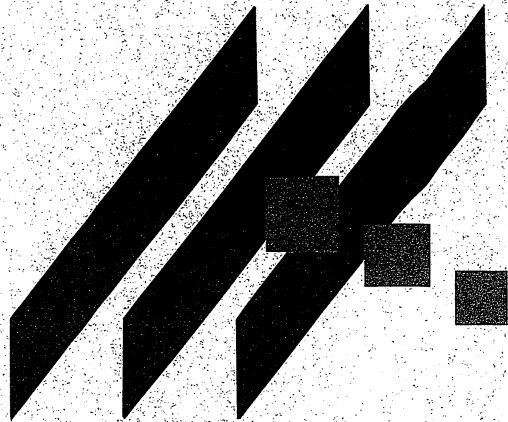
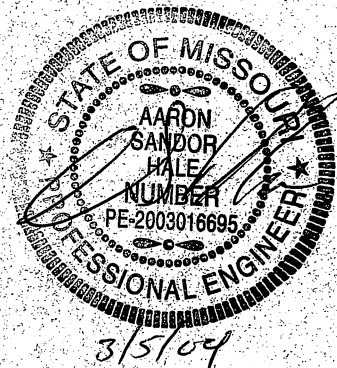


M K E C E N G I N E E R I N G C O N S U L T A N T S , I N C



**DETENTION POND REDESIGN
FOR
TWIN OAKS ADDITION, PHASE 2
PECULIAR, MISSOURI**

MARCH 2004



Redesign of Twin Oaks Addition Phase II Detention Pond Peculiar, Missouri

Location

Twin Oaks Phase II Addition is located in the City of Peculiar, Cass County, Missouri, north of Elm Street (215th Street) and east of School Road. The property lies in Section 10, Township 45N, Range 32W. The total site area is approximately 14 acres. The site is bounded by undeveloped land on the north and east, Elm Street on the south, and Twin Oaks Phase I on the west. The existing detention pond is located north of Elm Street near Harr Grove Road.

Existing Conditions

Current Development

The site is a single family residential development.

Current Facility

The existing detention facility covers an area approximately 1.6 acres and varies in elevation from 958 ft to 964 ft (see Appendix A for a drawing of the facility). The detention facility covers an area roughly equivalent to eight 80'x110' residential lots bounded by White Oak Street on the north and Elm Street on the south. Flow enters this facility via 24" and 12" pipes from the north. Discharge is controlled first by a 4" orifice, then by an 8" orifice, and finally by a 3'x3' opening on top of the concrete structure (see Appendix B for detail). Flow entering the structure is discharged by a 24" HDPE outlet pipe. The outlet pipe drains to an area inlet structure located in the drainage swale running on the north side of Elm Street. This will connect to an existing 18" CMP running under Elm Street and discharge to the south. According to construction plans by *Samuel J. Styron Consulting Engineers, Inc.* the detention facility has a storage volume of 3.52 ac-ft and a 31.4 cfs 100-yr peak discharge.

Runoff Conditions

MKEC Engineering Consultants, Inc. analyzed the runoff entering the detention facility. A 21.6 acre basin drains south into and across the existing Twin Oaks Phase II development. The rational method was used to calculate the pre-developed and developed peak flow rates. A coefficient of 0.30 was selected in accordance with the American Public Works Association (APWA) standards for pre-developed conditions. A developed coefficient of 0.51 was used per APWA criteria to represent residential single family areas. Table 1 below shows the 10, 25, and 100 year runoff for pre-developed and developed conditions with no detention (see Appendix D for detailed calculations and basin map).

Table 1: Basin Runoff

	10-yr (cfs)	25-yr (cfs)	100-yr (cfs)
Pre-Developed	31.1	39.9	55.1
Developed	55.1	72.7	97.8

Proposed Changes

Existing Drainage Facility Issues

The current facility is adequate to handle the detention needs of the subdivision, although the design does not lend an aesthetic value to the overall community. The combination of very shallow slopes and only a 4" orifice would leave water standing in the pond for a period of time. The current design will tend to devalue the adjacent lots within the subdivision and could lead to maintenance and mosquito problems in the summer months.

Proposed Drainage Facility

MKEC proposes to redesign the existing drainage pond. The new facility will remain in the same location, but will decrease in size and eliminate the concrete box control structure. The new dry facility will have 1.2 ac-ft of storage and will cover two residential lots instead of eight. The existing 24" outlet pipe that connects into the drainage swale area inlet will remain and control the facility. The existing 18" CMP under Elm Street will be replaced with a new 24" pipe and connect into the south side of the area inlet along Elm Street. The existing 24" and 12" pipes entering the facility will remain in the same respective locations (see Appendix C for a drawing of the proposed facility).

