

## Discussion on Epidemic Prevention and Control Regarding to Rural Drainage System and Development of Rural Water Environment Management



 **重庆市科学技术研究院**  
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# Introduction of Speaker

## Education Background:

Bachelor and Master of Environmental Engineering, Tsinghua University, Beijing, 1986-1994,  
 Master of Environmental Engineering, University of British Columbia, Canada, 2002-2005.

**Technical Area:** management, academic research and technological development of various professional fields, including water and wastewater system operation and management, rural safe drinking water, Sponge City Construction, Integrated Water Environment Management, Low-carbon technology and Carbon Trading and other professional fields.

## Published Monographs:

Black-odorous Water Treatment and Management in the Three Gorges Reservoir Region Theory and Practice;  
 Sponge City of Mountainous Region Theory and Practice;  
 Sponge City of Mountainous Region: Case Study.



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Deputy Director of Research Center for Low-carbon, Ecological and Environmental Protection of Chongqing Academy of Science and Technology;  
 Deputy Director of Chongqing Research Center of Engineering and Technology of Sponge City Construction

# Introduction of Team



## ◆ Chongqing Low-Carbon and Ecological Environmental Protection Research Center

It was established in 2010.

It is a key R & D center of Chongqing Academy of Science and Technology.

## ◆ Cooperation and Joint Research and Transformation Platforms

China-Canada Three Gorges Water Science and Technology Research Center

Chongqing Sponge City Construction Engineering Technology Research Center

Chongqing Chongke Lisheng Water Purification Technology Co., Ltd.

Water Environment Research Institute of Chongqing Jiaotong University

Chongqing University of Technology Teacher Practice (Student Internship) Base

## ◆ Research directions and fields

Rural safe drinking water;

Integrated treatment of water environment;

Mountainous region sponge city construction, etc.



## Measures and Suggestions for Microbial Removal and Operation Management in Drinkable Water Plants in Mountainous Region during Epidemic Period.

疫期山地饮用水厂微生物去除与控制运行管理对策措施与防控建议

原创 雷晓玲, 等 中国给水排水  
2月29日

蓝碳照学 关注我们



雷晓玲(1967—), 教授, 研究生导师, 重庆英才·创新领军人才。现担任重庆市科学技术研究院低碳与生态环保研究中心负责人, 兼任重庆市海绵城市建设专家委员会副主任

面对疫情, 村镇环境科技产业联盟在行动! 联盟专家与企业代表共议新冠疫情下的村镇水环境安全

封面 魏泽军 水工业市场杂志 2月27日

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“虽然我们不能走到武汉抗击疫情的最前线, 但只要我们尽力做好本职工作, 这就是对抗击疫情做出的最大贡献。”面对新型冠状病毒疫情, 村镇环境科技产业联盟在积极贡献自己的力量!

疫情发生以来, 联盟专家和企业心系村镇水环境安全, 并针对疫情下各种村镇水环境问题发表见

## How to Better Prevent Water Pollution and Secure Water Environment Safety in Mountainous Region during the Epidemic?

疫情期间如何加强山地地区水污染防治与水环境安全?

水工业市场杂志 2月22日

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## 重庆市住房和城乡建设委员会

城建排水 [2020] 3号

重庆市住房和城乡建设委员会  
关于印发《重庆市新型冠状病毒肺炎疫情期间城镇排水系统风险防范工作指南(试行)》的通知

主编单位: 重庆市市政设计研究院

参编单位: 重庆大学

重庆市水务资产经营有限公司

重庆水务集团股份有限公司

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Facing the Epidemic, the Rural Environmental Technology Industry Alliance is Taking Action! Alliance Experts and Enterprise Representatives Discuss the Safety of Rural Water Environment During the Epidemic.

Guide to Risks of Drainage System in Chongqing



# "One Belt One Road" and Chongqing Municipality



**Chongqing** is an strategically important base for the economic development of west China. Chongqing has outstanding geographical **location at the junction of the silk road economic belt and the Yangtze river economic belt**, which can be connected to north and south, west and east, plays a unique and irreplaceable role in the economic development of west China and the opening to the outside world. Chongqing is given a vital mission in supporting economic growth in west China, **leading “One Belt One Road” initiative** and serving as an role model in establishing a sustainable economy along the Yangtze River by the Nation’s plan for economic development in the new era.

