ISAACSON & ARFMAN, P.A. Consulting Engineering Associates
Thomas O. Isaacson, PE(RET.) & LS(RET.) . Fred C. Arfman, PE . Åsa Nilsson-Weber, PE

June 30, 2015

FEMA LOMC Clearinghouse
Attention: LOMR Manager
847 South Pickett Street
Alexandria, VA 22304-4605

RE: Case No. 15-06-0805R
Response to Request for Additional Information

Dear Mr. Makhdoom:

I received your comments of April 8, 2015. Unfortunately I was unable to reach you to address my questions. I hope all is well with you.

In general, I'm concerned that you did not receive all of the CLOMR that I mailed, since there were some items that you requested that were included in my last submittal, such as the Topographic Work Map, proposed channel and box culvert plans, and as-builts. I'm also sorry that the Letters of Notification were illegible. Below is a link that will provide you with a pdf of the full CLOMR from the current submittal:

https://iacivil.sharefile.com/d-se2b69db97974c549

In order to make sure you have all critical parts of the submittal, I would appreciate it if you would download this complete pdf.

The following numbered sections are your review comments followed by my response.

1. *"Your recent submittal includes a copy of your letter dated January 7, 2013, addressed to U.S. Fish and Wildlife Service (the Services,) New Mexico Ecological Services Field Office. However, it is not clear if the above-referenced submittal included a copy of the biological assessment report prepared by Marron and Associates dated January 2013, determining the impacts that the proposed project will have on each threatened or endangered species present in the area affected by the project. Please ensure that all of the required information is submitted to the Services. Once a response is received from the Services, please submit to us, a copy of your assessment (including all background information), and all correspondence with the Services."*

   Below is the response Marron & Associate received via email from the USFWS, which is again included at the end of Appendix G, after the copy of the letter that was sent to the USFWS requesting a statement:

   > "Thank you for requesting technical assistance. Under the Endangered Species Act, as amended, it is the responsibility of the Federal action agency or its designated representative to determine if a proposed action "may affect" endangered, threatened, or proposed species,

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or designated critical habitat, and if so, to consult with the U. S. Fish and Wildlife Service (Service) further. Similarly, it is the responsibility of the action agency or project proponent, not the Service, to make "no effect" determinations. If you determine that your projects will have "no effect" on threatened or endangered species or their respective critical habitat, you do not need to seek concurrence with the Service. Still, after reviewing your information, we agree with your determination of no effect."

This email from the USFWS has been accepted in other CLOMR submittals to FEMA. As an example, please see the Mirehaven Arroyo CLOMR, Case No. 13-06-4693R.

2. *"Please submit an as-built survey for the Box Culverts under Tramway Boulevard. Please also submit construction plans for the proposed Pino Arroyo Box Culvert, as previously requested in our letter dated January 7, 2015. Please highlight the dimension of the structures and all elevations necessary for verification of the hydraulic modeling. Please ensure that the drawings are certified (sealed, signed, and dated) by a registered Professional Engineer and reference the vertical datum."*

The as-builts that call out the existing box culvert including type of culvert, location, and invert elevations were previously included in Appendix C. I made sure the inverts (on NGVD 1929 datum) were highlighted in this submittal. In the old datum, they were designed to be at 6010 (inlet) and 6017 (outlet) at the centerline. Per the current design survey they are 6012.39 (inlet) and 6019.95 (outlet) on the NAVD 1988 datum.

Prior to design of this site, I looked for as-builts at the NMDOT, AMAFCA, the City of Albuquerque, and the FEMA library. To the best of my knowledge, the as-builts included in Appendix C are the only as-builts that exist for this area of Tramway Blvd.

NMDOT (formerly NMSHT&D) has historically used and currently uses standard details for culverts and other items, and do not require inclusion of those details in construction plan sets. The construction plans call for location, inverts, size, and type of culvert. Contractors are expected to obtain copies of the standard details before construction, and use them where appropriate. I have found the old standard details for concrete box culverts that show concrete thicknesses and steel design, and included them in Appendix C.

The portions of the proposed box culvert construction plans that apply to the hydrology and hydraulics were previously included in Appendix D after the AMAFCA turnkey agreement and before the Hydraflow Storm Sewer calculations. They are included again.

I am very concerned that you didn't receive these plans in the previous submittal, as they were part of what was mailed. In order to make sure this doesn't happen again, please download the full submittal using the link provided at the beginning of this letter.

3. *"According to the submittal, improvements were made to Tramway Boulevard in 1993 that were never addressed with a CLOMR request and a Letter of Map Change (LOMC). This issue was raised in our letter dated January 7, 2015, but no concrete response was provided. Please provide details of all the construction already completed at the site, including dates when these*

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changes occurred. Please also provide a detailed explanation of the circumstances for not submitting a Letter of Map Revision (LOMR) request for all the completed work so far."

The details of all the work that was completed at the site after the first FIRM map in the area (in 1988) are contained within the NMDOT Tramway Blvd as-builts previously provided in Appendix C. I have included them again in this submittal. This work was done in 1993. Any other changes to the natural drainageway since that time appear to be due to ongoing erosion because storm flows were concentrated by that construction.

You asked again why NMDOT didn't submit a LOMC in 1993. In my previous response I gave you my best guess as to their reasons. This time I did contact NMDOT to present your question, although I feel it was outside the needs of this submittal. The response is attached at the end of this letter.

Your question is in regards to past NMDOT policy, not whether the CLOMR we have provided adequately addresses proposed hydrologic and hydraulic changes to the floodplain. If FEMA needs further answers to this question please have them contact NMDOT directly through other venues. We are requesting the current CLOMR on behalf of Americus, LLC, not the NMDOT, and the submittal addresses the gap between the effective and existing conditions per FEMA's instructions for the MT-2 forms and to the best of our ability.

4. *"Our review revealed that the 1-percent-annual-chance Base Flood Elevations (BFEs) are higher than the end points of Cross-Sections 1873.47, 1086, and 1054.4 in the submitted existing conditions HEC-RAS hydraulic computer model and Cross-Sections 1086 and 1054.4 in the submitted proposed conditions HEC-RAS model along Pino Arroyo. The use of vertically extended cross-sections might both overestimate the BFEs and underestimate the width of the base floodplain. This issue was raised in our letter of January 7, 2015; however, no concrete justification was provided in this regard. Please revise the cross-section geometry coordinates so that the end points of all cross-sections are equal to or extend higher than the corresponding BFEs, or provide documentation that quantifies the amount of split flow that would occur if the cross-sections were not extended, and the extent of all flow breakouts."*

I eliminated Cross Sections 1086 and 1054.4 from both the existing and proposed conditions. They are outside the area of revision, and only were intended to provide some downstream extension of the model. As I mentioned before, both are within the 100-year Pino Dam pool, so those Cross Sections are not truly overtopping. They are just submerged in the dam pool during a major event. There will never be a situation where they don't model as overtopping and they aren't important to the analysis, so I just removed them.

In the existing condition I extended Cross Section 1873.47 125' to the south. I also extended Cross Sections 1878.66, 1887.76, and 1891.58 at gradually decreasing increments to allow for a smoother transition between the Cross Sections.

Since the existing condition is planned to go away and doesn't reflect either the effective or proposed condition, we aren't really mapping the width of the existing floodplain. This was indicated by you when you asked me to remove the existing condition from the Topographic Work Map in the previous round of comments.

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5. *"Our review revealed that the submitted existing and proposed conditions hydraulic models were run using the mixed flow regime. FEMA accepts base floodplain boundary delineations based on supercritical flow depths only for concrete-lined engineered channels. Because the existing and proposed channel is not concrete lined, critical depth is the minimum depth permissible to map the base floodplain boundary delineations along this reach. This issue was raised in our letter of January 7, 2015; however, no concrete justification was provided in this regard. Please revise the hydraulic analysis for this portion of the channel using subcritical modeling, or provide an explanation along with a concrete justification for not using subcritical modeling."*

My previous response was:

> "According to the cHECk-RAS results 'The profile is computed as mixed flow regime. It is acceptable if part of the stream is an engineered channel. For Flood Insurance Studies a subcritical flow regime should be selected, for natural streams. Supercritical flow regime should be selected if the entire stream is an engineered channel. The flow regime should be changed appropriately or justify the selection of mixed flow regime.'
>
> Both the existing and proposed conditions are a mix of lined and natural channel.
>
> In the existing condition the culvert under Tramway Blvd and the concrete rundown into the Pino Dam are lined channels in a supercritical condition. The remaining portions are natural. There is hydraulic jump upstream and downstream of the existing box culvert.
>
> For the proposed condition the 70'± portion upstream of the existing condition is a natural channel. Everything else is either in a culvert or a lined channel. There is hydraulic jump upstream of the existing box culvert.
>
> Per the HEC-RAS User's Manual, hydraulic jump is another reason to use the mixed flow regime. Mixed flow regime is appropriate for both analyses."

I included my previous response again because I believe it provided some explanations that are still appropriate. I want to make sure that this comment is adequately addressed this time, so I will expand on my reasoning below.

I also added some language in the CLOMR report under both the existing condition (page 10) and the proposed condition (page 12) to include a reference to the HEC-RAS v4.1 Hydraulic Reference Manual on Page 3-23, in the 3rd paragraph. It says **"In cases where the flow regime will pass from subcritical to supercritical, or supercritical to subcritical, the program should be run in a mixed flow regime mode."** This statement is the initial basis of my claim that a mixed flow regime is appropriate. Further explanation is included below.

EXISTING CONDITION

A 631'± portion of the existing channel between the existing box culvert under Tramway Blvd and the concrete-lined rundown is natural. There is also a 66'± transition area just upstream of the existing 5-barrel box culvert that is not lined in both the proposed and existing conditions. The transition area is required to show a practical transition from the effective upstream limits, showing the floodplain narrowing down at the entrance to the existing box culvert. This area is

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where the hydraulic jump occurs and for a short space the flows become subcritical. At the entrance to the existing box culvert the flows again become supercritical.

This is a total of 697'± out of the 1,081' area revised in this CLOMR that is in a natural state. The remaining 384'± is concrete-lined and mostly supercritical. (36% hard-lined, 64% natural)

I disagree with your assertion that the existing condition isn't a concrete-lined channel. A more accurate statement would be that it is a partially concrete-lined, engineered channel. **Assuming that the existing condition is all natural and in a subcritical state creates false results in the modeling.**

To check my suppositions, I reran the existing condition using subcritical flow regime. I have included the results with this letter (see attached) as a reference to explain why a subcritical flow regime is incorrect for this site. **The existing conditions model in the CLOMR report is still the mixed flow regime.**

Please note that for most of the run the subcritical regime calculates a Fruede number of 1.0. I believe these areas are most likely in a supercritical condition, either because it is in a concrete-lined rundown, a concrete box culvert, or it is a supercritical natural channel. (The natural channel is in a highly erosive state.)

