SEDIMENT POND & CONVEYANCE DITCH DESIGN

Sediment Pond Design

Applicable Regulations:

1816/1817.45  
1816/1817.46  
1816/1817.49

In accordance with 62 Ill. Adm. Code 1816/1817.46(b)(2), all surface drainage from the disturbed areas is required to be passed through a siltation structure before leaving the permit area unless an exemption is granted by the Department. Siltation structures for an area must be constructed before beginning any surface mining activities in that area. After construction completion, siltation structures must be sealed by a qualified registered professional engineer in accordance with 62 Ill. Adm. Code 1816/1817.46(b)(3). This Technical Guidance Document will serve as a resource to the Applicant and/or Operator while designing and constructing a sediment pond in accordance with 62 Ill. Adm. Codes 1816/1817.46(c) and 1816.1817.49.

Sedimentation ponds must:
(1) be located as near as possible to the disturbed area and have appropriate access for continual maintenance;
(2) provide adequate sediment storage volume;
(3) contain or treat the appropriate precipitation event;
(4) provide adequate detention time to allow the effluent from the ponds to meet effluent limitations specified in Section 1816/1817.42;
(5) have the capacity to store the sediment volume and the inflow from the design storm
(6) include appropriately designed discharge structures
(7) maintain a minimum freeboard; and
(8) contain a properly constructed liner for protection of groundwater, where applicable.

More detailed information for each of the sediment pond design components are outlined below:
(1) Sediment Pond Location

The sediment pond is to be located downstream as near as possible to the disturbed area to capture and treat all sediment-laden runoff prior to leaving the permit area. The location of the sediment pond should assure access is available for periodic maintenance which includes but is not limited to sediment removal sufficient to maintain adequate volume for the design event and maintenance on spillways. Therefore, all sediment ponds should maintain a twenty (20’) foot corridor from property boundaries, stream buffer zones, and other structures (e.g., refuse disposal facilities) to ensure appropriate access will be available for required maintenance activities.

(2) Sediment Storage Volume

Sedimentation ponds shall be designed, constructed, and maintained to provide adequate sediment storage volume. The Department requires a minimum sediment storage volume of 0.1 acre-feet per acre disturbed within the upstream drainage area.

(3) Design Event

Sedimentation ponds shall be designed, constructed, and maintained to contain or treat the ten (10) year, twenty-four (24) hour precipitation event (“design event”) unless a lesser design event is approved by the Department. The Department has received various forms of calculations to determine the calculated inflow from a design storm. Whether these calculations are performed by hand or by computer software, the following design components shall be consistent with the Departments guidelines.

Rainfall Depth

For the 10-year, 24-hour storm event utilized in the design of sediment ponds, an associated rainfall depth (based on geographic location) is utilized in the calculations to determine the peak flow. The Department realizes there are multiple data sources available to obtain rainfall depth information. However, based on the data reviewed and to maintain consistency, the Department requires the use of Table 13 from Bulletin 70 from the Illinois State Water Survey for rainfall depths for given storm events. Any use of alternative rainfall depth data must be justified by the Applicant and approved by the Department.

Storm Distribution

The storm distribution is defined by the variability of rainfall intensity throughout the storm duration. Though a particular storm event will produce a given rainfall amount, the intensity of the rainfall can be modeled differently based on a selected distribution. The varying distribution models can produce significantly different peak flows. Historically, the Department has accepted the NRCS Type II Storm Distribution. The Department has recognized other distribution models are available for our geographic region and have been found acceptable. The Department will continue to accept the NRCS Type II Distribution; however, the use of the Huff Distribution Models will also be acceptable.
using the 10% probability level. The Department recognizes other probability curves are available for the Huff Distribution; however, it is the Department’s position that the use of the 10% probability level gives the highest confidence that runoff and peak discharge will not be exceeded and is consistent with prudent engineering practices.

(4) Detention Time

Sedimentation ponds shall be designed, constructed, and maintained to provide adequate detention time to allow the effluent from the ponds to meet effluent limitations specified in Section 1816/1817.72. The Department requires a minimum detention time of 10 hours for a 24-hour storm event.

(5) Sediment Pond Capacity

The capacity of the sediment pond shall be such to store the sediment storage volume plus the calculated inflow from the design for the required 10 hours of detention time to allow the effluent to meet the appropriate limitations.

