



# **COLLIN COUNTY**

# **DRAINAGE DESIGN STANDARDS**

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**DRAFT January 13, 2020**

Approved by the Collin County Commissioners Court on \_\_\_\_\_

Court Order Number \_\_\_\_\_

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## **COLLIN COUNTY DRAINAGE DESIGN STANDARDS**

### **1.01 DEFINITIONS**

For the purpose of these Standards, the following terms, phrases, words and their derivations shall have the meaning given herein. Definitions not expressly prescribed herein are to be determined in accordance with customary usage in planning and engineering practice. The word “shall” is mandatory and the word “may” is permissive.

**100-YR STORM EVENT** - the rainfall event having a 1 percent chance of being equaled or exceeded in any given year.

**ADVERSE IMPACT** - changes to flooding, erosion, and water quality caused by development of a property and negatively impacting adjacent properties.

**APPLICANT** - an Owner or Developer who seeks approval of a development proposal pursuant to these Standards.

**BASE FLOOD** – the flood having a 1 percent chance of being equaled or exceeded in any given year. Also, the flood resulting from the 100-yr storm event.

**BASE FLOOD ELEVATION (BFE)** – the WSEL resulting from any flood in Collin County, including outside of SFHAs, that has a 1 percent chance of equaling or exceeding that level in any given year, also called the 100-yr storm event. The BFE is used to delineate the Base Flood in plan view. The BFE may be calculated by the Developer’s Engineer or as shown on the FIRM and found in the accompanying FIS for Zones A, AE, or AH for Collin County. The BFE shall be in relation to the datum specified in the FIS for Collin County.

**BEST MANAGEMENT PRACTICES** - physical, structural or managerial procedures that decrease the potential for facilities to pollute downstream channels, lakes, and waterways.

**COUNTY** – Collin County, Texas.

**DEVELOPER** – any person, partnership, firm association, corporation (or combination thereof), or any officer, agent, employee, servant or trustee thereof, who performs or participated in the performing of any act toward the development of a subdivision, within the intent, scope and purview of these Standards.

**DEVELOPMENT** – all land modification activity, including the grading or construction of buildings, roadways, parking lots and/or other impervious structures or surfaces.

**DIRECTOR OF ENGINEERING** - where used in these Standards, “Director of Engineering” shall mean the Collin County Director of Engineering and his authorized and/or appointed representatives.

**DRAINAGE PLAN OR STUDY** – a plan for handling stormwater affecting existing and proposed property and/or roadways due to development, including water surface

elevations, floodplains, velocities, and mitigation measures. Drainage plans or studies include all areas handling stormwater, including SFHAs.

**EASEMENT** – an area for restricted use on private property upon which a public utility/entity shall have the right to remove and keep removed all or part of any buildings, fences, trees, shrubs or other improvements or growth which in any way endanger or interfere with the construction, maintenance and/or efficiency of its respective systems on or within any of these easements.

**ENGINEER** – a person licensed under the provisions of the Texas Engineering Registration Act to practice the profession of engineering in the State of Texas.

**EXISTING CONDITIONS WATERSHED** - the land use of any watershed or drainage area at the time the Applicant submits a request for development permit or plat approval.

**FEMA** – Federal Emergency Management Agency.

**FLOOD OR FLOODING** – a general and temporary condition of partial or complete inundation of normally dry land areas from:

- (1) the overflow of inland waters.
- (2) the unusual and rapid accumulation or runoff of surface waters from any source.

**FLOOD INSURANCE RATE MAP (FIRM)** – an official map of a Community, on which FEMA has delineated both the SFHAs and the risk premium zones applicable to the Community.

**FLOOD INSURANCE STUDY (FIS)** – the official report provided by FEMA. The report contains flood profiles, water surface elevation of the base flood, as well as the FIRM.

**FLOOD STUDY** – an examination, evaluation and determination of flood hazards and corresponding water surface elevations, floodplains, and velocities. Flood studies, when used herein, are associated with analysis of regulated SFHAs.

**FLOODPLAIN OR FLOOD-PRONE AREA** – any land area susceptible to being inundated by water from any source (see definition of flooding). A floodplain is a plan view depiction of the extent of flooding based on calculated water surface elevations.

**FULLY DEVELOPED WATERSHED** - the land use of any watershed or drainage area at full build-out based on the best available information for planned future land use.

**INTEGRATED STORMWATER MANAGEMENT PROGRAM (iSWM)** - the current set of guidelines created by North Central Texas Council of Governments (NCTCOG) to mitigate adverse impacts. iSWM technical references are available at <http://iswm.nctcog.org/>

**OWNER** – the owner of land of record subject to these requirements.

**PLAT** – a drawing or map depicting the division or subdivision of land into lots, blocks, parcels, tracts or other parts.

**POST-DEVELOPMENT** - the land use of the subject property after completion of development.

**PRE-DEVELOPMENT** - the land use of the subject property at the time the Applicant submits a request for development permit or plat approval.

