recovered; the glades will become forest lands; vegetation biomass and forest canopy density will increase significantly; and the adjacent scattered forest lands will connect with each other.

The plantation project will also have some impacts on the soil environment: the unreasonable land preparation methods are prone to cause soil erosion, thus changing the physical properties of the soil, increasing soil bulk density, decreasing the porosity, reducing the water retention and permeability of the soil, affecting trees' absorption and utilization of nutrients and water from forest lands, and leading to soil degradation; mechanical rolling during light-transmitting tending and ecological thinning operations will reduce the porosity of the soil, resulting in soil compaction. Application of base fertilizer and topdressing in young forest tending will change the environment and soil fertility in forest lands. Unreasonable fertilizer and spraying ways may cause soil nonpoint source pollution.

Low mountains and hills cover most of the project area, with relatively large gradient and great potential risk of soil erosion. According the site investigation and data collection, it is found that water erosion is the dominated form of soil erosion in the project area. During the cleaning up and soil preparation process of forest lands, the ruderal will be eliminated, which will contribute to local land exposure and small amounts of water and soil loss. Young forest tending measures include ruderal eliminating and fertilizer applying, will result in local soil disturbance and soil erosion. In the project area, there is luxuriant forest, large coverage rate of understory shrub and grass, and thick dead vegetation and moss layer, thus the light-transmitting tending and ecological thinning will not lead to obvious water and soil loss.

## 8.2 Mitigation Measures of Environmental Impact

(1) We should to carry out environmental education for participants in the project, especially forest tending and glade reforestation workers, raise their awareness and quality, and strictly prohibit hunting, transacting of wild animals and randomly picking wild plants. Once the protected wild animal or plant is found, we should make a record and field marks, take measures to protect the site and set aside enough surrounding space for them to grow.

(2) We need to design reasonable schedules for plantation activities to shorten the operation period. We will conduct forest cleaning up and soil preparation in autumn and winter, and carry out planting, pruning and bush-cutting in spring. We should avoid clearing forest and eliminating ruderal of young forest in rainy seasons, and take temporary protective measures during the operation in rainy seasons.

(3) We will adopt the mixed plantation method. The varieties of trees include spruce, larch, *Mongolian scotch pine, Pinus koraiensis*, etc. The mixed plantation can increase biodiversity and make the artificial forest ecosystem generate a food chain, where pests and predators can coexist, so as to prevent plant diseases and insect pests. Reasonable mix of tree species serves as the premise to maintain the stability of the forest ecosystem. When conducting forest species mix, we should take into consideration of the complementarities of ecological habits among them. Plantation of multiple species and varieties is the basis of maintaining the stability of forest

ecosystem. Trees of different species and varieties have different resistance to pests. Thus large-scale pest disasters of single species or variety can be avoided.

(4) Cave-shaped soil preparation can be helpful to reduce disturbance of natural vegetation; we should protect the miscellaneous shrubs under the gullies and ridges during soil preparations and plantation, and try to maintain the under forest vegetation and vegetation on forest edge during the operation. In the process of soil preparation, we should set up drains, retaining walls and take other measures in areas with steep slope to stop the overland runoff. The fracture surface of catch drain is U-shaped or trapezoidal; the horizontal catch drain is connected with the vertical drainage ditch, which is laid along the gentle slope; when the slope is greater than 15 degrees, catch drain is at a same angle with the drainage ditch, or connected with the mountain pass to form a S-pattern. The bottom and both sides of catch drain and drainage ditch can be used for stone masonry to protect if condition required, or we can plant grass to protect gully under other circumstances.

(5) The tending method should be partial tending. Tending measures such as fertilizing and weeding must be controlled within the 65cm radius of the plant. Put the weeds under the saplings during the tending, and keep the leaves in the cave to promote sapling growth and water and soil conservation.

(6) We use topsoil to refill the cave and bury leaves as fertilizer to increase organic matter in forest lands. We should avoid soil preparation in drought and after-rain seasons to keep the physicochemical properties of forest soil.

(7) When conducting plantation, we should rationally applicate the fertilizer according to soil fertility conditions, including determining rational fertilizer type, fertilizing amount and fertilization proportion. In fertile forest lands, we could use less or even no fertilizer, and the organic fertilizer should be the priority.

(8) When applying the base fertilizer, we should put the fertilizer into the cave, cover it with loose soil to reduce the chance of pollution caused by the rainfall; When it comes to topdressing, we will dig the caves around the tree trunk and bury the fertilizer in the soil, in order to prevent it from running off and polluting the environment. As for the fertilization, we can bury the leaves, weeds cut off in tending process into the soil to enhance soil fertility and promote the growth of trees.

(9) The residuums after pruning and bushes cutting should be centrally placed in the forest to reduce soil degradation; branches, leaves and other residuums after light-transmitting tending and ecological thinning operations should be returned to the forest.

(10) Pesticides and herbicides are restricted to reduce soil pollution.

(11) Tending and reclamation will be integrated to improve the physicochemical properties of the soil and enhance the quality of forest lands.

# 9 Integrated Pest Management

The integrated pest management aims to ensure the healthy growth and development of the forests. For this purpose, the *Pest Management Plan* is formulated in particular to be implemented in the project.

In the *Pest Management Plan*, we should strengthen the forecast of pest disease and make full use of the existing forecast agencies in each county, city and province. The integrated pest management (IPM) method will be utilized to prevent and control the pest disease. The chemical pesticides usage shall meet the requirements of the Pesticide Assignment Guidance of the World Health Organization (2009). The use of pesticides which belong to class I shall be prohibited and these of class U and class III will be encouraged and promoted. We should prevent environmental pollution, ensure human and animal safety and minimize the destruction of beneficial organisms. We must do our utmost to minimize the damage caused by the diseases and pests.

# 10 Forest Fire Prevention

(1) The forest fire prevention in the project forests must be included in the local forest fire management system at each level. Each unit which is responsible for plantation must draw up forest fire prevention plans and establish fire management agencies. Detailed plans about fire protection, public education, patrolling, law enforcement and fire emergency should be made.

(2) Each entity which is responsible for plantation must formulate forest protection and fire prevention plans, village regulations and agreements, and delimit areas of responsibility for fire prevention. Forest rangers should be appointed according to the forest area, and they shall report to the the project management office and forest protection and fire prevention organization regularly.

(3) The fire prevention planning should be considered during the design stage of plantation. Firebreaks must be established in each forest land which covers an contiguous area of more than 100 $hm^2$, to divide the forest land into several sub-compartments. The main firebreak is 20m in width, and the subsidiary firebreak is 15m in width. Trees planted in firebreak areas include *Schima superba* and waxberry, with a plant spacing of 2 × 2m.

# 11 Road Design

In order to facilitate various activities in the project area, forest roads shall be constructed, which need planning beforehand. Existing forest paths shall be utilized to the largest extent and the road shall be constructed along the contour line. Forest roads are required to be 0.8 ~ 1.0m in width, with an average density of 30 ~ 80 m/hm$^2$. Large-scale excavation shall be avoided in the construction of forest roads to minimize ground breaking areas and soil erosion.

# Attachment 3. Environmental Codes of Practice of Small Civil Engineering and Architecture Projects

## Contents

# Chapter 1 Overview

## 1.1 Contents of Small Civil Engineering Projects

The main contents of small civil engineering construction involved in this project are shown in Table 1-1. The layout map is shown in Figure1-1. All the projects in the table below should be carried out according to the Environmental Codes of Practice (ECOP) of the small civil engineering projects. The Environmental Codes of Practice majorly includes project introduction, set-up of environmental management institutions, implementation plan of environmental protection measures, environmental supervision and management plan, reporting mechanism and documentation management.

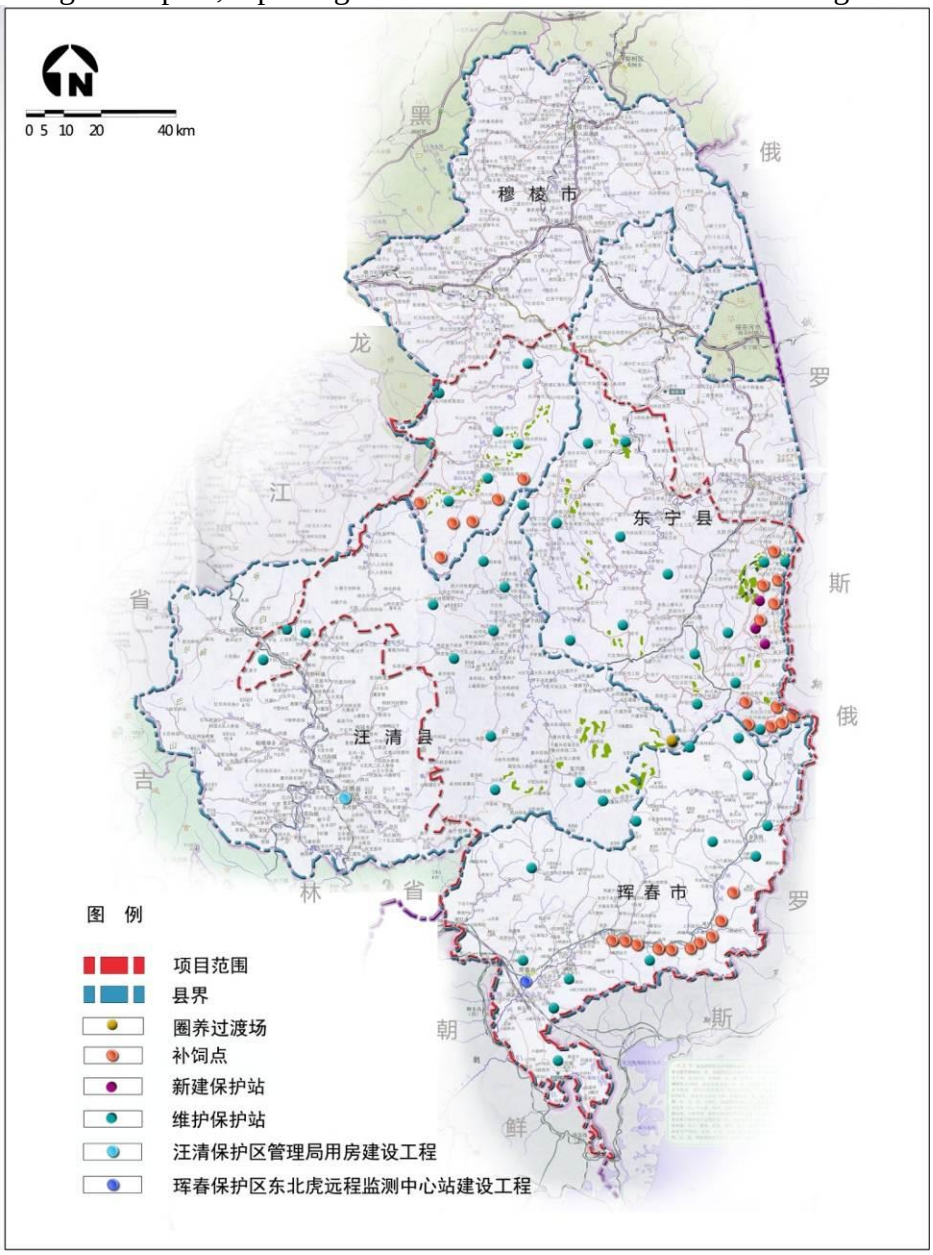



**Figure 1-1 Layout Map of Small Civil Engineering Construction**

**Legend:**

project boundary

county boundary

transitional enclosure

supplementary feeding station

 newly-built protection station
 maintained protection station
 building construction of Wangqing Reserve Authority
 Construction of the Siberian Tiger Remote Monitoring Station in Hunchun Reserve

