# DRAINAGE REPORT
# FOR
# VENTANA RANCH SUBDIVISION
# TRACT 15

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## MARCH 27, 2000

**PREPARED FOR:**

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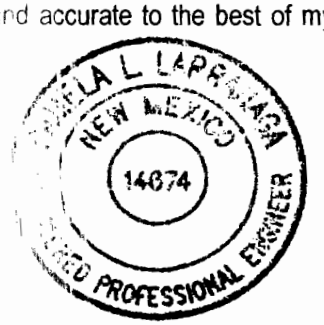
I hereby certify that I am a registered professional engineer licensed to practice in the State of New Mexico, that this report was prepared by me or under my supervision and is true and accurate to the best of my knowledge and belief.

Pamela Larrañaga 3/27/00

Pamela Larrañaga, P.E. # 14674 Date

4/20/00



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### PLATES

## I. INTRODUCTION AND PURPOSE

The purpose of this report is to present the drainage management plan for Tract 15 of the Ventana Ranch Subdivision for preliminary plat and grading plan approval by the Development Review Board (DRB). The proposed development of Tract 15 consists of 183 single family detached residential lots on approximately 33.2 acres. Please refer to the location map included as Figure 1 following the text.

## II. METHODOLOGIES AND REFERENCES

The Drainage Ordinance and the Development Process Manual (DPM) are utilized to develop this plan. The modified rational method contained within the July 1997 edition of the Development Process Manual (DPM) is utilized to determine the hydrologic discharges and volumes generated by this development. Hydraulic analysis of the typical street sections is performed utilizing Manning's Equation for proposed street slopes. This analysis identifies the street flow capacities allowed within the typical street sections, and in proposed storm sewer inlets required to intercept street flow from the surface.

Existing approved drainage reports referenced in the preparation of this plan include the "Las Ventanas Subdivision Drainage Master Plan" (LVDMP) prepared by Bohannan Huston (originally dated April 1995 and updated October 1995). This report identifies downstream drainage improvements, including the AMAFCA Las Ventanas Drainage Facility #1, which was completed by AMAFCA in 1999, to which developed flows from this tract will drain. See Appendix A for excerpts from this report.

The "Addendum # 3 for the Design Analysis Report for Ventana Ranch Subdivision Drainage Facilities" (Addendum # 3) prepared by Bohannan Huston (submitted March 1999) is referenced herein to provide an analysis of the West Branch Calabacillas Diversion Storm Sewer. This proposed storm sewer diverts to the Las Ventanas Dam the vast majority of developed flows from that portion of Ventana Ranch that previously drained directly to the West Branch of the Calabacillas Arroyo.

Also referenced herein are three drainage reports for adjoining approved subdivisions, including "Drainage Report-Ventana Ranch Subdivision Tract 22" (dated March 1999), the "Drainage Study – Tracts 16 & 17A, Ventana Ranch Subdivision" (dated September 1998), the "Drainage Report – Ventana Ranch Subdivision, Tracts 28A, 28B & 25B" (dated March 1999), all of which were prepared by Bohannan Huston. See Appendix A for excerpts from these reports.

## III. SUMMARY OF RELATED PLATTING / SITE DEVELOPMENT PLAN ACTIONS

A copy of the preliminary plat is included as Plate 5. The preliminary plat will be submitted concurrently with this drainage report for review and approval by the Development Review Board. The construction plans for the public infrastructure, which will be reviewed by the Design Review Committee, are currently being developed.

## IV. SITE LOCATION AND CHARACTERISTICS

Ventana Ranch is a 940-acre development located west of Paradise Hills between Paseo del Norte and Irving Boulevards. Tract 15 is located near the northwest central area of the Ventana Ranch Master Plan. The tract is bound by Las Ventanas Road to the north and west, Rainbow Boulevard to the east and existing West Pointe Unit II Subdivision (Tract 16 & 17), Ventana Ranch, to the south. The site will be accessible from two new subdivision entrances off of Las Ventanas Road, as well as the extensions of two existing streets within the existing West Pointe Subdivision.

In its existing condition, the site consists of undulating terrain with slopes from 14% to less than 1%. Existing drainage patterns direct runoff to the northeast across Irving Boulevard to the West Branch of the Calabacillas Arroyo. The site was previously grading by AMAFCA as a borrow site for material needed to construct the Las Ventanas Dam (Las Ventanas Drainage Facility #1).

## V. EXISTING HYDRAULIC AND HYDROLOGIC CONDITIONS

The existing conditions map from the "Las Ventanas Drainage Master Plan" (Plate 2) shows that the tract lies primarily within existing Basins 503 and 504, which drain north toward Irving Boulevard and ultimately to the West Branch of Calabacillas Arroyo. The West Branch is located approximately one-half mile northeast of the site.

Developed runoff from the site will be intercepted and conveyed by the West Branch Calabacillas Diversion Storm Sewer. This storm sewer was analyzed within Addendum # 3 (see excerpts in Appendix A). Portions of this storm sewer have been completed in conjunction with the development of Country Meadows Subdivision (Tract 28A) and Terrazas Subdivision (Tract 22A). Please see Appendix A for excerpts highlighting the specific reaches of this storm sewer that have been completed.

Existing drainage facilities adjacent to and downstream of this tract include the Las Ventanas Detention Dam, which was completed by AMAFCA in 1999, and the Las Ventanas Dam Outfall Storm Sewer, which was completed by AMAFCA in 1998.

## VI. PROPOSED HYDRAULIC AND HYDROLOGIC CONDITIONS

The vast majority of this development will be graded to convey runoff toward the east. Tract 15 will be graded according to the grading plans in Plate 1. Runoff will be collected by and diverted to the proposed Las Ventanas Detention Dam by the West Branch Calabacillas Arroyo Storm Sewer. The storm drain system, including all drainage subbasins and flow rates, is shown on Plate 3, the Drainage Plan for the subdivision.

The "Addendum # 2 for the Design Analysis Report for Ventana Ranch Subdivision Drainage Facilities", (Addendum #2) dated December 2, 1997 originally proposed a large diameter storm sewer in lieu of a channel for the Calabacillas Arroyo West Branch Diversion. The Addendum # 3 reanalyzes that storm sewer system and adjusts the drainage basins discharging to

it. The alignment of this large storm sewer follows the alignment of Ventana Hills Road through Tracts 28A and 25B and into the Las Ventanas Detention Dam. Portions have been completed in conjunction with the development of Country Meadows Subdivision (Tract 28A) and Terrazas Subdivision (Tract 22A). Construction of the remainder of this storm sewer will coincide with development of Tracts 24 and 28B. Addendum # 3 identified 36" and 48" storm sewer extensions through Tract 22A and across Rainbow Boulevard to provide a drainage outfall for Tract [redacted] 15, Ventana Ranch.

