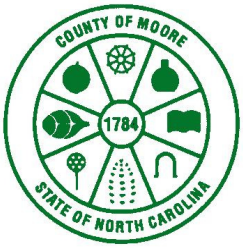
WATER POLLUTION CONTROL PLANT (WPCP)

STANDARDS & SPECIFICATIONS MANUAL



MOORE COUNTY PUBLIC WORKS DEPARTMENT

INTRODUCTION

The purpose of this Manual is to present the policy established by Moore County for the construction of Water Pollution Control Plants (WPCP), also termed wastewater treatment plants, which will or may come under the jurisdiction of Moore County. The Manual includes standards and specifications for the processes and components of the WPCP. The design life of the constructed facility shall be for a minimum of 20 years.

Some of the items included in the manual are summarized below by Section:

- Performance and maintenance bonds are required by the developer.
- The plant must be self sufficient, with rates set to offset all costs.
- The plant effluent shall meet the reclaimed water standards where disposal on-site is possible, such as for golf course communities. Surface water discharges and their associated NPDES permitting shall be the responsibility of the Developer in other developments.
- The plant shall be constructed of cast-in-place concrete. (no packaged plants are allowed)
- Class B treated sludge shall be produced on site; a sludge disposal plan shall be prepared

PREFACE

The standards alone do not constitute a complete set of construction documents. The owner's or developer's Professional Engineer is responsible for providing plans and specifications that encompass all the needs of the project and complies with the standards within this manual.

The standards do not include a complete commentary on methods of construction` and detailed information or quality of workmanship in place. The owner's or developer's Professional engineer must include detailed information on methods of construction and should expand on the testing and any of the special requirements to the engineer's satisfaction, subject to the approval of Moore County. Owners or developers are required to include appropriate contract requirements for construction safety and protection of existing property and utilities in their project documents.

From time to time, these standards will be amended and/or expanded at the pleasure of Moore County. It will be the responsibility of the owner or developer to contact Moore County to obtain updated standards.

There may be circumstances whereby the design engineer may wish to propose changes or modifications to these standards; when this occurs permission from the County Engineer shall be obtained prior to submission to NCDEQ.

Much of this manual was extracted from the 2004 Edition of "Recommended Standard for Wastewater Facilities" (hereinafter referred to as **10 States Standards**) that was written by the Wastewater Committee of the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. The North Carolina Department of

Environmental Quality utilize the 10 States Standards as a guidance document used for their review and permitting of water pollution control plants. The latest revision of those Standards shall apply, unless approved otherwise by Moore County. The numbering system as presented in the 10 States Standards is retained; some of the articles have been edited and/or removed by Moore County.

NCDEQ regulations and standards shall be strictly adhered to at all times.

Disclaimer

To the best of their ability, the authors have attempted to present material in this manual that is accurate and reliable. The design of engineered facilities, however, requires considerable judgment on the part of the designer. It is the responsibility of the design professional to ensure that techniques utilized are appropriate for a given situation. Therefore, neither Moore County, nor any author or other individual, group, etc., associated with production of this manual, accepts any responsibility for improper design, any loss, damage, or injury as a result of the use of this manual.

TABLE OF CONTENTS

MANUAL 8 - WATER POLLUTION CONTROL PLANT

20. OWNERSHIP

21 GENERAL

Where wastewater service is not available to a proposed development as determined by Moore County, the Developer will be responsible for the construction of a community wastewater collection system and a water pollution control plant (WPCP). The plant will be designed and constructed to meet the standards and specifications of this Manual. The wastewater collection system shall meet the policies, standards and specifications as established by Moore County.

When the construction of the development progresses in phases, the construction of the WPCP may be constructed in phases as well. If a temporary wastewater flow is needed to allow an oversized plant to operate properly, it is the responsibility of the Developer to pay for the construction of facilities to pump and pipe wastewater from an alternate location.

The Developer is responsible for acquiring all permits, performing all environmental assessments and studies, property acquisition, design and construction of facilities and all other measures needed to provide a complete and operational wastewater collection system and WPCP for the purpose intended. Developer shall employ a Professional Engineer who specializes in engineering wastewater collection and treatment facilities for the design, construction administration and inspection of the wastewater facilities. A Licensed General Contractor shall construct the plant and related facilities.

22 DEVELOPER OWNED PLANTS

The Developer shall provide a North Carolina certified Operator-in-Responsible-Charge (ORC) to perform needed sampling, operations and maintenance. The ORC shall designate staff available to respond to emergencies/alarms within one hour at all times. Operators for the WPCP and the wastewater collection system shall be provided. The Developer shall provide a list of the operators with contact information. A collections system maintenance program shall be developed and submitted to Moore County.

It is imperative that the constructed facilities be self-sufficient with rates set to offset all costs. The Developer will set user sewer fees acceptable to the NC Utilities Commission. The fees will be collected by the Developer to finance the system and plant's operation. For informational purposes, the Developer shall provide the following items to Moore County annually:

a. budgeted costs and revenues
b. the method to calculate the rate and fee structures

c. administrative procedures for non-payment of sewer bills
d. statement of how retained earnings and emergency funds are to be handled

The Developer shall have a residual management plan which covers the treatment and disposal of the wastewater sludge for a 10-year period, minimum. The plan shall include contracts with licensed sludge haulers and disposal facilities, which automatically roll forward, unless Moore County is specifically notified otherwise.

Should the Developer decide to sell the facilities, Moore County shall have the first right of refusal to purchase the facilities.

23 BONDS

23.1 Performance and Payment Bonds

The Developer shall provide or require his contractor to provide Performance and Payment Bonds, each equal to 100% of the construction cost of the wastewater collection system and WPCP. These bonds shall be in place for the duration of the construction period luntil final Completion d

23.2 Maintenance Bond

The Developer shall have a maintenance bond in place in the amount of 2% of the Performance and Payment Bonds in the name of Moore County to cover the cost for the operations and maintenance of the plant in case of default by the Developer. The Bond shall be for a period of 20 years. unless Moore County takes ownership of the WPCP, subject to the Developer providing financial evidence showing that there is enough build out to assure the WPCP is viable.

50. WASTEWATER TREATMENT FACILITIES

51. PLANT LOCATION

51.1 General

Some items to be considered when selecting a plant site are follows:

51.11 Impact on Existing Wastewater Facilities

The impact of the proposed project on all existing wastewater facilities, including gravity sewers, lift stations, and treatment facilities must be evaluated.

51.12 Site Information

Project site information include topography, soils, geologic conditions, depth to bedrock, groundwater level, floodway or floodplain considerations, and other pertinent site information.

51.13 Planning and Service Area

Planning area and existing and potential future service area shall be considered.

51.2 Flood Protection

The treatment plant structures, electrical, and mechanical equipment shall be protected from physical damage by the one hundred (100) year flood. Treatment plants should remain fully operational and accessible during the twenty-five (25) year flood. This requirement applies to new construction and to existing facilities undergoing major modification. Flood plain regulations of state, province, and federal agencies shall be considered. Any development or construction within the one hundred (100) year floodplain will require the issuance of a Floodplain Development Permit from Moore County Planning and Community Development.

52. QUALITY OF EFFLUENT

The effluent from the treatment plant process selected shall meet the North Carolina reclaimed water standards that are set forth in Chapter 15A of the North Carolina Administrative Code (NCAC). Moore County requires the non-discharge method of disposal of the reuse quality wastewater effluent, where available, such as in golf course communities. For plants that are allowed to discharge to surface waters, the Developer is responsible for obtaining the NPDES permit and meeting all NCDEQ regulations, including Subchapter 2H of Chapter 15A of the NCAC.

53. DESIGN

53.1 Type of Treatment

The plant design shall provide the necessary flexibility to perform satisfactorily within the expected range of waste characteristics and volumes.

53.2 Required Engineering Data for New Process and Application Evaluation

Refer to the 10 States Standards for required submittals for New Processes.