**Table 1-1 Table of Small Civil Engineering and Architecture Projects in the Siberian Tiger Protection Project**

| No. | Name of the Sub-project | Scale（$m^2$） | Construction Description | Structure | Location | GPS dimensions |
|---|---|---|---|---|---|---|
| 1 | Reconstruction and Expansion Projects of Management and Protection Stations ( 47 in total ) | | | | | |
| 1.1 | Dongning Suiyang Laoyeling Nature Reserve (5 in total) | | | | | |
| | Nuanquanhe Management and Protection Station | 75 | reconstruction of the original buildings in the forest farm | brick and concrete | Nuanquanhe Forest Farm | N：43°31′45″，E：130°07′25″ |
| | Sanchahe Management and Protection Station | 70 | reconstruction of the original buildings in the forest farm | brick and concrete | Sanchahe Forest Farm | N：43°28′45″，E：131°08′50″ |
| | Yuanshan Management and Protection Station | 70 | reconstruction of the original buildings in the forest farm | brick and concrete | Yuanshan Forest Farm | N：43°36′50″，E：130°00′10″ |
| | Zhongguliu Management and Protection Station | 70 | reconstruction of the original buildings in the forest farm | brick and concrete | Zhongguliu Forest Farm | N：43°31′36″，E：130°51′47″ |
| | Sanjiela Management and Protection Station | 70 | reconstruction of the original buildings in the forest farm | brick and concrete | Sanjiela Management Station | N：43°32′30″，E：130°59′20″ |
| 1.2 | Muling Taxus Cuspidata Nature Reserve ( 3 in total) | | | | | |
| | Heping Management and Protection Station in the Nature Reserve | 85 | renovation of the old house, with complete water and electricity supply | brick and concrete | Heping | N：43°53′16″，E：130°05′43″ |
| | Longzhuagou Management and Protection Station in the Nature Reserve | 80 | renovation of the old house, with complete water and electricity supply | brick and concrete | Longzhuagou | N：44°00′42″，E：130°12′27″ |
| | Gonghe Management and Protection Station in the Nature Reserve | 80 | renovation of the old house, with complete water and electricity supply | brick and concrete | Gonghe | N：44°06′44″，E：130°12′25″ |
| 1.3 | Hunchun Nature Reserve (6 in total) | | | | | |
| | Qinglongtai Management and Protection Station in Hunchun Nature Reserve -1 | 300 | office building | framework | Huashu Village | N：43°16′15″，E：131°08′33″ |
| | Chunhua Management and Protection | 806 | office building | framework | Chunhua Town | N：43°11′52″，E：131°04′05″ |

| No. | Name of the Sub-project | Scale（$m^2$） | Construction Description | Structure | Location | GPS dimensions |
|---|---|---|---|---|---|---|
| | Station in Hunchun Nature Reserve -2 | | | | | |
| | Madida Management and Protection Station in Hunchun Nature Reserve -3 | 970 | office building | framework | Madida Village | N：42°55′49″，E：130°47′50″ |
| | Yangpao Management and Protection Station in Hunchun Nature Reserve -4 | 300 | bungalow office | brick and concrete | Yangpao Town | N：42°54′04″，E：130°29′36″ |
| | Banshi Management and Protection Station in Hunchun Nature Reserve -5 | 302 | bungalow office | brick and concrete | Taiyang Village | N：42°47′24″，E：130°25′59″ |
| | Jingxin Management and Protection Station in Hunchun Nature Reserve -6 | 826 | office building | framework | Jingxin Town | N：42°38′05″，E：130°28′30″ |
| 1.4 | Wangqing Nature Reserve ( 5 in total) | | | | | |
| | Lanjia Management and Protection Station | 500 | renovation of the old house, with complete water and electricity supply | brick and concrete | Lanjia Forest Farm | N：43°25′44″，E：130°58′13″ |
| | Xinancha Management and Protection Station | 500 | renovation of the old house, with complete water and electricity supply | brick and concrete | Xinancha Forest Farm | N：43°13′57″，E：130°46′35″ |
| | Duhuangzi Management and Protection Station | 500 | renovation of the old house, with complete water and electricity supply | brick and concrete | Duhuangzi Forest Farm | N：43°17′59″，E：130°40′23″ |
| | Jincang Management and Protection Station | 500 | renovation of the old house, with complete water and electricity supply | brick and concrete | Jincang Forest Farm | N：43°21′46″，E：130°29′12″ |
| | Dahuanggou Management and Protection Station | 500 | renovation of the old house, with complete water and electricity supply | brick and concrete | Dahuanggou Forest Farm | N：43°06'57"，E：130°24'47" |
| 1.5 | Suiyang Bureau of Forestry ( 8 in total ) | | | | | |
| | Qingshan Management and Protection Station | 140 | reconstruction of the original buildings in the forest farm | brick and concrete | Qingshan Forest Farm | N：44°03'50"，E：130°25'50" |
| | Huangsong Management and Protection Station | 160 | reconstruction of the original buildings in the forest farm | brick and concrete | Huangsong Management Station | N：44°04'00"，E：130°32'00" |

| No. | Name of the Sub-project | Scale（$m^2$） | Construction Description | Structure | Location | GPS dimensions |
|---|---|---|---|---|---|---|
| | Hanconghe Management and Protection Station | 160 | reconstruction of the original buildings in the forest farm | brick and concrete | Hanconghe Management Station | N：43°59'30"，E：130°32'30" |
| | Shuangyazi Management and Protection Station | 160 | reconstruction of the original buildings in the forest farm | brick and concrete | Shuangyazi Management Station | N：44°07'40"，E：130°37'20" |
| | Wanbaowan Management and Protection Station | 160 | reconstruction of the original buildings in the forest farm | brick and concrete | Wanbaowan Forest Farm | N：43°46'50"，E：130°45'00" |
| | Huichuan Management and Protection Station | 160 | reconstruction of the original buildings in the forest farm | brick and concrete | Huichuan Management Station | N：44°10'10"，E：130°42'00" |
| | Daohe Management and Protection Station | 160 | reconstruction of the original buildings in the forest farm | brick and concrete | Daohe Forest Farm | N：44°00'00"，E：130°41'30" |
| | Liuqiaogou Management and Protection Station | 160 | reconstruction of the original buildings in the forest farm | brick and concrete | Liuqiaogou Forest Farm | N：43°45'30"，E：130°31'45" |
| 1.6 | Muling Forest Bureau ( 4 in total ) | | | | | |
| | Shuangning Forest Farm | 60 | reconstruction of the original buildings in the forest farm | brick and concrete | Shuangning Forest Farm | N：44°51′56″，E：130°32′59″ |
| | Huashuhe Forest Farm | 60 | reconstruction of the original buildings in the forest farm | brick and concrete | Huashuhe Forest Farm | N：44°48′52″，E：130°52′58″ |
| | Dongxing Management Station | 60 | reconstruction of the original buildings in the forest farm | brick and concrete | Dongxing Management Station | N：44°37′58″，E：130°17′46″ |
| | Yangmuqiao Forest Farm | 60 | reconstruction of the original buildings in the forest farm | brick and concrete | Yangmuqiao Forest Farm | N：44°42′08″，E：130°46′25″ |
| 1.7 | Hunchun Municipal Bureau of Forestry ( 2 in total ) | | | | | |
| | Chunhua Management and Protection Station | 220 | simple maintenance of the existing buildings, with complete water and electricity supply | brick and concrete | Xitumenzi Village, Chunhua Town, Hunchun City | N：43°11′46″，E：131°04′10″ |
| | Hunchun Management and Protection Station | 50 | simple maintenance of the existing buildings, with | brick and concrete | office building of Hunchun | N：42°51′54″，E：130°21′37″ |

| No. | Name of the Sub-project | Scale（$m^2$） | Construction Description | Structure | Location | GPS dimensions |
|---|---|---|---|---|---|---|
| | | | complete water and electricity supply | | Municipal Bureau of Forestry | |
| 1.8 | Hunchun Forest Bureau ( 2 in total ) | | | | | |
| | Dafangzi Management and Protection Station | 60 | protection station buildings | brick and concrete | Dafangzi | N：43°25′05″，E：131°08′08″ |
| | Lanjia Management and Protection Station | 40 | protection station buildings | brick and concrete | Lanjia | N：43°19′33″，E：131°08′09″ |
| 1.9 | Tianqiaoling Nature Reserve / Tianqiaoling Forest Bureau of Wangqing County ( 5 in total ) | | | | | |
| | Xiangyang Management and Protection Station | 120 | protection station office, storehouse | brick and concrete | Xiangyang Forest Farm | N：43°51′53″，E：130°12′42″ |
| | Xidahe Management and Protection Station | 120 | protection station office, storehouse | brick and concrete | Xidahe Forest Farm | N：43°47′50″，E：130°04′7″ |
| | Neihe Management and Protection Station | 120 | protection station office, storehouse | brick and concrete | Neihe Forest Farm | N：43°42′23″，E：130°13′41″ |
| | Shanghe Management and Protection Station | 100 | protection station office, storehouse | brick and concrete | Shanghe Forest Farm | N：43°47′45″，E：130°16′33″ |
| | Huapi Management and Protection Station | 100 | protection station office, storehouse | brick and concrete | Huapi Forest Farm | N：43°39′48″，E：130°05′14″ |
| 1.10 | Wangqing Forest Bureau ( 2 in total) | | | | | |
| | Duhuangzi Management and Protection Station | 200 | renovation of the old house, with complete water and electricity supply | brick and concrete | Duhuangzi | N：43°17′59″，E：130°40′23″ |
| | Diyingou Management and Protection Station | 240 | renovation of the old house, with complete water and electricity supply | brick and concrete | Diyingou | N：43°26′51″，E：130°15′28″ |
| 1.11 | Wangqing County Forest Bureau ( 3 in total ) | | | | | |
| | Management and Protection Station in Shangtun Forest Farm | 180 | maintenance of the old buildings | brick and concrete | Shangtun Forest Farm in | N：43°43′22″，E：129°33′45″ |

| No. | Name of the Sub-project | Scale（$m^2$） | Construction Description | Structure | Location | GPS dimensions |
|---|---|---|---|---|---|---|
| | | | | | Chunyang Town | |
| | Management and Protection Station in Daxing Forest Farm | 200 | maintenance of the old buildings | brick and concrete | Daxing Forest Farm in Chunyang Town | N：43°24′40″，E：129°39′18″ |
| | Management and Protection Station in Tianqiaoling Forest Farm | 150 | maintenance of the old buildings | brick and concrete | Tianqiaoling Forest Farm in Tianqiaoling Town | N：43°35′27″，E：129°37′53″ |
| 1.12 | Dongning County Forest Bureau ( 2 in total ) | | | | | |
| | Management and Protection Station -1 | 60 | house | brick and concrete | Qianying | N：43°51′47″，E：131°13′30″ |
| | Management and Protection Station -2 | 300 | house，supplementary feeding storehouse | brick and concrete | Tiaoshigou | N：43°51′44″，E：131°9′34″ |
| 2 | New Construction projects of Management and Protection Station ( 3 in total ) | | | | | |
| 2.1 | Dongning County Niaoqingshan Nature Reserve ( 3 in total ) | | | | | |
| | Management and Protection Station -1 | 100 | house, storehouse | brick and concrete | Ganhezi, Miaoling | N：43°47′57″，E：131°12′22″ |
| | Management and Protection Station -2 | 100 | house, storehouse | brick and concrete | Liangzichuan production house | N：43°38′51″，E：131°9′13″ |
| | Management and Protection Station -3 | 120 | house, storehouse | brick and concrete | Yijian Management and Protection Huse | N：43°42′7″，E：131°6′6″ |
| 3 | Supplementary Feeding Station ( 32 in total ) | | | | | |

