

DEVELOPMENT ENGINEERING DIVISION CHECKLIST SITE DEVELOPMENT PLAN **COMMERCIAL** APPLICATION

I. SUBMISSION DOCUMENTS *(Made thru Project Dox)*

- A. Certification Letter from Professional Engineer that the Public Water/Sewer Plans have been submitted for review and site is included in Metropolitan District
- B. APFO Study w/Accident Analysis & Mitigation Plan included in set
- C. Sight Distance Analysis w/85th Percentile Speed Study
- D. Retaining Wall Computations, Plans w/Sections, Details, Profiles
- E. Stormwater Management/Storm Drain Computations
- F. Geotechnical Report for Stormwater Management/Retaining Walls
- G. 100-year Floodplain Study
- H. Noise Study w/ Mitigation identified and included on plan
- I. Design Manual Waiver Request
- J. Letter of Permission for Offsite Disturbance
- K. *Written verification that the Environmental Concept Plan is approved*

II. GENERAL INFORMATION

- A. Standard title and signature blocks (**ALL SHEETS**)
 - 1. Owner/Developer name, address and phone number
 - 2. Design Professional name, address, phone number, seal, signature, date
 - 3. Project name, zoning, tax map, election district, street address, parcel number
 - 4. Permit, file reference numbers, water & sewer contract numbers, etc.
- B. Vicinity map requirements (**COVER SHEET**)
 - 1. Scale 1" = 200' , north arrow shown
 - 2. ADC Map Coordinates
 - 3. Two (2) Howard County Geodetic Coordinates shown and labeled
 - 4. Site delineated
- C. Notes and information (**COVER SHEET**)
 - 1. Howard County Standard General Notes for Commercial Development
 - 2. Site Analysis Data Sheet
 - 3. Legend
 - 4. Sheet Index
- D. General sheet information (**ALL SHEETS**)
 - 1. Plan Scale 1" = 10' to 1" = 50'
 - 2. Profile scale 1" = 5' vertical, 1" = 50' horizontal
 - 3. Minimum three (3) grid ticks on plan sheets
 - 4. North arrow
 - 5. Match lines labeled and referenced
 - 6. Profiles, details and cross-sections drawn to scale
 - 7. Design Professional's seal, signature and date
 - 8. Sheets numbered

III. SITE DEVELOPMENT PLAN

- A. Site information required
 - 1. Layout with appropriate boundary information
 - 2. Adjacent right-of-ways, street names, centerline stationing, street classification shown
 - 3. Adjacent property owner information
 - 4. Existing and proposed easements shown and labeled with recording references
- B. Topographic information
 - 1. Onsite existing contours labeled (at no greater an interval than 2'). Field run or aerial survey. (**Howard County GIS shall not be used**)
 - 2. Offsite topography shown within 200' of all property lines. Field run or aerial survey only within 25' of all property lines and within all public rights-of-way. Howard County GIS aerial may be used for remaining area within 200'
 - 3. Existing features, trees, buildings, pavement, utilities, etc., within 200' shown and labeled where appropriate
- C. Proposed grading
 - 1. Proposed contours shown (at no greater an interval than 2')
 - 2. Spot elevations at building corners, driveways, grade breaks, P.C.'s, P.T.'s, etc. to adequately portray site grading
 - 3. Retaining walls shown with spot grades at top and bottom of wall (Wall requirements in accordance with Section XII of this checklist)
- D. Utility information
 - 1. Label all existing and proposed storm drain pipes and structures
 - 2. Show public water and sewer mains on-site (with easements)
 - 3. Show and label existing and proposed WHC and SHC
 - 4. Label if the meter is inside or outside building and if Public or Private
 - 5. Existing and proposed fire hydrants shown and labeled
 - 6. Dimension utilities and check for conflicts
 - 7. Label the Siamese fire connection on the building
- E. Site improvements
 - 1. Label type of paving, curb and gutter, sidewalks, handicap ramps, curb transitions, etc.
 - 2. Specify travelway widths, parking space dimensions
 - 3. Dumpster enclosure located and details provided and referenced
 - 4. Noise mitigation shown and details provided w/associated easements
- F. Locate entrance intersection along the public roadway
 - 1. Provide centerline station equation or coordinate value
 - 2. Driveway shall conform to DMV IV, R-6.07, R-6.08 or R-6.09 requirements
 - 3. Design Manual Waiver (if necessary) for use of alternative radii
- G. Provide a sight distance analysis at all intersections with existing roads in accordance with DMV III, Section 2.2.D (Intersection Sight Distance for Major Collectors and higher, Stopping Sight Distance for Minor Collectors and below). Include the following:
 - 1. 85th Percentile Speed Study
 - 2. Intersection/Stopping Sight Distance Analysis (scale 1"=5'V/50'H or larger)
 - 3. Survey along line of sight (horizontal/vertical obstructions shown)
 - 4. Design Manual Waiver (if necessary) for use of Stopping Sight Distance

IV. STORM DRAIN DRAINAGE AREA MAP

- A. Drainage area map requirements
 - 1. Delineate all the drainage areas to storm drain structures
 - 2. Label total drainage area, percent impervious, "C" factor for each subarea
 - 3. Delineate soils classifications
 - 4. Show existing and proposed grading to substantiate drainage delineation
 - 5. Show storm drain system with pipes and structures labeled

