Case File Report

HILGARTWILSON
ENGINEER | PLAN | SURVEY | MANAGE

Registered Professional Engineer (Civil) CERTIFICATE NO. 59301 BRIAN BROCKMAN DATE SIGNED 3/13/17 ARIZONA U.S.A.
Expires: 3/31/18

TECHNICAL MEMORANDUM

To: City of Scottsdale

From: HILGARTWILSON

Date: March 13th, 2017

RE: Great Hearts Academies – Scottsdale Preparatory Field Preliminary Drainage Analysis

Introduction and Background

This technical memorandum has been prepared in support of the Great Hearts Academies (GHA) proposed athletic field (the Project) located southwest of Trailside View and 91st Street, east of Pima Road and the 101 Highway, in the City of Scottsdale (the City). Refer to Figure 1 (Vicinity Map). Specifically, this memorandum discusses the regulatory framework in which the Project will be designed in accordance with as well as preliminary drainage considerations.

Future drainage reports will be prepared in accordance with the most current version of the City of Scottsdale (COS) Design Standards & Policies Manual (DSPM) and the Flood Control District of Maricopa County's (FCDMC) current versions of the Drainage Policies and Standards (DPSM), Drainage Design Manuals (DDM) for Maricopa County, - Hydrology and - Hydraulics.

Hydrologic Flow Determination

In July 2013, T.Y. Lin prepared the *Pinnacle Peak South Area Drainage Master Study Draft* (ADMS) (T.Y. Lin 2013) on behalf of the FCDMC that details the hydrologic and hydraulic conditions of a 45 square mile drainage area extending from Frank Lloyd Wright Boulevard to Dynamite Boulevard and from Scottsdale Road into the McDowell Mountains. The primary goal of the study was to characterize regional flows using the most up to date hydrologic study of the watershed referencing the most current land uses, rainfall data, detailed topography, and analysis. The hydrologic and hydraulic analysis for the study area was completed using FLO-2D, a volume conserving, two-dimensional flood routing modeling program best suited for simulating shallow, distributary flows within a watershed. The ADMS reported a worst case scenario flow of 488 cfs entering the northwest corner of the Project via box culverts beneath, as well as overtopping, Trailside View from the north. The ADMS also reported smaller flows for the 100-year, 6-hour and 24-hour events of 217cfs and 257cfs respectively. FLO-2D results from the ADMS are included as Attachment 1.

Site Location Relative to Known FEMA Flood Hazard Zones

The property is located within the Federal Emergency Management Agency's (FEMA) Special Flood Hazard Area (SFHA) Zone AO as delineated on the FEMA Flood Insurance Rate Maps (FIRMs) panel number 04013C1320L, revised October 16, 2013, which are presented on Figure 2 (FEMA Flood Map). The SFHA Zone associated with this Project is defined below.

4-ZN-2017
3/14/2017

Zone AO:

> The flood insurance rate zone that corresponds to areas subject to inundation by 1-percent annual chance (100-year storm event) shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone.

As the entire Project is located in a FEMA SFHA AO Zone, lowest floor elevations of nonresidential structures shall be elevated to conform to Chapter 37, Article I. Floodplain Management - Special Flood Hazard Areas, Section 37-22 of the Scottsdale Revised Ordinance Code.

Hydraulic Analysis

The 100-year water surface extents of the watercourse through the site were determined in order to identify the anticipated flooding impacts to the proposed field. The preliminary hydraulic analyses for the Project was performed using Hydraflow with parameters referenced from obtained topographic data for the Project. The top widths specified in the Hydraflow results were used to delineate the washes approximate water surface extents. The supporting hydraulic calculations are included as Attachment 2 and the estimated watersurface extents shown on Figure 3 (Drainage Summary Exhibit). It can be seen that based on the current field and parking lot layout, the worst case scenario flows crossing Trailside View do not impact the Project.

Onsite Design Requirements

The proposed Project will comply with the City's required drainage standards as well as Maricopa County Planning and Development Design guidelines and regulations. In accordance with the approved regional drainage report entitled DC Ranch Planning Unit I Part 4 Drainage Plan Study and stormwater storage waiver for the site, onsite stormwater storage is not anticipated to be required.

References

T.Y. Lin, 2013. *Pinnacle Peak South Area Drainage Master Study (Draft).* Phoenix, Arizona. July 2013.

Attachments

Figure 1: Vicinity Map
Figure 2: FEMA Flood Map
Figure 3: Drainage Summary Exhibit
Attachment 1: Pinnacle Peak South ADMS FLO-2D Results
Attachment 2: Hydraflow Calculations

HILGARTWILSON, LLC
2141 E Highland Avenue, Suite 250
Phoenix, Arizona 85016-4736
Phone: 602-490-0535

