MONTGOMERY

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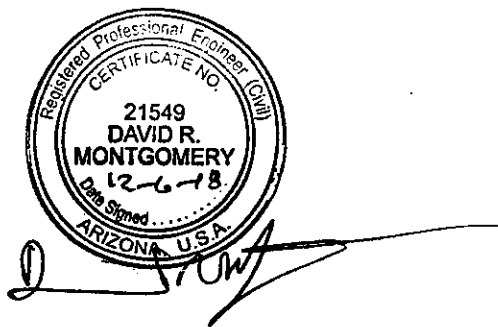
PRELIMINARY DRAINAGE REPORT

LOT 1 LAVITT MANOR II

7525 N. IRONWOOD DRIVE
PARADISE VALLEY, ARIZONA

OCTOBER 2018
REV. 1 DECEMBER 2018 (MOVE STREET)

Benchmark: ½" rebar at the intersection of Invergordon Road and Cheney Drive
Elevation 1372.241 (NAVD '88) GDAC #22515-11

21549
DAVID R.
MONTGOMERY
12-6-18

Seal is for Drainage Calculations for subject lot only and not
to be used for any other purpose

1.0 Table of Contents

Appendices

2.0 INTRODUCTION

This report was prepared to determine drainage paths and high-water elevations based on the 100-year rainfall for Lavitt Manor II, a replat of Lavitt Manor Lot 1, splitting the current lot into two lots. The current address is 7525 N. Ironwood Drive, Paradise Valley, Arizona located in a residential area zoned R-43. See Appendix A for vicinity map.

The parent lot is 2.77 acres in size with proposed lots of 1.1 acres each. The existing residence, guest house and tennis court will be demolished. A new street and cul-de-sac are proposed on the south side of the lot to provide access to the lots. Two-offsite drainage areas drain to this lot. The largest drainage channel enters the west side of the lot and curves to exit the lot on the north side. Minor drainage flow enters the south lot line and drains into the larger flow noted above prior to exiting the site. A culvert is proposed under the proposed street to convey runoff from Watershed Basin 'B' to its historical outlet location.

3.0 FEMA FLOODPLAIN CLASSIFICATION

This site is located in FEMA flood zone 'X' per flood map 04013C, panel 1765L, dated 10-16-2013. See Appendix B for a FIRM map showing the floodplain classification.

4.0 PURPOSE

This Drainage Report has been prepared to meet Paradise Valley requirements in accordance with the Paradise Valley Storm Drainage Manual plus noted portions of the Maricopa County Drainage Policies and Standards, Drainage Design Manuals for Maricopa County, (MCDDM) Volume 1 – Hydrology and Volume 2 – Hydraulics. This report will determine the 100-year runoff for sizing culverts retention and drainage easement locations.

The following pages show calculations for the 100-year runoff, the high-water elevation and culvert sizing for the proposed street. Retention calculations are provided for street improvements in Appendix G. Retention for future custom home development will be provided at the time of permitting for the residence

and is not part of this report. Retention will be provided for a 100-year 2-hour rainfall for the street and landscape area at this time.

5.0 OFF-SITE DRAINAGE DESCRIPTION

Offsite runoff is divided into two Watershed Basins (WB) as shown on the watershed exhibit in Appendix I. WB 'A' begins at a ridge on Mummy Mountain and flows easterly to the subject lot. Terrain consists of steep mountain grades to developed residential land. WB 'B' is located south of the subject property that drains northerly to the subject lot. Terrain is a residential lot with desert landscape and buildings.

6.0 ON-SITE DRAINAGE DESCRIPTION

On-site runoff from WB 'A' enters the property at the west side at a dip in Ironwood Drive and follows a well-defined channel that curves to the north and exits the lot at the north boundary. No change or disturbance to the drainage path is proposed.

On-site runoff from WB 'B' enters the south side of the property and flows north to join the channel from WB 'A' before exiting the property. The existing driveway has a 16-inch diameter culvert conveying runoff to the north. The proposed street improvements will remove the existing culvert to be replaced with a new culvert, see Appendix E for culvert calculations.

7.0 SPECIAL CONDITIONS

The large wash entering the west side of the lot is assumed to be a 404 wash, no disturbance to the wash is proposed for this project. A Stormwater Pollution Protection Plan and dust control permit will be required for this project. No phasing is proposed.

8.0 HYDROLOGY METHODS

Runoff was calculated using the rational Method and the Maricopa County Drainage program for the Retention Method with watershed areas determined using Maricopa County Aerial Contour Maps, see Appendix C for Rational calculations and Appendix I for a watershed exhibit. WB 'A' runoff is 162 cfs and WB 'B' is 5 cfs for the 100-year event. Post vs. pre-runoff will not increase from this project due to retention added for the 100-year runoff at the improved areas, see 10.0 below.

9.0 HYDRAULICS METHODS

Flowmaster computer program was used to calculate the high-water elevations at section locations shown on the Paving, Grading and Drainage plan in Appendix I. HY-8 computer program was used to size the culvert for the 100-year runoff. Calculations with 50% of the culvert depth plugged are included to conservatively check for adverse conditions. Calculations are in Appendix E.

10.0 STORMWATER RETENTION

Retention is provided for the paved and landscaped areas of the Tract A right of way and Tract B landscape area. Volume required is based on 100% of the 2 hour 100-year event. Calculations are in Appendix G. First Flush requirements are exceeded by the retention provided.

11.0 FINISH FLOOR ELEVATION REQUIREMENTS

Finish Floor elevations are not a part of this report. Plans for the custom homes will be required to provide finish floor protection a minimum of 1 foot above the high-water elevation and highest adjacent grade, whichever is highest plus all regulations in affect at that time.

12.0   SEDIMENTATION AND EROSION HAZARDS

The existing drainage channels show no evidence of sedimentation deposits or on-site erosion. Future development will need to study mitigation of sedimentation and erosion for any proposed structures.

13.0   CONCLUSIONS AND RECOMMENDATIONS

In summary, runoff is 162 cfs at the large west wash from Watershed Basin A and 5 cfs at the south wash from Watershed Basin B, runoff from B joins A at its historical location. A 24-inch diameter corrugated metal culvert is proposed at the street crossing. An existing drainage easement will remain for areas inundated from the west wash. Improvements to Ironwood Drive and the proposed cul-de-sac are shown in the Paving, Grading and Drainage plan, see Appendix J. Runoff from WB 'B' channel is less than 10 square feet with no drainage easement proposed.