Cross Sections 1168.85, 1239.93, and 1251.03 cover the existing concrete rundown on the side slopes of the Pino Dam. This is a 6'± deep, 20' bottom-width, trapezoidal concrete channel at a 20% longitudinal slope. Manning's equation shows this portion of the arroyo as supercritical. (See attached.) When using the subcritical flow regime these cross sections all model as overtopping. I don't believe overtopping subcritical flows are the true existing condition, since there is no sign of erosion behind the edges of the rundown. (Even if it were actually subcritical, the overtopping flows would all be contained by the dam pool. They would not harm other nearby structures.)

In the natural channel that lies between the existing 5-barrel box culvert and the concrete rundown, there is evidence of extensive erosion in the existing field conditions. This can be an indication of a natural channel in a supercritical state.

The steep slopes and high flows in the existing 5-barrel box culvert are also inconsistent with subcritical flow. I used Manning's equation to confirm that existing conditions are supercritical for one of the five 10'x10' barrels carrying 1/5 of the flow treated as an open channel. (See attached.)

The subcritical flow regime provides an analysis that is inconsistent with other calculation methods and visual evidence in the field. A supercritical flow regime would not take into account portions of the natural channel that are subcritical. The mixed flow regime results are consistent with all of this information.

Finally, the existing condition will be eliminated in the proposed condition. The existing condition model is not indicative of either the effective condition or the proposed condition of the floodplain. The existing condition model isn't intended to affect the final outcome of the floodplain, except to provide BFE's for comparison to the proposed condition since the effective condition no longer reflects reality.

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By providing a subcritical flow regime in this case, the existing BFEs calculate at higher than reality, and make it appear that there are fewer places where the proposed BFEs increase by 1'.

The subcritical flow regime is inappropriate for the existing condition model. The mixed flow regime should be used.

PROPOSED CONDITION

In the proposed condition **everything from the entrance of the existing box culvert to the dam water surface elevation is concrete-lined and supercritical**. This means 1,015'± of the 1,081'± in the revision area (94%) is hard-lined.

There is also a 66'± transition area just upstream of the existing 5-barrel box culvert that is not lined. (6% natural.) This area is required to show a practical transition from the effective upstream limits, showing the floodplain narrowing down at the entrance to the existing box culvert. This area is where the hydraulic jump occurs and for a short space the flows become subcritical. At the entrance to the existing box culvert the flows again become supercritical.

I disagree with your assertion that the proposed condition isn't a concrete-lined channel. A more accurate statement would be that it is a mostly concrete-lined, engineered channel, with a minor section of natural channel. **Assuming that the proposed condition is all natural and in a subcritical state creates false results in the modeling.**

Manning's equation confirms the 12'x12' portion of the proposed box culvert (if treated as an open channel) as supercritical at the flattest slope. (See attached.) Manning's equation also shows the existing concrete-lined sections calculate as supercritical, as mentioned above.

Subcritical flow regime would not be at all appropriate for the proposed condition. The steep slopes and high velocity are inconsistent with subcritical flows. Supercritical flow regime would be closer to appropriate, but wouldn't reflect the transition area upstream of the existing 5-barrel concrete box culvert where we have a short subcritical run.

The mixed flow regime is appropriate for the proposed condition.

We have had other CLOMR projects approved by FEMA with mixed flow regime for channels with mixed lining options. As a recent example, please see the Mirehaven Arroyo CLOMR, Case No. 13-06-4693R that I mentioned above.

6. *"Our review revealed that Appendix A of the submitted report entitled "Request for CLOMR for Pino Arroyo at the Foothills," prepared by Isaacson & Arfman, P.A. Consulting Engineering Associates, revised dated February 27, 2015, did not include any topographic work map, as listed under the table of contents of the above report. Please submit a topographic work map, certified by a registered Professional Engineer that shows all applicable items listed in Section C of Application/Certification Form 2, entitled "Riverine Hydrology and Hydraulics Form". Moreover, a quick review of the digital Computer-Aided Design (CAD) copy, included with the recent submittal, indicates the following issues that should also be resolved."*

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Again, I am very concerned that you didn't receive the Topographic Work Map in the previous submittal. In order to make sure this doesn't happen again, please download the full submittal using the link provided at the beginning of this letter.

a. *"Please ensure that the submitted work map shows clearly boundary delineations of the proposed conditions and currently effective base floodplain on the same map. Please continue to show a legend to all the proposed and effective flood hazard information shown."*

   The effective and proposed limits are again provided on the same map.

b. *"Please ensure that logical tie-in is provided between the proposed and effective flood hazard boundary delineations. Please ensure to provide BFE tie-in at both ends."*

   The BFE's are shown on both ends.

c. *"Please continue to show topographic contour information used in the hydraulic model and for the boundary delineations of the base floodplain."*

   Provided.

d. *"Cross-Sections 2183.63 and 2200 are intersecting each other. Similarly, Cross-Sections 1942.35 and 1948.66 are also intersecting. Cross-Section 1948.66 is shown on the work map but not included in the hydraulic analysis. Please ensure that all cross-sections used in the hydraulic model are shown on the work map and do not intersect each other."*

   I shortened Cross Section 2183.63 by 1' to make sure it doesn't overlap with Cross Section 2200. Thank you for bringing that to my attention.

   In the existing condition, Cross Section 1948.66 is fine. Because it's for the existing condition it doesn't actually appear on the work map, although there was a label for it that I hadn't removed. You logically mistook that for Cross Section 1960.26. (The 1948.66 label is now removed. Thank you for pointing that out.)

   I checked the proposed condition at Cross Section 1960.26. It does appear on the work map, and could seem like it intersects the proposed condition Cross Section 1942.35. Actually Cross Section 1960.26 is about 0.7' short so it doesn't really cross 1942.35. It just looks like it does because of the thickness of the polyline.

e. *"Certification by a registered Professional Engineer."*

   Provided.

f. *"Reference to a datum, such as the National Geodetic Vertical Datum of 1929."*

   Added to General Note 3. It is NAVD 1988.

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g. *"Please ensure that the topwidth of the base floodplain computed in the proposed conditions hydraulic model match, at all cross-sections, the base floodplain topwidth shown on the topographic work map. The geometry of the cross-sections in the proposed conditions hydraulic model should reflect the topography shown on the work map."*

The topwidths were imported using GIS technology, and were confirmed to be consistent with the survey by me.

h. *"Please ensure that the channel distances computed in the proposed conditions hydraulic analysis at all cross-sections match the approximate channel distance shown on the above-referenced topographic work map."*

The channel distances were imported using GIS technology, and were confirmed to be consistent with the survey by me.

i. *"Please continue to provide digital Computer-Aided Design (CAD) or Geographic Information System (GIS) data that reflect the revised topographic work map. Please ensure that the digital data are spatially referenced and cite what projection (coordinate system, example: UTM/State Plane) was used, so that the data may be used for accurate mapping. The important data to show on the digital work map are the contour information, the profile baseline, the cross-section lines, the road crossings and hydraulic structures, the effective and proposed conditions flood hazard delineations, and the tie-in locations. All data should be clearly labeled, and all information should be contained within the drawing and not externally referenced."*

See CD in Appendix F.

7. *"Please submit an updated annotated FIRM, if needed, at the scale of the effective FIRM, that clearly shows the effective boundary delineation and revised boundary delineation as shown on the submitted work map of the base floodplain and how the revised boundary delineation ties-in to the boundary delineation shown on the effective FIRM at the downstream and upstream ends of the revised reach."*

These are provided in Appendix A.

8. *"Our review indicates that the proposed project causes an increase of more than 1.0 foot in BFEs, the elevation of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) at Cross-Sections 1370.42, 1310.72, 1251.03 and 1239.93, where there is an increase of 1.08, 2.64, 2.81, and 2.86 feet, respectively when compared to existing BFEs. Please provide evidence that the proposed project satisfies the requirements of Section 65.12 of the National Flood Insurance Program (NFIP) regulations, including the items stated below.*

a. *Evaluation of alternatives that would not result in an increase in BFE of more than 1.0 foot and an explanation why these alternatives are not feasible."*

The only alternative that would not result in an increased BFE in those locations would require that the proposed box culvert invert be lowered by approximately 3 feet at the outlet. We are constrained by a future sewer main depth to keep it at the inverts provided.

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While the BFE is more than 1' higher than the calculated existing water surface in those locations, it is actually contained in an underground structure. The adjacent grades are raised to provide cover over the proposed box culvert. The only property that is within the area affected by the increased depth is owned by Americus, LLC. (the developer,) and that area is removed from the concerns of flooding by these improvements.

b. *"Documentation that individual legal notices have been sent to all property owners affected by the increases in BFEs due to the proposed project. Documentation of legal notice may take the form of a copy of the letter sent and either a mailing list or certified mailing receipts. The template attached with our letter dated January 7, 2015, may be used to prepare the legal notice.* ***Prior to distribution, please submit a draft copy of the notice for verification of content.*** *Copies of the draft letter included with your recent submittal were not legible. Please submit legible copies of the draft notifications."*

I'm sorry they weren't legible. I've attached the draft copies that I sent previously at the end of this letter, as well as in the appendices of the CLOMR.

If these are acceptable, I will send them to the neighbors.

c. *"Certification by a Professional Engineer that no structures are located in areas that would be impacted by the increased BFEs due to the project."*

Before the re-construction of Tramway Blvd that built the existing 5-barrel box culvert, the Pino Arroyo essentially sheet flowed across this site. (This is reflected in the effective floodplain.) The current natural channel has been eroded down from that historic grade. The entirety of the Foothills site, even the banks of the natural channel, is lower than the adjacent subdivision to the north and the apartment complex to the south. (I call your attention to the existing contours on the Topographic Work Map.) If flows overtop the existing natural channel, they still surface flow west towards the top of the Pino Dam. In the existing condition, the storm water does not approach the structures to the north or south, and they flow away from Tramway Blvd.

I certify that no existing structures are impacted by the increased BFEs. Future structures will be above the proposed BFE, and will also not be impacted by the increased BFEs.

9. *"Please submit a copy of the newspaper notice stating an intent to revise or establish the flood hazard information (i.e., base flood elevations/base flood depths, and base flood floodplain) along Pino Arroyo and Tributary 1 Pino Arroyo, or submit documentation that individual legal notices were sent to all the property owners affected by any increases in or establishment of flood hazard information. Documentation of legal notice may take the form of a copy of the letter sent along with certified mailing receipts or a mailing list. The newspaper notice or individual legal notices must include contact information for any interested parties.* ***Please submit draft copies of the sample letter prior to distribution. Please also note that a newspaper notice may not be used to fulfill the notification requirement of NFIP Regulation 65.12."***

I'm sorry they weren't legible. I've attached the draft copies that I sent previously at the end of this letter, as well as in the appendices of the CLOMR.

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If these are acceptable, I will send them to the neighbors and newspaper.

If you have further questions, I can be reached at gennyd@iacivil.com or 505-268-8828.

Sincerely,
Isaacson & Arfman, P.A.