This proposed detention facility would adequately reduce the developed peak flow rate from Twin Oaks Phase II. Since the new facility will be dry, the area can be used as a park/open area. Hydraflow® by Intelisolve was utilized to analyze the detention. Table 2 shows the 10, 25, and 100 year detention discharge compared to the pre-developed peak flow rates. The new detention facility will match or reduce peak flow rates from the basin (see Appendix D for detention facility inflow and discharge hydrographs).

Table 2: Post-Detention Discharge

	10-yr (cfs)	25-yr (cfs)	100-yr (cfs)
Pre-Developed	31.1	39.9	55.1
After Detention	28.3	32.7	37.3

Summary

Twin Oaks Phase II is 14 acres of land north of Elm Street and east of School Road. The detention facility is currently constructed with shallow slopes and a box control structure. MKEC proposes to replace the current facility with a new facility that requires less land area and uses a pipe control structure. Post-developed runoff will be less than pre-

developed runoff with the new detention facility in place. The new facility meets detention requirements and still allows for an open area and more residential lots in the proposed addition. Construction documents will be issued to the city prior to construction.

Appendix A

Existing Detention Facility

Appendix B

Outlet Structure Detail

Appendix C

Proposed Detention Facility

Appendix D

**Drainage and Detention Calculations
Basin Map**

Area 8

BSH

2/19/2004

Existing Drainage

Overall Watershed Summary

Area=	21.6 ac	T _f =	14.68 min	15	i ₁₀ =	4.8 in/hr
Distance=	1150 ft	T _t =	4.20 min		i ₂₅ =	5.6 in/hr
Max. Elev.=	988 ft	T _c =	19 min		i ₁₀₀ =	6.8 in/hr
Min. Elev.=	960 ft					
C=	0.3	Q ₁₀ =	31.1 cfs			
Slope=	2.43 %	Q ₂₅ =	39.9 cfs			
		Q ₁₀₀ =	55.1 cfs			

T_f Calculations

Distance=	135 ft	T _f =	14.68 min
Max. Elev.=	988 ft		
Min. Elev.=	986 ft		
C=	0.3		
Slope=	1.48 %		

T_T Calculations

Distance=	1015 ft	T _T =	4.20 min
Max. Elev.=	986 ft		
Min. Elev.=	960 ft		
C=	0.3		
Slope=	2.56 %		

Proposed Drainage

Overall Watershed Summary

Area=	21.6 ac	T _f =	14.36 min	14	i ₁₀ =	5.0 in/hr
Distance=	1150 ft	T _t =	2.90 min		i ₂₅ =	6.0 in/hr
Max. Elev.=	988 ft	T _c =	17 min		i ₁₀₀ =	7.1 in/hr
Min. Elev.=	960 ft					
C=	0.51	Q ₁₀ =	55.1 cfs			
Slope=	2.43 %	Q ₂₅ =	72.7 cfs			
		Q ₁₀₀ =	97.8 cfs			

T_f Calculations

Distance=	250 ft	T _f =	14.36 min
Max. Elev.=	988 ft		
Min. Elev.=	984 ft		
C=	0.51		
Slope=	1.60 %		

T_T Calculations

Distance=	900 ft	T _T =	2.90 min
Max. Elev.=	984 ft		
Min. Elev.=	960 ft		
C=	0.51		
Slope=	2.67 %		

