El Paso Natural Gas Company, L.L.C.
a Kinder Morgan company

November 4, 2024

Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Attention: Ms. Debbie-Anne A. Reese, Secretary

Re: El Paso Natural Gas Company, L.L.C.;
Docket No. CP24-550-000
Responses to Data Request - OEP/DG2E/Gas Branch 2

Dear Ms. Reese:

On October 24, 2024, El Paso Natural Gas Company, L.L.C. ("EPNG") received a data request ("Data Request") from the Office of Energy Projects ("OEP") seeking information pertaining to the proposed Maricopa Lateral Expansion Project. Accordingly, EPNG is herein filing with Federal Energy Regulatory Commission ("Commission") its responses to the Data Request.

Description of Proceeding

On September 17, 2024, EPNG submitted a Request for Prior Notice Authorization Pursuant to Blanket Certificate in the above-referenced docket seeking authorization to construct, install and operate a new compressor station and appurtenances to be located in Yavapai County, Arizona as part of its Maricopa Lateral Expansion Project.

Description of Information Being Filing

EPNG is herein submitting its responses to the Data Request. EPNG is proposing to submit the response to Data Request Nos. 7, 11, 13, 14, 15, 16, 17, 18, 19, 20, 30, and 32 by no later than November 7, 2024.

Filing Information

EPNG is e-Filing this letter and its responses with the Commission's Secretary in accordance with the Commission's Order No. 703, *Filing Via the Internet*, guidelines issued on November 15, 2007 in Docket No. RM07-16-000.

Respectfully submitted,

EL PASO NATURAL GAS COMPANY, L.L.C.

By_____________/s/_________________
Francisco Tarin
Director, Regulatory

Enclosures

Certificate of Service

I hereby certify that I have this day caused a copy of the foregoing documents to be served upon each person designated on the official service list compiled by the Commission's Secretary in this proceeding in accordance with the requirements of Section 385.2010 of the Federal Energy Regulatory Commission's Rules of Practice and Procedure.

Dated at Colorado Springs, Colorado as of this 4th day of November 2024.

/s/
Francisco Tarin

Two North Nevada Avenue
Colorado Springs, Colorado 80903
(719) 667-7517

STATE OF COLORADO)
)
COUNTY OF EL PASO)

FRANCISCO TARIN, being first duly sworn, on oath, says that he is the Director of the Regulatory Department of El Paso Natural Gas Company, L.L.C.; that he has read the foregoing Responses filed on November 4, 2024, to the Office of Energy Projects' Data Request dated October 24, 2024 in Docket No. CP24-520-000, that as such he is authorized to verify the Responses, that he is familiar with the contents thereof; and that the matters and facts set forth therein are true to the best of his information, knowledge and belief.

Francisco Tarin

SUBSCRIBED AND SWORN TO before me, the undersigned authority, on this 4th day of November 2024.

STACIE S GONZALEZ
NOTARY PUBLIC - STATE OF COLORADO
NOTARY ID 20184008426
MY COMMISSION EXPIRES FEB 21, 2026

Stacie S. Gonzalez
Notary Public, State of Colorado
My Commission Expires: February 21, 2026

Resource Report (RR) 1: General Project Description

1. Section 1.7 of RR1 states that construction activities would occur up to 10 hours per day, 6 days per week. Section 9.2.3 of RR9 states that daytime construction hours are 7:00 am to 10:00 pm. Clarify the construction hours and days of construction (example: 7:00 am to 7:00 pm, Monday-Friday). Indicate if construction would take place on weekends and federal holidays.

Response:

Construction activities for EPNG's Maricopa Lateral Expansion Project (the "Project") will be conducted between the hours of 7:00 a.m. to 7:00 p.m., Monday through Saturday excluding any federal holidays. However, certain specialized construction activities such as hydrostatic testing, pipe drying, welding, x-ray activities, emergencies, and other atypical circumstances may require continuous construction that includes nighttime, Sunday hours, and/or federal holidays.

Response prepared by or under the supervision of:

Raul Ronquillo
Project Manager
Kinder Morgan Project Management
(719) 520-3771

Resource Report 2: Water Use and Quality

2. Section 2.2.3 states that existing access road crosses the Zone A portion of an unnamed ephemeral drainage, and a small part of the southern portion of the site and the existing access road do occur within the mapped FEMA base flood elevation. Describe any efforts to avoid, minimize, and otherwise mitigate impacts to the floodplain.

Response:

As part of its assessment and review of the station siting, EPNG retained JE Fuller, a civil engineering firm with subject matter expertise, to develop a drainage report titled "Drainage Statement for Haystack Compressor Station (Parcel 800-20-027Z) Yavapai County, Arizona" (the "Drainage Report"). A copy of the Drainage Report is provided as Attachment 1 behind this response. The Drainage Report identified the extent of the 100-year floodplain in relation to the Haystack Compress Station. Consistent with the Drainage Report, EPNG will site all of the Project's above ground facilities outside of the 100-year floodplain to avoid and minimize any flood-related effects. Additionally, any access roads within the 100-year floodplain that are sited within the station will be constructed with crushed rock and will be designed as low water crossings to allow for the passage of water during flood events.

Response prepared by or under the supervision of:

Raul Ronquillo
Project Manager
Kinder Morgan Project Management
(719) 520-3771

DRAINAGE STATEMENT FOR HAYSTACK COMPRESSOR STATION (PARCEL 800-20-027Z, YAVAPAI COUNTY, ARIZONA

YAVAPAI COUNTY PERMIT NUMBER______________

Sept. 2024

Prepared for: Kinder Morgan
Raul Ronquillo – Project Manager
2 N. Nevada Ave
Colorado Springs, Colorado

Christopher Rod
Registered Professional Engineer (Civil)
CERTIFICATE NO. 36672
CHRISTOPHER B. ROD
DATE SIGNED 9/30/2024
ARIZONA, USA

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define•communicate•solve
40 E. Helen Street
Tucson, AZ 85205
Christopher Rod, P.E.
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520-623-3112

TABLE OF CONTENTS

EXHIBITS

TITLE **LOCATION**

APPENDICES

1 Introduction

The following document will serve as the Drainage Statement to support the construction of a roadway crossing (Crossing) over an Unnamed Tributary (Unnamed Wash) to Granite Creek. The Crossing is part of a rural access road leading to a proposed Kinder Morgan Compressor Station (Haystack CM). It will consist of eight (8) 8'x 4' Reinforced Concrete Box Culverts (ADOT STD 620). The roadway above will consist of two (2) 10-foot travel lanes. To ensure the long-term integrity of the roadway and the culvert, the roadway surface will be paved with 8" of concrete over a compacted engineered aggregate base. Rock armoring will be used to prevent scouring on the upstream and downstream sides of the roadway embankment and on the outlet side of the culvert. The remainder of this report summarizes the analyses used for this design in support of a Floodplain Use Permit from the Yavapai County Flood Control District.

2 Report Project Purpose

In support of the proposed construction of the Crossing, the following analytical methods were used.

1) A HEC-HMS model was constructed to quantify the peak discharge associated with Unnamed Wash.
2) A one-dimensional HEC-RAS model was constructed to determine the 25-year and 100-year floodplain associated with Unnamed Wash. This model constituted the existing conditions for the Unnamed Wash.
3) The existing conditions model was revised to design the proposed crossing and provide the flow parameters necessary to quantify the potential scour in the channel for the design of the rock armoring and downstream cut off walls for the culvert.
4) The scour potential (Long-term and Short-Term) was determined using State Standards and the Pima County Scour Methodology.

3 Project Location and Description

The subject parcel in which the Compressor Station will be located is identified by the Yavapai Assessor's Office as APN 800-20-027 and is owned by the Arizona State Land Department. The Crossing is located southwest of the compressor station in the southwest ¼ of Section 04, Township 16 North, Range 01 West. Figure 1 depicts the location of the Crossing and Compressor Station within the subject parcel and the Township Range and Section. Figure 2 has been provided to illustrate an aerial view of the crossing location.

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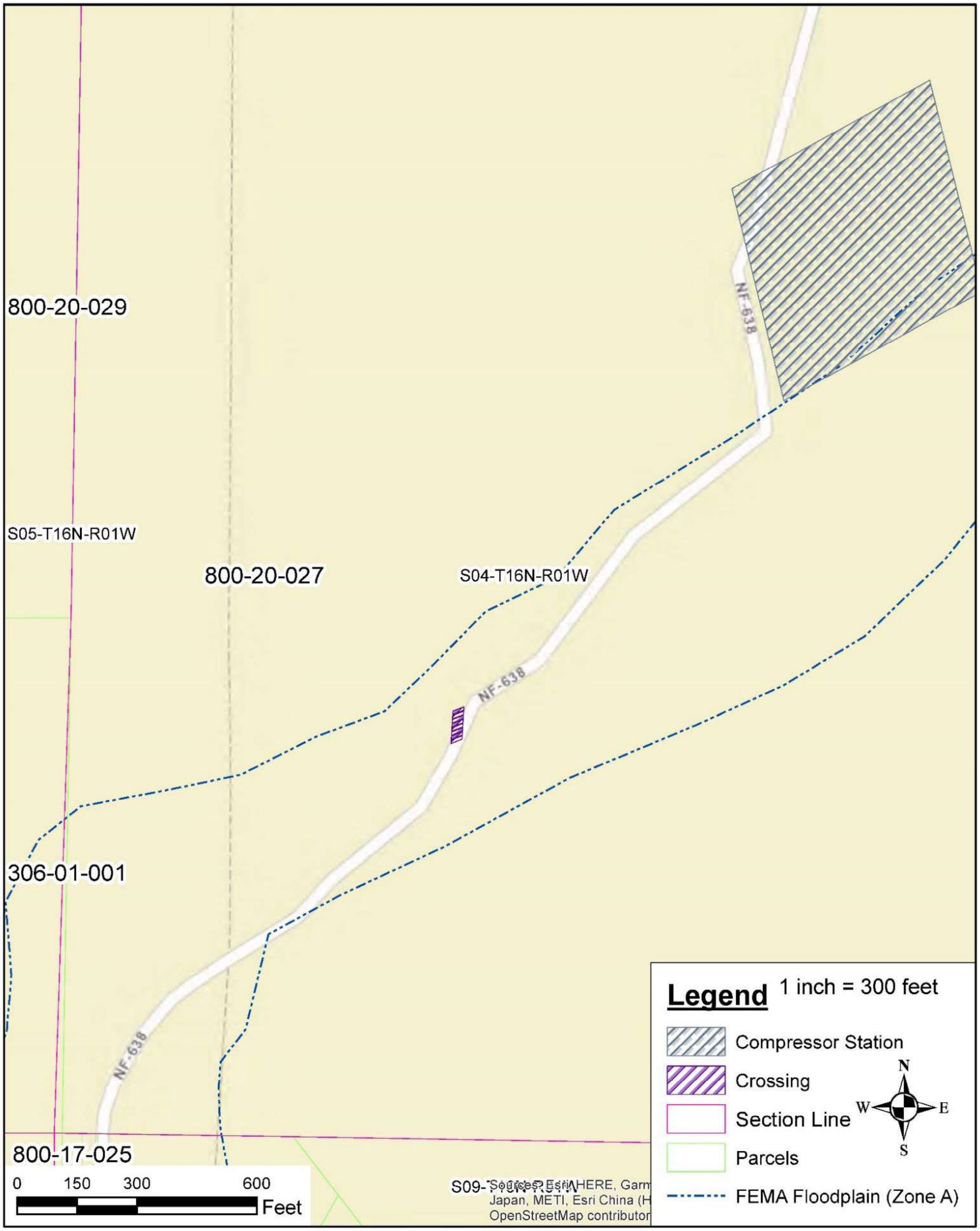


