THE KLEINGERS GROUP

CINCINNATI
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September 25, 2015

The City of Grove City
4035 Broadway
Grove City, OH 43123

ATTN: Cindi Fitzpatrick, PE
City of Grove City Service Superintendent

RE: Pinnacle Pets
Stormwater Narrative

Ms. Fitzpatrick,

The proposed Pinnacle Pets project will construct a 9,600 ft² facility and parking lot on an undeveloped lot on Farm Bank Way approximately 500' north of Southwest Boulevard. The current site drains from south to north to an existing pond constructed with the Broadway Professional Village development.

The existing pond was designed for water quality treatment for the Broadway Professional Village property. Pinnacle Pets will be constructed on the parcel considered Phase 2 in the Broadway Professional Village construction documents produced by CDE, dated 07/07/2005. In their design, CDE accounted for water quality treatment of Phase 1 and Phase 2 in the pond. Additionally, a volume of 11,200 ft³ of detention volume was provided for Phase 2 water quantity storage above the water quality storage, resulting in a total storage volume of 41,200 ft³. The pond volume has been verified by survey and provides approximately 47,000 ft³ of storage, which satisfies the original design by CDE.

Stormwater calculations were performed for the Pinnacle Pets site using the SCS Unit Hydrograph hydrologic method in the Haestad Methods' PondPack, Version 10.1 software.

Pre-Developed Condition

The following is the pre-developed data used to produce the runoff hydrograph for the area:

Pre-developed	CN=80	T_C = 0.367 hrs	Area = 1.77 Ac

The runoff hydrographs for the "Pre-Developed" areas were calculated and peak flow rates for each storm frequency are:

Pre:

Q_1= 1.14 cfs
Q_2= 1.68 cfs
Q_5= 2.51 cfs
Q_{10}= 3.24 cfs
Q_{25}= 4.29 cfs
Q_{50}= 5.18 cfs
Q_{100}= 6.13 cfs

Post-Developed Condition

The following is the post-developed data used to produce the runoff hydrograph for the area:

Post-developed	CN=86	Tc = 0.392 hrs	Area = 1.77 Ac

The runoff hydrographs for the "Post-Developed" areas were calculated and peak flow rates for each storm frequency are:

Post:

Q_1= 1.70 cfs
Q_2= 2.32 cfs
Q_5= 3.22 cfs
Q_{10}= 3.98 cfs
Q_{25}= 5.06 cfs
Q_{50}= 5.96 cfs
Q_{100}= 6.91 cfs

Stormwater Runoff Control Criteria

The City of Grove City requires projects to adhere to the stormwater management requirements provided in the Grove City Subdivision Regulations. These regulations stipulate a critical year storm design method. This method is used to determine the allowable release rates from the analysis areas. The critical storm method states that the percent increase in runoff volume for a one year frequency, 24-hour storm determines the critical storm event. The post-developed runoff must be controlled for storms of a frequency between one year and the critical storm so that the rate of runoff does not exceed the peak rate of runoff for a pre-developed 24-hour, one year frequency storm. All storm events greater than the critical year must be controlled such that the post-developed runoff rate does not exceed the pre-developed runoff rate for the same given storm event frequency.

The 1 year pre-developed hydrological volume for the site is 0.101 acre-feet (pg. 1.02). The 1 year post-developed hydrological volume for the site is 0.148 acre-feet (pg. 1.01). The difference between the two hydrological volumes represents an increase in stormwater runoff of 46.5%. Referencing the Grove City Subdivision Regulations, this percentage signifies that the project must adhere to the 5 year critical year storm event.

The amount of storage required can be estimated by taking the difference between the post-developed hydrological volume of the critical year storm event and the pre-developed 1 year hydrological volume.

PRE-DEVELOPED	POST-DEVELOPED	REQUIRED VOLUME
1 YR=0.101 ac-ft	1 YR=0.148 ac-ft	**0.175 ac-ft**
2 YR=0.145 ac-ft	2 YR=0.199 ac-ft	**0.175 ac-ft**
5 YR=0.211 ac-ft	**5 YR=0.276 ac-ft**	**0.175 ac-ft**
10 YR=0.270 ac-ft	10 YR=0.341 ac-ft	0.071 ac-ft
25 YR= 0.356 ac-ft	25 YR= 0.435 ac-ft	0.079 ac-ft
50 YR=0.429 ac-ft	50 YR=0.514 ac-ft	0.085 ac-ft
100 YR=0.509 ac-ft	100 YR=0.599 ac-ft	0.090 ac-ft

As noted above, the required storage volume is determined by the critical year storm event, and is 0.175 ac-ft (7,623 ft^3).

