DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

DIVISION OF SOIL AND WATER CONSERVATION

Statutory Authority: 7 Delaware Code, Chapter 42 (7 **Del.C.**, Ch. 42)

FINAL

Secretary's Order No. 2009-S-0044

5103 (DELAWARE DAM SAFETY REGULATIONS
Date of Issuance: November 16, 2009
Effective Date: December 11, 2009

Under the authority vested in the Secretary of the Department of Natural Resources and Environmental Control ("Department" or "DNREC") the following findings, reasons and conclusions are entered as an Order of the Secretary in the above-referenced rulemaking proceeding.

Background and Procedural History

This Order considers proposed regulation entitled "Delaware Dam Safety Regulations." The Department's Division of Soil and Water Conservation commenced the regulatory development process with Start Action Notice 2006-16, which was approved on ….DSWC's Dam Safety Program held 4 meetings with the regulatory advisory committee, as required by the Dam Safety Act (Act), and a public workshop on December 11, 2008.

The Department published the proposed regulations in the April 1, 2009 *Delaware Register of Regulation* and held a public hearing on April 27, 2009. The Department's presiding hearing officer, Robert P. Haynes, prepared a Hearing Officer's Report dated November 9, 2009 (Report). The Report recommends certain findings and the adoption of as a final regulation as "Delaware Dam Safety Regulations," attached to the Report as Appendix A (Regulation).

Findings and Discussion

I find that the Regulation is well-supported by the record developed by DSWC and adopt the Report to the extent it is consistent with this Order. DSWC's experts developed the record and the Regulation was drafted with the cooperation and coordination by members of the regulatory advisory committee. In addition, DSWC held a public workshop. As a result of the extensive informal regulatory development process, the proposed regulation only received two public comments. DSWC and the Report recommend that one comment's editorial and clarifying changes be reflected as non-substantive changes and the other comment was on a specific problem with one pond that did not require any change to the proposed regulation.

I find that the Department's experts in DSWC fully developed the record to support adoption of the final regulations. As final regulations, the Department will have improved authority to regulate dams, particularly the existing 53 dams that are subject to the Department's regulation. The regulation also will regulate to any new dams that fall within the size and classification that are subject to the regulation. The regulations will require annual inspections of high hazard dams and inspections of the significant hazard dams every two years. All dams will be subject to review and supervision by a licensed Delaware professional engineer. The dams that are regulated are public owned dams that have a certain height or size of impoundment or hazard classification to warrant regulation under the Act, or any privately owned dam that may seek to be regulated by agreement.

The regulation adopted by this Order provides more details and clarification to the owners of dams regulated by the Act. The regulation's procedures set forth how to apply to the Department for permission to design, construct, operate, maintain, inspect and abandon a regulated dam. The regulation that this Order adopts will provide a comprehensive and sound basis to regulate those dams in Delaware that are subject to regulation under the Act. In conclusion, the following findings and conclusions are entered:

1.) The Department has jurisdiction under its statutory authority to issue an Order adopting this final

regulation;

2.) The Department provided adequate public notice of the proposed regulation and provided the public with an adequate opportunity to comment on the proposed regulations, including at a public hearing;

3.) The Department held a public hearing on the proposed regulations in order to consider public comments before making any final decision, and has considered all relevant and timely public comments it received;

4) The Department's Hearing Officer's Report, including its recommended record and the Recommended Regulation, as set forth in Appendix A, are adopted to provide additional reasons and findings for this Order;

5.) The Recommended Regulation does not reflect any substantive changes from the Proposed Regulation published in the April 1, 2009, *Delaware Register of Regulations*;

6.) The Recommended Regulation should be adopted as a final regulation because it is consistent with the Act and its purposes to reduce the risk of loss of life and property damage from a failure of a dam subject to the Act's regulation, will enable the Department to administer its duties under the Act, and is well supported by documents in the record; and that

7.) The Department shall submit this Order approving the final regulation to the *Delaware Register of Regulations* for publication in its next available issue, and provide such other notice as the law and regulation require and the Department determines is appropriate.

Collin P. O'Mara
Secretary

5103 Delaware Dam Safety Regulations

Scope and Applicability

Legislation

The Delaware State Legislature passed House Bill No. 514 on June 30, 2004 to amend Section 1 Title 7 of the Delaware Code by enacting in Part IV a new "Chapter 42, Dam Safety." These Regulations have been promulgated pursuant to Title 7 of the Delaware Code, Chapters 42 and 60. The text of House Bill No. 514 is attached as Appendix A. The Act provides for the regulation of publicly owned dams that meet the definition of a dam as defined by the Act and these Regulations and have a hazard classification of High or Significant Hazard Potential.

Purpose of Regulations

It is the purpose of these Regulations to provide for the proper design, construction, operation, maintenance, and inspection of dams in the interest of public health, safety, and welfare, in order to reduce the risk of failure of dams and to prevent death or injuries to persons; damage to downstream property, infrastructure, and lifeline facilities; and loss of reservoir storage.

1.0 Regulating Agency

1.1 The Delaware Dam Safety Program shall be administered by the Delaware Department of Natural Resources and Environmental Control (Department). The program shall be administered and directed by an engineer, licensed in the State of Delaware, or by an individual otherwise clearly qualified by training and experienced in the design, construction, reconstruction, enlargement, repair, alteration, breach, removal, maintenance, operation, and abandonment of dams and reservoirs.

1.2 The Department shall have the authority to review and approve the design, construction, reconstruction, enlargement, alteration, repair, maintenance, operation, breach, abandonment, and removal of dams and reservoirs for the protection of life, property, public infrastructure, and lifeline facilities.

1.3 In making any investigation or inspection necessary to enforce these Regulations, the Department or its representatives may enter upon such private property of the dam owner as may be necessary.

1.4 When the Department determines that a dam and reservoir constitute a risk to life or property, the agency shall order the owner to take such action as necessary to remove the resultant risk to life and property.

1.5 No action shall be brought against the State of Delaware, or any agent of the Department, or any employee of the State of Delaware or the Department for damages sustained through the partial or total failure of any dam, its misoperation, or its maintenance by reason of any supervision or other action taken pursuant to or under these Regulations. Nothing in these Regulations shall relieve an owner or operator of a dam from the legal duties, obligations, and liabilities arising from such ownership and operation.

2.0 Definition of Terms

The following words, terms, and phrases, when used in these Regulations, shall have the meanings ascribed to them except where the context clearly indicates a different meaning:

"**Abandonment**" means to render a dam non-impounding by dewatering and filling the reservoir created by that dam with solid materials and by diverting the natural drainageway around the site.

"**Adverse consequences**" means negative impacts that may occur upstream, downstream, or at other locations remote from the dam. The primary concerns are loss of human life, economic loss (including property damage), disruption of lifeline facilities, and environmental impact.

"**Alterations**", "**modifications**" or "**repairs**" means only alterations, modifications, or repairs to existing dam and appurtenant structures that may directly affect the operation, performance, or safety of the dam, spillway, outlet works, ancillary structures, or reservoir, as determined by the Department. This definition does not include maintenance or minor repairs.

"**Application approval**" means authorization in writing issued by the Department to an owner who has applied to the agency for permission to construct, reconstruct, enlarge, repair, alter, remove, maintain, operate, or abandon a dam and which specifies the conditions or limitations under which work is to be performed by the owner or under which approval is granted.

"**Appurtenant works**" include, but are not limited to, structures such as spillways, either in or separate from the dam; the reservoir and its rim; low-level outlet works; and water conduits such as tunnels, pipelines, or penstocks either through the dam or its abutments.

"**As-Built Drawings**" or" **Record Drawings**" mean the approved post-construction plans;

(1) With verification of all significant as-constructed values, dimensions, and elevations; and

(2) Bearing the seal of the supervising engineer responsible for certifying that to the best of his/her knowledge, the construction was completed in accordance with the approved plans and specifications or with changes approved by the Department.

"**Auxiliary Spillway**" means the second used spillway during flood flows which is not the emergency spillway.

"**Breach**" means partial removal of a dam, creating a channel through the dam to the original stream bottom elevation.

"**Dam**" shall mean any artificial barrier, including appurtenant works, with the ability to impound or divert water, wastewater, or liquid-borne materials. No obstruction in a canal used to raise or lower water shall be considered a dam. A fill or structure for highway or railroad use, or for any other purpose that may impound water, may be subject to review by the Department and shall be considered a dam if the criteria in these Regulations are found applicable and if it is classified as a high hazard potential or significant hazard potential dam.

"**Danger reach**" means that area downstream of a dam that will be flooded by the sudden release of waters resulting from failure of the dam.

"**Days**" when used in establishing deadlines, means calendar days including Sundays and holidays.

"**Department**" means the Delaware Department of Natural Resources and Environmental Control.

"**Design freeboard**" means the minimum freeboard which would exist during passage of the design flood.

"**Dominant discharge**" means the flow rate capacity, in cubic feet per second, of the stream channel considering steady, uniform flow.

"**Emergency Action Plan**" (EAP) means a plan prepared by the dam owner and approved by the Department that identifies emergency conditions at a dam and specifies preplanned actions to minimize loss of life and property damage in the event of a potential dam failure.

"**Emergency condition**" means a sudden unforeseen occurrence or condition requiring exigency or a circumstance that the Department determines constitutes a present or imminent danger to the public health or safety or to the environment. This includes, but is not necessarily limited to: breaches and all conditions leading to or causing a breach, overtopping, or any other condition in a dam and its appurtenant structures that may be construed as unsafe or threatening to life or property.

