Skye Second Area Plan

STORM DRAIN SECTION

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Skye

Storm Drainage

Design Criteria:	• Area west of Texas Instruments Property – Maximum allowable discharge into existing storm system in SR-92 to be 196 cfs (See exhibits A and B in Appendix B) • Area east of Texas Instruments Property – *Ponds 2 and 5*: Maximum allowable discharge rate for native ground: 0.1 cfs/acre; Maximum allowable discharge rate for developed ground: 0.2 cfs/acre *Pond 3*: Maximum allowable discharge into existing storm system to be 72.65 cfs per historic rates as indicated by capacity of existing pipe • *Area north of Texas Instruments Property – Pond 4*: Maximum allowable discharge rate for native ground: 0.1 cfs/acre. Maximum allowable discharge rate for developed ground: 0.2 cfs/acre. Infiltration – Assumed through bottom of ponds as recommended by geotechnical report. Specific pond infiltration rates can be found in Table 2. The infiltration report is provided in Appendix C. All ponds were sized to handle the runoff from the 100-year 24-hour storm and will be designed to retain the 80th percentile storm to comply with local and state MS4 requirements. All trunklines and pipes were sized to accommodate the runoff from a 10-year storm. Pipes and inlets that discharge to the detention ponds were sized for the 100-year storm to ensure that all storm runoff is captured and conveyed to the ponds.
Minimum pipe size: Pipe Type:	12” Pipe type per Lehi City design standards.
Summary of Results:	Five ponds will be required to detain the runoff flows from the project. Four of the five ponds are proposed, and the other is existing and will need to be expanded to fit the projected runoff. See Appendix E for exhibits showing the locations of all ponds, pipes, and contributing areas. • Pond 1 is an existing pond that will need to be resized to detain the excess runoff from the new development. • Ponds 2, 3, 4, and 5 are proposed ponds to be placed within the project. Pond 2 will discharge into the existing Maple Hollow drainage; Pond 3 will discharge into an existing pipeline constructed for upstream historic flows. Ponds 4 and 5 will be placed in the upper portion of the development. Pond 4 will discharge into the proposed storm drain system by way of the existing cut-off ditch on Texas Instruments’ property while Pond 5 will discharge into an existing channel that leads to the Maple Hollow Drainage. Seven other detention ponds are currently located on or near the existing Texas Instruments property: • Pond A will be removed with the new development, and all discharge from the contributing area will be caught in pipes and directed through the project to be detained in Pond 1. • Ponds B-D will remain undisturbed. It is assumed that they have been constructed with sufficient capacity to handle all flows from the Texas Instruments facility as well as any applicable upstream flows. • Pond E is an existing pond located in Canyon Hills. The discharge used in this study is the design discharge from the subdivision, which includes pass-through flows from the upper areas labeled as Offsite 1 and Offsite 2. • Pond F is an existing detention pond that will be removed with the new development. A portion of the flows going to this pond will be conveyed directly to the existing system at 500 West. • Pond G is an existing detention pond that will be removed with the new development. All flows previously discharging to this pond will be conveyed to and detained in Pond 1.

Methodology:

All basin and runoff modeling was done with the Autodesk Storm and Sanitary Analysis software (SSA). The model was run using the Soil Conservation Service (SCS) Technical Release-55 (TR-55) method. Subbasins were entered into the model based on each land use "pod". Each subbasin in the model was assigned a curve number and time of concentration based on soil type, slope, and proposed land use. Table 1 on the following page provides a summary of each subbasin and its corresponding area, curve number, and time of concentration. Refer to the exhibits in Appendix E for the location of all subbasins and pipes.

Curve Numbers: The TR-55 method uses curve numbers (CN) to represent the amount of rainfall that will runoff a particular surface. The curve number is based on the ground cover as well as the hydrologic soil classification. Using local hydrologic soil groups published by the Natural Resources Conservation Service (NRCS), as well as recommended curve numbers for land use from *Stormwater Conveyance Modeling and Design* from Haestad and Durrans, each subbasin was assigned a composite curve number for use in calculating runoff. Refer to Appendix D for the NRCS soil map and CN values.

Time of Concentration: The time of concentration is the time it takes for the rainfall to travel from the hydraulically most distant point of each subbasin to the bottom, or outfall, of that subbasin. The time of concentration was calculated based on the methodology outlined in TR-55 published by the United States Department of Agriculture (USDA), dated June 1986. Based on this methodology, Manning's Kinematic Equation was used for the first 300 feet of overland flow to find the sheet flow time. For the next section of flow, which is represented by shallow concentrated flow, the velocity of the flow was determined using the equation $v = 16.1345 * \sqrt{S}$ for offsite/open space areas and $v = 20.3282 * \sqrt{S}$ for developed areas. The third and final section of flow is the open channel flow once the runoff enters and is conveyed by the storm drain pipes or channels. For this section, assumed velocities of 3-5 feet per second (fps) was used to estimate the travel time. Once all these separate times were calculated they were added up as the total time of concentration. For smaller subbasins, a minimum time of concentration of 6 minutes was used per guidelines within the SCS method.

Design Rainfall and Storm Depth: The storm depth is necessary to estimate the total amount of rain that will fall during a specific storm event. Based on the TR-55 methodology the storm was modeled using the SCS type 2 storm event. All five new detention ponds were sized to accommodate the 24-hour 100-year storm. Rainfall depths were chosen based on NOAA Atlas 14, Volume 1, Version 5, and are located in Appendix A.

Subbasin Discharge: The peak discharge from each subbasin was calculated within the model as described above using the SCS method. Certain subbasins were assumed to detain runoff onsite and discharge into the proposed system at a specified rate. School 1 and School 2 have existing detention systems onsite. Therefore, all of School 1 and the west side of School 2 were modeled to discharge into the system at a rate of 0.2 cfs/acre. The discharge from the east side of the School 2 site is being caught in existing underground retention. Additionally, Mixed Use 1, Mixed Use 2, and the civic sites will be required to detain storm water onsite at a rate of 0.2 cfs/acre. Mixed Use 3, which is composed of an apartment area and DR Horton's office building, will freely discharge into the system. Offsite 1 and Offsite 2 flow into the existing Canyon Hills stormwater system, which discharges at a controlled rate of approximately 27.6 cfs based on the original design of that system.

Table 1: Summary of Subbasins with Associated Areas, Curve Numbers, and Times of Concentration

Subbasin Name	Area (ac)	Curve Number	Tc (min)
AA1	11.17	89.89	20.08
AA2	21.54	89.27	28.92
AA3	5.31	89.43	22.80
Berm 2	34.71	77.59	31.66
Center Street 1	53.79	57.33	33.06
Center Street 2	13.91	82.64	35.78
Civic 1	22.58	82.64	35.78
Civic 2	4.47	86.88	6.00
Clubhouse	6.03	61.00	50.62
Ditch	135.95	67.85	60.37
HD1	4.42	84.08	14.38
HD2	3.02	89.00	17.51
HD3	10.87	82.00	18.55
HD6	6.72	85.00	13.17
HD7	15.35	85.04	25.07
HD8	4.17	85.00	11.86
HD9	2.83	85.00	15.99
HD10	7.11	85.00	22.78
Inverness HD5	17.06	90.00	34.67
Inverness LD1	17.06	82.00	26.09
Inverness LD2	17.34	81.81	49.31
Inverness LD3	10.16	81.85	42.47
Inverness LD4	43.41	82.00	35.02
Inverness LD5	72.49	78.44	45.91
Inverness LD6	33.99	75.69	35.98
Inverness Offsite 1	25.34	55.00	24.50
Inverness Offsite 2	77.40	67.53	31.72
LD1	7.08	74.44	24.29
LD2	1.01	72.00	23.88
LD3	16.14	77.79	27.55
LD4	23.96	80.69	33.00
LD5	9.11	81.00	44.96
LD6	3.51	77.66	17.48
LD7	4.48	75.00	17.64
LD8	15.44	72.18	47.96
LD9	13.52	72.28	31.05
MD1	14.20	79.30	22.33
MD2	6.76	82.76	21.75
MD3	10.55	85.35	22.76
MD4	8.28	80.26	26.53

MD5	**3.86**	**76.63**	**25.10**
MD6	**1.76**	**75.03**	**18.23**
MD7	**11.82**	**80.88**	**31.56**
MD8	**2.44**	**85.00**	**28.08**
MD9	**4.51**	**75.00**	**25.20**
MD10	**11.92**	**82.00**	**25.94**
MD11	**7.58**	**75.00**	**20.51**
MD12	**9.39**	**75.00**	**33.76**
MD13	**5.79**	**75.13**	**24.02**
MU1	**17.87**	**92.67**	**6.39**
MU2	**15.91**	**93.87**	**6.00**
MU3	**19.33**	**87.33**	**14.51**
MU4	**30.31**	**93.56**	**10.87**
MU5	**33.65**	**92.13**	**8.80**
Offsite 1	**162.20**	**59.97**	**41.72**
Offsite 2	**94.34**	**75.00**	**30.00**
Offsite 4	**131.80**	**78.39**	**35.39**
Offsite 5A	**17.05**	**75.14**	**18.39**
Offsite 5B	**1.14**	**90.18**	**10.56**
Offsite 5C	**11.20**	**59.45**	**49.53**
Offsite 5D	**0.74**	**90.18**	**6.00**
Open Space 1	**0.28**	**61.00**	**6.00**
Open Space 2	**2.25**	**73.67**	**6.54**
Open Space 3	**3.71**	**72.50**	**21.19**
Open Space 4	**9.08**	**70.23**	**18.68**
Open Space 5	**1.65**	**65.21**	**13.96**
Open Space 6	**7.36**	**69.29**	**24.60**
Open Space 7	**1.07**	**74.00**	**6.00**
Open Space 8	**0.74**	**70.90**	**6.00**
Open Space 10	**0.72**	**91.00**	**11.15**
Park 1	**1.65**	**61.00**	**7.67**
Park 2	**2.62**	**70.38**	**28.99**
Park 3	**3.10**	**74.00**	**33.93**
Road Left 1	**0.87**	**97.00**	**6.00**
Road Left 2	**2.67**	**97.00**	**7.43**
Road Left 3	**3.93**	**97.00**	**7.48**
Road Left 4	**2.41**	**97.00**	**8.17**
Road North	**1.61**	**97.00**	**6.00**
Road Right 1a	**1.67**	**97.00**	**7.60**
Road Right 1b	**0.89**	**97.00**	**6.00**
Road Right 2	**4.47**	**97.00**	**10.21**
Road Right 3	**3.54**	**97.00**	**10.94**