Figure 1 - Location Map

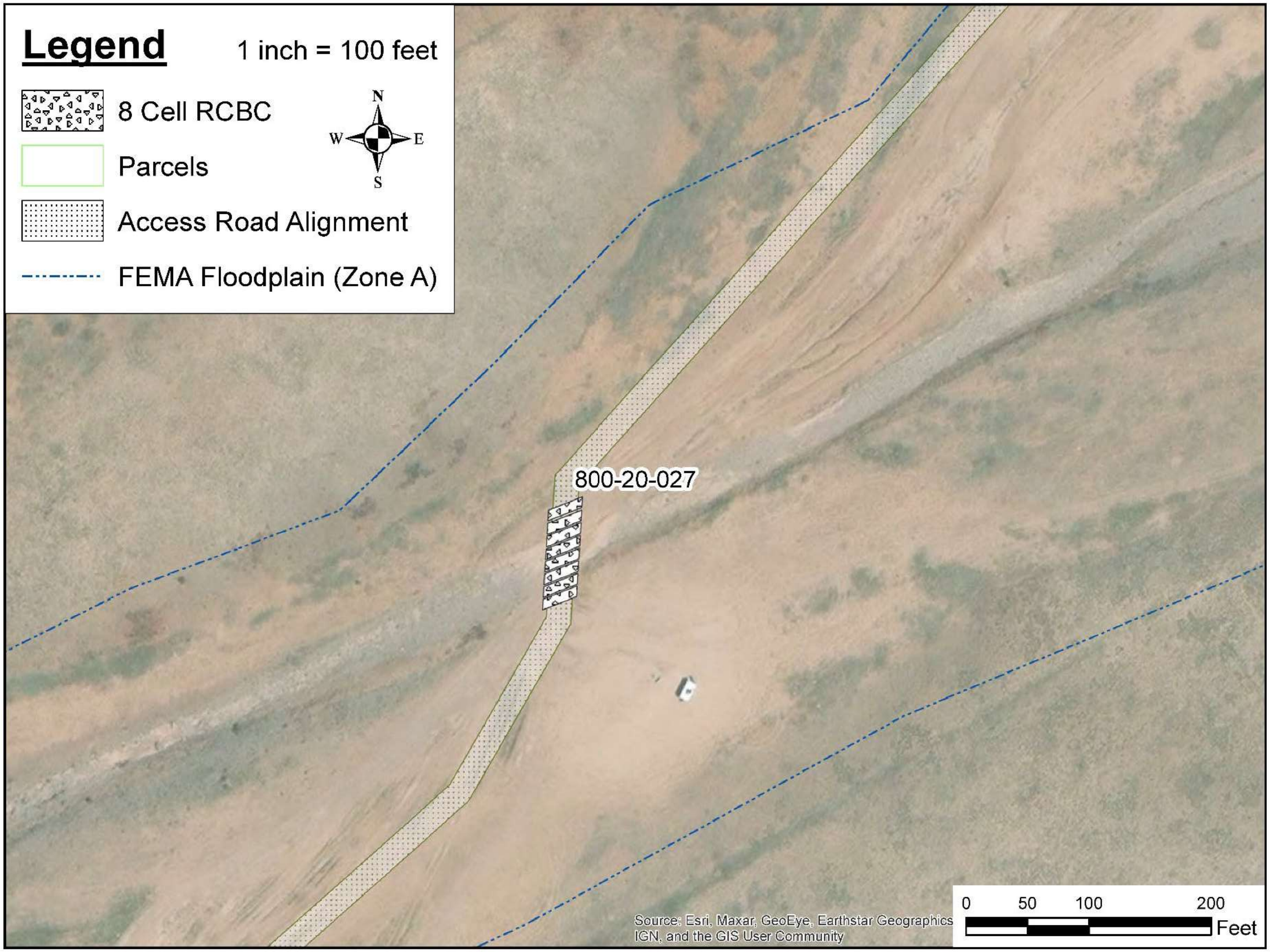


Figure 2 - Aerial Map

4 HYDROLOGIC ANALYSIS (HEC-HMS)

As review of the current FIS did not provide a peak discharge for Unnamed Wash nor was a hydraulic model available that would also provide this information. In order to obtain this information, a hydrologic model, using the Army Corps of Engineers software package HEC-HMS, was created. This model was based on the guidelines presented in Arizona Department of Water Resources State Standard for Hydrologic Modeling SS10-07 (Arizona Department of Water Resources, 2007). Per this guideline, the model used the Green and Ampt Method to determine rainfall loss and rainfall excess, the Clark Unit Hydrograph for determining the travel times and time of concentration and Normal Depth Routing for routing flow from the upper watersheds through the lower watersheds. The information used to develop the model was obtained from National Oceanic and Atmospheric Administration (NOAA), National Resource Conservation Service (NRCS), site reconnaissance, and those typically used for hydrologic modeling and accepted by the Yavapai County Flood Control District. The parameters used to construct the model are discussed in the sections below.

4.1 TOPOGRAPHIC INFORMATION

The topographic information was obtained from the USGS (3DEP). The data set was collected in 2021 and was considered to be the best available information for areas outside of the project limits. Additional information was provided by Kinder Morgan as part of a recent topographic survey. This information combined with the USGS data. Both sets of data were on a NAVD 88 Datum. The topographic information was used to delineate the watersheds, the flow length and centroidal length of the watershed, and for the development of a representative channel for flow routing.

4.2 RAINFALL DATA

The precipitation data was obtained from the NOAA National Weather Service Hydrometeorological Design Study Center Precipitation Data Server. For this study, the data from a single location central to the project was used. The precipitation data values are provided in Table 1. Because the design of the crossing required peak discharges from the small storm events, the 100-yr, 25-yr and 10-yr frequencies were modeled.

Table 1 - Rainfall Data

PDS-based point precipitation frequency estimates with 90% confidence interva								
Duration	Average recurrence interval (years)							
	1	2	5	10	25	50	100	200
5-min	0.226 (0.193-0.266)	0.293 (0.249-0.344)	0.397 (0.336-0.465)	0.482 (0.407-0.563)	0.604 (0.504-0.704)	0.705 (0.583-0.820)	0.814 (0.665-0.947)	0.930 (0.750-1.08)
10-min	0.344 (0.293-0.405)	0.445 (0.379-0.523)	0.604 (0.512-0.708)	0.734 (0.619-0.857)	0.920 (0.768-1.07)	1.07 (0.888-1.25)	1.24 (1.01-1.44)	1.42 (1.14-1.65)
15-min	0.426 (0.363-0.502)	0.552 (0.469-0.648)	0.749 (0.634-0.877)	0.909 (0.767-1.06)	1.14 (0.952-1.33)	1.33 (1.10-1.55)	1.54 (1.25-1.79)	1.76 (1.42-2.05)
30-min	0.574 (0.489-0.676)	0.743 (0.632-0.873)	1.01 (0.854-1.18)	1.22 (1.03-1.43)	1.54 (1.28-1.79)	1.79 (1.48-2.08)	2.07 (1.69-2.41)	2.36 (1.91-2.76)
60-min	0.711 (0.606-0.837)	0.920 (0.782-1.08)	1.25 (1.06-1.46)	1.52 (1.28-1.77)	1.90 (1.59-2.21)	2.22 (1.83-2.58)	2.56 (2.09-2.98)	2.92 (2.36-3.41)
2-hr	0.823 (0.711-0.956)	1.04 (0.902-1.22)	1.38 (1.19-1.61)	1.67 (1.43-1.93)	2.08 (1.76-2.40)	2.42 (2.02-2.79)	2.79 (2.31-3.21)	3.19 (2.61-3.69)
3-hr	0.886 (0.778-1.03)	1.12 (0.983-1.30)	1.45 (1.27-1.68)	1.73 (1.50-1.99)	2.12 (1.83-2.44)	2.46 (2.10-2.82)	2.82 (2.38-3.25)	3.22 (2.68-3.73)

Note that aerial reduction of the precipitation depths was applied. The reduction was performed within HEC-HMS.

