Arroyo del Sol Condominiums

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Drainage Report

May 1996
C.L. Weiss Engineering, Inc.

Arroyo del Sol Condominiums

CHRISTOPHER L. WEISS
NEW MEXICO
6651
REGISTERED PROFESSIONAL ENGINEER

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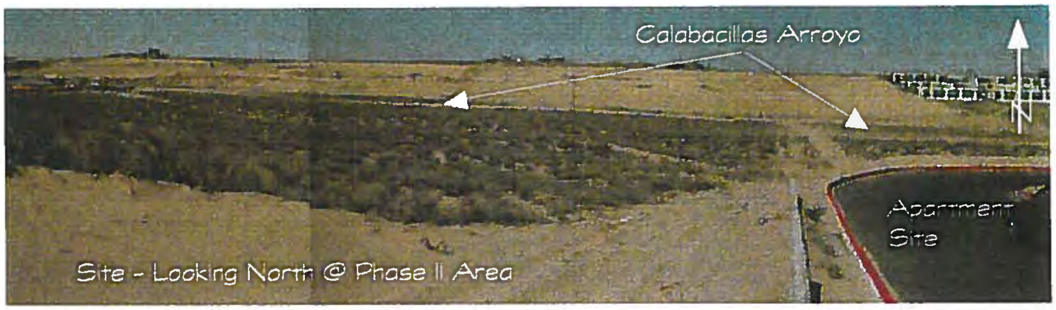
• Introduction

The Arroyo del Sol Condominium site is located NW of the intersection of Irving Blvd. and Golf Course Road. The 20 acre site slopes down from Irving Blvd. to the north toward the Calabacillas Arroyo, with slopes which vary from slight to 10%. The proposed use for the R-2 tract will consist of 50 four-plex units, which will be sold as individual condominiums. Adjacent development consists of an apartment complex on the East, and single family residences located on the west.



The internal street system will be constructed and maintained as a private access, with parking provided on the driveways at each unit in addition to several designated off-street parking areas located throughout the site. Header and standard curbs will be used throughout the site, with the street constructed as an inverted "V" to provide storm water carrying capacity, where required. Storm drain inlets or valley gutters will be placed at strategic locations in the street to divert these flows to defined drainage areas in order to reduce the overall peak discharge handled by the streets.

Typical of the "V" Street and townhouse project previously completed by same developer.

Although drainage management will allow free discharge into the Calabacillas Arroyo (criteria established in a pre-design meeting with Mr. Fred Aguirre, COA Hydrology Dept.), due to the erosive nature of the soil, the drainage design for the site will attempt to use as many infiltration basins, water entrapments and detention ponds as feasible to reduce the amount of peak flow handled by the streets or other areas which route storm runoff to the Calabacillas Arroyo. Total storm volume generated on site, less the initial abstractions, will be provided a path to the site outfall, but the peak discharge affecting the overall system will be tempered and reduced by a multitude of these routing diversions. This concept is workable in that the overall site landscaping and drainage system's integrity will be maintained by one entity, the Arroyo del Sol Condominium Association..

For the final discharge point from the site, the outlet facility will be situated the bank of the existing Arroyo and constructed to match similar outfalls with erosion protection around the pipe outlet, as shown.


Existing outlet on north side of Arroyo

The Arroyo del Sol Condominium site is isolated from all offsite drainage by virtue of existing development and street improvements on all sides. The north side is bounded by the Calabacillas Arroyo. Flows carried by the Calabacillas Arroyo do not impact the site (see flood map insert). Additional setback criteria, as determined by plotting the prudent line obtained from AMAFCA records, has determined that the potential erosion effects of the Calabacillas Arroyo fall outside the property. The prudent line was verified as being an acceptable current representation in conversations with Dr. Richard Heggen, who completed recent studies of the Calabacillas Arroyo for AMAFCA (see correspondence in back of report).

The intent of this plan is to show:

- Grading relationships between the existing ground elevations and proposed finished elevations in order to facilitate positive drainage to designated discharge points.
- The extent of proposed site improvements, buildings, pavement, storm drainage facilities.
- The flow rate / volume of rainfall across or around these improvements and methods of handling these flows to meet COA requirements for drainage management.
- The relationship of on-site improvements with existing neighboring property to ensure an orderly transition between proposed and surrounding grades.

• Recent Site Improvements

Street improvements for Irving Blvd. have recently been completed in front of the apartment site located to the east of the Arroyo del Sol Condominium site. A widened temporary street section has been constructed in front of the Arroyo del Sol site, but this section will be upgraded to a permanent section with these site improvements.


Irving Blvd. looking West

Storm drainage improvements for Irving Blvd. have been completed as part of the development for the area and have isolated this site from any flows carried by Irving Blvd.