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**Guidelines for risk management amid operations of rural drainage systems during the epidemic (Trial)**

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- 4** **Key Protection Measures for Sewerage Collection System**
- 5** **Key Protection Measures for Sewage Treatment Station (Plant)**
- 6** **Discussion of the Development of Rural Water Environment Treatment**

# Chapter 1

## Application Scope of The Guidelines



# 1.1 Purpose and Scope of the Guidelines

## Purpose of the Guidelines

☛ **Ensure** the safe and stable operation of the village and town drainage system, **reduce** the risk of the spread of the COVID-19 virus through the drainage system, and **protect** the health of the production workers and surrounding residents and the safety of the water environment.

## Scope of the Guidelines

☛ This guidelines (for trial implementation) is a **guidance document** for the prevention and control of rural drainage system operational risks during the epidemic situation, and can also be used **as a reference** for prevention and control of future public health accidents similar to the epidemic situation and **as a supplement** to rural sewage treatment contingencies.



# 1.2 Contents of the Guidelines

## (1) General

The compilation **background, basis and application scope** of the guide.

## (2) Foundational Regulations

**Basic practices and foundational regulations** during the COVID-19 epidemic.

## (3) General Protective Measures for On-site Operators

**General protection and practices** for the safety protection of production and operating personnel.

## (4) Key Protection Measures for Sewerage System

Including the protection measures of the **courtyard sewage collection system, sewage transfer pipeline network and ancillary facilities**.

## (5) Key Protection Measures for Sewage Treatment Station (Plant)

**Sewage treatment terminal**. Take the typical process with complete functional unit as an example to introduce **the key prevention parts and measures** in the whole process of sewage treatment.

## (6) Other Suggestions

# Chapter 2

## Foundational Regulations and Practices During the Epidemic



# 2.1 Strengthen Management

## (1). Strengthen Organization Management

Organizational management and organizational security are the foundation of the work, Establish an epidemic prevention and control safety production working group, responsible for emergency, safe production, publicity and guidance of epidemic prevention and control.



**What should we do in rural areas where technology is absent?**

# 2.1 Strengthen Management

## (2). Strengthen the Management of Pipe Network and Sewage Plant Operation

☞ The collection of sewage, the smooth flow of the transmission pipe network, and the normal operation of sewage treatment are the foundations of the safety of the water environment, so all measures should be taken to ensure these normal operations.

## (3). Implementing Prevention and Control in Stages

☞ Emergency work should be graded and partitioned, **not** suitable for ‘one size fits all’.



**Sewage Plant**

## 2.2 Strengthen Material Supply

☞ **First:** materials for normal operation of sewage treatment;

☞ **Second:** materials for personnel protection.

It is recommended that the water supply and drainage industries be included in the list of necessary priority protection enterprises.



Material Supply



## 2.3 Strengthen the Supervision

### (1). Strengthen the Supervision of Rural Medical Sewage Disposal

☞ The supervision in the rural areas is relatively weak, and the supervision of sewage in **medical institutions** in key areas should be strengthened, such as the village pre-diagnosis and designated institutions.

### (2). Strengthen the Supervision of Key Sites

☞ Most rural **drinking water sources** are reservoirs and groundwater. Surface water and shallow groundwater would be easily polluted by run-off. Thus, sewage collection and supervision of water sources should be strengthened.

### (3). Strengthen the investigation of the drainage system of the residence of key personnel

What are the key personnel?

☞ Checklist: whether the drainage is clogged, whether there is leakage or overflow, drainage facilities, floor leakage, water seal, etc.



# 2.4 Disinfection

## (1). Reasonably Choose Disinfection Methods

1. Surface disinfection method
2. Hand and skin disinfection method
3. Indoor air disinfection method (ensure that no one is indoors).

When using disinfectant, pay attention to the corrosiveness of some disinfectants (such as chlorine), flammable and explosive (such as ethanol).



Mass disinfection (X)

## (2). Carefully Carry Out Large-scale Environmental Disinfection

✘ It is not suitable for large-scale disinfection of the external environment (outside air, closed river reservoir), and it is not appropriate to disinfect the whole body by spraying



large-scale disinfection (X)

## 2.5 Public Awareness and Education

### Strengthen Public Awareness and Education:

- ▣ **First** : strengthen the publicity and education of the staff of the drainage system, and raise the level of awareness and protection;
- ▣ **Second**: strengthen publicity and education to the masses.