Discharge generated by Tract 15 will be collected by and flow through the internal streets when fully developed. As shown on the Drainage Plan (Plate 3), this discharge will then be collected by storm drain inlets and conveyed through the proposed storm sewer system, which discharges to the existing storm sewers within Rainbow Boulevard. This storm sewer system then conveys flow through Terrazas Subdivision (Tract 22A), crosses Las Ventanas Road through the proposed street north of Deerbourne in Tract 24 and then ultimately will connect to the West Branch Calabacillas Diversion Storm Sewer. The West Branch Calabacillas Diversion Storm Sewer will then convey this flow to the Las Ventanas Detention Dam. This storm drain in Ventana Hills Road will convey developed runoff from Tracts 23, 24, 25, 26, and 28 to the Las Ventanas Dam as identified and analyzed with Addendum # 3. It will also carry the flow from the future Las Ventanas Road storm drain, which will provide a drainage outfall for Tracts 12, 13, 14, 15 and portions of Rainbow Boulevard. Preliminary design of the Ventana Hills Road storm drain, which was based on projected developed flows from these areas, is provided in the Addendum # 3 (see excerpts in Appendix A). The storm drain analysis herein assumes that all developed flow from the contributing areas is collected into the storm drain

Las Ventanas Road and the associated storm drain (designed and built by Las Ventanas) intercepts all potential offsite runoff. Therefore, no consideration for conveyance of offsite runoff is necessary.

In the interim, until the outfall storm sewer is completed across Tract 24, 25B, and 28A, the storm sewer will discharge east of Las Ventanas Road into a temporary retention pond which was identified with the drainage report for Terrazas Subdivision (Tract 22). The volume of the

existing pond will be increased to accommodate the developed flows from Tract 15. This temporary pond is sized to contain the 100-year, 10-day volume generated by all upstream basins that discharge to it. A 6" outlet pipe is proposed to allow the pond to drain within a few days along its historic flow path. Details of the interim pond are included as Plate 4 of this report. Discharge to the pond will be via temporary earth channel constructed with the development of Terrazas Subdivision. The owner will maintain these temporary facilities. The Bulk Land Plat for Tracts 25B-1, 28A, 28B, & X-1-A-1, Ventana Ranch (DOC 99-C-109) includes a note (note 8) that grants the right to provide temporary improvements on site with regard to ponding. An agreement and covenant between the City of Albuquerque and Las Ventanas Limited Partnership impacting this area with regard to earthen channels has also been filed with Bernalillo County. See Appendix A for excerpts.

## VII. CONCLUSION

The LVDMP governs the development of Tract 15 of the Ventana Ranch Subdivision. The "Las Ventanas Subdivision Interim Drainage Facilities Plan" (originally dated October 1995) provides further guidance about interim facilities and phasing of subdivision development. This includes the construction of the downstream storm sewer system such as the Las Ventanas Dam and the outfall storm sewer from the dam to the West Branch of the Calabacillas Arroyo. Addenda #2 and #3 identify and analyze the major storm sewer system that carries runoff from and through this tract to the Las Ventanas Dam. Addendum # 3 provides design criteria and hydraulic analysis of the West Branch Diversion System.

Increases in runoff, depth and velocity due to proposed development are within parameters anticipated within the previously approved Master Drainage Plan for this area. These flows can be safely conveyed by the improvements proposed in this drainage plan to drainage facilities existing, planned, or currently under construction, which have adequate capacity to accept such runoff. Erosion and dust control, consisting of erosion control berms, snow fencing and sedimentation basins, are proposed to prevent soil washing or blowing into paved streets, storm sewers, and existing development areas.