This required volume is less than the detention volume (11,200 ft^3) provided in the existing pond and should satisfy Grove City requirements.

Should you have any additional comments or questions, please do not hesitate to contact us.

Sincerely,

THE KLEINGERS GROUP

Michael J. Couvreur, PE, CPESC, LEED AP BD+C
Senior Engineer

cc: File

MASTER DESIGN STORM SUMMARY

Network Storm Collection: CITY OF COLUMBUS

Return Event	Total Depth in	Rainfall Type	RNF ID
1	2.2000	Synthetic Curve	TypeII 24hr
2	2.6300	Synthetic Curve	TypeII 24hr
5	3.2400	Synthetic Curve	TypeII 24hr
10	3.7400	Synthetic Curve	TypeII 24hr
25	4.4400	Synthetic Curve	TypeII 24hr
50	5.0200	Synthetic Curve	TypeII 24hr
100	5.6300	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POST-DEVELOPED	AREA	1	.148		12.1500	1.70		
POST-DEVELOPED	AREA	2	.199		12.1000	2.32		
POST-DEVELOPED	AREA	5	.276		12.1000	3.22		
POST-DEVELOPED	AREA	10	.341		12.1000	3.98		
POST-DEVELOPED	AREA	25	.435		12.1000	5.06		
POST-DEVELOPED	AREA	50	.514		12.1000	5.96		
POST-DEVELOPED	AREA	100	.599		12.1000	6.91		
*POST-DEVELOPED	JCT	1	.148		12.1500	1.70		
*POST-DEVELOPED	JCT	2	.199		12.1000	2.32		
*POST-DEVELOPED	JCT	5	.276		12.1000	3.22		
*POST-DEVELOPED	JCT	10	.341		12.1000	3.98		
*POST-DEVELOPED	JCT	25	.435		12.1000	5.06		
*POST-DEVELOPED	JCT	50	.514		12.1000	5.96		
*POST-DEVELOPED	JCT	100	.599		12.1000	6.91		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
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Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
PRE-DEVELOPED	AREA	1	.101		12.1500	1.14		
PRE-DEVELOPED	AREA	2	.144		12.1000	1.68		
PRE-DEVELOPED	AREA	5	.211		12.1000	2.51		
PRE-DEVELOPED	AREA	10	.270		12.1000	3.24		
PRE-DEVELOPED	AREA	25	.355		12.1000	4.29		
PRE-DEVELOPED	AREA	50	.429		12.1000	5.18		
PRE-DEVELOPED	AREA	100	.509		12.1000	6.13		
*PRE-DEVELOPED	JCT	1	.101		12.1500	1.14		
*PRE-DEVELOPED	JCT	2	.144		12.1000	1.68		
*PRE-DEVELOPED	JCT	5	.211		12.1000	2.51		
*PRE-DEVELOPED	JCT	10	.270		12.1000	3.24		
*PRE-DEVELOPED	JCT	25	.355		12.1000	4.29		
*PRE-DEVELOPED	JCT	50	.429		12.1000	5.18		
*PRE-DEVELOPED	JCT	100	.509		12.1000	6.13		

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TIME OF CONCENTRATION CALCULATOR
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Segment #1: Tc: TR-55 Sheet

Mannings n	.2400	
Hydraulic Length	100.00	ft
2yr, 24hr P	2.6300	in
Slope	.011000	ft/ft
Avg.Velocity	.08	ft/sec

Segment #1 Time: .3332 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	352.00	ft
Slope	.010800	ft/ft
Unpaved		
Avg.Velocity	1.68	ft/sec

Segment #2 Time: .0583 hrs

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Total Tc: .3915 hrs
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Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400	
Hydraulic Length	100.00	ft
2yr, 24hr P	2.6300	in
Slope	.011200	ft/ft
Avg.Velocity	.08	ft/sec

Segment #1 Time: .3308 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	236.00	ft
Slope	.013000	ft/ft
Unpaved		
Avg.Velocity	1.84	ft/sec

Segment #2 Time: .0356 hrs

==========
Total Tc: .3665 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

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Elevation (ft)	Planimeter (sq.in)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	Volume (ac-ft)	Volume Sum (ac-ft)
833.50	-----	20472	0	.000	.000
835.50	-----	27175	71234	1.090	1.090

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2