53.3 Design Period

The design period shall be for a period of 20 years minimum.

53.4 Design Loads

The criteria to be used for the design loading of the water pollution control plant are shown below.

53.41 Treatment Plant Flow

The Treatment Plant flow criteria is presented below.

53.411 Critical Flow Conditions

Initial low flow conditions must be evaluated in the design to minimize operational problems with freezing, septicity, flow measurements and solids dropout. The design peak hourly flows must be considered in evaluating unit processes, pumping, piping, and ancillary facilities.

53.412 Hydraulic Design

The average day, minimum and maximum day design flows that the plant is designed to treat shall be provided. Provide calculations to substantiate the design.

53.413 Flow Equalization

Facilities for the equalization of flows and organic shock load shall be considered at all plants which are critically affected by surge loadings.

53.42 Septage Influent

The effects of septage flow which may be accepted at the plant shall be given consideration and appropriate facilities shall be included in the design. Receiving devices at the sludge storage and treatment facilities shall be provided.

53.43 Shock Effects

The shock effects of high concentrations and diurnal peaks for short periods of time on the treatment process, particularly for small treatment plants, shall be considered.

53.5 Conduits

All piping and channels shall be designed to carry the maximum expected flows. The incoming sewer should be designed for unrestricted flow. Bottom corners of the channels must be filleted. Conduits shall be designed to avoid creation of pockets and corners where solids can accumulate.

Suitable gates or valves should be placed in channels to seal off unused sections which might accumulate solids. The use of shear gates, stop plates or stop planks is permitted where they can be used in place of gate valves or sluice gates. Non-corrodible materials shall be used for these control gates.

53.6 Arrangement of Units & Redundancy

Component parts of the plant should be arranged for greatest operating and maintenance convenience, flexibility, economy, continuity of maximum effluent quality, and ease of installation of future units. Complete redundancy of all mechanical equipment, such as pumps blowers, and chemical feed systems shall be provided.

53.7 Flow Division Control

Flow division control facilities shall be provided as necessary to ensure organic and hydraulic loading control to plant process units and shall be designed for easy operator access, change, observation, and maintenance. The use of upflow division boxes equipped with adjustable sharp-crested weirs or similar devices is recommended. The use of valves for flow splitting is not acceptable. Appropriate flow measurement facilities shall be incorporated in the flow division control design.

54. PLANT DETAILS

54.1 Installation of Mechanical Equipment

The specifications shall be written requiring the start-up of major items of mechanical equipment will be inspected and approved by a representative of the manufacturer.

Blowers and other noisy equipment to be located near a residential area shall be placed inside a building.

Submittals for major equipment items shall be submitted to Moore County during the design phase. During the Construction phase, copies of shop drawings approved by the Developer's engineer shall be submitted to Moore County for record purposes.

54.2 Unit Bypasses

54.21 Removal from Service

Properly located and arranged bypass structures and piping shall be provided so that each unit of the plant can be removed from service independently. The bypass design shall facilitate plant operation during unit maintenance and emergency repair so as to minimize deterioration of effluent quality and ensure rapid process recovery upon return to normal operational mode.

Bypassing may be accomplished through the use of duplicate or multiple treatment units in any stage if the design peak instantaneous flow can be handled hydraulically with the largest unit out of service.

The actuation of all bypasses shall require manual action by operating personnel. All power-actuated bypasses shall be designed to permit manual operation in the event of power failure and shall be designed so that the valve will fail as is, upon failure of the power operator.

A fixed high water level bypass overflow should be provided in addition to a manually or power actuated bypass.

54.3 Unit Dewatering, Flotation Protection, and Plugging

Means such as drains or sumps shall be provided to completely dewater each unit to an appropriate point in the process. Due consideration shall be given to the possible need for hydrostatic pressure relief devices to prevent flotation of structures. Pipes subject to plugging shall be provided with means for mechanical cleaning or flushing.

54.4 Construction Materials

Construction materials and equipment used for the wastewater treatment plant shall be original parts of high quality manufactured for the purpose intended suitable for use in a municipal wastewater treatment plant. The basins shall be manufactured of cast-in-place concrete; packaged plants with basins of metallic construction will not be allowed.

Materials shall be selected that are appropriate under conditions of exposure to hydrogen sulfide and other corrosive gases, greases, oils, and other constituents frequently present

in wastewater. This is particularly important in the selection of metals and paints. Contact between dissimilar materials should be avoided or other provisions made to minimize galvanic action.

54.5 Painting

The use of paints containing lead or mercury shall be avoided. In order to facilitate identification of piping, particularly in the large plants, it is suggested that the different lines be color-coded. The following color scheme is recommended for purposes of standardization.

Raw sludge line - brown with black bands
Sludge recirculation suction line - brown with yellow bands
Sludge draw off line - brown with orange bands
Sludge recirculation discharge line - brown
Sludge gas line - orange (or red)
Natural gas line - orange (or red) with black bands
Nonpotable water line - blue with black bands
Potable water line - blue
Chlorine line - yellow
Sulfur Dioxide - yellow with red bands
Sewage (wastewater) line - gray
Compressed air line - green
Water lines for heating digesters or buildings - blue with a 6-inch (150 mm) red band spaced 30 inches (760 mm) apart
Fuel oil/diesel - red
Plumbing drains and vents - black
Polymer - purple

The contents and direction of flow shall be stenciled on the piping in a contrasting color. Paint manufacturer shall be approved by Moore County.

54.6 Operating Equipment & Spare Parts

A complete outfit of tools, accessories, and spare parts necessary for the plant operator's use shall be provided. Provide one spare pump for every pump station in the proposed plant. Provide spare parts for all major equipment items. Submit a spare parts list to the Moore County for approval.

Readily accessible storage space and workbench facilities shall be provided, and consideration shall be given to provision of a garage for large equipment storage, maintenance, and repair.

54.7 Erosion Control During Construction

Effective site erosion control shall be provided during construction.

54.8 Grading, Landscaping, Fencing and Lighting

Upon completion of the plant, the ground shall be graded and sodded or seeded. All-weather walkways should be provided for access to all units. Where possible, steep slopes should be avoided to prevent erosion. Surface water shall not be permitted to drain into any unit. Particular care shall be taken to protect all treatment process units and equipment from stormwater runoff. Provision should be made for landscaping, particularly when a plant must be located near residential areas. Submit a Grading and Landscaping plan to Moore County for approval. Provide a fenced site; vinyl coated chain link material or equal. In addition to the fence, adequate screening must be provided along all property lines that abut property used or zoned for residential uses. Provide lighting sufficient to allow the operation and maintenance of the plant during nighttime hours. Submit a lighting plan. Particular attention shall be given to prevent obtrusive treatment to nearby residential areas.

55. PLANT OUTFALLS

55.1 Discharge Impact Control

Where discharge of wastewater effluent is approved, the outfall sewer shall be designed to discharge to the receiving stream in a manner acceptable to the reviewing authority. Consideration should be given in each case to the following:

a. Preference for free fall or submerged discharge at the site selected;
b. Utilization of cascade aeration of effluent discharge to increase dissolved oxygen;
c. Limited or complete across-stream dispersion as needed to protect aquatic life movement and growth in the immediate reaches of the receiving stream.

55.2 Protection and Maintenance

The outfall sewer shall be so constructed and protected against the effects of floodwater, tide, ice, or other hazards as to reasonably ensure its structural stability and freedom from stoppage. A manhole should be provided at the shore end of all gravity sewers extended into the receiving waters. Hazards to navigation shall be considered in designing outfall sewers.

55.3 Sampling Provisions

All outfalls shall be designed so that a sample of the effluent can be obtained at a point after the final treatment process and before discharge to or mixing with the receiving waters.

56. ESSENTIAL FACILITIES

56.1 Emergency Power Facilities

56.11 General

All plants shall be provided with an alternate source of electric power or pumping capability to allow continuity of operation during power failures.