4.3 Soils Data

The soils information was obtained from the dataset prepared as part of the Arizona Department of Transportation Drainage Manual. This information was a composite of both detailed and general soil surveys for Yavapai County. The General Soil Survey contained the soils information for the Prescott National Forest. The Detailed Soil Survey contained the soils information for the areas within incorporated Yavapai County. From the two sources, 19 distinct soil types were identified. The information used in the Green & Ampt Method were obtained from the Appendix B of the Arizona Department of Transportation Highway Drainage Design Manual (Arizona Department of Transportation, 2014) .The soil boundaries and the Soil ID assigned by the NRCS are provided on Figure 3. A summary of the NRCS Soils is presented Table 2. The parameters used in the model are provided on the calculation sheets presented in Appendix A.

Table 2 – On-site Soils

NRCS Soil ID	Description	NRCS Soil ID	Description	NRCS Soil ID	Description
AaB	Abra gravelly sandy loam, 0 to 8 percent slopes	**JaD**	Jacks very rocky loam, 15 to 30 percent slopes	**SlB**	Springerville cobbly clay, 0 to 8 percent slopes
As	Apache gravelly loam	**LwD**	Luzena cobbly loam, 0 to 30 percent slopes	**TdE**	Thunderbird cobbly clay loam, 15 to 40 percent slopes
AvD	Arp cobbly clay loam, 10 to 25 percent slopes	**Ly**	Lynx soils	**TlB**	Tortugas gravelly loam, 2 to 8 percent slopes
AyC	Arp-Lynx association, rolling	**PmB**	Pastura-Lynx association, undulating	**TmD**	Tortugas very rocky loam, 8 to 30 percent slopes
BmF	Barkerville cobbly sandy loam, 20 to 60 percent slopes	**s368**	Nuffel-Kech-Barx (s368)	**TnF**	Tortugas extremely rocky loam, 15 to 60 percent slopes
CaD	Cambern sandy loam, 5 to 10 percent slopes	**s381**	Poley-Pastura-Partri-Lynx-Abra (s381)		
FlE	Faraway-Luzena complex, 20 to 40 percent slopes	**s403**	nona-Spudrock-Rock outcrop (s403)		

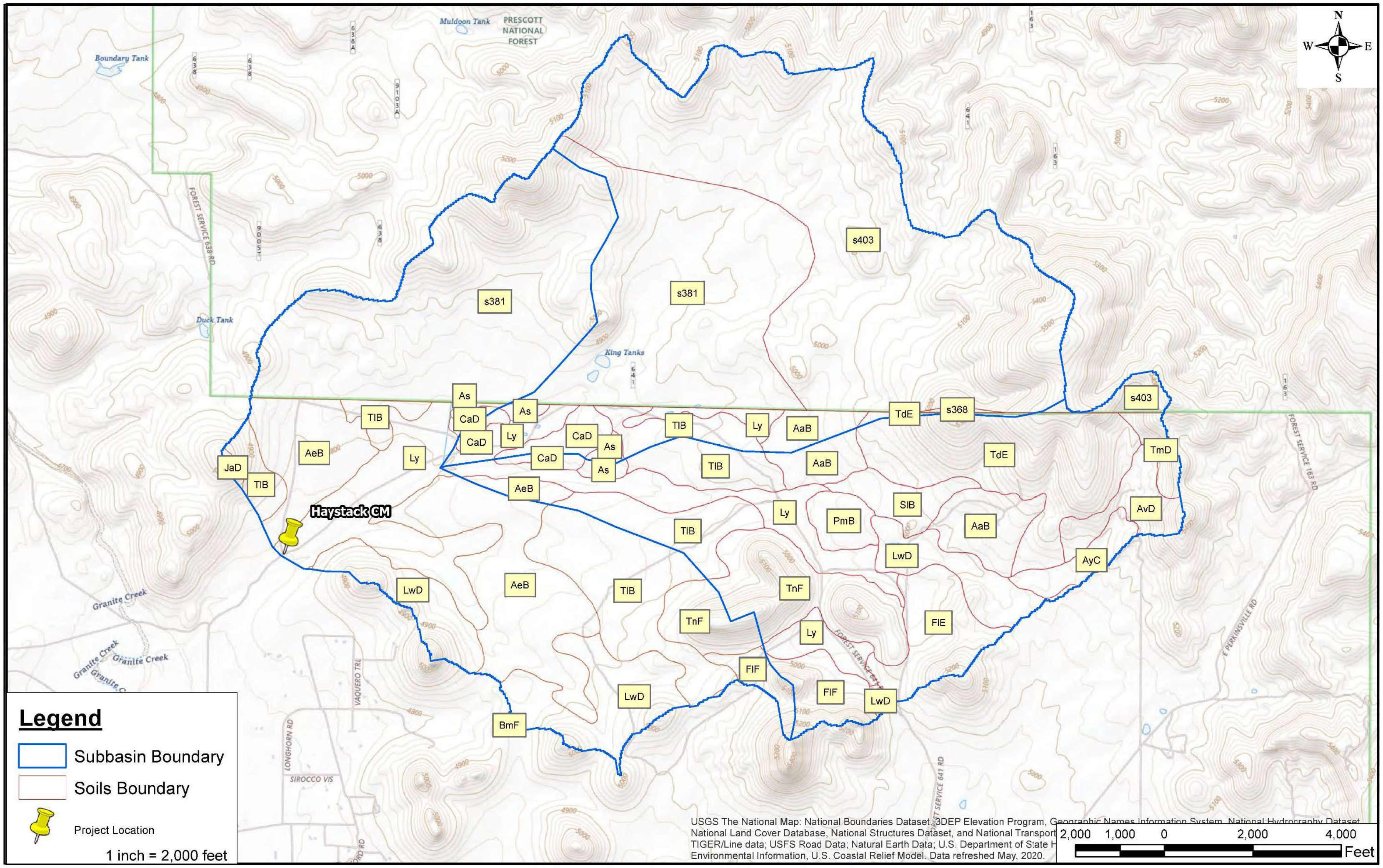


Figure 3 – Soils Map

4.4 Watershed Delineation

To determine the peak discharge generated by the contributing area for Unnamed Wash, which was found to encompass 7.74 sq miles, the overall watershed was divided into three sub-watersheds (Sub-1 thru Sub-3). A map representing the delineated watersheds is provided in Figure 4. It should be noted that the resolution of the 3DEP Topography would allow for contours to be generated at approximately 1-foot intervals. However, because of the topographic relief, a 1-foot contour interval was found to be too dense to display and thus 20-foot contours were presented on Figure 4.

4.5 Results

The results of the HEC-HMS analysis are summarized in Table 2. Because the design of the crossing required peak discharges from the small storm events, the 100-yr, 25-yr and 10-yr frequencies were modeled. Due to the size of the overall watershed, the 3-hour storm duration was used for the analysis.

Table 3 –Hydrologic Analysis Results

WATERSHED	DRAINAGE AREA	PEAK DISCHARGE 10-YEAR	PEAK DISCHARGE 25-YEAR	PEAK DISCHARGE 100-YEAR
Sub-1	2.8	255	554	1138
Sub -2	2.192	266	488	883
Sub -3	2.75	384	764	1479
Sub 1 – Sub 3 (HMS Junction 2)	7.74	737	1604	3228

The HEC-HMS model is available via download from the link provided in Appendix B and also in the Table of Contents. The calculations used to generate the various parameters are provided in Appendix A.

4.6 CALIBRATION (STREAM STAT COMPARISON)

To verify the accuracy of the HEC-HMS model, the calculated peak discharges from the HEC-HMS Model were compared with those calculated using Regional Regression Equations as determined through the USGS web-based software STREAMSTATS. The results of this comparison are presented in Table 3.

Table 4 –Hydrologic Analysis Results

STORM EVENT	PEAK DISCHARGE (HEC-HMS)	PEAK DISCHARGE (STREAM SATS)
10-YEAR	737	729
25-YEAR	1604	1150
100-YEAR	3228	2040

The comparison found that the HMS Results were higher than those calculated using regional regression. This was attributed to the steepness of the watershed which would increase the rainfall runoff above what StreamStats would determine. Because the HMS values were conservative, they were considered acceptable for the design of the crossing.