(6) Discharge Structures

A sedimentation pond shall include either a combination of principal and emergency spillways or a single spillway configured as specified in Section 1816.49(a)(9). Spillways shall be designed and constructed to safely discharge the peak flow of a precipitation event depending upon the size of the impoundment and be located such to minimize to the extent possible any short circuiting. The size classifications for impoundments as specified by 62 Ill. Adm. Code 1816/1817.49 are: Impoundments meeting the Class B or C criteria for dams in the U.S. Department of Agriculture, Soil Conservation Service Technical Release No. 60, “Earth Dams and Reservoirs” (hereinafter referred to as TR-60 Impoundments), impoundments meeting the size and other qualifying criteria of 30 CFR 77.216(a) (hereinafter referred to as MSHA Impoundments), and impoundments not meeting the size of TR-60 Impoundments or MSHA Impoundments (hereinafter referred to as Other Impoundments). The appropriate design criteria for each of the impoundments are provided below.

TR-60 Impoundments

The sediment pond shall be provided with a spillway that meets the criteria in the “Minimum Emergency Spillway Hydrologic Criteria” table in TR-60, or such larger event as may be specified by the Department based on factors such as terrain, topography, and soil type.

MSHA Impoundments

The sediment pond shall be provided with a spillway that will safely discharge a 100-year, 6-hour precipitation event, or such larger event as may be specified by the Department based on factors such as terrain, topography, and soil type.
Other Impoundments

The sediment pond shall be provided with a spillway that will safely discharge a 25-year, 6-hour precipitation event, or such larger event as may be specified by the Department based on factors such as terrain, topography, and soil type.

(7) Minimum Freeboard (Other Impoundments)

The minimum elevation at the top of the settled embankment shall be 1.0 foot above the water surface in the pond with the emergency spillway flowing at design depth.

(8) Liner Construction (where applicable)

Any sediment pond receiving coal or coal refuse contact runoff requires a liner to prevent negative impacts to the groundwater quality in accordance with 62 Ill. Adm. Code 1816/1817.41. Design of a low permeability liner with a minimum hydraulic conductivity of $1 \times 10^{-7}$ cm/sec and consistent with the requirements of the Illinois Environmental Protection Agency should be incorporated into the permit application. The liner thickness necessary to achieve this conductivity must be detailed and justified in a permit proposal. This applies to a compacted clay liner or a synthetic liner capable of an equivalent level of groundwater protection. A Quality Assurance/Quality Control Plan for liner installation and geotechnical testing should be provided in the application. Finally, after construction completion, the pond and associated ditches where liners were installed must be sealed by a qualified registered professional engineer in accordance with 62 Ill. Adm. Code 1816/1817.46(b)(3). The appropriate geotechnical testing results should be maintained and available to the Department upon request.

The Applicant and/or Operator need to consider procedures necessary to maintain the integrity of the liner during any maintenance activities such as sediment removal. The Application should include a narrative describing the measures to be implemented to ensure preservation of the integrity of the liner during sediment cleanout operations as part of the response to Part 5.4.5 of the application.

All the sediment pond design components are to be included in response to Part 5.4 of the Permit Application. In addition, a summary of the calculations is to be provided in Table 5.4.1.

Conveyance Ditch Design

Applicable Regulations:

1816/1817.43
1816/1817.49

In accordance with 62 Ill. Adm. Code 1816/1817.43, all diversions shall be designed to minimize adverse impacts to the hydrologic balance within the permit and adjacent areas, to prevent material damage outside the permit area and to assure the safety of the public. Diversion ditches
are designed and constructed for various situations associated with coal mining activities. This Technical Guidance Document will serve as an additional resource to the Applicant and/or Operator while designing and constructing conveyance ditches to meet the minimum requirements.

Conveyance ditch design must:

(1) Incorporate the appropriate channel lining;
(2) maintain adequate freeboard;
(3) provide energy dissipaters, as needed;
(4) be designed for the appropriate design event; and
(5) contain a properly constructed liner for protection of groundwater, where applicable.

