CHAPTER 656. WATER POLLUTION CONTROL FACILITY CONSTRUCTION STANDARDS

SUBCHAPTER 3. PERMIT PROCEDURES

252:656-3-1. Permitting process

(a) This Subchapter implements the permitting process of Part 4, Wastewater and Wastewater Treatment Systems, 27A O.S. § 2-6-401 et seq., and the Oklahoma Uniform Environmental Permitting Act, 27A O.S. § 2-14-101 et seq.

(b) Permits are required for the construction or modification of non-industrial wastewater and water reuse systems.

(c) The permit application is a two-step process:

(1) The first step is the submission of an engineering report (as described in 252:656-3-4); and

(2) The second step is the submission of the final design report along with the required application forms and fees. The final design report shall:

(A) include 2 sets of plans and specifications, with at least one set of plans printed on 11" x 17" paper and at least one set of specifications loosely bound and suitable for scanning, or alternatively submit through DEQ's electronic submission portal as authorized, and

(B) reflect any changes from the approved engineering report. Provided, an authorized design-build project may use the flexible permitting process upon approval by DEQ as provided in these rules. If design-build is used, the final design package must encompass the entire completed project.

(d) Unless an extension is granted, a construction permit expires if construction does not begin within one year from the date the permit is issued.

(e) Permits to construct or modify non-industrial wastewater and water reuse systems shall only be issued to public entities unless all components of the proposed systems, including all service lines, are located on property:

(1) owned by the applicant, or

(2) dedicated to the applicant through a recorded easement for the installation and operation of the system.

252:656-3-2. Applications

(a) **Permit application requirements.** Applicants seeking permits to construct either a non-industrial wastewater or water reuse system shall submit the following to DEQ:

(1) an application;

(2) the appropriate fee;

(3) two (2) copies of an engineering report in compliance with OAC 252:656-3-4, or alternatively submit through DEQ's electronic submission portal as authorized;

(4) two (2) sets of plans and specifications, or alternatively submit through DEQ's electronic submission portal as authorized; and

(5) documentation of adequate financial accountability.

(b) **Application.** The application shall be complete and legible and include:

(1) the type of entity that is applying for the permit,

(2) the legal description of the property where the system will be located,

(3) a final design analysis,and

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(4) a list of all applicable ASTM standards required for construction, installation and testing of the processes and equipment listed in the plans and specifications.

(c) **Governing body and authority of public entity.** Public entities other than municipalities shall provide certified copies of the results of the last election or appointment of the members of the governing body. Public entities must also provide citations to their legal authority to own and operate the proposed facility.

(d) **Notice to political subdivision.** If the proposed facility is to be located within a political subdivision, the applicant must notify the political subdivision.

(e) **Financial accountability.** All applicants must demonstrate they have adequate financial accountability, and technical and managerial capacity to comply with the requirements of this Chapter and to continuously maintain the facility.

(1) If the applicant is not a city, town or other public entity, the applicant must demonstrate to the satisfaction of the DEQ:

(A) that the applicant can cover the expected costs for operation and maintenance, replacement and closure;

(B) that the applicant can provide for the continued existence and financial accountability of the facility;

(C) that provisions have been made for continued existence of the operating entity for the expected life of the facility; and

(D) that all components of the non-industrial wastewater or water reuse system, including service lines, are located on property under the control of the applicant through a recorded easement or ownership of the property. [See 27A O.S. § 2-6-401(A)].

(2) Financial accountability may be demonstrated in one of the following fashions:

(A) The applicant must provide proof of a sufficient amount on deposit to the credit of a trust, the powers of which are to operate and maintain the wastewater system for the expected life of the facility; or

(B) Other proof of financial viability, such as the issuance of a bond or insurance contract covering the operation and maintenance of the wastewater system may be submitted to DEQ for approval; and

(3) Costs for closure of the wastewater system as required by law must be included in any funding plan.

(f) **Transferring applications.** Applications and unexpired permits may be transferred upon showing the transferee has legal authority and financial accountability, and that both parties agree to the transfer.

(g) **Compliance with permit.** Applicants shall:

(1) construct wastewater and water reuse systems according to the plans and specifications approved by DEQ;

(2) comply with the terms of the permits that are issued by DEQ. Permits may contain provisions more stringent than these rules in order to meet water quality standards;

(3) not proceed with construction before the permit is issued by DEQ; and
(4) not deviate from the approved plans and specifications.

252:656-3-4. Engineering report

(a) Applicants shall submit to DEQ two (2) copies of the engineering report, or alternatively submit through DEQ's electronic submission portal as authorized, or alternatively submit through DEQ's electronic submission portal as authorized;for proposed new construction or modifications to sewage collection systems, or treatment works at least thirty (30) days prior to the submittal of plans and specifications. Applicants shall also submit a letter in which the applicant endorses the contents of each engineering report submitted to DEQ. For line extension and lift station construction, the submission of an Engineering Report Form, developed by DEQ, signed and sealed by an engineer licensed by the State of Oklahoma, may be submitted to meet the requirements of the necessary engineering report, unless a full engineering report is required by DEQ. Engineering reports shall include:

(1) **Volume and strength of sewage flow.** Establish the existing and anticipated design average and design peak flows and waste load for the existing and ultimate conditions. Include the basis for projecting initial current and/or future dry and wet weather flows and waste load for the existing, or initial, service area, and the anticipated future service area. For discharging facilities, the report must demonstrate that the proposed project complies with the design flow in the 208 Plan and other applicable OPDES permit limits.

(2) **Existing system.** Describe the existing system, including the need for the project related to health and safety, system operations and maintenance, and population growth. Issues that must be addressed include, but are not limited to, suitability of existing facilities for continued use, adequacy of water supply, history of compliance with state and federal requirements, and comparison of existing treatment units with state and federal design requirements.