Public Awareness Promotion

# Chapter 3

## General Protective Measures for On-site Operators



# 3.1 Organization and Management

## (1). Highlight Organization and Management of Epidemic Prevention

There should be no “Not me” mindset in the prevention and control of drainage systems, and the prevention and control of epidemics should be highly valued.

## (2). Earnestly Carry Out Training and Education on Epidemic Prevention

Raise the awareness of the personnel of the drainage system on the spread of viruses and targets of attack, and improve the active defense capabilities of the personnel on the site.



Public Awareness Education



## 3.2 Protective Measures

**Drainage system protection measures:**

☞ Mask.

☞ Mask, goggles, rubber gloves.

☞ Masks, goggles, rubber gloves, protective clothing, etc.

☞ Disinfectants should be easily and quickly obtained.



**mask**



**mask and goggles**



**mask, goggles and  
rubber gloves**



**masks, goggles, rubber gloves  
and protective clothing**

## 3.2 Protective Measures

### Equipped with Spare Masks

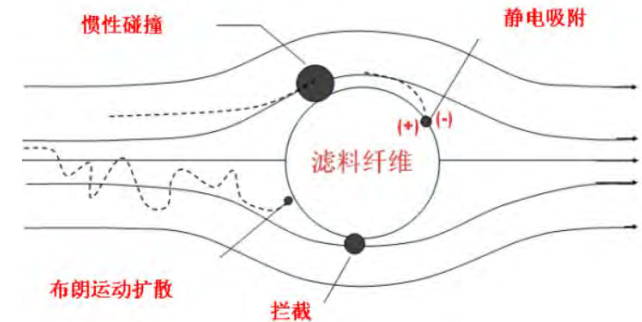
**Mask categories:** medical protective masks, surgical masks, medical disposable masks, other masks

For example, N95 masks, N means not suitable for oily particles (oil fume), 95 means that under the specified detection conditions, 0.3 $\mu\text{m}$  particle filtration efficiency reaches 95%. 90 masks are the same.

After soaking, the electrostatic effect disappears and the filtration efficiency decreases.



N95 masks



the principle of mask interception filtering

# 3.3 Disinfection

## (1). Strengthen Hand Disinfection

In particular, on-site operators must perform cleaning and disinfection operations in accordance with regulations.



15 seconds in running water

## (2). After the Operation

- ☞ personal cleaning and disinfection
- ☞ tool cleaning and disinfection (to prevent subsequent users from contacting and spreading viruses)



hands disinfection

## (3). Safe Use of Disinfectant

Anti-corrosion, Anti-flammable and Anti-explosive



Clothes prevent corrosion



Prevent skin corrosion



flammable and explosive

## 3.4 Increase protection level

### (1). High-risk Places Need to Increase the Protection Level High-risk locations:

1. Places and confined spaces that are prone to aerosols (such as pump rooms, desilting rooms, etc.).
2. Areas that are easily in direct contact with sewage, sludge and sewage slag.



Pump room

### (2). Emergency Rescue Operations

1. Should be instructed by the main leader;
2. Strengthen personnel protection;
3. Pay attention to the health changes of emergency personnel.



Grille

# Chapter 4

## Key Protective Measures for Sewage Collection System





# 4.1 Exposure and Risk Points

Places where **aerosols are likely to be generated** or where **sewage and sludge are in direct contact**, such as toilets, septic tanks, biogas tanks, inspection wells, falling wells, overflows, pipeline leaks, etc.



pipeline inspection well



biogas digester



falling well



leakage, overflow

## 4.2 General Provisions of Sewage Collection System

(1) Sewage collection, smooth flow of transmission pipe network and safe operation are the foundation of all protection.

(2) Strengthen the inspection of the sewage pipe network; when hidden dangers are found, **set warning signs, isolate the crowds**, report them immediately, and deal with them after personnel protection. Reduce the corresponding operations in the pipe and reduce the direct contact risk of sewage and sludge.

(3) Reduce the cleaning of septic tanks and dry toilets, and suspend the dropping of manure into the fields.

(4) For **excreta and dirt in confirmed or suspected cases**, septic tanks need to **be sterilized**, and those collected in separate containers are **discharged after disinfection**.