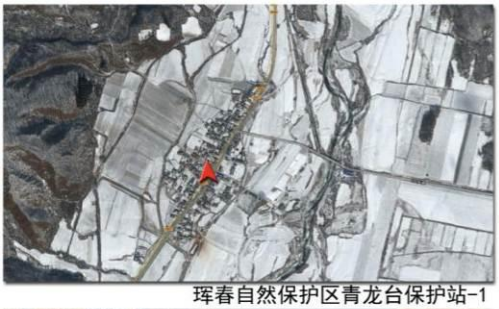
| No. | Name of the Sub-project | Scale（$m^2$） | Construction Description | Structure | Location | GPS dimensions |
|---|---|---|---|---|---|---|
| 3.1 | Supplementary Feeding Stations in Forest Industry Co., Ltd. Project Area ( 12 in total ) | | | | | |
| | Supplementary Feeding Station -1 | 3 | customize supplementary feeding trough, build snow-proof shed | wooden | 2nd compartment of Sacha River Forest Farm | Depending on animals' activity |
| | Supplementary Feeding Station -2 | 3 | customize supplementary feeding trough, build snow-proof shed | wooden | 25th compartment of Sacha River Forest Farm | Depending on animals' activity |
| | Supplementary Feeding Station -3 | 3 | customize supplementary feeding trough, build snow-proof shed | wooden | 33th compartment of Sacha River Forest Farm | Depending on animals' activity |
| | Supplementary Feeding Station -4 | 3 | customize supplementary feeding trough, build snow-proof shed | wooden | 20th compartment of Sacha River Forest Farm | Depending on animals' activity |
| | Supplementary Feeding Station -5 | 3 | customize supplementary feeding trough, build snow-proof shed | wooden | 4th compartment of Sacha River Forest Farm | Depending on animals' activity |
| | Supplementary Feeding Station -6 | 3 | customize supplementary feeding trough, build snow-proof shed | wooden | Lawn in Nuanquanhe Village | Depending on animals' activity |
| | Supplementary Feeding Station -7 | 50 | feed is placed in 5 gathering sites of feeded animals in the nature reserve | wooden | 30th compartment of Muling Nature Reserve | Depending on animals' activity |
| | Supplementary Feeding Station -8 | 50 | feed is placed in 5 gathering sites of feeded animals in the nature reserve | wooden | 70th compartment of Muling Nature | Depending on animals' activity |

| No. | Name of the Sub-project | Scale（$m^2$） | Construction Description | Structure | Location | GPS dimensions |
|---|---|---|---|---|---|---|
| | | | | | Reserve | |
| | Supplementary Feeding Station -9 | 50 | feed is placed in 5 gathering sites of feeded animals in the nature reserve | wooden | 25th compartment of Muling Nature Reserve | Depending on animals' activity |
| | Supplementary Feeding Station -10 | 50 | feed is placed in 5 gathering sites of feeded animals in the nature reserve. | wooden | 16th compartment of Muling Nature Reserve | Depending on animals' activity |
| | Supplementary Feeding Station -11 | 50 | feed is placed in 5 gathering sites of feeded animals in the nature reserve | wooden | 135th compartment of Muling Nature Reserve | Depending on animals' activity |
| | Supplementary Feeding Station -12 | 50 | feed is placed in 5 gathering sites of feeded animals in the nature reserve | wooden | 6th compartment of Huashuhe Forest Farm in Muling | Depending on animals' activity |
| 3.2 | Jilin Provincial Project Area ( 10 in total ) | | | | | |
| | Supplementary Feeding Station in Nongping Village, Hadamen Town, Hunchun City | 16 | supplementary feeding shed and trough in the forest | wooden | valley between Nongping and Baihu Mountain | Depending on animals' activity |
| | Supplementary Feeding Station in Sidaogou Village, Chunhua Town, Hunchun City | 16 | supplementary feeding shed and trough in the forest | wooden | Sidaogou River Valley | Depending on animals' activity |
| | Supplementary Feeding Station -3 | 16 | supplementary feeding shed and trough in the forest | wooden | Sidaogou Village, Chunhua Town, Hunchun City (Sidaogou River Valley ) | Depending on animals' activity |

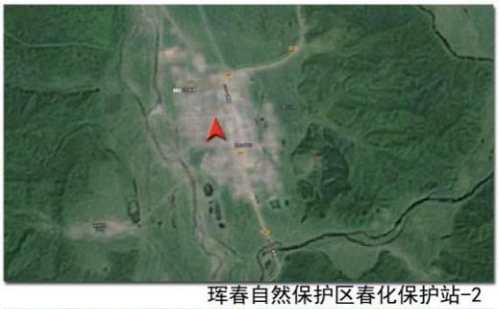
| No. | Name of the Sub-project | Scale ($m^2$) | Construction Description | Structure | Location | GPS dimensions |
|---|---|---|---|---|---|---|
| | Supplementary Feeding Station -4 | 16 | supplementary feeding shed and trough in the forest | wooden | Sidaogou Village, Chunhua Town, Hunchun City (Sidaogou River Valley ) | Depending on animals' activity |
| | Supplementary Feeding Station -5 | 16 | supplementary feeding shed and trough in the forest | wooden | Sandaogou Forest Farm in Hadamen Town, Hunchun City | Depending on animals' activity |
| | Supplementary Feeding Station -6 | 16 | supplementary feeding shed and trough in the forest | wooden | Area between Shuguang and Wudaogou village in Chunhua Town, Hunchun City | Depending on animals' activity |
| | Supplementary Feeding Station -7 | 16 | supplementary feeding shed and trough in the forest | wooden | Shuguang Village, Chunhua Town, Hunchun City | Depending on animals' activity |
| | Supplementary Feeding Station -8 | 16 | supplementary feeding shed and trough in the forest | wooden | Area between Madida and Tazigou village in Hadamen Town, Hunchun City | Depending on animals' activity |
| | Supplementary Feeding Station -9 | 16 | supplementary feeding shed and trough in the forest | wooden | Sandaogou Forest Farm in Hadamen Town, Hunchun City | Depending on animals' activity |
| | Supplementary Feeding Station -10 | 16 | supplementary feeding shed and trough in the forest | wooden | Xuedai Mountain | Depending on animals' activity |

| No. | Name of the Sub-project | Scale（$m^2$） | Construction Description | Structure | Location | GPS dimensions |
|---|---|---|---|---|---|---|
| | | | | | Pasture in Hadamen Town, Hunchun City | |
| 3.3 | Heilongjiang Provincial Project Area ( 5 in total ) | | | | | |
| | Supplementary Feeding Station -1 | 60 | supplementary feeding platform | wooden | Erheilingzi in Miaoling | Depending on animals' activity |
| | Supplementary Feeding Station -2 | 60 | supplementary feeding platform | wooden | Jinshagou in Ganhezi | Depending on animals' activity |
| | Supplementary Feeding Station -3 | 60 | supplementary feeding platform | wooden | Guosonggou | Depending on animals' activity |
| | Supplementary Feeding Station -4 | 80 | supplementary feeding platform | wooden | Yindonggou | Depending on animals' activity |
| | Supplementary Feeding Station -5 | 90 | supplementary feeding platform | wooden | Xujundadi | Depending on animals' activity |
| 4 | Transitional feedlot of Jilin provincial project area | 22 | transitional domestication of released deer | fence | Lanjia | N：43°26′39″，E：130°49′57″ |
| 5 | Building construction project of Wangqing Nature Reserve Administration | 1350 | remove the old buildings of forest safety department, add new buildings for the Administration | reconstruction of wasted houses | on the site of Forest Safety Department of Wangqing County | N：43°19′2″，E：129°45′25″ |
| 6 | Long-distance monitor center of Siberian tiger construction project in Hunchun Nature Reserve | 700 | utilize the existing office building in the nature reserve | utilize the existing building | Hunchun City | N：42°52′1″，E：130°20′35″ |

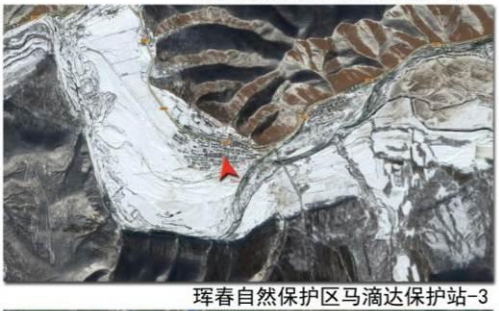
The geographical location of protection stations is shown in Figure 1-2.