(3) **Project description and alternatives.** The report must contain a description of the alternatives that were considered to meet the identified need. Provide a service area and project site maps showing the existing and proposed systems. The information must describe legal and natural boundaries, major obstacles, elevations, and any other information necessary to properly evaluate the project. Describe the proposed project and, where two or more solutions exist, discuss the alternatives including cost analysis and discuss the reasons for selecting the one recommended. For each alternative considered, the report must provide the following:

(A) **Description.** A description of the collection system, pumping systems, treatment, and discharge facilities associated with each alternative as applicable.

(B) **Design criteria.** The design parameters used for evaluation purposes.

(C) **Schematic.** A schematic diagram(s) of all existing and proposed treatment processes.

(D) **Land requirements.** The identification of sites and easements that will be used and whether the sites:

(i) are currently owned or leased by the applicant, or
(ii) will be acquired or leased by the applicant.

(E) **Construction problems.** A discussion of concerns such as subsurface rock, high water table, limited access, or other conditions that may affect the cost of construction or the operation of the facility.

(F) **Advantages and disadvantages.** A description of the ability of each alternative to meet the owner's needs, address violations cited in any enforcement orders, satisfy public and environmental concerns, and comply with regulatory requirements. The report must demonstrate the compatibility of each alternative with existing, comprehensive, and area-wide development plans. Provide a short description of environmental impacts that may preclude any alternatives.

(G) **Selected alternative.** A complete description of the proposed project based on the general description presented in the evaluation of alternatives. The report must show that the proposed project will comply with all the requirements of this Chapter. At a minimum, the following information must be included:

(i) **Treatment.** A description of the processes, including biosolids management, in detail and the identification of the location of the plant and the site of any discharges; a status of compliance with the 208 Plan, and if applicable, include current revisions with copy of DEQ approval letter, if approved in the current 208 Plan.

(ii) **Pumping stations.** The size, type, location and any special power requirements, including provisions for emergency operations, of all pumping stations.

(iii) **Collection system layout.** Identify general location of line improvements, including: lengths, sizes and key components.

(iv) **Calculations.** Provide supporting calculations in sufficient detail to demonstrate compliance with DEQ design requirements to assure adequate capacity for the collection and treatment system as a whole to transport and treat the wastewater or reclaimed water. For collection system projects, the submittal must include a map with a list of manholes and pipes and the associated characteristics, such as elevation of inverts, pipe diameter, pipe segment length, and other information necessary to evaluate the project. The report must provide assurance that the receiving collection and treatment systems have adequate capacity.

(4) **Construction sequence.** A description of the sequence of construction and steps needed to maintain compliance during construction. If the project is not to be completed in one sequence, then provide details of the phases.

(5) **Site.** Describe the topography, soils, geologic conditions, depth to bedrock, groundwater level, floodway or floodplain considerations, and other pertinent site information. The project must be constructed on the site consistent with approved plans. Include 6 months of data on the groundwater level. Provide soil boring information pursuant to OAC 252:656-11-3 (a) for projects that include lagoons or other non-industrial impoundments.

(6) **Water supply.** Identify surface water intakes within five (5) miles of the discharge and known public and private water wells within three hundred feet (300').
(7) **Receiving stream.** Identify the receiving stream and its wasteload requirements according to the Water Quality sections of OAC 252:606 and Oklahoma's Water Quality Management Plan (208 Plan).
(8) **Disposition of biosolids.** Discuss the available alternatives for biosolids reuse and/or disposal (OAC 252:606 and OAC 252:515). Submit a sludge management or sludge disposition plan to DEQ for approval. All biosolids that will be land applied and/or disposed in a landfill must comply, at a minimum, with the Class B pathogen reduction requirements contained at 40 CFR, Part 503, adopted by reference at OAC 252:606.
(9) **Industrial wastes.** Discuss the characteristics and volume of anticipated industrial wastes.
(10) **Collection system.** Describe the area to be served by existing and proposed sewers. Sewer capacities must be designed for the estimated ultimate population that will be served. Similarly, consideration must be given to the maximum anticipated loadings from institutions, industrial parks and other similarly situated facilities.
(11) **Financing.** Provide itemized cost estimates to build, operate and maintain the proposed project including, but not limited to:

(A) development, construction, land and rights-of-way, legal services, engineering services, contingencies, refinancing, and any other factors associated with the proposed project;
(B) discuss financing methods;
(C) provide information regarding rate structures, annual operating and maintenance (O&M) cost, tabulation of users by monthly usage categories and revenue received for the last three fiscal years; and
(D) give status of existing debts and required reserve accounts. Include a schedule of short-lived assets and a recommended annual reserve deposit to fund replacement of short-lived assets such as pumps, paint and small equipment.

(12) **Enforcement orders.** Discuss all applicable enforcement orders, including the violations cited in the orders and how the project will eliminate said violations.
(13) **Conclusions and Recommendations.** Provide any additional findings and recommendations that must be considered in development of the project. This must include:

(A) recommendations for a specific course of action to be undertaken;
(B) any special studies to be developed;
(C) highlight the need for special coordination, include a recommended plan of action to expedite project development, etc.

(14) **Project Schedule.** The report must propose a schedule to:

(A) obtain funds to complete the proposed project;
(B) submit construction plans, specifications, and permit application(s);
(C) start construction;
(D) complete construction, and
(E) attain compliance with applicable OPDES discharge permits.

(b) **Water reuse treatment and reclaimed water distribution systems.** Applicants shall submit to DEQ two (2) copies of the engineering report for proposed new construction or modifications to water reuse treatment and reclaimed water distribution systems. Engineering reports shall be submitted at least thirty (30) days prior to the submission of plans and specifications and all engineering reports submitted to DEQ shall be signed and sealed by an engineer licensed by the State of Oklahoma. Applicants shall also submit a letter in which the applicant endorses the contents of each engineering report submitted to DEQ. For line extension and lift station construction, the submission of an Engineering Report Form, developed by DEQ, signed and sealed by an engineer licensed by the State of Oklahoma, may be submitted to meet the requirements of the necessary engineering report, unless a full engineering report is required by DEQ. Engineering reports shall include the following, as applicable:

(1) **Volume and quality of reclaimed water flow.** Describe anticipated flow from wastewater treatment works to the water reuse treatment facility. For discharging facilities, the report must demonstrate how the proposed project impacts the design flow in the 208 Plan and other applicable OPDES permit limits.