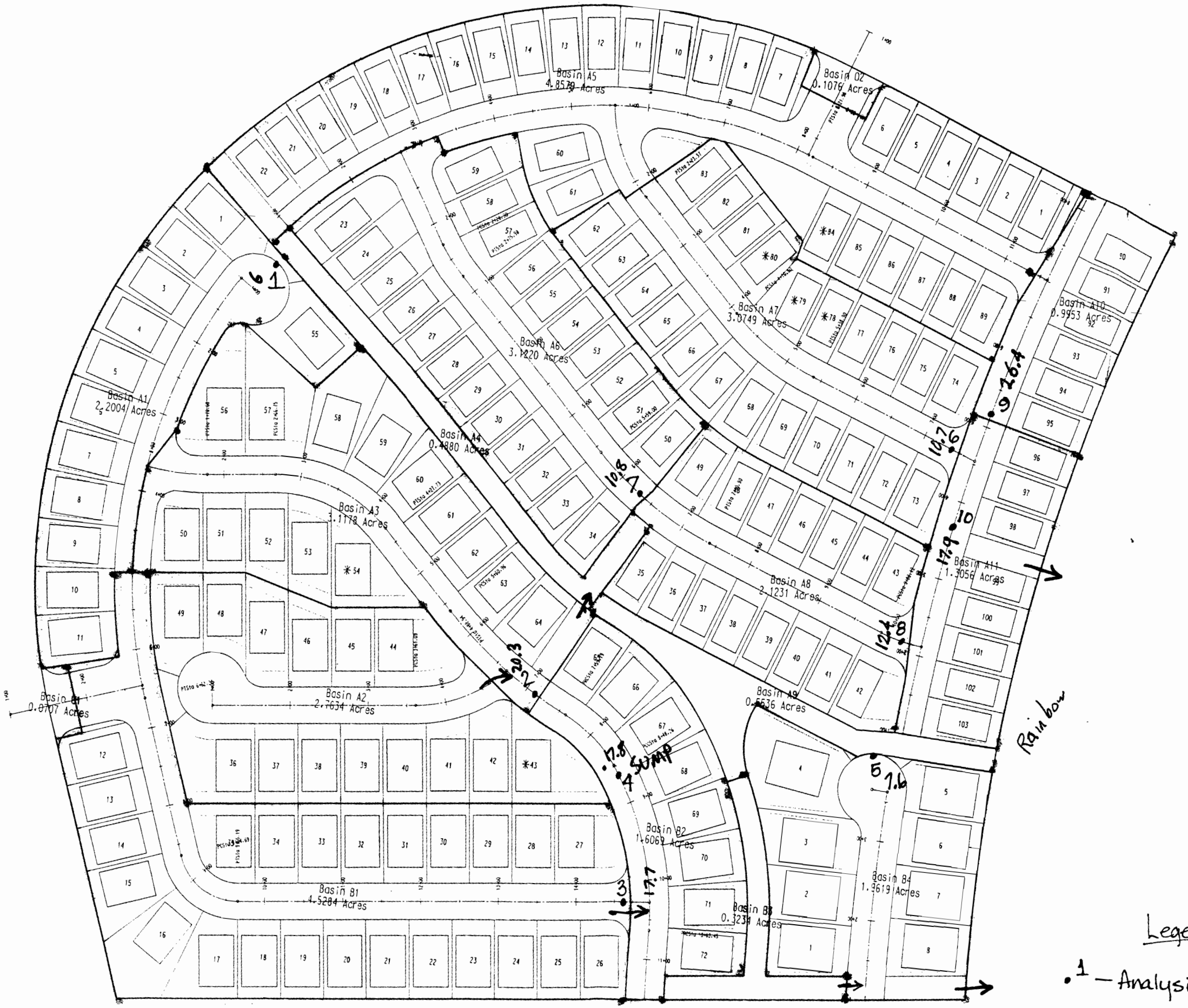
## TRACT 15 @ VENTANA RANCH

| BASIN I.D. | AREA (AC) | UNITS # | % LAND TREATMENT A | B | C | D | RUNOFF (AC-FT) 10 YR | 100 YR | DISCHARGE (CFS) 10 YR | 100YR |
|---|---|---|---|---|---|---|---|---|---|---|
| **HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (EXISTING)** | | | | | | | | | | |
| T15 | 33.19 | | 98.0% | 0.0% | 2.0% | 0.0% | 2.25 | 3.97 | 9.1 | 43.2 |
| **HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (DEVELOPED)** | | | | | | | | | | |
| A1 | 1.74 | 12 | 0.0% | 23.4% | 23.4% | 53.2% | 0.12 | 0.21 | 3.6 | 6.1 |
| A2 | 2.76 | 14 | 0.0% | 23.4% | 23.4% | 53.2% | 0.19 | 0.33 | 5.7 | 9.6 |
| A3 | 3.08 | 14 | 0.0% | 23.4% | 23.4% | 53.2% | 0.21 | 0.37 | 6.3 | 10.7 |
| A4 | 0.49 | 0 | 0.0% | 36.7% | 36.7% | 26.7% | 0.02 | 0.05 | 0.8 | 1.4 |
| A5 | 4.86 | 30 | 0.0% | 23.4% | 23.4% | 53.2% | 0.33 | 0.58 | 10.0 | 16.9 |
| A6 | 3.12 | 22 | 0.0% | 23.4% | 23.4% | 53.2% | 0.21 | 0.37 | 6.4 | 10.8 |
| A7 | 3.07 | 22 | 0.0% | 23.4% | 23.4% | 53.2% | 0.21 | 0.37 | 6.3 | 10.7 |
| A8 | 2.12 | 15 | 0.0% | 23.4% | 23.4% | 53.2% | 0.14 | 0.25 | 4.4 | 7.4 |
| A9 | 0.55 | 0 | 0.0% | 36.7% | 36.7% | 26.7% | 0.03 | 0.05 | 0.9 | 1.6 |
| A10 | 1.00 | 9 | 0.0% | 23.4% | 23.4% | 53.2% | 0.07 | 0.12 | 2.0 | 3.5 |
| A11 | 1.31 | 5 | 0.0% | 23.4% | 23.4% | 53.2% | 0.09 | 0.16 | 2.7 | 4.5 |
| SUBTOTAL | 24.11 | 143 | | | | | | | 49.1 | 83.1 |
| B1 | 5.10 | 24 | 0.0% | 23.4% | 23.4% | 53.2% | 0.35 | 0.61 | 10.5 | 17.7 |
| B2 | 1.61 | 8 | 0.0% | 23.4% | 23.4% | 53.2% | 0.11 | 0.19 | 3.3 | 5.6 |
| B3 | 0.32 | 0 | 0.0% | 36.7% | 36.7% | 26.7% | 0.02 | 0.03 | 0.5 | 1.0 |
| B4 | 1.90 | 8 | 0.0% | 23.4% | 23.4% | 53.2% | 0.13 | 0.23 | 3.9 | 6.6 |
| SUBTOTAL | 8.93 | 40 | | | | | | | 18.2 | 30.8 |
| O1 | 0.07 | 0 | 0.0% | 23.4% | 23.4% | 53.2% | 0.00 | 0.01 | 0.1 | 0.2 |
| O2 | 0.11 | 0 | 0.0% | 23.4% | 23.4% | 53.2% | 0.01 | 0.01 | 0.2 | 0.4 |
| O3 | 0.06 | 0 | 0.0% | 23.4% | 23.4% | 53.2% | 0.00 | 0.01 | 0.1 | 0.2 |
| SUBTOTAL | 0.24 | 0 | | | | | | | 0.5 | 0.8 |
| TOTAL | 33.27 | 183 | | | | | 2.23 | 3.94 | 67.7 | 114.5 |

NOTES: 2) Impervious percentages were calculated from the DPM equation A-4. The remaining percentages were distributed evenly between land treatment types B and C, except for Basin A4, A9, and B3 which calculated type D from a cross-section and the rest was distributed evenly between land treatments types B and C.

N=UNITS/ACRES = 5.5

%D= 7*SQRT((N*N)+(5*N)) = 53.2 %


Basin A5
4.8539 Acres
Basin A6
3.1220 Acres
Basin A7
3.0749 Acres
Basin A8
2.1231 Acres
Basin A9
0.6636 Acres
Basin A10
0.9953 Acres
Basin A11
1.3056 Acres
Basin A1
2.2004 Acres
Basin A2
2.7634 Acres
Basin A3
1.1178 Acres
Basin A4
0.4880 Acres
Basin B1
4.5284 Acres
Basin B2
1.6069 Acres
Basin B3
0.3234 Acres
Basin B4
1.9619 Acres
Basin B5
0.8707 Acres
SUMP
Rainbow
Legend
• 1 — Analysis Point Number

Street Flow Analysis

**TRACT 15 @ VENTANA RANCH**

| ANALYSIS POINT | CONTRIBUTING BASINS | FLOW (CFS) 10 YEAR | FLOW (CFS) 100 YEAR | STREET NAME | WIDTH (feet) | SLOPE (%) | DEPTH of FLOW | ENGERGY HEAD |
|---|---|---|---|---|---|---|---|---|
| 1 | A1 | 3.59 | 6.05 | LONGMONT PL. | 28 | 1.20 | 0.33 | 0.42 |
| 2 | A2 & A3 | 12.02 | 20.26 | MARIN DR. | 28 | 2.80 | 0.38 | 0.68 |
| 3 | B1 | 8.60 | 17.68 | SILVERTHORNE RD. | 28 | 2.50 | 0.36 | 0.59 |
| 4 | B2 & bypass flows from Analysis Points 2 & 3 | 8.41 | 17.81 | MARIN DR. | 32 | 5.00 | 0.33 | 0.68 |
| 5 | B3 & B4 | 4.43 | 7.56 | WICKENBURG ST. | 32 | 0.60 | 0.35 | 0.41 |
| 6 | A7 | 6.33 | 10.67 | QUARTZITE AVE. | 28 | 0.80 | 0.38 | 0.46 |
| 7 | A6 | 6.43 | 10.83 | TOLLESON AVE. | 28 | 1.00 | 0.37 | 0.47 |
| 8 | A4, A8 & bypass flows from Analysis Point 7 | 6.87 | 12.38 | TOLLESON AVE. | 28 | 1.00 | 0.38 | 0.49 |
| 9 | A1, A5, & A10 | 15.64 | 26.36 | FLAGSTAFF DR. | 28 | 0.60 | 0.54 | 0.69 |
| 10 | A9, A11 & bypass flows from Analysis Points 6, 8 & 9 | 8.65 | 17.85 | FLAGSTAFF DR. | 28 | 0.60 | 0.47 | 0.58 |

1. See attached street section hydraulic analysis

C-2

ANALYSIS OF AN INLET IN A SUMP CONDITION - **Pt 1 at lowpoint at Longmont Pl. cul-de-sac**

