# WEST VIRGINIA
# SECRETARY OF STATE
**KEN HECHLER**
# ADMINISTRATIVE LAW DIVISION

Form #1

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OFFICE OF WEST VIRGINIA
SECRETARY OF STATE

## NOTICE OF PUBLIC HEARING ON A PROPOSED RULE

AGENCY: West Virginia Department of Natural Resources TITLE NUMBER: 47

RULE TYPE: Legislative ; CITE AUTHORITY W. Va. Code §§20-5I-3(b) and 20-5I-7(a)

AMENDMENT TO AN EXISTING RULE: YES___ NO X

IF YES, SERIES NUMBER OF RULE BEING AMENDED: _____

TITLE OF RULE BEING AMENDED: _____

IF NO, SERIES NUMBER OF NEW RULE BEING PROPOSED: 31

TITLE OF RULE BEING PROPOSED:

"State Water Pollution Control Revolving Fund Program"

DATE OF PUBLIC HEARING: Monday, December 11, 1989 TIME: 1:30 pm

LOCATION OF PUBLIC HEARING: Director's Conference Room 674
Building 3, State Capitol Complex
Charleston, West Virginia

COMMENTS LIMITED TO: ORAL___, WRITTEN___, BOTH X

COMMENTS MAY ALSO BE MAILED TO THE FOLLOWING ADDRESS: SRF Rule Comments
Room 712, Building 3
State Capitol Complex
Charleston, WV 25305

The Department requests that persons wishing to make comments at the hearing make an effort to submit written comments in order to facilitate the review of these comments.

The issues to be heard shall be limited to the proposed rule.

ATTACH A **BRIEF** SUMMARY OF YOUR PROPOSAL

J. Edward Hamrick III

# MEMORANDUM OF CONSENT

TO: J. Edward Hamrick III, Director
Division of Natural Resources

FROM: Leonard A. Harvey, Secretary
Department of Commerce, Labor,
and Environmental Resources

SUBJECT: Approval of Regulatory Proposal

RE: State Water Pollution Control
Revolving Fund Program

I have reviewed the proposed rule and authorize its filing for public comment in accordance with the provisions of the West Virginia Administrative Procedures Act.

Leonard A. Harvey
Secretary

11/9/89
Date

FISCAL NOTE FOR PROPOSED RULES



Rule Title: State Water Pollution Control Revolving Fund Program

Type of Rule: X Legislative ___ Interpretive ___ Procedural

Agency: West Virginia Department of Natural Resources

Address: Building 3, State Capitol Complex, Charleston, West Virginia

| 1. Effect of Proposed Rule (Estimated Total Cost) | ANNUAL Increase $ | ANNUAL Decrease $ | Current $ | FISCAL YEAR Next $ | FISCAL YEAR Thereafter $ |
|---|---|---|---|---|---|
| Personal Services | | | 902,556 | 902,556 | 902,556 |
| Current Expense | 40,123 | | 197,900 | 237,946 | 237,946 |
| Repairs and Alterations | 1,000 | | 16,100 | 17,100 | 17,100 |
| Equipment | 1,000 | | 49,500 | 50,500 | 50,500 |
| Other | | | | | |

2. Explanation of Above Estimates:

The estimates reflect the costs incurred in the administration of the State's Construction Grants Program. This program will be phased out over the next several years and its staff will be transferred to the new State Water Pollution Control Revolving Fund Program established by this rule.

3. Objectives of These Rules:

This rule implements the provisions of the 1989 Water Pollution Control Revolving Fund Act.

4. Explanation of Overall Economic Impact of Proposed Rule.

Please see the attachment below.

Date: November 6, 1989

J. Edward Hamrick III
Director

ATTACHMENT TO FISCAL NOTE

Rule Title: State Water Pollution Control Revolving Fund Program

Agency: West Virginia Department of Natural Resources

4. Explanation of Overall Economic Impact of Proposed Rule.

A. Economic Impact on State Government.

The State must appropriate $25 million to this program over the next six years in order to receive $132 million in matching dollars from the federal government.

B. Economic Impact on Political Subdivisions, Specific Industries, or Specific Groups of Citizens.

When fully capitalized six years hence, this program will have $157 million available to provide low-interest loans to municipalities and public service districts for planning, designing, and constructing wastewater treatment systems. Such projects improve the quality of life for citizens of this state, provide a catalyst for local economic development, and enable communities to meet federal and State water quality standards.

C. Economic Impact on Citizens/Public at Large. No impact.

**PREAMBLE TO A NEW LEGISLATIVE RULE CONCERNING THE STATE WATER POLLUTION CONTROL REVOLVING FUND PROGRAM**



**STATE AGENCY:** West Virginia Department of Natural Resources

**REGULATIONS:** Title 47, Series 31, "State Water Pollution Control Revolving Fund Program"

**AUTHORITY:** W. Va. Code §§20-5I-3(b) and 20-5I-7(a)

**ACTION:** Proposed Rule; Notice of Public Hearing

**DATES:** A public hearing on the proposed rule will be held on Monday, December 11, 1989 at 1:30 p.m. in the Director's Conference Room 674, Building 3, State Capitol Complex, Charleston, West Virginia. Written comments will be received by the Department through the close of the hearing.

**SUMMARY:** The Department is proposing a new legislative rule to implement the provisions of the 1989 Water Pollution Control Revolving Fund Act (House Bill 2696). The revolving fund created by this Act and administered under today's rule will provide low-interest loans to municipalities and public service districts for the planning, design, and construction of wastewater treatment systems. Key provisions of the proposed rule include:

1. Provisions related to the establishment and administration of the revolving fund, including the procedures by which local governments may apply for low-interest loans to fund eligible projects;

2. Provisions related to project management, including procurement standards, financial management and record keeping, and facilities planning;

3. Provisions related to the environmental review of proposed projects and the contents of required program documents; and

4. Provisions related to the review and approval of project plans and specifications, including design standards for wastewater treatment works and collection systems.

TITLE 47
LEGISLATIVE RULES
DEPARTMENT OF NATURAL RESOURCES

SERIES 31
STATE WATER POLLUTION CONTROL REVOLVING FUND PROGRAM

§47-31-1. General.

1.1. Scope and Purpose. -- This legislative rule establishes requirements to govern the disbursement and use of loans from moneys held in the State Water Pollution Control Revolving Fund. Such loans shall be made to local governments for the planning, design, acquisition, or construction of wastewater treatment works, for the implementation of point and nonpoint source control management programs, and for the development and implementation of water conservation and management plans.

1.2. Authority. -- West Virginia Code §§20-5I-3(b) and 20-5I-7(a).

1.3. Filing Date. --

1.4. Effective Date. --

1.5. Incorporation by Reference. -- Whenever federal or State statutes or regulations are incorporated into these regulations by reference, the reference is to the statute or regulation in effect on November 3, 1989.

§47-31-2. Definitions.

2.1. "Act" means the Water Pollution Control Revolving Fund Act, W. Va. Code §20-5I, et seq.

2.2. "Applicant" means a local government that applies for a loan pursuant to the provisions of these regulations.

2.3. "Alternative Technology" means proven wastewater treatment processes and techniques that provide for the reclamation and reuse of water, the productive recycling of wastewater constituents, the elimination of pollutant discharges, or the recovery of energy. Specific examples of alternative technology include land application of effluent and sludge; aquifier recharge; aquiculture; direct reuse of nonpotable water; horticulture; revegetation of disturbed land; containment ponds; sludge composting and drying prior to land application; self-sustaining incineration; methane recovery; co-disposal of sludge and solid waste; and individual and on-site systems.

2.4. "Authority" means the West Virginia Water Development Authority.

2.5. "Clean Water Act" or "CWA" means the Federal Water Pollution Control Act, as amended by the Water Quality Act of 1987, 33 U.S.C. §1251, et. seq.

2.6. "Contract" means a legally binding obligation between the applicant and a private contractor or supplier to provide construction services or materials and supplies for construction.

2.7. "Cost" means the total of all costs incurred by a local government that are reasonable and necessary for carrying out all works and undertakings necessary or incident to the accomplishment of any project including:

2.7.1. The costs of developmental, planning, and feasibility studies, surveys, plans, and specifications;

2.7.2. The costs of architectural, engineering, financial, legal, or other special services;

2.7.3. The costs of acquisition of land and any buildings and improvements thereon, including the discharge of any obligations of the sellers of such land, buildings, or improvements;

2.7.4. The costs of site preparation and development, including demolition or removal of existing structures, construction and reconstruction, labor, materials, machinery, and equipment;

2.7.5. The reasonable costs of financing incurred by the local government in the course of the development of the project, carrying charges incurred before placing the project in service, interest on funds borrowed to finance the project to a date subsequent to the estimated date the project is to be placed in service, necessary expenses incurred in connection with placing the project in service, and the funding of accounts and reserves as required by the Authority; and

2.7.6. Such other items as are deemed reasonable and necessary by the Instrumentality.

2.8. "Conventional Technology" means wastewater treatment processes and techniques involving the treatment of wastewater at a centralized treatment works by means of either biological or physical/chemical unit processes followed by direct point source discharges to surface waters.

2.9. "Disbursement" means the transfer of cash from the Fund to an applicant.

2.10. "Eligible Recipient" means a local government that:

2.10.1. Appears on the State Project Priority List;

2.10.2. Has been included on the State's intended use plan as a proposed loan recipient;

2.10.3. Has submitted a complete application for a project with eligible costs; and

2.10.4. Will be in a state of readiness to proceed to construction and use loan payments in a timely manner.

2.11. "Director" means the director of the West Virginia Department of Natural Resources or his authorized representative.

2.12. "EPA" means the United States Environmental Protection Agency.

2.13. "Formal Advertising" means the public solicitation of sealed bids and the awarding of a contract based upon a fixed price (lump sum, unit price, or a combination of both) to the lowest, responsive, responsible bidder.

2.14. "Fund" or "SRF" means the State Water Pollution Control Revolving Fund.

2.15. "Instrumentality" means the West Virginia Department of Natural Resources.

2.16. "Innovative Technology" means developed wastewater treatment processes and techniques that have not been fully proven under the circumstances of their contemplated use and that represent a significant advancement over the state of the art in terms of significant reduction in life cycle costs or significant environmental benefits through the reclamation and reuse of water, the elimination of pollutant discharges, the utilization of recycling techniques such as land treatment, the more efficient use of energy and resources, improved or new methods of waste treatment management for combined municipal and industrial systems, or the confined disposal of pollutants so that they will not migrate to cause water or other environmental pollution.

2.17. "Intended Use Plan" means a plan developed in conformance with the provisions of CWA Section 606(c) that identifies the intended uses of moneys available for loans in the Fund for each fiscal year.

2.18. "Loan" means a loan made by the Authority to an applicant pursuant to Section 4 of these regulations for funding all or part of a project's costs.

2.19. "Loan Agreement" means an agreement entered into between the Authority and the Instrumentality, on behalf of the State, and the applicant pertaining to a loan.

2.20. "Local Government" means any county, city, town, municipal corporation, authority, district, public service district, commission, or political subdivision in West Virginia.

2.21. "Major Procurement Action" means a procurement action involving an aggregate amount in excess of five thousand dollars ($5,000).

2.22. "Minor Procurement Action" means a single procurement action involving an aggregate amount that does not exceed five thousand dollars ($5,000), including all extraneous charges.

2.23. "NPDES" means National Pollutant Discharge Elimination System.

2.24. "Project" means any wastewater treatment facility located or to be located in West Virginia and includes:

2.24.1. Sewage and wastewater collection, treatment, and disposal facilities;

2.24.2. Drainage facilities and projects;

2.24.3. Administrative, maintenance, storage, and laboratory facilities related to the facilities delineated in Sections 2.24.1 and 2.24.2 of these regulations;

2.24.4. Interests in land related to the facilities delineated in Sections 2.24.1 and 2.24.2 of these regulations; and

2.24.5. Other projects allowable under federal statute.

2.25. "Project Completion" means the date on which operation of the project is initiated or is capable of being initiated, whichever is earlier.

2.26. "Recipient" means a local government that has received a loan pursuant to the provisions of these regulations.

2.27. "State Project Priority List" means the list of projects that may qualify for SRF loan assistance.

2.28. "Subagreement" means a contractual obligation between the applicant and a private professional firm to provide services other than construction work.

2.29. "Treatment Works" means any device or system for the storage, collection, treatment, recycling, and reclamation of municipal sewage, domestic sewage, or liquid industrial waste used to implement CWA Section 201 or necessary to recycle or reuse water at the most economical cost over the design life of the works.

§47-31-3. State Priority System and Project Priority List.

3.1. An annual State Project Priority List shall be developed in conformance with the provisions of CWA Section 216. The list shall contain those projects for construction of treatment works that are eligible for SRF loan assistance.

3.2. The State Project Priority List shall be developed utilizing a priority rating system designed and approved by the Instrumentality.

§47-31-4. Fund Establishment and Administration.

4.1. Establishment of the Fund. The Authority shall establish a permanent and perpetual fund to be known as the "West Virginia Water Pollution Control Revolving Fund." The Fund shall be kept separate and apart from all other funds or programs of the Authority and the Instrumentality.

4.2. Sources of Moneys for the Fund. The Fund shall be comprised of moneys appropriated by the Legislature, moneys allocated to the State by the federal government for the purposes of establishing and maintaining the Fund, all receipts from loans made from the Fund to local governments, all income from the investment of moneys held in the Fund, and all other sums designated for deposits to the Fund from any source, public or private.

4.3. Use of Moneys in the Fund. Moneys in the Fund shall be used solely to make loans to local governments to finance or refinance the costs of a project and to defray the costs incurred by the Authority and the Instrumentality in administering the Fund and the program created by the Act and these regulations.

4.4. Depositories for the Fund. The Authority and the Instrumentality shall select a depository or depositories to hold all moneys in the Fund. A depository to which moneys of the Fund are paid shall act as the trustee of such moneys and shall hold them solely for the purposes set forth in Section 4.3 of these regulations.

4.5. Investment of Moneys in the Fund. The Authority shall invest the moneys in the Fund that are not needed for immediate disbursement or use in obligations or securities that are lawful investments for public funds of the State.

4.6. Disbursement of Moneys from the Fund. Moneys shall be disbursed from the Fund only upon a written authorization from the director of the Authority or his duly authorized designee.

4.7. Loans from the Fund. Moneys in the Fund shall be loaned to local governments for projects that are in compliance with provisions of the Clean Water Act and these regulations. Each loan shall be in an amount that covers those costs of a project for which funds are sought by the applicant from the Authority and which are not provided by other available sources.

4.8. Evidence of and Security for Loans. Each loan shall be evidenced by revenue bonds or notes or other debt instruments issued by the applicant and purchased by the Authority, at par or at a discount to reflect the costs of the Authority and the Instrumentality incurred relating to financing, in whole or in part, the costs of a project, and shall be secured by a pledge of the fees, charges, and all other revenues of the project to be constructed, in whole or in part, with the proceeds of the loan and any other collateral as may be required by the Authority.

4.9. Applications for Loans. A local government, or a combination of local governments, that has the authority under applicable law to undertake a project and that has been approved as an eligible recipient by the Instrumentality may apply for a loan. An eligible recipient desiring a loan shall make a separate application to the Authority, on the forms prescribed by the director of the Authority, for each project for which a loan is desired.

4.10. Determination of Eligible Recipient Status. Local governments projected to be able to qualify for SRF loan assistance will be identified in the annual intended use plan. Only those projects on the State Project Priority List for the current fiscal year shall be considered in the determination of eligible recipient status.

4.11. Determination of Priority for Loans. The priority of each project for which an application for a loan is received by the Authority shall be fixed, in relation to other projects of eligible recipients for which such applications are received, on the date on which the applicant has:

4.11.1. Provided documentation satisfactory to the Authority that the project is eligible for a loan under the provisions of the Act;

4.11.2. Provided documentation satisfactory to the Authority that, if the project will be financed in part by a construction grant, the applicant has received a commitment for such a grant;

4.11.3. Provided documentation satisfactory to the Authority that the project is on the State Project Priority List for the current fiscal year;

4.11.4. Provided documentation satisfactory to the Authority that the project is in conformance with the provisions of CWA Sections 208 and 303(e);

4.11.5. Demonstrated to the satisfaction of the Authority that the applicant has enacted or will enact all necessary ordinances or resolutions in a form and substance satisfactory to the Authority and has taken or will take all measures required by law to enable it to enter into a loan agreement and to issue its revenue bonds or notes for purchase by the Authority;

4.11.6. Demonstrated to the satisfaction of the Authority that the applicant has obtained or will obtain from all necessary governmental agencies, including the West Virginia Public Service Commission, approval of user charges for the project which will provide annual net revenues to the applicant that exceed, by an amount or percentage specified in the loan agreement, the annual payments required to be made by the applicant to the Authority under the loan agreement;

4.11.7. Demonstrated to the satisfaction of the Authority that the applicant can provide the financial, institutional, legal, and managerial capabilities necessary to complete the project; and

4.11.8. Provided to both the Authority and the Instrumentality an acceptable schedule for project initiation and completion.

4.12. Loan Agreements. Prior to providing a loan to an eligible recipient, the Authority shall execute and enter into a loan agreement with the applicant which shall be binding under the laws of the State and which shall contain such provisions as may be required by the Authority and the Instrumentality under the Act and the Clean Water Act including:

4.12.1. The cost of the project, the amount of the loan, and the terms of repayment of the loan and the security therefor, which may include -- in addition to a pledge of the fees, charges, and other revenues from such project after a reasonable allowance for operation, maintenance, renewal, and

replacement expenses -- a deed of trust or other appropriate security instrument creating a lien on such project provided that the annual repayment of principal and payment of interest begins not later than one (1) year after project completion and that the final payment date shall not exceed twenty (20) years from said completion date;

4.12.2. The specific purposes for which the proceeds of the loan shall be expended, the procedures as to the disbursement of loan proceeds including an estimated monthly draw schedule, and the duties and obligations imposed upon the applicant in regard to the acquisition or construction of the project;

4.12.3. The agreement of the applicant to impose, collect, and, if required to repay the obligations of such applicant under the loan agreement, increase service charges from persons utilizing the project. Service charges shall be pledged for the repayment of the loan together with all interest, fees, and charges thereon and all other financial obligations of the applicant under the loan agreement;

4.12.4. If notes or other interim obligations are being issued by the applicant, the agreement of the applicant to issue the revenue bonds and take such other actions as are required of the applicant under the loan agreement;

4.12.5. The agreement of the applicant to accept the Authority's remedies in the event of any default under the loan as specifically set forth in Section 5 of the Act; and

4.12.6. The agreement of the applicant to comply with all applicable federal and State statutes and regulations and all applicable local ordinances pertinent to the financing, acquisition, construction, operation, maintenance, and use of the project.

4.13. Payment of Principal and Interest on Loans. Payments of the principal or any interest on a loan shall be made by the applicant in accordance with the provisions of the loan agreement.

4.14. Computation of Interest on Loans. Each loan shall bear interest from the date of the delivery of the bonds or notes of the applicant evidencing the loan to the applicant at a rate or rates per annum, either fixed or variable, as determined by the Authority and the Instrumentality provided that said rate or rates shall be made at or below the market rate as defined in the Clean Water Act and further provided that, pursuant to the provisions of the loan agreement, the interest rate or rates shall reflect the costs of the Authority incurred in issuing its

obligations, if any, and other costs relating to the making of the loan.

4.15. Fees and Charges. In addition to payments of principal and interest on a loan, each applicant shall agree in the loan agreement to pay fees and charges to the Authority equal to the applicant's share of the administrative expenses of the Authority relating to the loan program described in Section 4 of these regulations including the fees and expenses of the trustee and paying agents for any bonds or notes to be issued by the Authority for contribution to the Fund and the fees and expenses of any corporate trustee for the Fund.

4.16. Loans Conditioned Upon Availability of Moneys in the Fund. The obligation of the Authority to make any loan shall be conditioned upon the availability of moneys in the Fund in such amounts and on such terms and conditions as, in the sole judgement of the Authority, will enable it to make the loans.

4.17. Disbursement of Loan Moneys.

4.17.1. On a monthly basis, the Authority shall disburse to each recipient the amount certified to the Authority as funds expended for the project. Said certification shall be made in the form prescribed by the Authority and shall be accompanied by a written approval from the Instrumentality. The director of the Authority or his duly authorized representative shall then provide written authorization to the appropriate Fund depository for the disbursement of the approved dollar amount to the recipient.

4.17.2. Each recipient shall comply with all terms and conditions of both the loan agreement and the resolution or ordinance authorizing the issuances of revenue bonds or notes or other debt instruments evidencing the loan.

§47-31-5. Program Requirements.

5.1. General Requirements.

5.1.1. The applicant shall request a pre-application meeting with the director to discuss the requirements of the program. A pre-application package, in a form prescribed by the Instrumentality, shall be completed and submitted to the director prior to this meeting.

Note: The review and approval by the director of facilities plans, design drawings and specifications, or other documents is for administrative purposes only and does not relieve the applicant or his agents and employees from properly planning, designing, constructing, operating, and maintaining the

project as required under applicable federal and State statutes and regulations.

5.1.2. The applicant shall demonstrate to the director that he has the financial, institutional, legal, and managerial capabilities to ensure adequate construction, operation, and maintenance of the treatment works. As a part of this demonstration, the applicant shall complete and submit to the director financial capability worksheets supplied by the Instrumentality.

5.1.3. If the project will serve or involve two (2) or more legal entities, the applicant shall submit an inter-municipal agreement to the director in a form prescribed by the Instrumentality.

5.1.4. An adequate user charge system shall be developed by the applicant and submitted to the director for approval.

5.1.5. A sewer use ordinance shall be developed by the applicant and submitted to the director for approval.

5.2. Procurement Standards.

5.2.1. Procurement Responsibilities.

5.2.1.a. The local government is responsible for the settlement and satisfactory completion of all contractural obligations in accordance with sound business judgement and good administrative practices.

5.2.1.b. The local government shall maintain a system to assure that contractors perform in accordance with the terms, conditions, and specifications of their subagreements.

5.2.1.c. The local government shall review its proposed procurement actions in order to avoid unnecessary or duplicated actions.

5.2.1.d. The local government shall follow all applicable procurement procedures set forth in the West Virginia Code.

5.2.2. Minor Procurement Actions.

5.2.2.a. The recipient may use small purchase procedures set forth in the West Virginia Code in lieu of the procedures set forth in Section 5.2.3 of these regulations when undertaking a minor procurement action.

5.2.2.b. If the recipient chooses to use the small purchase procedures, he shall contact no fewer than three (3) vendors with a request for proposals. This request may be tendered by letter or by telephone; however, all request made via telephone calls shall be documented in writing.

5.2.2.c. The recipient shall not divide a procurement action into smaller parts in order to avoid compliance with the procedures set forth in Section 5.2.3 of these regulations.

5.2.2.d. The awarding of the contract in a minor procurement action shall be made to the lowest, responsive, responsible bidder.

5.2.3. Major Procurement Actions.

5.2.3.a. Applicability. The requirements of Section 5.2.3 of these regulations apply to all major procurement actions except as provided in Sections 5.2.4 and 5.2.5 of these regulations.

5.2.3.b. Formal Advertising. The formal advertising method shall be used in major procurement actions. At a minimum, formal advertising shall include:

5.2.3.b.A. A complete, adequate, and realistic specification or purchase description of what is required;

5.2.3.b.B. Two (2) or more responsible bidders who are willing and able to compete effectively; and

5.2.3.b.C. The selection of the successful bidder based upon price.

5.2.3.c. Public Notice. Public notice of the solicitation of bids shall be provided for major procurement actions.

5.2.3.c.A. The public notice shall be provided by means of a Class II legal advertisement, publication in a professional journal, direct letter solicitation, or a combination of these methods.

5.2.3.c.B. The public notice shall include a statement of when and how the bidding documents may be obtained or examined.

5.2.3.c.C. A minimum of thirty (30) days shall be provided between the date on which the public notice was

initially published or otherwise given and the date on which bidding closes.

5.2.3.c.D. The local government shall publicly open bids at the place, date, and time announced in the bidding documents.

5.2.3.d. Bidding Documents. Bidding documents shall include:

5.2.3.d.A. A complete statement detailing the work to be performed including, where appropriate, design drawings and specifications and the required performance schedule;

5.2.3.d.B. The terms and conditions of the contract to be awarded including payment terms, delivery schedules, point of delivery, and acceptance criteria;

5.2.3.d.C. A clear explanation of the method of bidding, the method of evaluating bid prices, and the basis and method for awarding the contract;

5.2.3.d.D. All other responsibility requirements or evaluation criteria which will be used in the evaluation of the bids received;

5.2.3.d.E. The prevailing wage determination made under the Davis-Bacon Act (40 U.S.C. 276, et seq.), if applicable; and

5.2.3.d.F. The deadline for the receipt of bids and the address to which bids are to be submitted.

5.2.3.e. Awarding of Contracts. All bids shall be evaluated in accordance with the methods and criteria set forth in the bidding documents. The awarding of a contract shall be made to the lowest, responsive, responsible bidder. All of the tendered bids may be rejected only when sound, documented business reasons exist in support of that rejection.

5.2.4. Competitive Negotiation for Subagreements.

5.2.4.a. Applicability. The requirements of Section 5.2.4 of these regulations apply to all subagreements in excess of five thousand dollars ($5,000).

5.2.4.a.A. Where there is an existing relationship between the applicant and a private professional firm that the applicant desires to continue, documentation of procurement shall be submitted to the director for review and

approval. If the director does not approve the procurement, the applicant shall then comply with the requirements of Sections 5.2.4.b through 5.2.4.e of these regulations.

5.2.4.b. Request for Proposals. A request for proposals shall be provided for competitively-negotiated subagreements.

5.2.4.b.A. The request for proposals shall be provided by means of a Class II legal advertisement, publication in a professional journal, direct letter solicitation, or a combination of these methods.

5.2.4.b.B. The request for proposals shall include a statement of when and how the documents associated with the subagreement may be obtained or examined.

5.2.4.b.C. The request for proposals shall contain sufficent information to enable a prospective offeror to prepare a proposal.

5.2.4.b.D. The request for proposals shall contain all criteria that will be used to evaluate submitted proposals and the relative importance of each criterion.

5.2.4.b.E. The request for proposals shall include the deadline for the receipt of proposals and the address to which proposals are to be submitted.

5.2.4.b.F. A minimum of thirty (30) days shall be provided between the date on which the request for proposals was initially published or otherwise given and the date on which proposals will no longer be accepted.

5.2.4.c. Evaluation of Proposals. All acceptable proposals from qualified offerors shall be objectively evaluated under the criteria set forth in the request for proposals.

5.2.4.d. Negotiation and Awarding of Subagreements. Unless stated in the request for proposals that the awarding of the subagreement will be based upon initial offer, meaningful negotiations shall be conducted with the most qualified offerors who have tendered acceptable proposals. The subagreement shall be awarded to the responsible offeror whose written proposal is most advantageous, considering price and the established criteria. Unsuccessful offerors shall be promptly notified. Documentation of the procurement process shall be available for review by the director.

5.2.4.e. Professional Services. In the competitive negotiation for a subagreement for professional services

related to a project, the following procedures may be used in lieu of the procedures set forth in Section 5.2.4.d of these regulations:

5.2.4.e.A. A statement of qualifications shall be requested from each prospective offeror so that the most technically qualified firms for the service required can be selected and ranked.

5.2.4.e.B. Technical proposals shall be requested from each of the selected firms. This request shall inform each firm of the evaluation criteria that will be used to rank submitted proposals.

5.2.4.e.C. After all submitted proposals have been evaluated and ranked, the local government shall proceed to negotiate fair and reasonable compensation with the firm that submitted the best technical proposal. If appropriate compensation cannot be agreed upon, negotiations shall be terminated and the local government shall proceed to negotiate with the offeror who tendered the next-best technical proposal. This process shall continue until an acceptable agreement has been negotiated. Once negotiations have been terminated with a offeror, the local government cannot renegotiate with that offeror.

5.2.5. Noncompetitive Negotiation. Noncompetitive negotiation may be used to award a contract if the procurement methods described in Sections 5.2.3 of these regulations are inappropriate because:

5.2.5.a. The item is available only from a single source;

5.2.5.b. A public exigency or emergency exists and urgency will not permit competitive procurement; or

5.2.5.c. After solicitation from a number of sources, competition is inadequate.

5.2.6. Subagreement Forms. A standard form of agreement as prescribed by the director shall be utilized for all subagreements.

