Final Drainage Report

Aspen Village Subdivision

May 2, 2016
(Revised May 11, 2016)
(Revised August 24, 2016)

Prepared for:

McCurter Land and Development Company, LLC
PO Box 2007
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Prepared by:

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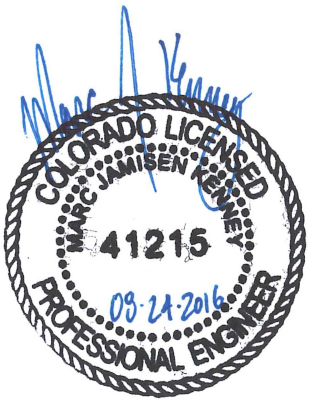
Job No. 1071-006

Engineer's Certification

I hereby certify that this *Final Drainage Report* for the design of the **Aspen Village Subdivision** was prepared by me, or under my direct supervision, in accordance with the provisions of the *Stormwater Management Manual* (dated December 31, 2007 and issued April 2008) for the owners thereof. I understand that the **City of Fruita** does not and will not assume liability for drainage facilities designed by others.



Marc J. Kenney, P.E.
State of Colorado Reg. No. 41215

I. INTRODUCTION

A. Background

The purpose of this Drainage Report is to identify pre and post development drainage conditions for the proposed site of the Aspen Village Subdivision. This report identifies the following items with respect to the site: floodplain boundaries, existing drainage issues, potential drainage issues resulting from this development, solutions to the potential drainage issues, detention and stormwater quality requirements, design of the various elements of the storm drain system for the site, and post construction BMPs.

River City Consultants, Inc. prepared this Final Drainage Report for **McCurter Land and Development Company, LLC**.. This report addresses comments and changes to the design made as a result of the comments received from the City of Fruita (i.e., City of Fruita Engineer) dated May 16th, 2016.

B. Project Location

The location of the proposed Aspen Village Townhouses development is at 1062 18 Road on the east side of 18 Road (aka North Pine Street) within the City of Fruita. In more legal terms, it lies at the SW ¼ of the NW ¼ of Section 16, Township 1 North, Range 2 West of the Ute Meridian. The site will be made up of one existing parcels (parcel # 2697-162-00-020).

Primary access to the site will be from 18 Road. Development in the area is comprised of the Fish Minor Subdivision to the north and the Cottonwoods Subdivision to the southeast. All land adjacent to the proposed subdivision has been developed except for the two parcels immediately southeast of the project parcel. Surrounding zoning varies between Community Residential and Planned Unit Development. The proposed project proposed density and type is similar to and compatible with adjacent developments. Refer to Figure 1 for the General Location Map.

C. Project Description

The project site is comprised of one parcel totaling approximately 6.7 acres. There are three existing buildings located in the southwest portion of the site. All existing structures on the site are to be removed. The remainder of the site is covered with predominantly undeveloped irrigated agricultural land.

According to the NRCS web site, the soil present at the site consists of Sagers silty clay loam (Bc) (100.0%). This soil is well drained and has a hydrologic soil classification of B. Soils information is included in Appendix C.

The existing topography at the site slopes from northeast to southwest at grades between 0.0 and 2.0 percent. A small portion of the site along the northern border that drains north to existing trail and the existing grated manhole lids in the trail. Based on the Mesa County contours and a site visit to verify the grading of adjacent properties the site receives no off-site flow.

Existing on-site drainage facilities evident include small ditches and culverts used to convey irrigation water within the site. The primary existing drainage feature near the site is a Grand Valley Drainage District pipe which runs along the northern and western borders of the site. The pipe ranges from 24" to 36" and conveys stormwater that used to be conveyed in open ditches. These pipes are part of the "Murray Drain".

On-site irrigation facilities are gated pipe, ditches and field creases.

The proposed land use for the site will include single-family homes on ~0.25 acre lots, Homeowners' Association (HOA) lots for access, drainage, irrigation, and open space, and right-of-way. No encumbrances to this subdivision were noted at the site.

D. Previous Investigations

According to the Mesa County GIS website, the site lies within the 117 Major Drainage Basin. Williams Engineering's Stormwater Management Master Plan – City of Fruita (1998) is the only study listed for the 117 Major Drainage Basin on Mesa County's website.

The drainage report for the Cottonwoods Subdivisions located to the southeast of the site was reviewed. The Cottonwoods Subdivision had a positive impact on drainage within the Murray Drain. This was accomplished by over-detaining flows, reducing peak flows, and making available detention credits for purchase (in-lieu of on-site detention). Drainage reports for the proposed site and other adjacent properties were either unavailable or non-existent.

Development of this property was investigated by this Client with RCC's assistance in 2008. That project looked into developing the project parcel and a parcel to the southeast and creating a development with multi-family townhomes. This project went through three rounds of development comments and the most recent drainage report for the project was used as a basis for this report (Aspen Village Townhomes Final Drainage Report dated October 8, 2008 and revised April 2, 2009 by River City Consultants, Inc.).

II. DRAINAGE SYSTEM DESCRIPTION

A. Existing Drainage Conditions

The 117 Major Drainage Basin includes 4.09 square miles and drains to the Colorado River. Existing conditions within the major drainage basin vary from urbanized to undeveloped. The predominant drainage pattern for the major basin area is characterized by overland flow sloping towards the river at varying grades. Channels, ditches, roads and other features intermittently cross the sloping ground surface collecting and concentrating surface runoff. The general flow of surface water is from northeast to southwest. Consideration of these parameters led to the watershed boundary definitions of the major basin.

Existing topography at the site consists of grades between 0.0 and 2.0 percent. Existing cover on-site consists primarily of fallow agricultural land in fair condition (50 to 75% ground cover). A small portion of the project (5%) is currently covered by roofs and gravel. The site slopes from northeast to southwest. The Major Drainage Basin and Floodplain Map, Figure 2, shows the project location relative to Major Drainage Basin Boundaries and the Colorado River.

Historically, runoff would sheet and shallow concentrated flow from the northeast to the southwest. Runoff from the site collects in existing irrigation ditches and channels and is conveyed offsite via the Murray Drain. There is no offsite flow onto the property because there is a ditch along the north property line, an irrigation tailwater ditch along the southern line, and 18 Road (Pine Street) to the west.

The historical (existing) drainage was characterized by a single basin. The Existing Drainage Conditions Map, Figure 3, shows the historical basin for the property. Historic cover conditions include a portion of roofs and dirt, but the majority of the site is undeveloped agricultural land. The historic 100 year 24-hour storm peak discharge rate for the site is 1.62 cubic feet per second (cfs) and the total runoff is 0.89 inches. This value was calculated in the hydrologic/hydraulic model, the results of which have been included in Appendix A.

B. Master Drainage Plan

According to the Mesa County Drainage Basins Map, the proposed development is within the 117 Major Drainage Basin. This major basin includes 4.09 square miles and drains directly into the Colorado River. The

Major Drainage Basin Map, Figure 2, shows the project location relative to the Major Drainage Basin Boundaries and Colorado River.

The 1998 Fruita Stormwater Management Master Plan (SWMMP) determined that the Murray Drain as it exists was insufficient to accommodate historical flows. As a result, new developments draining to the Murray Drain are required to reduce discharge by 48% of the historic discharge rate. Cottonwoods Subdivision provided regional detention, which decreased the peak flows in the Murray Drain. This created a situation where Cottonwoods Subdivision was over detaining and decreased the peak flow rate by 53 cfs more than was required. As a result, over-detention credits were given to the Cottonwoods Subdivision to the amount of 53 cfs. These credits are available for purchase by other developments within the Murray Drain Basin. It is the intent of this project to purchase and utilize these credits in regards to stormwater discharge.

C. Offsite Tributary Area

As previously noted, this site receives no off-site flows.

D. Proposed Drainage System Description

The lots will be a mix of Type A and Type B. Type A lots are sloped and drain to the street. Type B lots are split and slope to the street and back of the lot. Flow to the street will be collected and conveyed by the curb and gutter. Flow to the back of the lots will be conveyed by back yard swales and drains.

Most of the runoff will be directed to a small pond located in the southwest corner of the project. The pond has been designed to detain stormwater and reduce the peak flow. Flow out of the pond is restricted by a 1" x 1" rectangular orifice and a 2 ft broad crested weir. The pond outlet will tie into the existing storm sewer in 18 Road. A portion of the project (~1.6 acres) will drain to 18 Road and to a pair of existing inlets located along the west end of Laura Drive. The peak flow from the 1.6 acre catchment is 1.7 cfs during the 100-year 24ohour storm. There is also a small (0.26 acre) catchment that drains north to the existing bike path.

The existing inlets along Laura Drive are part of the storm sewer in 18 Road, which is part of the Murray Drain. This system ultimately empties into the Colorado River. As previously noted there is a small catchment along to the north along the existing trail that drains north and will continue to drain north. There are existing manholes with slotted lids that do and will collect the flow from this small area.

The predicted combined peak release rate from the site during the 100 year 24-hour storm will be 1.89 cfs, or roughly a 17% increase in peak flow from the site. The average total runoff under developed conditions predicted by the hydrologic/hydraulic model is 1.09 inches.

The developer will pay a reimbursement fee to the City of Fruita for the Cottonwoods discharge "credits". The fee is calculated using the following formula: Recapture Amount = - (CDR-0.173) x Developed Acres x $14,591.98

If the recapture amount is negative the fee is zero. CDR is the Calculated Discharge Reduction in cfs per acre versus historic 100-year flow per acre. Aspen Village's CDR is:
Historic = 1.62 cfs/6.7 acres = 0.24;
Developed = (1.94+0.32) cfs/6.7 acres = 0.34;
CDR = Historic – Developed = 0.24 - 0.34 = -0.1.

Accordingly, the recapture fee is:
Recapture Amount = - (-0.1-0.173) x 6.7 x $14,591.98 = $26,690.19

E. Drainage Facility Maintenance

Ownership and maintenance of the proposed drainage improvements within public right of way shall be by the City of Fruita. Ownership and maintenance of the proposed drainage improvements on private property shall be by the Homeowners' Association. Easements will be provided to the City of Fruita to maintain drainage facilities on private property in the event that the Homeowners' Association does not provide adequate maintenance of the drainage facilities.

Maintenance of all drainage facilities outside the right-of-way shall be performed by the owner, in accordance with SWMM Section 403.10, *Drainage Facility Maintenance*. All facilities shall be inspected annually by a qualified erosion control specialist to verify maintenance activities. It is advisable drainage facilities be inspected following any major storms in addition to scheduled inspection. Inspection reports documenting said activities shall be provided to the City of Fruita.

