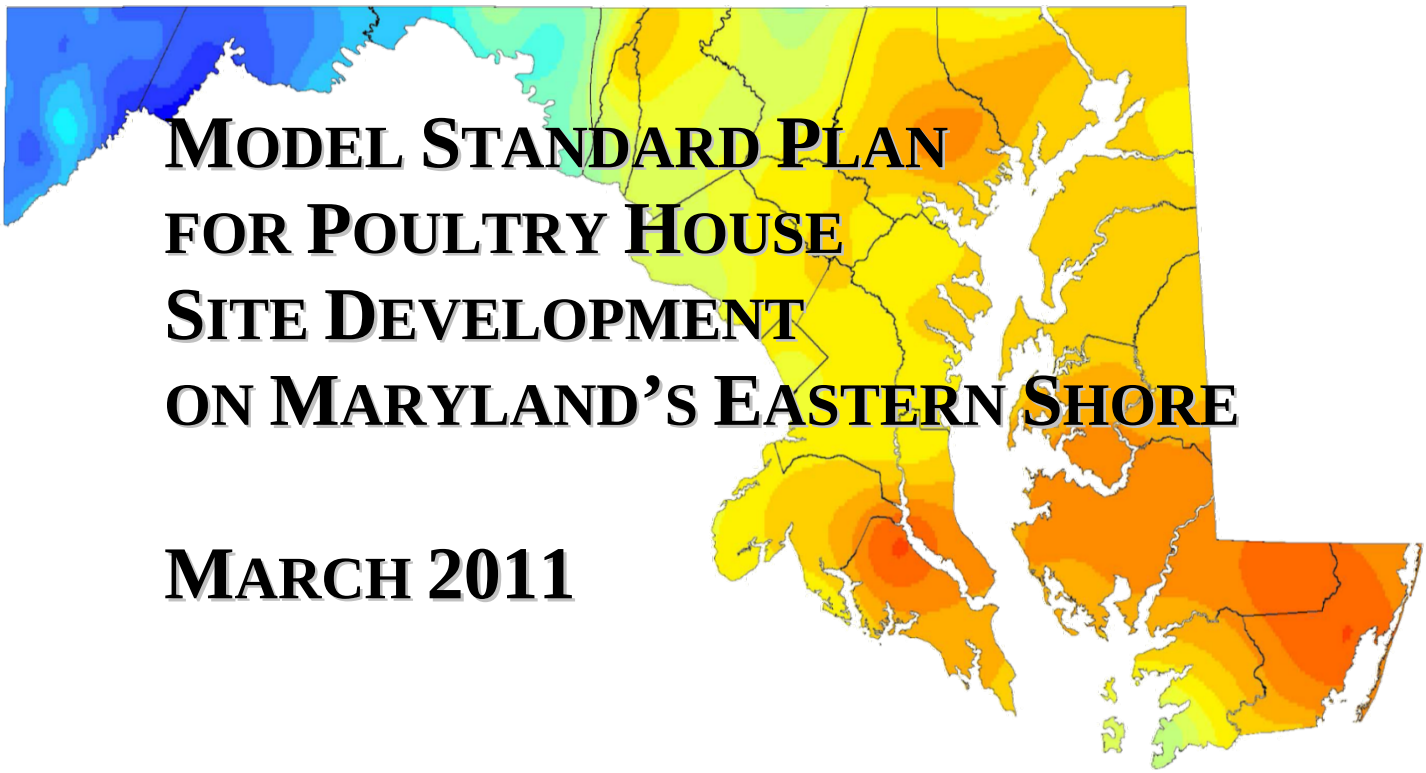

MODEL STANDARD PLAN FOR POULTRY HOUSE SITE DEVELOPMENT ON MARYLAND'S EASTERN SHORE

MARCH 2011

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Overview

The Maryland Department of the Environment (MDE), in conjunction with the Maryland Department of Agriculture (MDA), the Natural Resources Conservation Service (NRCS), and the Soil Conservation Districts (SCDs), has developed a standard plan for providing stormwater management at poultry operations on the Eastern Shore of Maryland. The proposed plan reflects the heightened requirements of the Stormwater Management Act of 2007 by implementing environmental site design (ESD) to the maximum extent practicable (MEP). The following provides the background for the Standard Plan to be used to address stormwater management obligations for poultry operations.

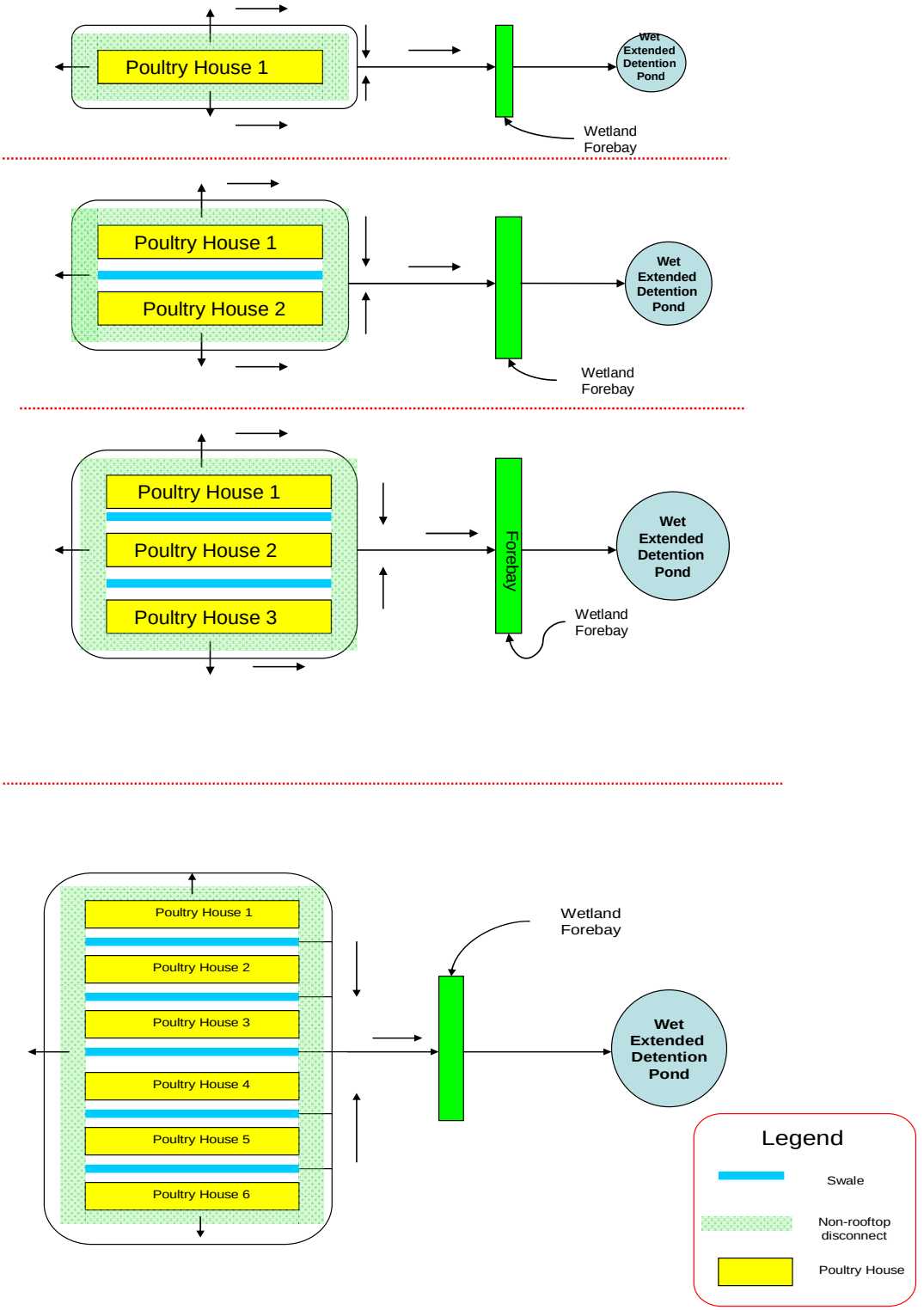
The Standard Plan presented herein is a single design option that is intended to be used by the SCDs, County stormwater management authorities, and local designers to facilitate the development of poultry operations on the Eastern Shore. It provides a design that satisfies Maryland's stormwater management requirements by stipulating necessary management practices, their layout, and sizes. The Standard Plan conveys the two dimensional requirements of the site. Elevations, inverts, and slopes will have to be determined for each site as will the erosion and sediment control plan and other site-dependent requirements outlined in the Standard Plan. Use of the Standard Plan is not obligatory. A unique stormwater management design that meets ESD to the MEP and the approval of the local plan approval authority may be used.

The Standard Plan includes multiple ESD practices, namely non-rooftop disconnections, grass swales, infiltration, and wetlands. Structural practices have been limited to a single wet extended detention pond. One of the design options uses only ESD with no pond. MDE has developed detailed site development plans for 12 different design options. A standard layout has been developed for 1, 2, 3, 4, 5, and 6 poultry houses. The figure on the following page demonstrates how the same essential layout applies to a varying number of houses.

Because on-site soil conditions affect stormwater, two different designs have been provided for each number of houses. Hydrologic Soil Group (HSG) "A" and "B" soils use one option, and "C" and "D" soils use the other. The plan options are included in the Standard Plan in an 8½ x 11 format. Larger formats may be attained electronically from MDE upon request.

MDE has developed a stormwater management "calculator" using Microsoft Excel that automates the sizing of the stormwater management practices. Inputting three values (HSG soil type, number of houses, and length of the houses) sizes the stormwater management practices and provides the required storage volumes and pond outflow in an output table. The stormwater management calculator is available electronically from MDE.

Poultry House STORMWATER MANAGEMENT Layouts Concept Plan (1,2,3 and 6 houses)



Maryland Department of the Environment
Water Management Administration
Standard Stormwater Management Plan for
Poultry House Site – MODEL

Building
Permit: _____
Grading Permit: _____

Project Name/Location: _____

Tax Map _____ Block _____ Parcel _____
Road Map Coordinates Page: _____ Block: ____/_____

Owners Name: _____ Phone: _____
Owners Address: _____
_____ Zip: _____
Contractors Name: _____ Phone: _____
Contractors Address: _____
_____ Zip: _____
Engineer/Surveyor: _____ Phone: _____

Total area of site: _____ square feet or acres.
Total area of disturbance: _____ square feet or acres.
Total impervious area: _____ square feet or acres.
Total volume of excavation or fill: _____ cubic yards.