Genevieve Donart, PE
GD/gld

ATTACHMENTS

Cc: Curtis Cherne, City of Albuquerque Floodplain Administrator
Lynn Mazur, AMAFCA
John Mechenbier, Americus, LLC

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Genny Donart

From: Friedt, Nicole, NMDOT <Nicole.Friedt@state.nm.us>
Sent: Monday, May 11, 2015 9:45 AM
To: Genny Donart (gennyd@iacivil.com)
Cc: Trujillo, Timothy R, NMDOT; Barber, Ted L., NMDOT
Subject: FEMA Floodplains at Pino Arroyo and Tramway Blvd.

In regard to the widening of Tramway Blvd at the Piño Arroyo: This project was developed and constructed in the late 1980's. Very little information exists documenting the decision making that led to the final project improvements. Specifically, no documentation is available that identifies how floodplain delineations impacted the decisions made for this project. Therefore, at this time, we, as a department, cannot identify why a LOMR was not submitted for this project at the time.

The department's standard criteria is to not adversely affect the floodplains on either side of the right-or-way (upstream or downstream). A significant number of our drainage infrastructure is to convey runoff from one side of the road to the other, maintaining historic floodpaths, and are sized to assure that the flood carrying capacity is maintained. As such, floodplains that cross the highways were not modified as the effects of the our construction would not alter the floodplain delineations that impact private property owners. Since the department is not required to carry flood insurance for roadways, the removal or alteration of floodplains within our right-of-way is not our primary mission. Most of these modifications would simply show the floodplain going into and out of a closed structure or pass through a bridge. We look to the local communities who participate in the NFIP to identify when and where a LOMR will be needed. The FEMA FIRM maps have undergone several modifications over the years, and this area, to my knowledge, has not been identified by the community as a need for update.

Sorry I could not be of more assistance. Please let me know if you have any further questions.
Thanks,
Nicole

Nicole Friedt, P.E., CFM
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P: 505.827.5329 | C: 505.670.1540

New Mexico DEPARTMENT OF TRANSPORTATION
MOBILITY FOR EVERYONE

PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

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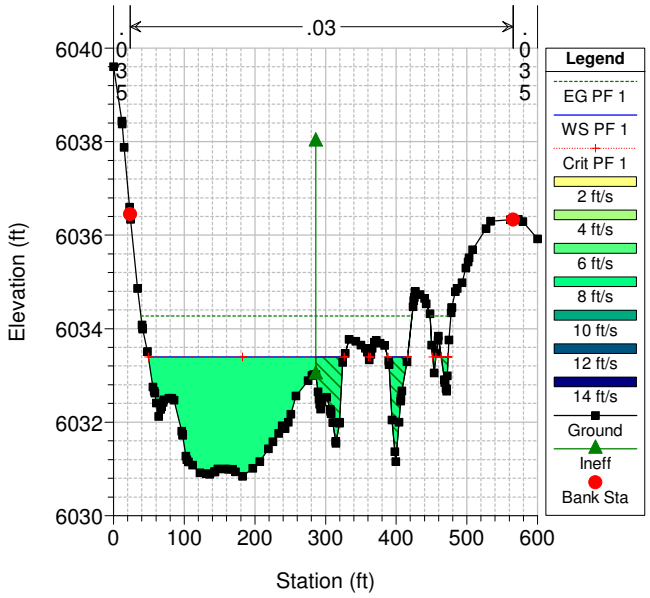

PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

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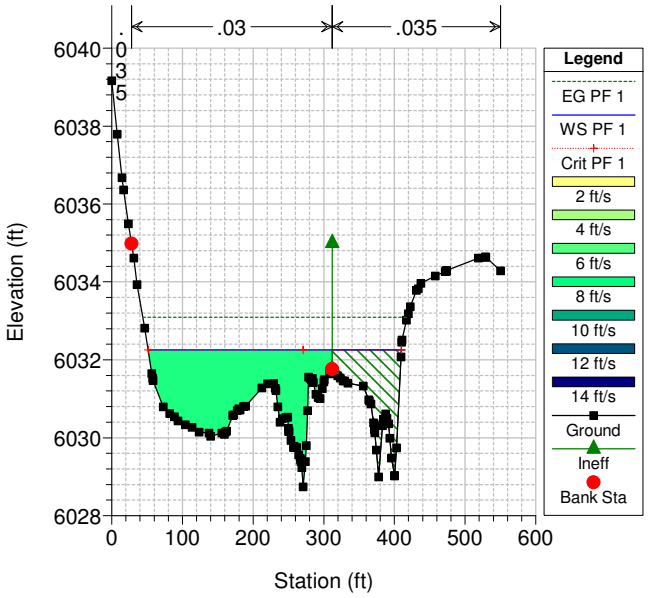

PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

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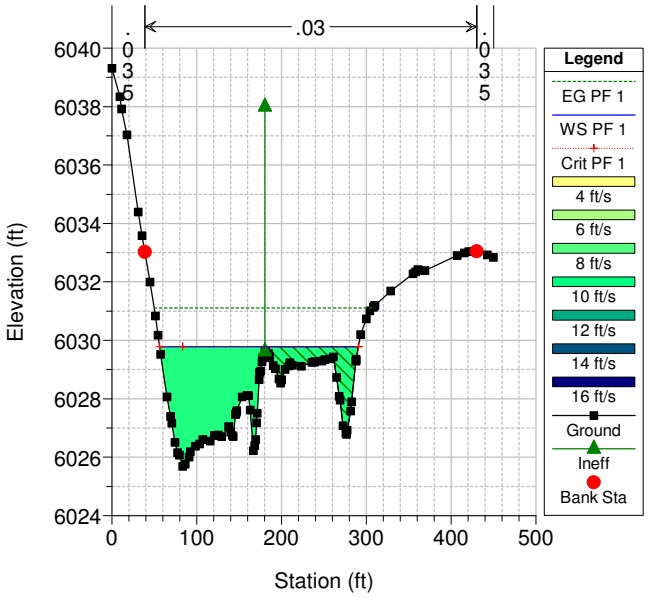

PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

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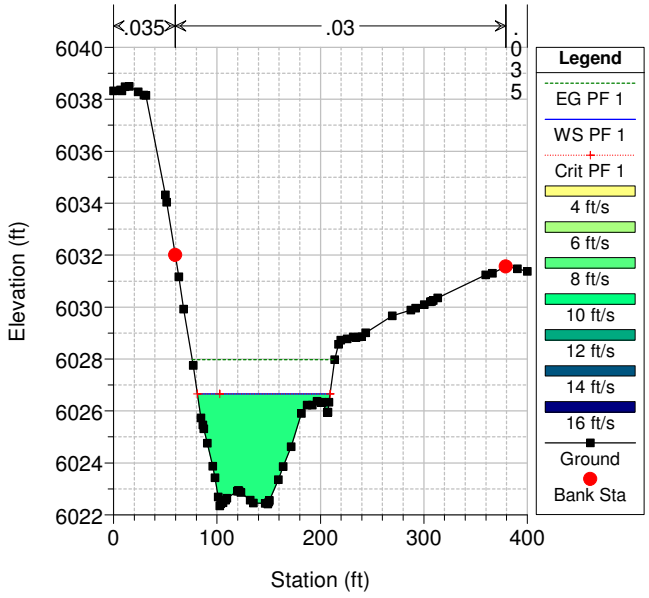

PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

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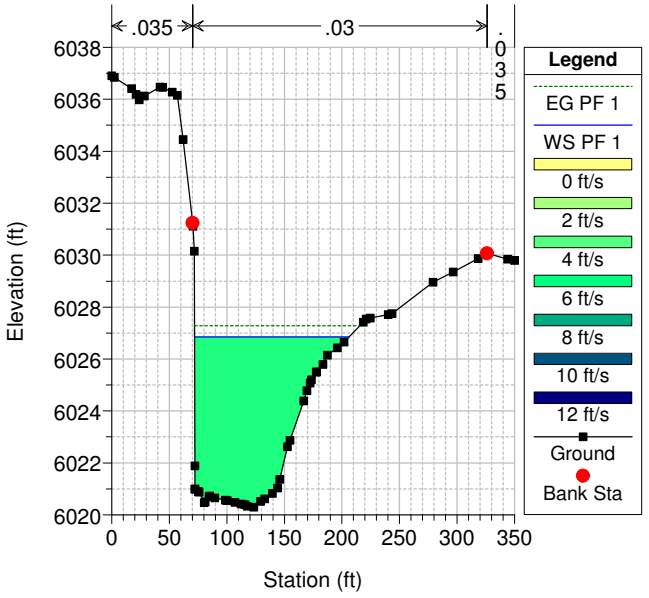
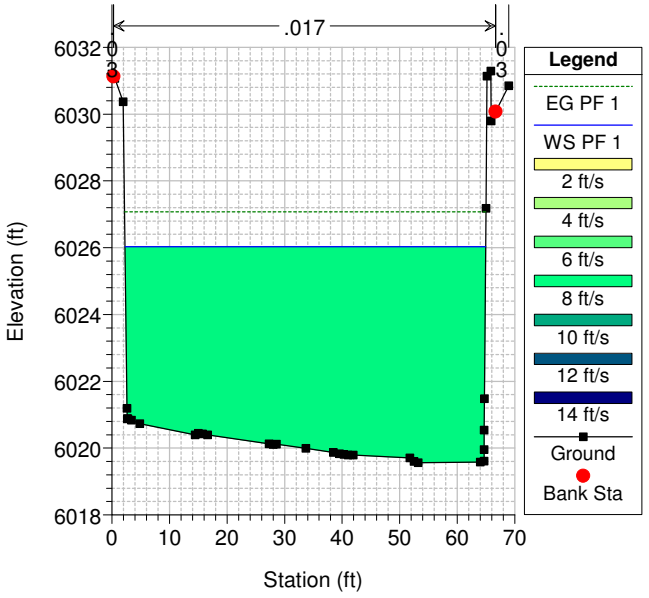


PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

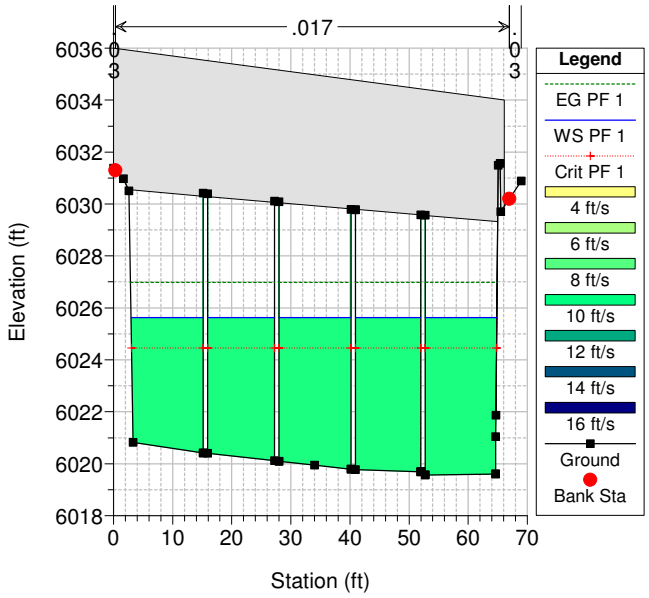
RS = 2183.63



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

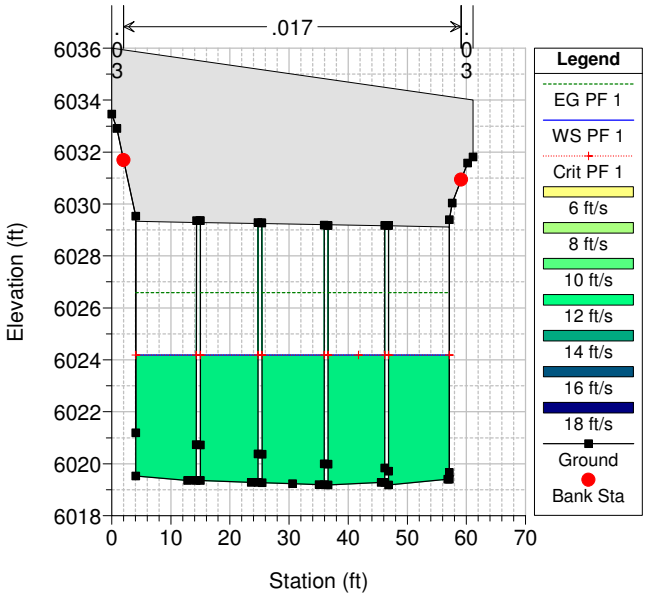
RS = 2183.05



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

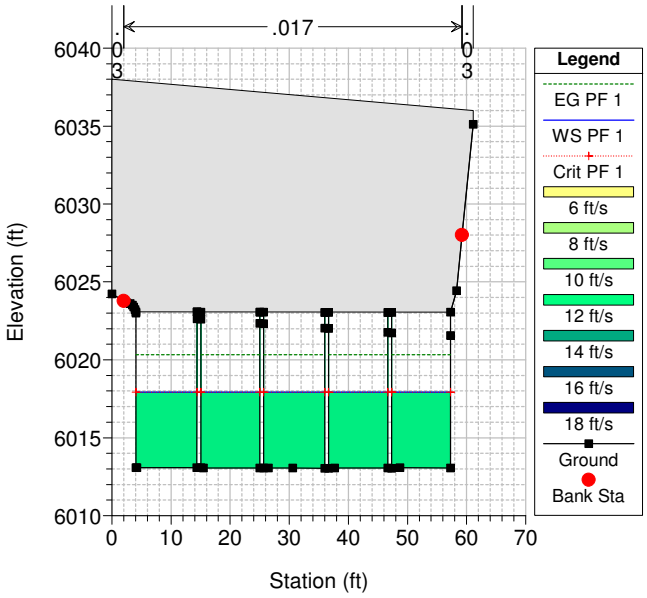
RS = 2162



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

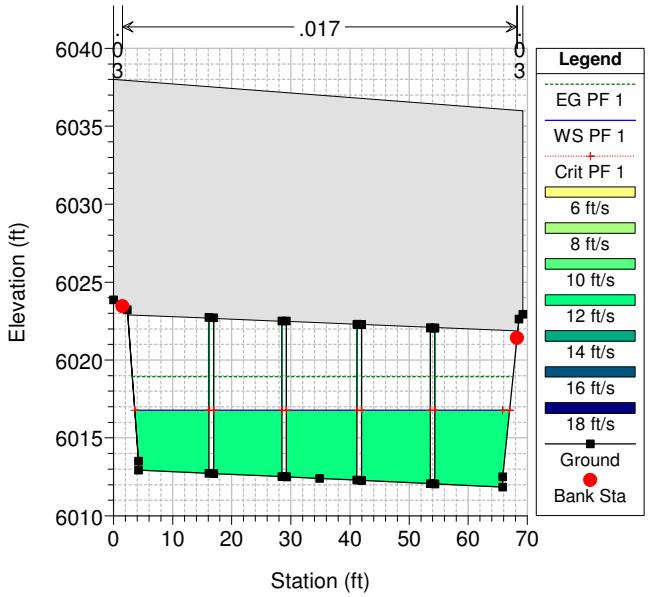
RS = 1980



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

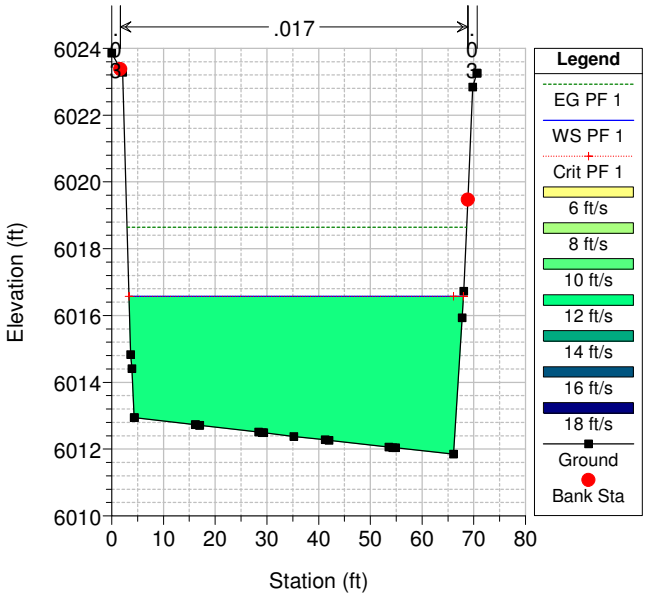
RS = 1960.84



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

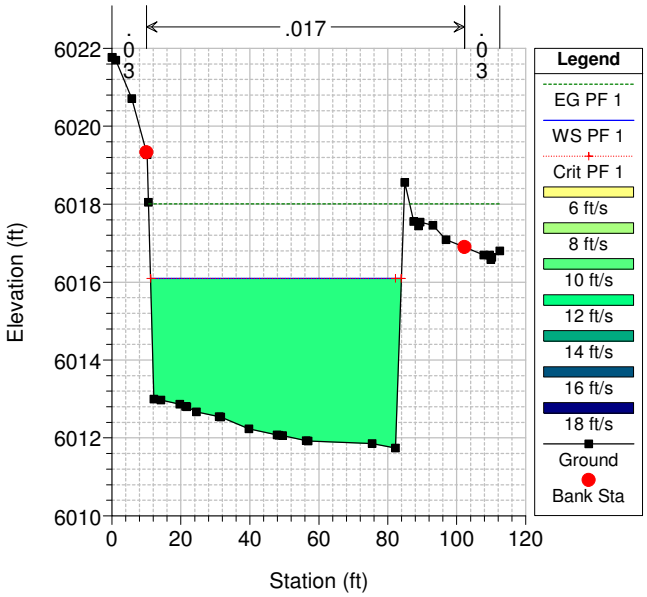
RS = 1960.26



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

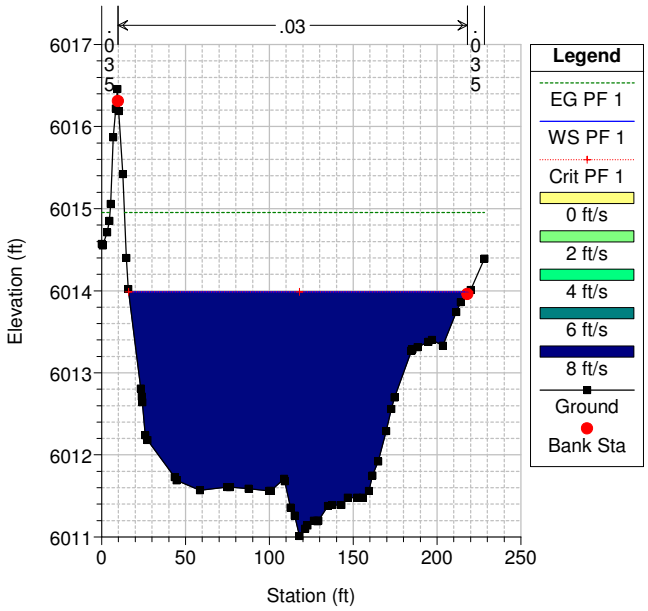
RS = 1948.66



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

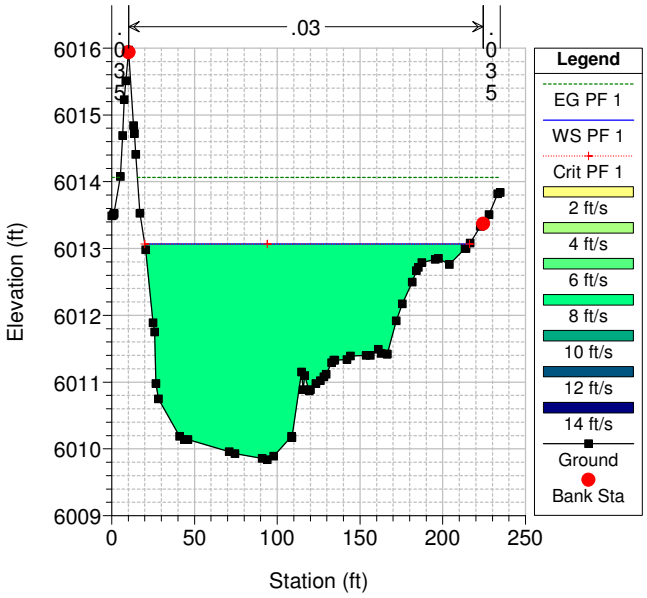
RS = 1901.89



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

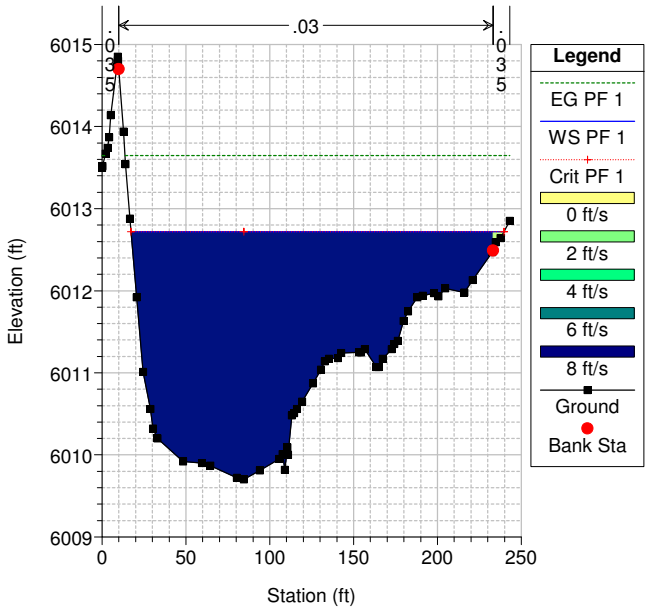
RS = 1898.1



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

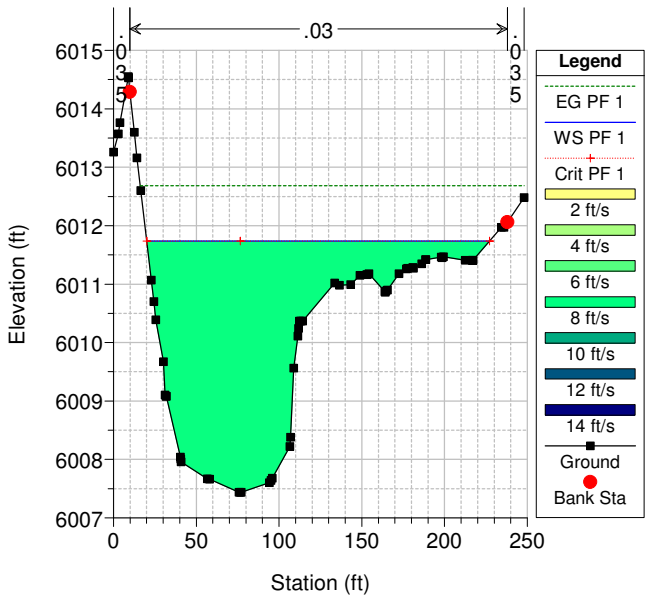
RS = 1891.58



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

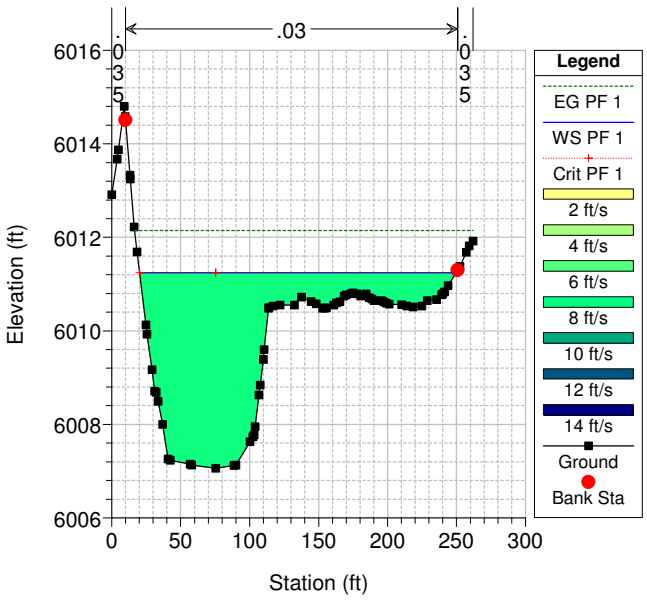
RS = 1887.76



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

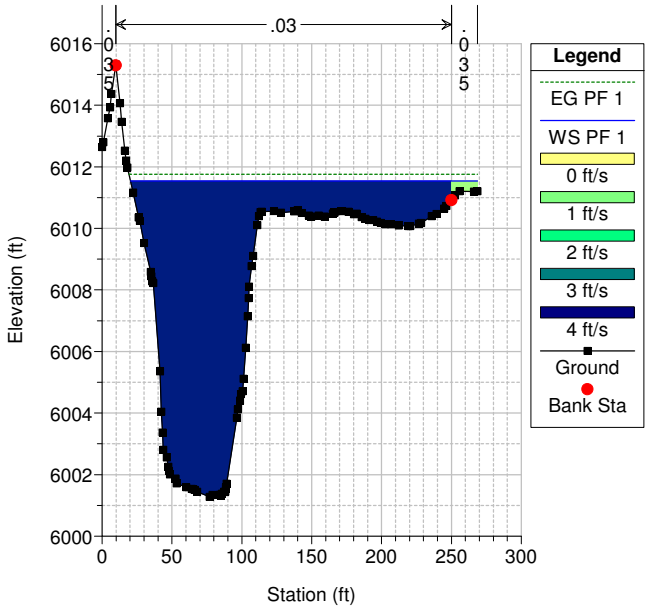
RS = 1878.66



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

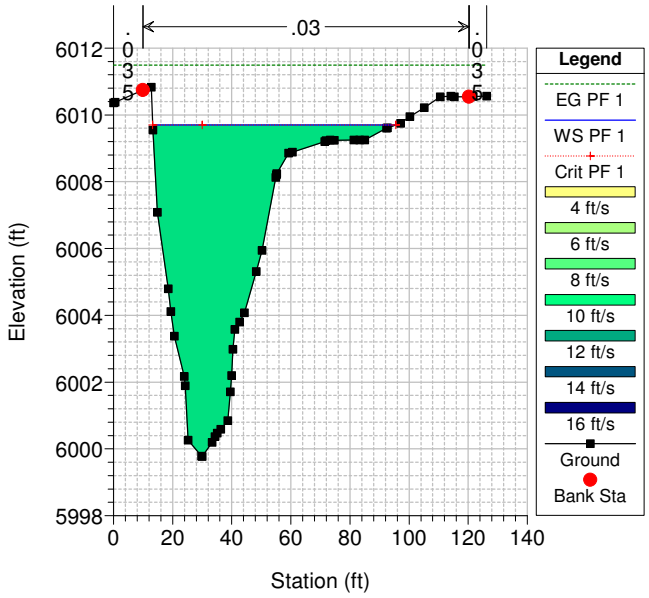
RS = 1873.47



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

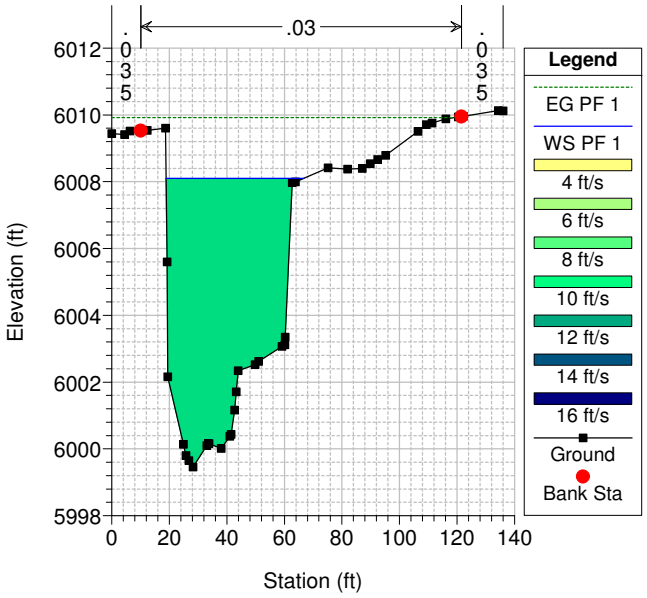
RS = 1828.98



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

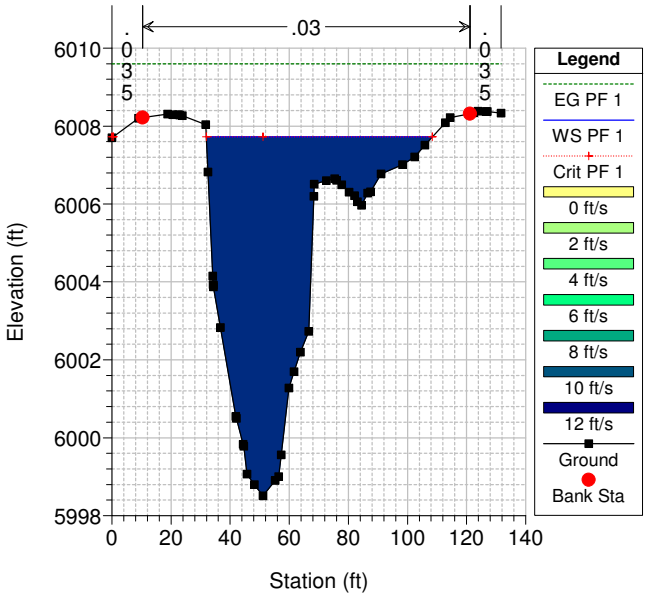
RS = 1807.37



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