Road Right 4	**5.58**	**97.00**	**16.93**
School 1	**12.71**	**80.95**	**6.00**
School 2a	**14.66**	**80.29**	**7.88**
VLD1	**10.53**	**80.00**	**47.18**
VLD2	**5.2**	**80.00**	**43.44**

System Discharges:

West Side

According to a study done by MW Brown, the Lehi City allowable discharge for the area west of the Texas Instruments facility, including adjacent properties, is **196.0 cfs** (See Drainage Agreement Exhibit B – Allowable Flow Rate in Appendix B). The SR-92 storm drain trunk line was designed to handle the 196.0 cfs peak offsite discharge from the Skye property and surrounding areas. The model in this study has been developed to size the detention pond with the appropriate discharge rate and provide a proposed drainage plan that will not exceed the 196.0 cfs of offsite drainage. Pond 1 and the existing outfall at 500 West will make up the west discharge of Skye. Pond 1 will detain flows and discharge into the existing system at a rate of 66.89 cfs. The existing detention pond near 500 W will be removed and the 100-year discharge from 500 W will flow undetained into the existing system at a rate of 67.5 cfs, still under the outfall capacity of 76.28 cfs as shown in the drainage agreement in Appendix B. The new drainage concept is intended to utilize the existing pipes in 500 W as much as possible to route the flows to the existing outfall in SR-92. Part of the existing pipe system routes drainage across the street into the pond through a series of smaller pipes. With the removal of the pond, new 36" pipes will need to be installed to extend the system past the pond and into the outfall in SR 92. The existing orifice near the pond will be removed and all pipes leading to the pond and running through the pond will be abandoned or removed as well. The combined discharge of Pond 1 and the 500 W outfall will be approximately 134.39 cfs, well under the allowed 196.0 cfs discharge. Pond 4 will be located in the upper development and will detain runoff and discharge at rates specified above in the design criteria section. This discharge will be routed to Pond 1. Refer to Table 2 below for a summary of discharges from each pond.

The Utah Department of Transportation (UDOT) has directed that the maximum allowable discharge into SR-92 is 0.2 cfs/acre. The 134.39 cfs discharge outlined above represents a discharge rate of 0.14 cfs/acre, well below the 0.2 cfs/acre allowed.

East Side

Pond 2

The east side drainage to Pond 2 will be restricted in a similar way the original area plan specified – 0.1 cfs/acre and 0.2 cfs/acre for native ground and developed ground, respectively. The pond will discharge into the existing Maple Hollow drainage that sits to the west. See Table 2 below for a summary of each discharge from the project.

Pond 3

There is an existing storm drain line that captures historic drainage from the east side of the Skye area plan, as well as native areas above. It sits just to the north of the Dry Creek Highlands subdivision. Pond 3 will capture the runoff from the upstream area and discharge into this existing storm drain line at or below the existing pipe capacity (72.65 cfs), which is assumed to be the historic flow. Discharge from

Pond 3 will not exceed this capacity and will remain consistent with historic flows. See Table 2 below for a summary of each discharge from the project.

Pond 5

The drainage from the east side of the upper development will discharge in Pond 5, which will detain and discharge at the rates specified in the design criteria section above. See Table 2 below for a summary of each discharge from the project.

Table 2: Discharge Information

Pond	Contributing Area (acres)	Infiltration Rate (in./hr)	Peak Inflow (cfs)	Required Volume (cf)	Required Volume (acre-ft)	100-Year Peak Detained Discharge (cfs)	Allowable Discharge (cfs)
Pond 4[1]	86.83	8.0	36.76	52,350	1.20	10.07	14.83
Pond 1	510.97	10.0	188.17	226,258	5.19	66.89	
500 W Discharge	366.37	-	67.50	N/A	N/A	67.50 (un-detained)	
Total	**964.17**					**134.39**	**196**
Pond 2	131.57[2]	10.8	52.98	71,377	1.64	20.28	26.31
Pond 3[3]	188.63	15.0	133.41	121,217	2.78	72.61	72.65
Pond 5	227.42	8.0	80.07	113,699	2.61	28.37	37.74

Notes:

1. *The discharge from Pond 4 will flow into Pond 1. The total west side discharge is the sum of the discharge from Pond 1 and the 500 W discharge.*
2. *Pond 2 has no undeveloped contributing areas.*
3. *Discharge of Pond 3 is capped at 72.65 cfs per existing pipe capacity.*

Low Impact Development (LID) Requirement:

The storm drain system for the new development will follow local & state requirements for the MS4 program. This will include designing all detention ponds with the ability to retain the 80th percentile volume while releasing historic discharge into the existing system. Any commercial sites within the development that will need to detain onsite will be required to retain the 80th percentile storm and will be encouraged to implement other LID practices.

Pond Sizing:

The sizing of the ponds for the development depended largely on the maximum allowable discharges mentioned above, as well as infiltration into the ground. The geotechnical report provided infiltration rates near the areas of Ponds 1, 2, and 3. A factor of safety of 2.5 was applied to the rates at Pond 2 and 3 for a more conservative estimate. The infiltration rate for Pond 1 was exceptionally high (240 in/hr), so a large factor of safety was applied to provide a more reasonable and conservative rate consistent with the other ponds. Infiltration tests have not yet been done in the upper development, but it is expected that the soil in those areas will drain similarly to what has been tested down below. An infiltration rate of 8 in/hr has been assigned to Ponds 4 and 5 for this study. Additional testing will be done and pond sizing for this upper area

will be re-evaluated at final design. These rates were used in calculating ground infiltration through the bottom of the pond. Refer to the infiltration test results in Appendix C for more details. All ponds are designed to detain the runoff from the 100-year 24-hour storm and to discharge within the maximum allowable discharge requirements presented above.

Pipe and Channel Sizing:

All pipes were sized for the 10-year peak flows using the Manning's Equation within the SSA model. According to this method, pipe size is based on peak inflow from contributing areas, the approximate slope of the project based on existing contours, and an assumed manning's n value of 0.013. Table 3 below shows all expected pipe sizing within the model. See Appendix E for locations of each pipe. All channels shown in the model are existing channels that will be used to convey water to and from detention ponds. Dimensions of the existing channels were modeled to ensure that they had sufficient capacity for the flows. See Table 4 below for channel sizing and Appendix F for channel cross section designs.

Debris Basins:

Debris basins will be required above the project to prevent debris from coming into the development during flood events. These basins were sized and designed in collaboration with GeoStrata geotechnical engineers to capture all debris and storm runoff. The debris basins will be owned and maintained by the HOA. An exhibit from the geotechnical report showing the proposed locations of the debris basins can be seen in Appendix G. These locations are subject to change as the development and final grading design progress.

Conclusion:

An SSA model was developed to size detention basins and trunk lines for the Skye development. One existing pond will be upsized, two ponds will be added with the north development, and two ponds will be added on the east side. All discharges from the project will remain under the allowable rates.

Table 3: Pipe Lengths, Slopes, Sizes, and Flows

Pipe Number	Pipe Diameter (in)	Peak Flow (cfs)	Design Flow Capacity (cfs)
102	18	3.58	17.31
106*	24	33.45	52.87
109	18	2.40	27.12
110	24	10.77	44.50
113	15	8.12	11.42
114	18	8.65	10.15
115	12	1.26	10.26
116*	36	54.62	82.82
117*	36	133.20	165.67
119*	24	36.46	60.47
123*	30	35.17	69.98
124*	24	47.28	55.46
125	12	0.53	10.14
127	15	3.41	18.13
130	18	4.86	10.11
131	12	0.27	11.24
132	12	0.65	11.66
135	12	0.31	8.75
139*	30	67.50	102.65
141	12	1.10	5.86
142*	24	9.48	19.84
145*	24	43.76	59.84
146	36	22.46	198.25
147	18	2.36	32.21
148	18	6.74	27.85
149	18	3.69	29.03
150*	30	43.76	57.69
152	30	14.56	104.53
154	15	2.77	22.76
155	18	0.00	0.58
156	15	2.50	12.92
157	18	0.00	26.33
158	24	16.34	61.62
159	24	16.31	67.30
161	15	0.01	16.40
165	18	3.35	15.34
166	18	9.29	33.12
168	12	2.24	10.05
169	18	10.35	17.40
171	24	15.02	55.79
172	12	2.68	9.34

173	24	14.99	17.98
174	18	5.56	25.80
65	30	13.85	103.28
89	18	0.00	38.31
90	24	7.92	62.06
92	18	6.12	26.76
93	18	1.41	29.86

*Denotes pipes that have been sized for 100-year flows.