**RIGHT OF WAY** – a parcel of land that is occupied or intended to be occupied, by a roadway or alley.

**SPECIAL FLOOD HAZARD AREA (SFHA)** – the land in the floodplain subject to a 1 percent or greater chance of flooding in any given year. Areas of special flood hazard are depicted on the Collin County FIRM as Zones A, AO, AH, or AE.

**SURVEYOR** – a person licensed under the provisions of the Texas Professional Land Surveying Practices Act to practice the profession of surveying in the State of Texas.

**TCEQ** – Texas Commission on Environmental Quality.

**WATER SURFACE ELEVATION (WSEL)** – the height, in relation to the datum shown in the FIS for Collin County, of floods of various magnitudes and frequencies.

**X-YR STORM EVENT** – the flood having 1/X percent chance of being equaled or exceeded in any given year.

## **1.02 GENERAL REQUIREMENTS**

- A. The iSWM Technical Manuals are incorporated into these Standards by reference. Where conflicts occur between iSWM and these Standards, these Standards govern.
- B. These Standards have been prepared to aid in the orderly development of land within the unincorporated areas of Collin County. Refer to the Collin County Subdivision Regulations for additional requirements within municipal extraterritorial jurisdictions (ETJ).
- C. The standards and methods described in these Standards represent minimum requirements. Alternatives that are higher standards may be approved by the Director of Engineering.
- D. Exceptions to these Standards may be allowed by the Director of Engineering when they are in the best interest of the public and the alternative will be equivalent to the commonly accepted engineering practices.
- E. All drainage structures and appurtenances shall be designed and sized by an Engineer.
- F. Design calculations, civil construction plans, and details are the responsibility of the Developer's Engineer. The County's review and approval of civil construction plans does not represent that the County has re-engineered or verified the engineering of the proposed improvements. The Developer's Engineer is responsible for all engineering and recognizes that specific site circumstances or conditions may require improvements constructed to exceed the minimum standards contained herein. The Developer's Engineer is responsible for the applicability and accuracy of the civil construction plans and specifications.
- G. No final plat, replat, or building permit shall be approved unless stormwater drainage improvements and flood control measures have been provided in accordance with these Standards and approved by the Director of Engineering.
- H. Stormwater discharges from all development projects shall conform to all applicable federal, state, and local regulations, including but not limited to the National Pollutant Discharge Elimination System (NPDES) requirements of the Clean Water Act and the requirements of the Texas Commission on Environmental Quality and the Texas Water Code.
- I. Development within the 100-yr floodplain shall be in accordance with Collin County Floodplain Management Regulations.
- J. Lot-to-lot drainage, defined as runoff from one individually owned private lot to another, is not allowed without dedication of a drainage easement. No adverse impacts will be allowed on the downstream lot unless adequately quantified and contained within an easement. Once runoff is conveyed to a public right of way or drainage or

floodplain easement, it may not be directed back onto private property outside of a drainage or floodplain easement.

- K. Adverse impacts shall not be allowed within the County. Adverse impacts take place when the actions of one property owner adversely affects the rights of another property owner. Adverse impacts can be measured in terms of increased flood peaks, increased flood stages, higher flood velocities, increased erosion and sedimentation, degradation of stormwater quality, or other impacts the County considers important. Adverse impact management helps the Developer and County identify the potential impacts of development and implement action to mitigate them before the damages occur.

### 1.03 DRAINAGE DESIGN

Drainage calculations shall be based on methods described herein or other method(s) approved by the Director of Engineering based on commonly accepted engineering practices outlined in iSWM. All appropriate calculations showing runoff and capacity of on-site and receiving drainage structures, including creeks and ditches, shall be provided for all drainage areas and structures, including design and 100-yr flow, velocity, outlet velocity, hydraulic grade line, capacity, and headwater depth.

All pre-development and post-development outfall locations, where runoff leaves the project site, shall be identified and classified as sheet flow or concentrated flow. The Developer's Engineer shall calculate the pre-development and post-development flow rate and velocity at each outfall location on the site. The Developer's Engineer shall provide evidence in enough detail for the Director of Engineering to be satisfied that no adverse impacts to adjacent properties will be created.

#### A. Hydrologic Analysis

The following methods have been selected as acceptable approaches for estimating runoff.

*Table 1.03-1 Hydrology Methods*

Hydrologic Method	Drainage Area Size Limitation
Rational Method	< 200 acres
Modified Rational	< 200 acres
Unit Hydrograph (SCS)	Any size
Unit Hydrograph (Snyder's)	> 1 acre
TxDOT Regression Equation	10 to 100 sq mi (rural design applications)
USGS Regression Equation	3 to 40 sq mi (urban design applications)

1. Runoff coefficients for fully developed watersheds
    - a. The Developer's Engineer shall evaluate fully developed runoff conditions for all watersheds and drainage areas based on future land use. The Engineer shall utilize future land use maps of the associated municipal long range planning areas. For drainage areas outside a municipality's planning area, the Engineer shall use runoff coefficients for suburban single-family density of six (6) dwelling units per acre (1/8 acre lots) for future land use unless otherwise directed by the Director of Engineering.
  2. Time of Concentration
    - a. The Developer's Engineer must identify the flow path along which the longest travel time is likely to occur. Methods acceptable for calculating the time of concentration are outlined in iSWM. Alternative methods may be approved by the Director of Engineering.
  3. Rainfall Estimation
    - a. Rainfall rates for drainage design purposes shall be estimated in accordance with standard technical information provided in iSWM.
- B. Hydraulic Design & Analysis