(2) **Existing system.** Describe existing wastewater treatment and water reuse systems. Descriptions shall include: the suitability of existing facilities for continued use, adequacy of water supply and the facility's history of compliance with state and federal requirements.

(3) **Project description.** Provide service area and project site maps showing the existing and proposed systems. The information shall describe legal and natural boundaries, elevations, major obstacles and any other information necessary to properly evaluate the project. Project descriptions shall include the following:

(A) **Description.** A description of the wastewater treatment system preceding the water reuse treatment facility.

(B) **Design criteria.** The design parameters used for evaluation purposes.

(C) **Schematic.** Schematic diagrams of all existing and proposed treatment processes.

(D) **Land requirements.** Identification of the sites and easements that will be used and whether the sites:

(i) are currently owned or leased by the applicant, or

(ii) will be acquired or leased by the applicant.

(E) **Treatment.** A detailed description of the treatment processes, including biosolids management, identification of the location of the plant and the site of any discharges:

(i) **Pumping stations.** Identify the size, type, location, any special power requirements and provisions for emergency operations of all pumping stations.

(ii) **Reclaimed water distribution system layout.** Identify the general locations of line improvements, including lengths, sizes and key components.

(iii) **Calculations.** Provide supporting calculations in sufficient detail to demonstrate compliance with DEQ design requirements.

(4) **Construction sequence.** A description of the sequence of construction and steps needed to maintain compliance during construction. If the project is not to be

completed in one sequence, then provide details of the phases.

(5) **Site.** Describe the topography, soils, geologic conditions, depth to bedrock, groundwater level, floodway or floodplain considerations, and other pertinent site information. The project must be constructed on the site consistent with approved plans. Include 6 months of data on the groundwater level. Provide soil boring information pursuant to OAC 252:656-11-3 (a) for projects that include lagoons or other non-industrial impoundments.

(6) **Biosolids handling.** If the proposed project will increase the production of biosolids and/or residuals, provide a description of any modifications necessary to properly treat and dispose of biosolids. All biosolids that will be land applied and/or disposed in a landfill must comply, at a minimum, with the Class B pathogen reduction requirements contained at 40 CFR, Part 503, adopted by reference at OAC 252:606. Submit a sludge management or sludge disposition plan as appropriate to the DEQ for approval.

(7) **Reclaimed water distribution system.** A description of the following:

(A) The location, size, and direction of flow of all existing and proposed reclaimed water distribution lines from the point of connection with the existing or proposed treatment works or storage locations to the end user.

(B) A summary of quantities that includes, at a minimum, pipe size, materials and linear feet of piping, types of testing and number and size of pumps.

(C) The disinfection system design based on one of the following criteria:

(i) maintaining a chlorine residual to end-of-pipe pursuant to Appendix A of OAC 252:627; or

(ii) a DEQ approved calibrated model of chlorine decay rate in the distribution system to demonstrate that adequate chlorine residual will be maintained to prevent slime growth and regrowth of pathogens to end-of-pipe.

(8) **Financing.** Itemized cost estimates to build, operate and maintain the proposed project including, but not limited to:

(A) development, construction, land and rights-of-way, legal services, engineering services, contingencies, refinancing, and any other factors associated with the proposed project;

(B) financing methods;

(C) information regarding rate structures, annual operating and maintenance (O&M) cost, tabulation of users by monthly usage categories and revenue received for the last three fiscal years; and

(D) the status of existing debts and required reserve accounts. Include a schedule of short-lived assets and a recommended annual reserve deposit to fund replacement of short-lived assets such as pumps, paint and small equipment.

(9) **Enforcement orders.** A discussion of all enforcement orders, identifying the violations cited in orders and explaining how the project will eliminate those violations.

(10) **Conclusions and Recommendations.** All engineering reports shall include a recommendation for a specific course of action to be undertaken. The conclusions and

recommendations shall also include any additional findings, identify any special studies to be developed, and any other recommendations that must be considered in development of the project.

(11) **Project Schedule.** A proposed schedule to obtain funds to:

(A) complete the proposed project;

(B) submit construction plans, specifications, and permit application(s);

(C) start construction;

(D) complete construction; and

(E) attain compliance with applicable OPDES discharge permits.

(c) Authorized design-build projects may use the flexible permitting process as approved in the engineering report, including:

(1) Label cover documents prominently as "Design-build;"

(2) Provide completed attestation form from applicant certifying that project is design-build;

(3) Description of design packages, including the number (maximum of six), scope of each package, expected schedule of each package, and expected schedule of completion for major construction items;

(4) The engineering report will address the entire scope of the project at 100% completion.

SUBCHAPTER 11. LAGOON STANDARDS

252:656-11-2. Basis of design

(a) **Facultative Lagoons.** Facultative lagoons depend on the relationship between organic loading and surface area (algal photosynthesis) or on surface area and supplemental mechanical aeration to provide an aerobic layer of water at the surface. Facultative lagoons may be either total retention or flow-through (discharge) to waters of the state.

(b) **Flow-through lagoons.**

(1) **Organic loading.** Limit the organic load to 35 pounds BOD per acre (water surface area) per day for any cell depending solely on algal photosynthesis for oxygen. The total water surface area requirement based on organic loading is calculated at the average water depth. Flow-through lagoon systems will not consistently provide ammonia removal through the nitrification process so the effluent from these facilities may be toxic to aquatic life and thus cause whole effluent toxicity test failures.