5.3. Financial Management and Record Keeping.

5.3.I. Financial Management. The recipient shall establish and maintain a financial management system to account for all costs incurred related to a project. This system shall assure that generally accepted accounting principles and

practices are consistently applied in all financial matters related to the project.

5.3.1.a. Financial management shall include the following elements:

5.3.1.a.A. The establishment of appropriate controls over project funds, property, and other assets;

5.3.1.a.B. The maintenance of ledgers containing accurate, current, and complete records of all financial actions related to the project;

5.3.1.a.C. The maintenance of records that identify the source and amount of all moneys used for the project and document how such moneys were used;

5.3.1.a.D. The maintenance of records that allow a comparison of actual project costs with budgeted costs; and

5.3.1.a.E. The establishment of procedures that assure a timely resolution of audit findings and recommendations.

5.3.1.b. In maintaining his accounting system, the recipient shall:

5.3.1.b.A. Establish a separate account for the project;

5.3.1.b.B. Record all transactions in ledgers (i.e., double entry accounting);

5.3.1.b.C. Record all transactions in a timely and verifiable manner;

5.3.1.b.D. Designate one (1) person who is not responsible for project operations to account for all project funds; and

5.3.1.b.E. Prepare monthly reports of the financial status of the project.

5.3.2. Records. The recipient shall maintain official records for each loan received that include:

5.3.2.a. The loan application and loan approval documents;

5.3.2.b. All contracts and subagreements related to the project;

5.3.2.c. All documents related to financial management prescribed under Section 5.3.1 of these regulation;

5.3.2.d. All documents requiring action by the State (e.g., sewer use ordinances, intermunicipal agreements, water pollution control permits, operation and maintenance manuals);

5.3.2.e. A documentation of compliance with applicable federal and State statutes and regulations;

5.3.2.f. A documentation of the amount of moneys received and expended for the project;

5.3.2.g. A documentation of all property that was purchased for the project; and

5.3.2.h. Time records related to the project.

5.3.3. Inspections.

5.3.3.a. All records maintained pursuant to the provisions of these regulations shall be made available for inspection by the director upon request.

5.3.3.b. At his discretion, the director shall conduct a construction management evaluation of any project. This evaluation shall consist of an on-site inspection and evaluation of the recipient's financial management system and managerial performance with respect to recordkeeping practices, accounting practices, construction oversight, and general management practices.

5.3.4. Force Account. The recipient may use its own work force to construct and administer parts of the project if prior approval has been granted by the director.

§47-31-6. Environmental Review of Funded Projects.

6.1. General. The Instrumentality shall conduct an environmental review for each project funded, in whole or in part, from the Fund. Any adverse environmental impacts that may occur on a project, as determined by the director, shall be mitigated by the local government. The local government shall implement all measures, as stipulated by the director, that are necessary to prevent adverse impact to the public health, safety, or welfare or to the environment.

6.2. Adoption of Federal Regulations. The director hereby adopts and incorporates by reference the provisions contained in 40 C.F.R. Part 6, Subparts A through E, with the following modifications:

6.2.1. Wherever the term Administrator or Assistant Administrator is used, the term shall be deleted and replaced by the term director of the West Virginia Department of Natural Resources.

6.2.2. Wherever the term Agency, Environmental Protection Agency, EPA, or OEA is used, the term shall be deleted and replaced by the term West Virginia Department of Natural Resources.

6.2.3. Wherever the term Federal Register is used, the term shall be deleted and replaced by the term State Register.

6.2.4. Wherever the term Wastewater Treatment Construction Grants Program is used, the term shall be deleted and replaced by the term State Water Pollution Control Revolving Fund Program.

6.2.5. The definition of "grant" that appears in 40 C.F.R. §6.101(e) shall be deleted and replaced by the definition of "loan" that appears in Section 2.18 of these regulations.

6.2.6. The phrase "Freedom of Information Act (5 U.S.C. Section 552(b))" contained in 40 C.F.R. §6.402(a) shall be deleted and replaced by the phrase "West Virginia Freedom of Information Act (W. Va. Code §29B, et seq.)."

6.2.7. The phrase "five or more years old" contained in 40 C.F.R. §6.508(b)(2)(i) shall be deleted and replaced by the phrase "two or more years old."

§47-31-7. Facilities Planning.

7.1. Facilities Plan Preparation. The applicant shall prepare a facilities plan as one component of his application for SRF loan assistance. The facilities plan shall establish the need for the project, evaluate alternative solutions, and select a cost-effective, environmentally sound project. The facilities plan also represents a public record of decision making and shall be written to provide the general public, municipal officials, and regulatory officials with a clear understanding of the problem, solutions, and consequences of the project. The applicant shall submit his completed facilities plan to the director for review and approval.

7.1.1. Facilities Plan Guidance. Prior to the submission of a facilities plan with an application for SRF loan assistance, a local government shall seek guidance from the director concerning the preparation of an acceptable facilities plan. The local government shall seek this guidance during the early stages of project planning.

7.1.2. Facilities Plan Contents. The facilities plan shall include or address:

7.1.2.a. The requirements set forth in Appendix A of these regulations; and

7.1.2.b. The requirements set forth in the following sections of the Clean Water Act:

7.1.2.b.A. CWA Section 201(b), which requires the applicant to utilize the best practicable waste treatment technology in his project;

7.1.2.b.B. CWA Section 201(g)(2), which requires the applicant to consider alternative technologies in the design of his project;

7.1.2.b.C. CWA Section 201(g)(3), which requires the applicant to show that the related sewer collection system is not subject to excessive infiltration;

7.1.2.b.D. CWA Section 201(g)(5), which requires the applicant to study innovative and alternative treatment technologies and to make more efficient use of energy and resources in the design and construction of his project;

7.1.2.b.E. CWA Section 201(g)(6), which requires the applicant to analyze potential recreation and open space opportunities in the planning of his project; and

7.1.2.b.F. CWA Section 204(b)(1), which requires the applicant to develop a user charge system and to have the financial, institutional, legal, and managerial capabilities to construct, operate, and maintain his project.

7.2. Facilities Plan Review and Approval.

7.2.1. Facilities Plan Review. The director shall review an applicant's facilities plan for completeness and conformance with the requirements of these regulations and the Clean Water Act. In his review, the director shall give special attention to the requirements set forth in the following sections of the Clean Water Act:

7.2.1.a. CWA Section 201(g)(1), which delineates the projects for which SRF loan assistance may be provided by the State;

7.2.1.b. CWA Section 201(n)(1), which provides that funds under CWA Section 205 may be used for water quality problems due to discharges from combined sewer overflows if such discharges are a major State priority;

7.2.1.c. CWA Section 201(o), which calls on the State to encourage and assist communities in the development of capital financing plans;

7.2.1.d. CWA Sections 204(a)(1) and 204(a)(2), which require that an applicant's project be included in plans developed pursuant to CWA Sections 208 and 303(e);

7.2.1.e. CWA Section 211, which requires that a major rehabilitation or replacement of collectors is not eligible for SRF loan assistance unless the collector is necessary to assure the total integrity of the treatment works or, for a new collector, that adequate capacity exists at the facility; and

7.2.1.f. CWA Section 511(c), which requires that the State conduct an environmental review of the applicant's project as provided in Section 6 of these regulations.

7.2.2. Facilities Plan Approval. The director shall approve a facilities plan only after the applicant has satisfied all requirements contained in Section 7 of these regulations and an environmental review has been conducted in accordance with the provisions of Section 6 of these regulations.

§47-31-8. Project Design and Construction.

8.1. Pre-Design Conference. After a facilities plan has been approved by the director, he shall hold a pre-design conference with the applicant in order to review the activities which shall take place during the design of the project.

8.2. Project Design Guidance. During the design phase of a project, the applicant shall seek guidance from the director concerning acceptable project design and shall arrange to periodically meet with the director to review the progress of the project design work.

8.3. Project Plans and Specifications. The applicant shall submit his completed project plans and specifications to the director for review and approval. The director shall approve the project plans and specifications only after he has determined that the minimum technical and administrative requirements of

these regulations and applicable federal statutes and regulations have been met.

8.3.1. Technical Requirements for Project Plans and Specifications.

8.3.1.a. The project design shall follow the recommendations contained in the approved facilities plan. Failure to follow the approved facilities plan shall be grounds for the rejection of the project plans and specifications by the director.

8.3.1.b. The project design shall ensure that the project shall be both biddable and constructable. Failure to produce a design that is both biddable and constructable, as determined by the director, shall be grounds for the rejection of the project plans and specifications by the director.

8.3.1.c. The project design shall ensure that minimum NPDES discharge requirements set by the State are achieved.

8.3.1.d. All project plans and specifications shall be sealed and signed by a registered professional engineer who holds a current certificate of registration issued by the State in accordance with the provisions of W. Va. Code §30-13.

8.3.2. Project Plans.

8.3.2.a. All project plans submitted to the director shall conform with the standards set forth in Appendix B of these regulations.

8.3.2.b. Unless otherwise provided in these regulations, all project plan drawings shall be submitted on blue-line or black-line prints that are twenty-four inches by thirty-six inches (24" x 36") in size. Upon approval from the director, construction details shall be included on the drawings for all work that cannot be adequately represented on the scale specified by these regulations.

8.3.2.c. Geotechnical information, including boring logs and the groundwater level at each borehole, shall be included either on the project plan drawings or in the project specifications submitted with the project plans. Borings shall be taken at the proposed location of each pumping station that will be ten (10) or more feet deep and at appropriate locations on the treatment works site. Geotechnical information for collector lines may be required by the director on a case-by-case basis.

8.3.2.d. Plans for a treatment works shall include:

8.2.3.d.A. An index;

8.2.3.d.B. A comprehensive legend;

8.2.3.d.C. A location map of the project site showing the location, dimensions, and elevations of all existing and proposed structures and facilities;

8.2.3.d.D. A hydraulic profile of the project site;

8.2.3.d.E. A piping plan showing all facility piping in complete detail at a scale of one inch equal to ten inches (1" = 10") and including profiles for all in-plant piping and drainage systems;

8.2.3.d.F. A site grading plan;

8.2.3.d.G. A site erosion and sedimentation control plan; and

8.2.3.d.H. Sufficient drawings to describe every element of construction including, but not limited to, structural, reinforcing, and architectural drawings, detail sheets, and a complete set of electrical drawings.

8.3.2.e. Plans for pumping or vacuum stations shall be drawn on a horizontal scale of one inch equal to ten feet (1" = 10') and a vertical scale of one inch equal to five feet (1" = 5') with 25-year and 100-year flood elevations noted and shall show facility piping and electrical systems in complete detail.

8.3.2.f. Plans for collection systems shall be drawn on topographic base sheets using a two-foot contour interval, a horizontal scale of one inch equal to fifty feet (1" = 50'), and a vertical scale of one inch equal to five feet (1" = 5') with plan and profile views on the same plan sheet. Each plan sheet shall include a key, an index of property owners, and a general project map drawn on a scale of one inch equal to four hundred feet (1" = 400'). Alternative mapping scales may be approved by the director on a case-by-case basis.

8.3.2.f.A. Drawings of collector lines shall be of sufficient detail to completely describe the required construction, shall show the flow direction for each collector line, and shall include a profile view of each collector line. Lateral connections do not have to be shown.

8.3.2.f.B. Drawings of the collection system shall show all property lines and easements, all West Virginia Department of Highways right-of-ways, the location of existing sewers and buildings, and the limits of construction.

8.3.2.g. In addition to meeting the applicable requirements of Section 8.3.2.f of these regulations, plans for alternative collection systems -- vacuum, grinder pump/pressure, variable grade sewers (VGSs), septic tank effluent pumps (STEPs), or other systems requiring construction of devices other than a collector line on or through a customer's property -- shall show the proposed location of each device.

8.3.2.h. Plans for projects estimated to cost over ten million dollars ($10,000,000), either as stated in the facilities plan or subsequent to the approval of that plan, shall include a value engineering review in accordance with the provisions of CWA Section 218.

8.3.3. Project Specifications.

8.3.3.a. Davis-Bacon labor wage provisions shall be incorporated into the project specifications in accordance with the provisions of CWA Section 513.

8.3.3.b. A "Buy American" requirement shall be incorporated into the project specifications in accordance with the provisions of CWA Section 215. In order to administer this federal requirement, the director hereby adopts and incorporates by reference the provisions contained in 40 C.F.R. §33.710.

8.3.3.c. General conditions mandated by federal agencies and provided by the director shall be incorporated into the project specifications.

8.3.3.d. The project specifications shall include complete technical specifications to govern the construction of collector lines, pumping stations, treatment works, and all other appurtenances. The technical specifications shall include complete information related to:

8.3.3.d.A. Requirements for the quality of materials and workmanship, size, operating characteristics, rating of equipment, and testing of materials and equipment for all mechanical and electrical equipment (e.g., machinery, valves, piping, joining of pipes, electrical motors, wiring, instrumentation and meters, laboratory fixtures and equipment, manholes, force mains, and gravity lines);

8.3.3.d.B. Requirements for the quality and testing of construction materials; and

8.3.3.d.C. Requirements for performance tests of completed works, testing of soils and concrete, and warranty provisions.

8.3.3.e. If required by the director, a bypass prevention plan shall be included in the project specifications. The bypass prevention plan shall provide detailed instructions on how the contractor shall keep existing facilities in operation and prevent the discharge of raw or partially treated sewage during construction.

8.3.3.f. The project specifications shall not be used to direct the purchase of equipment from a single manufacturer or to preclude other bidders. If the name of a manufacturer for a specific piece of equipment is included in a project specification, an approved equal must also be supplied. A list of approved equipment shall be included with each specification.

8.3.4. Modification of Approved Project Plans and Specifications.

8.3.4.a. Changes to the approved project plans and specifications shall be submitted to the director for review and approval before being incorporated into change orders or addenda.

8.3.4.b. A complete and updated estimate of project costs and a financial affordability analysis shall be submitted to the director along with the proposed changes to the approved project plans and specifications.

8.3.4.c. Changes that affect capacity, flow, operation, process, or point of discharge shall receive written approval from the director before such changes are initiated.

8.3.5. Implementation of Approved Project Plans and Specifications.

8.3.5.a. A complete report detailing all land and right-of-way acquisitions related to the project -- including the names of property owners, tax numbers, and all other pertinent information -- shall be submitted to the director. The director shall not allow a project to go to bid until at least eighty percent (80%) of the number (not the linear feet) of required right-of-ways and real property acquisitions are in hand. West Virginia Department of Highways right-of-ways shall be counted as one right-of-way for this determination.

8.3.5.b. The director's approval of project plans and specifications shall be valid for only one (1) calendar year from the date of approval. Any subpart of the approved plans and

specifications not advertised for competitive bids within the one-year period shall be resubmitted to the director for reapproval. Failure to seek such reapproval shall be grounds for the issuance of an immediate stop work order and the project shall not be resumed until the reapproval is obtained from the director.

8.3.5.c. All project bidding shall follow the two-envelope bidding system provided by the director.

8.3.5.d. All contracts shall be bid as unit price or lump sum proposals. Lump sum contracts shall be itemized into detailed work elements, with a separate price included in the bid schedule for each element.

8.3.5.e. Change orders shall be negotiated on the basis of unit price, lump sum, or time and materials. All change orders must receive prior written approval from the director and have complete price documentation, including a memorandum of negotiation.

8.4. Pre-Construction Conference. After the project plans and specifications have been approved by the director, he shall hold a pre-construction management conference with the recipient in order to review the activities which shall take place during the construction of the project.

8.5. Project Inspections. Interim inspections of the project shall be conducted by the director periodically during construction. A final inspection shall be conducted by the director after construction has been substantially completed and before the final construction loan payment is disbursed.

8.6. Certified Operator. A certified operator shall have been hired by the recipient prior to the time when construction is fifty percent (50%) complete.

8.7. Operation and Maintenance Manual. An operation and maintenance manual (O & M manual) shall be compiled and submitted to the director for approval prior to the time when construction is ninety percent (90%) complete.

8.8. As-Built Plans. The project engineer shall submit as-built plans to the recipient within sixty (60) days of project completion.

8.9. Project Certification. Within sixty (60) days of the end of the first year after project completion, the recipient's engineer shall compile for the recipient a written report on the operation and maintenance of each element of the project for submission to the director. When submitting a copy of this

report to the director, the recipient shall also certify that the project meets the design specifications and effluent limitations included in his permit in accordance with the provisions of CWA Section 204(d)(2).

APPENDIX A

REQUIRED CONTENTS OF A FACILITIES PLAN

A facilities plan shall be prepared for inclusion with each application for SRF loan assistance unless (a) a facilities plan exists for the project that was approved by the State after September 30, 1987 but prior to September 29, 1989 or (b) plans and specifications, based upon a facilities plan approved by the State prior to September 29, 1989, are complete or currently being prepared. This provision includes equipment purchases and force account work. The format of a facilities plan shall follow this outline:

I. Introduction
II. Current Situation
III. Future Situation
IV. Alternatives
V. Plan Selection and Public Participation
VI. Environmental Information
VII. Project Summary
VIII. Appendices

I. Introduction.

A brief review of the project including a description of the planning area, the implementing authority, and the project history shall be provided in this section of the plan.

II. Current Situation.

A. Information related to current wastewater disposal practices (e.g., septic tanks, direct discharges, public sewers) and the names of all streams currently receiving effluent shall be provided in this section of the plan.

B. Population and probable customer counts, with nonresidential customers shown as equivalent dwelling units (EDUs), and the source of this data shall be included in this section of the plan.

C. A complete infiltration/inflow analysis (I/I analysis) for existing collection systems shall be included in this section of the plan. This analysis shall be obtained through a physical inspection of the system, flow monitoring of major subsystems, and smoke testing. A summary of analysis findings shall show domestic waste production, average and peak infiltration rates,

and inflow rates for each subsystem as well as for the system as a whole.

D. A complete sewer map, a calculation of the percentage of homes not currently sewered, a potential/certified health hazards certification, an excessive/nonexcessive infiltration/inflow determination, and any recommendations for project work resulting from the I/I analysis shall be provided in this section of the plan. Information required pursuant to Section 7.1.2.b.C of these regulations shall be included in this section of the plan.

E. A complete description of existing wastewater treatment facilities, including layout maps and schematic diagrams, shall be provided in this section of the plan. This description of existing facilities shall include the physical condition, capacities, maintenance data, and other pertinent information for each component of the facility.

F. Existing NPDES permit requirements, new waste load allocation (WLA), or both shall be provided in this section of the plan.

G. Other documentation of need, including septic tank failure rates and West Virginia Health Department reports, shall be included in this section of the plan.

H. The name of each stream receiving effluent and its effluent limitations, stream designation (effluent or water quality limited), and major river basin shall be included in this section of the plan.

III. Future Situation.

A. Population projections, including historic growth rates for the project area and any other supporting arguments for the growth rate selected, shall be provided in this section of the plan. Population figures shall be translated into a customer count. Commercial/industrial flows shall be converted to equivalent dwelling units (EDUs) and then included in the customer count.

B. Waste flow projections, including the domestic water consumption of customers not currently connected to collection systems, shall be provided in this section of the plan. Both average flow and peak daily flow shall be included in these projections.

Note: The maximum allowable flow rate for existing systems is one hundred twenty gallons per capita per day (120 gpcd). The maximum allowable flow rate for new systems is the domestic water

use plus an allowance of two hundred (200) gallons per inch diameter per mile per day for infiltration. Inflow allowance is zero.

C. A waste load allocation for the selected treatment alternative and any NPDES permit requirements shall be included in this section of the plan.

IV. Alternatives.

A. Alternatives for the type of treatment, type of collection system, and location of the treatment works shall be evaluated in this section of the plan. This evaluation shall include both a present-worth cost analysis and a discussion of other, nonmonetary factors (e.g., maintenance requirements, flexibility, public acceptance) for each alternative. The no-action alternative shall also be discussed in this evaluation.

Note: In general, only the most cost-effective alternative will be considered for SRF loan assistance in accordance with CWA Section 218. Furthermore, SRF loan assistance will normally be limited to projects proposing secondary treatment, advanced treatment, new interceptors and appurtenances, or the correction of infiltration/inflow problems; however, up to twenty percent (20%) of the state's annual allotment of SRF funds can be used to fund other projects within the definition of treatment works contained in CWA Section 212 and for certain nonpoint source control and groundwater protection purposes, as defined in CWA Section 319.

1. In the evaluation of treatment alternatives, a complete cost-effectiveness analysis shall be made of oxidation ditches and aerated lagoons. The evaluation of other processes, such as pre-engineered extended aeration and sequencing batch reactors may be required by the director on a case-by-case basis. A separate subsection of this evaluation shall be devoted to sludge processing and its final disposal.

2. In the evaluation of collection system alternatives, the utilization of existing systems as well as new gravity, vacuum, grinder-pump/pressure, and small-diameter gravity systems shall be discussed. Maps of each alternative collection system, drawn on a scale of one inch equal to five hundred feet (1" = 500'), shall be included in this evaluation; these maps shall also identify existing and projected customers.

Note: More than one collection system technology may be utilized in the recommended system. For new collectors in an existing community, adequate capacity must exist at the treatment facility in accordance with CWA Section 211.

3. In the evaluation of alternative locations for the proposed treatment works, special consideration shall be given to the aesthetics and costs associated with each alternative site. A map of each alternative site, drawn on a scale of one inch equal to one hundred feet (1" = 100') and showing the 25-year and 100-year flood elevations, shall be included in this evaluation.

Note: The treatment works shall remain accessible during a 25-year flood and be completely protected from damage during a 100-year flood. Sites not meeting these criteria shall be eliminated from consideration. Sites that cannot conform with the buffer zone distances outlined in Table E of Appendix B of these regulations shall also be eliminated from consideration.

B. Information required pursuant to Sections 7.1.2.b.A and 7.1.2.b.B of these regulations shall be included in this section of the plan.

C. Information required pursuant to Sections 7.1.2.b.D and 7.1.2.b.E of these regulations shall be included in this section of the plan.

V. Plan Selection and Public Participation.

A brief discussion of the factors influencing the choice of the selected alternatives shall be provided in this section of the plan. The minutes of public meetings held to discuss the proposed project and a ranking of the various alternatives shall also be included in this section of the plan.

Note: Public meetings shall be announced at least thirty (30) days in advance by means of a Class II legal advertisement; additional means of notification, such as flyers and newspaper articles, are also recommended.

VI. Environmental Information.

An assessment of the impacts of the proposed project upon archaeological and historical sites, endangered species, farmland, wetlands, and 25-year and 100-year flood elevations shall be provided in this section of the plan. A list of contacts for each federal or State agency that requires consultation on these topics shall be obtained from the director. Unavoidable adverse impacts of the project, and the measures that will be taken to mitigate or minimize those impacts, shall be addressed in this assessment. Other potential impacts to the project area, such as substantially increased development that will result due to the project, shall be also discussed in this section of the plan.

VII. Project Summary.

A summary of the proposed project, including detailed descriptions of all project facilities, systems, and appurtenances (e.g., the length and size of pipes, pumping station capacities) shall be provided in this section of the plan.

VIII. Appendices.

A. A project cost summary appendix shall be included in the facilities plan to detail:

1. Preliminary cost estimates for treatment works and collection system construction, ten percent (10%) contingency reserve, basic engineering design and construction, special engineering services, resident inspection, administrative and legal services, land acquisitions, financing, Step II design allowance with allowable percentage (if appropriate), and SRF loan assistance required.

2. Projected annual costs for operation and maintenance, personnel, utilities, supplies, administration, billing and collection, outside services, and capital improvements.

3. Existing debt information including debt costs for the proposed project, loan conditions (specify funding agency), term of loan in years, interest payments, capital recovery factor, coverage, debt service per year, and total annual costs.

4. User charge information including the cost per one thousand (1,000) gallons (uniform rate), water sales to sewer customers in gallons per day, the minimum bill at two thousand (2,000) gallons per month, and the typical bill at four thousand five hundred (4,500) gallons per month.

B. A project schedule appendix shall be included in the facilities plan to detail the anticipated dates of:

1. Approval of facilities plan;

2. Loan application acceptance;

3. Loan receipt;

4. Initiation of project design work;

5. Submission of project plans and specifications;

6. Approval of project plans and specifications;

7. Submission of user charges to the West Virginia Public Service Commission for approval;

8. Advertisement for bids;

9. Receipt of bids;

10. Awarding of contracts;

11. Commencement of project construction; and

12. Completion of project construction.

C. A project documents appendix shall be included in the facilities plan to provide copies of:

1. A resolution of acceptance if needed from the implementing agency;

2. All intermunicipal agreements;

3. A copy of the existing NPDES permit or waste load allocation;

4. All A-95 clearinghouse comments;

5. A statement of availability of proposed wastewater treatment works site; and

6. All other pertinent correspondence and documents.

APPENDIX B

DESIGN STANDARDS FOR COLLECTION SYSTEMS AND TREATMENT WORKS

PART A. SEWAGE COLLECTION SYSTEMS.

1. Approvable Systems.

1.1. New collection systems or extensions to an existing collection system designed to carry sanitary sewage flows plus an allowance for nonexcessive infiltration are approvable.

1.2. Modifications to existing collection systems designed to carry sanitary sewage flows plus an allowance for nonexcessive infiltration and inflow are approvable.

1.3. Overflows from new interceptor sewers shall be reviewed by the director on a case-by-case basis.

1.4. No new combined system shall be approved by the director.

1.5. In determining the required capacities of sanitary sewers, the following design factors shall be considered:

1.5.1. Maximum hourly quantity of sewage;

1.5.2. Additional maximum wastewater flow from industrial plants; and

1.5.3. Groundwater infiltration.

1.6. New collection systems shall be designed based upon:

1.6.1. Estimates from a fully-documented analysis of water use records adjusted for consumption and losses; or

1.6.2. An assumed wastewater flow of seventy gallons per capita per day (70 gpcd) for residential customers added to a calculated wastewater flow from all nonresidential customers derived through the use of the values set forth in Table A of this appendix.

2. Gravity Collection Systems.

2.1. Design Life. The maximum allowable design life for gravity sewers is fifty (50) years for the estimated tributary area. Phasing of collection systems will be allowed.

2.2. Infiltration Allowance and Industrial Flows. An infiltration allowance of two hundred (200) gallons per inch diameter per mile per day and a reasonable allowance for future industries may be added to the per capita design flows to arrive at the average daily flow.

2.3. Peak Flows. Gravity sewers shall be designed to carry a peak flow, when flowing full, of:

2.3.1. Four (4) times the average daily flow for lateral sewers; and

2.3.2. Three and one-half (3.5) times the average daily flow for trunk, interceptor, and outfall sewers.

2.4. Alternate Method. When deviations from the peak design flows set forth in Section 2.3 of Part A of this appendix are desired, a brief justification and description of the procedure used for sewer design shall be submitted to the director with the project plans.

2.5. Calculations. Computations and other design data shall be presented in an appropriate form for all proposed sewage collection and treatment facilities. These computations shall include the average daily flow and peak daily flow at critical points (e.g., where a change in the size of the sewer occurs) and the velocity at minimum, average, and peak flows in the sewers.

2.6. Minimum Size. Gravity sewers shall be no less than eight inches (8") in diameter with the exception that six inch (6") diameter pipe may be used for collector sewers where no possibility of future extension exists and no more than either thirty (30) mobile homes or fifteen (15) residences can be served, or where the slope exceeds twenty percent (20%).

Note: Small-diameter gravity sewers, of a minimum size of four inches (4") in diameter, may be utilized for sanitary sewage collection. Cleanouts may be used instead of manholes and shall be installed at all changes in direction and at all connections. Pretreatment is required prior to discharge into small-diameter gravity sewers.

2.7. Cover. The minimum allowable earth cover on sewers shall be three feet (3') unless otherwise approved by the director. Gravity sewers shall be placed sufficiently deep to drain basement fixtures and to prevent freezing.

2.8. Slopes.

2.8.1. All new gravity sewers shall be so designed and constructed to give velocities, when flowing full, of not less

than two feet per second (2.0 fps) based on Kutter's or Manning's formula using an "n" value of 0.013. An "n" value of 0.015 is recommended for the determination of existing sewer capacities. Other practical "n" values may be used if deemed justifiable on the basis of research or field data presented by the consulting engineer.

2.8.2. Minimum allowable slopes for gravity sewers are delineated in Table B of this appendix.

2.8.3. Under special conditions, slopes slightly less than those required to provide the prescribed two feet per second (2.0 fps) velocity may be used. Whenever such decreased slopes are selected, computations of the depth of flow in such pipes at minimum, average, and peak rates of flow shall be submitted to the director with the project plans.