## 4.3 Courtyard Sewage Collection and Discharge System

**(1) Key Prevention and Control Parts:** toilets, public toilets, septic tanks, biogas tanks, aqua latrines, scattered discharge and direct discharge of individual households, and the sewage discharge and collection system of **key personnel** (such as suspected and isolated personnel).

**(2) Protective Measures:** ensure the septic tanks and other facilities are **covered and intact**. If not, cover should be added temporarily. In order to reduce the overflow of the virus with the aerosol through the vent, spray disinfectant on or around the cover, and cover breathable and flexible coverings containing disinfectant, etc.

**(3) Public Toilets:** 2 times/day spray disinfection of the use area, and cover the septic tank, or disinfection of the surrounding 2-5 meters range ( If no cover, temporarily add shelter). If the effluent from the septic tank is discharged directly, added a disinfection device temporarily, and the added **chlorine dioxide concentration should not be less than 20mg / L** or the **effective chlorine content should not be less than 10mg / L**.

## 4.4 Sewage Collection Pipe Network and Ancillary Facilities

### (1) Key Prevention Parts

Drainage pipe network **inspection wells, lifting pumping stations, drop wells, etc. around key areas**(Such as designated medical institutions, centralized isolation points, etc.),and **overflows, uncovered ditches and other parts** need to pay attention to.



designated medical institution



centralized isolation point

## 4.4 Sewage Collection Pipe Network and Ancillary Facilities

### (2) Operation and Safety Protection

To deal with the **hidden dangers** of the pipeline network, it should be implemented in accordance with the emergency rescue workflows. Pipeline dredging should use **non-manual direct contact methods** such as suction truck or hydraulic flushing.

After the operation, clean the skin and tools in time, and disinfect the spilled mud and water according to the situation.

### (3) Lift Pump Room

The **closed lift pump room** is not ventilated and easily produces aerosols, which is the key protection area. The open lift pump station is better and also needs to be protected.



lift pump room



# Chapter 5

## Key Protective Measures for Sewage Treatment Station (Plant)



# 5.1 Exposure and Risk Points

- (1) Household integrated device: leakage, overflow;
- (2) **Primary treatment of sewage (station) plant:** grid slag, aeration grit tank; **biochemical unit:** anaerobic tank, aeration tank;
- (3) Focus on **sludge disposal units, overflows** in front of the plant, etc.



Leakage and overflow of household treatment tank



Grille and slag



Aeration swirling grit



anaerobic tank



Aeration tank



Oxidation ditch aeration turntable



Belt desilting

## 5.2 General Provisions

- (1) **Strengthen operation management.** The safe and up-to-standard operation of the sewage plant is the basis of 'pollution control and antivirus'.
- (2) One is the internal safety management of the water plant. The second is to **reduce** the residents' proximity to the sewage plant, and **reduce** the risk of sewage or aerosol exposure.
- (3) **Reduce** the inspection and on-site stay time of high-risk areas in the factory, and **improve** the protection level during the inspection.
- (4) Pay great attention to the **pump room**, strengthen protection and disinfection.



Meet or exceed the standard



safe production

# 5.3 Decentralized Processing of Single or Multiple Households

**(1) Inspection subject?** The village committee supervises and the users are responsible for inspection.

**(2) What to inspect?** Collect hidden dangers such as pipe network, tank damage, and overflow.

**(3) How to deal with hidden dangers?** According to the user's risk level of epidemic situation, strengthen personnel protection and deal with it in time.