***Table 1.03-2 - Hydraulic Design Criteria***

MINIMUM DESIGN STANDARD FOR VARIOUS FACILITIES		
Structure Type	Design Frequency	Check Frequency (Fully Developed)
Closed Storm Sewers	10-YR	100-YR
Open Channel Design	25-YR	100-YR
Roadside Ditches	5-YR	100-YR
Driveway Culvert	5-YR	100-YR
Minor Culvert (< 20' wide)	10-YR	100-YR
Bridge Class Culvert (≥ 20' wide)	25-YR	100-YR
Span Bridge	25-YR	100-YR

1. General Design Requirements
  - a. Drainage structures shall be of sufficient size to carry the design frequency shown in Table 1.03-2 for the post-development, fully developed watershed. All drainage structures, systems, and appurtenances shall be evaluated for a



100-yr storm event in the post-development, fully developed watershed to ensure no on-site insurable structure is negatively impacted by the proposed drainage improvement.

- i. The 100-yr headwater and tailwater elevation shall be shown on all culvert profiles.
    - ii. The 100-yr headwater and tailwater elevations and associated floodplains for all drainage structures shall be maintained within the right of way and/or drainage easements.
  - b. No obstructions to design frequency floodplains are allowed. Fences and utility appurtenances shall not be placed within the design frequency floodplain.
2. Closed Storm Sewer
  - a. Storm sewer lines are considered public if they cross property lines and collect runoff from adjacent properties. Enclosed pipe systems require 20' minimum drainage easement when serving more than one lot or property.
  - b. Storm sewer systems shall be reinforced concrete.
  - c. Inlets shall be spaced to maintain ponding widths outside of travel lanes during the design frequency shown in Table 1.03-2.
3. Open Channel Design
  - a. The use of existing channels in their original condition is encouraged when possible.
  - b. New open channels shall have a minimum flowline grade of 0.50% with maximum 4H:1V side slopes.
  - c. An adequate drainage easement shall be dedicated to meet channel requirements.
    - i. The 100-yr flood shall be wholly contained within a dedicated drainage easement.
    - ii. Provide an Erosion Hazard Setback and Maintenance Easement of 25 feet horizontally, parallel to and measured from the top of open channel bank, on both sides of the open channel. This easement may be reduced to 15 feet on one side of the open channel if stabilization measures are provided to prevent channel erosion and meander.
4. Roadside Ditch and Culvert Design
  - a. Roadside ditches shall have a minimum flowline grade of 0.50% with maximum 4H:1V side slopes.
  - b. The 100-yr storm event shall be wholly contained within a dedicated drainage easement.

c. Driveway Culverts

- i. Culvert/Driveway permits are required for any new driveway connection or culvert installation along roadways maintained by the County. Culvert/Driveway permit applications must be submitted to the Collin County Development Services Department at the same time as the On Site Sewage Facility permit or development permit for a residential or commercial structure. The application can be found at the link below: [https://www.collincountytx.gov/development\\_services/Documents/Permit\\_Application\\_Culvert.pdf](https://www.collincountytx.gov/development_services/Documents/Permit_Application_Culvert.pdf)
- ii. All new driveway culverts shall be designed by an Engineer or sized by Collin County Public Works.
- iii. Installation of all driveways and driveway culverts are the responsibility of the individual lot owner. Driveway culverts shall be made of corrugated metal pipe (CMP) or reinforced concrete pipe (RCP). Driveway culverts shall have a minimum flowline slope of 0.50% and be no less than fifteen inches (15") in diameter.
- iv. A minimum cover of eight inches (8"), measured from the top of culvert to finished grade, shall be placed above all new culverts.
- v. Non-compliant culverts will be removed at the Owner's expense.
- vi. Length of driveway culverts shall be a minimum of the driveway width plus 4 feet on each side, but not more than 60 feet unless otherwise approved by the Director of Engineering. Culverts over 50 feet in length must have a vent placed at the midpoint of the culvert.
- vii. Both ends of driveway culverts shall be mitered 6H:1V. Pipe runners (safety end treatments) are required for culverts over twenty-four inches (24") in diameter when located along any roadways outside of a residential subdivision.
  - (1) Provisions for roadside safety within residential subdivisions is the responsibility of the Developer's Engineer.
- viii. All driveway culverts shall be installed prior to issuance of building permits or construction activities on the lot.

d. Minor Cross Culverts

- i. All culvert structures less than 20 feet, when measured along the roadway centerline, are considered "minor culverts".
- ii. Minor culverts shall be made of CMP or RCP. Minor culverts shall have a minimum flowline slope of 0.30% and be no less than twenty-four inches (24") in diameter.