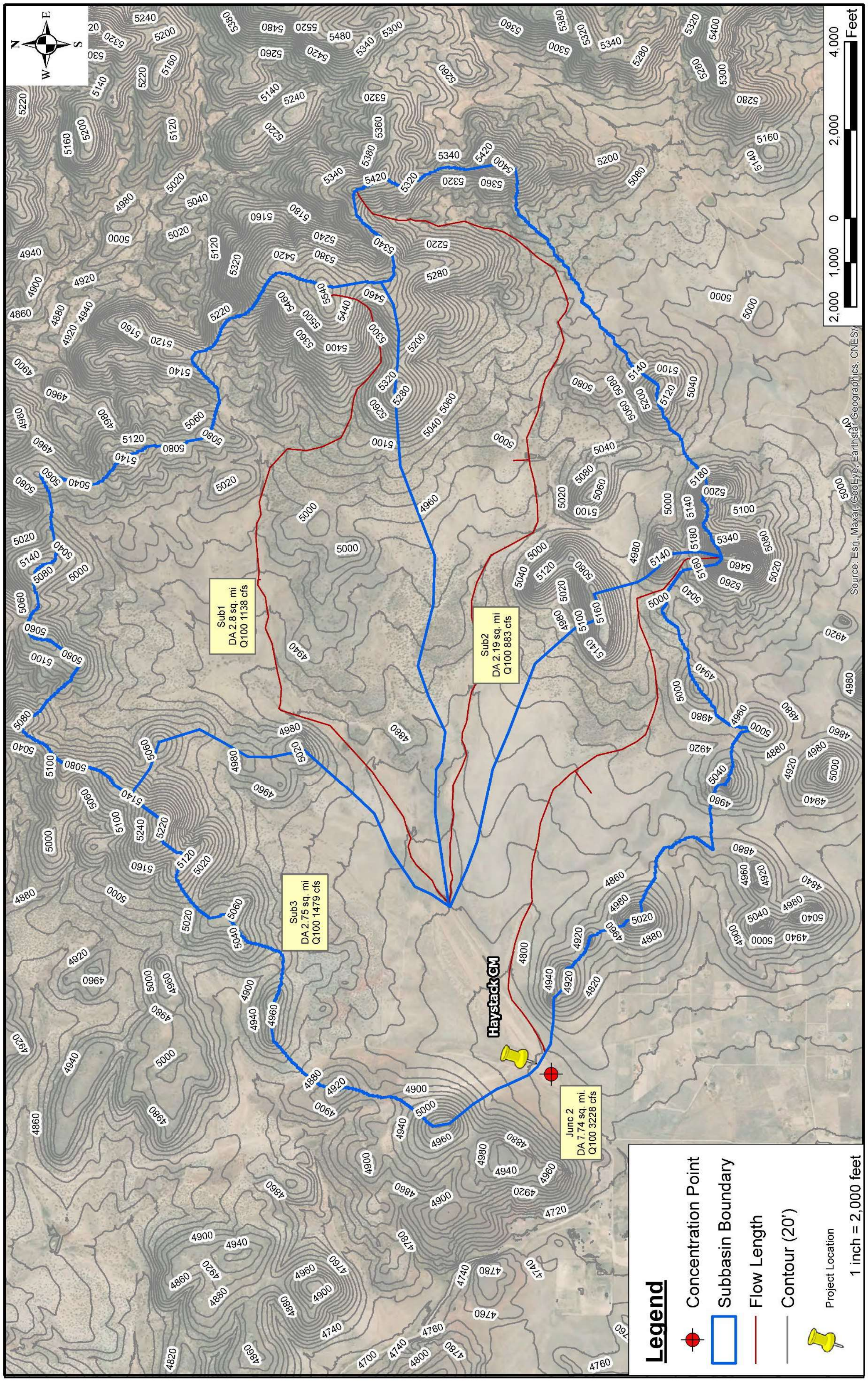


Figure 4 – Watershed Map

5 Floodplain Determination

5.1 FEMA Floodplains

A review of the effective Flood Insurance Rate Map (FIRM), Panel Number 04025C1320G and Panel Number 04025C1320G determined that Unnamed Wash, which the Crossing will ford, has an associated Zone A floodplain. A copy of the FIRMette specific to the site is provided on Figure 5.

5.2 Site Specific Floodplain Determination

Because the floodplain model used to define the Zone A Special Flood Hazard Area for Unnamed Wash was unavailable, a hydraulic model specific to this project was prepared. This analysis used the Army Corps of Engineer's HEC-RAS software (One-Dimensional Model). The parameters used in the model were supported by field observations and those typical for hydraulic modeling in a riverine environment. In that regard, the roughness coefficients for the main channel were set at 0.03,while the overbanks were set at 0.04. The peak discharges used in the analysis came directly from the results of the HEC-HMS Models. The floodplain for Unnamed Wash under existing conditions is presented on Figure 6. A summary of the results is presented in Table 5. Output from the model is provided in Appendix A. The model in its electronic format can be obtained from the link presented in the Table of Contents.

Table 5 – Existing Conditions Hydraulic Analysis Results (HEC-RAS)

HEC-RAS Plan: EX_100yr_Fin River: Granite Creek Reach: Kinder M

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
Kinder Morgan	1003	3-hr	3228.00	4729.56	4737.91	4735.95	4738.83	0.002969	8.71	491.75	149.77	0.62
Kinder Morgan	1003.2	3-hr	3228.00	4731.34	4737.73	4737.73	4739.98	0.007866	12.41	286.88	76.96	0.99
Kinder Morgan	1003.6	3-hr	3228.00	4735.84	4741.77	4741.77	4742.64	0.005157	9.22	587.63	317.73	0.79
Kinder Morgan	1003.99	3-hr	3228.00	4738.16	4744.68	4744.68	4745.41	0.003554	8.39	720.36	459.19	0.67
Kinder Morgan	1005	3-hr	3228.00	4741.46	4747.39	4747.39	4748.26	0.005034	8.57	580.20	354.54	0.77
Kinder Morgan	1005.2	3-hr	3228.00	4743.34	4748.35	4748.35	4749.40	0.007478	9.52	505.95	298.69	0.92
Kinder Morgan	1005.5	3-hr	3228.00	4745.25	4749.95	4749.95	4750.87	0.006616	9.69	555.07	328.59	0.88
Kinder Morgan	1005.7	3-hr	3228.00	4745.47	4751.71	4751.71	4752.54	0.004612	9.16	619.15	342.81	0.75
Kinder Morgan	1006	3-hr	3228.00	4748.05	4755.26	4755.26	4756.15	0.004891	8.24	557.77	433.72	0.75
Kinder Morgan	1006.4	3-hr	3228.00	4755.89	4758.19	4758.19	4758.66	0.008682	6.75	726.60	705.20	0.89
Kinder Morgan	1006.6	3-hr	3228.00	4756.41	4759.36	4759.26	4759.71	0.005984	7.34	886.11	755.90	0.79
Kinder Morgan	1006.7	3-hr	3228.00	4756.75	4760.23	4760.23	4760.93	0.007210	7.54	626.99	649.85	0.86
Kinder Morgan	1006.8	3-hr	3228.00	4756.66	4761.03	4761.03	4761.55	0.004468	8.01	873.49	719.71	0.73
Kinder Morgan	1006.9	3-hr	3228.00	4756.90	4761.76	4761.76	4762.36	0.004220	8.29	836.56	705.00	0.72
Kinder Morgan	1007	3-hr	3228.00	4757.09	4762.31	4762.31	4762.93	0.004156	7.67	782.76	639.61	0.70
Kinder Morgan	1007.4	3-hr	3228.00	4757.72	4764.23	4764.23	4764.88	0.002934	7.52	804.44	651.69	0.61
Kinder Morgan	1007.5	3-hr	3228.00	4758.62	4765.31	4765.31	4765.90	0.002428	7.71	926.51	698.29	0.57
Kinder Morgan	1007.6	3-hr	3228.00	4758.72	4765.40	4765.40	4766.25	0.003575	8.02	631.57	534.70	0.66
Kinder Morgan	1008	3-hr	3228.00	4760.30	4766.72	4766.72	4767.35	0.003273	7.17	754.23	632.52	0.63
Kinder Morgan	1008.2	3-hr	3228.00	4760.87	4767.37	4767.37	4768.09	0.004166	7.80	719.21	643.00	0.70
Kinder Morgan	1008.7	3-hr	3228.00	4762.24	4769.04	4769.04	4769.59	0.002857	6.97	915.46	911.69	0.59
Kinder Morgan	1009	3-hr	3228.00	4763.11	4770.09	4770.09	4770.63	0.002055	7.47	1031.72	906.36	0.53
Kinder Morgan	1010	3-hr	3228.00	4765.87	4772.37	4772.37	4773.74	0.004103	10.12	446.06	190.82	0.74
Kinder Morgan	1010.2	3-hr	3228.00	4770.25	4774.55	4774.55	4775.90	0.007717	10.27	404.68	169.32	0.95
Kinder Morgan	1011.001	3-hr	3228.00	4772.28	4778.10	4778.10	4779.13	0.007689	9.61	481.15	243.66	0.92
Kinder Morgan	1011.4	3-hr	3228.00	4779.78	4786.47	4786.47	4788.39	0.008109	11.12	295.43	93.02	0.98
Kinder Morgan	1011.7	3-hr	3228.00	4783.29	4790.89	4790.89	4792.96	0.007344	11.59	289.84	87.20	0.94
Kinder Morgan	1011.9	3-hr	3228.00	4785.93	4793.76	4793.76	4795.96	0.008877	11.91	271.03	64.41	1.01
Kinder Morgan	1012	3-hr	3228.00	4788.41	4795.95	4795.95	4798.38	0.008354	12.52	259.59	60.86	1.00

6 EROSION HAZARD SETBACK

As part of the hydraulic analysis the erosion hazard setback for the watercourse located along the southern boundary of the project was determined. Based on the calculated 100-year discharge of 3390 cfs, the setback was calculated to be 57 feet using State Standard 5-96 (Arizona Department of Water Resources, 1996). The erosion hazard setback is depicted on Figure 6.