56.12 Power for Aeration

Standby generating capacity normally is not required for aeration equipment used

in the activated sludge process. In cases where a history of long-term (4 hours or more) power outages have occurred, auxiliary power for minimum aeration of the activated sludge will be required. Full power generating capacity may be required for waste discharges to certain critical stream segments, such as upstream of public water supply intake.

56.13 Power for Disinfection

Continuous disinfection shall be provided during all power outages. Continuous dechlorination is required for those systems that dechlorinate.

56.2 Water Supply

56.21 General

An adequate supply of potable water under pressure should be provided for use in the laboratory and for general cleanliness around the plant. No piping or other connections shall exist in any part of the treatment plant which, under any conditions, might cause the contamination of a potable water supply. The chemical quality should be checked for suitability for its intended uses such as in heat exchangers, chlorinators, etc. Provide backflow prevention.

56.22 Direct Connections

Potable water from a municipal or separate supply may be used directly at points above grade for the following hot and cold supplies:

a. Lavatory;
b. Water closet;
c. Laboratory sink (with vacuum breaker);
d. Shower;
e. Drinking fountain;
f. Eye wash fountain; and
g. Safety shower.

Hot water for any of the above units shall not be taken directly from a boiler used for supplying hot water to a sludge heat exchanger or digester heating unit.

56.23 Indirect Connections

Where a potable water supply is to be used for any purpose in a plant other than those listed in Paragraph 56.22, a break tank, pressure pump, and pressure tank shall be provided. Water shall be discharged to the tank through an air gap at least 6 inches (150 mm) above the maximum flood line or the spill line of the tank, whichever is higher.

A sign shall be permanently posted at every hose bib, faucet, hydrant, or sill cock located on the water system beyond the break tank to indicate that the water is not safe for drinking.

56.24 Separate Potable Water Supply

Where it is not possible to provide potable water from a public water supply, a separate well may be provided. Location and construction of the well should comply with requirements of the governing state or province and local regulations. Requirements governing the use of the potable water supply are those contained in Paragraphs 56.22 and 56.23.

56.25 Separate Non-Potable Water Supply

A separate non-potable water supply is to be provided for in-plant use. All system outlets shall be posted with a permanent sign indicating the water is not safe for drinking. Submit a plan for in-plant water use to the Engineer for approval.

56.3 Sanitary Facilities

Toilet, shower, lavatory, and locker facilities should be provided in sufficient numbers and at convenient locations to serve the expected plant personnel.

56.4 Floor Slope

Floor surfaces shall be sloped adequately to a point of drainage.

56.5 Stairways

Stairways shall be installed in lieu of ladders for access to units requiring routine inspection and maintenance, such as digesters, aeration tanks, clarifiers, tertiary filters, etc. Spiral or winding stairs are permitted only for secondary access where dual means of egress are provided. Stairways shall meet the NC Building Code.

56.6 Flow Measurement

56.61 Location

Flow measurement facilities shall be provided to measure the following flows:

a. Plant influent and effluent flow;

b. Plant influent flow: If influent flow is significantly different from effluent flow, both shall be measured. This would apply for installations such as sequencing batch reactors, and plants with excess flow storage or flow equalization;

c. Excess flow treatment facility discharges;

d. Other flows required to be monitored under the provisions of the discharge permit; and

e. Other flows such as return activated sludge, waste activated sludge, recirculation, and recycle required for plant operational control.

56.62 Facilities

Indicating, totalizing, and recording flow measurement devices shall be provided for all mechanical plants. All flow measurement equipment must be sized to function effectively over the full range of flows expected and shall be protected against freezing.

56.63 Hydraulic Conditions

Flow measurement equipment including approach and discharge conduit configuration and critical control elevations shall be designed to ensure that the required hydraulic conditions necessary for accurate measurement are provided. Conditions that must be avoided include turbulence, eddy currents, air entrainment, etc., that upset the normal hydraulic conditions that are necessary for accurate flow measurement.

56.7 Sampling Equipment

Effluent composite sampling equipment shall be provided at all plants with a design average flow of 0.1 MGD or greater and at other where necessary to meet discharge permit monitoring requirements. Composite sampling equipment shall also be provided for influent sampling and for monitoring plant operations. The influent sampling point should be located prior to any process return flows.

57. SAFETY

57.1 General

Adequate provision shall be made to effectively protect plant personnel and visitors from hazards. All safety devices shall meet OSHA requirements. The following shall be provided to fulfill the particular needs of each plant:

a. Enclosure of the plant site with a fence and signs designed to discourage the entrance of unauthorized persons and animals;

b. Hand rails and guards around tanks, trenches, pits, stairwells, and other hazardous structures with the tops of walls less than 42 inches (1070 mm) above the surrounding ground level;

c. Gratings over appropriate areas of treatment units where access for maintenance is required;

d. First aid equipment;

e. "No Smoking" signs in hazardous areas;

f. Protective clothing and equipment, such as self-contained breathing apparatus, gas detection equipment, goggles, gloves, hard hats, safety harnesses, etc.;

g. Portable blower and sufficient hose;

h. Portable lighting equipment complying with the National Electrical Code requirements;

i. Gas detectors listed and labeled for use in Class I, Division 1, Group D locations;

j. Appropriately-placed warning signs for slippery areas, non-potable water fixtures, low head clearance areas, open service manholes, hazardous chemical storage areas, flammable fuel storage areas, etc.;

k. Adequate ventilation in pump station areas in accordance with Paragraph 42.7;

l. Provisions for local lockout on stop motor controls;

m. Provisions for confined space entry and laboratory safety in accordance with OSHA and regulatory agency requirements; and

n. Adequate vector control.

57.2 Hazardous Chemical Handling

Hazardous chemical handling shall meet all requirements of OSHA.

57.21 Containment Materials

The materials utilized for storage, piping, valves, pumping, metering, splash guards, etc., shall be specially selected considering the physical and chemical characteristics of each hazardous or corrosive chemical. Hazardous chemicals shall be stored in a locked area of the plant.

57.22 Secondary Containment

Chemical storage areas shall be enclosed in dikes or curbs which will contain the stored volume until it can be safely transferred to alternate storage or released to the wastewater at controlled rates which will not damage facilities, inhibit the treatment processes, or contribute to stream pollution. Liquid polymer should be similarly contained to reduce areas with slippery floors, especially to protect travelways. Non-slip floor surfaces are desirable in polymer-handling areas.

57.23 Liquefied Gas Chemicals

Properly designed isolated areas shall be provided for storage and handling of chlorine and sulfur dioxide and other hazardous gases. Gas detection kits, alarms, controls, safety devices, and emergency repair kits shall also be provided.

57.24 Splash Guards

All pumps or feeders for hazardous or corrosive chemicals shall have guards which will effectively prevent spray of chemicals into space occupied by personnel. The splash guards are in addition to guards to prevent injury from moving or rotating machinery parts.

57.25 Piping, Labeling, Coupling Guards, Location

All piping containing or transporting corrosive or hazardous chemicals shall be identified with labels every 10 feet (3 m) and with at least two labels in each room, closet, or pipe chase. Color-coding may also be used, but is not an adequate substitute for labeling.

All connections (flanged or other type), except those adjacent to storage or feeder areas, shall have guards which will direct any leakage away from space occupied by personnel. Pipes containing hazardous or corrosive chemicals should not be located above shoulder level except where continuous drip collection trays and coupling guards will eliminate chemical spray or dripping onto personnel.

57.26 Protective Clothing and Equipment

The following items of protective clothing or equipment shall be provided to the Owner and utilized for all operations or procedures where their use will minimize injury hazard to personnel:

a. Self-contained breathing apparatus recommended for protection against chlorine;
b. Chemical worker's goggles or other suitable goggles (safety glasses are insufficient);
c. Face masks or shields for use over goggles;
d. Dust mask to protect the lungs in dry chemical areas;
e. Rubber gloves;
f. Rubber aprons with leg straps;
g. Rubber boots (leather and wool clothing should be avoided near caustics); and
h. Safety harness and line.