(2) **Flow Control.** Provide at least two primary cells on new systems. Design the primary cells so they may be operated in either series or in parallel, with at least 60 days retention time. Provide at least two secondary cells operating in series with the primary cells and in series with each other. Provide a bypass line around any secondary cell in a series to the next cell. The secondary cells shall have at least 60 days detention for a total of at least 120 days detention in the system.

(3) **Depth.** The maximum water depth shall not exceed 6 feet in primary cells and 10 feet in secondary cells. Provide structures to allow the primary cells to operate between four foot depth and the maximum design depth plus three feet of freeboard. The operating depth for a flow-through lagoon shall be between 4 and 6 feet.

(c) **Total Retention.** Size the primary cell(s) for the expected organic loading and additional evaporation cells designed for the hydraulic load. Base the design of all cells receiving raw wastewater on an organic loading of 35 lbs BOD per surface acre per day at the average operating depth. Design the primary cells so they may be operated in either series or in parallel.

(1) **Surface evaporation.** Where more than one acre of surface area is needed, provide at least two cells. For those systems greater than five (5) acres surface area provide at least two primary cells.

(A) Provide sufficient area to evaporate the annual influent flow based on the average daily design flow with allowances for infiltration and inflow to the sewage collection system.

(B) Base the evaporation rates on the annual average pan evaporation minus the 90th percentile annual precipitation for the geographical location, as contained in Appendix E.

(C) The system shall be designed with a five (5) foot operating depth, with three (3) feet of freeboard.

(2) **Land Application.** Design two (2) primary cells and one storage cell. Follow design guidelines stated in Subchapter 25 of this Chapter.

(A) Primary cells shall have sixty (60) days of retention time.

(B) Secondary cells shall have ninety (90) days of storage with the operating depth not to exceed ten (10) feet.

(d) **Aerated lagoon systems.** The following apply to all new aerated lagoon systems. Only partial-mix systems will be considered for systems with 30 day average concentration limits for BOD and TSS of 30 mg/l and 90 mg/l, respectively, as their basic permit requirement. Aerated lagoon systems will not consistently provide ammonia removal through the nitrification process so the effluent from these facilities may be toxic to aquatic life and thus cause whole effluent toxicity test failures.

(1) **Number of cells.** At least two aerated cells, in series, followed by one settling lagoon and provide a hydraulic retention time of at least two days.

(2) **Depth.** The design water depth shall be 10 to 15 feet.

(3) **Design Requirements.** Submit design calculations to the DEQ for review, and justify the use of any constants not listed.

(4) **Aeration requirements.** Oxygen requirements will depend on organic loading, required treatment, and concentration of suspended solids to be maintained in the aerated cells. Aeration equipment shall be capable of maintaining a minimum dissolved oxygen level of 2 mg/l in the lagoons at all times. In the absence of experimentally determined values, the design oxygen requirements shall be 1.8 lb O_2/lb BOD applied at maximum loading.

(5) **Additional information.** For a more detailed discussion of aerated lagoon design see *Design Manual Municipal Wastewater Stabilization Ponds*, U.S. Environmental Protection Agency, EPA-625/1-83-015 (1983). Also use ~~*Wastewater Engineering: Treatment, Disposal & Reuse*~~ *Wastewater Engineering Treatment and Resource Recovery*, Metcalf & Eddy~~, Inc.~~ AECOM ~~4th Edition, (2003)~~ 5th Edition (2014).

(6) **Disinfection.** Disinfection shall be required for all lagoon systems proposed to discharge to "waters of the state" where the beneficial use of the receiving water body

is designated in Oklahoma's Water Quality Standards (OAC 252:730) as either "Primary Body Contact Recreational" or "Public or Private Water Supply".

SUBCHAPTER 13. PRELIMINARY TREATMENT STANDARDS

252:656-13-2. Grit chambers

(a) **Where required.** Grit chambers are required at all mechanical sewage treatment plants, ahead of pumps and other equipment that may be damaged by grit.

(b) **Outside facilities.** Protect grit removal facilities located outside from freezing.

(c) **Chamber design.**

(1) Rectangular horizontal-flow grit chambers shall be designed to regulate velocity to minimize organic matter deposition. Channels shall be designed for velocities of 0.8 to 1.3 fps, with a total detention time of 20 seconds to one minute.

(2) Aerated grit chambers shall be designed for a detention time of two (2) to five (5) minutes. Aerated grit chambers shall be sized in accordance with Appendix A.

(d) **Grit washing.** Provide grit washing devices to further separate organic and inorganic materials in all chambers not equipped with positive velocity control. Include provisions for draining each unit.

(e) **Grit removal.** Provide facilities for hoisting grit to ground level from equipment located in deep pits, provide access by stairways, and provide adequate ventilation and lighting.

(f) **Grit disposal.** Provide for the removal, handling, storage and disposal of grit.

(g) **Vortex-type grit chambers.**

(1) The flow into the grit chamber shall be through a straight and smooth channel. The length of the inlet channel must be at least seven (7) times the width or fifteen (15) feet, whichever is greater.

(2) Total detention time in the chamber at design flow is thirty (30) seconds. Other designs may be authorized with engineering justification.

(3) The equipment specifications shall identify the required grit removal rates. Removal rates shall be based on the equipment manufacturer's specifications for downstream processes and meet the following minimum criteria:

(i) 95% removal rate for 50-mesh grit.

(ii) 85% removal rate for 70-mesh grit.

(iii) 65% removal rate for 100-mesh grit.

(4) Provide a propeller with a variable speed drive to operate the unit based on the plant flow.

(5) Provide air or water scour to loosen compacted grit and facilitate the grit lifting and removal from the chamber.

(6) Provide inclined screws, conveyors, chain elevators or pumps, including top mounted self-priming suction lift pumps to lift the grit from the chamber and transfer the grit to the washing and separating facilities. Air lift pumps shall not be used for this purpose.