PROJ.NO.:	1792
DATE:	MAR 2017
SCALE:	1" = 600'
DRAWN BY:	SL
CHECKED BY:	AT

GREAT HEARTS ACADEMIES

SCOTTSDALE PREPATORY FIELD
SCOTTSDALE, ARIZONA

FIG. 1: VICINITY MAP

HILGARTWILSON
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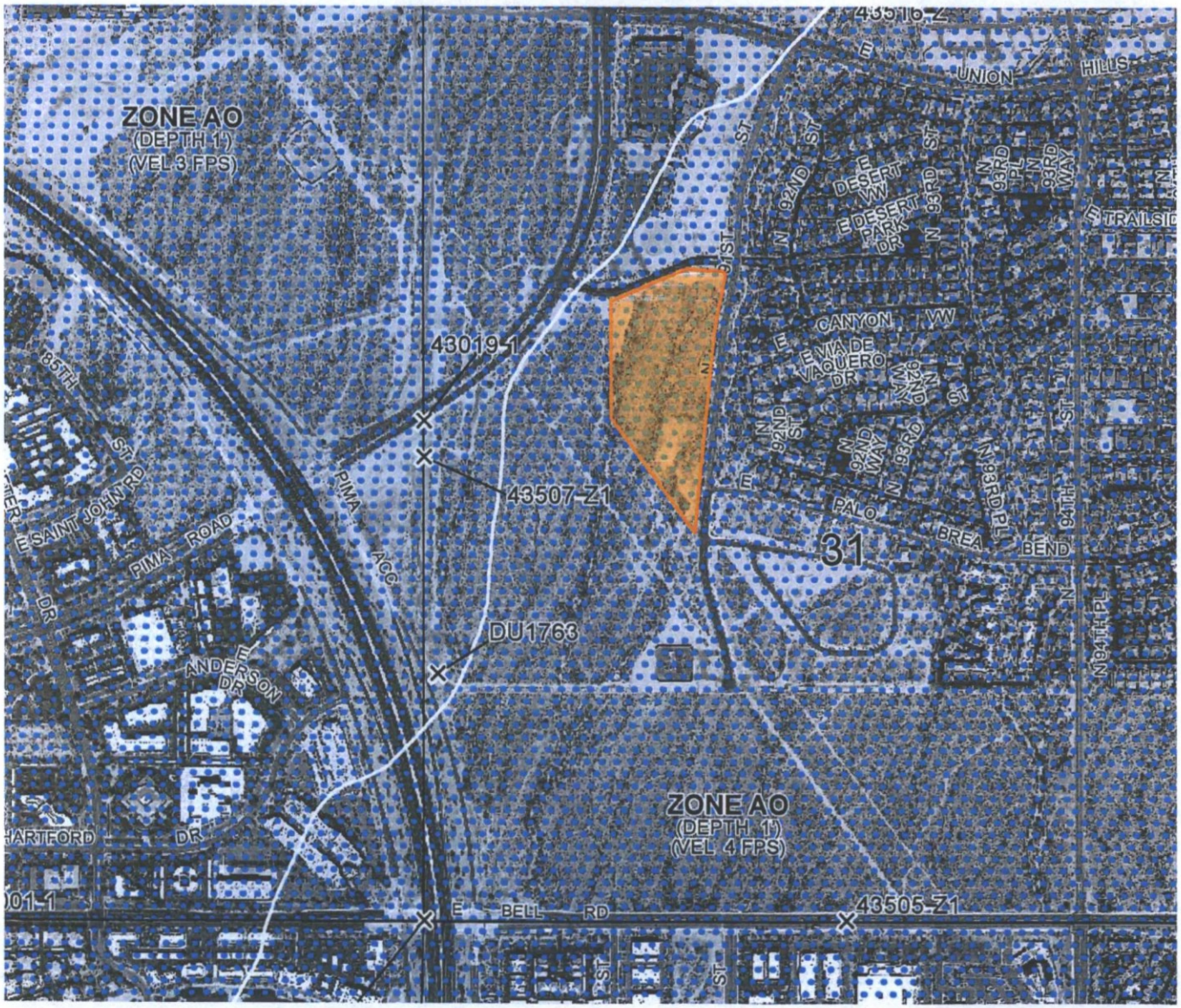

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1320L

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 1320 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	1320	L
PHOENIX, CITY OF	040051	1320	L
SCOTTSDALE, CITY OF	045012	1320	L

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1320L

MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

LEGEND

PROJECT LIMITS

N

600 300 0 600

SCALE FEET

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GREAT HEARTSACADEMY
SCOTTSDALE PREPATORY FIELD
SCOTTSDALE, ARIZONA

FIG. 2: FEMA FLOOD MAP

PROJ. NO.:	1792
DATE:	MAR 2017
SCALE:	1" = 600'
DRAWN BY:	SL
CHECKED BY:	AT

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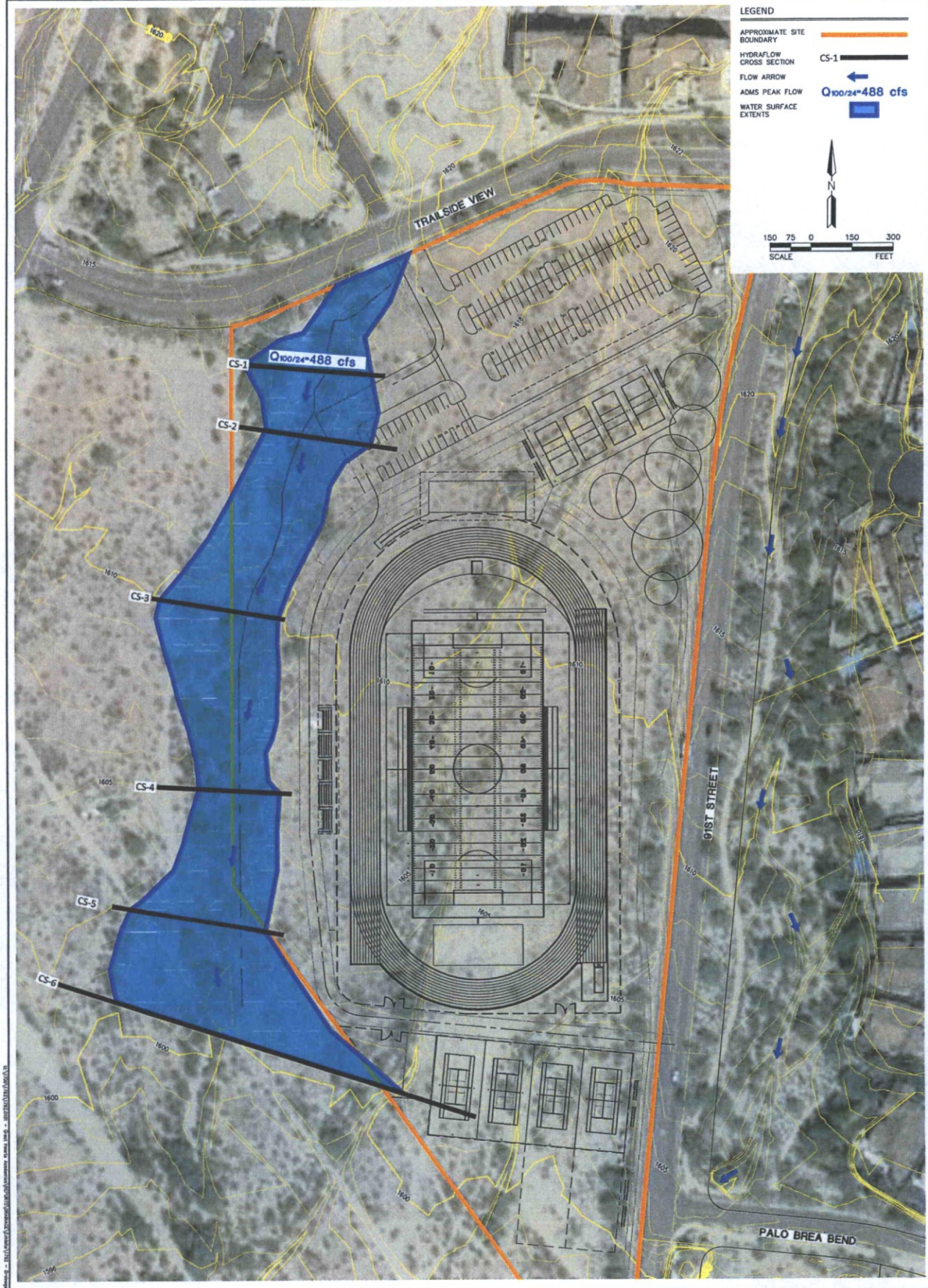