Distance of disturbed area from the nearest perennial stream and its associated 100-year floodplain, any tidal or nontidal wetland, or mean high water line: _____ feet.

Number of proposed poultry houses _____
Hydrologic Soil Group (HSG) _____

Limitations

1. The project consists of one to six poultry houses located on the Eastern Shore;
2. This Standard Plan shall not be used in areas of special concern or if site conditions such as soil type or high groundwater, etc. present a challenge.

Requirements

The requirements for stormwater management found in [local ordinance] and the Code of Maryland Regulations (COMAR) are satisfied when environmental site design (ESD) practices are used to the maximum extent practicable (MEP) to treat runoff according to Chapter 5 of the **2000 Maryland Stormwater Design Manual** (Manual). The stormwater management systems provided in this Standard Plan are intended to integrate site design, natural hydrology, and smaller controls to capture and treat runoff onsite. If the following design conditions are met, all stormwater management obligations will be satisfied.

Design

A. Poultry House requirements:

1. All poultry houses shall be oriented so that they run parallel to the direction of the prevailing slope.
2. All poultry waste storage sheds (PWSS) are preferred to be located in the footprint of the heavy use area (HUA) located at the high side (top) of the site. The size of the HUA may be reduced but not increased.

3. A second HUA, 80 feet wide, may be provided along the low side (bottom) of the site. The size of the HUA may be reduced but not increased.
4. Each poultry house shall be no wider than 67 feet.
5. The length of the poultry house(s) shall be no greater than 660 feet. The management requirements are proportioned for length.
6. The distance between houses shall be at least 60 feet.
7. The distance between houses shall be at least 100 feet when there are two service roads.
8. Perimeter roads at the edge of any site shall be no wider than 15 feet and service roads between the houses no wider than 12 feet.
9. A 3 to 5 foot wide splash strip shall be provided along both sides of the houses, beneath the edge of the roof, to prevent erosion.

B. Stormwater management features

1. All off-site drainage area shall be diverted around the site.
2. A minimum 20 foot grass buffer shall be provided around the site perimeter.
3. Vegetated disconnection areas shall be provided as indicated on the plan. Between poultry houses, vegetated (grass) disconnections shall be provided along both sides of the grass swales, between the swale and the house or service road. The HUAs and roads shall be graded so that runoff across the surface enters the vegetated disconnection as sheetflow. In A/B soils, vegetated disconnections shall be provided along the sides of the site. The ratio of the disconnection length to contribution length shall be at least 1:1. The disconnection area shall have a slope no greater than 5%. The disconnection area shall be permanently stabilized with vegetation in accordance with NRCS Maryland Conservation Practice Standard for Critical Area Planting, Code 342. Acceptable vegetation includes woods, meadow, pasture, orchards, and grass. Crops are considered acceptable when the following criteria are met:
   a. The farm has a current Soil & Water Conservation Plan and Nutrient Management Plan;
   b. The crops in the disconnection area meet the NRCS Maryland Conservation Practice Standards for Residue and Tillage Management, No-Till/Strip-Till/Direct-Seed, Code 329, and Residue and Tillage Management, Mulch-Till, Code 345, in conjunction with the NRCS Maryland Conservation Practice Standard for Cover Crop, Code 340. Minimum residue requirements will be reflected by leaving all crop residues from row crops on the field following harvest. When residues such as corn stalks or soybean residue are removed, a cover crop will be used to supplement cover lost from residue removal.
4. For a single poultry house in HSG A/B soils, an infiltration pocket is required between the grass buffer and vegetation disconnection. The volume of the infiltrations pocket shall be determined by the Stormwater Calculator
5. An 8 foot wide, flat bottom, grass swale with 4:1 side slopes shall be provided between poultry houses. The slope of the swale must not exceed 4%.
6. In HSG C/D soils, an 8 foot wide, flat bottom, grass swale with 4:1 side slopes shall be provided along the side of the site. The slope of the swale must not exceed 4%.
7. A wetland forebay shall be provided as indicated on the plan. The length, width, and depth of the forebay shall be determined by the Calculator. An appropriately armored weir window shall be provided between the forebay and pond and discharges shall be non-erosive. (Note: For a single poultry house in HSG A/B soils, the forebay and pond are not required.)
8. A wet extended detention pond shall be provided at the downgrade (bottom) of the site. The volume of the pond and outflow rate shall be determined by the Stormwater Calculator. Larger volumes may be necessary depending on local requirements. A safety bench shall be provided for ponds deeper than 4 feet. The outlet structure shall be designed as site conditions determine. All discharges shall be non-erosive. The design and construction of the pond shall follow the latest version of the NRCS-MD 378 Pond Code Standards and Specifications for Small Pond Design and shall be approved by the local Soil Conservation District.

C. The following must be attached to this application for coverage under the standard plan:
   1. A site plan showing the following:
      a. Dimensions of property lines and road frontage;
      b. Limits of disturbance;
      c. HSG soil type;
      d. Existing and proposed ground elevations;
      e. Location and dimensions of all proposed structures (e.g., poultry houses, agricultural buildings, entrances, roads, wells, septic systems); and
      f. If present, the location of the Critical Area buffer, nontidal and tidal wetlands, and perennial streams and their associated floodplain.
   2. A copy of the applicable standard stormwater management design plan, selected based on the soil type and number of proposed poultry houses.
   3. A copy of the input and output from the Stormwater Calculator.

Conditions

1. An acceptable erosion and sediment control plan shall be submitted to and approved by the [local approval authority].
2. The [local approval authority] shall be contacted at least 48 hours prior to the start of construction.
3. All stormwater practices and/or runoff controls shall be installed and maintained according to this Standard Plan and the criteria contained in Chapter 5 of the Manual. Subsequent alteration or modification of these practices requires the approval from the [local approval authority].
4. Access to the site will be made available at all reasonable times during construction and with reasonable notification after construction for inspection by the [the local approval authority].
5. The applicant/owner shall promptly repair and/or restore all stormwater practices found in noncompliance by [local approval authority].
6. The [local approval authority] reserves the right to deny approval under this Standard Plan and require that a design be prepared according to the [local ordinance] and the Manual.
7. Nothing in this Standard Plan relieves the applicant from complying with any and all federal, State, and local laws and regulations (e.g., Stormwater Management, Critical Area, Forest Conservation, Grading, etc.).
8. At a minimum, inspections shall be made by county, municipal, or Soil Conservation District staff or by a professional engineer licensed in the State. For each ESD planning technique and practice inspections shall be prepared and documented upon completion of final grading, establishment of permanent stabilization, and before issuance of use and occupancy approval. All other stormwater management practices (e.g., ponds, wetlands) shall be inspected according to the Manual.
9. Coverage under this Standard Plan shall remain valid for [two] years from the date of approval.

I hereby certify that I have the authority to make application to this Standard Plan; that the information contained herein is correct and accurate; and that all clearing, grading, construction, and development will be conducted according to the above Requirements, Conditions and Project Information.

Signature of Applicant Date

Printed Name of Applicant

Approved by Date

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Description of the stormwater management design

The standard plan for poultry house sites is divided into four drainage areas: A, B, C, and D regardless of the number of poultry houses being constructed. The drainage areas are indicated on the plan drawings**.**

Items in bold are design requirements.

Area A is the interior of the site and is comprised of the poultry houses along with the grass swales and service roads running between the houses. Area A is subdivided into multiple sub-drainage areas depending on the number of houses on the site. Each subarea consists of the interior area between two adjacent houses as well as rooftop that drains toward that area. (The roofs are assumed to be crowned in the center.) A two house facility has one subarea, and a three house facility has two subareas, etc. If only one house is being constructed, there is no interior area.

The site layout is based on a typical spacing between houses of 60 feet. Because a centrally located service building is necessary for facility operation, the spacing is 100 feet for one of the interior areas. Three standard subareas have been developed for Area A. They are as follows:

- A 100 foot wide interior area with 2 service roads and not to exceed a 24 ft x 32 ft service building
- A 60 foot wide interior area with no roads
- A 60 foot wide interior area with one service road

Refer to the respective plan options to see which subareas apply to the layout for a particular number of houses.

ESD treatment for this area is provided by non-rooftop disconnection, grass swales, and a wetland forebay. Stormwater runs off the roof, drops onto the splash strip, sheet flows across the disconnection, collects in the grass swale, and drains to a culvert that delivers the flow to the wetland forebay.

A 3 to 5 foot wide splash strip is provided along both sides of the houses, beneath the edge of the roof, to prevent erosion. Where designated, a service road is provided along the splash strip. Runoff from the roof and road will drain to a grass area and then into a grass swale. **This grass area is being used as a non-rooftop disconnection and must be graded to achieve sheet flow.** (Because the poultry houses do not have gutters, flow from the roof drops onto the splash strip, mimicking the flow conditions of non-rooftop disconnection rather than roof-top disconnection.) Runoff from the impervious surface flows onto the vegetated area where it can soak into or filter over the ground. This disconnects the impervious surfaces from the stormwater conveyance system, reducing both runoff volume and pollutants delivered to receiving waters. The slopes in this area will be well below the maximum allowable slope of 5%.

The grass swales between the poultry houses provide conveyance, water quality treatment, and flow attenuation of stormwater runoff. Pollutant removal is attained through vegetative filtering, sedimentation, biological uptake, and infiltration into the underlying soil. **The grass swales have a trapezoidal cross section consisting of an 8 foot wide bottom and 4:1 side slopes. The maximum allowable slope is 4%. The swale is centered in the area between the two houses except for the 60 foot wide area with one service road.** In order to balance the treatment attained through the disconnection area, the flow length on the side with the road needs to be longer. **For the 60 foot wide area with one service road, the center line of the grass swale is three feet further from the road than from the splash strip on the opposite side.** The drawing reflects this. Calculations indicate that the flow velocity for a 4% slope is well below the 1 fps design criteria (see Appendix).