"**Emergency Spillway**" means the spillway capable of passing the spillway design storm with the principal and/or auxiliary spillway blocked.

"**Enlargement**" means any change in or addition to an existing dam or reservoir, which raises or may raise the water storage elevation of the water impounded by the dam.

"**Floodplain**" means that area along or adjacent to a stream or a body of water of that is capable of storing or conveying flood waters. As used herein, "floodplain" may or may not be the same area depicted as a special flood hazard zone on the Flood Insurance Rate Maps prepared by the Federal Emergency Management Agency.

"**Formal inspection**" means the inspection by a Delaware licensed professional engineer to reevaluate the safety and integrity of the dam and appurtenant structures to determine if the structure meets current design criteria, including a field inspection and a review of the records on project design, construction and performance.

"**Freeboard**" means the vertical distance to the top of a dam above the maximum design water surface elevation.

"**Independent Review Board**" means one or more independent professional engineers who are qualified in the design, construction and rehabilitation of dams to perform a review of the project design and construction.

“**Informal Inspection**” means the visual inspection of the dam by the dam owner or operator to detect apparent signs of deterioration or other deficiencies of the dam structure or function.

"**Hazard potential**" means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the dam or appurtenances. The hazard potential classification of a dam does not reflect in any way on the current condition of the dam and its appurtenant structures (e.g., safety, structural integrity, flood-routing capacity).

"**Height of dam**" means the vertical distance from the lowest point on the downstream toe of the dam to the lowest point on the top of the dam, independent of low points caused by partial failure or collapse.

"**High Hazard Potential Dam**" shall mean any dam whose failure or misoperation will cause probable loss of human life.

"**Incremental**" means the difference in impacts, under the same conditions (e.g., flood, earthquake, or other event), that would occur due to failure of the dam or those that would have occurred without failure of the dam and appurtenances.

"**Inflow design flood**" means the size of flood coming into the reservoir that is used as a basis for designing the dam.

"**Low-hazard potential dam**" means any dam whose failure or misoperation is unlikely to cause loss of human life but may cause minor economic and/or environmental losses.

“**Maintenance**” means routine activities associated with keeping the dam and ancillary structures in safe operating condition, including, but not limited to such activities as mowing and vegetation removal, cleaning drains, painting metal parts, lubricating and exercising mechanical parts, cleaning debris from channels and trash racks, etc.

"**Maximum capacity**" means the storage volume of a reservoir, in acre-feet, at the lowest point on the top of dam independent of low points caused by partial failure or collapse.

"**Maximum storage elevation**" means the elevation of the lowest point of the top of dam independent of low points caused by partial failure or collapse.

“**Minor repairs**” means activities that restore sections of the dam, spillway, outlet works, and ancillary structures which exhibit minor deterioration to their intended state and that do not require the alteration (permanent or temporary) of any facilities that would effect performance, operation or safety of the dam as determined by the Department.

"**Normal depth**" means the maximum vertical distance from the streambed invert at the upstream toe of the dam to the normal water surface.

“**One-hundred year storm**” means the storm which is estimated to have a one percent chance, or one chance in 100, of being equaled or exceeded in one year.

“**Outlet**” means an opening through which water can be freely discharged from a reservoir for a particular purpose.

"**Overflow spillway**" means any operating, emergency, or other spillway that discharges with a free water surface over or around the dam as opposed to an orifice, gate, or conduit that discharges through or beneath the dam or nearby ground.

"**Owner**" shall include any one or more of the following who owns, controls, operates, maintains, manages, or proposes to construct, reconstruct, enlarge, repair, alter, remove, or abandon a dam or reservoir: the state and its departments, institutions, agencies, and political subdivisions; every municipal or quasi-municipal corporation; every public utility; every district; every person; the duly authorized agents, lessees, or trustees of any of the foregoing; and receivers or trustees appointed by any court for any of the foregoing.

"**Permit to Impound**" means authorization in writing issued by the Department to an owner who has complied with the conditions specified in the Provisional Certificate to Impound issued by the Department, or has completed construction, reconstruction, enlargement, repair, or alteration of a dam, and which specifies the conditions or limitations under which the dam and reservoir are to be maintained and operated.

"**Person**" means any person, firm, association, organization, partnership, business trust, corporation, or company.

"**Preliminary Hazard Classification**" means the initial hazard potential classification determined by the Department based on approximate methods, and is not based on detailed analyses as described in paragraph 5.3 of these Regulations.

"**Principal spillway**" means the primary or first used spillway during normal inflow and flood flows.

"**Probable**" means likely to occur; reasonably expected; realistic.

"**Probable Maximum Flood**" (PMF) means the most severe flood considered possible in a specific region based on the Probable Maximum Precipitation (PMP), as determined by the National Weather Service.

"**Probable Maximum Precipitation**" (PMP) means the theoretically greatest depth of precipitation for a given duration that is physically possible, over a given size storm area, at a particular geographic location, at a certain time of year.

"**Provisional Certificate to Impound**" means temporary authorization in writing issued by the Department to the owner of a dam that existed prior to June 30, 2004, and that the Department has determined meets the criteria for regulation as contained in paragraph 3.1 of these Regulations, and which specifies the conditions that must be met by the dam owner to obtain a Permit to Impound.

"**Reconstruction**" means removal and replacement of an existing dam.

"**Regular Inspection**" means the visual inspection of a dam by a Delaware licensed professional engineer to detect any signs of deterioration in material, developing weaknesses or unsafe hydraulic or structural behavior.

"**Removal**" means complete elimination of the dam embankment or structure to restore the approximate original topographic contours of the valley.

"**Reservoir**" means any basin that contains or will contain impounded water, wastewater, or liquid-borne materials because it has been impounded by a dam.

"**Secretary**" means the Secretary of the Delaware Department of Natural Resources and Environmental Control.

"**Significant Hazard Potential Dam**" shall mean any dam whose failure or misoperation will cause possible loss of life, economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.

"**Standard project flood**" means the most severe flood considered reasonably characteristic of the specific region. This is calculated for a specific dam site using one or more of the recognized methods acceptable to the Department.

"**State or state**" means the State of Delaware.

"**Spillway**" means a structure other than low flow outlets, over or through which flood flows are discharged.

"**Spillway Design Storm**" means the storm upon which the hydraulic capacity of the spillway structure is designed.

"**Supervising Engineer**" shall mean the design engineer who is responsible for conducting dam construction quality assurance inspections in order to certify the construction has been completed in accordance with the approved plans and specifications.

"**Sunny day failure**" means the failure of a dam with the water level at the normal pool elevation and no rainfall.

"**Toe of dam**" means the junction of the downstream face of a dam with the ground surface or the invert of the outlet pipe whichever is the lowest point.

3.0 Permit-By-Rule

3.1 Applicability

3.1.1 These Regulations shall apply to any dam that is owned by the State or any county in the State, or any municipality, or any quasi-governmental agency of the State that is 25 feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the barrier or from the lowest elevation of the outside limit of the barrier, or if it is not across a stream channel or watercourse, measured at maximum water storage elevation; or any dam having an impounding capacity, at maximum storage elevation, of 50 acre-feet or more; or any dam that is deemed by the Secretary to be a significant- or high-hazard potential structure due to its location or other physical characteristics.

3.1.2 It is unlawful to construct, reconstruct, enlarge, repair, alter, remove, maintain, operate, or abandon any dam or reservoir that comes under these Regulations except upon application approval of the Department.

3.2 Exclusions

3.2.1 These Regulations shall not apply to any dam that is not in excess of 6 feet in height regardless of storage capacity, or any dam having a storage capacity at maximum water storage elevation not greater than 15 acre-feet regardless of height, or any low-hazard potential dam constructed prior to June 30, 2004, unless deemed by the Secretary to be a significant or high-hazard potential structure due to its location or other physical characteristics.

3.2.2 These Regulations shall not apply to any private owner of a dam unless such owner executes a document with the Department requesting such coverage.

3.2.3 The requirements in these Regulations shall not apply to routine maintenance and operation not affecting the safety of the structure.

3.2.4 These Regulations do not apply to dams that are owned and operated by the Federal Government.

4.0 General Requirements and Prohibitions

4.1 Construction of New Dams

4.1.1 No owner shall begin the construction of any dam to which these Regulations apply without written approval from the Department. Owners intending to construct any dam to which these Regulations apply shall file with the Department a preliminary application that shall include a dam break analysis; the dam height; the maximum impounding capacity; the purpose, location, and determination of hazard class; and other information required by the Department. If, on the basis of this information, it is the opinion of the Department that the proposed dam is exempt from the provisions of these Regulations, the Department shall notify the owner that no approval from the Department pursuant to these Regulations will be required. If, on the basis of the submitted information it is the opinion of the Department that the proposed dam is not exempt, the Department shall notify the owner that construction shall not commence until a full application has been filed by the owner and such application approved in accordance with Sections 6.0 and 7.0 of these Regulations.

4.1.2 The Department shall require Emergency Action Plans (EAPs) and operation and maintenance (O&M) plans for high- or significant-hazard potential dams, and may also require of owners so notified the filing of any additional information it deems necessary, including, but not limited to, stream flow and rainfall data, maps, reports, plans, and specifications.