(7) Automatically controlled grit lifting, washing and separating equipment with the ability to manually override.

252:656-13-4. Wet weather flow equalization basins

(a) **Basin type.** For gravity inlet systems, provide flow splitting or automated flow diversion devices to divert excess flows to the flow equalization basin(s). Design shall include a method to return contents to primary basins. For pumped systems, installation of control valves or dedicated pumps to handle wet weather flow shall be used to divert wet weather flow to the basin. Depending on the elevation of the basin, it may be possible to return the flow to the plant's primary units by gravity. If not, a pump return system will be necessary.

(b) **Design criteria.** The design of basins requires a thorough evaluation of flow patterns and volumes. Items to be considered are basin geometry, construction materials, storage capacity and operational controls.

(c) **Basin layout.** Basins designed for storage of five million gallons or more require a minimum of two compartments designed to operate in series. All flow must be diverted to a lined basin where solids can settle and, at a predetermined elevation, overflow to additional basins. A single basin equipped with an impervious liner is acceptable where the required storage capacity is less than five million gallons. Provisions are required for returning the contents of the basins to the treatment plant and for removal of settled solids.

(d) **Basin construction.** Basin construction must be in accordance with OAC 252:656-11-1, OAC 252:656-11-3, and OAC 252:656-11-4 with the following exceptions:

(1) Top of dikes may be reduced to a width of 6 feet.

(2) Bottoms of lagoon cells shall be adequately sloped to allow drainage to waste return structure(s).

(3) For basins with two compartments, the first basin must be lined below the maximum design water elevation with concrete, asphalt, or equivalent material. Single compartment basins must be lined as above.

(e) **Storage capacity.** Design minimum storage to contain the anticipated excess flow during the largest seven-day wet weather period in 10 years, with the capability to be emptied in a timely manner. Actual flow data shall be used to develop flow balance or mass diagrams for determining basin capacity. Base the frequency and duration of storms on field data and weather service records.

(f) **Aeration requirements.** Where oxygen is required to prevent the wastewater from becoming anaerobic provide air at the rate of 1.25 to 2.0 cfm per 1,000 gallons basin volume. Where mechanical aerators are used, 7.5 horsepower per million gallons of basin capacity is required.

(g) **Pumps and flow control methods.** Controls are required to regulate flow to the basin and return flow to the plant. Adequate controls with measuring devices are required to divert all flow in excess of the plant hydraulic capacity to the basin. Provisions and controls are required to return the basin contents to the plant after the wet weather event has passed and influent flow returned to normal. Return flow may be manual or automatic, but sufficient flow measurement and instrumentation devices must be included to determine the actual flow to the first treatment unit. Where basin return flow is automatic, control equipment must limit the combination of plant influent plus the basin return flow to the hydraulic capacity of the plant.

SUBCHAPTER 16. BIOLOGICAL TREATMENT STANDARDS

252:656-16-1. Suspended growth systems

(a) **General.** Suspended growth wastewater treatment systems generally consist of one or more basins where incoming wastewater is mixed with mixed liquor suspended solids and aerated for a period of time. The mixed liquor suspended solids are then separated from the mixture where a portion is returned to the mixing basin and the remainder diverted to other units for additional treatment before beneficial re-use by land application or landfill disposal. The liquid after separation from the solid is discharged or diverted to other units for additional treatment before discharge. Suspended growth systems covered by these standards are commonly know as the Activated Sludge process including the Sequencing Batch Reactor ("SBR") process. The activated sludge process includes several modifications. The most common is the extended aeration process which includes the oxidation ditch and SBR variations. Submit a complete design analysis for all suspended growth systems to DEQ for review. Contact stabilization is not recommended as the only secondary treatment process, but may be considered where equalization of flow is provided or where other treatment units follow.

(b) **Primary treatment.** The conventional activated sludge process must be preceded by primary treatment in the form of a primary clarifer(s) in accordance with 252:656-17. Provide equipment necessary to adequately remove sludge as it accumulates and transport it to sludge treatment facilities.

(c) **System Design.** Submit a comprehensive discussion of all functional design calculations used to size activated sludge treatment facilities. Include the following:

(1) influent wastewater characteristics,
(2) temperature range of wastewater,
(3) primary treatment of the waste,
(4) hydraulic and organic loading applied to the aeration basin,
(5) anticipated mixed liquor suspended solids level to be maintained in the aeration basin,
(6) aeration time,
(7) oxygen and mixing requirements for average and peak flows,
(8) recirculation and sludge wasting,
(9) degree of treatment anticipated, and
(10) equation(s) used to compute treatment efficiency.

(d) **Aeration basins.**

(1) **Capacities and permissible loadings.** The minimum design criteria for activated sludge systems are listed in Appendix A, Design Tables.

(2) **Arrangement of aeration basins.**

(A) **Basin dimensions.** Design each unit to:

(i) Maintain effective mixture and use of air.
(ii) Prevent unaerated sections and noticeable channeling.
(iii) Maintain velocities sufficient to prevent deposition of solids.
(iv) Restrict short-circuiting through the tank.

(B) **Basin lining.** Line earthen aeration basins with concrete, asphalt or equivalent material below the maximum water elevation. Do not use plastic liners in aeration tanks.

(C) **Number of units.** Divide the total aeration basin volume into at least two units, capable of independent operation.

(D) **Inlets and outlets.**

(i) **Controls.** Provide inlet and outlet devices to control flow and maintain constant water level in all aeration basins. Design the system to allow for the maximum instantaneous hydraulic load with any single unit out of service.

(ii) **Channels.** Design channels and pipes to maintain a velocity sufficient to hold solids in suspension or provide a mechanical means for suspending the solids. Provide for draining each channel when it is not being used.

(E) **Freeboard.** Provide at least 18 inches of freeboard.

(e) **Aeration equipment.**

(1) **Common elements.** Aeration equipment must be capable of maintaining at least 2.0 mg/l of dissolved oxygen in the mixed liquor at all times and provide thorough mixing.