**(4) Are the tank, overflow sewage and sludge disinfected?**  
The disinfection method is the same as described above.

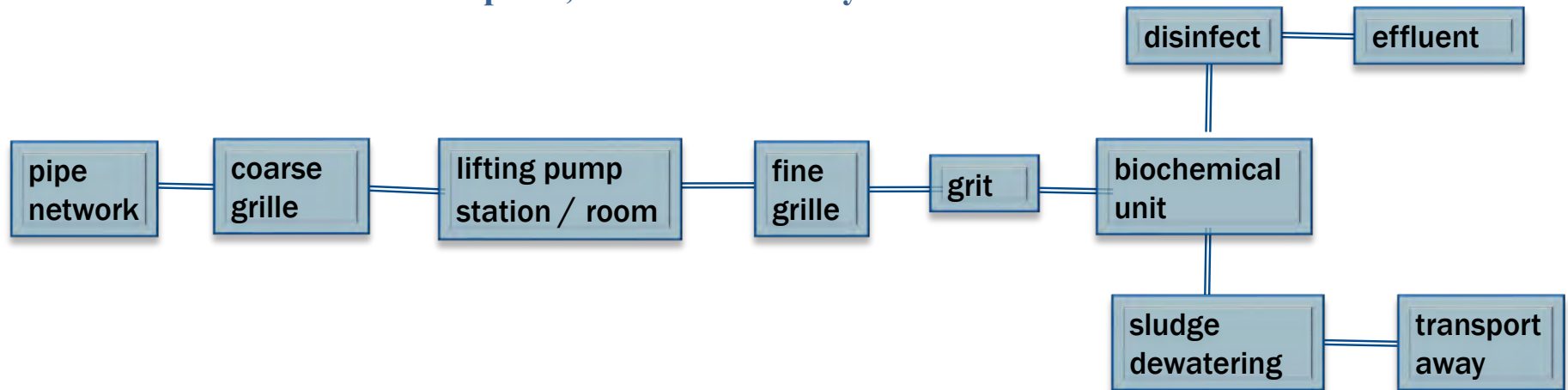


# 5.4 Sewage Treatment Station (Plant)

## (1) Activated Sludge Method (take A<sup>2</sup> / O as an example)

### Key Prevention Parts:

**Primary treatment unit** (such as grille room, aeration and sedimentation tank), **aerobic aeration tank of biochemical unit**, **sludge disposal unit**, **overflow in front of the plant**, **odor treatment system**.



## 5.4 Sewage Treatment Station (Plant)

### (2) Process Inspection and Safety Protection

- ☞ The inspection of key parts should strengthen the protection and **reduce the stay time**;
- ☞ **Reduce the risk of personnel contact** with grid slag, sewage and sludge, such as **reducing manual sampling and testing, adding temporary protective cover** to splash equipment. When contacting mud and water, **strengthen personnel protection**.
- ☞ Disinfect the objects, equipment and facilities in the factory according to the requirements of the ‘Guide’.



## 5.4 Sewage Treatment Station (Plant)

### (3) Other Typical Process Considerations

1. The water distribution system of the **biological filter** is prone to aerosols, and inspection should be conducted after strengthening the protection. **It is not advisable to turn the packing;** if there is a **backwashing system**, it is not appropriate to observe it on the spot.
2. **Reduce or stop the inspection** of the bio-film status of **the bio-rotary disk process** (covered)
3. **Reduce on-site inspection** of the oxidation ditch process for aeration of the turntable, **especially in the aerobic section.**



aeration tank



biological turntable

# 5.5 Natural Biological Treatment Method

(Example: artificial fast penetration )

## (1) Key Prevention Parts:

pretreatment unit (slag, sludge, sewage)

water distribution and treatment unit

## (2) Process Inspection and Safety Protection:

- ☞ **Strengthen** the pretreatment, **reduce** the frequency of filler maintenance, and **reduce** the risk of personnel contact;
- ☞ **Suspend** the cleaning and teding of the filler, and **strengthen** the management of the sludge, filler and pretreated sludge.



Artificial fast penetration

# 5.5 Natural Biological Treatment Method

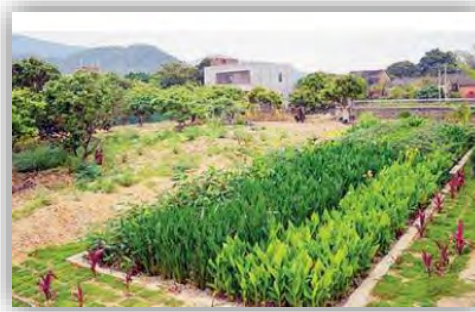
## (3) Notes on other typical processes of natural biological treatment:

**Constructed wetlands:** Suspended management of plant harvesting and impurity removal in constructed wetlands.

**Stable pond:** Suspend the management of aquatic plant harvesting and impurity removal in the pond, pay attention to prevent people from approaching, especially prevent direct contact with sewage in the pond, such as hand washing and laundry.