V. GRADING AND SEDIMENT CONTROL PLAN

- A.** Erosion and sediment control plan requirements
 1. Show existing and proposed grading with minimum of 2' contour intervals
 2. Show the entire limit of disturbance
 3. Show all the sediment control devices necessary for site construction
- B.** Erosion and sediment control notes and detail requirements
 1. Sediment Control Site Analysis Data completed

VI. DETAILS & SCHEDULES

- A.** Detail and Schedule requirements
 1. Any special detail or deviation from County standards (Scaled details)
 2. Structure schedule for storm drain structures
 3. Pipe schedule specifying size, type, and total length for each
 4. Sequence of construction with approximate time frames noted

VII. PROFILES

- A.** Private Water and Sewer profiles
 1. Profile with existing and proposed ground over the centerline of the pipes
 2. Structures numbered, labeled, pipe size, type, slopes specified
 3. Check for all utility crossings for minimum clearance from other utilities
 4. Check for minimum and maximum cover for all the utilities
 5. AASHTO T-180 Specifications referenced for pipes in fill
- B.** Storm Drain profiles
 1. Sediment Control Site Analysis Data completed
 2. Structures numbered, labeled
 3. Check for all utility crossings for the minimum clearance from other utilities
 4. Check for minimum and maximum cover
 5. Label pipe size, type, length (station), amount of flow, velocity, slope inverts
 6. Show outfall protection detail and design computations
 7. 10-year HGL shown (min. at crown of pipe)
 8. AASHTO-T-180 Specifications referenced for pipes in fill

VIII. STORM DRAIN COMPUTATIONS

- A.** Provide a storm drain study in conformance with the DMV I to include:
 1. Impervious Area computations
 2. Storm drain computations
 3. Inlet & gutter computations
 4. Hydraulic gradient & headloss computations
 5. Provide adequate outfall
 6. Offsite easements as required

IX. APFO STUDY

- A. Provide an APFO Traffic Study in conformance with the DMVIII requirements:
 1. Title Page to include:
 - a. Job Name
 - b. Owner
 - c. Design Professional
 - d. Date prepared
 - e. Seal and signature
 2. Table of Contents to include:
 - a. Sections listed
 - b. Appendix listed
 - c. Figures and tables listed
 3. Narrative to include:
 - a. Limits of study
 - b. Trip generation source
 - c. Vicinal developments included
 - d. Proposed mitigation
 - e. Accident analysis
 4. Appendix to contain all computations, design charts and relevant data referenced
 5. All page numbers referenced in the Table of Contents

X. 100 YEAR FLOODPLAIN STUDY

- A. The design professional must study the following in the field before starting design?
 1. Drainage Area
 2. Time of Concentration Paths
 3. Ground Cover/Stream Characteristics
 4. Downstream Hazards
 5. Soils Investigation
- B. Hydrologic Analysis
 1. Drainage area map shall include:
 - a. Sub-areas shown per Design Manual Volume I Section 2.2.4 requirements and identifying all study points
 - b. Time of concentration paths shown in segments as sheet flow, concentrated flow and channel flow
 - c. Ultimate drainage area information provided (T_c , RCN, area) for each sub-area
 - d. Soil types and hydrologic soils groups shown
 2. Hydrologic Computations shall include:
 - a. RCN based on general plan or most recent zoning map
 - b. Time of concentration computations
 - (1) Maximum L (sheet flow) = 100'
 - (2) P100 = 7.2 inches (sheet flow)
 - (3) Concentrated flow per TR-55
 - (4) Channel flow per TR-55 (with cross section information)
 - c. Soils map with sub-watershed boundaries indicated
 - d. Zoning Map/Land Use Map with sub-watershed boundaries indicated
 - e. Watershed schematic of TR-20
 - f. Backup calculations for stage discharge and discharge-area relationships for channel routing rating tables
 - g. Backup calculations for stage discharge and stage-storage relationships for the reservoir routing rating tables

C. Report Submission Requirements

1. Title Page
 - a. Job Name
 - b. Owner
 - c. Design Professional
 - d. Date prepared
 - e. Seal and signature
2. Table of Contents
 - a. Sections listed
 - b. Appendix listed
 - c. Figures and tables listed
3. Narrative
 - a. Introduction – gives overview of what is contained in report
 - b. Brief description of existing conditions
 - c. Detailed description of ultimate site conditions (including any modifications to the channel)
 - d. Explanation of assumptions made (methodology, channel data, etc.)
 - e. Explanation of HEC-2/HEC-RAS cross-section information
 - f. Determination of starting water surface elevation
 - g. Determination of Manning's "n" (verification included in appendix)
 - h. Summary
 - i. Conclusions and Recommendations
 - j. Appendix (contains all computations, design charts and relevant data references.) Number all sheets and provide list of included computations in the Table of Contents

D. Plan submission requirements:

1. Vicinity map on the cover sheet of the plans
2. Floodplain drainage area map conforming to requirements above
3. Plans at a scale of (1' = 50', 1" = 100', etc.) to include:
 - a. North arrow
 - b. Grid ticks (3) at 250' intervals (minimum)
 - c. Scale
 - d. Plan view with site boundaries
 - e. Contour (2' interval, field run or aerial, Howard County only used for offsite areas)
 - f. Cross section locations identified
 - (1) Existing WSEL listed
 - (2) Proposed WSEL listed
 - (3) Section number listed
 - g. Existing 100 year WSEL delineated
 - h. Proposed improvements/modifications shown
 - i. Proposed 100 year WSEL delineated
 - j. Summary listing of Section/Flow/WSEL (EX)/WSEL (PR)
 - k. Each sheet signed and sealed
4. Profiles with consistent scales (1" = 5' vertical, 1" = 50' horizontal)
(Can use printout from HEC-RAS model)
 - a. Existing:
 - (1) Stream profile
 - (2) 100 year WSEL plotted/labeled
 - (3) Existing obstructions plotted
 - (4) Sections and distances between located