APPENDIX A

N MOCKINGBIRD LANE

E STALLION RD

E CHENEY DRIVE

VICINITY MAP
NO SCALE

N INVERGORDON RD

SITE

N IRONWOOD DRIVE
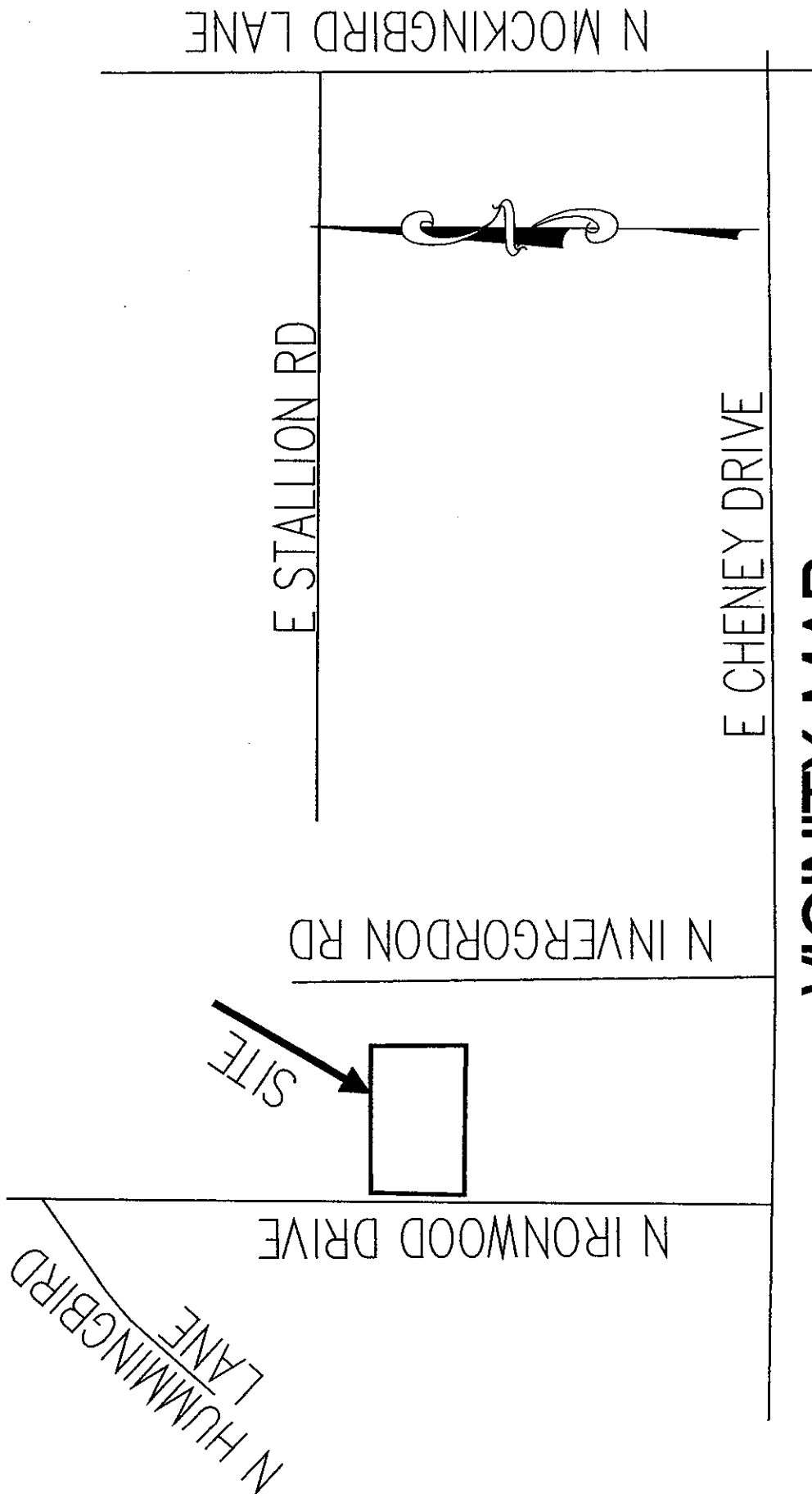
N HUMMINGBIRD LANE

APPENDIX B

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS OF FLOOD HAZARD

NO SCREEN — Area of Minimal Flood Hazard *Zone X*

Effective LOMRs

OTHER AREAS
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

- Cross Sections with 1% Annual Chance
- Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline

OTHER FEATURES
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/22/2018 at 2:59:32 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Map labels:
- SITE
- TOWN OF PARADISE VALLEY 040119
- AREA OF MINIMAL FLOOD HAZARD Zone X
- 04013C1765L eff. 10/16/2013
- T2N R4E S3
- T2N R4E S4
- 33°32'31.70"N 111°56'23.61"W
- 33°32'31.88"N 111°57'1.07"W
- USGS The National Map: Orthoimagery. Data refreshed October 2017.
- 1:6,000
- Feet 0 250 500 1,000 1,500 2,000
- N

APPENDIX C

Flood Control District of Maricopa County
Drainage Design Management System
SUB BASINS
Project Reference: LAVITT MANOR LOT 1

10/16/2018

ID

Sub Basin Data

	Area (acres)	Length (ft)	USGE	DSGE	Slope (ft/mi)	Kb
A	40.7	4,450	2,230.00	1,362.00	1,029.9	0.057
B	1.0	408	1,378.00	1,368.00	129.4	0.040

Sub Basin Hydrology Summary

Major Basin ID: 01

		2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
A	Q (cfs)	46.6	67.2	83.3	113.0	139.7	161.9
	C	0.55	0.55	0.55	0.61	0.66	0.68
	CA (ac)	22.39	22.39	22.39	24.83	26.86	27.68
	Volume (ac-ft)	1.0626	1.3346	1.5318	2.0779	2.5689	2.9771
	Tc (min)	12	11	10	10	10	10
	i (in/hr)	2.08	3.00	3.72	4.55	5.20	5.85
B	Q (cfs)	1.1	1.5	1.8	2.4	3.0	3.5
	C	0.48	0.48	0.48	0.53	0.58	0.60
	CA (ac)	0.48	0.48	0.48	0.53	0.58	0.60
	Volume (ac-ft)	0.0202	0.0276	0.0331	0.0441	0.0552	0.0644
	Tc (min)	10	10	10	10	10	10
	i (in/hr)	2.28	3.10	3.72	4.55	5.20	5.85

Flood Control District of Maricopa County
Drainage Design Management System
LAND USE
Project Reference: LAVITT MANOR LOT 1

Sub Basin	Land Use Code	Area (acres)	Area (%)	Kb	Runoff Coefficient C						Description
					2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	

Major Basin ID: 01

Sub Basin	Land Use Code	Area (acres)	Area (%)	Kb	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	Description
A	130	31.60	77.6	0.030	0.48	0.48	0.48	0.53	0.58	0.60	Large Lot Residential - Single Family (1 du per acre to 2 du
	730	9.10	22.4	0.152	0.80*	0.80*	0.80*	0.88*	0.95*	0.95*	Passive Open Space (Includes mountain preserves and washes)
		40.700	**100.0**								
B	130	1.00	100.0	0.040	0.48	0.48	0.48	0.53	0.58	0.60	Large Lot Residential - Single Family (1 du per acre to 2 du
		1.000	**100.0**								

Flood Control District of Maricopa County
Drainage Design Management System
RAINFALL DATA
Project Reference: LAVITT MANOR LOT 1

Page 1

10/16/2018

ID	Method	Duration	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
DEFAULT	NOAA14	5 MIN	0.246	0.333	0.400	0.491	0.560	0.631
	NOAA14	10 MIN	0.374	0.507	0.609	0.747	0.853	0.961
	NOAA14	15 MIN	0.464	0.629	0.755	0.926	1.057	1.191
	NOAA14	30 MIN	0.625	0.847	1.017	1.247	1.424	1.604
	NOAA14	1 HOUR	0.773	1.048	1.259	1.543	1.762	1.985
	NOAA14	2 HOUR	0.889	1.187	1.415	1.726	1.963	2.209
	NOAA14	3 HOUR	0.969	1.269	1.508	1.842	2.109	2.385
	NOAA14	6 HOUR	1.151	1.473	1.730	2.079	2.352	2.637
	NOAA14	12 HOUR	1.284	1.625	1.892	2.253	2.529	2.815
	NOAA14	24 HOUR	1.532	1.984	2.342	2.840	3.232	3.642

APPENDIX D

LAVITT MANOR II

FLOWMASTER SUMMARY

SECTION	HIGH WATER ELEVATION	DEPTH (FT)	VELOCITY (fps)
1	1371.55	0.95	6.58
2	1369.12	2.12	7.65
3	1368.82	2.22	4.22
4	1368.87	1.87	5.85
5	1363.92	1.72	6.02
6	1372.27	0.47	3.72
7	1370.66	0.66	2.45
8	1370.36	0.56	2
9	1369.8	0.5	2.77
10	1368.95	0.6	3.83

Cross Section for Irregular Channel

Project Description

Worksheet	1
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Section Data

Mannings Coeff	0.020	
Slope	0.015000	ft/ft
Water Surface I	1,371.55	ft
Elevation Rang	0 to 1,373.00	
Discharge	162.00	cfs
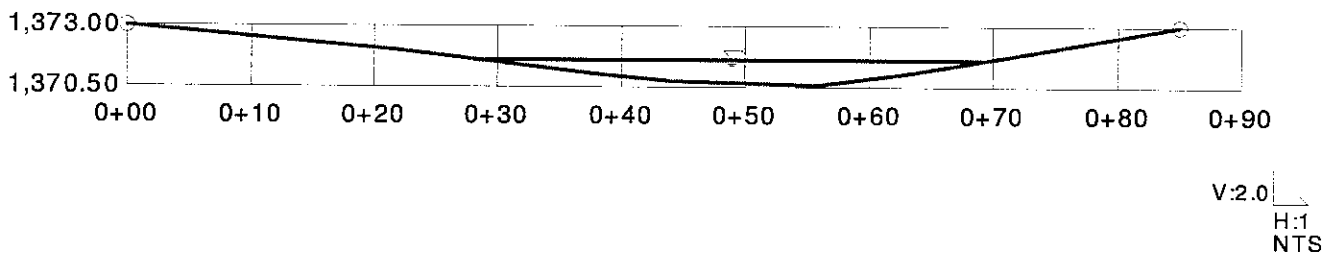