• Existing Drainage Basin Patterns

The existing drainage patterns can be identified by a single basin which slopes into the Calabacillas Arroyo on the north side of the site. No distinct drainage patterns are evident across the site, due largely to the high infiltration rate of the soil. However, the surface can be easily eroded when flows are concentrated across an unprotected area. The SCS soil classification for the site is the Bluepoint series (BCC, Bb), Hydrologic soil group "A", with a permeability rate of 6 to 20 "/hr. Further soil background is included with a letter from the soils engineer in the back of this report

• Proposed Drainage Improvements – Upper 12 Units

The area typically draining from each lot to the street will include the front one third of the building roof area, driveway and a small portion of the adjacent side yards. The remainder of the side yards and roof will drain to the rear yard area to be captured by defined landscaped surface catchment basins (see landscaping details in back of report). The minimum required catchment area will be determined from the volume generated by one-third of two adjacent units because the catchment basins will be shared by both units. Maximum stored depth is established at 18". No allowance for simultaneous infiltration in the catchment basins will be computed in order to provide a more conservative estimate of the storage requirements, but given the high infiltration rate of the soil in the area, standing waters should be a rare occurrence. If flows exceed soil absorption capacity, however, each catchment basin can overflow into the next area basin before backed up storm flow could affect adjacent buildings. With each of the series of back yard basins interconnected to provide a path for any discharge to a street or one of the two larger detention ponds, the catchment/infiltration basins will remove a substantial area of the site from contributing to the peak discharge handled by the two detention ponds.

In most instances, rear yard catchment basins will be defined by retaining walls along the rear of the units. The walls will be limited to a maximum five foot height, unless noted, creating a terraced grade transition across the site where multiple walls are needed. All retaining walls will be KeyStone type walls, using tie-backs where required. The non-grouted nature of the wall construction will eliminate hydrostatic pressure from building up behind the respective wall, diffusing any subsoil transfer of the flows through the wall. Xeriscaping will be situated in the "terrace" portion below each wall. to utilize any and all storm runoff to help sustain it

Typical grade changes, creating terraces along rear of townhouses,

Development of the project will proceed from the upper area toward the north. Rough grading for the street grades and house pads will be established for the entire site in order to achieve an earthwork balance. All catchment basins/pond areas will be rough graded to provide interim storm routing down to the Calabacillas Arroyo. Final drainage improvements will be completed as development proceeds north.

• Summary of Basin 1 Drainage System

Basin 1 peak flow in street = 5.3 cfs, volume = 8222 cf. This flow will be collected by storm drain inlets and routed in the storm drain pipe to a detention pond located in the NE corner of the east open space area. The pond will have with a working depth of 18" A bleeder drain from the pond will keep any standing water from accumulating if for any reason infiltration into the pond bottom is reduced. The outfall path from the pond will be directed along the east side of the site between two parallel retaining walls within a drainage easement. This area will serve as a path for spillway as well as the "bleeder" flows from the pond.

Typical side yard grade changes, utilizing small grade walls, larger retaining walls and grassed slopes

• Proposed Drainage Improvements - Lower 38 Units

Rear yard catchment basins will be used for the units to handle the roof flows and associated side/rear yard areas. All basins will act independently of each other, handling only the flows from the respective adjoining units, as referenced previously, except that an overflow path to each succeeding lower basin will be possible to handle greater than a 100 year storm event. The same areas typically draining to the street from each lot will include the front one third of the building roof area, driveway and a small portion of the adjacent side yards.

The open space (Basins 2 & 3) between the upper and lower developments will be left untouched, except for the associated construction of the serpentine street and work on the retaining walls adjoining the open space area. Additional seeding for slope stabilization will be the only activity planned for this area.

Flows from the east half of the open area (Basin 2) will follow historic drainage patterns and be intercepted by a series of retaining walls. Excess drainage not entrapped by the initial wall will pass through the upper wall to next one below, and so on. The rear yard basins along the bottom of the wall will act as the final catchment of any sheet flows from Basin 2. The storage capacity of these catchment basins and interconnected routing capability will accomodate any potential overflow from Basin 2

Drainage from the west half of the open area (Basin 3) will be allowed to intercept the series of retaining walls planned along the north side of Basin 3 in the same manner as referenced for the east half of the open area. The walls and terraces will diffuse the effect of the runoff, reducing the potential of concentrating the flows to any one point.

The serpentine street between the upper and lower developments will drain into a landscaped common activity area (Basin 6). Flows from this area will be routed to the common collection area for Basins 4, 5 and 6. The loop street drains clockwise (Basin 4) and counterclockwise (Basin 5) from the serpentine intersection, discharging at the street's low point into the main pond at the NE corner of the site.

• Summary of Basin 2 and 3 - Open Space

Sheet flow from each basin will be intercepted by the retaining walls to the north. The volume and velocity of these flows will be attenuated by the retaining walls, with the individual ponds in the rear of each unit acting as final entrapment areas. All of these ponds will be interconnected to act in series to provide an ultimate flow path of any stored runoff to main pond at the NE corner of the property.

• Summary of Basin 4, 5 & 6 Drainage System

Total flow of 8.9 cfs (13,808 cf) from Basin 4 will be routed within the loop street to the main detention pond located in the NE corner of the site and released directly into the Calabacillas Arroyo.

Total flow of 5.6 cfs (8,571 cf) from Basin 5 will be routed within the loop street to the same detention pond.