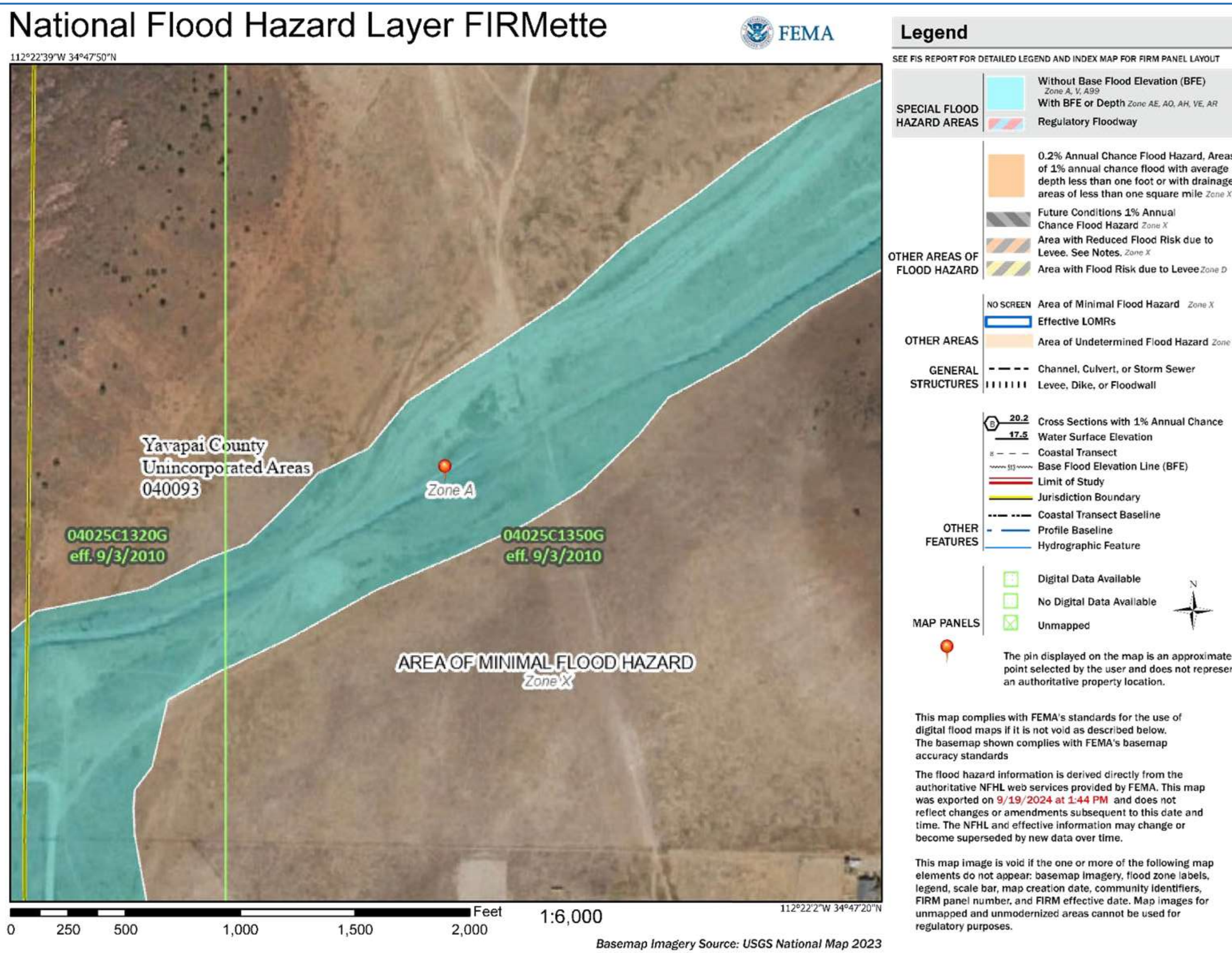
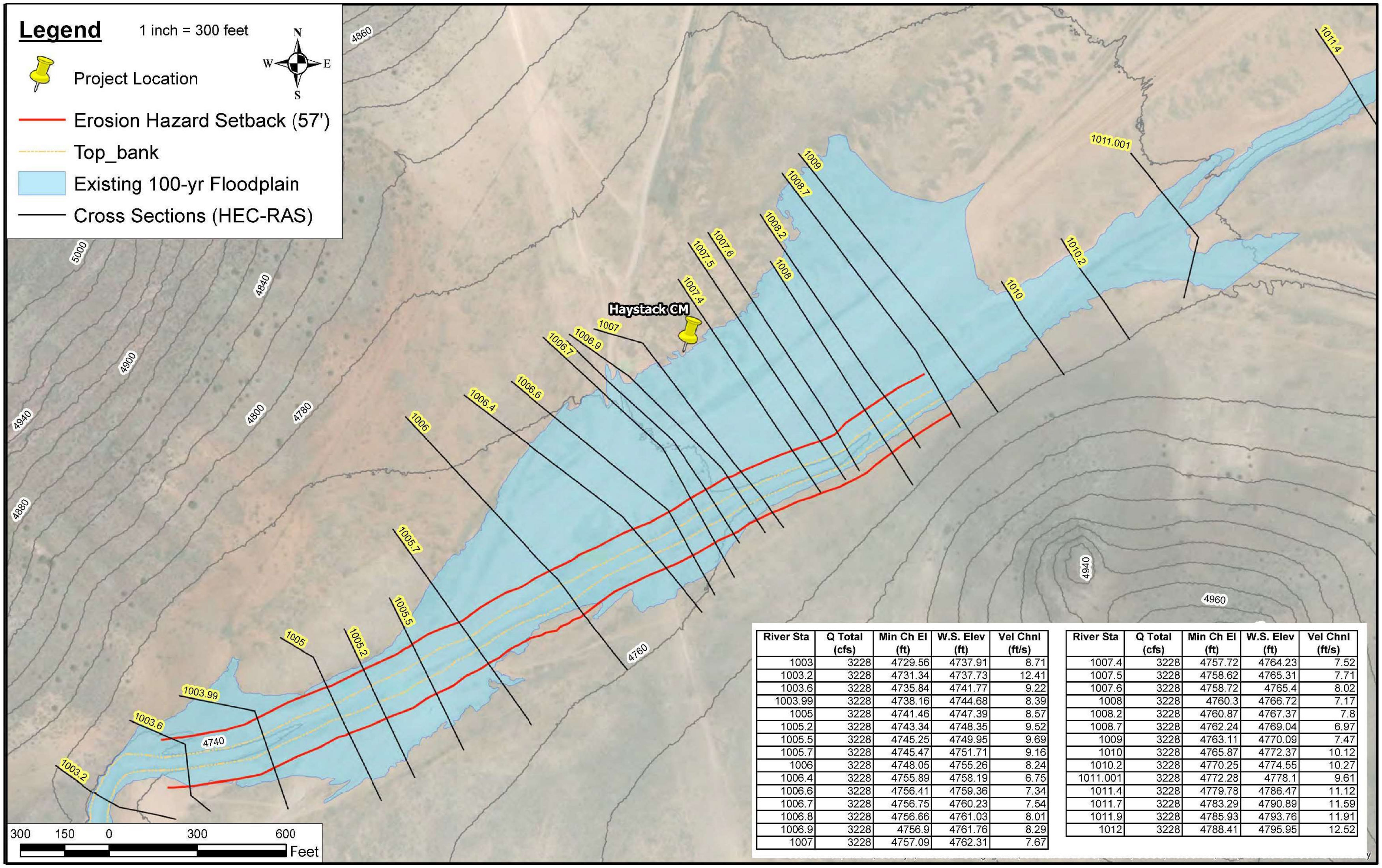


Figure 5 – Site Specific FEMA FIRMette (Reference 1)



River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Vel Chnl (ft/s)
1003	3228	4729.56	4737.91	8.71
1003.2	3228	4731.34	4737.73	12.41
1003.6	3228	4735.84	4741.77	9.22
1003.99	3228	4738.16	4744.68	8.39
1005	3228	4741.46	4747.39	8.57
1005.2	3228	4743.34	4748.35	9.52
1005.5	3228	4745.25	4749.95	9.69
1005.7	3228	4745.47	4751.71	9.16
1006	3228	4748.05	4755.26	8.24
1006.4	3228	4755.89	4758.19	6.75
1006.6	3228	4756.41	4759.36	7.34
1006.7	3228	4756.75	4760.23	7.54
1006.8	3228	4756.66	4761.03	8.01
1006.9	3228	4756.9	4761.76	8.29
1007	3228	4757.09	4762.31	7.67

River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Vel Chnl (ft/s)
1007.4	3228	4757.72	4764.23	7.52
1007.5	3228	4758.62	4765.31	7.71
1007.6	3228	4758.72	4765.4	8.02
1008	3228	4760.3	4766.72	7.17
1008.2	3228	4760.87	4767.37	7.8
1008.7	3228	4762.24	4769.04	6.97
1009	3228	4763.11	4770.09	7.47
1010	3228	4765.87	4772.37	10.12
1010.2	3228	4770.25	4774.55	10.27
1011.001	3228	4772.28	4778.1	9.61
1011.4	3228	4779.78	4786.47	11.12
1011.7	3228	4783.29	4790.89	11.59
1011.9	3228	4785.93	4793.76	11.91
1012	3228	4788.41	4795.95	12.52

Figure 6 – Unnamed Wash Floodplain Map (HEC-RAS)

7 ENVIRONMENTAL CONSTRAINTS

7.1 CLEAN WATER ACT – SECTION 404 COMPLIANCE

As part of this project but separate from this report, the status of Granite Creek and the Unnamed Tributary as a water of the United States, is being determined. If so determined, the crossing will need to apply for Nationwide General Permit project such that the construction of the Crossing will comply with Section 404 of the Clean Water Act.

7.2 CLEAN WATER ACT – SECTION 401 COMPLIANCE

The construction of the proposed roadway crossing will be considered part of the larger development for the Haystack Compressor Station. Because the overall disturbance will disturb more than 1-acre, a Stormwater Pollution Prevention Plan (SWPPP) will be required as part of an ADEQ Construction General Permit. The SWPPP will be prepared under separate cover. It will be the responsibility of Kinder Morgan to oversee the implementation of the measures discussed in the SWPPP and to file the Notice of Intent to Discharge with ADEQ.