Table 4: Channel Dimensions and Flows

Channel Segment	Average Slope (%)	Channel Height (ft)	Channel Width (ft)	Peak Flow (cfs)	Design Flow Capacity (cfs)
143*	4.35	1.5	55	115.12	234.29
144*	7.60	1.0	50	120.98	143.30
153*	5.70	1.0	50	85.85	124.10

Appendix A: NOAA Rainfall Data

NOAA Atlas 14, Volume 1, Version 5
Location name: Lehi, Utah, US*
Coordinates: 40.4394, -111.8468
Elevation: 4973ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.130** (0.115–0.151)	**0.165** (0.146–0.191)	**0.227** (0.198–0.263)	**0.283** (0.244–0.329)	**0.371** (0.313–0.435)	**0.454** (0.372–0.535)	**0.549** (0.437–0.656)	**0.661** (0.506–0.803)	**0.842** (0.610–1.05)	**1.01** (0.699–1.28)
10-min	**0.198** (0.174–0.230)	**0.252** (0.222–0.291)	**0.345** (0.302–0.400)	**0.431** (0.372–0.501)	**0.565** (0.476–0.662)	**0.691** (0.566–0.814)	**0.835** (0.664–0.997)	**1.01** (0.770–1.22)	**1.28** (0.929–1.59)	**1.53** (1.06–1.95)
15-min	**0.246** (0.216–0.285)	**0.312** (0.275–0.361)	**0.428** (0.374–0.496)	**0.534** (0.461–0.620)	**0.701** (0.590–0.820)	**0.856** (0.702–1.01)	**1.04** (0.823–1.24)	**1.25** (0.955–1.52)	**1.59** (1.15–1.98)	**1.90** (1.32–2.42)
30-min	**0.331** (0.290–0.383)	**0.420** (0.370–0.486)	**0.576** (0.504–0.667)	**0.719** (0.621–0.836)	**0.943** (0.795–1.11)	**1.15** (0.945–1.36)	**1.39** (1.11–1.67)	**1.68** (1.29–2.04)	**2.14** (1.55–2.66)	**2.56** (1.77–3.25)
60-min	**0.410** (0.359–0.474)	**0.519** (0.458–0.602)	**0.713** (0.624–0.826)	**0.890** (0.769–1.03)	**1.17** (0.984–1.37)	**1.43** (1.17–1.68)	**1.73** (1.37–2.06)	**2.08** (1.59–2.53)	**2.65** (1.92–3.29)	**3.16** (2.20–4.03)
2-hr	**0.512** (0.464–0.580)	**0.640** (0.576–0.723)	**0.836** (0.748–0.945)	**1.02** (0.902–1.16)	**1.31** (1.13–1.50)	**1.58** (1.33–1.82)	**1.90** (1.55–2.22)	**2.27** (1.78–2.70)	**2.87** (2.14–3.51)	**3.42** (2.44–4.28)
3-hr	**0.595** (0.543–0.663)	**0.736** (0.672–0.818)	**0.931** (0.845–1.03)	**1.11** (0.999–1.24)	**1.39** (1.23–1.56)	**1.64** (1.42–1.86)	**1.95** (1.63–2.23)	**2.31** (1.88–2.73)	**2.90** (2.25–3.55)	**3.44** (2.57–4.33)
6-hr	**0.785** (0.728–0.854)	**0.965** (0.892–1.05)	**1.17** (1.08–1.28)	**1.36** (1.25–1.49)	**1.64** (1.48–1.79)	**1.87** (1.66–2.06)	**2.13** (1.86–2.38)	**2.44** (2.09–2.77)	**3.02** (2.50–3.58)	**3.53** (2.84–4.37)
12-hr	**1.01** (0.929–1.10)	**1.23** (1.14–1.34)	**1.49** (1.37–1.62)	**1.71** (1.56–1.87)	**2.02** (1.83–2.23)	**2.28** (2.04–2.53)	**2.56** (2.25–2.87)	**2.87** (2.47–3.26)	**3.35** (2.81–3.90)	**3.75** (3.07–4.44)
24-hr	**1.13** (1.05–1.21)	**1.38** (1.29–1.49)	**1.65** (1.54–1.77)	**1.87** (1.75–2.01)	**2.17** (2.02–2.33)	**2.40** (2.23–2.57)	**2.63** (2.44–2.90)	**2.89** (2.64–3.30)	**3.39** (2.91–3.94)	**3.79** (3.10–4.48)
2-day	**1.35** (1.26–1.45)	**1.65** (1.55–1.77)	**1.98** (1.85–2.11)	**2.24** (2.09–2.39)	**2.59** (2.42–2.77)	**2.87** (2.66–3.06)	**3.15** (2.90–3.36)	**3.42** (3.14–3.67)	**3.79** (3.45–4.08)	**4.07** (3.68–4.53)
3-day	**1.48** (1.37–1.59)	**1.81** (1.68–1.95)	**2.16** (2.01–2.33)	**2.46** (2.29–2.64)	**2.86** (2.65–3.08)	**3.18** (2.93–3.42)	**3.50** (3.21–3.77)	**3.82** (3.49–4.13)	**4.26** (3.85–4.62)	**4.59** (4.13–5.07)
4-day	**1.60** (1.48–1.73)	**1.96** (1.82–2.13)	**2.35** (2.18–2.54)	**2.68** (2.48–2.89)	**3.13** (2.89–3.38)	**3.48** (3.20–3.77)	**3.85** (3.52–4.17)	**4.22** (3.84–4.58)	**4.72** (4.25–5.15)	**5.11** (4.57–5.61)
7-day	**1.90** (1.76–2.07)	**2.33** (2.16–2.53)	**2.79** (2.58–3.02)	**3.16** (2.92–3.42)	**3.67** (3.38–3.97)	**4.06** (3.73–4.40)	**4.46** (4.08–4.83)	**4.86** (4.43–5.28)	**5.39** (4.87–5.88)	**5.80** (5.20–6.35)
10-day	**2.15** (1.99–2.32)	**2.63** (2.44–2.84)	**3.13** (2.90–3.37)	**3.52** (3.27–3.80)	**4.05** (3.74–4.36)	**4.44** (4.09–4.78)	**4.82** (4.44–5.20)	**5.20** (4.77–5.62)	**5.69** (5.18–6.17)	**6.04** (5.48–6.57)
20-day	**2.83** (2.62–3.06)	**3.48** (3.22–3.75)	**4.11** (3.81–4.43)	**4.61** (4.26–4.95)	**5.23** (4.83–5.62)	**5.68** (5.24–6.11)	**6.11** (5.63–6.57)	**6.52** (6.00–7.02)	**7.02** (6.44–7.59)	**7.38** (6.74–7.99)
30-day	**3.42** (3.17–3.68)	**4.19** (3.88–4.51)	**4.93** (4.58–5.31)	**5.51** (5.11–5.93)	**6.26** (5.79–6.73)	**6.80** (6.28–7.32)	**7.33** (6.75–7.90)	**7.83** (7.19–8.46)	**8.46** (7.73–9.16)	**8.90** (8.11–9.67)
45-day	**4.27** (3.97–4.59)	**5.22** (4.86–5.62)	**6.13** (5.71–6.59)	**6.83** (6.36–7.34)	**7.73** (7.19–8.30)	**8.38** (7.78–9.00)	**9.00** (8.35–9.67)	**9.59** (8.87–10.3)	**10.3** (9.49–11.1)	**10.8** (9.92–11.7)
60-day	**5.07** (4.70–5.44)	**6.19** (5.76–6.67)	**7.26** (6.75–7.80)	**8.08** (7.51–8.67)	**9.12** (8.46–9.79)	**9.85** (9.14–10.6)	**10.6** (9.77–11.4)	**11.2** (10.4–12.1)	**12.0** (11.0–13.0)	**12.5** (11.5–13.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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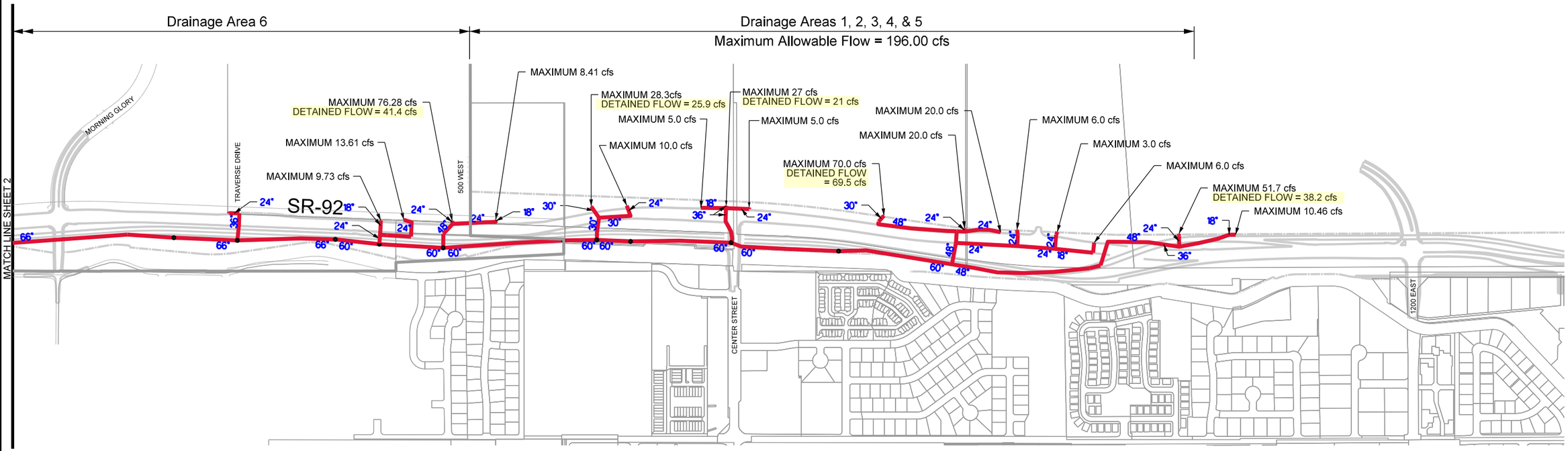
PF graphical

Appendix B: Allowable Discharge Exhibits



NOTES

1- DOES NOT INCLUDE UDOT FLOWS.