The storm drain system has been designed to minimize maintenance. There are no mechanical items to check and maintain (i.e., pumps). Anticipated maintenance includes periodic (1-2 times per year and after major storm events) cleaning and clearing of debris.

It is anticipated the highest sediment load to the storm drain system will occur during construction of homes/buildings on the lots within the subdivision. Proper installation and maintenance of construction BMPs as per

the written Construction Stormwater Management Plan (CSWMP) and associated SWMP sheets will be crucial for minimizing sediment transport during this phase of the project.

III. DRAINAGE ANALYSIS AND DESIGN CRITERIA

A. Regulations

The policy, design criteria, design constraints, methods of analysis, recommendations, and conclusions presented in this report are in conformance with standard engineering practice and the Stormwater Management Manual (date December 31, 2007 and issued April 2008). The Urban Drainage and Flood Control District's Drainage Criteria Manual Volumes 1, 2, and 3 were also consulted in regards to stormwater quality and BMPs.

B. Development Criteria

The only drainage constraint noted for this project was the Master Drainage Plan's mandate to reduce the developed peak flow to 52% of the historic peak flow. This can be done through detention or the purchase of "detention credits".

C. Hydrologic Criteria

The hydrologic design criteria presented in this report are in conformance with standard engineering practice and the Stormwater Management Manual (date December 31, 2007 and issued April 2008), except as noted within the report.

D. Hydraulic Criteria

The hydraulic design criteria presented in this report are in conformance with standard engineering practice and the Stormwater Management Manual (SWMM) (dated December 31, 2007 and issued April 2008.

E. Calculation Methodology

All hydrology and hydraulic calculations were performed using Autodesk Storm and Sanitary Analysis program. The modeling methods selected for this project are listed below.

Hydrology	EPA SWMM
Time of Concentration	Kirpich
Rainfall	SCS Type II Storm
Infiltration Method	SCS Curve Number

HEC-1 Unit Hydrograph	Clark
HEC-1 Loss Method	Uniform
Hydraulic Routing	Hydrodynamic
Force Main Equation	Hazen-Williams
Channel & Pipe Analysis	Manning's Equation

Storm and Sanitary Analysis incorporates the hydrologic and hydraulic aspects of design into one model. This is accomplished by inputting basins (catchments) and linking these with hydraulic elements (swales, ditches, channels, pipes, manholes, ponds, orifices, weirs, etc.).

The hydrology portion of the model includes items such as time of concentration calculation, composite curve number computations, and initial abstraction. Basin hydrographs are then routed through the hydraulic model elements and are combined with other hydrographs were applicable. Modeling results include peak flows, water surface elevations (hydraulic grade lines), energy grade lines, ponded volumes, and more. The Storm and Sanitary Analysis output for this project has been included in Appendix A.

F. Results for Developed Conditions

The results of the analysis of the site drainage under developed conditions are presented in the following paragraphs and in Appendix A. Flow values under proposed conditions are shown on the Developed Conditions Drainage Map, Figure 4, of this report. Design and analysis results of note include the following:

- The Historic 100 year, 24-hour storm peak flow from the site = 1.62 cfs. The Historic 100 year 24-hour total runoff = 0.89 inches.
- The Developed 100 year, 24-hour storm peak flow from the site = 2.26 cfs. The Developed 100 year 24-hour total runoff = 1.16 inches.
- The Recapture Amount as calculated by the City of Fruita formula is $26,690.19.

IV. CONCLUSIONS

A. Compliance with Manual

The policy, design criteria, design constraints, methods of analysis, recommendations, and conclusions presented in this report are in conformance with standard engineering practice and the Stormwater Management Manual (dated December 31, 2007 and issued April 2008), with the exception of the points noted in Section III. E. Variance from Criteria.

B. Areas in Flood Hazard Zone

According to the floodplain maps on Mesa County web site, this site is not affected by any previously known flood hazard zones.

V. REFERENCES

1. Stormwater Management Manual, WRC Engineering under the direction of Mesa County Colorado, dated December 31, 2007 and issued April 2008.

2. Stormwater Management Manual, Williams Engineering for the City of Grand Junction and Mesa County Colorado, May 1996.

3. Mesa County Colorado GIS Website, http://gis.mesacounty.us/interactive.aspx .

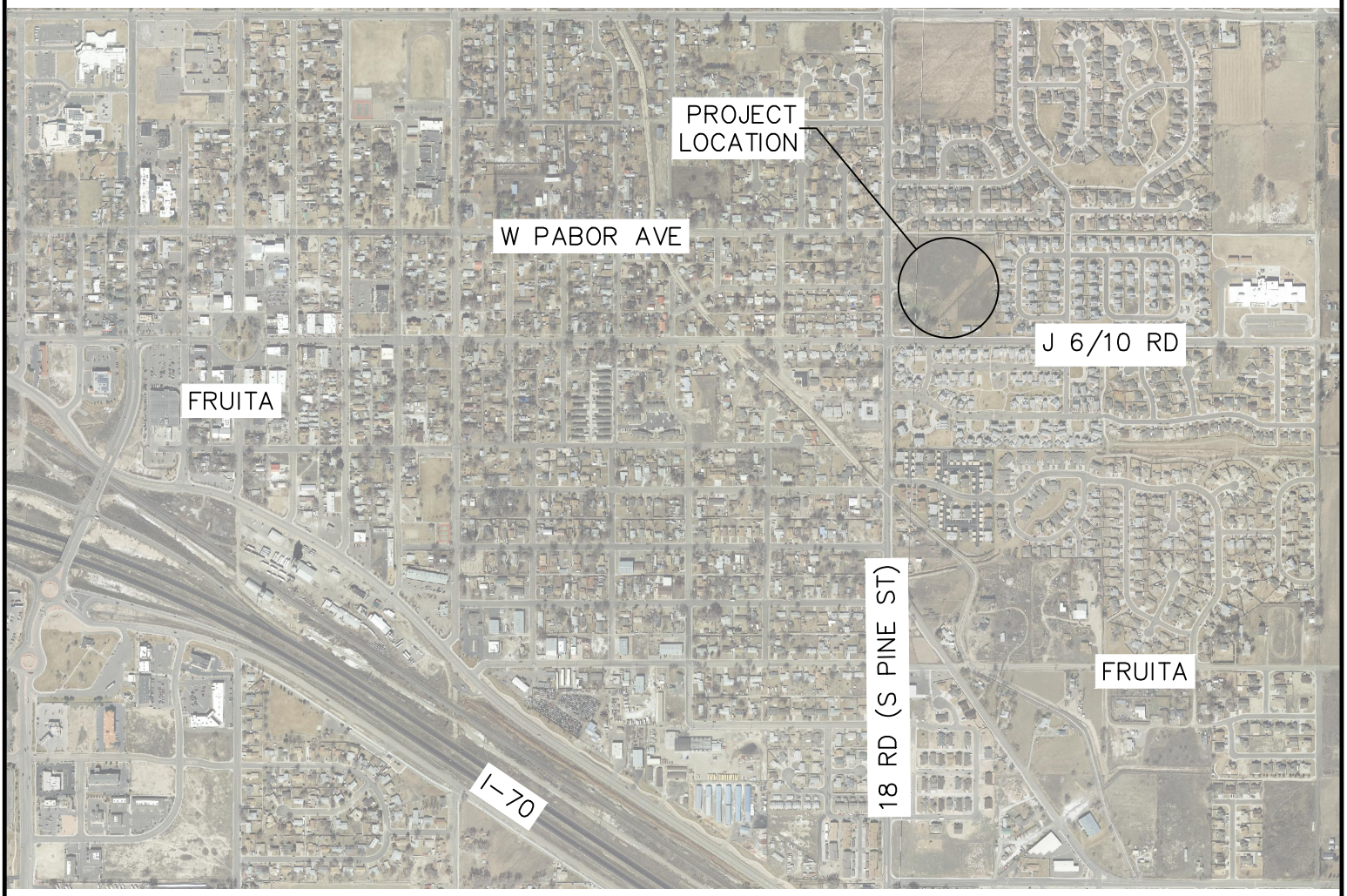
4. Natural Resources Conservation Service National Cooperative Soils Survey Website, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx .

5. Drainage Criteria Manual, Urban Drainage and Flood Control District, Volumes 1, 2, & 3; Denver, Colorado 2001.

6. Final Drainage Report for Phase 3 of the Cotton Woods Subdivision, GR Williams Engineering, Inc., dated March 2004.

7. Fruita Stormwater Management Master Plan (SWMMP), Williams Engineering for the City of Fruita, 1998.

FIGURES



Aspen Village

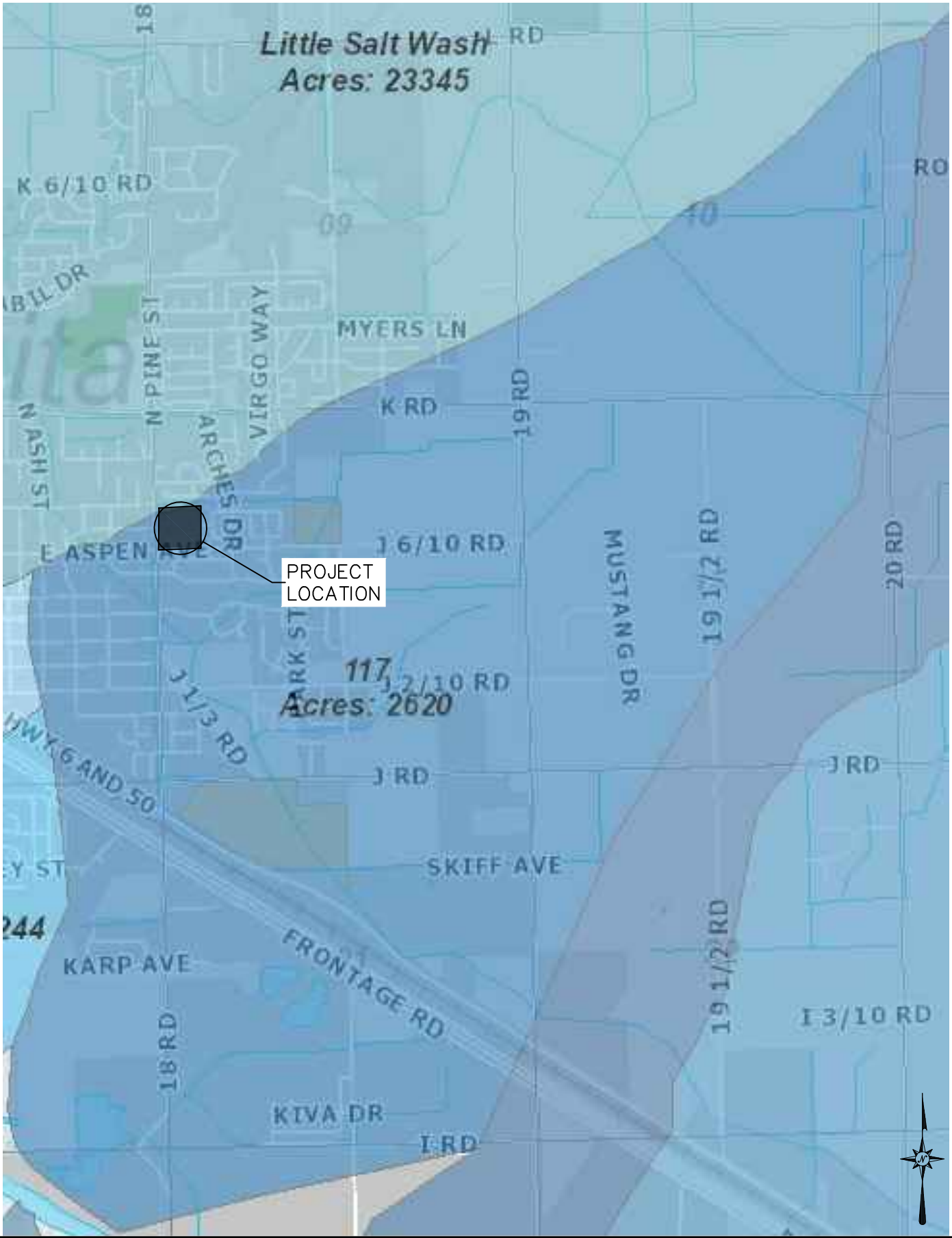
General Location Map

DATE: 21.Apr.2016 Not To Scale

Figure

1

RIVER CITY CONSULTANTS



Aspen Village	*Figure* 2	RIVER CITY CONSULTANTS
Major Basin & Floodplain Map		
DATE: 05.May.2016 Not To Scale		

E Pabor Ave

E Laura Ave

18 Rd (N Pine St.)

Historic

Area 6.7 AC | Curve # 84.7

Claremont Dr

Heatherly Ln

Arches Dr

W Addington Ln

Discharge Point
100 YR/24HR Peak
Discharge: 1.62 cfs

E Aspen Ave

J 6/10 Rd

18 Rd (S Pine St.)

Kent St.

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CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

SCALE

100 0 50 100

(IN FEET)

CONTOUR INTERVAL = 1 FOOT

REVISIONS

NO.	DATE	DESCRIPTION	BY

RIVER CITY CONSULTANTS
744 Horizon Court, Suite 110
Grand Junction, Co, 81506
Phone: 970.241.4722
Fax: 970.241.8841

PRELIMINARY

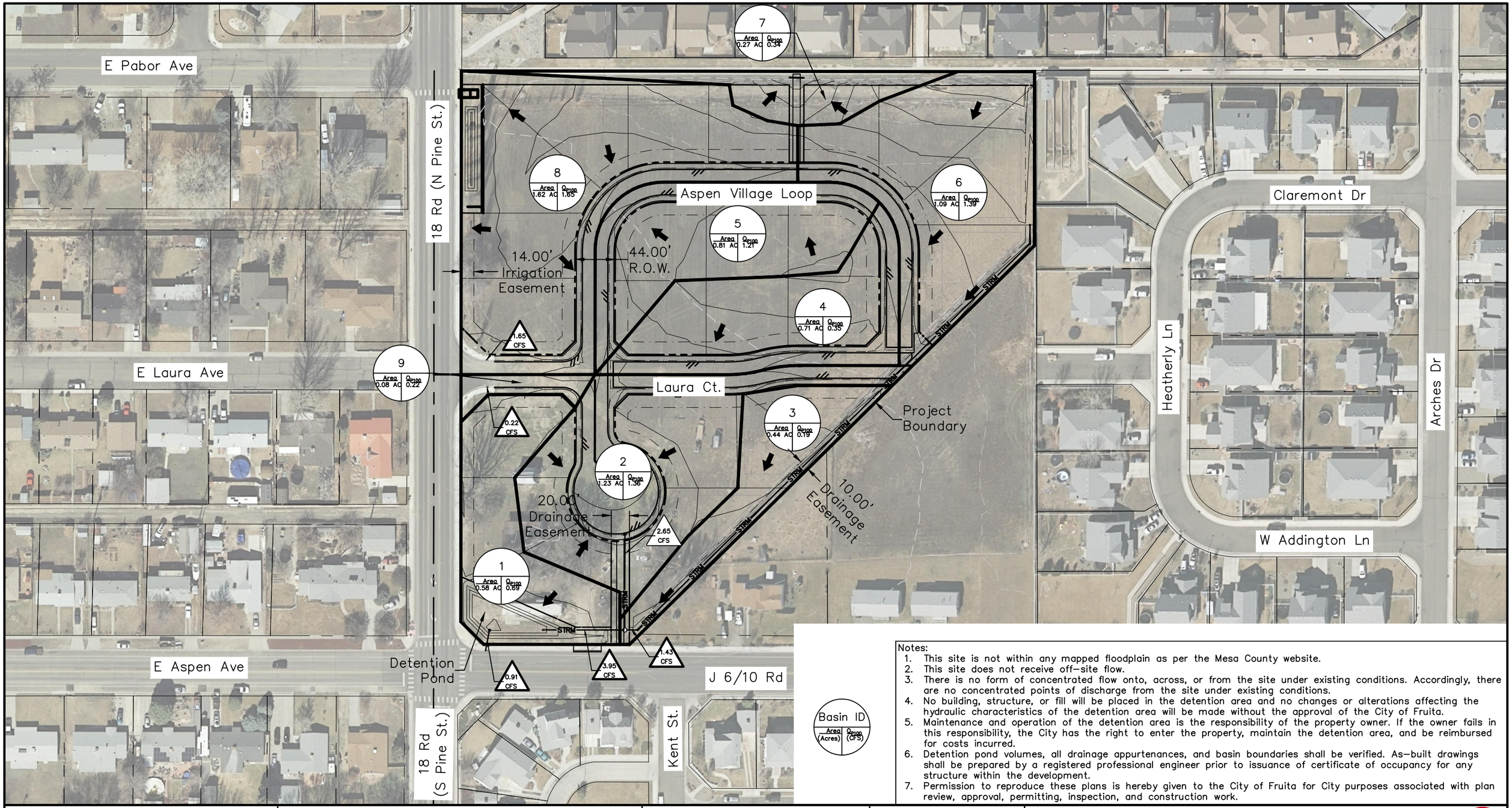
McCurter Land Company

Aspen Village

Existing Conditions Map

DRAWN BY:	DSP		
CHECKED BY:	MJK	RCC PROJECT #:	1071-006
HORZ SCALE:	AS SHOWN	DATE ISSUED:	21.Apr.2016
VERT SCALE:	N/A	ORIGINAL SHEET SIZE:	11 x 17

EX1



Basin ID
Area (Acres) | Q100 (CFS)

Notes:
1. This site is not within any mapped floodplain as per the Mesa County website.
2. This site does not receive off-site flow.
3. There is no form of concentrated flow onto, across, or from the site under existing conditions. Accordingly, there are no concentrated points of discharge from the site under existing conditions.
4. No building, structure, or fill will be placed in the detention area and no changes or alterations affecting the hydraulic characteristics of the detention area will be made without the approval of the City of Fruita.
5. Maintenance and operation of the detention area is the responsibility of the property owner. If the owner fails in this responsibility, the City has the right to enter the property, maintain the detention area, and be reimbursed for costs incurred.
6. Detention pond volumes, all drainage appurtenances, and basin boundaries shall be verified. As-built drawings shall be prepared by a registered professional engineer prior to issuance of certificate of occupancy for any structure within the development.
7. Permission to reproduce these plans is hereby given to the City of Fruita for City purposes associated with plan review, approval, permitting, inspection, and construction work.

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SCALE
100 0 50 100
(IN FEET)
CONTOUR INTERVAL = 1 FOOT

REVISIONS

NO.	DATE	DESCRIPTION	BY

RIVER CITY CONSULTANTS
744 Horizon Court, Suite 110
Grand Junction, Co, 81506
Phone: 970.241.4722
Fax: 970.241.8841

PRELIMINARY

McCurter Land Company

Aspen Village

Developed Conditions Map

DRAWN BY:	DSP		
CHECKED BY:	MJK	RCC PROJECT #:	1071-006
HORZ SCALE:	AS SHOWN	DATE ISSUED:	25.Aug.2016
VERT SCALE:	N/A	ORIGINAL SHEET SIZE:	11 x 17