- (5) Property limits shown
- (6) Flows delineated at each cross-section
- (7) Each sheet signed and sealed
- (8) 3-dimensional printout along centerline (HEC-RAS only)
- b. Proposed:
 - (1) Stream profile
 - (2) 100 year WSEL plotted/labeled
 - (3) Proposed obstructions/changes plotted
 - (4) Sections and distances between located
 - (5) Property limits shown
 - (6) Flows delineated at each cross-section
 - (7) Each sheet signed and sealed
 - (8) 3-dimensional printout along centerline (HEC-RAS only)
- 5. Cross-Sections with consistent scale (1" = 5' vertical; 1" = 50' horizontal)
Can use printout from HEC-RAS model
 - a. Existing ground plotted
 - b. Overbank stations located
 - c. Cross-section labeled
 - d. Flow at section listed
 - e. 100 year WSEL (existing) shown & labeled
 - f. Each sheet signed and sealed
- 6. Additional plans – (reasonable scales)
 - a. Zoning Map/Land Use Map with sub-watershed boundary indicated
 - b. Soils Map – with sub-watershed boundary indicated
- E. Letter of Map Amendment/Revision (LOMA/LOMR) – FEMA
 - 1. Does FEMA Floodplain exist? Yes No
 - 2. Does floodplain change existing FEMA Floodplain Yes No
 - 3. Is LOMA/LOMR required? Yes No
 - 4. Has the Department of Public Works, Bureau of Environmental Services, Stormwater Management Division been contacted? Yes No
 - 5. Provide verification letter from the Department of Public Works, Bureau of Environmental Services, Stormwater Water Management Division specifying developer responsibility to obtain LOMA/LOMR from FEMA.
- F. Obviously not critical floodplain study
 - 1. Justification for non-critical study
 - 2. TR-55 and 100-year flow determination
 - 3. Drainage area map with RCN, Tc and Area listed
 - 4. Zoning map with watershed boundaries drawn on it
 - 5. Manning's "n" with justification provided

XI. NOISE STUDY w/MITIGATION

- A. Provide a noise study for residential uses (including residential uses in commercial zoning) in conformance with the DMV III to include:
 - 1. Title Page
 - a. Job Name
 - b. Owner
 - c. Design Professional
 - d. Date Prepared
 - e. Seal and Signature

2. Table of Contents
 - a. Sections Listed
 - b. Appendix Listed
 - c. Figures & Tables Listed
 3. Introduction stating project location and description
 4. Noise fundamentals (i.e. what's acceptable and what's not)
 5. Ambient noise measurements (used for calibration) identifying the type of monitor used
 6. Predicted noise levels specifying methodology (HUD/TNM/Stamina) and description
 7. Summary of parameters specifying:
 - a. Source of ADT or peak hours volumes
 - b. Source of vehicle type splits
 - c. Source of operating speeds
 - d. Type and source of other pertinent information or assumed values
 8. Results and conclusions specifying any mitigation that may be required
- B.** Provide an appendix in the report to include:
1. Map showing roads to be evaluated, proposed subdivision layout, contours and other physical features, state grid coordinates (3), receptor locations and proposed 65dBA contour line
 2. Input data showing work sheets for HUD method or computer input copy for Stamina (use state grid coordinates for roadway, receptor, etc.points)
 3. Output data showing work sheets for HUD method or computer output sheets for Stamina
 4. Mitigation showing work sheets for HUD method or computer output Stamina/Optima
 5. Cross sections (optional)

XII. RETAINING WALLS

- A.** General items to include:
1. Retaining walls greater than 3' in height measured from finished grade at the front to the top of the wall shall require structural design
 2. Grades shall not exceed 2:1 above the wall or 4:1 below the wall within the maintenance easement
 3. Horizontal dimensions measured from bottom face of the wall at the proposed grade
 4. Retaining walls shall not be constructed on fill materials
 5. Retaining walls & supports shall not be within a Howard County right-of-way or easement
 6. Computations signed and sealed by the appropriate design professional
- B.** Construction drawings – plan view:
1. Retaining walls in plan view at a maximum scale of 1" = 50'
 2. Grading around the retaining wall showing flow patterns around the wall
 3. Grading around the wall shall show spot elevations every 50' along the length of the wall at the top and bottom of the wall
 4. Flow arrows along the top of the wall indicating drainage patterns
 5. Sheet flow approaching wall
 6. Provide scour protection for runoff that cascades over the wall
 7. Walls less than 10' in height, 10' wide construction easement is required from the face of the wall
 8. For all walls the width of easement shall be equivalent to height of wall plus one-half the wall height
 9. Easement clear of floodplains, buffers, wetlands, property boundaries, structures utility easements, environmentally sensitive areas
 10. No structures or underground utilities within the maintenance easement
 11. Global stability analysis for walls 10' in height or greater
 12. "NO TREE PLANTING ZONE" for all block or timber walls identified
 13. Maintenance easement shall not encroach on the building envelope of any residential lot