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1,373.00
1,370.50
        0+00   0+10   0+20   0+30   0+40   0+50   0+60   0+70   0+80   0+90
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Worksheet
Worksheet for Irregular Channel

Project Description

Worksheet	1
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Input Data

Slope	15000	ft/ft
Discha	62.00	cfs

Options

Current Roughness	Lotter's Method
Open Channel Weig	Lotter's Method
Closed Channel Wei	Horton's Method

Results

Mannings Coefl	0.020	
Water Surface I	1,371.55	ft
Elevation Rang	i0 to 1,373.00	
Flow Area	24.6	ft²
Wetted Perimet	40.07	ft
Top Width	40.01	ft
Actual Depth	0.95	ft
Critical Elevatio	1,371.76	ft
Critical Slope	0.006476	ft/ft
Velocity	6.58	ft/s
Velocity Head	0.67	ft
Specific Energy	1,372.23	ft
Froude Number	1.48	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+85	0.020

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	1,373.00
0+22	1,372.00
0+38	1,371.00
0+44	1,370.70
0+56	1,370.60
0+63	1,371.00
0+74	1,372.00
0+85	1,373.00

Project Description

Worksheet	2
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Section Data

Mannings Coefl	0.050	
Slope	0.050000	ft/ft
Water Surface I	1,369.12	ft
Elevation Rang	10 to 1,372.00	
Discharge	162.00	cfs

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Project Engineer: dave
FlowMaster v6.1 [614k]
Page 1 of 1

Worksheet
Worksheet for Irregular Channel

Project Description

Worksheet	2
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Input Data

Slope	50000	ft/ft
Dischaı	62.00	cfs

Options

Current Roughness	Lotter's Method
Open Channel Weig	Lotter's Method
Closed Channel Wei	Horton's Method

Results

Mannings Coefl	0.050	
Water Surface I	1,369.12	ft
Elevation Rang	0 to 1,372.00	
Flow Area	21.2	ft²
Wetted Perimet	17.15	ft
Top Width	16.43	ft
Actual Depth	2.12	ft
Critical Elevatio	1,369.30	ft
Critical Slope	0.034619	ft/ft
Velocity	7.65	ft/s
Velocity Head	0.91	ft
Specific Energy	1,370.03	ft
Froude Number	1.19	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+33	0.050

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	1,372.00
0+08	1,370.00
0+17	1,367.50
0+23	1,367.00
0+25	1,368.00
0+33	1,372.00

Cross Section for Irregular Channel

Project Description

Worksheet	3
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Section Data

Mannings Coeff	0.040	
Slope	0.008000	ft/ft
Water Surface I	1,368.82	ft
Elevation Rang;0 to 1,370.00		
Discharge	162.00	cfs
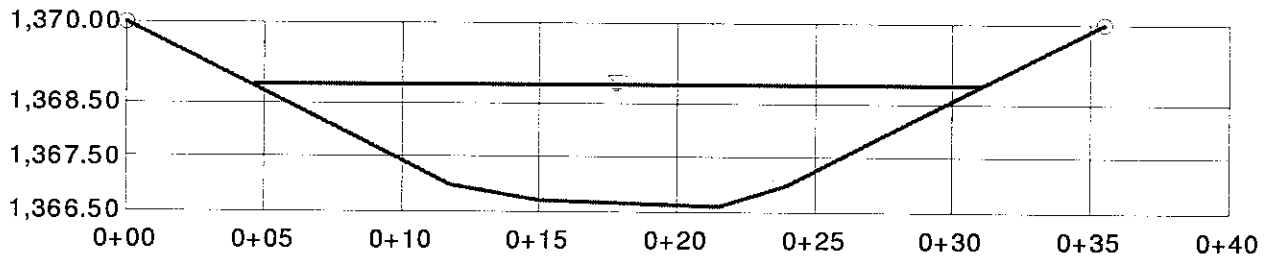
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Page 1 of 1

Worksheet
Worksheet for Irregular Channel

Project Description

Worksheet	3
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Input Data

Slope   08000 ft/ft
Dischai 62.00 cfs

Options

Current Roughness I Lotter's Method
Open Channel Weig Lotter's Method
Closed Channel Wei Horton's Method

Results

Mannings Coefl	0.040	
Water Surface I	1,368.82	ft
Elevation Rang	0 to 1,370.00	
Flow Area	38.4	ft²
Wetted Perimet	26.87	ft
Top Width	26.36	ft
Actual Depth	2.22	ft
Critical Elevatio	1,368.33	ft
Critical Slope	0.022625	ft/ft
Velocity	4.22	ft/s
Velocity Head	0.28	ft
Specific Energy	1,369.10	ft
Froude Number	0.62	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+36	0.040

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	1,370.00
0+12	1,367.00
0+15	1,366.70
0+22	1,366.60
0+24	1,367.00
0+36	1,370.00

Project Description

Worksheet	4
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Section Data

Mannings Coefl	0.040	
Slope	0.020000	ft/ft
Water Surface I	1,366.87	ft
Elevation Rang	0 to 1,369.00	
Discharge	162.00	cfs

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Worksheet
Worksheet for Irregular Channel

Project Description

Worksheet	4
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Input Data

Slope	20000	ft/ft
Dischai	62.00	cfs

Options

Current Roughness I	Lotter's Method
Open Channel Weig	Lotter's Method
Closed Channel Wei	Horton's Method

Results

Mannings Coefi	0.040	
Water Surface I	1,366.87	ft
Elevation Rang	0 to 1,369.00	
Flow Area	27.7	ft²
Wetted Perimet	23.55	ft
Top Width	23.14	ft
Actual Depth	1.87	ft
Critical Elevatio	1,366.82	ft
Critical Slope	0.022695	ft/ft
Velocity	5.85	ft/s
Velocity Head	0.53	ft
Specific Energy	1,367.41	ft
Froude Number	0.94	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+34	0.040

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	1,368.00
0+10	1,365.60
0+20	1,365.00
0+26	1,366.00
0+34	1,369.00

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Page 1 of 1

Project Description

Worksheet	5
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Section Data

Mannings Coeff	0.040	
Slope	0.023000	ft/ft
Water Surface I	1,363.92	ft
Elevation Rang 0 to 1,367.90		
Discharge	162.00	cfs
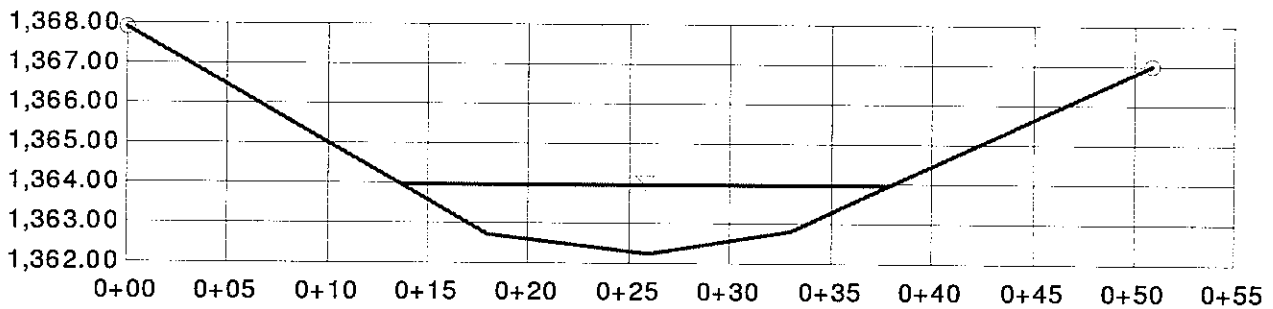
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Page 1 of 1