Note: Such decreased slopes may result in additional sewer maintenance.

2.8.4. Gravity sewers shall generally be laid in a straight line, with a uniform slope between manholes or clean-outs. Gravity sewers laid on a slope of twenty percent (20%) or greater may follow the ground slope but shall be anchored securely with concrete anchors, or an approved equal, and spaced as follows:

2.8.4.a. Not over thirty-six feet (36') center to center on slopes between twenty to thirty-five percent (20% to 35%);

2.8.4.b. Not over twenty-four feet (24') center to center on slopes between thirty-five to fifty percent (35% to 50%); and

2.8.4.c. Not over sixteen feet (16') center to center on slopes of fifty percent (50%) or greater.

2.9. Alignment. Gravity sewers of twelve inches (12") or less in diameter shall be laid with straight alignment between manholes.

2.10. Increasing Size. When a smaller sewer joins a larger one, the invert of the larger sewer shall be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to place the eight-tenths (0.8) depth of both sewers at the same elevation.

2.11. High Velocity Protection. Where velocities greater than fifteen feet per second (15.0 fps) are attained, special

provisions shall be made to protect against displacement by erosion and shock.

2.12. Materials. The material selected for gravity sewer pipes should be adapted to local conditions such as the character of industrial wastes, the possibility of septicity, soil characteristics, exceptionally heavy external loadings, abrasion, and similar problems. All nonmetallic pipe shall have a metallic-impregnated identification tape buried directly above it that identifies that pipe as a sewer line.

2.13. Loadings. All gravity sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the sewer shall be made according to the width and depth of trench. Gravity sewer lines shall be constructed of clay, plastic, cast iron, ductile iron, or concrete sewer pipe that conforms to the specifications set forth in Table C of this appendix.

2.14. Bedding. Class "A", Class "B", or Class "C" bedding in accordance with the American Society of Civil Engineers (ASCE) "Manual & Report on Engineering Practice No. 37" may be used for gravity sewers. The class of bedding shall be determined by the engineer to provide the strength necessary for the soil load conditions that will be encountered.

2.15. Inverted Siphons. Inverted siphons shall have a minimum pipe size of six inches (6") in diameter and shall be provided with necessary appurtenances for convenient flushing and maintenance. Manholes shall have adequate clearances for rodding. Sufficient head shall be provided and pipe sizes selected in order to secure velocities of at least three feet per second (3.0 fps) for average flows. Ductile iron pipe, SDR 25 PVC pipe, or an approved equal shall be utilized. Two (2) pipes, each capable of handling the design peak flow, shall be used.

2.16. Other Siphons. Siphons used in conjunction with siphon chambers shall only require a single pipe meeting the applicable requirements of Section 2.15 of Part A of this appendix.

2.17. Stream Crossings. Whenever gravity sewers must cross under a stream or watercourse, a minimum separation of three feet (3') between the stream bed and the top of the sewer pipe shall be provided. Ductile iron pipe or an approved equal shall be used when crossing a stream. If the minimum separation cannot be maintained for the entire crossing, mechanical joint ductile iron pipe or an approved equal shall be used.

2.18. Aerial Sewers. The use of aerial sewers is an approvable design.

2.19. Water Supply Interconnections. There shall be no physical connection between a public or private drinking water supply system and a sewer or its appurtenance.

2.20. Relation to Water Works Structures. Unless otherwise approved by the director, gravity sewers shall not be located within ten horizontal feet (10') of a drinking water supply.

2.21. Relation to Public Wells. Unless otherwise approved by the director, gravity sewers shall not be located within one hundred feet (100') of any well or spring utilized for a public drinking water system.

2.22. Relation to Private Wells. Unless otherwise approved by the director, gravity sewers shall not be located within fifty feet (50') of a private or individual homeowner's drinking water system. Under no circumstances shall a sewer line be constructed within ten feet (10') of a homeowner's well.

2.23. Relation to Water Lines.

2.23.1. Standard Horizontal Separation. Routinely, gravity sewers shall not be located within ten horizontal feet (10') of any existing or proposed water lines. If it is not possible to maintain this separation, the sewer line shall be constructed and tested as prescribed in Section 2.23.3 of Part A of this appendix. Under no circumstances shall a sewer line be constructed within three feet (3') of a water line.

2.23.2. Standard Vertical Separation. Gravity sewers that must cross water lines shall be constructed so that the top of the sewer line is at least eighteen inches (18") beneath the bottom of the water line. If it is not possible to maintain this separation, the sewer line shall be constructed and tested as prescribed in Section 2.23.4 of Part A of this appendix.

2.23.3. Variant Horizontal Separation. In cases where water and sewer lines must be laid closer than ten horizontal feet (10') apart, the sewer line shall be at least eighteen inches (18") lower than the water line unless otherwise approved by the director. These sewer lines shall be constructed using a pressure-type pipe that meets American Water Works Association (AWWA) requirements for water lines and shall be pressure tested to assure watertightness prior to backfilling. Maximum possible horizontal distance between the lines shall be maintained. Water lines shall be placed upon an undisturbed earth shelf or bench; backfilling to create the bench is not permissible. When the lines are placed within five feet (5') of each other, each line shall have a metallic-impregnated permanent identification tape buried directly above it denoting either "Sewer Line" or "Potable Water Line."

2.23.4. Variant Vertical Separation. In cases where water and sewer lines must be laid closer than eighteen vertical inches (18") apart, the sewer line shall be located so that it crosses under the water line at mid-joint. A sewer line shall not be constructed over the top of a water line. These sewer lines shall be constructed using a pressure-type pipe that meets American Water Works Association (AWWA) requirements for water lines at the crossing. A minimum vertical clearance of six inches (6") between water and sewer lines shall be maintained. If it is not possible to meet these conditions, the sewer line shall be encased so that said casing extends at least fifteen feet (15') on each side of the crossing.

2.24. Sewer Riser Pipes. All mobile home lots shall be provided with a sewer riser pipe having a minimum diameter of four inches (4") and extending at least four inches (4") above the ground in a vertical position. All sewer riser pipes, when not serving a mobile home, shall be tightly plugged or capped to render them watertight.

3. Manholes.

3.1. Location. Manholes shall be provided at all changes in sewer line slope, size, or alignment and at all intersections. Manholes shall be provided at distances not greater than four hundred feet (400') for sewers that are fifteen inches (15") in diameter or less and at distances of five hundred feet (500') for sewers that are eighteen to thirty inches (18" to 30") in diameter. Greater spacing may be used in larger sewers and in sewers carrying settled effluent upon approval from the director. Cleanouts may be constructed at the upper end of all lines. Cleanouts may be substituted for manholes in some special situations upon approval from the director.

3.2. Materials. Manholes shall be made of precast concrete, poured-in-place concrete, or polyethylene.

3.3. Drop Pipes. An outside drop pipe shall be provided for a sewer entering a manhole at an elevation of twenty-four inches (24") or more above the manhole invert. The entire drop connection shall be encased in concrete. If an inside drop is necessary, the pipe shall be fastened to the manhole and access provided for cleaning. Where the difference in elevation between the incoming sewer and manhole invert is less than twenty-four inches (24"), the invert shall be filled.

3.4. Manhole Diameters. The minimum base diameter of manholes shall be forty-eight inches (48"); larger diameters are preferable for large-diameter sewers. The minimum size for manhole openings shall be twenty-four inches (24").

3.5. Manhole Steps. Noncorrosive steps embedded in the walls, offset and spaced twelve to eighteen inches (12" to 18") apart, shall be provided in each manhole.

3.6. Flow Channel. The inside base of the manhole shall be filled with concrete to form a bench sloping toward the flow channel. Both the flow channel and the bench shall be trowelled to a smooth surface.

3.7. Watertightness. Solid, gasketed manhole covers shall be used wherever manhole covers may be flooded by street runoff or high water. Concrete manholes shall be waterproofed on the exterior wherever groundwater conditions are unfavorable. Pipe connections to manholes and joints on manholes shall be watertight.

4. Pumping Stations.

4.1. General Designs Standards.

4.1.1. Flood Protection. Pumping stations and their attendant electrical equipment shall either be located at an elevation not subject to a 100-year flood or be adequately protected against damage from a 100-year flood.

4.1.2. Station Location. Pumping stations shall be readily accessible structures, preferably located off the right-of-way of streets and alleys, and shall be located as far as possible from the nearest dwelling. Fencing shall be provided around each station to prevent the entry of unauthorized persons unless a satisfactory method of locking is utilized.

4.1.3. Overflows. No overflows or bypasses from pumping stations shall be used at new facilities.

4.1.4. Pumping Rates and Number of Pumping Units. At a minimum, dual pumps shall be provided at all pumping stations, with each pump capable of providing the maximum design flow. Pumping units shall be sized to provide the minimum cleaning velocity of two feet per second (2.0 fps) at the rated capacity, assuming a C=120 for plastic pipe and a C=100 for all other pipe materials in the Hazen-Williams Formula.

4.1.5. Station Type. Either the wet well or wet well/dry well type of pumping station is an approvable design.

4.2. Specfic Design Standards.

4.2.1. Long Drive Shaft Pumps. A wet well installation in which the pump is mounted in the wet well and connected

by a drive shaft to the motor above the wet well is not an approvable design.

4.2.2. Separation. Wet wells and dry wells, including their superstructures, shall be completely separated.

4.2.3. Pump Removal. Provisions shall be made to facilitate the removal of pumps and motors.

4.2.4. Access. Suitable and safe means of access shall be provided to all dry wells and shall be provided to wet wells containing either bar screens or mechanical equipment requiring inspection or maintenance.

4.2.5. Size. The effective capacity of the wet well shall provide a detention time not exceeding thirty (30) minutes for the design average flow.

4.2.6. Floor Slope. The wet well floor shall have a minimum slope of one vertical to one horizontal (1:1) towards the hopper bottom. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation and function of the inlet. Bottoms shall have a smooth finish.

4.2.7. Protection Against Clogging. Pumps handling raw sewage shall be preceded by readily accessible bar screens with clear openings not exceeding two and one-half inches (2½") unless special devices are installed to protect the pumps from clogging or damage. Where the size of the installation warrants, a mechanically-cleaned bar screen with grinder or comminution device is recommended. Where screens are located, convenient facilities shall be provided for handling screenings. For the larger or deeper sections, duplicate protection units of proper capacity are preferred.

4.2.8. Pump Openings. Pumps shall either be capable of passing two and one-half inch (2½") solids or be of the grinder pump type when used in residential developments of five hundred (500) persons or less. Pumps for all other installations shall either be capable of passing three inch (3") solids or be of the grinder pump type. All pumps shall be of the nonclogging type.

4.2.9. Priming. Except as specified for suction lift pumps, all pumps shall be so placed that, under normal operating conditions, they will operate under a positive suction head.

4.2.10. Electrical Equipment. Electrical systems and components (e.g. motors, lights, cables, conduits, switchboxes, control circuits) in enclosed or partially enclosed spaces shall

be made of materials that are resistant to the environment in which they are used.

4.2.11. Intake. Each pump shall have an individual intake. The wet well shall be designed to avoid turbulence near the intake.

4.2.12. Dry Well Dewatering. A separate pump shall be provided in the dry well to remove leakage or drainage, with the discharge above the overflow level of the wet well. A connection to pump suction is recommended as an auxiliary feature in the dry well design. Water ejectors connected to a drinking water supply is not an approvable design. All floor and walkway surfaces shall be sloped to a point of drainage.

4.2.13. Controls. Control float cables shall be so located as not to be affected by the flows entering the wet well or by the suction of pumps. Float tubes in dry wells shall extend high enough to prevent overflow. Provisions shall be made to automatically alternate the pump in use. Pump stations with motors or controls below grade shall be equipped with a secure external disconnect switch.

4.2.14. Valves and Piping. Except on submersible and vacuum-primed pumps, all pumps shall be equipped with a full closing valve on the suction piping. A check valve, followed by a gate or plug valve, shall be installed on the discharge piping. Valves shall not be located in a wet well without an intermediate floor and proper ventilation. All hardware located in a wet well (e.g., guide rails, chains, mounting brackets) shall be made of stainless steel or other corrosion-resistant materials approved by the director (i.e., the use of hardware made of galvinized steel is not an approvable design).

4.2.15. Wet Well Ventilation. Wet well ventilation may be either continuous or intermittent. If continuous, the ventilation shall provide at least twelve (12) complete air changes per hour. If intermittent, the ventilation shall provide at least thirty (30) complete air changes per hour.

4.2.16. Dry Well Ventilation. Mechanical ventilation shall be provided for all dry well installations. Dry well ventilation may be either continuous or intermittent. If continuous, the ventilation shall provide at least six (6) complete air changes per hour. If intermittent, the ventilation shall provide at least thirty (30) complete air changes per hour.

4.2.17. Flow Measurement. The capability for emplacing suitable devices for measuring sewage flow shall be provided at all pumping stations. Such devices shall be installed at all critically-located pumping stations.

4.2.18. Water Supply. No physical connection shall exist between any potable water supply and a pumping station.

4.2.19. Alarm Systems. A high water alarm light shall be installed at all pumping stations.

4.2.20. Portable Equipment. Upon approval from the director, portable equipment may furnish service to more than one (1) pumping station; however, where such equipment is utilized, it shall have the capability to operate between the wet well and the discharge side of the station. The station shall be provided with permanent fixtures which will facilitate rapid and easy connection of lines.

4.2.21. Emergency Power Generation. Emergency power generation capability may be required under special circumstances (e.g., above water intakes or recreational waters) as determined by the director. All emergency power generation equipment shall have instructions that mandate the routine and regular starting and running of the units at full load. Generating unit size shall be adequate to provide emergency power for starting pump motors and for lighting, ventilation, and all other auxiliary equipment necessary for safety and proper station operation. The operation of only one (1) pump during periods of auxiliary power supply must be justified on the basis of maximum anticipated flows relative to single-pump capacity, anticipated length of power outage, and storage capacity. Special sequencing controls shall be provided to start pump motors unless the generating equipment has the capacity to start all pumps simultaneously with auxiliary equipment operating.

4.3. Suction Lift Pumps.

4.3.1. Type. Suction lift pumps shall be of the self-priming or vacuum-priming type.

4.3.1.a. Self-Priming Pumps. Self-priming pumps shall be capable of rapid priming and repriming at the "lead pump on" elevation automatically under design operating conditions. Suction piping should not exceed the size of the pump suction, shall not exceed twenty-five feet (25') in total length, and shall be ductile iron or stainless steel. Priming lift at the "lead pump on" elevation shall include a safety factor of at least four feet (4') from the maximum allowable priming lift for the specific equipment at design operating conditions. The combined total of dynamic suction lift at the "pump off" elevation and required net positive suction head at design operating conditions shall not exceed twenty-two feet (22').

4.3.1.b. Vacuum-Priming Pumps. Vacuum-priming pumping stations shall be equipped with dual vacuum pumps capable

of automatically and completely removing air from the suction lift pump. The vacuum pumps shall be adequately protected from damage due to sewage. The combined total of dynamic suction lift at the "pump off" elevation and required net positive suction head at design operating conditions shall not exceed twenty-two feet (22').

4.3.2. Capacity. The capacity of a suction lift pumping station shall be limited by the net positive suction head and specific speed requirements as stated on the manufacturer's pump curve under the most severe operating conditions.

4.3.3. Location. Suction lift pumps shall not be located within the wet well.

4.3.4. Access. Access to the wet well shall not be through the dry well unless the design utilizes pump units mounted directly above the wet well, in which case the dry well shall have a gas-tight seal on the wet well entrance.

4.4. Submersible Pumps.

4.4.1. Pump Removal. Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well.

4.4.2. Hoist Provision. A station with a submersible pump shall have a hoist for removing the pump from the wet well.

4.4.3. Electrical Controls. Electrical controls shall be located in a suitable housing outside the wet well that provides protection against weather and vandalism.

4.5. Pneumatic Ejectors.

4.5.1. The use of pneumatic ejectors is not an approvable design.

4.6. Force Mains.

4.6.1. Size. The minimum size of force mains serving a population equivalent of five hundred (500) people or less shall be three inches (3") for solids passing pumps. The minimum size of force mains serving a population equivalent of over five hundred (500) people shall be four inches (4") for solids passing pumps. Smaller force mains may be utilized in conjunction with grinder pumps.

4.6.2. Air Relief Valves. Air relief valves shall be placed at high points in the force mains.

4.6.3. Termination. A force main shall enter the receiving manhole with its centerline horizontal and with an invert elevation which will insure a smooth laminar flow transition to the gravity flow section. In no case shall a force main enter a gravity sewer at a point more than one foot (1') above the flow line of the receiving manhole. The design shall prevent turbulence at the point of entry. Immediately upstream, the force main design shall include a positive trap to keep the force main full of liquid at all times. For discharge into deep manholes, a raised section may be provided; for shallow manholes, a depressed section may be provided. Consideration shall be given to the use of inert material or protective coatings for receiving manholes and sewers to prevent deterioration as a result of hydrogen sulfide.

4.6.4. Materials of Construction. Force mains shall be constructed of plastic, cast iron, or ductile iron bearing the National Sanitation Foundation (NSF) seal of the pressure class required by the total dynamic head. All nonmetallic pipe shall have a metallic-impregnated identification tape buried directly above it that identifies that pipe as a sewer line.

4.6.5. Anchoring. Force mains shall be sufficiently anchored within the pumping station and throughout the line length. The number of bends shall be as few as possible. Thrust blocks, restrained joints, or tie rods shall be provided where restraint is needed.

5. Vacuum Collection Systems.

5.1. Main Lines.

5.1.1. Schedule 40 DWV, Class 200, or SDR 21 PVC or ABS plastic pipe shall be used for main lines. All nonmetallic pipe shall have a metallic-impregnated identification tape buried directly above it that identifies that pipe as a sewer line.

5.1.2. Joints shall be solvent-welded, "O"-ring, or heat-fusion joints that have been specifically designed to seal against vacuum.

5.1.3. The minimum diameter pipe size shall be three inches (3") in the collection system.

5.1.4. Cleanouts shall be provided at a maximum of every two hundred feet (200') on straight runs and at every change in direction.

5.1.5. Main lines shall be buried as deeply as dictated by frost depth or load condition but in no instance

shall be less than three feet (3') deep unless otherwise approved by the director.

5.1.6. All vacuum system designs shall be certified, in writing, by the system manufacturer.

5.1.7. The manufacturer's recommendation for reform pockets and lifts shall be utilized.

5.1.8. The total available head loss from any input point shall not exceed eighteen feet (18') of water. Five feet (5') of water shall be reserved for valve operation.

5.1.9. During installation, the collection system shall be vacuumed to twenty-four inches (24") of mercury vacuum pressure, allowed fifteen (15) minutes to stabilize, and thereafter shall not lose more than one percent (1%) vacuum pressure per hour over a minimum of a four (4) hour period. This testing shall be done prior to the installation of valves.

5.2. House Connections.

5.2.1. The minimum valve size shall be three inches (3"). Valves shall be actuated by pneumatic controllers; an electrically controlled valve system is not an approvable design.

5.2.2. Valves shall be located outside the dwelling. Either the pipe between the dwelling and the valve shall provide ten to fifteen (10 to 15) gallons storage or a thirty (30) gallon tank shall be located between the dwelling and the valve. A permanent maintenance easement for the valve and its appurtenances shall be obtained.

5.2.3. Valve boxes shall have a solid bottom and be counterweighted to prevent flotation when located in an area subject to flooding or high groundwater. The cover and valve box material shall be of adequate strength to withstand the expected maximum dynamic and static loading conditions. Valve boxes shall be well vented to reduce condensation and shall be constructed of corrosion-resistant material.

5.2.4. The vent system for the house shall have a diameter of three inches (3") or greater to prevent evacuation of traps during vacuum valve operation. The vent pipe shall be extended above the eaves of the house. Alternative venting methods may be approved by the director on a case-by-case basis.

5.2.5. Those systems using a pneumatic controller shall have adequate protection of the sensor controllers. Any portion of the controller apparatus vented to atmosphere shall be

protected from flooding, screened from insect entry, and provided with rain covers.

5.3. Sewage Collection Tanks.

5.3.1. Sewage collection tanks shall be either epoxy-coated, annodically-protected welded steel or fiberglass and shall be vacuum-tight.

5.3.2. Each inlet to the tank shall have its own shutoff valve.

5.3.3. Liquid level sensors shall be installed to operate the discharge sewage pumps and the high level alarm and to interrupt the electrical power to the vacuum pumps.

5.3.4. The collection tank shall be sized to hold a maximum of ten (10) minutes design flow. Collection tanks shall be sized at one and one-half (1.5) times the operating volume or four hundred (400) gallons, whichever is greater.

5.4. Vacuum Pumps.

5.4.1. Vacuum reserve tanks shall be installed in series between the sewage collection tank and the vacuum pumps.

5.4.2. Either liquid ring or sliding vane vacuum pumps shall be used as long as they are compatible with pumping moist air containing some sewer gases.

5.4.3. A check valve shall be installed between the vacuum reservoir tank and the vacuum pumps.

5.4.4. Dual vacuum pumps, each capable of handling the load, shall be provided.

5.4.5. Emergency backup power shall be provided to operate the vacuum pumps and all pumping station equipment under the maximum load.

5.4.6. The vacuum pump exhaust shall be vented to the outside of the building. The evacuation line from the vacuum reserve shall utilize carbon absorption if there is a possibility of objectional odors reaching nearby occupied structures.

5.5. Sewage Pumps.

5.5.1. Dual pumps, each capable of handling three and one-half (3.5) times the average daily flow, shall be provided.

5.5.2. Emergency backup power shall be provided to operate the sewage pumps and all pumping station equipment under the maximum load.

5.5.3. The sewage pumps shall be capable of meeting net positive suction head requirements as directed by the vacuum conditions in the sewage collection tanks.

5.5.4. Shutoff valves shall be provided so that each pump may be isolated for repairs.

5.5.5. The discharge piping shall incorporate the check valve - gate valve arrangement prescribed under Section 4.2.14 of Part A of this appendix.

5.5.6. High level alarms and loss-of-vacuum alarms shall be capable of alerting three (3) or more responsible parties.

5.6. Maintenance and Operation.

5.6.1. Maintenance personnel employed by a local government operating a vacuum collection system shall attend a factory training course on maintenance and operation of the proposed units. Maintenance personnel shall be available around-the-clock in order to correct any operational problem that may arise.

5.6.2. Spare parts (e.g., valves, controllers, valve pits, and other vital parts) shall be kept in inventory. Spare controllers, valves, and sensors shall be retained on a basis of one (1) per every fifteen (15) units installed.

5.6.3. The mixing of equipment (i.e., different makes and models) for a specific project is prohibited.

5.7. Miscellaneous Design Requirements.

5.7.1. Collection stations shall be supplied with ventilators, heaters, and dehumidifiers.

5.7.2. Branch lines shall have individual cutoff valves to allow isolation of the line for repair. Main line sections shall have isolation valves no less than two thousand feet (2,000') apart.

5.7.3. In new systems where water-saving devices such as vacuum toilets are used, some lessening in the size of the treatment units may be approved by the director.

5.7.4. Manufacturer recommendations shall be followed in the design of vacuum collection systems whenever the standards set forth in Section 5 of Part A of this appendix are not applicable.

5.8. Design Submissions.

5.8.1. Hydraulic calculations for the vacuum mains and force mains shall be submitted to the director with the project plans.

5.8.2. Plans and profiles of all vacuum mains shall be submitted to the director with the project plans. Profiles shall indicate depth to mains and all valves shall be indicated on the plans.

6. Pressure Collection Systems.

6.1. Approvable Systems.

6.1.1. Simplex units shall serve no more than three (3) residences. Duplex units shall serve no more than ten (10) residences. Other multiple source applications shall be approved by the director on a case-by-case basis.

6.1.2. Grinder pump pressure systems and septic tank effluent pumping pressure systems are approvable pressure collection systems.

6.1.3. Submersible centrifugal grinder pumps or semi-positive displacement grinder pumps shall be used in grinder pump pressure systems. Grinder pumps shall be readily removable and replaceable without dewatering the wet well. Pressure relief valves shall be used with semi-positive displacement grinder pumps unless other means of pressure relief are approved by the director. Nonclogging submersible centrifugal effluent pumps shall be used in septic tank effluent pumping systems.

6.1.4. Wet wells shall be constructed of concrete, fiberglass, plastic, or epoxy-coated, annodically-protected welded steel. Interior hardware shall be made of rigid, corrosion-resistant metallic materials (e.g., plastic guide rails are not an approvable design).

6.3. Pressure Mains.

6.3.1. Schedule 40 PVC, SDR 21 PVC, SDR 26 PVC, polyethylene, or ductile iron pipe shall be used for pressure mains. All nonmetallic pipe shall have a metallic-impregnated identification tape buried directly above it that identifies that pipe as a sewer line.

6.3.2. The minimum diameter service line from the grinder pump to the collection main shall be one and one-quarter inches (1¼").

6.3.3. Mains shall be valved at junctions so that segments of the system may be taken out of service for maintenance. Cleanouts shall be provided at junctions so that lines may be cleaned. A method of providing continuity of service shall be provided for main collector lines.

6.3.4. Cleanouts with valves shall be provided every six hundred to eight hundred feet (600' to 800') on straight runs and at every change in direction.

6.3.5. Air release valves shall be provided at high points in the line. Ball or gate valves with cleanouts shall be provided at the ends of lines.

6.3.6. Concrete thrust blocks shall be provided at changes in direction and at "T" junctions.

6.3.7. One of the following flushing methods shall be provided:

6.3.7.a. Flush tanks with a capacity of one thousand (1,000) gallons with pumps at the ends of lines;

6.3.7.b. Water hydrants with nonremovable, reduced-pressure type backflow preventers at the ends of lines; or

6.3.7.c. A water tank truck with pumps.

6.3.8. The relation of pressure mains to water lines shall conform to the separations prescribed under Section 2.23 of Part A of this appendix.

6.4. Grinder Pump Pressure System.

6.4.1. Station Location. The pumping station shall generally be located outside of the building served by the system. The control box for a single pump unit shall be located on the outside of the building served, preferably with the pumping station. For dual pump units, the control box shall be located with the pumping station.

6.4.2. Electrical Controls. Control panels shall be of the National Electrical Manufacturers Association (NEMA) Type 4 enclosure. The pump and float electrical controls shall be designed for disconnection without the need for entry into the main control box.

6.4.3. Electrical Service. Electrical service shall be provided either by service from the customer's power drop or by cluster service. Service from the customer's power drop shall include the installation of a lockable NEMA Type 4 enclosure located between the customer's electrical meter and service panel. This control panel shall contain two (2) circuit breakers, one for the service panel and the other for the pump installation. Cluster service shall consist of metered drops serving multiple pumping units and providing power via conduit and conductors, direct burial cable, or both.

6.4.4. Alarms. Where a single pump unit is utilized, a high water alarm light shall be placed outside of the building served. Where a dual pump unit is utilized, an alarm light shall be placed at the control box.

6.4.5. Emergency Holding Tanks. A septic tank may be used as an emergency holding tank. In areas of frequent power outages of a duration of more than four (4) hours each, an emergency holding tank with a capacity of at least two hundred (200) gallons shall be installed.

6.4.6. Sequence of Connections. The sequence of connections from the building served to the collection force main shall be as follows: a four inch (4") sewer line, a gate valve, the pump, a check valve, and a connection line with a forty-five degree ($45^{o}$) bend in the direction of flow.

6.4.7. Check and Gate Valves. Check and gate valves shall be made of either plastic or bronze. Check valves shall be either swing or ball type; if swing type check valves are used, a one to two foot (1' to 2') horizontal run of straight pipe shall be constructed on the downstream side of the check valve.

6.4.8. Level Controls. Level controls in the pump station shall be either mercury-magnetic switches, mercury switches, or pressure switches.

6.5. Septic Tank Effluent Pressure Systems.

6.5.1. Station Location. The pumping station shall be located outside of the building served by the system. The control box for a single pump unit shall be located on the outside of the building served, preferably with the pumping station. For dual pump units, the control box shall be located with the pumping station.

6.5.2. Electrical Controls. Control panels shall be of the National Electrical Manufacturers Association (NEMA) Type 4 enclosure. The pump and float electrical controls shall be designed for disconnection without the need for entry into the main control box.

6.5.3. Alarms. Where a single pump unit is utilized, a high water alarm light shall be placed outside of the building served. Where a dual pump unit is utilized, an alarm light shall be placed at the control box.