C. Construction drawings - elevations:

1. Elevations for all walls at a scale not to exceed 1" = 5' (1" = 10' horizontal for walls over 50' long) Provide a vertical scale bar and horizontal stationing across the bottom of the elevation
2. Front view shall have typical section identified by a letter or number
3. Section breaks clearly identified
4. Element of the elevation shall include:
 - a. Complete outline of the wall
 - b. Finished grade line superimposed over the wall at top and bottom
 - c. Locations of weep holes (40' on center or as required by Geotechnical Engineer)
 - d. Location of all utilities in proximity to the walls shown
 - e. Proposed GeoGrid arrangement location and length
 - f. Vertical placement of GeoGrid identified
 - g. Required allowable bearing strength for each typical section indicated
 - h. Dimension typical section maximum height allowed

D. Construction drawings – cross sections:

1. Typical cross section for each wall as it varies by height and GeoGrid placement and/or other significant design features. Maximum scale 1" = 5'
2. Typical section maximum height of wall
3. Graphically show the number of blocks or timbers vertically placed
4. Typical reinforcement for reinforced concrete walls
5. Design notes for reinforced concrete walls including spacing requirements
6. Indicate the slope above and below the wall
7. Bearing strength required for soil beneath the wall on each typical section
8. Drain placement behind the base of the wall shown, details, fabric placement
9. GeoGrid placement by layers and length shown in cross section detail

E. Construction drawings – fences/guardrails/details

1. Fence for all retaining walls 30" in height or greater along the entire length
2. Fences shall be a minimum of 36" in height, openings less than 4" in width
3. Fences shall withstand 200lbs loading applied horizontally at any point
4. Typical fence footing detail provided
5. If fence is setback from the wall, ends shall be tapered to prevent access
6. Fences shall be shown in plan view
7. Walls in proximity to vehicular traffic require guard rails
8. For roadways/parking lots, 7" curb shall be a minimum 2' in front of guard rail or wall
9. Face of guardrail shall be a minimum 3' from face at the top of wall to the side of the guardrail facing the wall

F. Design calculations/failure analysis:

1. Computations shall contain a failure analysis meeting the following factors of safety:
 - a. 2.0 for sliding failure (1.5 for manufactured block)
 - b. 2.0 for overturning failure
 - c. 2.0 for bearing failure for concrete or timber walls
 - d. 3.0 for bearing failure for concrete walls
2. Failure analysis shall contain likely or anticipated surcharge loads
3. For manufactured block walls, supplemental design booklets may be substituted for failure analysis but shall not be considered as part of the construction drawings
4. Provide a complete set of design calculations, including the placement and spacing of steel reinforcement for reinforced concrete walls

G. Construction drawings required notes:

1. On all retaining wall General Notes include the following:
 - a. Retaining walls shall only be constructed under the observation of a Registered Professional Engineer and a (NICET, WACEL or equivalent) certified soils technician
 - b. The required bearing pressure beneath the footing of the wall shall be verified in the field by a certified spoils technician. Testing documentation shall be provided to Howard County Inspector prior to the start of construction. The required test procedure shall be the Dynamic Cone Penetrometer Test ASTM STP-399
 - c. The suitability of fill material shall be confirmed by the onsite soils technician. Each eight (98) inch lift shall be compacted to a minimum of 95% Standard Procter Density and the testing report shall be made available to the Howard County Inspector upon completion of construction
 - d. For “CRITICAL” walls, one soil boring shall be required every 100’ along the entire length of the wall. Copies of all boring reports shall be provided to the Howard County Inspector prior to the start of construction
 - e. If no surcharge loads are considered add a note to the cross section details stating, “THIS WALL NOT DESIGNED FOR SURCHARGE LOADS.”
2. All information required for the construction of the retaining walls shall be included on the construction drawings including:
 - a. Material specification
 - b. Block wall system manufacturer notes
 - c. Design Engineer notes
 - d. Specific instruction for non typical designs
3. Design plans and computations shall include:
 - a. Seal, signature and date of responsible design professional
 - b. Name, address, telephone number of responsible design firm
 - c. Name, address, telephone number of owner/developer

H. Tiered walls:

1. Tiered walls 10’ high or greater shall be designed as “CRITICAL” walls
2. Setback between walls shall be equal to the height of the lower wall or greater
3. Slope between tiered walls shall not exceed 4:1

I. Retaining walls in stormwater management facilities:

1. Toe of retaining wall, tie backs, GeoGrid outside the phreatic line
2. Maximum height of 3’ in publicly maintained facilities
3. Maximum height of 10’ in privately maintained facilities
4. Upper walls of tiered walls do not influence lower walls
5. Retaining walls above upper maintenance bench less than 3’ and in cut
6. Retaining walls designed to withstand hydrostatic pressure and saturated ground conditions
7. Retaining walls shall not be used as a pond embankment
8. Retaining walls in excess of 30” in height shall have appropriate safety railing or fence

XIII. STORM WATER MANAGEMENT (ESD to the MEP)

NOTE: OTHER AGENCIES RESERVE THE RIGHT TO ENFORCE MORE STRINGENT CRITERIA AND SHOULD THEREFORE BE CONSULTED AS TO THEIR ADDITIONAL REQUIREMENTS. THE MORE RESTRICTIVE CRITERIA SHALL GOVERN.