Worksheet
Worksheet for Irregular Channel

Project Description

Worksheet	5
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Input Data

Slope 23000 ft/ft
Dischai 62.00 cfs

Options

Current Roughness I Lotter's Method
Open Channel Weig Lotter's Method
Closed Channel Wei Horton's Method

Results

Mannings Coefl	0.040	
Water Surface I	1,363.92	ft
Elevation Rang:0 to 1,367.90		
Flow Area	26.9	ft²
Wetted Perimet	24.32	ft
Top Width	23.98	ft
Actual Depth	1.72	ft
Critical Elevatio	1,363.92	ft
Critical Slope	0.022859	ft/ft
Velocity	6.02	ft/s
Velocity Head	0.56	ft
Specific Energy	1,364.48	ft
Froude Number	1.00	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+51	0.040

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	1,367.90
0+18	1,362.70
0+26	1,362.20
0+33	1,362.80
0+51	1,367.00

Project Description

Worksheet	6
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Section Data

Mannings Coefl	0.050	
Slope	0.110000	ft/ft
Water Surface I	1,372.27	ft
Elevation Rang	0 to 1,373.00	
Discharge	5.00	cfs
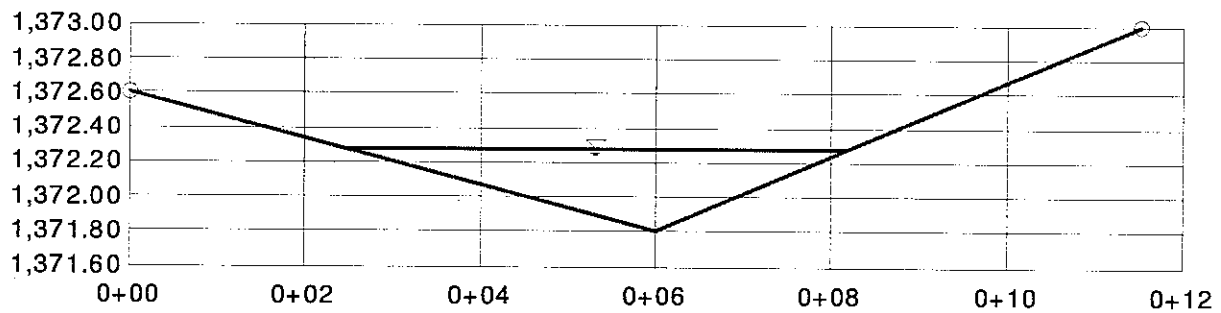
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Page 1 of 1

Worksheet
Worksheet for Irregular Channel

Project Description

Worksheet	6
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Input Data

Slope	10000	ft/ft
Dischai	5.00	cfs

Options

Current Roughness I	Lotter's Method
Open Channel Weig	Lotter's Method
Closed Channel Wei	Horton's Method

Results

Mannings Coefl	0.050	
Water Surface I	1,372.27	ft
Elevation Rang	0 to 1,373.00	
Flow Area	1.3	ft²
Wetted Perimet	5.78	ft
Top Width	5.70	ft
Actual Depth	0.47	ft
Critical Elevatio	1,372.33	ft
Critical Slope	0.057740	ft/ft
Velocity	3.72	ft/s
Velocity Head	0.22	ft
Specific Energy	1,372.49	ft
Froude Numbei	1.35	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+12	0.050

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	1,372.60
0+06	1,371.80
0+12	1,373.00

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Cross Section for Irregular Channel

Project Description

Worksheet	7
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Section Data

Mannings Coefl	0.040	
Slope	0.020000	ft/ft
Water Surface I	1,370.66	ft
Elevation Rang	0 to 1,373.00	
Discharge	5.00	cfs

V:2.0
H:1
NTS

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Montgomery Engineering

Project Engineer: dave
FlowMaster v6.1 [614k]
Page 1 of 1

Worksheet
Worksheet for Irregular Channel

Project Description

Worksheet	7
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Input Data

Slope	20000	ft/ft
Dischai	5.00	cfs

Options

Current Roughness I	Lotter's Method
Open Channel Weig	Lotter's Method
Closed Channel Wei	Horton's Method

Results

Mannings Coefl	0.040	
Water Surface I	1,370.66	ft
Elevation Rang	0 to 1,373.00	
Flow Area	2.0	ft²
Wetted Perimet	6.42	ft
Top Width	6.20	ft
Actual Depth	0.66	ft
Critical Elevatio	1,370.59	ft
Critical Slope	0.036780	ft/ft
Velocity	2.45	ft/s
Velocity Head	0.09	ft
Specific Energy	1,370.75	ft
Froude Number	0.75	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+19	0.040

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	1,373.00
0+10	1,372.00
0+13	1,370.00
0+19	1,370.80

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Page 1 of 1

Worksheet
Worksheet for Irregular Channel

Project Description

Worksheet	8
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Input Data

Slope	13000	ft/ft
Dischai	5.00	cfs

Options

Current Roughness I	Lotter's Method
Open Channel Weig	Lotter's Method
Closed Channel Wei	Horton's Method

Results

Mannings Coeff	0.040	
Water Surface I	1,370.36	ft
Elevation Rang	0 to 1,372.00	
Flow Area	2.5	ft²
Wetted Perimet	7.67	ft
Top Width	7.50	ft
Actual Depth	0.56	ft
Critical Elevatio	1,370.25	ft
Critical Slope	0.037416	ft/ft
Velocity	2.00	ft/s
Velocity Head	0.06	ft
Specific Energy	1,370.42	ft
Froude Number	0.61	
Flow Type	Subcritical	

Calculation Messages:
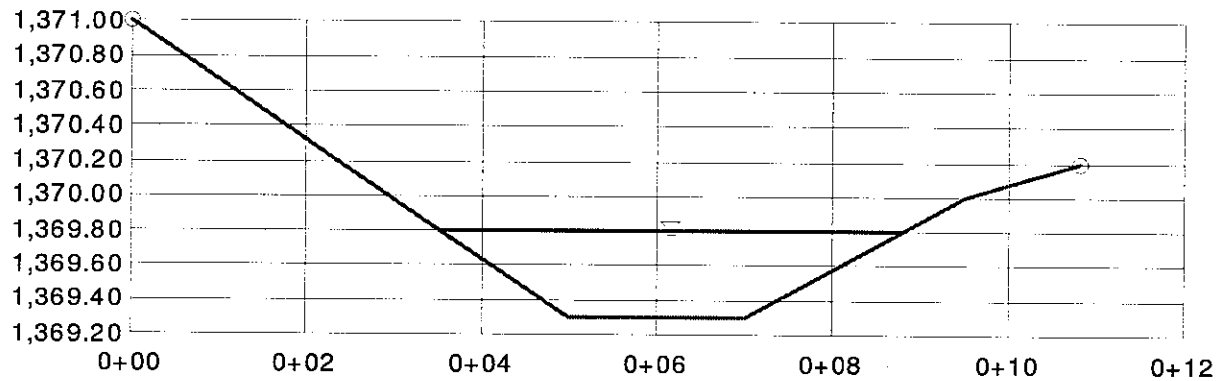Water elevation exceeds lowest end station by 0.5770951e-1 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+12	0.040

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	1,372.00
0+06	1,369.80
0+10	1,370.00
0+12	1,370.30

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Page 1 of 1

Cross Section for Irregular Channel

Project Description

Worksheet	9
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Section Data

Mannings Coefi	0.040	
Slope	0.024000	ft/ft
Water Surface I	1,369.80	ft
Elevation Rang	0 to 1,371.00	
Discharge	5.00	cfs

V:2.0
H:1
NTS

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Project Engineer: dave
FlowMaster v6.1 [614k]
Page 1 of 1

Worksheet
Worksheet for Irregular Channel

Project Description

Worksheet	9
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Input Data

Slope	24000	ft/ft
Dischai	5.00	cfs

Options

Current Roughness I	Lotter's Method
Open Channel Weig	Lotter's Method
Closed Channel Wei	Horton's Method

Results

Mannings Coefi	0.040	
Water Surface I	1,369.80	ft
Elevation Rang	0 to 1,371.00	
Flow Area	1.8	ft²
Wetted Perimet	5.39	ft
Top Width	5.24	ft
Actual Depth	0.50	ft
Critical Elevatio	1,369.75	ft
Critical Slope	0.035461	ft/ft
Velocity	2.77	ft/s
Velocity Head	0.12	ft
Specific Energy	1,369.92	ft
Froude Number	0.83	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+11	0.040