8 Crossing Design Site Development

8.1 Post-Construction Hydraulic Analysis

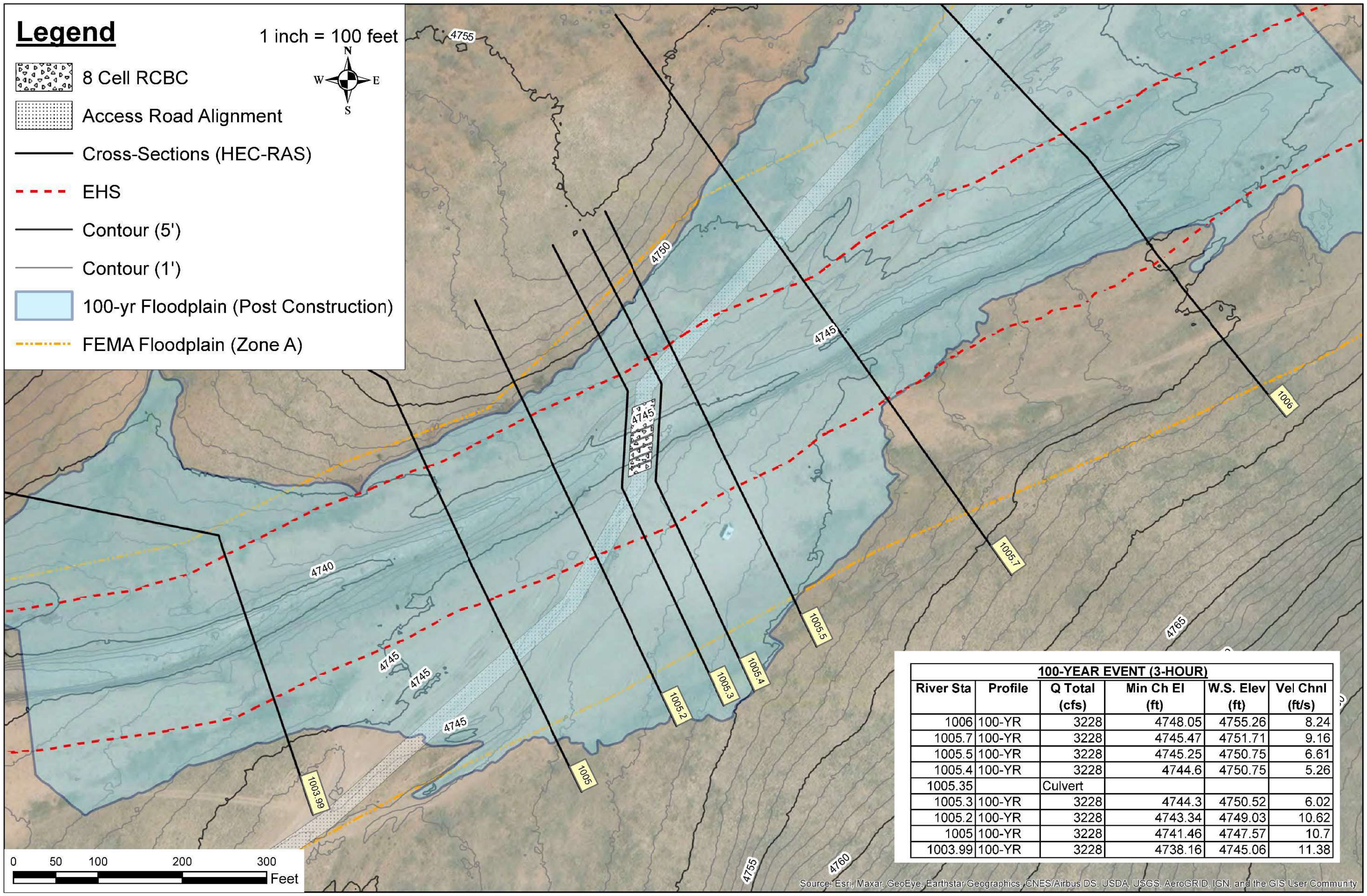
In designing the roadway crossing, the HEC-RAS model used to define the floodplain for Unnamed Wash was modified to reflect the new crossing. The modifications included adding two bounding cross-sections directly upstream and downstream of proposed crossing location (XS 1005.3 and XS 1005.4), increasing the contraction and expansion coefficients and adding the proposed culvert and overlying roadway. The results of analysis are summarized in Table 6. It should be noted that only the results for the reach of Unnamed Wash adjacent to the culvert are presented in Table 6 as the floodplain further upstream and downstream of the culvert did not change. The design needed to account for the flow conveyed through the culvert during the 10-year and 25-year event; therefore, the results from these two additional storm events were also provided.

Table 6 – Crossing Specific Hydraulic Analysis Results (HEC-RAS)

HEC-RAS Plan: DEV_100y_FIN Locations: User Defined

River	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
Granite Creek	Kinder Morgan	1006	3-hr	3228.00	4748.05	4755.26	4755.26	4756.15	0.004891	8.24	557.77	433.72	0.75
Granite Creek	Kinder Morgan	1006	25-yr	1604.00	4748.05	4753.72	4753.72	4754.77	0.009789	8.22	198.94	119.50	0.97
Granite Creek	Kinder Morgan	1005.7	3-hr	3228.00	4745.47	4751.71	4751.71	4752.54	0.004612	9.16	619.15	342.81	0.75
Granite Creek	Kinder Morgan	1005.7	25-yr	1604.00	4745.47	4750.28	4750.28	4751.20	0.006653	8.61	255.43	145.12	0.85
Granite Creek	Kinder Morgan	1005.5	3-hr	3228.00	4745.25	4749.95	4749.95	4750.87	0.006616	9.69	555.07	328.59	0.88
Granite Creek	Kinder Morgan	1005.5	25-yr	1604.00	4745.25	4749.04	4749.04	4749.78	0.006455	7.97	294.87	230.76	0.83
Granite Creek	Kinder Morgan	1005.4	3-hr	3228.00	4744.60	4749.33	4748.33	4750.16	0.000518	7.68	705.58	349.00	0.62
Granite Creek	Kinder Morgan	1005.4	25-yr	1604.00	4744.60	4748.81	4746.93	4749.16	0.000233	4.76	336.72	294.76	0.41
Granite Creek	Kinder Morgan	1005.35		Culvert									
Granite Creek	Kinder Morgan	1005.3	3-hr	3228.00	4744.30	4748.60	4747.90	4749.56	0.000669	8.21	618.35	311.93	0.70
Granite Creek	Kinder Morgan	1005.3	25-yr	1604.00	4744.30	4748.08	4746.58	4748.48	0.000304	5.07	316.21	271.04	0.46
Granite Creek	Kinder Morgan	1005.2	3-hr	3228.00	4743.34	4748.35	4748.35	4749.40	0.007478	9.52	505.95	298.69	0.92
Granite Creek	Kinder Morgan	1005.2	25-yr	1604.00	4743.34	4747.67	4747.67	4748.33	0.005603	7.08	314.35	260.11	0.77
Granite Creek	Kinder Morgan	1005	3-hr	3228.00	4741.46	4747.39	4747.39	4748.26	0.005034	8.57	580.20	354.54	0.77
Granite Creek	Kinder Morgan	1005	25-yr	1604.00	4741.46	4746.38	4746.38	4747.17	0.005603	7.38	266.01	247.50	0.77
Granite Creek	Kinder Morgan	1003.99	3-hr	3228.00	4738.16	4744.68	4744.68	4745.41	0.003554	8.39	720.36	459.19	0.67
Granite Creek	Kinder Morgan	1003.99	25-yr	1604.00	4738.16	4742.89	4742.89	4744.43	0.009443	10.08	172.94	81.34	1.01

The post construction floodplain for the 100-year event is provided on Figure 7. For reference purposes, the FEMA Zone A Special Flood Hazard Area has also been provided.



100-YEAR EVENT (3-HOUR)					
River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Vel Chnl (ft/s)
1006	100-YR	3228	4748.05	4755.26	8.24
1005.7	100-YR	3228	4745.47	4751.71	9.16
1005.5	100-YR	3228	4745.25	4750.75	6.61
1005.4	100-YR	3228	4744.6	4750.75	5.26
1005.35		Culvert			
1005.3	100-YR	3228	4744.3	4750.52	6.02
1005.2	100-YR	3228	4743.34	4749.03	10.62
1005	100-YR	3228	4741.46	4747.57	10.7
1003.99	100-YR	3228	4738.16	4745.06	11.38

Figure 7 – Crossing Specific Floodplain Map (HEC-RAS)

8.2 Crossing Design

The roadway crossing will consist of an 8-inch layer of concrete placed above an eight (8) cell 4'x8' Reinforced Concrete Box Culvert (ADOT 620). The minimum width of the concrete layer will be 20-feet. While the remaining portion of the access road will not be hardscaped, to minimize the potential for the crossing to be flanked as a result of channel migration, the concrete will extend beyond the erosion hazard setback computed in Section 6. To divert overbank flow towards the culvert, a training berm will be constructed on the southeast side of the crossing. To prevent erosion, the fill banks surrounding the culvert will be armored with riprap. Further scour mitigation, in the form of a riprap splash pad will be constructed downstream of the culvert outfall. The splash pad will have a length of 62 feet and consist of a 1-foot-thick layer of 6-inch mean diameter rock. The riprap will be in accordance with MAG Standard Section 703. The underlying geotextile will be in accordance with MAG Standard Section 796.

The splash pad design was based on HEC-6 as presented in Section 6.7 of the Standards Manual For Drainage Design and Floodplain Management, Tucson Arizona (Simons Li & Associates, 1998). The calculations for the design are provided in Appendix A. The depth of scour for the cutoff walls was determined using the equations in Section 6.6 from the same document, though they were converted to a spreadsheet created by the Pima County Regional Flood Control District. The calculations are provided in Appendix A. The Site Plan of the proposed crossing is presented in Appendix C.

8.3 All-Weather Crossing Discussion

The design intent is to convey the 100-year peak discharge of 3,228 cfs over the roadway at depths less than 1-foot while attempting to convey the 25-year storm under the road. Based on the results from the HEC-RAS Model, the depth of flow over the roadway during the 100-year event is 0.73 feet. The depth of flow over the roadway during the 25-year event is 0.02 feet. While not required, to provide all weather access, the proposed crossing essentially is an all-weather access crossing. That said, because flow will overtop the roadway during the larger storm events, warning signs will be installed upstream and downstream of the crossing.

8.4 Inspections and Maintenance

It is anticipated that Kinder Morgan will maintain the crossing. In that regard, the crossing will be routinely inspected (i.e., twice per year or after a significant flow event). Items to be inspected include but are not limited to.

- The condition of the splash pad and underlying geofabric.
- The condition of the rock armoring on the banks
- The condition of the training berm
- The condition of the channel upstream and downstream of the culvert
- The extents of the debris and sediment within the culvert
- The condition of the dirt access road/concrete layer interface.

Routine maintenance will be scheduled within a reasonable time following the inspection. Minor repairs will be initiated 4-6 weeks from the inspection. Emergency repairs will begin immediately following discovery.

