Sinclair Wash Restoration Feasibility Study

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May 5, 2020

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Acknowledgments

We would like to acknowledge our Grader, Technical Advisor and Client Mark Lamer. Without his guidance we would be lost.

We would also like to thank the previous Sinclair Wash capstone teams, who's previous work we are building on.

1.0 Project Introduction

1.1 Background

Riparian habitats aid in the dissipation of the energy in streams through curves in their path as well as vegetation. This reduction in the flow of the stream helps to reduce soil erosion, settle out suspended solids reducing the turbidity, and to filter out pollutants. These zones also provide habitats for diverse native wildlife and plants. When the balance of these habitats is disturbed the system can be thrown out of balance resulting in reduced or increased water flow, invasive species being introduced, and the general decline of the habitat. The purpose of the Sinclair Wash Restoration Feasibility Study is to identify three areas within the Northern Arizona University reach of Sinclair Wash which are in need of repair/restoration. The intent of the study is to develop a restoration plan to improve the chosen wash sites and restore them to proper function as a riparian habitat as well as channels for floodplain health while promoting it as an area for recreational opportunities and interpretive educational experiences.

1.2 Location

The project site is located in the City of Flagstaff in the State of Arizona, as shown in Figure 1.1. The project location will be the section of Sinclair Wash between I-17 and Lone Tree Road

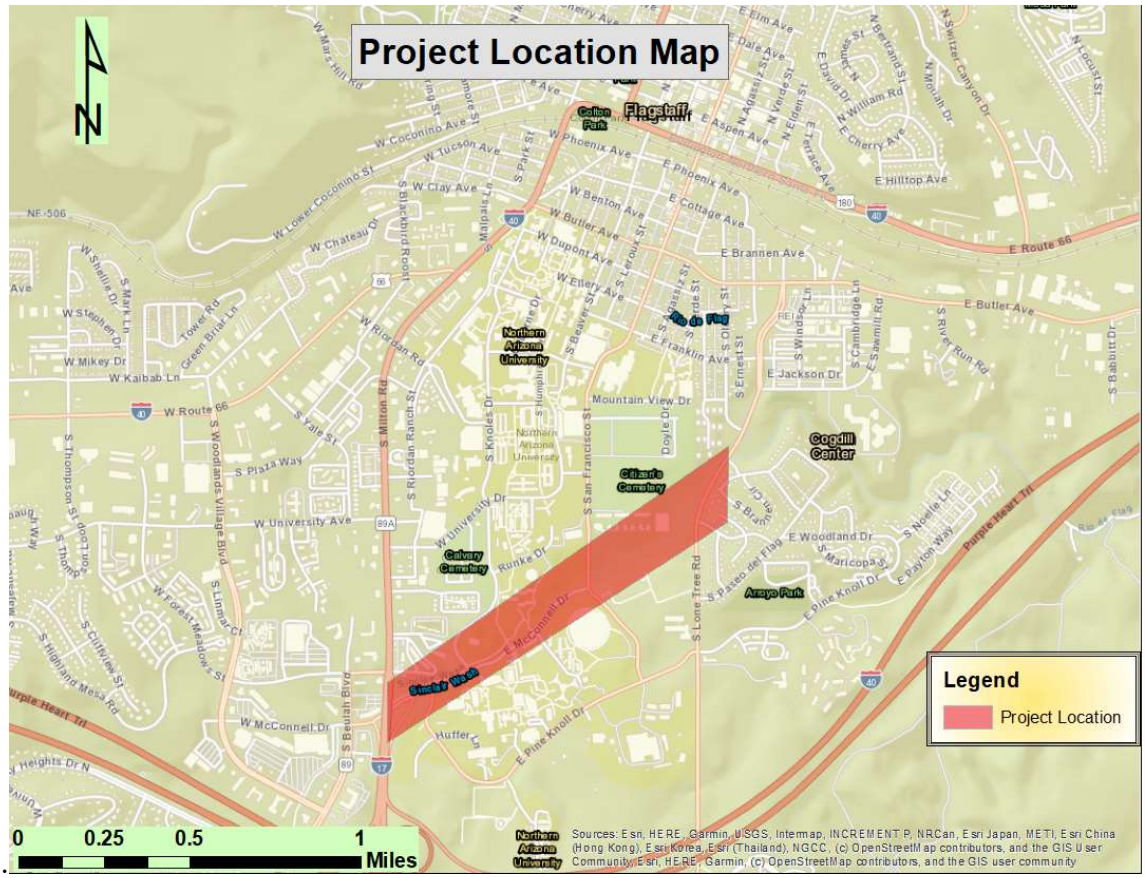


Figure 1-1 – Project location map

This section of Sinclair Wash, located within Northern Arizona University, will be the focus of the project and is outlined in Figure 1.2. The map also contains information from the FEMA Regulatory Floodway Map.

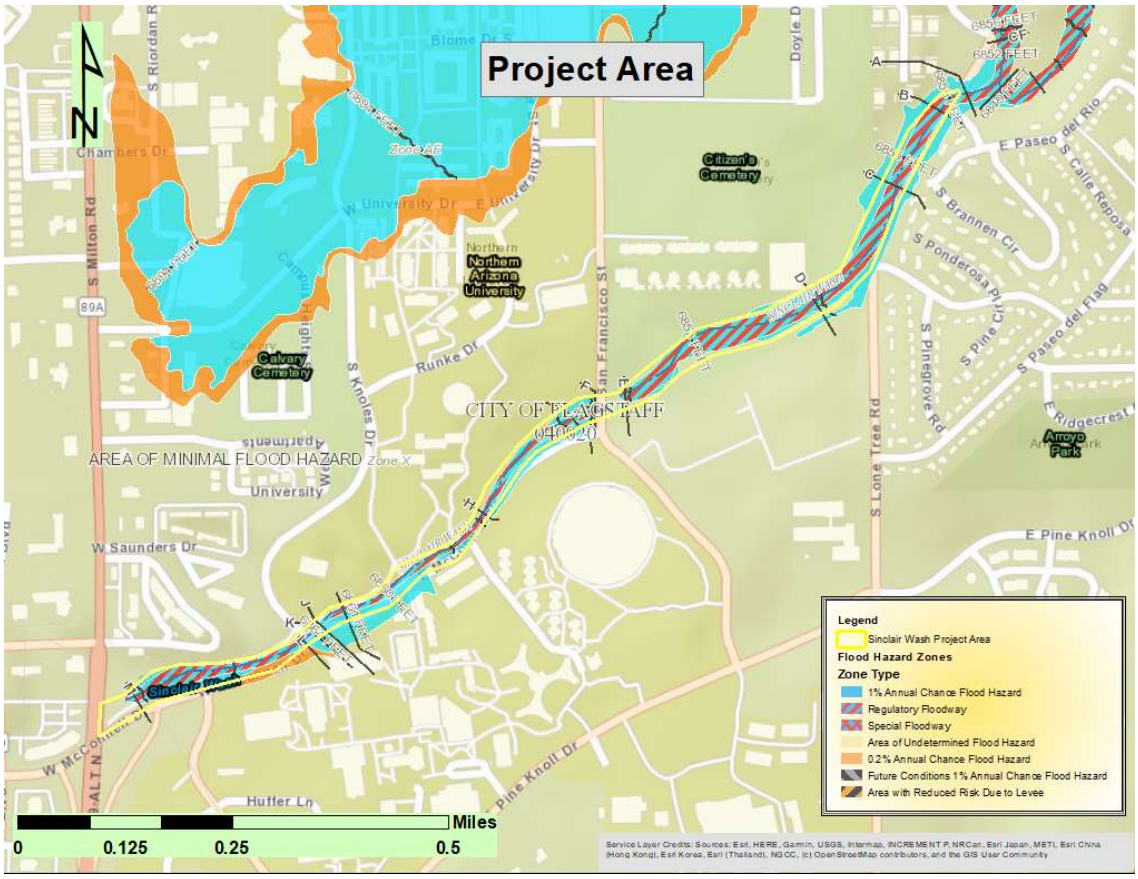


Figure 1-2 – Site location map outlining Sinclair Wash Project

1.3 Current Conditions

Sinclair Wash currently contains multiple problem areas throughout the reach. Portions of the wash are prone to sediment deposits building up and impeding the normal flow of the channel. Overgrown vegetation, such as that in Fig. 1.3, causes the water carried by the channel to flow at lower speeds, resulting in backflow as well as puddling in areas where the channel bed has eroded away. During instances of heavy rain portions of the Flagstaff Urban Trail system, which runs adjacent to Sinclair Wash's path through the NAU campus as well as crosses it in some places, become flooded and become hazardous to users while also being eroded by the larger flood events that overtop them by design. The current design of these crossings would need constant maintenance to ensure their safe continued use.

Figure 1-3 - Overgrown vegetation in portion of Sinclair Wash

Portions of the wash are eroded and washed out which allows for the puddling of water at low flows, such as the Knoles Drive culvert shown in Fig. 1.4.

Figure 1-4 - Knoles Drive culvert with water flowing (left) and water pooled (right)

2.0 Site Selection

2.1 Analysis of Previous Studies

A previous capstone team recently performed a study on Sinclair Wash [1]. The study the team performed required extensive surveying of the wash which resulted in relatively new surveying data being available for the site. This data allowed us to take not only the previous teams topographic models but their hydraulic models as well in order to use as a base point for the beginning of our study.

2.2 Analysis of Civil 3D Data

The previous capstone team's topographic map was analyzed in Civil 3D in order to determine high points and low points throughout the reach. Once the points were determined, the map, along with prior knowledge of the wash, was examined to determine three sites in order to focus the study on. In order to determine the sites to focus on, the following criteria were considered: low points, path of thalweg, and channel lining.

2.3 Site 1

The first site chosen from the analysis of the wash is approximately 156ft East of the I-17 culvert and extends just past the first crossing of the Flagstaff Urban Trail System that follows the wash on campus, as seen in Figure 2.1. The river station is the beginning of the Sinclair Wash from STA 63+78.119 to STA 59+97.055.

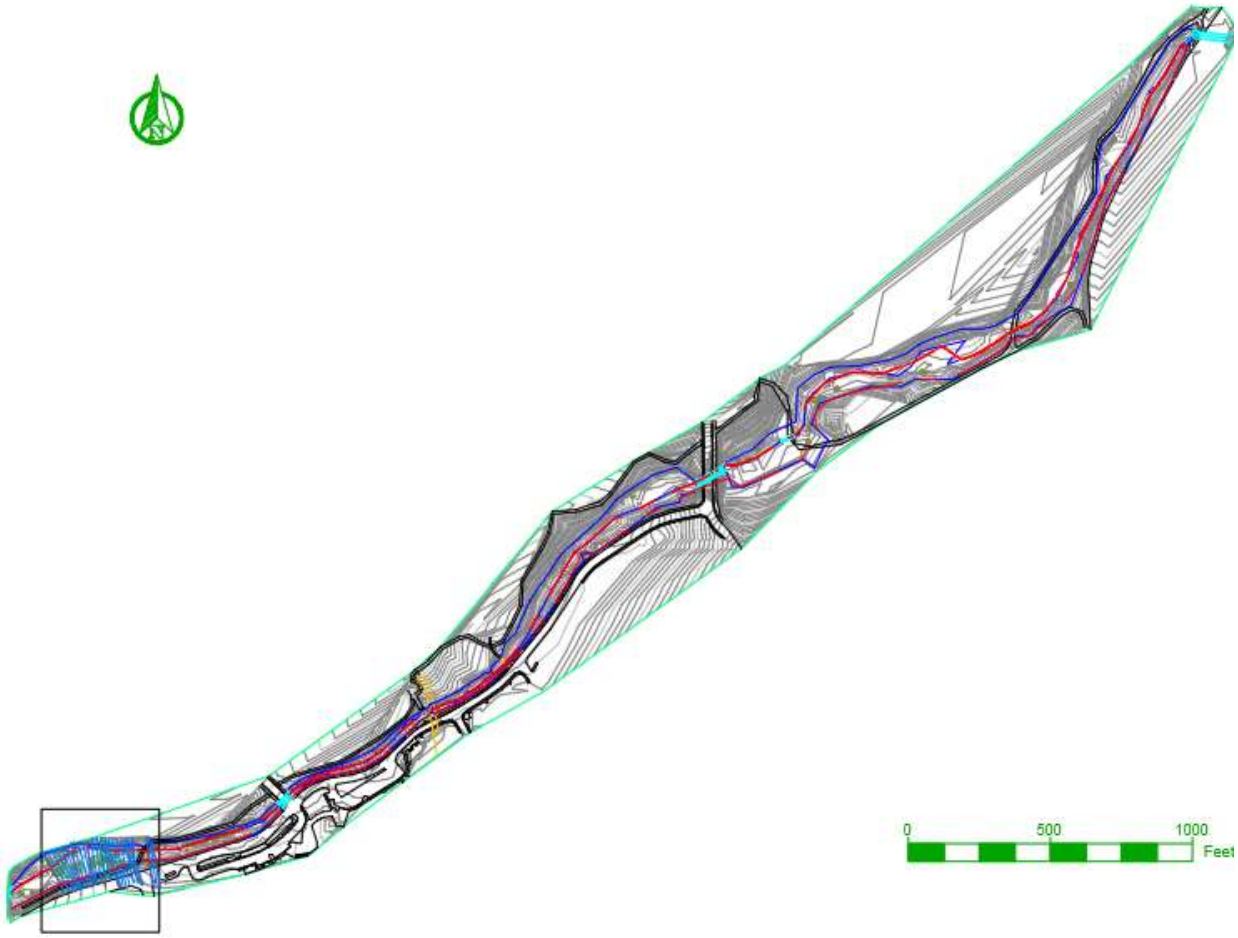


Figure 2-1 - Site 1 Location

The site was chosen for multiple reasons. In performing the low point analysis of the site it was determined that the site had a number of low points, represented by the red x's in Figure 2.2, away from the thalweg. These low points indicate that this section of the wash will be prone to ponding

in certain flood events. The site was also chosen due to an abundance of vegetation in the channel which would slow the flow of water traveling in the channel.

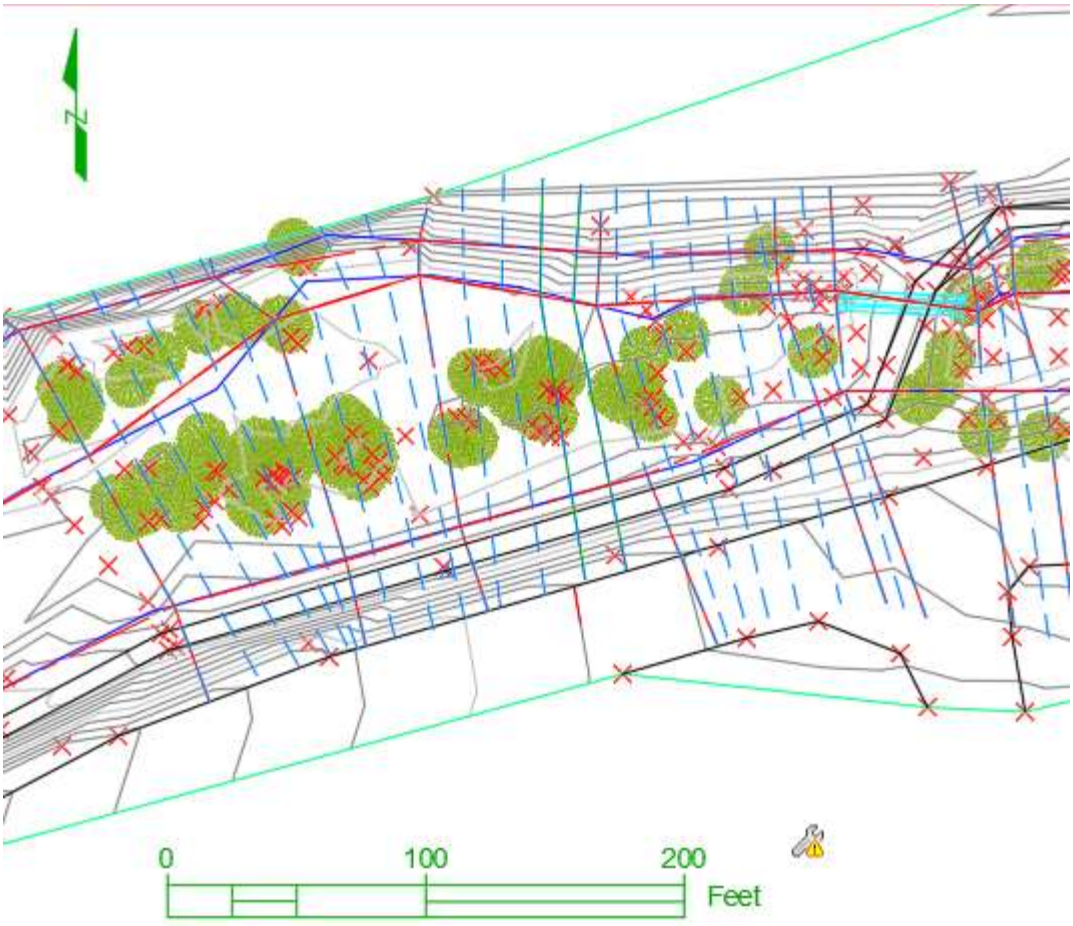


Figure 2-2 - AutoCAD Drawing of Site 1 showing trees and low points within the site.

2.4 Site 2

The second site to be chosen is located 550ft NE of the San Francisco Street culvert. And continues for 870ft in the same direction as shown in Figure 2.3. The Liszewski model was shortened by deleting cross sections occuring outside river station 2882.191 ft through 2112.564 in order to match the site selected. Culvert location's were specified in the geometric data view located at river station 2228 ft and logged in the program.

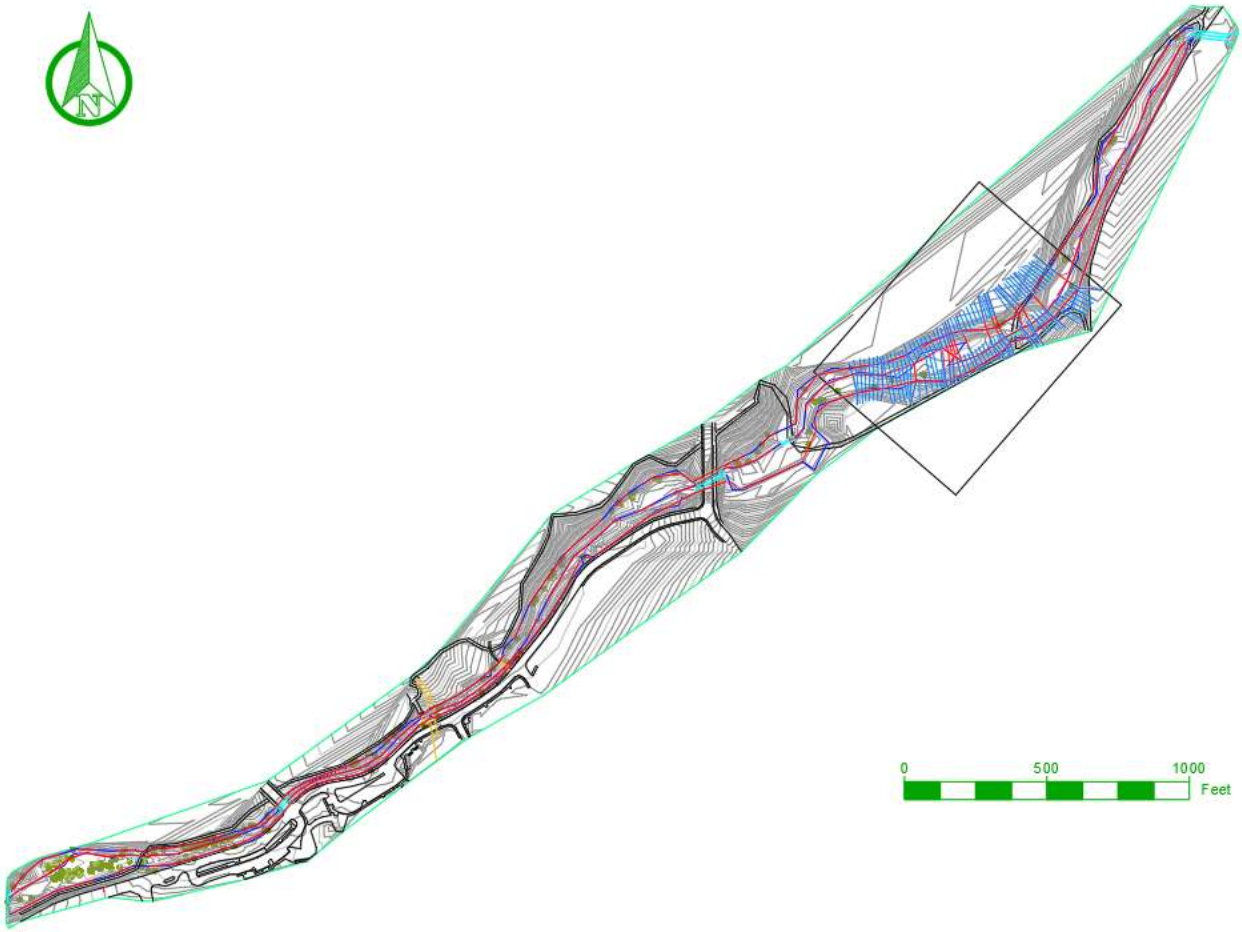


Figure 2-3 - Site 2 Location

Site 2 was chosen for two reasons. The first reason is that in the initial analysis of the data, the thalweg line for the channel cuts back on itself before continuing in the channel, shown in Figure 2.4 running in the center of the channel bed. This cut back may cause unnecessary erosion at the cutback points as well as erosion to the channel bed itself. The cause of this cutback, be it natural or man made, is currently unknown and will be investigated to determine if it may be removed in order to better direct the flow within the channel. The second reason for the selection of the site is due to the area containing a large amount of vegetation which will inhibit the flow of water in the channel. Though some vegetation is wanted to help reduce erosion, the amount in the area seems to be in abundance and therefore may need to be removed to an extent.

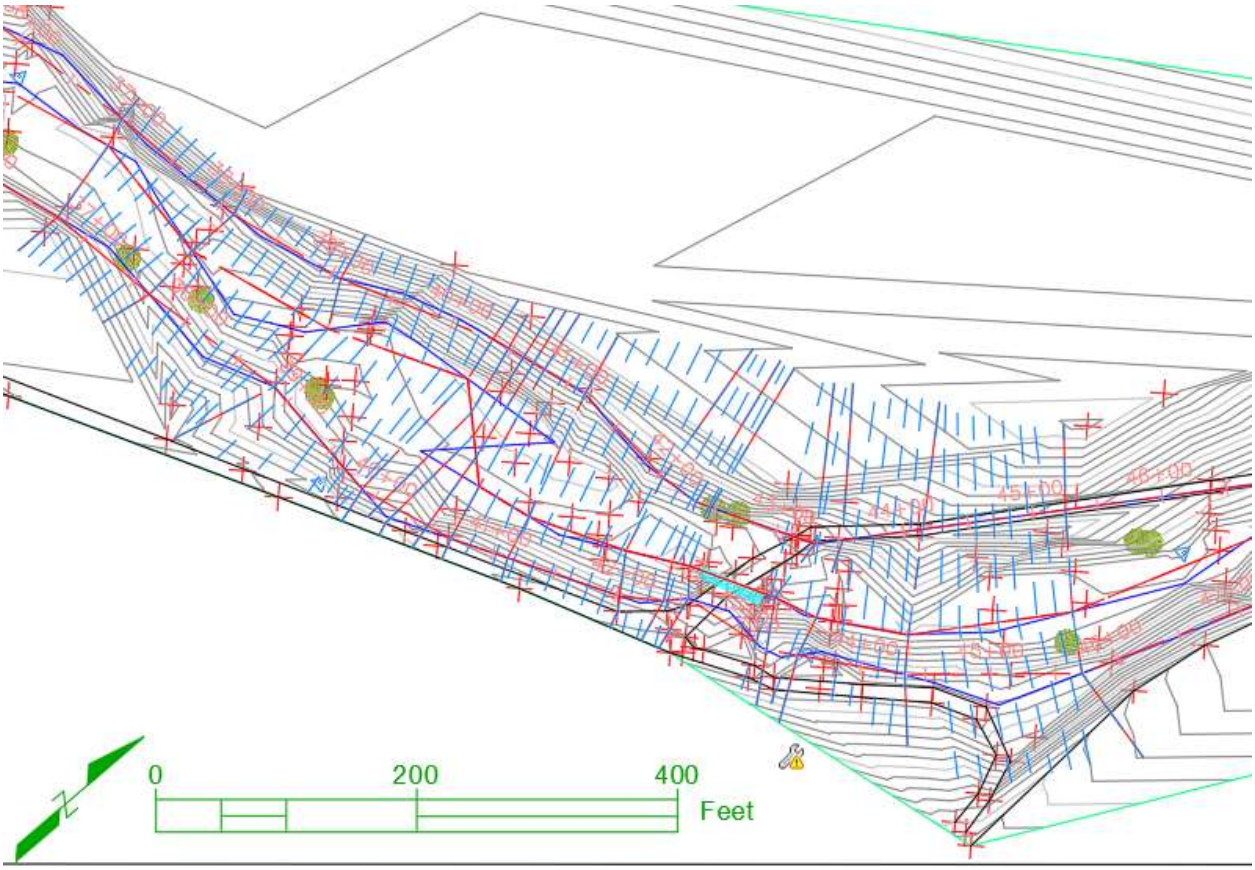


Figure 2-4 - Site 2 Showing cutback in thalweg line.

2.5 Site 3

The third site ends at just before the Lone Tree Road culvert and begins approximately 1000ft SW of the culvert as seen in Figure 2.5. For Site 3 Liszewski's model was cut down to represent the chosen area in the HEC RAS model located from river stations 1985.073 through 1047 from . Site 3 does not contain a culvert within the site but does contain one just beyond site location

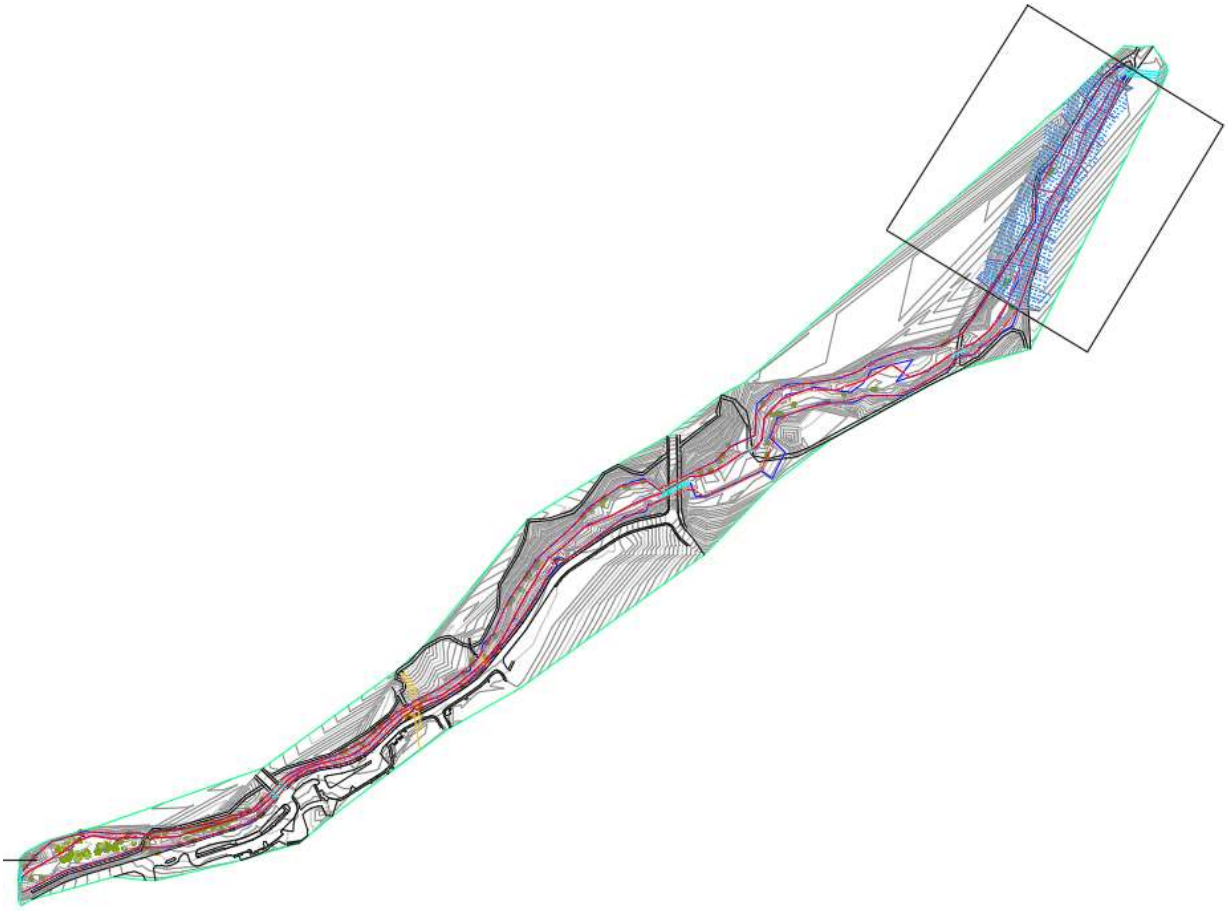


Figure 2-5 - Site 3 Location

Site 3 was selected due to the construction activity which occurred in the area in 2019, resulting in the channel lining to be replaced with dirt and gravel. This channel bed has a high chance of being eroded away in storm events if left alone. There are also areas of ponding which were noticed in previous visits to the site.