Because the non-rooftop disconnection and the grass swales do not manage a full inch of rainfall (P_E), a wetland forebay is provided to treat the remaining P_E. (Refer to the stormwater management calculator for the amount of P_E treated by each ESD practice and Area D for a description of the wetland forebay.) The flow in the grass swale(s) is directed to culvert(s) that pass under the HUA and discharges into the wetland forebay. The minimum cover over the culverts is 1 foot. For MDE's design prototype (see Appendix), a 12" culvert passes the 2-year storm, but the 10-year storm overtops the road. A 15" pipe passes the 10-year storm without overtopping the HUA.

Area B is the drainage area along the "top" of the site comprised of a HUA, one or two PWSS, a 20 foot grass buffer, a vegetated disconnection area, and the peripheral areas along the sides of the HUA and disconnection area. The dimensions of the HUA are provided on the respective plans. The "length" of the HUA is dependent on the number of poultry houses at the site, but the "width" cannot exceed 125 feet. **The HUA in Area B needs to be graded to slope away from the poultry houses, "bucking" the direction of the site's prevailing slope. Additionally the grading must assure that runoff enters the grass buffer as sheet flow.** Minor adjustments to the HUA area to accommodate local development requirements (e.g., setbacks) or certain site conditions (e.g., existing ditches) will need to be identified in the site development plan and approved by the appropriate approval authority.

ESD treatment for Area B is provided by non-rooftop disconnection. Runoff from the impervious surface flows onto the vegetated area where it can soak into or filter over the ground. This disconnects the impervious surfaces from the stormwater conveyance system, reducing both runoff volume and pollutants delivered to receiving waters. To manage a full inch of rainfall (P_E), the ratio of the disconnection length to contribution length must be at least 1:1. The 125 foot dimension is the contributing impervious flow length; therefore the disconnection length must be at least 125 feet**. The first 20 feet of the disconnection is grass buffer. An additional 105 feet of vegetated disconnection must be provided.** The disconnection areas will typically be sloped at 0.5% to 1% (well below the 5% maximum allowable disconnection slope). The disconnection areas are permanently stabilized with vegetation that includes woods, meadow, pasture, orchards, grass, and no-till crops.

Depending on the site's soils, drainage ditches may need to be provided to collect the runoff after it has sheet flowed across the disconnection. For A/B soils, it is anticipated that the runoff will infiltrate into the ground. For C/D soils, ditches draining the area will probably have to be constructed if there are not already ditches in place. The ditches should connect to the grass swales in Areas C1 and C2.

An infiltration pocket is provided for the "one house in A/B soils" option. Runoff from the HUA is directed to this storage area and infiltrates into the surrounding soils prior to the next storm event. The infiltration pocket manages 1.0 inch of rainfall (P_E). The infiltration pocket is located between the 20 foot grass buffer and the vegetated disconnection and runs the length of the HUA in Area B (104 feet). It is 6 inches deep and a minimum of 13 feet wide with 3:1 or flatter side slopes and is essentially shaped like a trough.

For the purposes of the hydrologic and hydraulic analysis (see Appendix), Area B is divided into two segments, one that eventually flows along the "right" side of the site and one that flows along the "left" side of the site.

Area C is the drainage area along the "sides" of the poultry house facility. There are two Area Cs – Area C1 and Area C2. The two areas are mirror images of each other except one side has the entrance. Each Area C includes half a poultry house (the half that pitches toward the side of the site), a splash strip, a 15 foot wide perimeter road, a 20 foot wide grass buffer, and depending on the soils, either a vegetated disconnection or a grass swale.

ESD treatment for Area C is provided by non-rooftop disconnection and grass swales. **A 3 to 5 foot wide splash strip is provided along the sides of the houses, beneath the edge of the roof, to prevent erosion.** A perimeter road runs along the splash strip. The contributing flow length is 51 feet (see Appendix for calculations). **Runoff from the roof and road will drain to the 20 foot grass buffer. This grass area is being used as a partial non-rooftop disconnection and must be graded to achieve sheet flow.** (Because the poultry houses do not have gutters, flow from the roof drops onto the splash strip, mimicking the flow conditions of non-rooftop disconnection rather than roof-top disconnection.) Runoff from the impervious surface flows onto the vegetated area where it can soak into or filter over the ground. This disconnects the impervious surfaces from the stormwater conveyance system, reducing both runoff volume and pollutants delivered to receiving waters. **The slope of the grass buffer must be 5% or less.**

Because the grass buffer does not provide sufficient management, a second ESD practice is provided in this area.

For sites with A/B soils, a 31 foot wide vegetated disconnection is provided along the edges of the site. This extends the ratio of the disconnection length to contribution length to 1:1 and manages a full inch of rainfall (P_E). **The slope of the non-rooftop disconnections must be 5% or less.**

For sites with C/D soils, grass swales are provided along the edges of the site. The grass swales provide conveyance, water quality treatment, and flow attenuation of stormwater runoff. Pollutant removal is attained through vegetative filtering, sedimentation, biological uptake, and infiltration into the underlying soils. **The grass swales have a trapezoidal cross section consisting of an 8 foot wide bottom and 4:1 side slopes. The maximum allowable slope is 4%.** Calculations indicate that the flow velocity for a 4% slope is well below the 1 fps design criteria (see Appendix).

Area D is the drainage area along the "bottom" of the site consisting of an HUA, a 20 foot grass buffer, the peripheral areas along the sides of the HUA, and the wetland forebay. The dimensions of the HUA are provided on the respective plans. The "length" of the HUA is dependent on the number of poultry houses at the site, but the "width" is 80 feet.

ESD treatment is provided by non-rooftop disconnection and a wetland forebay.

Runoff from the HUA will drain to the 20 foot grass buffer. To manage a full inch of rainfall (P_E), the ratio of the disconnection length to contribution length must be at least 1:1. The 1:4 ratio for this area results in a partial disconnection and treatment of 0.25 inches of P_E. **The grass buffer is being used as a non-rooftop disconnection and must be graded to achieve sheet flow. The maximum allowable slope for the disconnection is 5%.**

A wetland forebay is provided to treat a portion of the ESD volumes from Area D and Area A. (Refer to the stormwater management calculator for a break down of these volumes.) Flow into the wetland is distributed throughout the system. Wetland plants provide nutrient uptake, and physical and chemical treatment processes allow filtering and absorption of organic matter. The wetland also serves as a forebay to the pond. Flow from Area B and Areas C1 and C2 discharge into the forebay before flowing into the pond.

The wetland forebay runs almost the entire length of the HUA in Area D. It is 6 inches deep with 3:1 or flatter side slopes and is essentially shaped like a trough. The bottom of the forebay must be level to maximize water quality enhancement. The width of the forebay varies depending on the respective design option. Refer to the stormwater management calculator for the required dimensions.

Wet extended detention pond

The target rainfall (P_E) for the site ranges from 1.6 inches to 2.2 inches, depending on the soil conditions. The ESD practices only capture and treat 1.0 inch of rainfall (or slightly more) for each sub drainage area. (Refer to the stormwater management calculator for a breakdown of treated P_E.) Because the target P_E cannot be met through ESD, stormwater management requirements for the remaining ESD volume, channel protection and any local requirement for the 2-year storm are to be satisfied by a pond.

A wet extended detention pond is sized to hold the portion of the site's ESD volume that has not been managed through ESD practices as well as the storage volume needed for 24 hour extended detention of the 1-year storm. Depending on soil conditions, either the ESD volume or the extended detention volume will control the size of the pond. **These volumes are computed by the stormwater management calculator.**

The procedure used to calculate the channel protection storage volume (Cpv) and outflow discharge for the 1-year storm is outlined in used Appendix D.11 of the 2000 stormwater management Manual. Reduced runoff curve numbers (RCNs) from Table 5.3 of the stormwater management Manual have been applied to the proposed conditions.

To attain the necessary "dry" storage volume, an embankment will have to be constructed along the downgrade portion of the pond. The slope of the site and the volume requirements will determine the height and extent of the embankment. The pond must be constructed to meet the stormwater management storage volume and outflow requirements. Larger volumes may be necessary depending on local requirements. The desirable length to width ratio for the pond is 1.5:1. A safety bench is necessary for ponds deeper than 4 feet. The outlet structure shall be designed as site conditions determine. All discharges shall be non-erosive.