珲春自然保护区青龙台保护站-1



珲春自然保护区春化保护站-2

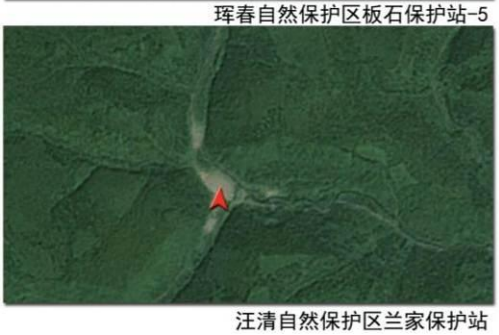


珲春自然保护区马滴达保护站-3

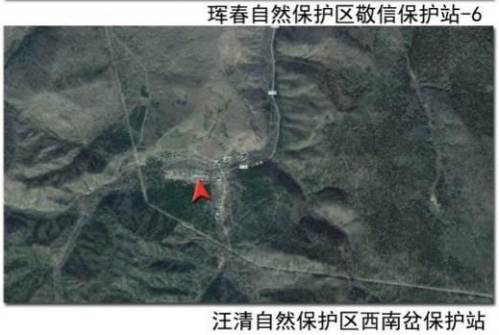
珲春自然保护区杨泡保护站-4

珲春自然保护区板石保护站-5

珲春自然保护区敬信保护站-6



汪清自然保护区兰家保护站

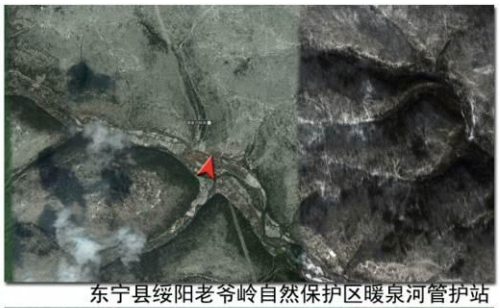


汪清自然保护区西南岔保护站

汪清自然保护区杜荒子保护站

汪清自然保护区金苍保护站

汪清自然保护区大荒沟保护站

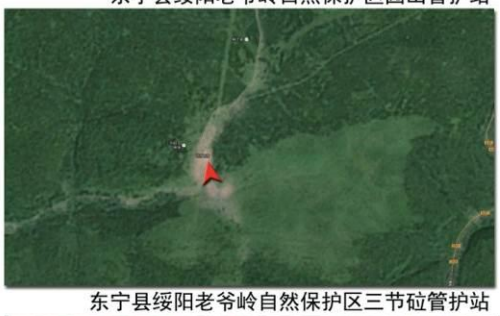


东宁县绥阳老爷岭自然保护区暖泉河管护站

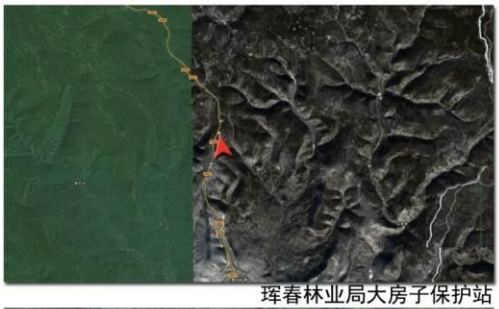
东宁县绥阳老爷岭自然保护区三岔河管护站

东宁县绥阳老爷岭自然保护区园山管护站

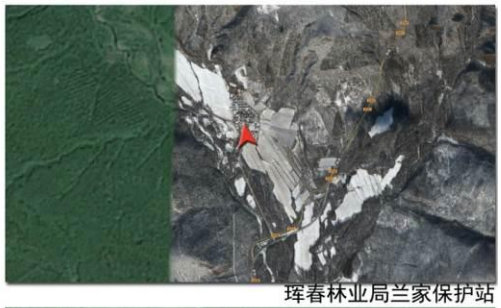
东宁县绥阳老爷岭自然保护区中股流管护站



东宁县绥阳老爷岭自然保护区三节砬管护站



珲春林业局大房子保护站



珲春林业局兰家保护站

杜荒子保护站

地阴沟保护站

绥阳林业局青山管护站

绥阳林业局黄松管护站

绥阳林业局寒葱河管护站

绥阳林业局双栎子管护站

绥阳林业局万宝湾管护站

绥阳林业局会川管护站

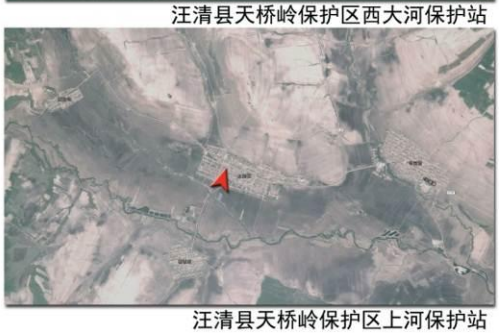
绥阳林业局道河管护站

绥阳林业局柳桥沟管护站

汪清县天桥岭保护区向阳保护站

汪清县天桥岭保护区西大河保护站

汪清县天桥岭保护区内河保护站



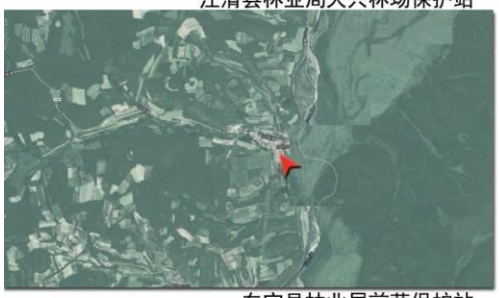
汪清县天桥岭保护区上河保护站

汪清县天桥岭保护区桦皮保护站

汪清县林业局上屯林场保护站

汪清县林业局大兴林场保护站

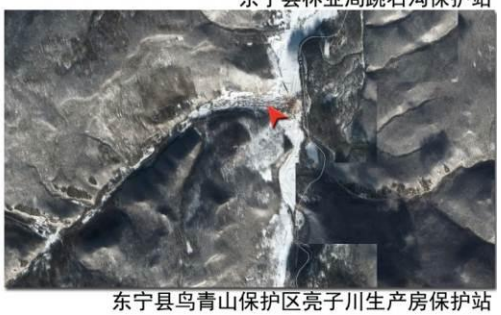
汪清县林业局天桥岭林场保护站



东宁县林业局前营保护站

东宁县林业局跳石沟保护站

东宁县鸟青山保护区庙岭干河子保护站



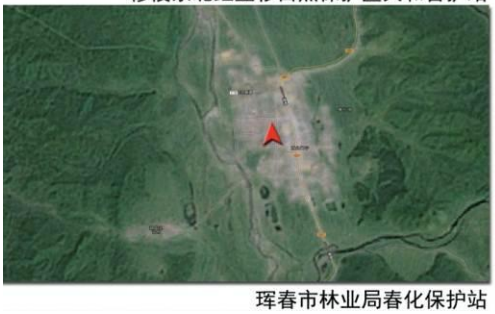
东宁县鸟青山保护区亮子川生产房保护站

东宁县鸟青山保护区一检管护房

穆棱东北红豆杉自然保护区和平管护站

穆棱东北红豆杉自然保护区共和管护站

穆棱东北红豆杉自然保护区龙爪沟管护站



珲春市林业局春化保护站

珲春保护站

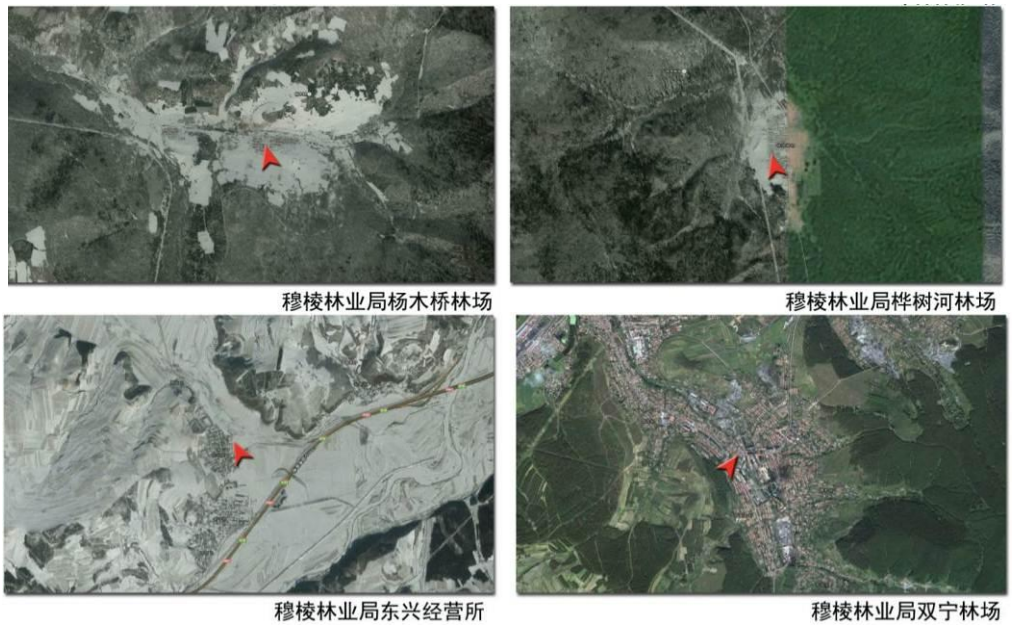



**Figure 1-2 Geographical Location of Protection Stations**

## 1.2 Relevant Laws and Regulations and the World Bank's Safeguard Policy

### 1.2.1 Relevant Policies, Laws and Regulations of China

Environmental Protection Law of the People's Republic of China (December, 1989);

Law of the People's Republic of China on Prevention and Control of Water Pollution (June, 2008)

Law of the People's Republic of China on the Prevention and Control of Air Pollution (September, 2000);

Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste (April, 2005);

Law of the People's Republic of China on Prevention and Control of Pollution from Environmental Noise (March, 1996);

Law of the People's Republic of China on the Protection of Cultural Relics (December, 2007);

Law of the People's Republic of China on Environmental Impact Assessment (October, 2002);

Regulations on the Administration of Construction Project Environmental Protection of the People's Republic of China (November, 1998)

Catalogue for the Classified Administration of Environmental Protection for Construction Projects (January 1st, 2003)

Regulation on the Implementation of the Land Administration Law of the People's Republic of China (August 28th, 2004).

### 1.2.2 The World Bank's Safeguard Policy

This Environmental Codes of Practice is promulgated as per requirements of the Environmental Assessment in OP4.01 World Bank Safeguard Policies: for environmental assessment of Category B projects, environment plans for pre-construction and the construction phase need to be made and carried out during the

construction, and mitigation measures should be supervised.

## 1.3 The Purpose of the Environmental Codes of Practice

The ECOP aims to formulate a series of operable environment policies to specify the environmental mitigation measures, environment management and institution building of the construction units and environment management departments during the project construction and operation periods, to eliminate or compensate for the potential negative impacts of the project on environment and society, and lower the impacts to acceptable level. The specific objectives include:

(1) To specify environment management responsibilities and duties of the construction unit and the carrier operator

Construction units and related design institutions should check the environmental protection objectives referred in the project area on site, put forward practicable environmental protection and mitigation measures and incorporate them into the project design. These measures will be contract responsibilities of the construction units.

⑵ To work as the operation guideline of environment management

The environmental codes of practices in construction and operation periods put forward in the ECOP can ensure the effective implementation of environmental protection and mitigation measures. This ECOP will be offered to environmental management units and other related units. It will specify responsibilities of related functional departments and management institutions and put forward the communication channels and methods among various departments.

## 1.4 Scope of Application

Based on the screening and classification requirements in the World Bank Safeguard Policy OP4.01— environmental assessment, and after the environmental identification of the type, location, sensitivity, scale, characteristics and degree of potential environmental impact, this project is classified into category B project. Projects of this category will generate impacts on the environment to different extent during the construction and operation periods. Thus relevant environmental management mechanism, environmental protection and mitigation measures are needed to lower the potentially adverse environment impact as much as possible.

This Environmental Codes of Practice applies to small civil engineering construction sub-projects of protection station, wild boar domestication station, transitional feeding station in the Siberian tiger reserves. According to the domestic Environmental Impact Analysis (EIA) requirements on construction project, this Environmental Codes of Practice is formed as the guideline for the environmental management units and construction units to effectively adopt all kinds of mitigation measures to reduce negative environmental impacts and to ensure a proper monitoring system.

# Chapter 2 ECOP Management System

## 2.1 Project Implementation Institution

In order to ensure that the project be carried out successfully and pushed forward actively and steadily, a coordinated, unified, and hierarchical management approach will be taken to strengthen the management of small civil engineering projects in Landscape Approach to Wildlife Conservation in China Northeast Project. Jilin Forestry Department, Heilongjiang Forestry Department and the General Bureau of Heilongjiang Forest Industry shall set up executive offices of Siberian tiger habitat protection program, which will be responsible for the daily management of the overall project. All Forestry Bureaus participated in the project shall set up project offices with similar structure with Provincial (Group) Forestry Department project offices. Provincial (Group) Project Offices are in charge of coordinating and managing all the matters related to the project in the areas of all the Forestry Bureaus participated in the project, and establishing the system of contact, report, and operation between relevant departments of higher, the same or lower levels.

Here below (Figure 2-1) is the institutional framework of small civil engineering projects of the Landscape Approach to Wildlife Conservation in China Northeast Project.

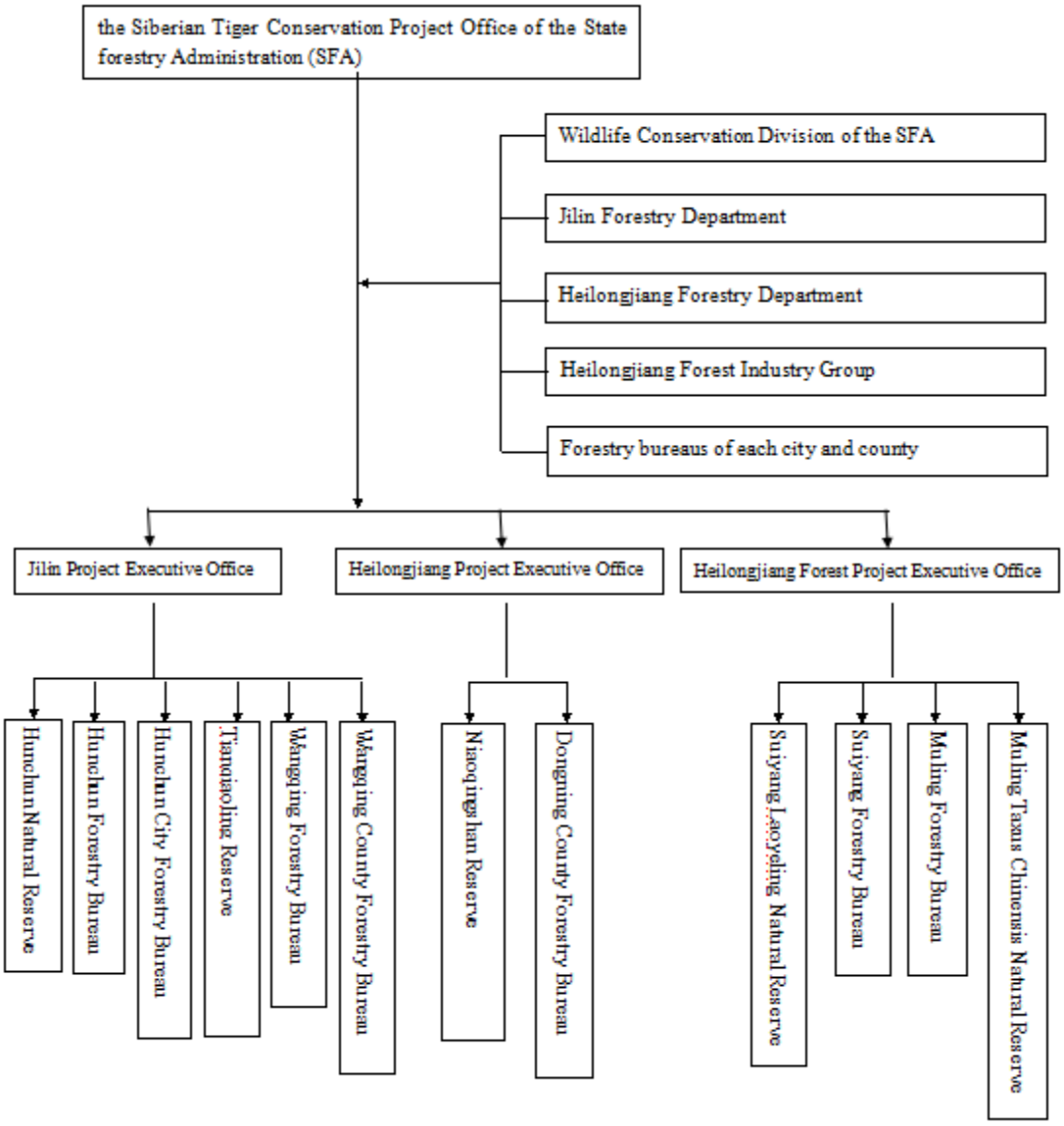


**Table 2-1 The Institution Frame of Small Civil Engineering Projects in the Landscape Approach to Wildlife Conservation in China Northeast Project**

## 2.2 Management System of ECOP

In accordance with relevant regulations of World Bank loan and actual need and based on the implementation institution frame, the ECOP sets up designated management institutions, which take charge of the environmental management and supervision of the project. An internal environmental management institution frame is intended to established among the provincial project offices, participating county (town) project offices, external design organizations, and supervision departments. As external environmental supervision and management departments, Environmental protection departments of the city, district and county related to the project will carry out the environmental management and supervision.