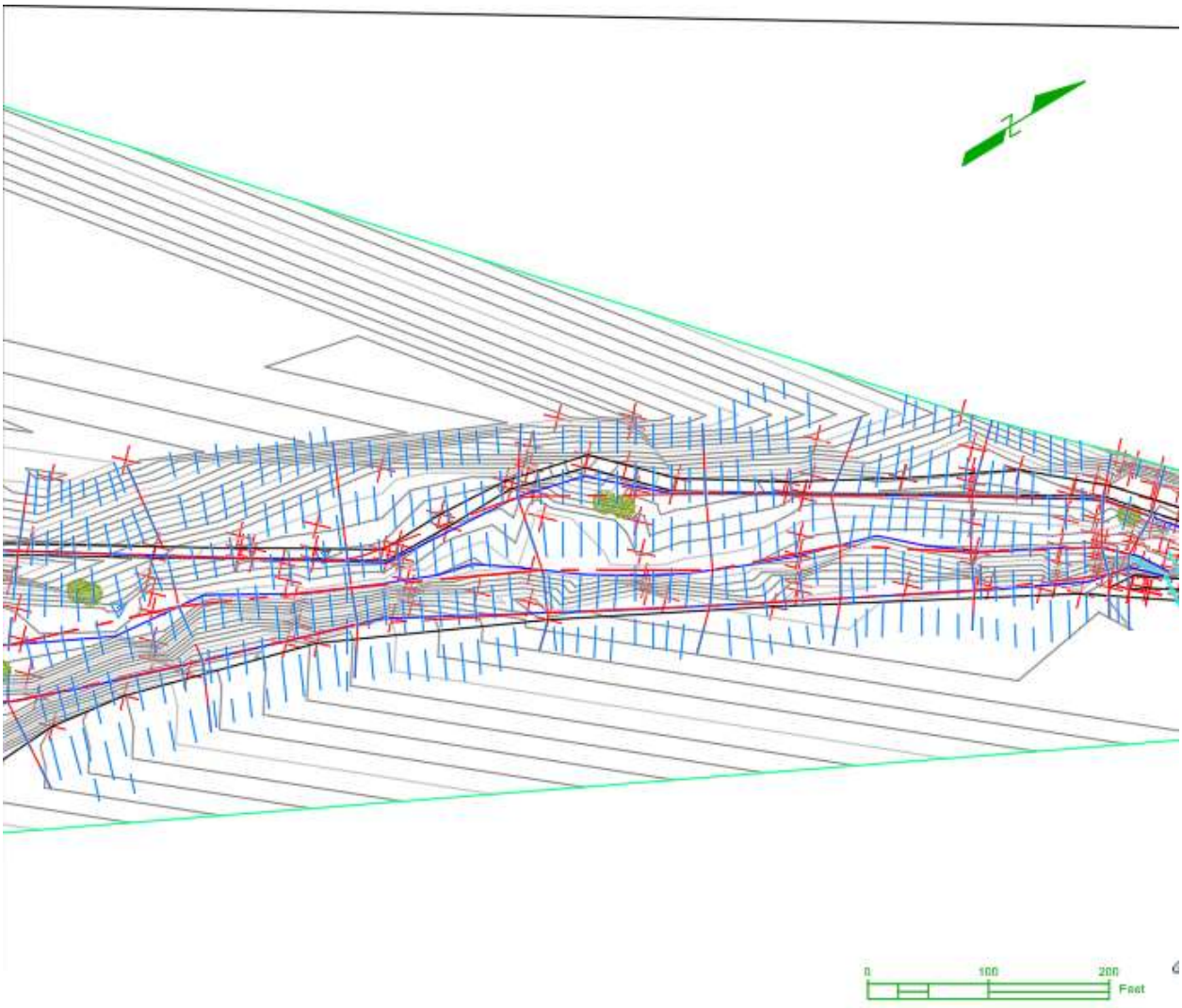


Figure 2-6 - Site 3

3.0 Effective Hydraulic Model

3.1 Effective Hydraulic Model Utilization

Summer 2019's capstone team performed an analysis of the reach of Sinclair Wash Located on campus [1]. The model created by this team was utilized in order to create the effective model for each of the three sites in the study. These models will be referred to as Liszewski's models from here one. Liszewski's model of the site was reproduced three times each was broken into one of the three sites in order to create smaller effective hydraulic models. The models were run in HEC-RAS 5.0.5 in order to compare the results to the original model. The 100-yr storm event with a flow rate of 890 cfs according to the Flood Insurance Study provided to Liszewski's team [2]. Storm events of 10 and 50 years were used as well utilizing flow rates of 350cfs and 670cfs respectively. Additionally, using Liszweski's model, rating curves for all sites were created to

account for the flow running through the whole wash, as the discharge and water surface elevation is Site 1, 2, and 3 HEC RAS models are shown in the Appedicies D, H, and J respectively.

3.2 Site 1

Site 1 cut Liszewski's model in order to show just the cross sections along site 1. In order to compare and contrast with the correct effective model, delete cross section expect site 1 area and the 890 cfs was inputted into HEC-RAS to perform a steady flow test. Rating curve was created for site 1 because the water flowing needs to be accounted for as when the water is flowing across the culvert located at San Francisco, it generates a high depth of water surface elevation that leads to a backflow.

3.3 Site 2

A similar procedure was followed for Site 2, Then flow of 890cfs as per 100 yr storm event as well as the 350cfs and 670cfs for the 10 and 50, input and flow test were computed in HEC RAS. The rating curve was created for site 2 as it is important to account for the flow, because the flow approaching the culvert in site 2 increases velocity which results in area reduction, and increases the water surface elevation, which will lower the channel conveyance leading to low capacity.

3.4 Site 3

In order to compare and contrast with the correct effective model, use the similar procedure to run the Site 3 HEC-RAS model. Then, find some difference between two models. Rating curve done for site 3 to account for water flowing upstream through downstream. It was done due to water velocity increases underneath the culvert and area decreasing causing the water surface elevation to have a constant increase affecting the surrounding society.

4.0 Corrected Effective Model

4.1 Analysis and Optimization of Corrected Effective Model

Using the finished effective hydraulic models additional cross-sections are created in each site for more detailed analysis. Cross sections were created using intervals of approximately 15 feet beginning of Liszewski's first cross-section on each of the sites using Civil 3D. These new sections were then imported into HEC-RAS for analysis. The manning's value for each of the sites was updated to better reflect the current flow conditions due to changes in the channel lining and the topography changes. The sites were then analyzed based on the FEMA FIS data in the Effective Hydraulic Model. The analysis results show in Appendices L-S for each site. HEC RAS was utilized to run corrected effective models for all three sites. The process was similar to an effective model as rating curves were created to account for water flowing within the upstream and downstream of the whole wash. Within our correction to each site, the area of each site was increased leading to water flowing in wider space across the wash from upstream to downstream and crossing underneath each culvert, and not affecting the surrounding community per City of Flagstaff requirements [3].

5.0 Proposed Restoration Plans

5.1 Proposed Restoration Plan Site 1

The first step to restoration was to first determine the bankfull area to be used in order to change the geometry of the channel. The bankfull area was determined by the Sinclair Wash Classification capstone team [4]. This value was determined by taking an average of all the bankfull areas that fell within the site. From their analysis it was determined that Site 1 would require a bankfull area of 10.95 square feet. Using the Channel Design/Modification tool in HEC-RAS a trapezoidal channel was developed that was approximately 10.95 square feet. This trapezoidal channel was then used to ensure that the required area fit within the channel. A smaller trapezoidal cut was made at the center of this main cut to allow for water to flow through the channel bed at low flows. This channel was applied to all cross sectional cuts and the centering of it was varied to ensure that the wash curved as it flowed downstream. The profile of the section was also changed to reflect a ripple, run, pool, glide type of profile [5]. A slope was taken from the first cross section to the last cross section in order to determine the slope for the run section of the profile. The slope for the ripple section was set to be larger than that of the run section. A sudden slope was created, which transitioned to a flat portion, in order to create the pool section. A small negative section was utilized to create the glide section, which would then be followed by another ripple section.

The FUTS trail crossing found at STA 49+97.43 was removed from the channel and it is recommended that a prefabricated bridge be installed in its place. In order to determine the design specifications of the bridge, it is suggested that further study be done. The removal of the bridge will reduce the damage to the channel caused by the culvert while also removing the need for costly repairs due to overtopping of the culvert. The slopes of the cuts being performed are to be at a H:V ratio of 3:1. The channel as well as the banks will be seeded using natural grass seeding as per City of Flagstaff Stormwater Design Manual 8.4.4. It is also recommended that a waist tall hedge be planted to prohibit crossings at the nearby intersection of McConnell and Pine Knoll.

5.2 Proposed Restoration Plan Site 2

In a similar fashion to Site 1, the HEC RAS Channel Design/Modification Editor was used to make the template to be applied to Site 2.The slopes were at a H:V of 3:1 similar to site 1 once again reasoning that the slope was more stable. The profile was altered to produce a repeating ripple, run, pool, glide profile throughout the site [5]. The geometry of the channel was updated to accommodate the calculated bankfull area for Site 2 of 20.693 square feet [4]. In addition to that, the channel's template cut was once again trapezoidal in shape with a smaller trapezoid cut to allow smaller flows to flow. Per City of Flagstaff Stormwater Design Manual 8.4.4., the banks and channels will require seeding natural grass to be seeded and erosion will be prevented across site 2 area [3].

5.3 Proposed Restoration Plan Site 3

The development of the Site 3 restoration plan was again, similar to that of Sites 1 and 2. An average bankfull for the reach was determined, 20.23 square feet [4]. Using the HEC-RAS Channel Design/Modification Editor, a template for a cut to the channel was developed to accommodate the bankfull area. The designed trapezoidal channel, which includes a smaller trapezoidal cut at the bottom of the channel to allow for water to flow through, was then applied to the various cross sections of the channel. The profile of the site was altered to reflect a repeating riffle, run, pool, glide profile [5]. The side cuts of the channel are again cut to a H:V ratio of 3:1. According to current condition and the City of Flagstaff Stormwater Design Manual 8.4.4 [3]. Site 3 area should plant the local vegetation and grass to prevent river banks from being eroded.

5.4 Cut and Fill Summary

Table 5.1 summarizes the cut and fill for the three sites. Included in the summary is a cost of performing the work utilizing an estimated rate given by our Technical Advisor of $6/yd^3$ and $7/yd^3$. The costs are left as a cost of performing both and totaled together.

Table 5-1 -- Summary Table of Cut and Fill work.

	Cut	Rate $/yd^3	Fill	Rate $/yd^3	Cost
Site 1	262 yd^3	$6	650 yd^3	$7	$6,122
Site 2	541 yd^3	$6	6544 yd^3	$7	$49,054
Site 3	4327 yd^3	$6	709 yd^3	$7	$30,925
Total	5130 yd^3		7903 yd^3		$86,101

6.0 Summary of Engineering Work

6.1 Proposal Schedule

The original schedule from the project proposal can be found in Appendix AA. This schedule was made with the intention of performing a study on 4 sites.

6.2 Updated Project Schedule

The final project schedule can be found in Appendix AB. The schedule was altered in order to take into account the changes due to the reduction in sites to be studied. The only changes made were the removal of the extra tasks.

7.0 Summary of Engineering Cost

7.1 Staffing Hours

Table 7.1 shows the summary of the project staffing hour that the engineer predicted from the original project proposal.

Table 7-1 -- Matrix Table of Staffing Positions

	Senior Engineer	Engineer II	Engineer I	Engineering Intern	Total
Task Name	**SENG**	**ENG II**	**ENG I**	**INT**	
1.0 Site Selection Research	6	10	12	12	40
1.1 Surveying Data	1	1	3	3	
1.2 FEMA Flood Way and FIS Data	1	2	2	2	
1.3 Hydrologoic Data	1	2	2	2	
1.4 Hydraulic Data	1	1	2	2	
1.5 Geomorphic Data	1	2	2	2	
1.6 Site Selection Criteria	1	2	1	1	
2.0 Effective Hydraulic Model	4	6	9	11	30
2.1 Input Data Development	1	1	4	5	
2.2 Hydraulic Modeling	2	3	3	3	
2.3 Site Selection	1	2	2	3	
3.0 Corrected Effective Model	16	24	30	31	101
3.1 Site 1 Corrected Effective Model					
3.1.1 Site 1 Input Data Development	2	3	5	6	
3.1.2 Site 1 Hydraulic Modeling	2	6	4	4	
3.2 Site 2 Corrected Effective Model					
3.2.1 Site 2 Input Data Development	2	2	4	4	
3.2.2 Site 2 Hydraulic Modeling	2	3	3	3	
3.3 Site 3 Corrected Effective Model					
3.3.1 Site 3 Input Data Development	2	2	4	4	
3.3.2 Site 3 Hydraulic Modeling	2	3	3	3	
3.4 Site 4 Corrected Effective Model					
3.4.1 Site 4 Input Data Development	2	2	4	4	
3.4.2 Site 4 Hydraulic Modeling	2	3	3	3	

4.0 Proposed Restoration Plan	17	48	59	56	180
4.1 Site 1 Restoration Plan					
4.1.1 Site 1 Geomorph Plan	1	4	6	5	
4.1.2 Site 1 Hydraulic Plan	3	6	8	10	
4.1.3 Site 1 Vegetation Plan	1	8	6	5	
4.2 Site 2 Restoration Plan					
4.2.1 Site 2 Geomorph Plan	1	3	4	3	
4.2.2 Site 2 Hydraulic Plan	2	3	5	6	
4.2.3 Site 2 Vegetation Plan	1	4	4	3	
4.3 Site 3 Restoration Plan					
4.3.1 Site 3 Geomorph Plan	1	3	4	3	
4.3.2 Site 3 Hydraulic Plan	2	3	5	6	
4.3.3 Site 3 Vegetation Plan	1	4	4	3	
4.4 Site 4 Restoration Plan					
4.4.1 Site 4 Geomorph Plan	1	3	4	3	
4.4.2 Site 4 Hydraulic Plan	2	3	5	6	
4.4.3 Site 4 Vegetation Plan	1	4	4	3	
5.0 Plan Set	5	45	71	65	186
5.1 Cover Page	1	4	6	3	
5.2 Notes	0	3	4	4	
5.3 Details	1	7	8	6	
5.4 Topographic Map	0	1	3	2	
5.5 Site Plans	3	30	50	50	
6.0 Deliverables	31	55	56	45	187
6.1 30% Submittals	2	10	10	8	
6.2 60% Submittals	4	10	10	8	
6.3 90% Submittals	4	10	10	8	
6.4 Final Report and Plan Set	6	8	8	10	
6.5 Final Presentation	7	8	8	5	

6.6 Meeting Memo Binder	1	1	1	2	
6.7 Website	5	5	6	2	
6.8 Impacts	2	3	3	2	
7.0 Project Management	49	34	23	23	129
7.1 Team Meetings	15	15	15	15	
7.2 Technical Advisor Meetings	8	8	8	8	
7.3 Client Meetings	5	5	0	0	
7.4 Schedule Management	1	3	0	0	
7.5 Resource Management	20	3	0	0	
Total hours	128	222	260	243	853

Table 7.2 shows the summary staffing hours changes based on the project team member changed.

Table 7-2 -- Matrix Table of Staffing Positions

	Senior Engineer	Engineer II	Engineer I	Engineering Intern	Total
Task Name	**SENG**	**ENG II**	**ENG I**	**INT**	
1.0 Site Selection Research	6	9	9	9	33
1.1 Surveying Data	1	1	3	3	
1.2 FEMA Flood Way and FIS Data	1	2	2	2	
1.3 Hydrologoic Data	1	2	1	1	
1.4 Hydraulic Data	1	1	1	1	
1.5 Geomorphic Data	1	1	1	1	
1.6 Site Selection Criteria	1	2	1	1	
2.0 Effective Hydraulic Model	4	4	6	8	22
2.1 Input Data Development	1	1	3	3	
2.2 Hydraulic Modeling	2	2	2	4	
2.3 Site Selection	1	1	1	1	

3.0 Corrected Effective Model	12	23	26	27	88
3.1 Site 1 Corrected Effective Model					
3.1.1 Site 1 Input Data Development	2	5	6	7	
3.1.2 Site 1 Hydraulic Modeling	2	6	5	5	
3.2 Site 2 Corrected Effective Model					
3.2.1 Site 2 Input Data Development	2	4	5	5	
3.2.2 Site 2 Hydraulic Modeling	2	3	4	4	
3.3 Site 3 Corrected Effective Model					
3.3.1 Site 3 Input Data Development	2	2	3	3	
3.3.2 Site 3 Hydraulic Modeling	2	3	3	3	
4.0 Proposed Restoration Plan	13	30	40	39	122
4.1 Site 1 Restoration Plan					
4.1.1 Site 1 Geomorph Plan	2	5	6	6	
4.1.2 Site 1 Hydraulic Plan	2	4	6	8	
4.1.3 Site 1 Vegetation Plan	1	3	4	3	
4.2 Site 2 Restoration Plan					
4.2.1 Site 2 Geomorph Plan	1	3	4	3	
4.2.2 Site 2 Hydraulic Plan	2	3	5	6	
4.2.3 Site 2 Vegetation Plan	1	4	4	3	
4.3 Site 3 Restoration Plan					
4.3.1 Site 3 Geomorph Plan	1	2	3	2	
4.3.2 Site 3 Hydraulic Plan	2	2	4	5	

4.3.3 Site 3 Vegetation Plan	1	4	4	3	
5.0 Plan Set	4	30	51	45	130
5.1 Cover Page	1	4	6	3	
5.2 Notes	0	3	4	4	
5.3 Details	1	7	8	6	
5.4 Topographic Map	0	1	3	2	
5.5 Site Plans	2	15	30	30	
6.0 Deliverables	31	55	56	45	187
6.1 30% Submittals	2	10	10	8	
6.2 60% Submittals	4	10	10	8	
6.3 90% Submittals	4	10	10	8	
6.4 Final Report and Plan Set	6	8	8	10	
6.5 Final Presentation	7	8	8	5	
6.6 Meeting Memo Binder	1	1	1	2	
6.7 Website	5	5	6	2	
6.8 Impacts	2	3	3	2	
7.0 Project Management	41	26	10	10	87
7.1 Team Meetings	10	10	5	5	
7.2 Technical Advisor Meetings	5	5	5	5	
7.3 Client Meetings	5	5	0	0	
7.4 Schedule Management	1	3	0	0	
7.5 Resource Management	20	3	0	0	
Total hours	111	177	198	183	669

The original proposal contained a higher cost due to the fact that the project was to originally contain 4 sites of study. With the reduction of sites, the project cost dropped significantly. There were some items which had a reduction in the proposed hours while some others required an increase in the hours.

7.2 Project Cost

Table 7.3 shows the predicted cost of the project from the original proposal.

Table7.3 - Cost of Engineering Services

1.0 Personnel	Classification	Hours	Rate, $/hr	Cost
	SENG	128	213	$ 27,264.00
	ENG II	222	136	$ 30,192.00
	ENG I	260	85	$ 22,100.00
	INT	243	22	$ 5,346.00
	Total Personnel			**$ 84,902.00**
2.0 Travel	N/A			$ -
3.0 Supplies	Surveying Equipment Rental (Tentative)		$100/day	$ 100.00
	Geotechnical Lab Time (Tentative)		$100/day	$ 100.00
4.0 Subcontract	N/A			$ -
5.0 Total				**$ 85,102.00**

Table 7.4 below summarizes the total cost of the final project including personnel, travel, supplies, and subcontracting.

Table 7.4 - Cost of Final Project

1.0 Personnel	Classification	Hours	Rate, $/hr	Cost
	SENG	111	213	$ 23,643.00
	ENG II	177	136	$ 24,072.00
	ENG I	198	85	$ 16,830.00
	INT	183	22	$ 4,026.00
	Total Personnel			**$ 68,571.00**
2.0 Travel	N/A			$ -
3.0 Supplies	Surveying Equipment Rental (Tentative)		$100/day	$ -
	Geotechnical Lab Time (Tentative)		$100/day	$ -
4.0 Subcontract	N/A			$ -
5.0 Total				**$ 68,571.00**

As stated in 7.1 due to the reduction in work, the overall engineering costs were severely reduced. The changes in the hours resulted in a decrease in the overall cost of the project from $85,102 to $68,571.

8.0 Impacts

Being a feasibility study, the impacts of the project are almost entirely theoretical.

8.1 Social Impacts

The rehabilitation of Sinclair Wash may lead to increased use of the area. With the site returning to its natural habitat, people may better enjoy walking through the FUTS trail located in the site. With an increase in the use of the site for recreation, there is the chance that people's lives may be improved leading to increased health, demeanor, and quality of life.

8.2 Environmental Impacts

The expected environmental impacts of the project are mostly positive. The purpose of the project is to improve the overall health of the riparian habitat in the area by removing invasive plants, promoting the growth of native plants, and improving the flow of water through the area. By improving the channel lining in the area it is the hope of the team that there will be a reduction in flooding caused by sediment buildup and blockage of the stream. With the reduction in invasive species, it is the hope that native plants are better situated to make a return in the area, promoting the native species which survive off of them. Negative impacts from the project include the impact that will occur due to the change of vegetation in the area due to the project.

8.3 Economic Impacts

The major potential economic impact of the project would occur due to the removal of the two culverts in the wash. The two which are to be removed were designed with overtopping in mind. These culverts required regular maintenance to repair damages and erosion to the path that crossed over them. Another potential economic impact of the project is the increased foot traffic may increase spending both on and around campus. A negative impact of the project is the fact that there is no direct way to generate revenue from the project being that it is not a business or service which is pay to use. Overall the benefits of the project are expected to outweigh the costs.

9.0 Conclusion

In order to implement the restoration plan presented by Hyde Engineering, it would cost an estimated $68,500. The plan put forth did not exceed the design criteria set out by the City of Flagstaff Stormwater Management Design Manual, including velocity less than 18 feet per second, Froude Numbers not exceeding 0.86, and side slopes no greater than 3:1 H:V ratio [3]. Appendixes X-Z depicts the effects of applying the proposed changes on the three sites. In Site 1 it can be seen that the water surface decreases along the site, the velocity is increasing, and there is an overall reduction in the top width with an increase in the froude number. Site 2 contains areas of elevation increase as well as decreases. The velocity mostly increases with areas of decrease. The opposite occurs for the top width with a majority being decreased with some increases. The froude number for the most part is being increased with some decreases. Site 3 is

the site that we do see the most negative effects on the channel. There are large increases to the water surface elevations and mostly negative impacts to the velocity of the channel. The top width of the channel is increased all along the channel and the Froude number mostly decreases throughout. The issues with the water surface elevation can be addressed by dropping the elevation of the sites profile by 2.5ft. Further studies will be needed to ensure that these effects can be remedied by this approach. Table 9.1 shows a rough estimation of the cost for each site's plan to be put into effect.

Table 9-1 - Estimate of total work per site.

SITE 1		**SITE 2**		**SITE 3**	
Cut (yd^3)	262	**Cut (yd^3)**	541	**Cut (yd^3)**	4327
Fill (yd^3)	650	**Fill (yd^3)**	6544	**Fill (yd^3)**	709
Major Changes	Tree remals and culvert removals	**Major Changes**	Culvert removal, urban trail redirect, and channel filling	**Major Changes**	Lining and cutting of channel
Proposed Cost	$17,800	**Proposed Cost**	$54,900	**Proposed Cost**	$31,500

The costs calculated include the cost of the cut/fill already calculated in 5.4, an estimate of $800 dollars per tree for removal and an estimation of about $1,000 per site for seeding mix. Also included in the table is what is to be considered the major change being applied to each of the sites. By making the recommended channel alterations, the riparian habitat is expected to repair itself with time while also promoting improvements to the surrounding areas.

References

[1] C. Liszewski and A. Najjar, "Feasibility Analysis for Stream Revitalization and Electronic Monitoring," 2019.

[2] Federal Emergency Management Agency, "Flood Insurance Study Volume 1 of 2," Department of Homeland Security, 2010.

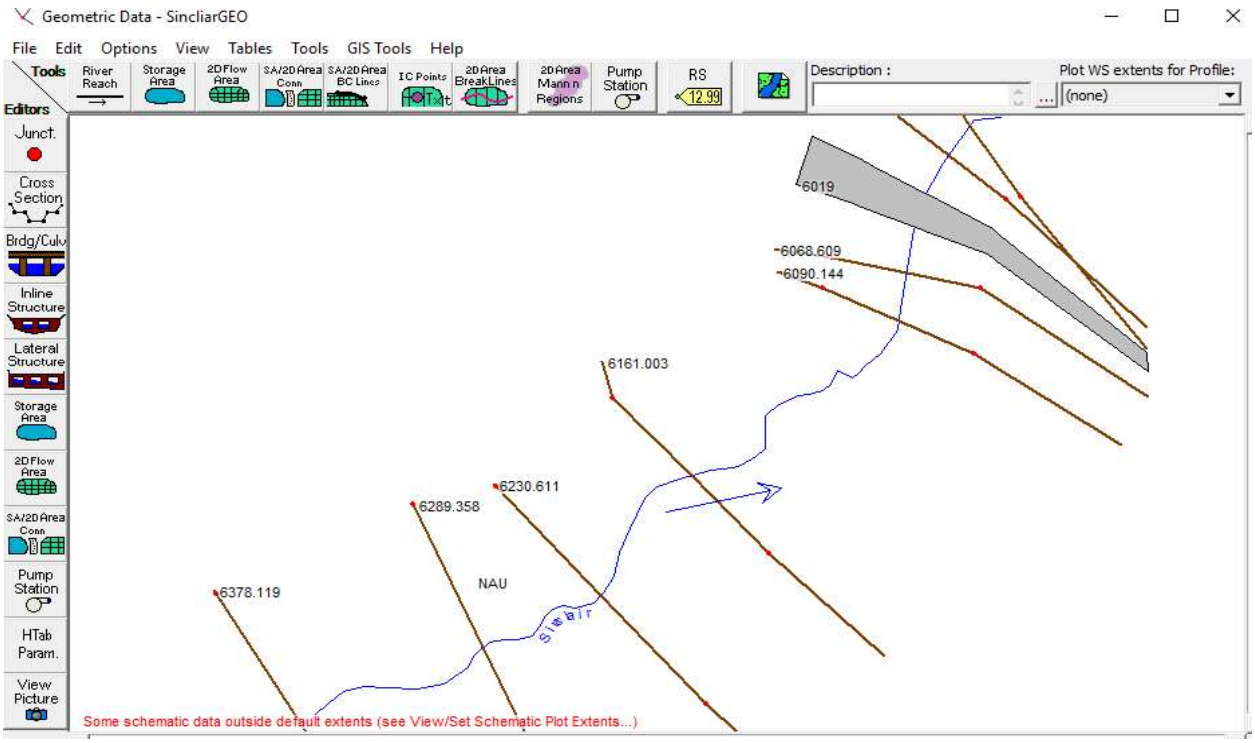
[3] City of Flagstaff Engineering Division Stormwater Management Section, "City of Flagstaff Stormwater Management Design Manual," Flagstaff, 2009.

[4] M. Xu, S. Yao and T. Li, "Sinclair Wash Channel Classification," 2019.

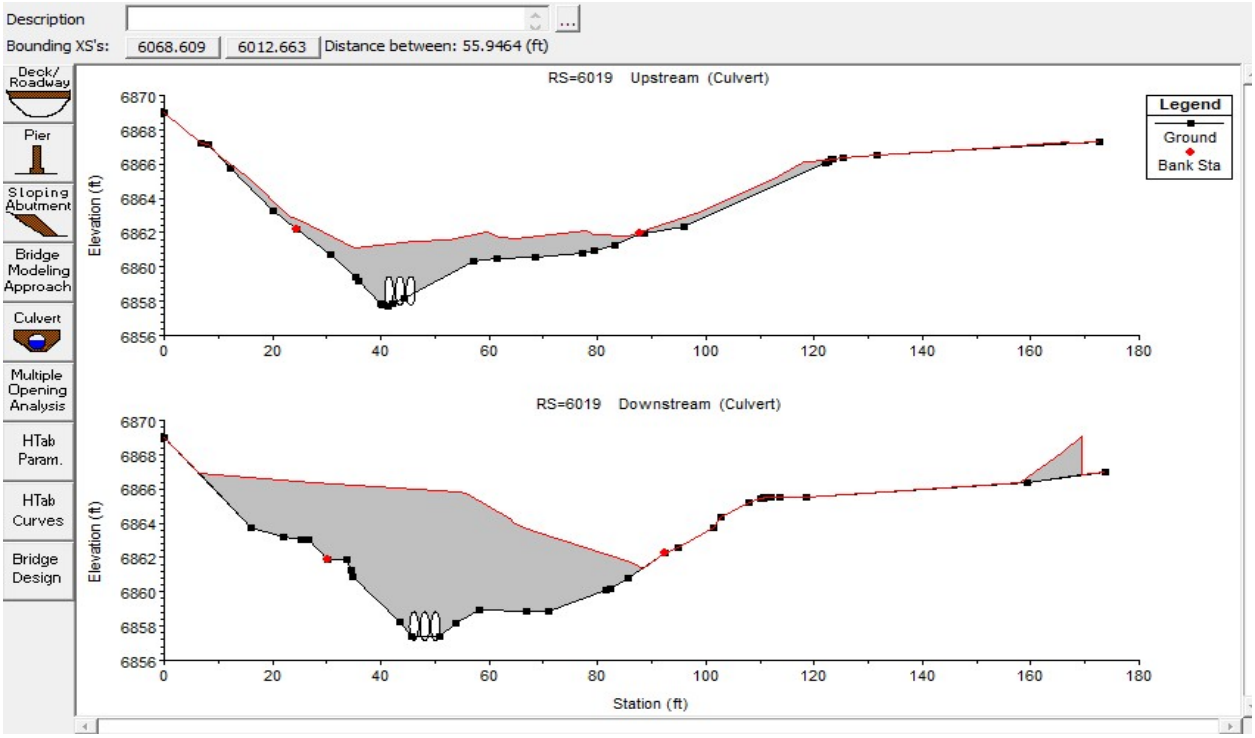
[5] The Fedral Interagency Stream Restoration Working Group, "Stream Corridor Restoration: Principles, Processes, and Practices," 2001.