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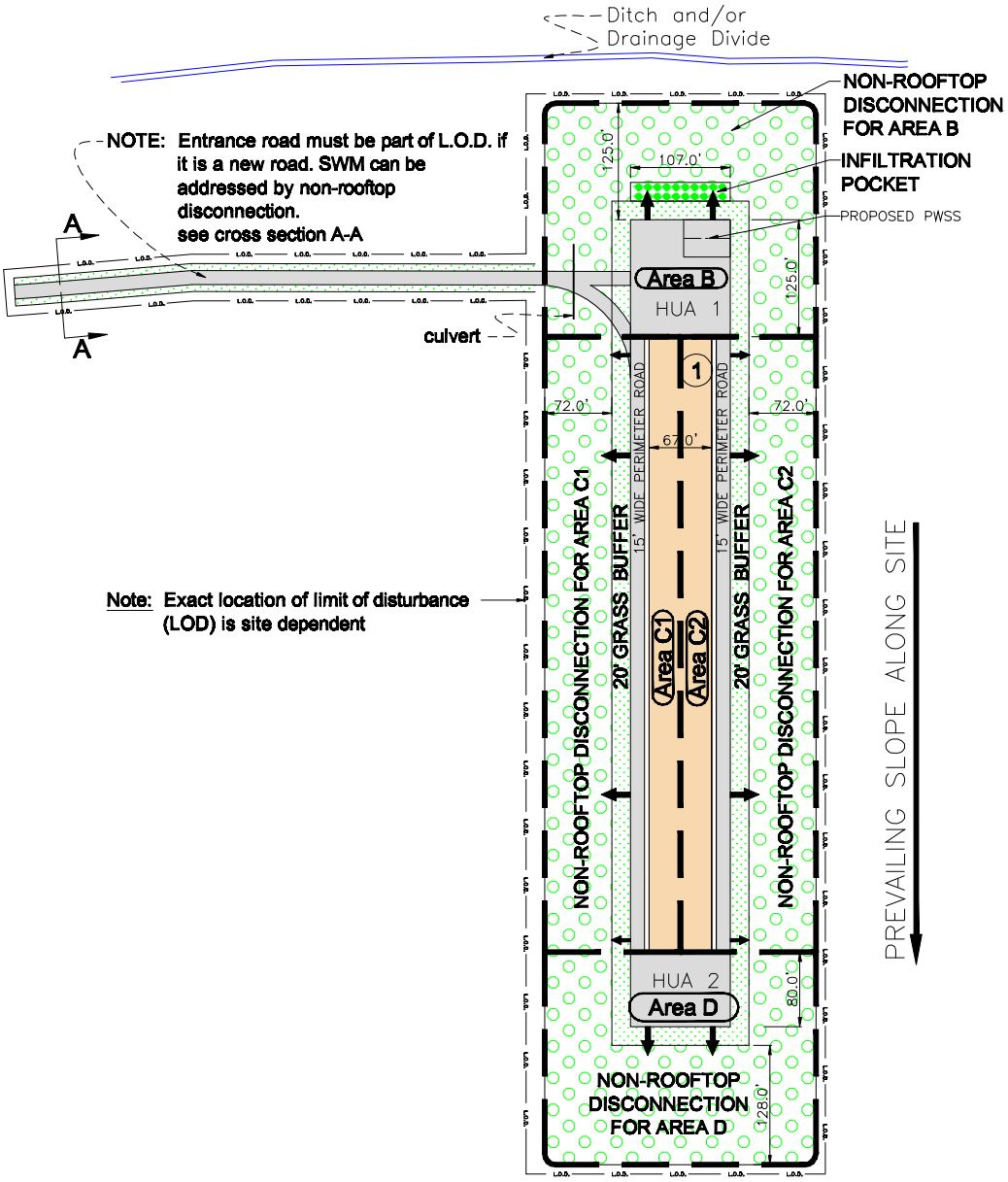
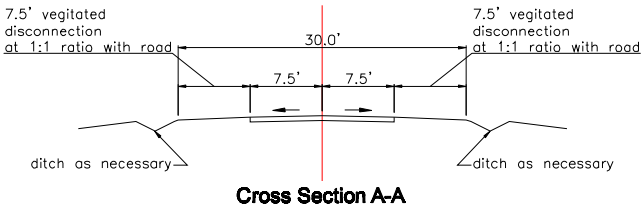
SWM STANDARD PLAN
FOR ONE POULTRY HOUSE
(HSG 'A' or 'B' soils)

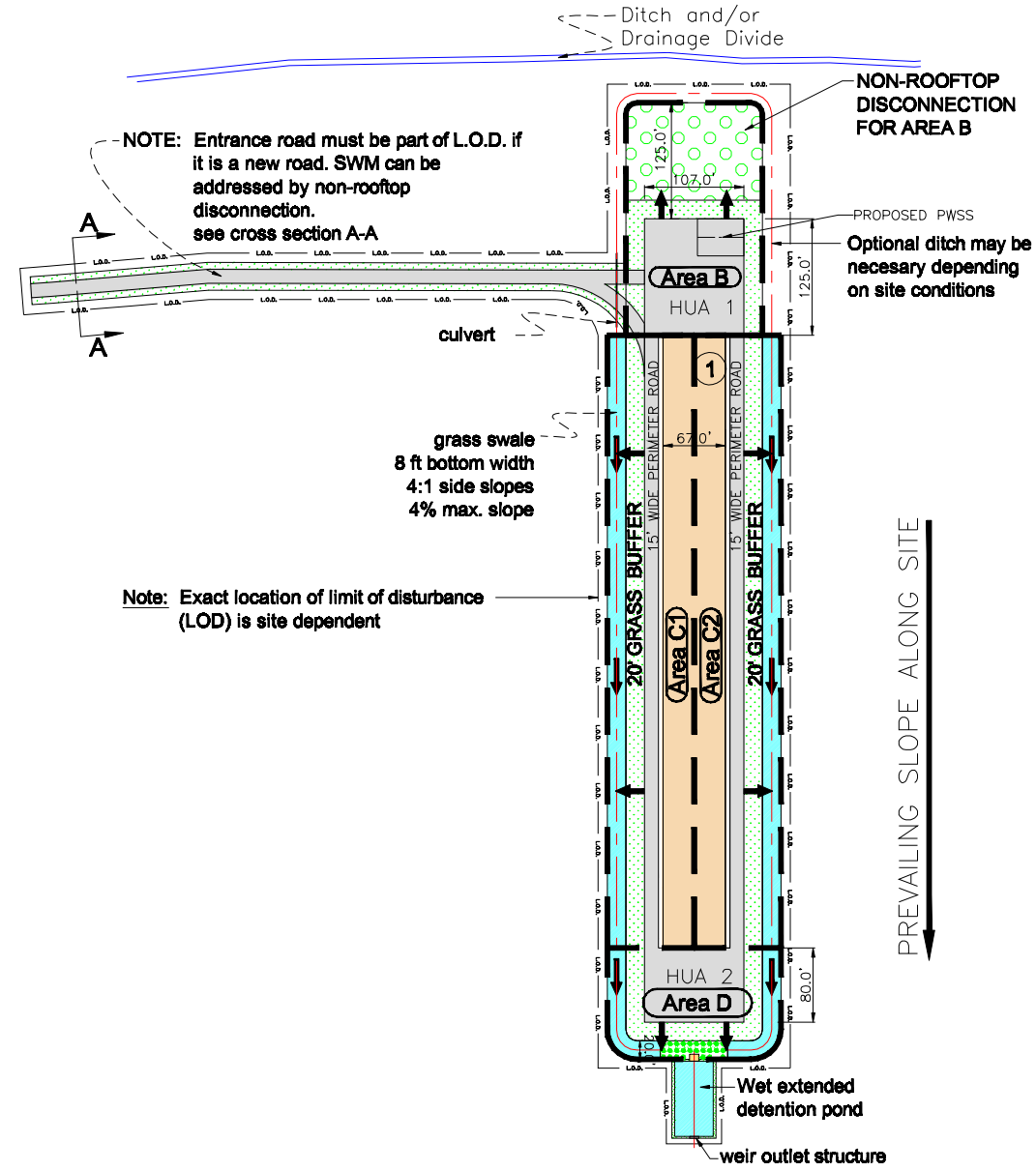




Cross Section A-A

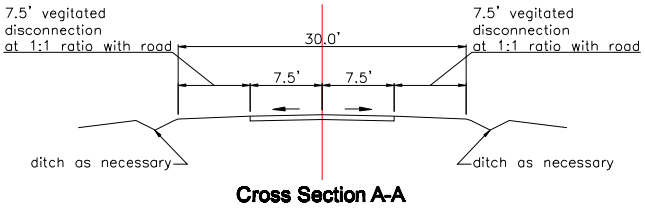
Scale: 1" = 200'

SWM STANDARD PLAN
FOR ONE POULTRY HOUSE
(HSG 'C' or 'D' soils)



Note: Shape and orientation of wetland pond and outfall are site dependent.

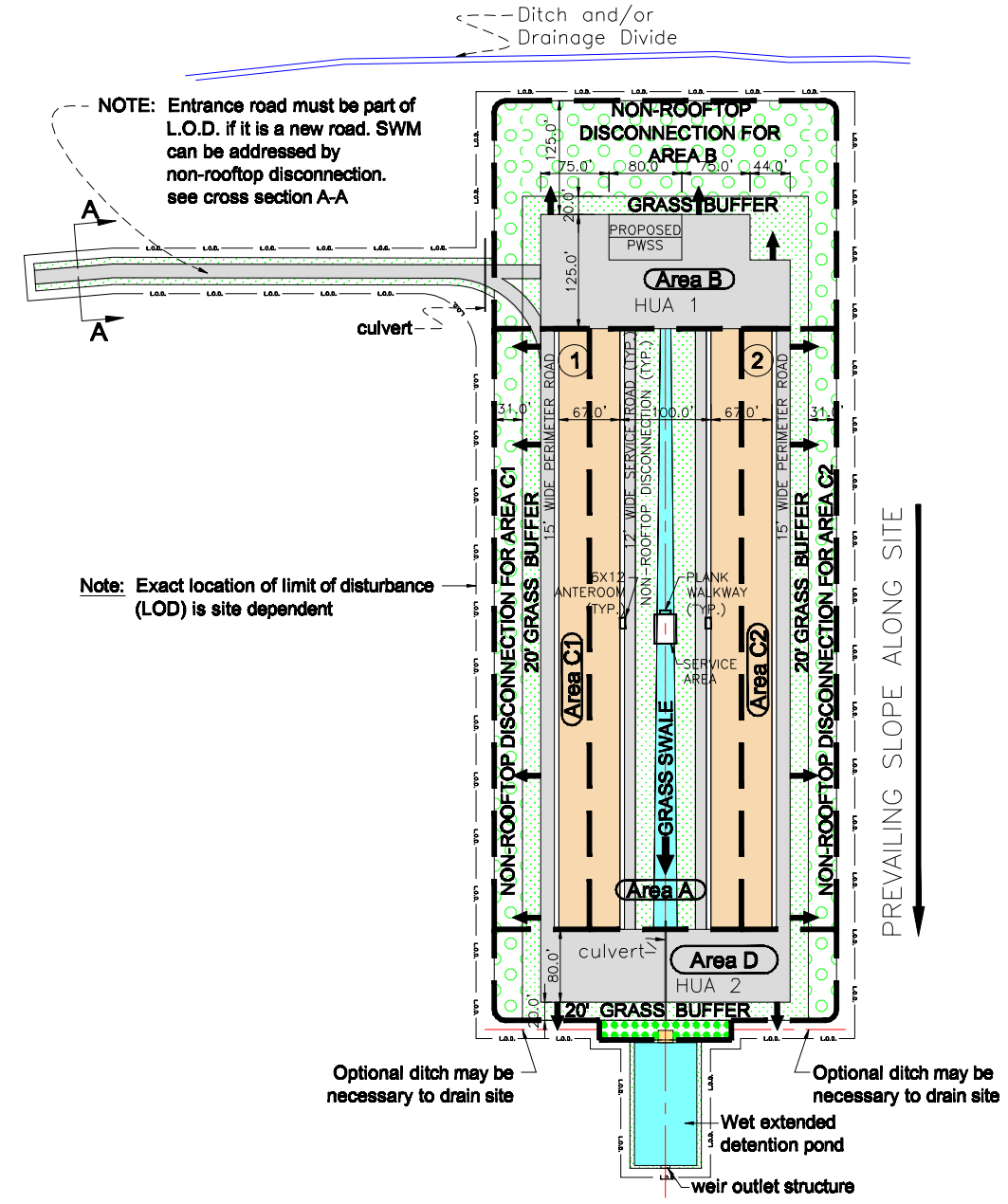
Safety bench must be provided for ponds deeper than four feet.