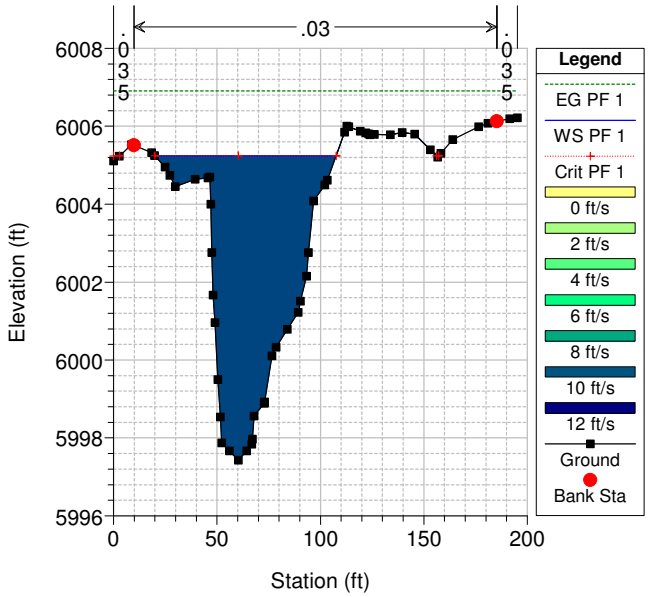
RS = 1763.38



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

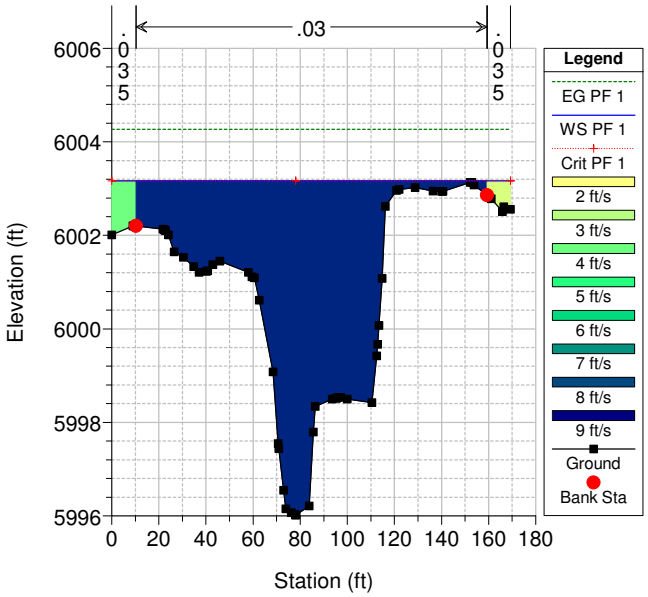
RS = 1700



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

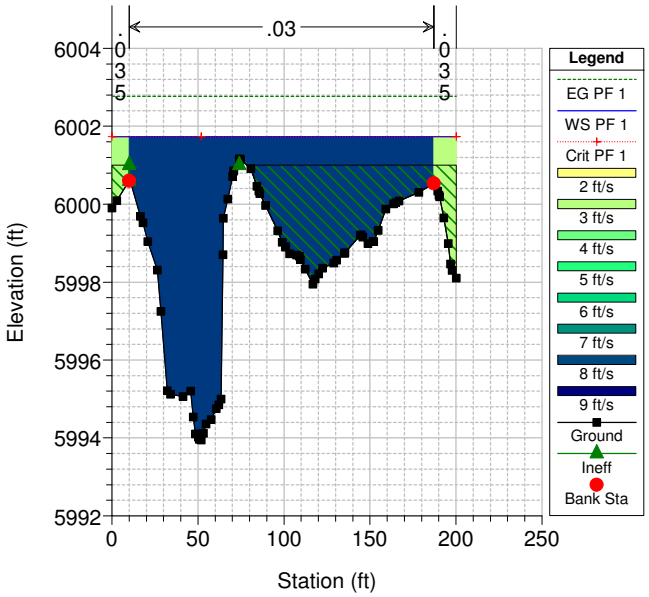
RS = 1629.49



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

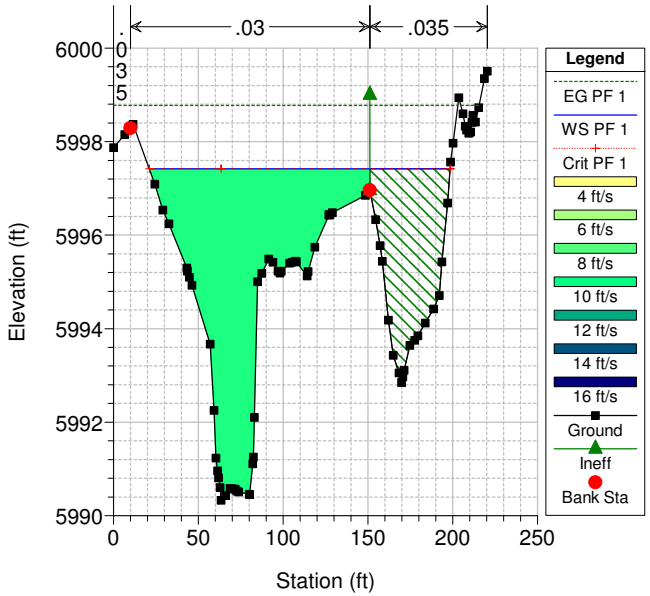
RS = 1550



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

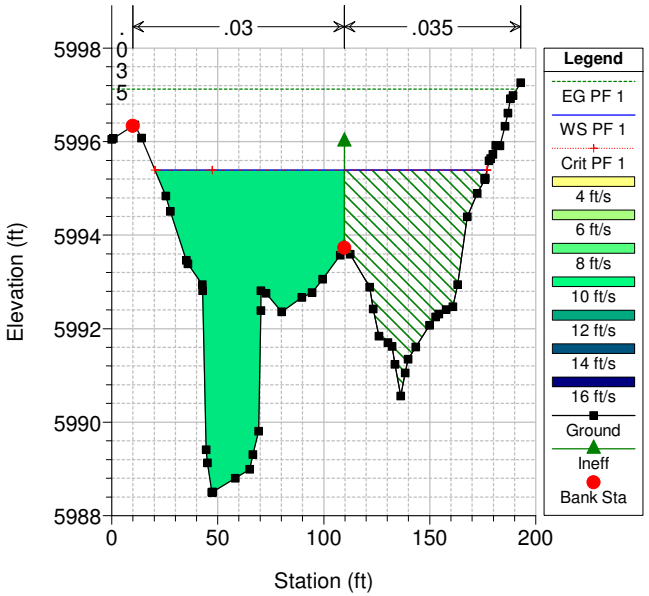
RS = 1481.63



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

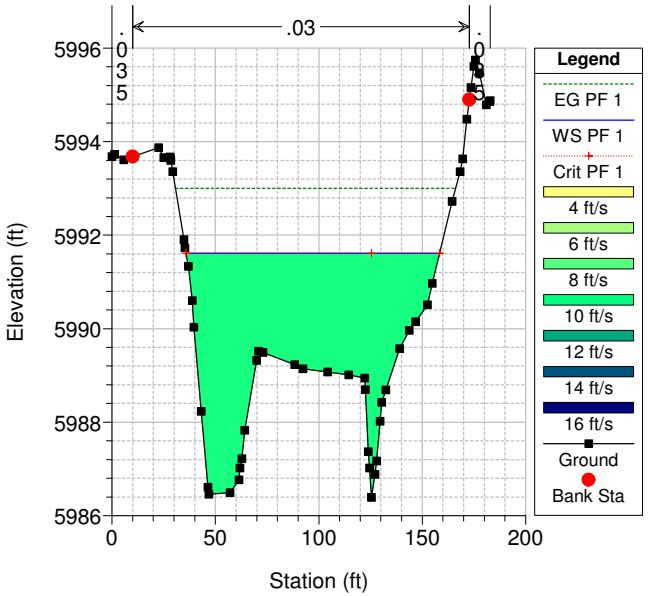
RS = 1426.03



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

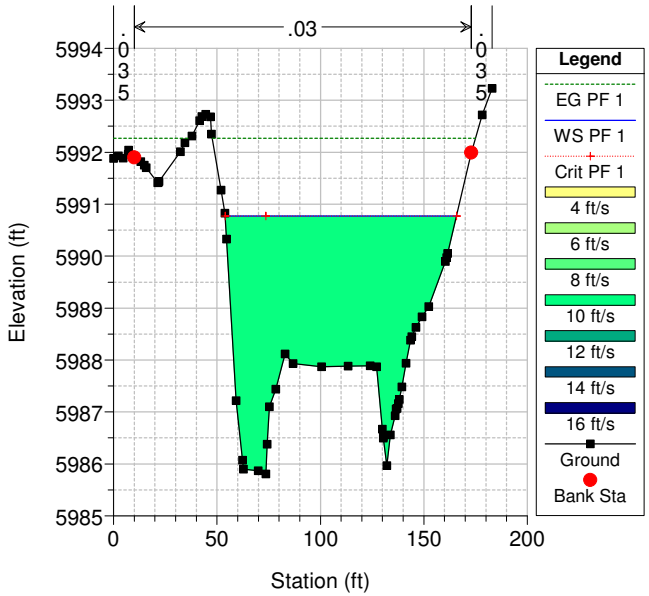
RS = 1370.42



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

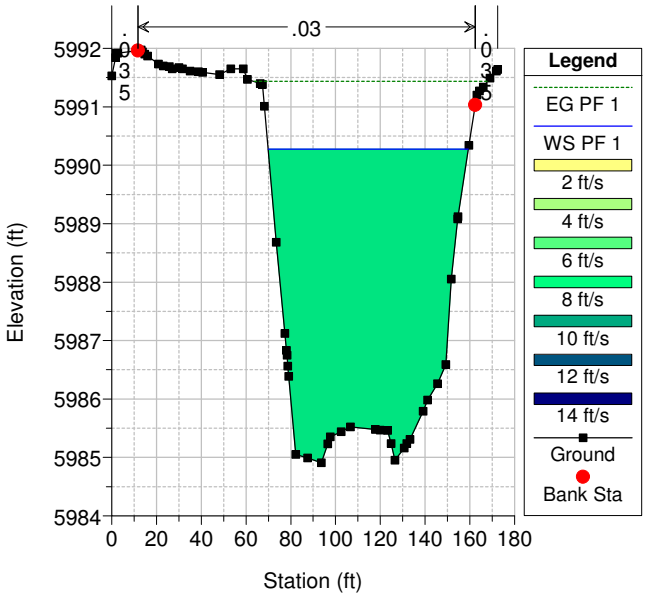
RS = 1350



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

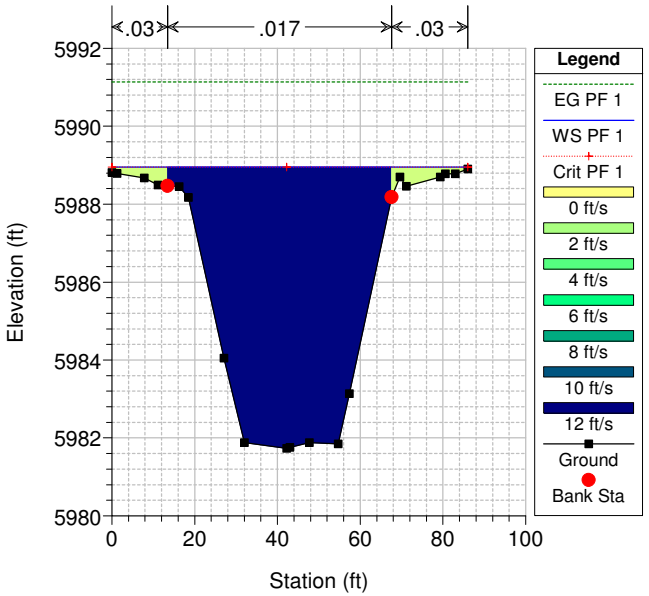
RS = 1310.72



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

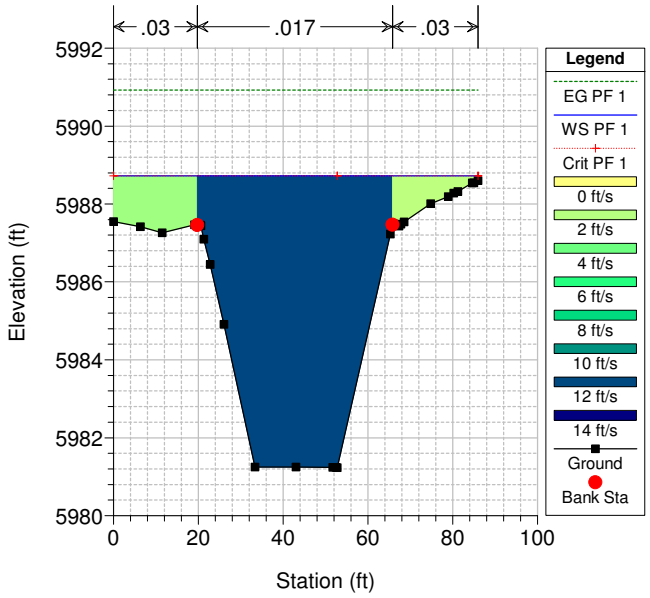
RS = 1251.03



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

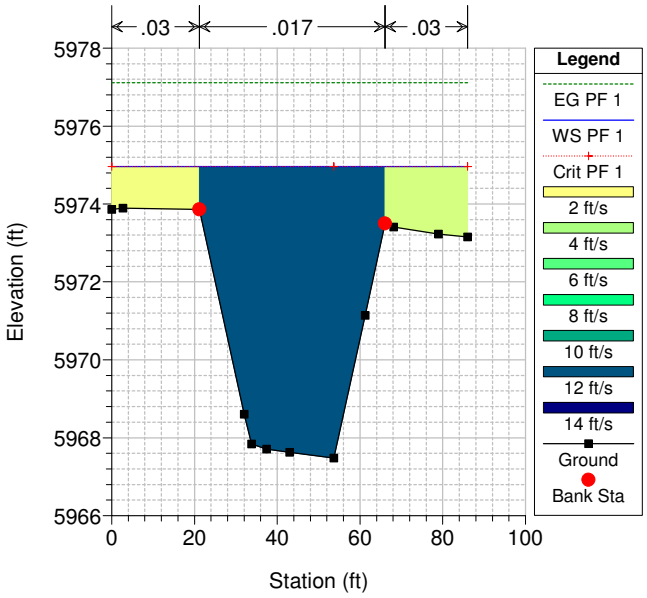
RS = 1239.93



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

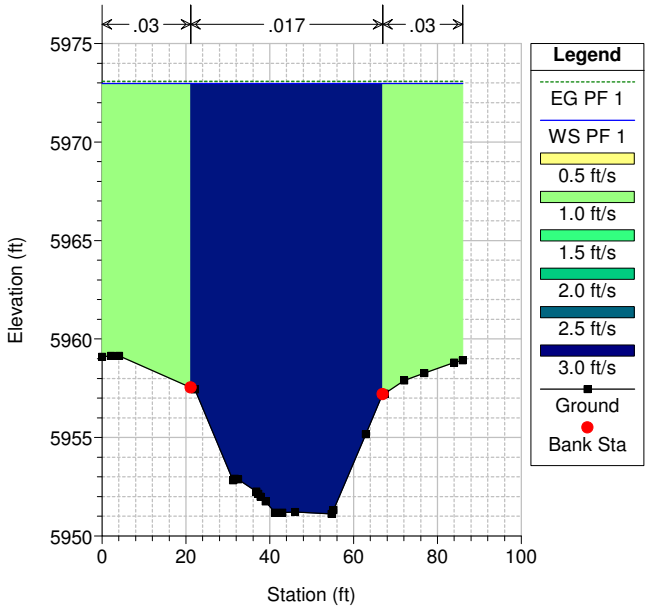
RS = 1168.85



PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

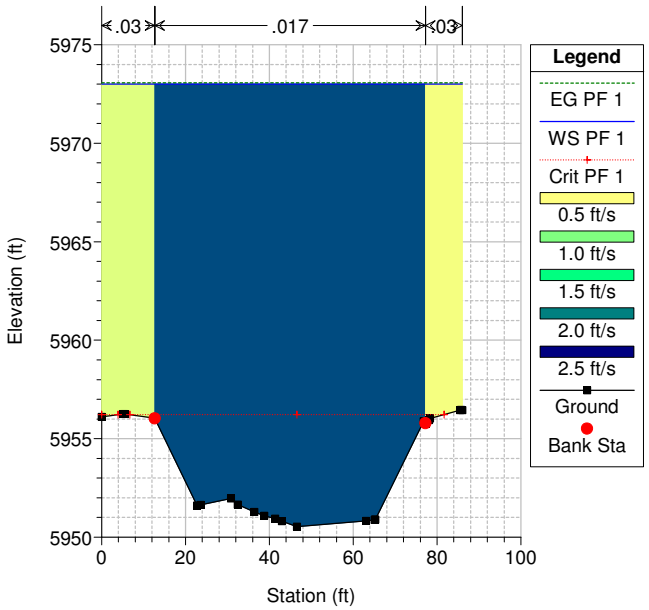
RS = 1086

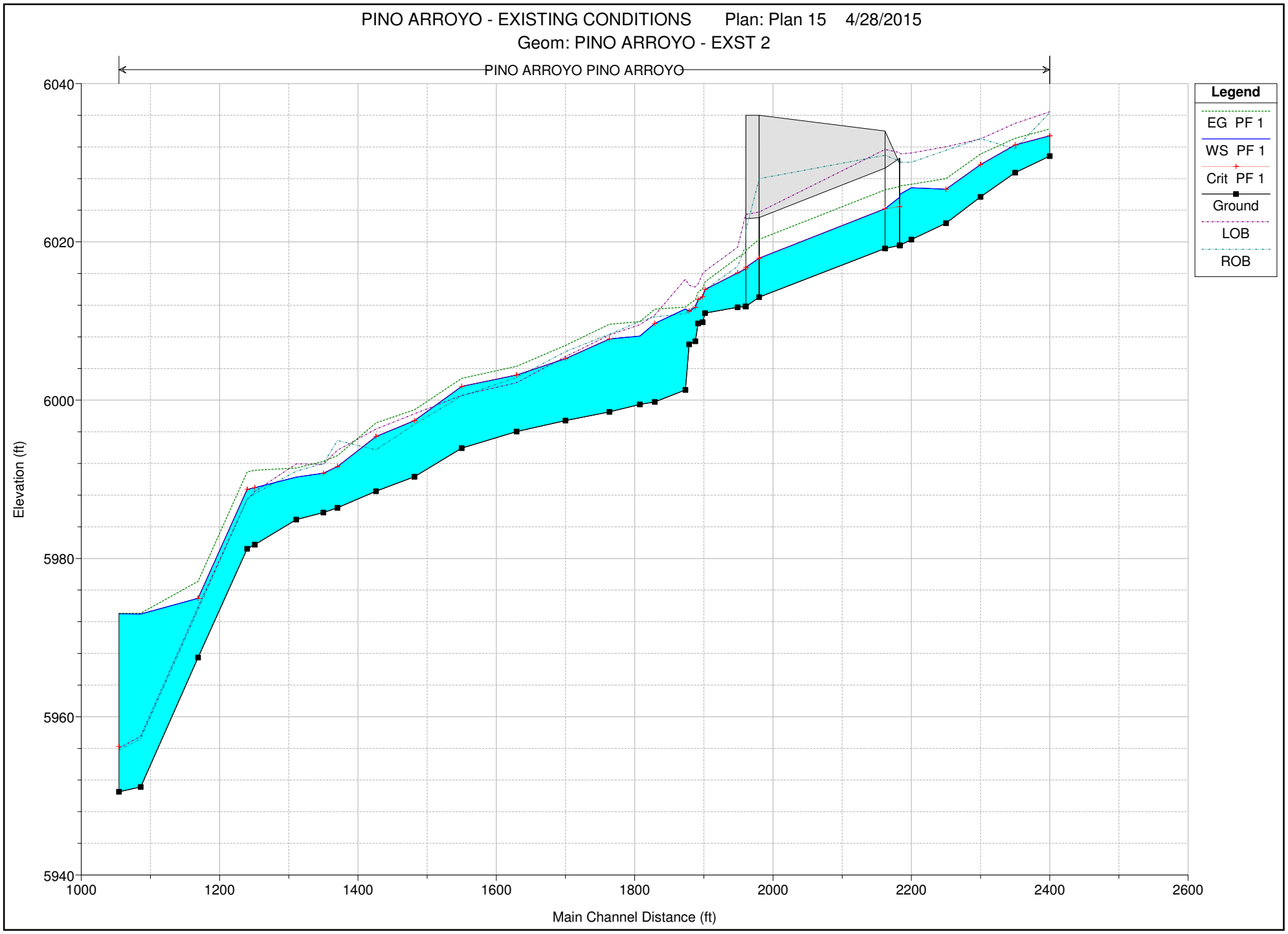


PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015

Geom: PINO ARROYO - EXST 2

RS = 1054.4




PINO ARROYO - EXISTING CONDITIONS Plan: Plan 15 4/28/2015
Geom: PINO ARROYO - EXST 2
PINO ARROYO PINO ARROYO
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
LOB
ROB
Elevation (ft)
6040
6020
6000
5980