- iii. A minimum cover of twelve inches (12"), measured from the top of culvert to finished grade, shall be placed above all new culverts.
- iv. Safety end treatments are required when the ends of the culvert are inside the roadway Right of Way or if roadway side slopes are steeper than 4H:1V. Sloped safety end treatments with pipe runners shall be provided on all cross culverts matching the front slope of the roadway.
- e. Bridge Class Cross Culverts
  - i. All culvert structures greater than or equal to 20 feet, when measured along the roadway centerline, are considered "bridge class culverts".
  - ii. Bridge class culverts shall be structurally designed using Texas Department of Transportation Box Culvert Standards.
  - iii. Safety end treatments, guard fence, headwalls, or wingwalls shall be constructed at both the ends of all bridge class culverts. The safety end treatments, guard fence, headwalls, or wingwalls shall be constructed in accordance with Texas Department of Transportation standards.
  - iv. Safety end treatments or guard fence are required when the ends of the culvert are inside the roadway Right of Way or if roadway side slopes are steeper than 4H:1V. Where safety end treatments are used, sloped safety end treatments with pipe runners shall be provided on all cross culverts matching the front slope of the roadway.
- f. Span Bridges
  - i. Span bridges shall be designed to accommodate one (1) foot of freeboard above the fully developed watershed design frequency water surface elevation.

## **1.04 DOWNSTREAM EVALUATION**

### **A. Downstream Evaluation**

1. In all situations, the Standard of Care and Standard Engineering Practices as it relates to downstream impacts shall be subject to approval by the Director of Engineering.
2. The purpose of the downstream evaluation is to protect downstream properties from adverse impacts that may occur as a result of increased runoff and increased velocities due to upstream development. If, in the opinion of the Director of Engineering, the post-development runoff causes adverse impacts, alternative approaches to routing and/or detention shall be considered in order to reduce the peak discharge, velocities and/or concentrated flow onto adjacent properties.

3. The post-development stormwater discharge shall not cause adverse impacts to adjacent or downstream properties. The design of the drainage system shall account for the offsite flows that are routed through the development, and the impacts of the development and the drainage system on downstream facilities.
4. Adverse impacts may be or may result from:
  - a. Changing surface runoff from sheet flow to concentrated flow without mitigation.
  - b. Increases in water surface elevations and ponding widths for any design year events in channels.
  - c. Increases in runoff volumes.
  - d. Increase in outfall velocities.
  - e. Increased erosion or sedimentation at the outfall location.
5. The downstream evaluation shall include the entire zone of influence, described as the area from the outfall of the development to a point downstream where the effect of the development no longer has an adverse impact. The zone of influence shall be evaluated based on existing conditions watershed. The zone of influence shall be determined by the Developer's Engineer through a detailed hydrologic and hydraulic modeling analysis approved by the Director of Engineering.
6. For properties less than 20 acres, the downstream evaluation may use the 10% rule to determine the zone of influence.
  - a. The 10% rule states the zone of influence is the point where the drainage area controlled by the drainage facility comprises 10% of the total drainage area. As an example, if a drainage area for a structural control is 10 acres, the zone of influence ends at a point downstream where the total drainage area is at least 100 acres.
  - b. If a portion of a larger property is being developed, the zone of influence shall be determined based on the portion being developed.
7. The findings of the downstream evaluation shall be a part of the drainage plans and approved prior to plat submittal or issuance of any permits.
8. For all developments, the downstream evaluation shall include the following properties:
  - a. Hydrologic analysis of the pre-development, existing conditions watershed and post-development, fully developed watershed on-site conditions
  - b. Drainage path that defines extent of the analysis
  - c. Capacity analysis of all existing constraint points along the drainage path, such as existing floodplain developments, underground storm drainage

systems, culverts, bridges, tributary confluences, or channels.

- d. Comparison of the pre-development, existing conditions watershed and post-development, fully developed watershed analysis of runoff (2-yr, 5-yr, 10-yr, 25-yr, 50-yr, and 100-yr storm event), capacity, velocity, and erosion evaluation of downstream conditions for the zone of influence.

#### B. Outfall Design

1. Each outfall shall be designed to mitigate the adverse impacts resulting from increased runoff, velocity or concentrated flow on adjacent properties for all storm events.
2. Adverse impacts for the 10-yr and 100-yr storm events shall be mitigated within the subject development.
3. All other storm events may be mitigated within the subject development or downstream by containment within easements or right of way obtained from downstream property owners.
4. In no case shall an adverse impact occur outside of such easements or right of way.
5. The Developer's Engineer shall make every attempt to maintain existing sheet flow conditions.
  - a. Level spreaders are required to mitigate adverse impacts due to concentrated flows where downstream easements cannot be obtained.
  - b. The entirety of the post-development, fully developed drainage area shall be mitigated. The allowable post-development, fully developed watershed discharge is equal to the pre-development, existing conditions watershed sheet flow discharge, determined for a pre-development drainage area having a sheet flow discharge width, at the proposed level spreader location, equal to that of the proposed level spreader.
  - c. Downstream post-development velocities shall be checked to ensure they are non-erosive.
  - d. Certified elevations from a Surveyor are required to show that the level spreader has been installed according to the construction drawing.
6. The Developer's Engineer shall incorporate the following design elements when evaluating concentrated flow outlet conditions.
  - a. The last fifteen feet (15') of the outfall pipe shall be laid a maximum grade of 0.5%.
  - b. Energy dissipators or stone protection shall be provided when the outfall velocities exceed six (6) feet per second or erosive velocities for the receiving channel, ditch, swale, etc., whichever is lower.