It's recommended to appoint responsible persons of environmental management in province project offices and participating county (town) project offices separately, and establish an environmental management system with these responsible persons as the center. The detailed information is shown in Figure 2-2 and Table 2-1.

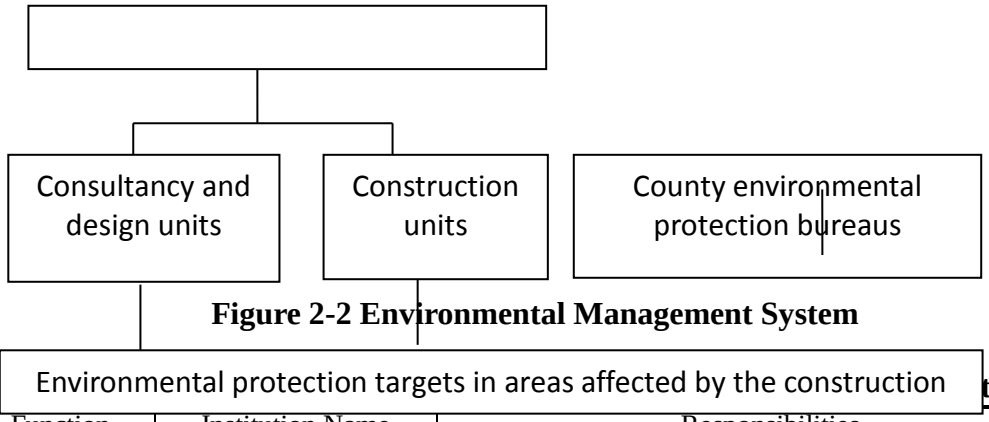



**Figure 2-2 Environmental Management System**

**T tem**

| Function | Institution Name | Responsibilities |
|---|---|---|
| Administrative institutions | project executive offices | To conduct and manage each sub-project |
| Supervisory institutions | County (local) environmental protection bureaus | As the administrative and supervisory institutions of the government, they shall review the environmental protection schemes of construction units and check the implementation of the environmental protection measures before acceptance. |
| Enforcement institutions | Construction units | As an implementing institution, they shall carry out relevant environmental protection measure stipulated in ECOP |
| Consultancy and service institutions | Consultancy and design institutions | Responsible for scientific research, environmental impact assessment, design and bidding; to reflect the environment protection on papers and drawings to make it convenient for implementation of construction units. |

## 2.3 Major Responsibilities of All Institutions of This Environmental Management System

In the management system, there are some internal institutions of the project, some hired consultancy institutions and some external institutions. All these institutions constitute an integrated environmental management system where each institution plays a different role in different phases of the project. Major responsibilities of each

institution in different phases of the project are shown in Table 2-2 as below.

**Table 2-2 Major Responsibilities of Environmental Management Institutions**

| Institutions | Phases | Major Environmental Responsibilities |
|---|---|---|
| Project Executive Offices | Preparation Phase | ① In charge of all the environmental protection management work in the phases of project design and preparation; ②Put environmental protection fund in place; ③Contact and coordinate with provincial project offices to carry out matters concerned to environmental management; |
| | Construction Phase | Designate environmental management personnel to implement ECOP, track and report the progress, timely coordinate with designers and constructors to implement environmental management measures, receive and deal with environmental complaints; |
| Design Consultancy Institution | Preparation Phase | ① Ensure that the engineering technology scheme produces the least environmental impact; ②Incorporate the scientific research, preliminary design and all the environmental protection measures that are brought up in the environmental impact assessment into the designing plan and budget, as well as relevant technical specification; |
| EIA Consultancy Institution | Preparation Phase | ① Compile the Environmental Impact Report (table); ② Formulate ECOP; |
| County Environmental Protection Bureau | Preparation Phase | As the administrative agency of the government on environmental protection, it shall reply to the environment assessment of the project construction. |
| | Construction Phase and Operation Phase | As an external supervisory institution, it shall supervise on the implementation of environmental supervision and management of the project. |
| Construction units | Construction Phase | Verify the requirements of relevant techniques documents, such as the environmental impact assessment, ECOP, and designing documents before construction, implement environment projects and management requirements during construction period. |

## 2.4 Environmental Management Personnel and their Major Responsibilities

To better carry out major responsibilities of environmental management institutions, it is recommended that environmental management institutions designate relevant environmental management personnel in accordance with requirements in Table 2-3 as below.

**Table 2-3 Table of Environmental Management Staff**

| Environmental Management Institution | Personnel Designation | Major Duties | Qualification Requirements |
|---|---|---|---|
| Project Executive Offices | 1 director in Heilongjiang Forestry Department, Jilin Forestry Department, and the General Bureau of | ① Conduct on-site environmental inspection at least once every month, fill in and file the Environmental Protection Inspection Check-list;<br>② Organize and carry out environmental management trainings;<br>③ Supervise and urge the implementation of environmental protection measures in the ECOP; | |

| | | | |
|---|---|---|---|
| | Forestry Industry respectively | | |
| | One complaints receptionist in above agencies respectively | ① Record and compile complaints raised during construction and operation, report to the manager, and solve public complaints;<br>② Cooperate with the director to do better work in environmental protection; | |
| Construction Units | One environmental management coordinator; | ① Implement environmental protection measures brought up in the ECOP;<br>② Report to County (District) Project Office in time when environmental emergencies happen in construction period; | |

## 2.5 Environmental Management Tasks in Each Phase of the Project

In different phases of project implementation, the ECOP is featured by different works, as referred to Figure 2-3.

The most important mission of ECOP is to ensure that every environmental protection measure be carried out in a pragmatic and effective way, including: (1) To engage the environmental protection measure of ECOP into project design and construction contract; and (2) The Environmental Supervision supervises on the implementation of the environmental protection measures by the construction units during project construction, and examines the effectiveness and implementation of the environmental protection measure.

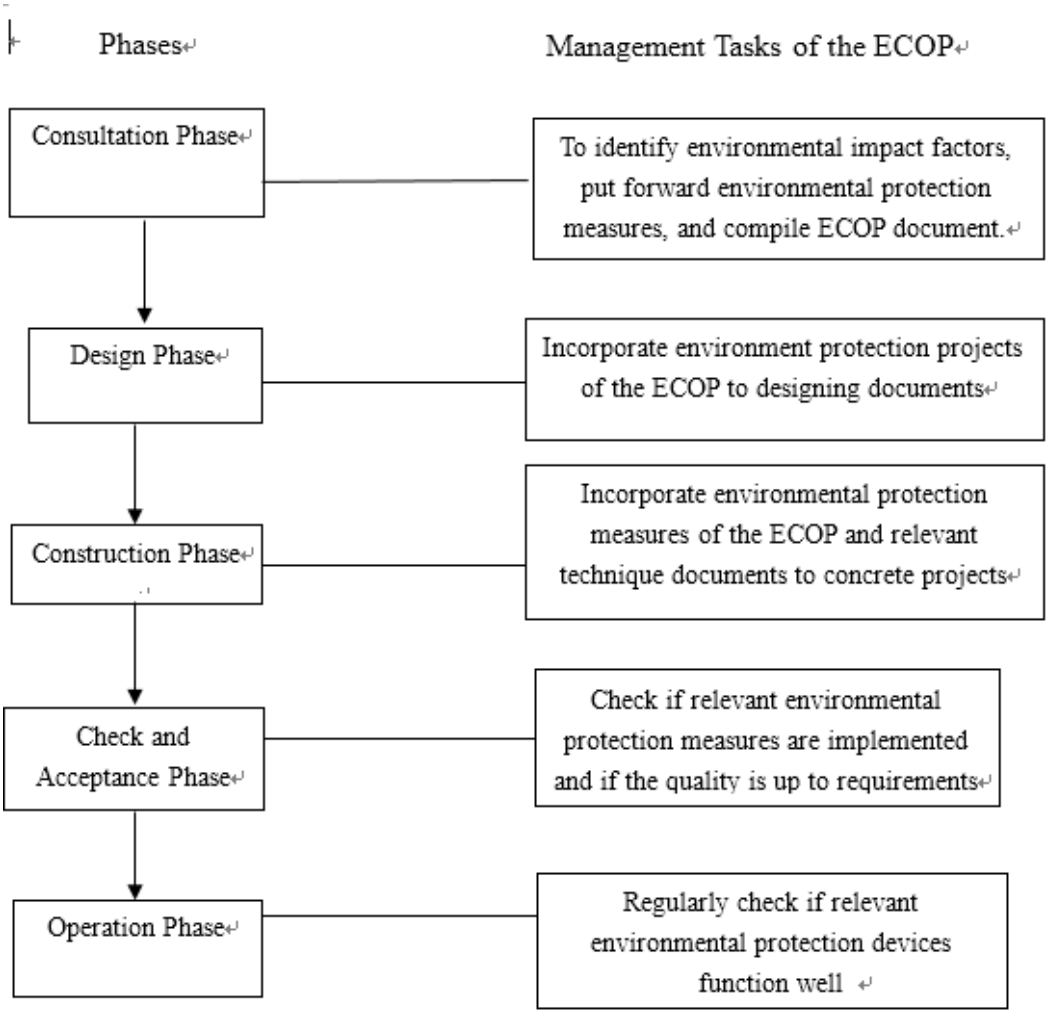



**Figure 2-3 Contents of ECOP in Different Phases of Project Implementation**

## 2.6 Document Management

During the implementation of ECOP, the project executive offices, the project office in charge of the Siberian protection project in the State Forestry Administration, environmental-impact assessment institutions and construction units shall all manage relevant documentations. Requirements for document management of each institution are shown in Table 2-4 as below.

**Table 2-4 Requirements for Document Management of each Institution**

| Serial Number | Name | Documentation Management |
|---|---|---|
| 1 | Construction units | ① The environmental management coordinator of the construction unit shall record and file detailed implementation of construction work every week;<br>② The construction units shall work together to complete and file the *Construction Site Inspection Check-List*, and report to Province (Group) Project Executive Office;<br>③ In case of emergencies, the environmental management coordinator of the construction unit shall record and file detailed implementation of construction work, store it, and report it to the local environmental protection department and the construction unit;<br>④ The construction units shall complete rectification within three working days after receiving the Rectification Notice (complete the part within 10 working days if it needs the coordination of |

| | | |
|---|---|---|
| | | administrative institutions), and file the documents. |
| 2 | Environmental -Impact Assessment Institution | ① To compile the *Environmental Codes of Practice of Small Civil Engineering and Architecture Projects*, refine the first draft and send relevant drafts for examination and approval, and file these drafts;<br>② To formulate and file domestic environmental impact assessment of each sub-project, refine the first draft and send relevant drafts for examination and approval, and file these drafts; |
| 3 | Project executive offices | ① To formulate and file regulations on implementing environmental management of each sub-project;<br>② To file the domestic approval and reply documents of environmental impact assessment;<br>③ To formulate and file training programs for implementing environmental management;<br>④ To record, compile and file complaints raised during construction and operation of the project;<br>⑤ To sign, collect and file the *Construction Site Inspection Check-List* submitted by construction units, and verify environmentally sensitive problems;<br>⑥ To manage and file the reported rectification notices. |
| 4 | Bureau Project Office | ① To supervise the implementation and file the *Environmental Codes of Practice of Small Civil Engineering and Architecture Projects*;<br>② To record the reports of Bureau Project Office every six months, submit and file relevant reports to the GEF. |

# Chapter 3 General Requirements of the ECOP

In construction process, contractors play the vital role in environment management, pollution control and prevention measures implementation. For the effective implementation of ECOP, the general requirements listed in this chapter apply to the major institutions involved in the construction process, which urge construction units to carry out environmental protection measures proposed by the ECOP under the coordination and supervision from internal and external side.