INLET TYPE: Single Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: Q=C*L*H^1.5

| Wing opening | Grate opeining | ORIFICE: Q=C*A*(2*G*H)**0.5 Grate opening | Wing opening |
|---|---|---|---|
| C= 3.0 | C=3.0 | C=0.6 | C=0.6 |
| L= 4.0 ft | L(single grate)=[(2.67')+2(1.8')]=6.27 ft | A(single grate)=4.09 sf | A=2.0 sf |
| Q=3.0(4.0')H**1.5= 12.0H**1.5 | Q=3.0(6.27)H^1.5=18.81*H^1.5 | Q=2.46*(64.4*H)^0.5 | Q=1.2*(64.4*H)^0.5 |

| | WS ELEVATION | HEIGHT ABOVE INLET | Q (CFS) WEIR WING OPENING | Q (CFS) WEIR SINGLE GRATE | Q (CFS) ORIFICE SINGLE GRATE | TOTAL Q (CFS) | COMMENTS: |
|---|---|---|---|---|---|---|---|
| ~FL @ INLET | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Flow at single "A" inlet w/ two wing openings |
| | 0.10 | 0.10 | 0.38 | 0.59 | 6.24 | 1.35 | Weir controls on grate analysis |
| | 0.20 | 0.20 | 1.07 | 1.68 | 8.82 | 3.83 | |
| | 0.30 | 0.30 | 1.97 | 3.09 | 10.80 | 7.03 | Q(100 yr) = 6.05 cfs is provided at this depth |
| | 0.40 | 0.40 | 3.04 | 4.76 | 12.47 | 10.83 | |
| | 0.50 | 0.50 | 4.24 | 6.65 | 13.94 | 15.14 | Q(2x100 yr) = 12.10 cfs is provided at this depth |
| | 0.60 | 0.60 | 5.58 | 8.74 | 15.27 orif | 19.90 | orifiz controls |
| TOP OF CURB | 0.70 | 0.70 | 7.03 | 11.02 | 16.50 | 25.07 | |
| | 0.80 | 0.80 | 8.59 | 13.46 | 17.64 | 30.63 | |
| | 0.90 | 0.90 | 10.25 | 16.06 | 18.71 | 36.55 | |
| ROW LIMIT | 1.00 | 1.00 | 12.00 | 18.81 | 19.72 | 42.81 | |

NOTE: The total runoff intercepted by the inlet at the low point in the road is:

Q(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].

THE 100 YR STORM EVENT = 6.05 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 12.10 CFS at the sump condition

Check Pipe Capacity (Orifice): (See sheet C-13 thru C-15 for Pipe Orifice Analysis)

**STORM DRAIN HYDROLOGIC VOLUMETRIC & DISCHARGE DATA**

**MARIN DRIVE - Double GRATE ON EACH SIDE w/TWO INLETS ON LEFT SIDE**

**HYDRAULIC EVALUATION OF INLETS - HEC12 METHOD**
**100-YEAR STORM - STREET FLOWS W/ 20% CLOGGING FACTOR**
**15% REDUCTION IN ROUTED Q'S FOR ATTENUATION**

Qi = Intercepted Flow
Qb = Bypass Flow
S = Longitudinal Slope
Sx = Cross Slope
Vo = Gutter Velocity where splash-over first occurs

Eo = Ratio of frontal flow to total gutter flow
Rf = Ratio of frontal flow intercepted to total frontal flow
Rs = Ratio of side flow intercepted to total side flow
E = Efficiency

| Inlet ID | Total Rtd Q (cfs) | Inlet Width (ft) | Inlet Length (ft) | Ponding Width (ft) | Pond Depth (ft) | Qi (cfs) | Qb (cfs) | S (ft/ft) | Sx (ft/ft) | Vo (fps) | V (fps) | Eo | Rf | Rs | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANALYSIS POINT 2 (LT)** | | | | | | | | | | | | | | | |
| 1 | 10.13 | 1.54 | 5.32 | 18.93 | 0.38 | 6.01 | 4.12 | 0.0060 | 0.0200 | 9.5 | 2.8 | 0.20 | 1.0 | 0.5 | 0.59 |
| 2 | 4.12 | 1.54 | 5.32 | 13.52 | 0.27 | 2.90 | 1.22 | 0.0060 | 0.0200 | 9.5 | 2.3 | 0.28 | 1.0 | 0.6 | 0.70 |
| | | *Section Total Intercepted Flow:* | | | | *8.91* | | | | | | | | | |
| | | ***Total Intercepted Flow:*** | | | | *8.91* | | | | | | | | | |
| **ANALYSIS POINT 2 (RT)** | | | | | | | | | | | | | | | |
| 1 | 10.13 | 1.54 | 5.32 | 18.93 | 0.38 | 6.01 | 4.12 | 0.0060 | 0.0200 | 9.5 | 2.8 | 0.20 | 1.0 | 0.5 | 0.59 |
| | | *Section Total Intercepted Flow:* | | | | *6.01* | | | | | | | | | |
| | | ***Total Intercepted Flow:*** | | | | *6.01* | | | | | | | | | |
| | | ***Total Bypass Flow to Analysis Point 4:*** | | | | | *5.35* | | | | | | | | |

C-4

**STORM DRAIN HYDROLOGIC VOLUMETRIC & DISCHARGE DATA**

**SILVERTHORNE ROAD - Double GRATE ON EACH SIDE**

**HYDRAULIC EVALUATION OF INLETS - HEC12 METHOD**
**100-YEAR STORM - STREET FLOWS W/ 20% CLOGGING FACTOR**
**15% REDUCTION IN ROUTED Q'S FOR ATTENUATION**

Qi = Intercepted Flow
Qb = Bypass Flow
S = Longitudinal Slope
Sx = Cross Slope
Vo = Gutter Velocity where splash-over first occurs

Eo = Ratio of frontal flow to total gutter flow
Rf = Ratio of frontal flow intercepted to total frontal flow
Rs = Ratio of side flow intercepted to total side flow
E = Efficiency

| Inlet ID | Total Rtd Q (cfs) | Inlet Width (ft) | Inlet Length (ft) | Ponding Width (ft) | Pond Depth (ft) | Qi (cfs) | Qb (cfs) | S (ft/ft) | Sx (ft/ft) | Vo (fps) | V (fps) | Eo | Rf | Rs | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANALYSIS POINT 3** | | | | | | | | | | | | | | | |
| 1 | 8.84 | 1.54 | 5.32 | 17.98 | 0.36 | 5.39 | 3.45 | 0.0060 | 0.0200 | 9.5 | 2.7 | 0.21 | 1.0 | 0.5 | 0.61 |
| | | *Section Total Intercepted Flow:* | | | | *5.39* | | | | | | | | | |
| | | ***Total Intercepted Flow:*** | | | | *5.39* | | | | | | | | | |
| | | ***Total Bypass Flow to Analysis Point 4:*** | | | | | *6.89* | | | | | | | | |

ANALYSIS OF AN INLET IN A SUMP CONDITION - **Pt 4 at lowpoint on left and right side of Marin Drive**

INLET TYPE: Single Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: Q=C*L*H^1.5

| Wing opening | Grate opeining | ORIFICE: Q=C*A*(2*G*H)**0.5 Grate opening | Wing opening |
|---|---|---|---|
| C= 3.0 | C=3.0 | C=0.6 | C=0.6 |
| L= 4.0 ft | L(single grate)=[(2.67')+2(1.8')]=6.27 ft | A(single grate)=4.09 sf | A=2.0 sf |
| Q=3.0(4.0')H**1.5= 12.0H**1.5 | Q=3.0(6.27)H^1.5=18.81*H^1.5 | Q=2.46*(64.4*H)^0.5 | Q=1.2*(64.4*H)^0.5 |

| | WS ELEVATION | HEIGHT ABOVE INLET | Q (CFS) WEIR WING OPENING | Q (CFS) WEIR SINGLE GRATE | Q (CFS) ORIFICE SINGLE GRATE | TOTAL Q (CFS) | COMMENTS: |
|---|---|---|---|---|---|---|---|
| ~FL @ INLET | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Flow at single "A" inlet w/ two wing openings |
| | 0.10 | 0.10 | 0.38 | 0.59 | 6.24 | 1.35 | Weir controls on grate analysis |
| | 0.20 | 0.20 | 1.07 | 1.68 | 8.82 | 3.83 | |
| | 0.30 | 0.30 | 1.97 | 3.09 | 10.80 | 7.03 | |
| | 0.40 | 0.40 | 3.04 | 4.76 | 12.47 | 10.83 | |
| | 0.50 | 0.50 | 4.24 | 6.65 | 13.94 | 15.14 | |
| | 0.60 | 0.60 | 5.58 | 8.74 | 15.27 | 19.90 | Q(100 yr) = 17.81 cfs is provided at this depth |
| TOP OF CURB | 0.70 | 0.70 | 7.03 | 11.02 | 16.50 | 25.07 | |
| | 0.80 | 0.80 | 8.59 | 13.46 | 17.64 | 30.63 | |
| | 0.90 | 0.90 | 10.25 | 16.06 | 18.71 | 36.55 | Q(2x100 yr) = 35.62 cfs is provided at this depth |
| ROW LIMIT | 1.00 | 1.00 | 12.00 | 18.81 | 19.72 | 42.81 | |

C-9

NOTE: The total runoff intercepted by the inlet at the low point in the road is:

Q(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].

