Sec. 4-133. - Design and construction of stormwater management areas.

(a) *General design criteria.* The NRCS TR-55 method (or equivalent third-party software) shall be utilized for modeling pre- and post-runoff hydrographs. Grady pond wetlands shall not be designated as stormwater management facilities.

(b) *Functional design of stormwater drainage systems.* The drainage system shall at a minimum accommodate peak flows from at least a 25-year frequency design storm.

All roadway cross drain and side drain pipe shall be the equivalent of the minimum size of fifteen (15) inches in diameter. All piping within the ROW shall be reinforced concrete and all joints shall be wrapped with geotextile filter fabric. Alternate pipe materials may be approved by the city engineer outside the roadway prism on a case-by-case basis. The minimum cover for drainage pipes shall be according to the pipe manufacturer specifications.

Roadway cross-drains for all local and collector streets shall be designed for a 25-year frequency storm, providing that the roadway is not overtopped by the 100-year frequency storm and that no structures are flooded by the 100-year frequency storm.

Roadway cross-drains for arterial streets or higher street classification shall be designed for a 50-year frequency storm, providing that the roadway is not overtopped by the 100-year frequency storm and that no structures are flooded by the 100-year frequency storm.

Minimum design velocities for storm drainage systems shall be at least three (3) feet per second to ensure that the system has some capability for self-cleaning.

The minimum internal diameter of manholes or junction boxes shall be forty-eight (48) inches.

(c) *Design of open channels.* Front slopes within the ROW shall be four-to-one (4:1) maximum. A maximum of three-to-one (3:1) side slopes and flat bottom ditch is required otherwise, unless the approval is received by the City Engineer for a variation. Where proposed lots gain access across an existing or a proposed ditch, calculations shall be submitted that shows the required size of future driveway culverts.

Headwalls and endwalls shall be installed on all street culverts with the use of flared headwalls or slope paved headwalls (four-to-one (4:1) slope or flatter) used within any public right-of-way.

The applicant/owner shall be required to carry away by pipe or open ditch any spring or surface water that may exist either previously to, or as a result of, the development. Such drainage facilities shall be located in the road right-of-way.

(d) *Design of curb and gutter and inlets.* For curb and gutter application on proposed roadways, inlets shall be spaced such that flow from a 25-year design storm does not result in ponding water covering more than one-half (½) the width of the outermost traveling lane.

Curb inlets shall be designed so that surface water shall not be carried across any roadways nor for a distance of more than five hundred (500) feet in the gutter or valley. Inlets shall be located at uphill corners of each street intersection to prevent sheet flow of stormwater through the intersection In addition, double-wing inlets shall be placed at all vertical sags in the roadway.

(e) *Analysis of upstream and downstream system.* The layout shall include an appropriate conveyance of offsite flows that does not pass through required detention areas. Stormwater discharges from a developed site must be routed to an existing natural or manmade stormwater channel with adequate capacity. Calculations must be submitted that show the capacity of the receiving stormwater channel to handle the required design storms. The routing calculations must extend at least as far as the second downstream street crossing or to a named water body. Routing calculations must extend even further downstream, if the city engineer has reasonable concern about the capacity of a downstream stormwater channel based on scientific or engineering evidence.

Analysis of the downstream system shall include flow capacity and velocity for existing and proposed flow conditions, using manning's equation at a minimum.

(f) *Detention design and construction.* All site development projects requiring a land disturbance permit shall incorporate stormwater detention and first flush treatment, to reduce flooding potential and preserve or improve water quality. The first flush (WQV) shall be treated, infiltrated, or reused onsite to the maximum extent practicable using LID techniques. Stormwater detention is not required in the following two (2) situations:

(1) The project discharges stormwater runoff directly into a tidally influenced water body. This does not include discharges of stormwater runoff that flows through a public drainage system or across a downstream property boundary.

(2) Stormwater detention for a project site is either unwarranted or impractical. The design engineer shall submit complete hydrologic and hydraulic computations to support this conclusion. This conclusion must be affirmed by the city engineer. Typically this might occur in the very lowest downstream reaches of a major watershed, if it can be proved that undetained stormwater should be discharged quickly to avoid peak discharge timing for the entire watershed. The hydrologic analysis should include more than one (1) representative downstream location for comparing hydrographs.

Even if stormwater detention is waived for the above two (2) situations, the site development must still provide first flush treatment of the WQV in order to protect water quality.

If LID techniques are not employed due to site constraints, the detention basin shall detain the first one and one-quarter (1.25) inch of runoff (Rational Method) from a storm event and release the subsequent runoff water at a predevelopment rate. There should also be adequate sizing of the detention basin to store

an accumulation of one-half (½) inch sediment during construction. The first flush volume for any stormwater detention structure must be contained and then slowly released over a minimum time period of twenty-four (24) hours and maximum time period of seventy-two (72) hours.