57.27 Warning System and Signs

Facilities shall be provided for automatic shutdown of pumps and sounding of alarms when failure occurs. Alarms shall be a part of the overall plant SCADA system and local control and alarm systems. Local audible alarms and remote radio or dialer alarms are required. Submit SCADA control diagram and local control logic with description to Moore County for approval.

Warning signs requiring use of goggles shall be located near chemical stations, pumps, and other points of frequent hazard.

57.28 Dust Collection

Dust collection equipment shall be provided to protect personnel from dusts injurious to the lungs or skin and to prevent polymer dust from settling on walkways which become slick when wet.

57.29 Eyewash Fountains and Safety Showers

Eyewash fountains and safety showers utilizing potable water shall be provided on each floor level or work location involving hazardous or corrosive chemical storage, mixing (or slaking), pumping, metering, or transportation unloading. These facilities are to be as close as practical to points of chemical exposure. They are to be fully operable during all weather conditions.

The eyewash fountains shall be supplied with water of moderate temperature 50° to 90°F (10 °C to 32 °C) suitable to provide 15 to 30 minutes of continuous irrigation of the eyes. The emergency showers shall be capable of discharging 30 to 50 gpm (1.9 L/s to 3.2 L/s) of water at moderate temperature and at pressures of 20 to 50 psi (140 kPa to 345 kPa).

57.3 Hazardous Chemical Container Identification

The identification and hazard warning data included on shipping containers, when received, shall appear on all containers (regardless of size or type) used to store, carry, or use a hazardous substance. Wastewater and sludge sample containers should be adequately labeled. Below is a suitable label to identify a wastewater sample as a hazardous substance:

RAW SEWAGE WASTEWATER
Sample point No. _____
Contains Harmful Bacteria.
May contain hazardous or toxic material.
Do not drink or swallow.
Avoid contact with openings or breaks in the skin.

58. LABORATORY

58.1 General

All treatment plants shall include a laboratory for making the necessary analytical determinations and operating control tests, except for those plants utilizing only processes not requiring laboratory testing for plant control and where satisfactory off-site laboratory provisions are made to meet the permit monitoring requirements. For plants where a fully equipped laboratory is not required, the requirements for utilities, fume hoods, etc., may be reduced. The laboratory shall have sufficient size, bench space, equipment, and supplies to perform all self-monitoring analytical work required by discharge permits, and to perform the process control tests necessary for good management of each treatment process included in the design.

The facilities and supplies necessary to perform analytical work to support industrial waste control programs will normally be included in the same laboratory. The laboratory arrangement should be sufficiently flexible to allow future expansion should more analytical work be needed. Laboratory instrumentation and size should reflect treatment plant size, staffing requirements, process complexity, and applicable certification requirements. Experience and training of plant operators should also be assessed in determining treatment plant laboratory needs.

Treatment plant laboratory needs may be divided into the following three general categories:

I. Plants performing only basic operational testing; this typically includes pH, temperature, and dissolved oxygen;

II. Plants performing more complex operational and permit laboratory tests including biochemical oxygen demand, suspended solids, and fecal coliform analysis, and;

III. Plants performing more complex operational, permit, industrial pretreatment, and multiple plant laboratory testing.

Expected minimum laboratory needs for these three plant classifications are outlined in this Section. However, in specific cases laboratory needs may have to be modified or increased due to the industrial monitoring needs or special process control requirements.

58.2 Category I: Plants performing only basic operational testing.

58.21 Location and Space

A floor area up to 150 square feet (14 m2) should be adequate. It is recommended that this be at the treatment site. Another location in the community utilizing space in an existing structure owned by the involved wastewater authority may be acceptable.

58.22 Design and Materials

The facility shall provide for electricity, water, heat, sufficient storage space, a sink, and a bench top. The lab components need not be of industrial grade materials. Laboratory equipment and glassware shall be of types recommended by Standard Methods for the Examination of Water and Wastewater and the reviewing authority.

58.3 Category II: Plants performing more complex operational and permit laboratory tests including biochemical oxygen demand, suspended solids, and fecal coliform analysis.

58.31 Location and Space

The laboratory size should be based on providing adequate room for the equipment to be used. In general, the laboratories for this category of plant should provide a minimum of approximately 300 square feet (28 m2) of floor space. Adequate bench space for each analyst shall be provided. The laboratory should be located at the treatment site on ground level. It shall be isolated from vibrating, noisy, or high-temperature machinery or equipment which might have adverse effects on the performance of laboratory staff or instruments.

The following items shall be provided in accordance with the 10 States Standards:

58.32 Floors
58.33 Cabinets and Bench Tops
58.34 Fume Hoods, Sinks, and Ventilation
- **58.341 Fume Hoods**
- **58.342 Sinks**
- **58.343 Ventilation**

58.35 Balance and Table
58.36 Equipment, Supplies, and Reagents
58.37 Utilities
- **58.371 Power Supply**
- **58.372 Laboratory Water**

58.38 Safety
- **58.381 Equipment**
- **58.382 Eyewash Fountains and Safety Showers**

58.4 Category III: Plants performing more complex operational, permit, industrial pretreatment and multiple plant laboratory testing.

58.41. Location and Space

The laboratory should be located at the treatment site on ground level, with environmental control as an important consideration. It shall be isolated from vibrating, noisy, high temperature machinery or equipment which might have adverse effects on the performance of laboratory staff or instruments.

The laboratory facility needs for Category III plants should be described in the engineering report or facilities plan. The laboratory floor space and facility layout should be based on an evaluation of the complexity, volume, and variety of sample analyses expected during the design life of the plant including testing for process control, industrial pretreatment control, user charge monitoring, and discharge permit monitoring requirements.

Consideration shall be given to the necessity to provide separate (and possibly isolated) areas for some special laboratory equipment, glassware, and chemical storage. The analytical and sample storage areas should be isolated from all potential sources of contamination. It is recommended that the organic chemical facilities be isolated from other facilities. Adequate security shall be provided for sample storage areas. Provisions for the proper storage and disposal of chemical wastes shall be provided. At large plants, office and administrative space needs should be considered.

For less complicated laboratory needs bench-top working surface should occupy at least 35 percent of the total laboratory floor space. Additional floor and bench space should be provided to facilitate performance of analysis of industrial wastes, as required by the discharge permit and the utility's industrial waste pretreatment program. Ceiling height should be adequate to provide for the installation of wall mounted water stills, deionizers, distillation racks, hoods, and other equipment with extended height requirements.

The following items shall be provided in accordance with the 10 States Standards:

58.42 Floors and Doors
58.43 Cabinets and Bench Tops
58.44 Hoods
58.45 Sinks, Ventilation, and Lighting
58.46 Balance and Table
58.47 Equipment, Supplies, and Reagents
58.48 Utilities and Services
58.49 Safety

60. SCREENING, GRIT REMOVAL, AND FLOW EQUALIZATION

61. SCREENING DEVICES

61.1 Coarse Screens

61.11 Where Required

Protection for pumps and other equipment shall be provided by trash racks, coarse bar racks, or coarse screens.

The following items shall be provided in accordance with the 10 States Standards:

61.12 Design and Installation
61.13 Access and Ventilation
61.14 Safety and Shields
61.15 Electrical Equipment and Control Systems

61.2 Fine Screens

61.21 General

Fine screens as discussed here have openings of approximately 1/16 inch (2 mm). The amount of material removed by fine screens is dependent on the waste stream being treated and screen opening size.

Fine screens should not be considered equivalent to primary sedimentation but may be used in lieu of primary sedimentation where subsequent treatment units are designed on the basis of anticipated screen performance. Selection of screen capacity should consider flow restriction due to retained solids, gummy materials, frequency of cleaning, and extent of cleaning. Where fine screens are used, additional provision for removal of floatable oils and greases shall be considered.

The following items shall be provided in accordance with the 10 States Standards:

61.22 Design

A minimum of two fine screens shall be provided, each unit being capable of independent operation. Capacity shall be provided to treat design peak instantaneous flow with one unit out of service.