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	1,371.00
0+05	1,369.30
0+07	1,369.30
0+10	1,370.00
0+11	1,370.20

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Montgomery Engineering

Project Engineer: dave
FlowMaster v6.1 [614k]
Page 1 of 1

Project Description

Worksheet	10
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Section Data

Mannings Coefl	0.040	
Slope	0.056000	ft/ft
Water Surface I	1,368.95	ft
Elevation Rang	5 to 1,370.30	
Discharge	5.00	cfs
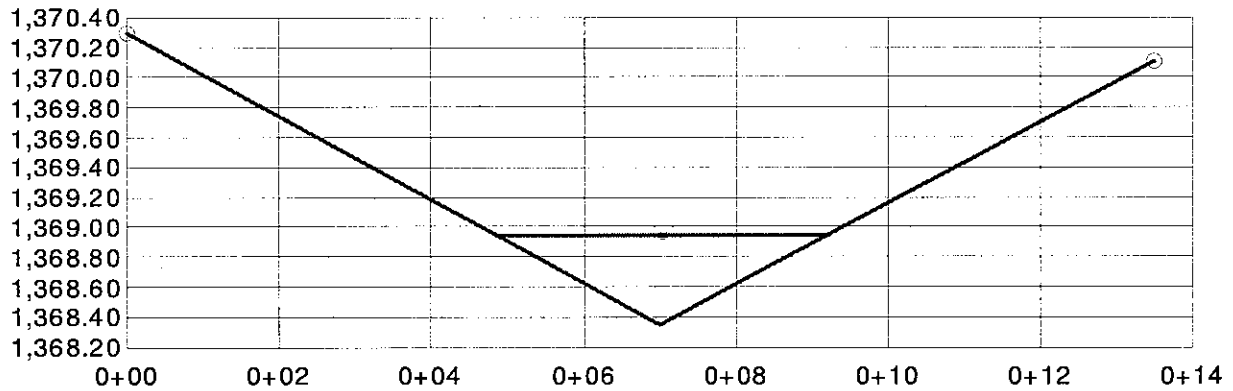
V:2.0
H:1
NTS

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Montgomery Engineering

Project Engineer: dave
FlowMaster v6.1 [614k]
Page 1 of 1

Worksheet
Worksheet for Irregular Channel

Project Description

Worksheet	10
Flow Element	Irregular Ch
Method	Manning's F
Solve For	Channel De

Input Data

Slope	56000	ft/ft
Dischar	5.00	cfs

Options

Current Roughness I	Lotter's Method
Open Channel Weig	Lotter's Method
Closed Channel Wei	Horton's Method

Results

Mannings Coefl	0.040	
Water Surface I	1,368.95	ft
Elevation Rang	5 to 1,370.30	
Flow Area	1.3	ft²
Wetted Perimet	4.52	ft
Top Width	4.36	ft
Actual Depth	0.60	ft
Critical Elevatio	1,369.00	ft
Critical Slope	0.035576	ft/ft
Velocity	3.83	ft/s
Velocity Head	0.23	ft
Specific Energy	1,369.18	ft
Froude Number	1.24	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+14	0.040

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	1,370.30
0+07	1,368.35
0+14	1,370.10

APPENDIX E

HY-8 Culvert Analysis Report

LAVITT MANOR II

Crossing Discharge Data

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1371.01	5.00	5.00	0.00	1
1371.07	5.50	5.50	0.00	1
1371.14	6.00	6.00	0.00	1
1371.20	6.50	6.50	0.00	1
1371.26	7.00	7.00	0.00	1
1371.32	7.50	7.50	0.00	1
1371.38	8.00	8.00	0.00	1
1371.43	8.50	8.50	0.00	1
1371.49	9.00	9.00	0.00	1
1371.54	9.50	9.50	0.00	1
1371.60	10.00	10.00	0.00	1
1374.26	23.93	23.93	0.00	Overtopping

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 5 cfs

Maximum Flow: 10 cfs

Table 1 - Summary of Culvert Flows at Crossing: STREET CROSSING

Rating Curve Plot for Crossing: STREET CROSSING

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	1371.01	1.092	1.210	2-M2c	0.855	0.783	0.783	0.626	4.385	1.774
5.50	5.50	1371.07	1.154	1.275	2-M2c	0.904	0.825	0.825	0.655	4.497	1.819
6.00	6.00	1371.14	1.215	1.338	2-M2c	0.950	0.865	0.865	0.682	4.609	1.861
6.50	6.50	1371.20	1.274	1.399	2-M2c	0.995	0.903	0.903	0.708	4.720	1.900
7.00	7.00	1371.26	1.332	1.459	2-M2c	1.040	0.939	0.939	0.733	4.831	1.937
7.50	7.50	1371.32	1.389	1.518	2-M2c	1.085	0.974	0.974	0.757	4.941	1.972
8.00	8.00	1371.38	1.445	1.575	2-M2c	1.130	1.006	1.006	0.779	5.052	2.006
8.50	8.50	1371.43	1.500	1.632	2-M2c	1.174	1.038	1.038	0.801	5.160	2.037
9.00	9.00	1371.49	1.555	1.689	2-M2c	1.219	1.069	1.069	0.823	5.269	2.068
9.50	9.50	1371.54	1.609	1.744	2-M2c	1.264	1.098	1.098	0.843	5.378	2.097
10.00	10.00	1371.60	1.664	1.800	2-M2c	1.311	1.126	1.126	0.863	5.487	2.125
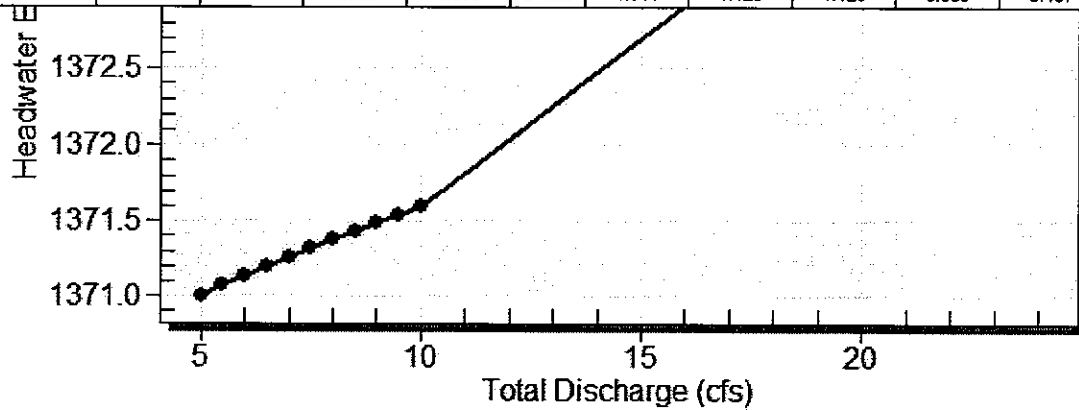
Table 2 - Culvert Summary Table: Culvert 1