2- MAXIMUM DETAINED FLOWS ARE DETAINED 100 YR FLOWS.

SCALE (FEET)

0 400 800 1200 1600

MW BROWN ENGINEERING, INC
Office: (801) 377-1790 Fax: (801) 377-1789
578 East 770 North, Orem UT 84097

REGISTERED PROFESSIONAL ENGINEER
NO. 174774
MATT W. BROWN
STATE OF UTAH

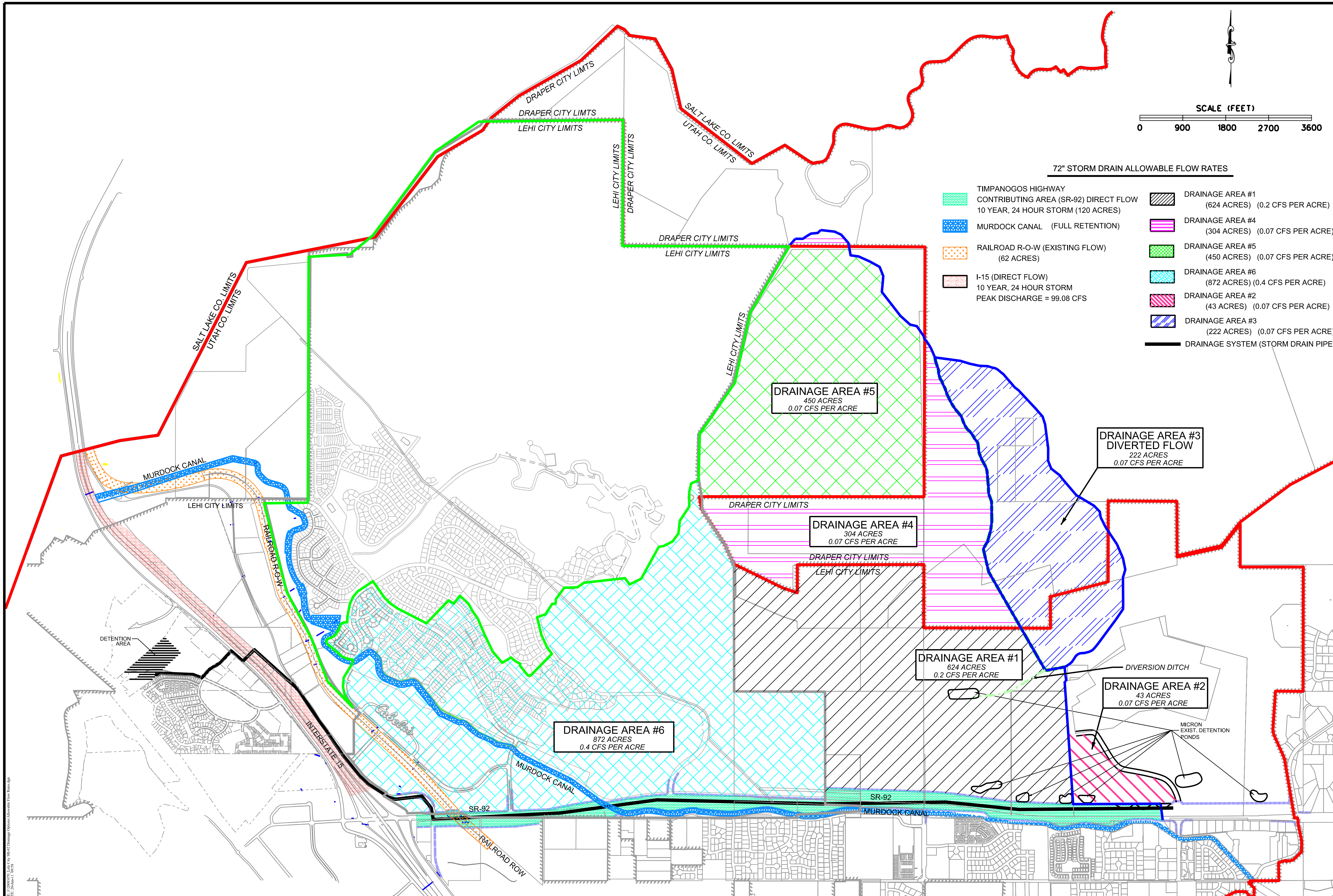
No.	Date	By	Notes
REVISIONS			

Designed
Drawn J.M. MYERS
Checked M.W. BROWN
Date 4-09-2013

Title: DRAINAGE AGREEMENT EXHIBIT B
Client: LEHI CITY ALLOWABLE FLOW RATE
Drawing Name: REVISED - AUG 13, 2013

PROJECT NO.
2012.059

SHEET NO.
2



MW BROWN ENGINEERING, INC
Office: (801) 377-1790 Fax: (801) 377-1789
578 East 770 North, Orem UT 84097

REVISIONS

No.	Date	By	Notes

Designed
Drawn: D.A. BUFFO
Checked: M.W. BROWN
Date: JANUARY 27, 2010

Title: EXHIBIT "A"
Client: LEHI CITY ALLOWABLE FLOW RATE
DATE: JANUARY 4, 2013

PROJECT NO. 2012.059

SHEET NO. 1

Appendix C: Geotechnical Report with Infiltration Testing

GeoStrata 14425 S Center Point Way, Bluffdale, Utah 84065
T: (801) 501-0583 ~ info@geostrata-llc.com

To: **D.R. Horton**
Attention: Dan Mitchell
12351 South Gateway Park Place
Draper, Utah 84020

From: **Caleb R. Allred, P.E.**
Project Geotechnical Engineer

Date: **June 23, 2021**

Subject: **Micron Property – Infiltration Testing**
Approximately 500 West and State Road 92
Lehi, Utah
GeoStrata Job No. 589-100

Mr. Mitchell;

At your request, GeoStrata has completed infiltration testing in general accordance with Appendix C of the Utah Administrative Code R317-4 for the proposed retention pond areas as highlighted on an Exhibit Map provided by LEI within the Micron Property located in the Lehi, Utah. Due fencing and limited site access one of the infiltration locations was more north along the same drainage. The location of the infiltration testing is shown on Plate A-1, *Infiltration Test Location Map*.

GeoStrata completed the infiltration testing generally according to Appendix C of the Utah Administrative Code R317-4, because this method provides guidelines of how to prepare the infiltration hole and how to perform the test and complete the test. The problem with infiltration testing is the testing is very difficult to reproduce. A relatively small change in elevation or location can provide produce a variety of results. We recommend that during the design of the retention areas that the infiltration rates provided in the letter have a factor of safety applied, and the infiltration rates used in design are compared to published documents for similar soil types such as Utah City Engineers Association, Saturated Hydraulic Conductivity Rate According to Soil Types (https://www.ucea.net/copy-of-wet-swales-7).

On June 17th, 2021, the test pits were excavated at the four locations as shown in Plate A-1 and the infiltration tests were performed at depths of between 4 feet 10 inches and 5 feet 6 inches below the existing ground surface. Subsurface soils at the site varied dramatically across the property. Logs of the subsurface conditions, as encountered in the explorations, were recorded at the time of excavation by a qualified representative of GeoStrata and are presented on Plates B-1 through B-4. GeoStrata has elected to classify the soils according to both USCS and USDA methods. To aid with the soil classification we have completed laboratory testing, results of the laboratory testing are included on Plates B-1 to B-4.

INFILTRATION TEST RESULTS

The infiltration testing was completed by excavating a hole that was approximately 4 inches in diameter and between 14 to 20 inches in depth. The excavated hole was then prepared to remove the smeared soils and 2 to 3 inches of gravel was placed in the bottom of the hole. The hole was then filled to a minimum of 12 inches above the gravel. According to Appendix C of the Utah Administrative Code R317-4 the infiltration tests at IT-2, IT-3, and IT-4 consisted of Type 1 or Type 2 soils, (12 inches of water seeps away in 10 minutes, two times in succession. As such, the Test Procedure for Type 1 and Type 2 soils was completed for this location.