(A) **CBOD removal.** Where data is not available, the design oxygen requirement for the activated sludge process is 1.1 lb O_2/lb peak BOD applied to the aeration basins. For the extended aeration process, the requirement is 1.8 lb O_2/lb peak BOD.

(B) **Nitrification.** For nitrification the oxygen requirement for oxidizing ammonia must be added to the requirement for carbonaceous BOD removal. The nitrogen oxygen demand (NOD) shall be taken as 4.6 lb O_2/lb NH_3 at peak diurnal flow. Assure sufficient alkalinity to maintain pH as required by 252:656-16-3 (b)(3). If the alkalinity is not sufficient, then chemical addition must be required.

(2) **Diffused air systems.**

(A) **Common elements.** Normal air requirements for all activated sludge processes, except extended aeration, is 1,500 ft3/lb peak BOD for aeration basin loading. For the extended aeration process the value is 2,000 ft3/lb peak BOD loading.

(B) **Blowers.** Design the blower system to account for temperature extremes ranging from 4 degrees F to 104 degrees F.

(C) **Multiple units.** Provide multiple units with enough capacity to meet the maximum air demand with the largest unit out of service. The design must also allow the volume of air delivered to be varied in proportion to the load demand of the plant.

(D) **Diffusers.** Systems must be capable of providing the diurnal peak oxygen demand or 200% of the design average oxygen demand, whichever is larger. Design air piping systems where the total head loss from blower outlet (or silencer outlet where used) to the diffuser inlet does not exceed 0.5 psi at average operating conditions. The spacing of diffusers must be in accordance with the oxygen requirements through the length of the channel or basin, and designed to allow spacing adjustment without major revisions to the air header piping. All plants using less than four aeration basins must be designed to incorporate removable diffusers that can be serviced and/or replaced without dewatering the basin.

(E) **Filters.** Provide all blowers with air filters.

(3) **Mechanical aeration systems.** The design requirements of a mechanical aeration system shall meet the following:

(A) Maintain all mixed liquor suspended solids in suspension;

(B) Meet maximum oxygen demand and maintain process performance with the largest unit out of service. A minimum of two units shall be provided;

(C) Provide for varying the amount of oxygen transferred in proportion to the load demand on the plant; and

(D) If depth of submersion is an important criteria, the aerators must be adjustable or the basin liquid levels must be easily controlled with regard to depth.

(f) **Sequencing batch reactor systems.**

(1) **Reactor design.** Provide at least three (3) reactors. Design each reactor to operate in a cyclic mode with sufficient time to fill, aerate, settle and remove the clarified liquid.

(A) Organic loading shall be between 5 to 20 pounds of BOD per thousand cubic feet per day. Design the system using food to mass (F/M) ratios of 0.05 to 0.30. The total reactor volume must provide at least 18 hours of hydraulic detention time. Size the reactor volume on the hydraulic retention time and decant volume.

(B) The design operating levels shall be 10 to 20 feet with at least two feet of freeboard.

(C) Design for no more than four operating cycles per day per reactor at average design flow.

(D) Sludge production depends on the mode of operation. For extended aeration mode (24 hours retention time), base sludge handling design on a minimum sludge production of 0.5 lbs. per lb. of BOD removed. For conventional activated sludge mode, or for systems using more than two cycles per day, base sludge production on 0.75 to 0.95 lbs. per lb. of BOD.

(E) Base sludge storage requirements on a concentration of 8,000 mg/l with a specific gravity of 1.02 for the settled sludge. Base the calculated sludge volume on the liquid depth after decanting.

(2) **Aeration equipment.** Aeration equipment must provide at least 1.4 lbs. of oxygen per lb. of BOD removed at a minimum residual dissolved oxygen level of 2.0 mg/l during the aeration period. Where nitrification is required, the aeration equipment shall have the capacity to provide an additional 4.6 lbs. of oxygen per lb. of ammonia nitrogen.

(3) **Decanter systems.** Design the decanter system to draw effluent from 12 to 18 inches below the surface and to prohibit floating scum from entering the system during fill and aeration periods. The design must not create currents that pull solids from the settled zone at the lowest point in the cycle. The entrance velocities into the decanter shall not exceed 1.0 fps at the maximum design flow condition.

(4) **Scum management.** Provide resuspension or removal equipment to control excessive scum build-up.

(g) **Oxidation ditches.** An oxidation ditch may take any linear shape as long as it forms a closed circuit, and does not produce any eddies or dead spots.

(1) **Pretreatment.** Bar screens and grit removal facilities are required. Primary settling is not necessary except for high strength waste.

(2) **Aeration basin.**

(A) The volume of the oxidation ditch must provide 18 to 24 hours hydraulic detention time at average dry weather flow. Organic loading may range from 12 to 15 pounds BOD per 1,000 ft3/day.

(B) Depth shall be at least 3 feet.

(C) Freeboard shall be at least one foot at maximum water depths.

(D) Aeration equipment shall maintain at least 1 fps velocity throughout the ditch.

(E) Construct the ditch with reinforced concrete at least 4 inches thick for ditches up to 5 feet deep, and 6 inches thick where deeper.

(F) Rotor weight shall not be supported directly by gear reduction or motor equipment. Protect motors, gear reduction equipment and bearings from inundation and rotor spray.

(3) **Rotor aerators.**

(A) Install at least two complete rotor units. Design the system so a single rotor can provide the average design oxygen demand and minimum velocity of 1 fps throughout the basin.

(B) Place rotors before a long, straight ditch section.

(C) Provide a method to control rotor submergence.

(4) **Miscellaneous.**

(A) Introduce raw sewage and returned sludge immediately upstream of the rotor that is farthest from the effluent control weir.

(B) Provide elevated walkways for rotor maintenance.