APPENDIX

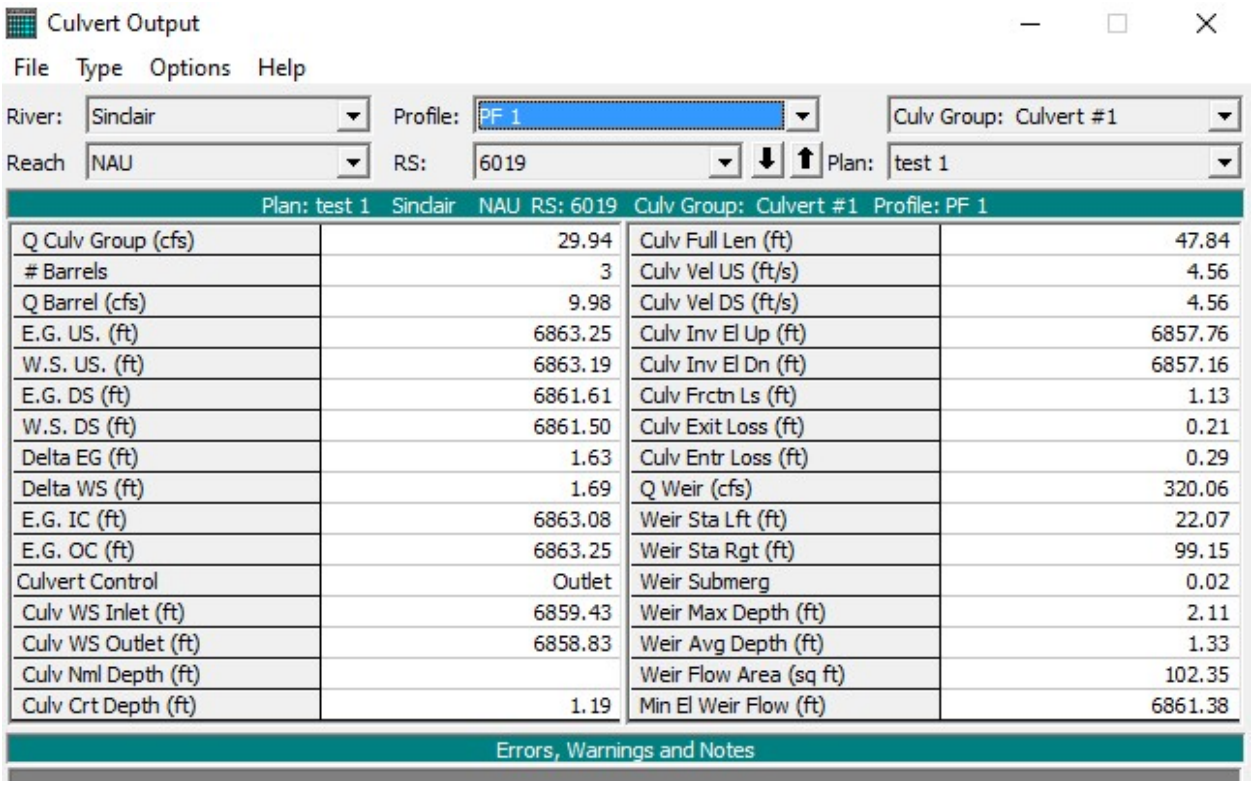
Appendix A: Effective Hydraulic Model cross section diagram



Appendix B: Site 1 Effective Hydraulic Model culvert graphs



Appendix C: Site 1 Effective Hydraulic Model HEC RAS culvert summary table



Culvert Output

File Type Options Help

River: Sinclair Profile: PF 1 Culv Group: Culvert #1

Reach NAU RS: 6019 Plan: test 1

Plan: test 1 Sinclair NAU RS: 6019 Culv Group: Culvert #1 Profile: PF 1

Q Culv Group (cfs)	29.94	Culv Full Len (ft)	47.84
# Barrels	3	Culv Vel US (ft/s)	4.56
Q Barrel (cfs)	9.98	Culv Vel DS (ft/s)	4.56
E.G. US. (ft)	6863.25	Culv Inv El Up (ft)	6857.76
W.S. US. (ft)	6863.19	Culv Inv El Dn (ft)	6857.16
E.G. DS (ft)	6861.61	Culv Frctn Ls (ft)	1.13
W.S. DS (ft)	6861.50	Culv Exit Loss (ft)	0.21
Delta EG (ft)	1.63	Culv Entr Loss (ft)	0.29
Delta WS (ft)	1.69	Q Weir (cfs)	320.06
E.G. IC (ft)	6863.08	Weir Sta Lft (ft)	22.07
E.G. OC (ft)	6863.25	Weir Sta Rgt (ft)	99.15
Culvert Control	Outlet	Weir Submerg	0.02
Culv WS Inlet (ft)	6859.43	Weir Max Depth (ft)	2.11
Culv WS Outlet (ft)	6858.83	Weir Avg Depth (ft)	1.33
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	102.35
Culv Crt Depth (ft)	1.19	Min El Weir Flow (ft)	6861.38

Errors, Warnings and Notes

Culvert Output

File Type Options Help

River: Sinclair Profile: PF 2 Culv Group: Culvert #1

Reach NAU RS: 6019 Plan: test 1

Plan: test 1 Sinclair NAU RS: 6019 Culv Group: Culvert #1 Profile: PF 2

Q Culv Group (cfs)	13.00	Culv Full Len (ft)	47.84
# Barrels	3	Culv Vel US (ft/s)	1.98
Q Barrel (cfs)	4.33	Culv Vel DS (ft/s)	1.98
E.G. US. (ft)	6864.12	Culv Inv El Up (ft)	6857.76
W.S. US. (ft)	6863.98	Culv Inv El Dn (ft)	6857.16
E.G. DS (ft)	6863.85	Culv Frctn Ls (ft)	0.21
W.S. DS (ft)	6863.76	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.27	Culv Entr Loss (ft)	0.05
Delta WS (ft)	0.21	Q Weir (cfs)	657.00
E.G. IC (ft)	6864.01	Weir Sta Lft (ft)	19.14
E.G. OC (ft)	6864.12	Weir Sta Rgt (ft)	105.36
Culvert Control	Outlet	Weir Submerg	0.83
Culv WS Inlet (ft)	6859.43	Weir Max Depth (ft)	2.99
Culv WS Outlet (ft)	6858.83	Weir Avg Depth (ft)	2.01
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	173.67
Culv Crt Depth (ft)	0.77	Min El Weir Flow (ft)	6861.38

Errors, Warnings and Notes

Culvert Output

File Type Options Help

River: Sinclair Profile: PF 3 Culv Group: Culvert #1

Reach NAU RS: 6019 Plan: test 1

Plan: test 1 Sinclair NAU RS: 6019 Culv Group: Culvert #1 Profile: PF 3

Q Culv Group (cfs)	5.98	Culv Full Len (ft)	47.84
# Barrels	3	Culv Vel US (ft/s)	0.91
Q Barrel (cfs)	1.99	Culv Vel DS (ft/s)	0.91
E.G. US. (ft)	6865.55	Culv Inv El Up (ft)	6857.76
W.S. US. (ft)	6865.41	Culv Inv El Dn (ft)	6857.16
E.G. DS (ft)	6865.50	Culv Frctn Ls (ft)	0.04
W.S. DS (ft)	6865.42	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.06	Culv Entr Loss (ft)	0.01
Delta WS (ft)	0.00	Q Weir (cfs)	835.56
E.G. IC (ft)	6858.46	Weir Sta Lft (ft)	14.08
E.G. OC (ft)	6865.55	Weir Sta Rgt (ft)	114.80
Culvert Control	Outlet	Weir Submerg	0.97
Culv WS Inlet (ft)	6859.43	Weir Max Depth (ft)	4.42
Culv WS Outlet (ft)	6858.83	Weir Avg Depth (ft)	3.06
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	307.94
Culv Crt Depth (ft)	0.52	Min El Weir Flow (ft)	6861.38

Errors, Warnings and Notes

Appendix D: Site 1 Effective Hydraulic Model HEC-RAS cross section summary table

Profile Output Table - Standard Table 1

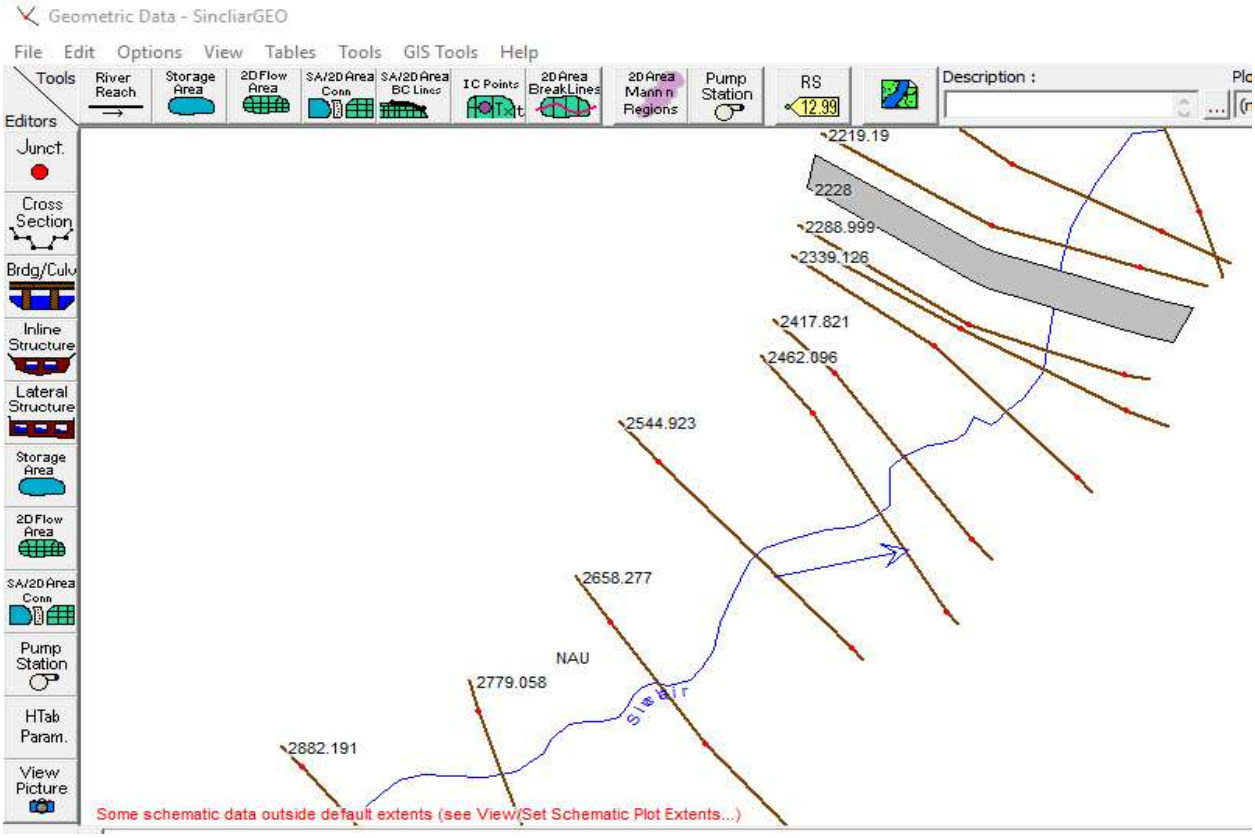
File Options Std. Tables Locations Help

HEC-RAS Plan: test 1 River: Sinclair Reach: NAU

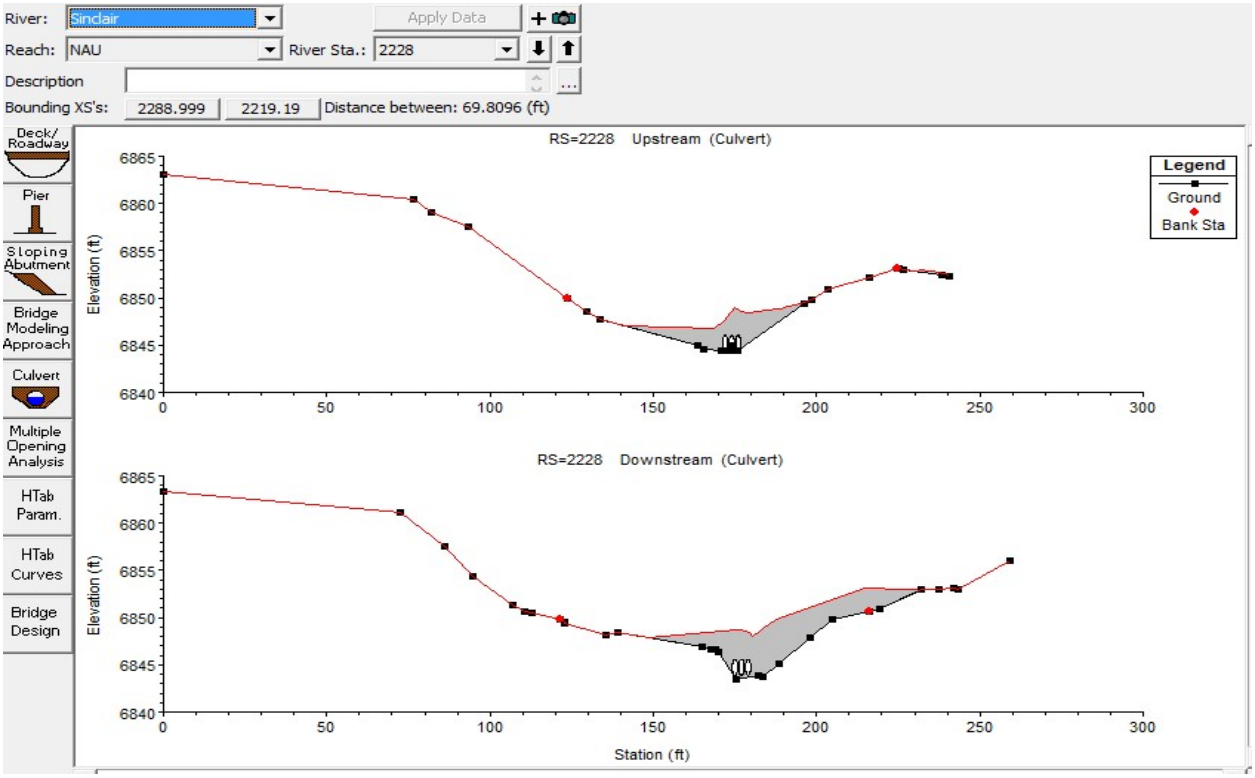
Reload Data

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
NAU	6378.119	PF 1	350.00	6859.53	6863.54	6861.19	6863.56	0.000834	1.03	339.19	130.66	0.11
NAU	6378.119	PF 2	670.00	6859.53	6864.57	6861.59	6864.60	0.001040	1.41	478.51	138.39	0.13
NAU	6378.119	PF 3	890.00	6859.53	6865.84	6861.81	6865.86	0.000671	1.36	657.91	144.46	0.11
NAU	6289.358	PF 1	350.00	6859.53	6863.46		6863.47	0.001100	0.86	407.22	133.30	0.09
NAU	6289.358	PF 2	670.00	6859.53	6864.46		6864.48	0.001546	1.22	549.88	144.73	0.11
NAU	6289.358	PF 3	890.00	6859.53	6865.77		6865.79	0.001033	1.19	741.20	148.33	0.09
NAU	6230.611	PF 1	350.00	6858.82	6863.41		6863.42	0.000851	0.82	424.27	121.93	0.08
NAU	6230.611	PF 2	670.00	6858.82	6864.38		6864.40	0.001372	1.22	553.19	136.27	0.10
NAU	6230.611	PF 3	890.00	6858.82	6865.71		6865.73	0.000968	1.20	739.44	143.17	0.09
NAU	6161.003	PF 1	350.00	6858.50	6863.31		6863.33	0.001844	1.17	298.96	90.49	0.11
NAU	6161.003	PF 2	670.00	6858.50	6864.21		6864.26	0.003036	1.73	390.22	104.72	0.15
NAU	6161.003	PF 3	890.00	6858.50	6865.60		6865.64	0.001880	1.64	540.59	112.98	0.12
NAU	6090.144	PF 1	350.00	6857.61	6863.22		6863.26	0.000268	1.57	229.31	85.37	0.16
NAU	6090.144	PF 2	670.00	6857.61	6864.06		6864.14	0.000429	2.33	304.49	93.87	0.21
NAU	6090.144	PF 3	890.00	6857.61	6865.50		6865.57	0.000249	2.18	449.92	108.35	0.16
NAU	6068.609	PF 1	350.00	6857.67	6863.19	6860.93	6863.25	0.001738	1.61	205.98	81.44	0.16
NAU	6068.609	PF 2	670.00	6857.67	6863.98	6861.59	6864.12	0.002378	2.20	272.96	89.44	0.20
NAU	6068.609	PF 3	890.00	6857.67	6865.41	6861.95	6865.55	0.000993	1.75	411.99	104.00	0.13
NAU	6019		Culvert									
NAU	6012.663	PF 1	350.00	6857.41	6861.50		6861.61	0.006779	2.69	130.18	54.71	0.31
NAU	6012.663	PF 2	670.00	6857.41	6863.76		6863.85	0.002371	2.36	284.47	85.29	0.20
NAU	6012.663	PF 3	890.00	6857.41	6865.42		6865.50	0.001059	1.96	435.16	99.06	0.14
NAU	5997.055	PF 1	350.00	6858.52	6861.22	6860.34	6861.40	0.035321	3.45	101.36	55.54	0.45
NAU	5997.055	PF 2	670.00	6858.52	6863.69	6861.01	6863.79	0.007780	2.50	267.75	81.26	0.24
NAU	5997.055	PF 3	890.00	6858.52	6865.40	6861.40	6865.46	0.003074	2.05	431.42	130.68	0.16

Appendix E: Site 2 Effective Hydraulic Model cross section diagram



Appendix F: Site 2 Effective Hydraulic Model culvert graphs



Appendix G: Site 2 Effective Hydraulic Model HEC RAS culvert summary table

Culvert Output

File Type Options Help

River: Sinclair Profile: PF 1 Culv Group: Culvert #1

Reach NAU RS: 2228 Plan: test 1

Plan: test 1 Sinclair NAU RS: 2228 Culv Group: Culvert #1 Profile: PF 1

Q Culv Group (cfs)	8.36	Culv Full Len (ft)	50.00
# Barrels	3	Culv Vel US (ft/s)	1.27
Q Barrel (cfs)	2.79	Culv Vel DS (ft/s)	1.27
E.G. US. (ft)	6849.35	Culv Inv El Up (ft)	6844.36
W.S. US. (ft)	6849.31	Culv Inv El Dn (ft)	6843.90
E.G. DS (ft)	6849.24	Culv Frctn Ls (ft)	0.09
W.S. DS (ft)	6849.18	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.11	Culv Entr Loss (ft)	0.02
Delta WS (ft)	0.13	Q Weir (cfs)	341.64
E.G. IC (ft)	6849.30	Weir Sta Lft (ft)	126.59
E.G. OC (ft)	6849.35	Weir Sta Rgt (ft)	194.27
Culvert Control	Outlet	Weir Submerg	0.91
Culv WS Inlet (ft)	6846.03	Weir Max Depth (ft)	2.56
Culv WS Outlet (ft)	6845.57	Weir Avg Depth (ft)	1.60
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	108.37
Culv Crt Depth (ft)	0.61	Min El Weir Flow (ft)	6847.91

Errors, Warnings and Notes

Culvert Output

File Type Options Help

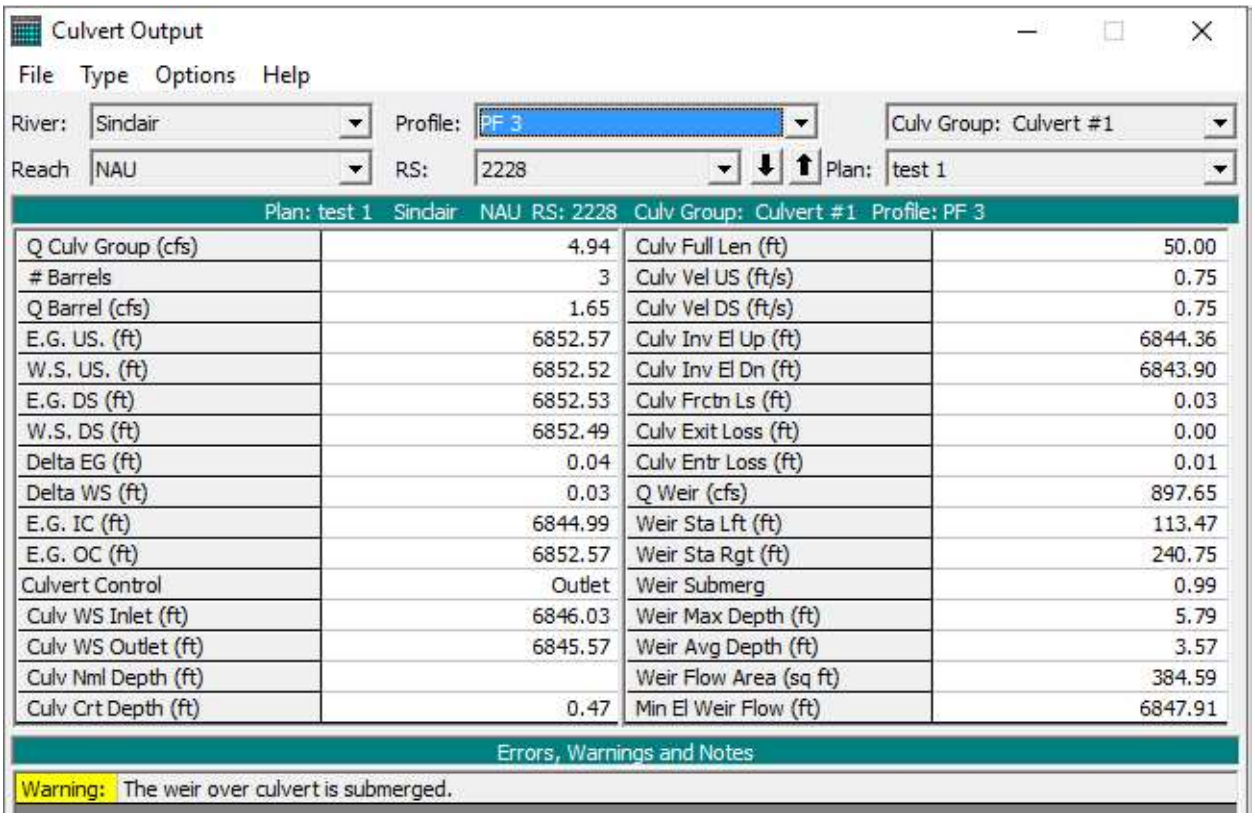
River: Sinclair Profile: PF 2 Culv Group: Culvert #1

Reach NAU RS: 2228 Plan: test 1

Plan: test 1 Sinclair NAU RS: 2228 Culv Group: Culvert #1 Profile: PF 2

Q Culv Group (cfs)	6.18	Culv Full Len (ft)	50.00
# Barrels	3	Culv Vel US (ft/s)	0.94
Q Barrel (cfs)	2.06	Culv Vel DS (ft/s)	0.94
E.G. US. (ft)	6850.89	Culv Inv El Up (ft)	6844.36
W.S. US. (ft)	6850.81	Culv Inv El Dn (ft)	6843.90
E.G. DS (ft)	6850.82	Culv Frctn Ls (ft)	0.05
W.S. DS (ft)	6850.75	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.06	Culv Entr Loss (ft)	0.01
Delta WS (ft)	0.06	Q Weir (cfs)	650.65
E.G. IC (ft)	6845.08	Weir Sta Lft (ft)	120.32
E.G. OC (ft)	6850.89	Weir Sta Rgt (ft)	202.96
Culvert Control	Outlet	Weir Submerg	0.97
Culv WS Inlet (ft)	6846.03	Weir Max Depth (ft)	4.11
Culv WS Outlet (ft)	6845.57	Weir Avg Depth (ft)	2.73
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	225.46
Culv Crt Depth (ft)	0.52	Min El Weir Flow (ft)	6847.91

Errors, Warnings and Notes

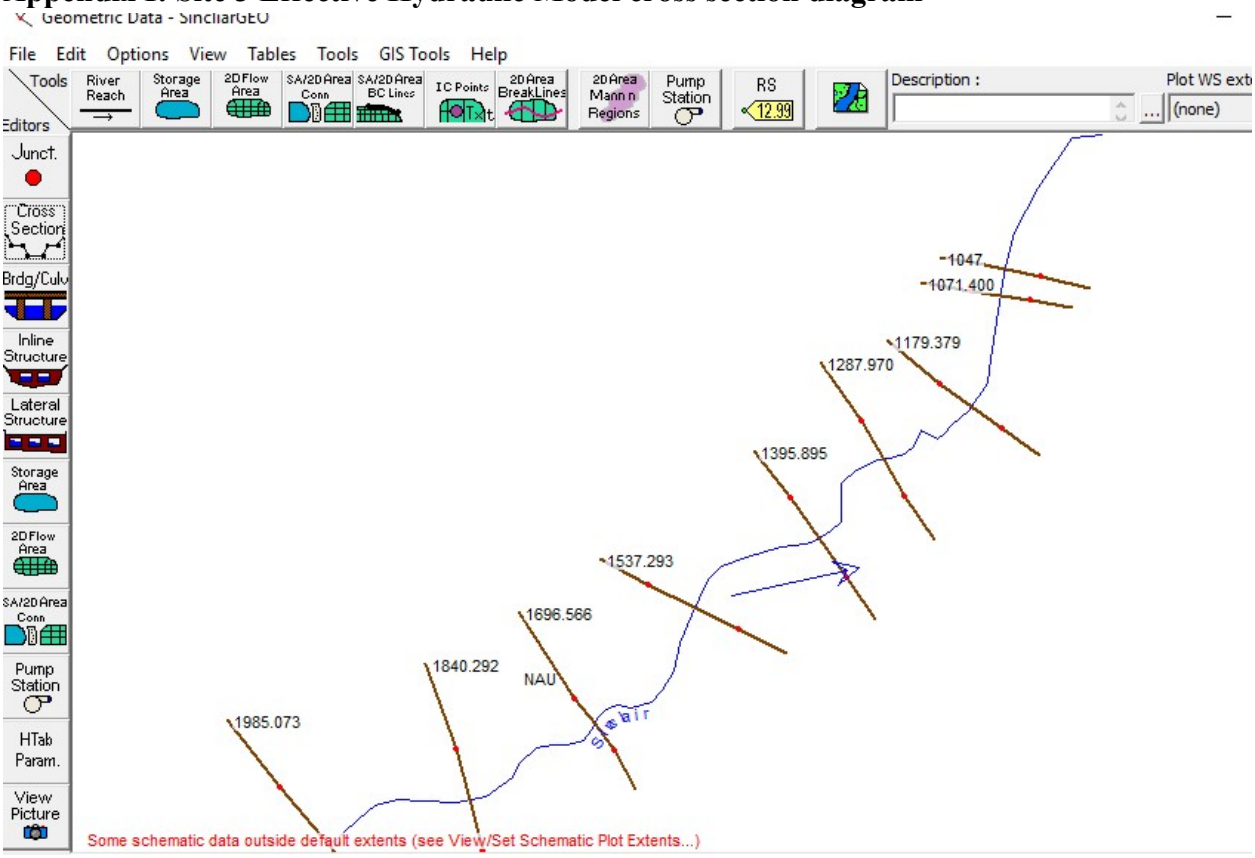

Culvert Output
File Type Options Help
River: Sinclair
Profile: PF 3
Culv Group: Culvert #1
Reach NAU
RS: 2228
Plan: test 1
Plan: test 1 Sinclair NAU RS: 2228 Culv Group: Culvert #1 Profile: PF 3
Q Culv Group (cfs) 4.94
Barrels 3
Q Barrel (cfs) 1.65
E.G. US. (ft) 6852.57
W.S. US. (ft) 6852.52
E.G. DS (ft) 6852.53
W.S. DS (ft) 6852.49
Delta EG (ft) 0.04
Delta WS (ft) 0.03
E.G. IC (ft) 6844.99
E.G. OC (ft) 6852.57
Culvert Control Outlet
Culv WS Inlet (ft) 6846.03
Culv WS Outlet (ft) 6845.57
Culv Nml Depth (ft)
Culv Crt Depth (ft) 0.47
Culv Full Len (ft) 50.00
Culv Vel US (ft/s) 0.75
Culv Vel DS (ft/s) 0.75
Culv Inv El Up (ft) 6844.36
Culv Inv El Dn (ft) 6843.90
Culv Frctn Ls (ft) 0.03
Culv Exit Loss (ft) 0.00
Culv Entr Loss (ft) 0.01
Q Weir (cfs) 897.65
Weir Sta Lft (ft) 113.47
Weir Sta Rgt (ft) 240.75
Weir Submerg 0.99
Weir Max Depth (ft) 5.79
Weir Avg Depth (ft) 3.57
Weir Flow Area (sq ft) 384.59
Min El Weir Flow (ft) 6847.91
Errors, Warnings and Notes
Warning: The weir over culvert is submerged.