Infiltration Test Location IT-1 did not meet the Type 1 or Type 2 soil classification and the 4-hour saturation period, and minimum 16-hour swell period was achieved prior to running the final infiltration test. A summary of the results of our infiltration testing is as follows;

Micron Property Lehi, Utah Location: IT-1 Soils: CL-ML (Sandy Clay Loam) Test Elevations: 5-ft to 5-ft 6-in Diameter: 4 inches				
Depth	Time Difference (minutes)	Depth Difference (inches)	Infiltration Rate	
			(min/in)	(in/hour)
5-5½	30	7	4.29	14.00
5-5½	30	6	5.00	12.00
5-5½	30	5	6.00	10.00
5-5½	30	4.75	6.32	9.50
5-5½	30	4.5	6.67	9.00
5-5½	30	4.5	6.67	9.00
Finalized Rate			6.67	9.00

Micron Property Lehi, Utah Location: IT-2 Soils: SM (Loamy Sand) Test Elevations: 4-ft 6-in to 5-ft Diameter: 4 inches				
Depth	Time Difference (minutes)	Depth Difference (inches)	Infiltration Rate	
			(min/in)	(in/hour)
4½-5	2	8	0.25	240.00
4½-5	2	8	0.25	240.00
4½-5	2	8	0.25	240.00
Finalized Rate			0.25	240.00

Micron Property Lehi, Utah Location: IT-3 Soils: Sandy SILT (Loam) Test Elevations: 5-ft to 5-ft 6 inches Diameter: 4 inches				
Depth	Time Difference (minutes)	Depth Difference (inches)	Infiltration Rate	
			(min/in)	(in/hour)
4½-5	10	5.25	1.90	31.50
4½-5	10	5	2.00	30.00
4½-5	10	4.75	2.11	28.50
4½-5	10	4.5	2.22	27.00
4½-5	10	4.5	2.22	27.00
Finalized Rate			2.22	27.00

Micron Property Lehi, Utah Location: IT-4 Soils: Clayey SAND (Sandy Loam) Test Elevations: 5-ft to 5-ft 6 inches Diameter: 4 inches				
Depth	Time Difference (minutes)	Depth Difference (inches)	Infiltration Rate	
			(min/in)	(in/hour)
5-5½	5	3.5	1.43	42.00
5-5½	5	3.5	1.43	42.00
5-5½	5	3.25	1.54	39.00
5-5½	5	3.125	1.60	37.50
5-5½	5	3.125	1.60	37.50
5-5½	5	3.125	1.60	37.50
Finalized Rate			1.60	37.50

It should be noted that the tests were performed using clean water. Sediment collected from runoff may reduce the performance of the retention ponds resulting in slower than observed infiltration rates. If possible, sediment should be settled/filtered out of the flow prior to entering the drainage area.

The results of the testing contained in this memorandum are based on the information available to us at the time of our evaluation, the results of our field observations, our limited subsurface exploration and our understanding of the proposed site development. This memorandum was prepared in accordance with the generally accepted standard of practice at the time the report was written. No other warranty, expressed or implied, is made.

This memorandum was written for the exclusive use of D.R. Horton and only for the proposed project described herein. It is the Client's responsibility to see that all parties to the project including the Designer, Contractor, Subcontractors, etc. are made aware of this memorandum in its entirety. We are not responsible for the technical interpretations by others of the information described or documented in this memorandum. The use of information contained in this memorandum for bidding purposes should be done at the Contractor's option and risk.

ATTACHMENTS

Appendix A

Plate A-1	Infiltration Test Location Map

Appendix B

Plate B-1 to B-4	Test Pit Logs

400 0 400 800 1200 1600 ft

1:20000

N

Legend

Infiltration Test Locations

D.R. Horton
Mircon Property - Infiltration Testing
Lehir, Utah
Project Number: 589-100

Infiltration Test Location Map

Plate A-1

DATE
STARTED: 6/17/21
COMPLETED: 6/18/21
BACKFILLED: 6/18/21

D.R. Horton
Micron Property Infiltration Testing
Lehi, Utah
Project Number 589-100

GeoStrata Rep: C. Allred
Rig Type: Track-hoe

TEST PIT NO:
IT-1
Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION -ft

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit; 10 20 30 40 50 60 70 80 90)
0	0				SM	Silty SAND - slightly moist, light brown, some organics thoughout						
					CL-ML	Silty CLAY with sand - medium stiff, moist, brown (Sandy Clay Loam)						
1												
	5					Bottom of Test Pit @ 5.5 Feet						
2												

GeoStrata

SAMPLE TYPE
- GRAB SAMPLE
- 2.5" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
- MEASURED
- ESTIMATED

NOTES:

Plate
B - 1

2020 LOG OF TEST PIT - PLATE (B) INFILTRATION TESTING.GPJ GEOSTRATA.GDT 6/23/21

DATE
STARTED: 6/17/21
COMPLETED: 6/17/21
BACKFILLED: 6/17/21

D.R. Horton
Micron Property Infiltration Testing
Lehi, Utah
Project Number 589-100

GeoStrata Rep: C. Allred
Rig Type: Track-hoe

TEST PIT NO:
IT-2
Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION -ft

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0				SP	Poorly Graded SAND - slightly moist, brown, some organic thoughout					
					GM	Silty GRAVEL with sand - medium dense, moist, brown, 3-inch minus materials					
1					SM	Silty SAND - medium dense, moist, brown (Loamy Sand)		7.5	38.8		
	5					Bottom of Test Pit @ 5 Feet					
2											

Moisture Content and Atterberg Limits
Plastic Limit | Moisture Content | Liquid Limit
10 20 30 40 50 60 70 80 90

2020 LOG OF TEST PIT - PLATE (B) INFILTRATION TESTING.GPJ GEOSTRATA.GDT 6/23/21

GeoStrata

SAMPLE TYPE
- GRAB SAMPLE
- 2.5" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
- MEASURED
- ESTIMATED

NOTES:

Plate
B - 2

DATE
STARTED: 6/17/21
COMPLETED: 6/17/21
BACKFILLED: 6/17/21

D.R. Horton
Micron Property Infiltration Testing
Lehi, Utah
Project Number 589-100

GeoStrata Rep: N. Flores
Rig Type: Track-hoe

TEST PIT NO:
IT-3
Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION -ft

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0				SC	Clayey SAND - medium dense, slightly moist, brown, some organics thoughout					
					CL	Lean CLAY with sand - medium stiff, moist, dark brown, trace amount of organic material					
					ML	Sandy SILT - medium dense, moist, light brown, some iron staining (Loam)		11.0	76.3		
1											
	5					Bottom of Test Pit @ 5.3 Feet					
2											

Moisture Content and Atterberg Limits

Plastic Limit — Moisture Content — Liquid Limit

10 20 30 40 50 60 70 80 90

2020 LOG OF TEST PIT - PLATE (B) INFILTRATION TESTING.GPJ GEOSTRATA.GDT 6/23/21

GeoStrata

SAMPLE TYPE
- GRAB SAMPLE
- 2.5" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
- MEASURED
- ESTIMATED

NOTES:

Plate
B - 3

DATE
STARTED: 6/17/21
COMPLETED: 6/17/21
BACKFILLED: 6/17/21

D.R. Horton
Micron Property Infiltration Testing
Lehi, Utah
Project Number 589-100

GeoStrata Rep: N. Flores
Rig Type: Track-hoe

TEST PIT NO:
IT-4
Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION -ft

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit; 10 20 30 40 50 60 70 80 90)
0	0				SC	Clayey SAND - medium dense, slightly moist to moist, brown to gray-brown, some organics in the top 6 inches (Sandy Loam)		2.5	26.2			
1	5					Bottom of Test Pit @ 5.5 Feet						
2												

SAMPLE TYPE
- GRAB SAMPLE
- 2.5" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
- MEASURED
- ESTIMATED

NOTES:

Plate
B - 4

GeoStrata

2020 LOG OF TEST PIT - PLATE (B) INFILTRATION TESTING.GPJ GEOSTRATA.GDT 6/23/21

Appendix D: NRCS Soil Group Map and Curve Numbers

Map Scale: 1:12,800 if printed on D landscape (34" x 22") sheet.

Meters: 0, 150, 300, 600, 900

Feet: 0, 500, 1000, 2000, 3000

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 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Salt Lake Area, Utah
Survey Area Data: Version 13, Jun 8, 2020

Soil Survey Area: Utah County, Utah - Central Part
Survey Area Data: Version 13, Jun 8, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jun 19, 2016—Sep 14, 2018

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.

Table 5.5 Runoff curve numbers for urban areas (Mockus, 1969)[a]

Cover Description	Average Percent Impervious Area[b]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[c]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious area only)[d]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1 to 2 in. sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre (506 m^2) or less (town houses)	65	77	85	90	92
1/4 acre (1,012 m^2)	38	61	75	83	87
1/3 acre (1,349 m^2)	30	57	72	81	86
1/2 acre (2,023 m^2)	25	54	70	80	85
1 acre (4,047 m^2)	20	51	68	79	84
2 acres (8,094 m^2)	12	46	65	77	82
Developing urban areas					
Newly graded area (pervious areas only, no vegetation)[e]		77	86	91	94
Idle lands (CNs are determined using cover types similar to those in Table 5.6)					

a. Average runoff condition, and $I_a = 0.2S$.

b. The average percent impervious area shown was used to develop the composite *CN*s. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a *CN* of 98, and pervious areas are considered equivalent to open space in good hydrologic condition.

c. *CN*s shown are equivalent to those of pasture. Composite *CN*s may be computed for other combinations of open space cover type.

d. Composite *CN*s for natural desert landscaping should be computed using Figure 2.3 or 2.4 (in TR-55) based on the impervious area percentage (*CN* = 98) and the pervious area *CN*. The pervious area *CN*s are assumed equivalent to desert shrub in poor hydrologic condition.

e. Composite *CN*s to use for the design of temporary measures during grading and construction should be computed using Figure 2.3 or 2.4 (in TR-55) based on the degree of development (impervious area percentage) and the *CN*s for the newly graded pervious areas.