****

Straight Culvert

Inlet Elevation (invert): 1369.80 ft,   Outlet Elevation (invert): 1369.30 ft

Culvert Length: 44.00 ft,   Culvert Slope: 0.0114
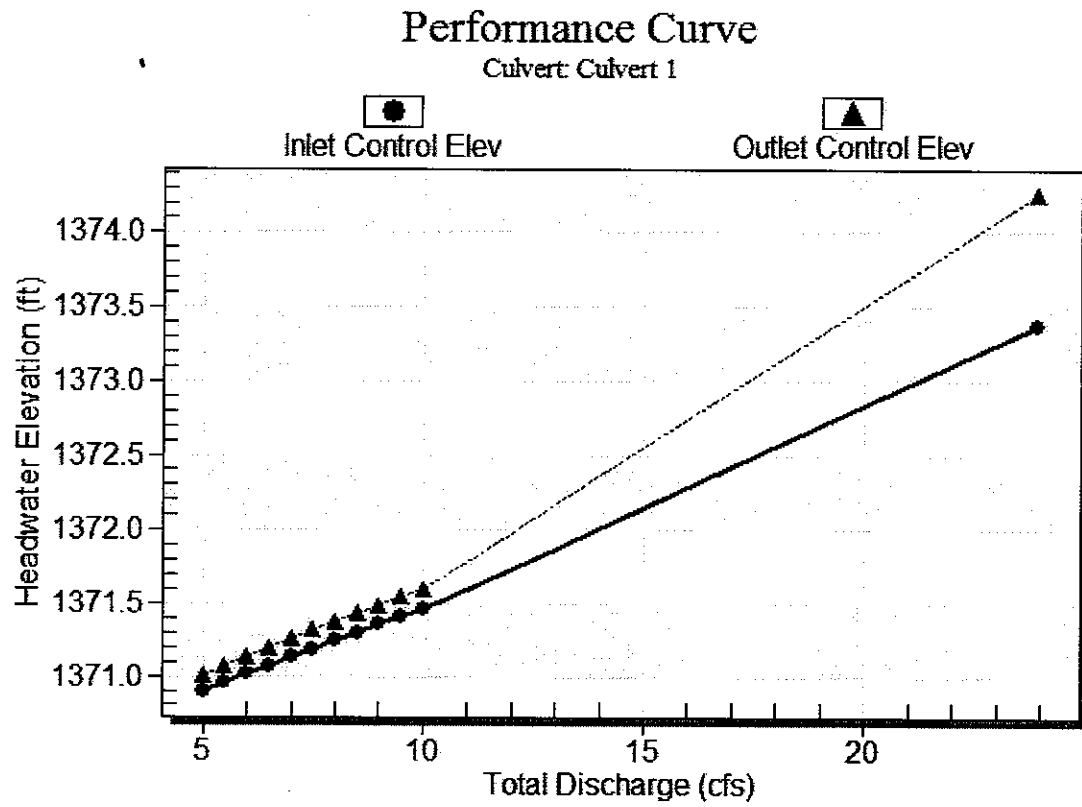
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Culvert Performance Curve Plot: Culvert 1

Performance Curve
Culvert: Culvert 1

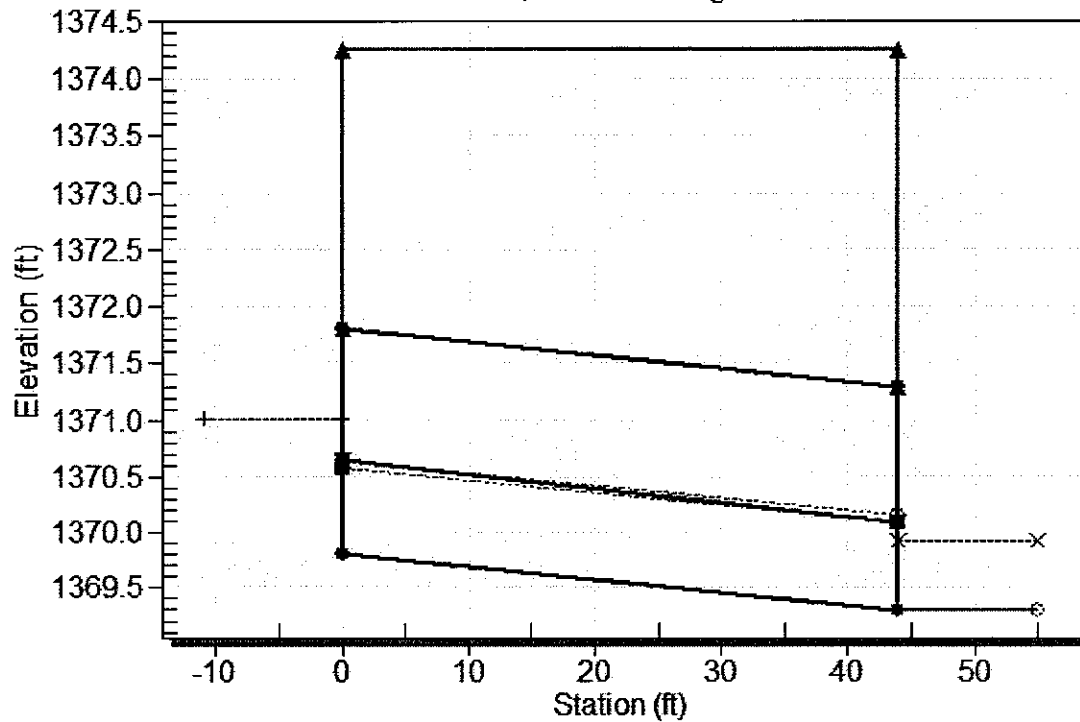Inlet Control Elev   Outlet Control Elev

Water Surface Profile Plot for Culvert: Culvert 1

Crossing - STREET CROSSING, Design Discharge - 5.0 cfs

Culvert - Culvert 1, Culvert Discharge - 5.0 cfs

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1369.80 ft

Outlet Station: 44.00 ft

Outlet Elevation: 1369.30 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: STREET CROSSING)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	1369.93	0.63	1.77	0.39	0.49
5.50	1369.95	0.65	1.82	0.41	0.50
6.00	1369.98	0.68	1.86	0.43	0.50
6.50	1370.01	0.71	1.90	0.44	0.50
7.00	1370.03	0.73	1.94	0.46	0.50
7.50	1370.06	0.76	1.97	0.47	0.51
8.00	1370.08	0.78	2.01	0.49	0.51
8.50	1370.10	0.80	2.04	0.50	0.51
9.00	1370.12	0.82	2.07	0.51	0.51
9.50	1370.14	0.84	2.10	0.53	0.51
10.00	1370.16	0.86	2.12	0.54	0.52

Tailwater Channel Data - STREET CROSSING

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V):   4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0450

Channel Invert Elevation: 1369.30 ft

Roadway Data for Crossing: STREET CROSSING

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 1374.26 ft

Roadway Surface: Paved

Roadway Top Width: 44.00 ft

HY-8 Culvert Analysis Report

LAVITT MANOR II

CHECK 50% PLUGGED

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 5 cfs

Maximum Flow: 5 cfs

Table 1 - Summary of Culvert Flows at Crossing: STREET CROSSING

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1372.12	5.00	5.00	0.00	1
1372.12	5.00	5.00	0.00	1
1372.12	5.00	5.00	0.00	1
1372.12	5.00	5.00	0.00	1
1372.12	5.00	5.00	0.00	1
1372.12	5.00	5.00	0.00	1
1372.12	5.00	5.00	0.00	1
1372.12	5.00	5.00	0.00	1
1372.12	5.00	5.00	0.00	1
1372.12	5.00	5.00	0.00	1
1372.12	5.00	5.00	0.00	1
1374.26	8.85	8.85	0.00	Overtopping

Total Rating Curve
Crossing: STREET CROSSING
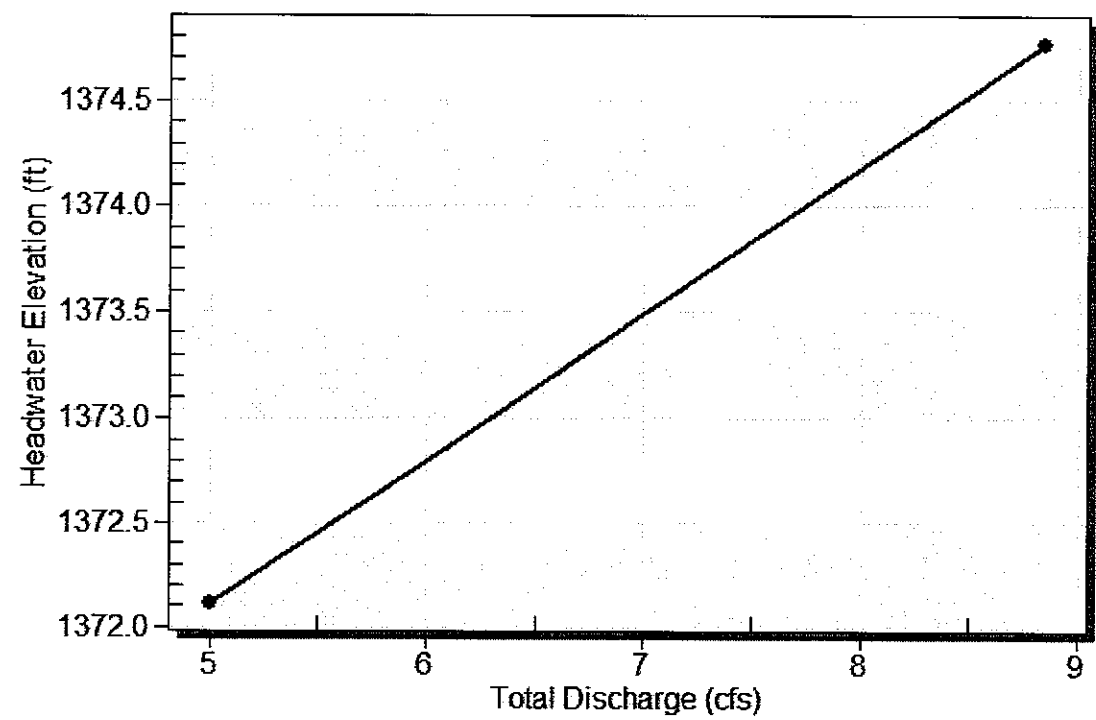
Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774
5.00	5.00	1372.12	0.908	1.315	7-M2c	1.000	0.571	0.571	0.626	4.663	1.774