HILGARTWILSON	
PROJ NO.: 1792	
DATE: MAR. 2017	
SCALE: 1" = 50'	
DRAWN: BB	
DESIGNED: HW	
APPROVED: AT	

GREAT HEARTS ACADEMIES

SCOTTSDALE PREPATORY FIELD
SCOTTSDALE, ARIZONA

FIG. 3: PRELIMINARY DRAINAGE SUMMARY EXHIBIT

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REV.:

HILGARTWILSON
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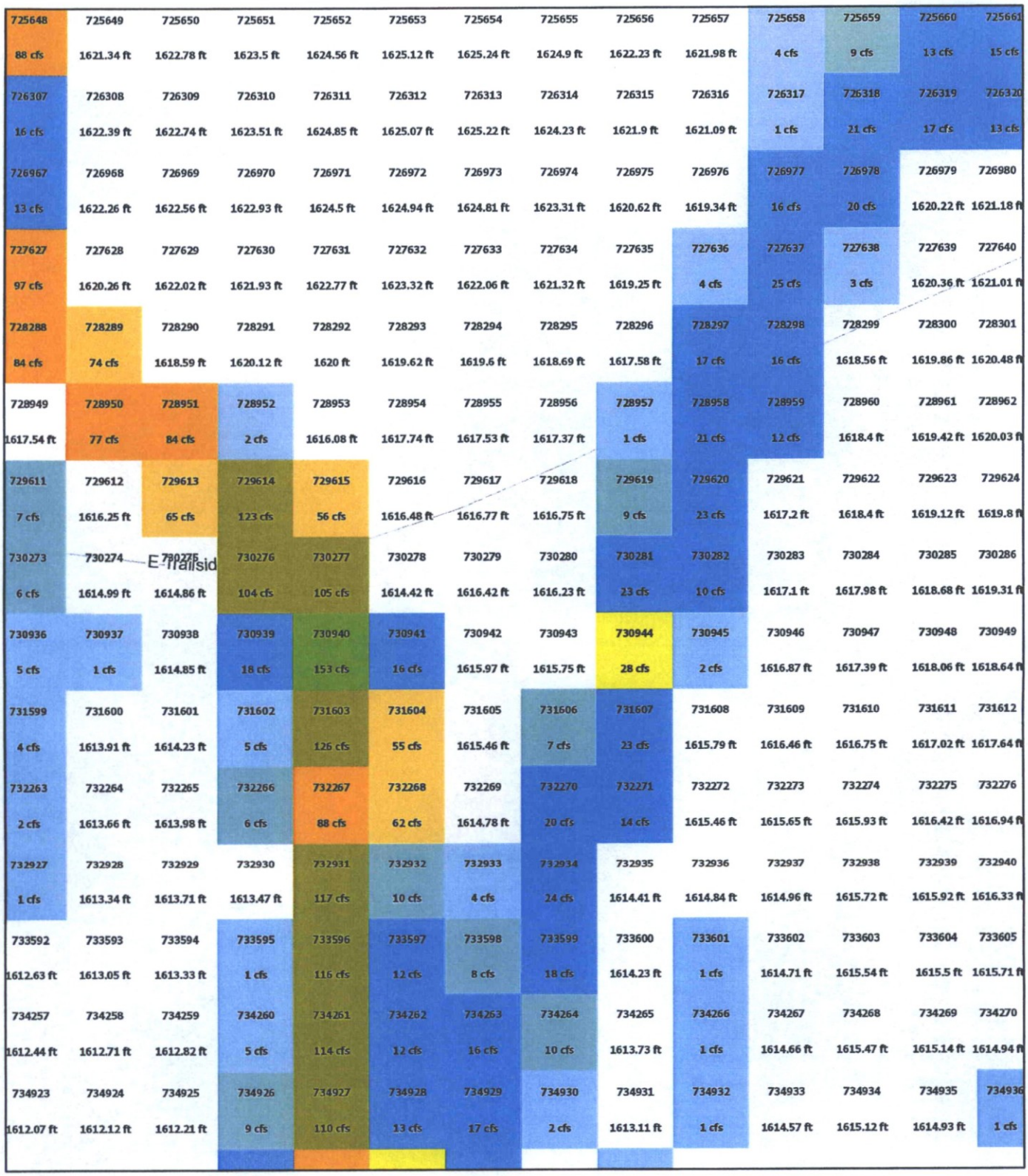
ATTACHMENT 1
PINNACLE PEAK SOUTH ADMS FLO-2D RESULTS