Table 5.7 Runoff curve numbers for other agricultural lands[a] (Mockus, 1969)

Cover Description		Curve Numbers for Hydrologic Soil Group			
Cover Type	Hydrologic Condition	A	B	C	D
Pasture, grassland, or range-continuous forage for grazing[b]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed grass mixture with brush the major element[c]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30[d]	48	65	73
Woods-grass combination (orchard or tree farm)[e]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[f]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30[d]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots		59	74	82	86

a. Average runoff condition, and $I_a = 0.2S$

b. *Poor:* less than 50% ground cover or heavily grazed with no mulch. *Fair:* 50 to 75% ground cover and not heavily grazed. *Good:* more than 75% ground cover and lightly or only occasionally grazed

c. *Poor:* less than 50% ground cover. *Fair:* 50 to 75% ground cover. *Good:* more than 75% ground cover

d. Actual curve number is less than 30; use $CN = 30$ for runoff computations

e. *CN*s shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the *CN*s for woods and pasture.

f. *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning. *Fair:* Woods are grazed but not burned, and some forest litter covers the soil. *Good:* Woods are protected from grazing, and litter and brush adequately cover the soil

Table 5.8 Runoff curve numbers for arid and semiarid rangelands[a] (Mockus, 1969)

Cover Description		Curve Numbers for Hydrologic Soil Group:			
Cover Type	Hydrologic Condition[b]	A[c]	B	C	D
Herbaceous-mixture of grass, weeds, and low-growing brush, with brush the minor element	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen-mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper-pinyon, juniper, or both; grass understory	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub-major plants include saltbush, greasewood, creosote-bush, blackbrush, bursage, palo verde, mesquite, and cactus	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

a. Average antecedent moisture condition, and $I_a = 0.2S$. For range in humid regions, use Table 5.7.

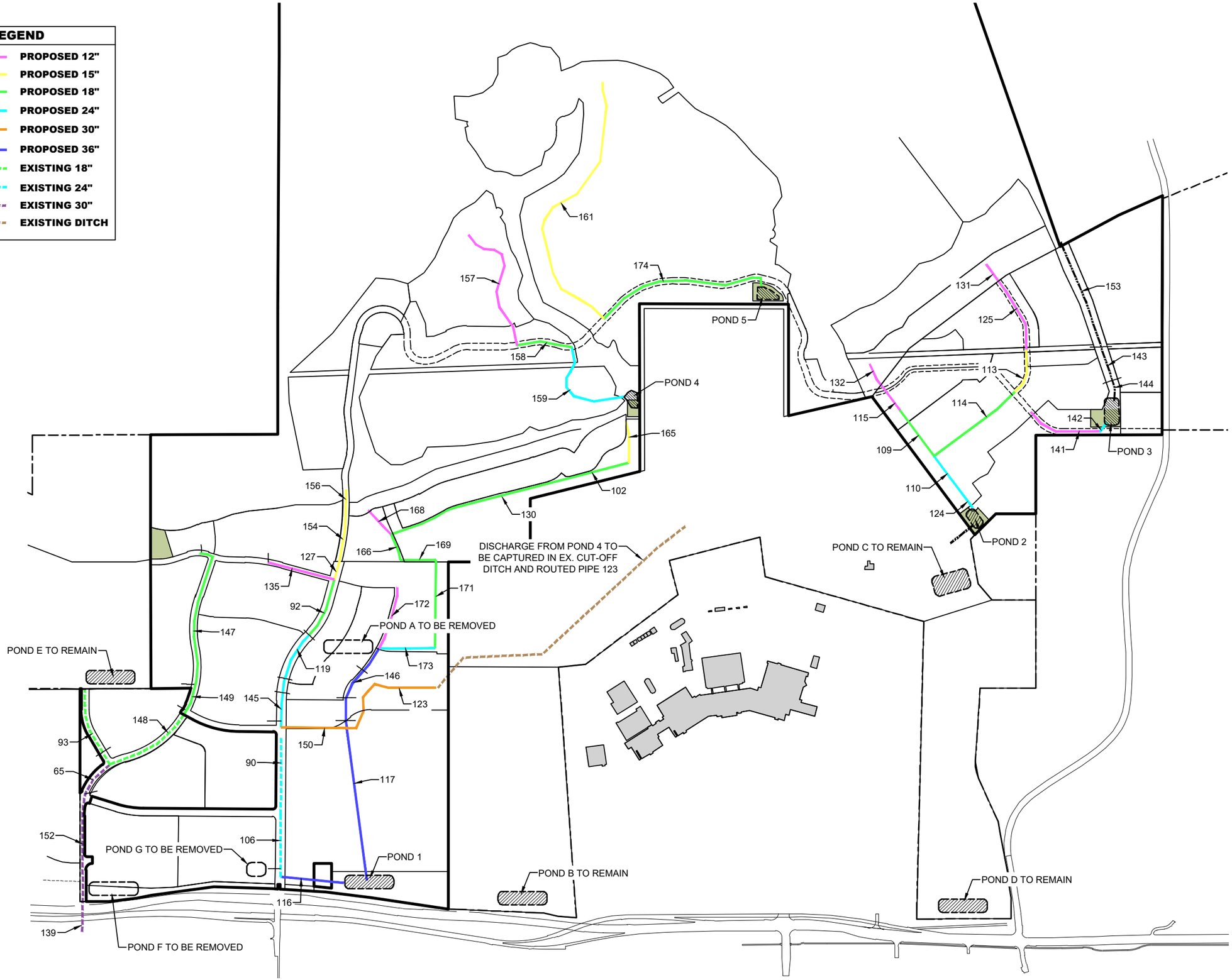
b. *Poor:* less than 30% ground cover (litter, grass, and brush overstory). *Fair:* 30 to 70% ground cover. *Good:* more than 70% ground cover.

c. Curve numbers for group A have been developed for desert shrub.

Appendix E: Pond and Pipe Location Exhibit

LEGEND

- PROPOSED 12"
- PROPOSED 15"
- PROPOSED 18"
- PROPOSED 24"
- PROPOSED 30"
- PROPOSED 36"
- EXISTING 18"
- EXISTING 24"
- EXISTING 30"
- EXISTING DITCH



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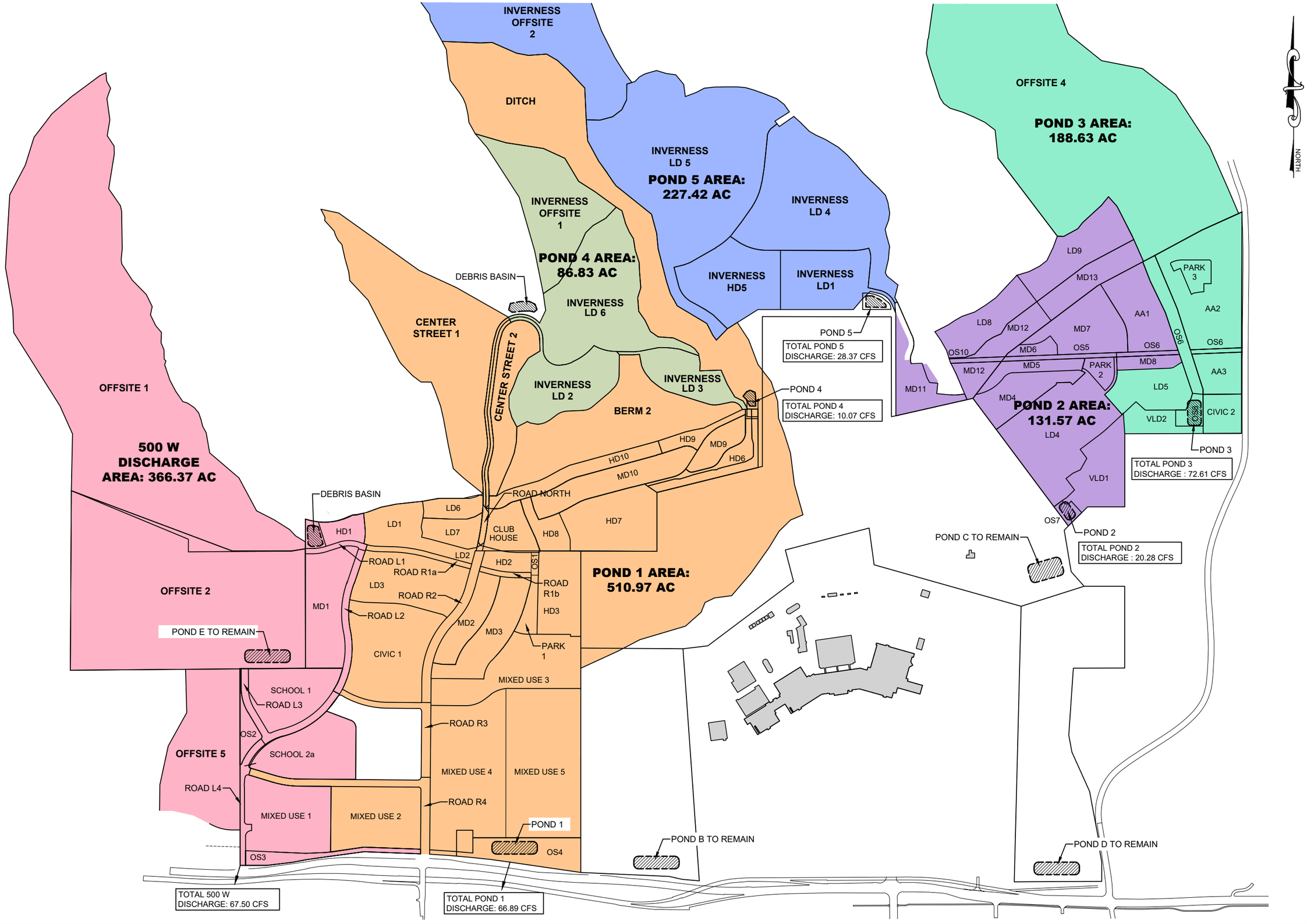
SKYE
LEHI, UTAH