5960
5940
1000
1200
1400
1600
1800
2000
2200
2400
2600
Main Channel Distance (ft)

HEC-RAS Plan: EXST River: PINO ARROYO Reach: PINO ARROYO Profile: PF 1

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)	
PINO ARROYO	2400	PF 1	3061.00	6030.84	6033.40	6033.40	6034.27	0.011102	7.50	408.36	322.08	1.01
PINO ARROYO	2350	PF 1	3061.00	6028.74	6032.25	6032.25	6033.09	0.011789	7.34	417.07	358.40	1.02
PINO ARROYO	2300	PF 1	3061.00	6025.69	6029.78	6029.78	6031.11	0.009617	9.26	330.44	234.34	1.00
PINO ARROYO	2250	PF 1	3061.00	6022.35	6026.66	6026.66	6027.98	0.009810	9.21	332.34	128.40	1.01
PINO ARROYO	2200	PF 1	3061.00	6020.29	6026.85		6027.28	0.001722	5.29	578.34	134.01	0.45
PINO ARROYO	2183.63	PF 1	3061.00	6019.56	6026.03		6027.08	0.001009	8.20	373.41	62.65	0.59
PINO ARROYO	2183.05	PF 1	3061.00	6019.57	6025.62	6024.45	6026.98	0.002820	9.36	327.02	58.82	0.70
PINO ARROYO	2162	PF 1	3061.00	6019.18	6024.19	6024.19	6026.59	0.006015	12.43	246.31	50.42	0.99
PINO ARROYO	1980	PF 1	3061.00	6013.03	6017.93	6017.93	6020.33	0.006023	12.43	246.23	50.59	0.99
PINO ARROYO	1960.84	PF 1	3061.00	6011.85	6016.78	6016.78	6018.93	0.005241	11.77	260.16	60.37	1.00
PINO ARROYO	1960.26	PF 1	3061.00	6011.85	6016.57	6016.57	6018.65	0.002999	11.55	264.95	64.66	1.01
PINO ARROYO	1948.66	PF 1	3061.00	6011.74	6016.09	6016.09	6018.01	0.002998	11.11	275.64	72.70	1.01
PINO ARROYO	1901.89	PF 1	3061.00	6011.01	6013.99	6013.99	6014.96	0.010680	7.89	387.75	203.24	1.00
PINO ARROYO	1898.1	PF 1	3061.00	6009.84	6013.07	6013.07	6014.06	0.010793	8.01	382.28	196.22	1.01
PINO ARROYO	1891.58	PF 1	3061.00	6009.70	6012.72	6012.72	6013.65	0.010887	7.73	396.46	222.43	1.01
PINO ARROYO	1887.76	PF 1	3061.00	6007.44	6011.74	6011.74	6012.69	0.010724	7.82	391.58	207.17	1.00
