

EXHIBIT NO. 33

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Detention/Retention Basin Computation Sheet

Project: _____ By: _____ Date: _____

Storm Water Detention/Retention Basin Design

Refer to Sections ST 701, 702, 711 and/or 712 for design criteria. This computation sheet may be used for drainage areas, off-site and on-site, totaling not more than 200 acres. Design criteria for all detention and retention basins that have contributing drainage areas totaling more than 200 acres must be established on a case-by-case basis.

Required Storage

The required storage is the volume of runoff obtained by using the formulas in this EXHIBIT. It shall be the difference between the post-development Q_{100} , based on an adjusted post-development runoff coefficient C_6 as indicated below, and the pre-development Q_{10} , based on an adjusted pre-development runoff coefficient C_3 as indicated below.

The detention of storm water shall occur in two (2) stages. Stage One (1) shall provide for a pre-development one (1) year storm and Stage Two (2) shall provide for a pre-development ten (10) year storm. Refer to Section ST 711(i) and Section ST 711(l).

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a_1 = On-site pre-development drainage area (acres), See Section ST 711(d)(1)	=	
a_2 = Off-site drainage area (acres) See Section ST711(d)(1)	=	
a_3 = Total pre-development drainage area (acres) = $a_1 + a_2$	=	
a_4 = On-site post development drainage area to release structure	=	
a_5 = Total post development drainage area to release structure $a_2 + a_4$	=	
c_1 = On-site pre-development runoff coefficient, See Section ST 711(f)	=	
c_2 = Off-site pre-development runoff coefficient, See Section ST 711(f)	=	
c_3 = Adjusted pre-development runoff coefficient = $\frac{c_1 a_1 + c_2 a_2}{a_1 + a_2}$	=	
c_4 = On-site post-development runoff coefficient, See Section ST 702(c) & ST 711(g)	=	
c_5 = Off-site post-development runoff coefficient See Section ST 711(g)	=	
c_6 = Adjusted post-development runoff coefficient = $\frac{c_4 a_1 + c_5 a_2}{a_1 + a_2}$	=	
tc_{10} = Time of concentration to release structure (pre-development condition) using the adjusted pre-development runoff coefficient (c_3) and EXHIBIT NO. 5	=	
tc_{100} = Time of concentration to release structure (post-development condition) using the adjusted post-development runoff coefficient (c_6) and EXHIBIT NO. 5 =	=	

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Pre-Development Ten (10) Year Storm

$$I_{10} = \frac{170}{tc_{10} + 23} = \frac{170}{() + 23} = () \text{ in/hr}$$

$$\text{Pre } Q_{10} = c_3 a_3 I_{10} = () () () = () \text{ c.f.s.}$$

NOTE: $c_3 = c_1$ and $a_3 = a_1$ when off-site runoff does not exist

$$q_0 = \text{Pre } Q_{10} = \text{Maximum Release Rate} = () \text{ c.f.s.}$$

Orifice Controlled Outflow Condition:

Storm Duration Producing Maximum Detention Storage

$$T_c = [290 \times 31 c_6 a_5 \div (2q_0 \div 3 - q_0^2 tc_{100} \div 290 \div 6 \div c_6 \div a_5)]^{1/2} - 31$$

$$T_c = [\text{_____} \div (\text{_____} - \text{_____} \div \text{_____} \div \text{_____} \div \text{_____} \div \text{_____})]^{1/2} - 31$$

$$T_c = \text{_____} \text{ minutes}$$

Rainfall Intensity

$$I_{100} = \frac{290}{T_c + 31} = \frac{290}{() + 31} = () \text{ in/hr}$$

Peak Rate of Flow Post-Development Q_{100}

$$Q_0 = c_6 a_5 I_{100} = () () () = () \text{ c.f.s.}$$

Detention Storage Volume

$$V = 60 Q_0 T_c - \frac{2 q_0 (T_c + tc_{100}) (60)}{3} + \frac{(q_0)^2 (tc_{100}) (60)}{6 Q_0}$$

$$V = 60 () () - \frac{2 () [() + ()] (60)}{3} + \frac{()^2 () (60)}{6 ()}$$

$$V = () - () + () = () \text{ cu. ft.}$$

$$V = () \div 43560 = () \text{ Acre-Ft}$$

NOTE: $c_6 = c_4$ and $a_3 = a_1$ when off-site runoff does not exist.