POND & PIPE EXHIBIT

REVISIONS
1 -
2 -
3 -
4 -
5 -

LEI PROJECT #: 2011-0066
DRAWN BY: RWH
DESIGNED BY: BCT
SCALE: 1" = 1000'
DATE: 04/4/2023

SHEET
E1



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LOWER CONTRIBUTING AREA EXHIBIT

REVISIONS
1 -
2 -
3 -
4 -
5 -

LEI PROJECT #: 2011-0066
DRAWN BY: RWH
DESIGNED BY: BCT
SCALE: 1" = 1000'
DATE: 05/12/2023

SHEET
E2

Appendix F: Channel Cross Section Designs

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Dec 22 2021

Channel 143

Triangular

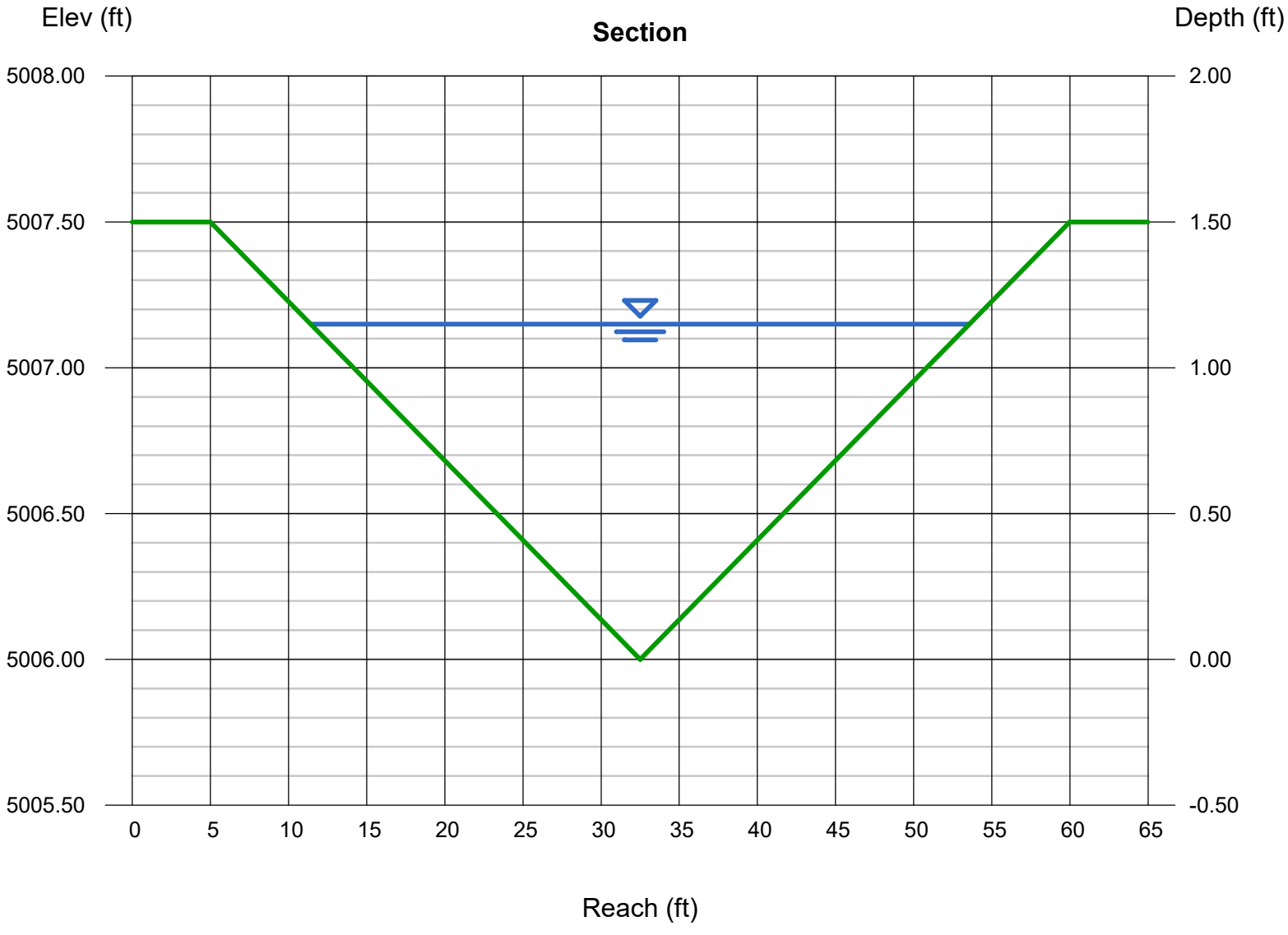
Side Slopes (z:1)	= 18.33, 18.33
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 5006.00
Slope (%)	= 4.35
N-Value	= 0.045

Calculations

Compute by:	Known Q
Known Q (cfs)	= 115.17

Highlighted

Depth (ft)	= 1.15
Q (cfs)	= 115.17
Area (sqft)	= 24.24
Velocity (ft/s)	= 4.75
Wetted Perim (ft)	= 42.22
Crit Depth, Yc (ft)	= 1.20
Top Width (ft)	= 42.16
EGL (ft)	= 1.50



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Dec 22 2021

Channel 144

Triangular

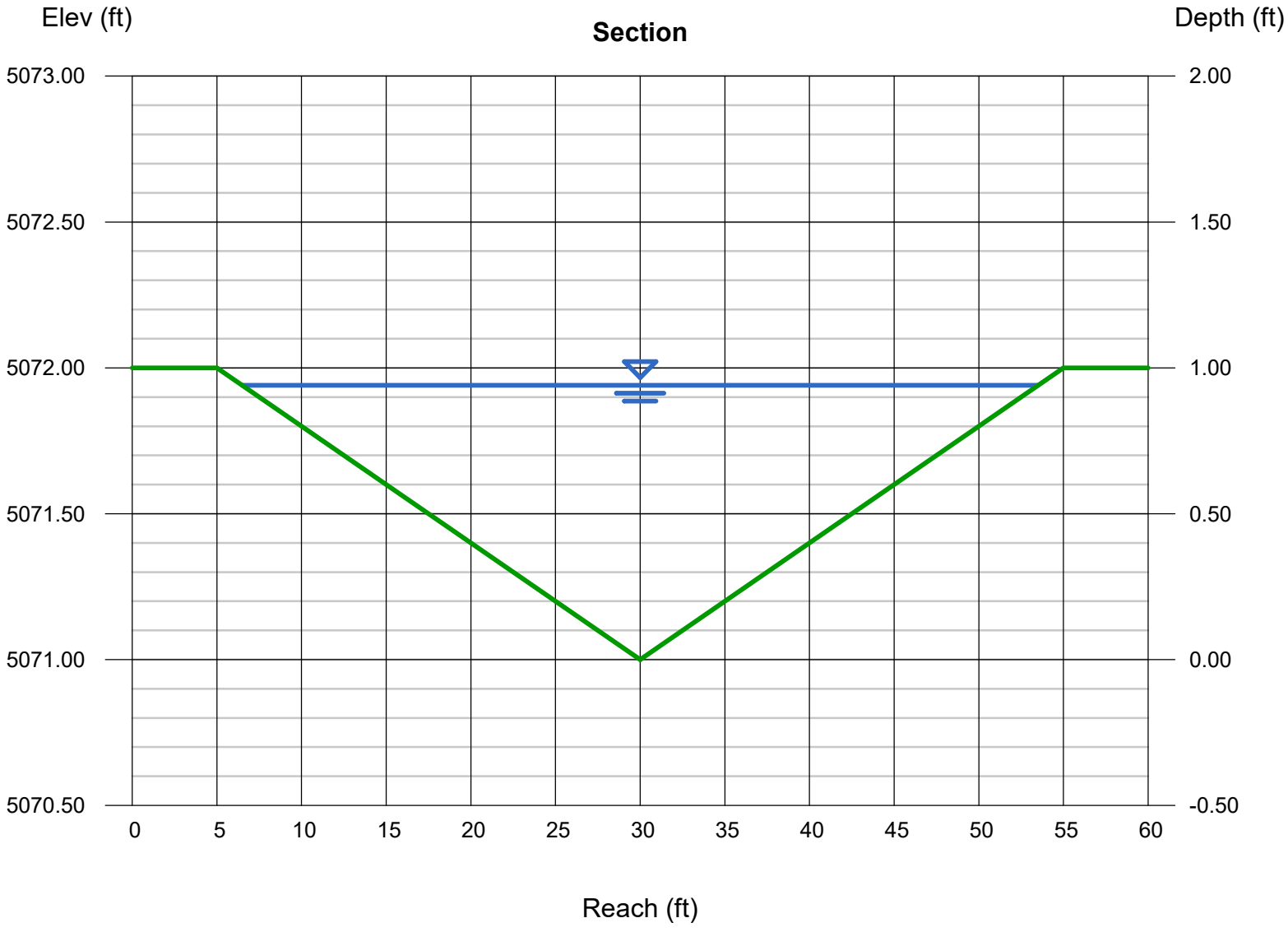
Side Slopes (z:1)	= 25.00, 25.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 5071.00
Slope (%)	= 7.60
N-Value	= 0.045