4.1.3 Every owner applying for approval of a dam subject to the provisions of these Regulations shall also file with the Department a Certificate from a qualified professional engineer licensed in the State of Delaware. The Certificate should state that the engineer is qualified and responsible for the design of the dam; that the design is safe and adequate; and that the engineer shall be responsible for construction quality assurance to certify that the construction has been completed in accordance with the approved plans.

4.1.4 The Department shall send a copy of each completed application to the Delaware Emergency Management Agency and other State, Federal, and local agencies it considers appropriate for review and comment.

4.1.5 Upon receipt of a full application in proper form, the Secretary shall give notice in an advertisement in a newspaper of general circulation in the county in which the activity is proposed and in a daily newspaper of general circulation throughout the State, providing:

4.1.5.1 An announcement of the fact that the application has been received;

4.1.5.2 A brief description of the nature of the application;

4.1.5.3 Notification of location(s) where a copy of the application may be inspected; and

4.1.5.4 Procedures to request a public hearing.

4.1.6 The Secretary shall hold a public hearing on an application if he receives a request from any party whose interests are substantially affected by the proposed application, as determined by the Secretary, if such request is received within 21 calendar days of the public notice. A notice shall

also be sent by mail to any person who has requested such notification from the Department and provides a name and address.

4.2 Repair, Alteration, or Removal of Existing Dams

4.2.1 Before commencing the repair, alteration, or removal of any dam to which these Regulations apply, application shall be made by the owner for written approval by the Department, except as otherwise provided by these Regulations. The installation of utility lines in a dam shall be considered an alteration to the dam and will require permitting under these regulations. The application shall state the name and address of the owner; shall adequately detail the changes it proposes to effect, as well as impacts or modifications to O&M plans and EAPs; and shall be accompanied by maps, plans, and specifications setting forth such details and dimensions as the Department requires.

4.2.2 The Department may waive the requirements of this Section for the repair or alteration of a dam if the proposed action is determined to be minor as defined by the Department by regulation. The application shall contain such other information concerning the dam and reservoir required by the Department; shall include information concerning the safety of any change that it may require; and shall state the proposed time of commencement and completion of the work.

4.2.3 When the Department determines an application has been completed, it may refer the application for agency review and report, as provided by paragraph 4.1.4 of these Regulations in the case of original construction. The application for repair, alteration, or removal of the dam shall be subject to the public notice requirements.

4.2.4 Upon receipt of a full application in proper form, the Secretary shall give notice in an advertisement in a newspaper of general circulation in the county in which the activity is proposed and in a daily newspaper of general circulation throughout the state, providing:

4.2.4.1 An announcement of the fact that the application has been received;

4.2.4.2 A brief description of the nature of the application;

4.2.4.3 Notification of location(s) where a copy of the application may be inspected; and

4.2.4.4 Procedures to request a public hearing.

4.2.5 The Secretary shall hold a public hearing on an application if he receives a request from any party whose interests are substantially affected by the proposed application, as determined by the Secretary, if such request is received within 21 calendar days of the public notice. A notice shall also be sent by mail to any person who has requested such notification from the Department and provides a name and address.

4.2.6 When repairs are necessary to safeguard life and property, they may be started immediately. The Department shall be notified as soon as practical but no longer than 24 hours after such repairs have commenced. The owner shall be required to submit as-built plans and certification from a professional engineer, licensed in Delaware, demonstrating that the repairs comply with these Regulations.

4.3 Supervision by Qualified Engineers; Reports and Modifications During Work

4.3.1 Any project for which the Department’s approval is required under these Regulations shall be designed and the construction supervised by a licensed professional engineer in the State of Delaware with related experience in dam design and construction.

4.3.2 During the construction, enlargement, repair, alteration, or removal of any dam to which these Regulations apply, the Department may require such progress reports from the supervising engineer responsible for design and construction quality assurance as it deems necessary.

4.3.3 If, based on inspection reports, construction inspections, or other information, the Department finds that the work is not in compliance with the provisions of the approval and the approved plans and specifications; it shall give written notice to the person who received the approval and to the person in charge of construction of the dam. The notice shall state the particulars of the lack of compliance, and shall order immediate compliance with the terms of approval and the approved plans and specifications. The Department may order that no further construction work be undertaken until such compliance has been effected and approved by the Department. A failure to comply with the approval and the approved plans and specifications shall render the approval revocable unless compliance is made after notice, as provided in these Regulations.

4.4 Notice of Completion; Certification of Final Approval

4.4.1 Within 7 days of completion of construction, reconstruction, enlargement, repair, alteration, or removal of any dam to which these Regulations apply, notice of completion shall be given to the Department. Within 60 days thereafter, supplementary drawings or descriptive matter showing or describing the dam as actually constructed (as-built drawings) in compliance with the approval and the approved plans and specifications shall be filed with the Department in such detail as the Department may require.

4.4.2 Upon completion of the project, the supervising engineers, having inspected the work during construction and upon finding that the work has been done as required and that the dam is safe, shall file with the Department a Certificate and as-built plans demonstrating that the work has been completed in accordance with the approved design plans, specifications, and other requirements. After review of the supervising engineer's Certificate and as-built plans, unless the Department has reason to believe that the dam is unsafe or is not in compliance with any applicable rule or law, the Department shall grant final approval of the work in accordance with the Certificate, subject to such terms as it deems necessary for the protection of life and property.

4.4.3 Pending issuance of the Department's final approval, the dam shall not be filled except on written consent of the Department, subject to conditions it may impose.

4.5 Operation and Maintenance (O&M) of New or Existing Dams

4.5.1 The Department shall require that dam owners and operators develop, use, and update as necessary an operations and maintenance (O&M) Plan that provides guidance and instruction to personnel for the proper O&M of any reservoir or dam to which these Regulations apply in order to safeguard life and property.

4.5.2 The O&M Plan shall be subject to the approval of the Department and may be reviewed, modified, or amended by the Department as deemed necessary to safeguard life and property.

4.5.3 The Secretary may adopt, amend, modify, or repeal standards for the maintenance and operation of dams as may be necessary for the purposes of this Section. The Department may vary the standards applicable to the various dams giving due consideration to the type and location of the structure, the hazards to which it may be exposed, and the peril of life and property in the event of a failure or misoperation of the dam.

4.6 Monitoring and Inspection of New or Existing Dams

4.6.1 The Department shall require regular monitoring and inspection of any dam to which these Regulations apply, to safeguard life and property.

4.6.2 The Secretary may adopt, amend, modify, or repeal standards for the monitoring and inspection of dams as may be necessary for the purposes of this Section. The Department may vary the standards applicable to the various dams giving due consideration to the type and location of the structure, the hazards to which it may be exposed, and the peril of life and property in the event that a dam fails to perform its function.

4.7 Emergency Action Plans (EAPs) for New or Existing Dams

4.7.1 The owner of any new or existing dam that is regulated under these Regulations and is classified as a Class I High Hazard Potential, or Class II Significant Hazard Potential, in accordance with Section 5.0 of these Regulations, shall prepare an Emergency Action Plan (EAP) in accordance with the requirements of these Regulations.

4.7.2 The Department shall inform the Delaware Emergency Management Agency of any dam presenting a risk of peril of life and property in the event that the dam fails.

4.8 Permit to Impound

4.8.1 The owners of all existing dams regulated under these Regulations must apply for and obtain from the Department a Permit to Impound in accordance with the requirements of these Regulations.

4.8.2 Within 60 days of the satisfactory receipt of the Supervising Engineer's Certificate, as-built plans, the O&M Plan, and the EAP, from the owners of new dams or existing dams that have been modified, the Department will issue a Permit to Impound prior to the impoundment of water behind the dam.

5.0 Hazard Classification of Dams

5.1 General Requirements

5.1.1 Dams shall be classified in accordance with the federal classification system into three classes that are rated according to the potential damage that could be caused if the dams fail. Those three classes shall be designated as follows:

5.1.1.1 Class I High Hazard Potential

5.1.1.2 Class II Significant Hazard Potential

5.1.1.3 Class III Low Hazard Potential

5.1.2 Per state legislation and these Regulations, Class III Low-Hazard dams are exempt from the requirements of these Regulations.

5.1.3 The Department will use the guidelines in this section to classify dams according to hazard. Probable future development of the area downstream from the dam, which might be affected by its failure, will be considered in determining the hazard classification.

5.1.4 The Department may, at its discretion, change the hazard class of any proposed or existing dam.

5.2 Description of Hazard Class

5.2.1 Class I – High Hazard Potential: This classification includes any dam whose failure or misoperation will cause probable loss of human life. The existence of normally occupied homes in the area that are susceptible to significant damage in the event of a dam failure will be assumed to mean "probable loss of life." Recreational facilities below a dam, such as a campground or recreation area, may be sufficient reason to classify a dam as having a high-hazard potential.

5.2.2 Class II – Significant Hazard Potential: This classification includes any dam whose failure or misoperation will cause possible loss of human life, economic loss, environmental damage, and disruption of lifeline facilities, or can impact other concerns. This classification applies to predominantly rural agricultural areas, where dam failure may damage isolated homes, major highways, or railroads or cause interruption of service of relatively important public utilities.

5.2.3 Class III – Low Hazard Potential: This classification includes any dam whose failure or misoperation is unlikely to cause loss of human life but may cause minor economic and/or environmental losses. This classification applies to rural or agricultural areas where failure may damage farm buildings other than residences, agricultural lands, or non-major roads. Class III dams are exempted from the requirements of these Regulations.