Total flow of 2.8 cfs (3,661 cf) from Basin 6 will be routed through the common open area to same point of discharge as Basins 4 and 5.

Total runoff volume generated by Basins 4, 5, and 6 will be 26,040 cf. Total detention storage volume available in the pond at an 18" depth is 24,644 cf. Excess flow generated by the contributing basins will be released through a pipe outlet into the Calabacillas Arroyo (See inflow / outflow hydrograph in back of the report).

Comparable existing project, combining developed landscaping and natural ground cover.

Upper Basin - 12 Units (Basin 1)

AREA OF SITE: 62,700 SF = 1.44 Ac.

Calculations are based on the Drainage Design Criteriafor Bernalillo County, Section 22.2, DPM, Vol 2, dated Jan., 1993

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	62,700	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	62,700	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=		SF
Area b	=	19,120	SF
Area c	=	0	SF
Area d	=	43,580	SF
Total Area	=	62,700	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E =	0.44 in.	
Developed E =	1.57 in.	

On-Site Volume of Runoff: V360 = $\frac{E*A}{12}$

Historic V360 = 2299 CF	Developed V360 = 8222 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37

Historic Qp = 1.9 CFS	Developed Qp = 5.3 CFS

BASIN FLOWS: The area which drains to the Basin 1 detention pond is comprised of the front portion of each unit, driveway and associated yard, along with the street area. Flows from this basin are picked up by inlets in the street and routed through a storm pipe to a detention pond located on the east side of the site below the open space. The pond volume will have a maximum depth of 18" and does not account for simultaneous infiltration into the soil. The capacity of the pond will meet or exceed the estimated volume from the contributing basin, with an overflow route provided along the east side of the site to the final detention pond located in the NE corner. of

STORM INLET: Flow characteristics of the street will be based on a longitudinal slope of 6%, resulting in a flow depth of less than 0.2' and a spread of approximately 10' each side of the street centerline (See Worksheet - "V" Street Section @ SS Inlet). The storm inlet will consist of three square grates, with slotted drains extending from the main inlet each side to capture the flow spread. Working with a transverse slope of 2%, a longitudinal slope of 6%, the grate inlet coefficient K = 38 (from Neenah graph from actual flow testing of inlet #R-3076L). Solving for Q=(K)D^5/3, where D = 0.2' upstream of the grate, Q = 2.6 cfs capacity, each grate, for a total interception of 7.8 cfs. Allowing for a 30% clogging factor, interception rate is 5.5 cfs, vs 5.3 cfs peak flow generated by the basin. The flow spread in the street will be intercepted with 10' of slotted drain each side of the main inlet. Using the test results from the Federal Highway Administration, the slotted drain capacity is 0.04 cfs/ft, for a total capture of 0.8 cfs. If any carry-over of the flows occurs, the runoff will continue in the street to the next collection area at the intersection, where flows will be routed through the off-street landscaped infiltration basins to the main pond.

POND INLET: Flow from the street inlet to the pond can be achieved through a 10" dia. pipe (See Worksheet - Inlet Pipe - Basin #1 Pond - First Reach), and an 8" dia. pipe (See Worksheet - Inlet Pipe - Basin #1 Pond -Second Reach). The outlet of the storm sewer pipe will be turned to discharge the flow up, similar to a bubbler effect. Erosion protection will be provided around the base of the pipe in the form of a 10' diameter rip-rap pad, typical.

POND: Total flow draining to the pond is 8222 cf. The pond will detain the initial peak flow of the basin at a depth of 18". Any volume that doesn't infiltrate into the pond will be released through an opening in the outlet standpipe. The release pipe will also serve as the spillway from the pond and be sized to handle the peak rate of the basin.

POND OUTLET: The release pipe will be connected to a vertical standpipe set with the rim 18" above the pond bottom to provide an emergency outflow from the pond. The size of the standpipe for emergency overflow will be based on the orifice eq., where Q = CA(2GH)^1/2. For a head of 0.5' for a maximum depth of 2' in the pond, C = 0.6, Q =5.3 cfs, solving for A = 1.6 sf. With a 50% clogging factor, a minimum 24" diameter pipe will provide the required area. The release pipe to handle the peak flow of 5.3 cfs will be a 10" pipe (See Worksheet - Outlet Pipe - Basin #1 Pond). A 4" dia. opening in the standpipe set 0.5' above the pond bottom will provide the necessary control to empty the pond in less than 24 hrs. The outlet of the release pipe will be turned to discharge the flow up, with erosion protection as indicated for the storm sewer inlet pipe previously referenced, with the flow path following the area between two retaining walls to the main outlet pond in the NE corner of the site.

"V" Street Section @ SS Inlet
Worksheet for Triangular Channel

Project Description	
Project File	d:\project\mcclinti\project1.fm2
Worksheet	v street
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.015	
Channel Slope	0.060000	ft/ft
Left Side Slope	50.000000	H : V
Right Side Slope	50.000000	H : V
Discharge	5.30	cfs

Results		
Depth	0.16	ft
Flow Area	1.20	ft²
Wetted Perimeter	15.51	ft
Top Width	15.50	ft
Critical Depth	0.23	ft
Critical Slope	0.006707	ft/ft
Velocity	4.41	ft/s
Velocity Head	0.30	ft
Specific Energy	0.46	ft
Froude Number	2.79	
Flow is supercritical.		