Calculations

Compute by:	Known Q
Known Q (cfs)	= 121.03

Highlighted

Depth (ft)	= 0.94
Q (cfs)	= 121.03
Area (sqft)	= 22.09
Velocity (ft/s)	= 5.48
Wetted Perim (ft)	= 47.04
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 47.00
EGL (ft)	= 1.41



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Dec 22 2021

Channel 153

Triangular

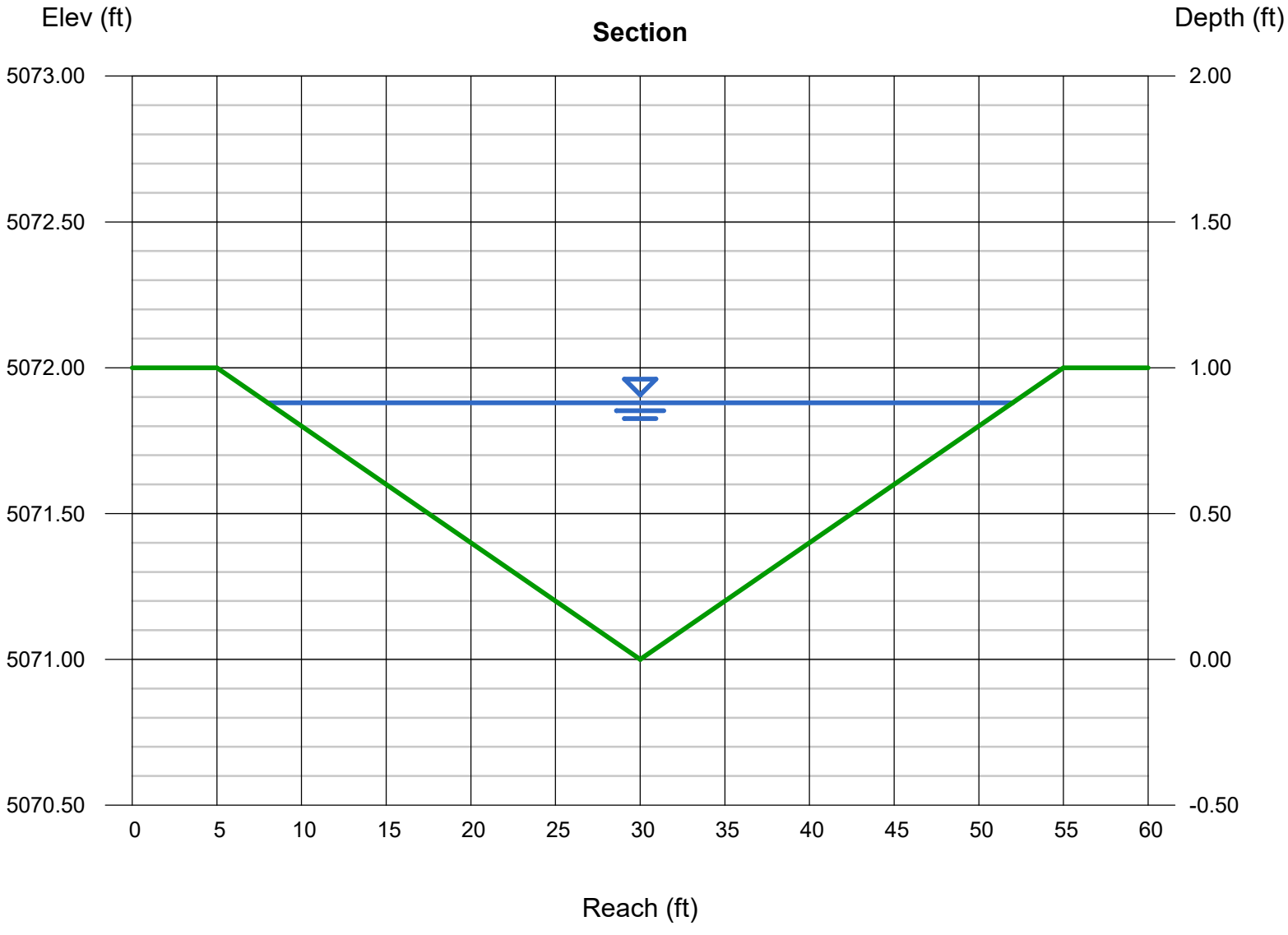
Side Slopes (z:1)	= 25.00, 25.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 5071.00
Slope (%)	= 5.70
N-Value	= 0.045

Calculations

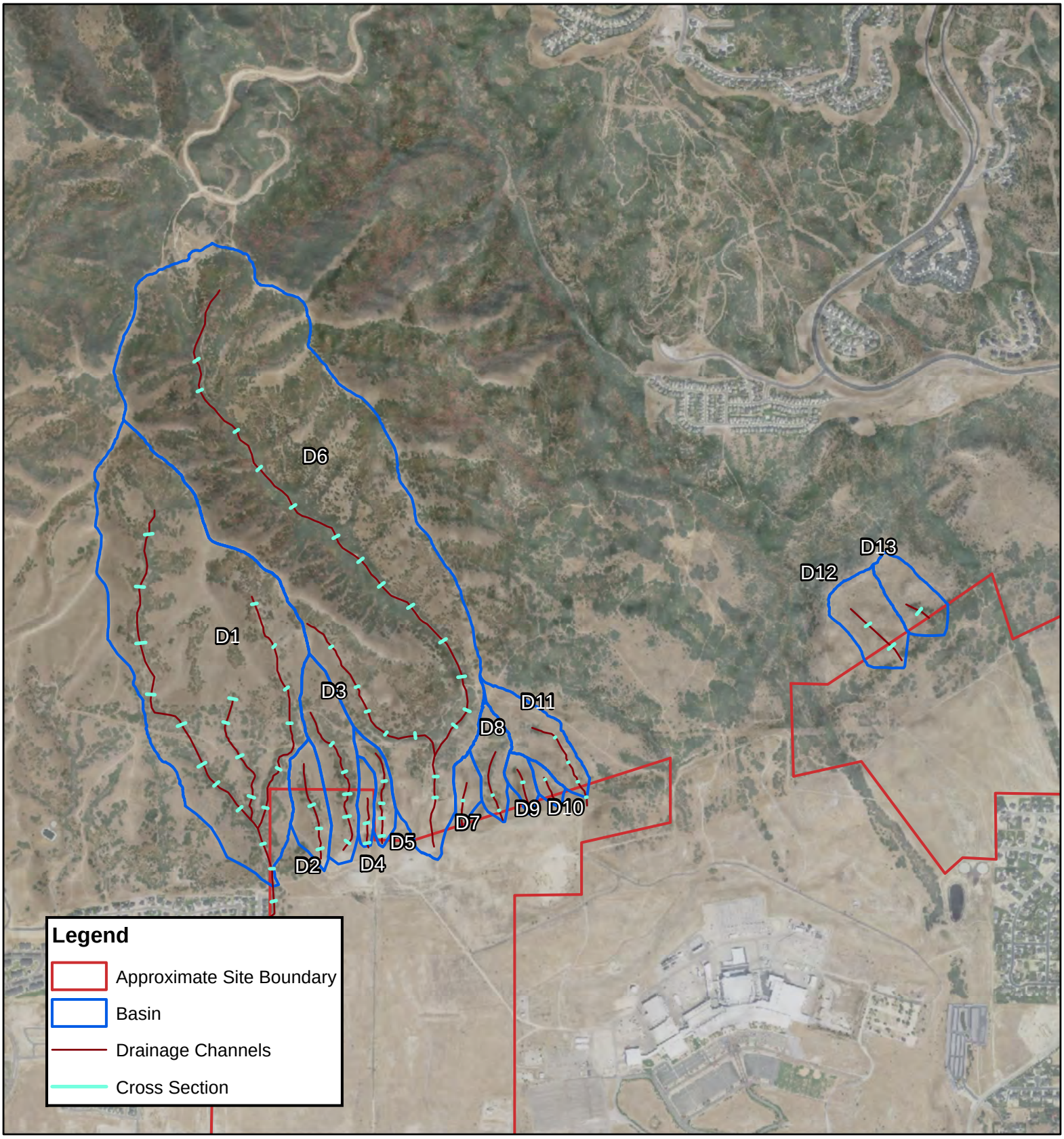
Compute by:	Known Q
Known Q (cfs)	= 85.89

Highlighted

Depth (ft)	= 0.88
Q (cfs)	= 85.89
Area (sqft)	= 19.36
Velocity (ft/s)	= 4.44
Wetted Perim (ft)	= 44.04
Crit Depth, Yc (ft)	= 0.95
Top Width (ft)	= 44.00
EGL (ft)	= 1.19



Appendix G: Debris Basin Exhibit

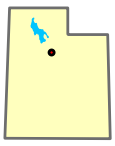


0 500 1,000 2,000 3,000 4,000 Feet

1:20,000

Basemap:
2012 12.5 cm HRO aerial imagery and hillshades derived from DEMs provided by the State of Utah AGRC

N



GeoStrata

Debris Flow Hazard Study
DR Horton
Micron Project
Lehi, Utah
Project Number: 589-100

Debris Flow Assessment Map

Plate A-8