6.5.4. Sequence of Connections. The sequence of connnections from the building served to the collection force main shall be as follows: a four inch (4") sewer line, the septic tank, a pumping chamber with the pump, a check valve, a gate valve, and a connection line with a forty-five degree ($45^{o}$) bend in the direction of flow.

6.5.5. Check and Gate Valves. Check and gate valves shall be made of either plastic or bronze. Check valves shall be either swing or ball type; if swing type check valves are used, a one to two foot (1' to 2') horizontal run of straight pipe shall be constructed on the downstream side of the check valve.

6.5.6. Level Controls. Level controls in the pump station shall be either mercury-magnetic switches, mercury switches, or pressure switches.

6.5.7. Miscellaneous Requirements. Provisions for the treatment of septage shall be provided at the treatment works. A septic tank pumping vehicle shall be available for use.

6.6. Maintenance and Operation.

6.6.1. Maintenance personnel employed by a local government operating a pressure collection system shall attend a factory training course on maintenance and operation of the proposed units.

6.6.2. Permanent maintenance easements shall be obtained if pumping equipment and other appurtenances are located on private property.

6.6.3. A truck with a hoist shall be available for use.

6.6.4. Spare parts (e.g., air relief valves, gate valves, relay switches, and other vital parts) shall be kept in inventory.

6.6.5. Spare pumps shall be provided in the initial design in accordance with the requirements set forth in Table D of this appendix.

6.6.6. The mixing of equipment (i.e., different makes and models) for a specific project is prohibited.

6.7. Design Submissions.

6.7.1. Hydraulic calculations for the pressure mains shall be submitted to the director with the project plans.

6.7.1.a. Peak flows shall be determined using manufacturer recommendations for the pumping equipment used.

6.7.1.b. Head losses due to valves and fittings shall be included in the hydraulic calculations.

6.7.1.c. For the purposes of calculation, a C=120 for plastic pipe and a C=100 for all other pipe materials in the Hazen-Williams Formula shall be used.

6.7.1.d. For the purposes of calculation, the design velocity shall be in the range of two to five feet per second (2.0 to 5.0 fps).

6.7.1.e. For the purposes of calculation, the design life of the pumps shall be computed on the basis of ten (10) years.

6.7.2. Plans and profiles of all pressure mains shall be submitted to the director with the project plans. Profiles shall indicate depth to mains and all valves shall be indicated on the plans.

6.8. Miscellaneous Requirements.

6.8.1. Manufacturer recommendations shall be followed in the design of pressure collection systems whenever the standards set forth in Section 6 of Part A of this appendix are not applicable.

7. Grease Traps.

7.1. Necessity. A grease trap shall be provided for all restaurants and similar establishments where the quantity of grease and fats in liquid wastes is likely to be large.

7.2. Location. Only those plumbing fixtures into which grease and fats are to be discharged shall be connected to the grease trap. The grease trap shall be located within thirty feet (30') of the fixtures served in an easily accessible place that is outside of the building served.

7.3. Capacity. Grease traps shall have a minimum capacity of one hundred fifty (150) gallons; larger grease traps may be required depending upon the actual loading.

PART B. SEWAGE TREATMENT WORKS.

1. General Design Standards.

1.1. Design Life. Treatment works shall be designed to provide for an estimated population twenty (20) years hence. Except where circumstances preclude the probability of expansion, all treatment works shall be designed so that they can readily be increased in capacity.

1.2. Plant Location.

1.2.1. The site selected for a treatment works shall be as far as practicable from any present built-up area or any area likely to become built-up within a reasonable future period.

1.2.2. A buffer zone as prescribed in Table E of this appendix shall be provided between the treatment works site and any occupied structure.

1.2.3. The direction of prevailing winds shall be considered when selecting the treatment works site.

1.2.4. Treatment units shall either be located at an elevation which is not subject to a 100-year flood or be adequately protected against damage from a 100-year flood. The treatment works shall be designed to remain fully operational during a 25-year flood and be readily accessible in all seasons.

1.2.5. The site selected for a treatment works shall be of sufficient size to accommodate expansion or addition of facilities to increase the degree of treatment.

1.3. New Processes, Methods, and Equipment. The director encourages the development of new processes, methods, and equipment for sewage treatment that are not delineated in the standards set forth in Part B of this appendix. Such innovative or alternative technologies shall be approved by the director on a case-by-case basis. If new processes, methods, or equipment are incorporated in the design of a treatment works:

1.3.1. Monitoring observations, including test results and engineering evaluations, demonstrating the efficiency of such processes may be required by the director;

1.3.2. Testing, including a detailed description of the test methods used, under various ranges of strength and flow rates (including daily variations) and waste temperatures over a sufficient length of time to demonstrate performance under climatic and other conditions which may be encountered in the area of the proposed installations may be required by the

director. The director may require that appropriate testing be conducted and evaluations made under the supervision of a competent process engineer other than those employed by the manufacturer or developer; and

1.3.3. A performance bond may be required for all new processes or equipment.

1.4. Design Considerations.

1.4.1. Industrial Wastes. When treating industrial and institutional wastes at a treatment works, consideration shall be given to the character of the wastes in the design of the treatment works. In such cases, treatability studies on the composite wastewater may be required by the director.

1.4.2. Hydraulic Loading. The design of operational units of a treatment works shall be based upon the peak rate of sewage flow over twenty-four (24) hours.

1.4.3. Existing Sewage Systems. Where there are existing sewers, the treatment works shall be designed based upon the characteristics, volume, and strength of the present flow of sewage, the additional volume that may result from the estimated increase in the service area population, and the presence of nonexcessive infiltration or inflow. The volume and strength of sewage flow shall be determined from actual flow measurements, preferably for both wet and dry weather periods.

1.4.4. New Sewage Systems. Where new sewers are to be constructed, the treatment works shall be designed based upon:

1.4.4.a. Estimates from a fully-documented analysis of water use records adjusted for consumption and losses; or

1.4.4.b. An assumed wastewater flow of seventy gallons per capita per day (70 gpcd) for residential customers added to a calculated wastewater flow from all nonresidential customers derived through the use of the values set forth in Table A of this appendix.

1.4.5. Organic Loading. The design organic loading of a treatment works shall either be determined by means of laboratory analyses made on flow proportional composite samples taken over twenty-four (24) hour periods, preferably for both wet and dry weather periods, or be calculated using an assumed biochemical oxygen demand (BOD) of 0.17 pounds per person per day and an assumed total Kjeldahl nitrogen (TKN) of 0.04 pounds per person per day.

1.4.6. Conduits. All piping and channels shall be designed to carry the maximum expected flows. The incoming sewer shall be designed for free discharge. Bottom corners of the channels shall be filleted. Pockets and corners where solids can accumulate shall be eliminated. Suitable gates shall be placed in channels to seal off unused sections which might accumulate solids. The use of shear gates or stop planks is permitted where they can be used in place of gate valves or sluice gates.

1.4.7. Arrangement of Units. Component parts of a treatment works shall be arranged for the greatest operating convenience, flexibility, and economy in order to facilitate the installation of future units. Multiple treatment units shall be provided for all treatment works.

1.5. Miscellaneous Requirements.

1.5.1. Provisions for Taking Units Out of Service. Appurtenances shall be provided in such a manner that any treatment unit or units may be temporarily taken out of service while the remainder of the treatment works remains operational. In the case of oxidation ditches, this requirement is satisfied if multiple mixing units are provided. Properly located and arranged diversion piping and structures shall be provided so that either dual or multiple units of the treatment works can be removed from service independently for inspection, maintenance, and repairs.

1.5.2. Dewatering. Means shall be provided to easily dewater each unit. Consideration shall be given to the possible need for hydrostatic pressure relief devices.

1.5.3. Construction Materials. Consideration shall be given to the selection of materials, particularly metals and paints, which are to be used in treatment works in light of the possible presence of hydrogen sulfide, other corrosive gases, greases, oils, and similar constituents in sewage. Dissimilar metals shall be avoided to minimize galvanic action. Cathodic or anodic protection shall be provided for all steel tanks. Concrete and glass-lined steel tanks shall be used wherever possible to insure a design life of at least twenty (20) years.

1.5.4. Treatment Unit Covers. Properly vented covers may be used.

1.5.5. Painting. In order to facilitate the identification of piping, different lines should be color-coded. The color scheme presented in Table F of this appendix is recommended for the purposes of standardization; this color scheme shall be used at all treatment works that have a capacity of greater than one hundred thousand gallons per day (100,000 gpd).

1.5.6. Operating Equipment. The design specifications for a treatment works shall include a complete outfit of tools and accessories for the operator's use (e.g., rakes, shovels, squeegees, valve keys, wrenches). A portable pump shall be provided. Readily accessible storage space and work bench facilities shall be provided and consideration shall be given to the provision of a garage area which would also provide space for large equipment and maintenance or repair work.

1.5.7. Grading and Landscaping. Concrete, asphalt, or gravel walkways shall be provided for access to all units. Where possible, steep slopes shall be avoided to prevent erosion. Surface water shall not be permitted to drain into any unit. Particular care shall be taken to protect trickling filter beds, sludge beds, and intermittent sand filters from surface water. Provisions shall be made for landscaping, particularly when a treatment works must be located near residential areas.

1.6. Plant Outfalls.

1.6.1. Outlet. Where practicable, the outfall sewer shall be extended to the low water level of the receiving body of water in such a manner to insure satisfactory dispersion of the effluent. The outlet shall not be submerged. Headwalls may be used where adequate dispersion is obtained without carrying the outfall into the stream. The outlet shall be marked with a permanent sign stating the owner's name, outlet number, and NPDES permit number.

1.6.2. Design and Construction. The outfall sewer shall be so constructed and protected against the effects of flood water, ice, or other hazards to reasonably insure its structural stability and freedom from stoppage.

1.7. Essential Facilities.

1.7.1. Emergency Power.

1.7.1.a. Continuity of Operation. All treatment works shall be provided with an alternate source of electric power to allow continuity of operation during power failures. Methods of providing alternate sources include:

1.7.1.a.A. The connection of at least two (2) independent public utility substations. A powerline from each substation is required unless documentation is received and approved by the director verifying that a duplicate line is not necessary to minimize water quality violations;

1.7.1.a.B. Portable or in-place internal combustion engine equipment which will generate electrical or mechanical energy; or

1.7.1.a.C. Portable pumping equipment when only emergency pumping is required.

1.7.1.b. Power for Aeration. Standby generating capacity normally is not required for aeration equipment used in the activated sludge process; however, in areas where power outages of a duration of four (4) hours or more are common, auxiliary power for minimum aeration of the activated sludge shall be provided. Full power generating capacity may be required by the director on certain critical stream segments.

1.7.1.c. Power for Disinfection. Continuous disinfection shall be provided during all power outages.

1.7.2. Electrical Equipment. All electrical equipment and electrical conduits shall either be of waterproof design or be located above the 100-year flood elevation. All outdoor equipment shall be adequately protected from the weather. Motors located indoors near liquid handling piping and equipment shall be of splash-proof design. All electrical wires in underground conduits or in conduits that can be flooded shall have water-resistant insulation that conforms to National Electrical Code specifications.

1.7.3. Water Supply.

1.7.3.a. General Requirements. An adequate supply of drinking water shall be provided for use in the laboratory of and for general cleanliness around a treatment works. No piping or other connections shall exist in any part of a treatment works which, under any condition, might cause the contamination of a drinking water supply. The chemical quality of the water shall be checked for suitability for the intended use (e.g., in heat exchangers, chlorinators).

1.7.3.b. Direct Connections. The drinking water supply line to each treatment works shall be equipped with an approved reduced-pressure type backflow preventer. The backflow preventer shall be installed in such a location as to prevent flooding or corrosion and to allow for adequate, quick service and periodic inspections. Installation in below grade meter type vaults is not an approvable design; however, installation in manholes or concrete valve vaults is acceptable. All water supply take-off points shall follow the backflow preventer. No extension of the water supply line to serve the public shall be allowed. Drinking water from a municipal or separate supply may be used directly at points above grade for lavatory sinks, water

closets, laboratory sinks which are equipped with approved vacuum breakers, showers, drinking fountains, outside hydrants, hose bibbs which are equipped with nonremovable vacuum breakers, and chlorinators provided with suitable vacuum breakers or other appropriately installed approved backflow preventers. 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 coils.

1.7.3.c. Indirect Connections. Where a potable water supply is to be used at a treatment works for any purpose not enumerated in Section 1.7.3.b of Part B of this appendix, a break tank, pressure pump, and pressure tank shall be provided. Water shall be discharged to the break tank through an air gap that is at least six inches (6") above the maximum flood line or the spill line of the tank, whichever is higher. A sign shall be permanently posted at every hose bibb, faucet, or stop cock located on the water system beyond the break tank to indicate that the water is not safe to drink.

1.7.3.d. Separate Drinking Water Supply. Where it is not possible to provide drinking water from a public water supply to a treatment works, a separate well may be provided upon approval from the director. Such a well shall be constructed in conformance with the provisions of 64 C.S.R. 19 and the requirements set forth in Paragraphs 1.7.3.b and 1.7.3.c of Part B of this appendix shall govern the use of its water.

1.7.3.e. Separate Nonpotable Water Supply. Where a separate nonpotable water supply is to be provided at a treatment works, a permanent sign shall be posted at every hose bibb, stop cock, or other water outlet to indicate that the water is not safe to drink.

1.7.4. Sanitary Facilities. A treatment works equipped with laboratory facilities shall be provided with shower, toilet, lavatory, and locker facilities.

1.7.5. Sewage Flow Measurement. All treatment works shall be provided with facilities for measuring the volume of sewage flows. All treatment works that have a capacity of greater than one hundred thousand gallons per day (100,000 gpd) shall be equipped with indicating, recording, and totalizing equipment for effluent flow measurement.

1.7.6. Floor Slope. Floor surfaces shall be sloped to a point of drainage.

1.7.7. Stairways. Stairways shall be installed with a slope of thirty to thirty-five degrees ($30^{\circ}$ to $35^{\circ}$) from the horizontal to facilitate the carrying of samples or tools. All

stairways shall be provided with handrails. All risers in a stairway shall be of equal height.

1.8. Safety Requirements.

1.8.1. All treatment works shall comply with the provisions of the federal Occupational Safety and Health Act.

1.8.2. All treatment works shall be enclosed by a chain link fence at least six feet (6') high with a locked entrance gate designed to discourage the entrance of animals or unauthorized persons.

1.8.3. All treatment works shall be provided with handrails, grating, and guardrails wherever necessary (e.g., open basins, screen channels, around mechanical equipment). All safety devices shall be made of a noncorroding material such as aluminum or fiberglass; painted steel is not acceptable. Manhole steps shall have slip-proof, railroad type rungs. A grating shall be provided for extended aeration units that have a capacity of forty thousand gallons per day (40,000 gpd) or less.

1.8.4. All electrical wiring at a treatment works shall be properly grounded and insulated. No part of the treatment works piping may be used for grounding.

1.8.5. "No Smoking" signs shall be posted in all locations where flammable materials or gases may be present. Explosion-proof electrical equipment and nonsparking tools shall be provided in work areas where hazardous conditions may exist, such as digester vaults and other locations where potentially explosive atmospheres of flammable gas or vapor accumulate. Separate storage located remotely from the treatment works shall be provided for flammable and hazardous materials. Heating devices with open flames shall be located at or above grade in separate rooms with outside entrances.

1.8.6. Adequate ventilation shall be provided in all facilities at a treatment works. Special safety precautions shall be installed for gas collection piping. Chlorinator rooms and chlorine storage areas shall be equipped with heat, lighting, and a ventilation fan, all of which can be turned on from outside of the room. Chlorinator rooms and chlorine storage areas shall be located at or above grade and shall have a viewing window from the treatment works interior.

1.8.7. All treatment works shall be provided with:

1.8.7.a. Protective clothing and equipment such as self-contained breathing appartus, gloves, hard hats, and rubber boots;

1.8.7.b. Appropriate first-aid equipment;

1.8.7.c. Portable lighting equipment;

1.8.7.d. A portable, gasoline-powered suction and discharge blower;

1.8.7.e. A portable, gasoline-powered trash pump;

1.8.7.f. Sufficient hose to pump between manholes or treatment units; and

1.8.7.g. A tripod, hoist, and body harness for accessing manholes.

1.9. Laboratory Space.

1.9.1. All treatment works shall have facilities, either on-site or on a contractual basis, for making all necessary analytical determinations and operating control tests. Whenever an on-site laboratory is utilized, isolation shall be such as to render the laboratory reasonably free from the adverse effects of dust, heat, noise, and vibration.

1.9.2. The minimum laboratory space for treatment works at which biochemical oxygen demand and suspended solids testing are not performed on-site shall be one hundred (100) square feet of floor space with thirty-five (35) square feet of bench area.

1.9.3. The minimum laboratory space for treatment works at which biochemical oxygen demand, suspended solids, or fecal coliform analyses are performed on-site shall be four hundred (400) square feet of floor space and one hundred fifty (150) square feet of bench space. If more than two (2) people will be working in the laboratory at any given time, one hundred (100) additional square feet of space shall be provided for each additional person.

1.9.4. The minimum laboratory space for an advanced wastewater treatment works shall be five hundred (500) square feet of floor space and one hundred seventy-five (175) square feet of bench space.

1.10. Laboratory Equipment.

1.10.1. All extended aeration treatment works shall be equipped with:

1.10.1.a. A comparator type kit for pH and chlorine residual testing;

1.10.1.b. Two (2) one-liter graduated beakers;

1.10.1.c. A Secchi disk; and

1.10.1.d. A squeegee with a handle of suitable length, a five (5) quart bucket, and rubber gloves.

1.10.2. All other treatment works shall be equipped with laboratory equipment suitable for performing all necessary tests associated with the type and complexity of the treatment processes. Lists of laboratory equipment for on-site facilities shall be compiled from "Standard Methods for the Examination of Water and Wastewater," 16th Edition, American Public Health Association, Washington, District of Columbia, 1985.

1.11. Testing and Start-Up. All new or rebuilt basins, mechanical equipment, piping, and similar units shall be tested and then brought on-line using clean water; testing or start-up using untreated or partially-treated sewage is prohibited.

2. Screening Devices and Comminutors.

2.1. Screens.

2.1.1. Type. Protection for pumps and other equipment shall be provided by mechanically-cleaned bar screens at all treatment works.

2.1.2. Location.

2.1.2.a. Indoor Screens. Screening devices installed in a building where other equipment or offices are located shall be accessible only through a separate outside entrance.

2.1.2.b. Outdoor Screens. Screening devices installed outside shall be protected from freezing.

2.1.2.c. Access to Screens. Screening areas shall be provided with stairway access, lighting, ventilation, and a convenient means for removing the screenings.

2.1.3. Design and Installation.

2.1.3.a. Bar Spacing. Clear openings between bars shall be no larger than one-half inch (½") for all screens. Clear openings for mechanically-cleaned screens may be as small as one-quarter inch (¼").

2.1.3.b. Channels. For treatment works that have a capacity of greater than one hundred thousand gallons per day

(100,000 gpd), dual channels shall be provided and equipped with the necessary gates to isolate flow from any screening unit except for those equipped with "arc-type" screens. Provisions shall be made to facilitate the dewatering of each unit. The channel preceding and following the screen shall be shaped to eliminate stranding and settling of solids. Channels shall be three to six inches (3" to 6") below the invert of the incoming sewer.

2.1.3.c. Slope. Manually-cleaned screens, except those for emergency use, shall be placed on a slope of thirty to forty-five degrees ($30^{\circ}$ to $45^{\circ}$) from the horizontal.

2.1.3.d. Velocities. At normal operating flow conditions, approach velocities shall be no less than one and one-quarter feet per second (1.25 fps), to prevent settling, and no greater than three feet per second (3.0 fps) through the bar screen, to prevent forcing material through the openings.

2.1.3.e. Mechanical Devices. A positive means of locking-out each mechanical device shall be provided.

2.1.4. Control Systems.

2.1.4.a. Timing Devices. All mechanical units without timing devices shall be run continuously. All mechanical units which are operated by timing devices shall be provided with auxiliary controls that will set the cleaning mechanism in operation at predetermined high water elevations.

2.1.4.b. Electrical Controls. Electrical fixtures and controls in screening areas where explosive gases may accumulate shall meet the requirements of the National Electrical Code for Class 1, Group D, Division 1 locations.

2.1.4.c. Manual Override. Automatic controls shall be supplemented by a manual override.

2.1.5. Auxiliary Screens. Where mechanically-operated screening devices are used, auxiliary manually-cleaned screens shall be provided. The treatment works design shall provide for the automatic diversion of the entire sewage flow through the auxiliary screens should the regular units fail.

2.1.6. Fine Screens. The use of fine screens in lieu of sedimentation is not an approvable design except in special cases where it can be demonstrated that the features peculiar to fine screens may be advantageous.

2.1.7. Disposal of Screenings. Facilities shall be provided for the removal, handling, storage, and disposal of

screenings in a sanitary manner. Manually-cleaned screening facilities shall include an accessible platform from which the operator may rake screenings easily and safely. Suitable drainage shall be provided both for the platform and for storage areas. Screenings shall be disposed in a manner approved by the director. Grinding of screenings and return to the sewage flow is prohibited. Open area disposal is prohibited.

2.2. Comminutors.

2.2.1. The use of comminutors is not an approvable design.

3. Grit Removal.

3.1. Necessity. Grit removal facilities shall be provided for all treatment works serving combined sewer systems and for all treatment works that have anaerobic digesters. Where a new collection system will serve a treatment works that has a capacity of greater than one hundred thousand gallons per day (100,000 gpd), provisions shall be made for the installation of additional grit removal facilities. Grit removal facilities may be required by the director for new treatment works served by existing collection systems.

3.2. Location. Unless otherwise approved by the director, grit removal facilities shall be located ahead of pumps and comminuting devices. Coarse bar racks shall be placed ahead of mechanically-cleaned grit removal facilities.

3.3. Type and Number of Units. Grit removal facilities for treatment works serving combined sewer systems shall have at least two (2) manually-cleaned units or one (1) mechanically-cleaned unit and a bypass channel. Grit removal facilities other than channel types are desirable for treatment works that have a capacity of greater than one hundred thousand gallons per day (100,000 gpd); if utilized, such facilities shall be provided with grit removal equipment and flexible controls for agitation or mixing (e.g., aerators, paddles, or pumps).

3.4. Velocity-Controlled Grit Removal.

3.4.1. Inlets. Inlet turbulance shall be minimized.

3.4.2. Velocity and Detention. Channel type chambers shall be designed to provide a velocity of one foot per second (1.0 fps). The detention time shall be based upon the size of particles (usually 0.21 mm) to be removed. The design shall take into consideration undesirable turbulence and velocities at inlets and outlets. Channels shall be trapezoidal and controlled by a Parshall flume or other suitable control device.

3.4.3. Grit Washing. The need for grit washing shall be determined by the method of final grit disposal.

3.4.4. Drains. Provisions shall be made for the dewatering of each unit.

3.4.5. Water. An adequate supply of water under pressure shall be provided for cleanup.

3.4.6. Deep Pits. Grit removal facilities located in deep pits shall be provided with mechanical equipment for pumping or hoisting grit to ground level. Such pits shall have a stairway, an elevator or manlift, lighting, ventilation, and a means of drainage.

3.5. Aerated Grit Removal.

3.5.1. Air Diffusers. Air diffusers shall be located on one side of the tank and two to three feet (2' to 3') above the tank bottom.

3.5.2. Air Supply Rate. A detention time of three (3) minutes at the maximum rate of flow shall be provided.

3.5.3. Inlet and Outlet. Aerated grit chambers shall be designed to prevent short-circuiting at the inlet and outlet. The inlet to the chamber shall introduce the wastewater directly into the circulation pattern caused by the air diffusers. The outlet shall be at a right angle to the inlet. A baffle shall be installed near the outlet.

3.5.4. Mechanical Equipment. Aerated grit chambers shall be provided with mechanical grit removal equipment.

3.6. Grit Handling and Disposal. Impervious surfaces with drains shall be provided for grit handling areas. If grit is to be transported, the conveying equipment shall be designed to avoid the loss of material and to provide protection from freezing. Grit shall be disposed in a manner approved by the director.

4. Pre-Aeration.

4.1. The pre-aeration of sewage to reduce septicity may be required by the director on a case-by-case basis.

5. Flow Equalization.

5.1. Necessity. Flow equalization shall be provided where large daily variations in organic or hydraulic loadings are expected.

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

5.3. Type. Flow equalization shall be provided either 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.

5.4. Design Standards.

5.4.1. Mixing. Mixing requirements for normal raw domestic wastewaters shall range from two-hundredths to four-hundredths (0.02 to 0.04) horsepower per one thousand (1,000) gallons of maximum storage volume.

5.4.2. Aeration. A minimum of one milligram per liter (1.0 mg/l) of dissolved oxygen shall be maintained in the mixing basin at all times. The air supply rate shall be a minimum of one and one-quarter (1.25) cubic feet per minute per one thousand (1,000) gallons of storage capacity.

5.4.3. Storage. Sufficient storage shall be provided to allow those sections of the treatment works which follow the storage to operate at or below their rated design capacity.

5.4.4. Detention/Equalization. Basins designed for a combination of storage of wet weather flows and equalization shall be compartmentalized to allow utilization of a portion of the basins for dry weather flow equalization.

5.4.5. Flow Discharge Control. Multiple pumping units capable of delivering the desired flow rate from the equalization basin with the largest pumping unit out of service shall be provided.

5.4.6. Aeration Support. When floating surface aerators are provided, provisions shall be made to protect the units when the tank is dewatered.

5.4.7. Basin Cleaning. Facilities shall be provided to flush solids and grease accumulations from the basin walls.

5.4.8. Scum Control. All treatment works that have a capacity of greater than one hundred thousand gallons per day (100,000 gpd) shall be provided with a high water level takeoff for withdrawing floating material where subsurface diffusers are used.

5.4.9. Controls. All treatment works that have a capacity of greater than one hundred thousand gallons per day

(100,000 gpd) shall be provided with inlets and outlets for all basin compartments that are suitably equipped with accessible external valves, stop plates, weirs, or other devices to permit flow control, level control, and the removal of an individual unit from service. Facilities shall be provided to measure and indicate liquid levels and flow rates.

6. Settling Tanks.

6.1. Inlets. Inlets shall be designed to dissipate the inlet velocity, to distribute the flow equally, and to prevent short-circuiting. Channels shall be designed to maintain a velocity of at least one foot per second (1.0 fps) at one-half (½) design flow. Corner pockets and dead ends shall be eliminated and corner fillets or channeling used where necessary. Provisions shall be made for elimination or removal of floating materials in inlet structures having submerged ports.

6.2. Dimensions. The minimum length of flow from inlet to outlet shall be ten feet (10') unless special provisions are made to prevent short-circuiting. The liquid depth of mechanically-cleaned settling tanks shall be as shallow as practicable but not less than seven feet (7'). Side water depth for final clarifiers for activated sludge shall be not less than twelve feet (12') for treatment works that have a capacity of greater than one hundred thousand gallons per day (100,000 gpd).

6.3. Scum Removal. Effective scum collection and removal facilities, including baffling, shall be provided ahead of the outlet weirs on all settling tanks. Provisions may be made for discharge of scum with the sludge; other provisions may be necessary to dispose of floating materials which may adversely affect sludge handling and disposal.

6.4. Weirs.

6.4.1. Overflow weirs shall be adjustable.

6.4.2. Weir loadings shall not exceed ten thousand (10,000) gallons per day per linear foot for treatment works that are designed for average flows of one million gallons per day (1.0 MGD) or less.

6.4.3. Weir loadings shall not exceed fifteen thousand (15,000) gallons per day per linear foot for treatment works that are designed for flows in excess of one million gallons per day (1.0 MGD).

6.4.4. If pumping is required, the pump capacity shall be related to the tank design in order to avoid excessive weir loading.

6.5. Submerged Surfaces. The tops of beams and similar construction features which are submerged shall have a minimum slope of one and four-tenths vertical to one horizontal (1.4:1). The underside of such features shall have a slope of one vertical to one horizontal (1:1) to prevent the accumulation of scum or solids.

6.6. Multiple Units. Multiple units capable of independent operation shall be provided at all treatment works.

6.7. Protective and Servicing Facilities. All settling tanks shall be designed for easy access for maintenance; stairways, walkways, and handrails shall be provided for access and safety purposes. If side walls are extended for some distance above the liquid level to provide flood protection or for other purposes, walkways shall be provided to facilitate housekeeping and maintenance of weirs.