Fine screens shall be preceded by a coarse bar screening device. Fine screens shall be protected from freezing and located to facilitate maintenance.

61.23 Electrical Equipment, Fixtures and Control

Electrical equipment, fixtures and controls in the screening area where hazardous gases may accumulate shall meet the requirements of the National Electrical Code for Class I, Division 1, Group D locations.

61.24 Servicing

Hosing equipment shall be provided to facilitate cleaning. Provision shall be made for isolating and removing units from their location for servicing.

62. COMMINUTORS (NOT USED)

63. GRIT REMOVAL FACILITIES

63.1 Required

Grit removal facilities are required for all wastewater treatment plants. Consideration shall be given to possible damaging effects on pumps, and other preceding equipment, and the need for additional storage capacity in treatment units where grit is likely to accumulate.

63.2 Location

63.21 General

Grit removal facilities should be located ahead of pumps. Coarse bar racks should be placed ahead of grit removal facilities.

The following items shall be provided in accordance with the 10 States Standards:

63.22 Housed Facilities

63.221 Ventilation

63.222 Access

63.223 Electrical

63.23 Outside Facilities

63.3 Type and Number of Units

A single manually cleaned or mechanically cleaned grit chamber with bypass is acceptable for small wastewater treatment plants serving separate sanitary sewer systems. Minimum facilities for larger plants serving sanitary sewers should be at least one mechanically cleaned unit with a bypass.

Facilities other than channel-type shall be provided with adequate and flexible controls for velocity and/or air supply devices and with grit collection and removal equipment. Aerated grit chambers should have air rates adjustable in the range of 3 to 8 cubic feet per minute per foot of tank length. Detention time in the tank should be in the range of 3 to 5 minutes at design peak hourly flows.

The following items shall be provided in accordance with the 10 States Standards:

63.4 Design Factors

63.41 General

63.42 Inlet
63.43 Velocity and Detention
63.44 Grit Washing
63.45 Dewatering
63.46 Water
63.47 Grit Handling

64. PREAETATION (not used)

65. FLOW EQUALIZATION

65.1 General
Flow equalization to attenuate peak flows shall be considered in the design of the plant.

65.2 Location
Equalization basins should be located downstream of pretreatment facilities such as bar screens and grit chambers.

65.3 Type
Flow equalization can be provided by using separate basins or on-line treatment units, such as aeration tanks. Equalization basins may be designed as either in-line or side-line units. Unused treatment units, such as sedimentation or aeration tanks, may be utilized as equalization basins during the early period of design life.

65.4 Size
Equalization basin capacity should be sufficient to effectively reduce expected flow and load variations to the extent deemed to be economically advantageous. With a diurnal flow pattern, the volume required to achieve the desired degree of equalization can be determined from a cumulative flow plot over a representative 24-hour period.

The following items shall be provided in accordance with the 10 States Standards:

65.5 Operation
65.51 Mixing
65.52 Aeration
65.53 Controls
65.6 Electrical
65.7 Access

70. CLARIFICATION

71. GENERAL

71.1 Number of Units

Multiple units capable of independent operation are desirable and shall be provided in all plants where design average flows exceed 100,000 gallons/day. Plants not having multiple units shall include other provisions to
assure continuity of treatment.

71.2 Flow Distribution

Effective flow splitting devices and control appurtenances (i.e., gates, splitter boxes, etc.) shall be provided to permit proper proportioning of flow and solids loading to each unit, throughout the expected range of flows. Refer to Paragraph 53.7.

72. DESIGN CONSIDERATIONS

The following items shall be provided in accordance with the 10 States Standards:

72.1 Dimensions

72.2 Surface Overflow Rates

72.21 Primary Settling Tanks

Primary Settling tanks are required unless it is demonstrated by the process manufacturer that they not required for the selected process, e.g. Bardenpho process. Primary settling tank sizing should reflect the degree of solids removal needed and the need to avoid septic conditions during low flow periods. Sizing shall be calculated for both design average and design peak hourly flow conditions, and the larger surface area determined shall be used.

The surface overflow rates shall be provided in accordance with the 10 States Standards.

72.22 Intermediate Settling Tanks

Intermediate Settling Tanks are required as dictated by the selected treatment process. Surface overflow rates for intermediate settling tanks following series units of fixed film reactor processes shall not exceed 1,500 gallons per day per square foot based on design peak hourly flow.

72.23 Final Settling Tanks

Settling tests shall be conducted wherever a pilot study of biological treatment is warranted by unusual waste characteristics, treatment requirements, or where proposed loadings go beyond the limits set forth in this Section.

72.24 Final Settling Tanks - Activated Sludge

To perform properly while producing a concentrated return flow, activated sludge settling tanks must be designed to meet thickening as well as solids separation requirements. Since the rate of recirculation of return sludge from the final settling tanks to the aeration or reaeration tanks is quite high in activated sludge processes, surface overflow rate and weir overflow rate should be adjusted for the various processes to minimize the problems with sludge loadings, density

currents, inlet hydraulic turbulence, and occasional poor sludge settleability. The size of the settling tank must be based on the larger surface area determined for surface overflow rate and solids loading rate.

The following items shall be provided in accordance with the 10 States Standards:

72.3 Inlet Structures
72.4 Weirs
72.41 General
72.42 Location
72.43 Design Rates
72.44 Weir Troughs
72.5 Submerged Surface
72.6 Unit Dewatering
72.7 Freeboard

73. SLUDGE AND SCUM REMOVAL

73.1 Scum Removal

Full surface mechanical scum collection and removal facilities, including baffling, shall be provided for all settling tanks. The unusual characteristics of scum which may adversely affect pumping, piping, sludge handling and disposal, shall be recognized in design. Provisions shall be made to remove scum from the wastewater treatment process and direct it to the sludge treatment process. Other special provisions for disposal may be necessary.

73.2 Sludge Removal

Mechanical sludge collection and withdrawal facilities shall be designed to assure rapid removal of the sludge. Suction withdrawal should be provided for activated sludge clarifiers over 60 feet (18 m) in diameter, especially for activated sludge plants that nitrify.

Each settling tank shall have its own sludge withdrawal lines to ensure adequate control of sludge wasting rate for each tank.

The following items shall be provided in accordance with the 10 States Standards:

73.21 Sludge Hopper
73.23 Sludge Removal Pipeline
73.24 Sludge Removal Control

74. PROTECTIVE AND SERVICE FACILITIES

74.1 Operator Protection

All settling tanks shall be equipped to enhance safety for operators. Such features shall appropriately include machinery covers, life lines, stairways, walkways, handrails, and slip resistant surfaces.

74.2 Mechanical Maintenance Access

The design shall provide for convenient and safe access to routine maintenance items such as gear boxes, scum removal mechanisms, baffles, weirs, inlet stilling baffle areas, and effluent channels.

74.3 Electrical Equipment, Fixtures and Controls

Electrical equipment, fixtures and controls in enclosed settling basins and scum tanks, where hazardous concentrations of flammable gases or vapors may accumulate, shall meet the requirements of the National Electrical Code for Class 1, Division 1, Group D locations. The fixtures and controls shall be located so as to provide convenient and safe access for operation and maintenance. Adequate area lighting shall be provided.

80. SLUDGE PROCESSING, STORAGE, AND DISPOSAL

81. GENERAL

Facilities for processing sludge shall be provided at all mechanical wastewater treatment plants. Handling equipment shall be capable of processing sludge to a form suitable for ultimate disposal, i.e, Class B sludge in accordance with the 40 CFR 503 rules and regulations, unless provisions acceptable to NCDEQ and Moore County are made for processing the sludge at an alternate location. The Developer shall provide documentation to Moore County that the sludge can be properly processed at the alternate facility, and pay all costs associated with the study.

NCDEQ and Moore County should be contacted if sludge unit processes not described in this Chapter are being considered or are necessary to meet state, provincial, or federal sludge disposal requirements.