9 Conclusion

To provide access to the future Haystack Compressor Station, a stabilized roadway crossing over an unnamed tributary to Granite Creek is being proposed. Eight reinforced concrete box culverts (4'x 8 RCBC) will allow the runoff from the 100-year event to pass over the top of the crossing at depths less than a foot while providing conveyance of the runoff from the 25-year event under the roadway through the underlying box culvert. Training berms will be constructed to divert flow from the smaller storm events. To ensure the long-term stability of the crossing, the roadway surface will be concrete lined, with the limits extending to the calculated lateral migration potential for Unnamed Wash. Riprap armoring will be used to prevent scouring on the embankments and downstream of the culvert. Based on the results of the analysis and proposed design, the project will meet the requirements required for a rural crossing such that a Floodplain Use Permit can be issued.

10 Engineer's Statement

The findings presented in this report were prepared in accordance with state and local regulations and are specific to the subject parcel and associated study area. The results are not intended to be used outside the scope of this project. If so used, the registrant of record does not assume any liability associated with that use. It will be up to the individual or the individual's professional to certify the results on their own and accept all liability therein.

11 References

Arizona Department of Transportation. (2014). *Highway Design Manual Volume 2 - Hydrology.* Phoenix.

Arizona Department of Water Resources. (1996). *SS5-96 Watercourse System Sediment Balance.* Phoenix.

Arizona Department of Water Resources. (2007). *State Standard for Hydrologic Modeling Guidelnes.* Phoenix.

Yavapai County Development Services. (2005). *Yavapai County Drainage Criteria Manual.* Prescott.

Yavapai County Flood Control District. (2015). *Drainage Design Manual for Yavapai County.* Prescott.

Yavapai County Public Works. (2020). *Yavapai County Roadway Design Standards.* Prescott.

Appendix A
Calculation Sheets

HEC-HMS PARAMETES AND RESULTS

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Project Name:	Haystack CM Roadway Crossing	**Made By:**	CBR	**Date:**	CBR
Project No.:	P4373.01	**Checked By:**	NDV	**Date:**	NDV
Reference:	Arizona Department of Transportation: Highway Draingage Design Manual - Hydrology 2014				

Desert/mountain:

$$T_c = 2.4A^{0.1}L^{0.25}L_{ca}^{0.25}S^{-0.2} \qquad 4.1$$

T_c = time of concentration, in hours,
A = area, in square miles,
S = watercourse slope, in ft/mile,
L = Length of the watercourse to the hydraulically most distance point, in miles,
L_{ca} = length measured from the concentration point along L to a point on L that is perpendicular to the watershed centroid, in miles, and

The storage coefficient is a Clark unit hydrograph parameter that relates the effects of direct runoff storage in the watershed to unit hydrograph shape. The equation for estimating the storage coefficient (R) is:

$$R = 0.37T_c^{1.11}L^{0.8}A^{-0.57} \qquad 4.4$$

where R is in hours and the other variables are as defined for the T_c equations.

Sub 1

Upstream	Downstream	Length (mi)	Length (ft)	$(d^3/H_i)^{.5}$
5546	5112	0.654485	3455.68	9751.143896
5112	4959	0.6024	3180.67	14502.15736
4959	4800	2.15518	11379.4	96267.04564
		3.412065	18015.7	120520.3469
			Slope =	**117.9819618**

Sub 2

Upstream	Downstream	Length (mi)	Length (ft)	$(d^3/H_i)^{.5}$
5428	5101	0.733881	3874.89	13338.76046
5101	4988	0.805264	4251.79	26080.69066
4988	4791	2.396363	12652.8	101402.0369
		3.935508	20779.5	140821.488
			Slope =	**114.9649642**

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Project Name:	Haystack CM Roadway Crossing	**Made By:**	CBR	**Date:**	CBR
Project No.:	P4373.01	**Checked By:**	NDV	**Date:**	NDV
Reference:	Arizona Department of Transportation: Highway Draingage Design Manual - Hydrology 2014				

Sub 3

Upstream	Downstream	Length (mi)	Length (ft)	$(d^3/H_i)^{.5}$
5548	5017	0.2369271	1250.98	1920.108328
5017	4950	0.3239367	1710.39	8641.790087
4950	4756	2.154627	11376.4	87118.05394
		2.7154908	14337.8	97679.95235
			Slope =	**113.7594702**

Subbasin 1		Subbasin 2		Subbasin 3	
A	2.8	A	2.19	A	2.75
S	117.9819618	S	114.9649642	S	113.759
L	3.412065	L	3.935508	L	2.71549
Lca	1.78	Lca	2.15	Lca	1.45
Tc	**1.60850808**	**Tc hours**	**1.713966646**	**Tc**	**1.45128**

Subbasin 1		Subbasin 2		Subbasin 3	
A	2.8	A	2.19	A	2.75
Tc	1.60850808	Tc	1.713966646	Tc	1.45128
L	3.412065	L	3.94	L	2.71549
R	**0.930819101**	**R**	**1.289104673**	**R**	**0.69888**

Project Name:	Haystack CM Roadway Crossir	Made By:	CBR	Date:	CBR
Project No.:	P4373.01	Checked By:	NDV	Date:	NDV
Reference:	Arizona Department of Transportation: Highway Drainage Design Manual - Hydrology 2014				

The composite *Conductivity* is calculated by Equation 3.1:

$$\overline{\text{Conductivity}} = \text{antilog}\left(\frac{\sum A_i \log Conductivity_i}{A_T}\right) \quad 3.1$$

where:
$\overline{Conductivity}$ = composite hydraulic conductivity , (inches/hour),
$Conductivity_i$ = hydraulic conductivity of the soil in a subarea, (inches/hour),
A_i = size of a subarea, and
A_T = size of the drainage area or modeling subbasin.

A correction of conductivity for vegetation cover (Figure 3–1) is made after the composite value of conductivity is determined (Equation 3.1).

Subbasin 1	2.80				
MUSYM	Area	Area %	Conductiv	log Condu	A*logC
AaB	0.05	0.02	0.38	-0.42022	-0.022414763
As	0.02	0.01	0.14	-0.85387	-0.020049768
CaD	0.07	0.02	0.02	-1.69897	-0.110684498
Ly	0.09	0.03	0.15	-0.82391	-0.072298816
TdE	0.01	0.00	0.02	-1.69897	-0.018770221
TIB	0.08	0.03	0.21	-0.67778	-0.0539466
s403	1.61859	0.58	0.4	-0.39794	-0.644101719
s381	0.859067	0.31	0.08	-1.09691	-0.942319194
s368	0.00555	0.00	0.25	-0.60206	-0.003341433
					-1.887927011
Conductivity	0.21				
Vegetation Adjusted	0.235462461				
Ratio for VC = 20%	1.11				

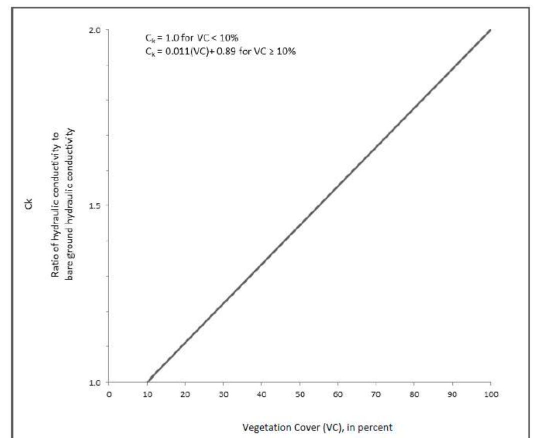

Figure 3–1 Effect of Vegetation Cover on Hydraulic Conductivity (source: DDM for Maricopa County, Volume 1, Hydrology)

Note that the adjusted conductivity is limited to two inches per hour (2 in/hr). In no case should a conductivity value greater than two be used.

Project Name:	Haystack CM Roadway Crossir	Made By:	CBR	Date:	CBR
Project No.:	P4373.01	Checked By:	NDV	Date:	NDV
Reference:	Arizona Department of Transportation: Highway Drainage Design Manual - Hydrology 2014				

Subbasin 2		2.19			
MUSYM	Area	Area %	Conductiv	log Condu	A*logC
AaB	0.18	0.08	0.38	-0.42022	-0.073945901
AeB	0.03	0.01	0.16	-0.79588	-0.024215445
As	0.01	0.01	0.14	-0.85387	-0.012219762
AvD	0.09	0.04	0.02	-1.69897	-0.159217275
AyC	0.07	0.03	0.05	-1.30103	-0.085462058
CaD	0.02	0.01	0.02	-1.69897	-0.028483232
FIE	0.17	0.08	0.19	-0.72125	-0.119545869
FIF	0.10	0.04	0.19	-0.72125	-0.069993357
LwD	0.13	0.06	0.13	-0.88606	-0.119396133
Ly	0.26	0.12	0.15	-0.82391	-0.211969474
s403	0.041059	0.02	0.4	-0.39794	-0.016339019
PmB	0.06	0.03	0.16	-0.79588	-0.04774723
SIB	0.08	0.04	0.02	-1.69897	-0.13527539
TdE	0.43	0.19	0.02	-1.69897	-0.723594723
TIB	0.24	0.11	0.21	-0.67778	-0.161729999
TmD	0.04	0.02	0.14	-0.85387	-0.03609573
TnF	0.25	0.12	0.23	-0.63827	-0.160943518
					-2.186174113
Conductivity	0.1005				
Vegetation Adjusted	0.111601003				
Ratio for VC = 20%	1.11				

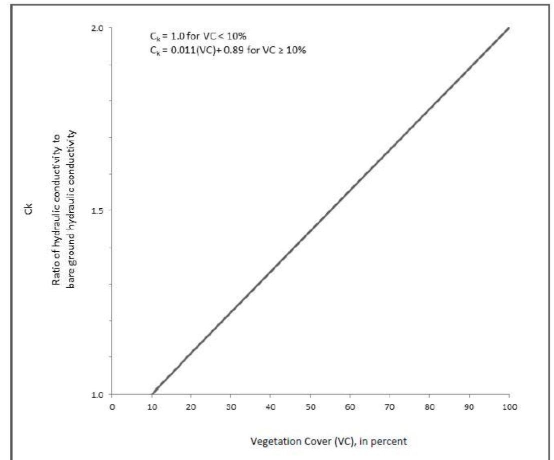

Figure 3–1 Effect of Vegetation Cover on Hydraulic Conductivity (source: DDM for Maricopa County, Volume 1, Hydrology)

Note that the adjusted conductivity is limited to two inches per hour (2 in/hr). In no case should a conductivity value greater than two be used.