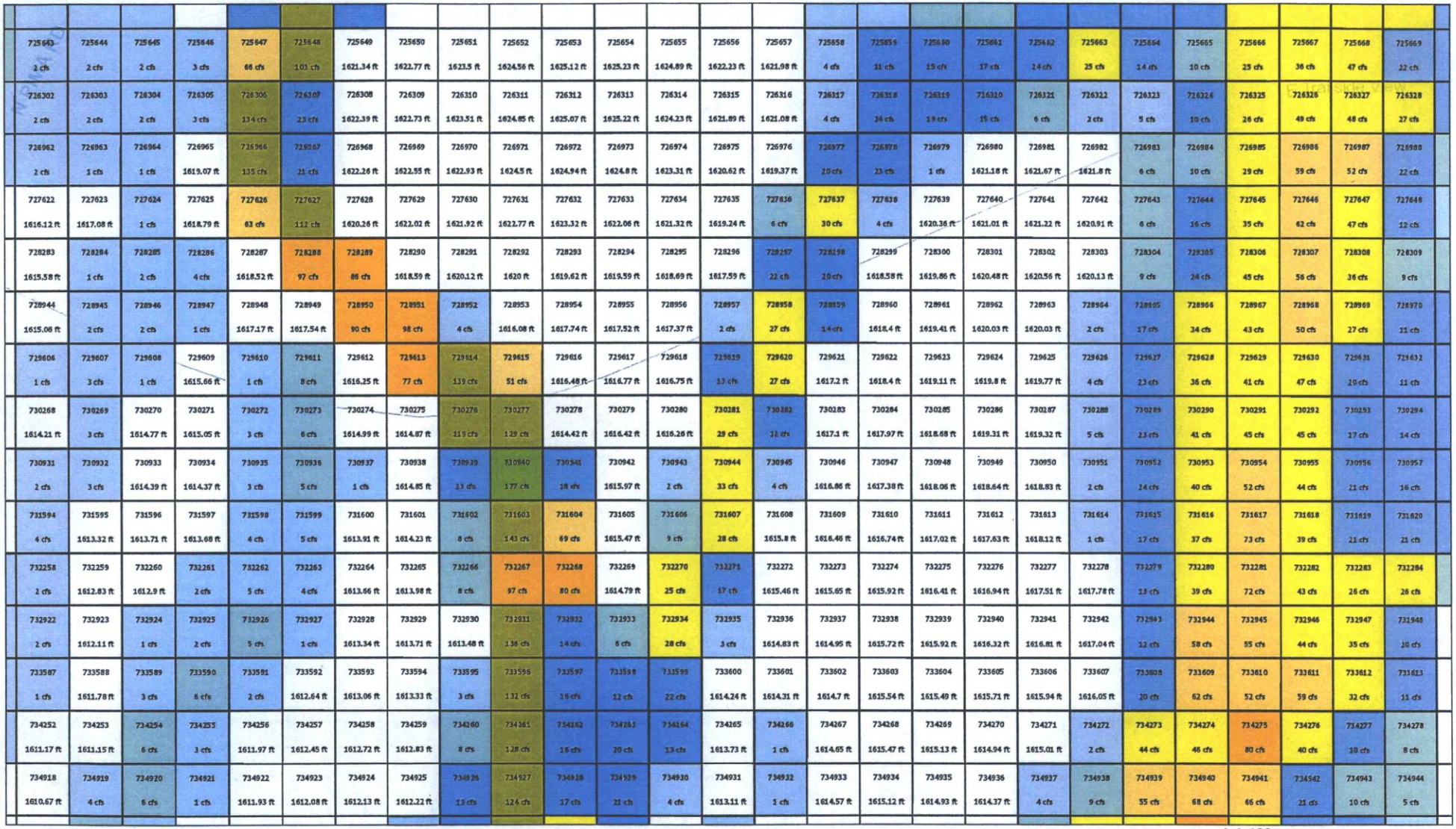
Flo2D Viewer

Model: 2D_PinnaclePeakSouth/100YR6HR_P



Flo2D Viewer

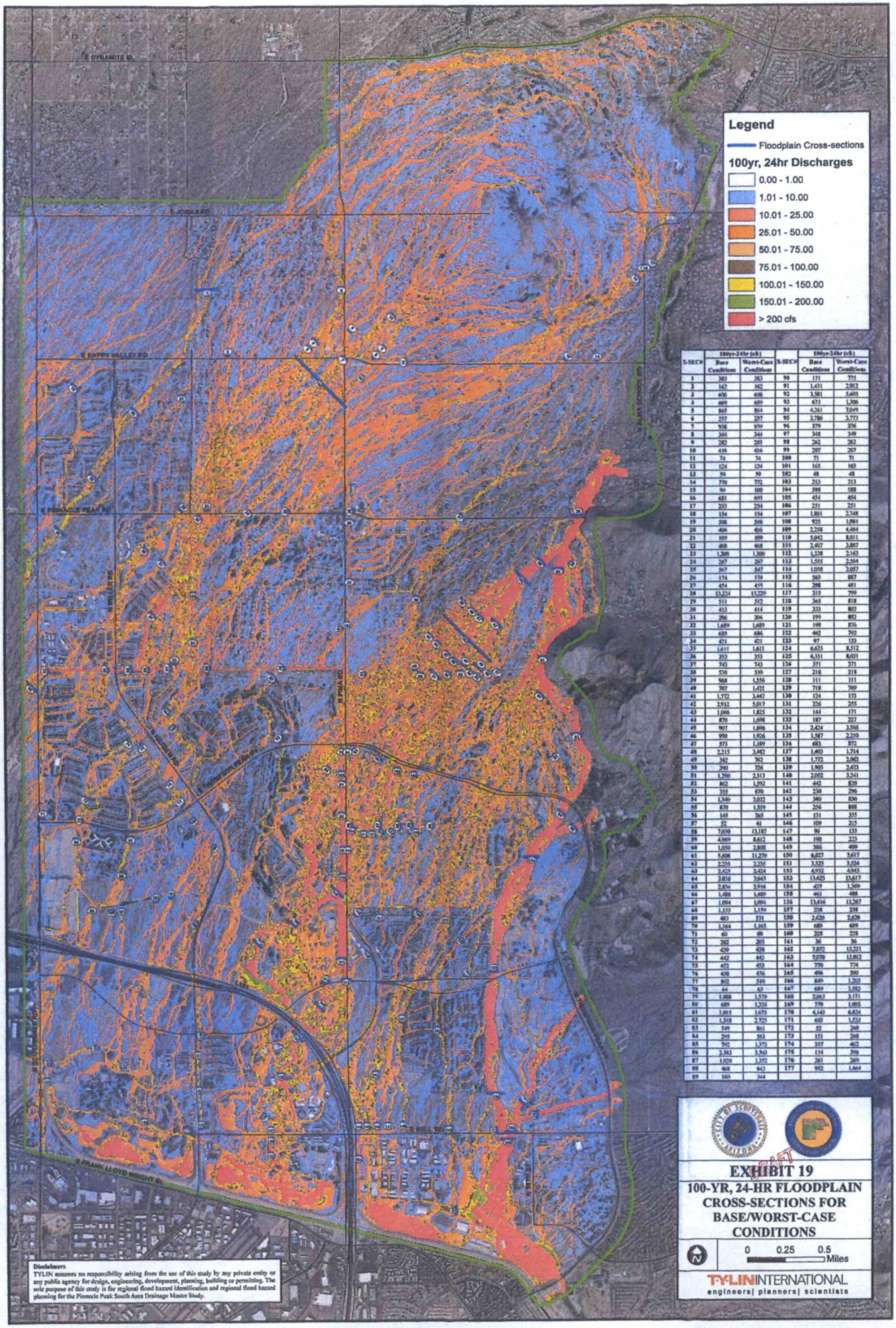
Model: 2D_PinnaclePeakSouth/100YR24HR_P



1:1,132

0 0.0075 0.015 0.03 mi

PINNACLE PEAK SOUTH ADMS



X-SEC#	100yr-24hr (cfs) Base Conditions	100yr-24hr (cfs) Worst-Case Conditions	X-SEC#	100yr-24hr (cfs) Base Conditions	100yr-24hr (cfs) Worst-Case Conditions
1	383	383	90	171	775
2	162	162	91	1,431	2,912
3	606	606	92	3,581	5,603
4	669	669	93	673	1,306
5	865	864	94	4,261	7,049
6	257	257	95	3,786	3,773
7	938	939	96	379	376
8	344	344	97	348	349
9	282	281	98	262	262
10	416	416	99	207	207
11	74	74	100	71	71
12	124	124	101	165	165
13	59	59	102	48	48
14	770	772	103	213	213
15	90	100	104	588	588
16	681	693	105	454	454
17	253	254	106	251	251
18	154	154	107	1,851	2,748
19	508	508	108	925	1,984
20	406	406	109	2,258	4,464
21	109	109	110	5,042	8,011
22	468	468	111	2,407	3,887
23	1,300	1,300	112	1,338	2,163
24	267	267	113	1,535	2,564
25	567	547	114	1,058	2,057
26	174	174	115	565	887
27	454	455	116	298	481
28	13,224	13,229	117	315	799
29	511	512	118	365	818
30	413	414	119	333	803
31	206	206	120	199	883
32	1,689	1,689	121	199	876
33	685	686	122	462	792
34	421	421	123	97	133
35	1,611	1,611	124	6,633	8,512
36	353	353	125	6,331	8,031
37	743	743	126	371	371
38	530	530	127	218	218
39	968	1,556	128	111	111
40	707	1,421	129	718	769
41	1,772	3,447	130	124	173
42	2,912	5,017	131	226	255
43	1,066	1,825	132	144	171
44	870	1,698	133	187	227
45	907	1,896	134	2,424	3,566
46	990	1,926	135	1,587	2,210
47	573	1,189	136	683	872
48	2,215	3,482	137	1,403	1,714
49	382	762	138	1,772	2,062
50	390	726	139	1,905	2,423
51	1,290	2,513	140	2,052	3,241
52	862	1,592	141	442	820
53	355	670	142	230	296
54	1,349	2,022	143	380	830
55	870	1,559	144	256	888
56	145	265	145	131	355
57	52	41	146	109	215
58	7,030	13,187	147	96	133
59	4,069	8,612	148	190	223