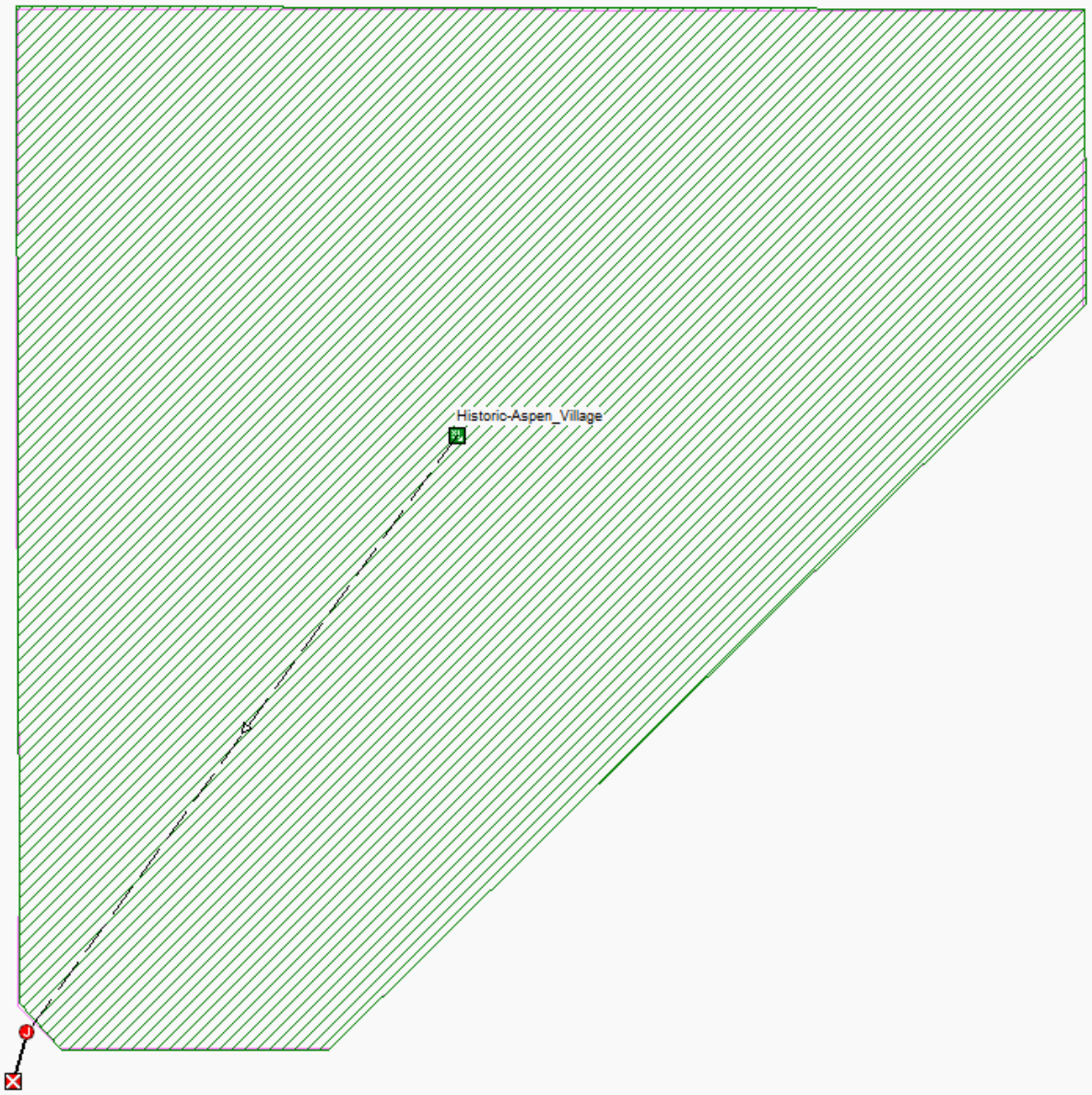
EX1

APPENDIX A

Calculations & Results

MC100yr24hr

Aspen Village - Historic Hydrologic/Hydraulic Model Overview



Aspen Village Subdivision - Fruita Colorado
Existing Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Rain Gage
MJK 05.03.2016

Element ID	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
MC100yr24hr	MC100yr24hr	Intensity	inches	Colorado	Mesa	100	2.01	SCS Type II 24-hr

Aspen Village Subdivision - Fruita Colorado
Existing Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Subbasin Results
MJK 05.03.2016

Element ID	Area (acres)	Weighted Curve Number	Average Slope (%)	Equivalent Width (ft)	Impervious Area (%)	Impervious Area No Depression (%)	Impervious Area Depression Depth (inches)	Impervious Area Manning's Roughness	Pervious Area Depression Depth (inches)	Pervious Area Manning's Roughness	Total Precipitation (inches)	Total Runon (inches)	Total Evaporation (inches)	Total Infiltration (inches)	Total Runoff (inches)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)	Qpeak/ Area (cfs/acre)
Historic-Aspen_Village	6.66	84.70	1.0000	340.00	5.00	0.00	0.0800	0.0100	0.2000	0.1000	2.01	0.00	0.0000	0.9250	0.89	1.62	0 02:27:06	0.24

Aspen Village Subdivision - Fruita Colorado
Existing Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Junction Results
MJK 05.03.2016

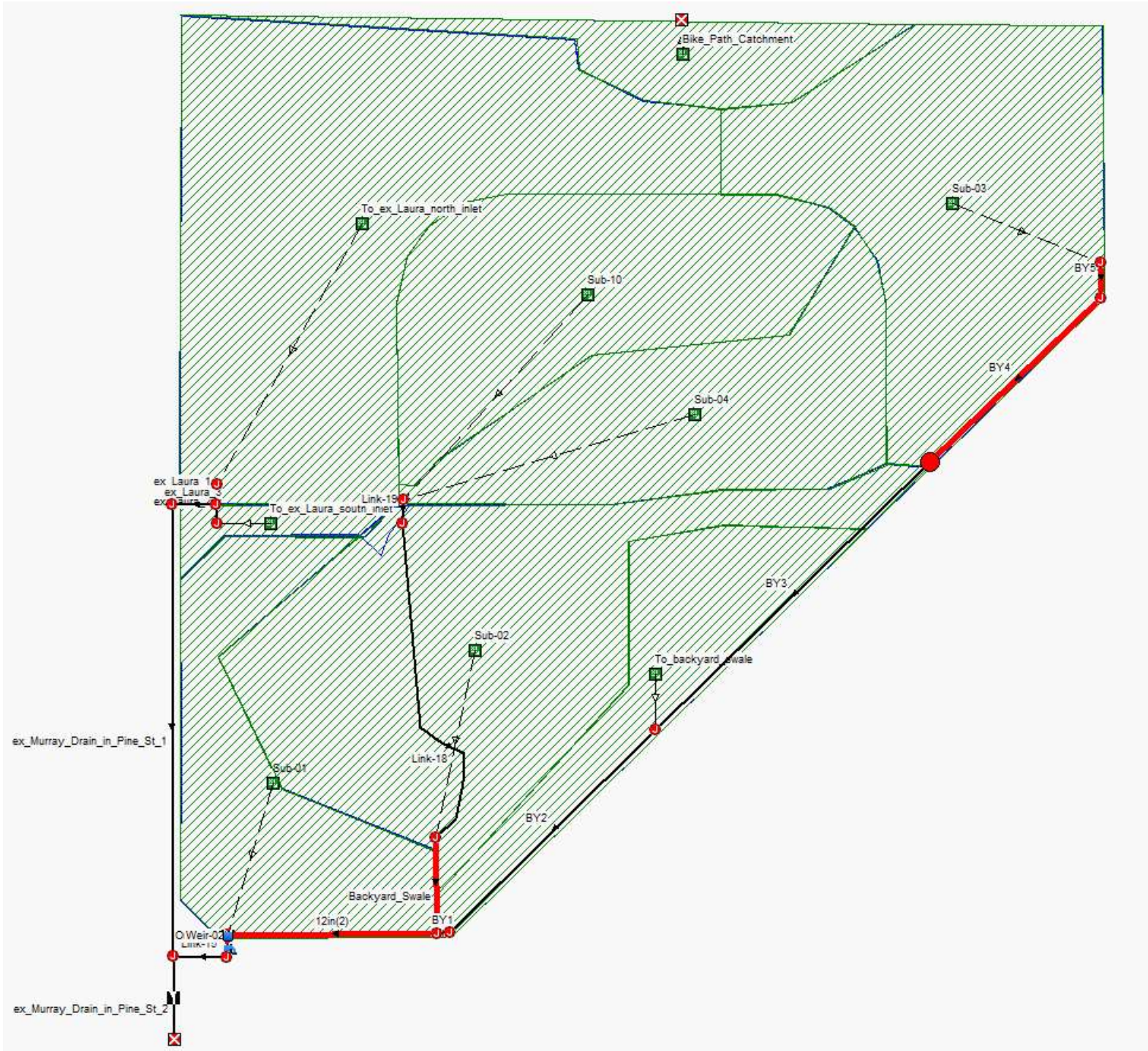
SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Depth (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Elevation Attained (ft)	Maximum HGL Depth Attained (ft)	Maximum Surcharge Depth Attained (ft)	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Time Flooded (minutes)
1	64	4527.00	4582.00	0.00	1.62	1.62	4527.14	0.14	0.00	0 12:09	0 00:00	0.00

Aspen Village Subdivision - Fruita Colorado
Existing Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Channel Results
MJK 05.03.2016

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Channel Type	Channel Height (ft)	Channel Width (ft)	Channel Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)	Froude Number	Reported Condition
Link-04	29.41	4526.00	0.00	4527.00	0.00	-1.00	-3.4000	Trapezoidal	1.000	24.00	0.0300	0.0000	0.0000	0.0000	1.62	0 12:09	2.12	0.23	89.03	0.02	0.14	0.00	0.14	0.51	Calculated

Aspen Village Subdivision - Fruita Colorado
Existing Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Outfalls
MJK 05.03.2016

Element ID	Invert Elevation (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Depth Attained (ft)	Maximum HGL Elevation Attained (ft)
Out-02	4526.00	1.62	0.00	0.14	4526.14


Bike_Path_Catchment
Sub-03
To_ex_Laura_north_inlet
BY5
Sub-10
BY4
Sub-04
ex_Laura_1
ex_Laura_3
Link-19
To_ex_Laura_soutn_inlet
BY3
Sub-02
To_backyard_Swale
ex_Murray_Drain_in_Pine_St_1
Link-18
Sub-01
BY2
Backyard_Swale
12in(2)
BY1
Weir-02
ex_Murray_Drain_in_Pine_St_2

Aspen Village Subdivision - Fruita Colorado
Developed Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Rain Gage
MJK 08.24.2016

Element ID	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
MC100yr24hr	MC100yr24hr	Intensity	inches	Colorado	Mesa	100	2.01	SCS Type II 24-hr

Aspen Village Subdivision - Fruita Colorado
Developed Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Subbasin Results
MJK 08.24.2016