Inlet Pipe - Basin #1 - First Reach
Worksheet for Circular Channel

Project Description	
Project File	d:\project\mcclinti\project1.fm2
Worksheet	Inlet Pipe - Basin #1 - First Reach
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.010	
Channel Slope	0.033600	ft/ft
Diameter	10.00	in
Discharge	5.30	cfs

Results		
Depth	0.70	ft
Flow Area	0.49	ft^2
Wetted Perimeter	1.92	ft
Top Width	0.62	ft
Critical Depth	0.82	ft
Percent Full	83.41	
Critical Slope	0.031632	ft/ft
Velocity	10.90	ft/s
Velocity Head	1.85	ft
Specific Energy	2.54	ft
Froude Number	2.17	
Maximum Discharge	5.62	cfs
Full Flow Capacity	5.22	cfs
Full Flow Slope	0.034628	ft/ft
Flow is supercritical.		

Inlet Pipe - Basin #1 - Second Reach
Worksheet for Circular Channel

Project Description	
Project File	d:\project\mcclinti\project1.fm2
Worksheet	Inlet Pipe - Basin #1 Pond - 2nd Reach
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.010	
Channel Slope	0.127300	ft/ft
Diameter	8.00	in
Discharge	5.30	cfs

Results		
Depth	0.52	ft
Flow Area	0.29	ft²
Wetted Perimeter	1.44	ft
Top Width	0.56	ft
Critical Depth	0.67	ft
Percent Full	77.47	
Critical Slope	0.110338	ft/ft
Velocity	18.26	ft/s
Velocity Head	5.18	ft
Specific Energy	5.70	ft
Froude Number	4.46	
Maximum Discharge	6.03	cfs
Full Flow Capacity	5.60	cfs
Full Flow Slope	0.113837	ft/ft
Flow is supercritical.		

Inlet Pipe - Basin #1 - Third Reach
Worksheet for Circular Channel

Project Description	
Project File	d:\project\mcclinti\project1.fm2
Worksheet	Inlet Pipe - Basin #1 - Third Reach
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.010	
Channel Slope	0.560000	ft/ft
Diameter	8.00	in
Discharge	5.30	cfs

Results		
Depth	0.31	ft
Flow Area	0.16	ft²
Wetted Perimeter	1.01	ft
Top Width	0.67	ft
Critical Depth	0.67	ft
Percent Full	47.08	
Critical Slope	0.110338	ft/ft
Velocity	32.80	ft/s
Velocity Head	16.72	ft
Specific Energy	17.04	ft
Froude Number	11.74	
Maximum Discharge	12.65	cfs
Full Flow Capacity	11.76	cfs
Full Flow Slope	0.113837	ft/ft
Flow is supercritical.		

Inlet Pipe - Basin #1 - Fourth Reach
Worksheet for Circular Channel

Project Description	
Project File	d:\project\mcclinti\project1.fm2
Worksheet	Inlet Pipe - Basin #1 - Fourth Reach
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.010	
Channel Slope	0.155000	ft/ft
Diameter	8.00	in
Discharge	5.30	cfs

Results		
Depth	0.48	ft
Flow Area	0.27	ft²
Wetted Perimeter	1.34	ft
Top Width	0.60	ft
Critical Depth	0.67	ft
Percent Full	71.28	
Critical Slope	0.110338	ft/ft
Velocity	19.91	ft/s
Velocity Head	6.16	ft
Specific Energy	6.64	ft
Froude Number	5.29	
Maximum Discharge	6.65	cfs
Full Flow Capacity	6.18	cfs
Full Flow Slope	0.113837	ft/ft
Flow is supercritical.		

Outlet Pipe - Basin #1 Pond
Worksheet for Circular Channel

Project Description	
Project File	d:\project\mcclinti\project1.fm2
Worksheet	Outlet Pipe - Basin #1 Pond
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.010	
Channel Slope	0.060000	ft/ft
Diameter	10.00	in
Discharge	5.30	cfs

Results		
Depth	0.54	ft
Flow Area	0.38	ft²
Wetted Perimeter	1.57	ft
Top Width	0.79	ft
Critical Depth	0.82	ft
Percent Full	65.20	
Critical Slope	0.031632	ft/ft
Velocity	14.07	ft/s
Velocity Head	3.08	ft
Specific Energy	3.62	ft
Froude Number	3.60	
Maximum Discharge	7.50	cfs
Full Flow Capacity	6.98	cfs
Full Flow Slope	0.034628	ft/ft
Flow is supercritical.		