More detailed information for each of the conveyance ditch design components are outlined below:

(1) Channel Lining

Conveyance ditch channel lining must be designed using standard engineering practices to safely pass the design velocities. The minimum velocities accepted by the Department for vegetated channels is 5.0 ft/sec. Riprap must consist of non-degradable, non-acid or toxic forming rock such as sandstone, limestone, or other durable rock that will not slake in water and will be free of coal, clay or shale. For non-IDOT approved riprap sources, the Operator needs to have the material certified in accordance with Operator Memorandum 2016-04.

(2) Minimum Freeboard

Freeboard shall be no less than 0.3 feet, except if the terrain is such that out-of-bank flows can accommodate the design precipitation event without endangering health or the environment as a result of flooding, such as physical harm or slope failure. The design should provide protection for transition of flows and for critical areas such as swales and curves. Where the area protected is a critical area, as determined by the Department, the design freeboard may be required to increased.

(3) Energy Dissipaters

Energy dissipaters shall be installed, when necessary, at discharge points where diversions intersect with natural streams or sediment ponds and exit velocity of the ditch flow is greater that the receiving body.

(4) Design Event

Conveyance ditches must be designed for the appropriate precipitation event based on the specified use and for the time the ditch will be in operation. The following minimum design conditions shall be followed.
1. Perimeter collection ditches that segregate disturbed drainage from adjacent undisturbed areas are to be designed to the standards of the receiving ponds spillway requirements. For example, if the receiving sediment pond discharge structure is designed for a 25-year 6-hour storm, the perimeter collection ditches should be designed to the same standard. This can be accomplished by either proper ditch dimensions or by constructing an outer berm adjacent to lesser designed ditches to contain any overflow to within the disturbed areas.

The Department considers perimeter conveyance ditches as part and parcel to the functionality of the receiving pond. Therefore, as-builds for perimeter ditches shall be provided as part of the requirements to certify pond construction under 62 Ill. Adm. Code 1816/1817.49.

2. Internal Collection ditches that will not result in an off-site discharge if they are overtopped can be designed for the lesser events. The Department regards any ditch that collects miscellaneous flow that will have a life of 2 years or greater as permanent. Such ditches shall be designed to safely convey a 10-year 6-hour event. Shorter term internal ditches can be designed for the minimal 2-year 6-hour event.

3. If conveyance ditches are proposed to divert upstream undisturbed overland flow around the disturbed area, they should be designed as enumerated in condition 1 above for perimeter collection ditches. They should be designed to the standards of the spillway of the pond that would receive this run-on if not for the diversion ditch. This assures that the design of that pond will be adequate for the required design storm by preventing any additional watershed from contributing to the pond inflow. This can be accomplished by either proper ditch dimensions or by constructing a berm adjacent to the permit area to exclude any potential overflow from the disturbed area.

(5) Liner Construction (where applicable)

Any conveyance ditch receiving coal or coal refuse contact runoff requires a liner to prevent negative impacts to the groundwater quality in accordance with 62 Ill. Adm. Code 1816/1817.41. Design of a low permeability liner with a minimum hydraulic conductivity of $1 \times 10^{-7}$ cm/sec and consistent with the requirements of the Illinois Environmental Protection Agency should be incorporated into the permit application. The liner thickness necessary to achieve this conductivity must be detailed and justified in a permit proposal. This applies to a compacted clay liner or a synthetic liner capable of an equivalent level of groundwater protection. A Quality Assurance/Quality Control Plan for liner installation and geotechnical testing should be provided in the application. Finally, after construction completion, the pond and associated ditches where liners were installed must be sealed by a qualified registered professional engineer in accordance with 62 Ill. Adm. Code 1816/1817.46(b)(3). The appropriate geotechnical testing results should be maintained and available to the Department upon request.

The Applicant and/or Operator need to consider procedures necessary to maintain the integrity of the liner during any maintenance activities such as sediment removal. The Application should include a narrative describing the measures to be implemented to ensure preservation of the
integrity of the liner during sediment cleanout operations as part of the response to Part 5.4.5 of the application.

All conveyance ditch design components are to be included in response to Part 5.3 of the Permit Application. In addition, a summary of the calculations is to be provided in Table 5.3.1.

NOTE: The design standards enumerated above are considered as a minimum. Based on field experience and site specific conditions, a designer is strongly encouraged to incorporate additional volume to minimize sediment cleanout and avoid non-compliant discharges. This is especially applicable to longer term ponds and ditches or those that serve a watershed that has the potential for long term disturbed ground.