Appendix H: Site 2 Effective Hydraulic Model HEC RAS cross section summary table

HEC-RAS Plan: test 1 River: Sinclair Reach: NAU — Reload Data

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
NAU	2882.191	PF 1	350.00	6849.55	6852.46	6851.40	6852.56	0.009305	2.57	136.04	78.62	0.34
NAU	2882.191	PF 2	670.00	6849.55	6853.24	6852.01	6853.42	0.010338	3.37	198.80	82.66	0.38
NAU	2882.191	PF 3	890.00	6849.55	6853.80	6852.31	6854.00	0.009454	3.62	245.70	85.56	0.38
NAU	2779.058	PF 1	350.00	6847.57	6850.47		6850.79	0.040297	4.56	76.82	56.39	0.69
NAU	2779.058	PF 2	670.00	6847.57	6851.75		6852.02	0.018296	4.17	160.51	74.29	0.50
NAU	2779.058	PF 3	890.00	6847.57	6852.84		6853.03	0.009260	3.57	249.70	89.54	0.37
NAU	2658.277	PF 1	350.00	6845.98	6849.62		6849.69	0.003579	2.00	174.58	71.17	0.23
NAU	2658.277	PF 2	670.00	6845.98	6851.16		6851.24	0.002933	2.28	294.45	85.35	0.22
NAU	2658.277	PF 3	890.00	6845.98	6852.48		6852.55	0.001954	2.13	418.26	103.48	0.18
NAU	2544.923	PF 1	350.00	6844.75	6849.52		6849.54	0.000596	0.95	369.28	121.27	0.10
NAU	2544.923	PF 2	670.00	6844.75	6851.06		6851.09	0.000625	1.17	572.27	141.79	0.10
NAU	2544.923	PF 3	890.00	6844.75	6852.42		6852.44	0.000452	1.15	773.99	154.27	0.09
NAU	2462.096	PF 1	350.00	6844.27	6849.48		6849.50	0.000396	0.86	407.20	113.45	0.08
NAU	2462.096	PF 2	670.00	6844.27	6851.02		6851.04	0.000479	1.14	589.55	124.41	0.09
NAU	2462.096	PF 3	890.00	6844.27	6852.39		6852.41	0.000393	1.16	766.94	134.90	0.09
NAU	2417.821	PF 1	350.00	6844.02	6849.46		6849.47	0.000571	1.00	349.31	101.95	0.10
NAU	2417.821	PF 2	670.00	6844.02	6850.99		6851.02	0.000681	1.30	516.56	116.64	0.11
NAU	2417.821	PF 3	890.00	6844.02	6852.36		6852.39	0.000537	1.30	685.81	129.46	0.10
NAU	2339.126	PF 1	350.00	6845.23	6849.34		6849.39	0.002341	1.73	202.04	74.67	0.19
NAU	2339.126	PF 2	670.00	6845.23	6850.86		6850.92	0.002210	2.06	325.85	89.03	0.19
NAU	2339.126	PF 3	890.00	6845.23	6852.26		6852.32	0.001482	1.93	460.46	102.17	0.16
NAU	2302.391	PF 1	350.00	6844.60	6849.32		6849.36	0.000352	1.70	205.31	70.78	0.18
NAU	2302.391	PF 2	670.00	6844.60	6850.83		6850.90	0.000361	2.08	322.09	83.69	0.19
NAU	2302.391	PF 3	890.00	6844.60	6852.24		6852.30	0.000252	1.98	448.78	95.63	0.16
NAU	2288.999	PF 1	350.00	6844.37	6849.31	6846.69	6849.35	0.002163	1.74	201.67	69.59	0.18
NAU	2288.999	PF 2	670.00	6844.37	6850.81	6847.49	6850.89	0.002123	2.13	315.86	82.02	0.19
NAU	2288.999	PF 3	890.00	6844.37	6852.23	6847.90	6852.29	0.001543	2.03	445.28	101.46	0.16
NAU	2228		Culvert									
NAU	2219.19	PF 1	350.00	6843.48	6849.18		6849.24	0.003661	1.94	180.09	77.58	0.22
NAU	2219.19	PF 2	670.00	6843.48	6850.75		6850.82	0.002647	2.11	321.76	106.92	0.20
NAU	2219.19	PF 3	890.00	6843.48	6852.20		6852.26	0.001330	1.90	489.45	123.71	0.15
NAU	2183.901	PF 1	350.00	6844.94	6849.08		6849.13	0.002511	1.79	195.03	71.49	0.19
NAU	2183.901	PF 2	670.00	6844.94	6850.67		6850.74	0.002204	2.12	316.71	81.97	0.19
NAU	2183.901	PF 3	890.00	6844.94	6852.14		6852.21	0.001420	2.00	449.17	100.93	0.16
NAU	2112.564	PF 1	350.00	6844.87	6847.78	6847.78	6848.53	0.086595	6.95	50.33	34.57	1.02
NAU	2112.564	PF 2	670.00	6844.87	6850.15	6848.66	6850.40	0.013343	4.06	165.17	62.62	0.44
NAU	2112.564	PF 3	890.00	6844.87	6851.88	6849.11	6852.02	0.005181	3.05	291.43	83.20	0.29

Appendix I: Site 3 Effective Hydraulic Model cross section diagram



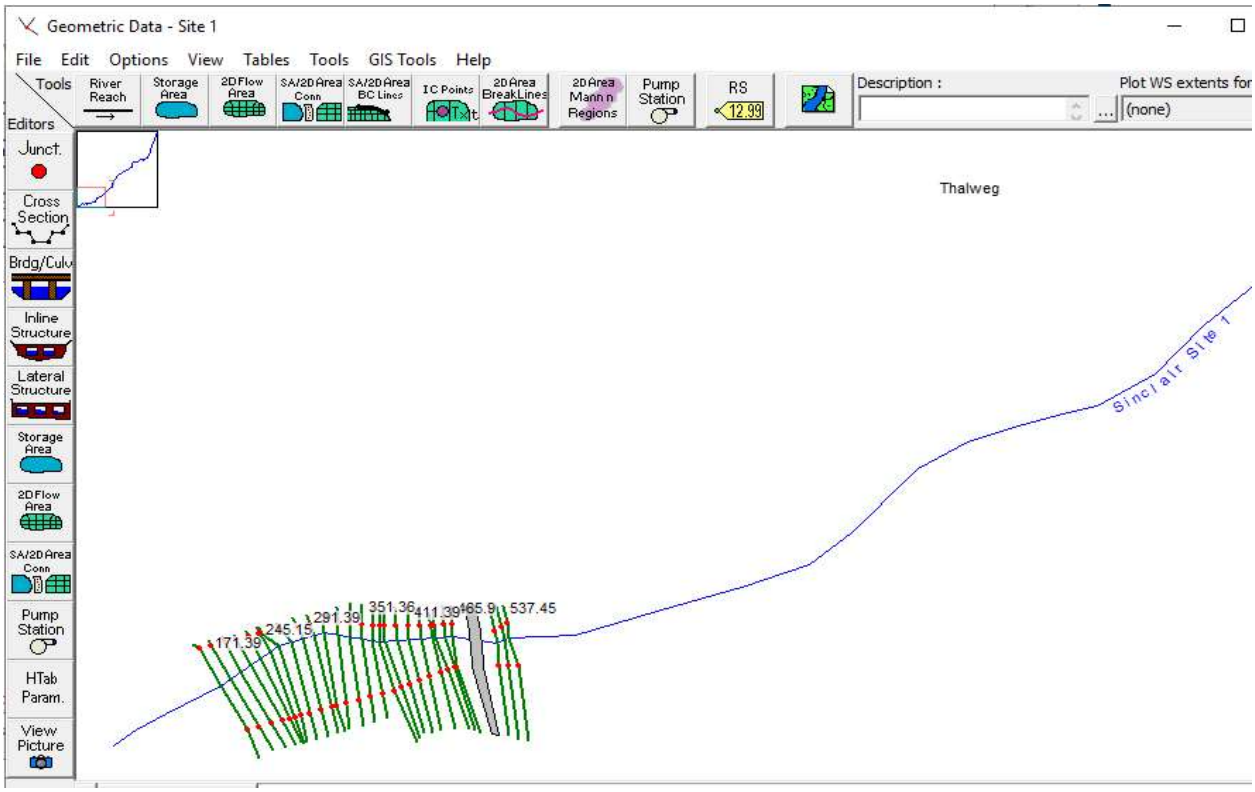
Appendix J: Site 3 Effective Hydraulic Model HEC RAS cross section summary table

File Options Std. Tables Locations Help

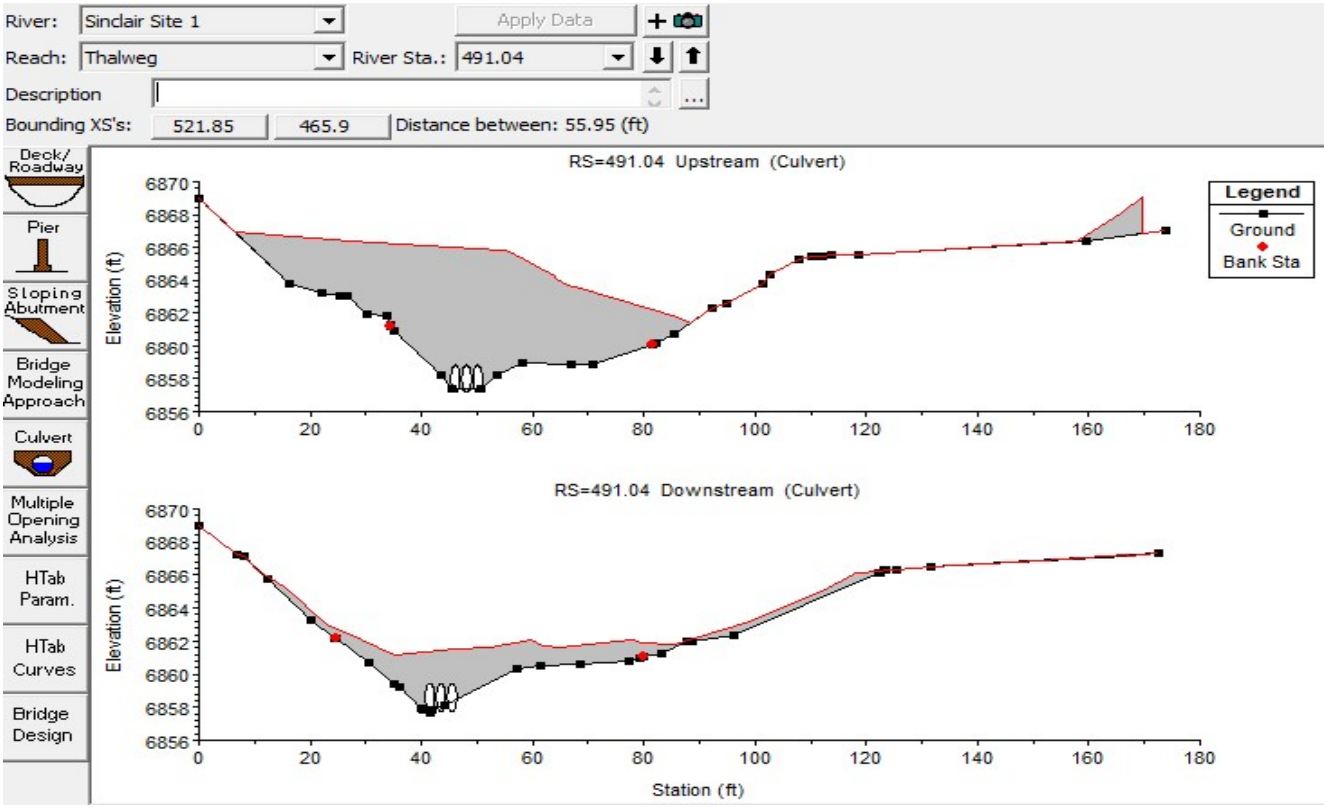
HEC-RAS Plan: test 1 River: Sinclair Reach: NAU — Reload Data

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
NAU	1985.073	PF 1	350.00	6845.30	6849.70	6846.92	6849.73	0.001193	1.38	253.45	79.27	0.14
NAU	1985.073	PF 2	670.00	6845.30	6850.94	6847.49	6851.00	0.001607	1.88	357.18	88.00	0.16
NAU	1985.073	PF 3	890.00	6845.30	6851.55	6847.83	6851.63	0.001866	2.16	412.40	91.97	0.18
NAU	1840.292	PF 1	350.00	6845.06	6849.32		6849.42	0.004830	2.48	141.01	51.85	0.27
NAU	1840.292	PF 2	670.00	6845.06	6850.39		6850.56	0.006753	3.32	201.96	61.74	0.32
NAU	1840.292	PF 3	890.00	6845.06	6850.90		6851.12	0.007895	3.80	234.38	67.63	0.35
NAU	1696.566	PF 1	350.00	6844.48	6847.88		6848.36	0.011433	5.56	63.02	38.47	0.75
NAU	1696.566	PF 2	670.00	6844.48	6848.97		6849.50	0.007524	5.98	121.24	64.84	0.66
NAU	1696.566	PF 3	890.00	6844.48	6849.73		6850.19	0.005201	5.69	176.98	82.26	0.56
NAU	1537.293	PF 1	350.00	6844.62	6847.77		6847.83	0.001078	1.99	175.47	83.40	0.24
NAU	1537.293	PF 2	670.00	6844.62	6848.95		6849.04	0.000939	2.40	280.27	99.22	0.24
NAU	1537.293	PF 3	890.00	6844.62	6849.72		6849.82	0.000796	2.52	360.06	107.61	0.23
NAU	1395.895	PF 1	350.00	6844.07	6847.40		6847.56	0.003656	3.21	108.89	63.13	0.43
NAU	1395.895	PF 2	670.00	6844.07	6848.66		6848.83	0.002546	3.31	202.54	85.69	0.38
NAU	1395.895	PF 3	890.00	6844.07	6849.50		6849.66	0.001652	3.18	285.87	103.45	0.32
NAU	1287.970	PF 1	350.00	6843.57	6847.13		6847.25	0.002153	2.85	122.77	56.96	0.34
NAU	1287.970	PF 2	670.00	6843.57	6848.45		6848.60	0.001682	3.16	220.39	86.85	0.32
NAU	1287.970	PF 3	890.00	6843.57	6849.35		6849.50	0.001249	3.09	303.03	96.12	0.28
NAU	1179.379	PF 1	350.00	6842.77	6846.96		6847.06	0.001383	2.49	141.64	62.91	0.28
NAU	1179.379	PF 2	670.00	6842.77	6848.32		6848.44	0.001213	2.87	249.25	104.02	0.28
NAU	1179.379	PF 3	890.00	6842.77	6849.26		6849.38	0.000850	2.78	351.02	110.62	0.24
NAU	1071.400	PF 1	350.00	6842.51	6846.45	6845.04	6846.70	0.013864	4.02	87.07	33.34	0.44
NAU	1071.400	PF 2	670.00	6842.51	6847.70		6848.09	0.015918	5.04	133.02	40.12	0.49
NAU	1071.400	PF 3	890.00	6842.51	6848.76		6849.12	0.011414	4.90	195.75	75.66	0.43
NAU	1047	PF 1	350.00	6842.51	6845.05	6845.05	6845.95	0.081878	7.64	45.81	25.54	1.01
NAU	1047	PF 2	670.00	6842.51	6846.77	6846.10	6847.50	0.036497	6.82	98.20	35.10	0.72
NAU	1047	PF 3	890.00	6842.51	6848.17	6846.65	6848.68	0.029137	5.75	154.75	61.05	0.64

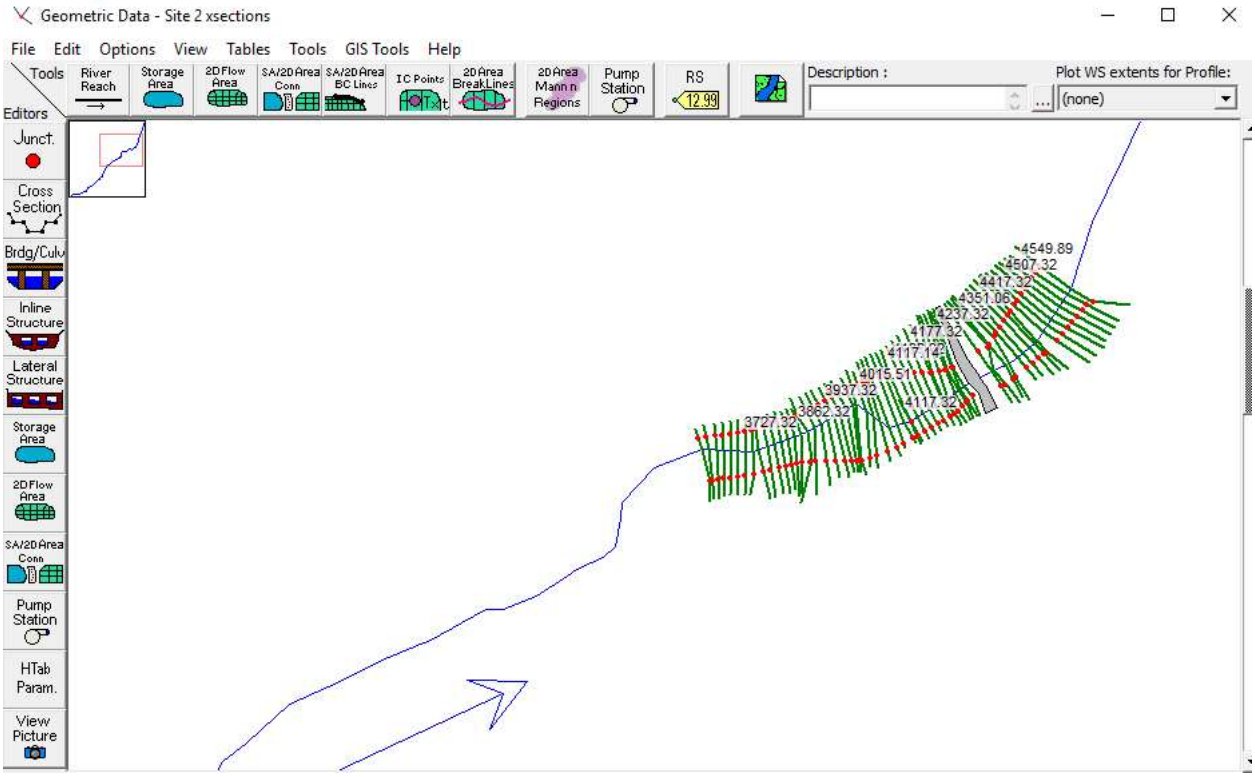
Appendix K: Corrected Effective Model Site 1 cross section diagram



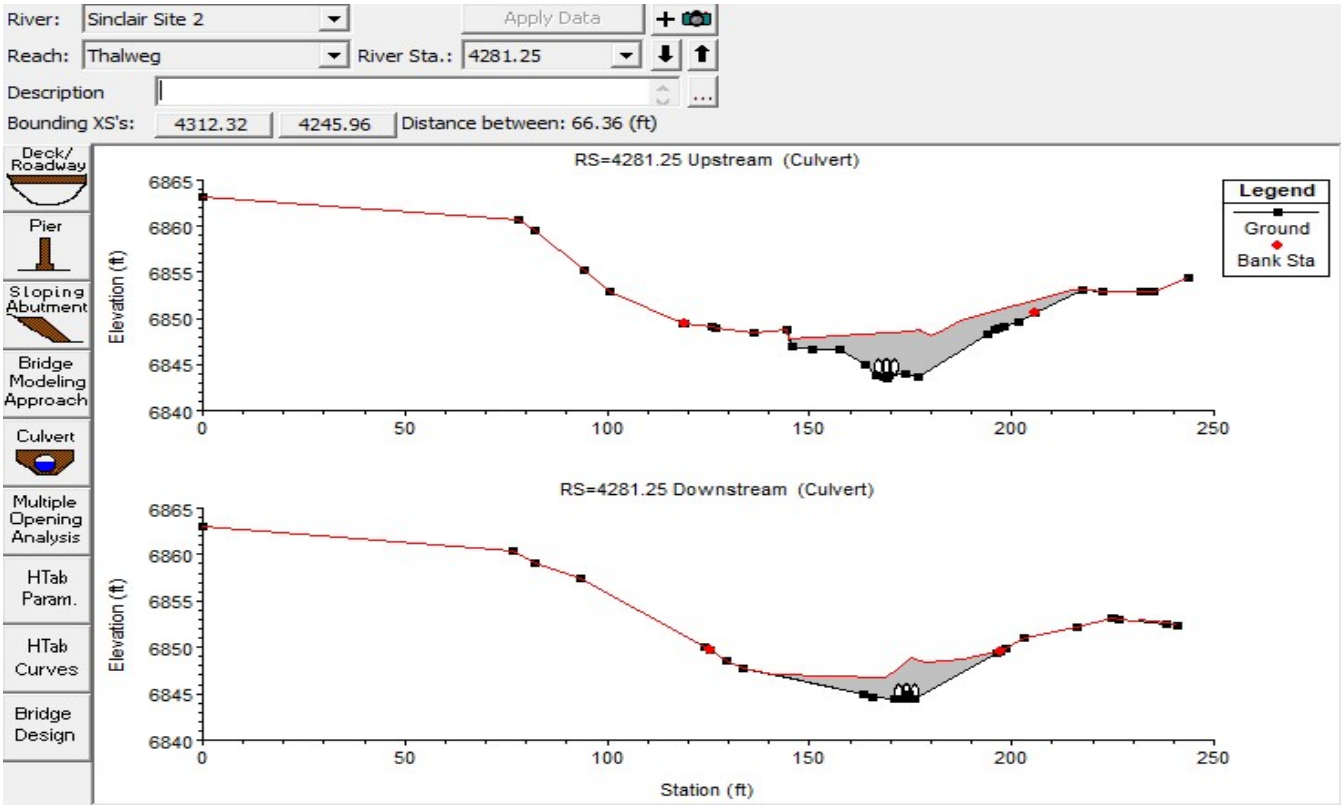
Appendix L: Corrected Effective Model Site 1 culvert graphs



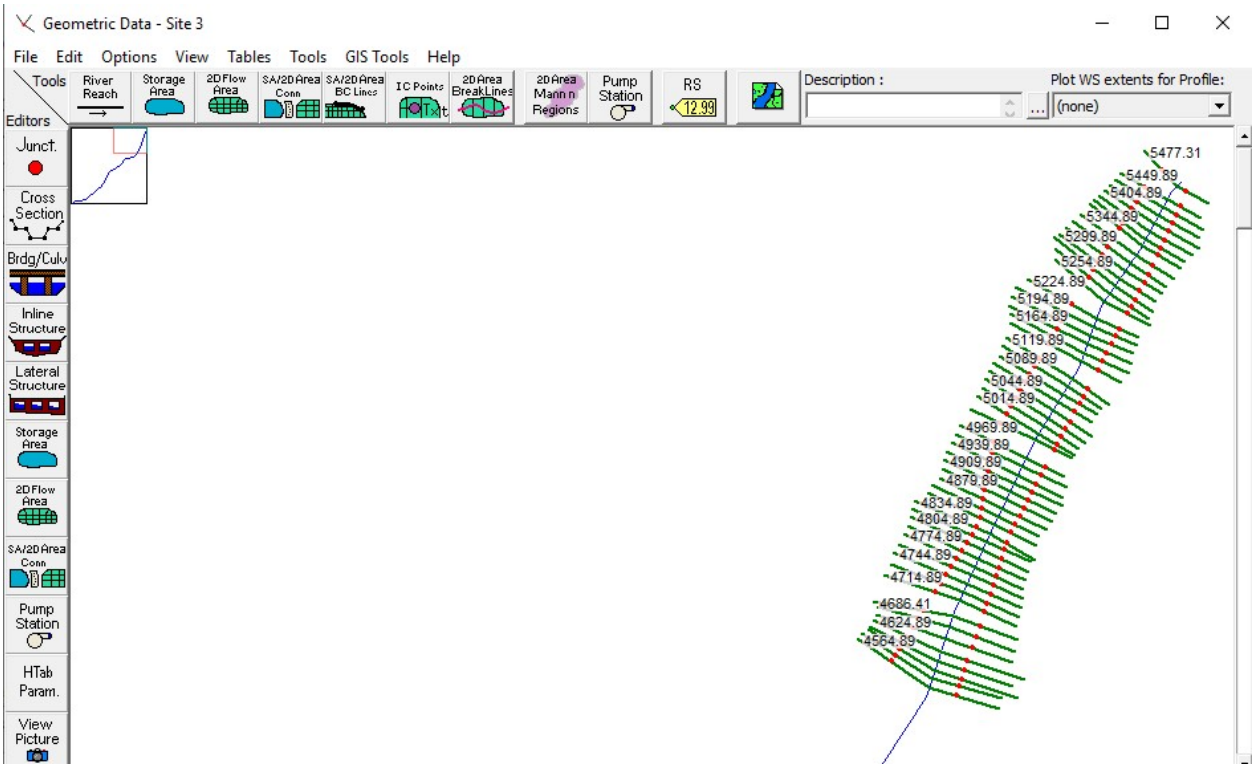
Appendix M: Site 2 Corrected Effective Model cross section diagram



Appendix N: Site 2 Corrected Effective Model culvert graphs



Appendix O: Corrected Effective Model Site 3 cross section diagram



Appendix P: Corrected Effective Model Site 1 HEC RAS culvert summary table

Steady Flow Data - test 10,50 and 100 yrs

File Options Help

Enter/Edit Number of Profiles (32000 max): 3 Reach Boundary Conditions ... Apply Data

Locations of Flow Data Changes

River: Sinclair Site 1 Add Multiple...

Reach: Thalweg River Sta.: 537.45 Add A Flow Change Location

Flow Change Location				Profile Names and Flow Rates		
	River	Reach	RS	PF 1	PF 2	PF 3
1	Sinclair Site 1	Thalweg	537.45	350	670	890

Culvert Output

File Type Options Help

River: Sinclair Wash Profile: 10 yr Culv Group: Culvert #1

Reach Thalweg RS: 4997.43 Plan:

Plan: Plan 02 Sinclair Wash Thalweg RS: 4997.43 Culv Group: Culvert #1 Profile: 10 yr

Q Culv Group (cfs)	35.02	Culv Full Len (ft)	47.84
# Barrels	3	Culv Vel US (ft/s)	5.33
Q Barrel (cfs)	11.67	Culv Vel DS (ft/s)	5.33
E.G. US. (ft)	6863.29	Culv Inv El Up (ft)	6857.76
W.S. US. (ft)	6863.24	Culv Inv El Dn (ft)	6857.16
E.G. DS (ft)	6861.10	Culv Frctn Ls (ft)	1.55
W.S. DS (ft)	6860.90	Culv Exit Loss (ft)	0.24
Delta EG (ft)	2.19	Culv Entr Loss (ft)	0.40
Delta WS (ft)	2.34	Q Weir (cfs)	314.98
E.G. IC (ft)	6863.18	Weir Sta Lft (ft)	70.58
E.G. OC (ft)	6863.29	Weir Sta Rgt (ft)	143.12
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	6859.43	Weir Max Depth (ft)	2.41
Culv WS Outlet (ft)	6858.83	Weir Avg Depth (ft)	1.33
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	96.47
Culv Crt Depth (ft)	1.29	Min El Weir Flow (ft)	6861.83

Errors, Warnings and Notes

Culvert Output

File Type Options Help

River: Sinclair Wash Profile: 50 yr Culv Group: Culvert #1

Reach Thalweg RS: 4997.43 Plan:

Plan: Plan 02 Sinclair Wash Thalweg RS: 4997.43 Culv Group: Culvert #1 Profile: 50 yr

Q Culv Group (cfs)	35.56	Culv Full Len (ft)	47.84
# Barrels	3	Culv Vel US (ft/s)	5.41
Q Barrel (cfs)	11.85	Culv Vel DS (ft/s)	5.41
E.G. US. (ft)	6864.13	Culv Inv El Up (ft)	6857.76
W.S. US. (ft)	6864.03	Culv Inv El Dn (ft)	6857.16
E.G. DS (ft)	6862.04	Culv Frctn Ls (ft)	1.59
W.S. DS (ft)	6861.67	Culv Exit Loss (ft)	0.08
Delta EG (ft)	2.09	Culv Entr Loss (ft)	0.41
Delta WS (ft)	2.36	Q Weir (cfs)	634.87
E.G. IC (ft)	6864.04	Weir Sta Lft (ft)	64.30
E.G. OC (ft)	6864.13	Weir Sta Rgt (ft)	148.34
Culvert Control	Outlet	Weir Submerg	0.09
Culv WS Inlet (ft)	6859.43	Weir Max Depth (ft)	3.26
Culv WS Outlet (ft)	6858.83	Weir Avg Depth (ft)	1.95
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	163.70
Culv Crt Depth (ft)	1.30	Min El Weir Flow (ft)	6861.83

Errors, Warnings and Notes

Culvert Output

File Type Options Help

River: Sinclair Wash Profile: 100 yr Culv Group: Culvert #1

Reach Thalweg RS: 4997.43 Plan:

Plan: Plan 02 Sinclair Wash Thalweg RS: 4997.43 Culv Group: Culvert #1 Profile: 100 yr

Q Culv Group (cfs)	35.70	Culv Full Len (ft)	47.84
# Barrels	3	Culv Vel US (ft/s)	5.43
Q Barrel (cfs)	11.90	Culv Vel DS (ft/s)	5.43
E.G. US. (ft)	6864.59	Culv Inv El Up (ft)	6857.76
W.S. US. (ft)	6864.45	Culv Inv El Dn (ft)	6857.16
E.G. DS (ft)	6862.57	Culv Frctn Ls (ft)	1.61
W.S. DS (ft)	6862.09	Culv Exit Loss (ft)	0.00
Delta EG (ft)	2.02	Culv Entr Loss (ft)	0.41
Delta WS (ft)	2.36	Q Weir (cfs)	853.79
E.G. IC (ft)	6864.54	Weir Sta Lft (ft)	62.00
E.G. OC (ft)	6864.59	Weir Sta Rgt (ft)	149.79
Culvert Control	Outlet	Weir Submerg	0.14
Culv WS Inlet (ft)	6859.43	Weir Max Depth (ft)	3.72
Culv WS Outlet (ft)	6858.83	Weir Avg Depth (ft)	2.32
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	203.25
Culv Crt Depth (ft)	1.30	Min El Weir Flow (ft)	6861.83