6.8. Surface Settling Rates.

6.8.1. Primary Settling Tanks. Surface settling rates for primary tanks shall not exceed one thousand (1,000) gallons per day per square foot at design flow or one thousand five hundred (1,500) gallons per square foot for peak hourly flows, whichever is larger, for treatment works that have a design flow of one million gallons per day (1.0 MGD) or less. Higher surface settling rates may be approved by the director for larger treatment works.

6.8.2. Intermediate Settling Tanks. Surface settling rates for intermediate settling tanks, where used following fixed film reactors, shall not exceed one thousand five hundred (1,500) gallons per square foot based upon design flow.

6.8.3. Fixed Film Biological Reactors. Surface settling rates for settling tanks following trickling filters or rotating biological contactors shall not exceed one thousand two hundred (1,200) gallons per square foot based upon peak hourly flow.

6.8.4. Activated Sludge.

6.8.4.a. The hydraulic design of intermediate and final settling tanks following the activated sludge process shall be based upon the anticipated peak hourly flow for the area downstream of the inlet baffle.

6.8.4.b. Hydraulic loading shall not exceed one thousand two hundred (1,200) gallons per square foot per day for conventional processes, step aeration, contact stabilization, and the carbonaceous stage of the second-stage nitrification process.

Hydraulic loading shall not exceed one thousand (1,000) gallons per square foot per day for extended aeration. Hydraulic loading shall not exceed eight hundred (800) gallons per square foot per day following the second-stage nitrification process.

6.8.4.c. The solids loading for all activated sludge processes shall not exceed fifty (50) pounds of solids per square foot per day at peak flow rate.

6.9. Freeboard. Settling tanks walls shall extend at least six inches (6") above the surrounding ground surface and shall provide not less than twelve inches (12") of freeboard. Extra freeboard or the use of wind screens is recommended where larger settling tanks are subject to high velocity winds that may cause tank surface waves and inhibit effective scum removal.

6.10. Scum Removal. Effective 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, or sludge handling and disposal shall be recognized in the settling tank design. Provisions may be made for the discharge of scum with the sludge; however, other special provisions for disposal may be necessary.

6.11. Sludge Removal. Provisions shall be made to permit continuous sludge removal from settling tanks. Except for in-basin clarifers, final clarifiers at activated sludge treatment works that have a capacity of greater than two hundred fifty thousand gallons per day (250,000 gpd) shall be provided with positive scraping devices. Each sludge withdrawal line shall be at least four inches (4") in diameter, if pumped, and at least six inches (6") in diameter, if gravity flow. Each sludge withdrawal line shall be individually valved. Air lift methods of sludge removal shall utilize piping that is sized appropriately for the design withdrawal rate. At least thirty inches (30") of head shall be available for the withdrawal of sludge by gravity. Provisions shall be made for rodding or backflushing individual pipe runs.

6.12. Sludge Hopper. The minimum slope of the side walls of a sludge hopper shall be one and seven-tenths vertical to one horizontal (1.7:1). Hopper wall surfaces shall be smooth and have rounded corners to aid in sludge removal. Hopper bottoms shall have a maximum dimension of two feet (2') in either direction.

7. Activated Sludge.

7.1. Settling Tanks. Activated sludge treatment works shall conform to the settling tank requirements set forth in Section 6 of Part B of this appendix.

7.2. Bypass. When a primary settling tank is used at an activated sludge treatment works, provisions shall be made for discharging raw sewage directly to the aeration tanks in order to facilitate both start-up and operation during the initial stages of the treatment works design life.

7.3. Aeration.

7.3.1. Aeration Tanks.

7.3.1.a. Tank Capacities. Multiple aeration tanks capable of independent operation shall be utilized at all activated sludge treatment works. Aeration tank size for any particular adaptation of the activated sludge process shall be based upon such factors as the size of the treatment works, degree of treatment desired, sludge age, mixed liquor suspended solids concentration, biochemical oxygen demand loading, and food to microorganism (F/M) ratio. Calculations related to these factors shall be submitted to the director with the project plans in order to justify the tank size selected. The aeration tank capacities and permissible loadings set forth in Table G of this appendix shall be used in making these calculations.

7.3.1.b. Arrangement of Tanks. The dimensions of each independent mixed liquor aeration tank shall be such as to maintain effective mixing and utilization of air. Liquid depths shall not be less than ten feet (10') for activated sludge treatment works that have a capacity of greater than one hundred thousand gallons per day (100,000 gpd). For a very small tank or a tank with special configurations, the shape of the tank and the installation of aeration equipment shall assure the elimination of short-circuiting through the tank.

7.3.2. Inlets and Outlets. Inlets and outlets for each aeration tank unit shall be appropriately equipped with valves, gates, stop plates, weirs, or other devices to permit control of the flow and to maintain a reasonably constant liquid level. The hydraulic properties of the system shall permit the maximum instantaneous hydraulic load to be carried with any single aeration tank unit out of service.

7.3.3. Conduits. Channels and pipes carrying liquids with solids in suspension shall either be designed to maintain self-cleaning velocities or be agitated to keep such solids in suspension at all rates of flow within the design limits.

7.3.4. Measuring Devices. All activated sludge treatment works shall have devices installed for indicating flow rates of air, influent sewage, and return sludge to each aeration tank. For activated sludge treatment works that have a capacity of greater than one million gallons per day (1.0 MGD), devices

shall be installed for totalizing, indicating, and recording influent sewage and returned sludge to each aeration tank. Where the design of an activated sludge treatment works provides for all returned sludge to be mixed with the raw sewage or primary effluent at one location, the mixed liquor flow rate to each aeration unit shall be measured.

7.3.5. Freeboard and Foam Control. Aeration tanks shall have a freeboard of at least eighteen inches (18"). Foam control devices shall be provided for aeration tanks at all activated sludge treatment works that have a capacity of greater than ten thousand gallons per day (10,000 gpd). Provisions shall be made for draining spray lines to prevent damage by freezing.

7.4. Aeration Equipment.

7.4.1. Oxygen Requirements.

7.4.1.a. Aeration equipment shall be designed to supply sufficient oxygen to maintain a minimum dissolved oxygen concentration of two milligrams per liter (2.0 mg/l) throughout the mixed liquor at all times.

7.4.1.b. Aeration equipment shall be capable of transferring one and one-half (1.5) pounds of oxygen per pound of peak biochemical oxygen demand applied to the aeration tank.

7.4.1.c. Aeration equipment for the extended aeration process shall be capable of transferring one and eight-tenths (1.8) pounds of oxygen per pound of peak biochemical oxygen demand applied to the aeration tank.

7.4.1.d. Aeration equipment for carbonaceous biochemical oxygen demand removal in the nitrification process shall be capable of meeting the oxygen requirements set forth in Section 7.4.1.b of Part B of this appendix plus the oxygen requirements for oxidizing ammonia. In calculating this additional oxygen demand, the nitrogenous oxygen demand shall be assumed to be four and six-tenths (4.6) times the daily peak total Kjeldahl nitrogen (TKN) content of the influent and the oxygen demands due to recycle flows (e.g., heat treatment supernatant, vacuum filtrate, elutriates) shall also be considered.

7.4.1.e. Oxygen requirement calculations shall be submitted to the director with the project plans in order to justify the aeration equipment selected.

7.4.2. Controls. Variable air controls to aeration tanks shall be provided. Time clocks, variable speed devices, or variable depth weirs for the blowers or aerators may be used. A

twenty-four (24) hour time clock graduated in fifteen (15) minute intervals shall be provided at activated sludge treatment works that utilize extended aeration.

7.4.3. Diffused Air Systems.

7.4.3.a. The aeration equipment for diffused air systems shall be designed to meet the requirements set forth in Table H of this appendix.

7.4.3.b. The specified capacity of blowers or air compressors, particularly centrifugal blowers, shall take into account that the air intake temperature may reach forty degrees centigrade (40$^{o}$ C) or higher and the pressure will be less than atmospheric.

7.4.3.c. Blowers shall be provided in multiple units. The blowers shall be so arranged and in such capacities as to meet the maximum air demand with the largest single unit out of service. Provisions shall be made for varying the volume of air delivered in proportion to the load demand of the treatment works.

7.4.3.d. Diffusers shall be spaced in accordance with the oxygenation requirements through the length of the channel or tank and shall be designed to facilitate adjustments of their spacing without a major revision to air header piping. The arrangement of diffusers shall permit their removal for inspection maintenance and replacement without dewatering the tank and without shutting off the air supply to other diffusers in the tank.

7.4.3.e. Individual assembly units of diffusers shall be equipped with control valves, preferably with indicator markings for throttling or for complete shutoff. Diffusers in any single assembly shall have substantially uniform pressure loss.

7.4.3.f. Air filters shall be provided to prevent clogging of the diffuser system and to protect the blowers.

7.4.4. Mechanical Aeration Systems.

7.4.4.a. The mechanism and drive unit of a mechanical aeration system shall be designed for the expected conditions in the aeration tank in terms of power performance. Certified testing shall verify mechanical aerator performance.

7.4.4.b. A mechanical aeration system shall be designed to maintain all biological solids in suspension, meet the maximum oxygen demand and maintain process performance with

the largest single unit out of service, and provide for varying the amount of oxygen transferred in proportion to the load demand on the treatment works. Where a single unit installation is proposed, a spare aeration mechanism shall be provided.

7.5. Return Sludge Equipment.

7.5.1. Return Sludge Rate. The rate of sludge return expressed as a percentage of the average design flow of sewage shall generally be variable between the limits set forth in Table I of this appendix.

7.5.2. Return Sludge Pumps. If motor-driven return sludge pumps are used, the maximum return sludge capacity shall be obtained with the largest pump out of service. A positive head shall be provided on pump suctions. Pumps shall have at least three inch (3") suction and discharge openings. If air lifts are used for returning sludge from each settling tank hopper, a standby unit need not be provided if the design of the air lifts facilitates rapid, easy cleaning and removal and other standby measures are provided. Air lifts shall be at least two and one-half inches (2½") in diameter.

7.5.3. Return Sludge Piping. Discharge piping shall be at least three inches (3") in diameter and shall be designed to maintain a velocity of not less than two feet per second (2.0 fps) when return sludge facilities are operating at normal return sludge rates.

7.5.4. Waste Sludge Facilities. Aerated sludge holding tanks shall be provided at all treatment works except lagoons and those works with anaerobic digestors. Sludge holding tanks shall be designed with a minimum capacity sufficent to hold ten (10) days of sludge production; larger holding capacities may be required by the director on a case-by-case basis.

7.6. Sequential Batch Reactor and Intermittant Wastewater Treatment Systems.

7.6.1. Batch reactor and intermittant treatment technologies shall utilize an alternating two-tank system.

7.6.2. Blowers shall be provided in multiple units for treatment works that have a capacity of greater than twenty thousand gallons per day (20,000 gpd). The blowers shall be so arranged and in such capacities as to meet the maximum air demand with the largest single unit out of service.

7.6.3. Individual assembly units of diffusers shall be equipped with control valves, preferably with indicator markings for throttling or for complete shutoff.

7.6.4. Five-day biochemical oxygen demand loading and aeration requirements shall be no less than the requirements specified by the manufacturer for each particular proprietary sequencing batch reactor (SBR) process. Written concurrence with the proposed design and specifications for a particular installation shall be obtained from the manufacturer of a proprietary system or technology and provided with the project plans.

7.6.5. Each unit shall be capable of independent operation during low, average, peak, and storm flows.

7.6.6. Provisions shall be made to insure that decant or discharge valves cannot in any way be in an open position during any phase of operation except at the end of the "settle" or the "idle" phase or period.

7.6.7. Given the intermittant nature of sequencing batch reactor (SBR) effluent discharges, methods of disinfection other than chlorination shall be evaluated.

8. Trickling Filters.

8.1. Loadings. Trickling filters shall be designed to provide the necessary reduction in carbonaceous and nitrogenous oxygen demand and to properly condition the sewage for subsequent treatment processes. The hydraulic loading on standard rate trickling filters shall be between two million and four million (from 2,000,000 to 4,000,000) gallons per acre per day with an organic loading equal to or less than four hundred (400) pounds of biochemical oxygen demand per acre foot per day.

8.2. Dosing Equipment.

8.2.1. Distribution. Sewage shall be distributed over the filter by rotary distributors or other suitable devices which will permit reasonably uniform distribution to the surface area. At design average flow, the deviation from a calculated uniformly distributed volume per square foot of the filter surface shall not exceed plus or minus ten percent (±10%) at any point.

8.2.2. Dosing. Sewage shall be applied to the filter by siphons, pumps, or gravity discharge preceding treatment units when suitable flow characteristics have been developed. Application of sewage shall be practically continuous. Consideration shall be give to a piping system which will permit recirculation.

8.2.3. Hydraulics. All hydraulic factors involving proper distribution of sewage on the filters shall be carefully calculated. For reaction-type distributors, a minimum head of twenty-five inches (25") between the low water level in the siphon chamber and the center of the arms shall be provided.

Surge relief, to prevent damage to distributor seals, shall be provided where sewage is pumped directly to the distributors.

8.2.4. Clearance. A minimum clearance of six inches (6") between the media and the distributor arms shall be provided. Greater clearance shall be provided in locales where icing occurs.

8.3. Filter Media.

8.3.1. Quality. The filter media shall be crushed rock, slag, field stone, or a specially manufactured material. The media shall be durable, resistant to spalling or flaking, and relatively insoluble in sewage. The top eighteen inches (18") of the media shall have a loss by the twenty-cycle sodium sulfate soundness test of not more than ten percent (10%), as prescribed by the American Society of Civil Engineers (ASCE) in its "Manual of Engineering Practice No. 13, Filtering Materials for Sewage Treatment Plants." The balance of the media shall pass a ten-cycle test using the same criteria. Slag media shall be free from iron. Manufactured media shall be structurally stable and chemically and biologically inert.

8.3.2. Depth.

8.3.2.a. Rock, Slag, Field Stone, or Similar Media. Rock, slag, or field stone filter media shall have a minimum depth of five feet (5') above the underdrains and a maximum depth of ten feet (10').

8.3.2.b. Manufactured Media. Manufactured filter media shall have a minimum depth of ten feet (10') to provide adequate contact time with the wastewater and a maximum depth of thirty feet (30').

8.3.3. Size and Grading.

8.3.3.a. Rock, Slag, and Similar Media. Rock, slag, and similar media shall not contain more than five percent (5%) by weight of pieces whose longest dimension is three (3) times its shortest dimension. Such media shall be free of thin and elongated flat pieces, clay, dust, sand, or other fine material. Rock, slag, and similar media shall conform to the standards set forth in Table J of this appendix when mechanically graded over vibrating screens with square openings.

8.3.3.b. Hand-Picked Field Stone. Field stone used as filter media shall be selected by hand and have maximum dimensions of five inches (5") and minimum dimensions of three inches (3").

8.3.3.c. Manufactured Media. The use of manufactured media shall be approved by the director on a case-by-case basis.

8.3.4. Handling and Placing of Media. Media material delivered to the filter site shall be stored on wood planks or other clean, hard-surfaced areas. All media material shall be rehandled at the filter site and no material shall be dumped into the filter. Crushed rock, slag, and similar media shall be rescreened or forked at the filter site to remove all fines. The media material shall be placed by hand to a depth of twelve inches (12") above the tile so as not to damage the underdrains. The remainder of the material may be placed by the engineer. Manufactured media shall be handled and placed as approved by the engineer. Trucks, tractors, or other heavy equipment shall not be driven over the filter during or after construction.

8.4. Underdrainage System.

8.4.1. Arrangement. Underdrains with semicircular inverts shall be provided and the underdrainage system shall cover the entire floor of the filter. Inlet openings into the underdrains shall have an unsubmerged gross combined area equal to at least fifteen percent (15%) of surface area of the filter.

8.4.2. Slope. The underdrains shall have a minimum slope of one percent (1%). Effluent channels shall be designed to produce a minimum velocity of two feet per second (2.0 fps) at the average daily rate of application to the filter.

8.4.3. Flushing. Provisions shall be made for flushing the underdrains. The use of a peripheral head channel with vertical vents is acceptable for flushing purposes. Inspection facilities shall be provided.

8.4.4. Ventilation. The underdrainage system, effluent channels, and effluent pipe shall be designed to permit the free passage of air. The size of drains, channels, and pipe shall be such that not more than fifty percent (50%) of their cross-sectional area will be submerged under the design hydraulic loading. Provisions shall be made in the design of the effluent channels to allow the possibility of increased hydraulic loading.

8.5. Special Features.

8.5.1. Flooding. Provisions shall be made in the design of filter structures so that they may be flooded.

8.5.2. Maintenance. All distribution devices, underdrains, channels, and pipes shall be installed so that they can be properly maintained, flushed, or drained.

8.5.3. Freeboard. A minimum freeboard of four feet (4') shall be provided for tall, manufactured media filters in order to minimize windblown spray.

8.5.4. Flow Measurement. Devices shall be provided to permit the measurement of all flows to the filter, including recirculated flows.

8.5.5. Recirculation. Consideration shall be given to the merits of recirculation for various purposes (e.g, to prevent drying of a standard rate filter between dosings).

8.6. Two-Stage Filters. Consideration shall be given to the use of two-stage filters where single-stage filters may not accomplish the required removals.

8.7. Efficiencies. Expected filter efficiencies shall be calculated and documented in the project plans. Consideration shall be given to the effect of climatic conditions upon the overall filter performance.

8.8. Rotary Distributor Seals. The use of mercury seals is not an approvable design. Ease of seal replacement shall be considered in the filter design.

9. Sewage Stabilization Ponds.

9.1. Location.

9.1.1. Distance Requirements. Stabilization ponds of four (4) acres or larger in size shall be located a minimum distance of one thousand five hundred feet (1,500') from the nearest occupied structure. Stabilization ponds of less than four (4) acres in size shall be located a minimum distance of three hundred feet (300') from the nearest occupied structure.

9.1.2. Wind Sweep. Stabilization ponds shall be located in such a manner as to foster an unobstructed wind sweep across the ponds.

9.1.3. Water Supply. Stabilization ponds shall be located a minimum distance of three hundred feet (300') from public water supply wells or springs; this minimum distance shall be increased to six hundred feet (600') if the well or spring is down gradient from the pond or lower in elevation than the bottom of the pond.

9.2. Geology and Soils. Borings shall be made to determine surface and subsurface characteristics of the pond site. A soil report for the site shall be obtained from the Soil Conservation Service of the U.S. Department of Agriculture.

9.3. Pond Shape. Stabilization ponds shall have a uniform perimeter, rounded corners, and no coves, islands, or peninsulas. The shape of stabilization ponds should be either round, square, or rectangular with the length not exceeding three (3) times the width.

9.4. Pond Design.

9.4.1. Loading. Stabilization ponds shall be designed to handle an assumed loading of thirty-four (34) pounds of five-day biochemical oxygen demand per surface acre per day.

9.4.2. Ponds in Series. If one (1) or more ponds are added in series with the primary pond, the primary pond shall be designed to handle the loading set forth in Section 9.4.1 of Part B of this appendix.

9.4.3. Pretreatment. Where stabilization ponds follow some type of conventional treatment facility, a reduction of the loading set forth in Section 9.4.1 of Part B of this appendix may be approved by the director on a case-by-case basis. All ponds shall be preceded by a bar screen that conforms to the requirements set forth in Section 2 of Part B of this appendix.

9.4.4. Pond Depth. The liquid depth of stabilization ponds shall be no less than three and one-half feet (3½') and no greater than five feet (5'). A minimum freeboard of three feet (3') shall be provided.

9.5. Influent Lines.

9.5.1. Location of Discharge. Influent lines shall discharge at a point that is approximately the one-third point of the primary stabilization pond. Ponds following the primary pond or secondary treatment facilities in multiple unit systems shall be edge-discharging.

9.5.2. Gravity Lines. Influent lines from a gravity collection system shall discharge at a point that is twelve to eighteen inches (12" to 18") above the pond surface.

9.5.3. Pressure Lines. Influent lines from a pressure collection system shall discharge either above the pond surface or at a point that is one foot (1') above the pond bottom. When discharging below the pond surface, the end of the pressure line shall rest upon a concrete apron that has an area of at least two (2) square feet.

9.5.4. Pipe Support. Influent lines shall be supported on piers or other open structures. The use of dikes for pipe support is not an approvable design.

9.6. Pond Details.

9.6.1. Embankments. Embankments shall be constructed of compacted impervious materials with a minimum top width of eight feet (8'). All vegetation shall be removed from the area upon which the embankment is to be placed. Dike walls exposed to wave action shall be provided with suitable protection such as riprap. The slopes of the embankment shall not be steeper than one vertical to two horizontal (1:2) or flatter than one vertical to four horizontal (1:4).

9.6.2. Pond Bottoms. Pond bottoms shall be level and cleared of all vegetation and debris.

9.6.3. Watertightness. Ponds shall be made watertight either through the use of a liner of man-made materials or clay or through the use of a soil additive. A synthetic liner shall be of the thickness and construction recommended by its manufacturer.

9.7. Effluent Lines.

9.7.1. Location of Discharge. The effluent line shall be designed to discharge from a point that is eighteen inches (18") below the surface of the pond onto a concrete slab or riprap apron. Effluent lines shall be placed at the farthest point from the influent line discharge.

9.7.2. Discharge Structure. For ponds larger than two and one-half (2.5) acres in size, discharge structures capable of variable depth control shall be provided. Depth shall be adjustable between three and one-half and five feet (from 3.5' to 5') in increments of one-half foot (0.5') or less. Withdrawal points shall be spaced from eighteen inches (18") below the surface to twelve inches (12") above the pond bottom discharge structures. These structures shall be placed at the farthest point from the influent line discharge and be readily accessible from the embankment.

9.8. Recirculation. Recirculation shall be considered for multiple pond facilities. Whenever recirculation is proposed, and pond size is thereby reduced, calculations justifying the proposed reduction shall be submitted to the director with the project plans.

9.9. Dewatering. If more than one (1) pond is utilized in the facility design, provisions shall be made to allow for individual ponds to be taken out of service and dewatered. The use of drainage lines that discharge directly to a receiving stream is not an approvable design.

9.10. Miscellaneous Requirements.

9.10.1. Surface Runoff. Provisions shall be made to divert storm and surface water around stabilization ponds.

9.10.2. Fencing. Stabilization ponds shall be enclosed by a chain link fence at least six feet (6') high with a locked entrance gate designed to discourage the entrance of animals or unauthorized persons. Several signs stating the nature of the facility shall be installed on the fence.

9.10.3. Prefilling. Stabilization ponds shall be prefilled with clean water to a minimum depth of two feet (2') prior to use.

9.10.4. Access Road. An all-weather access road shall be provided to the pond site.

10. Anaerobic and Aerated Lagoons.

10.1. Anaerobic Lagoons.

10.1.1. Location. Anaerobic lagoons shall be located a minimum distance of one thousand five hundred feet (1,500') from the nearest occupied structure. Anaerobic lagoons shall be located a minimum distance of three hundred feet (300') from public water supply wells or springs; this minimum distance shall be increased to six hundred feet (600') if the well or spring is down gradient from the lagoon or lower in elevation than the bottom of the lagoon.

10.1.2. Geology and Soils. Borings shall be made to determine surface and subsurface characteristics of the lagoon site. A soil report for the site shall be obtained from the Soil Conservation Service of the U.S. Department of Agriculture.

10.1.3. Lagoon Shape. Anaerobic lagoons shall have a uniform perimeter, rounded corners, and no coves, islands, or peninsulas. The shape of anaerobic lagoons should be either round, square, or rectangular with the length not exceeding three (3) times the width.

10.1.4. Lagoon Design. Anaerobic lagoons shall be designed in conformance with "West Virginia Standard for Disposal Lagoon (359)," Soil Conservation Service, U.S. Department of Agriculture, October 1972.

10.2. Aerated Lagoons.

10.2.1. Location. Aerated lagoons shall be located a minimum distance of one hundred feet (100') from the nearest

occupied structure. Aerated lagoons shall be located a minimum distance of three hundred feet (300') from public water supply wells or springs; this minimum distance shall be increased to six hundred feet (600') if the well or spring is down gradient from the lagoon or lower in elevation than the bottom of the lagoon.

10.2.2. Geology and Soils. Borings shall be made to determine surface and subsurface characteristics of the lagoon site. A soil report for the site shall be obtained from the Soil Conservation Service of the U.S. Department of Agriculture.

10.2.3. Lagoon Shape. Aerated lagoons shall have a uniform perimeter, rounded corners, and no coves, islands, or peninsulas. The shape of aerated lagoons should be either round, square, or rectangular with the length not exceeding three (3) times the width.

10.2.4. Pretreatment and Aeration. Aerated lagoon facilities shall include pretreatment and an aeration basin and, if necessary, a settling basin and supplementary treatment.

10.2.5. Lagoon Facility Design.

10.2.5.a. Method. Aeration basin design is normally based upon the aerated lagoon theory using a $K_e$ of 0.5 (at 20° C). The formula set forth in Table K of this appendix shall be used in designing aeration basins.

10.2.5.b. Depth. The aeration basin shall be six to fifteen feet (6' to 15') deep. Air shall be supplied to the aeration basin by means of surface aerators or subsurface air diffusers. Basins shall be designed to distribute oxygen throughout but not to keep solids in suspension.

10.2.5.c. Settling. A settling pond shall follow the aeration basin and shall be designed to handle an assumed loading of thirty-four (34) pounds of five-day biochemical oxygen demand per surface acre per day.

10.2.6. Lagoon Details.

10.2.6.a. Embankments. Embankments shall be constructed of compacted impervious materials with a minimum top width of eight feet (8'). All vegetation shall be removed from the area upon which the embankment is to be placed. Dike walls exposed to wave action shall be provided with suitable protection such as riprap. The slopes of the embankment shall not be steeper than one vertical to two horizontal (1:2) or flatter than one vertical to four horizontal (1:4).

10.2.6.b. Lagoon Bottoms. Lagoon bottoms shall be level and cleared of all vegetation and debris.

10.2.6.c. Watertightness. Lagoons shall be made watertight either through the use of a liner of man-made materials or clay or through the use of a soil additive. A synthetic liner shall be of the thickness and construction recommended by its manufacturer.

10.2.7. Effluent Lines. The effluent line shall be designed to discharge from a point that is eighteen inches (18") below the surface of the lagoon on to a concrete slab or riprap apron. Effluent lines shall be placed at the farthest point from the influent line discharge.

10.2.8. Dewatering. If more than one (1) lagoon is utilized in the facility design, provisions shall be made to allow for individual lagoons to be taken out of service and dewatered. The use of drainage lines that discharge directly to a receiving stream is not an approvable design.

10.2.9. Miscellaneous Requirements.

10.2.9.a. Surface Runoff. Provisions shall be made to divert storm and surface water around aerated lagoons.

10.2.9.b. Fencing. Aerated lagoons shall be enclosed by a chain link fence at least six feet (6') high with a locked entrance gate designed to discourage the entrance of animals or unauthorized persons. Several signs stating the nature of the facility shall be installed on the fence.

10.2.9.c. Prefilling. Aerated lagoons shall be prefilled with clean water to a minimum depth of two feet (2') prior to use.

10.2.9.d. Access Road. An all-weather access road shall be provided to the lagoon site.

11. Alternative Treatment Systems.

11.1. Rotating Biological Contactors. The use of rotating biological contactors (RBCs) is not an approvable design for a new treatment works or as part of the upgrading of an existing treatment works.

11.2. Other Biological and Mechanical Systems. Alternative or innovative biological and mechanical treatment schemes with promising applicability in wastewater treatment may be approvable designs. The director shall consider approval of such designs after a review of data provided with the project plans in

accordance with the provisions of Section 1.3 of Part B of this appendix.

12. Disinfection.

12.1. Necessity. The effluent from all treatment works shall be adequately disinfected prior to discharge.

12.2. Chlorination.

12.2.1. Terminology. Unless otherwise indicated, when used in Section 12 of Part B of this appendix the term "chlorine" shall refer to dry chlorine.

12.2.2. Equipment.

12.2.2.a. Feed Equipment Type. Solution-feed vacuum-type chlorinators are generally preferred for treatment works that have a capacity of greater than one hundred thousand gallons per day (100,000 gpd). The use of hypochlorite solution feeders of the positive displacement type may be considered. Tablet-type chlorinators may be used for treatment works that have a capacity of one hundred thousand gallons per day (100,000 gpd) or less.