60	1,050	2,808	149	386	409
61	5,608	11,270	150	6,027	7,617
62	2,235	2,235	151	3,523	3,524
63	2,425	2,424	152	4,932	4,943
64	3,036	3,043	153	13,623	13,617
65	2,836	2,916	154	437	1,369
66	1,488	1,489	155	461	488
67	1,094	1,094	156	13,416	13,267
68	1,153	1,159	157	238	238
69	483	531	158	2,620	2,620
70	1,164	1,165	159	689	689
71	60	60	160	228	228
72	202	203	161	36	36
73	439	438	162	7,872	13,221
74	442	443	163	7,070	13,812
75	452	453	164	770	774
76	438	436	165	496	500
77	502	510	166	849	1,203
78	64	63	167	689	1,583
79	1,058	1,579	168	2,063	3,171
80	689	1,326	169	779	1,005
81	1,015	1,675	170	4,143	6,824
82	1,518	2,725	171	665	1,533
83	749	861	172	52	268
84	295	563	173	151	268
85	792	1,373	174	357	462
86	2,583	3,560	175	114	396
87	1,029	1,352	176	261	269
88	468	643	177	952	1,464
89	160	344			

EXHIBIT 19

100-YR, 24-HR FLOODPLAIN CROSS-SECTIONS FOR BASE/WORST-CASE CONDITIONS

TYLININTERNATIONAL
engineers| planners| scientists

Disclaimer:
TYLIN assumes no responsibility arising from the use of this study by any private entity or any public agency for design, engineering, development, planning, building or permitting. The sole purpose of this study is for regional flood hazard identification and regional flood hazard planning for the Pinnacle Peak South Area Drainage Master Study.

HILGARTWILSON
ENGINEER | PLAN | SURVEY | MANAGE

ATTACHMENT 2
HYDRAFLOW CALCULATIONS

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 13 2017

CS-1

User-defined

Invert Elev (ft)	= 1614.00
Slope (%)	= 1.75
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 488.00

Highlighted

Depth (ft)	= 2.46
Q (cfs)	= 488.00
Area (sqft)	= 86.59
Velocity (ft/s)	= 5.64
Wetted Perim (ft)	= 97.24
Crit Depth, Yc (ft)	= 2.51
Top Width (ft)	= 96.90
EGL (ft)	= 2.95

(Sta, El, n)-(Sta, El, n)...

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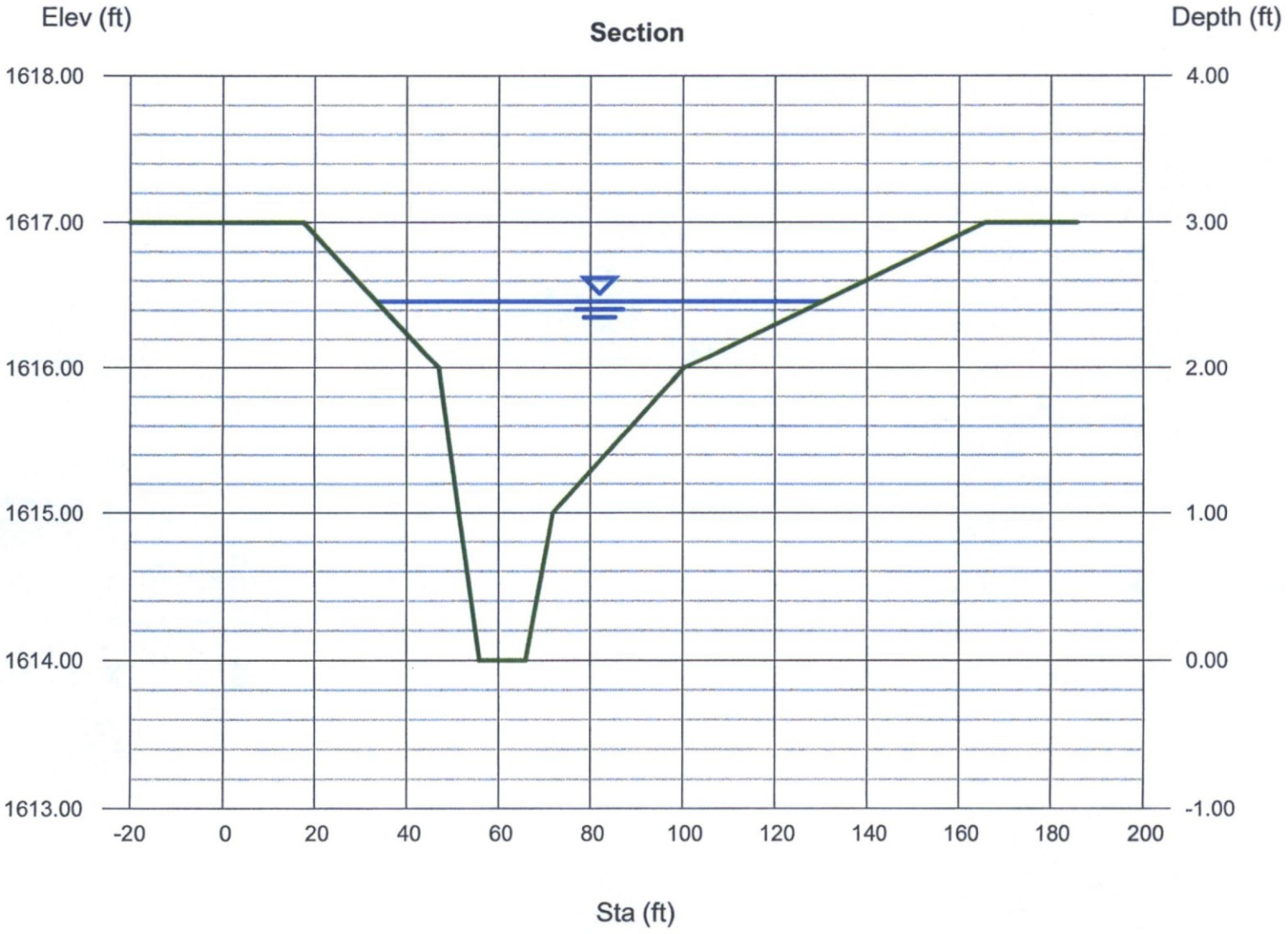