THE 100 YR STORM EVENT = 17.81 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 35.62 CFS at the sump condition

Check Pipe Capacity (Orifice): (See sheet C-13 thru C-15 for Pipe Orifice Analysis)

ANALYSIS OF AN INLET IN A SUMP CONDITION - **Pt 5 at lowpoint at Wickenburg St. cul-de-sac**

INLET TYPE: Single Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: Q=C*L*H^1.5

| Wing opening | Grate opeining |
|---|---|
| C= 3.0 | C=3.0 |
| L= 4.0 ft | L(single grate)=[(2.67')+2(1.8')]=6.27 ft |
| Q=3.0(4.0')H**1.5= 12.0H**1.5 | Q=3.0(6.27)H^1.5=18.81*H^1.5 |

ORIFICE: Q=C*A*(2*G*H)**0.5

| Grate opening | Wing opening |
|---|---|
| C=0.6 | C=0.6 |
| A(single grate)=4.09 sf | A=2.0 sf |
| Q=2.46*(64.4*H)^0.5 | Q=1.2*(64.4*H)^0.5 |

| | WS ELEVATION | HEIGHT ABOVE INLET | Q (CFS) WEIR WING OPENING | Q (CFS) WEIR SINGLE GRATE | Q (CFS) ORIFICE SINGLE GRATE | TOTAL Q (CFS) | COMMENTS: |
|---|---|---|---|---|---|---|---|
| ~FL @ INLET | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Flow at single "A" inlet w/ two wing openings |
| | 0.10 | 0.10 | 0.38 | 0.59 | 6.24 | 1.35 | Weir controls on grate analysis |
| | 0.20 | 0.20 | 1.07 | 1.68 | 8.82 | 3.83 | |
| | 0.30 | 0.30 | 1.97 | 3.09 | 10.80 | 7.03 | |
| | 0.40 | 0.40 | 3.04 | 4.76 | 12.47 | 10.83 | Q(100 yr) = 7.56 cfs is provided at this depth |
| | 0.50 | 0.50 | 4.24 | 6.65 | 13.94 | 15.14 | |
| | 0.60 | 0.60 | 5.58 | 8.74 | 15.27 | 19.90 | Q(2x100 yr) = 15.13 cfs is provided at this depth |
| TOP OF CURB | 0.70 | 0.70 | 7.03 | 11.02 | 16.50 | 25.07 | |
| | 0.80 | 0.80 | 8.59 | 13.46 | 17.64 | 30.63 | |
| | 0.90 | 0.90 | 10.25 | 16.06 | 18.71 | 36.55 | |
| ROW LIMIT | 1.00 | 1.00 | 12.00 | 18.81 | 19.72 | 42.81 | |

C-7

NOTE: The total runoff intercepted by the inlet at the low point in the road is:

Q(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].

THE 100 YR STORM EVENT = 7.56 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 15.13 CFS at the sump condition

Check Pipe Capacity (Orifice): (See sheet C-13 thru C-15 for Pipe Orifice Analysis)

**STORM DRAIN HYDROLOGIC VOLUMETRIC & DISCHARGE DATA**

**QUARTZITE AVE. - Double GRATE ON EACH SIDE**

**HYDRAULIC EVALUATION OF INLETS - HEC12 METHOD**
**100-YEAR STORM - STREET FLOWS W/ 20% CLOGGING FACTOR**
**15% REDUCTION IN ROUTED Q'S FOR ATTENUATION**

Qi = Intercepted Flow
Qb = Bypass Flow
S = Longitudinal Slope
Sx = Cross Slope
Vo = Gutter Velocity where splash-over first occurs

Eo = Ratio of frontal flow to total gutter flow
Rf = Ratio of frontal flow intercepted to total frontal flow
Rs = Ratio of side flow intercepted to total side flow
E = Efficiency

| Inlet ID | Total Rtd Q (cfs) | Inlet Width (ft) | Inlet Length (ft) | Ponding Width (ft) | Pond Depth (ft) | Qi (cfs) | Qb (cfs) | S (ft/ft) | Sx (ft/ft) | Vo (fps) | V (fps) | Eo | Rf | Rs | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANALYSIS POINT 6** | | | | | | | | | | | | | | | |
| 1 | 5.33 | 1.54 | 5.32 | 14.88 | 0.30 | 3.59 | 1.75 | 0.0060 | 0.0200 | 9.5 | 2.4 | 0.25 | 1.0 | 0.6 | 0.67 |
| | | *Section Total Intercepted Flow:* | | | | *3.59* | | | | | | | | | |
| | | ***Total Intercepted Flow:*** | | | | *3.59* | | | | | | | | | |
| | | ***Total Bypass Flow to Analysis Point 10:*** | | | | | *3.49* | | | | | | | | |

C-8

**STORM DRAIN HYDROLOGIC VOLUMETRIC & DISCHARGE DATA**

**MIDDLE OF TOLLESON AVE. - Double GRATE ON EACH SIDE**

**HYDRAULIC EVALUATION OF INLETS - HEC12 METHOD**
**100-YEAR STORM - STREET FLOWS W/ 20% CLOGGING FACTOR**
**15% REDUCTION IN ROUTED Q'S FOR ATTENUATION**

Qi = Intercepted Flow
Qb = Bypass Flow
S = Longitudinal Slope
Sx = Cross Slope
Vo = Gutter Velocity where splash-over first occurs

Eo = Ratio of frontal flow to total gutter flow
Rf = Ratio of frontal flow intercepted to total frontal flow
Rs = Ratio of side flow intercepted to total side flow
E = Efficiency

| Inlet ID | Total Rtd Q (cfs) | Inlet Width (ft) | Inlet Length (ft) | Ponding Width (ft) | Pond Depth (ft) | Qi (cfs) | Qb (cfs) | S (ft/ft) | Sx (ft/ft) | Vo (fps) | V (fps) | Eo | Rf | Rs | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANALYSIS POINT 7** | | | | | | | | | | | | | | | |
| 1 | 5.42 | 1.54 | 5.32 | 14.97 | 0.30 | 3.63 | 1.78 | 0.0060 | 0.0200 | 9.5 | 2.4 | 0.25 | 1.0 | 0.6 | 0.67 |
| | | *Section Total Intercepted Flow:* | | | | *3.63* | | | | | | | | | |
| | | ***Total Intercepted Flow:*** | | | | *3.63* | | | | | | | | | |
| | | ***Total Bypass Flow to Analysis Point 8:*** | | | | | *3.57* | | | | | | | | |