82. PROCESS SELECTION

The selection of sludge handling unit processes should be based upon at least the following considerations:

a. Local land use;
b. System energy requirements;
c. Cost effectiveness of sludge thickening and dewatering;
d. Equipment complexity and staffing requirements;
e. Adverse effects of heavy metals and other sludge components upon the unit processes;
f. Sludge digestion or stabilization requirements, including appropriate pathogen and vector attraction reduction;
g. Side stream or return flow treatment requirements (e.g., digester or sludge storage facilities supernatant, dewatering unit filtrate, wet oxidation return flows);
h. Sludge storage requirements;

i. Methods of ultimate disposal; and
j. Back-up techniques of sludge handling and disposal.

83. SLUDGE THICKENERS

83.1 Design Considerations

Sludge thickeners to reduce the volume of sludge should be considered. The design of thickeners (gravity, centrifuge, and others) should consider the type and concentration of sludge, the sludge stabilization processes, storage requirements, the method of ultimate sludge disposal, chemical needs, and the cost of operation.

The use of gravity thickening tanks for unstabilized sludges is not recommended because of problems due to septicity unless provisions are made for adequate control of process operational problems and odors at the gravity thickener and any following unit processes.

Particular attention should be given to the pumping and piping of the concentrated sludge and possible onset of anaerobic conditions.

84. ANAEROBIC SLUDGE DIGESTION

84.1 General

84.11 Multiple Units

Multiple units (primary and secondary anaerobic digestors) shall be provided.

The following items shall be provided in accordance with the 10 States Standards:

84.12 Depth
84.13 Design Maintenance Provisions
84.14 Toxic Materials

84.2 Sludge Inlets, Outlets, Recirculation, and High Level Overflow
84.3 Tank Capacity
84.4 Gas Collection, Piping, and Appurtenances
84.5 Digestion Tank Heating
84.6 Supernatant Withdrawal
84.7 Anaerobic Digestion Sludge Production

85. AEROBIC SLUDGE DIGESTION

85.1 General

The aerobic sludge digestion system shall include provisions for digestion, supernatant separation, sludge concentration, and any necessary sludge storage. These provisions may be accomplished by separate tanks or processes, or in the digestion tanks.

85.2 Multiple Units

Multiple digestion units capable of independent operation are desirable and shall be provided in all plants where the design average flow exceeds 100,000 gallons per day.

The following items shall be provided in accordance with the 10 States Standards:

85.3 Tank Capacity
85.4 Mixing
85.5 Air Requirements
85.6 Supernatant Separation and Scum and Grease Removal
85.7 High Level Emergency Overflow
85.8 Aerobic Digestion Sludge Production
85.9 Digested Sludge Storage Volume

86. HIGH pH STABILIZATION

86.1 General

Alkaline material may be added to liquid primary or secondary sludges for sludge stabilization to supplement digestion treatment facilities in order to produce a stabilized sludge in accordance with the 40 CFR 503 regulations. There is no direct reduction of organic matter or sludge solids with the high pH stabilization process. There is an increase in the mass of dry sludge solids. Without supplemental dewatering, additional volumes of sludge will be generated. The design shall account for the increased sludge quantities for storage, handling, transportation, and disposal methods and associated costs.

86.2 Operational Criteria

Sufficient alkaline material shall be added to liquid sludge in order to produce a homogeneous mixture with a minimum pH of 12 after 2 hours of vigorous mixing. Facilities for adding supplemental alkaline material shall be provided to maintain the pH of the sludge during interim sludge storage periods. The following items shall be provided in accordance with the 10 States Standards:

86.3 Odor Control and Ventilation
86.4 Mixing Tanks and Equipment
86.5 Chemical Feed and Storage Equipment
86.6 Sludge Storage

86.7 Disposal

Immediate sludge disposal methods and options are recommended to be utilized in order to reduce the sludge inventory on the treatment plant site and amount of sludge that may need to be retreated to prevent odors if sludge pH decay occurs. If the land application disposal option is utilized for high pH stabilized sludge, said sludge should be incorporated into the soil during the same day of delivery to the site.

The Developer is responsible for securing all permits, contracts, and expenses associated with the disposal of the sludge, including securing disposal sites, transportation, and other processing fees. A sludge disposal plan shall be submitted to Moore County as part of the plant design.

87. SLUDGE PUMPS AND PIPING

87.1 Sludge Pumps

87.11 Capacity

Pump capacities shall be adequate but not excessive. Provision for varying pump capacity is desirable. A rational basis of design shall be provided with the plan documents.

87.12 Duplicate Units

Duplicate units shall be provided at all installations.

87.13 Type

Plunger pumps, screw feed pumps or other types of pumps with demonstrated solids handling capability shall be provided for handling raw sludge. Where centrifugal pumps are used, a parallel positive displacement pump shall be provided as an alternate to pump heavy sludge concentrations, such as primary or thickened sludge, that may exceed the pumping head of the centrifugal pump.

The following items shall be provided in accordance with the 10 States Standards:

87.14 Minimum Head

87.15 Sampling Facilities

87.2 Sludge Piping

87.21 Size and Head

87.22 Slope and Flushing Requirements

87.23 Supports

88. SLUDGE DEWATERING

88.1 General

On-site sludge dewatering facilities shall be provided for all plants, although the following requirements may be reduced with on-site liquid sludge storage facilities or approved off-site sludge disposal.

For calculating design sludge handling and disposal needs for sludge stabilization processes other than described in Paragraphs 84.7 for anaerobic digestion and 85.8 for aerobic digestion, a rational basis of design for sludge production values shall be developed and provided to the reviewing authority for approval on a case-by-case basis.

88.2 Sludge Drying Beds

88.21 Applicability

Sludge drying beds may be used for dewatering well digested sludge from either the anaerobic or aerobic process. Due to the large volume of sludge produced by the aerobic digestion process, consideration should be given to using a combination of dewatering systems or other means of ultimate sludge disposal. Sludge drying beds shall be covered.

The following items shall be provided in accordance with the 10 States Standards:

88.22 Unit Sizing

88.23 Percolation Type Bed Components

88.3 Mechanical Dewatering Facilities

88.31 General

Provision shall be made to maintain sufficient continuity of service so that sludge may be dewatered without accumulation beyond storage capacity. The number of vacuum filters, centrifuges, filter presses, belt filters, other mechanical dewatering facilities, or combinations thereof should be sufficient to dewater the sludge produced with the largest unit out of service. Unless other standby wet sludge facilities are available, adequate storage facilities of at least 4 days production volume in addition to any other sludge storage needs shall be provided. Documentation must be submitted justifying the basis of design of mechanical dewatering facilities.

88.32 Water Supply Protection

Provisions for water supply to mechanical dewatering facilities shall be in accordance with Paragraph 56.23.

The following items shall be provided in accordance with the 10 States Standards:

88.33 Auxiliary Facilities for Vacuum Filters

88.34 Ventilation

88.35 Chemical Handling Enclosures

88.4 Drainage and Filtrate Disposal

88.5 Other Dewatering Facilities

If it is proposed to dewater sludge by other methods, a detailed description of the process and design data shall accompany the plans. Refer to Paragraph 53.2 for any new process determinations.

89. SLUDGE STORAGE AND DISPOSAL

89.1 Storage

89.11 General

Sludge storage facilities shall be provided at all mechanical treatment plants. Appropriate storage facilities may consist of any combination of drying beds, lagoons, separate tanks, additional volume in sludge stabilization units, pad areas or other means to store either liquid or dried sludge. Refer to Paragraphs 88.2 and 89.2 for drying bed and lagoon design criteria, respectively.

The design shall provide for odor control in sludge storage tanks and sludge lagoons including aeration, covering, or other appropriate means.