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 13 2017

CS-2

User-defined

Invert Elev (ft)	= 1611.00
Slope (%)	= 1.13
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 488.00

Highlighted

Depth (ft)	= 2.89
Q (cfs)	= 488.00
Area (sqft)	= 109.68
Velocity (ft/s)	= 4.45
Wetted Perim (ft)	= 128.42
Crit Depth, Yc (ft)	= 2.77
Top Width (ft)	= 128.13
EGL (ft)	= 3.20

(Sta, El, n)-(Sta, El, n)...

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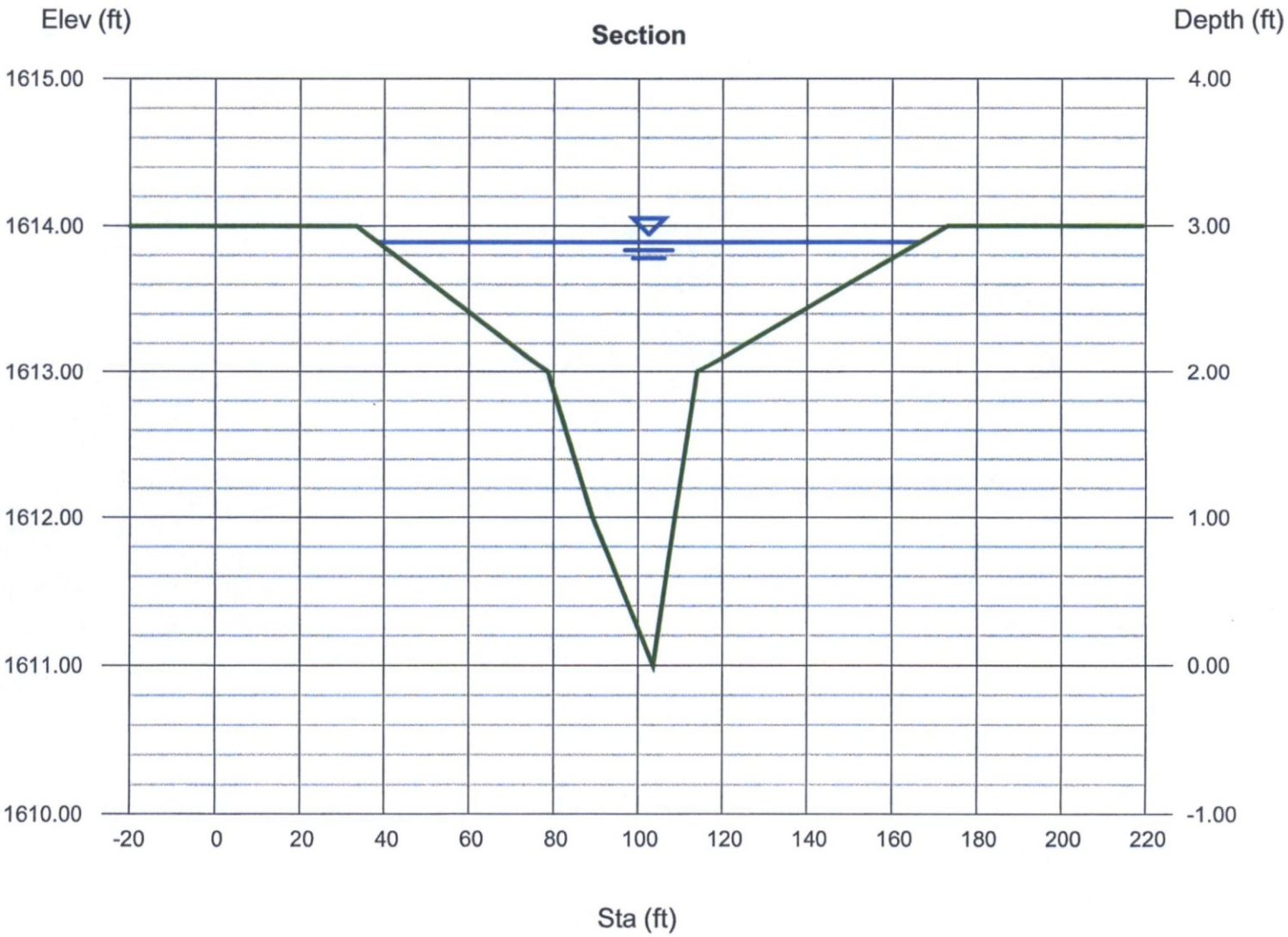

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 13 2017

CS-3

User-defined

Invert Elev (ft)	= 1608.00
Slope (%)	= 2.33
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 488.00

Highlighted

Depth (ft)	= 1.63
Q (cfs)	= 488.00
Area (sqft)	= 93.31
Velocity (ft/s)	= 5.23
Wetted Perim (ft)	= 145.94
Crit Depth, Yc (ft)	= 1.70
Top Width (ft)	= 145.79
EGL (ft)	= 2.06

(Sta, El, n)-(Sta, El, n)...