- c. Stone protection shall be provided at the downstream end of concrete flumes or concentrated flow locations.
  - d. The entirety of the post-development, fully developed drainage area shall be mitigated.
  - e. Concentrated flows shall be contained in a downstream drainage easement extending to the point where the flow returns to pre-development, existing conditions volumes and velocities.
- C. Downstream Conveyance
  - 1. Drainage channels or other suitable means to convey stormwater to the outfall must be designed and constructed in accordance with the requirements for open channels and must be contained within an easement. There can be a zero-foot rise in the 100-yr water surface elevation of the receiving floodplain or drainage channel. If offsite easements are required, they must be provided to Collin County prior to plan or plat approval.
  - 2. All channels found to be adversely impacted within the zone of influence shall be stabilized for their full depths to mitigate erosive velocities.

## **1.05 STORMWATER DETENTION REQUIREMENTS**

### **A. General**

- 1. It is the intent of Collin County to ensure that all new subdivisions and developments have no adverse impact on properties adjacent to and downstream of the proposed development.
- 2. Stormwater detention is required to mitigate the adverse impacts of the 10-yr and 100-yr storm events, and may be used to mitigate adverse impacts of other storm events if downstream easements cannot be obtained.
- 3. An exception to stormwater detention requirements may be approved by the Director of Engineering if the following conditions are met and clearly shown in the civil construction documents:
  - a. Runoff from the site in both the pre- and post-development conditions is predominantly sheet flow at the outfall location;
  - b. The subject property before platting is 10 acres or less; and
  - c. The development is for residential use with lots greater than or equal to 1 acre.

### **B. Stormwater Detention**

- 1. Stormwater Detention involves collecting excess runoff before it enters the adjacent property, regional streams, channels, rivers, lakes, etc. It can be used effectively and economically to reduce peak flow rates and mitigate problems of

flooding, pollution, and soil erosion.

2. All detention facilities shall be fully contained within a single lot and be owned by an individual lot owner or a Homeowners Association.
3. Lots with detention facilities shall have restrictive covenants to preserve the facilities and include a maintenance plan.

#### C. Design Criteria

1. The Modified Rational Method may be used to design all detention facilities except in cases where a large drainage basin is present and a method such as SCS Tabular, HEC-1 or TR-20 is justified.
2. The detention facilities may be ponds or underground storage. The outlets shall be designed to detain post-development, fully developed watershed peak flows and velocities for the 10-yr and 100-yr storm events to pre-development, existing conditions watershed peak flows and velocities.

#### D. Pond Layout

1. Side slopes shall be 4H:1V maximum.
2. The bottom of all detention (dry bottom) ponds shall have a minimum 0.50% slope and a concrete pilot channel from the most upstream point and any inlet points to the pond outlet.
3. Retention (wet bottom) ponds shall have a minimum depth below the lowest outlet elevation of five feet (5') to discourage mosquito breeding.
4. A minimum one-foot (1') freeboard above the 100-yr storm event must be provided.
5. Spot elevations for proposed and existing grades in the pond area and for at least one hundred and fifty feet (150') downstream of all outlet structures shall be shown with differentiation on the plans.
6. Embankments for ponds shall meet the requirements of the Texas Dam Safety Program.

#### E. Maintenance

1. Detention/retention facilities shall be required to have a maintenance plan that considers debris removal, mowing, trimming, and a regular inspection schedule. The plan shall be provided to the Director of Engineering and implemented by the lot owner or Homeowners Association.
2. At a minimum, the following maintenance guidelines apply to all detention ponds.
  - a. A maintenance ramp shall be provided for vehicular access for maintenance purposes. The slope of the ramp shall not exceed 6H:1V, and the minimum width shall be 12 feet.

- b. Retention basins with permanent water storage must include dewatering facilities with a dedicated outfall location for maintenance purposes. Provisions shall be made to mitigate flooding and erosive velocities downstream of the dewatering outfall locations.
- c. Access shall be provided for cleaning of underground detention facilities.

F. Outlet Structures

- 1. Outlets shall be typically composed of one or all of the following elements: reinforced concrete pipes (RCP), reinforced concrete box structure, reinforced concrete weir, v-notch structure, and/or level spreader. For all ponds, a stabilized earthen or concrete overflow structure must be provided just above the 100-yr storm event WSEL and have a minimum depth of twelve inches (12").

G. Construction

- 1. Embankments for detention ponds shall be designed and their installation inspected by a Geotechnical Engineer.
- 2. All ponds shall be sodded and retain 100% vegetative coverage prior to final acceptance.
- 3. Approval of the detention facility by the Director of Engineering is required prior to plat filing or issuance of any development permits.
- 4. The Director of Engineering shall provide final inspection of detention facility functionality, cleanliness, and vegetation.
- 5. Submit the following to the Director of Engineering:
  - a. Geotechnical Engineer certification that embankment materials used and compaction achieved meet the minimum requirements of the Geotechnical Engineer's design.
  - b. All outlet elevations and detention facility geometry verified for elevation and dimensions by the Developer's Surveyor or Engineer.