5.3 Determination of the Hazard Class

5.3.1 The hazard classification shall be determined by establishing a danger reach downstream of the dam by conducting a dam breach analysis and routing the dam breach flood wave through the downstream valley. At the discretion of the Department, this analysis may require routing several spillway design floods through the danger reach, with and without the effects of failure of the dam, including at a minimum the following events:

5.3.1.1 100-year frequency flood

5.3.1.2 50 percent probable maximum flood (PMF)

5.3.1.3 Probable maximum flood (PMF)

5.3.1.4 A sunny day failure for dams with permanent pools

5.3.2 The applicant shall use computational methods for analyzing dam failure flooding that are generally acceptable in the engineering community and are verifiable, reliable, and acceptable to the Department.

5.3.3 The Department shall determine and assign the hazard classification according to the criteria above based on:

5.3.3.1 An evaluation of hydrologic calculations assuming ultimate development of the watershed using existing comprehensive plans and zoning; and

5.3.3.2 Review of potential damage within the danger reach.

5.3.4 Failure damage potential shall consider future development and use of the area flooded throughout the danger reach and the damage that would be expected from a complete breaching of the dam. If, in the opinion of the Department, future development is probable in the area flooded throughout the danger reach, the dam shall be categorized as Class I.

5.3.5 The classification of the proposed dam shall be assigned by the Department after the applicant has provided information on the potential damage within the danger reach, as defined herein. After

the classification has been assigned, the inflow design flood and spillway design may be established.

6.0 Application Procedures

6.1 Application Procedures for Existing Dams

6.1.1 Upon promulgation of these Regulations, the Department shall notify in writing the owner of each regulated dam that existed prior to June 30, 2004, that the Department has determined that they own, or have operational control over, a regulated dam and are subject to the provisions of these Regulations. The Department shall provide to each owner a copy of all information that the Department has gathered about the dam, including photographs, measurements, maps, plans, etc. The notification shall include the dam's Preliminary Hazard Classification as determined by the Department.

6.1.2 Within 90 days of receipt of the Department's notification that they own a regulated dam, each dam owner shall submit a letter to the Department acknowledging ownership or operational control of the dam and shall provide to the Department a copy of any existing information in the owner's possession concerning the dam (plans, surveys, engineering reports, etc.).

6.1.3 In the event that a dam owner wishes to dispute the Department's determination that they own or have operational control over a particular dam, that owner must submit a letter to the Department within 90 days of receipt of the Department's notification of ownership. The owner's letter to the Department shall provide documentation supporting the owner's claim of non-ownership or non-control. In cases of disputed ownership, the Department will review the documentation provided by the dam owner, and may conduct additional investigation as deemed necessary by the Department to resolve the dispute.

6.1.4 Upon receipt by the Department of the owner's acknowledgment of dam ownership, the Department will perform a condition assessment of each dam.

6.1.4.1 If the condition of the dam is determined to be satisfactory, the Department will issue to the owner a Provisional Certificate to Impound.

6.1.4.2 If the condition of the dam is determined to be unsatisfactory, the Department will notify the owner in writing of the deficiencies with the required actions by the owner with deadlines for remedying the unsafe or deficient conditions.

6.1.4.2.1 Within 30 calendar days of receiving notice of an unsatisfactory dam, the owner shall respond to the Department with their intended actions to remedy the deficiencies within the required timeframe.

6.1.4.2.2 Within 30 days of receiving the owner's intended actions, the Department shall make a determination as to whether or not a Permit to Construct, Alter, or Repair a Dam is required and issue a written directive to the owner as to the appropriate course of action.

6.1.4.2.3 If a Permit to Construct a New Dam or a Permit to Alter, Repair or Remove an Existing Dam is required, the owner shall follow the application procedures in Section 6.2 of these Regulations. If such permits are not required, the Department will issue to the owner a Provisional Certificate to Impound within 30 days of remedying the unsatisfactory conditions, as determined by the Department.

6.1.5 Upon issuance of the Provisional Certificate to Impound by the Department, the dam owner will be required to submit to the Department, the following minimum supporting documentation for each dam. The Provisional Certificate to Impound shall include a specific list of the items to be submitted for each dam, and a time frame for the submittal of each item.

6.1.5.1 Application fee in accordance with paragraph 7.2 of these Regulations

6.1.5.2 Basic information about the dam, including:

6.1.5.2.1 Dam location, including the County, nearest town, and stream on which the dam is located

6.1.5.2.2 A map showing the location of the dam

6.1.5.2.3 Dam type

6.1.5.2.4 Dam crest elevation and height, as measured from the downstream toe to the lowest point along the crest

6.1.5.2.5 Steepness of dam slopes

6.1.5.2.6 Seepage controls (if known)

6.1.5.2.7 Slope protection

6.1.5.2.8 Normal pool elevation

6.1.5.2.9 Spillway type and crest elevation

6.1.5.2.10 Spillway capacity in terms of flow

6.1.5.2.11 Storm event return frequency that the spillway is capable of passing without overtopping the dam

6.1.5.2.12 A dam break analysis and downstream danger reach map indicating structures, roads, railroads, critical infrastructure, and other man-made features that are within the danger reach

6.1.5.3 A report, prepared under the supervision of a Delaware-licensed professional engineer experienced with dams, that consists of a site inspection report, documentation of the above information, and an overall evaluation of the condition and safety of the dam and appurtenant facilities

6.1.5.4 An Operations and Maintenance (O&M) Plan

6.1.5.5 An Emergency Action Plan (EAP)

6.1.5.6 Any additional information that exists about the dam, which may include:

6.1.5.6.1 Plans, specifications, and/or engineering analyses and engineering reports

6.1.5.6.2 Inspection reports

6.1.5.6.3 Documentation of repairs and/or modifications to the dam

6.1.5.6.4 Photographs

6.1.5.6.5 Correspondence

6.1.5.6.6 Any other information that exists

6.1.6 The Department will evaluate the information provided by the applicant, make an assessment about its adequacy, and determine whether additional information is necessary to issue a Permit to Impound. The Department shall notify the applicant within 30 calendar days of receipt of the application package if any additional information is required and the nature of that additional information.

6.1.7 Within 90 calendar days of receiving all required information the Department shall issue a Permit to Impound to the dam owner.

6.2 General Application Procedures for Construction of a New Dam or the Repair, Alteration, or Removal of an Existing Dam

6.2.1 The procedures for applying for a Permit to Construct a New Dam or for a Permit to Alter, Repair, or Remove an Existing Dam, and for submitting the supporting engineering documents include the pre-application stage and the application stage, as described below.

6.2.2 The applicant for either type of dam permit referenced in 6.2.1 must use a Delaware-licensed professional engineer (Supervising Engineer) to prepare the plans and specifications and to supervise the inspection of construction, as required in Section 4.0 of these Regulations.

6.2.3 The Department may require any owner or operator of an existing dam to obtain a Permit to Alter, Repair, or Remove an Existing Dam in order to repair or alter the dam, spillway, outlet works, or other and appurtenances where:

6.2.3.1 Repair, alteration, or removal is necessary to for the protection of human health or safety; or

6.2.3.2 Alteration, repair, or removal is required to comply with the provisions of these Regulations, unless compliance is impracticable, and noncompliance poses no unacceptable threat to human health or safety, as determined by the Department.

6.2.4 Except as otherwise provided in these Regulations, any action or determination by the Department under these Regulations shall be subject to appeal to the Environmental Appeals Board in accordance with the provisions of 7 **Del.C.** § 6008.

6.2.5 Appeals of decisions by the Environmental Appeals Board shall be conducted pursuant to 7 **Del.C.** § 6009.

6.3 Pre-Application Stage for the Construction of New Dams or for the Repair, Alteration, or Removal of Existing Dams

6.3.1 The applicant must submit a written Preliminary Report that must include the following:

6.3.1.1 A general description of the dam and all appurtenances thereto, and the proposed dam classification, pursuant to the requirements of these Regulations. The description shall include the following:

6.3.1.1.1 A statement of the purpose for which the dam and appurtenances are to be used; and

6.3.1.1.2 A description of the potential effects of project construction and operation upon the environment.

6.3.1.2 Maps of the area within one-half mile of the dam and impoundment boundary, showing the following:

6.3.1.2.1 The location of the proposed dam and all appurtenances

6.3.1.2.2 The location of all structures

6.3.1.2.3 The county and nearest town

6.3.1.2.4 The boundary of the reservoir

6.3.1.2.5 The location of all streets and roads

6.3.1.2.6 The location of all major utilities, including pipe lines and transmission, telegraph, and telephone lines; all minor utilities shall be identified in the immediate vicinity of the dam impoundment area

6.3.1.2.7 The topography and scale

6.3.1.2.8 All other structures or facilities affected by the proposed dam, including the area downstream from the dam (state, county, and U.S. Geological Survey maps and aerial photographs may be used for this purpose)

6.3.1.2.9 Photographs of the site

6.3.1.3 A written report of the surficial conditions (geology, topography, land-use, existing structures and facilities, etc.), based upon a field reconnaissance by the applicant's engineer

6.3.1.4 Typical cross-sections of the dam and any dike(s) and levee(s), showing proposed elevations, pool levels, and top and bottom widths

6.3.1.5 Preliminary design data, tentative conclusions, and references. The design data shall address hydrologic features such as drainage area and rainfall data, the basis for proposed dam location, the basis for the type of structure and spillway proposed, the soils and geologic engineering criteria, and the basis for design and construction

6.3.1.6 The hydrologic design procedure and the storm durations that are used in the design

6.3.1.7 All documentation and information related to determining hazard classification

6.3.1.8 Other information required by the Department

6.3.2 At this time, the applicant shall also submit an application for a Subaqueous Lands Permit and any other State and Federal permits required.