Are RSD Practices Required	Yes	No
Are Structural Practices Required	Yes	No

A. REPORT SUBMISSION

1. Title Page
 - a. Job Name
 - b. Owner
 - c. Design Professional
 - d. Date Prepared
 - e. Seal, Signature and Professional Certification
2. Table of Contents
 - a. Sections listed
 - b. Appendix Listed
 - c. Figures & Tables Listed
3. Narrative
 - a. Introduction – gives overview of what is contained in report
 - b. Field investigation – gives overview of findings of design professional from site visit prior to starting design. Includes narratives on drainage areas, time of concentration paths, ground cover, downstream hazards, soil investigations, etc.
 - c. General site information: (i.e., acreage, zoning, locations, slopes, soils, vegetation, average conditions, variances, restrictions, etc.)
 - d. Impervious cover information (existing and proposed)
 - e. Site Specific Information
 - 1) Justification for type of ESD to the MEP practices used
 - 2) Justification for type of Structural Practices used
 - 3) Provide narrative in response to each of the Performance Standards defined in the MDE SWM Design Manual, Vol I, Chapter I (as applicable)
 - 4) Define facility ownership (ESD and Structural Practices)
 - 5) Methodology/analysis used for design (reference all assumptions)
 - 6) WQv, Rev and/or or ESDv requirements/analysis (as applicable)
 - 7) Quantity requirements/analysis
 - 8) Facility summary (ESD and Structural Practices)
 - 9) Drainage Easements
 - 10) Drainage Systems
 - 11) Floodplain information
 - 12) Affects of development on adjacent properties
 - 13) Affects of development on the natural and traditional character of the waterway
 - 14) Erosion sedimentation control measures
 - 15) Cut/fill and soil disposal
 - 16) Impact on existing and proposed utilities
 - 17) Provide name of watershed and stream use designations for all discharge points. (Verify need to provide Op and Qf with DPZ/DED)
 - f. Summary: In tabular form identify the area in acres, the required and provided Pe, ESDv, Cpv, Qp10 and Qf100 as applicable for the overall site
 - g. Conclusions and recommendations
 - h. Appendix (contains all computations, design charts and relevant data references. Number all sheets and provide list of included computations in the table of contents.

B. DRAINAGE AREA MAPS

1. ESD Drainage Area Map

- a. Soil types and hydrologic soils groups shown on the map
- b. ESD practices shown and labeled with corresponding outfalls indicated
- c. Drainage areas showing the area (in acres), impervious area, pervious area, woods and ESDv required to each micro-scale practices and outfall locations
- d. Grading shown to justify volume, surface area, disconnection practices and outfall locations
- e. Summary table with required and provided stormwater ESDv, Pe, Cpv, Q10 and Q100 requirements (if applicable) listed

2. Structural Practices – Existing Drainage Area Map

- a. Sub-areas shown per Design Manual, Volume I, Section 2.2.4 requirements. Identify study points
- b. Subareas include offsite area draining through the property
- c. Time of Concentration Paths shown from the hydrologically most distant point in the subarea. Segments are shown as sheet flow (100' maximum length), concentrated flow and channel flow. Each segment specifies type, length and slope
- d. Existing Tc, RCN, Area (acres) specified for each sub-area
- e. Soil types and hydrologic soil groups shown on the map
- f. Summary table with existing peak runoff for Q1, Q10, Q100 listed for each study point

3. Structural Practices – Proposed Drainage Area Map

- a. Sub-areas shown per Design Manual, Volume I, Section 2.2.4 requirements. Identify study points.
- b. Subareas include offsite area draining through the property
- c. Time of Concentration Paths shown from the hydrologically most distant point in the subarea. Segments are shown as sheet flow (100' maximum length), concentrated flow and channel flow. Each segment specifies type, length and slope
- d. Proposed Tc, RCN, Area (acres) specified for each sub-area
- e. Soil types and hydrologic soil groups shown on the map
- f. Rough grading contours (2' max. interval) on the map
- g. Summary table with proposed peak runoff for Q1, Q10 and Q100 listed for each study point

C. HYDROLOGIC COMPUTATIONS

1. ESD to the MEP Calculations

- a. Overall Site analysis
 - 1) Site Area
 - 2) Limit of Disturbance (LOD)
 - 3) Impervious Area by soil type
 - 4) Pervious Area by soil type
 - 5) Woods Area by soil type
 - 6) Target RCN woods
 - 7) Rainfall target(Pe)
 - 8) Runoff depth to size ESD, practices (Qe)
 - 9) Total runoff volume required (ESDv)
 - 10) Recharge volume required (Rev)
 - 11) Cpv requirements (if applicable)
- b. Sub Area Analysis
 - 1) % impervious
 - 2) Reduced RCN (if applicable)
 - 3) ESDv required
 - 4) ESDv provided
 - 5) Rev provided per device/sub area

2. Structural Practices Calculations (TR-55 & TR-20 Methods Only)

- a. Existing RCN (All cropland assumed to be meadow, developed land and other covers in good hydrologic condition only)
- b. Onsite developed RCN shall be based on actual land use within the drainage area
- c. Time of concentration computations (sheet flow max 100 ft in developed condition concentrated flow and channel flow as per TR-55, channel flow must have cross sectional information for velocity computation)
- d. Discharge computations
 - 1) 1-year storm managed (as required)
 - 2) 10-year storm managed (as required)
 - 3) 100-year storm managed (as required)
- e. BMP Design Methodology

Final design computations considering credits for all proposed structural practices (include credit for non-structural practices):