12.2.2.b. Feed Equipment Capacity. Required chlorinator capacities will vary depending upon the use and the point of application of the chlorine. For disinfection, the chlorinator capacity shall be such to produce a residual of five-tenths milligram per liter (0.5 mg/l) maximum in the final effluent at peak flow rates.

12.2.2.c. Chlorination Equipment. If chlorination is the selected method of disinfection, dual chlorinators shall be used. Each chlorinator alone shall be able to provide the required chlorination at peak flow rates. An inventory of parts subject to wear and breakage shall be maintained on hand.

12.2.2.d. Water Supply. A supply of water shall be available for operating the chlorinators. Where a booster pump is necessary, duplicate pumping equipment shall be provided. When connection is made from domestic water supplies, equipment for backflow prevention shall be provided. Pressure gauges shall be provided on chlorinator water supply lines.

12.2.2.e. Measurement Equipment. Equipment for measuring the amount of chlorine used shall be provided.

12.2.2.f. Evaporators. Where manifolding of several cylinders will be required to feed sufficient chlorine, consideration shall be given to the installation of evaporators.

12.2.2.g. Leak Detection and Controls. A bottle of ammonium hydroxide solution shall be available for detecting chlorine leaks. Consideration shall be given to the provision of caustic soda solution reaction tanks for absorbing the contents of leaking chlorine cylinders where such cylinders are in use. Automatic leak detectors shall be installed wherever gas chlorination is used.

12.2.2.h. Piping and Connections. Piping systems shall be well supported, adequately sloped to allow drainage, and protected from mechanical damage. Suitable allowance shall be provided for pipe expansion due to changes in temperature. Where adequate superheat is not provided by a vaporizer, condensation shall be prevented by reducing the pressure by means of a pressure reducing valve. Chlorine solution piping shall be so arranged that both pre-chlorination and post-chlorination may be accomplished by any or all chlorinators.

12.2.3. Housing.

12.2.3.a. Fire Protection. Any building that will house chlorine equipment or containers shall be designed or modified to protect all elements of the chlorine system from fire hazards. If flammable materials are stored or processed in the same building with chlorination equipment that does not utilize hypochlorite solutions, a fire wall shall be erected to separate the flammable materials area from the chlorination equipment.

12.2.3.b. Gaseous Chlorine. If gas chlorination equipment and chlorine cylinders will be placed in a room of a building used for other purposes, a gas-tight partition shall separate this room from all other parts of the building. This room shall be at ground level, shall have doors equipped with panic hardware, and shall permit easy access to all equipment. The gaseous chlorine storage area shall be separated from the feed area.

12.2.3.c. Exits and Windows. A means of exit to the outside of the building shall be provided from each separate room or building in which chlorine, other than hypochlorite, is stored, handled, or used. A clear glass, gas-tight window shall be installed in an exterior door or an interior wall of the chlorinator room to permit the chlorinator to be viewed without entering the room.

12.2.3.d. Temperature Maintenance. Chlorinator rooms shall be provided with a means of heating so that a temperature of at least sixty degrees Fahrenheit ($60^{\circ}$ F) can be maintained. Chlorinator rooms shall be protected from excess heat.

12.2.3.e. Ventilation. Forced, mechanical ventilation that will provide one (1) complete air change per minute shall be installed in all chlorine feed rooms and rooms where chlorine cylinders are stored. The entrance to the air exhaust duct from such rooms shall be near the floor and the point of discharge shall be so located as not to contaminate the air inlets to any building or inhabited area. Air inlets shall be so located as to provide cross-ventilation with air and at a temperature that will not adversely affect the chlorination equipment. The vent hose shall run without traps from the chlorinator and shall discharge to the outside atmosphere above ground level.

12.2.3.f. Electrical Controls. The controls for the fans and lights in all chlorine feed rooms and rooms where chlorine cylinders are stored shall be such that they will automatically operate when the door is opened and can also be manually operated from outside of the room without opening the door.

12.2.4. Respiratory Protection. Respiratory air-pac protection equipment meeting the requirements of the National Institute for Occupational Safety and Health (NIOSH) shall be available where chlorine gas is handled. Such equipment shall be stored at a convenient location near to but not inside any room where chlorine is used or stored. Instructions for using the equipment shall be posted. A minimum of two (2) air-pacs shall be available for use. These units shall use compressed air, have a capacity of least thirty (30) minutes, and be compatible with the units used by the fire department responsible for the treatment works.

12.2.5. Application of Chlorine.

12.2.5.a. Mixing With Flow. Provisions shall be made to ensure uniform mixing of the chlorine solution with the wastewater flow near the point of application.

12.2.5.b. Contact Period. A minimum contact period of forty (40) minutes at average daily flow or fifteen minutes (15) at maximum daily flow shall be provided. Additional contact time may be required by the director if the discharge point is in the proximity of a water supply intake, recreational area, or similar area.

12.2.5.c. Contact Tank. Chlorine contact tanks shall be designed to minimize any short-circuiting of flow. Either over-and-under or end-around baffling shall be provided. Air lift or submersible pumps and sludge returns from the contact tank shall be used unless preceded by a filter or polishing pond. Multiple units shall be used unless lamella or tube type settlers are utilized in conjunction with a sludge withdrawal system.

12.2.6. Dechlorination. The removal of all or part of the chlorine residual may be necessary prior to final discharge in order to meet water quality standards or other requirements for particular streams.

12.3. Other Disinfection Methods.

12.3.1. Approvable Methods. The use of disinfection methods other than chlorination shall be approved by the director on a case-by-case basis after a review of:

12.3.1.a. Data provided with the project plans in accordance with the provisions of Section 1.3 of Part B of this appendix.

12.3.1.b. Data provided with the project plans related to minimum effluent conditions such as clarity, soluble organics, and pH required for adequate disinfection;

12.3.1.c. An evaluation provided with the project plans concerning the methods for dispersion and mixing with the waste stream; and

12.3.1.d. An evaluation provided with the project plans concerning other relevant factors such as equipment reliability, safety, and application rates required for varying waste flows.

12.3.2. Bromine Chloride. Bromine chloride shall be considered to be equivalent to gaseous chlorine when used as a disinfectant except that contact time shall be reduced to twenty (20) minutes at average daily flow.

12.3.3. Ultraviolet Light (UV).

12.3.3.a. Ultraviolet disinfection equipment shall be designed to achieve a disinfection level in treated wastewater of two hundred (200) total coliform per one hundred milliliters (100 ml). An ultraviolet disinfection system shall be able, at a minimum, to provide a thirty-five thousand to seventy thousand milliwatts per square centimeter-second (35,000 to 70,000 $mw/cm^2$-sec) dosage to achieve this disinfection level.

12.3.3.b. The minimum reaction time for ultraviolet disinfection shall be five and one-half (5.5) seconds.

12.3.3.c. All submersed or wetted metal parts of an ultraviolet disinfection unit shall be made of stainless steel. The control box for the disinection system shall be protected from the waste stream and contain all wiring and controls for the entire system.

12.3.3.d. The bulb arrangement in an ultraviolet disinfection system shall be parallel to the flow direction and installed in an open channel; closed systems may be approved by the director on a case-by-case basis. Each lamp module shall be provided with a lamp intensity monitor to indicate when lamps need to be replaced or cleaned. At no time shall lamp intensity be allowed to fall below sixty-five percent (65%) of new lamp intensity before replacement or cleaning can be accomplished.

12.3.3.e. If an ultraviolet disinfection system is proposed for a treatment works, its manufacturer shall be provided with a representative sample of the wastewater to be disinfected so that he may certify that the proposed system will provide the requisite disinfection.

12.4. Evaluation of Disinfection Effectiveness.

12.4.1. Sampling. Facilities shall be provided for securing a sample prior to effluent discharge in order to determine the effectiveness of the disinfection.

12.4.2. Residual Chlorine Testing and Control. When chlorine is used for disinfection, equipment shall be provided for measuring chlorine residual. Where the discharge occurs in critical areas, the installation of facilities for continuous automatic chlorine residual analysis, recording, and proportioning systems may be required by the director.

13. Supplementary Treatment.

13.1. Necessity. Supplementary treatment shall be provided when health considerations or waste load allocations and effluent limitations necessitate more effective treatment than secondary wastewater treatment can provide.

13.2. Alternating Surface Sand Filters.

13.2.1. Approvable Use. Alternating surface sand filters normally will be used for treatment works that have a capacity of one hundred thousand gallons per day (100,000 gpd) or less but may be approved by the director on a case-by-case basis for works that have a capacity of greater than one hundred thousand gallons per day (100,000 gpd).

13.2.2. Filter Rate. An alternating surface sand filter shall be designed for a filter rate of not more than twenty (20) gallons per square foot per day.

13.2.3. Effluent Application. Effluent shall be applied by a pump or siphon chamber designed to dose all sections of the filter equally with three to four inches (3" to 4") of

liquid. Where elevation differences allow, application of effluent to the filter by gravity may be approved by the director if an uniform distribution of effluent can be provided.

13.2.4. Location. Alternating surface sand filters shall be located a minimum distance of one hundred feet (100') from the nearest occupied structure. This distance requirement may be waived by the director if acceptable screening techniques are employed.

13.2.5. Media. The sand used in alternating surface sand filters shall be coarse, clean sand of an uniform grain size (i.e., an effective size of three-tenths of a millimeter to six-tenths of a millimeter (0.3 to 0.6 mm) in diameter with a uniformity coefficient of no greater than 4.0). Alternative media may be approved by the director on a case-by-case basis.

13.2.6. Construction. The side walls and bottom of alternating surface sand filters shall be lined with a suitable plastic liner.

13.2.7. Disinfection. Disinfection of wastewater shall occur at a point that is after its passage through the alternating surface sand filters and before its discharge into a receiving stream.

13.3. High Rate Effluent Filtration.

13.3.1. Approvable Use. High rate gravity filters may be used at all treatment works. High rate pressure filters may be used at treatment works that have a capacity of greater than one hundred thousand gallons per day (100,000 gpd).

13.3.2. Filtration Rates. Filtration rates for high rate gravity filters shall not be greater than one (1) gallon per minute per square foot per day based upon the maximum flow rate applied. Filtration rates for pressure filters shall not be greater than five (5) gallons per minute per square foot per day based upon the maximum flow rate applied.

13.3.3. Number of Units. Total filter area shall be provided in two (2) or more units and the filtration rate shall be calculated based upon the total available filter area with one (1) unit out of service.

13.3.4. Backwash. Backwash shall include either air scouring or positive surface wash. Filtered effluent shall be used for backwash and waste filter backwash water shall be returned to the head of the treatment works.

13.3.4.a. Backwash Water Storage. Total backwash water storage capacity shall equal or exceed one (1) complete backwash cycle.

13.3.4.b. Backwash Rate. The backwash rate shall not exceed twenty (20) gallons per minute per square foot with a minimum backwash period of ten (10) minutes.

13.3.4.c. Pumps. Pumps for backwashing filter units shall be sized and interconnected to provide the required rate to any filter with the largest pump out of service.

13.3.5. Proprietary Equipment. Where proprietary filtration equipment not conforming to the requirements set forth in Section 13.3 of Part B of this appendix is proposed, data which supports the capability of the equipment to meet effluent requirements under design conditions shall be provided with the project plans. Such equipment shall be approved by the director on a case-by-case basis.

13.4. Total Kjeldahl Nitrogen (TKN) Removal.

13.4.1. Necessity. Total Kjeldahl nitrogen (TKN) removal shall be considered when the TKN limit, as stated in the discharge load allocation, is less than eighteen milligrams per liter (18.0 mg/l).

13.4.2. Approved Removal Methods. Methods which may be used to achieve TKN removal include additional aeration in extended aeration treatment works, second-stage nitrification, break-point chlorination, nitrification column, and alternating surface sand filters. Because TKN removal is temperature dependent, consideration shall be given to the use of winter-summer discharge load allocations or ammonia-based waste load allocations.

13.5. Microscreening. The use of microscreening units for the removal of residual suspended solids is not an approvable design.

13.6. Polishing Ponds. Polishing ponds shall be designed in accordance with the requirements for stabilization ponds set forth in Section 9 of Part B of this appendix with the following exception:

13.6.1. Capacity. Polishing ponds shall either have a capacity of at least sixty-five thousand (65,000) gallons or a capacity for a detention time sufficent to handle ten (10) days of the design flow, whichever is greater.

13.7. Post-Aeration. A discharge load allocation of six milligrams per liter (6.0 mg/l) of dissolved oxygen shall be met by means of either cascade aeration or a post-aeration tank with air added by diffusion or mechanical means.

14. Sludge Handling and Disposal.

14.1. Anaerobic Sludge Digestion.

14.1.1. Digestion Tanks. Multiple tanks shall be used for anaerobic sludge digestion. For those units that serve as supernatant separation tanks, tank depth shall be sufficient to allow for the formation of a reasonable depth of supernatant liquor. A side water depth of at least ten feet (10') shall be provided.

14.1.2. Tank Design.

14.1.2.a. Bottom Slope. Digestion tank bottom shall be sloped to drain toward the withdrawal pipe. For tanks equipped with a suction mechanism for the withdrawal of sludge, the bottom slope shall be not less than one vertical to twelve horizontal (1:12). Where the sludge is to be removed by gravity alone, the bottom slope shall be not less than one vertical to four horizontal (1:4).

14.1.2.b. Access Manholes. At least two (2) access manholes of at least thirty-six inches (36") in diameter shall be provided in the top of the tank in addition to the gas dome. Stairways to reach the access manholes shall be provided. A separate side wall manhole shall be provided with an opening large enough to permit the use of mechanical equipment to remove grit and sand.

14.1.2.c. Safety Equipment. Nonsparking tools, safety lights, rubber-soled shoes, safety harnesses, detectors for inflammable and toxic gases, and at least two (2) self-contained breathing units shall be provided for emergency use.

14.1.3. Sludge Inlets and Outlets.

14.1.3.a. Recirculation. Multiple recirculation withdrawal and return points shall be provided unless mixing facilities are incorporated within the digester. The return shall discharge above the liquid level and be located near the center of the tank.

14.1.3.b. Raw Sludge Discharge. Raw sludge discharge to the digester shall be either through the sludge heater and recirculation return piping or directly to the tank if internal mixing facilities are provided.

14.1.3.c. Withdrawal. Sludge withdrawal shall be from the bottom of the tank through a pipe that is interconnected with the recirculation piping.

14.1.4. Tank Capacity. The total digestion tank capacity shall be determined by calculations based upon such factors as volume of sludge added, its percent solids and character, the temperature to be maintained in the digestors, the degree or extent of mixing to be obtained, and the degree of volatile solids reduction required. When calculations are not based upon these factors, the minimum combined digestion tank capacity shall be calculated based upon the assumption that the raw sludge will be derived from ordinary domestic wastewater, that digestion temperature will be maintained in the range from thirty-two to thirty-eight degrees centigrade ($32^{o}$ C to $38^{o}$ C), that from forty to fifty percent (40% to 50%) volatile matter will be maintained in the digested sludge, and that the digested sludge will be removed frequently from the system. Tank capacity calculations shall be submitted to the director with the project plans to justify the digestion tank design selected.

14.1.4.a. Completely-Mixed Digestion Systems. Completely-mixed systems shall provide for effective mixing and may be loaded at a rate up to eighty (80) pounds of volatile solids per one thousand (1,000) cubic feet of volume per day in the active digestion units. When grit removal facilities are not provided, reduction of digester volume due to grit accumulation shall be considered.

14.1.4.b. Moderately-Mixed Digestion Systems. For digestion systems where mixing is accomplished only by circulating sludge through an external heat exchanger, the system may be loaded at a rate up to forty (40) pounds of volatile solids per one thousand (1,000) cubic feet of volume per day in the active digestion units. This loading may be modified upward or downward depending upon the degree of mixing provided.

14.1.5. Gas Collection, Piping, and Appurtenances.

14.1.5.a. Design. All portions of the digestion system -- including the space above the tank liquor, the storage facilities, and the piping -- shall be designed so that the gas will be maintained under positive pressure under all normal operating conditions including sludge withdrawal. All enclosed areas where gas leakage might occur shall be adequately ventilated.

14.1.5.b. Safety. All necessary safety facilities shall be provided where gas is produced. Pressure and vacuum relief valves, flame traps, and safety shutoff valves

shall be provided. Gas safety equipment and gas compressors shall be housed in a separate room with an exterior entrance.

14.1.5.c. Gas Piping and Condensate. Gas piping shall slope to condensate traps at low points. The use of float-controlled condensate traps is not an approvable design.

14.1.5.d. Gas Utilization Equipment. Gas-fired boilers for heating digesters shall be located in a separate room not connected to the digester gallery.

14.1.5.e. Electrical Fixtures. Electrical fixtures and controls in places enclosing anaerobic digestion appurtenances where hazardous gases are normally contained in the tanks and piping shall comply with the National Electrical Code for Class 1, Group D, Division 2 locations. Digester galleries shall be isolated from normal operating areas in order to avoid an extension of the hazardous location.

14.1.5.f. Waste Gas Burners. Waste gas burners shall be readily accessible and located at least twenty-five feet (25') away from any plant structure if placed at ground level. Waste gas burners may be located on the roof of the control building if sufficiently removed from the tank. All waste gas burners shall be equipped with automatic ignition (e.g., a pilot light or a device using a photoelectric cell sensor). Consideration shall be given to the use of natural or propane gas to insure reliability of the pilot light. If approved by the director for a remote location, waste gas may be discharged to the atmosphere through a return-bend screened vent terminating at least ten feet (10') above the ground surface if the assembly incorporates a flame trap.

14.1.5.g. Ventilation. Underground enclosures connecting with digestion tanks or containing either sludge or gas piping or equipment shall be provided with forced ventilation. The piping gallery for digesters shall not be connected to other passages. Tight-fitting, self-closing doors shall be provided at connecting passageways and tunnels to minimize the spread of gas.

14.1.5.h. Meter. A gas meter with a bypass shall be provided to meter total gas production.

14.1.6. Digester Heating.

14.1.6.a. Insulation. Unless otherwise approved by the director, tanks shall be constructed above the local water table and shall be suitably insulated to minimize heat loss.

14.1.6.b. Heating Facilities. Sludge may be heated by circulation through external heaters or by heating units located inside the digestion tank. Piping for external heating shall be designed to provide for the preheating of feed sludge before its introduction to the digesters. Provisions shall be made in the layout of the piping and valving to facilitate the cleaning of these lines. Heat exchanger sludge piping shall be sized to meet heat transfer requirements. Other types of heating facilities may be approved by the director on a case-by-case basis.

14.1.6.c. Heating Capacity. Heating capacity sufficient to consistently maintain the design sludge temperature shall be provided. Where digester tank gas is used for sludge heating, an auxiliary fuel supply shall be provided.

14.1.6.d. Hot Water Internal Heating Controls. An automatic mixing valve shall be provided to temper the boiler water with return water so that the inlet water to the heat jacket can be held below a temperature at which caking will be accentuated. Manual control shall be provided by bypass valves. The boiler shall be provided with automatic controls to maintain boiler temperature at approximately one hundred eighty degrees Fahrenheit (180° F) and to shut off the main gas supply in the event of pilot burner, electrical failure, low boiler water level, or excessive temperature. Thermometers shall be provided to show temperatures of the sludge, hot water feed, hot water return, and boiler water.

14.1.7. Supernatant Withdrawal.

14.1.7.a. Piping Size. Supernatant piping shall be at least six inches (6") in diameter.

14.1.7.b. Withdrawal. Piping shall be arranged so that withdrawal can be made from three (3) or more levels in the digester. A positive, unvalved, vented overflow shall be provided. If a supernatant selector is provided, at least one (1) other drawoff level located in the supernatant zone of the tank shall be provided in addition to the unvalved emergency supernatant drawoff pipe. High-pressure backwash facilities shall be provided.

14.1.7.c. Sampling. Provisions shall be made for sampling at each supernatant drawoff level. Sampling pipes shall be at least one and one-half inches (1½") in diameter and shall terminate at a suitably-sized sampling sink or basin.

14.1.7.d. Alternate Supernatant Disposal. Where appropriate, consideration shall be given to supernatant

conditioning in relation to its effect on treatment works performance and effluent quality.

14.2. Aerobic Sludge Digestion.

14.2.1 Digestion Tanks. Multiple tanks designed to provide effective air mixing, reduction of organic matter, supernatant separation, and sludge concentration under controlled conditions shall be used for aerobic sludge digestion. A single digestion tank may be used at a small treatment works where a single unit will not adversely affect normal operations and provisions are made for sludge handling.

14.2.2. Mixing and Aeration Requirements. Aerobic digestion tanks shall be designed to keep solids in suspension and maintain dissolved oxygen levels of one to two milligrams per liter (1.0 to 2.0 mg/l). At least thirty (30) cubic feet of air per one thousand (1,000) cubic feet of tank volume shall be provided with the largest blower out of service. If diffusers are used, nonclogging blowers shall be used in a design that permits continuity of service. If mechanical aerators are used, a minimum of one (1.0) horsepower per one thousand (1,000) cubic feet shall be provided.

14.2.3. Tank Capacity. The total digestion tank capacity shall be determined by calculations based upon such factors as quantity of sludge produced, sludge characteristics, time of aeration, and sludge temperature. Tank capacity calculations shall be submitted to the director with the project plans to justify the digestion tank design selected.

14.2.3.a. Volatile Solids Loading. The volatile suspended solids loading shall not exceed one (100) hundred pounds per one thousand (1,000) cubic feet of volume per day in the digestion units. Lower loading rates may be necessary depending upon temperature, type of sludge, and other factors.

14.2.3.b. Solids Retention Time. Required minimum solids retention time for stabilization of biological sludges varies with the type of sludge. Unless otherwise approved by the director, a minimum of ten (10) days retention time shall be provided for waste activated sludge and twenty (20) days retention time shall be provided for either a combination of primary and waste activated sludge or primary sludge alone. Where sludge temperature is lower than fifty degrees Fahrenheit ($50^{\circ}$ F), additional detention time shall be considered.

14.2.4. Supernatant Separation. Facilities shall be provided for the separation and withdrawal of supernatant and the collection and removal of scum and grease.

14.2.5. Sludge Thickening. Prior to placement on sludge drying beds, all sludge produced by the activated sludge process shall be conditioned to a minimum solids content of two percent (2%) by weight.

14.3. Sludge Pumps and Piping.

14.3.1. Sludge Pumps.

14.3.1.a. Type. Plunger pumps, screw feed pumps, recessed impeller centrifugal pumps, progressive cavity pumps, or other types of pumps capable of handling solids shall be provided for handling raw sludge. Duplicate pumps shall be provided regardless of the type selected.

14.3.1.b. Minimum Head. A minimum positive head of twenty-four inches (24") shall be provided at the suction side of centrifugal pumps and is desirable for all other types of sludge pumps. Maximum suction lifts shall not exceed ten feet (10') for plunger pumps.

14.3.1.c. Sampling Facilities. Unless sludge sampling valves are installed at the sludge pumps, valves and piping shall be at least one and one-half inches (1½") in diameter.

14.3.2. Sludge Piping.

14.3.2.a. Size and Head. Sludge withdrawal piping shall have a minimum diameter of six inches (6") for gravity withdrawal and three inches (3") for pump suction and discharge lines. Where withdrawal is by gravity, the available head on the discharge pipe shall provide a velocity of at least three feet per second (3.0 fps).

14.3.2.b. Slope. Gravity piping shall be laid on an uniform grade and alignment at a slope of at least three percent (3%). Provisions shall be made for cleaning, draining, and flushing discharge lines.

14.3.2.c. Supports. Special consideration shall be given to the corrosion resistance and continuing stability of supporting systems located inside the digestion tank.

14.4. Sludge Dewatering.

14.4.1. Sludge Drying Beds.

14.4.1.a. Sizing. The size of sludge drying beds shall be based upon an assumed four (4) square feet per capita when the drying bed is the primary method of dewatering and one

(1) square foot per capita when the drying bed is to be used as a backup dewatering unit.

14.4.1.b. Surface Water Intrusion. Sludge drying beds shall be designed so that surface water cannot enter the bed area.

14.4.1.c. Gravel Course. The lower course of sludge drying beds shall be composed of gravel that is graded and placed around the underdrains. The gravel shall be twelve inches (12") in depth and extend at least six inches (6") above the top of the underdrains. The gravel shall be placed in two (2) or more layers with a top layer that is at least three inches (3") in depth. This top layer shall be composed of gravel that is one-eighth of an inch to one-quarter of an inch (1/8" to 1/4") in size. Gravel shall be placed on a watertight membrane of concrete or plastic in order to prevent any contamination of groundwater.

14.4.1.d. Sand Course. The top course of sludge drying beds shall be composed of six to nine inches (6" to 9") of coarse, clean sand of an uniform grain size (i.e., an effective size of three-tenths of a millimeter to six-tenths of a millimeter (0.3 to 0.6 mm) in diameter with a uniformity coefficient of no greater than 4.0). The finished sand surface shall be level.

14.4.1.e. Underdrains. Underdrains shall be at least four inches (4") in diameter and spaced not more than twenty feet (20') apart.

14.4.1.f. Partially-Paved Beds. Partially-paved drying bed shall be designed with sufficent space for the operation of mechanical equipment for removing dried sludge.

14.4.1.g. Walls. Drying bed walls shall be watertight, extend fifteen to eighteen inches (15" to 18") above and at least six inches (6") below the bed surface, and be physically connected to the liner to prevent leakage. Outer walls shall be curbed to prevent soil from washing onto the beds.

14.4.1.h. Sludge Removal. Not less than two (2) drying beds shall be provided and so arranged to facilitate sludge removal.

14.4.1.i. Sludge Influent. Sludge pipes to drying beds shall terminate at least twelve inches (12") above the bed surface. Concrete splash plates for percolation-type drying beds shall be provided at sludge discharge points.

14.4.1.j. Protective Enclosure. A protective enclosure shall be provided for all drying beds.

14.4.1.k. Polymer Addition. Facilities for polymer addition shall be provided for sand drying beds.

14.4.2. Mechanical Dewatering Facilities. Provisions shall be made to maintain continuity of service so that sludge may be dewatered without accumulation beyond storage capacity. The number of vacuum filters, vacuum beds, centrifuges, filter presses, belt filters, or other mechanical dewatering facilities shall be sufficient to dewater the sludge produced with the largest unit out of service. Facilities for polymer addition shall be provided. Unless standby facilities are available, adequate storage facilities shall be provided. Storage capacity shall be sufficient to handle at least a three (3) month accumulation of sludge production.

14.4.2.a. Auxiliary Facilities for Vacuum Filters and Vacuum-Assisted Beds. Backup vacuum pumps and filtrate pumps shall be provided for vacuum filter and vacuum-assisted beds. An uninstalled backup vacuum or filtrate pump may be used for every three (3) or less vacuum filters provided the installed unit can easily be removed and replaced.

14.4.2.b. Ventilation. The dewatering area shall be properly ventilated and exhaust air shall be conditioned in order to avoid nuisance odors.

14.4.3. Drainage and Filtrate Disposal. Drainage from drying beds or filtrate from dewatering units shall be returned to the sewage treatment process at appropriate points.

14.4.4. Alternative Dewatering Facilities. The director may approve alternative dewatering facilities on a case-by-case basis. A detailed description of the process and design data shall be submitted to the director with the project plans.

15. Disposal of Sewage Sludge.

15.1. Sewage sludge shall be disposed in conformance with applicable State regulations.

16. Land Application of Sewage Effluent.

16.1. Approvable Use. Land application may be used as a means of disposing of sewage effluent which has received secondary wastewater treatment (i.e., land application of sewage effluent that has received primary treatment only is prohibited). Land application may be used in cases where the effluent of a treatment works contains pollutants that can be successfully

removed through organic decomposition in the vegetation-soil complex and by absorptive, physical, and chemical reactions with earth materials. Effluent to be disposed by means of land application shall contain not more than thirty milligrams per liter (30 mg/l) of suspended solids or thirty milligrams per liter (30 mg/l) of five-day biochemical oxygen demand.

16.2. Preliminary Considerations. In selecting a site on which sewage effluent will be applied, consideration shall be given to the compatibility of the effluent with the organic and earth material content, percolation rates, and exchange capacity of the soils at the site. Land application of sewage effluent will eventually recharge the local groundwater; therefore, consideration shall be given to the quality, direction, rate of movement, present use, and future use of the groundwater beneath the site. Other factors that shall be considered when selecting an appropriate site include geology, hydrology, topography, local weather, agriculture practices, adjacent land use, and equipment selection and installation.