Surface flow constructed wetland



Subsurface flow constructed wetland



Stable pond

## 5.6 Integrated Equipment

### (1) Key prevention parts:

pretreatment unit, equipment ventilation / outlet

### (2) Process inspection and safety protection:

- ☞ Strengthen the management of the pretreatment unit.  
Refer to this guide for and pretreatment sludge.
- ☞ Reduce on-site inspections, grid slag use **intelligent integrated equipment**, and use **remote inspections and operations** as much as possible.
- ☞ Strengthen the frequency of remote inspections to ensure the normal and stable operation of equipment.
- ☞ **Strengthen signs and warnings** to avoid irrelevant personnel from approaching.



Integrated Equipment

# 5.7 Sludge Treatment and Disposal

(1) Attach great importance to **the remaining sludge and pretreated sludge**. After treatment with activated sludge, **the virus is generally removed in 2-3 orders of magnitude**, from the liquid phase to the solid phase, that is, from the sewage to the sludge.

(2) **Strengthen sludge management**, strengthen ventilation and disinfection in the process of dehydration and transfer, and avoid direct human contact.

(3) For **sludge disinfection**, **lime or alkali** can be added to stabilize, or **10-15% bleach powder** can be added to the sludge concentration tank or sludge storage tank for disinfection.

(4) If the sludge is not transported out in time, it should be sprayed with **high-concentration disinfectant or sterilized with 10-15% bleaching powder** and then sealed with a lid. **Strictly prevent** rain or ground runoff from washing the deposited sludge to form muddy water outflow.



sludge treatment



# 5.8 Disinfection

- (1) **Disinfection is the key to ensure the safety of microorganisms.** All measures should be taken to ensure the normal operation of disinfection facilities, and a variety of disinfection techniques can be used in combination.
- (2) It is **not the more the disinfectant is added, the better.** Pay attention to the impact of disinfectant on the aquatic environment. According to reports, a large number of disinfectants were used during the epidemic, resulting in an increase in bird mortality over the same period and a greater impact on the water environment.
- (3) The disinfection facilities of sewage stations are not perfect, and disinfection devices should be added and perfected. Can use **integrated disinfection equipment** (on-site pharmaceuticals), simple dosing tank (medicine storage), etc.



disinfection equipment



## 5.9 Sewage Station

### (1). Tail Water Discharge

Set clear warnings to remind the hazards of contact.

### (2). Overflow in Front of the Plant:

Overflow is generally not allowed during the epidemic. If necessary, disinfectant should be added, and the dosage, please refer to the 'Guide'.

### (3). Inspection of Small Sewage Stations (Long-term Unattended):

- ☛ **Strengthen the frequency of inspections** to ensure normal operation, paying special attention to the normal operation of **disinfection equipment**.
- ☛ **Strengthen safety protection**, one is the safety protection of personnel during the inspection, and the other is the safety warning to prevent the risk of residents' close contact.

# Chapter 6

## Discussion of the Development of Rural Water Environment Treatment



# 6.1 Discussion on the Development of Rural Drainage System

## Rural drainage system features:

**Small quantity, scattered and remote; lack of technical personnel**

## Discussion on the development of rural sewage treatment:

### (1) **Development direction of rural sewage treatment:**

Separate quality treatment, resource utilization.

### (2) **Development model of drainage system:**

Centralized planning, integrated construction and management.

### (3) **Development trend of rural sewage treatment:**

Decentralized governance, local treatment, and local use.

### (4) **Technical requirements for sewage treatment:**

Intelligent and integrated equipment;

Intensive and professional services;

Environmentally friendly, simple operation and maintenance, unattended.

# 6.2 Policy Recommendations for Comprehensive Management of Water Environment in Mountainous Region

## For the issue of rain and pollution overflow in mountainous cities

- Promote the ‘unified planning, integrated construction and management’ model and the ‘integration and distribution, local processing, local supply’ governance model.

## For the use of recycled water:

- Set recycled water standards according to local conditions

## For pollution problems in the backwater area:

- Strengthen pollution control in the backwater area.
- Make a strategy based on the river

## For third-party evaluation:

- Pay attention to the third-party evaluation mechanism and establish a professional leading group.

- ☛ What is the solution to the rural drainage network unpaid accounts?  
Who pays?
- ☛ What is the regime of rural sewage treatment operation management?  
Scattered or concentrated?

## Questions and Discussions

- ☛ What are the discharge standards for rural sewage treatment?
- ☛ What are the technical requirements for rural sewage treatment?  
Adapt to local conditions

# THANKS!

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