C-9

**STORM DRAIN HYDROLOGIC VOLUMETRIC & DISCHARGE DATA**

**TOLLESON AVE. - Double GRATE ON EACH SIDE**

**HYDRAULIC EVALUATION OF INLETS - HEC12 METHOD**
**100-YEAR STORM - STREET FLOWS W/ 20% CLOGGING FACTOR**
**15% REDUCTION IN ROUTED Q'S FOR ATTENUATION**

Qi = Intercepted Flow
Qb = Bypass Flow
S = Longitudinal Slope
Sx = Cross Slope
Vo = Gutter Velocity where splash-over first occurs

Eo = Ratio of frontal flow to total gutter flow
Rf = Ratio of frontal flow intercepted to total frontal flow
Rs = Ratio of side flow intercepted to total side flow
E = Efficiency

| Inlet ID | Total Rtd Q (cfs) | Inlet Width (ft) | Inlet Length (ft) | Ponding Width (ft) | Pond Depth (ft) | Qi (cfs) | Qb (cfs) | S (ft/ft) | Sx (ft/ft) | Vo (fps) | V (fps) | Eo | Rf | Rs | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANALYSIS POINT 8** | | | | | | | | | | | | | | | |
| 1 | 8.19 | 1.54 | 5.32 | 15.74 | 0.31 | 4.05 | 2.14 | 0.0060 | 0.0200 | 9.5 | 2.5 | 0.24 | 1.0 | 0.5 | 0.65 |
| | | *Section Total Intercepted Flow:* | | | | *4.05* | | | | | | | | | |
| | | ***Total Intercepted Flow:*** | | | | *4.05* | | | | | | | | | |
| | | ***Total Bypass Flow to Analysis Point 10:*** | | | | | *4.28* | | | | | | | | |

C-10

**STORM DRAIN HYDROLOGIC VOLUMETRIC & DISCHARGE DATA**

**FLAGSTAFF DR. - 2 Double GRATES ON EACH SIDE**

**HYDRAULIC EVALUATION OF INLETS - HEC12 METHOD**
**100-YEAR STORM - STREET FLOWS W/ 20% CLOGGING FACTOR**
**15% REDUCTION IN ROUTED Q'S FOR ATTENUATION**

Qi = Intercepted Flow
Qb = Bypass Flow
S = Longitudinal Slope
Sx = Cross Slope
Vo = Gutter Velocity where splash-over first occurs

Eo = Ratio of frontal flow to total gutter flow
Rf = Ratio of frontal flow intercepted to total frontal flow
Rs = Ratio of side flow intercepted to total side flow
E = Efficiency

| Inlet ID | Total Rtd Q (cfs) | Inlet Width (ft) | Inlet Length (ft) | Ponding Width (ft) | Pond Depth (ft) | Qi (cfs) | Qb (cfs) | S (ft/ft) | Sx (ft/ft) | Vo (fps) | V (fps) | Eo | Rf | Rs | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANALYSIS POINT 9** | | | | | | | | | | | | | | | |
| 1 | 13.18 | 1.54 | 5.32 | 20.89 | 0.42 | 7.38 | 5.80 | 0.0060 | 0.0200 | 9.5 | 3.0 | 0.18 | 1.0 | 0.5 | 0.56 |
| 2 | 5.80 | 1.54 | 5.32 | 15.36 | 0.31 | 3.84 | 1.96 | 0.0060 | 0.0200 | 9.5 | 2.5 | 0.25 | 1.0 | 0.6 | 0.66 |
| | | *Section Total Intercepted Flow:* | | | | *11.22* | | | | | | | | | |
| | | ***Total Intercepted Flow:*** | | | | *11.22* | | | | | | | | | |
| | | ***Total Bypass Flow to Analysis Point 10:*** | | | | | *3.92* | | | | | | | | |

ANALYSIS OF AN INLET IN A SUMP CONDITION - **Pt 10 at lowpoint on left and right side of Flagstaff Drive**

INLET TYPE: Single Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: Q=C*L*H^1.5

| Wing opening | Grate opeining |
|---|---|
| C= 3.0 | C=3.0 |
| L= 4.0 ft | L(single grate)=[(2.67')+2(1.8')]=6.27 ft |
| Q=3.0(4.0')H**1.5= 12.0H**1.5 | Q=3.0(6.27)H^1.5=18.81*H^1.5 |

ORIFICE: Q=C*A*(2*G*H)**0.5

| Grate opening | Wing opening |
|---|---|
| C=0.6 | C=0.6 |
| A(single grate)=4.09 sf | A=2.0 sf |
| Q=2.46*(64.4*H)^0.5 | Q=1.2*(64.4*H)^0.5 |

| | WS ELEVATION | HEIGHT ABOVE INLET | Q (CFS) WEIR WING OPENING | Q (CFS) WEIR SINGLE GRATE | Q (CFS) ORIFICE SINGLE GRATE | TOTAL Q (CFS) | COMMENTS: |
|---|---|---|---|---|---|---|---|
| ~FL @ INLET | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Flow at single "A" inlet w/ two wing openings |
| | 0.10 | 0.10 | 0.38 | 0.59 | 6.24 | 1.35 | Weir controls on grate analysis |
| | 0.20 | 0.20 | 1.07 | 1.68 | 8.82 | 3.83 | |
| | 0.30 | 0.30 | 1.97 | 3.09 | 10.80 | 7.03 | |
| | 0.40 | 0.40 | 3.04 | 4.76 | 12.47 | 10.83 | |
| | 0.50 | 0.50 | 4.24 | 6.65 | 13.94 | 15.14 | |
| | 0.60 | 0.60 | 5.58 | 8.74 | 15.27 | 19.90 | Q(100 yr) = 17.85 cfs is provided at this depth |
| TOP OF CURB | 0.70 | 0.70 | 7.03 | 11.02 | 16.50 | 25.07 | |
| | 0.80 | 0.80 | 8.59 | 13.46 | 17.64 | 30.63 | |
| | 0.90 | 0.90 | 10.25 | 16.06 | 18.71 | 36.55 | Q(2x100 yr) = 35.71 cfs is provided at this depth |
| ROW LIMIT | 1.00 | 1.00 | 12.00 | 18.81 | 19.72 | 42.81 | |

NOTE: The total runoff intercepted by the inlet at the low point in the road is:

Q(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].