6.3.3 The Department will review the pre-application, and within 30 days of its receipt, the Department will notify the applicant of what design criteria will apply. The Department may identify key issues for the applicant to address or may request additional information from the applicant.

6.3.4 Applicants for a permit to conduct minor repairs to an existing dam are not required to submit a preliminary report unless the Department determines it to be necessary.

6.4 Application Stage for the Construction of New Dams or for the Repair, Alteration, or Removal of Existing Dams

6.4.1 The application shall be on forms specified and supplied by the Department and must be accompanied by two copies of the final design report and five sets of all plans, drawings, designs, and specifications. Upon the written request of the applicant, the Department may waive certain requirements for documentation in the application stage set forth below for a permit to repair, alter, or remove an existing dam.

6.4.2 The application shall include a Final Design Report, which must contain the following:

6.4.2.1 A report of the field and laboratory investigation(s) of the foundation soils and/or bedrock**[, beneath the dam; and the soil, concrete and rock that will comprise the project structures;]** and a location map to identify borings and the materials that will comprise the dam and any dikes or levees. Stability, settlement, and seepage analyses are required, unless the applicant can demonstrate to the satisfaction of the Department that these analyses are not necessary.

6.4.2.2 The bases, references, calculations, and conclusions relative to hydrologic studies and design of spillway.

6.4.2.3 Structural and hydraulic design studies and calculations. Structural, hydraulic and hydrologic design procedures should be used, as established by one of the following: the U.S. Army Corps of Engineers, the **[~~U.S.~~]** Bureau of Reclamation, the **[~~U.S.~~]** Natural Resource **[~~and~~]** Conservation Service, the Federal Energy Regulatory Commission, and other procedures **[~~universally~~ broadly]** accepted as **[representing]** sound engineering practice

6.4.3 The application must include all drawings necessary to fully describe the proposal. Drawings must be prepared in accordance with the following:

6.4.3.1 All drawings must be prepared under the supervision of a Delaware-licensed professional engineer.

6.4.3.2 Drawings must clearly show the datum to which elevations shown are referred. The North American Vertical Datum of 1988 (NAVD 88) should be used wherever possible. If the N.G.V.D. datum is not used, an appropriate conversion equation must be indicated on the drawings. The Delaware State Plane Coordinate System, North American Datum of 1983 (NAD 83) shall be used as the horizontal datum reference.

6.4.3.3 The applicant must submit drawings showing the following information:

6.4.3.3.1 Existing conditions of the site including topography, property lines, easements, vegetation, existing structures and roads, etc.

6.4.3.3.2 A general plan of the dam, drawn to an appropriate scale, which must show proposed topography, the accurate position of all essential details, such as the spillway and its point of discharge into the stream; pipes through the dam, inlets, outlets, screen chambers, gate or valve houses, head-races, the canal mill or power plant, tailraces and downstream bridges that might cause backwater on the dam

6.4.3.3.3 A longitudinal section of the dam and cross-section of the valley at the site of the dam, showing the elevation of the crest of the dam; the elevation of the normal and design storm flow line of the lake or reservoir; the original surface of the ground; **[a general characterization of]** the nature and depth of the underlying strata; the probable depth of the excavation for the foundation of the dam and for the cutoff; foundation treatment; elevation of the restored surface of the ground; the location and elevation of all pipes or conduits passing through the dam; the core wall, if any; and the spillway structure

6.4.3.3.4 Typical cross sections, including a maximum section of the dam and of a spillway section that shall meet the following requirements;

6.4.3.3.4.1 Cross sections must show the original surface of the ground, **[a general characterization of]** subsurface conditions as disclosed by test pits or borings, the probable depth of excavations for the foundation and for cutoff or other seepage barriers, the elevations of the top of the dam, the crest of the spillway, and the normal flow line or water surface in the reservoir.

6.4.3.3.4.2 For earth dams, the following information shall be shown: the depth of stripping; the position, material, and dimensions of the cutoff or other seepage barriers; the width of the crest; the slopes and the nature and dimensions of the slope protection; the position and dimensions of the outlet pipes or conduits, and the seepage controls to control seepage along such structures; the disposition of different classes of embankment material if of varying composition; internal drains and filters; clay blankets; and other seepage barriers.

6.4.3.3.4.3 For concrete or other composite dams, the cross sections shall show all **[key structure]** dimensions and shall indicate the position and kinds of material to be included in the structure

6.4.3.3.5 If not clearly indicated on one or more of the drawings listed above, the following details shall be shown on additional detail sheets:

6.4.3.3.5.1 Detail of spillway or overflow, showing the length and depth of opening, together with the width and shape of the crest, grade, and shape of the approach and discharge channels, if any; methods of protecting the toe of the dam or end of the discharge channel from erosion; the dimensions of all walls, floors, and paving

6.4.3.3.5.2 Details of the intake and outlet works, showing the location and dimensions of all valves or sluice gates, intakes, screen chambers, racks, outlet towers, and gate houses and appurtenances

6.4.3.3.5.3 For **[~~reinforced~~]** concrete dams **[and reinforced concrete structures]**, detailed drawings must also be submitted, showing the size, spacing, and arrangement of all reinforcing steel **[~~and expansion~~]** joints**[, joint in-filling and other protective treatments.]**

6.4.3.3.5.4 Special drawings shall be submitted showing any special construction features not otherwise shown, such as pilings, fishways, aprons, materials used in the core wall, movable dams, tainter gates and mechanical devices, drains, and instrumentation

6.4.3.3.6 Sediment and erosion control practices

6.4.4 The application must include specifications, containing the following:

6.4.4.1 General provisions, specifying the rights, duties, and responsibilities of the owner, applicant, applicant's engineer, and the builder

6.4.4.2 The estimated project schedule and sequence of work

6.4.4.3 Technical provisions, describing carefully and in detail the approved work methods and procedures, standards for equipment and testing, materials to be used, and the results to be obtained

6.4.5 The applicant shall complete all investigations, including the following, prior to submission of the final design report that shall meet the following requirements:

6.4.5.1 The scope and the degree of precision of investigations required for a specific project shall be based on the complexities of the site, the importance of the proposed structure, and the hazard created by the proposed structure

6.4.5.2 The foundation investigation shall consist of borings, test pits, geophysical investigations, or other subsurface explorations and must be performed so as to **[~~accurately~~ reasonably]** define the soil and rock stratigraphy and the ground water conditions to the satisfaction of the Department

6.4.5.3 Laboratory testing of undisturbed and remolded soil**[, ~~specimens~~ concrete]** and**[/or]** rock samples may be required by the Department

6.4.5.4 The applicant must determine the nature and extent of materials that are proposed for use in the structure (e.g., **[earth and rock]** borrow material, concrete **[~~aggregate~~ constituents (cement, fly ash, coarse and fine aggregates, admixtures)]**, riprap stone, filter materials) and their structural properties when incorporated into the proposed structure

6.4.5.5 Stability analysis and calculations for the proposed structure to ensure safety against failure due to overturning, sliding, or overstressing must be submitted and approved by the Department

6.4.5.6 Topographic surveys must be performed with sufficient accuracy to locate the proposed construction and to define the volume of the storage in the reservoir and the flowage limits. The upstream and downstream areas must be investigated in order to delineate the area of potential damage in case of failure or flooding. Locations of baselines, centerlines, and other horizontal and vertical control points must be shown on the topographic map of the site

6.4.5.7 The drainage area must be accurately **[~~determined~~ delineated]**. Both present and projected future land use **[(based on available information))]** must be considered in determining the runoff characteristics of the drainage area. The most severe of these two conditions must be used in the design. The hydrologic assumptions and design calculations used in spillway designs shall be specified and shall include:

6.4.5.7.1 Drainage area size

6.4.5.7.2 Rainfall and runoff data

6.4.5.7.3 Reservoir inflow hydrographs

6.4.5.7.4 Reservoir area-capacity-elevation data

6.4.5.7.5 Spillway elevation-discharge data

6.4.5.7.6 Reservoir flood routings, except as otherwise provided in this subchapter

6.4.6 All applicants must submit an O&M Plan in accordance with these Regulations, and applicants for Class I and II dams shall prepare and submit an EAP that shall include at a minimum a dam breach analysis, inundation maps, and emergency notification and evacuation plans.

6.4.7 A permit for a dam does not imply approval of other permits. It is the responsibility of the applicant to obtain all other necessary local, State, and Federal permits.

6.4.8 The application to remove or breach a dam shall include the following:

6.4.8.1 Design report, and plans and computations to effect the breach, including size of breach, shape of breach, and disposal of spoil material

6.4.8.2 Plans and computations for stabilization of the lake bed, including the channel upstream of the breach, and for the control of sediment within the lake and downstream of the breach during and after the breach has been effected

6.4.8.3 Computations for design of the method and timing for dewatering the lake, unless waived by the Department

6.4.8.4 Computations detailing the effects of the breach on the downstream channel and demonstrating that the project will not adversely affect flooding conditions downstream during the 10-, 50-, and 100-year storms.