- 1) Stormwater Management Pond
 - (i) P-1 micropool extended detention pond
 - (ii) P-2 wet pond
 - (iii) P-3 wet extended detention pond
 - (iv) P-4 multiple pond system
 - (v) P-5 pocket pond
- 2) Stormwater Wetlands
 - (i) W-1 shallow wetland
 - (ii) W-2 ED shallow wetland
 - (iii) W-4 pond/wetland system
 - (iv) W-5 pocket wetland
- 3) Infiltration Systems
 - (i) I-1 infiltration trench
 - (ii) I-2 infiltration basin
- 4) Stormwater filtering systems
 - (i) F-1 surface sand filter
 - (ii) F-2 underground sand filter
 - (iii) F-3 perimeter sand filter
 - (iv) F-4 organic filter
 - (v) F-5 pocket sand filter
 - (vi) F-6 bioretention
- 5) Open channel systems
 - (i) O-1 dry swale
 - (ii) O-2 wet swale
- 6) Others (must be approved MDE, DPZ/DED)
- f. Storage Computations
 - 1) Storage of runoff required and provided (Use TR-55 worksheet 2,3,4&6)
 - 2) Forebay storage (363 cft. over impervious surfaces) does not County toward the WQv storage requirement

D. STRUCTURAL PRACTICES HYDRAULICS & OTHER COMPUTATIONS

1. Stage – storage table and curve
2. Stage discharge table and curve (Composite hydraulic performance table including detailed design of orifice, weir and barrel flow)
3. Check barrel control prior to riser/orifice flow
4. 1-year, 10-year and 100-year routing TR-20 method

5. Emergency spillway sized per MD-378. Routing table and curve provided
6. Flotation analysis (factor of safety 1.5:1)
7. Dam Breach Analysis
8. Anti-seep collar design as per USDA/SCS/MD-378
9. Outlet protection (per SCD). Use 10-year, 100-year if no emergency spillway
10. 100-year flood plain study referenced, provided
11. Channel Impact Analysis (if required) using HEC-RAS showing existing and proposed velocities with channel improvement and slope stabilization
12. Retention/Infiltration pond dewatering device (capped)
13. Stability analysis of pond's side slopes for surface drainage

E. SOILS INVESTIGATION

1. Geotechnical report submitted by the appropriate design professional giving conclusions and recommendations. Report shall include registration number, date, seal, signature and professional certification of the responsible design professional
2. Minimum boring locations:
 - a. Structural BMP's – At least 1 in the embankment centerline, 1 in the pool area, 1 in emergency spillway minimum depth of 5 feet below the proposed bottom of structure, seasonal high ground water or refusal (Proposed bottom of infiltration structure to be a minimum four feet above both)
 - b. ESD Micro-scale practices – Minimum boring locations: 1 at least within 50 feet of each device
3. Unified Soil Classification System textural classification for various layers with depth
4. Seasonal high ground water determination
5. Fill areas identified
6. In-situ permeability test, minimum geotechnical requirements for Infiltration shall be based on Volume II of the Stormwater Design Manual, Appendix D.1. Minimum rate of 1.02 in/hr required for acceptability. (ex. Drywells and pervious pavement over 10,000 sft.)
7. Rate of infiltration
8. Scaled boring location map with surface elevation

F. PLANS SUBMISSION – INCLUDE ALLOF THE FOLLOWING ON PLANS

1. Stormwater Management Plan (1" = 50' or less) for ESD Micro-scale Practices
 - a. General Items
 - 1) Type of ESD and/or Disconnection Practice labeled per MDE nomenclature (i.e., M-1, M-2, N-1, N-2, etc.)
 - 2) Existing and final contours (1' or 2' interval)
 - 3) Existing and proposed improvements
 - 4) Locations of soil borings
 - 5) Outflow pipe, outlet protection (detailed required), and outfall channel
 - 6) Positive overflow drainage away from structures
 - 7) Existing and proposed utility locations
 - 8) Show floodplain, environmental sensitive areas, wetlands, etc.
 - 9) 5' buffer from end of outfall to property lines
 - 10) Outlet channel outside of stream or wetland buffers
 - b. Maintenance Items – provide vehicular access to all shared ESD practices
 - 1) Indicate the ownership and maintenance responsibility of the facility (i.e., private, HOA or public)
 - 2) Minimum easement width = 20'
 - 3) Maximum slope for unpaved surface is 10%
 - 4) Maximum slope for paved surface is 12%
 - 5) Maximum cross slope is 3%
 - 6) Clear of structures (eg. Utilities, drainage, fences, and streetlights)

2. Stormwater Management Plan (1" = 50' or less) for Structural Practices

a. General Items

- 1) Type and hazard classification of BMP facility labeled
- 2) Existing and final contours (1' or 2' interval)
- 3) Existing and proposed improvements
- 4) Delineation of permanent, Rev, WQv, Cpv, Qp10 and Qp100 WSEL elevations
- 5) Locations of soil borings
- 6) Outflow pipe, outlet protection (detailed required), and outfall channel
- 7) Inflow improvements (appropriate details required), storm drains carried to normal pool (wet) or pond's bottom (dry)
- 8) Emergency spillway level section and outlet channel
- 9) Existing and proposed utility location/protection
- 10) Ponding and/or pond slopes on private property must have easements
- 11) Show floodplain, environmentally sensitive areas, wetlands, etc.
- 12) 15' no woody vegetation zone delineated from toe of slope
- 13) 25' pond buffer from 100-year WSEL, top of cut or toe of fill to property lines
- 14) Adjacent structures 2' vertical from 100-year WSEL
- 15) 25' buffer from end of riprap outlet channel to property lines
- 16) Outlet channel outside of stream or wetland buffers
- 17) Provide a summary table identifying the area in acres, the required and provided Rev, WQv, Cpv, Qp10 and QP100 for each drainage area
- 18) Forebay delineated, invert above permanent pool elevation or extended detention 1-year pool elevation, gabion embankment and control structure