Errors, Warnings and Notes

Appendix Q: Corrected Effective Model Site 1 cross section summary table

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

HEC-RAS Plan: Plan 02 River: Sinclair Wash Reach: Thalweg Profile: 10 yr

Reload Data

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Thalweg	5331.57	10 yr	350.00	6859.53	6863.34	6861.21	6863.35	0.000252	1.12	312.93	124.27	0.12
Thalweg	5316.57	10 yr	350.00	6859.51	6863.33		6863.35	0.000238	1.09	324.52	128.49	0.12
Thalweg	5301.57	10 yr	350.00	6859.56	6863.33		6863.35	0.000238	1.09	323.18	126.37	0.12
Thalweg	5286.57	10 yr	350.00	6859.54	6863.33		6863.34	0.000208	1.05	337.00	126.59	0.11
Thalweg	5271.57	10 yr	350.00	6859.41	6863.33		6863.34	0.000152	0.95	370.05	127.75	0.10
Thalweg	5256.57	10 yr	350.00	6859.44	6863.32		6863.34	0.000156	0.96	366.77	127.54	0.10
Thalweg	5242.81	10 yr	350.00	6859.53	6863.32		6863.34	0.000135	0.91	388.69	132.51	0.09
Thalweg	5226.57	10 yr	350.00	6859.34	6863.32		6863.33	0.000123	0.90	394.38	128.36	0.09
Thalweg	5211.57	10 yr	350.00	6859.29	6863.32		6863.33	0.000115	0.89	401.39	126.42	0.09
Thalweg	5196.57	10 yr	350.00	6859.09	6863.32		6863.33	0.000097	0.86	416.44	124.62	0.08
Thalweg	5184.06	10 yr	350.00	6858.83	6863.32		6863.33	0.000096	0.85	413.39	121.30	0.08
Thalweg	5166.57	10 yr	350.00	6859.05	6863.31		6863.33	0.000120	0.93	377.26	112.51	0.09
Thalweg	5151.57	10 yr	350.00	6858.85	6863.31		6863.32	0.000154	1.03	342.49	106.21	0.10
Thalweg	5136.6	10 yr	350.00	6859.12	6863.30		6863.32	0.000189	1.12	314.10	100.32	0.11
Thalweg	5123.56	10 yr	350.00	6858.78	6863.30		6863.32	0.000201	1.18	298.76	92.85	0.11
Thalweg	5114.45	10 yr	350.00	6858.50	6863.29		6863.32	0.000195	1.19	297.46	90.35	0.11
Thalweg	5106.57	10 yr	350.00	6858.28	6863.29		6863.31	0.000196	1.20	294.01	88.34	0.11
Thalweg	5091.57	10 yr	350.00	6857.96	6863.29		6863.31	0.000192	1.21	293.14	86.61	0.11
Thalweg	5076.57	10 yr	350.00	6857.82	6863.28		6863.31	0.000252	1.34	264.85	83.94	0.13
Thalweg	5061.57	10 yr	350.00	6857.72	6863.27		6863.30	0.000316	1.48	245.03	89.01	0.14
Thalweg	5046.57	10 yr	350.00	6857.63	6863.26		6863.30	0.000358	1.57	234.22	86.33	0.15
Thalweg	5043.59	10 yr	350.00	6857.61	6863.26		6863.30	0.000370	1.60	232.51	85.76	0.15
Thalweg	5031.57	10 yr	350.00	6857.55	6863.25		6863.29	0.000444	1.72	217.68	82.87	0.17
Thalweg	5022.06	10 yr	350.00	6857.67	6863.24	6860.93	6863.29	0.000491	1.80	209.87	81.95	0.18
Thalweg	4997.43		Culvert									
Thalweg	4966.11	10 yr	350.00	6857.41	6860.90		6861.10	0.003665	3.61	98.30	51.27	0.44
Thalweg	4956.57	10 yr	350.00	6858.52	6860.75		6861.04	0.007499	4.33	80.93	51.90	0.61
Thalweg	4950.51	10 yr	350.00	6858.52	6860.34	6860.34	6860.94	0.022410	6.23	56.15	46.96	1.01

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

HEC-RAS Plan: Plan 02 River: Sinclair Wash Reach: Thalweg Profile: 50 yr

Reload Data

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Thalweg	5331.57	50 yr	670.00	6859.53	6864.21	6861.59	6864.24	0.000357	1.60	428.69	136.84	0.15
Thalweg	5316.57	50 yr	670.00	6859.51	6864.20		6864.24	0.000334	1.55	443.01	139.66	0.15
Thalweg	5301.57	50 yr	670.00	6859.56	6864.20		6864.23	0.000338	1.56	439.78	137.78	0.15
Thalweg	5286.57	50 yr	670.00	6859.54	6864.19		6864.23	0.000306	1.51	454.58	139.86	0.14
Thalweg	5271.57	50 yr	670.00	6859.41	6864.19		6864.22	0.000236	1.40	488.28	139.84	0.13
Thalweg	5256.57	50 yr	670.00	6859.44	6864.19		6864.22	0.000241	1.42	484.14	138.97	0.13
Thalweg	5242.81	50 yr	670.00	6859.53	6864.19		6864.22	0.000212	1.35	510.38	143.97	0.12
Thalweg	5226.57	50 yr	670.00	6859.34	6864.18		6864.21	0.000202	1.35	512.46	140.04	0.12
Thalweg	5211.57	50 yr	670.00	6859.29	6864.18		6864.21	0.000193	1.35	517.83	138.24	0.12
Thalweg	5196.57	50 yr	670.00	6859.09	6864.18		6864.21	0.000170	1.31	532.03	138.22	0.11
Thalweg	5184.06	50 yr	670.00	6858.83	6864.18		6864.20	0.000170	1.31	526.16	135.25	0.11
Thalweg	5166.57	50 yr	670.00	6859.05	6864.17		6864.20	0.000210	1.42	482.13	126.82	0.12
Thalweg	5151.57	50 yr	670.00	6858.85	6864.16		6864.20	0.000265	1.56	441.44	120.36	0.13
Thalweg	5136.6	50 yr	670.00	6859.12	6864.15		6864.19	0.000324	1.69	407.38	114.28	0.15
Thalweg	5123.56	50 yr	670.00	6858.78	6864.14		6864.19	0.000359	1.78	385.45	107.49	0.16
Thalweg	5114.45	50 yr	670.00	6858.50	6864.13		6864.18	0.000353	1.81	381.70	104.23	0.16
Thalweg	5106.57	50 yr	670.00	6858.28	6864.13		6864.18	0.000359	1.83	376.35	102.26	0.16
Thalweg	5091.57	50 yr	670.00	6857.96	6864.12		6864.17	0.000352	1.86	373.51	100.09	0.16
Thalweg	5076.57	50 yr	670.00	6857.82	6864.10		6864.17	0.000437	2.03	343.63	98.89	0.17
Thalweg	5061.57	50 yr	670.00	6857.72	6864.09		6864.16	0.000534	2.21	321.07	97.50	0.19
Thalweg	5046.57	50 yr	670.00	6857.63	6864.07		6864.15	0.000603	2.35	307.23	94.48	0.20
Thalweg	5043.59	50 yr	670.00	6857.61	6864.06		6864.15	0.000621	2.39	304.93	93.91	0.21
Thalweg	5031.57	50 yr	670.00	6857.55	6864.04		6864.14	0.000735	2.56	287.03	91.21	0.22
Thalweg	5022.06	50 yr	670.00	6857.67	6864.03	6861.59	6864.13	0.000808	2.67	277.80	89.98	0.23
Thalweg	4997.43		Culvert									
Thalweg	4966.11	50 yr	670.00	6857.41	6861.67		6862.04	0.004565	4.94	139.62	55.66	0.52
Thalweg	4956.57	50 yr	670.00	6858.52	6861.50	6860.92	6861.98	0.007649	5.55	121.92	57.86	0.65
Thalweg	4950.51	50 yr	670.00	6858.52	6861.02	6861.02	6861.87	0.020126	7.42	90.31	53.56	1.01

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

HEC-RAS Plan: Plan 02 River: Sinclair Wash Reach: Thalweg Profile: 100 yr

Reload Data

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Thalweg	5331.57	100 yr	890.00	6859.53	6864.68	6861.81	6864.73	0.000409	1.85	494.05	138.87	0.16
Thalweg	5316.57	100 yr	890.00	6859.51	6864.68		6864.72	0.000380	1.79	509.48	141.03	0.16
Thalweg	5301.57	100 yr	890.00	6859.56	6864.67		6864.72	0.000389	1.81	505.34	140.00	0.16
Thalweg	5286.57	100 yr	890.00	6859.54	6864.67		6864.71	0.000351	1.75	521.09	142.17	0.15
Thalweg	5271.57	100 yr	890.00	6859.41	6864.66		6864.71	0.000280	1.65	554.55	141.16	0.14
Thalweg	5256.57	100 yr	890.00	6859.44	6864.66		6864.70	0.000286	1.67	549.79	140.29	0.14
Thalweg	5242.81	100 yr	890.00	6859.53	6864.66		6864.70	0.000253	1.59	578.45	145.27	0.13
Thalweg	5226.57	100 yr	890.00	6859.34	6864.65		6864.69	0.000245	1.60	578.49	141.39	0.13
Thalweg	5211.57	100 yr	890.00	6859.29	6864.65		6864.69	0.000236	1.60	583.00	139.54	0.13
Thalweg	5196.57	100 yr	890.00	6859.09	6864.65		6864.69	0.000212	1.56	597.34	140.36	0.12
Thalweg	5184.06	100 yr	890.00	6858.83	6864.65		6864.68	0.000212	1.56	590.06	137.68	0.12
Thalweg	5166.57	100 yr	890.00	6859.05	6864.63		6864.68	0.000260	1.69	541.77	129.50	0.14
Thalweg	5151.57	100 yr	890.00	6858.85	6864.62		6864.67	0.000324	1.84	497.65	123.03	0.15
Thalweg	5136.6	100 yr	890.00	6859.12	6864.61		6864.67	0.000393	1.99	460.33	116.93	0.17
Thalweg	5123.56	100 yr	890.00	6858.78	6864.59		6864.66	0.000446	2.11	435.05	110.75	0.18
Thalweg	5114.45	100 yr	890.00	6858.50	6864.59		6864.66	0.000444	2.14	429.49	106.94	0.18
Thalweg	5106.57	100 yr	890.00	6858.28	6864.58		6864.65	0.000453	2.18	423.07	105.06	0.18
Thalweg	5091.57	100 yr	890.00	6857.96	6864.57		6864.64	0.000440	2.21	419.15	103.35	0.18
Thalweg	5076.57	100 yr	890.00	6857.82	6864.55		6864.64	0.000542	2.42	388.18	102.12	0.20
Thalweg	5061.57	100 yr	890.00	6857.72	6864.52		6864.63	0.000655	2.62	364.62	101.09	0.21
Thalweg	5046.57	100 yr	890.00	6857.63	6864.50		6864.61	0.000742	2.78	349.02	98.95	0.23
Thalweg	5043.59	100 yr	890.00	6857.61	6864.50		6864.61	0.000764	2.82	346.31	98.27	0.23
Thalweg	5031.57	100 yr	890.00	6857.55	6864.47		6864.60	0.000899	3.02	326.77	95.67	0.25
Thalweg	5022.06	100 yr	890.00	6857.67	6864.45	6861.94	6864.59	0.000986	3.15	316.57	94.24	0.26
Thalweg	4997.43		Culvert									
Thalweg	4966.11	100 yr	890.00	6857.41	6862.09		6862.57	0.004982	5.65	164.01	61.83	0.55
Thalweg	4956.57	100 yr	890.00	6858.52	6861.91	6861.30	6862.50	0.007676	6.21	146.14	60.94	0.67
Thalweg	4950.51	100 yr	890.00	6858.52	6861.38	6861.38	6862.39	0.019045	8.05	110.71	57.13	1.01

Appendix R: Corrected Effective Model Site 2 HEC RAS culvert summary table

Steady Flow Data - test 10,50 and 100 yrs

File Options Help

Enter/Edit Number of Profiles (32000 max): 3 | Reach Boundary Conditions ... | Apply Data

Locations of Flow Data Changes

River: Sinclair Site 2 | Add Multiple...

Reach: Thalweg | River Sta.: 4549.89 | Add A Flow Change Location

Flow Change Location				Profile Names and Flow Rates		
	River	Reach	RS	PF 1	PF 2	PF 3
1	Sinclair Site 2	Thalweg	4549.89	350	670	890

Culvert Output

File Type Options Help

River: Sinclair Wash | Profile: 10 yr | Culv Group: Culvert #1

Reach: Thalweg | RS: 1206.75 | Plan: Plan 02

Plan: Plan 02 Sinclair Wash Thalweg RS: 1206.75 Culv Group: Culvert #1 Profile: 10 yr

Q Culv Group (cfs)	9.00	Culv Full Len (ft)	50.00
# Barrels	3	Culv Vel US (ft/s)	1.37
Q Barrel (cfs)	3.00	Culv Vel DS (ft/s)	1.37
E.G. US. (ft)	6849.35	Culv Inv El Up (ft)	6844.36
W.S. US. (ft)	6849.30	Culv Inv El Dn (ft)	6843.90
E.G. DS (ft)	6849.21	Culv Frctn Ls (ft)	0.11
W.S. DS (ft)	6849.16	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.13	Culv Entr Loss (ft)	0.03
Delta WS (ft)	0.14	Q Weir (cfs)	341.00
E.G. IC (ft)	6849.30	Weir Sta Lft (ft)	46.69
E.G. OC (ft)	6849.35	Weir Sta Rgt (ft)	114.10
Culvert Control	Outlet	Weir Submerg	0.91
Culv WS Inlet (ft)	6846.03	Weir Max Depth (ft)	2.55
Culv WS Outlet (ft)	6845.57	Weir Avg Depth (ft)	1.59
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	107.16
Culv Crt Depth (ft)	0.64	Min El Weir Flow (ft)	6848.05

Errors, Warnings and Notes

Culvert Output

File Type Options Help

River: Sinclair Wash Profile: 50 yr Culv Group: Culvert #1

Reach Thalweg RS: 1206.75 Plan: Plan 02

Plan: Plan 02 Sinclair Wash Thalweg RS: 1206.75 Culv Group: Culvert #1 Profile: 50 yr

Q Culv Group (cfs)	6.18	Culv Full Len (ft)	50.00
# Barrels	3	Culv Vel US (ft/s)	0.94
Q Barrel (cfs)	2.06	Culv Vel DS (ft/s)	0.94
E.G. US. (ft)	6850.95	Culv Inv El Up (ft)	6844.36
W.S. US. (ft)	6850.88	Culv Inv El Dn (ft)	6843.90
E.G. DS (ft)	6850.89	Culv Frctn Ls (ft)	0.05
W.S. DS (ft)	6850.82	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.06	Culv Entr Loss (ft)	0.01
Delta WS (ft)	0.06	Q Weir (cfs)	662.79
E.G. IC (ft)	6845.08	Weir Sta Lft (ft)	37.50
E.G. OC (ft)	6850.95	Weir Sta Rgt (ft)	120.70
Culvert Control	Outlet	Weir Submerg	0.97
Culv WS Inlet (ft)	6846.03	Weir Max Depth (ft)	4.17
Culv WS Outlet (ft)	6845.57	Weir Avg Depth (ft)	2.78
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	230.88
Culv Crt Depth (ft)	0.52	Min El Weir Flow (ft)	6848.05

Errors, Warnings and Notes

Culvert Output

File Type Options Help

River: Sinclair Wash Profile: 100 yr Culv Group: Culvert #1

Reach Thalweg RS: 1206.75 Plan: Plan 02

Plan: Plan 02 Sinclair Wash Thalweg RS: 1206.75 Culv Group: Culvert #1 Profile: 100 yr

Q Culv Group (cfs)	4.94	Culv Full Len (ft)	50.00
# Barrels	3	Culv Vel US (ft/s)	0.75
Q Barrel (cfs)	1.65	Culv Vel DS (ft/s)	0.75
E.G. US. (ft)	6852.34	Culv Inv El Up (ft)	6844.36
W.S. US. (ft)	6852.27	Culv Inv El Dn (ft)	6843.90
E.G. DS (ft)	6852.30	Culv Frctn Ls (ft)	0.03
W.S. DS (ft)	6852.24	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.04	Culv Entr Loss (ft)	0.01
Delta WS (ft)	0.03	Q Weir (cfs)	839.67
E.G. IC (ft)	6844.99	Weir Sta Lft (ft)	23.47
E.G. OC (ft)	6852.34	Weir Sta Rgt (ft)	126.31
Culvert Control	Outlet	Weir Submerg	0.98
Culv WS Inlet (ft)	6846.03	Weir Max Depth (ft)	5.56
Culv WS Outlet (ft)	6845.57	Weir Avg Depth (ft)	3.50
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	359.52
Culv Crt Depth (ft)	0.47	Min El Weir Flow (ft)	6848.05

Errors, Warnings and Notes

Warning: The weir over culvert is submerged.

HEC-RAS Plan: Plan 02 River: Sinclair Wash Reach: Thalweg Profile: 10 yr

Reload Da

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Thalweg	1820.64	10 yr	350.00	6849.47	6852.26		6852.41	0.015894	3.16	110.77	70.04	0.44
Thalweg	1805.64	10 yr	350.00	6849.25	6851.80		6852.06	0.035101	4.12	85.02	65.56	0.64
Thalweg	1790.64	10 yr	350.00	6848.86	6851.15	6851.09	6851.64	0.020818	5.64	62.07	57.18	0.95
Thalweg	1775.64	10 yr	350.00	6848.46	6850.82	6850.77	6851.33	0.020810	5.72	61.23	55.35	0.96
Thalweg	1760.64	10 yr	350.00	6848.13	6850.68		6851.05	0.012208	4.83	72.45	56.45	0.75
Thalweg	1745.64	10 yr	350.00	6847.83	6850.57		6850.87	0.008979	4.40	79.49	56.43	0.65
Thalweg	1732.51	10 yr	350.00	6847.57	6850.26	6850.09	6850.70	0.015899	5.36	65.26	52.82	0.85
Thalweg	1719.42	10 yr	350.00	6847.29	6849.88	6849.88	6850.45	0.021281	6.06	57.71	48.29	0.98
Thalweg	1700.64	10 yr	350.00	6846.92	6849.50	6849.22	6849.86	0.011318	4.78	73.24	54.63	0.73
Thalweg	1685.64	10 yr	350.00	6846.60	6849.54		6849.71	0.003794	3.30	105.94	60.61	0.44
Thalweg	1670.64	10 yr	350.00	6846.40	6849.53		6849.65	0.002423	2.84	123.27	63.27	0.36
Thalweg	1655.64	10 yr	350.00	6846.35	6849.48		6849.61	0.002653	2.97	117.67	60.28	0.38
Thalweg	1640.64	10 yr	350.00	6846.27	6849.40		6849.57	0.003297	3.23	108.37	57.66	0.42
Thalweg	1625.64	10 yr	350.00	6846.39	6849.41		6849.51	0.001654	2.57	136.42	60.94	0.30
Thalweg	1612.4	10 yr	350.00	6845.98	6849.41		6849.49	0.001159	2.19	159.72	69.21	0.25
Thalweg	1595.64	10 yr	350.00	6845.21	6849.41		6849.47	0.000822	1.88	186.58	78.72	0.21
Thalweg	1580.64	10 yr	350.00	6844.57	6849.41		6849.45	0.000630	1.59	220.53	98.05	0.19
Thalweg	1565.64	10 yr	350.00	6844.54	6849.42		6849.44	0.000316	1.23	285.61	111.81	0.14
Thalweg	1550.64	10 yr	350.00	6844.84	6849.41		6849.43	0.000242	1.12	313.22	115.65	0.12
Thalweg	1535.64	10 yr	350.00	6845.14	6849.41		6849.43	0.000237	1.07	326.10	126.08	0.12
Thalweg	1520.64	10 yr	350.00	6844.98	6849.41		6849.43	0.000200	1.02	342.09	124.93	0.11
Thalweg	1505.64	10 yr	350.00	6844.82	6849.41		6849.42	0.000176	1.00	351.55	121.67	0.10
Thalweg	1498.37	10 yr	350.00	6844.75	6849.41		6849.42	0.000167	0.99	355.31	119.73	0.10
Thalweg	1472.45	10 yr	350.00	6844.59	6849.40		6849.42	0.000156	1.00	350.85	110.03	0.10
Thalweg	1454.87	10 yr	350.00	6844.47	6849.40		6849.41	0.000128	0.94	372.61	110.60	0.09
Thalweg	1438.37	10 yr	350.00	6844.38	6849.40		6849.41	0.000114	0.89	393.79	116.64	0.09
Thalweg	1415.55	10 yr	350.00	6844.27	6849.40		6849.41	0.000107	0.88	397.29	112.94	0.08
Thalweg	1400.64	10 yr	350.00	6844.11	6849.39		6849.41	0.000113	0.91	383.03	107.72	0.09
Thalweg	1385.64	10 yr	350.00	6843.97	6849.39		6849.40	0.000139	0.99	354.55	103.64	0.09
Thalweg	1370.82	10 yr	350.00	6844.02	6849.39		6849.40	0.000152	1.02	341.94	101.25	0.10
Thalweg	1355.64	10 yr	350.00	6844.23	6849.38		6849.40	0.000207	1.14	306.20	97.10	0.11
Thalweg	1340.64	10 yr	350.00	6844.32	6849.37		6849.40	0.000222	1.18	296.42	94.28	0.12
Thalweg	1325.64	10 yr	350.00	6844.59	6849.37		6849.39	0.000289	1.31	267.67	88.87	0.13
Thalweg	1310.64	10 yr	350.00	6845.55	6849.34		6849.38	0.000540	1.63	214.39	81.60	0.18
Thalweg	1295.64	10 yr	350.00	6845.29	6849.33		6849.38	0.000631	1.77	197.32	74.51	0.19
Thalweg	1292.13	10 yr	350.00	6845.23	6849.33		6849.37	0.000597	1.74	200.68	74.49	0.19
Thalweg	1280.64	10 yr	350.00	6845.03	6849.32		6849.37	0.000531	1.69	206.87	73.64	0.18
Thalweg	1265.64	10 yr	350.00	6844.78	6849.31		6849.36	0.000513	1.69	207.23	71.97	0.18
Thalweg	1255.39	10 yr	350.00	6844.60	6849.31		6849.35	0.000523	1.71	204.57	70.68	0.18
Thalweg	1250.64	10 yr	350.00	6844.52	6849.30		6849.35	0.000540	1.73	201.78	69.91	0.18
Thalweg	1242	10 yr	350.00	6844.37	6849.30	6846.70	6849.35	0.000545	1.74	201.11	69.53	0.18
Thalweg	1206.75		Culvert									
Thalweg	1175.64	10 yr	350.00	6843.55	6849.16		6849.21	0.000773	1.88	186.38	73.66	0.21
Thalweg	1172.19	10 yr	350.00	6843.48	6849.15		6849.21	0.000951	1.97	177.66	77.16	0.23
Thalweg	1145.64	10 yr	350.00	6845.00	6849.10		6849.18	0.001393	2.29	152.68	70.99	0.28
Thalweg	1136.9	10 yr	350.00	6844.94	6849.11		6849.16	0.000607	1.77	197.20	71.66	0.19
Thalweg	1115.64	10 yr	350.00	6844.92	6849.10		6849.15	0.000525	1.68	207.84	73.66	0.18
Thalweg	1100.64	10 yr	350.00	6844.91	6849.09		6849.14	0.000653	1.79	195.89	75.15	0.20
Thalweg	1085.64	10 yr	350.00	6844.89	6849.04		6849.11	0.004190	2.18	160.55	65.06	0.24
Thalweg	1070.64	10 yr	350.00	6844.87	6848.86		6849.01	0.010384	3.13	111.95	52.05	0.38
Thalweg	1065.06	10 yr	350.00	6844.87	6848.66		6848.92	0.021278	4.11	85.20	44.98	0.53
Thalweg	1040.64	10 yr	350.00	6844.90	6848.39		6848.54	0.010220	3.12	112.04	51.58	0.37
Thalweg	1025.64	10 yr	350.00	6844.93	6848.29		6848.40	0.006917	2.66	131.40	57.41	0.31
Thalweg	1010.64	10 yr	350.00	6844.95	6848.23		6848.31	0.004936	2.23	157.14	69.91	0.26
Thalweg	995.64	10 yr	350.00	6844.99	6848.17		6848.24	0.003758	2.04	171.92	71.20	0.23
Thalweg	980.64	10 yr	350.00	6845.07	6848.10		6848.17	0.004682	2.18	160.58	70.88	0.26
Thalweg	965.64	10 yr	350.00	6845.16	6848.00		6848.09	0.006437	2.41	145.02	69.83	0.30
Thalweg	950.64	10 yr	350.00	6845.24	6847.85		6847.97	0.009711	2.77	126.50	67.60	0.36
Thalweg	938.07	10 yr	350.00	6845.30	6847.63	6846.92	6847.80	0.017489	3.36	104.13	64.68	0.47

HEC-RAS Plan: Plan 02 River: Sinclair Wash Reach: Thalweg Profile: 50 yr

Reload Dat

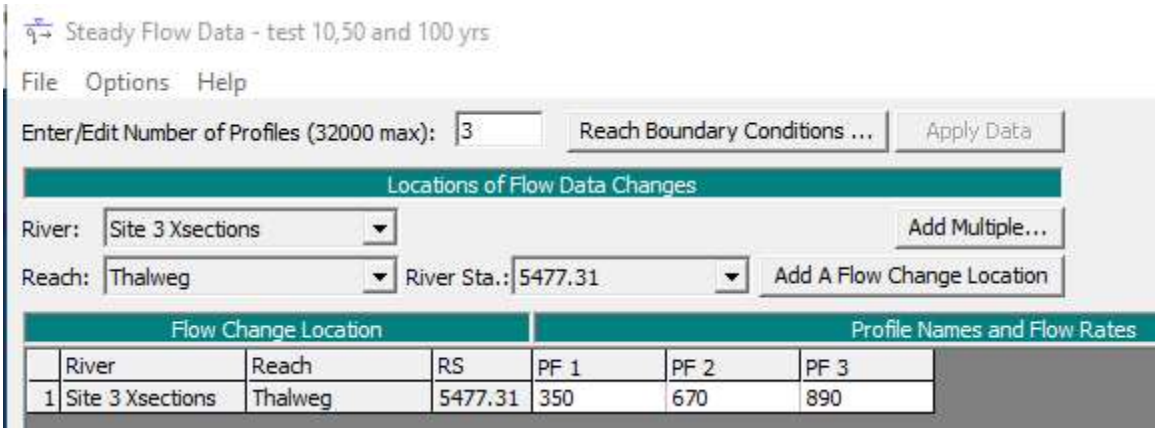
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Thalweg	1835.64	50 yr	670.00	6849.55	6853.27	6852.01	6853.44	0.009904	3.32	201.55	82.83	0.38
Thalweg	1820.64	50 yr	670.00	6849.47	6852.98		6853.24	0.017517	4.13	162.32	73.69	0.49
Thalweg	1805.64	50 yr	670.00	6849.25	6852.44		6852.86	0.035543	5.23	128.04	69.38	0.68
Thalweg	1790.64	50 yr	670.00	6848.86	6851.73	6851.70	6852.44	0.019778	6.81	98.45	65.68	0.98
Thalweg	1775.64	50 yr	670.00	6848.46	6851.54	6851.38	6852.15	0.015330	6.28	106.60	66.31	0.87
Thalweg	1760.64	50 yr	670.00	6848.13	6851.44		6851.92	0.010836	5.60	119.70	68.34	0.75
Thalweg	1745.64	50 yr	670.00	6847.83	6851.32		6851.76	0.008946	5.30	126.32	67.61	0.68
Thalweg	1732.51	50 yr	670.00	6847.57	6851.07		6851.61	0.012215	5.91	113.37	65.08	0.79
Thalweg	1719.42	50 yr	670.00	6847.29	6850.99		6851.45	0.009239	5.43	123.39	65.12	0.70
Thalweg	1700.64	50 yr	670.00	6846.92	6851.04		6851.28	0.003573	3.94	170.02	71.18	0.45
Thalweg	1685.64	50 yr	670.00	6846.60	6851.06		6851.22	0.001930	3.18	210.57	77.06	0.34
Thalweg	1670.64	50 yr	670.00	6846.40	6851.06		6851.19	0.001403	2.88	232.98	80.20	0.29
Thalweg	1655.64	50 yr	670.00	6846.35	6851.02		6851.16	0.001589	2.99	224.22	77.48	0.31
Thalweg	1640.64	50 yr	670.00	6846.27	6850.98		6851.14	0.001815	3.14	213.42	75.63	0.33
Thalweg	1625.64	50 yr	670.00	6846.39	6850.99		6851.10	0.001196	2.68	249.59	81.64	0.27
Thalweg	1612.4	50 yr	670.00	6845.98	6850.99		6851.08	0.000840	2.39	280.59	83.83	0.23
Thalweg	1595.64	50 yr	670.00	6845.21	6851.00		6851.06	0.000640	2.04	328.63	101.53	0.20
Thalweg	1580.64	50 yr	670.00	6844.57	6851.00		6851.05	0.000408	1.71	393.66	119.48	0.16
Thalweg	1565.64	50 yr	670.00	6844.54	6851.01		6851.04	0.000239	1.41	477.54	127.31	0.13
Thalweg	1550.64	50 yr	670.00	6844.84	6851.01		6851.03	0.000204	1.32	509.22	130.31	0.12
Thalweg	1535.64	50 yr	670.00	6845.14	6851.01		6851.03	0.000180	1.24	541.22	140.93	0.11
Thalweg	1520.64	50 yr	670.00	6844.98	6851.01		6851.03	0.000169	1.20	556.74	142.41	0.11
Thalweg	1505.64	50 yr	670.00	6844.82	6851.00		6851.03	0.000167	1.19	562.70	142.62	0.11
Thalweg	1498.37	50 yr	670.00	6844.75	6851.00		6851.02	0.000163	1.19	563.47	141.02	0.10
Thalweg	1472.45	50 yr	670.00	6844.59	6851.00		6851.02	0.000168	1.23	543.54	131.47	0.11
Thalweg	1454.87	50 yr	670.00	6844.47	6850.99		6851.02	0.000143	1.20	560.27	125.38	0.10
Thalweg	1438.37	50 yr	670.00	6844.38	6850.99		6851.01	0.000127	1.13	591.40	131.68	0.09
Thalweg	1415.55	50 yr	670.00	6844.27	6850.99		6851.01	0.000122	1.14	585.77	124.17	0.09
Thalweg	1400.64	50 yr	670.00	6844.11	6850.99		6851.01	0.000132	1.19	563.36	119.36	0.10
Thalweg	1385.64	50 yr	670.00	6843.97	6850.98		6851.01	0.000158	1.26	529.86	117.14	0.10
Thalweg	1370.82	50 yr	670.00	6844.02	6850.98		6851.00	0.000171	1.30	515.27	116.53	0.11
Thalweg	1355.64	50 yr	670.00	6844.23	6850.97		6851.00	0.000218	1.42	473.44	113.17	0.12
Thalweg	1340.64	50 yr	670.00	6844.32	6850.96		6851.00	0.000231	1.47	457.20	107.98	0.13
Thalweg	1325.64	50 yr	670.00	6844.59	6850.95		6850.99	0.000287	1.60	419.70	102.56	0.14
Thalweg	1310.64	50 yr	670.00	6845.55	6850.93		6850.99	0.000458	1.88	355.91	96.46	0.17
Thalweg	1295.64	50 yr	670.00	6845.29	6850.91		6850.98	0.000556	2.03	330.77	92.98	0.19
Thalweg	1292.13	50 yr	670.00	6845.23	6850.91		6850.98	0.000529	2.03	330.80	89.55	0.19
Thalweg	1280.64	50 yr	670.00	6845.03	6850.91		6850.97	0.000483	2.00	335.63	88.67	0.18
Thalweg	1265.64	50 yr	670.00	6844.78	6850.90		6850.96	0.000469	2.03	332.59	85.83	0.18
Thalweg	1255.39	50 yr	670.00	6844.60	6850.89		6850.96	0.000480	2.06	327.44	84.19	0.18
Thalweg	1250.64	50 yr	670.00	6844.52	6850.89		6850.96	0.000491	2.08	323.01	83.12	0.18
Thalweg	1242	50 yr	670.00	6844.37	6850.88	6847.48	6850.95	0.000469	2.12	321.31	82.58	0.18
Thalweg	1206.75		Culvert									
Thalweg	1175.64	50 yr	670.00	6843.55	6850.82		6850.89	0.000543	2.05	331.50	95.82	0.19
Thalweg	1172.19	50 yr	670.00	6843.48	6850.82		6850.89	0.000605	2.10	328.63	108.03	0.20
Thalweg	1145.64	50 yr	670.00	6845.00	6850.78		6850.87	0.000778	2.40	284.83	90.59	0.22
Thalweg	1136.9	50 yr	670.00	6844.94	6850.79		6850.85	0.000505	2.05	326.49	82.79	0.18
Thalweg	1115.64	50 yr	670.00	6844.92	6850.78		6850.84	0.000449	1.96	341.29	85.19	0.17
Thalweg	1100.64	50 yr	670.00	6844.91	6850.77		6850.83	0.000509	1.98	337.73	91.62	0.18
Thalweg	1085.64	50 yr	670.00	6844.89	6850.73		6850.82	0.003155	2.33	288.07	85.56	0.22
Thalweg	1070.64	50 yr	670.00	6844.87	6850.60		6850.75	0.006191	3.03	220.85	72.85	0.31
Thalweg	1065.06	50 yr	670.00	6844.87	6850.50		6850.70	0.009403	3.56	188.34	66.87	0.37
Thalweg	1040.64	50 yr	670.00	6844.90	6850.39		6850.52	0.004947	2.80	239.02	75.06	0.28
Thalweg	1025.64	50 yr	670.00	6844.93	6850.35		6850.44	0.003509	2.43	275.44	82.81	0.24
Thalweg	1010.64	50 yr	670.00	6844.95	6850.33		6850.40	0.002227	2.07	324.06	88.41	0.19
Thalweg	995.64	50 yr	670.00	6844.99	6850.30		6850.36	0.001863	1.96	341.09	87.66	0.18
Thalweg	980.64	50 yr	670.00	6845.07	6850.27		6850.33	0.002006	2.03	329.90	85.15	0.18
Thalweg	965.64	50 yr	670.00	6845.16	6850.23		6850.30	0.002213	2.09	320.24	85.21	0.19
Thalweg	950.64	50 yr	670.00	6845.24	6850.19		6850.27	0.002567	2.20	305.23	84.58	0.20
Thalweg	938.07	50 yr	670.00	6845.30	6850.15	6847.49	6850.23	0.002963	2.32	289.37	82.39	0.22