6.4.8.5 Specifications containing the technical provision that describe in detail the proposed work methods and equipment and, in addition, a work schedule for the entire project

6.4.8.6 A plan of the existing dam and lake along with surrounding property lines

6.4.8.7 A description of the potential effects of the dam removal or breach upon the environment

6.4.8.8 A description of the potential effects of the dam removal or breach upon life and property downstream of the dam

6.5 Actions by the Department Upon Applications

6.5.1 Public notice of application shall consist of an advertisement in a newspaper of general circulation in the county in which the activity is proposed and in a daily newspaper of general circulation throughout the state to include the fact that the application has been received, a brief description of the nature of the application, and the location(s) where a copy of the application may be inspected.

6.5.2 Following the receipt of requested comments, the Department shall approve, disapprove, or approve subject to conditions necessary to ensure safety, all applications pursuant to these Regulations.

6.5.3 A defective application shall not be rejected but notice of the defects shall be sent to the owner. If the owner fails to file a corrected application within 30 days of the date of the notice, the original application shall be canceled unless further time is allowed.

6.5.4 If the Department disapproves an application, one copy shall be returned with a statement of its objections. If an application is approved, the approval shall be attached thereto along with a Permit to Construct a New Dam or a Permit to Alter, Repair, or Remove an Existing Dam, as applicable, and a copy returned to the applicant. Approval shall be granted under terms, conditions, and limitations that the Department deems necessary to safeguard life and property.

6.5.5 Construction shall be commenced within 2 years after the date of approval of the application and completed within 5 years of commencement of construction, or the approval is void. The Department upon written application and demonstrated good cause may extend the time for commencing construction or for completing the construction. Notice by registered or certified mail shall be given the Department at least 10 days before construction is commenced.

7.0 Fees

7.1 General Provisions. The fees provided for in this subsection shall be required of all owners of dams that are regulated by these Regulations.

7.2 Application Fees for Existing Dams. Owners of existing dams shall submit a $500 application fee upon issuance of a Provisional Certificate to Impound by the Department.

7.3 Fees for the Construction of New Dams or for the Repair, Alteration, or Removal of Existing Dams

7.3.1 An applicant for the construction of a new dam or for the repair, alteration, or removal of an existing dam shall submit to the Department a fee of $500 at the time the Application is submitted.

7.3.2 The Department will not act on an application until the fee is submitted.

8.0 Requirements for Engineering and Design

8.1 Geotechnical Investigation

8.1.1 A geotechnical investigation shall be conducted to characterize the soil**[, concrete]** and rock conditions at the dam and spillway site and borrow areas (if appropriate) sufficient for design purposes. The investigations may consist of **[~~either~~]** intrusive **[and/]**or non-intrusive techniques that are deemed acceptable to the Department.

8.1.2 The means and methods for conducting the investigation of existing dams shall be selected so as not to jeopardize the integrity of the dam or ancillary facilities.

8.2 Spillway Requirements

8.2.1 The minimum Spillway Design Flood (SDF) used to calculate required spillway capacity shall be determined as follows:

8.2.1.1 Hazard Class I - The SDF shall be the PMF

8.2.1.2 Hazard Class II - the SDF shall be 50% of the PMF

8.2.1.3 Hazard Class III - the SDF shall be the 24-hour, 100-year frequency, Type II storm. Any later technology adopted by the U.S. Department of Agriculture, Natural Resources Conservation Service, may be substituted for the use of the Type II storm with the approval of the Department.

8.2.2 For existing dams, it is recognized that the relationships between valley slope and width, **[**~~T~~t**]**otal reservoir storage, drainage area, and other hydrologic factors have a critical bearing on determining the safe SDF. When appropriate, and upon the approval of the Department, an incremental flooding assessment may be used for the rational selection of a reduced spillway design for specific site conditions based on quantitative and relative impact analysis. The spillway should be sized so that the increased downstream damage resulting from overtopping failure of the dam would not be significant as compared with the damage caused by the flood in the absence of a dam overtopping failure. The minimum design storm for the dam shall be the 100-year storm.

8.2.3 All Class II and III dams shall, where practicable, incorporate in the proposed design the ability to make modifications necessary to increase the spillway capacity of the facility or other alternative measures if the downstream hazard potential increases.

8.2.4 All dams shall have an adequate storage for the SDF or have a spillway system that will safely pass the SDF without endangering the safety of the dam.

8.2.5 Each spillway shall include a satisfactory means of dissipating the energy of flow at its outlet without endangering the safety of the dam.

8.2.6 The capacity of the spillway system shall be equal to the peak inflow of the design flood unless the applicant demonstrates by flood routing procedures that the spillway system has the capacity to safely pass the resulting water flow.

8.2.7 Pipe conduits may be used for the primary (principal) spillway. When so used, the following requirements shall be met:

8.2.7.1 Pipe conduits shall be of such design as to safely support without leakage the total external loads in addition to the total internal hydraulic pressure. The type of construction material used shall be consistent with the anticipated life of the structure. Corrugated metal pipe shall not be used in the construction of new dams

8.2.7.1.1 For Class I and II dams, the minimum allowable inside dimension of the pipe conduit is 30 inches to allow for inspection.

8.2.7.1.2 For Class III dams, the minimum allowable inside diameter of the pipe conduit is 18 inches.

8.2.7.2 All pipe conduits shall convey water at the maximum design velocity without damage to the interior surface.

8.2.7.3 The pipe conduit must be designed so that negative pressures will not occur at any point along the primary (principal) spillway system.

8.2.7.4 Filter diaphragms or other seepage control methods approved by the Department must be installed to control seepage along the conduit.

8.2.7.5 Adequate allowances shall be incorporated in the design to compensate for differential settlement and possible elongation of the pipe conduit.

8.2.7.6 An anti-vortex device must be included in the design, unless the applicant can demonstrate that one is not necessary.

8.2.7.7 A **[self-cleaning]** trash rack, approved by the Department, shall be installed at the intake to prevent clogging of the pipe conduit.

8.2.7.8 An emergency spillway shall be provided.

8.2.7.9 Corrosion protection shall be provided for all steel pipes as necessary.

[8.2.7.10 Concrete cradles or encasements shall be provided for conduits through earth dams.]

8.2.7.**[~~10~~11]** All structural concrete and steel structures shall be designed to resist the anticipated design loads using current design methodologies acceptable to the Department.

8.2.8 Should a vegetated or unlined auxiliary spillway, approved by the Department, be installed, it must be able to pass the SDF without jeopardizing the safety of the structure and with a computed average frequency of use less than:

8.2.8.1 Once in 100 years for Class I dams,

8.2.8.2 Once in 50 years for Class II dams, or

8.2.8.3 Once in 25 years for Class III.

8.3 Outlet Works and Drawdown Requirements

8.3.1 Except for excavated impoundments, dams shall include a device to allow draining of the reservoir within a reasonable amount of time. The following factors shall be considered in determining the reasonable time period for drainage:

8.3.1.1 The risk and nature of a potential dam failure

8.3.1.2 The time likely to be available to avert a failure after notice of conditions threatening the safety or stability of the dam

8.3.1.3 The influence of rapid drawdown on the stability of the dam, its appurtenant works, and the natural upstream slopes of the reservoir

8.3.2 Unless the applicant demonstrates to the satisfaction of the Department that there is a need to locate a valve downstream from the dam and that the areas downstream of the dam will remain protected, all valves or sluice gates in pipe conduit drains must be installed upstream of the dam.

8.3.3 All pipe conduits used as drawdown drains for all dam classifications shall meet the requirements of Section 8.2.7, except that the minimum allowable inside dimension may be less than 30 inches.

8.4 Dam Requirements

8.4.1 The dam design shall designate what materials are suitable for the foundation of the dam, estimate the amount of foundation settlement, and describe the necessary foundation treatment for the structure.

8.4.2 The dam design shall designate what materials are to be used to construct the dam structure and provide the necessary design criteria for those materials. For embankment dams this includes, but is not limited to gradation, plasticity, strength, permeability, compaction and moisture criteria, lift thickness, and other properties that may be required by the Department. The source of the materials for embankment dams shall be designated. For concrete dams, the information provided shall include, but not be limited to the type of concrete, type of cement, aggregates, mix design, unconfined compressive strength, slump, and placement and curing procedures.

8.4.3 The applicant must demonstrate that the dam structure is stable under its various loading conditions, which must include at a minimum: during and after construction case, steady state case, maximum pool case, rapid drawdown case, and appropriate earthquake loading case. The engineering analysis and design shall follow current accepted engineering practices such as those of the U.S Army Corps of Engineers, the Natural Resources Conservation Service, the U.S. Bureau of Reclamation, the Federal Energy Regulatory Agency or other recognized standards and methodologies acceptable to the Department.

8.4.4 A seepage analysis shall be conducted to estimate the quantity of seepage that is anticipated to flow through, beneath, and/or around the dam. Unless it can be demonstrated that they are unnecessary, the design should include seepage reduction and/or control features to limit and/or collect and control seepage. Example techniques to reduce seepage include cut-off trenches, low-permeability cores, slurry trenches, or other proven methodologies acceptable to the Department. Example techniques for controlling and collecting seepage generally include drains, filters, and relief wells or other methodologies acceptable to the Department.

8.4.5 The design shall allow for certain freeboard as a minimum, not to be reduced under any circumstances during the operation of the dam and reservoir. The design freeboard is for that reservoir stage that will exist when the pool has reached maximum level during the spillway design flood with the outlet works and overflow spillway operating as planned. The freeboard is to be calculated to prevent overtopping and protect the dam against the destructive forces of waves, frost, settlement, and surface erosion.