**1.06 STORMWATER POLLUTION PREVENTION PLAN (SW3P)**

A. General Requirements

- 1. The Contractor is responsible for complying with the requirements of the Texas Commission on Environmental Quality (TCEQ) General Permit for Stormwater Discharges Associated with Construction Activities (TXR150000) (Construction General Permit). Additional information on the Texas Construction General Permit can be found at the following link: <https://www.tceq.texas.gov/permitting/stormwater/construction>
- 2. The Owner shall provide proof of compliance with applicable local, state, and federal environmental regulations upon request by the County.



3. Sites that disturb less than one acre and that are not part of a larger common plan of development that would disturb one or more acres, are not required to have coverage under the Construction General Permit. An erosion and sedimentation control plan must be prepared and submitted to the Director of Engineering.
4. Individual lots in a subdivision are considered part of a larger common plan of development, regardless of when construction activity takes place on that lot in relation to the other lots, and are required to have BMPs and comply with the Construction General Permit.
  - a. The developer, contractor, or builder of any structure on a single lot in a developing subdivision shall prepare a SW3P and submit to the Director of Engineering prior to receiving any permits.
5. All pervious disturbed areas within a construction site shall be sodded, plugged, sprigged, hydro-mulched, or seeded, except that solid sod shall be used in new open channels and ponds.
6. Erosion control mats shall be installed in roadside ditches and slopes steeper than 4H:1V.
7. Grass areas shall be established with 100% coverage with appropriate grass for the growing season. An approved perennial grass shall be planted at the soonest growing season for that grass before construction activities will be accepted by the County. If 100% coverage cannot be established prior to acceptance, temporary cover protection of all disturbed areas will be required as well as the addition of the cost of 100% vegetative coverage into the Maintenance Bond.

#### **1.07 DRAINAGE EASEMENTS**

- A. The Owner shall dedicate all drainage easements in accordance with the requirements of the Collin County Subdivision Regulations, as may be amended from time to time, and the requirements specified in these Standards.
- B. Where the improvement or construction of a stormwater drainage facility is required along a property line common to two (2) or more owners, the Developer shall be responsible for the required improvements at the time of development, including the dedication of all necessary rights of way or easements, to accommodate the improvements.
- C. Off-site drainage easements may be required downstream to address adverse impacts to adjoining properties. These easements may be required to encompass streambank stabilization measures, rock riprap, headwalls, or velocity dissipators. The easement shall include sufficient area to disperse concentrated flows to pre-development

conditions. It is the responsibility of the Owner or Applicant to obtain such easements prior to permit or plat approval.

- D. Drainage easements shall be provided for access and maintenance of channels, swales, ditches, and other drainage structures and systems.
- E. Drainage easements shall be provided to contain the 100-yr floodplain of ditches, channels, swales, and other drainage facilities, including those not located in FEMA special flood hazard areas.
- F. Drainage easements shall be maintained by the property owner and such maintenances shall be specified in the restrictive covenants.

## **1.08 DRAINAGE PLAN REQUIREMENTS**

### **A. General**

- 1. The drainage plans shall include all appropriate calculations depicting the anticipated flow of all drainage onto and from the proposed development and showing all major topographic features on or adjacent to the property, including, but not limited to, all water courses, 100-yr floodplain boundaries, ravines, bridges and culverts. The drainage plan shall show how and where water will be collected, handled and routed within the proposed development. In addition, show how and where it will outfall to a recognized drainage way.
- 2. The drainage plans shall also include such off-site drainage improvements as are necessary to assure that the proper transition between on-site and off-site drainage can be maintained. The criteria for on-site drainage facilities shall also apply to off-site.
- 3. The drainage plans and accompanying calculations and studies shall be sealed by the Developer's Engineer.
- 4. Submit proposed restrictive covenants with drainage plan.

### **B. Drainage Plan Checklist**

The following information is intended to assist the Developer's Engineer in preparation of civil construction plans for review by the County. The following checklist is not intended to be a definitive list of all information or a list of design requirements. The number of sheets necessary to clearly present the information required is at the discretion of the Developer's Engineer.

#### **1. Erosion Control Plan**

- Existing and proposed contours clearly shown/labeled.
  - Contour intervals shall not be greater than one (1) feet for land with less than 5% grade.
  - Contour intervals shall not be greater than two (2) feet for land with

greater than 5% grade.