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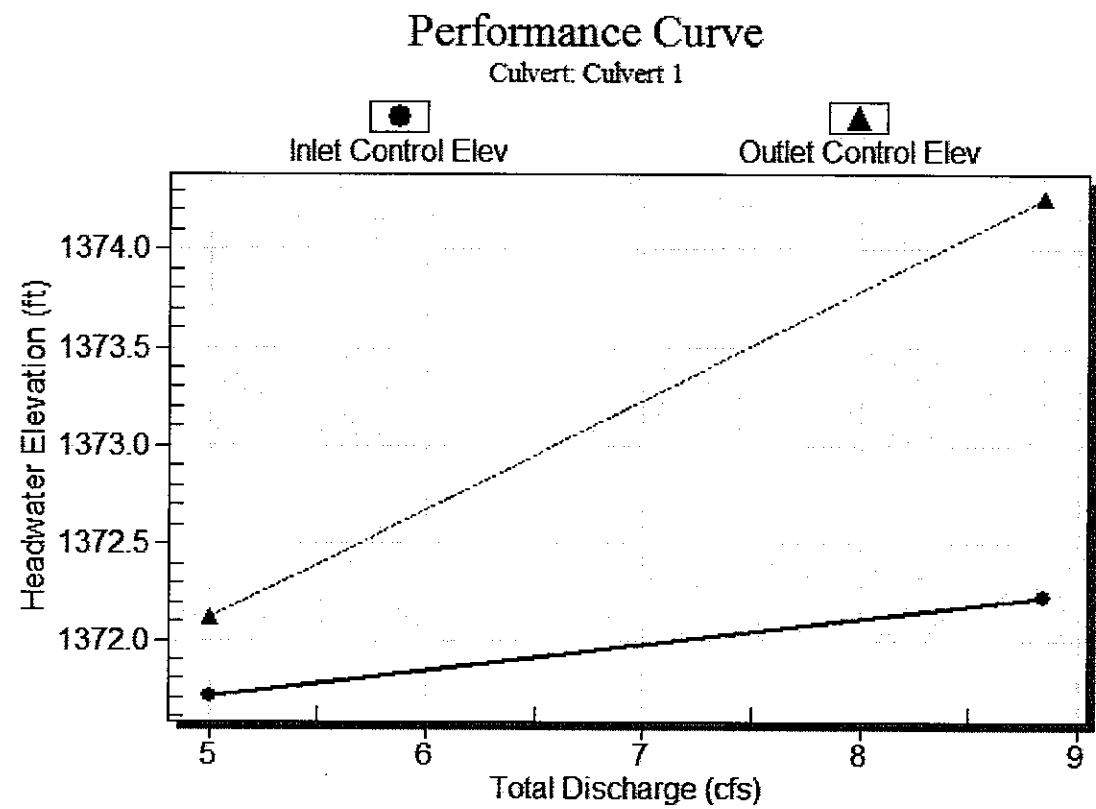
Straight Culvert

Inlet Elevation (invert): 1370.80 ft,   Outlet Elevation (invert): 1370.30 ft

Culvert Length: 44.00 ft,   Culvert Slope: 0.0114

****

Culvert Performance Curve Plot: Culvert 1

Performance Curve

Culvert: Culvert 1

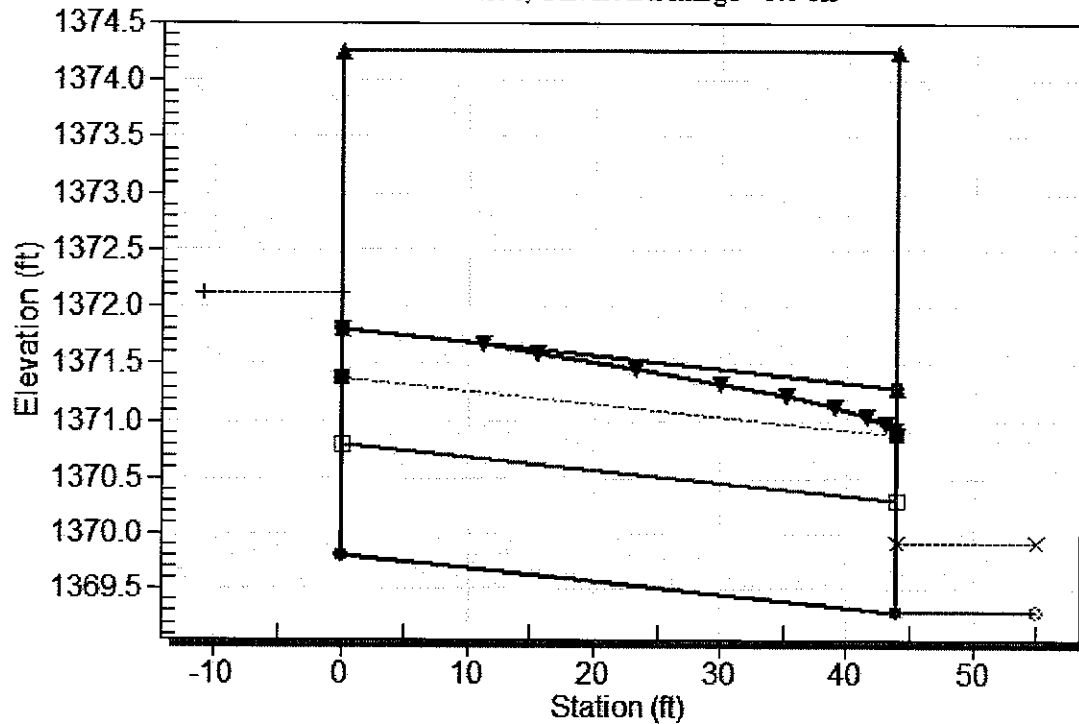| ●	▲
Inlet Control Elev	Outlet Control Elev

Water Surface Profile Plot for Culvert: Culvert 1

Crossing - STREET CROSSING, Design Discharge - 5.0 cfs

Culvert - Culvert 1, Culvert Discharge - 5.0 cfs

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1369.80 ft

Outlet Station: 44.00 ft

Outlet Elevation: 1369.30 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 12.00 in

Barrel Manning's n: 0.0240 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: STREET CROSSING)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	1369.93	0.63	1.77	0.39	0.49
5.00	1369.93	0.63	1.77	0.39	0.49
5.00	1369.93	0.63	1.77	0.39	0.49
5.00	1369.93	0.63	1.77	0.39	0.49
5.00	1369.93	0.63	1.77	0.39	0.49
5.00	1369.93	0.63	1.77	0.39	0.49
5.00	1369.93	0.63	1.77	0.39	0.49
5.00	1369.93	0.63	1.77	0.39	0.49
5.00	1369.93	0.63	1.77	0.39	0.49
5.00	1369.93	0.63	1.77	0.39	0.49
5.00	1369.93	0.63	1.77	0.39	0.49

Tailwater Channel Data - STREET CROSSING

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V):   4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0450

Channel Invert Elevation: 1369.30 ft

Roadway Data for Crossing: STREET CROSSING

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 1374.26 ft

Roadway Surface: Paved

Roadway Top Width: 44.00 ft

APPENDIX F

Riprap will be provided to mitigate erosion and sized for the 100-year event.