8.4.6 The design shall provide for upstream slope protection against the action of waves and ice.

8.5 Other Requirements

8.5.1 Design references used shall be cited in the information submitted to the Department.

8.5.2 The Department may include, either at the time of granting a Permit to Construct a New Dam, or a Permit to Alter or Repair an Existing Dam or at a later date, a requirement that the owner provide and install devices necessary for the future inspection and surveillance of the dam. The number, type, and location of the devices shall be determined as a result of the Department's evaluation of the site and nature of the dam, the complexity of local natural conditions, and the degree of risk resulting from any future deterioration or failure. The requirement may include provisions for the measurement of the settlement of the crest or slopes of dams, the movement of walls in the valley or reservoir, the increases in pore water pressure in earth or increases in flow from drainage systems, and the installation of other devices required to detect serious changes in the structure or the affected area to allow the repair of deficiencies before more serious risk develops.

8.5.3 The applicant shall demonstrate to the Department that the riparian rights of downstream property owners will be protected during construction, during the period when the reservoir is being filled and during the life of the dam and reservoir.

8.5.4 The Department may require the design and installation of any additional or modified measures by any applicant for a dam permit where appropriate to ensure the protection of human health or safety.

8.5.5 In the case of multiple dams, when they are spaced so that the failure of an upstream dam or structure could endanger the safety of one downstream, the possibility of a multiple failure shall be considered in reviewing the design. **[~~Additional safety shall be provided in either structure by increasing the retarding storage or increasing the emergency spillway capacity, or both.~~]**

8.5.6 Utilities crossing within dam embankments are prohibited unless demonstrated to the satisfaction of the Department that such utilities will not jeopardize the safety of the dam.

9.0 Requirements for Construction

9.1 General Requirements

9.1.1 Construction shall be conducted under the **[~~oversight~~ observation]** of the Supervising Engineer as defined in these Regulations. The Supervising Engineer shall submit progress reports to the Department at least once each month during the construction period.

9.1.2 All applicants shall submit a written description of the work to be performed and schedule of the proposed construction, including:

9.1.2.1 The name and qualifications of the construction firm to perform the work, including the qualifications of their project manager and site superintendent

9.1.2.2 The estimated time to complete the construction activities

9.1.2.3 Where applicable, a description of the means by which stream flow will be diverted around or through the dam site, or otherwise kept from interfering with the work

9.1.2.4 The name of the Supervising Engineer and a description of the construction quality control and testing program including the number, names, and qualifications of on-site representatives working under the direction of the supervising engineer

9.1.2.5 Steps to be taken to minimize erosion and sediment production during construction

9.1.3 The Supervising Engineer shall submit the Construction Quality Control Plan as described below. The plan must be approved by the Department, prior to construction.

9.1.4 **[~~The diversion facility, as outlined above, must remain open and n~~N]**o water may be permanently stored in the reservoir until the applicant demonstrates to the Department that storage of water will neither interfere with construction activities nor create a hazard to life, health, or property.

9.1.5 The applicant shall promptly advise the Department of all proposed changes in the approved design, plans, or specifications. There may be no change in the approved design, plans, or specifications without prior approval of the Department. All approved changes must be recorded on the complete set of as-built plans, as required below. The Department may require the submission of revised designs at any time. Written prior approval from the Department is required for major modifications, which shall include significant changes in scale, use, design, impact, etc., of the project as initially approved. The Department may require written prior approval of any proposed modification.

9.1.6 Within 7 days of completion of construction, the Owner or Supervising Engineer shall notify the Department that construction has been completed.

9.1.7 Within 60 days of completion of construction, the Supervising Engineer shall submit the written Supervising Engineer's Certificate with accompanying project documentation as required in Section 9.3.3.

9.1.8 The Department may, in its discretion, require the owner to obtain the services of an independent review board to oversee the design and construction of any proposed or existing dam.

9.2 Construction Quality Control Plan Requirements. The Construction Quality Control Plan shall be prepared by the supervising engineer and submitted to the Department. The plan shall include the following:

9.2.1 A description of the work that is to be inspected

9.2.2 A description of the tasks to be used to adequately inspect the work to **[~~confirm~~ verify]** that it **[~~is being~~ has been]** conducted **[~~according to~~ in general accordance with]** the approved design, and the frequency or duration of site visits and inspections (such as full-time**[, ~~or half-time~~ during pre-defined critical activities, etc.]**)

9.2.3 A description of the field and laboratory testing, including the types and frequency of tests, the requirements for acceptable tests, and the procedures for **[~~dealing with~~ addressing]** test**[~~s~~ results]** that are out of compliance

9.2.4 The name(s) and qualifications of the site quality control representative(s) who will work under the direction of the Supervising Engineer

9.3 Documentation and Reporting Requirements

9.3.1 The Supervising Engineer shall submit periodic construction progress reports to the Department. Progress report forms and the frequency of reporting will be provided by the Department before construction.

9.3.2 A history of the construction shall be maintained at the construction site by the Supervising Engineer and shall include:

9.3.2.1 Date, location, and results of all materials tests made

9.3.2.2 Narrative of problems encountered during construction and changes in design. Necessity for these changes shall be reported to the **[~~Administration~~ Department]** for approval before proceeding with construction

9.3.2.3 “As built" plans

9.3.3 As required in Section 9.1.7, before filling the reservoir, the Supervising Engineer shall submit to the Department, the above information along with the Supervising Engineer’s Certificate stating that to the best of his/her knowledge, the completed structure has been constructed in **[general]** accordance with plans and specifications and changes approved by the Department. The Supervising Engineer’s Certificate shall state that the structure has been made ready for filling and that the pool area has been cleared of debris. The report shall describe the limitations on the amount of water restrained from flowing downstream and describe the methods to be followed for the surveillance of the project during the period when the structure is receiving its initial loading.

9.4 Department Inspections

9.4.1 The Department may inspect the dam during construction to ensure that it is being built in compliance with the designs, plans, and specifications submitted to the Department. Departmental inspections in no way relieve either the permittee or the Supervising Engineer from the responsibility of providing adequate inspection of the work.

9.4.2 If, at any time during the progress of the work, the Department finds that the work is not being performed in accordance with the approved designs, plans, and specifications and any approved changes, the Department will serve a written notice to that effect on the permittee or his

representative. Such notice will state the particulars with which the work has not complied. Additionally, the Department may order the immediate compliance with such designs, plans, specifications, and changes and order the suspension of all other work until compliance has been effected. If the owner or his representative fails to comply with this order, the permit under which construction is authorized may be revoked or suspended by the Department.

9.4.3 Within 60 days of receipt of the Supervising Engineer's Certificate and as-built plans (as required in Section 9.3.3), the Department will visit the site and issue its final approval with a Permit to Impound if it finds that the construction has been completed in **[general]** accordance with the approved designs, plans, specifications, and approved changes.

10.0Requirements for Operation, Maintenance and Inspections

10.1 General Requirements

10.1.1 The owners and operators of all dams regulated under these Regulations shall operate and maintain the dams according to the requirements of these Regulations.

10.1.2 Specific requirements include the following:

10.1.2.1 Develop and follow an O&M Plan, which provides guidance and instruction to project personnel for the proper operation, maintenance, surveillance, and inspection of the dam and reservoir.

10.1.2.2 Conduct routine surveillance and formal and informal inspections in accordance with the requirements of these Regulations and the O&M Plan.

10.1.2.3 Trees and other woody vegetation shall be prevented from growing on the dam unless waived by the Department.

10.1.2.4 Conduct in a timely manner and document any routine maintenance and any repair work performed at the dam and reservoir citing the date and work performed.

10.1.2.5 Prepare an EAP that complements the O&M Plan and provides detailed guidance on surveillance, including what constitutes an emergency situation and the actions to be followed in the event of an emergency.

10.1.2.6 Review and update **[if necessry]** the O&M Plan on a yearly basis and provide the updated plan to the Department by July 1 of each year.

10.2 Operation and Maintenance (O&M) Plan

10.2.1 The O&M Plan shall describe the steps to be followed by the owner to provide for the continued operation and maintenance of the dam and reservoir during the expected life of the structure. It shall consist of four parts as described in the following sections.

10.2.2 Part One of the O&M Plan shall include an introduction, project description, project authorizations, project history, and list of project **[~~contracts~~ contacts]**.

10.2.3 Part Two of the O&M Plan shall describe the steps to be followed by the owner to provide for the safe operation of the dam and reservoir and the continued minimum releases, withdrawals, etc.

10.2.4 Part Three of the O&M Plan shall describe what work is to be done at periodic intervals (or when necessary) to keep the structure in **[~~good~~ proper operating]** condition. This work could include

mowing or cutting bushy growth on embankments, preventing erosion or gullying of embankment surfaces, clearing toe drains, preventing trash and debris accumulation, protecting against **[or treating]** rust and spalling, and **[lubricating and]** exercising valves or other mechanical equipment. The description of this program shall be submitted to the Department for approval and inclusion among the required conditions of the construction period.

10.2.5 Part Four of the O&M Plan shall describe the requirements for surveillance and inspection of the dam and reservoir and shall reference the EAP in the event that severe deficiencies or signs of a potential emergency condition are encountered.

10.3 Surveillance and Inspections

10.3.1 The owner is responsible for the safety of the dam and for the necessary surveillance and inspections. The surveillance shall be performed by the owner, or a representative of the owner, and shall **[~~provide a close watch~~ focus]** on **[~~the~~]** conditions **[~~affecting~~ important to]** the dam's safety. The owner shall conduct Informal Inspections on at least a quarterly basis and promptly notify the Department of significant changes in condition. The Department has the right to require more frequent Informal Inspections by the owner, if deemed necessary.