- Existing and proposed storm lines and inlets shown with protective measures.
  - List the total disturbed acreage including offsite and delineate limits of construction.
  - Label outfall locations with description of nearest and ultimate receiving waters.
  - Sediment basin provided for disturbed basins ten (10) acres or greater. Sediment basins shall be designed in accordance with iSWM Technical Manual. Design calculations are required.
  - Fully developed 100-yr floodplain for FEMA-mapped creeks (SFHAs), fully developed 100-yr floodplain for non-FEMA mapped creeks, ditches, open channels, and drainage swales.
  - Appropriate BMP's used and identified.
  - Phasing of BMP's with construction activities listed/described.
  - BMP details per current NCTCOG/iSWM standards.
  - Stockpile area and batch plant areas shown and labeled.
  - Areas to be sodded or seeded shown and specified with permanent perennial vegetation.
  - Watering plan for vegetation.
2. Post Construction Stormwater Quality Plan
- Existing and proposed contours clearly shown/labeled.
    - Contour intervals shall not be greater than one (1) feet for land with less than 5% grade.
    - Contour intervals shall not be greater than two (2) feet for land with greater than 5% grade.
  - Contours should be shown for the subject property and no less than 50' onto surrounding properties.
  - Label outfall locations with description of nearest and ultimate receiving waters.
  - Adjacent roadways shown from the subject property line to the opposite right of way or property line.
  - Proposed drainage areas and sub areas delineated and labeled.
  - Proposed stormwater conveyance systems such as storm lines, storm inlets, grass channels, and vegetated swales shown.
  - Show detention facilities.
  - Flow arrows for surface drainage shown.
  - Proposed non-structural (vegetation, ground cover) and structural (stabilization, dissipation) post-construction (permanent) BMPs.

- Wetlands delineated where applicable.
- Design-yr and 100-yr floodplains (FEMA and non-FEMA) for all stormwater conveyance systems with delineated easements.
- Description of long-term operation and maintenance of BMPs.
- The following notes shall be included on the Post Construction Stormwater Quality Plan as part of the civil construction plans and in the restrictive covenants for the subdivision:
  - The Owner of the detention facility lot shall be responsible for all maintenance of detention facilities.
  - Detention facilities shall be mowed at least twice per year or more frequently when needed to control weeds and inhibit woody growth.
  - Debris, litter, and sediment shall be removed from all detention facilities, culverts, and outfall structures at least twice per year and after each storm event with more than 2 inches of rainfall in a 24-hour period, with particular attention given to the removal of debris, litter, and sediment around outlet structures, trash racks, and pilot channels.
  - A maintenance log shall be kept and shall be made available for review by the County upon request.

### 3. Drainage Area Maps (Pre-development & Post-development)

- Pre-development and post-development contours clearly shown for *entire* drainage basin, both onsite and offsite.
  - Contour intervals shall not be greater than one (1) feet for land with less than 5% grade.
  - Contour intervals shall not be greater than two (2) feet for land with greater than 5% grade.
- Zone of influence.
- Show contours for 50' outside the subject property and zone of influence. Aerial topography or similar is acceptable for offsite areas with major contour labels shown.
- Adjacent roadways shown from the subject property line to the opposed right of way or property line.
- Pre-development and post-development drainage areas and sub areas delineated and labeled.
- Pre-development and post-development outfall locations and classification (sheet flow, concentrated flow).
- Flow arrows shown to indicate direction of surface drainage.
- Existing and proposed storm lines and open channels shown.
- Inlet designation labels shown.
- Detention facilities shown and labeled.

- Drainage and utility easements shown and labeled.
- Pre-development and post-development Peak Runoff Computation Table showing runoff computation method used, outfall location, flow rate, and contributing drainage area. Label where the outfall flows to.
  - Time of concentration and weighted runoff coefficient calculations shown as needed.
  - Runoff Computation Table may be shown with Hydraulic Calculations on a “Hydrologic and Hydraulic Calculations” sheet.
- List the *total* site impervious area (area of all paving, roof areas, etc.)
- 100-yr existing conditions and fully developed floodplain along streams/creeks and open channels (mapped and unmapped), and FEMA 100-yr floodplain
- Design-yr floodplains for all drainage ways shown.

#### 4. Grading Plan

- Both onsite and offsite existing/proposed contours shown clearly labeled
  - Contour intervals shall not be greater than 1 foot for land with less than 5% slope;
  - Contour intervals shall not be greater than 2 feet for land with greater than 5% slope.
- Adjacent roadways shown from the subject property line to the opposed right of way or property line.
- Drainage clarified by flow arrows, high points, sags, ridges, and valley gutters.
- Show driveway locations, if known.
- Show drop grade beams and elevations as needed.
- Positive overflow provided at all low points in curb and gutter roadways, easements dedicated as needed.
- Finished pad and/or floor elevations labeled on all lots and shown to be 18” above surrounding ground. Provide a typical lot grading detail.
- Minimum finished floor elevations 2’ above the fully developed BFE shown adjacent to 100-yr floodplains, ponds, creeks/channels, etc.
- Clearly show all walls and label top/bottom elevations of wall at key locations.
- FEMA 100-yr floodplain and fully developed 100-yr floodplain delineated for all stormwater conveyance systems (show both pre-development floodplain and post-development floodplain).
- Design-yr floodplain for all stormwater conveyance systems.
- Cross-sections and flow data for all swales and open channels.
  - Spot shots shown to ensure proper drainage.
- Drainage easements necessary to contain the 100-yr fully developed floodplain of channels, swales, and ditches.

- Easements necessary for access and maintenance of channels, swales, ditches, and drainage structures.
- Utility easements outside the design-yr floodplain shown and labeled.