89.12 Volume

Rational calculations justifying the number of days of storage to be provided shall be submitted and shall be based on the total sludge handling and disposal system. Refer to Paragraphs 84.7 and 85.8 of the 10 States Standards for anaerobically and aerobically digested sludge production values. Sludge production values for other stabilization processes should be justified in the basis of design. If the land application method of sludge disposal is the only means of disposal utilized at a treatment plant, storage shall be provided based on considerations including at least the following items:

a. Inclement weather effects on access to the application land;
b. Temperatures including frozen ground and stored sludge cake conditions;
c. Haul road restrictions including spring thawing conditions;
d. Area seasonal rainfall patterns;
e. Cropping practices on available land;
f. Potential for increased sludge volumes from industrial sources during the design life of the plant;
g. Available area for expanding sludge storage; and
h. Appropriate pathogen reduction and vector attraction reduction requirements.

A minimum range of 120 to 180 days storage should be provided for the design life of the plant unless a different period is approved by the reviewing authority. Refer to Paragraph 89.33 for other sludge land application considerations.

89.2 Sludge Storage Lagoons

89.21 General

Sludge storage lagoons will be permitted only upon proof that the character of the digested sludge and the design mode of operation are such that offensive odors will not result. Where sludge lagoons are permitted, adequate provisions shall be made for other acceptable sludge handling methods in the event of upset or failure of the sludge digestion process.

89.22 Location

Sludge lagoons shall be located as far as practicable from inhabited areas or areas likely to be inhabited during the lifetime of the structures. Siting of sludge lagoons shall comply with the requirements of the reviewing authority.

89.23 Seal

Adequate provisions shall be made to seal the sludge lagoon bottoms and embankments in accordance with the requirements of Paragraph 93.422 to prevent leaching into adjacent soils or ground water. The seal shall be protected to prevent damage from sludge removal activities. Groundwater monitoring may be required by the reviewing authority in accordance with Paragraph 93.55.

89.24 Access

Provisions shall be made for pumping or heavy equipment access for sludge removal from the sludge lagoon on a routine basis.

89.25 Supernatant Disposal

Lagoon supernatant shall be returned to the wastewater treatment process at appropriate points and rates. (See also Paragraphs 56.7 and 84.64.)

89.3 Disposal

89.31 General

Drainage facilities for sludge vehicle transfer stations shall be provided to allow any spillage or washdown material to be collected and returned to the wastewater treatment plant or sludge storage facility.

89.32 Sanitary Landfilling

Sludge and sludge residues may be disposed of in approved sanitary landfills under the terms and conditions of the regulatory agency.

89.33 Land Application

The reviewing authority should be contacted for specific design and approval requirements governing land application of municipal sludges. Additional operating criteria may be obtained from applicable federal regulations. Sludge may be utilized as a soil conditioner for agricultural, horticultural, or reclamation purposes. Important design considerations include but are not necessarily limited to: sludge stabilization process, appropriate pathogen and vector attraction reduction, sludge characteristics including the presence of inorganic and organic chemicals, application site characteristics (soils, groundwater elevations, setback distance requirements, etc.), local topography and hydrology, cropping practices, spreading and incorporation techniques, population density and odor control, local groundwater quality and usage.

Sludge mixing equipment or other provisions to assist in the monitoring of land applied sludge should be considered in the design of sludge handling and storage facilities.

Due to inclement weather and cropping practices, alternative sludge disposal options are recommended to ensure the sludge is properly managed.

Sludge should not be applied to land which is used for growing food crops to be eaten raw, such as leafed vegetables and root crops.

90. BIOLOGICAL TREATMENT

91. TRICKLING FILTERS (not used)

92. ACTIVATED SLUDGE

92.1 General

92.11 Applicability

92.111 Biodegradable Wastes
The activated sludge process and its various modifications may be used for domestic wastewater which is amenable to biological treatment.

92.112 Operational Requirement
This process requires close attention and competent operating supervision, including routine laboratory control. These requirements shall be considered when proposing this type of treatment.

92.113 Energy Requirements
This process requires major energy usage to meet aeration demands. Energy costs and potential mandatory emergency public power reduction events in relation to critical water quality conditions must be carefully evaluated. Capability of energy usage phase-down while still maintaining process viability, both under normal and emergency energy availability conditions, must be included in the activated sludge design. Provide variable rate blower controls as appropriate for the size of the plant.

92.12 Specific Process Selection
The activated sludge process and its several modifications may be employed to accomplish varied degrees of removal of suspended solids and reduction of carbonaceous and/or nitrogenous oxygen demand to meet reuse quality standards. Choice of the process most applicable will be influenced by the degree and consistency of treatment required, type of waste to be treated, proposed plant size, anticipated degree of operation and maintenance, and operating and capital costs. All designs shall provide for flexibility in operation and should provide for operation in various modes, if feasible.

92.13 Winter Protection

In severe climates, protection against freezing shall be provided to ensure continuity of operation and performance. Insulation of the tanks by earthen banks should be considered.

92.2 Pretreatment

Where primary settling tanks are not used, effective removal or exclusion of grit, debris, excessive oil or grease, and screening of solids shall be accomplished prior to the activated sludge process. Screening devices with clear openings of 1/4 inch (6 mm) or less shall be provided.

Where primary settling is used, provision shall be made for discharging raw wastewater directly to the aeration tanks to facilitate plant start-up and operation during the initial stages of the plant's design life.

The following items shall be provided in accordance with the 10 States Standards:

92.3 Aeration
- **92.31 Capacities and Permissible Loadings**
- **92.32 Arrangement of Aeration Tanks**
- **92.321 Number of Units**
- **92.322 Inlets and Outlets**
- **92.323 Freeboard**
- **92.33 Aeration Equipment**
- **92.331 General**
- **92.332 Diffused Air Systems**
- **92.333 Mechanical Aeration Systems**

92.4 Return Sludge Equipment
- **92.41 Return Sludge Rate**
- **92.42 Return Sludge Pumps**
- **92.43 Return Sludge Piping**
- **92.44 Waste Sludge Facilities**

92.5 Measuring Devices

Devices should be installed in all plants for indicating flow rates of raw wastewater or primary effluent, return sludge, and air to each tank unit. For plants designed for design average wastewater flows of 1 MGD or more as dictated by NCDEQ, these devices should totalize and record, as well as indicate flows. Where the design provides for all return sludge to be mixed with the raw wastewater (or primary effluent) at one location, then the mixed liquor flow rate to each aeration unit should be measured.

100. DISINFECTION

101. GENERAL

Disinfection of the effluent shall be provided as necessary to meet applicable standards. The design shall consider meeting both the bacterial standards and the disinfectant residual limit in the effluent. The disinfection process should be selected after due

consideration of waste characteristics, type of treatment process provided prior to disinfection, waste flow rates, pH of waste, disinfectant demand rates, current technology application, cost of equipment and chemicals, power cost, and maintenance requirements.

Chlorine is the most commonly used chemical for wastewater disinfection. The forms most often used is sodium hypochlorite. Other disinfectants, including chlorine dioxide, ozone, bromine, or ultraviolet disinfection, may be accepted by the reviewing authority in individual cases. If halogens are utilized, it maybe necessary to dehalogenate if the residual level in the effluent exceeds effluent limitations or would impair the natural aquatic habitat of the receiving stream.

Where a disinfection process other than chlorine is proposed, supporting data from pilot plant installations or similar full scale installations may be required as a basis for the design of the system.

102. CHLORINE DISINFECTION

102.1 Type

Chlorine is available for disinfection in gas, liquid (hypochlorite solution), and pellet (hypochlorite tablet) form. The type of chlorine should be carefully evaluated during the facility planning process. The use of chlorine gas or liquid will be most dependent on the size of the facility and the chlorine dose required. Large quantities of chlorine, such as are contained in ton cylinders and tank cars, can present a considerable hazard to plant personnel and to the surrounding area should such containers develop leaks. Both monetary cost and
the potential public exposure to chlorine should be considered when making the final determination.