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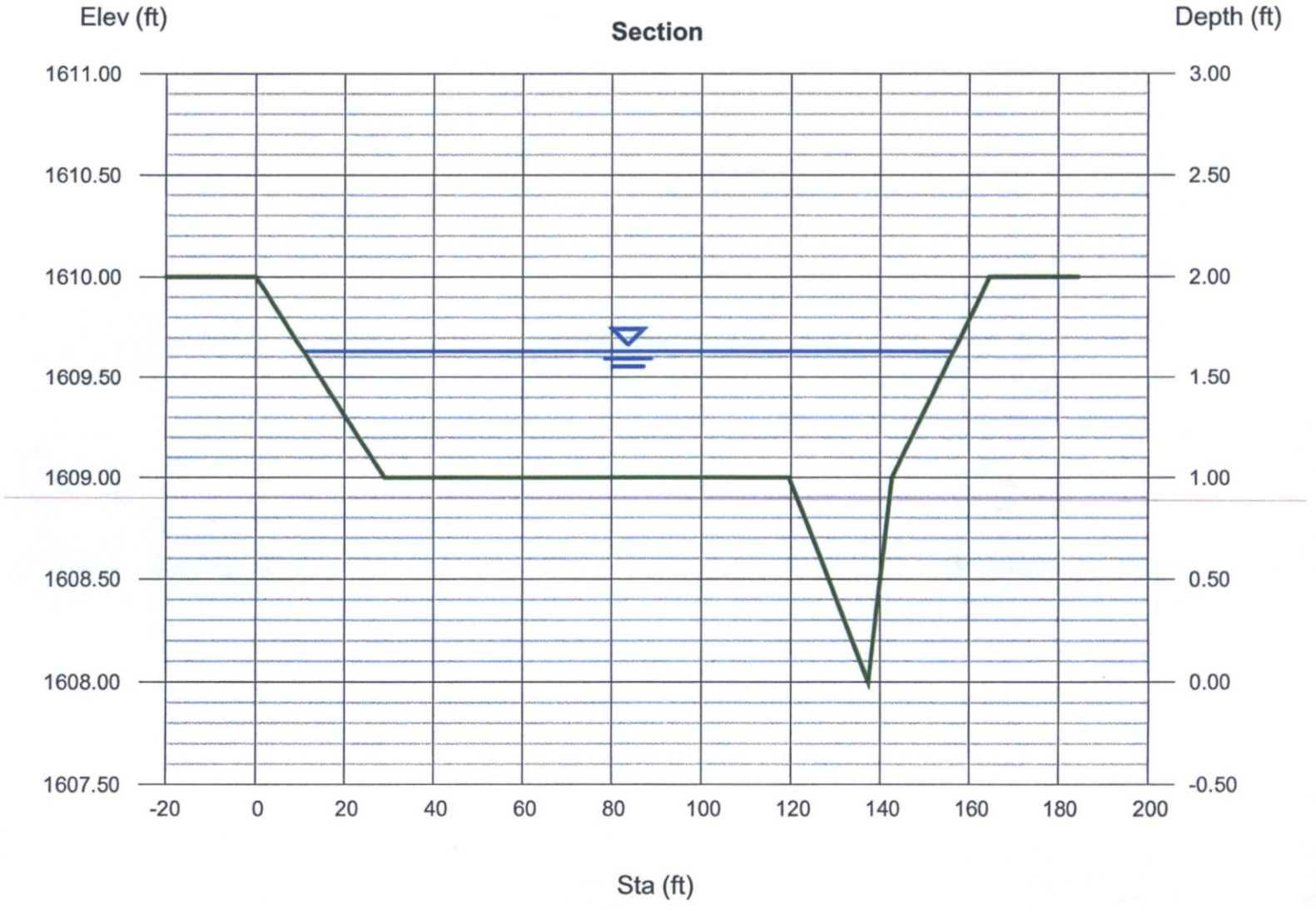

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 13 2017

CS-4

User-defined

Invert Elev (ft)	= 1604.00
Slope (%)	= 2.06
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 488.00

Highlighted

Depth (ft)	= 1.68
Q (cfs)	= 488.00
Area (sqft)	= 83.56
Velocity (ft/s)	= 5.84
Wetted Perim (ft)	= 101.03
Crit Depth, Yc (ft)	= 1.77
Top Width (ft)	= 100.97
EGL (ft)	= 2.21

(Sta, El, n)-(Sta, El, n)...

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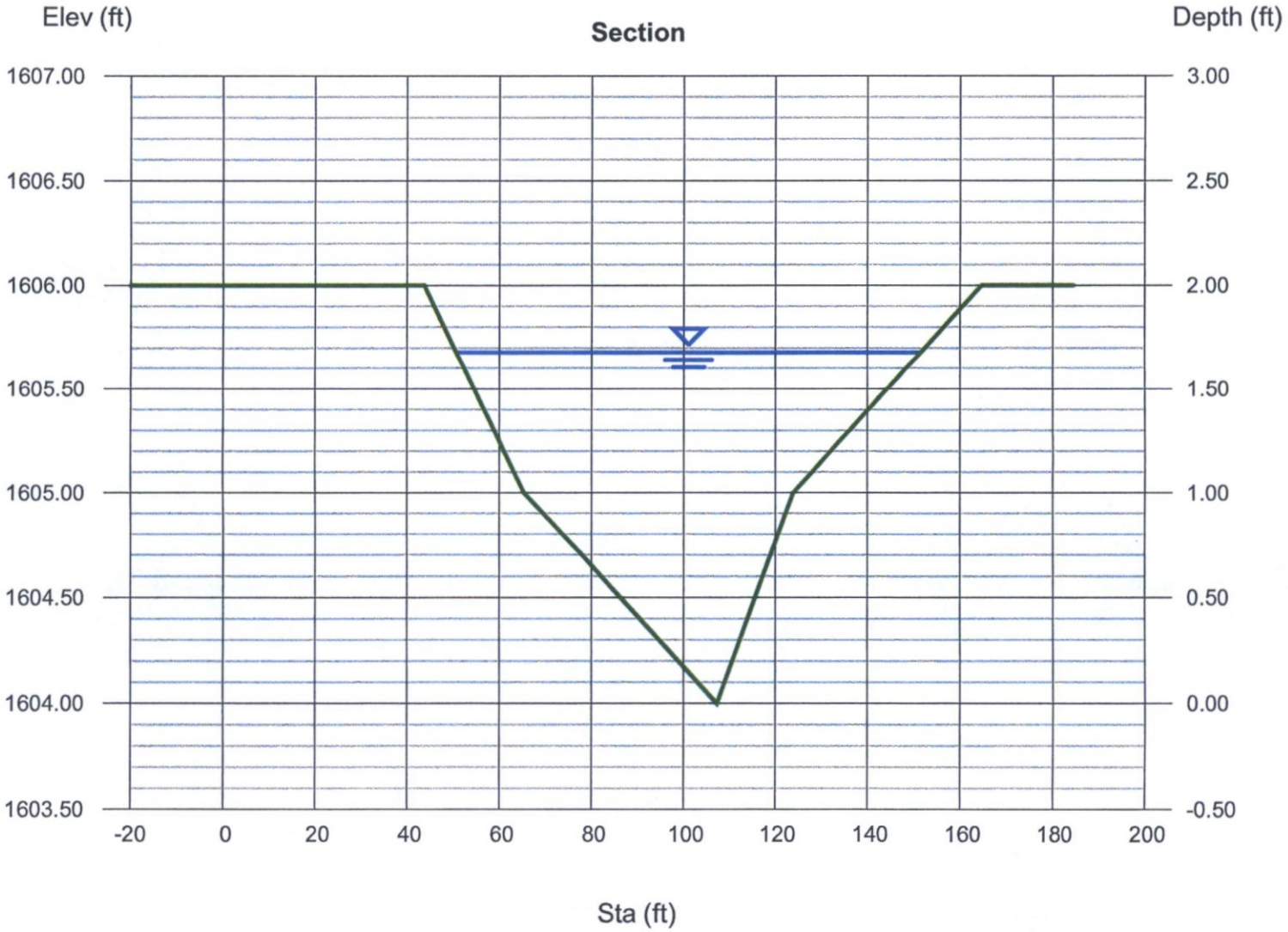