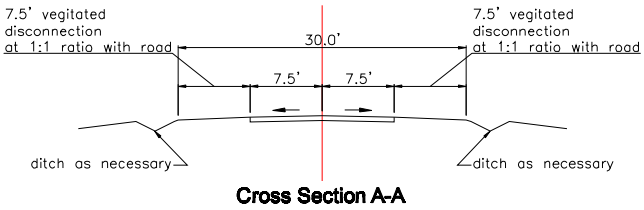


Cross Section A-A

Scale: 1" = 200'

SWM STANDARD PLAN
FOR TWO POULTRY HOUSES
(HSG 'A' or 'B' soils)





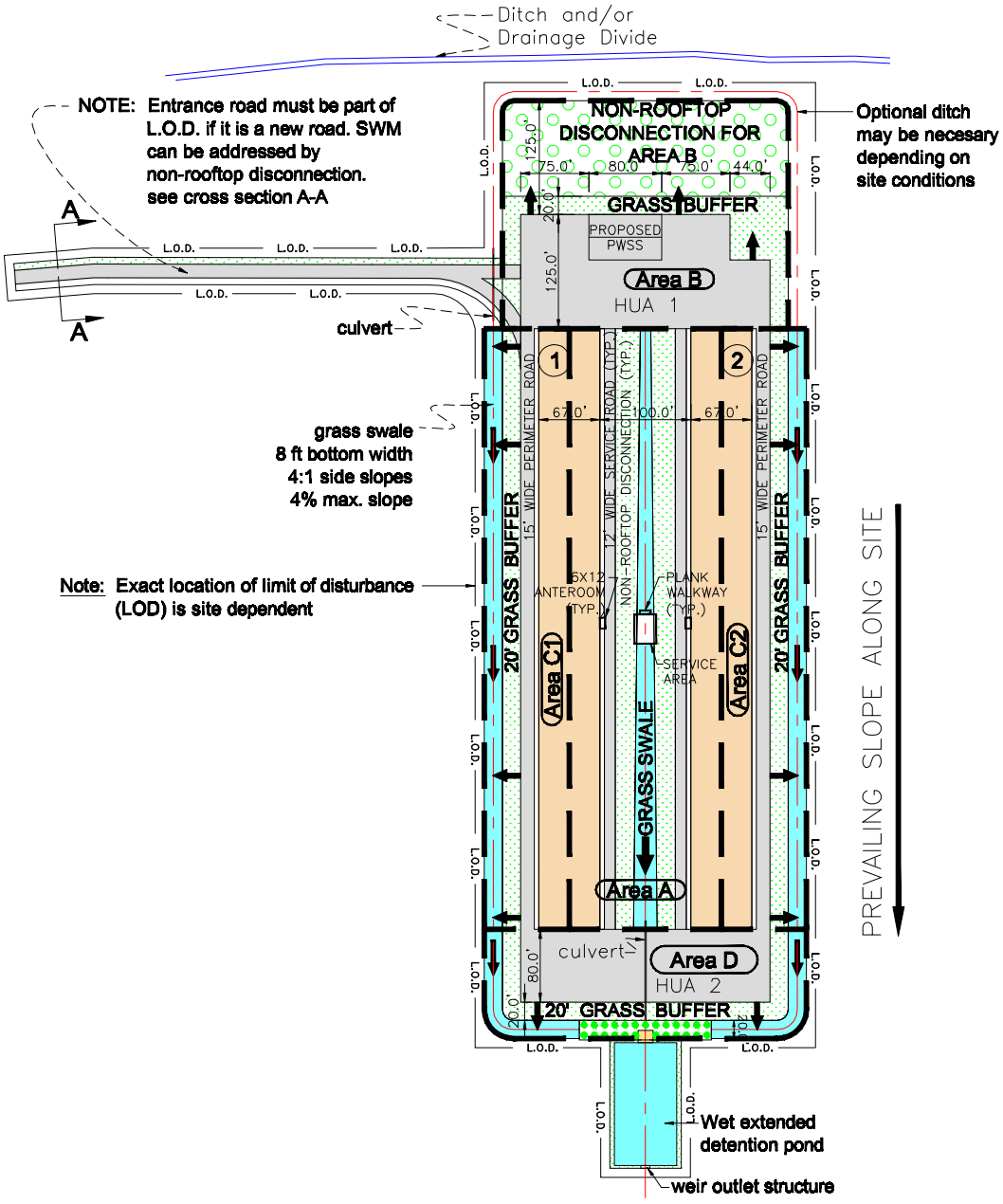
Cross Section A-A

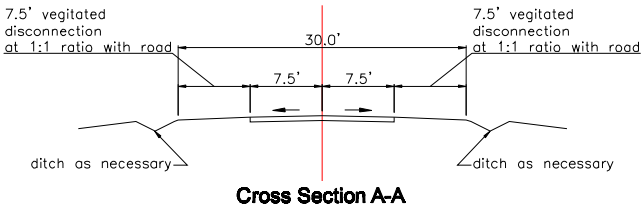
Note: Shape and orientation of wetland pond and outfall are site dependent.

Safety bench must be provided for ponds deeper than four feet.

Scale: 1" = 200'

SWM STANDARD PLAN
FOR TWO POULTRY HOUSES
(HSG 'C' or 'D' soils)





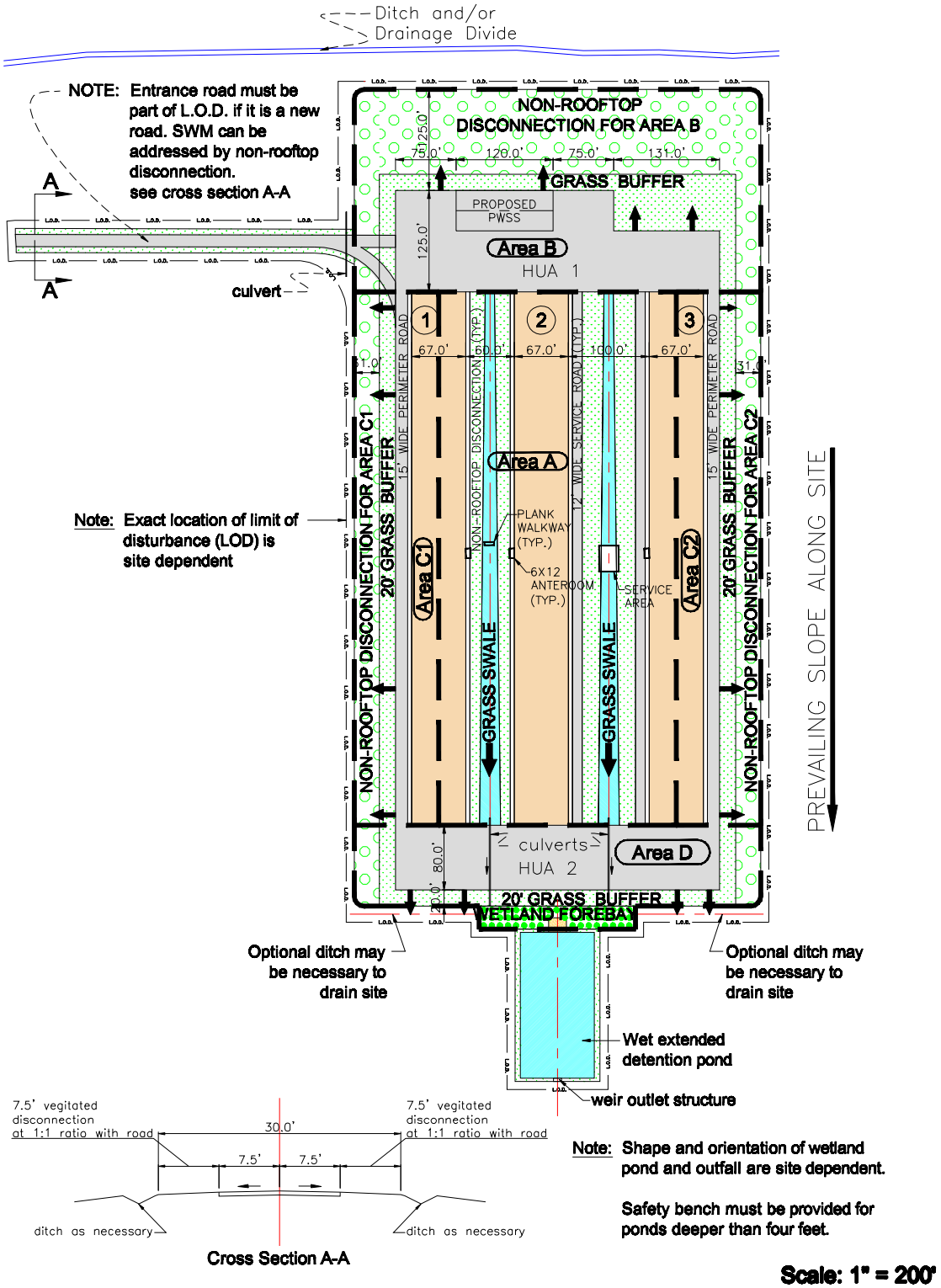
Cross Section A-A

Note: Shape and orientation of wetland pond and outfall are site dependent.