#### 5. Hydraulic Calculations

- Proposed Roadside Ditch Flow Computation Table provided for all roadways (public and private) for design-yr and 100-yr storm events. Include flow rate, velocity, WSEL, shear, and shear resistance of ditch lining.
- Existing Roadside Ditch Flow Computation Table provided for all roadways (public and private) for design-yr and 100-yr storm events. Indicate the capacity of existing roadside ditches flowing full in terms of volumetric flow (cubic feet per second). Include flow rate, velocity, WSEL, shear, and shear resistance of ditch lining.
- Cross sections at not greater than 100' intervals showing the roadway, parallel ditch, driveways, driveway culverts, right of way or drainage easement with design-yr water surface elevation and 100-yr water surface elevation on the sections. The 100-yr storm event shall be encompassed within the total right of way and/or drainage easement. Cross sections shall include a proportionate number of sections with driveways/culverts on one and both sides of the roadway.
- Open channels - Include a typical cross section with all hydraulic data. Include flow rate, velocity, WSEL, shear, and shear resistance of channel lining.
- Driveway culvert computations for design-yr and 100-yr storm events, including headwater and tailwater elevations, outlet velocities, shear forces, and the shear resistance of the ditch lining.
- Cross culvert computations for design-yr and 100-yr storm events, including headwater and tailwater elevations, outlet velocities, shear forces, and the shear resistance of the ditch lining. Show section and profile of cross culverts with depiction of WSEL containment.
- Inlet Interception Computation Table including roadway ponding widths provided for all public inlets for design-yr and 100-yr storm events.
- Pipe Hydraulics Computation Table provided for all public lines for design-yr and 100-yr storm events. Include flow rate, velocity, WSEL, and hydraulic grade line.
- Provide electronic copies of all hydraulic computations on USB drive or other media.
- Adverse impact documentation within the zone of influence including pre-development, existing condition and post-development, fully developed runoff, velocity, shear, shear resistance of area receiving runoff.

## 6. Detention Design and Hydraulic Calculations

- Detention facility design calculations shown, method used specified.
- Provide detention facility volume sizing calculations and/or computation table.
- Provide stage-discharge table and/or curve information.
- Provide weir and/or orifice sizing calculations for outfall structure.
- Provide pilot channel design and details.
- Provide electronic copies of all hydraulic computations or data files (HMS, RAS, StormCAD, PondPack, etc.) on USB drive or other media.
- Existing and proposed contours shown and labeled.
- Cross-section of pond including side slopes, normal pool elevation (if applicable), show 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, and 100-yr water surface elevations.
- Detail of outfall structure showing all elevations as necessary.
- Provide outfall channel with dissipators as needed to distribute flow.
- Trash rack (and detail) provided for smaller orifice openings.
- Overflow spillway location, stabilization method, and design information provided.
- Show and label all existing/proposed utilities and easements.
- Access/maintenance ramp provided (max slope 6H:1V).
- Submit Geotechnical design report for pond embankment.
- Submit documentation that pond embankment is designed to meet the requirements of the Texas Dam Safety Program.

## 7. Closed Storm Sewer Systems

### a. Plan View

- Show and label all existing and proposed utilities.
- Dimension location/spacing of utilities.
- Label inlet type, inlet block-outs, size, paving station, and top of curb elevation at a minimum.
- Label type and size of existing/proposed structures (i.e. headwalls, manholes/junction boxes).
- Label type, size and dimensions of all permanent outfall erosion protection.
- Show centerline stationing for pipe with PC & PT stations and curve data.
- Label centerline stations for lateral connections, manhole & junction box locations, pipe size changes, headwalls, and future stub out connections.
- Junction boxes shall be utilized instead of bends at horizontal changes in direction greater than 15 degrees.
- Design-yr gutter flows and ponding widths at each inlet.
- 100-yr gutter flows and bypass shown at each inlet.

- FEMA 100-yr floodplain, and Fully Developed 100-yr floodplain shown.
  - Design-yr floodplains shown.
  - Show easement for closed storm sewer system and adjacent utility easements.
  - Provide applicable construction details for all drainage structures.
  - Adjacent roadways shown from the subject property line to the opposed right of way or property line.
- b. Profile View
- Existing and proposed ground line at centerline of pipe shown and labeled.
  - Show all hydraulic data including design flow, 100-yr flow, full flow capacity, hydraulic grade line, friction slope, velocity, and velocity head. For partial flow conditions show design flow, full flow capacity, normal depth, normal velocity, and velocity head.
  - Label station and flowline elevation information for all structures, crossings, laterals, etc.
  - Label flowlines at every 50-foot station.
  - Indicate length, type/class, slope and size of all storm pipes.
  - Show and label 100-yr and design-yr hydraulic grade line (HGL), label HGL elevations at all junctions.
  - All utility crossings and parallel utility lines shown in profile.
  - Design-yr and 100-yr WSEL shown at outfall for detention facilities, creeks, ditches and channels. Provide outfall velocity, shear, and shear resistance of receiving area.



**APPENDIX A** Drainage Study Administrative Review Checklist

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