Open Area - East Side (Basin 2)

AREA OF SITE: 38,800 SF = 0.89 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	38,800	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	38,800	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	38,800	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	38,800	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.44 in.	Developed E	=	0.44 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	1423 CF	Developed V360	=	1423 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37
Historic Qp	=	1.1 CFS	Developed Qp	=	1.1 CFS

BASIN FLOWS: This area will be used as an open space. Additional native grasses and vegetation will be planted to further increase the slope stability and storm water interception, particularly those areas disturbed by adjoining wall construction and the access road which passes through the open space. Storm runoff patterns will continue as sheet flow, which will be intercepted by a series of retaining walls to the north.

Open Area - West Side (Basin 3)

AREA OF SITE: 61,200 SF = 1.4 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	61,200	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	61,200	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	61,200	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	61200	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.44 in.	Developed E	=	0.44 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	2244 CF	Developed V360	=	2244 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37
Historic Qp	=	1.8 CFS	Developed Qp	=	1.8 CFS

BASIN FLOWS: This area will also be dedicated to open space. Additional native grasses and vegetation will be planted to further increase the slope stability and storm water interception, as stated for Basin 2. Storm runoff patterns will continue as sheet flow, which will be intercepted by a series of retaining walls to the north.

Lower Area - 38 Units - West Half of Loop Street (Basin 4)

AREA OF SITE: 110,900 SF = 2.55 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	110,900	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	110,900	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	40,600	SF
Area c	=	0	SF
Area d	=	70,300	SF
Total Area	=	110,900	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.44 in.	Developed E	=	1.49 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	4066 CF	Developed V360	=	13808 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37
Historic Qp	=	3.3 CFS	Developed Qp	=	8.9 CFS

BASIN FLOWS: This basin is comprised of the front portion of each unit, driveway and associated yard, along with the street area. Flow from this basin is routed in the street to the main pond located in the NE corner of the site. This pond will serve as the common collection point for all the lower basins and would also collect any flows which might overflow the pond system of the upper basins. Basin flows will be routed to the pond by way of the loop street (See Worksheet - "V" Street Section - Basin #4).

"V" Street - Basin # 4
Worksheet for Triangular Channel

Project Description	
Project File	d:\project\mcclinti\project1.fm2
Worksheet	"V" Street - Basin # 4
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.015	
Channel Slope	0.020000	ft/ft
Left Side Slope	50.000000	H : V
Right Side Slope	50.000000	H : V
Discharge	8.90	cfs

Results		
Depth	0.23	ft
Flow Area	2.68	ft^2
Wetted Perimeter	23.14	ft
Top Width	23.14	ft
Critical Depth	0.29	ft
Critical Slope	0.006259	ft/ft
Velocity	3.33	ft/s
Velocity Head	0.17	ft
Specific Energy	0.40	ft
Froude Number	1.72	
Flow is supercritical.		

Lower Area - 38 Units - East Half of Loop Street (Basin 5)

AREA OF SITE: 69,600 SF = 1.6 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	69,600	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	69,600	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	26,350	SF
Area c	=	0	SF
Area d	=	43,250	SF
Total Area	=	69,600	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.44	in.	Developed E	=	1.48	in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	2552	CF	Developed V360	=	8571	CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37

Historic Qp	=	2.1	CFS	Developed Qp	=	5.6	CFS

BASIN FLOWS: This basin is comprised of the front portion of each unit, driveway and associated yard, along with the street area. Flow from this basin is routed in the street to the aforementioned main pond located in the NE corner of the site. Basin flows will be routed to the pond by way of the loop street (See Worksheet - "V" Street Section - Basin #5).

"V" Street - Basin # 5
Worksheet for Triangular Channel

Project Description	
Project File	d:\project\mcclinti\project1.fm2
Worksheet	"V" Street - Basin # 5
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.015	
Channel Slope	0.033000	ft/ft
Left Side Slope	50.000000	H : V
Right Side Slope	50.000000	H : V
Discharge	5.60	cfs

Results		
Depth	0.18	ft
Flow Area	1.57	ft²
Wetted Perimeter	17.71	ft
Top Width	17.70	ft
Critical Depth	0.24	ft
Critical Slope	0.006658	ft/ft
Velocity	3.57	ft/s
Velocity Head	0.20	ft
Specific Energy	0.38	ft
Froude Number	2.12	
Flow is supercritical.		

Lower Area - Open Space Inside Loop (Basin 6)

AREA OF SITE: 51,960 SF = 1.19 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	51,960	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	51,960	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	44,950	SF
Area c	=	0	SF
Area d	=	7010	SF
Total Area	=	51,960	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E =	0.44 in.	Developed E =	0.85 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360 =	1905 CF	Developed V360 =	3661 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa =	1.29	Qpc =	2.87
Qbb =	2.03	Qpd =	4.37
Historic Qp =	1.5 CFS	Developed Qp =	2.8 CFS

BASIN FLOWS: Flow from this basin will be routed to the same main pond in the NE corner of the site. The majority of Basin #6 will be utilized as open space. Where flows have a chance to concentrate, infiltration basins will be incorporated into the flow path to help reduce the overall volume leaving the basin, but no volume reduction for the infiltration basins will be applied to the main detention pond. Basin flows will be routed to the main pond throughf a defined cobble swale (See Worksheet - "V" Outlet Swale - Basin #6) before crossing the low point of the loop street into the main pond inlet swale.