b. Maintenance Items

- 1) Maintenance Access – from public right-of-way or publicly traveled road or a private road in a multifamily project:
 - (i) Indicate the ownership and maintenance responsibility of the facility (i.e., private, HOA or public)
 - (ii) Minimum level width = 12' (surrounding the pool)
 - (iii) Minimum easement width = 20'
 - (iv) Maximum slope for unpaved surface is 10%
 - (v) Maximum slope for paved surface is 12%
 - (vi) Maximum cross slope = 3%
 - (vii) Provided around the entire pond
 - (viii) Access to riser, emergency spillway, forebays, and outfall structures
 - (ix) Clear of structures (e.g. utilities, drainage, fences and streetlights)
 - (x) Entrance marked at right-of-way with bollards
 - (xi) Severe horizontal geometry avoided
- 2) Maintenance easement (10' beyond any structure) shall include: riser structure; embankment; outfall; 100-year ponding area; access; adjacent property if necessary
- 3) Minimum permanent pool depth = 4'
- 4) Pond bottom slopes no flatter than 1%, 2% desirable
- 5) Concrete low flow channel for dry ponds at 1% min. slope

c. Public Safety Considerations

- 1) Maximum side slopes for earthen embankment no steeper than 3:1
- 2) Design Manual Alternative Compliance required for side slopes for alternative materials
- 3) Required benches for specific pond types

- 4) Riser design minimizing accessibility by small children
- 5) Fencing of all pipe outfalls 48" diameter or greater
- 6) End sections/headwall for outfalls
- d. Landscaping/Multiple Use/Aesthetic Considerations
(See Section 16.124 of the Subdivision and Land Development Regulations and Landscaping Manual and Appendix "A" of the MDE SWM Design Manual for minimum requirements)
 - 1) Landscaping plan, where required (e.g., low maintenance vegetation on steep slopes option a forestation outside of 1-year pool, aquatic plantings, etc.)
 - 2) Recreational plan, where required (active and/or passive)
 - 3) Aesthetic consideration of riser design
 - 4) Natural, variable looking pond shapes
 - 5) Clear Maintenance access
 - 6) Dam clear of tree and shrub plantings
- e. Wetlands Mitigation/Stream Restoration/Retrofit
 - 1) Mitigation areas not part of SWM facility
 - 2) Stream restoration plans for offsite mitigation
 - 3) Farm ponds retrofit for SWM (needs to meet current SWM requirements)
3. Profiles and Details for ESD Practices (consistent scales – e.g., 1"=5', 1"=50')
 - a. Alternative Surfaces (A-1, A-2, A-3)
 - 1) A-1 Green Roof - Provide a typical Green Roof Section
 - 2) A-2 Permeable Concrete – provide a section for the alternative pavement section
 - 3) A-3 Reinforced Turf – Provide a section for the alternative turf surface
 - b. Section & Profile through Micro-Scale Practice (M-2, M-5, M-6, M-7, M-9)
 - 1) Existing ground and proposed grade
 - 2) Soil boring locations with plot of textural classes
 - 3) Observation well location(s) (centered)
 - 4) Observation well cap and lock with depth clearly marked
 - 5) Aggregate depth – give elevations and inverts
 - 6) Aggregate size: 12 to 1 – 1/2 inch minimum; (with no fines)
 - 7) 1-foot minimum soil or gravel covering
 - 8) 6-inches of clean, washed sand on bottom of ESD practice
 - 9) Filter cloth specifications and location. No filter cloth on bottom of ESD practice
 - 10) Minimum 10' from basement walls and 100' from water wells in non-residential projects
 - c. Section & Profile through Micro-Scale Practice (M-1, M-3, M-4, M-8)
 - 1) M-1 Rainwater Harvesting – Provide a cross section and profile along the berm
 - 2) M-3 Landscape Infiltration – Provide a cross section and profile along the berm
 - 3) M-4 Infiltration Berm – Provide a cross section and profile along the berm
 - 4) M-8 Swales – Provide a cross section and profile along the swale. Show any check dams locations and provide a detail as applicable
 - d. Landscaping Section & Details
 - 1) Provide a landscaping plan for all pertinent ESD practices
 - 2) Provide a stormwater management landscape summary table specifying plan types, locations and quantities
4. Profiles for Structural Practices (consistent scales – e.g., 1"=5', 1"=50')
 - a. Principal Spillway
 - 1) Existing ground
 - 2) Proposed Ground (label slopes, 12' min. top width, outfall protection, etc.)
 - 3) Cut-off trench (4' bottom, 1:1 slopes, 4' depth, bottom elevation) fill material County approved