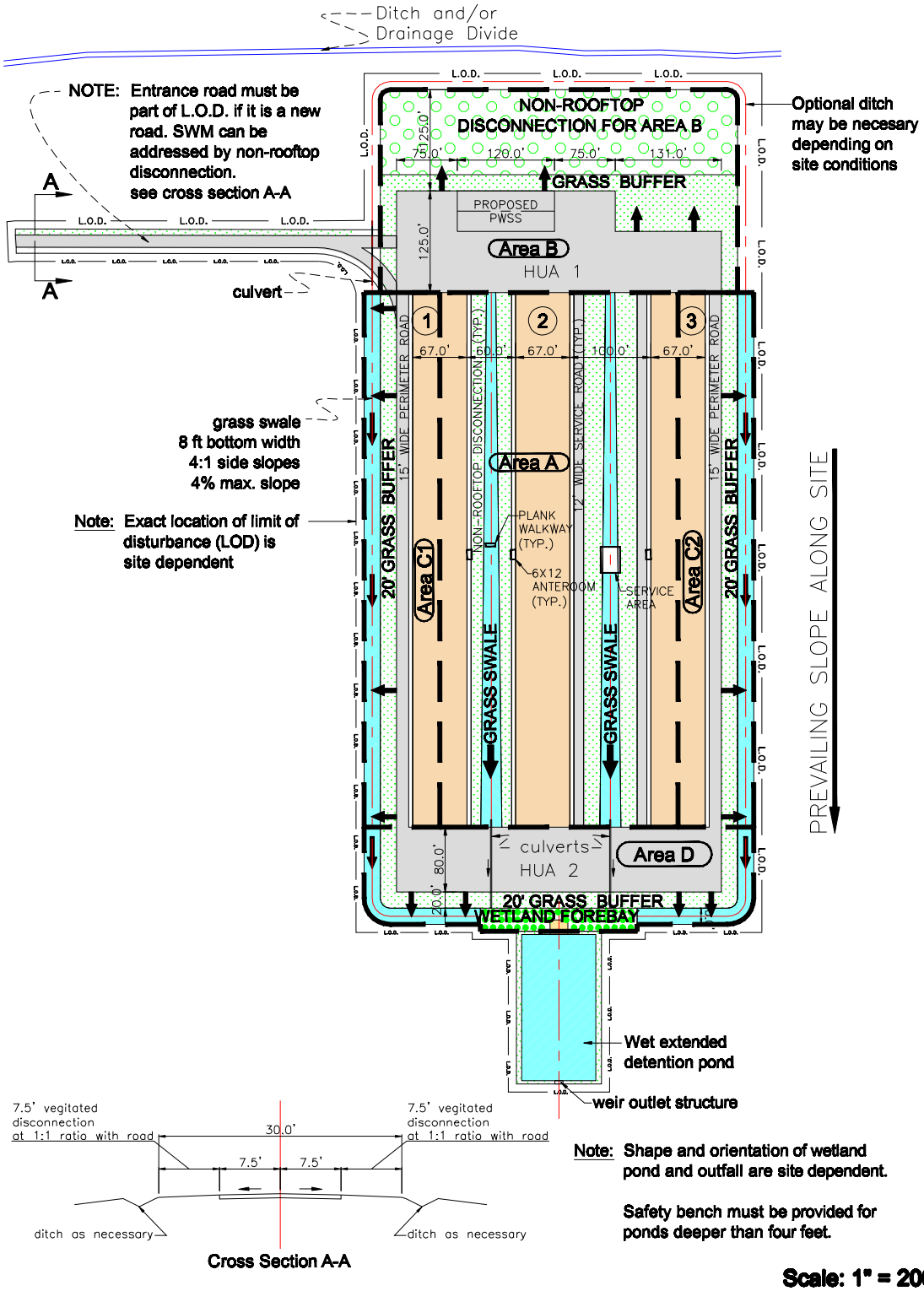
Safety bench must be provided for ponds deeper than four feet.

Scale: 1" = 200'

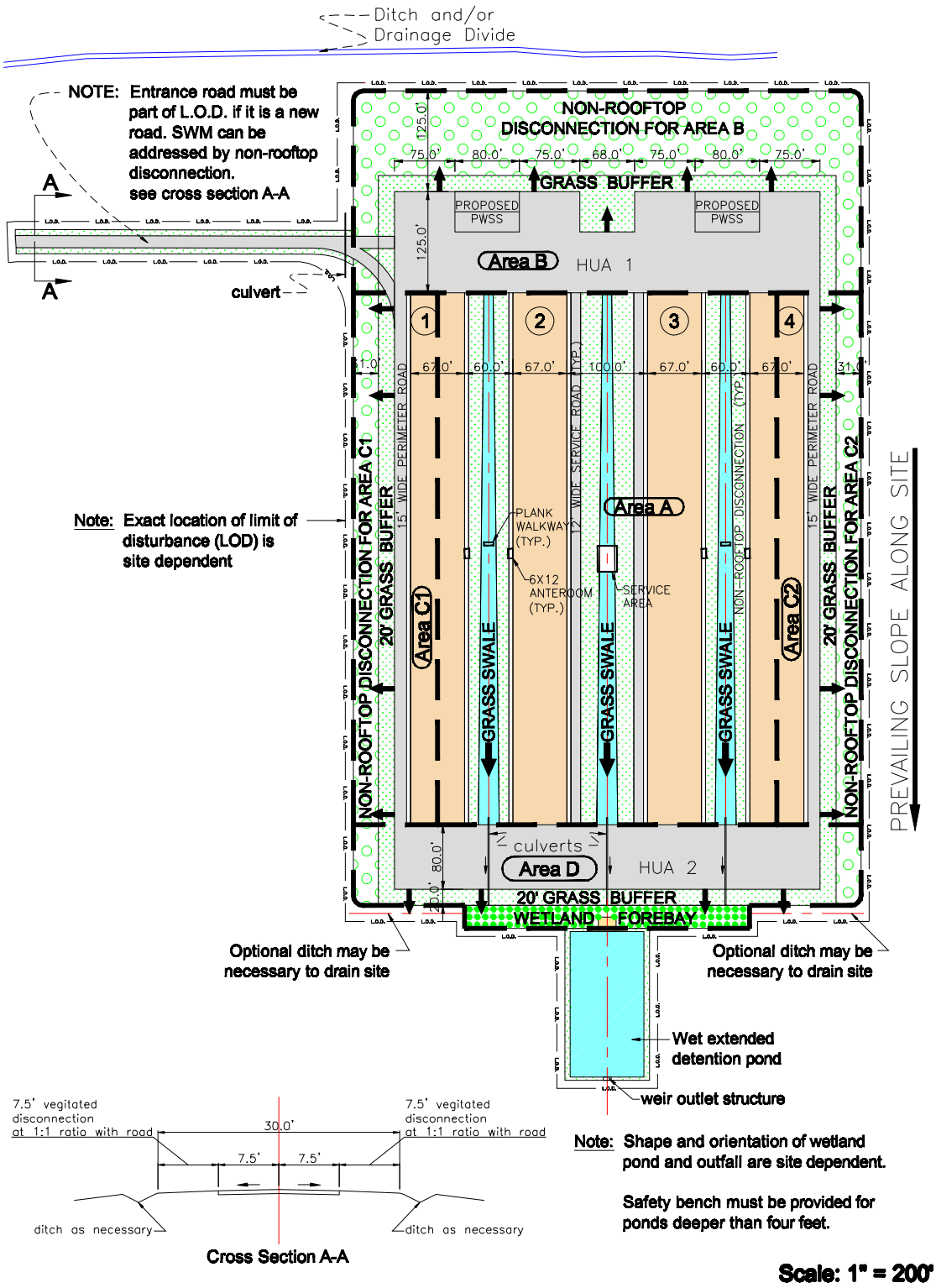
SWM STANDARD PLAN
FOR THREE POULTRY HOUSES
(HSG 'A' or 'B' soils)



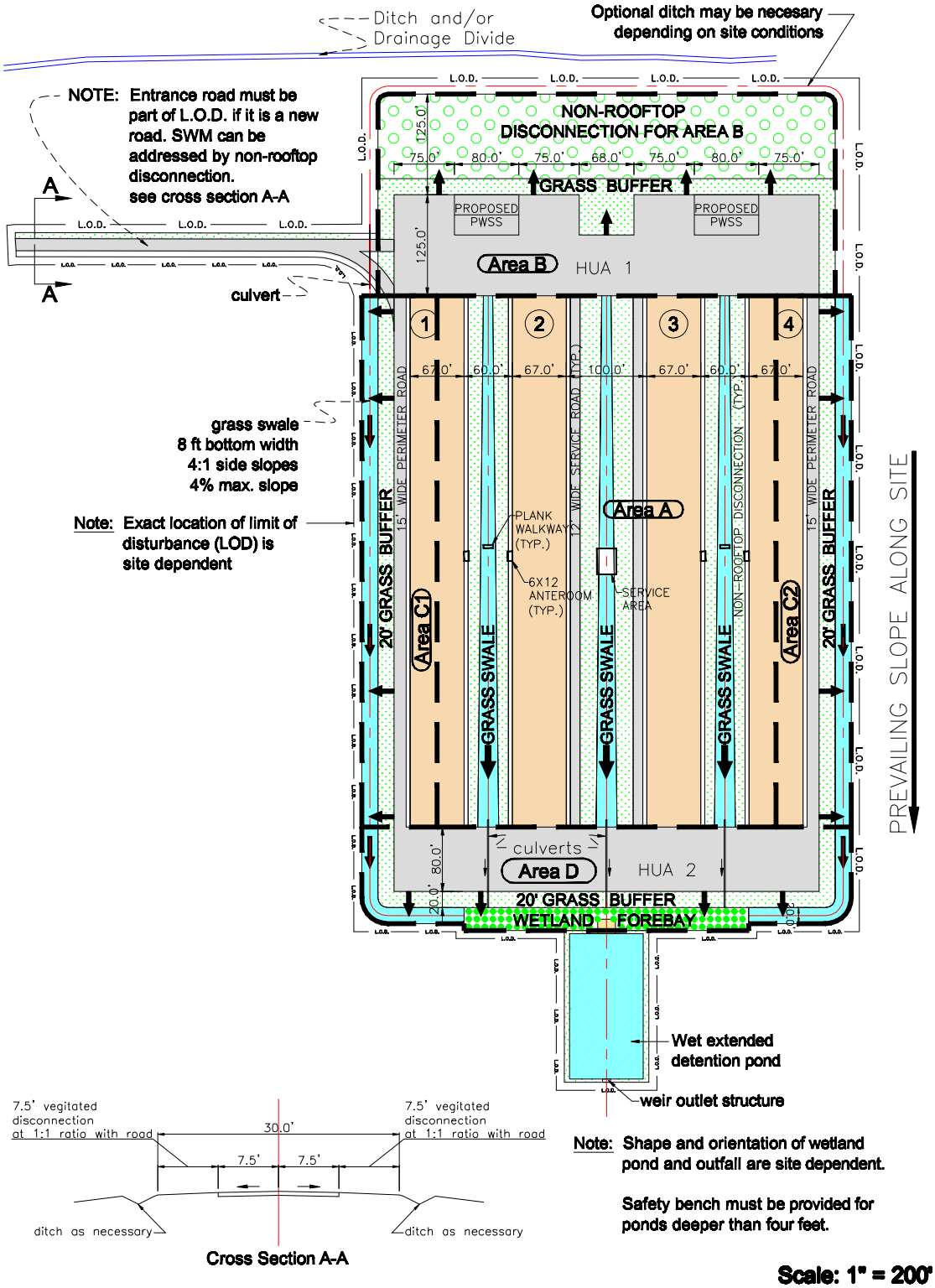
SWM STANDARD PLAN
FOR THREE POULTRY HOUSES
(HSG 'C' or 'D' soils)