POND: Total peak flow draining to the pond is 26,040 cf from Basins 4, 5 & 6. The pond volume does not reflect simultaneous infiltration into the soil and reflects an average depth of 18" to contain the required volume. Available volume within the pond is 24,644 cf, resulting in an outflow rate of 1.0 cfs (Refer to inflow/outflow hydrograph). The release pipe will also serve as the spillway from the pond and be sized to handle the peak rate of the basins draining to it. The pond will be landscaped in order to help stabilize the infiltration area and help increase the interception and usage rate of the stored runoff.

POND OUTLET: The release pipe will be connected to a vertical standpipe set with the rim 18" above the pond bottom to provide an emergency outflow from the pond. The size of the standpipe will be based on the orifice eq., where Q = CA(2GH)^1/2. For a head of 0.5' for a maximum depth of 2' in the pond, C = 0.6, Q =17.3 cfs, solving for A = 5.0 sf. With a 50% clogging factor, a minimum 42" diameter inlet will provide the required area. The release pipe to handle the peak flow of 17.3 cfs will be a 15" pipe (See Worksheet - Outlet Pipe - Site Pond). The size of the opening in the standpipe to provide the outflow control will be based on the orifice eq. For a head of 1.0' for a working depth of 1.5' in the pond, C = 0.6, Q =1 cfs, solving for A =0.2 sf. Two 4.5" dia openings will provide the outflow control to balance the inflow/outflow with available storage and provide a way to empty the pond in less than 24 hrs. The outlet of the pipe will be directed straight into the arroyo with erosion protection as indicated on the drawings. The outlet will be placed at the existing bank of the Calabacillas Arroyo.

"V" Outlet Swale - Basin # 6
Worksheet for Triangular Channel

Project Description	
Project File	d:\project\mcclinti\project1.fm2
Worksheet	"V" Outlet Swale - Basin # 6
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.020000	ft/ft
Left Side Slope	5.000000	H : V
Right Side Slope	5.000000	H : V
Discharge	2.80	cfs

Results		
Depth	0.49	ft
Flow Area	1.21	ft^2
Wetted Perimeter	5.01	ft
Top Width	4.91	ft
Critical Depth	0.45	ft
Critical Slope	0.030016	ft/ft
Velocity	2.32	ft/s
Velocity Head	0.08	ft
Specific Energy	0.57	ft
Froude Number	0.83	
Flow is subcritical.		

Outlet Pipe - Site Pond
Worksheet for Circular Channel

Project Description	
Project File	d:\project\mcclinti\project1.fm2
Worksheet	Outlet Pipe - Site Pond @ NE Corner
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.010	
Channel Slope	0.100000	ft/ft
Diameter	15.00	in
Discharge	25.50	cfs

Results		
Depth	0.98	ft
Flow Area	1.03	ft^2
Wetted Perimeter	2.72	ft
Top Width	1.03	ft
Critical Depth	1.25	ft
Percent Full	78.61	
Critical Slope	0.089382	ft/ft
Velocity	24.64	ft/s
Velocity Head	9.44	ft
Specific Energy	10.42	ft
Froude Number	4.32	
Maximum Discharge	28.56	cfs
Full Flow Capacity	26.55	cfs
Full Flow Slope	0.092215	ft/ft
Flow is supercritical.		

Rear Yard Catchment Basins - Units 1 - 4

AREA OF SITE: 46,747 SF = 1.07 Ac.

HISTORIC FLOWS:				DEVELOPED FLOWS:				EXCESS PRECIPITATION:		
On-Site Historic Land Condition				On-Site Developed Land Condition				Precip. Zone		1
Area a	=	46,747	SF	Area a	=	0	SF	Ea	=	0.44
Area b	=	0	SF	Area b	=	32,427	SF	Eb	=	0.67
Area c	=	0	SF	Area c	=	0	SF	Ec	=	0.99
Area d	=	0	SF	Area d	=	14,320	SF	Ed	=	1.97
Total Area	=	46,747	SF	Total Area	=	46,747	SF			

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E =	0.44 in.	Developed E =	1.07 in.

On-Site Volume of Runoff: $V360 = \frac{E^*A}{12}$

Historic V360 =	1714 CF	Developed V360 =	4161 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37
Historic Qp	=	1.4 CFS	Developed Qp	=	2.9 CFS

REAR YARD FLOWS: This drainage area is comprised of the rear 2/3's roof portion of each unit, walks, associated side and rear yards. Runoff from a contributing area is routed through roof drains or across the surface to the infiltration/catchment basin located along the rear portion between each unit. Each basin has an overflow path to the next lower basin in the series, with a 6" dia PVC release pipe draining to the street from the lowest basin, situated between Units 3 & 4. A total storage volume of 4591 cf for all of the basins acting in series will handle the volume flows for the area, which generates 4161 cf of runoff.

Rear Yard Catchment Basins -South Side of Unit 12

AREA OF SITE: 13,350 SF = 0.31 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	13,350	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	13,350	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	11,956	SF
Area c	=	0	SF
Area d	=	1,394	SF
Total Area	=	13,350	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

Weighted E = $\frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$

Historic E	=	0.44 in.	Developed E	=	0.81 in.