PINO ARROYO	1878.66	PF 1	3061.00	6007.06	6011.25	6011.25	6012.15	0.011284	7.62	401.70	229.66	1.02
PINO ARROYO	1873.47	PF 1	3061.00	6001.28	6011.54		6011.76	0.001115	3.78	815.36	248.16	0.36
PINO ARROYO	1828.98	PF 1	3093.00	5999.77	6009.70	6009.70	6011.49	0.009704	10.73	288.13	82.29	1.01
PINO ARROYO	1807.37	PF 1	3093.00	5999.46	6008.10		6009.92	0.005623	10.82	285.78	48.00	0.78
PINO ARROYO	1763.38	PF 1	3093.00	5998.51	6007.72	6007.72	6009.60	0.009667	10.99	281.47	76.87	1.01
PINO ARROYO	1700	PF 1	3093.00	5997.43	6005.24	6005.24	6006.91	0.009296	10.37	298.42	91.62	1.00
PINO ARROYO	1629.49	PF 1	3093.00	5996.02	6003.17	6003.17	6004.27	0.009391	8.49	373.85	169.27	0.96
PINO ARROYO	1550	PF 1	3210.00	5993.95	6001.73	6001.73	6002.77	0.010189	8.22	401.06	200.10	0.98
PINO ARROYO	1481.63	PF 1	3210.00	5990.33	5997.42	5997.42	5998.78	0.010111	9.35	343.25	177.35	1.01
PINO ARROYO	1426.03	PF 1	3210.00	5988.50	5995.39	5995.39	5997.12	0.009507	10.56	304.11	156.66	1.01
PINO ARROYO	1370.42	PF 1	3210.00	5986.39	5991.62	5991.62	5993.00	0.009679	9.45	339.75	122.69	1.00
PINO ARROYO	1350	PF 1	3210.00	5985.81	5990.78	5990.78	5992.27	0.009666	9.81	327.29	111.87	1.01
PINO ARROYO	1310.72	PF 1	3210.00	5984.91	5990.28		5991.43	0.004664	8.63	372.06	89.40	0.75
PINO ARROYO	1251.03	PF 1	3210.00	5981.73	5988.95	5988.95	5991.14	0.002342	11.89	278.57	86.00	0.94
PINO ARROYO	1239.93	PF 1	3210.00	5981.23	5988.72	5988.72	5990.92	0.002071	12.07	298.56	86.00	0.90
PINO ARROYO	1168.85	PF 1	3210.00	5967.48	5974.96	5974.96	5977.12	0.002050	12.06	309.76	86.00	0.89
PINO ARROYO	1086	PF 1	3210.00	5951.12	5972.97		5973.08	0.000022	2.90	1496.97	86.00	0.11
PINO ARROYO	1054.4	PF 1	3210.00	5950.53	5973.00	5956.22	5973.07	0.000011	2.20	1719.86	86.00	0.08