THE 100 YR STORM EVENT = 17.85 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 35.71 CFS at the sump condition

Check Pipe Capacity (Orifice): (See sheet C-13 thru C-15 for Pipe Orifice Analysis)

ORIFICE ANALYSIS OF A PIPE IN AN INLET

ORIFICE:

**18" RCP** Q=CA(2GH)^.5

C=0.6 Diameter (inches) = **18**

DEPTH OF INLET 4.00 '

AREA (SF) = 1.77

| WS ELEVATION (ft) | HEIGHT ABOVE ABOVE C.L. OF PIPE (ft) | Q (CFS) ORIFICE DOUBLE GRATE | COMMENTS |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | |
| 1.70 | 0.20 | 3.80 | |
| 1.90 | 0.40 | 5.38 | |
| 2.10 | 0.60 | 6.59 | |
| 2.30 | 0.80 | 7.61 | |
| 2.50 | 1.00 | 8.50 | |
| 2.70 | 1.20 | 9.32 | |
| 2.90 | 1.40 | 10.06 | |
| 3.10 | 1.60 | 10.76 | |
| 3.30 | 1.80 | 11.41 | |
| 3.50 | 2.00 | 12.03 | |
| 3.70 | 2.20 | 12.61 | Sump condition Analysis Point 1 |
| 3.90 | 2.40 | 13.18 | |
| 4.10 | 2.60 | 13.71 | |

ORIFICE ANALYSIS OF A PIPE IN AN INLET

ORIFICE:

**24" RCP** Q=CA(2GH)^.5

C=0.6 Diameter (inches) = **24**

DEPTH OF INLET 4.00

AREA (SF) = 3.14

| WS ELEVATION (ft) | HEIGHT ABOVE ABOVE C.L. OF PIPE (ft) | Q (CFS) ORIFICE DOUBLE GRATE | COMMENTS |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | |
| 2.20 | 0.20 | 6.76 | |
| 2.40 | 0.40 | 9.56 | |
| 2.60 | 0.60 | 11.71 | |
| 2.80 | 0.80 | 13.52 | |
| 3.00 | 1.00 | 15.12 | Sump condition Analysis Point 5 |
| 3.20 | 1.20 | 16.56 | |
| 3.40 | 1.40 | 17.89 | |
| 3.60 | 1.60 | 19.12 | |
| 3.80 | 1.80 | 20.28 | |
| 4.00 | 2.00 | 21.38 | |
| 4.20 | 2.20 | 22.43 | |
| 4.40 | 2.40 | 23.42 | |
| 4.60 | 2.60 | 24.38 | |
| 4.80 | 2.80 | 25.30 | |
| 5.00 | 3.00 | 26.19 | |
| 5.20 | 3.20 | 27.05 | |
| 5.40 | 3.40 | 27.88 | |
| 5.60 | 3.60 | 28.69 | |
| 5.80 | 3.80 | 29.47 | |
| 6.00 | 4.00 | 30.24 | |
| 6.20 | 4.20 | 30.98 | |
| 6.40 | 4.40 | 31.71 | |
| 6.60 | 4.60 | 32.43 | |

ORIFICE ANALYSIS OF A PIPE IN AN INLET

ORIFICE:

| | | |
|---|---|---|
| **30" RCP** | Q=CA(2GH)^.5 | |
| C=0.6 | Diameter (inches) = | **30** |
| DEPTH OF INLET | 4.00 | |
| AREA (SF) = | 4.91 | |

| WS ELEVATION (ft) | HEIGHT ABOVE ABOVE C.L. OF PIPE (ft) | Q (CFS) ORIFICE DOUBLE GRATE | COMMENTS |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | |
| 2.70 | 0.20 | 10.56 | |
| 2.90 | 0.40 | 14.94 | |
| 3.10 | 0.60 | 18.30 | |
| 3.30 | 0.80 | 21.13 | |
| 3.50 | 1.00 | 23.62 | |
| 3.70 | 1.20 | 25.88 | |
| 3.90 | 1.40 | 27.95 | |
| 4.10 | 1.60 | 29.88 | |
| 4.30 | 1.80 | 31.69 | |
| 4.50 | 2.00 | 33.41 | |
| 4.70 | 2.20 | 35.04 | |
| 4.90 | 2.40 | 36.60 | Sump condition Analysis Points 4 & 10 |
| 5.10 | 2.60 | 38.09 | |
| 5.30 | 2.80 | 39.53 | |
| 5.50 | 3.00 | 40.92 | |
| 5.70 | 3.20 | 42.26 | |
| 5.90 | 3.40 | 43.56 | |
| 6.10 | 3.60 | 44.82 | |
| 6.30 | 3.80 | 46.05 | |
| 6.50 | 4.00 | 47.25 | |
| 6.70 | 4.20 | 48.41 | |
| 6.90 | 4.40 | 49.55 | |
| 7.10 | 4.60 | 50.67 | |

C-15

Drainage Structure Analyzer

Pipe Hydraulic Analysis

Date: Thursday, March 23, 2000 02:40:41 PM

Input Data

| | | |
|---|---|---|
| Shape | Circular | |
| Material | RC C76-A | |
| Roughness | 0.013000 | |
| Method | Manning | |
| Flow Rate | 7.7200 | cfs |
| Slope | 0.600% | |
| Size (W x T): | 18.00 x 2.0000 | |

Output Results

| | | |
|---|---|---|
| Flow Rate | 7.7200 | cfs |
| Slope | 0.600% | |
| d/D | 0.78 | |
| Capacity | 8.1366 | cfs |
| Velocity | 5.24 | ft/s |
| Depth | 1.16 | ft |
| Critical Depth | 1.07 | ft |
| Size (W x T): | 18.00 x 2.0000 | |

Drainage Structure Analyzer

Pipe Hydraulic Analysis

Date: Thursday, March 23, 2000 02:43:31 PM

Input Data

| | |
|---|---|
| Shape | Circular |
| Material | RC C76-A |
| Roughness | 0.013000 |
| Method | Manning |
| Flow Rate | 26.7000 cfs |
| Slope | 0.600% |
| Size (W x T): | 24.00 x 2.5000 |

Output Results

| | |
|---|---|
| Flow Rate | 26.7000 cfs |
| Slope | 0.600% |
| d/D | 1.00 |
| Capacity | 17.5232 cfs |
| Velocity | 8.50 ft/s |
| Depth | 2.00 ft |
| Critical Depth | 1.80 ft |
| Size (W x T): | 24.00 x 2.5000 |

Drainage Structure Analyzer

Pipe Hydraulic Analysis

Date: Thursday, March 23, 2000 02:43:58 PM

Input Data

| | | |
|---|---|---|
| Shape | Circular | |
| Material | RC C76-A | |
| Roughness | 0.013000 | |
| Method | Manning | |
| Flow Rate | 30.8000 | cfs |
| Slope | 0.600% | |
| Size (W x T): | 30.00 x 2.7500 | |

Output Results

| | | |
|---|---|---|
| Flow Rate | 30.8000 | cfs |
| Slope | 0.600% | |
| d/D | 0.79 | |
| Capacity | 31.7717 | cfs |
| Velocity | 7.38 | ft/s |
| Depth | 1.98 | ft |
| Critical Depth | 1.89 | ft |
| Size (W x T): | 30.00 x 2.7500 | |

Drainage Structure Analyzer

Pipe Hydraulic Analysis

Date: Thursday, March 23, 2000 02:44:27 PM

Input Data

| | |
|---|---|
| Shape | Circular |
| Material | RC C76-A |
| Roughness | 0.013000 |
| Method | Manning |
| Flow Rate | 32.2200 cfs |
| Slope | 0.100% |
| Size (W x T): | 30.00 x 2.7500 |

Output Results

| | |
|---|---|
| Flow Rate | 32.2200 cfs |
| Slope | 0.100% |
| d/D | 1.00 |
| Capacity | 12.9708 cfs |
| Velocity | 6.56 ft/s |
| Depth | 2.50 ft |
| Critical Depth | 1.93 ft |
| Size (W x T): | 30.00 x 2.7500 |

Drainage Structure Analyzer

Pipe Hydraulic Analysis

Date: Thursday, March 23, 2000 02:44:56 PM

Input Data

| | |
|---|---|
| Shape | Circular |
| Material | RC C76-A |
| Roughness | 0.013000 |
| Method | Manning |
| Flow Rate | 30.4000 cfs |
| Slope | 0.600% |
| Size (W x T): | 36.00 x 3.0000 |