On-Site Volume of Runoff: V360 = $\frac{E*A}{12}$

Historic V360	=	490 CF	Developed V360	=	896 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37
Historic Qp	=	0.4 CFS	Developed Qp	=	0.7 CFS

REAR YARD FLOWS: The catchment basin on the south side of Unit 12 will pick up the flows from one half of the roof and associated open space. The total volume of1075 cf for the basin will handle the volume flows for the area which generates 896 cf of runoff.

Rear Yard Catchment Basins - Units 7 - 12

AREA OF SITE: 43,230 SF = 0.99 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	43,230	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	43,230	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	25,354	SF
Area c	=	0	SF
Area d	=	17,876	SF
Total Area	=	43,230	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.44 in.	Developed E	=	1.21 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	1585 CF	Developed V360	=	4350 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37
Historic Qp	=	1.3 CFS	Developed Qp	=	3.0 CFS

REAR YARD FLOWS: This drainage area is comprised of the rear 2/3's roof portion of each unit, walks, associated side and rear yards. Flow from a contributing area is routed through roof drains or across the surface to the infiltration/catchment basin located along the rear portion between each unit. Each basin has an overflow path to the next lower basin in the series, with a release pipe draining to the street from the lowest basin, situated at the rear of Unit 7. The total volume of 7938 cf for all of the basins acting in series will handle the peak volume for the area which generates 4350 cf of runoff.

Rear Yard Catchment Basins - Units 13 - 17

AREA OF SITE: 40,500 SF = 0.93 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	40,500	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	40,500	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	26,040	SF
Area c	=	0	SF
Area d	=	14,460	SF
Total Area	=	40,500	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.44 in.	Developed E	=	1.13 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	1485 CF	Developed V360	=	3828 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37
Historic Qp	=	1.2 CFS	Developed Qp	=	2.7 CFS

REAR YARD FLOWS: This drainage area is comprised of the rear 2/3's roof portion of each unit, walks, associated side and rear yards. Flow from a contributing area is routed through roof drains or across the surface to the infiltration/catchment basins located along the rear portion between each unit. Each basin has an overflow path to the next lower basin in the series with an overflow from the lowest basin situated at the rear of Unit 16, draining to the detention pond at the SE corner of the lower development. The rear yard basins common to Units 16 and 17 also overflows into the same detention pond area. The total volume of 3090 cf for all of the basins acting in series, plus additional storage in the larger detention pond amounting to an increase in storage depth of approximately 0.1', will handle the peak volumes for the respective area which generates 3828 cf of runoff.

Rear Yard Catchment Basins - Units 17 - 21

AREA OF SITE: 26,500 SF = 0.61 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	26,500	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	26,500	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	12,000	SF
Area c	=	0	SF
Area d	=	14,500	SF
Total Area	=	26,500	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E =	0.44 in.	Developed E =	1.38 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360 =	972 CF	Developed V360 =	3050 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37

Historic Qp =	0.8 CFS	Developed Qp =	2.0 CFS

REAR YARD FLOWS: This drainage area is comprised of the rear 2/3's roof portion of each unit, walks, associated side and rear yards. Flow from a contributing area is routed through roof drains or across the surface to the infiltration/catchment basin located along the rear portion between each unit. Each basin has an overflow path to the next lower basin in the series with an overflow from the lowest basin situated at the rear of Unit 21, draining to the main detention pond at the NE corner of the lower development. The total volume of 2932 cf for all of the basins acting in series will handle the peak volume for the respective area which generates 3050 cf of runoff. The numerical differences shown are insignificent and can be readily absorbed by the larger detention pond at the outfall point.

Rear Yard Catchment Basins - Units 22 - 29

AREA OF SITE: 59,045 SF = 1.36 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	59,045	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	59,045	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	32,655	SF
Area c	=	0	SF
Area d	=	26,390	SF
Total Area	=	59,045	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.44 in.	Developed E	=	1.25 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	2165 CF	Developed V360	=	6156 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37
Historic Qp	=	1.7 CFS	Developed Qp	=	4.2 CFS

REAR YARD FLOWS: This drainage area is comprised of the rear 2/3's roof portion of each unit, walks, associated side and rear yards. Flow from a contributing area is routed through roof drains or across the surface to the infiltration/catchment basin located along the rear portion between each unit. Each basin has an overflow path to the next lower basin in the series with an overflow from the lowest basin situated at the rear of Unit 22, draining to the main detention pond at the NE corner of the lower development. The total volume of 9373 cf for all of the basins acting in series will handle the peak volume for the respective area which generates 6156 cf of runoff.

Rear Yard Catchment Basins - Units 29 - 37

AREA OF SITE: 72,700 SF = 1.67 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	72,700	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	72,700	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	44,340	SF
Area c	=	0	SF
Area d	=	28,360	SF
Total Area	=	72,700	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E =	0.44 in.	Developed E =	1.18 in.