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Hyd. No. 18

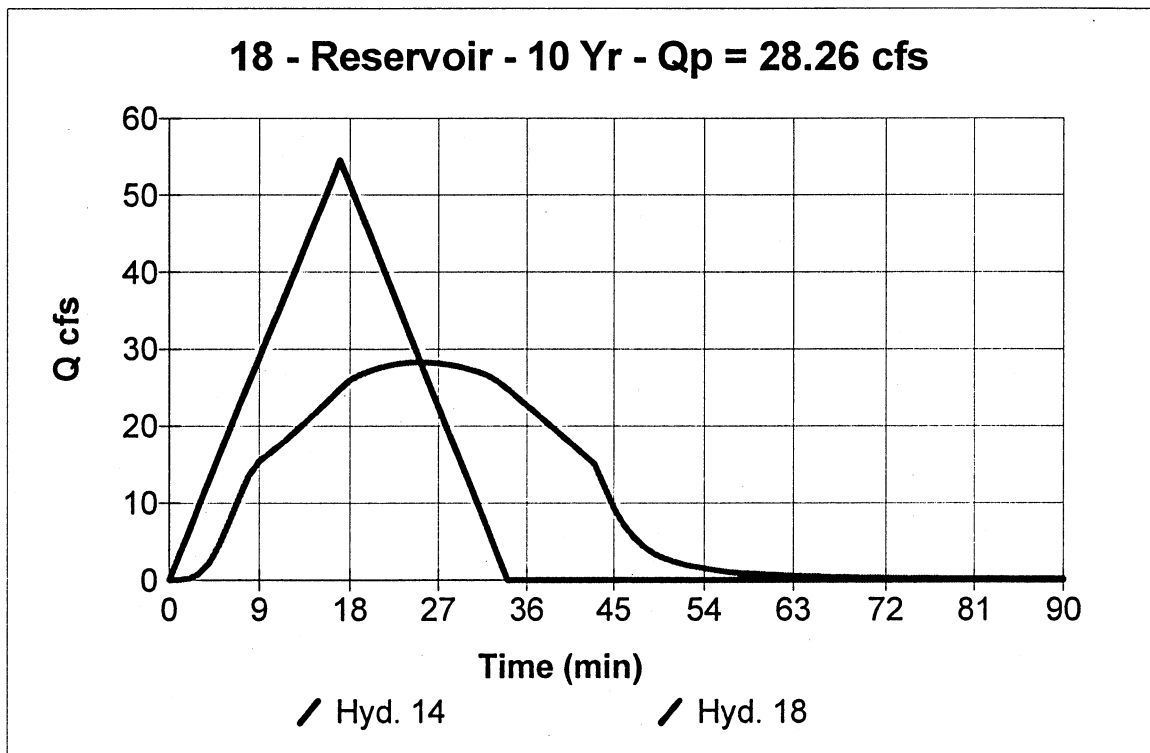
Proposed Pond 10-yr

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 14
Max. Elevation = 962.49 ft

Peak discharge = 28.26 cfs
Time interval = 1 min
Reservoir name = Mace Proposed P
Max. Storage = 0.513 acft

Storage Indication method used.

Hydrograph Volume = 1.276 acft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Hyd. No. 19

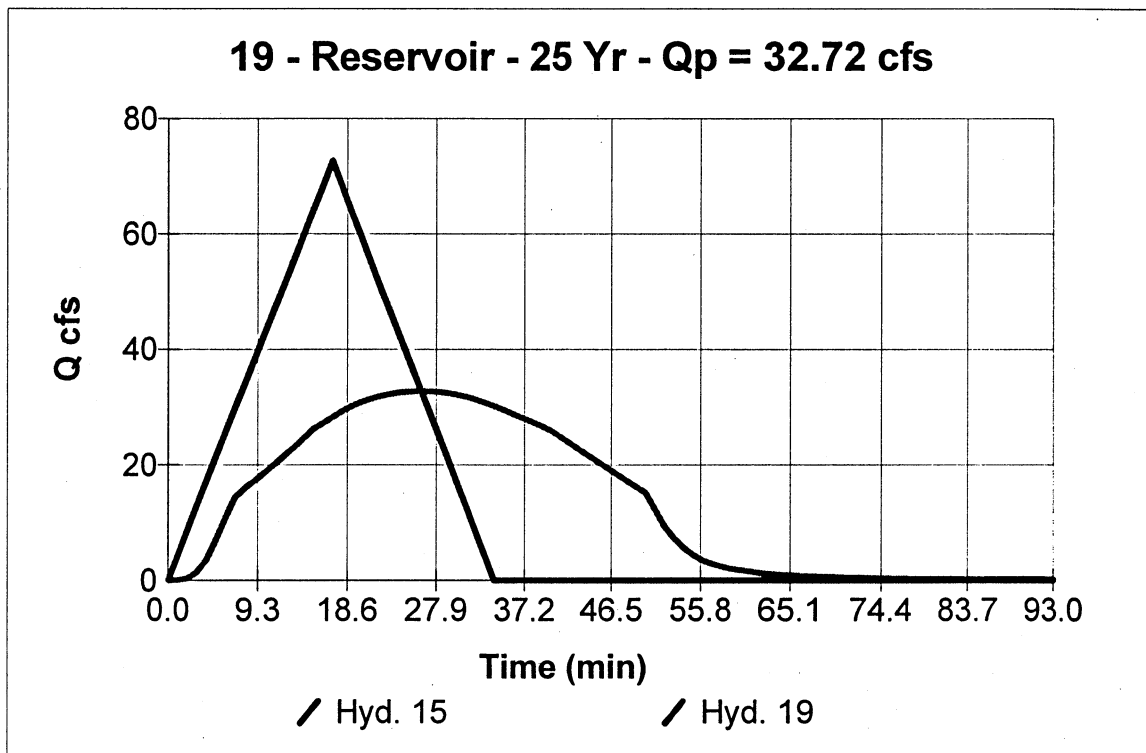
Proposed Pond 25-yr

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 15
Max. Elevation = 963.68 ft

Peak discharge = 32.72 cfs
Time interval = 1 min
Reservoir name = Mace Proposed P
Max. Storage = 0.787 acft

Storage Indication method used.

Hydrograph Volume = 1.701 acft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Hyd. No. 20

Proposed Pond 100-yr

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 16
Max. Elevation = 965.07 ft

Peak discharge = 37.27 cfs
Time interval = 1 min
Reservoir name = Mace Proposed P
Max. Storage = 1.218 acft

Storage Indication method used.

Hydrograph Volume = 2.304 acft