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, May 4 2015

<Name>

Trapezoidal

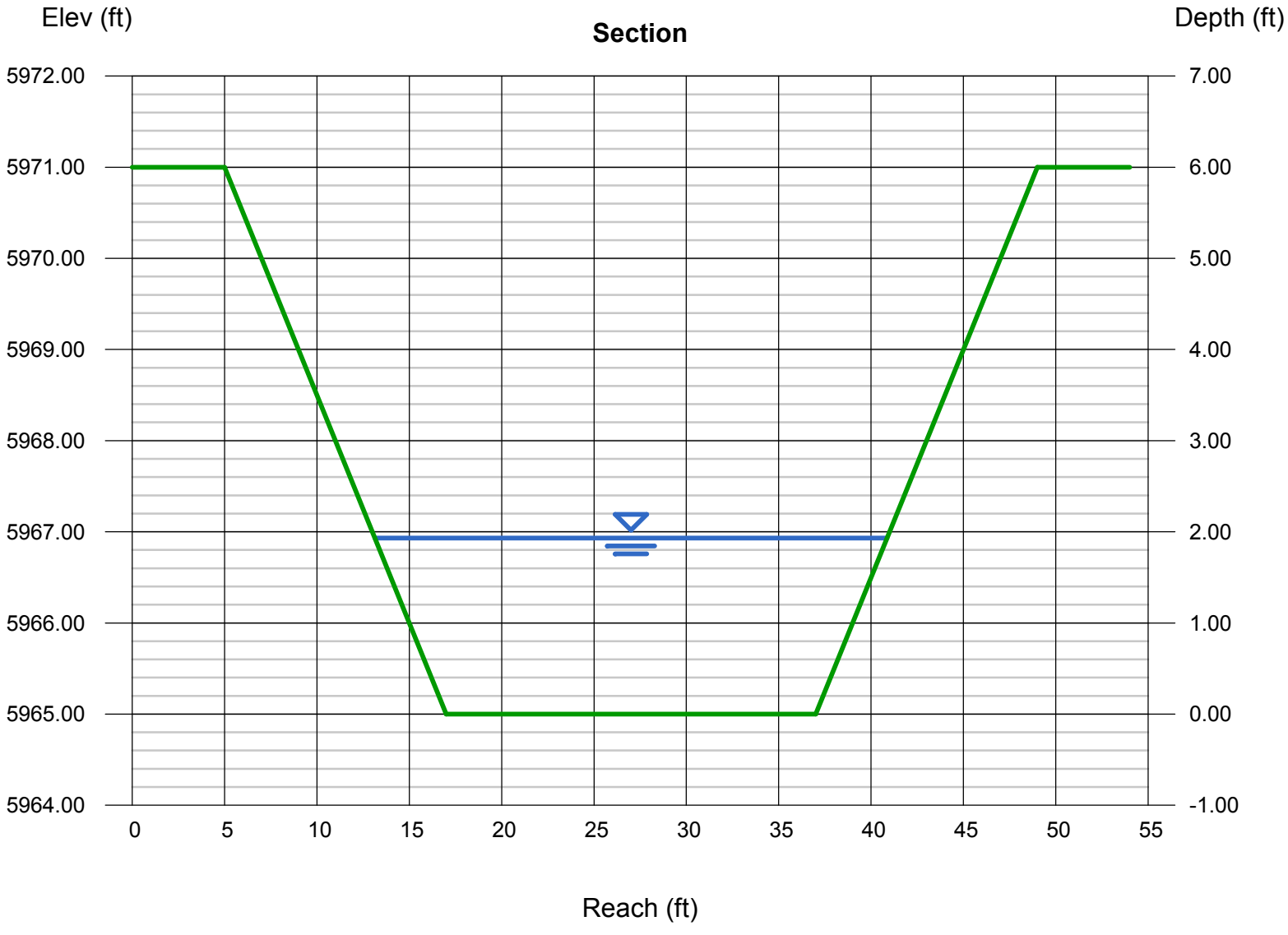
Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 6.00
Invert Elev (ft)	= 5965.00
Slope (%)	= 20.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3210.00

Highlighted

Depth (ft)	= 1.93
Q (cfs)	= 3,210
Area (sqft)	= 46.05
Velocity (ft/s)	= 69.71
Wetted Perim (ft)	= 28.63
Crit Depth, Yc (ft)	= 6.00
Top Width (ft)	= 27.72
EGL (ft)	= 77.48



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 5 2015

1/5 of Existing 5-barrel CBC with Total Q=3,061 cfs

Rectangular

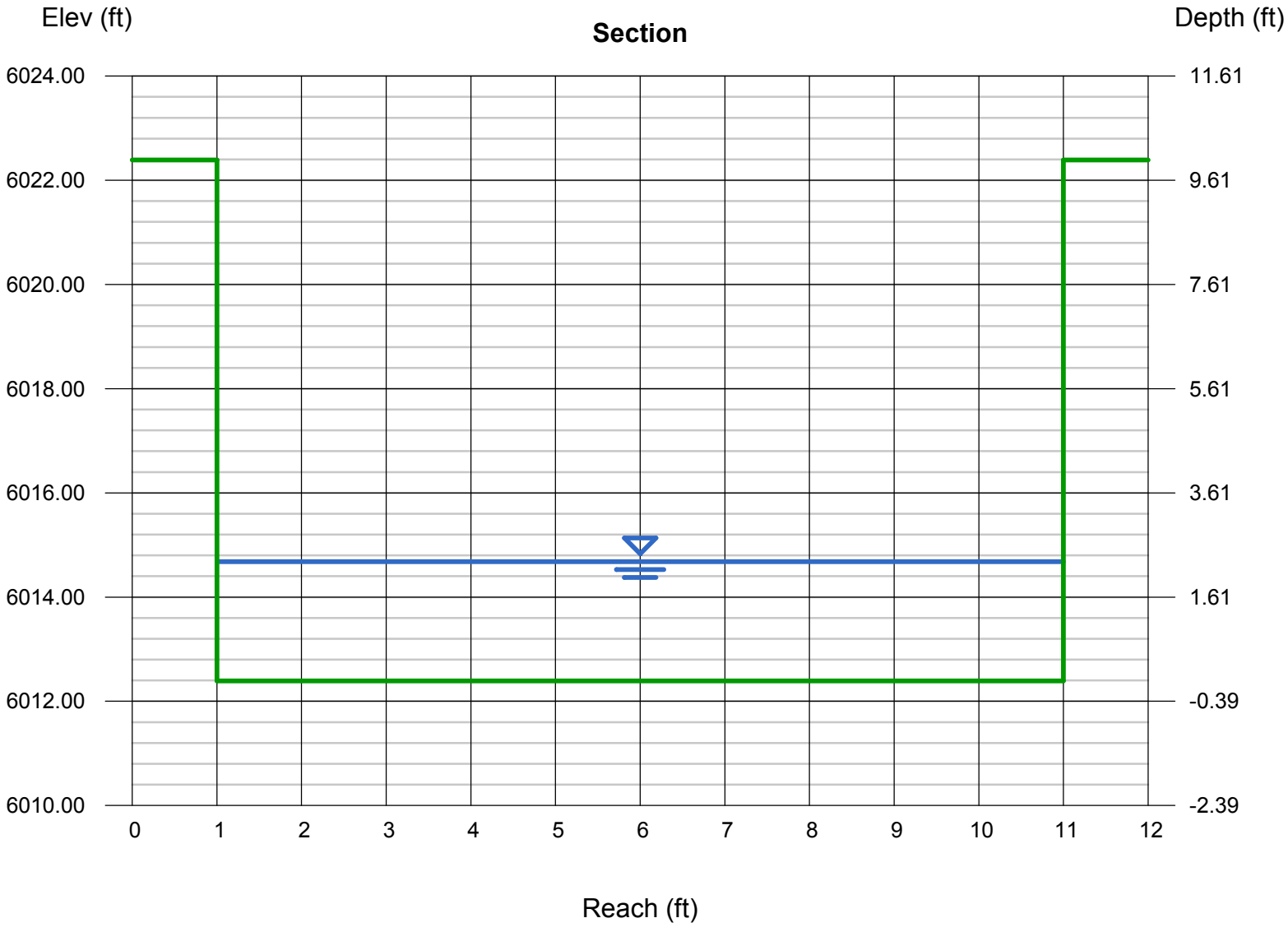
Bottom Width (ft)	= 10.00
Total Depth (ft)	= 10.00
Invert Elev (ft)	= 6012.39
Slope (%)	= 3.01
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 612.20

Highlighted

Depth (ft)	= 2.29
Q (cfs)	= 612.20
Area (sqft)	= 22.90
Velocity (ft/s)	= 26.73
Wetted Perim (ft)	= 14.58
Crit Depth, Yc (ft)	= 4.89
Top Width (ft)	= 10.00
EGL (ft)	= 13.40



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 5 2015

Proposed CBC with Total Q=3,210 cfs

Rectangular

Bottom Width (ft)	= 12.00
Total Depth (ft)	= 12.00
Invert Elev (ft)	= 5981.24
Slope (%)	= 1.21
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3210.00

Highlighted

Depth (ft)	= 9.05
Q (cfs)	= 3,210
Area (sqft)	= 108.60
Velocity (ft/s)	= 29.56
Wetted Perim (ft)	= 30.10
Crit Depth, Yc (ft)	= 12.00
Top Width (ft)	= 12.00
EGL (ft)	= 22.63