10.3.2 The owners or operators of all Class I dams shall have a Regular Inspection performed annually **[~~under the supervision of~~ by]** a Delaware-licensed professional engineer. These inspections must be attended by a professional engineer assigned from the Department. Depending on the degree of hazard and/or condition of the dam, the Department may require the owner of a Class I dam to provide more frequent surveillance, which could be in the form of visual inspections and/or monitoring of instrumentation. The Department may also require the owner to have a Formal Inspection conducted by a Delaware-licensed professional engineer, if deemed necessary to confirm the safety of a given dam.

10.3.3 Owners or operators of Class II dams shall have a Regular Inspection performed at least once every 2 years under the supervision of a Delaware-licensed professional engineer. The Department may also require the owner to have a Formal Inspection conducted by a Delaware-licensed professional engineer, if deemed necessary to confirm the safety of a given dam.

10.3.4 All dam inspections shall be performed from March through December and in compliance with the following requirements:

10.3.4.1 A written guide provided by the Department for the preparation of a Report on Condition of the dam shall be used for all inspections.

10.3.4.2 Regular dam inspections shall be performed **[~~under the supervision of~~ by]** a Delaware-licensed professional engineer **[with experience in dam design and construction]**. The required report shall be submitted to the Department by the engineer within **[~~30~~ 90]** days of completion of the inspection. The report shall indicate the results of the inspection, documenting the condition of the dam and appurtenant facilities, and problems or deficiencies noted as well as the engineer’s conclusions and recommendations.

10.3.4.3 The Department may also require more frequent inspections during the first filling and initial stages of operation of a new dam.

10.3.4.4 Informal or routine inspections may be performed by the dam owner or operator and the Report on Condition shall be part of the owner's or operator's permanent file and, unless requested by the Department, reports shall not be submitted to the Department.

10.3.4.5 Formal Inspections shall be followed up with a report by the Delaware-licensed professional engineer with his/her opinion as to the conformance of the dam to currently accepted design standards and its overall safety with recommendations, as appropriate. The required report shall be submitted to the Department by the engineer within **[~~30~~ 90]** days of completion of the inspection.

10.3.4.6 The Department may extend the time for submission of the required material for up to 30 days, if the owner or operator justifies the need for such extension.

10.3.4.7 Failure by the permittee to inspect within the required time periods or failure to submit the Report on Condition may result in an order to drain the impoundment and/or any other remedy allowed by law.

10.3.4.8 For good cause, the Department may require the owner or operator of any dam to perform an inspection of any type at any time.

10.3.4.9 The owner or operator of all Class I and II dams shall prepare and use an EAP, as described in these Regulations.

10.4 Emergency Action Plan (EAP) and Procedures

10.4.1 The EAP for Class I and II dams shall describe the steps to be followed in the event of a potential emergency condition. This includes requirements for surveillance; definitions of a potential emergency situation; a warning plan for notifying persons whose lives, property, or health may be endangered by failure, improper operation, or other circumstances affecting the safety of the dam; and an action plan for steps to be followed at the dam to mitigate the potential emergency. The warning plan shall identify the most practical and expeditious means for notifying potentially affected persons in close proximity to the dam or property owners.

10.4.2 The EAP shall include:

10.4.2.1 Identification of designated dam inspectors, and designated alternates, to observe the dam during storms anticipated to exceed the 10-year-frequency storm event.

10.4.2.2 A requirement that the dam inspectors measure and record the pool level and observe the dam during storm events and passage of flood peaks.

10.4.2.3 Requirements for observations, including at a minimum the pool level, rate of pool level rise, debris accumulation in the spillway, excessive seepage, and signs of embankment distress.

10.4.2.4 Identification of predetermined pool elevations or signs of distress in the dam to trigger notification and evacuation phases of the plan.

10.4.2.5 Actions to be taken by the dam inspector under specific conditions, including notification of the local emergency management agency.

10.4.2.6 A description of primary and backup capabilities for communications with the local emergency management agency.

10.4.2.7 A notification flow chart showing the agencies and personnel, with telephone numbers, to be contacted to provide a warning or to initiate an evacuation, and the order in which they will be notified.

10.4.2.8 A description of the role of each agency involved in the evacuation.

10.4.2.9 Inundation maps developed from the appropriate dam break modeling discussed in Section 5.0 of these Regulations and danger reach identifying areas and structures to be evacuated, evacuation routes, and roads to be closed.

10.4.2.10 A list of the addresses of structures to be evacuated.

10.4.2.11 Identification of the appropriate local authority to issue evacuation notices and to determine when evacuees may return.

10.4.2.12 Intervention procedures to be taken by the dam owner to alleviate the hazardous condition.

10.4.2.13 Lists of local contractors and material suppliers to be used in the event of an emergency.

10.4.3 A dam owner shall submit the EAP for review and approval by the Department, the state and local emergency management agency, and other local agencies that have a role in the plan.

10.4.4 A dam owner shall review the EAP annually to verify pertinent data, including personnel, telephone numbers, and identification of structures that may have been built within the danger reach. By July 1 of each year, the owner shall submit to the Department modifications and updated information necessary to maintain the EAP, including an annual exercise of the action plan. If no changes have occurred during that year to warrant an updated EAP, the owner shall issue a written statement to the Department to that effect.

10.5 Repairs and Routine Maintenance

10.5.1 Repairs or alterations to existing dams shall be undertaken in accordance with Sections 4.0 and 6.0 of these Regulations.

10.5.2 The owner is not required to contact the Department prior to performing routine maintenance activities, as defined in these Regulations.

11.0 Enforcement Procedures

11.1 Administrative and Legal Actions

11.1.1 The Department may take any administrative or legal action necessary for the enforcement of these Regulations.

11.1.2 An action or proceeding under this subsection may be initiated whenever any owner or any person acting as an agent of any owner:

11.1.2.1 Fails to comply with the requirements imposed by these Regulations or by any application approval, Permit to Construct, Permit to Impound, order, rule, regulation, or requirement of the Department under the authority of these Regulations, or

11.1.2.2 Commits or allows the commission of violations of these Regulations or any application approval, Permit to Construct, Permit to Impound, order, rule, regulation, or requirement of the Department under these Regulations.

11.1.3 Violators of these Regulations shall be fined as follows:

11.1.3.1 Any person who violates any rule, regulation, order, or condition imposed in an approved document or other provision of these Regulations shall be fined not less than $200 or more than $2,000 for each offense. Each day that the violation continues shall constitute a separate offense. The Justice of the Peace Courts shall have jurisdiction of offenses brought under this subsection.

11.1.3.2 Any person who, after written notice to comply, intentionally or knowingly violates any rule, regulation, order, or condition imposed in an approved document or other provision of these Regulations shall be fined not less than $500 or more than $10,000 for each offense. Each day the violation continues shall constitute a separate offense. The Superior Court shall have jurisdiction over offenses brought under this subsection.

11.2 Investigations by the Department

11.2.1 The Department shall make investigations and assemble such data as it deems necessary for a proper review and study of the design and construction of any dams, reservoirs, and appurtenances to which these Regulations applies, and for such purposes the Department or its agents may enter upon private property.

11.2.2 The Department may employ or make such agreements with geologists, engineers, or other expert consultants and such assistants as it deems necessary to carry out the provisions of these Regulations.

11.3 Rights of Investigation, Entry, Access, Inspection, and Protective Action

11.3.1 The Department shall have the right to direct the conduct of such investigations as it may reasonably deem necessary to carry out its duties prescribed in these Regulations, and the Department shall have the right to conduct such investigations. For the purpose of inspections, the employees of the Department and agents of the Department have the right to enter at reasonable times on any property, public or private, for the purpose of investigating the condition, construction, or operation of any dam or associated equipment facility or property, and to require written statements or the filing of reports under oath, with respect to pertinent questions relating to the construction or operation of any dam.

11.3.2 No person shall refuse entry or access to any authorized representative of the Department who requests entry for purposes of inspection and who presents appropriate credentials; nor shall any person obstruct, hamper, or interfere with any representative while in the process of carrying out official duties.

11.3.3 Notwithstanding any other provisions of these Regulations, the Department, upon receipt of information that any dam may present an imminent and substantial hazard to the public health, safety, or welfare, may take such actions as it determines to be necessary to protect the public health, safety, or welfare. The Department may direct the owner or custodian of the dam to take such actions as are necessary to prevent, eliminate, or reduce the hazard. In the event the owner or custodian fails to take such actions, the Department shall have the right to take all appropriate or necessary action including, but not limited to, breaching or draining. The Department may initiate legal proceedings to recover the emergency costs from the dam owner.

11.4 Other Requirements. When the safety and technical considerations pertaining to an application approval, to a Permit to Impound, to a dam, to a reservoir, or to plans and specifications require it, or when requested in writing to do so by the owner, the Department may appoint an Independent Review Board of consultants to report to the Department on the safety features involved. The cost and expense of a consulting board, if appointed on the request of an owner, shall be paid by the owner.

12.0 Owner Financial Responsibility

The Department requires that the applicant post a construction bond, irrevocable letter of credit, or other security acceptable to the Department to ensure that funds are available to complete the construction of the proposed project and for continued maintenance of the project throughout the life of the structure.

12 DE Reg. 1288 (04/01/09) (Prop.)