HEC-RAS Plan: Plan 02 River: Sinclair Wash Reach: Thalweg Profile: 100 yr

Reload Da

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Thalweg	1835.64	100 yr	890.00	6849.55	6853.70	6852.31	6853.92	0.010462	3.75	237.54	85.05	0.39
Thalweg	1820.64	100 yr	890.00	6849.47	6853.37		6853.70	0.018502	4.65	191.50	75.68	0.52
Thalweg	1805.64	100 yr	890.00	6849.25	6852.74		6853.29	0.038970	5.96	149.29	71.19	0.73
Thalweg	1790.64	100 yr	890.00	6848.86	6852.50		6853.04	0.009166	5.90	150.82	69.74	0.71
Thalweg	1775.64	100 yr	890.00	6848.46	6852.47		6852.89	0.006252	5.22	170.53	71.21	0.59
Thalweg	1760.64	100 yr	890.00	6848.13	6852.46		6852.78	0.004492	4.58	194.47	77.35	0.51
Thalweg	1745.64	100 yr	890.00	6847.83	6852.43		6852.71	0.003873	4.21	211.42	85.30	0.47
Thalweg	1732.51	100 yr	890.00	6847.57	6852.38		6852.65	0.003814	4.24	209.98	82.86	0.47
Thalweg	1719.42	100 yr	890.00	6847.29	6852.35		6852.60	0.003083	3.97	224.28	83.18	0.43
Thalweg	1700.64	100 yr	890.00	6846.92	6852.37		6852.54	0.001570	3.26	274.09	85.48	0.31
Thalweg	1685.64	100 yr	890.00	6846.60	6852.38		6852.50	0.000965	2.80	321.81	91.37	0.25
Thalweg	1670.64	100 yr	890.00	6846.40	6852.38		6852.49	0.000764	2.60	348.92	94.85	0.23
Thalweg	1655.64	100 yr	890.00	6846.35	6852.36		6852.47	0.000831	2.66	337.97	92.38	0.24
Thalweg	1640.64	100 yr	890.00	6846.27	6852.34		6852.46	0.000927	2.74	327.14	91.49	0.25
Thalweg	1625.64	100 yr	890.00	6846.39	6852.35		6852.44	0.000673	2.40	371.50	97.54	0.21
Thalweg	1612.4	100 yr	890.00	6845.98	6852.35		6852.43	0.000515	2.21	404.92	101.39	0.19
Thalweg	1595.64	100 yr	890.00	6845.21	6852.36		6852.41	0.000359	1.88	481.05	122.16	0.16
Thalweg	1580.64	100 yr	890.00	6844.57	6852.37		6852.41	0.000238	1.60	568.05	134.85	0.13
Thalweg	1565.64	100 yr	890.00	6844.54	6852.37		6852.40	0.000153	1.37	657.92	137.69	0.11
Thalweg	1550.64	100 yr	890.00	6844.84	6852.37		6852.40	0.000134	1.29	695.39	142.91	0.10
Thalweg	1535.64	100 yr	890.00	6845.14	6852.37		6852.39	0.000119	1.22	740.25	150.95	0.09
Thalweg	1520.64	100 yr	890.00	6844.98	6852.37		6852.39	0.000113	1.18	758.55	153.34	0.09
Thalweg	1505.64	100 yr	890.00	6844.82	6852.37		6852.39	0.000113	1.17	765.52	154.52	0.09
Thalweg	1498.37	100 yr	890.00	6844.75	6852.37		6852.39	0.000114	1.17	765.33	153.80	0.09
Thalweg	1472.45	100 yr	890.00	6844.59	6852.36		6852.39	0.000127	1.21	735.63	149.82	0.10
Thalweg	1454.87	100 yr	890.00	6844.47	6852.36		6852.38	0.000117	1.20	742.67	142.61	0.09
Thalweg	1438.37	100 yr	890.00	6844.38	6852.36		6852.38	0.000100	1.14	778.55	142.39	0.09
Thalweg	1415.55	100 yr	890.00	6844.27	6852.36		6852.38	0.000100	1.17	762.57	134.65	0.09
Thalweg	1400.64	100 yr	890.00	6844.11	6852.35		6852.38	0.000109	1.21	733.99	130.90	0.09
Thalweg	1385.64	100 yr	890.00	6843.97	6852.35		6852.37	0.000127	1.27	698.48	129.61	0.10
Thalweg	1370.82	100 yr	890.00	6844.02	6852.35		6852.37	0.000136	1.30	683.50	129.30	0.10
Thalweg	1355.64	100 yr	890.00	6844.23	6852.34		6852.37	0.000165	1.40	636.96	125.32	0.11
Thalweg	1340.64	100 yr	890.00	6844.32	6852.33		6852.37	0.000176	1.45	613.18	119.79	0.11
Thalweg	1325.64	100 yr	890.00	6844.59	6852.33		6852.36	0.000211	1.57	568.47	114.38	0.12
Thalweg	1310.64	100 yr	890.00	6845.55	6852.31		6852.36	0.000302	1.79	497.31	108.70	0.15
Thalweg	1295.64	100 yr	890.00	6845.29	6852.30		6852.35	0.000340	1.91	469.03	106.92	0.16
Thalweg	1292.13	100 yr	890.00	6845.23	6852.29		6852.35	0.000346	1.93	463.62	102.43	0.16
Thalweg	1280.64	100 yr	890.00	6845.03	6852.29		6852.35	0.000321	1.94	466.12	100.20	0.15
Thalweg	1265.64	100 yr	890.00	6844.78	6852.28		6852.34	0.000314	1.99	459.28	97.33	0.15
Thalweg	1255.39	100 yr	890.00	6844.60	6852.28		6852.34	0.000317	2.03	452.10	95.92	0.15
Thalweg	1250.64	100 yr	890.00	6844.52	6852.27		6852.34	0.000323	2.05	446.16	94.69	0.15
Thalweg	1242	100 yr	890.00	6844.37	6852.27	6847.88	6852.33	0.000317	2.09	448.99	101.94	0.15
Thalweg	1206.75		Culvert									
Thalweg	1175.64	100 yr	890.00	6843.55	6852.24		6852.30	0.000323	1.96	476.83	109.87	0.15
Thalweg	1172.19	100 yr	890.00	6843.48	6852.24		6852.29	0.000332	1.95	493.98	124.09	0.15
Thalweg	1145.64	100 yr	890.00	6845.00	6852.21		6852.28	0.000485	2.21	425.21	108.91	0.18
Thalweg	1136.9	100 yr	890.00	6844.94	6852.21		6852.27	0.000343	1.97	456.25	101.57	0.16
Thalweg	1115.64	100 yr	890.00	6844.92	6852.21		6852.27	0.000316	1.89	470.14	97.25	0.15
Thalweg	1100.64	100 yr	890.00	6844.91	6852.21		6852.26	0.000312	1.88	476.04	101.41	0.15
Thalweg	1085.64	100 yr	890.00	6844.89	6852.18		6852.25	0.001838	2.11	424.20	102.18	0.18
Thalweg	1070.64	100 yr	890.00	6844.87	6852.11		6852.21	0.003201	2.60	343.73	90.78	0.23
Thalweg	1065.06	100 yr	890.00	6844.87	6852.06		6852.19	0.004333	2.91	306.48	85.32	0.27
Thalweg	1040.64	100 yr	890.00	6844.90	6852.01		6852.10	0.002490	2.38	375.92	94.98	0.21
Thalweg	1025.64	100 yr	890.00	6844.93	6851.99		6852.06	0.001786	2.10	425.70	100.43	0.18
Thalweg	1010.64	100 yr	890.00	6844.95	6851.98		6852.03	0.001199	1.86	480.64	104.45	0.15
Thalweg	995.64	100 yr	890.00	6844.99	6851.96		6852.01	0.001066	1.80	499.21	104.88	0.14
Thalweg	980.64	100 yr	890.00	6845.07	6851.94		6852.00	0.001163	1.85	481.96	98.72	0.14
Thalweg	965.64	100 yr	890.00	6845.16	6851.92		6851.98	0.001238	1.89	471.59	94.26	0.15
Thalweg	950.64	100 yr	890.00	6845.24	6851.90		6851.96	0.001354	1.94	458.32	93.96	0.16
Thalweg	938.07	100 yr	890.00	6845.30	6851.88	6847.82	6851.94	0.001512	2.01	442.36	93.47	0.16

Appendix S: Corrected Effective Model Site 3 HEC RAS cross section summary table



HEC-RAS Plan: Plan 02 River: Sinclair Wah Reach: Thalweg Profile: 10 yr

Reload Da

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Thalweg	908.07	10 yr	350.00	6845.47	6850.79		6850.81	0.001608	1.19	293.12	77.23	0.11
Thalweg	893.07	10 yr	350.00	6845.55	6850.75		6850.78	0.002187	1.36	256.41	69.42	0.13
Thalweg	878.07	10 yr	350.00	6845.63	6850.70		6850.74	0.003250	1.60	219.01	62.84	0.15
Thalweg	863.07	10 yr	350.00	6845.71	6850.62		6850.68	0.005394	1.87	186.78	61.89	0.19
Thalweg	839.65	10 yr	350.00	6845.65	6850.48		6850.54	0.006565	1.99	175.46	61.37	0.21
Thalweg	818.97	10 yr	350.00	6845.40	6850.42		6850.45	0.002631	1.45	241.19	68.40	0.14
Thalweg	801.55	10 yr	350.00	6845.18	6850.37		6850.40	0.002954	1.51	232.50	68.31	0.14
Thalweg	793.29	10 yr	350.00	6845.06	6850.32		6850.37	0.004393	1.77	197.63	61.08	0.17
Thalweg	773.07	10 yr	350.00	6844.84	6850.15		6850.24	0.010183	2.36	148.05	56.83	0.26
Thalweg	758.07	10 yr	350.00	6844.77	6849.99		6850.09	0.009525	2.36	145.43	60.80	0.25
Thalweg	743.07	10 yr	350.00	6844.72	6849.84		6849.97	0.006166	2.03	155.70	60.92	0.20
Thalweg	728.07	10 yr	350.00	6844.67	6849.74		6849.89	0.004144	1.72	168.47	64.17	0.17
Thalweg	713.07	10 yr	350.00	6844.63	6849.68		6849.83	0.003213	1.55	178.00	68.02	0.15
Thalweg	698.07	10 yr	350.00	6844.58	6849.64		6849.79	0.002811	1.47	179.82	69.83	0.14
Thalweg	683.07	10 yr	350.00	6844.54	6849.53		6849.74	0.003681	1.55	159.80	72.29	0.16
Thalweg	668.07	10 yr	350.00	6844.51	6849.47		6849.68	0.003740	1.56	154.72	74.03	0.16
Thalweg	653.07	10 yr	350.00	6844.49	6849.40		6849.62	0.003888	1.57	151.31	74.31	0.16
Thalweg	649.57	10 yr	350.00	6844.48	6849.38		6849.61	0.003931	1.58	149.89	74.30	0.16
Thalweg	638.07	10 yr	350.00	6844.46	6849.32		6849.56	0.004475	1.66	145.56	73.65	0.17
Thalweg	623.07	10 yr	350.00	6844.44	6849.18		6849.47	0.007158	1.96	130.51	70.64	0.21
Thalweg	608.07	10 yr	350.00	6844.17	6849.17		6849.37	0.003573	1.50	162.35	78.24	0.15
Thalweg	593.07	10 yr	350.00	6844.05	6849.15		6849.32	0.001933	1.11	188.15	88.30	0.11
Thalweg	578.07	10 yr	350.00	6844.02	6849.15		6849.29	0.001100	0.87	221.92	91.34	0.09
Thalweg	563.07	10 yr	350.00	6843.84	6849.16		6849.26	0.000949	0.85	250.22	94.15	0.08
Thalweg	548.07	10 yr	350.00	6843.66	6849.15		6849.24	0.001158	0.94	256.72	97.25	0.09
Thalweg	533.07	10 yr	350.00	6844.19	6849.17		6849.22	0.000758	1.12	259.46	96.36	0.11
Thalweg	518.07	10 yr	350.00	6844.73	6849.14		6849.20	0.001182	1.29	233.64	94.49	0.13
Thalweg	490.29	10 yr	350.00	6844.62	6849.14		6849.17	0.000669	1.10	299.52	102.79	0.10
Thalweg	485.4	10 yr	350.00	6844.32	6849.14		6849.17	0.000443	0.96	335.57	93.11	0.09
Thalweg	473.07	10 yr	350.00	6844.18	6849.14		6849.16	0.000637	1.08	322.62	96.76	0.10
Thalweg	458.07	10 yr	350.00	6844.05	6849.13		6849.15	0.000119	1.13	309.89	89.99	0.11
Thalweg	443.07	10 yr	350.00	6844.05	6849.12		6849.15	0.000186	1.31	266.22	83.99	0.13
Thalweg	428.07	10 yr	350.00	6844.09	6849.10		6849.14	0.003752	1.54	227.98	77.98	0.16
Thalweg	413.07	10 yr	350.00	6844.12	6849.04		6849.08	0.004787	1.64	214.50	85.10	0.18
Thalweg	398.07	10 yr	350.00	6843.87	6848.94		6848.99	0.006733	1.80	194.62	84.69	0.21
Thalweg	383.07	10 yr	350.00	6843.98	6848.82		6848.88	0.008067	1.93	181.72	78.76	0.22
Thalweg	368.07	10 yr	350.00	6844.07	6848.71		6848.76	0.007380	1.85	188.97	81.45	0.21
Thalweg	348.9	10 yr	350.00	6844.07	6848.58		6848.63	0.006880	1.79	195.33	84.09	0.21
Thalweg	338.07	10 yr	350.00	6844.07	6848.50		6848.55	0.006633	1.76	198.84	89.40	0.20
Thalweg	323.07	10 yr	350.00	6844.07	6848.40		6848.45	0.006851	1.77	199.22	99.19	0.21
Thalweg	308.07	10 yr	350.00	6843.94	6848.28		6848.34	0.008206	1.87	188.42	98.09	0.22
Thalweg	293.07	10 yr	350.00	6843.81	6848.17		6848.23	0.006673	1.88	188.18	84.52	0.21
Thalweg	278.07	10 yr	350.00	6843.68	6848.10		6848.15	0.004217	1.64	214.68	83.79	0.17
Thalweg	263.07	10 yr	350.00	6843.63	6848.04		6848.08	0.004370	1.71	207.00	83.04	0.17
Thalweg	240.97	10 yr	350.00	6843.57	6847.89		6847.95	0.007755	2.05	173.02	81.07	0.22
Thalweg	233.07	10 yr	350.00	6843.54	6847.83		6847.91	0.004038	2.18	162.08	72.17	0.24
Thalweg	218.07	10 yr	350.00	6843.49	6847.75		6847.84	0.005222	2.37	149.18	70.00	0.27
Thalweg	203.07	10 yr	350.00	6843.38	6847.66		6847.75	0.005817	2.46	143.89	69.12	0.29
Thalweg	188.07	10 yr	350.00	6843.21	6847.59		6847.67	0.004941	2.33	151.64	69.66	0.26
Thalweg	173.07	10 yr	350.00	6843.04	6847.53		6847.60	0.004140	2.18	162.75	73.02	0.24
Thalweg	158.07	10 yr	350.00	6842.93	6847.47		6847.54	0.003793	2.10	168.42	74.48	0.23
Thalweg	143.07	10 yr	350.00	6842.84	6847.42		6847.48	0.003458	2.07	171.13	72.71	0.22
Thalweg	132.38	10 yr	350.00	6842.77	6847.38		6847.45	0.003437	2.09	169.85	71.59	0.22
Thalweg	124.45	10 yr	350.00	6842.74	6847.35		6847.42	0.003981	2.17	163.77	73.99	0.24
Thalweg	113.07	10 yr	350.00	6842.74	6847.28		6847.37	0.004755	2.33	151.78	70.23	0.26
Thalweg	98.07	10 yr	350.00	6842.74	6847.19		6847.29	0.005930	2.54	138.56	63.89	0.29
Thalweg	83.07	10 yr	350.00	6842.74	6847.06		6847.18	0.007852	2.82	124.19	56.58	0.33
Thalweg	68.07	10 yr	350.00	6842.74	6846.95		6847.07	0.007517	2.75	127.20	56.24	0.32
Thalweg	53.07	10 yr	350.00	6842.72	6846.85		6846.96	0.006395	2.62	133.49	56.13	0.30
Thalweg	38.07	10 yr	350.00	6842.71	6846.68		6846.84	0.009839	3.18	110.05	47.56	0.37
Thalweg	24.07	10 yr	350.00	6842.69	6846.34		6846.63	0.019728	4.32	81.01	36.85	0.51
Thalweg	10.64	10 yr	350.00	6842.59	6846.10	6845.10	6846.38	0.018232	4.23	82.84	36.60	0.50
Thalweg	0	10 yr	350.00	6842.51	6845.05	6845.05	6845.95	0.081878	7.64	45.81	25.54	1.01

HEC-RAS Plan: Plan 02 River: Sinclair Wah Reach: Thalweg Profile: 50 yr

Reload Da

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Thalweg	938.07	50 yr	670.00	6845.30	6852.24	6847.49	6852.27	0.001544	1.41	476.44	95.15	0.11
Thalweg	923.07	50 yr	670.00	6845.38	6852.21		6852.25	0.001734	1.47	454.38	92.09	0.12
Thalweg	908.07	50 yr	670.00	6845.47	6852.17		6852.21	0.002267	1.66	404.56	83.98	0.13
Thalweg	893.07	50 yr	670.00	6845.55	6852.12		6852.17	0.003176	1.88	356.26	78.60	0.16
Thalweg	878.07	50 yr	670.00	6845.63	6852.04		6852.11	0.004764	2.14	312.78	77.07	0.19
Thalweg	863.07	50 yr	670.00	6845.71	6851.94		6852.03	0.006951	2.42	277.02	75.71	0.22
Thalweg	839.65	50 yr	670.00	6845.65	6851.75		6851.85	0.008222	2.56	261.78	74.56	0.24
Thalweg	818.97	50 yr	670.00	6845.40	6851.66		6851.72	0.004206	2.01	333.17	82.38	0.18
Thalweg	801.55	50 yr	670.00	6845.18	6851.58		6851.64	0.004500	2.08	322.23	83.80	0.18
Thalweg	793.29	50 yr	670.00	6845.06	6851.51		6851.60	0.006070	2.39	279.29	78.66	0.21
Thalweg	773.07	50 yr	670.00	6844.84	6851.22		6851.43	0.010270	2.85	219.77	73.52	0.27
Thalweg	758.07	50 yr	670.00	6844.77	6850.91		6851.26	0.009988	2.80	205.91	70.90	0.26
Thalweg	743.07	50 yr	670.00	6844.72	6850.68		6851.12	0.007146	2.48	210.33	69.14	0.23
Thalweg	728.07	50 yr	670.00	6844.67	6850.61		6851.03	0.004687	2.08	229.23	74.47	0.18
Thalweg	713.07	50 yr	670.00	6844.63	6850.59		6850.95	0.003458	1.82	245.97	81.61	0.16
Thalweg	698.07	50 yr	670.00	6844.58	6850.57		6850.89	0.002861	1.69	251.92	85.82	0.15
Thalweg	683.07	50 yr	670.00	6844.54	6850.45		6850.84	0.003141	1.64	234.86	90.25	0.15
Thalweg	668.07	50 yr	670.00	6844.51	6850.41		6850.79	0.002789	1.54	233.64	92.64	0.14
Thalweg	653.07	50 yr	670.00	6844.49	6850.38		6850.75	0.002635	1.50	234.62	95.13	0.14
Thalweg	649.57	50 yr	670.00	6844.48	6850.37		6850.73	0.002581	1.49	234.44	95.55	0.14
Thalweg	638.07	50 yr	670.00	6844.46	6850.34		6850.70	0.002749	1.52	231.90	96.37	0.14
Thalweg	623.07	50 yr	670.00	6844.44	6850.21		6850.64	0.003833	1.71	214.53	93.56	0.16
Thalweg	608.07	50 yr	670.00	6844.17	6850.26		6850.56	0.002132	1.37	260.27	101.69	0.12
Thalweg	593.07	50 yr	670.00	6844.05	6850.27		6850.52	0.001228	1.05	295.57	104.42	0.09
Thalweg	578.07	50 yr	670.00	6844.02	6850.28		6850.49	0.000873	0.92	333.66	105.53	0.08
Thalweg	563.07	50 yr	670.00	6843.84	6850.28		6850.48	0.000811	0.92	363.20	105.62	0.08
Thalweg	548.07	50 yr	670.00	6843.66	6850.25		6850.46	0.000992	0.99	369.03	107.29	0.09
Thalweg	533.07	50 yr	670.00	6844.19	6850.29		6850.42	0.000759	1.27	375.97	110.27	0.11
Thalweg	518.07	50 yr	670.00	6844.73	6850.26		6850.41	0.001084	1.47	344.53	104.06	0.13
Thalweg	490.29	50 yr	670.00	6844.62	6850.29		6850.37	0.000747	1.31	423.14	115.33	0.11
Thalweg	485.4	50 yr	670.00	6844.32	6850.31		6850.35	0.000738	1.35	455.64	121.35	0.11
Thalweg	473.07	50 yr	670.00	6844.18	6850.30		6850.34	0.000856	1.47	442.72	110.07	0.12
Thalweg	458.07	50 yr	670.00	6844.05	6850.29		6850.33	0.000176	1.61	420.77	101.24	0.13
Thalweg	443.07	50 yr	670.00	6844.05	6850.28		6850.33	0.000256	1.82	369.55	95.20	0.16
Thalweg	428.07	50 yr	670.00	6844.09	6850.25		6850.32	0.004816	2.04	330.04	98.70	0.19
Thalweg	413.07	50 yr	670.00	6844.12	6850.17		6850.24	0.005400	2.10	315.85	94.85	0.20
Thalweg	398.07	50 yr	670.00	6843.87	6850.07		6850.15	0.006837	2.29	292.75	91.80	0.22
Thalweg	383.07	50 yr	670.00	6843.98	6849.95		6850.04	0.007707	2.36	286.32	102.10	0.23
Thalweg	368.07	50 yr	670.00	6844.07	6849.85		6849.93	0.006827	2.25	298.74	103.20	0.22
Thalweg	348.9	50 yr	670.00	6844.07	6849.73		6849.80	0.006203	2.16	309.74	105.25	0.21
Thalweg	338.07	50 yr	670.00	6844.07	6849.67		6849.74	0.005825	2.10	317.28	106.62	0.20
Thalweg	323.07	50 yr	670.00	6844.07	6849.58		6849.65	0.005656	2.07	321.75	108.56	0.20
Thalweg	308.07	50 yr	670.00	6843.94	6849.49		6849.56	0.006056	2.10	314.56	110.19	0.21
Thalweg	293.07	50 yr	670.00	6843.81	6849.39		6849.47	0.006312	2.18	301.15	101.10	0.21
Thalweg	278.07	50 yr	670.00	6843.68	6849.32		6849.39	0.004374	2.06	320.95	91.30	0.18
Thalweg	263.07	50 yr	670.00	6843.63	6849.25		6849.32	0.004638	2.08	313.89	94.06	0.18
Thalweg	240.97	50 yr	670.00	6843.57	6849.11		6849.20	0.006951	2.35	279.36	93.57	0.22
Thalweg	233.07	50 yr	670.00	6843.54	6849.05		6849.15	0.003853	2.59	263.71	90.34	0.25
Thalweg	218.07	50 yr	670.00	6843.49	6848.97		6849.08	0.004614	2.75	247.90	88.24	0.27
Thalweg	203.07	50 yr	670.00	6843.38	6848.89		6849.01	0.004982	2.83	241.04	86.83	0.28
Thalweg	188.07	50 yr	670.00	6843.21	6848.83		6848.94	0.004360	2.73	251.57	89.80	0.26
Thalweg	173.07	50 yr	670.00	6843.04	6848.78		6848.88	0.003654	2.55	272.15	99.68	0.24
Thalweg	158.07	50 yr	670.00	6842.93	6848.73		6848.82	0.003264	2.47	282.70	105.01	0.23
Thalweg	143.07	50 yr	670.00	6842.84	6848.69		6848.77	0.003086	2.44	289.26	111.13	0.22
Thalweg	132.38	50 yr	670.00	6842.77	6848.65		6848.74	0.003178	2.47	284.48	106.34	0.23
Thalweg	124.45	50 yr	670.00	6842.74	6848.62		6848.71	0.003412	2.52	277.60	103.09	0.23
Thalweg	113.07	50 yr	670.00	6842.74	6848.56		6848.67	0.004063	2.65	262.27	99.32	0.25
Thalweg	98.07	50 yr	670.00	6842.74	6848.48		6848.60	0.004936	2.85	242.85	92.59	0.28
Thalweg	83.07	50 yr	670.00	6842.74	6848.37		6848.52	0.006329	3.12	221.47	88.53	0.31
Thalweg	68.07	50 yr	670.00	6842.74	6848.27		6848.42	0.006233	3.12	220.48	87.69	0.31
Thalweg	53.07	50 yr	670.00	6842.72	6848.19		6848.33	0.005762	3.06	221.67	76.80	0.30
Thalweg	38.07	50 yr	670.00	6842.71	6848.02		6848.22	0.009432	3.60	186.28	66.65	0.37
Thalweg	24.07	50 yr	670.00	6842.69	6847.66		6848.02	0.018524	4.82	139.10	51.34	0.52
Thalweg	10.64	50 yr	670.00	6842.59	6847.40		6847.78	0.016671	4.96	135.11	43.62	0.50
Thalweg	0	50 yr	670.00	6842.51	6846.77	6846.09	6847.50	0.036498	6.82	98.20	35.11	0.72