16.3. Site Plan and Report. A site plan and report shall be included with the project plans submitted to the director.

16.3.1. Location Maps. A 7½-minute United States Geological Survey topographic map and a West Virginia Department of Highways county map showing the property that contains the site on which sewage effluent will be applied shall be included in the site plan and report.

16.3.2. Site Plan. A topographic map of the land application property and surrounding area, drawn on a workable scale, shall be included in the site plan and report. This map shall show:

16.3.2.a. The land application site and all areas of possible expansion;

16.3.2.b. The location of woodlots and fences or other barriers on the property;

16.3.2.c. The direction of the groundwater flow beneath the property;

16.3.2.d. The location of wells, springs, public water supplies, groundwater monitoring wells, and surface water bodies on the property or within two thousand feet (2,000') of the property boundaries;

16.3.2.e. The location of any sinkholes on the property or within two thousand feet (2,000') of the property boundaries; and

16.3.2.f. All structures on the property or within two thousand feet (2,000') of the property boundaries.

16.3.3. Soil Map. A soil map showing the soil types at the land application site shall be included in the site plan and report.

16.3.4. Site Report.

16.3.4.a. Site Geology. Information related to geological formations, local bedrock structure, the degree of bedrock weathering, the character and thickness of surficial deposits, and the presence of solution openings or sinkholes shall be included in the site plan and report.

16.3.4.b. Site Hydrology. Data related to the depth to the seasonal high water table and the chemical and bacterial composition of the groundwater beneath the site shall be included in the site plan and report.

16.3.4.c. Site Soils. The cation exchange capacity, thickness, types, and characteristics of the soils at the site shall be included in the site plan and report.

16.3.4.d. Climatological Data. The average daily rainfall and temperature at the site shall be included in the site report and plan.

16.3.4.e. Agricultural Practices. Information related to present and intended soil-crop management practices, kinds of crops to be grown, harvesting frequency, and ultimate use of crops grown on the property shall be included in the site report and plan.

16.3.4.f. Effluent Characteristics. A detailed chemical analysis of the effluent to be disposed at the site shall be included in the site report and plan.

16.3.4.g. Management Practices. Information related to the types of equipment to be used for effluent transport and application; site supervision and monitoring practices; contracts, land easements, land leases, and land purchases; and emergency procedures to be utilized in the event of plant or equipment breakdown shall be included in the site plan and report.

16.4. Site Design.

16.4.1. Holding Pond. A holding pond shall be constructed at the land application property in order to store effluent during periods when land application cannot occur. This

pond shall be capable of storing the effluent produced by the treatment works in ninety (90) days at peak flow. A residual water depth of at least two feet (2') shall be maintained in the holding pond at all times in order to prevent the growth of vegetation.

16.4.2. Application Rates. Maximum land application rates, in terms of depth of effluent, shall be one-quarter inch (¼") per hour, one-half inch (½") per day, and two inches (2") per week.

16.4.3. Slopes. Slopes at land application sites which are cultivated fields shall be four percent (4%) or less. Slopes at land application sites which are sodded fields shall be eight percent (8%) or less. Slopes at land application sites which are forested shall be eight percent (8%) or less for year-round operations and fourteen percent (14%) or less for seasonal operations.

16.4.4. Runoff. The land application site shall be designed to prevent surface runoff from entering or leaving the site.

16.4.5. Fencing. The land application site shall be enclosed by a chain link fence at least six feet (6') high with a locked entrance gate designed to discourage the entrance of animals or unauthorized persons. Several signs stating the nature of the facility shall be installed on the fence.

16.5. Spray Irrigation Systems.

16.5.1. Piping. The piping to the sprinklers in a spray irrigation system shall be arranged to allow the irrigation pattern to be varied easily. For a permanent system, provisions shall be made to allow the pipes to be completely drained to prevent pollution and freezing.

16.5.2. Pump Station. Duplicate pumps shall be provided for the delivery of effluent to the irrigation area. Each pump shall have the capacity to handle the maximum anticipated rate of flow plus an allowance to deplete stored volumes. A metering device shall be provided at the spray irrigation pump station. A control valve between the holding pond and the pump station shall be provided. The top of the wet well of the pump station shall be at least as high as the maximum holding pond surface elevation in order to prevent flooding when the spray irrigation equipment is not in operation.

16.5.3. Buffer Zone. The spray irrigation system shall be designed to provide an even distribution of effluent over the entire irrigation area. Sprinklers shall be so located

as to provide a nonirrigated buffer zone around the irrigated area. The fence prescribed under Section 16.4.5 of Part B of this appendix shall be placed at least fifty feet (50') beyond the normal projected irrigation area. Unless otherwise approved by the director, a minimum of three hundred fifty feet (350') shall be provided between the fence and the land application property boundaries or any road.

16.6. Ridge and Furrow Systems.

16.6.1. Design Requirements. Ridge and furrow systems may be used on land application sites that have a slope of eight percent (8%) or less. Furrows may be constructed down slope on sites that have a slope of one percent (1%) or less but shall be constructed at right angles to the slope on all other sites. Furrows shall be not more than one thousand feet (1,000') in length and shall be spaced from twenty to forty inches (20" to 40") apart.

16.7. Overland Flow Systems.

16.7.1. Design Requirements. Overland flow systems may be used on land application sites that have slopes that range from two to eight percent (2% to 8%) and run for one hundred fifty to three hundred feet (150' to 300'). Overland flow systems may be designed either to flood the land application site or for effluent application to be made by means of gated pipe or spray.

16.8. Monitoring and Reporting.

16.8.1. Monitoring Wells. At least one (1) groundwater monitoring well shall be placed down gradient of the land application site. Samples shall be collected from both the surface of and five feet (5') below the water table at each monitoring well. The location and design of monitoring wells and the frequency of sample collection shall be approved by the director.

16.8.2. Crop Analysis. If crops for animal or human consumption are grown on the land application site, a chemical analysis of each crop shall be performed at harvest.

16.8.3. Reporting. The frequency of reporting the results of groundwater monitoring or crop analysis shall be determined by the director on a case-by-case basis.

PART C. INDIVIDUAL SEWAGE SYSTEMS.

1. Approvable Systems.

1.1. Approvable individual sewage systems include:

1.1.1. Composting toilets;

1.1.2. Effluent disposal ponds;

1.1.3. Grey water disposal systems;

1.1.4. Holding tanks;

1.1.5. Home aeration units;

1.1.6. Mound systems;

1.1.7. Privies;

1.1.8. Recycle systems;

1.1.9. Septic tank soil absorption systems with standard soil absorption fields;

1.1.10. Serial distribution soil absorption fields;

1.1.11. Shallow soil absorption fields;

1.1.12. Soil absorption beds;

1.1.13. Any other system that provides waste treatment and disposal for individual dwellings, commercial establishments, or both.

1.2. Application forms and design data sheets for an individual sewage system may be obtained from the health department in the county in which the system will be located. The completed application and the design data sheets shall be submitted to the director with the project plans. A copy of the completed application, the design data sheets, and the project plans shall be submitted to the health department in the county in which the system will be located.

2. General Design Standards.

2.1. Location.

2.1.1. Unless otherwise approved by the director, no part of an individual sewage system shall be located in a poorly-drained or filled area or in any area where seasonal flooding occurs.

2.1.2. No part of an individual sewage system shall be located within ten feet (10') of a building, foundation, or property line.

2.1.3. No part of an individual sewage system shall be located within ten feet (10') of a private water supply line or within twenty-five feet (25') of a public water supply line.

2.1.4. No septic tank, home aeration unit, vault privy, or other sewage tank shall be located within fifty feet (50') of a private water supply well. The distance between a septic tank, home aeration unit, vault privy, or other sewage tank and a public water supply reservoir or well shall be approved by the director on a case-by-case basis.

2.1.5. No portion of a treatment unit or disposal system shall be located under a parking lot, roadway, or other paved surface or under any type of structure.

2.2. Miscellaneous Requirements.

2.2.1. Roof drains, foundation drains, sump pumps, surface drains, or similar drains shall not be connected to an individual sewage system.

2.2.2. The director may require the installation of a grease trap on an individual sewage system that serves a dwelling or establishment discharging a large amount of grease. Grease traps shall be designed in conformance with the requirements set forth in Section 7 of Part A of this appendix.

3. Septic Tanks.

3.1. Capacities. Septic tanks shall be designed in accordance with the capacities set forth in Table L of this appendix.

Note: It is recommended that dual compartment tanks or dual tanks be used. If dual compartment tanks or dual tanks are used, the volume ratio of the first compartment or tank to the second compartment or tank shall approximate two to one (2:1). In a dual compartment tank, the connection between compartments shall be an elbow with a minimum diameter of four inches (4"), placed so that the invert at the partition is approximately sixteen inches (16") below the liquid level.

3.2. Materials. Septic tanks shall be constructed of reinforced concrete, fiberglass, or a watertight, durable material approved by the director. The use of concrete blocks is not an approvable design.

3.2.1. Concrete Septic Tanks. In constructing a concrete septic tank, at least six (6) bags of cement shall be used per yard of concrete mix or equivalent with a minimum compressive strength of four thousand pounds per square inch (4,000 psi). Reinforcement shall be at least six inch by six inch (6" x 6") mesh of #10 welded wire fabric. Aggregate used in the concrete shall be no larger than one inch (1") in size. Concrete shall be vibrated to minimize honeycombing. Tank side walls shall be at least two and one-half inches (2½") thick and tank tops and bottoms shall be at least three inches (3") thick. Recommended dimensions for concrete septic tanks are set forth in Table M of this appendix.

3.2.2. Fiberglass and Plastic Tanks. Septic tanks that are made of fiberglass or plastic shall be approved by the director.

3.3. Design Standards.

3.3.1. The invert of the inlet pipe shall be at least two inches (2") above the invert of the outlet pipe.

3.3.2. Knockouts shall be at least four inches (4") in diameter.

3.3.3. The inlet shall be provided with a cast-in-place or inserted baffle or a sanitary tee that extends to a depth of at least six inches (6") but not more than twenty percent (20%) of the liquid depth.

3.3.4. The outlet shall be provided with a cast-in-place or inserted baffle or sanitary tee that extends to at least thirty-five percent (35%) but not more than forty percent (40%) of the liquid depth.

3.3.5. The top of the inlet and outlet baffles or tees shall extend at least six inches (6") above the flow line.

3.3.6. The liquid depth in a septic tank shall be at least thirty inches (30") but shall not exceed five feet (5') for tanks that have a capacity of less than three thousand (3,000) gallons or six feet (6') for tanks that have a capacity of three thousand (3,000) or more gallons.

3.3.7. A minimum of nine inches (9") of clearance shall be provided above the liquid level.

3.3.8. The top of the septic tank, or either end above the inlet or outlet, shall be embossed, imprinted, stenciled, or otherwise marked in an indelible and legible manner with the manufacturer's name and the tank's liquid capacity.

3.3.9. Access shall be provided to each compartment of the septic tank for inspection and cleaning. Manholes shall be provided at both inlet and outlet ends of the tank.

4. Individual Home Aeration Units.

4.1. Approvable Use. Individual home aeration units shall only be used where additional treatment is provided, such as soil absorption or another means of effluent disposal approved by the director. The director may require that the ownership, operation, and maintenance of a home aeration unit be under the control of a public or private utility regulated by the West Virginia Public Service Commission.

4.2. Design and Construction. The design and construction of an indivisual home areation unit shall meet the requirements of National Sanitation Foundation (NSF) Standard 40. Design specifications and operational data for proposed units shall be submitted to the director for evaluation with the project plans.

5. Soil Absorption Systems.

5.1. General Design Standards.

5.1.1. Location. Absorption fields, serial distribution systems, absorption beds, mound systems, and other soil absorption systems shall be located in accordance with the separation distances set forth in Table N of this appendix.

5.1.2. Site Evaluation. The evaluation of a site to determine its suitability for the installation of a soil absorption system shall be based upon percolation test results and an evaluation of a six foot (6') deep excavation performed in accordance with the procedures set forth in Table O of this appendix. A soil absorption system shall not be installed in soils where percolation test results show an average percolation time of less than five (5) minutes per inch unless all surrounding occupied structures are served by a public water supply.

5.1.3. Relation to Water Table. A minimum of three feet (3') shall be provided between any portion of a soil absorption system and the seasonal high water table.

5.1.4. Relation to Impermeable Layers. A minimum of three feet (3') shall be provided between any portion of a soil absorption system and an impermeable layer of rock or soil.

5.2. Standard Soil Absorption Fields.

5.2.1. Sizing. Standard soil absorption fields shall be designed in accordance with the sizings set forth in Table P of this appendix.

5.2.1.a. Absorption fields over three thousand (3,000) square feet in total area shall include some form of dosing. Dosing shall be accomplished by gravity distribution boxes or by pumping. Pumped systems shall dose the soil absorption field two to four (2 to 4) times per day; however, the dose shall be no more than seventy-five percent (75%) of the distribution pipe volume for soil absorption systems utilizing four inch (4") pipe. Pumping units shall be designed and constructed in conformance with the applicable requirements of Section 6.5 of Part A of this appendix.

5.2.1.b. When a total field area of over five thousand (5,000) square feet is necessary, the field shall be split into two (2) or more fields of approximately equal size.

5.2.1.c. When a structure other than a single-family dwelling is to be served, or more than one structure is to be served by a single system, land shall be reserved for the construction of two (2) standard soil absorption fields, each of adequate size to serve the proposed structure or structures.

5.2.2. Construction Materials.

5.2.2.a. Pipe used in gravity distribution soil absorption systems shall have a minimum diameter of four inches (4"). Pipe smaller than four inches (4") in diameter may be used for pressure distribution soil absorption systems.

5.2.2.b. Pipe used in the construction of soil absorption fields shall be ASTM - D 2729, D 2852, D 3350, D 2751, D 2836, D 3033, D 3034, D 3298, or F 789 plastic pipe.

5.2.2.c. Perforated pipe used in the construction of soil absorption fields shall have a minimum of two (2) rows of downward-facing holes that are ninety degrees ($90^{o}$) of arc apart.

5.2.2.d. Aggregate used in the construction of soil absorption fields shall be washed gravel, crushed stone, or slag that is one-half to two inches (½" to 2") in size and has a hardness of 3 on the Moh scale of hardness. Crushed limestone, when used as aggregate, shall be dolomitic limestone.

5.2.3. Construction on Level Terrain. Standard soil absorption fields on level terrain shall be constructed in conformance with the following specifications:

5.2.3.a. Trenches shall be one to three feet (1' to 3') wide with a maximum depth of thirty-six inches (36") and a minimum depth of eighteen inches (18").

5.2.3.b. The maximum length of a trench shall not exceed one hundred feet (100') with the exception that absorption fields dosed by a pump may utilize trenches of greater length upon approval from the director. If distribution lines greater than one hundred feet (100') in length are necessary, the solid sewer pipe from the septic tank shall be connected to the center of the distribution line so that the lengths on either side of the connection will be equal and not exceed one hundred feet (100') each.

5.2.3.c. The bottom of each trench and its distribution line shall be level. Trenches shall be constructed in a manner that minimizes the compaction or smearing of the sides and bottoms. Trenches shall not be constructed in soil that is so wet that it forms a "wire" instead of breaking apart when rolled between the hands. Trenches shall not be constructed during inclement weather which may interfere with or preclude correct construction procedures.

5.2.3.d. At least six inches (6") of aggregate shall be placed in the bottom of the trench beneath a pipe and at least two inches (2") of aggregate shall be placed on top of the pipe.

5.2.3.e. The surface of the aggregate shall be covered with three to four inches (3" to 4") of straw or hay, one (1) layer of untreated building paper, or a thickness of at least four (4) sheets of newspaper prior to backfilling.

5.2.3.f. At least six feet (6') of undisturbed earth shall be provided between the side walls of each trench. Additional separation may be required in order to avoid interaction between the trenches.

5.2.3.g. Soil absorption fields constructed in flat areas shall be designed to provide a continuous or closed-circuit system.

5.2.3.h. The backfilling of a soil absorption field shall be performed in a manner that minimizes the movement of heavy equipment upon the field. Backfill shall be mounded over the adsorption field to allow for settling and to promote runoff from the field. Backfilling shall not be performed when the ground is frozen. The area where a soil absorption field has been constructed shall not be graded after backfilling.

5.2.3.i. The sewer line from the structure to the septic tank shall be laid on a grade of not less than one-eighth of an inch (1/8") per foot.

5.2.3.j. If a soil absorption field is greater than one thousand five hundred (1,500) square feet in area, a siphon chamber or pump chamber may be required by the director to insure even distribution of effluent.

5.2.4. Construction on Sloping Terrain. Standard soil absorption fields on sloping terrain shall be constructed in conformance with the applicable requirements of Section 5.2.3 of Part C of this appendix and the following specifications:

5.2.4.a. Soil absorption fields constructed on sloping ground shall use a serial distribution system. The use of drop boxes is recommended.

5.2.4.b. Soil absorption fields shall not be constructed on slopes of greater than twenty-five percent (25%).

5.2.4.c. At least six inches (6") of cover shall be placed over the aggregate fill in each trench.

5.2.4.d. The absorption trenches shall follow the approximate ground surface contours so that variation in trench depth will be minimized.

5.2.4.e. Adjacent trenches shall be connected by a relief line, crossover, or drop box arrangement in such a manner so that each trench is completely filled with septic tank effluent to the full depth of the aggregate before effluent flows to succeeding trenches.

5.2.4.e.A. The relief line or crossover shall be solid four inch (4") sewer line with tight joints and a direct connection to the distribution lines or a drop box installation.

5.2.4.e.B. Relief lines, crossovers, and drop boxes shall not be constructed in any location or manner that will subject them to damage during or after construction. The location of relief lines, crossovers, and drop boxes shall be marked prior to backfilling to avoid damage from heavy equipment.

5.2.4.e.C. Trenches for relief lines or crossovers shall be no deeper than the top of the aggregate of the trenches being connected. Relief lines and crossovers shall rest on undisturbed earth and backfill shall be carefully tamped; care shall be exercised to insure that an undisturbed block of earth remains between the trenches.

5.2.4.e.D. The invert of the overflow pipe in the first relief line or crossover shall be at least four inches (4") lower than the invert of the septic tank outlet.

5.3. Absorption Beds.

5.3.1. Approvable Use. Absorption beds shall only be constructed when terrain or space limitations prevent the installation of a standard soil absorption field.

5.3.2. Sizing. Absorption beds shall be sized to provide an area that is thirty percent (30%) greater than the area required for a standard soil absorption field in order to compensate for side wall loss.

5.3.3. Design and Construction. Absorption beds shall be constructed in conformance with the applicable requirements of Section 5.2 of Part C of this appendix and the following specifications:

5.3.3.a. Absorption beds shall have a maximum depth of thirty-six inches (36") and a minimum depth of eighteen inches (18").

5.3.3.b. The piping distribution network within absorption beds shall be installed so that the pipes are located eighteen inches (18") from the sides of the bed in a continuous or closed-circuit design, with a minimum of three feet (3') between pipes.

5.4. Shallow and Elevated Soil Absorption Systems.

5.4.1. Approvable Systems. Due to the shallowness of many West Virginia soils, a soil absorption system will often have to either be placed at a shallow depth or be elevated above the original ground surface in order to maintain the mandatory three (3) or more feet above the seasonal high water table or an impermeable layer of rock or soil. The construction of a shallow or elevated soil absorption system is approvable where there is a suitable layer of soil, sufficient space for the system, and a natural slope that is not excessively steep. Approvable shallow and elevated soil absorption systems include soil absorption mounds, shallow fields, and unique systems designed for specific situations.

5.4.2. Mound Systems. Due to their complex construction and limited operational history, mound systems shall only be considered when intended to serve existing residences, to correct health hazards, or in other special cases. Mound systems shall be designed and constructed in conformance with "Design and Construction Manual for Wisconsin Mounds," James C. Converse, Agricultural Engineering Department, College of Agricultural and Life Sciences, University of Wisconsin at Madison, 1978.

5.4.3. Shallow Fields. Shallow fields are similar to standard soil absorption fields, more easily constructed than mound systems, and may be considered for new residences. Shallow fields may be used where a pervious rock layer, an impermeable layer of rock or soil, or the seasonal high water table is within three and one-half feet (3½') of the ground surface and the site has a slope of less than fifteen percent (15%). Modified evapotranspiration systems may be used where a pervious rock layer, an impermeable layer of rock or soil, or the seasonal high water table is within four feet (4') of the ground surface and the site has a slope of less than fifteen percent (15%). Shallow fields and modified evapotranspiration systems shall be constructed in conformance with the applicable requirements of Section 5.2 of Part C of this appendix and the following specifications:

5.4.3.a. The bottoms of trenches shall be at least three feet (3') above pervious rock, impermeable rock or soil, and the seasonal high water table.

5.4.3.b. The depth of trenches in natural ground may be set between six inches (6") and eighteen inches (18"), the space between trenches may be set between six feet (6') and twelve feet (12'), and the depth of cover material may be set between eighteen inches (18") and thirty-six inches (36") depending upon the depth selected for the trenches.

5.4.3.c. Cover material shall be placed prior to the construction of the trench system in conformance with the procedures set forth in Table Q of this appendix.

5.4.3.d. The percolation rate to be used when designing a shallow field shall be the rate determined at the field installation depth by means of the procedures set forth in Table O of this appendix.

5.5. Dual Soil Absorption Fields.

5.5.1. Approvable Use. Dual absorption fields may be used at sites where the percolation rate, as determined by means of the procedures set forth in Table O of this appendix, is between sixty (60) and ninety (90) minutes per inch.

5.5.2. Sizing. Dual absorption fields shall be sized after consultation with the director.

5.5.3. Design and Construction. Dual absorption fields shall be designed to meet the dosing requirements set forth in Section 5.2.1.a of Part C of this appendix. A junction box or valving arrangement shall be provided for alternation of the fields.

6. Individual Sewage Systems with Surface Water Discharge.

6.1. Approvable Use. Individual sewage systems with a surface water discharge require a lengthy approval process and, if approved, regular operational supervision and maintenance. For these reasons, such systems shall only be considered for existing residences or establishments when all other means of treatment and disposal have proven ineffective and a real or potential public health hazard exists.

6.2. Effluent Disposal Ponds.

6.2.1. An individual sewage system may be designed so that effluent from a septic tank or home aeration unit discharges into an effluent disposal pond.

6.2.2. An effluent disposal pond shall be designed to handle an assumed loading of thirty-four (34) pounds of five-day biochemical oxygen demand per surface acre per day. The size of the pond shall be based upon an assumed twenty-five (25%) reduction in five-day biochemical oxygen demand from a correctly sized and designed septic tank or upon an assumed seventy percent (70%) reduction in five-day biochemical oxygen demand from a home aeration unit. No pond shall have a surface area of less than one thousand eight hundred (1,800) square feet.

6.2.3. An effluent disposal pond shall be constructed in accordance with the requirements of Section 12 of Part C of this appendix.

6.2.4. Effluent from an effluent disposal pond may be discharged either to an approved land treatment system or, if the proper State permits are obtained, to a receiving stream following disinfection.

6.3. Intermittent Surface Sand Filters.

6.3.1. An individual sewage system may be designed so that effluent from a septic tank or home aeration unit discharges to intermittent surface sand filters.

6.3.2. Intermittent surface sand filters preceded by a septic tank shall be designed to achieve a filtration rate of five (5) gallons per square foot per day. Intermittent surface sand filters preceded by a home aeration unit shall be designed to achieve a filtration rate of ten (10) gallons per square foot per day. Two (2) filters, each of design size, shall be provided in order to allow alternation of operation.

6.3.3. Intermittent surface sand filters shall be constructed of reinforced concrete or concrete block. The

structure and excavation shall be made watertight through the use of a manufactured liner of suitable thickness securely attached to the structure. The bottom of each filter excavation shall have a slope of one vertical to twelve horizontal (1:12) in order to create a sump at the center. The filter shall be composed of layers of media in the order, thickness, and content prescribed in Table R of this appendix. A minimum of twelve inches (12") of freeboard shall be provided above the surface of the top layer of media.

6.3.4. Influent piping to intermittent surface sand filters shall be four inch (4") or six inch (6") Schedule 40 PVC, cast iron, or ductile iron pipe. Influent pipes shall terminate at the center of each filter upon a three foot by three foot by four inch (3' x 3' x 4") concrete splash pad. An upward-pointing ell shall be installed on the end of each influent pipe and three (3) one inch (1") diameter holes shall be drilled in the bottom of each ell to facilitate drainage. Four inch (4") perforated underdrains of Schedule 40 PVC, or an approved equal, shall be placed on a slope of one vertical to ninety-six horizontal (1:96 or 1/8":1') and drain to the disinfection facilities.

6.3.5. Intermittent surface sand filters serving individual sewage systems shall be provided with an insulated cover to maintain operation during inclement weather and shall be dosed by a pump or by a sewage siphon.

6.3.6. Effluent from an intermittent surface sand filter may be discharged either to an approved land treatment system or, if the proper State permits are obtained, to a receiving stream following disinfection.

7. Composting Toilets.

7.1. Approvable Use. Composting toilets may be used only in conjunction with an approved grey water disposal system.

7.2. Design and Construction. The design and construction of a composting toilet shall meet the requirements of National Sanitation Foundation (NSF) Standard 41.

8. Incinerating and Chemical Toilets.

8.1. Approvable Use. Incinerating and chemical toilets may be used only in conjunction with an approved grey water disposal system. Incinerating or chemical toilets may be used in emergency or temporary use situations or for recreational or isolated residences.

8.2. Design and Construction. The design and construction of an incinerating or chemical toilet shall be approved by the director.

9. Grey Water Disposal Systems.

9.1. Approvable Use. Houses served by a grey water disposal system shall have a house sewer of not more than two inches (2") in diameter and shall not have garbage disposal units.

9.2. Design and Construction. Manufactured grey water disposal systems shall be approved by the director. Noncommercial grey water disposal systems shall consist of:

9.2.1. A soil absorption field designed based upon an assumed thirty percent (30%) reduction in water usage and constructed in accordance with the requirements set forth in Sections 5.1 and 5.2 of Part C of this appendix; and

9.2.2. A septic tank designed in accordance with the sizings set forth in Table S of this appendix.

10. Privies.

10.1. Location. No privy shall be located within twenty feet (20') of any occupied structure, roadside cut, or surface water body. No privy shall be located within ten feet (10') of any property line.

10.2. Design and Construction. Every privy shall be provided with:

10.2.1. Either an earthen bottom pit with watertight walls, if the conditions set forth in Section 10.3 of Part C of this appendix are met, or a watertight vault or receptacle with walls that extend at least six inches (6") above ground level;

10.2.2. A crowned curb, constructed of compacted earth or other suitable material and at least six inches (6") thick, that extends from the top of the walls of the pit, vault, or receptacle in all directions over the surface of the ground for a distance of eighteen inches (18");

10.2.3. A riser designed to prevent the entrance of flies when not in use; and

10.2.4. A vent pipe that extends from the pit, vault, or receptacle to a point at least twenty-four inches (24") above the roof of the superstructure or through the wall of the superstructure. The vent shall be screened to prevent the entrance of flies and other insects.

10.3. Earthen Bottom Pits. An earthen bottom privy pit may be used if:

10.3.1. The pit is located in a soil with a tested percolation rate that exceeds sixty (60) minutes per inch;

10.3.2. The pit is located down gradient and at least one hundred feet (100') from any water supply reservoir, spring, or well;

10.3.3. The pit is so located that its leachate will not create a nuisance or unsanitary condition; and

10.3.4. The pit is no more than four feet (4') deep and it has been determined, by the excavation of a seven foot (7') deep observation hole, that a pervious rock layer, an impermeable layer of rock or soil, or the seasonal high water table does not occur within three feet (3') of the bottom of the pit.

10.4. Sanitary Conditions. Every privy shall be designed to prevent flies, rats, and wild or domestic animals from entering the privy pit, vault, or receptacle. The contents of a privy pit, vault, or receptacle shall be removed as often as necessary to prevent the creation of a nuisance or unsanitary condition.

10.5. Grey Water Disposal. In conjunction with the use of a privy, an approved grey water disposal system shall be installed to serve those residences with indoor plumbing or running water for sinks and showers. For those residences without indoor plumbing, a shallow leach trench or pit may be installed for the disposal of grey water.

11. Recirculating Toilets.

11.1. Location. Recirculating toilets and the piping for such toilets shall be separated from and not connected to the potable water system of any residence or other structure.