## 3.1 Environmental Measures Implementation in Drawing Construction Design and Bidding Document Preparation

In project implementation stage, project construction procurements will be conducted according to related procurement guidelines. The project executive offices shall require the bidding document preparation institution to commit the mitigation measures of potential negative environmental impacts into the technical specifications and construction drawing designs of the bidding documents. In bidding documents, tenderers should specify the following environmental management requirements, and include them in the contracts of small civil engineering and architecture.

(1) Contractors are required to equip one environmental management coordinator by his own, who takes charge of the environmental measures implementation during the entire construction period, makes sure the construction activities of project and subcontractor (if any) meet the demand of ECOP, and ensure the necessary environmental measures in construction process.

(2) The construction units must set up bulletin board on every construction site to inform the public with details of construction activities and time. Related information (contact person, contact number) of environmental management coordinator should be provided so that the public can complain or give recommendation on the construction activities.

(3) The construction units must include the *On-site Environment Management Plan* in the construction scheme.

(4) When the construction activities directly affect the environment protection objects, the construction units should communicate with local government and coordinate with the objects and determine the best construction methods and time that won't affect the environment protection objects and the normal travel and rest of local people.

(6) The construction units should abide by relevant local rules for conducting safe and civilized construction.

## 3.2 Preparation before construction

After the tender receipt, the project executive offices shall provide the results of environmental impact assessment to the construction units before the construction, including the EIA report, copy of relevant official reply documents from local environmental protection bureaus and the ECOP. The construction units are required to make environmental research on the construction site, which is aimed to verify and distinguish the description of each sub-project environmental impact assessment of surrounding areas of construction site and its environmental restricted factor. The *On-site Environmental management Plan* should be formulated based on the environmental management requirements in the contract, contents of which is shown in the Attachment 1 of this ECOP. In addition, there should be corresponding environmental protection measures for the environmental sensitive issues that's newly

discovered in the environment research before construction. The construction can begin only after getting approval of the environmental supervisory unit.

## 3.3 Environmental Management of Construction Site

During the construction of small civil engineering projects, direct environmental supervision of construction units' implementation of the ECOP shall be conducted throughout the whole project based on the *On-site Environmental Management Plan* made by the construction units. Meanwhile, the external environmental management supervision will be conducted by local environmental protection agencies, environmental protected objects and surrounding villagers.

## 3.3.1 Whole Process Environmental Supervision

The main responsibilities of environmental supervision unit include:

(1) Conduct daily supervision and give guidance to the environmental behavior of the contractor to comply with the ECOP;

(2) Inspect and approve the *On-site Environmental Management Plan* made by construction units;

(3) Track and monitor the implementation of measures taken by the construction units to protect the environment, avoid and mitigate the negative environmental effects;

(4) Supervise whether the construction behaviors of construction units meets the requirements of the ECOP;

(5) If one of the following situations (the environment protection requirements are failed to meet, adverse impacts on the environment are generated, or complaints about environments protection on the project sites occur) occurs, relevant investigation should be conducted immediately and the situation should be reported to the project executive office or local competent administrative department of environmental protection to seek resolutions. Meanwhile, the *Environmental Protection Rectification Notice* (see Appendix 3) should be given to the construction unit. Supervise the construction unit to take related rectification measures.

(6) Conduct regular environmental inspection of the construction site, fill in and file the *Environmental Protection Inspection Check-list* (see Appendix 2 for details).

## 3.3.2Supervision of Environmental Protection Departments and Public Advice

Throughout the construction, construction units shall closely cooperate with the local government and other departments to ensure to be in full obedience to the ECOP, to provide sufficient information to the public in the impact area. The local environmental protection bureau would conduct spot check on the environmental protection measures taken by the project owner and the construction unit, receive the on-site environmental supervision report offered by project owners and project executive offices, and take contingency measures in case unusual environment situation happened in construction.

The construction unit or shall make sure to post information in the constructing buildings and sites, and surrounding villages beforehand. The information should include the name of the construction unit, name and contact number of the environmental management coordinator, potential impacts and mitigation measures of the construction, estimated duration of the impacts, etc. The construction unit shall offer an open and transparent public participation mode, provide the hotline number

and office for receiving recommendation to follow up the consultation and recommendation from the public. As for the environmental problems reflected by the public, the contractor shall conduct immediate investigation and ensure to solve the environmental problem within the shortest time.

# Chapter 4 Management on Construction Site

This Chapter mainly introduce basic requirements of environmental management on construction sites. The construction units shall obey the administrative regulations and requirements of local environmental protection bureau.

## 4.1 Environmental Impact of the Construction Site

Construction activities, such as construction encampment, construction site sidewalk, storage and transportation of construction materials, gravel-soil-taken field, wasted dregs field, construction hours and construction vehicles will have various impacts on local environment. Besides, construction sewage and wasted air generated by construction machinery and equipment will also have impacts on the local surface water environment and air environment.

Impacts generated from the construction sites are temporary, which will disappear with the end of the construction work.

## 4.2 Management Measures on Construction Site

The construction units shall obey the following measures to reduce adverse environmental influence to minimum.

(1) Construction Hours

The construction hours shall be from 8:00 am to 8:00 pm, and there should be a break from 12:00 pm to 2:00 pm. Entry and exit time of construction vehicles should be consistent with the requirements of local government;

(2) Construction Encampment Arrangement

Construction units shall try as much as possible to rent residential houses in the surrounding areas or other construction encampments already in operation, and not to arrange construction encampment and boarding in the construction area, and only construction office, warehouse for construction materials and latrine pit are allowed in the construction area.

(3) Construction Site Sidewalk

Construction units shall try as much as possible not to build new construction site sidewalks and to use the existing local roads instead.

(4) Gravel-soil-taken Field and Wasted Dregs Field

Use existing legal gravel-soil-taken field, wasted dregs field determined by local environmental protection. No new fields shall be built. Excavation during the construction shall be reasonably allocated and transported to achieve “zero balancing” of the earthwork.

(5) The Public Information Board

① Erect the Construction Data Plate in the full position, to display the essential information of the project name, construction area, name of the construction unit, name of person in charge of the project, commencement and completion date of construction, supervision and complaint hot line, and detailed environmental protection measures, etc.;

② Construction units shall post notices of commencement of construction in surrounding areas of the construction site, which shall include the following contents of project summary, construction plan, the names of all responsible units of the construction and the project leader, and complaints and reports hot line, etc;

③ Night construction is restricted, and in case night construction cannot be avoided, prior notice should be made to inform the surrounding residents, striving to gain their understanding;

④ Five days prior to service interruptions (including water, electricity, communication and transportation, etc.) construction units shall post notices on the

construction site and the surrounding residential and enterprise areas to inform the public.

(6) Prevention of Accident

Construction units should set up accident prevention procedures beforehand and assign the personnel responsible for emergencies. Shall any accident occur, it should be handled in time and help should be sought from relevant departments.

(7) Public Safety and Health

Construction area shall be isolated and traffic signs and guardrail shall be set up, so as to ensure the safety of pedestrians; construction personnel should go through safety training before the construction begins, and personal safety protection equipment must be provided and used.

(8) The Prohibited Issues

It is prohibited to cut down trees at random outside authorized construction areas, to use unapproved hazardous materials, such as lead paint and asbestos; to use open fire, and for workers to use alcohol, etc.

# Chapter 5 Air Environment Quality Management

## 5.1 Impact Analysis of Air Environment Quality

The pollutants of the construction on air environment quality include construction dust and exhaust of vehicles.

### 5.1.1 Construction dust

Construction dust mainly includes road dust, stockyard dust, materials mixing dust and civil engineering construction dust.

Road dust is mainly caused by construction material transportation on construction roads.

The stirred dust in stockyard includes wind-caused dust of material piles, dust caused by loading and unloading, and re-entrainment of road dust caused by vehicles' passing by, etc.

Materials like concrete will cause a certain amount of dust in mixing process.

### 5.1.2 Exhaust of Vehicles

In construction period, another influencing element of the air quality is exhaust from various construction equipment and transport vehicles, which will mainly produce CO, $CO_2$, $NO_2$ and hydrocarbon. However, due to the short construction time of this project, the exhaust source is intermittent and fluid, with small amount, and has less influences on surrounding air quality.

## 5.2 Air Environment Quality Management Measures

To reduce the impacts of construction activities and machinery equipment on the air environment in the project area, we will strengthen the environment management, and take corresponding prevention and control measures aiming at different pollutant sources.

### 5.2.1 Construction Dust

(1) Select simple macadam pavement as construction roads and conduct regular sprinkling to reduce dust;

(2) Granular materials with fine particles piled in construction sites should be sealed or covered. Sprinkling on the surface of material piles accordingly can effectively reduce the dust amount;

(3) Control dust generated from concrete mixing process;

(4) The construction waste should be stored by categories and disposed in time according to related regulations for urban garbage classification; a certain amount of water should be sprayed before the transport and disposal;

(5) Strengthen the management of transport vehicles, and cover tarps over vehicles that will produce dust easily;

(6) Sprinkling measures should be taken in demolition projects. Dregs must be transported and cleared up in 3 days after the demolition is completed, which shall follow related regulations of demolition management.

(7) Measures of shelter, enclosure or sprinkling should be taken in dust-flying areas of construction sites;

(8) Storage places of materials and large frameworks should be smooth and solid;
(9) Spray water and clean construction sites in time;
(10) No burning of all solid waste.

## 5.2.2Vehicle Exhaust

(1) Choose construction machines and vehicles in good operating conditions;
(2) Fuel construction machines and vehicles must be operated in normal conditions to make sure the exhaust emission is within the standard amount;
(3) Utilize equipment properly and strengthen the maintenance and repair of equipment.

# Chapter 6 Sound Environment Quality Management

## 6.1 Sound Environment Quality Impact Analysis

Construction noise can be divided into mechanical noise, construction operation noise and vehicle noise.

The project construction period includes earthwork engineering phase, foundation construction phase, structural construction phase and decoration phase. The main noise sources and source intensity vary from each other in different phases.

## 6.2 Sound Environment Quality Management Measures

In different stages of the construction, each noise source will generate impacts to different degree on the sound environment in the project area. We will strengthen the environment management, and take corresponding prevention and control measures to reduce the impacts to the lowest degree.

(1) Select advanced and reliable equipment with low noise.

(2) The construction time is from 8:00am to 20:00pm. Construction activity is not allowed from 12:00am-14:00pm, which is time for noon break.

(3) Reasonably arrange the construction time and avoid operations of many large noise-making machines at the same construction site and at the same time.

(4) When vehicles go through environmentally sensitive areas like residential areas, construction units should take initiative measures, such as to limit the speed of construction machines and vehicles and forbid horn-blowing, to prevent and reduce noise influences.

(5) For the machines with loud noise, try to locate them at places far away from residential areas. In construction sites which is 5m or less away from residential areas, hospitals and schools, noise-reducing walls should be set up.

(6) Equip constructors with ear muff to reduce the influences.

# Chapter 7 Surface Water Environment Quality Management

## 7.1 Impact Analysis of Surface Water Environment Quality

The waste water in construction period mainly includes construction waste water and domestic sewage. Construction waste water mainly includes waste water caused by vehicle washing, construction site cleaning, construction material cleaning, concrete curing, and sandstone material washing. The waste water, though small in quantity, contains greasy dirt and sediments. If not handled properly, it will cause pollution to the soil, surface water and underground water. It will have greater impacts on surface water environment especially in rainy days.