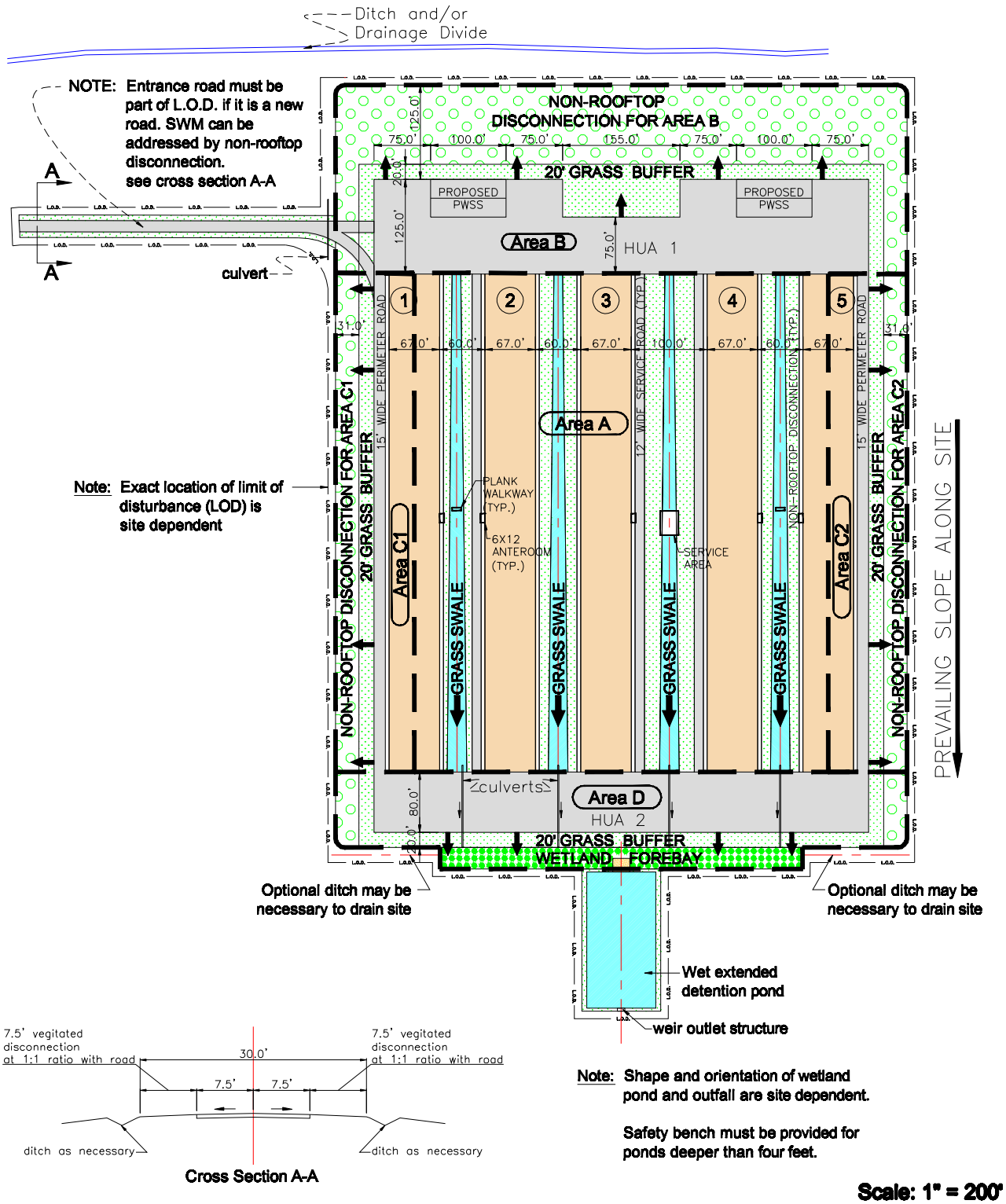
SWM STANDARD PLAN
FOR FOUR POULTRY HOUSES
(HSG 'A' or 'B' soils)



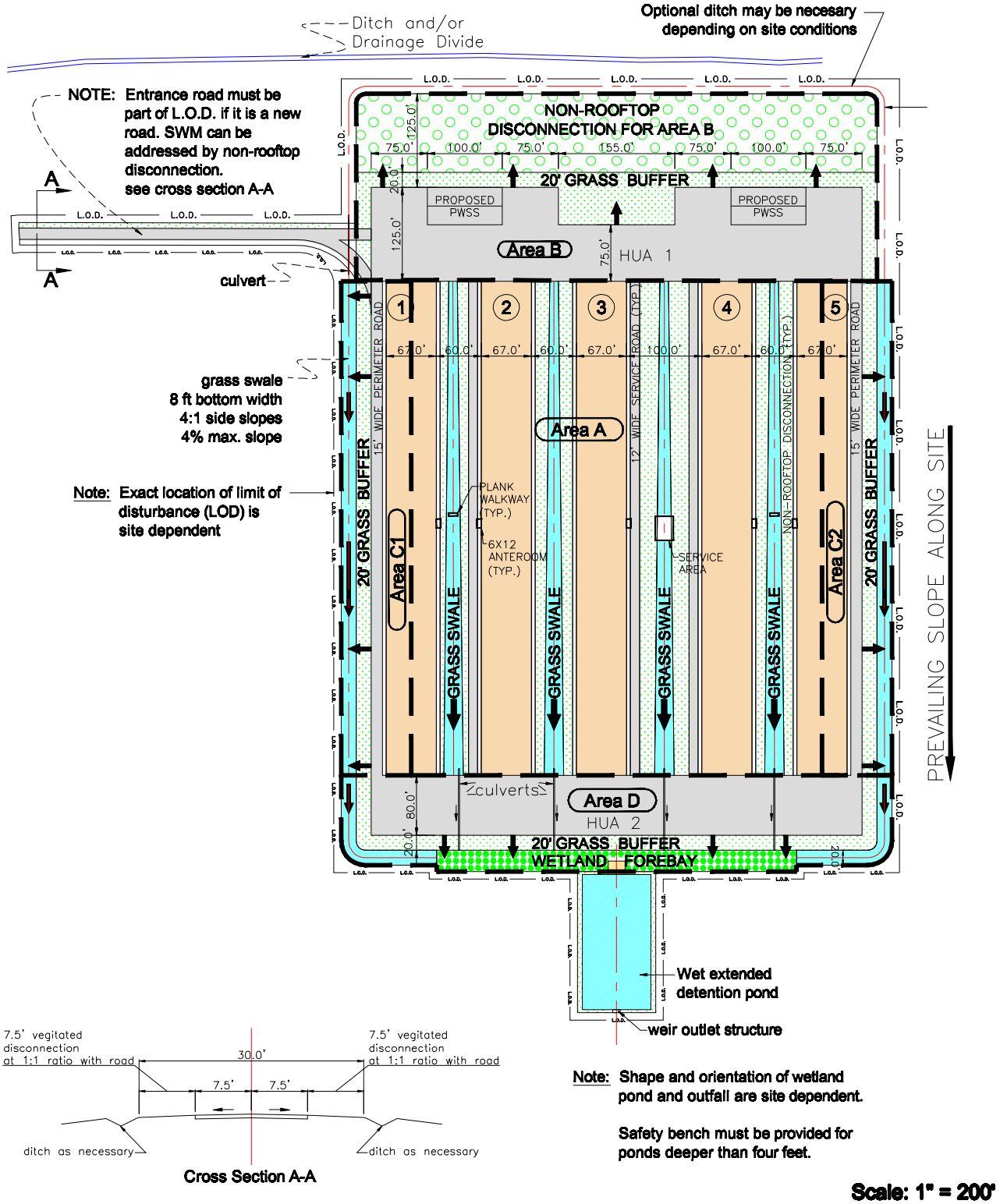
SWM STANDARD PLAN
FOR FOUR POULTRY HOUSES
(HSG 'C' or 'D' soils)