102.2 Dosage

For disinfection, the capacity shall be adequate to produce an effluent that will meet the applicable bacterial limits specified by the regulatory agency for that installation. Required disinfection capacity will vary, depending on the uses and points of application of the disinfection chemical. The chlorination system shall be designed on a rational basis and calculations justifying the equipment sizing and number of units shall be submitted for the whole operating range of flow rates for the type of control to be used. System design considerations shall include the controlling wastewater flow meter (sensitivity and location), telemetering equipment and chlorination controls. For normal domestic wastewater, the following may be used as a guide in sizing chlorination facilities.

Type of Treatment	Dosage
Activated sludge plant effluent	8 mg/L
Tertiary filtration effluent	6 mg/L

102.3 Containers

102.31 Cylinders

One hundred fifty pound cylinders are typically used where chlorine gas consumption is less than 150 pounds per day. Cylinders should be stored in an upright position with adequate support brackets and chains at 2/3 of cylinder height for each cylinder.

102.32 Ton Containers

The use of one-ton containers should be considered where the average daily chlorine consumption is over 150 pounds.

102.34 Liquid Hypochlorite Solutions

Storage containers for hypochlorite solutions shall be of sturdy, non-metallic lined construction and shall be provided with secure tank tops and pressure relief and overflow piping. Storage tanks should be either located or vented outside. Provision shall be made for adequate protection from light and extreme temperatures. Tanks shall be located where leakage will not cause corrosion or damage to other equipment. A means of secondary containment shall be provided to contain spills and facilitate cleanup. Due to deterioration of hypochlorite solutions over time, it is recommended that containers not be sized to hold more than one month's needs. At larger facilities and locations where delivery is not a problem, it may be desirable to limit on-site storage to one week. Refer to Section 57.

The following items shall be provided in accordance with the 10 States Standards:

- 102.4 Equipment
  - 102.41 Scales
  - 102.43 Mixing
  - 102.44 Contact Period and Tank
  - 102.45 Piping and Connections
  - 102.46 Standby Equipment and Spare Parts
  - 102.47 Chlorinator Water Supply
  - 102.48 Leak Detection and Controls
- 102.5 Housing
  - 102.51 Feed and Storage Rooms
  - 102.52 Inspection Window
  - 102.53 Heat
  - 102.54 Ventilation
  - 102.55 Electrical Controls
  - 102.56 Protective and Respiratory Gear
- 102.6 Sampling and Control
  - 102.61 Sampling
  - 102.62 Testing and Control

103. DECHLORINATION

103.1 Types

Dechlorination of wastewater effluent may be necessary to reduce the toxicity due to chlorine residuals. The most common dechlorination chemicals are sulfur compounds, particularly sulfur dioxide gas or aqueous solutions of sulfite or bisulfite. Pellet dechlorination systems are also available for small facilities.

The type of dechlorination system should be carefully selected considering criteria including the following: type of chemical storage required, amount of chemical needed, ease of operation, compatibility with existing equipment, and safety.

103.2 Dosage

The dosage of dechlorination chemical should depend on the residual chlorine in the effluent, the final residual chlorine limit, and the particular form of the dechlorinating chemical used. The most common dechlorinating agent is sulfite. The following forms of the compound are commonly used and yield sulfite (SO2) when dissolved in water.

Dechlorination Chemical	Theoretical mg/L Required to Neutralize (mg/l)
Chlorine (Cl2)	1.00
Sodium thiosulfate (solution)	0.56
Sodium sulfite (tablet)	1.78
Sulfur dioxide (gas)	0.90
Sodium meta bisulfite (solution)	1.34
Sodium bisulfite (solution)	1.46

Theoretical values may be used for initial approximations, to size feed equipment with the consideration that under good mixing conditions 10% excess dechlorinating chemical is required above theoretical values. Excess sulfur dioxide may consume oxygen at a maximum of 1.0 mg dissolved oxygen for every 4 mg SO2.

The liquid solutions come in various strengths. These solutions may need to be further diluted to provide the proper dose of sulfite.

The following items shall be provided in accordance with the 10 States Standards:

103.3 Containers
103.4 Feed Equipment, Mixing, and Contact Requirements
- **103.41 Equipment**
- **103.42 Mixing Requirements**
- **103.43 Contact Time**
- **103.44 Standby Equipment and Spare Parts**
- **103.45 Sulfonator Water Supply**

103.5 Housing Requirements
- **103.51 Feed and Storage Rooms**
- **103.52 Protective and Respiratory Gear**

103.6 Sampling and Control
- **103.61 Sampling**

103.62 Testing and Control

104. ULTRAVIOLET RADIATION DISINFECTION

Design standards, operating data, and experience for this process are not well established. Therefore, expected performance of the ultraviolet radiation disinfection (UVRD) units shall be based upon experience at similar full scale installations or thoroughly documented prototype testing with the particular wastewater. Critical parameters for UVRD units are dependent upon manufacturers' design, lamp selection, tube materials, ballasts, configuration, control systems, and associated appurtenances. Proposals on this disinfection process will be reviewed on a case-by-case basis at the discretion of the reviewing authority under the provisions of Paragraph 53.2.

Open channel designs with modular UVRD units that can be removed from the flow are required. At least two banks in series shall be provided in each channel for disinfection reliability and to ensure uninterrupted service during tube cleaning or other required maintenance. Operator safety (electrical hazards and UV radiation exposure) and tube cleaning frequency shall be considered. The hydraulic properties of the system shall be designed to simulate plug flow conditions under the full operating flow range. In addition, a positive means of water level control must be provided to achieve the necessary exposure time. Also refer to Paragraphs 54.2 and 54.3. Closed chamber units will be reviewed on a case by case basis in accordance with Paragraph 53.2.

This process should be limited to a high quality effluent having at least 65% ultraviolet radiation transmittance at 254 nanometers wave length, no greater than 10 NTU turbidity, and BOD and suspended solids concentrations no greater than 30 mg/L at any time. The UV radiation dosage shall be based on the design peak hourly flow. As a general guide in system sizing for an activated sludge effluent with the preceding characteristics, a UV radiation dosage not less than 30,000 $\mu W \cdot s/cm2$ may be used after adjustments for maximum tube fouling, lamp output reduction after 8760 hours of operation, and other energy absorption losses.

Provide 1 complete set of replacement bulbs, sleeves and ballasts for spare parts.

An alarm system shall be provided to separately indicate lamp failure and low UV intensity.

105. OZONE

Ozone systems for disinfection should be evaluated on a case-by-case basis. Design standards, operating data, and experience for this process are not well established. Therefore, design of these systems should be based upon experience at similar full scale installations or thoroughly documented prototype testing with the particular wastewater.

120. RECLAIMED WATER

The proposed Water Pollution Control Plant (WPCP) shall produce effluent meeting the requirements of the North Carolina Regulations in Subchapter 02U of the NC Administrative Code. Reclaimed water is wastewater effluent that has been highly treated and filtered resulting in a high quality water suitable for lawn irrigation, fire fighting, watering of shrubbery or non-edible. Even though reclaimed water has been treated, disinfected and is safe for incidental human contact, it is not "drinking water" and has not been approved for human consumption or contact. The use of reclaimed water to fill swimming pools, hot tubs, spas, wading pools is therefore prohibited.

Reclaimed water cannot be distributed for public use unless it meets strict treatment requirements which entail continuous monitoring, sampling and analysis. For this reason the supply of reclaimed water may be interrupted for short periods, without warning, if the quality of the water drops below these standards.

130. CLOSE-OUT DOCUMENTS

Developer shall provide the following documents to Moore County before transfer of ownership or operations of the facilities:

a. Record Construction Drawings

b. O&M Manual (include provisions for process upset and preventative maintenance items)

c. Recorded Plat and Deed for the property

d. Executed agreement suitable to the Moore County Attorney

e. Bonds, as stated in Chapter 20 herein

f. All other documents, records and reports for the proper transfer of property, including Environmental Assessment, FONSI, etc.

g. Proven compliance with all permits and regulations over a 12 consecutive month period.

h.