- 4) Impervious core (top width, top elevation)
 - 5) Riser (concrete, set into embankment)
 - 6) Trash rack shown
 - 7) Riser base (provide detail – separately)
 - 8) Low flow structure (diameter, class, type, trash, rack, filter)
 - 9) Barrel (diameter, class, length, slope, saturated length, concrete per ASTM C-361)
 - 10) Phreatic line and slope based on design storm
 - 11) Anti-seep collars (size, location, 2' minimum from pipe joint)
 - 12) Rubber gaskets ASTM (C-361) at pipe joints
 - 13) Riser to be of same material as barrel
 - 14) Show 1-, 10-, and 100-year tailwater and 10-year H.G.L.
 - 15) Barrel size (minimum 24" without an emergency spillway)
 - 16) SCS TR-46 A-2 Concrete Cradle (Provide detail)
 - 17) Outlet protection (length, width, thickness, stone class, d50, filter cloth, 3' toe wall, 10-year discharge and velocity provide design data in report)
 - 18) Elevations
 - (i) Emergency spillway (dotted line at crest)
 - (ii) Settled top of dam (1' & 2" freeboard)
 - (iii) Constructed top of dam
 - (iv) Riser crest
 - (v) Design storms water surfaces shown
 - (vi) Inlet and outlet pipe elevations (low flow, barrel)
 - 19) Pond Drain
 - (i) DIP, CIP, and RCP, non-clogging, easy access, reseating valve, out of constant flow, removable elbow at intake
 - (ii) Pond drain capable of draining permanent pool within 72 hours
 - 20) Forebay
 - (i) Profile through control section
 - (ii) Show existing ground, proposed grading and elevations
 - (iii) Slope and limits of protection
- b. Emergency Spillway Profiles
- 1) Existing ground, proposed grading (spillway in cut)
 - 2) Inlet, control and outlet section (lengths, elevation)
 - 3) Slope
 - 4) Flow quantity and velocity
 - 5) Limits of channel protection
- c. Cross Section of Dam along Centerline
- 1) Existing ground
 - 2) Proposed ground line within pond (invert)
 - 3) Top of dam (constructed and settled)
Add 10% minimum additional fill to account for settlement
 - 4) Emergency and principal spillways stationed
 - 5) Core (fill material County approved)
 - 6) Cut-off trench (County approved fill)
 - 7) Existing and proposed utility locations
 - 8) Location of soil borings

- d. Cross Section of Forebay Dam along Centerline
 - 1) Existing ground
 - 2) Proposed ground line within pond (invert)
 - 3) Top of dam (constructed and settled)
Add 10% minimum additional fill to account for settlement
 - 4) Location of soil borings
- e. Section & Profile through Infiltration Trench
 - 1) Existing ground and proposed grade
 - 2) Test boring locations with plot of textural classes
 - 3) Observation well location(s) (centered)
 - 4) Observation well cap and lock with depth clearly marked
 - 5) Aggregate depth – give elevations and inverts
 - 6) Aggregate size: 12 to 3 inch minimum; (with no fines)
 - 7) 1 foot minimum soil or gravel covering
 - 8) 6 inches of clean, washed sand on bottom of trenches
 - 9) Filter cloth specifications and location. No filter cloth on bottom of trench/well
 - 10) Minimum 10' from basement walls and 100' from water wells in non-residential projects
- f. Soil Information
 - 1) Boring logs on plan
 - 2) Unified soil classification system
 - 3) Seasonal high ground water
 - 4) Bearing strength
- 5. Details
 - a. Riser with reinforcement, key joint detail, pipe connection, strapping/wrapping, etc.
 - b. Anti-seep collar with reinforcement or filter diaphragm (provide construction specifications)
 - c. Low flow control
 - d. Pipe bedding
 - e. Outlet Channel (cross-section & profile for channel improvements and stabilization)
 - f. Emergency spillway typical cross-section
 - g. Trash Rack Detail
 - 1) Minimum 6' from face of structure
 - 2) Galvanized
 - 3) Removable
 - 4) Spacing 8" c.c. (maximum)
 - 5) Painted Battleship Grey
 - h. Cradle detail shown, (SCS TR-46 A-2 Concrete Cradle)
 - i. End walls and head walls
- 6. Construction Specifications (Latest MD-378 or for ESD practices, Appendix B.4 of the MDE SWM Design Manual, "Construction Specifications for Environmental Site Design Practices")
 - a. Site preparation
 - b. Earth fill (embankment, core cut-off)
 - c. Structural backfill
 - d. Concrete – meet Howard County requirements
 - e. Stabilization
- 7. Notes
 - a. Structure hazard classification (A,B,C or D)
 - b. Pertinent notes from standard list

- c. Additional stormwater management data
 - d. Operation and Maintenance Schedule for each type of facility specifying routine and non-routine maintenance
 - e. Sequence of construction with approximate time frames for each operation Details
8. Certifications
- a. Design Professional, sealed, signed and dated
 - b. Developer's signed and dated

(NOTE: SUBMISSION WILL NOT BE REVIEWED WITHOUT PROPERTY SIGNATURES)

G. LETTER OF MAP AMENDMENT/REVISION (LOMA/LOMR) – FEMA

1. Was a LOMA/LOMR required at Preliminary Plan? Yes No
2. Provide verification that FEMA has received information to approve requested LOMA/LOMR
3. Approval Letter from FEMA, with a copy to Howard County Department of Public Works, Bureau of Environmental Services, Stormwater Management Division (required prior to signature approval of plat)

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Check the Help and Resources Instructions accessible from the ProjectDox login screen for the appropriate locations to upload all documentation including this checklist. Once you have completed your uploads, remember to complete your ProjectDox task.