11.2. Installation. Recirculating toilets shall be installed and operated in accordance with the manufacturer's instructions. Color-coded pipe shall be used to facilitate inspection and maintenance of such installations.

12. Self-Contained Excreta Disposal Systems.

12.1. Design and Construction. All fixtures, tanks, or receptacles used in self-contained excreta disposal systems shall be made of impervious, easily cleaned material. Tanks and receptacles shall be watertight, vented to the outside air, and constantly supplied with sufficient amounts of an approved chemical agent to process and deodorize the contents thereof.

12.2. Sanitary Conditions. Self-contained excreta disposal systems shall be designed to prevent flies, rats, and wild or domestic animals from having access to the contents thereof. The contents of tanks and receptacles shall be removed, and the tank or receptacle thoroughly cleaned, as often as necessary to prevent the creation of a nuisance or unsanitary condition.

13. Holding Tanks.

13.1. Approvable Use. Unless otherwise approved by the director, holding tanks shall not be used for periods of time in excess of six (6) months.

13.2. Location. Holding tanks shall be located in an area that is readily accessible for pumping under all weather conditions and where accidental spillage during pumping presents the least hazard to public health.

13.3. Sizing. Holding tanks shall be designed with a capacity sufficient to contain the one (1) week design flow from the facility served by the tank.

13.4. Design and Construction.

13.4.1. Holding tanks shall be designed to provide adequate access for pumping, cleaning, and maintenance through the use of manholes and cleanouts.

13.4.2. Holding tanks shall be provided with a high level alarm that will trigger when the tank is approximately two-thirds (2/3) full. This alarm shall be located inside the facility served by the tank.

13.4.3. Holding tanks shall be constructed in accordance with the requirements of Section 3 of Part C of this appendix with the exception that no openings or pipes through which the contents of the tank may be discharged shall be permitted.

13.5. Additional Requirements.

13.5.1. In order for the use of a holding tank to receive approval from the director, the applicant shall have entered into a contract with a licensed sewage tank cleaner that provides for pumping and maintenance of the tank on a regular schedule.

13.5.2. In order for the use of a holding tank to receive approval from the director, the applicant shall submit to the director a letter from the owner of a treatment works stating that his facility will accept the pumpings from the applicant's tank.

13.5.3. When deemed necessary to protect the public health, the director may require additional assurances from the applicant before approving the use of a holding tank.

14. Abandonment of Individual Sewage Systems.

14.1. Sewage Tanks. The contents of a sewage tank shall be removed by a licensed sewage tank cleaner or by another means approved by the director. If in a useable condition, the empty tank shall be removed and the excavation filled to eliminate any physical hazard. If not in a useable condition, the empty tank shall be filled with earth or a similar inert material and the excavation shall be filled to eliminate any physical hazard.

14.2. Electrical and Water Service. Electrical service to the individual sewage system shall be terminated and electrical service boxes, switches, meters, and similar equipment shall be removed. Any water service to the system shall be disconnected.

14.3. Hazardous Equipment. Potentially hazardous equipment associated with the individual sewage system shall be removed.

15. Sewage Tank Cleaning.

15.1. Tank Cleaning Vehicles.

15.1.1. A sewage tank cleaning vehicle and its chassis shall be of sufficient capacity to haul all equipment necessary for pumping and cleaning sewage tanks and transporting and disposing of collected sewage.

15.1.2. A sewage tank cleaning vehicle shall carry, in a conspicuous place, a sign with the name and address of the firm or operator under which business is conducted. All lettering shall be at least two inches (2") high.

15.1.3. Hand tools, such as picks and shovels, and other necessary items, such as sand and cement for repairing concrete sewage tanks, shall be carried on the sewage tank cleaning vehicle.

15.1.4. All portable receptacles used for transporting the contents of sewage tanks shall be easily cleaned, in good repair, and equipped with tight-fitting lids. All such receptacles shall be cleaned, deodorized, and disinfected daily or more often if necessary.

15.2. Carrier Tanks.

15.2.1. Carrier tanks shall be fully enclosed, leakproof, and fly-proof. Carrier tanks shall be operated in a

manner that prevents spillage during the collection, removal, transportation, and disposal of the collected sewage. Carrier tanks shall be used solely for the transport of collected sewage.

15.2.2. Carrier tanks shall be made of heavy gauge metal, preferably 10 to 12 gauge.

15.2.3. Carrier tanks shall have a capacity of at least seven hundred fifty (750) gallons (i.e., a capacity that will readily hold the contents of the average size sewage tank serving a single-family dwelling).

15.2.4. Carrier tanks shall be constructed to facilitate proper cleaning of the interior and exterior of the tank. Carrier tank exteriors shall be painted. Carrier tanks and their appurtenances shall be kept clean and in a state of good repair.

15.2.5. Carrier tanks shall be conspicuously and permanently labeled "FOR SEWAGE ONLY" near the outlet valve in letters that are at least two inches (2") high. The capacity of the carrier tank, in gallons, shall be conspicuously painted on the side of the tank. The permit number for the sewage tank cleaner shall be prominently displayed on the carrier tank.

15.2.6. Carrier tanks shall have a manhole in the top to provide for easy access to the tank interior for flushing and cleaning purposes. The manhole may be in combination with, or separate from, the filling connection.

15.2.7. Carrier tanks shall have an outlet valve so located that the entire contents of the tank can be drained.

15.2.7.a. The outlet valve opening shall be at least three inches (3") in diameter and shall have a nonleaking, nonclogging type valve for draining the tank.

15.2.7.b. The outlet valve shall be adapted for a standard hose connection to the pump for recirculating the contents of the tank if required prior to emptying or for pumping to the disposal site if gravity draining is not feasible.

15.2.7.c. In pumping from the carrier tank, an air inlet is recommended to prevent collapsing the tank.

15.2.7.d. Outlet valves shall be capped when not in actual use to prevent leakage or spillage of collected sewage. The cap shall be secured to the outlet valve by a chain.

15.2.8. Facilities shall be available for flushing, cleaning, and deodorizing sewage tanks, carrier tanks, and sewage tank cleaning implements or equipment.

15.2.8.a. A direct connection to a water distribution system for flushing or cleaning operations shall only be used when the water distribution system is protected by one (1) or more approved and properly located backflow prevention devices.

15.2.8.b. Wastes resulting from the flushing or cleaning operations shall be disposed of at a treatment works that has received approval from the director to accept wastes from licensed sewage tank cleaners.

15.2.8.c. Odor controlling substances may be left in the sewage tank, carrier tank, or other sewage tank cleaning implements or equipment but in no case shall such substances be used in lieu of proper cleaning.

15.3. Pumps and Hoses.

15.3.1. Only nonclogging, self-priming pumps capable of handling the contents of sewage tanks shall be used for sewage tank cleaning purposes.

15.3.2. The use of potable water under pressure to prime pumps or to operate aspirators is prohibited.

15.3.3. Hoses shall be flexible and so constructed that they can be easily cleaned. Hoses shall be of sufficient length for recirculating the contents of the sewage tank or carrier tank and to readily reach the point of discharge at the disposal site.

15.3.4. Hoses shall be kept clean and in a state of good repair and shall be used and stored in a manner that prevents the leakage or spillage of tank contents. When not in actual use, hoses shall be tightly capped.

16. Septage Treatment and Disposal.

16.1. Approvable Methods. Approvable methods of septage treatment and disposal include trenching, lime stabilization, certain alternative methods, and disposal at a public treatment works that has received approval from the director to accept septage.

16.2. Trenching.

16.2.1. Site Conditions.

16.2.1.a. The trench site shall be free of rock outcroppings and shall not be located in a 25-year floodplain.

16.2.1.b. In permeable soils, at least four feet (4') of soil shall exist between the bottom of any trench and any pervious rock layer, impermeable rock or soil layer, or the seasonal high water table.

16.2.1.c. In impermeable clay soils, at least two feet (2') of soil shall exist between the bottom of any trench and any pervious rock layer, impermeable rock or soil layer, or the seasonal high water table.

16.2.2. Site Construction.

16.2.2.a. The trench site shall be designed so that surface runoff shall be diverted away from the trenches and no discharge from the trenches shall exist.

16.2.2.b. Trenches shall not be located within one thousand feet (1,000') of any existing occupied structure.

16.2.2.c. The trench site shall be enclosed by a chain link fence at least six feet (6') high with a locked entrance gate designed to discourage the entrance of animals or unauthorized persons. Several signs stating the nature of the facility shall be installed on the fence.

16.2.3. Site Operation.

16.2.3.a. The septage shall be placed in a trench in small lifts of six to eight inches (6" to 8") in order to minimize drying time.

16.2.3.b. When a trench has been filled with septage, two feet (2') of soil shall be placed over the trench as final cover and a new trench shall be opened.

16.2.3.c. Sufficient room shall be left between trenches to allow for the movement of heavy equipment.

16.3. Lime Stabilization. The addition of lime in sufficient quantities will stabilize septage and destroy pathogenic organisms; however, there is no destruction of organic matter or solids reduction during the lime stabilization process. If lime stabilization is utilized, the septage shall be mixed together with lime until a pH greater than 12 is reached and shall then be held at that pH for at least two (2) hours.

16.4. Alternative Methods of Treatment and Disposal. Approvable alternative methods of septage treatment and disposal include composting, pressure chlorination, electron treatment, incineration, and conventional waste treatment. These methods of

septage treatment and disposal shall be approved by the director on a case-by-case basis. The lagooning of septage is not an approvable means of disposal.

16.5. Disposal at Public Treatment Works.

16.5.1. A septage hauler shall obtain written permission to dispose of septage from the owner of a public treatment works that has received approval from the director to accept septage.

16.5.2. Septage shall not be disposed of at public treatment works that have a capacity of less than one hundred thousand gallons per day (100,000 gpd) unless pretreatment is provided.

TABLE A

Minimum Design Loadings for Sewage Treatment Works

| Facility Description | Design Flow (gpd) | Design Loading (lbs $BOD_5$/day) |
|---|---|---|
| Airports | | |
| Per employee | 15 | .05 |
| Per passenger | 5 | .02 |
| Apartment Houses | | |
| One bedroom | 140 | .34 |
| Two bedrooms | 210 | .51 |
| Three bedrooms | 280 | .60 |
| Assembly Halls | | |
| Per seat | 2 | .02 |
| Beauty Parlors and Barber Shops | | |
| Per chair | 150 | .50 |
| Per operator | 20 | .02 |
| Boarding Houses (with no food service) | | |
| Per guest | 50 | .15 |
| Bowling Alleys (with no food service) | | |
| Per alley | 75 | .13 |
| Per alley, with a bar | 225 | ?? |
| Churches | | |
| Per member | 2 | .01 |
| Per member, with a kitchen | 5 | .02 |
| Clinics | | |
| Per patient | 5 | .02 |
| Per staff | 20 | .03 |
| Country Clubs | | |
| Per nonresident member | 25 | .05 |
| Per resident member | 70 | .17 |

TABLE A continued

Minimum Design Loadings for Sewage Treatment Works

| Facility Description | Design Flow (gpd) | Design Loading (lbs $BOD_5$/day) |
|---|---|---|
| Dentist Offices | | |
| Per chair | 200 | .10 |
| Per staff | 20 | .02 |
| Disco/Dance Halls | | |
| Per seat | 5 | .01 |
| Doctor Offices | | |
| Per patient | 5 | .01 |
| Per staff | 20 | .02 |
| Factories (per person) | | |
| Heavy, with a cafeteria and shower | 35 | .04 |
| Light, with a cafeteria or shower | 25 | .02 |
| Light | 20 | .02 |
| Hospitals | | |
| Per patient (per bed) | 300 | .34 |
| Per nonresident staff | 20 | .02 |
| Per resident staff | 100 | .17 |
| Hotels (exclusive of restaurants or bars) | | |
| Per guest | 50 | .15 |
| Industrial Parks (sanitary waste only) | | |
| Per developable acre | 500 | .84 |
| Institutions | | |
| Per resident | 70 | .17 |
| Laundries (coin-operated) | | |
| Per machine | 400 | 1.34 |
| Mine Bath Houses | | |
| Per worker | 15 | .03 |

TABLE A continued

Minimum Design Loadings for Sewage Treatment Works

| Facility Description | Design Flow (gpd) | Design Loading (lbs $BOD_5$/day) |
|---|---|---|
| Mobile Homes | | |
| Per three occupants | 210 | .51 |
| Motels (exclusive of restaurants or bars) | | |
| Per unit | 80 | .15 |
| Nursing and Rest Homes | | |
| Per resident | 150 | .26 |
| Per resident staff | 70 | .17 |
| Office and Warehouses | | |
| Per worker | 20 | .03 |
| Per worker, with food service | 25 | .04 |
| Recreation Areas (per person) | | |
| Picnic areas | 10 | .02 |
| Beaches | 10 | .02 |
| Campgrounds | 25 | .05 |
| Amphitheaters | 5 | .01 |
| Historic sites | 5 | .01 |
| Parks | 10 | .02 |
| Lodges | 70 | .17 |
| Park residences | 70 | .17 |
| Park washhouses | 30 | .05 |
| Restaurants | | |
| 24-hour service, per seat | 50 | .17 |
| Normal hour service, per seat | 30 | .10 |
| Curb service, per car space | 50 | .17 |
| Fast food, per seat | 25 | .06 |
| Schools (per person) | | |
| Elementary school | 8 | .02 |
| High school | 10 | .03 |
| Boarding school | 70 | .17 |

TABLE A continued

Minimum Design Loadings for Sewage Treatment Works

| Facility Description | Design Flow (gpd) | Design Loading (lbs $BOD_5$/day) |
|---|---|---|
| Service Stations | | |
| 24-hour service | 1,000 | 1.60 |
| Normal service | 500 | .80 |
| Shopping Malls | | |
| Per 100 square feet | 15 | .03 |
| Shopping Centers | Based upon individual store occupancy | |
| Summer Cottages | | |
| Per resident | 50 | .17 |
| Swimming Pools | | |
| Per swimmer | 5 | .01 |
| Per swimmer, with showers | 7 | .02 |
| Taverns and Bars (with little or no food service) | | |
| Per seat | 20 | .04 |
| Theatres | | |
| Drive-in, per car space | 4 | .008 |
| Movie, per seat | 2 | .004 |
| Travel Trailer Parks (per resident) | | |
| No water to the site | 35 | .075 |
| With water to the site | 50 | .10 |

TABLE B

Minimum Slope for Gravity Sewers

| Sewer Size | Slope in feet per 100 feet |
|---|---|
| 6" | 0.62 |
| 8" | 0.40 |
| 10" | 0.28 |
| 12" | 0.22 |
| 14" | 0.17 |
| 15" | 0.15 |
| 16" | 0.14 |
| 18" | 0.12 |
| 21" | 0.10 |
| 24" | 0.08 |
| 27" and larger | 0.07 |

TABLE C

Minimum Specifications for Gravity Sewer Pipe

A. House Connection to Collector Sewers

1. Clay - ASTM C 700
2. Plastic - ASTM D 2729, D 2751, D 2836, D 2852
3. Ductile Iron - AWWA C-110, C-151, Cement lined
4. Cast Iron - ASTM A 74
5. Concrete - ASTM C 14

B. Collector and Interceptor Sewers

1. Clay - ASTM C 700
   a. Joints shall meet the requirements of ASTM C 425.
   b. Slip seal joints shall not be used.
   c. Cement joints shall not be used.
2. Plastic - ASTM D 3033, D 3034, F 789
3. Composite - ASTM D 2680
4. Ductile Iron - AWWA C-110, C-151, Cement lined
5. Cast Iron - AWWA C-108, Cement lined
6. Concrete - ASTM C-76

TABLE D

Minimum Specifications for Spare Pump Units
for Grinder Pumps, Effluent Pumps, and Vacuum Valves

| Installed Units | Spare Units |
|---|---|
| 1 to 10 | 1 |
| 11 to 20 | 2 |
| 21 to 30 | 3 |
| 31 to 40 | 4 |
| 41 to 50 | 5 |
| 51 to 75 | 6 |
| 76 to 100 | 7 |
| 101 to 150 | 8 |
| 151 to 200 | 9 |
| 201 to 300 | 10 |
| 301 to 400 | 11 |
| 401 to 500 | 12 |
| greater than 501 | As approved by the director |

TABLE E

Buffer Zone Requirements for Treatment Works

| | Buffer Zone Required |
|---|---|
| Package Sewage Treatment Plants | |
| 40,000 gpd or less | 100 feet |
| 40,001 to 100,000 gpd | 200 feet |
| greater than 100,000 gpd | 300 feet |
| polishing ponds | 100 feet |
| package sand filters | 100 feet |
| alternating surface sand filters | 100 feet |
| TKN removal equipment | 100 feet |
| aerated lagoons | 100 feet |
| stabilization ponds | 300 feet |
| trickling filters | 300 feet |
| land treatment systems | 300 feet |

Note: These buffer zone requirements may be waived by the director if suitable screening techniques and odor control are provided. These requirements do not apply to existing treatment works that are being upgraded or expanded.

TABLE F

Color Scheme for Treatment Works Piping

| Line | Color |
|---|---|
| Sludge line | Brown |
| Gas line | Orange |
| Potable water line | Blue |
| Chlorine line | Yellow |
| Sewage line | Gray |
| Compressed air line | Green |
| Water lines for heating digesters or buildings | Blue/Red* |

* Blue with six-inch red bands spaced thirty inches apart.

Note: The contents of each pipe shall be stenciled on the piping in a contrasting color.

TABLE G

Permissible Aeration Tank Capacities and Loadings

| Process | Aeration Tank Organic Loading (pounds $BOD_5$ per day per 1000 cubic feet) | F/M Ratio (pounds $BOD_5$ per day per pound MLSS) | Mixed Liquor Suspended Solids* (mg/l) |
|---|---|---|---|
| Conventional | 40 | 0.2 - 0.5 | 1,000 - 3,000 |
| Step Aeration | 40 | 0.2 - 0.5 | 1,000 - 3,000 |
| Complete Mix | 40 | 0.2 - 0.5 | 1,000 - 3,000 |
| Contact Stabilization | 50** | 0.2 - 0.5 | 1,000 - 3,000 |
| Extended Aeration | 15 | 0.05 - 0.1 | 3,000 - 5,000 |
| Oxidation Ditch | 15 | 0.05 - 0.1 | 3,000 - 5,000 |

* Mixed Liquor Suspended Solids (MLSS) values are dependent upon the surface area provided for sedimentation and the rate of sludge return as well as the aeration process.

** Total aeration capacity including both contact and reaeration capacities. Normally the contact zone provides thirty to thirty-five percent (30% to 35%) of the total aeration capacity.

Note: The values above apply to treatment works receiving peak to average daily load ratios ranging from about two to one (2:1) to four to one (4:1). Thus, the utilization of flow equalization facilities to reduce the daily peak organic load may be considered by the director as a justification to approve organic loading rates that exceed those specified above.

TABLE H

Minimum Air Requirements for Aeration Equipment

| Process | Cubic Feet of Air Available per Pound of $BOD_5$ Loading in the Aeration Tank |
|---|---|
| Conventional | 1,500 |
| Step Aeration | 1,500 |
| Contact Stabilization | 1,500 |
| Modified or "High-Rate" | 400 to 1,500* |
| Extended Aeration | 2,600 |

* Depending upon the expected $BOD_5$ removal.

Note: Air volume requirements for channels, pumps, and similar appurtenances shall be added to the above figures when designing the appropriate aeration equipment.

TABLE I

Sludge Return Rates

| | Sludge Return Rate as a Percentage of the Influent Flow | |
|---|---|---|
| | Minimum | Maximum |
| Standard Rate | 15% | 75% |
| Carbonaceous Stage of Second-Stage Nitrification | 15% | 75% |
| Step Aeration | 15% | 75% |
| Contact Stabilization | 50% | 150% |
| Extended Aeration | 50% | 150% |
| Nitrification Stage of Second-Stage Nitrification | 50% | 200% |

Note: The rate of sludge return shall be varied by means of variable speed motors, drivers, air lifts, or timers to pump sludge at the above rates.

TABLE J

Acceptable Media Sizes for Trickling Filters

| Media Size | Percent Acceptable |
|---|---|
| Passing through a 4½" screen | 100% by weight |
| Retained on a 3" screen | 95% - 100% by weight |
| Passing through a 2" screen | 0 - 2% by weight |
| Passing through a 1" screen | 0 - 1% by weight |

TABLE K

Design Formulas for Aeration Basins

$$t = \frac{\%\ \text{removed}}{(100 - \%\ \text{removed})\ K_T} = \text{days detention}$$

where $K_T = 0.5\ (1.075)^{T-20}$ and

T = average year-round air temperature at the site in $^{o}C$.

The dissolved oxygen level should be a minimum of two milligrams per liter (2.0 mg/1).

The ratio of oxygen transfer should be assumed to be nine-tenths (0.9).

The oxygen requirement should be based upon one and one-half (1.5) pounds of oxygen per pound of biochemical oxygen demand to be removed.

TABLE L

Minimum Capacities for Septic Tanks

1. Single-Family Dwellings

| Number of Bedrooms | Minimum Tank Capacity |
|---|---|
| 2 or less | 750 gallons |
| 3 or 4 | 1,000 gallons |
| 5 or more | 250 gallons for each additional bedroom |

2. Structures Other Than Single-Family Dwellings

| Average Daily Flow (ADF)* (gallons per day) | Minimum Tank Capacity+ (gallons) |
|---|---|
| Up to 1,500 | 1.5 X ADF |
| 1,500 to 4,000 | 1,000 + (0.75 X ADF) |
| 4,000 to 5,000 | ADF |

* Average daily flow may be calculated using the design flows listed in Table A of this appendix.

+ The minimum tank capacity for commercial establishments utilizing garbage grinders shall be increased by twenty percent (20%). However, garbage grinders are not recommended for any septic tank system, either residential or commercial.

TABLE M

Recommended Dimensions for Concrete Septic Tanks

| Tank Capacity | Interior Length | Interior Width | Interior Depth | Sewage Depth |
|---|---|---|---|---|
| 750 gallons | 6'-8" | 3'-4" | 5'-4" | 4'-6" |
| 1,000 gallons | 8'-0" | 3'-4" | 6'-0" | 5'-0" |
| 1,250 gallons | 8'-8" | 4'-0" | 6'-0" | 5'-0" |
| 1,500 gallons | 10'-0" | 4'-0" | 6'-6" | 5'-0" |
| 2,000 gallons | 12'-0" | 4'-6" | 6'-6" | 5'-0" |
| 2,500 gallons | 13'-6" | 5'-0" | 6'-6" | 5'-0" |

TABLE N

Minimum Horizontal Separation Distances Between
Soil Absorption Systems and Natural and Man-Made Features

| Distance | Feature |
|---|---|
| 10 feet | Foundation drains that are up slope from the disposal area. |
| 20 feet | Foundation drains that are down slope from the disposal area. |
| 20 feet | Stream banks and open drainage features, whether man-made or natural. |
| 20 feet | Man-made cuts in soil and curtain drains. |
| 50 feet | Man-made cuts that intersect rock or shale. |
| 100 feet | Water supply reservoirs, springs, or wells. |

TABLE O

Percolation Test Procedures for Siting Soil Absorption Fields

At least four (4) test holes shall be placed at equal distances over the proposed absorption field site. The following steps shall be taken to perform the necessary percolation tests:

1. Dig or bore holes from six to eight inches (6" to 8") in diameter at the proposed absorption field site. The holes shall be dug or bored to the depth of the proposed field but in no case shall be less than twenty-four inches (24") deep.

2. Scratch the bottom and sides of each hole with a sharp, pointed instrument or wire brush in order to remove any smeared soil surfaces which may interfere with the absorption of water.

3. Remove the loose dirt from the bottom of each hole and place two inches (2") of coarse sand or fine gravel into the hole to prevent sealing.

4. Place a 10-penny nail or similar marker in the wall of each hole at a point exactly six inches (6") above the level of sand or gravel.

5. Completely fill each hole with water to ground level. Keep water in the holes to a depth of at least twelve inches (12") for at least four (4) hours before beginning the percolation rate measurement.

6. Adjust the water depth in the holes to the level of the nail or marker. Accurately determine how many minutes it takes for all of the water to be absorbed into the soil. This time in minutes, divided by six (6), gives the rate of fall per inch.

7. Average the rate of fall for all test holes (i.e., add the rate of fall for each test hole together and divide by the number of test holes). This figure is the percolation rate used in calculating the size of the soil absorption field required. If the tests show extreme variations between holes, it may be necessary to relocate the field in a more suitable area.

8. Excavate a six foot (6') deep observation hole in the center of the proposed absorption field to evaluate the soil depth to any pervious rock layer, to any impermeable rock or rock layer, and to the seasonal high water table. If slopes at the proposed site exceed fifteen percent (15%), the observation hole shall be excavated at the location of the lowest proposed trench of the serial system.

TABLE P

The Sizing of Soil Absorption Systems

1. Single-Family Dwellings

| Percolation Rate* | Minimum Area of Soil Absorption System |
|---|---|
| Less than 5 minutes | Consult with the director |
| 5 to 10 minutes | 200 $ft^2$ per bedroom |
| 11 to 30 minutes | 250 $ft^2$ per bedroom |
| 31 to 45 minutes | 300 $ft^2$ per bedroom |
| 46 to 60 minutes | 400 $ft^2$ per bedroom |
| Over 60 minutes | Consult with the director |

2. Structures Other Than Single-Family Dwellings

| Percolation Rate* | Minimum Area of Soil Absorption System |
|---|---|
| Less than 5 minutes | Consult with the director |
| 5 to 10 minutes | 1,650 $ft^2$ per 1,000 gpd |
| 11 to 30 minutes | 2,500 $ft^2$ per 1,000 gpd |
| 31 to 45 minutes | 2,950 $ft^2$ per 1,000 gpd |
| 46 to 60 minutes | 3,300 $ft^2$ per 1,000 gpd |
| Over 60 minutes | Consult with the director |

* Determined by tests conducted in conformance with the procedures set forth in Table O of this appendix.

TABLE Q

Procedures for Placing Cover Material on a Shallow Field

A. Scarify the area, removing all vegetation prior to placing the cover material. Be careful to minimize the amount of soil removed in this step.

1. Plow the area to be filled with a moldboard plow. Use as large a plow as possible to reduce the number of driven-in furrows which result in compaction of the subsoil. Plow perpendicular to the direction of the surface slope, so the plow throws soil up slope, to a depth of seven to eight inches (7" to 8").

2. Plow only when the moisture content of the soil is low in order to avoid compaction and puddling. That is, plow only when the soil is friable or dry and falls apart when rolled into a "wire." If a fragment of soil approximately nine inches (9") below the surface can be easily rolled into a "wire," the soil should not be plowed since the moisture content is too high.

3. Keep all vehicular traffic off of the plowed area once plowing is completed. Minimize the time between plowing and filling; immediate filling after plowing is highly preferable. If it rains after plowing is completed, wait until the soil dries out before placing the cover material.

B. Place the cover material on the scarified area.

1. Place cover material around the edges of the scarified area. Suitable cover material shall consist of soil with a natural permeability of less than thirty (30) minutes per inch which contains no large, coarse fragments or debris. Keep the wheels of the dump truck off the scarified area as much as possible in order to reduce compaction and ruts.

2. Cover the scarified area in lifts of eight to twelve inches (8" to 12"). Compact each lift to not less than ninety-five (95%) of the maximum density. Initially, try to keep at least six inches (6") of fill under the tracks of the dump truck in order to minimize sealing.

3. Place cover material on the scarified area until the desired elevation is achieved.

C. Landscape the filled area by planting grasses on the surface after constructing trenches in conformance with the requirements set forth in Section 5.2 of Part C of this appendix.

TABLE R

Media Layers for Intermittent Surface Sand Filters

| Order of Layers | Thickness | Media Size | Content |
|---|---|---|---|
| First (Bottom) Layer | 3" | 1½" x 3/4" | washed gravel |
| Second Layer | 3" | 3/4" x 1/4" | washed gravel |
| Third Layer | 3" | 1/4" x 1/8" | washed gravel |
| Last (Top) Layer | 18" | | filter sand approved by the director |

TABLE S

Minimum Capacities for Septic Tanks
Used With Grey Water Disposal Systems

| Number of Bedrooms | Minimum Tank Capacity |
|---|---|
| 2 or less | 500 gallons |
| 3 or 4 | 750 gallons |
| 5 or more | 210 gallons for each additional bedroom |