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 13 2017

CS-5

User-defined

Invert Elev (ft)	= 1601.00
Slope (%)	= 1.82
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 488.00

Highlighted

Depth (ft)	= 1.52
Q (cfs)	= 488.00
Area (sqft)	= 107.17
Velocity (ft/s)	= 4.55
Wetted Perim (ft)	= 169.48
Crit Depth, Yc (ft)	= 1.53
Top Width (ft)	= 169.39
EGL (ft)	= 1.84

(Sta, El, n)-(Sta, El, n)...

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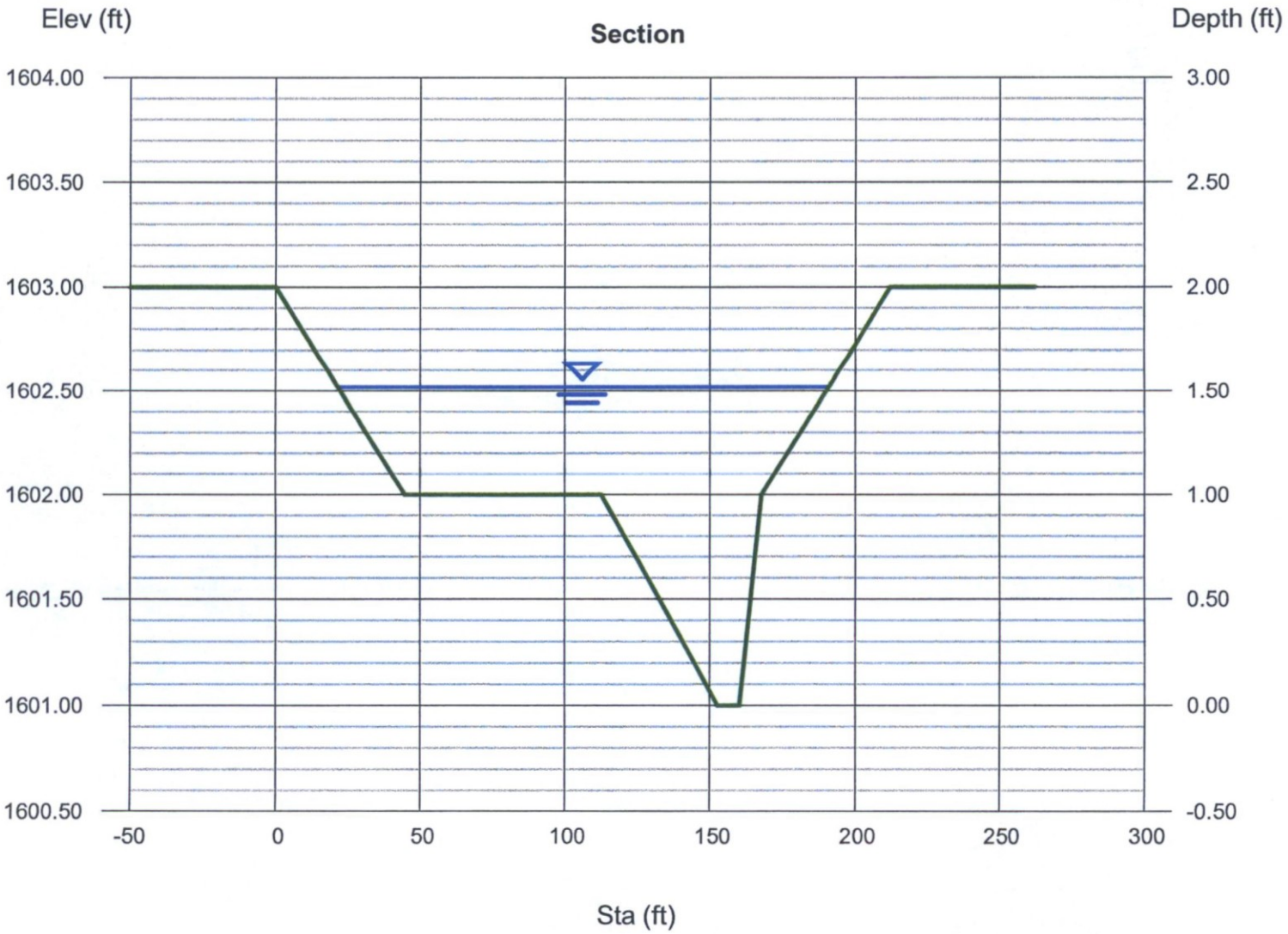

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 13 2017

CS-6

User-defined

Invert Elev (ft)	= 1600.00
Slope (%)	= 1.62
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 488.00

Highlighted

Depth (ft)	= 0.45
Q (cfs)	= 488.00
Area (sqft)	= 151.55
Velocity (ft/s)	= 3.22
Wetted Perim (ft)	= 360.69
Crit Depth, Yc (ft)	= 0.42
Top Width (ft)	= 360.65
EGL (ft)	= 0.61

(Sta, El, n)-(Sta, El, n)...

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