Output Results

| | |
|---|---|
| Flow Rate | 30.4000 cfs |
| Slope | 0.600% |
| d/D | 0.55 |
| Capacity | 51.6644 cfs |
| Velocity | 7.61 ft/s |
| Depth | 1.65 ft |
| Critical Depth | 1.78 ft |
| Size (W x T): | 36.00 x 3.0000 |

Drainage Structure Analyzer

Pipe Hydraulic Analysis

Date: Thursday, March 23, 2000 02:45:24 PM

Input Data

| | | |
|---|---|---|
| Shape | Circular | |
| Material | RC C76-A | |
| Roughness | 0.013000 | |
| Method | Manning | |
| Flow Rate | 79.4500 | cfs |
| Slope | 0.100% | |
| Size (W x T): | 48.00 x 4.0000 | |

Output Results

| | | |
|---|---|---|
| Flow Rate | 79.4500 | cfs |
| Slope | 0.100% | |
| d/D | 1.00 | |
| Capacity | 45.4240 | cfs |
| Velocity | 6.32 | ft/s |
| Depth | 4.00 | ft |
| Critical Depth | 2.70 | ft |
| Size (W x T): | 48.00 x 4.0000 | |

# Tract 15 at Ventana Ranch

| Basin I.D. | Area | Land Treatment Area A | B | C | D | Sum | Weighted E | $V_{360}$ (acre-ft) | **$V_{10\text{-day}}$ (acre-ft)** |
|---|---|---|---|---|---|---|---|---|---|
| A1 | 1.7446 | 0.0000 | 0.4083 | 0.4083 | 0.9281 | 1.7446 | 1.4364 | 0.21 | **0.32** |
| A2 | 2.7634 | 0.0000 | 0.6467 | 0.6467 | 1.4700 | 2.7634 | 1.4364 | 0.33 | **0.51** |
| A3 | 3.0774 | 0.0000 | 0.7202 | 0.7202 | 1.6371 | 3.0774 | 1.4364 | 0.37 | **0.57** |
| A4 | 0.4880 | 0.0000 | 0.1789 | 0.1789 | 0.1301 | 0.4880 | 1.1340 | 0.05 | **0.06** |
| A5 | 4.8579 | 0.0000 | 1.1368 | 1.1368 | 2.5842 | 4.8579 | 1.4364 | 0.58 | **0.90** |
| A6 | 3.1220 | 0.0000 | 0.7306 | 0.7306 | 1.6608 | 3.1220 | 1.4364 | 0.37 | **0.58** |
| A7 | 3.0749 | 0.0000 | 0.7196 | 0.7196 | 1.6357 | 3.0749 | 1.4364 | 0.37 | **0.57** |
| A8 | 2.1231 | 0.0000 | 0.4968 | 0.4968 | 1.1294 | 2.1231 | 1.4364 | 0.25 | **0.39** |
| A9 | 0.5536 | 0.0000 | 0.2030 | 0.2030 | 0.1476 | 0.5536 | 1.1340 | 0.05 | **0.07** |
| A10 | 0.9953 | 0.0000 | 0.2329 | 0.2329 | 0.5295 | 0.9953 | 1.4364 | 0.12 | **0.18** |
| A11 | 1.3056 | 0.0000 | 0.3055 | 0.3055 | 0.6945 | 1.3056 | 1.4364 | 0.16 | **0.24** |
| B1 | 5.0954 | 0.0000 | 1.1924 | 1.1924 | 2.7106 | 5.0954 | 1.4364 | 0.61 | **0.94** |
| B2 | 1.6069 | 0.0000 | 0.3760 | 0.3760 | 0.8548 | 1.6069 | 1.4364 | 0.19 | **0.28** |
| B3 | 0.3234 | 0.0000 | 0.1186 | 0.1186 | 0.0863 | 0.3234 | 1.1340 | 0.03 | **0.04** |
| B4 | 1.9045 | 0.0000 | 0.4457 | 0.4457 | 1.0131 | 1.9045 | 1.4364 | 0.23 | **0.32** |

D-1

**notes:** Bernalillo County precipitation zone 1

| **Total Volume =** | **5.98** | **acre-ft** |
|---|---|---|

Weighted E (in.) = $\frac{(E_A A_A + E_B A_B + E_C A_C + E_D A_D)}{(A_A + A_B + A_C + A_D)}$

$E_A$ = 0.44 in.

$E_B$ = 0.67 in.

$E_C$ = 0.99 in.

$E_D$ = 1.97 in.

$V_{360}$ (acre-ft) = weighted E x (AA+AB+AC+AD) / 12

$V_{10\text{-day}}$ (acre-ft) = $V_{360}$ + $A_D$ x ($P_{10\text{-day}}$-$P_{360}$) / 12

$P_{10\text{-day}}$ = 3.67 in.

$P_{360}$ = 2.20 in.

# Tract 22 at Ventana Ranch

| Basin I.D. | Area | Land Treatment Area A | B | C | D | Sum | Weighted E | $V_{360}$ (acre-ft) | **$V_{10\text{-day}}$ (acre-ft)** |
|---|---|---|---|---|---|---|---|---|---|
| A | 4.75 | 0.00 | 1.14 | 1.14 | 2.47 | 4.75 | 1.42 | 0.56 | **0.87** |
| B | 4.20 | 0.00 | 1.01 | 1.01 | 2.18 | 4.20 | 1.42 | 0.50 | **0.77** |
| C | 4.23 | 0.00 | 1.02 | 1.02 | 2.20 | 4.23 | 1.42 | 0.50 | **0.77** |
| D | 1.75 | 0.00 | 0.42 | 0.42 | 0.91 | 1.75 | 1.42 | 0.21 | **0.32** |
| D-1 | 0.31 | 0.00 | 0.00 | 0.03 | 0.28 | 0.31 | 1.87 | 0.05 | **0.08** |
| E | 0.46 | 0.00 | 0.43 | 0.00 | 0.03 | 0.46 | 0.75 | 0.03 | **0.03** |
| E-1 | 1.68 | 0.00 | 1.58 | 0.00 | 0.10 | 1.68 | 0.75 | 0.10 | **0.12** |
| F | 2.32 | 0.00 | 0.00 | 0.23 | 2.09 | 2.32 | 1.87 | 0.36 | **0.62** |
| Las Ventanas Road | 2.60 | 0.00 | 0.00 | 2.60 | 0.00 | 2.60 | 0.99 | 0.21 | **0.21** |
| Pond | 5.20 | 5.20 | 0.00 | 0.00 | 0.00 | 5.20 | 0.44 | 0.19 | **0.19** |

**notes:** Bernalillo County precipitation zone 1

| **Total Volume =** | **3.98** | **acre-ft** |
|---|---|---|

Weighted E (in.) = $\dfrac{(E_A A_A + E_B A_B + E_C A_C + E_D A_D)}{(A_A + A_B + A_C + A_D)}$

$E_A$ = 0.44 in.

$E_B$ = 0.67 in.

$E_C$ = 0.99 in.

$E_D$ = 1.97 in.

$V_{360}$ (acre-ft) = weighted E x (AA+AB+AC+AD) / 12

$V_{10\text{-day}}$ (acre-ft) = $V_{360}$ + $A_D$ x ($P_{10\text{-day}}$-$P_{360}$) / 12

$P_{10\text{-day}}$ = 3.67 in.

$P_{360}$ = 2.20 in.

D-2