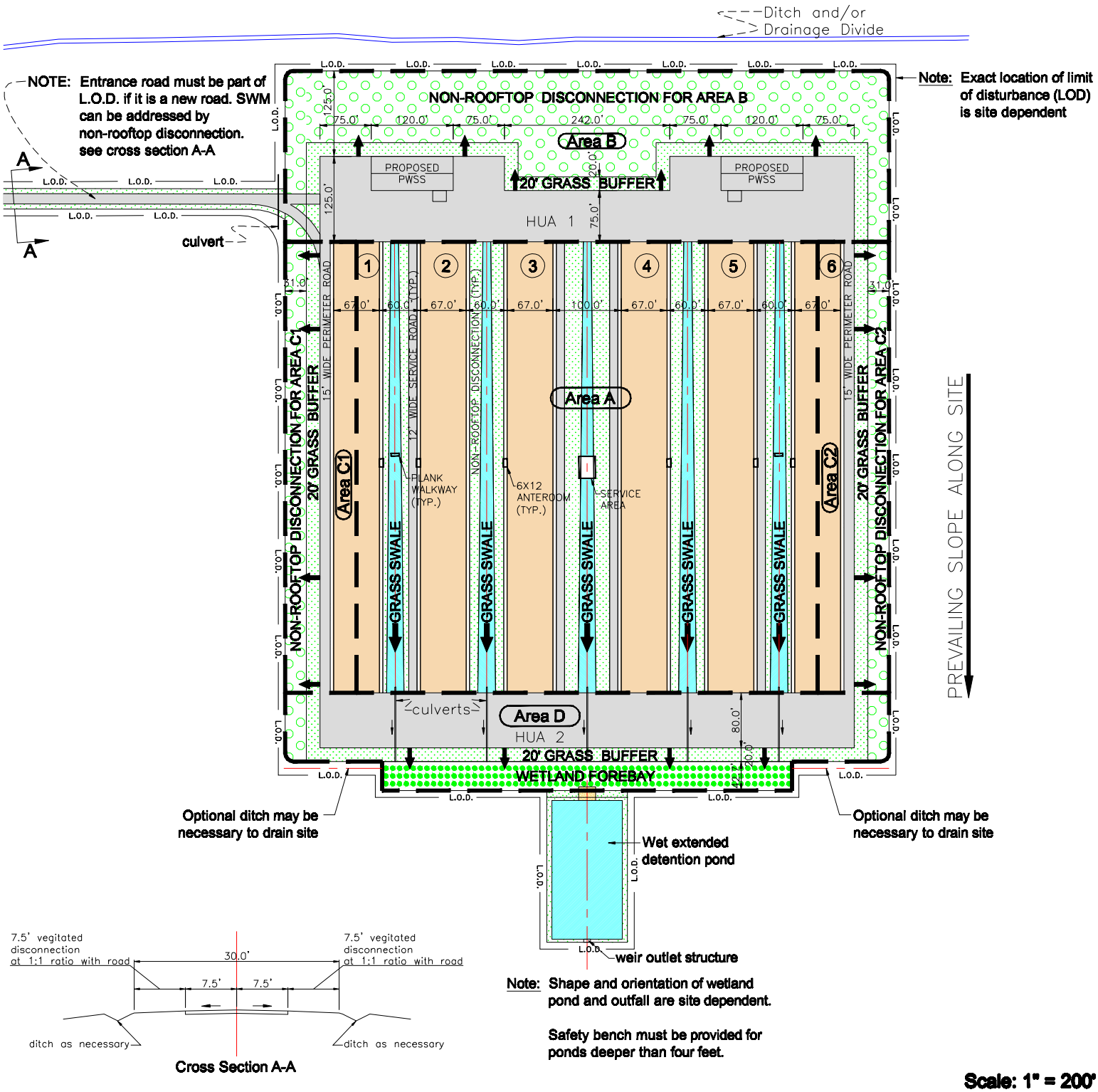
SWM STANDARD PLAN
FOR FIVE POULTRY HOUSES
(HSG 'A' or 'B' soils)



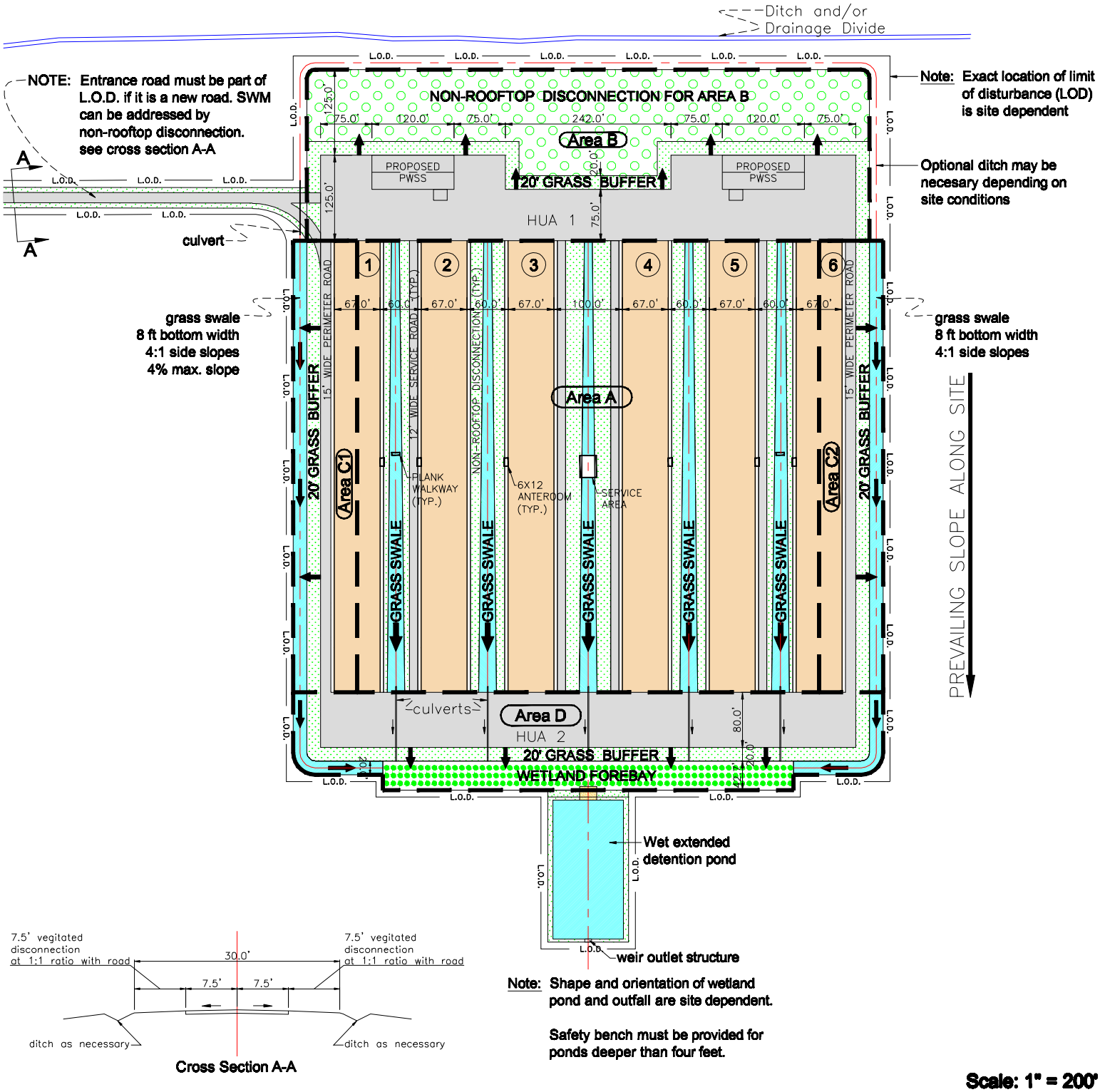
SWM STANDARD PLAN
FOR FIVE POULTRY HOUSES
(HSG 'C' or 'D' soils)



SWM STANDARD PLAN
FOR SIX POULTRY HOUSES
(HSG 'A' or 'B' soils)



SWM STANDARD PLAN
FOR SIX POULTRY HOUSES
(HSG 'C' or 'D' soils)



MARYLAND DEPARTMENT OF THE ENVIRONMENT
STORMWATER MANAGEMENT CALCULATOR
FOR POULTRY HOUSE SITES

INPUT	
HSG soil type (A, B, C, D)	**D**
number of poultry houses (1 - 6)	**6**
length of poultry house(s) (600 ft max)	**600**

OUTPUT	
INFILTRATION POCKET	
minimum volume (cf)	0
side slopes	0
depth (ft)	0
length (ft)	0
width (ft)	0
WETLAND FOREBAY	
minimum volume (cf)	6,027
side slopes	3:1
depth (ft)	0.5
length (ft)	560
width (ft)	20
POND	
minimum DRY storage volume (cf)	66,708
OUTFALL	
1- yr peak outflow discharge (cfs)	0.8

ESDv COMPUTATIONS								
	A-100	A-60	A-60 no road	**total A**	**B**	**C**	**D**	**Σ**
# of subareas in Area A (from adjacent table)	**1**	**2**	**2**	N/A	N/A	N/A	N/A	N/A
Ai (sf)	48,240	47,472	40,272	223,728	85,650	58,200	62,560	430,138
A (sf)	100,200	76,200	76,200	405,000	229,320	124,200	130,620	889,140
I (% imperviousness)	48.1	62.3	52.9	55.2	37.3	46.9	47.9	48.4
Rv	0.48	0.61	0.53	N/A	0.39	0.47	0.48	N/A
Pe (in) - function of soil (from adjacent table)	**1.8**	**1.8**	**1.8**	**N/A**	**1.6**	**1.8**	**1.8**	**N/A**
Pe (in) treated by disconnection	0.63	0.24	0.47	N/A	1.00	0.39	0.25	N/A
Pe (in) treated by infiltration pocket	0	0	0	N/A	0.00	0	0	N/A
Pe (in) treated by grass swales	0.48	0.63	0.63	N/A	0	0.39	0	N/A
Pe (in) treated by wetland forebay	0	0.13	0	N/A	0	0.22	0.75	N/A
Pe (in) treated in pond	0.69	0.80	0.70	N/A	0.60	0.80	0.80	N/A
req'd ESDv (cf) in pocket infiltration	0	0	0	0	0	0	0	0
req'd ESDv (cf) in wetland forebay	0	1009	0	1009	0	1091	3927	6,027
req'd ESDv (cf) in pond	2788	6205	4674	13667	4428	3906	4189	26,189
req'd Cpv (cf) in pond								66,708
req'd DRY storage volume (cf) in pond								66,708