Element ID	Area (acres)	Weighted Curve Number	Average Slope (%)	Equivalent Width (ft)	Impervious Area (%)	Impervious Area No Depression (%)	Impervious Area Depression Depth (inches)	Impervious Area Manning's Roughness	Pervious Area Depression Depth (inches)	Pervious Area Manning's Roughness	Total Precipitation (inches)	Total Runon (inches)	Total Evaporation (inches)	Total Infiltration (inches)	Total Runoff (inches)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)	Qpeak/ Area (cfs/acre)
Sub-01	0.58	75.00	1.0000	100.00	38.00	38.00	0.0800	0.0100	0.2000	0.1000	2.01	0.00	0.0000	0.8810	1.08	0.66	0 01:02:17	1.14
Sub-02	1.23	75.00	1.0000	115.00	38.00	38.00	0.0800	0.0100	0.2000	0.1000	2.01	0.00	0.0000	0.8860	1.07	1.35	0 01:30:15	1.10
Sub-03	0.44	75.00	1.0000	40.00	38.00	38.00	0.0800	0.0100	0.2000	0.1000	2.01	0.00	0.0000	1.0140	0.85	0.25	0 01:31:12	0.57
Sub-04	0.71	75.00	1.0000	100.00	38.00	38.00	0.0800	0.0100	0.2000	0.1600	2.01	0.00	0.0000	1.0140	0.85	0.41	0 01:29:44	0.58
Sub-05	0.81	85.00	0.5000	100.00	38.00	38.00	0.0800	0.0100	0.2000	0.1000	2.01	0.00	0.0000	0.6900	1.27	1.05	0 01:19:21	1.30
Sub-06	1.09	75.00	1.0000	120.00	38.00	38.00	0.0800	0.0100	0.2000	0.1000	2.01	0.00	0.0000	0.8840	1.08	1.21	0 01:21:57	1.11
Sub-07	0.27	75.00	1.0000	50.00	38.00	38.00	0.0800	0.0100	0.2000	0.1000	2.01	0.00	0.0000	0.8800	1.08	0.32	0 00:50:11	1.19
Sub-08	1.62	75.00	1.0000	100.00	38.00	38.00	0.0800	0.0100	0.2000	0.1000	2.01	0.00	0.0000	0.8900	1.07	1.70	0 01:55:33	1.05
Sub-09	0.08	98.00	1.0000	13.00	90.00	90.00	0.0800	0.0100	0.2000	0.1000	2.01	0.00	0.0000	0.0200	1.96	0.22	0 00:35:38	2.75

Aspen Village Subdivision - Fruita Colorado
Developed Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Junction Results
MJK 08.24.2016

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Depth (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Elevation Attained (ft)	Maximum HGL Depth Attained (ft)	Maximum Surcharge Depth Attained (ft)	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Time Flooded (minutes)
1	ADS_Inlet_1	4524.91	4526.80	0.00	1.38	0.00	4526.82	1.91	0.02	0 12:41	0 12:32	26.00
2	ADS_Inlet_2	4526.02	4528.05	0.00	1.40	0.25	4526.83	0.81	0.00	0 12:40	0 00:00	0.00
3	ADS_Inlet_3	4527.16	4530.25	0.00	1.21	0.00	4529.11	1.95	0.00	0 11:55	0 00:00	0.00
4	ADS_Inlet_4	4527.93	4531.80	0.00	1.21	0.00	4530.14	2.21	0.00	0 11:55	0 00:00	0.00
5	ADS_Inlet_5	4528.04	4532.00	0.00	1.21	1.21	4530.47	2.43	0.00	0 11:55	0 00:00	0.00
6	Aspen_Village_Ct_Inlet	4524.37	4528.34	0.00	2.60	1.35	4526.90	2.53	0.00	0 11:59	0 00:00	0.00
7	ex_Laura_Inlet_north	4523.50	4528.10	0.00	1.70	1.70	4523.95	0.45	0.00	0 11:58	0 00:00	0.00
8	ex_Laura_Inlet_south	4523.50	4528.10	0.00	0.22	0.22	4523.62	0.12	0.00	0 11:57	0 00:00	0.00
9	64	4521.50	4528.00	0.00	1.97	0.00	4522.01	0.51	0.00	0 11:59	0 00:00	0.00
10	64	4523.00	4528.50	0.00	1.92	0.00	4523.44	0.44	0.00	0 11:58	0 00:00	0.00
11	64	4522.12	4528.10	0.00	1.92	0.00	4522.68	0.56	0.00	0 11:58	0 00:00	0.00
12	64	4523.75	4527.00	0.00	0.88	0.00	4524.34	0.59	0.00	0 12:44	0 00:00	0.00
13	SDMH-J2-K2	4524.84	4528.55	0.00	3.92	0.00	4526.81	1.97	0.00	0 12:42	0 00:00	0.00
14	v-pan_north	4528.78	4529.28	0.00	1.38	1.38	4528.94	0.16	0.00	0 11:58	0 00:00	0.00
15	v-pan_south	4528.23	4528.73	0.00	1.38	0.00	4528.46	0.23	0.00	0 11:59	0 00:00	0.00

Aspen Village Subdivision - Fruita Colorado
Developed Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Channel Results
MJK 08.24.2016

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Channel Type	Channel Height (ft)	Channel Width (ft)	Channel Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)	Froude Number	Reported Condition
Curb & Gutter	150.00	4528.23	0.00	4527.34	2.97	0.89	0.5900	User-Defined	0.410	20.50	0.0320	0.5000	0.5000	0.0000	1.34	0 11:59	1.46	1.71	9.30	0.14	0.56	0.00	0.23	0.38	Calculated
V-pan	32.00	4528.78	0.00	4528.23	0.00	0.55	1.7200	User-Defined	0.330	26.00	0.0320	0.5000	0.5000	0.0000	1.38	0 11:58	1.33	0.40	12.33	0.11	0.60	0.00	0.20	0.21	Calculated

Aspen Village Subdivision - Fruita Colorado
Developed Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Pipe Results
MJK 08.24.2016

Element ID	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Total Drop (ft)	Average Slope (%)	Pipe Diameter or Height (inches)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)	Froude Number	Reported Condition
12in(2)	SDMH-J2-K2	Detention_Pond	142.52	4524.84	4524.50	0.34	0.2400	18.000	0.0130	1.2000	0.5000	0.0000	3.82	0 11:58	2.31	1.03	5.13	0.74	1.00	1099.00	1.50	0.08	SURCHARGED
Backyard_Swale	Aspen_Village_Ct_Inlet	SDMH-J2-K2	105.00	4524.37	4524.84	-0.47	-0.4500	12.000	0.0130	0.5000	0.5000	0.0000	2.56	0 11:58	3.27	0.54	2.38	1.08	1.00	1757.00	1.00	0.00	SURCHARGED
BY1	ADS_Inlet_1	SDMH-J2-K2	14.00	4524.91	4524.84	0.07	0.5000	12.000	0.0110	0.9000	0.5000	0.0000	1.38	0 11:57	1.75	0.13	2.98	0.46	1.00	1666.00	1.00	0.06	SURCHARGED
BY2	ADS_Inlet_2	ADS_Inlet_1	222.00	4526.02	4524.91	1.11	0.5000	12.000	0.0110	0.5000	0.5000	0.0000	1.38	0 11:57	2.22	1.67	2.98	0.46	0.90	0.00	0.90	0.10	Calculated
BY3	ADS_Inlet_3	ADS_Inlet_2	228.00	4527.16	4526.02	1.14	0.5000	8.040	0.0110	0.5000	0.5000	0.0000	1.21	0 11:55	3.96	0.96	1.01	1.20	0.88	0.00	0.59	0.08	> CAPACITY
BY4	ADS_Inlet_4	ADS_Inlet_3	154.50	4527.93	4527.16	0.77	0.5000	8.040	0.0110	0.5000	0.5000	0.0000	1.21	0 11:55	3.47	0.74	1.01	1.20	1.00	5.00	0.67	0.17	SURCHARGED
BY5	ADS_Inlet_5	ADS_Inlet_4	20.70	4528.04	4527.93	0.11	0.5300	8.040	0.0110	0.5000	0.5000	0.0000	1.21	0 11:57	3.47	0.10	1.04	1.16	1.00	6.00	0.67	0.17	SURCHARGED
ex_Laura_1	ex_Laura_Inlet_north	64	15.20	4523.50	4523.00	0.50	3.2900	18.000	0.0150	1.2000	0.5000	0.0000	1.70	0 11:58	3.88	0.07	16.51	0.10	0.30	0.00	0.45	0.32	Calculated
ex_Laura_2	ex_Laura_Inlet_south	64	15.70	4523.50	4523.00	0.50	3.1800	18.000	0.0150	1.2000	0.5000	0.0000	0.22	0 11:57	0.98	0.27	16.25	0.01	0.19	0.00	0.28	0.06	Calculated
ex_Laura_3	64	64	32.50	4523.00	4522.12	0.88	2.7100	18.000	0.0130	1.2000	0.5000	0.0000	1.92	0 11:58	3.79	0.14	17.28	0.11	0.33	0.00	0.50	0.23	Calculated
ex_Murray_Drain_in_Pine_St_1	64	64	309.24	4522.12	4521.50	0.62	0.2000	36.000	0.0130	1.2000	0.5000	0.0000	1.92	0 11:58	2.27	2.27	29.87	0.06	0.18	0.00	0.53	0.06	Calculated
ex_Murray_Drain_in_Pine_St_2	64	Out-02	56.50	4521.50	4521.25	0.25	0.4400	36.000	0.0130	1.2000	0.5000	0.0000	1.94	0 11:59	2.74	0.34	44.37	0.04	0.16	0.00	0.47	0.36	Calculated
Link-15	64	64	36.19	4523.75	4523.69	0.06	0.1700	12.000	0.0130	1.2000	0.5000	0.0000	0.88	0 12:44	2.29	0.26	1.45	0.61	0.49	0.00	0.49	0.32	Calculated

Aspen Village Subdivision - Fruita Colorado
Developed Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Pond Results
MJK 08.24.2016

Element ID	Invert Elevation (ft)	Max (Rim) Elevation (ft)	Max (Rim) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Peak Outflow (cfs)	Peak Exfiltration Flow Rate (cfm)	Maximum HGL Elevation Attained (ft)	Maximum HGL Depth Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Maximum HGL Occurrence (days hh:mm)	Total Exfiltration Volume (1000-ft^3)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)	Total Retention Time (seconds)
Detention_Pond	4524.00	4527.75	3.75	4524.00	0.00	4.45	0.66	0.88	0.00	4526.80	2.80	4524.67	0.67	0 12:44	0.00	0.00	0.00	0.00

Aspen Village Subdivision - Fruita Colorado
Developed Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Orifice Results
MJK 08.24.2016

Element ID	From (Inlet) Node Invert Elevation (ft)	To (Outlet) Node Invert Elevation (ft)	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (inches)	Orifice Invert Elevation (ft)	Orifice Invert Offset (ft)	Orifice Coefficient	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)
Orifice-01	4524.00	4523.75	SIDE	RECT_CLOSED	NO		4524.00	0.00	0.6260	0.06	0 12:19

Aspen Village Subdivision - Fruita Colorado
Developed Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Weir Results
MJK 08.24.2016

Element ID	From (Inlet) Node Invert Elevation (ft)	To (Outlet) Node Invert Elevation (ft)	Type	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient	Peak Flow (cfs)
Weir-02	4524.00	4523.75	RECTANGULAR	4526.55	2.55	2.00	1.00	3.33	0.83