HEC-RAS Plan: Plan 02 River: Sinclair Wah Reach: Thalweg Profile: 100 yr

Reload Da

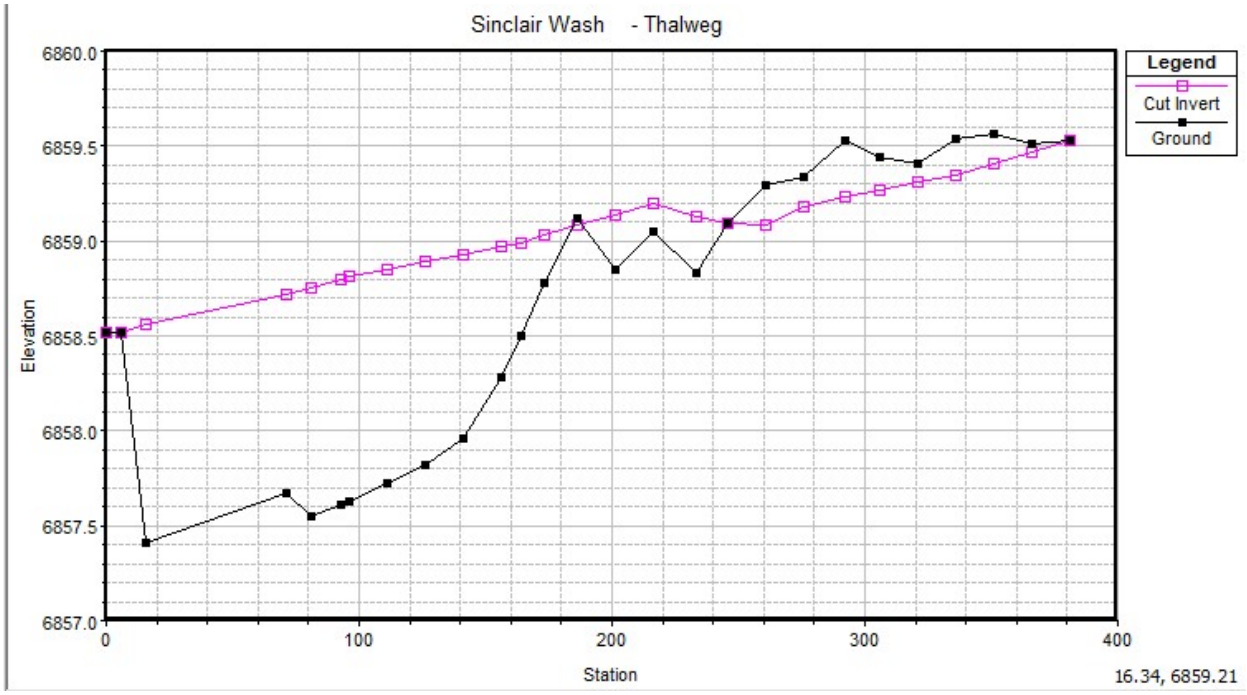
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Thalweg	938.07	100 yr	890.00	6845.30	6853.00	6847.82	6853.04	0.001774	1.62	551.47	102.40	0.12
Thalweg	923.07	100 yr	890.00	6845.38	6852.97		6853.02	0.001969	1.69	525.75	95.80	0.13
Thalweg	908.07	100 yr	890.00	6845.47	6852.92		6852.98	0.002595	1.90	469.14	87.68	0.14
Thalweg	893.07	100 yr	890.00	6845.55	6852.86		6852.93	0.003942	2.13	417.86	90.56	0.17
Thalweg	878.07	100 yr	890.00	6845.63	6852.77		6852.86	0.005656	2.39	372.60	91.72	0.21
Thalweg	863.07	100 yr	890.00	6845.71	6852.65		6852.76	0.007842	2.65	335.72	93.50	0.24
Thalweg	839.65	100 yr	890.00	6845.65	6852.44		6852.56	0.009115	2.78	319.29	93.33	0.26
Thalweg	818.97	100 yr	890.00	6845.40	6852.34		6852.42	0.004504	2.24	395.27	94.40	0.19
Thalweg	801.55	100 yr	890.00	6845.18	6852.25		6852.34	0.004632	2.30	381.78	90.49	0.19
Thalweg	793.29	100 yr	890.00	6845.06	6852.15		6852.29	0.005984	2.57	331.93	84.44	0.21
Thalweg	773.07	100 yr	890.00	6844.84	6851.74		6852.11	0.009981	3.01	258.86	78.66	0.27
Thalweg	758.07	100 yr	890.00	6844.77	6851.34		6851.93	0.010334	3.01	237.19	75.19	0.27
Thalweg	743.07	100 yr	890.00	6844.72	6851.09		6851.78	0.007711	2.70	239.25	73.21	0.24
Thalweg	728.07	100 yr	890.00	6844.67	6851.06		6851.66	0.004797	2.22	263.52	78.84	0.19
Thalweg	713.07	100 yr	890.00	6844.63	6851.07		6851.57	0.003322	1.89	286.06	86.29	0.16
Thalweg	698.07	100 yr	890.00	6844.58	6851.07		6851.51	0.002594	1.70	296.04	90.49	0.14
Thalweg	683.07	100 yr	890.00	6844.54	6851.00		6851.47	0.002515	1.57	286.73	97.37	0.14
Thalweg	668.07	100 yr	890.00	6844.51	6850.99		6851.43	0.002125	1.44	290.24	101.31	0.13
Thalweg	653.07	100 yr	890.00	6844.49	6850.98		6851.39	0.001932	1.38	295.32	105.18	0.12
Thalweg	649.57	100 yr	890.00	6844.48	6850.98		6851.37	0.001873	1.37	295.88	105.67	0.12
Thalweg	638.07	100 yr	890.00	6844.46	6850.96		6851.35	0.001933	1.38	296.20	108.49	0.12
Thalweg	623.07	100 yr	890.00	6844.44	6850.88		6851.31	0.002436	1.50	282.77	108.67	0.13
Thalweg	608.07	100 yr	890.00	6844.17	6850.92		6851.25	0.001464	1.23	331.53	111.65	0.10
Thalweg	593.07	100 yr	890.00	6844.05	6850.93		6851.22	0.000933	0.99	367.26	110.32	0.08
Thalweg	578.07	100 yr	890.00	6844.02	6850.94		6851.20	0.000734	0.91	404.91	110.24	0.08
Thalweg	563.07	100 yr	890.00	6843.84	6850.93		6851.19	0.000726	0.93	434.45	111.40	0.08
Thalweg	548.07	100 yr	890.00	6843.66	6850.90		6851.17	0.000901	1.01	440.58	113.22	0.08
Thalweg	533.07	100 yr	890.00	6844.19	6850.96		6851.13	0.000711	1.32	451.16	116.35	0.11
Thalweg	518.07	100 yr	890.00	6844.73	6850.90		6851.11	0.001091	1.50	415.53	117.98	0.13
Thalweg	490.29	100 yr	890.00	6844.62	6850.94		6851.06	0.000752	1.38	501.72	124.39	0.11
Thalweg	485.4	100 yr	890.00	6844.32	6850.97		6851.04	0.000708	1.44	539.05	128.01	0.11
Thalweg	473.07	100 yr	890.00	6844.18	6850.97		6851.03	0.000874	1.62	517.98	114.62	0.13
Thalweg	458.07	100 yr	890.00	6844.05	6850.97		6851.02	0.000199	1.84	491.35	107.80	0.15
Thalweg	443.07	100 yr	890.00	6844.05	6850.95		6851.01	0.000289	2.06	436.23	104.91	0.17
Thalweg	428.07	100 yr	890.00	6844.09	6850.93		6851.00	0.005115	2.23	400.32	114.23	0.20
Thalweg	413.07	100 yr	890.00	6844.12	6850.83		6850.92	0.005712	2.27	383.96	112.66	0.20
Thalweg	398.07	100 yr	890.00	6843.87	6850.73		6850.82	0.007057	2.44	365.96	123.08	0.23
Thalweg	383.07	100 yr	890.00	6843.98	6850.62		6850.72	0.007298	2.45	360.13	120.96	0.23
Thalweg	368.07	100 yr	890.00	6844.07	6850.52		6850.61	0.006410	2.36	373.58	121.26	0.22
Thalweg	348.9	100 yr	890.00	6844.07	6850.41		6850.50	0.005640	2.28	387.29	122.81	0.20
Thalweg	338.07	100 yr	890.00	6844.07	6850.36		6850.44	0.005189	2.22	396.69	124.29	0.20
Thalweg	323.07	100 yr	890.00	6844.07	6850.28		6850.36	0.004862	2.18	403.67	125.97	0.19
Thalweg	308.07	100 yr	890.00	6843.94	6850.21		6850.29	0.005040	2.19	399.09	127.20	0.19
Thalweg	293.07	100 yr	890.00	6843.81	6850.12		6850.21	0.005626	2.25	384.35	128.48	0.20
Thalweg	278.07	100 yr	890.00	6843.68	6850.05		6850.13	0.004477	2.19	396.09	121.36	0.18
Thalweg	263.07	100 yr	890.00	6843.63	6849.97		6850.06	0.004639	2.17	389.34	125.85	0.19
Thalweg	240.97	100 yr	890.00	6843.57	6849.84		6849.94	0.006392	2.40	351.72	111.02	0.22
Thalweg	233.07	100 yr	890.00	6843.54	6849.79		6849.90	0.003679	2.68	333.90	105.06	0.25
Thalweg	218.07	100 yr	890.00	6843.49	6849.71		6849.84	0.004321	2.82	316.48	101.19	0.26
Thalweg	203.07	100 yr	890.00	6843.38	6849.64		6849.77	0.004317	2.91	310.60	97.83	0.27
Thalweg	188.07	100 yr	890.00	6843.21	6849.59		6849.71	0.003788	2.80	324.25	100.58	0.25
Thalweg	173.07	100 yr	890.00	6843.04	6849.55		6849.65	0.003001	2.59	352.11	106.82	0.23
Thalweg	158.07	100 yr	890.00	6842.93	6849.52		6849.61	0.002657	2.50	368.10	112.25	0.21
Thalweg	143.07	100 yr	890.00	6842.84	6849.48		6849.57	0.002448	2.43	380.77	118.11	0.20
Thalweg	132.38	100 yr	890.00	6842.77	6849.45		6849.54	0.002537	2.47	372.19	111.94	0.21
Thalweg	124.45	100 yr	890.00	6842.74	6849.43		6849.52	0.002699	2.52	363.04	108.49	0.21
Thalweg	113.07	100 yr	890.00	6842.74	6849.38		6849.49	0.003167	2.62	346.60	106.59	0.23
Thalweg	98.07	100 yr	890.00	6842.74	6849.32		6849.44	0.003764	2.81	323.69	100.60	0.25
Thalweg	83.07	100 yr	890.00	6842.74	6849.24		6849.37	0.004547	3.01	300.73	94.57	0.27
Thalweg	68.07	100 yr	890.00	6842.74	6849.17		6849.31	0.004399	3.03	301.29	92.76	0.27
Thalweg	53.07	100 yr	890.00	6842.72	6849.10		6849.24	0.004075	3.03	303.23	92.86	0.26
Thalweg	38.07	100 yr	890.00	6842.71	6848.98		6849.16	0.006156	3.51	263.85	89.84	0.32
Thalweg	24.07	100 yr	890.00	6842.69	6848.73		6849.04	0.011444	4.47	201.94	72.29	0.42
Thalweg	10.64	100 yr	890.00	6842.59	6848.53		6848.88	0.011726	4.71	192.04	72.08	0.43
Thalweg	0	100 yr	890.00	6842.51	6848.17	6846.65	6848.69	0.020468	5.82	154.77	61.05	0.56

Appendix T: Manning's Value Reference Table

Table 3-1 Manning's 'n' Values

Type of Channel and Description	Minimum	Normal	Maximum
A. *Natural Streams*			
1. Main Channels			
a. Clean, straight, full, no rifts or deep pools	0.025	0.030	0.033
b. Same as above, but more stones and weeds	0.030	0.035	0.040
c. Clean, winding, some pools and shoals	0.033	0.040	0.045
d. Same as above, but some weeds and stones	0.035	0.045	0.050
e. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
f. Same as "d" but more stones	0.045	0.050	0.060
g. Sluggish reaches, weedy. deep pools	0.050	0.070	0.080
h. Very weedy reaches, deep pools, or floodways with heavy stands of timber and brush	0.070	0.100	0.150
2. Flood Plains			
a. Pasture no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
b. Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees, in winter	0.035	0.050	0.060
3. Light brush and trees, in summer	0.040	0.060	0.080
4. Medium to dense brush, in winter	0.045	0.070	0.110
5. Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
2. Same as above, but heavy sprouts	0.050	0.060	0.080
3. Heavy stand of timber, few down trees, little undergrowth, flow below branches	0.080	0.100	0.120
4. Same as above, but with flow into branches	0.100	0.120	0.160
5. Dense willows, summer, straight	0.110	0.150	0.200
3. Mountain Streams, no vegetation in channel, banks usually steep, with trees and brush on banks submerged			
a. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
b. Bottom: cobbles with large boulders	0.040	0.050	0.070

Appendix U: Site 1 Proposed Restoration Plan HEC RAS Data



Template: Site 1 Channel Type: User Entered Table

Fill Channel Below Template Cut to Daylight Side Slope: 3.

Table Template

Copy Left to Right

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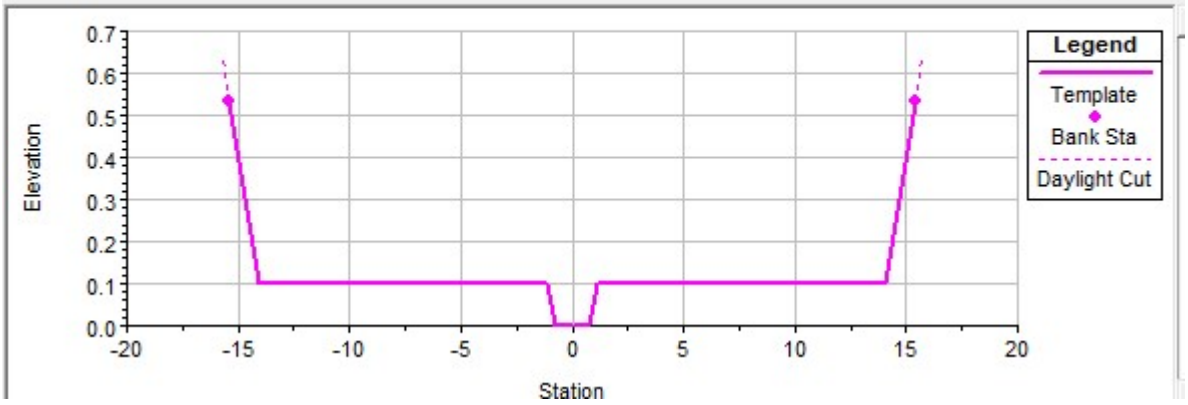
	DX	DY	Slope	N Val	Bank?	DX	DY	Slope	N Val	Bank?
1	0.75	0	0	0.35	○	0.75	0	0	0.35	○
2	0.4	0.1	0.25	0.35	○	0.4	0.1	0.25	0.35	○
3	12.93	0	0	0.045	○	12.93	0	0	0.045	○
4	1.2931	0.431	).3333076	0.045	◉	1.2931	0.431	).3333076	0.045	◉
5					○					○
6					○					○
7					○					○
8					○					○
9					○					○
10					○					○



Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Thalweg	5331.57	100 yr	890.00	6859.53	6863.46	6861.81	6863.57	0.001402	2.73	328.46	125.83	0.29
Thalweg	5316.57	100 yr	890.00	6859.51	6863.44		6863.55	0.001343	2.65	338.74	129.13	0.28
Thalweg	5301.57	100 yr	890.00	6859.56	6863.42		6863.53	0.001377	2.68	334.74	126.90	0.29
Thalweg	5286.57	100 yr	890.00	6859.54	6863.41		6863.51	0.001225	2.59	347.10	127.22	0.27
Thalweg	5271.57	100 yr	890.00	6859.41	6863.40		6863.49	0.000905	2.36	379.81	128.34	0.24
Thalweg	5256.57	100 yr	890.00	6859.44	6863.39		6863.47	0.000940	2.40	374.69	127.89	0.24
Thalweg	5242.81	100 yr	890.00	6859.53	6863.38		6863.46	0.000819	2.27	396.27	132.83	0.23
Thalweg	5226.57	100 yr	890.00	6859.34	6863.37		6863.45	0.000760	2.26	400.34	128.63	0.22
Thalweg	5211.57	100 yr	890.00	6859.29	6863.36		6863.43	0.000716	2.25	406.15	126.64	0.21
Thalweg	5196.57	100 yr	890.00	6859.09	6863.35		6863.42	0.000609	2.16	420.52	124.84	0.20
Thalweg	5184.06	100 yr	890.00	6858.83	6863.34		6863.42	0.000608	2.16	416.48	121.49	0.20
Thalweg	5166.57	100 yr	890.00	6859.05	6863.31		6863.40	0.000776	2.38	377.37	112.51	0.22
Thalweg	5151.57	100 yr	890.00	6858.85	6863.28		6863.39	0.001022	2.64	339.33	105.98	0.25
Thalweg	5136.6	100 yr	890.00	6859.12	6863.24		6863.37	0.001308	2.92	307.46	99.81	0.29
Thalweg	5123.56	100 yr	890.00	6858.78	6863.20		6863.35	0.001427	3.10	289.73	92.08	0.30
Thalweg	5114.45	100 yr	890.00	6858.50	6863.18		6863.33	0.001399	3.12	287.49	89.48	0.30
Thalweg	5106.57	100 yr	890.00	6858.28	6863.17		6863.32	0.001418	3.17	282.98	87.34	0.30
Thalweg	5091.57	100 yr	890.00	6857.96	6863.14		6863.30	0.001412	3.21	280.45	85.49	0.30
Thalweg	5076.57	100 yr	890.00	6857.82	6863.07		6863.27	0.001990	3.64	247.20	81.35	0.35
Thalweg	5061.57	100 yr	890.00	6857.72	6862.96		6863.23	0.002849	4.16	218.30	84.64	0.42
Thalweg	5046.57	100 yr	890.00	6857.63	6862.85		6863.18	0.003670	4.62	199.82	82.21	0.47
Thalweg	5043.59	100 yr	890.00	6857.61	6862.83		6863.17	0.003914	4.75	196.40	81.38	0.49
Thalweg	5031.57	100 yr	890.00	6857.55	6862.64		6863.10	0.006011	5.54	169.01	76.47	0.59
Thalweg	5022.06	100 yr	890.00	6857.67	6862.34		6863.01	0.010097	6.62	140.92	72.22	0.75
Thalweg	4966.11	100 yr	890.00	6857.41	6862.08		6862.57	0.005017	5.67	163.62	61.79	0.56
Thalweg	4956.57	100 yr	890.00	6858.52	6861.90	6861.30	6862.50	0.007764	6.24	145.61	60.88	0.67
Thalweg	4950.51	100 yr	890.00	6858.52	6861.39	6861.39	6862.39	0.019030	8.05	110.74	57.14	1.01

Appendix V: Site 2 Proposed Restoration Plan HEC RAS Data

Template: Site 2 Template Type: User Entered Table

Fill Channel Below Template Cut to Daylight Side Slope: 3.

Table Template

Copy Left to Right

	Left					Right				
	DX	DY	Slope	N Val	Bank?	DX	DY	Slope	N Val	Bank?
1	0.75	0	0	0.04	○	0.75	0	0	0.04	○
2	0.4	0.1	0.25	0.045	○	0.4	0.1	0.25	0.045	○
3	18.031	0	0	0.05	○	18.031	0	0	0.05	○
4	1.568	0.529	).3373725	0.04	◉	1.568	0.529	).3373725	0.04	◉
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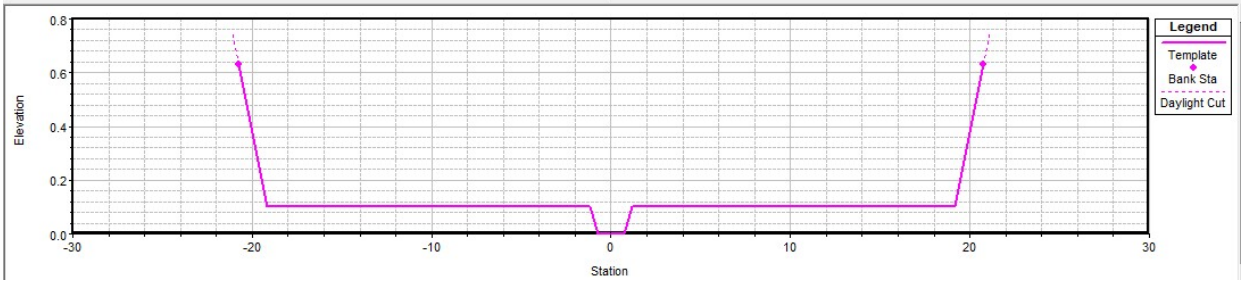
6					○					○
7					○					○
8					○					○
9					○					○
10					○					○



Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Thalweg	1835.64	100 yr	890.00	6849.55	6853.70	6852.30	6853.92	0.010468	3.75	237.50	85.05	0.39
Thalweg	1820.64	100 yr	890.00	6849.47	6853.37		6853.70	0.018524	4.65	191.42	75.68	0.52
Thalweg	1805.64	100 yr	890.00	6849.25	6852.73		6853.29	0.039308	5.98	148.87	71.16	0.73
Thalweg	1790.64	100 yr	890.00	6848.86	6852.49		6853.03	0.009328	5.93	149.97	69.67	0.71
Thalweg	1775.64	100 yr	890.00	6848.46	6852.46		6852.88	0.006363	5.25	169.56	71.14	0.60
Thalweg	1760.64	100 yr	890.00	6848.13	6852.44		6852.77	0.004566	4.60	193.41	77.24	0.51
Thalweg	1745.64	100 yr	890.00	6847.83	6852.42		6852.69	0.003943	4.23	210.17	85.18	0.48
Thalweg	1732.51	100 yr	890.00	6847.57	6852.36		6852.64	0.003880	4.26	208.69	82.65	0.47
Thalweg	1719.42	100 yr	890.00	6847.29	6852.34		6852.59	0.003134	3.99	222.94	82.96	0.43
Thalweg	1700.64	100 yr	890.00	6846.92	6852.35		6852.52	0.001593	3.27	272.76	85.31	0.32
Thalweg	1685.64	100 yr	890.00	6846.60	6852.37		6852.49	0.000978	2.81	320.34	91.20	0.25
Thalweg	1670.64	100 yr	890.00	6846.40	6852.37		6852.47	0.000773	2.61	347.44	94.68	0.23
Thalweg	1655.64	100 yr	890.00	6846.35	6852.35		6852.46	0.000841	2.67	336.57	92.21	0.24
Thalweg	1640.64	100 yr	890.00	6846.27	6852.33		6852.44	0.000939	2.75	325.67	91.30	0.25
Thalweg	1625.64	100 yr	890.00	6846.39	6852.33		6852.42	0.000682	2.41	369.93	97.35	0.21
Thalweg	1612.4	100 yr	890.00	6845.98	6852.34		6852.41	0.000521	2.22	403.24	101.13	0.19
Thalweg	1595.64	100 yr	890.00	6845.21	6852.34		6852.40	0.000364	1.88	479.08	121.91	0.16
Thalweg	1580.64	100 yr	890.00	6844.57	6852.35		6852.39	0.000240	1.61	565.88	134.71	0.13
Thalweg	1565.64	100 yr	890.00	6844.54	6852.35		6852.38	0.000154	1.38	655.70	137.55	0.11
Thalweg	1550.64	100 yr	890.00	6844.84	6852.35		6852.38	0.000136	1.30	693.09	142.76	0.10
Thalweg	1535.64	100 yr	890.00	6845.14	6852.35		6852.38	0.000120	1.22	737.82	150.83	0.09
Thalweg	1520.64	100 yr	890.00	6844.98	6852.35		6852.38	0.000115	1.19	756.01	153.21	0.09
Thalweg	1505.64	100 yr	890.00	6844.82	6852.35		6852.37	0.000114	1.17	762.96	154.37	0.09
Thalweg	1498.37	100 yr	890.00	6844.75	6852.35		6852.37	0.000115	1.17	762.85	153.66	0.09
Thalweg	1472.45	100 yr	890.00	6844.59	6852.35		6852.37	0.000128	1.21	733.21	149.61	0.10
Thalweg	1454.87	100 yr	890.00	6844.47	6852.34		6852.37	0.000118	1.20	740.37	142.39	0.09
Thalweg	1438.37	100 yr	890.00	6844.38	6852.34		6852.36	0.000101	1.15	776.25	142.27	0.09
Thalweg	1415.55	100 yr	890.00	6844.27	6852.34		6852.36	0.000101	1.17	760.34	134.53	0.09
Thalweg	1400.64	100 yr	890.00	6844.11	6852.34		6852.36	0.000110	1.22	731.88	130.75	0.09
Thalweg	1385.64	100 yr	890.00	6843.97	6852.33		6852.36	0.000128	1.28	696.39	129.46	0.10
Thalweg	1370.82	100 yr	890.00	6844.02	6852.33		6852.36	0.000137	1.31	681.42	129.15	0.10
Thalweg	1355.64	100 yr	890.00	6844.23	6852.32		6852.35	0.000166	1.40	634.88	125.17	0.11
Thalweg	1340.64	100 yr	890.00	6844.32	6852.32		6852.35	0.000178	1.46	611.26	119.65	0.11
Thalweg	1325.64	100 yr	890.00	6844.59	6852.31		6852.35	0.000213	1.57	566.63	114.24	0.12
Thalweg	1310.64	100 yr	890.00	6845.55	6852.29		6852.34	0.000305	1.80	495.56	108.57	0.15
Thalweg	1295.64	100 yr	890.00	6845.29	6852.28		6852.34	0.000344	1.92	467.31	106.78	0.16
Thalweg	1292.13	100 yr	890.00	6845.23	6852.28		6852.34	0.000350	1.94	461.97	102.29	0.16
Thalweg	1280.64	100 yr	890.00	6845.03	6852.27		6852.33	0.000325	1.94	464.51	100.07	0.15
Thalweg	1265.64	100 yr	890.00	6844.78	6852.27		6852.33	0.000318	1.99	457.72	97.20	0.15
Thalweg	1255.39	100 yr	890.00	6844.60	6852.26		6852.32	0.000320	2.04	450.56	95.78	0.15
Thalweg	1250.64	100 yr	890.00	6844.52	6852.26		6852.32	0.000326	2.06	444.64	94.55	0.16
Thalweg	1242	100 yr	890.00	6844.37	6852.25		6852.32	0.000321	2.10	447.35	101.73	0.15
Thalweg	1175.64	100 yr	890.00	6843.55	6852.24		6852.30	0.000323	1.96	476.83	109.87	0.15
Thalweg	1172.19	100 yr	890.00	6843.48	6852.24		6852.29	0.000332	1.95	493.98	124.09	0.15
Thalweg	1145.64	100 yr	890.00	6845.00	6852.21		6852.28	0.000485	2.21	425.21	108.91	0.18
Thalweg	1136.9	100 yr	890.00	6844.94	6852.21		6852.27	0.000343	1.97	456.25	101.57	0.16
Thalweg	1115.64	100 yr	890.00	6844.92	6852.21		6852.27	0.000316	1.89	470.14	97.25	0.15
Thalweg	1100.64	100 yr	890.00	6844.91	6852.21		6852.26	0.000312	1.88	476.04	101.41	0.15
Thalweg	1085.64	100 yr	890.00	6844.89	6852.18		6852.25	0.001838	2.11	424.20	102.18	0.18
Thalweg	1070.64	100 yr	890.00	6844.87	6852.11		6852.21	0.003201	2.60	343.73	90.78	0.23
Thalweg	1065.06	100 yr	890.00	6844.87	6852.06		6852.19	0.004333	2.91	306.48	85.32	0.27
Thalweg	1040.64	100 yr	890.00	6844.90	6852.01		6852.10	0.002490	2.38	375.92	94.98	0.21
Thalweg	1025.64	100 yr	890.00	6844.93	6851.99		6852.06	0.001786	2.10	425.70	100.43	0.18
Thalweg	1010.64	100 yr	890.00	6844.95	6851.98		6852.03	0.001199	1.86	480.64	104.45	0.15
Thalweg	995.64	100 yr	890.00	6844.99	6851.96		6852.01	0.001066	1.80	499.21	104.88	0.14
Thalweg	980.64	100 yr	890.00	6845.07	6851.94		6852.00	0.001163	1.85	481.96	98.72	0.14
Thalweg	965.64	100 yr	890.00	6845.16	6851.92		6851.98	0.001238	1.89	471.59	94.26	0.15
Thalweg	950.64	100 yr	890.00	6845.24	6851.90		6851.96	0.001354	1.94	458.32	93.96	0.16
Thalweg	938.07	100 yr	890.00	6845.30	6851.88	6847.82	6851.94	0.001512	2.01	442.36	93.47	0.16

Appendix W: Site 3 Proposed Restoration Plan HEC RAS Data

Cross Section Template Design

File View Options

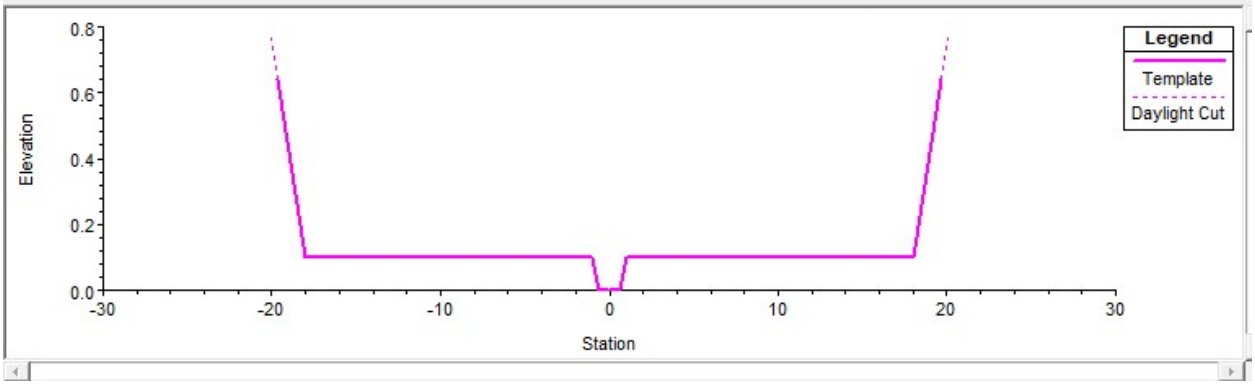
Template: channel design Type: User Entered Table

Fill Channel Below Template Cut to Daylight Side Slope: 3.