All stormwater detention structures must attenuate the post development peak flow rates from the two-year, five-year, ten-year, 25-year, 50-year and 100-year 24-hour design storms to release a graduated discharge at or below pre development peak flow rates.

Outfalls of detention areas shall be installed at least twenty-five (25) feet from any property line to allow velocity dissipaters to be installed if necessary for the prevention of offsite erosion. Exceptions may be approved by the Planning Commission for outfalls to approved drainage features such as an encased storm sewer system.

(g) *Dry detention basins.*

The maximum contributing drainage area to be served by a single dry detention basin is seventy-five (75) acres. Routing calculations must be used to demonstrate that the storage volume is adequate.

Vegetated embankments shall be less than twenty (20) feet in height and shall have no side slopes steeper than three-to-one (3:1). Riprap protected embankments shall be no steeper than two-to-one (2:1). Geotechnical slope stability analysis is required for embankments greater than ten (10) feet in height. The maximum depth of the basin should not exceed ten (10) feet. The detention basin shall be setback such that the outward toe of the berm is a minimum of twenty-five (25) feet from the property line.

A low flow or pilot channel across the facility bottom from the inlet to the outlet required to convey low flows and prevent standing water.

Inflow channels are to be stabilized with flared riprap aprons, or the equivalent. A sediment forebay sized to one-tenth (0.1) inches per impervious acre of contributing drainage shall be provided for dry detention basins that are part of the treatment process during construction activities.

The outlet structure shall be sized based on hydrologic routing calculations and can consist of a weir, orifice, outlet pipe, combination outlet, or other acceptable control structure that achieves the required graduated discharge.

Riprap, plunge pools or pads, or other energy dissipaters are to be placed at the end of the outlet to prevent scouring and erosion.

An emergency spillway is to be included in the stormwater pond design to safely pass the extreme flood flow. A minimum of one (1) foot of freeboard must be provided, measured from the top of the water surface elevation for the extreme flood, to the lowest point of the dam embankment not counting the emergency spillway.

(h) *Retention ponds.* Geotechnical analysis shall be required to ensure proper retention and

design.

A retention pond shall also provide the required storage above the permanent pool and meet the specified graduated allowable release. Stormwater ponds shall also be used to provide detention to control the required events. Where this is not required, the pond structure shall be designed to safely pass extreme storm flows.

Minimum setback requirements for stormwater pond facilities:

(1) Ten (10) feet from property line to outward toe of berm;

(2) One hundred (100) feet from private wells;

(3) Fifty (50) feet from a septic system tank/leach field.

Proper geometric design is essential to prevent hydraulic short-circuiting which results in failure of the pond to achieve adequate levels of pollutant removal. The minimum length-to-width ratio for the permanent pool shape is one-and-one-half-to-one (1.5:1), and should ideally be greater than three-to-one (3:1) to avoid short-circuiting. In addition ponds should be wedge-shaped when possible so that flow enters the pond and gradually spreads out, improving the sedimentation process. Baffles, pond shaping or islands can be added within the permanent pool to increase the flow path.

Maximum depth of the permanent pool should generally not exceed eight (8) feet to avoid stratification and anoxic conditions. Minimum depth for the pond bottom shall be four (4) feet.

Side slopes to the pond shall not exceed three-to-one (3:1).

The perimeter of all five (5) feet deep or greater pool areas should be surrounded by two (2) benches: safety and aquatic. For larger ponds, a safety bench extends approximately fifteen (15) feet outward from the normal water edge to the toe of the pond side slope. The maximum slope of the safety bench should be six (6) percent. An aquatic bench extends inward from the normal pool edge (fifteen (15) feet on average) and has a maximum depth of eighteen (18) inches below the normal pool water surface elevation.

Riprap, plunge pools or pads, or other energy dissipaters are to be placed at the outlet of the barrel to prevent scouring and erosion. An emergency spillway is to be included in the stormwater pond design to safely pass the extreme flood flow. The emergency spillway must be located so that downstream structures will not be impacted by spillway discharges. A minimum of one (1) foot of freeboard must be provided, measured from the top of the water surface elevation for the extreme flood to the lowest point of the dam embankment, not counting the emergency spillway.

A maintenance right-of-way must be provided to a pond from a public or private road. Maintenance access shall be at least fifteen (15) feet wide, having a maximum slope of no more than fifteen (15) percent and be appropriately stabilized to withstand maintenance equipment and vehicles. The maintenance access must extend to the forebay, safety bench, riser, and outlet and, to the extent feasible, be designed to allow vehicles to turn around.

The principal spillway opening shall not permit access by small children, and endwalls above pipe outfalls greater than forty-eight (48) inches in diameter shall be fenced to prevent access. Warning signs should be posted near the pond to prohibit swimming and fishing in the facility.

( Ord. No. 17-2039, § 1(Att.(Art. 4, § 4.3)), 9-5-17 )