Aspen Village Subdivision - Fruita Colorado
Developed Hydrology and Hydraulic Model Results - For 100 Year 24 Hour Storm
Outfalls
MJK 08.24.2016

Element ID	Invert Elevation (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Depth Attained (ft)	Maximum HGL Elevation Attained (ft)
Out-02	4521.25	1.94	0.00	0.43	4521.68
Out-03	4529.00	0.32	0.32	0.00	4529.00

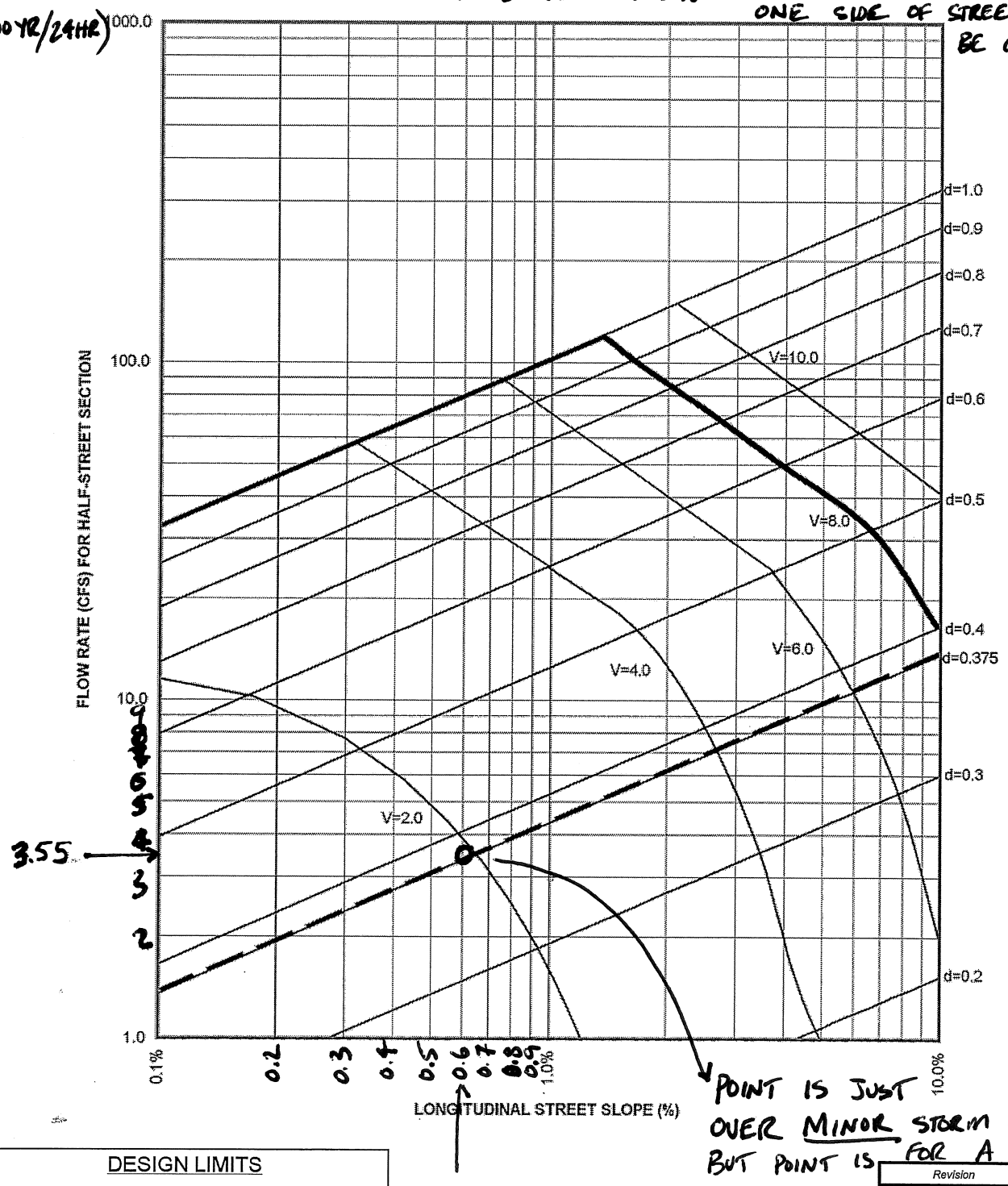
ASPEN VILLAGE SUBDIVISION — ½ STREET CAPACITY CHECK

STORMWATER MANAGEMENT MANUAL

MAX STREET FLOW IN MODEL IS LINK-07 @ 3.55 CFS. STREET SLOPE = 0.6%. ASSUME ALL FLOW IS ON ONE SIDE OF STREET TO BE CONSERVATIVE.

(100YR/24HR)

HALF-STREET FLOW CAPACITY
(RESIDENTIAL, MOUNTABLE CURB)



POINT IS JUST OVER MINOR STORM CAPACITY. BUT POINT IS FOR A MAJOR STORM. SO STREET CAPACITY IS NOT AN ISSUE.

DESIGN LIMITS
- MINOR STORM
- MAJOR STORM

Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING INC

REFERENCE:

FIGURE 1105

ASPEN VILLAGE SUBDIVISION - INLET CAPACITY CHECK

STORMWATER MANAGEMENT MANUAL

Maximum Inlet Capacities
Sump or Sag Condition

FOR: INLET ON SOUTH END OF ASPEN VILLAGE COURT (SUMP CONDITION TYPE R W/CURB OPENING)

	INLET TYPE	6-INCH VERTICAL CURB					
		SINGLE		DOUBLE		TRIPLE	
		2-YR	100-YR	2-YR	100-YR	2-YR	100-YR
2-INCH CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	9.8	12.4	14.7	20.1	19.6	27.8
	COMBINATION INLET (TYPE R GRATES)	9.8	11.1	14.7	18.8	19.6	26.5
	CURB-OPENING INLET CAPACITY	7.7	10.3	12.7	20.6	15.0	30.9
NO CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	6.4	9.3	9.5	14.2	12.7	19.1
	COMBINATION INLET (TYPE R GRATES)	5.1	8.1	9.5	13.0	12.7	17.9
	CURB-OPENING INLET CAPACITY	4.1	6.5	8.3	13.1	12.4	19.6

	INLET TYPE	4.5-INCH MOUNTABLE CURB					
		SINGLE		DOUBLE		TRIPLE	
		2-YR	100-YR	2-YR	100-YR	2-YR	100-YR
2-INCH CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	7.2	10.8	10.8	16.8	14.4	22.7
	COMBINATION INLET (TYPE R GRATES)	7.2	9.4	10.8	15.4	14.4	21.4
	CURB-OPENING INLET CAPACITY	5.6	8.0	9.3	16.0	11.0	23.9
NO CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	4.1	7.8	6.2	10.9	8.3	14.1
	COMBINATION INLET (TYPE R GRATES)	4.1	6.5	6.2	9.7	8.3	12.8
	CURB-OPENING INLET CAPACITY	2.3	4.2	4.7	8.5	7.0	12.7

See Chart Legend (Figure 1113) for standard inlet lengths. $3.55 cfs = Q_{P100YR/24HR}$ TO INLET

Inlet capacities shown above are based upon the following:
1. Type D grate used for calculation is Neenah model R-3577.
2. Type R grate used for calculation is Neenah model R-3289-C.
3. Angled- and curved-vane grates are not allowed for sump or sag design conditions.
4. Capacities shown are based upon maximum ponding depths for the 2-year and 100-year storm events:
   a. 2-year event maximum ponding depth: curb height
   b. 100-year event maximum ponding depth: 1.0 foot
5. Combination inlets are preferred for sump or sag conditions. Curb-opening inlets without grates are allowed.
6. Grate-only inlets are not allowed for sump or sag conditions.

$3.55 cfs < 9.4 cfs$

SO A SINGLE INLET IS OK!

Revision	Date
ORIGINAL ISSUE	3/27/06
REVISED CALCULATIONS	12/20/07

WRC ENGINEERING, INC.

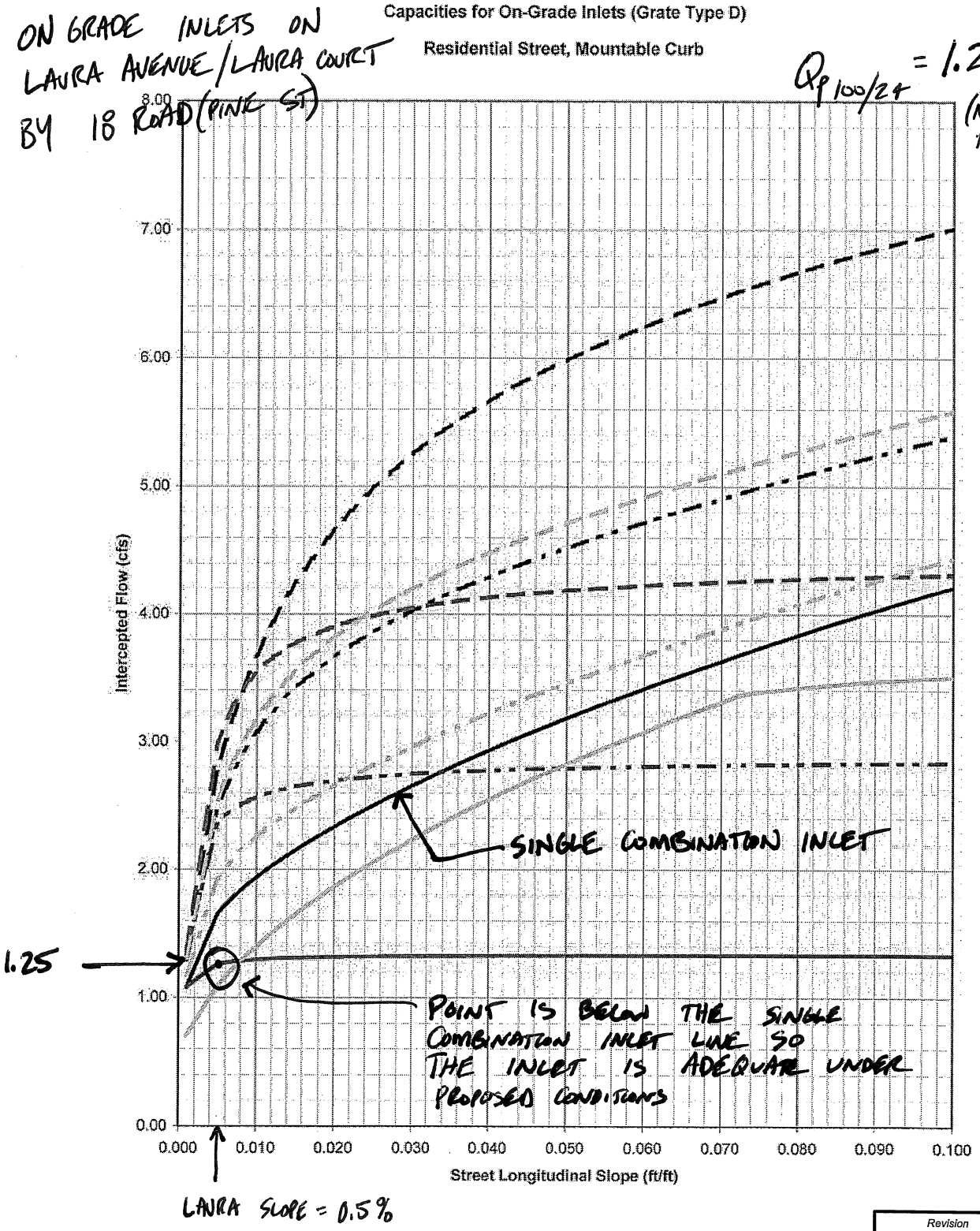
REFERENCE: HEC-12, FHWA
WATER-RESOURCES ENGINEERING, LINSLEY (1992)
GRAND JUNCTION STANDARD DETAILS