On-Site Volume of Runoff: $V360 = \frac{E^*A}{12}$

Historic V360 =	2666 CF	Developed V360 =	7131 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa =	1.29	Qpc =	2.87
Qbb =	2.03	Qpd =	4.37
Historic Qp =	2.2 CFS	Developed Qp =	4.9 CFS

REAR YARD FLOWS: This drainage are is comprised of the rear 2/3's roof portion of each unit, walks, associated side and rear yards. Flow from a contributing area is routed through roof drains or across the surface to the infiltration/catchment basin located along the rear portion between each unit. Each basin has an overflow path to the next lower basin in the series. An overflow path continues along the rear to the lowest basin at Uint 29, with an ultimate flow path available along the rear of Units 28 to 22. The total volume of13,650 cf for all of the basins acting in series will handle the peak volumes for the respective area which generates 7131 cf of runoff.

Rear Yard Catchment Basins - Typical of Units 38 - 50

AREA OF SITE: 232,460 SF = 5.34 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	5,300	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	5,300	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	2,575	SF
Area c	=	0	SF
Area d	=	2,725	SF
Total Area	=	5,300	SF

EXCESS PRECIPITATION:

Precip. Zone 1

Ea	=	0.44
Eb	=	0.67
Ec	=	0.99
Ed	=	1.97

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E =	0.44 in.	Developed E =	1.34 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360 =	194 CF	Developed V360 =	591 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 1

Qpa	=	1.29	Qpc	=	2.87
Qbb	=	2.03	Qpd	=	4.37

Historic Qp =	0.2 CFS	Developed Qp =	0.4 CFS

REAR YARD FLOWS: Units in this basin drain the rear 2/3's roof portion of each unit, walks, associated side and rear yards to common rear catchment basins with an average storage capacity of 732 cf spread amoung all the available basins. An average volume of 591 cf drains to each basin Each basin has an overflow path to the common open space, which in turn, drains to the main detention pond in the NE corner of the site.

Rear Yard Catchment Basins Data

Lot Location	Top Elev.	Bottom Elev.	Volume	Pipe / Flow	Invert
1	32.0	30.5	1720	Surface Flow	
1 - 2	31.0	29.5	400	Surface Flow	
2 - 3	31.0	29.5	554	Surface Flow	
3 - 4	31.0	29.5	1427	Pipe Outlet	31.0
4	31.0	29.5	490	Surface Flow	
5	31.0	29.5	1650	Surface Flow	
5 - 6	30.0	28.5	1808	Surface Flow	
7	28.5	27.0	2016	Pipe Outlet	30.0
7 - 8	28.5	27.0	1173	Surface Flow	
8 - 9	28.5	27.0	864	Surface Flow	
9 - 10	29.5	28.0	1822	Surface Flow	
10 - 11	29.5	28.0	514	Surface Flow	
11 - 12	30.5	29.0	1549	Surface Flow	
12	28.5	27.0	1075	Surface Flow	
13	87.0	85.5	160	Surface Flow	
13 - 14	84.0	82.5	326	Surface Flow	
14 - 15	83.0	81.5	840	Surface Flow	
15 - 16	80.0	78.5	884	Surface Flow	
16 - 17	79.0	77.5	880	Surface Flow	
17 - 18	78.0	76.5	1097	Surface Flow	
18 - 19	75.0	73.5	375	Surface Flow	
19 - 20	73.0	71.5	630	Surface Flow	
20 - 21	72.0	70.5	830	Surface Flow	
37	90.0	88.5	395	Surface Flow	
37 - 36	89.0	87.5	861	Surface Flow	
36 - 35	88.0	86.5	1071	Surface Flow	
35 - 34	87.0	85.5	1597	Surface Flow	
34 - 33	85.0	83.5	592	Surface Flow	
33 - 32	84.0	82.5	662	Surface Flow	
32 - 31	83.0	81.5	475	Surface Flow	
31 - 30	82.0	80.5	2621	Surface Flow	
30 - 29	79.0	77.5	5376	Surface Flow	

29 - 28	79.0	77.5	2172	Surface Flow	
28 - 27	78.0	76.5	698	Surface Flow	
27 - 26	77.0	75.5	1106	Surface Flow	
26 - 25	76.0	74.5	896	Surface Flow	
25 - 24	73.0	71.5	694	Surface Flow	
24 - 23	72.0	70.5	1231	Surface Flow	
23 - 22	70.0	68.5	2576	Surface Flow	
50 - 38	87.0	85.5	2484	Surface Flow	
38 - 39	85.0	83.5	742	Surface Flow	
39 - 40	77.0	75.5	580	Surface Flow	
40 - 41	74.0	72.5	257	Surface Flow	
41 - 42	73.0	71.5	281	Surface Flow	
50 - 49	89.0	87.5	518	Surface Flow	
49 - 48	85.0	83.5	497	Surface Flow	
48 - 47	84.0	82.5	726	Surface Flow	
47 - 46	78.0	76.5	1219	Surface Flow	
46 - 45	77.0	75.5	433	Surface Flow	
45 - 44	76.0	74.5	426	Surface Flow	
44 - 43	75.0	73.5	625	Surface Flow	