(h) **Return sludge equipment.**

(1) **Return rate.** Design all return pumping systems for the capability to be operated at the following return rates:

(A) Standard Rate:

(i) 15% minimum to

(ii) 75% maximum

(B) Carbonaceous Stage of Separate Stage Nitrification:

(i) 15% minimum to

(ii) 75% maximum

(C) Step Aeration:

(i) 15% minimum to

(ii) 75% maximum

(D) Extended Aeration:

(i) 50% minimum to

(ii) 150% maximum

(E) Nitrification Stage of Separate Stage Nitrification:

(i) 50% minimum to

(ii) 200% maximum.

(2) **Return pumps.** Maintain the maximum return sludge requirement with the largest pump out of service. Provide a positive head on all pumps' suctions under all operating

conditions. Provide a minimum pump's suction and discharge opening of at least 3 inches. Air lift systems shall be at least 3 inches in diameter. Further, air compressors shall be of sufficient capacity to supply design air requirements plus a 25% safety factor.

(3) **Return piping.** Provide minimum 4-inch discharge piping designed to maintain a minimum velocity of 2 fps at normal return rates. Provide mechanisms for observing, sampling and controlling return sludge flow from each clarifier.

(i) **Waste sludge facilities.** Waste sludge control facilities shall have a maximum capacity of not less than 25 percent of the average rate of sewage flow and function satisfactorily at rates of 0.5 percent of average sewage flow or a minimum of 10 gpm, whichever is larger.

(j) **Measuring devices.** Install a means to measure flow rates of raw sewage, primary effluent, waste sludge, return sludge, and air to each basin unit.

252:656-16-3. Biological nutrient removal

(a) **Purpose.** Processes for nutrient removal in wastewater include conversion of ammonia and organic nitrogen to nitrate nitrogen (nitrification), the conversion of nitrate nitrogen to nitrogen gas (denitrification) and removal of phosphorus.

(b) **Single stage (combined carbonaceous BOD removal and nitrification).** Design processes according to the requirements of 252:656 and submit all design calculations. The following factors will have a significant impact on the nitrification process: ammonia and nitrite concentrations, BOD/TKN ratio, dissolved oxygen concentration, temperature, alkalinity and pH. The following steps shall be considered in the design of the suspended growth reactor and the resulting calculations submitted to DEQ for review. If actual kinetic coefficients cannot be obtained, textbook values may be used for design.

(1) Select an appropriate safety factor to handle peak, diurnal and transient loadings (a minimum safety factor of 2.0 applied to design mean cell residence time is required).

(2) Select the mixed liquor dissolved oxygen (DO) concentration. The minimum acceptable level is 2.0 mg/l. Determine the amount of oxygen required to satisfy the nitrogenous oxygen demand. Provide a minimum of 4.6 mg O_2/mg N oxidized.

(3) Evaluate the requirement for pH control. Every mg/l of ammonium-nitrogen (NH4-N) oxidized will result in the destruction of 7.14 mg/l alkalinity.

(4) Estimate the maximum growth rate of nitrifying bacteria under the most adverse DO, pH and temperature conditions.

(5) Determine the design mean cell residence time with the safety factor (10-day is recommended).

(6) Predict the effluent nitrogen concentration.

(7) Determine the hydraulic retention time to achieve the necessary nitrogen concentration. A 10-hour retention time is needed to compensate for lower nitrification rates when wastewater temperatures are below 50 degrees F.

(c) **Separate-stage nitrification.** Design processes according to the requirements of 252:656 and submit all design calculations. Separate-stage suspended growth nitrification processes are similar in design to the activated sludge process. Show the process factors, considering the following:

(1) Experimentally measured nitrification rates are more appropriate than theoretical rates.

(2) Nitrification rates increase as the temperature increases.
(3) Nitrification rates increase as the BOD/TKN ratio decreases.
(4) Nitrification rates are affected by pH.
(5) Nitrification rates vary from 0.05 to 0.6 lbs. NH_4-N oxidized per pound of MLVSS.

(d) **Biological phosphorus removal.** Design proprietary processes and submit all design calculations according to the manufacturer's recommendations or ~~*Wastewater Engineering: Treatment, Disposal & Reuse*~~ *Wastewater Engineering Treatment and Resource Recovery*, Metcalf & Eddy~~, Inc.~~ AECOM, ~~4th Edition (2003)~~ 5th Edition (2014).

(e) **Chemical phosphorus removal.**

(1) **Preliminary testing.** Laboratory, pilot, or full scale studies of various chemical feed systems and treatment processes are recommended for existing plant facilities to determine the achievable performance level, cost-effective design criteria, and ranges of required chemical dosages.

(2) **System flexibility.** Systems shall be designed with sufficient flexibility to allow for several operational adjustments in chemical feed location, chemical feed rates, and for feeding alternate chemical compounds.

(3) **Dosage.** The design chemical dosage shall include the amount needed to react with the phosphorus in the wastewater, the amount required to drive the chemical reaction to the desired state of completion, and the amount required due to inefficiencies in mixing or dispersion. Excessive chemical dosage should be avoided.

(4) **Chemical feed points.** Selection of chemical feed points shall include consideration of the chemicals used in the process, necessary reaction times between chemical and polyelectrolyte additions, and the wastewater treatment processes and components utilized. Flexibility in feed locations shall be provided to optimize chemical usage.

(5) **Flash mixing.** Each chemical must be mixed rapidly and uniformly with the flow stream. Where separate mixing basins are provided, they shall be equipped with mechanical mixing devices. The detention period shall be at least 30 seconds.

(6) **Flocculation.** The particle size of the precipitate formed by chemical treatment may be very small. Consideration shall be given in the process design to the addition of synthetic polyelectrolytes to aid settling. The flocculation equipment shall be adjustable in order to obtain optimum floc growth, control deposition of solids, and prevent floc destruction.

(7) **Liquid-solids separation.** The velocity through pipes or conduits from flocculation basins to settling basins shall not exceed 1.5 feet per second in order to minimize floc destruction. Entrance works to settling basins shall also be designed to minimize floc shear.