APPENDIX G

RETENTION CALCULATIONS FOR TRACTS 'A' & 'B'

$V = C(R/12)A$

$A = $ AREA (SF) $= 4851$ SF (B) $+ 17098$ SF (A) $= 21949$ SF

$R = $ 100-YR 2-HOUR RAINFALL (INCHES) $= 2.2$"

$C_W = $ WEIGHTED AVERAGE
$= (11024$ SF PAVED $* 0.95 + 10925$ SF LANDSCAPE $* 0.5)/21949$ SF

$C_W = 0.726$

RETENTION REQUIRED FOR TRACTS 'A' & 'B'
$V = 0.726(2.2/12)21949 = 2922$ CF

FIRST FLUSH REQUIREMENT FOR TRACTS 'A' & 'B'
$V = CPA = 0.726(0.5/12)21949 = 664$ CF

RETENTION PROVIDED:

BASIN 1	712 CF
BASIN 2	417 CF
BASIN 3	904 CF
BASIN 4	1005 CF
TOTAL PROVIDED:	3038 CF

APPENDIX H

WARNING AND DISCLAIMER OF LIABILITY

The Town's Stormwater and Floodplain Management Ordinance is intended to minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding.

The Stormwater and Floodplain Management Ordinance identifies floodplains, floodways, flood fringes and special flood hazard areas. However, a property outside these areas could be inundated by floods. Also, much of the Town is a dynamic flood area; floodways, floodplains, flood fringes and special flood hazard areas may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY
The flood protection provided by the Stormwater and Floodplain Management Ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Floods larger than the base flood can and will occur on rare occasions. Floodwater heights may be increased by constructed or natural causes. The Stormwater and Floodplain Management Ordinance does not create liability on the part of the Town, any officer or employee thereof, or the federal, state or county government for any flood damages that result from reliance on the Ordinance or any administrative decision lawfully made thereunder.

Compliance with the Stormwater and Floodplain Management Ordinance does not ensure complete protection from flooding. Flood-related problems such as natural erosion, streambed meander, or constructed obstructions and diversions may occur and have an adverse effect in the event of a flood. You are advised to consult your own engineer or other expert regarding these considerations.
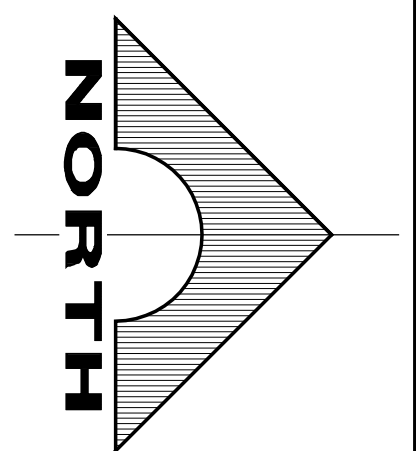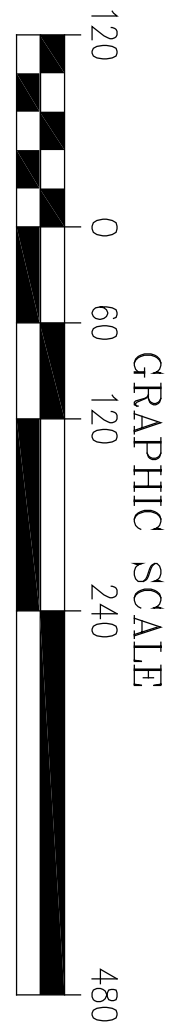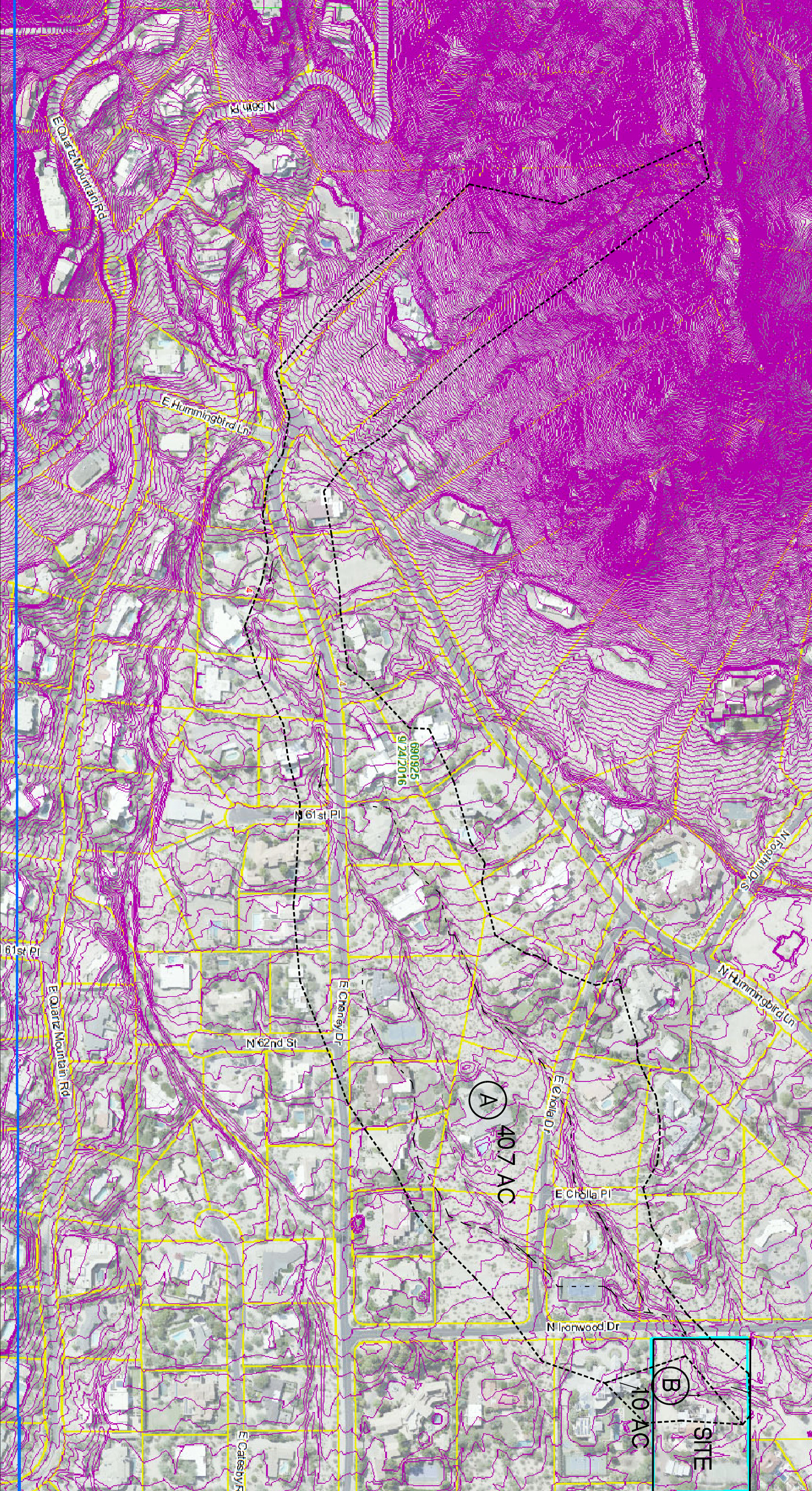
I have read and understand the above.

_____   _____   _____
Plan Check #   Owner   Date

WATERSHED EXHIBIT
LAVITT MANOR LOT 1
7525 N. IRONWOOD DRIVE, P.V.

GRAPHIC SCALE
120   0   60 120 240   480
(IN FEET)
1 inch = 120 ft.

NORTH

A 40.7 AC

B 10 AC

SITE

E Quartz Mountain Rd
E Hummingbird Ln
N 61st Pl
61st Pl
E Quartz Mountain Rd
N 62nd St
E Cheney Dr
N Ironwood Dr
E Cassidy R
E Cholla Pl
E Cholla Dr
N Hummingbird Ln
S Colli
690925
9/24/2016