Table Template

Copy Left to Right

	Left					Right				
	DX	DY	Slope	N Val	Bank?	DX	DY	Slope	N Val	Bank?
1	0.6	0	0	0.4		0.6	0	0	0.4	
2	0.4	0.1	0.25	0.45		0.4	0.1	0.25	0.45	
3	17	0	0	0.4		17	0	0	0.4	
4	1.62	0.54	).3333333	0.3		1.62	0.54	).3333333	0.3	
5										
6										
7										
8										
9										
10										



HEC-RAS Plan: Plan 06 River: Sinclair Wah Reach: Thalweg Profile: 100 yr

Reload Data

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Thalweg	908.07	100 yr	890.00	6845.47	6854.57		6854.72	0.008129	1.34	609.99	122.49	0.10
Thalweg	893.07	100 yr	890.00	6845.55	6854.40		6854.59	0.008884	1.39	584.50	119.53	0.11
Thalweg	878.07	100 yr	890.00	6845.50	6854.25		6854.46	0.009117	1.41	570.67	114.61	0.11
Thalweg	863.07	100 yr	890.00	6845.46	6854.06		6854.32	0.009224	1.42	554.30	108.43	0.11
Thalweg	839.65	100 yr	890.00	6845.39	6853.75		6854.09	0.010398	1.46	530.29	102.02	0.11
Thalweg	818.97	100 yr	890.00	6845.33	6853.49		6853.86	0.011244	1.55	488.25	99.44	0.12
Thalweg	801.55	100 yr	890.00	6845.07	6853.33		6853.69	0.009436	1.39	527.42	104.75	0.10
Thalweg	793.29	100 yr	890.00	6845.07	6853.09		6853.58	0.008302	1.30	514.06	106.12	0.10
Thalweg	773.07	100 yr	890.00	6845.33	6852.55		6853.38	0.008481	1.24	458.88	103.32	0.10
Thalweg	758.07	100 yr	890.00	6845.27	6852.27		6853.24	0.006527	1.08	436.82	103.45	0.09
Thalweg	743.07	100 yr	890.00	6845.21	6852.34		6853.11	0.003328	0.79	481.75	107.36	0.06
Thalweg	728.07	100 yr	890.00	6845.15	6852.46		6853.01	0.001751	0.59	520.85	113.73	0.04
Thalweg	713.07	100 yr	890.00	6845.10	6852.54		6852.94	0.001068	0.46	550.83	120.00	0.03
Thalweg	698.07	100 yr	890.00	6845.06	6852.59		6852.90	0.000737	0.38	575.54	125.34	0.03
Thalweg	683.07	100 yr	890.00	6845.02	6852.62		6852.87	0.000540	0.33	598.08	130.48	0.02
Thalweg	668.07	100 yr	890.00	6844.98	6852.65		6852.85	0.000414	0.29	618.89	135.27	0.02
Thalweg	653.07	100 yr	890.00	6844.94	6852.66		6852.84	0.000355	0.26	634.19	139.05	0.02
Thalweg	649.57	100 yr	890.00	6844.77	6852.66		6852.84	0.000335	0.26	649.03	140.66	0.02
Thalweg	638.07	100 yr	890.00	6844.77	6852.67		6852.83	0.000318	0.25	660.04	143.90	0.02
Thalweg	623.07	100 yr	890.00	6844.92	6852.65		6852.82	0.000327	0.26	653.47	142.24	0.02
Thalweg	608.07	100 yr	890.00	6844.86	6852.65		6852.82	0.000270	0.24	679.67	141.05	0.02
Thalweg	593.07	100 yr	890.00	6844.80	6852.66		6852.81	0.000228	0.22	704.53	139.89	0.02
Thalweg	578.07	100 yr	890.00	6844.74	6852.64		6852.80	0.000222	0.23	714.21	135.80	0.02
Thalweg	563.07	100 yr	890.00	6844.70	6852.61		6852.80	0.000259	0.25	707.12	132.73	0.02
Thalweg	548.07	100 yr	890.00	6844.66	6852.55		6852.79	0.000358	0.29	682.37	128.91	0.02
Thalweg	533.07	100 yr	890.00	6844.62	6852.50		6852.78	0.000488	0.36	667.73	130.46	0.03
Thalweg	518.07	100 yr	890.00	6844.58	6852.40		6852.76	0.000755	0.46	653.25	143.33	0.03
Thalweg	490.29	100 yr	890.00	6844.50	6852.40		6852.74	0.000758	0.49	686.91	151.08	0.04
Thalweg	485.4	100 yr	890.00	6844.49	6852.41		6852.72	0.000937	0.57	698.51	152.27	0.04
Thalweg	473.07	100 yr	890.00	6844.45	6852.39		6852.70	0.002283	0.85	638.38	151.84	0.06
Thalweg	458.07	100 yr	890.00	6844.15	6852.50		6852.58	0.004582	1.21	632.57	146.01	0.09
Thalweg	443.07	100 yr	890.00	6844.15	6852.43		6852.50	0.006100	1.33	597.52	145.95	0.10
Thalweg	428.07	100 yr	890.00	6844.30	6852.34		6852.39	0.007767	1.38	586.26	156.61	0.10
Thalweg	413.07	100 yr	890.00	6844.24	6852.23		6852.29	0.005982	1.25	614.75	153.28	0.09
Thalweg	398.07	100 yr	890.00	6844.18	6852.13		6852.20	0.006111	1.24	609.49	154.44	0.09
Thalweg	383.07	100 yr	890.00	6844.12	6852.02		6852.10	0.006419	1.23	597.86	153.14	0.09
Thalweg	368.07	100 yr	890.00	6844.06	6851.93		6852.01	0.006044	1.21	603.81	154.64	0.09
Thalweg	348.9	100 yr	890.00	6843.99	6851.83		6851.91	0.005681	1.18	611.39	156.77	0.09
Thalweg	338.07	100 yr	890.00	6843.96	6851.76		6851.84	0.005355	1.15	619.10	159.23	0.09
Thalweg	323.07	100 yr	890.00	6843.92	6851.69		6851.76	0.005000	1.13	628.58	161.84	0.08
Thalweg	308.07	100 yr	890.00	6843.88	6851.62		6851.69	0.004655	1.09	635.56	160.41	0.08
Thalweg	293.07	100 yr	890.00	6843.83	6851.53		6851.62	0.004865	1.08	618.93	154.42	0.08
Thalweg	278.07	100 yr	890.00	6843.79	6851.45		6851.55	0.004807	1.05	617.16	152.57	0.08
Thalweg	263.07	100 yr	890.00	6843.75	6851.37		6851.48	0.004173	0.97	620.85	149.72	0.07
Thalweg	240.97	100 yr	890.00	6843.68	6851.29		6851.39	0.004754	1.03	608.88	157.37	0.08
Thalweg	233.07	100 yr	890.00	6843.66	6851.23		6851.32	0.004672	1.02	596.85	154.26	0.08
Thalweg	218.07	100 yr	890.00	6843.62	6851.16		6851.25	0.005458	1.10	579.34	149.22	0.08
Thalweg	203.07	100 yr	890.00	6843.58	6851.08		6851.17	0.005703	1.12	573.38	154.09	0.08
Thalweg	188.07	100 yr	890.00	6843.54	6850.98		6851.09	0.005726	1.11	562.68	151.17	0.08
Thalweg	173.07	100 yr	890.00	6843.50	6850.89		6851.00	0.005129	1.04	563.83	159.22	0.08
Thalweg	158.07	100 yr	890.00	6843.20	6850.83		6850.93	0.004297	0.94	597.60	165.28	0.07
Thalweg	143.07	100 yr	890.00	6843.20	6850.76		6850.87	0.003769	0.87	604.11	172.72	0.06
Thalweg	132.38	100 yr	890.00	6843.36	6850.71		6850.83	0.004566	0.94	565.70	160.48	0.07
Thalweg	124.45	100 yr	890.00	6843.33	6850.64		6850.78	0.005222	1.00	548.05	163.50	0.07
Thalweg	113.07	100 yr	890.00	6843.29	6850.57		6850.71	0.006302	1.08	523.77	138.14	0.08

Thalweg	98.07	100 yr	890.00	6842.74	6850.48		6850.62	0.006914	1.16	535.61	117.37	0.08
Thalweg	83.07	100 yr	890.00	6842.70	6850.36		6850.50	0.008740	1.28	510.54	108.01	0.09
Thalweg	68.07	100 yr	890.00	6842.66	6850.21		6850.36	0.010922	1.41	486.39	101.55	0.10
Thalweg	53.07	100 yr	890.00	6842.62	6850.06		6850.18	0.013151	1.61	461.12	98.15	0.12
Thalweg	38.07	100 yr	890.00	6842.58	6849.84		6849.92	0.021910	1.94	437.58	95.58	0.15
Thalweg	24.07	100 yr	890.00	6842.54	6849.46		6849.55	0.030947	2.20	394.31	87.73	0.17
Thalweg	10.64	100 yr	890.00	6842.50	6848.95		6849.05	0.042610	2.46	358.03	92.23	0.20
Thalweg	0	100 yr	890.00	6842.51	6848.17	6846.66	6848.69	0.020468	5.82	154.77	61.05	0.56

Appendix X: Site 1 Proposed vs Corrected Effective Comparison

SITE 1 CHANGES			
W.S. Elev	Vel Chnl	Top Width	Froude # Chl
(ft)	(ft/s)	(ft)	
-0.76	0.48	-3.26	0.07
-0.77	0.33	-2.21	0.04
-0.77	0.29	-3.08	0.04
-0.78	0.31	-3.78	0.04
-0.77	0.34	-2.18	0.04
-0.78	0.24	-2.18	0.03
-0.78	0.3	-2.16	0.04
-0.78	0.26	-2.25	0.03
-0.79	0.25	-2.18	0.03
-0.83	0.79	-3.87	0.11
-0.89	1.28	-4.67	0.18
-0.93	1.46	-5.41	0.2
-0.98	1.49	-5.68	0.21
-1.03	1.53	-5.94	0.21
-1.08	1.69	-7.71	0.23
-1.14	1.87	-6.79	0.26
-1.18	1.98	-12.01	0.27
-1.23	1.82	-16.36	0.25
-1.36	2.07	-18.8	0.29
-1.46	2.06	-14.14	0.29
-1.54	1.87	-15.63	0.25
-1.5	1.19	-15.09	0.19
-1.55	1.3	-16.28	0.2
-1.62	1.47	-16.75	0.24
0.07	0.17	0.55	0.04

-0.1	0.54	-0.73	0.09
0.01	-0.01	0.03	-0.01

Appendix Y: Site 2 Proposed vs Corrected Effective Comparison

SITE 2 CHANGES			
W.S. Elev	Vel Chnl	Top Width	Froude # Chl
(ft)	(ft/s)	(ft)	
0.07	-0.07	-14.06	-0.07
0.64	-1.42	-9.4	-0.28
0.82	-1.39	-9.12	-0.27
0.79	-0.71	-12.56	-0.16
0.71	0.04	-21.71	-0.07
0.71	0.04	5.68	0.02
0.69	0.02	12.34	0.02
0.63	0.4	8.61	0.08
0.57	0.61	6.13	0.11
0.55	0.64	5.94	0.1
0.53	0.63	5.86	0.09
0.49	0.78	5.44	0.11
0.49	0.51	5.66	0.08
0.44	0.88	5.18	0.13
0.39	1.22	6.25	0.18
0.39	0.94	5.9	0.13
0.39	0.65	3.59	0.09
0.38	0.79	3.46	0.1
0.36	0.98	3.33	0.13
0.37	0.52	2.74	0.07
0.35	0.82	2.79	0.11
0.32	1.07	2.77	0.15
0.3	1.16	2.58	0.17
0.2	1.81	2.62	0.28

0.08	2.44	-76.26	0.24
0.05	2.43	-75.63	0.24
0.01	2.32	-67.35	0.23
0	2.22	-63.21	0.22
-0.03	2.12	-61.65	0.2
-0.05	2.05	-61.06	0.2
-0.07	1.91	-56.8	0.18
-0.05	1.51	-48.56	0.14
-0.07	1.32	-0.59	0.19
-0.08	1.12	-0.68	0.15
-0.09	0.91	-0.83	0.12
-0.08	0.87	-0.76	0.11
-0.09	0.69	-0.74	0.09
-0.09	0.58	-0.76	0.07
-0.1	0.55	-0.81	0.07
-0.1	0.57	-0.85	0.07
-0.1	0.51	-1.4	0.06
-0.11	0.31	-1.02	0.04
-0.1	0.21	-1.03	0.03
-0.11	0.17	-2	0.02
-0.14	0.66	-1.32	0.08
-0.16	0.79	-23.37	0.07
-0.16	0.55	-1.09	0.07
-0.15	0.31	-1.67	0.04
-0.1	-0.14	5.14	-0.01
-0.06	-0.53	12.04	-0.06
-0.03	-0.01	4.94	0
-0.04	0.3	-0.26	0.03
-0.04	0.49	0.28	0.06

-0.04	0.52	1.76	0.07
-0.04	0.55	3.46	0.08
-0.04	0.53	-17.61	0.04
-0.03	0.44	-16.81	0.03
0	0	0	0

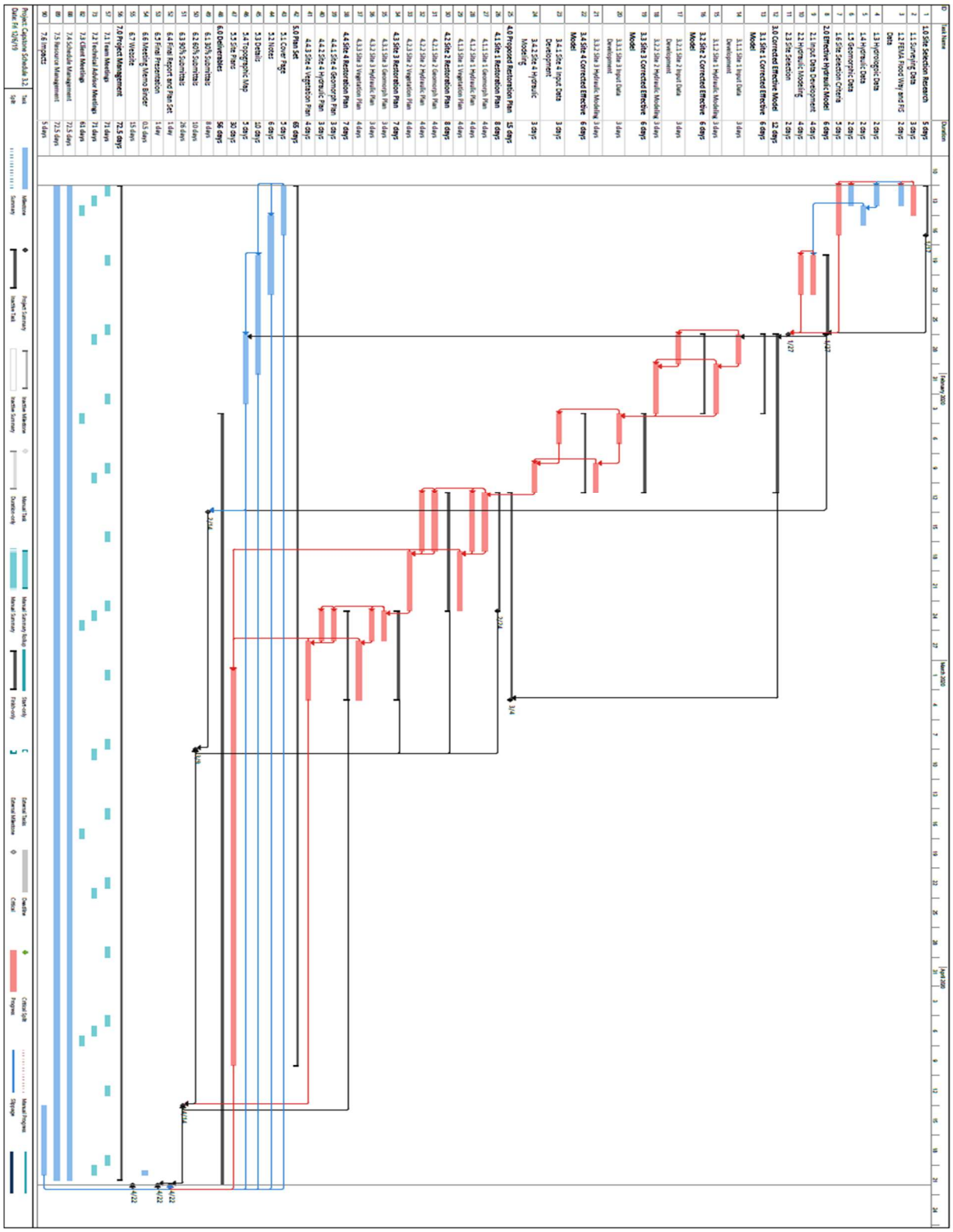
Appendix Z: Site 3 Proposed vs Corrected Effective Comparison

SITE 3 CHANGES			
W.S. Elev	Vel Chnl	Top Width	Froude # Chl
(ft)	(ft/s)	(ft)	
1.98	-0.5	34.06	-0.04
1.9	-0.68	38.22	-0.05
1.84	-0.91	31.3	-0.08
1.77	-1.09	24.03	-0.11
1.69	-1.28	16.01	-0.14
1.91	-1.36	12.3	-0.16
1.84	-0.71	10.39	-0.08
1.78	-0.86	20.95	-0.08
1.66	-1.28	28.6	-0.12
2.03	-1.59	36.69	-0.16
2.33	-1.61	41.81	-0.16
2.48	-1.33	47.43	-0.14
2.43	-0.9	46.23	-0.09
2.34	-0.6	43.53	-0.06
2.27	-0.43	43.47	-0.04
2.28	-0.32	40.77	-0.04
2.22	-0.21	40.76	-0.03
2.18	-0.18	40.3	-0.03
2.16	-0.17	40.73	-0.03
2.14	-0.19	38.72	-0.03
2.16	-0.32	37.25	-0.04
2.07	-0.07	32.73	-0.01
2.01	0.15	32.62	0.01
1.96	0.23	29.27	0
1.92	0.22	24.37	0.01

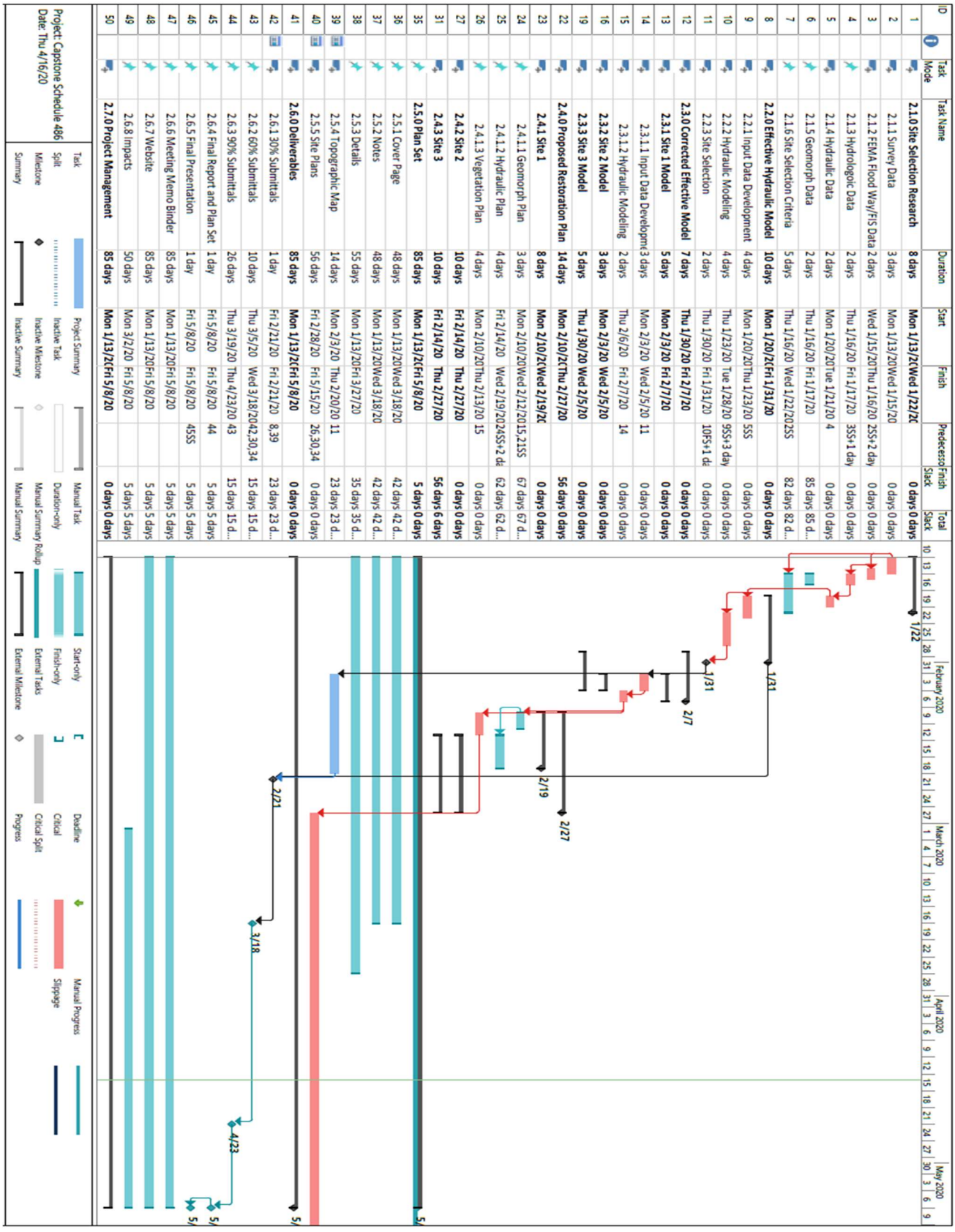
1.89	0.18	18.75	0.01
1.77	-0.1	32.07	-0.02
1.52	-0.52	25.86	-0.06
1.37	-0.89	24.82	-0.07
1.35	-0.86	22.41	-0.07
1.34	-0.76	35.68	-0.07
1.44	-0.58	35.97	-0.06
1.39	-0.72	39.29	-0.07
1.33	-0.86	40.54	-0.1
1.32	-1.04	40.3	-0.11
1.32	-1.21	31.05	-0.14
1.34	-1.25	31.03	-0.14
1.34	-1.13	31.92	-0.13
1.36	-1.11	32.66	-0.11
1.35	-1.09	33.68	-0.12
1.36	-1.08	34.6	-0.11
1.36	-1.12	33.02	-0.11
1.38	-1.19	25.78	-0.12
1.37	-1.16	31.09	-0.11
1.38	-1.22	23.79	-0.12
1.43	-1.39	46.3	-0.15
1.43	-1.68	49.18	-0.18
1.45	-1.77	48.08	-0.18
1.45	-1.84	56.41	-0.19
1.43	-1.73	50.84	-0.17
1.39	-1.61	52.77	-0.16
1.36	-1.59	53.36	-0.14
1.34	-1.59	54.88	-0.14
1.37	-1.09	49.04	-0.1

1.25	-1.56	55.22	-0.14
1.24	-1.59	40.01	-0.15
1.21	-1.67	17.74	-0.17
1.17	-1.75	14.51	-0.18
1.11	-1.67	9.64	-0.17
1.06	-1.22	5.84	-0.12
0.9	-1.47	5.93	-0.15
0.75	-2.2	15.41	-0.23
0.42	-2.18	19.88	-0.2
0	0	0	0

Appendix AA: Proposal Schedule



Appendix AB: Updated Schedule



ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Total Slack	Finish Slack
1		**2.1.0 Site Selection Research**	**8 days**	**Mon 1/13/2**	**Wed 1/22/2**		**0 days**	**0 days**
2		2.1.1 Survey Data	3 days	Mon 1/13/20	Wed 1/15/20		0 days	0 days
3		2.1.2 FEMA Flood Way/FIS Data	2 days	Wed 1/15/20	Thu 1/16/20	25S+2 day	0 days	0 days
4		2.1.3 Hydrologic Data	2 days	Thu 1/16/20	Fri 1/17/20	35S+1 day	0 days	0 days
5		2.1.4 Hydraulic Data	2 days	Mon 1/20/20	Tue 1/21/20	4	0 days	0 days
6		2.1.5 Geomorph Data	2 days	Thu 1/16/20	Fri 1/17/20		85 days	85 d...
7		2.1.6 Site Selection Criteria	5 days	Thu 1/16/20	Wed 1/22/202	5S	82 days	82 d...
8		**2.2.0 Effective Hydraulic Model**	**10 days**	**Mon 1/20/2**	**Fri 1/31/20**		**0 days**	**0 days**
9		2.2.1 Input Data Development	4 days	Mon 1/20/20	Thu 1/23/20	5SS	0 days	0 days
10		2.2.2 Hydraulic Modeling	4 days	Thu 1/23/20	Tue 1/28/20	9SS+3 day	0 days	0 days
11		2.2.3 Site Selection	2 days	Thu 1/30/20	Fri 1/31/20	10FS+1 da	0 days	0 days
12		**2.3.0 Corrected Effective Model**	**7 days**	**Thu 1/30/20**	**Fri 2/7/20**		**0 days**	**0 days**
13		**2.3.1 Site 1 Model**	**5 days**	**Mon 2/3/20**	**Fri 2/7/20**		**0 days**	**0 days**
14		2.3.1.1 Input Data Developm	3 days	Mon 2/3/20	Wed 2/5/20	11	0 days	0 days
15		2.3.1.2 Hydraulic Modeling	2 days	Thu 2/6/20	Fri 2/7/20	14	0 days	0 days
16		**2.3.2 Site 2 Model**	**3 days**	**Mon 2/3/20**	**Wed 2/5/20**		**0 days**	**0 days**
19		**2.3.3 Site 3 Model**	**5 days**	**Thu 1/30/20**	**Wed 2/5/20**		**0 days**	**0 days**
22		**2.4.0 Proposed Restoration Plan**	**14 days**	**Mon 2/10/2**	**Thu 2/27/20**		**56 days**	**0 days**
23		**2.4.1 Site 1**	**8 days**	**Mon 2/10/2**	**Wed 2/19/2**		**0 days**	**0 days**
24		2.4.1.1 Geomorph Plan	3 days	Mon 2/10/20	Wed 2/12/2015,21SS		67 days	67 d...
25		2.4.1.2 Hydraulic Plan	4 days	Fri 2/14/20	Wed 2/19/20245S+2 da		62 days	62 d...
26		2.4.1.3 Vegetation Plan	4 days	Mon 2/10/20	Thu 2/13/20	15	0 days	0 days
27		**2.4.2 Site 2**	**10 days**	**Fri 2/14/20**	**Thu 2/27/20**		**0 days**	**0 days**
31		**2.4.3 Site 3**	**10 days**	**Fri 2/14/20**	**Thu 2/27/20**		**56 days**	**6 days**
35		**2.5.0 Plan Set**	**85 days**	**Mon 1/13/2**	**Fri 5/8/20**		**5 days**	**0 days**
36		2.5.1 Cover Page	48 days	Mon 1/13/20	Wed 3/18/20		42 days	42 d...
37		2.5.2 Notes	48 days	Mon 1/13/20	Wed 3/18/20		42 days	42 d...
38		2.5.3 Details	55 days	Mon 1/13/20	Fri 3/27/20		35 days	35 d...
39		2.5.4 Topographic Map	14 days	Mon 2/3/20	Thu 2/20/20	11	23 days	23 d...
40		2.5.5 Site Plans	56 days	Fri 2/28/20	Fri 5/15/20	26,30,34	0 days	0 days
41		**2.6.0 Deliverables**	**85 days**	**Mon 1/13/2**	**Fri 5/8/20**		**0 days**	**0 days**
42		2.6.1 30% Submittals	1 day	Fri 2/21/20	Fri 2/21/20	8,39	23 days	23 d...
43		2.6.2 60% Submittals	10 days	Thu 3/5/20	Wed 3/18/2042,30,34		15 days	15 d...
44		2.6.3 90% Submittals	26 days	Thu 3/19/20	Thu 4/23/20	43	15 days	15 d...
45		2.6.4 Final Report and Plan Set	1 day	Fri 5/8/20	Fri 5/8/20	44	5 days	5 days
46		2.6.5 Final Presentation	1 day	Fri 5/8/20	Fri 5/8/20	45SS	5 days	5 days
47		2.6.6 Meeting Memo Binder	85 days	Mon 1/13/20	Fri 5/8/20		5 days	5 days
48		2.6.7 Website	85 days	Mon 1/13/20	Fri 5/8/20		5 days	5 days
49		2.6.8 Impacts	50 days	Mon 3/2/20	Fri 5/8/20		5 days	5 days
50		**2.7.0 Project Management**	**85 days**	**Mon 1/13/2**	**Fri 5/8/20**		**0 days**	**0 days**