FIGURE 1117

ASPEN VILLAGE SUBDIVISION – INLET CAPACITY CHECK

STORMWATER MANAGEMENT MANUAL

ON GRADE INLETS ON LAURA AVENUE / LAURA COURT BY 18 ROAD (PINE ST)



Revision	Date
ORIGINAL ISSUE	3/27/06
FIGURE VARIABLES	12/31/07

WRC ENGINEERING, INC.

REFERENCE:

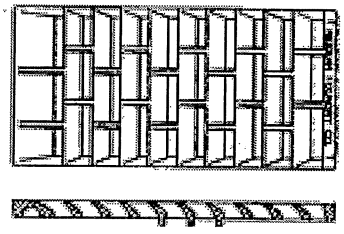
FIGURE 1114D

Chart Legend
Capacities for On-Grade Inlets

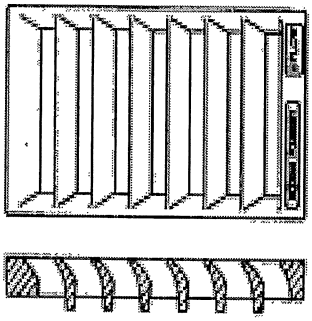
Grate-Only Inlets
Combination Inlets
Curb-Opening Inlets

Single Inlets
Double Inlets
Triple Inlets

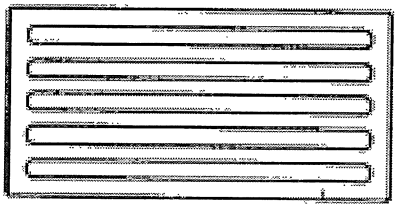
Standard Single Grate-Only or Combination Inlet
Length = 3'
Standard Single Curb-Opening Length = 5'



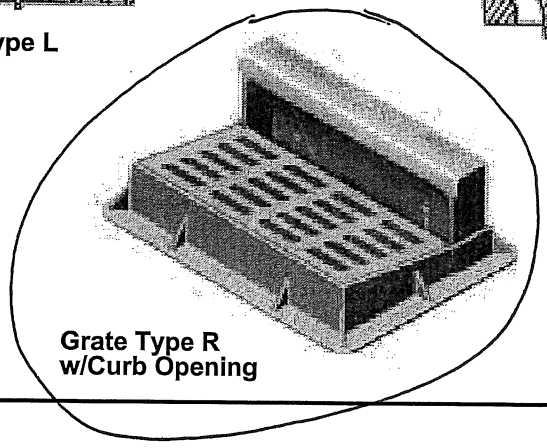
Grate Type L



Grate Type V



Grate Type D



Grate Type R
w/Curb Opening

Revision	Date
ORIGINAL ISSUE	3/27/06
ADDED GRATE DIAGRAMS	12/6/07
FIGURE VARIABLES	12/31/07

WRC ENGINEERING, INC.

REFERENCE:

FIGURE 1113

Aspen Village Detention Pond
Project: Aspen Village
Basin Description: Revised 8/23/2016

Contour Elevation	Contour Area (sq. ft)	Depth (ft)	Depth (ft)	Incremental Volume Avg. End (cu. ft)	Cumulative Volume Avg. End (cu. ft)	Incremental Volume Conic (cu. ft)	Cumulative Volume Conic (cu. ft)
4,524.00	118.49	N/A	0	N/A	0	N/A	0
4,524.25	666.58	0.25	0.25	98.13	98.13	88.84	88.84
4,524.50	1,539.79	0.25	0.50	275.80	373.93	268.29	357.13
4,524.75	1,702.08	0.25	0.75	405.23	779.16	405.07	762.20
4,525.00	1,872.31	0.25	1.00	446.80	1,225.96	446.63	1,208.83
4,525.25	2,050.49	0.25	1.25	490.35	1,716.31	490.18	1,699.01
4,525.50	2,236.60	0.25	1.50	535.89	2,252.20	535.72	2,234.73
4,525.75	2,430.65	0.25	1.75	583.41	2,835.61	583.24	2,817.97
4,526.00	2,632.65	0.25	2.00	632.91	3,468.52	632.74	3,450.71
4,526.25	2,842.58	0.25	2.25	684.40	4,152.92	684.24	4,134.95
4,526.50	3,060.46	0.25	2.50	737.88	4,890.80	737.71	4,872.66
4,526.75	3,320.82	0.25	2.75	797.66	5,688.46	797.44	5,670.10
4,527.00	3,610.85	0.25	3.00	866.46	6,554.92	866.21	6,536.30
4,527.25	3,929.02	0.25	3.25	942.48	7,497.41	942.20	7,478.51
4,527.50	4,249.49	0.25	3.50	1,022.31	8,519.72	1,022.05	8,500.56
4,527.75	6,259.58	0.25	3.75	1,313.63	9,833.36	1,305.55	9,806.11

APPENDIX B

NRCS Web Soil Survey

Hydrologic Soil Group—Mesa County Area, Colorado
(Aspen Village)

Map Scale: 1:1,630 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Mesa County Area, Colorado
Survey Area Data: Version 6, Sep 23, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 22, 2010—Sep 2, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Mesa County Area, Colorado (CO680)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Bc	Sagers silty clay loam, 0 to 2 percent slopes	C	6.8	100.0%
Totals for Area of Interest			**6.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

K Factor, Whole Soil—Mesa County Area, Colorado
(Aspen Village)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Soil Rating Lines
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Soil Rating Points
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Mesa County Area, Colorado
Survey Area Data: Version 6, Sep 23, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 22, 2010—Sep 2, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

K Factor, Whole Soil

K Factor, Whole Soil— Summary by Map Unit — Mesa County Area, Colorado (CO680)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Bc	Sagers silty clay loam, 0 to 2 percent slopes	.43	6.8	100.0%
Totals for Area of Interest			**6.8**	**100.0%**

Description

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

APPENDIX C

SWMM Checklists

ASPEN VILLAGE SUBDIVISION 05/06/2016

Table 302
Stormwater Management Manual
Drainage Report Checklist

Instructions:
1. Applicant to identify with a "check-mark" if information is provided with report. If applicant believes information is not required, indicate with "n/a" and attach separate sheet with explanation
2. The reviewer will determine if information labeled "n/a" is required and whether information must be submitted.
3. Those items noted with an "asterisk" are not typically required for conceptual/ preliminary report. Applicant shall confirm this with local jurisdiction.
4. Submit three (3) copies of report and include copy of check list bound with report.

TITLE PAGE

A. Type of report (Conceptual/Preliminary or Final Drainage Report).
B. Project Name.
C. Preparer name, firm, address, number, and date.
D. Professional Engineer's seal of preparer.
E. Certifications (see SWMM Section 303.1)

I. INTRODUCTION

A. Background
   1. Identify report preparer and purpose.
   2. Identify date of letter with previous County comments.
B. Project Location
   1. Identify Township, Range, and Section.
   2. Identify adjacent street and subdivision names.
   3. Reference to General Location Map.
C. Property Description
   1. Identify area in acres of entire contiguous ownership.
   2. Describe existing ground cover, vegetation, soils, topography and slopes.
   3. Describe existing drainage facilities, such as channels, detention areas, or structures.
   4. Describe existing irrigation facilities, such as ditches, head-gates, or diversions.
   5. Identify proposed types of land use and encumbrances.
D. Previous Investigations
   1. Identify drainage master plans that include the project area, including floodplain studies.
   2. Identify drainage reports for adjacent development.

II. DRAINAGE SYSTEM DESCRIPTION

A. Existing Drainage Conditions
   1. Describe existing topography and provide map with contours extending a minimum of 100 feet beyond property limits.
   2. Identify major drainageway or outfall drainageway and describe map showing location of proposed development within the drainageways.
   3. Identify pre-developed drainage patterns and describe map showing pre-developed sub-basins and concentrated discharge locations. Provide calculations of pre-developed peak flows entering and leaving the site.
B. Master Drainage Plan
   1. Describe location of the project relative to a previously prepared master drainage plan, including drainage plans prepared for adjacent development.
C. Offsite Tributary Area

(NONE) ✓
1. Identify all offsite drainage basins that are tributary to the project.

N/A
2. Identify assumptions regarding existing and future land use and effects of offsite detention on peak flows.

D. Proposed Drainage System Description

N/A
1. Identify how offsite stormwater is collected and conveyed through the site and ultimately to the receiving water(s).

✓
2. Identify sub-basins and describe, in general terms, how onsite stormwater is collected and conveyed through the site for each location where stormwater is discharged from the site.

✓ *
3. Describe detention volumes, release rates and pool elevations.

GEOTECH RPT UNAVAILABLE* AT THIS TIME
4. Identify the difference in elevation between pond invert and the groundwater table.

✓
5. Describe how stormwater is discharged from the site, including both concentrated and dispersed discharges and rates.

N/A ✓ *
6. Describe stormwater quality facilities.

✓ *
7. Describe maintenance access aspects of design.