## 7.2 Management of Environmental Quality for Surface Water

### 7.2.1 Rainwater Management and Collection

**(1) Rainwater Management**

Construction units are encouraged to utilize relevant functions like weather forecast and rainstorm warning on a regular basis, in order to cope with forthcoming adverse conditions. Water drainage management project should be adjusted and implemented to prevent possible massive runoff pollution.

**(2) Rainwater Collection**

Rainwater collection system should be highly valued in small civil construction sites. Corresponding water collection systems can be adopted according to the environment characteristics in the project region.

### 7.2.2 Management Measures of Waste Water Discharge

(1) Foundation pit drainage mainly includes underground water seepage and precipitation. The water quality is relatively good. It can be directly discharged without polluting the surface water environment when no construction waste water is not mixed inside, but it cannot be discharged into sensitive target protection areas like water source regions;

(2) Waste water caused by vehicle washing, construction materials washing, concrete curing, and sandstone materials washing in construction sites should be collected together. Mix and dilute the waste water to lower the PH, then lead it into temporary sedimentation tank, the size of which is at the standard where the waste water can stay for at least 12 hours. The processed waste water will be reused for construction sites cleaning, construction materials washing, concrete curing and sandstone materials washing.

(3) Set up temporary pail latrine in construction sites. Regularly clear the faces and turn them to farm fertilizer according to the actual conditions of rural areas.

(4) Strengthen the construction management and strictly control the running, emitting, dripping and leaking of construction machines; manage well the drainage system of temporary soil piles and take soil conservation measures to prevent the soil erosion from affecting the water environment.

(5) Each construction unit must implement every treatment measures regarding construction waste water and domestic sewage, and makes sure that the waste water is properly handled;

(6) Strengthen the environment conservation education of constructors and improve their environmental awareness. Constructors cannot litter or dump waste and waste water.

# Chapter 8 Protection and Management of Natural Resources

## 8.1 The Evaluation of Environmental Effects

The construction of the protection stations, the wild boar taming stations, the transitional feeding stations and the site excavation will greatly damage the present sedentary soil.

Impacts of the construction on vegetation mainly lies in damage of aboveground vegetation caused by the surface excavation, transporting and the stacking of construction materials and the production equipment, the rolling of the construction machines and the vehicles, and the treading of the operating personnel.

Noises caused by construction machines and activities of operating personnel are the main factors that will have effects on wildlife. Based on the field investigation, there is no large wild animals in this area, but some small birds and mouse will appear occasionally.

The reconstruction and expansion projects in the small civil engineering and architecture project will not occupy the forest lands, but the construction of protection stations, the wild boar taming stations and the transitional feeding stations will occupy a small amount of forest lands, which belong to forestry construction lands. Other lands are owned by the project owners. Thus it will not involve compensation for occupied land. Therefore, the construction will not have large impacts on the local forestry income and the ecological system.

The project will not have much impacts on the present utilization of the land in the project area. Because the land occupied by small civil engineering projects are mainly project owner's forestry construction lands. The change of land usage, though will change the current situation of land utilization in local areas, will also improve the utilization efficiency and the comprehensive value of the land, and improve the land use value in the end. This will improve the regional ecological protection value and lay foundations to the sustainable development of the forest regions.

## 8.2 Protection and Management Measures of Ecological Resources

(1) Reasonably optimize the layout of the construction sites, reduce the scope of construction activities, and minimize the damage degree of construction on the vegetation.

(2) Deliver the construction materials which need to be purchased from the outside, such as bricks, stones, sand, cement and timbers, only when they are needed, so as to reduce land occupation and vegetation destruction. Clean the construction site as soon as the project is completed. Afforest the construction site and restore the damaged vegetation to the utmost.

(3) Based on the investigation results of the construction site, set temporary protective fence around trees on the construction site that have not been cut down or transplanted before the construction.

(4) Allow no marks on trees except the identification tags. No construction materials shall be stacked and no machinery or equipment shall be stopped around the protection zone of trees.

(5) Build temporary intercepting ditches on the construction site, build flood drainage channels for surface runoff which is damaged by the project, so as to divert away the flood in the rainy season and avoid the erosion of the project by the surface runoff.

(6) With the quality assured, the construction unit should shorten the temporary occupation time of land, control the construction period of earthwork projects, maintain

the stable side slopes of excavating and filling, and reduce the impacts on areas outside the construction site.

## 8.3 Prevention and Control Measures of Water and Soil Loss

### 8.3.1 Engineering Measures

(1) Leveling the convex and backfilling the concave: including determining the area and depth of the backfilling area, measuring the capacity of backfilling material, the capacity and method and rolling compaction, the possible subsidence and its prevention and control measures.

(2) Lay out the transport route of backfilling materials and the covering soil.

(3) The backfilling and utilization: make full use of the waste soil, rock ballast for backfilling, try to use out the ballast and completely fill the pit after the backfilling.

(4) In the preliminary stage, determine the key section for backfilling according to the characteristic of the landform, topography and the depth of the backfilling area. Use machinery equipment such as bulldozers to deliver the earthwork to areas needed for backfilling. During the backfilling, try to make the fine-grained sandstones at the bottom, and the large stones on the top, then roll and flatten the surface.

### 8.3.2 Temporary Measures

There will be a long period in the foundation excavation of buildings, earth backfilling and the stacking of sand and stones. Temporary covering measures will be taken to avoid the erosion of wind and water.

### 8.3.3 Vegetation Measures

During the vegetation restoration on the construction site and the spoil area after the construction is completed, native species should be adopted and exotic species should be avoided.

# Chapter 9 Solid Waste Disposal Management

## 9.1 Environmental Impact Analysis of Solid Waste

Solid waste in construction period mainly comes from the construction waste, foundation excavation, waste soil after backfill and the constructors' domestic garbage.

## 9.2 Management Measures of Solid Waste Disposal

According to relevant laws and regulations, solid waste such as construction waste, and must be collected and disposed in a proper way.

(1) The clearance and transport of construction waste should be conducted in airtight containers. Aloft throwing is prohibited. The construction waste should be stored by categories and disposed in time according to related regulations for urban garbage classification;

(2) A certain amount of water should be sprayed before the transport and disposal of construction waste;

(3) Domestic garbage collected in bags from dustbins in construction sites should be transported to and processed in local domestic garbage landfill.

(4) Waste soil can be used to level and backfill convex and concaves in water and soil conservation project, and used as padding material for nearby road subgrade on the other as well. No spoil disposal area will be set;

(5) No burning of poisonous and harmful substances in construction sites, which will be processed according to relevant regulations;

(6) Dangerous waste produced in operating period should be processed by units with qualifications.

# Chapter 10 Construction Safety and Health

## 10.1 Analysis of Construction Safety and Health

The construction unit and the supervision unit shall take all reasonable measures to ensure the safety of workers and buildings around the construction site and prevent them from harm or damage. The construction safety and health of the project includes design and operation of general facilities, communication and training, human body risk and supervision.

## 10.2 Measures of Construction Safety and Health

The contractor shall conform to all national and local safety regulations and measures that can help to avoid accidents to ensure the safety and health of all construction workers.

(1) Ensure all buildings on the construction site are in good condition. Temporary buildings shall be safe and solid in structure, capable of resisting the bad weather, with adequate light, and can exclude some noise and dust.

(2) Provide and maintain fire extinguishing equipment on the construction site, which should be kept in good condition and placed where they are easy to reach.

(3)The constructor shall make sure to provide first aids that meet the requirement. There should be proper first-aid equipment on the construction site.

(4)Provide occupational health and safety training for all new workers, introduce fundamental working rules on the construction site, physical protection rules and how to avoid injuring other workers.

(5) Proper safety signs should be set at dangerous areas (such as power distribution room and compressor room), devices, materials, safety measures and emergency exits.

(6) Display safety signs on all electric devices and wires. Check all wires, cables and hand-held electric tools in case there should be any damaged or exposed wires. Determine the maximum allowable voltage of hand-held tools based on the manufacturer's advice. All electric devices used in the damp (or potentially damp) environment shall be double insulated or connected to the ground.

(7)Provide proper eye protection devices (such as welding goggles and welding masks) for all workers participate in or assist welding operation.

(8)Install protective fences at the edge of hazardous areas (there should be one bar in the middle and boards around). Meanwhile, equip workers with anti-fall devices (including safety belts and distance limit ropes).

(9) The construction units shall provide employees with personal protective equipment.

# Chapter 11 Cultural Heritage

According to relevant investigation and site inspection, there is no heritage in the construction area of each subproject. However, if there is any cultural relic discovered or suspected during the excavation or construction, according to the Law of People's Republic of China on the Protection of Cultural Relics (December 29th, 2007), the construction unit should protect the scene immediately, report it to the local bureau of cultural relics for identification and handling, and can resume to the construction with the agreement of the bureau of cultural relics. The construction unit shall stop the construction on the spot, tell the environment coordinator without delay, and protect the spot at the same time.

⑴ The environment coordinator of the construction unit shall report to the project executive office;

⑵ The project executive office shall report to the local county bureau of cultural relics and the project office bureau as soon as they get the report;

⑶ After receiving the report, the local county bureau of cultural relics shall immediately organize professional personnel to the scene for investigation, identification and evaluation. If no cultural relic is identified, the construction unit can continue the construction; if any cultural relic is identified, the local county bureau of cultural relics shall preliminary determine the level of protection, and report it to the provincial bureau of cultural relics.

**Appendix 1. Summary Table of Environmental Supervision and Management of Newly-built Protection Stations**

| No. | Content | Mitigation Measures | Implementing Unit | Supervision Unit |
|---|---|---|---|---|
| **Design Stage** | | | | |
| 1 | Water and Soil Loss | Design reasonably construction procedures and scientific methods. Reasonably select materials and positions to avoid soil erosion. | design unit<br>assessment unit | project executive offices, environmental protection bureaus |
| 2 | Greening | Conduct greening around the buildings | | |
| 3 | Forest Land Protection | Occupy as few forest lands as possible. | | |
| 4 | Air Pollution | Reduce dust. | | |
| **Construction Stage** | | | | |
| 1 | Land Resource and Surface Vegetation | (1) Reasonably optimize the layout of the construction sites, reduce the scope of construction activities, and minimize the damage degree of construction on the vegetation.<br>(2) Reduce land occupation and vegetation destruction when delivering the construction materials which need to be purchased from the outside. Clean the construction site as soon as the project is completed. Afforest the construction site and restore the damaged vegetation to the utmost.<br>(3) Based on the investigation results of the construction site, set temporary protective fence around trees on the construction site that have not been cut down or transplanted before the construction.<br>(4) Allow no marks on trees except the identification tags.<br>(5) Build temporary intercepting ditches on the construction site, build flood drainage channels for surface runoff which is damaged by the project, so as to divert away the flood in the rainy season and avoid the erosion of the project by the surface runoff.<br>(6) With the quality assured, the construction unit should shorten the temporary occupation time of land, control the construction period of earthwork projects, maintain the stable side slopes of excavating and filling, and reduce the impacts on areas outside the construction site. | construction unit | mental project executive offices, environmental protection bureaus supervision units |
| 2 | Water and Soil Loss | **1. Engineering Measures**<br>(1) The backfilling and levelling of convex and concaves: make full use of the wasted soil, rock ballast for backfilling, try to use out the ballast and completely fill the pit after the backfilling.<br>(2) Lay out the transport route of backfilling materials and the covering soil.<br>**2.Temporary Measures**<br>(1) Covering: Temporary covering measures will be adopted in the exposed parts of the temporary stacking yards. Dense dust-proof nets will be selected for the covering.<br>(2) Temporary straw-bag pressing: Fill straw bags with soil to press the dust-proof nets around the stacking yards. | the construction unit | project executive offices, environmental protection bureaus |