(8) **Sludge handling.** For design of the sludge handling system, special consideration shall be given to the type and volume of sludge generated in the phosphorus removal process.

(9) **Filtration.** Effluent filtration shall be provided where effluent phosphorus concentrations of 1 mg/l or less must be achieved.

SUBCHAPTER 17. CLARIFIER STANDARDS

252:656-17-2. Clarifier design considerations

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

(b) **Primary clarifier design criteria.** Primary clarifiers shall be placed downstream of flow distribution devices. Surface settling rates for primary tanks shall not exceed 1,000 gal/ft2/day at design average flows or 1,500 gal/ft2/day for peak hourly flows. Peak hourly flow is based upon a 2-hour sustained peak, as defined by ~~*Wastewater Engineering: Treatment, Disposal & Reuse*~~ *Wastewater Engineering Treatment and Resource Recovery*, Metcalf & Eddy, ~~Inc. 4th Edition (2003)~~ AECOM, 5th Edition (2024). The primary clarifier must have a minimum side water depth of twelve feet (12'). Clarifier sizing shall be calculated for both flow conditions and the larger surface area determined shall be used. Primary settling of normal domestic sewage can be expected to remove 30 to 35% of the influent BOD. However, anticipated BOD removal for sewage containing appreciable quantities of industrial wastes (or chemical additions to be used) shall be determined by laboratory tests and consideration of the quantity and character of the wastes.

(c) **Secondary clarifier design criteria.** See Appendix B.

(d) **Inlet structures.** Design inlets to prevent short-circuiting, to dissipate velocity and diffuse flow equally across the entire cross-section of the settling chamber. Design channels to maintain a velocity of at least 1 fps at one-half design flow. When scum ports in the inlet diffusion well baffle are provided, the elevation of the bottom edge of the ports shall be no lower than 0.10 feet below the elevation of the crest of the overflow weirs.

(e) **Weirs.** Overflow weirs shall be adjustable and level.

(1) **Location.** Locate overflow weirs to optimize hydraulic retention time and minimize short-circuiting.

(2) **Design rates.** Weir loadings shall not exceed 10,000 gal/linear foot/day for plants designed for average flows of 1.0 mgd or less. Higher weir loadings may be used for plants designed for larger average flows, but shall not exceed 15,000 gal/linear foot/day. Where the flow is pumped to the clarifier, the weir length shall be based on the average pump delivery rates to avoid short-circuiting.

(3) **Weir troughs.** Design weir troughs to prevent submergence at maximum design flow, and to maintain a velocity of at least 1 fps at one-half design flow.

(4) **Dewatering.** Provide the necessary piping and equipment to permit complete dewatering to the floor for the bypassing of individual units for maintenance and repair.

(5) **Freeboard.** Walls shall extend at least 6 inches above the surrounding ground surface and provide at least 12 inches of freeboard. Provide additional freeboard or wind screens for larger clarifiers subject to high velocity wind currents that would cause tank surface waves and inhibit scum removal.

SUBCHAPTER 27. WATER REUSE

252:656-27-1. Categories of reclaimed water

The following are the categories of and allowed uses for reclaimed water:

(1) **Category 1.** Reserved.

(2) **Category 2.** Category 2 reclaimed water shall only be used for the allowed uses in Categories 3, 4 and 5, and:

(A) drip irrigation on orchards or vineyards;

(B) spray or drip irrigation on sod farms, public access landscapes and public use areas/sports complexes, including unrestricted access golf courses;

(C) toilet and urinal flushing;

(D) fire protection systems;

(E) commercial closed-loop air conditioning systems;

(F) vehicle and equipment washing (excluding self-service car washes)

(G) range cattle watering; and

(H) make-up water for oil and gas production.

(3) **Category 3.** Category 3 reclaimed water shall only be used for the allowed uses in Categories 4 and 5, and:

(A) subsurface irrigation of orchards or vineyards;

(B) restricted access landscape irrigation;

(C) irrigation of livestock pasture;

(D) concrete mixing;

(E) dust control;

(F) aggregate washing/sieving;

(G) new restricted access golf course irrigation systems;

(H) industrial cooling towers, once-through cooling systems, and closed loop systems such as boiler feed water;

(I) restricted access irrigation of sod farms; and

(J) hydraulic fracturing.

(4) **Category 4.** Category 4 reclaimed water shall only be used for the allowed uses in Category 5 and:

(A) soil compaction and similar construction activities; and

(B) existing restricted access golf course irrigation systems utilizing water that has received primary treatment in lagoon systems. Permits to construct shall not be issued for new Category 4 restricted golf course irrigation systems pending further research and evaluation of performance data collected from existing systems.

(5) **Category 5.** Category 5 reclaimed water shall only be used for:

(A) restricted access pasture irrigation for range cattle;

(B) restricted access irrigation of fiber, seed, forage and similar crops; and

(C) irrigation of silviculture.

(6) **Category 6.** Category 6 reclaimed water, which does not require a permit to supply, must be drawn from the effluent of the final treatment process unit, with the intake located within or immediately downstream of the disinfection unit where disinfection is provided, and shall only be used within the wastewater treatment plant and includes:

(A) dilution water for chemicals used in the process such as polymers,coagulants, chlorination or dechlorination;

(B) mechanical seal water for gas compressors, pumps and other equipment;

(C) mechanical seal water and cooling water for pumps;
(D) odor and gas absorption including bio-filters used for odor control;
(E) centrifuge flushing;
(F) flushing grit and sludge pipes;
(G) gravity thickener make-up water;
(H) supply water for filter backwash;
(I) headworks screen washing;
(J) headworks screening washer-compactors;
(K) belt filter press;
(L) other reclaimed water that is permanently plumbed to a fixed nozzle and contained within unit operations;
(M) yard hydrants; and
(N) hose bibs.