8. Describe easements and tracts for drainage purposes, including limitation on use.

E. Drainage Facility Maintenance

✓ *
1. Identify responsible parties for maintenance of each drainage and water quality facility.

✓ *
2. Identify general maintenance activities and schedules.

III. DRAINAGE ANALYSIS AND DESIGN CRITERIA

A. Regulations

✓
1. Identify that analysis and design was prepared in accordance with the provisions of the Manual.

✓
2. Identify other regulations or criteria which have been used to prepare analysis and design.

B. Development Criteria

✓
1. Identify drainage constraints placed on the project, such as by a major drainage study, floodplain study or other drainage reports relevant to the project.

✓
2. Identify drainage constraints placed on the project, such as from major street alignments, utilities, existing structures, and other developments.

C. Hydrologic Criteria

(If Manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from the Manual.)

✓
1. Identify developed storm runoff peak flows and volumes and how they were determined, including rainfall intensity or design storm.

✓
2. Identify which storm events were used for minor and major flood analysis and design.

N/A
3. Identify how and why any other deviations from the Manual occurred.

D. Hydraulic Criteria

(If Manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from the Manual.)

✓ *
1. Identify type(s) of streets within and adjacent to development and source for allowable street capacity.

✓ *
2. Identify which type(s) of storm inlets were analyzed or designed and source for allowable capacity.

3. Identify which type of storm sewers which were analyzed or designed and

✓ * Manning's n-values used.

✓ * 4. Identify which method was used to determine detention volume requirements and how allowable release rates were determined.

✓ * 5. Identify how the capacity of open channels and culverts were determined.

N/A * 6. Identify any special analysis or design requirements not contained with the Manual.

N/A 7. Identify how and why any other deviations from the Manual occurred.

E. Variance from Criteria

✓ (N/A) 1. Identify any provisions of the Manual for which a variance is requested.

✓ (N/A) 2. Identify pre-existing conditions which cause the variance request.

*IV. POST CONSTRUCTION STORMWATER MANAGEMENT. See Manual Section 1600 for requirements.

Note: This section of the Final Drainage Report identifies additional information required by Mesa County's, City of Grand Junction's, and Town of Palisade's, Permit for Stormwater Discharges Associated with Municipal Separate Storm Sewer Systems (MS4s), permit No. COR-090000. The Final Drainage Plan and the Construction SWMP (see SWMM Section 1500) meets the requirements of the MS4s Permit. In general, this section identifies permanent BMP practices to control the discharge of pollutants after construction is complete.

N/A

*A. Stormwater Quality Control Measures

* 1. Describe the post-construction BMPs to control discharge of pollutants from the project site.

* 2. If compensating detention is provided, discuss practices to address water quality from area not tributary to detention area.

* 3. If underground detention is proposed, discuss how water quality facilities will be provided on the surface.

4. If proprietary BMPs are proposed, provide the justification and sizing requirements (see SWMM Section 1603.3).

*B. Calculations

1. Provide methods and calculations for WQCV, sediment storage, and water quality outlet structure.

V. CONCLUSIONS

A. Compliance with Manual

✓ Compliance with Manual and other approved documents, such as drainage plans and floodplain studies.

B. Design Effectiveness

✓ Effectiveness of drainage design to control impacts of storm runoff.

C. Areas in Flood Hazard Zone

✓ Meet requirements of Floodplain Regulations: Mesa County Land Development Code, Section 7.13; City of Grand Junction Zoning and Development Code, Section 7.1.

D. Variances from Manual

✓ Applicant shall identify any requested variances and provide basis for approving variance. If no variances are requested, applicant shall state that none are requested.

VII. REFERENCES

✓ Provide a reference list of all criteria, master plans, drainage reports, and technical information used.

TABLES

✓ Include copy of all tables prepared for report.

FIGURES

✓ A. General Location Map (See Section 303.2a)

B. Flood Plain Information
C. Drainage Plan (See Section 303.2b)
D. Other pertinent figures.

APPENDICIES

A. DESIGN CHARTS
   1. Provide copy of all design charts (i.e.: tables, figures, charts from other criteria) used for the report.

B. HYDROLOGIC CALCULATIONS (see Manual Sections 600 and 700)
   1. Land use assumptions for off-site runoff calculations.
   2. Time of concentration and runoff coefficients for pre-existing and post development conditions.
   3. Pre-developed hydrologic computations.
   4. Developed conditions hydrologic computations.

C. HYDRAULIC CALCULATIONS
   1. Capacity of existing channels, streets, storm sewers, inlets, culverts and other facilities.
   2. Calculations for existing storm sewer and open channel.
   3. Irrigation ditch flows and ditch system capacity.
   4. Detention pond design (see Manual, Section 1400 for requirements).
      a. Storage volume, release rates, and pool elevations for 10-year and 100-year storm.
      b. Outlet structure dimensions, orifice diameter, weir lengths, pipe headwater and other data.
      c. Outlet velocity and energy dissipation requirements.
      d. Routing of outlet flows and emergency spillway flows.
   5. Street capacity calculations, if data in Manual not used (see Section 1100).
   6. Storm inlet capacity calculations, if data in Manual not used (see Section 1100).
   7. Storm sewer capacity calculations, if data in Manual not used (see Section 1000).
   8. Channel capacity calculations, if data in Manual not used (see Section 800).
   9. Culvert capacity calculations (see Manual, Section 1200).
   10. Other hydraulic structure calculations (see Manual, Section 900).

D. STORMWATER QUALITY CALCULATIONS
   1. Water Quality Capture Volume (WQCV).
   2. Storage volume for sediment volume and pool elevations for WQCV.
   3. Outlet calculations for required area per row, diameter of individual holes, number of holes per row, and number of holes per column.

CERTIFICATION – PROFESSIONAL ENGINEER'S SEAL AND SIGNATURE

ACKNOWLEDGEMENTS

Drainage Report checklist was prepared by: _____

ASPEN VILLAGE SUBDIVISION 05/06/2016

Table 303
Stormwater Management Manual
Drainage Plan Checklist

Instructions:
1. Applicant to identify with a "check-mark" if information is provided. If applicant believes information is not required, indicate with "n/a".
2. County will determine if information labeled "n/a" is required and whether information must be submitted.

I. EXISTING FACILITIES

- ✓ A. Contours at two foot intervals, based on USGS datum. Contours to extend at least 50 feet past property line.
- SEE PLANS B. Location and elevation of USGS benchmarks or benchmarks referenced to USGS.
- ✓ C. Property lines.
- ✓ D. Drainage easements.
- ✓ E. Street names.
- ✓ F. Major and minor channels and floodplains.
- ✓ G. A historic drainage plan including historic basin boundaries and flow paths.

II. PROPOSED FACILITIES

- ✓ A. Contours at two-foot intervals, based on USGS datum.
- ✓ B. Property lines.
- ✓ C. Drainage easements.
- ✓ D. Street names and grades.
- SEE PLANS E. Right of way and easement.
- ✓ F. Finished floor elevations for protection from major storm run-off.
- G. Detention pond information:
  - ✓ 1. Location of each detention pond with site at 1"=50' scale or larger with 2-foot contour intervals.
  - SEE PLANS 2. Inlet and outlet structure, and trickle channel design details.
  - ↓ 3. Details of emergency spillway and channel.
  - N/A 4. Landscape information, including side slopes, vegetation and planting requirements.
  - 5. Details of water quality outlet structure.
- SEE PLANS H. Channel Information:
  - ↓ 1. Profiles with existing and proposed grades.
  - 2. Cross sections on 100-foot stations showing existing and proposed topography and required rights of way.
  - 3. Locations and size of all existing and proposed structures.
  - 4. Locations and profiles of adjacent utilities.
  - 5. Typical channel section and lining details.
- ✓ I. Storm sewer information:
  - SEE PLANS 1. Alignment and location of manholes, inlets, and outlet structures.
  - ↓ 2. Profile of invert and pipe crown.
  - 3. Invert elevations at manholes and inlets.
  - 4. Lengths and grades between manholes and inlets.
  - 5. Locations and elevations of utilities adjacent to and crossing storm sewer.
  - 6. Easement and other O&M access geometry.
  - 7. Outlet details, such as end sections, headwall and wingwalls, erosion control, and vegetation.
- ✓ SEE STREET CAPACITY CHECK CALCS IN RPT APPENDIX J. Street cross sections with design 100-year flood depth.
- N/A K. Other drainage related structures and facilities, including underdrains and sump pump discharge lines.
- N/A L. Other permanent BMP measures to control pollutant discharges to the County's MS4 system.

III. HYDRAULIC AND HYDROLOGIC INFORMATION

SEE MODEL OUTPUT IN RPT APPENDIX

A. Routing and accumulative runoff peaks at upstream and downstream ends of the site and at various critical points onsite for initial and major storms. Inflow and outflow from each subbasin shall be shown for both initial and major storms.

B. Street cross sections showing 100-year flood levels.

C. Major and minor channels and floodplains.

D. Detention pond data:
   1. Release rates for 10- and 100-year storm events.
   2. Required and provided volumes for 10- and 100-year storm events.
   3. Design depths for 10- and 100-year storm events.
   4. Water quality capture volume and pool elevation.

E. Channel data:
   1. Water surface profiles.
   2. Representative 100-year flow velocity and Froude number.

F. Storm sewer data:
   1. Profile of water surface for design flow rate.
   2. Peak flows for design flow, 2-year and 100-year storm events.

IV. STANDARD NOTES

✓ A. No building, structure, or fill will be placed in the detention areas and no changes or alterations affecting the hydraulic characteristics of the detention areas will be made without the approval of the ~~County~~. CITY

✓ B. Maintenance and operation of the detention ~~and water quality~~ areas is the responsibility of property owner. If owner fails in this responsibility, the ~~County~~ has the right to enter the property, maintain the detention areas, and be reimbursed for costs incurred.

✓ C. Detention pond volumes, all drainage appurtenances, and basin boundaries shall be verified. As-built drawings shall be prepared by a registered professional engineer prior to issuance of certificate of occupancy for any structure within the development.

✓ D. Permission to reproduce these plans is hereby given to ~~Mesa County for County~~ CITY OF FRUITA purposes associated with plan review, approval, permitting, inspection and for construction of work.

V. PROFESSIONAL ENGINEER'S SEAL AND SIGNATURE

VI. OTHER

SEE PLANS A. Horizontal and vertical control information and ties to existing and proposed features.

ACKNOWLEDGEMENTS

Drainage Plan checklist was prepared by: _____