| No. | Content | Mitigation Measures | Implementing Unit | Supervision Unit |
|---|---|---|---|---|
| | | (3) Water sprinkling: splash water on the construction site once or twice after the land clearance.<br>**3. Vegetation Measures**<br>During the vegetation restoration on the construction site and the spoil area after the construction is completed, native species should be adopted and exotic species should be avoided. | | |
| 3 | Surface Water Pollution | (1) Foundation pit drainage can be directly discharged when no construction waste water is not mixed inside, but it cannot be discharged into sensitive target protection areas like water source regions.<br>(2) Waste water in construction sites should be collected together by water channels, and reused after treatment.<br>(3) Set up temporary pail latrine in construction sites. Regularly clear the faces and turn them to farm fertilizer according to the actual conditions of rural areas.<br>(4) Strengthen the construction management and strictly control the running, emitting, dripping and leaking of construction machines; and take soil conservation measures to prevent the soil erosion from affecting the water environment.<br>(5) Each construction unit must implement every treatment measures regarding construction waste water and domestic sewage, and makes sure that the waste water is properly handled.<br>(6) Strengthen the environment conservation education of constructors and improve their environmental awareness. Constructors cannot litter or dump waste and waste water. | the construction unit | project executive offices, environmental protection bureaus |
| 4 | Construction Noise | (1) Select advanced and reliable equipment with low noise;<br>(2) The construction time is from 8:00am to 20:00pm. During 12:00am-14:00pm, construction activity is not allowed.<br>(3) Reasonably arrange the construction time and reduce the noise-affecting time. Try to minimize impacts of the construction noise on constructors;<br>(4) Shock-absorbing and vibration-attenuating support shall be done for machines producing loud noise, and wrap up damping materials;<br>(5) Reasonably arrange transport time. In environment sensitive areas like residential areas, construction units should take initiative measures of limiting the speed of construction machines and vehicles and forbid horn-blowing to prevent and reduce noise influences;<br>(6) Conduct regular and effective maintenance and repair on all the mechanical equipment to keep them in good condition, reduce noise and prolong equipment usage;<br>(7) Strictly manage the construction intensity, machinery and vehicle operators, working specifications, etc. | the construction unit | project executive offices, environmental protection bureaus |
| 5 | Air Pollution | (1) Select simple macadam pavement as construction roads and conduct regular sprinkling to reduce dust;<br>(2) Granular materials with fine particles piled in construction sites should be sealed or covered;<br>(3) Use concrete mixed at sites, which is easy to apply sealing measures;<br>(4) The construction waste should be stored by categories; a certain amount of water should be sprayed before the transport and disposal; | the construction unit | project executive offices, environmental protection bureaus |

| No. | Content | Mitigation Measures | Implementing Unit | Supervision Unit |
|---|---|---|---|---|
| | | (5) Strengthen the management of transport vehicles, and cover tarps over vehicles that will produce dust easily;<br>(6) Sprinkling measures should be taken in demolition projects;<br>(7) The soil and rock in construction sites should be centralized and covered; vehicles should not be overloaded in case of downfall during transport;<br>(8) Spray water and clean construction sites in time;<br>(9) No burning of all solid waste;<br>(10) Fuel construction machines and vehicles must be operated in normal conditions to make sure the exhaust emission is within the standard amount; | | |
| 6 | Construction Safety and Health | (1) Temporary buildings shall be safe and solid in structure.<br>(2) Proper safety signs should be set at dangerous areas (such as power distribution room and compressor room), devices, materials, safety measures and emergency exits.<br>(3) Provide and maintain fire extinguishing equipment on the construction site.<br>(4) There should be proper first-aid equipment on the construction site.<br>(5) Eliminate the pinching danger when designing machines and make sure the protruding part of machines will not harm human bodies during the operation.<br>(6) Display safety signs on all electric devices and wires. Check all wires, cables and hand-held electric tools in case there should be any damaged or exposed wires. Determine the maximum allowable voltage of hand-held tools based on the manufacturer's advice.<br>(7) Provide proper eye protection devices (such as welding goggles and welding masks) for all workers participate in or assist welding operation.<br>(8) Provide employees personal protective equipment.<br>(9) Install protective fences at the edge of hazardous areas. Meanwhile, equip workers with anti-fall devices.<br>(10) The construction unit shall establish procedures and systems of reporting and recording the occupational accidents, diseases and emergencies. | the construction unit | project executive offices, environmental protection bureaus |
| 7 | Others | (1) If there is any cultural relic is discovered, the construction should be stopped at once and related information should be reported to local department of cultural relics. Necessary measures shall be taken and construction shall be stopped before the competent department of cultural relics finish the identification work.<br>(4) Obvious warning signs and night signal lights should be set in the construction area. | the construction unit | project executive offices, environmental protection bureaus |

**Appendix 2. Construction Site Inspection Check-list**

Subproject Name: Contract No. and Subproject Location:

Construction Site Name: Check Date Weather:

Inspector: Check Date of Construction Site:

| Serial No. | Environmental Problems | Yes | No | Not Involved | Remark/ Recommendation |
|---|---|---|---|---|---|
| 1 | Are material cultural resources (like cemetery) extremely sensitive to local people be contained in the project? | | | | |
| 2 | Is there known archeological, historical of cultural heritage in project area? (including ancient tomb and mausoleum) | | | | |
| 3 | Are there demolitions in project area? | | | | |
| 4 | Will the project demolition involve part of business and enterprise? | | | | |
| 5 | Will the project construction cause short-term influence on local people for the use rights of infrastructure, service and related resources? | | | | |
| 6 | Are there many environmental protection targets (hospital, study, residential area, village, etc.) in the area influenced by the project? | | | | |
| 7 | Will the border trees involved in the project need to be transplanted? | | | | |
| 8 | Are there facilities of power supply (electric wire, electric pole, and transformer), communication, water supply and drainage and heating in construction site? | | | | |
| 9 | Will the construction roads conflict with local traffic? | | | | |
| 10 | Others (please specify) | | | | |

**Appendix 3. Environmental Protection Inspection Check-list in Construction Period**

Landscape Approach to Wildlife Conservation in Northeast China Project No.
Date

Direction: This form is the environmental protection checklist in construction period of "China Northeast Wild Animal Protection Methods Project", which can be reasonably added or adjusted according to specific subproject, local environment and related environmental measures.

Subproject Name: Contract No. and Subproject Location:
Construction Site Name:
Current Construction Stage:
Environmental Protection Check Date: Specific Time:
Check Date Weather:
Inspector:

| Check Element | Implementation | | Inapplicable | Remark |
|---|---|---|---|---|
| | Yes | No | | |
| **1. Air Pollution Control** | | | | |
| 1.1Whether the construction site is sprinkled to reduce raise dust | | | | |
| 1.2 Whether the powdered material stacking space is covered of sprinkled to reduce dust | | | | |
| 1.3Whether the vehicles loaded with powdered material is covered or sprinkled before leaving the site | | | | |
| 1.4 Whether sprinkling measure is taken in demolition | | | | |
| 1.5 Whether consecutive and closed fences are set up in construction site | | | | |
| 1.6 Whether the earthwork in construction site is focus stacked and covered | | | | |
| 1.7 Whether the storage place of material and large molds in construction site is smooth and solid | | | | |
| 1.8 Whether the dusty road is hardened, paved with sand or frequently sprinkled | | | | |
| 1.9 Whether the construction road required a speed limit, whether there is speed limit post | | | | |
| 1.10 Whether fuel machinery and vehicles are working in normal conditions, whether there is black smoke in operation | | | | |
| 1.11Whether there are waste combustions | | | | |
| 1.12Others (please specify) | | | | |
| | | | | |
| **2. Water Pollution Control** | | | | |
| 2.1 Whether the waste water treatment system (like temporary sedimentation tank) is normally used and maintained | | | | |
| 2.2 Whether construction waste water is effectively treated and utilized | | | | |
| 2.3Whether construction waste water is | | | | |

| Check Element | Implementation | | Inapplicable | Remark |
|---|---|---|---|---|
| | Yes | No | | |
| discharged into storm drains | | | | |
| 2.4 Whether there are facilities collecting and guiding construction waste water into sedimentation tank (like U-shape) | | | | |
| 2.5 Whether the U-shape mud discharge is conducted | | | | |
| 2.6 Whether the temporary sedimentation tank mud discharge is conducted | | | | |
| 2.7 Whether the sediment of washing facilities are precipitated and regularly cleaned out | | | | |
| 2.8Whether the domestic sewerage is properly handled | | | | |
| 2.9 Whether the faces in pail latrine are timely cleaned up | | | | |
| 2.10Others (please specify) | | | | |
| | | | | |
| **3. Noise Control** | | | | |
| 3.1Whether the equipment making large noise are placed indoor when running | | | | |
| 3.2Whether the idle equipment are turned off or set in throttling status | | | | |
| 3.3Whether effective noise reduction measures (vibration attenuation , noise reduction and noise barrier) have been taken | | | | |
| 3.4 Whether quiet equipment are used | | | | |
| 3.5 Whether the construction time is properly arranged | | | | |
| 3.6 Others (please specify) | | | | |
| | | | | |
| **4. Solid Waste Management** | | | | |
| 4.1Whether the construction site is clean and tidy | | | | |
| 4.2 Whether the construction waste is stored classified and timely cleared | | | | |
| 4.3 Whether the water is sprinkled before construction waste is cleared | | | | |
| 4.4Whether waste soil ( spoil) is timely comprehensively utilized | | | | |
| 4.5 Whether there are poisonous and harmful substances combustions in construction site | | | | |
| 4.6Whether the greasy dirt overflows, whether the polluted soil is immediately cleared up | | | | |
| 4.7Whether the asbestos waste are handled by registered professionals | | | | |
| 4.8Others (please specify) | | | | |
| | | | | |
| **5. Protections of Animals, Plants and Cultural Relics** | | | | |
| 5.1Whether the harm to terrestrial plants has been reduced to minima, whether the plants are protected | | | | |
| 5.2Whether there are rare species | | | | |
| 5.3Whether cultural relics are found in | | | | |

| Check Element | Implementation | | Inapplicable | Remark |
|---|---|---|---|---|
| | Yes | No | | |
| construction, if so, make sure the protective measures have been taken | | | | |
| 5.4Others (please specify) | | | | |
| | | | | |
| **6. Resource Protection** | | | | |
| 6.1Whether pipe burst and waste have been prevented | | | | |
| 6.2 Whether energy-saving measures have been taken | | | | |
| 6.3 Whether the material storage condition is good to prevent material degradation or waste | | | | |
| 6.4Others (please specify) | | | | |
| | | | | |
| **7. Soil Erosion Protection** | | | | |
| 7.1Whether temporary measures (temporary straw bag suppression, water sprinkling) | | | | |
| 7.2 Whether engineering measures (land consolidation) have been taken | | | | |
| 7.3 Whether vegetable measures (native species greening) have been taken | | | | |
| 7.4Others (please specify) | | | | |
| | | | | |
| **8. Construction Safety and Emergency Measures** | | | | |
| 8.1Whether the fire extinguisher or fire-fighting devices are kept in good conditions, whether the escape route is unblocked | | | | |
| 8.2Whether the construction site is equipped with proper first aid devices | | | | |
| 8.3Whether the right signboard are hung on dangerous areas and emergency exits | | | | |
| 8.4Whether the construction unit offer personal protective outfits for constructors | | | | |
| 8.5 Whether health education are conducted | | | | |
| 8.6Others (please specify) | | | | |
| | | | | |

* If any "non-implementation" record exists, there must be some conditions out of specification or need to be improved. Thus the environmental supervisor shall sign and issue "Environmental Rectification Notification" to contractors, and mark the serial number in Remark column. The detailed information of contractors' corrective actions shall be separately recorded.

**Signature of On-site Inspector:** **Date:**
**Signature of Environmental Supervisor:** **Date:**

**Appendix 4. Environmental Protection Rectification Notice**

Subproject Name: Contract No. and Subproject Location:
Construction Site Name:
Current Construction Stage:

| |
|---|
| Problems found in site inspection: |
| The construction unit analyses reasons and puts forward measures for improvement: |
| Rectification opinions of environmental protection department(if necessary): |
| Supervisor: Date:<br>Finish the rectification within days. Receiver: Date: |
| Inspection conclusions:<br><br>Reviewer: Date: |