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Project Name:	Haystack CM Roadway Crossir	**Made By:**	CBR	**Date:**	CBR
Project No.:	P4373.01	**Checked By:**	NDV	**Date:**	NDV
Reference:	Arizona Department of Transportation: Highway Drainage Design Manual - Hydrology 2014				

Subbasin 3			2.75		
MUSYM	Area	Area %	Conductiv	log Condu	A*logC
AeB	0.569204	0.20735	0.16	-0.79588	-0.453018089
As	0.007174	0.00261	0.14	-0.85387	-0.006125677
BmF	0.002988	0.00109	0.63	-0.20066	-0.00059957
CaD	0.011124	0.00405	0.02	-1.69897	-0.018899342
FIF	0.047841	0.01743	0.19	-0.72125	-0.034505149
JaD	0.008288	0.00302	0.02	-1.69897	-0.014081063
LwD	0.353462	0.12876	0.13	-0.88606	-0.313187355
Ly	0.303936	0.11072	0.15	-0.82391	-0.250415527
s381	0.968544	0.35282	0.08	-1.09691	-1.062405612
TIB	0.377977	0.13769	0.21	-0.67778	-0.256185518
TnF	0.094582	0.03445	0.23	-0.63827	-0.060369058
					-2.469791961
Conductivity	0.125978743				
Vegetation Adjusted	0.139836404				
Ratio for VC = 20%	1.11				

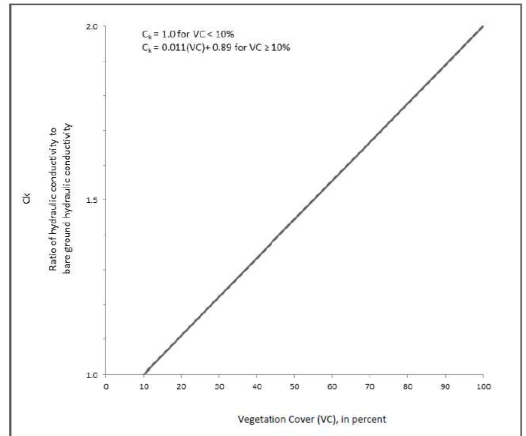

Figure 3–1 Effect of Vegetation Cover on Hydraulic Conductivity (source: DDM for Maricopa County, Volume 1, Hydrology)

Note that the adjusted conductivity is limited to two inches per hour (2 in/hr). In no case should a conductivity value greater than two be used.

Project Name:	Haystack CM Roadway Crossing	Made By:	CBR	Date:	CBR
Project No.:	P4373.01	Checked By:	NDV	Date:	NDV
Reference:	Arizona Department of Transportation: Highway Drainage Design Manual - Hydrology 2014				

Composite soil suction is computed using a log-averaging method in the same manner as conductivity, as shown in Equation 3.2 and with guidance presented in Section 3.3.1:

$$\overline{\text{Suction}} = \text{antilog}\left(\frac{\sum A_i \log Suction_i}{A_T}\right) \quad 3.2$$

where:
- $\overline{\text{Suction}}$ = composite soil suction, (inches),
- $Suction_i$ = conductivity of the soil in a subarea, (inches),
- A_i = size of a subarea, and
- A_T = size of the drainage area or modeling subbasin.

Subbasin 2 2.19

MUSYM	Area	Suction	log Suction	A*logS	Suction	11.82216
AaB	0.18	4.43	0.646404	0.113748		
AeB	0.03	11.67	1.067071	0.032467		
As	0.01	14.01	1.146438	0.016407		
AvD	0.09	15.81	1.198932	0.112357		
AyC	0.07	14.74	1.168497	0.076756		
CaD	0.02	14.03	1.147058	0.01923		
FIE	0.17	11.78	1.071145	0.177541		
FIF	0.10	11.57	1.063333	0.103191		
LwD	0.13	14.01	1.146438	0.154483		
Ly	0.26	13.77	1.138934	0.293017		
s403	0.041059	5.11	0.708421	0.029087		
PmB	0.06	13.6	1.133539	0.068004		
SIB	0.08	13.14	1.118595	0.089065		
TdE	0.43	15.73	1.196729	0.509689		
TIB	0.24	11.65	1.066326	0.254443		
TmD	0.04	9.86	0.993877	0.042014		
TnF	0.25	10.52	1.022016	0.257706		
				2.349206		

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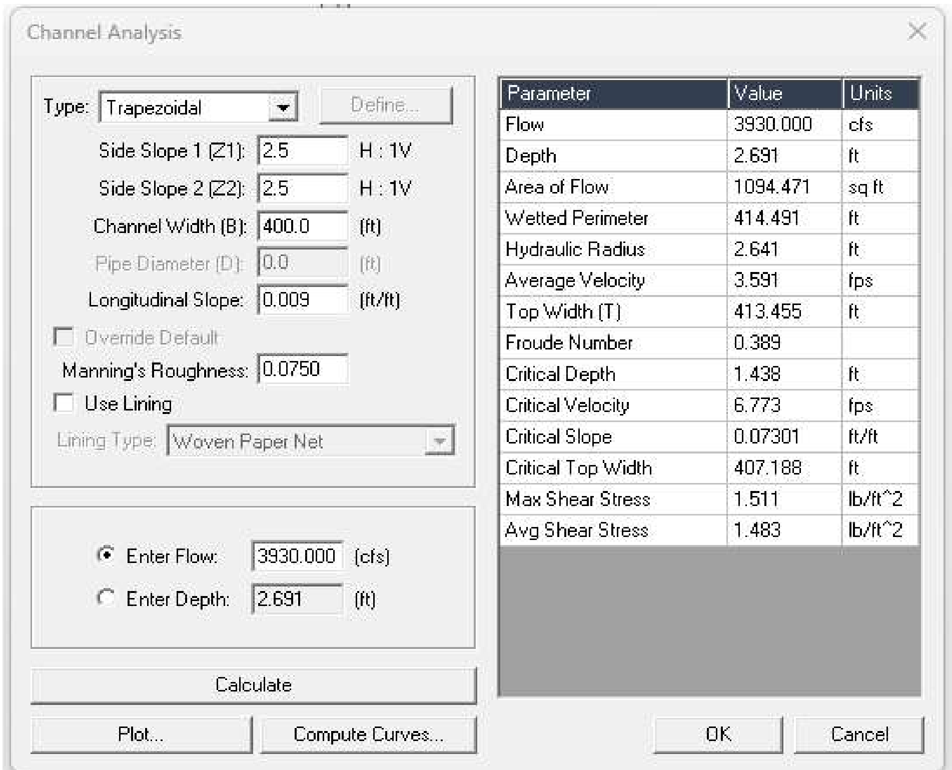
Project Name:	Haystack CM Roadway Crossing	**Made By:**	CBR	**Date:**	CBR
Project No.:	P4373.01	**Checked By:**	NDV	**Date:**	NDV
Reference:	Arizona Department of Transportation: Highway Drainage Design Manual - Hydrology 2014				

Subbasin 1		2.80				
MUSYM	Area	Suction	log Suction	A*logS	Suction	7.948676
AaB	0.05	4.43	0.646404	0.03448		
As	0.02	14.01	1.146438	0.02692		
CaD	0.07	14.03	1.147058	0.074729		
Ly	0.09	13.77	1.138934	0.099943		
TdE	0.01	15.73	1.196729	0.013221		
TIB	0.08	11.65	1.066326	0.084872		
s403	1.61859	5.11	0.708421	1.146643		
s381	0.859067	16.02	1.204663	1.034886		
s368	0.00555	8.41	0.924796	0.005133		
				2.520825		

Subbasin 3		2.75				
MUSYM	Area	Suction	log Suction	A*logS	Suction	13.49216
AeB	0.569204	11.67	1.067071	0.607381		
As	0.007174	14.01	1.146438	0.008225		
BmF	0.002988	3.32	0.521138	0.001557		
CaD	0.011124	14.03	1.147058	0.01276		
FIF	0.047841	11.57	1.063333	0.050871		
JaD	0.008288	12.41	1.093772	0.009065		
LwD	0.353462	14.01	1.146438	0.405222		
Ly	0.303936	13.77	1.138934	0.346163		
s381	0.968544	16.02	1.204663	1.166769		
TIB	0.377977	11.65	1.066326	0.403047		
TnF	0.094582	10.52	1.022016	0.096664		
				3.107724		

Project Name:	Haystack CM Roadway Crossing	**Made By:**	CBR	**Date:**	CBR
Project No.:	P4373.01	**Checked**	NDV	**Date:**	NDV
Reference:					

Length (ft)	3966.49	Elevation Upstream	Downstream Elevation
Bottom width	21.22	4790.77	4756.1
Slope	0.00874		
Manning's n	0.035		
Side slope	2.5		
Index flow (CFS)	3100		



JE FULLER define•communicate•solve

Project Name:	Haystack CM Roadway Crossi	**Made By:**	CBR	**Date:**	CBR
Project No.:	P4373.01	**Checked By:**	NDV	**Date:**	NDV
Reference:	Arizona Department of Transportation: Highway Drainage Design Manual - Hydrology 2014				

Composite soil moisture contents for both initial and saturated condition are computed using a simple area-weighted procedure, as shown in Equation 3.2 and with guidance presented in Section 3.3.3.

$$\overline{SMC} = \frac{\sum A_i SMC_i}{A_T} \qquad 3.3$$

where:
- $\overline{SMC}$ = composite soil moisture content, (inches),
- SMC_i = soil moisture content of the soil in a subarea,
- A_i = size of a subarea, and
- A_T = size of the drainage area or modeling subbasin.

Equation 3.3 applies to both the initial and saturated soil moisture content. The initial soil moisture content should be selected based on land cover type. The initial soil moisture content for natural areas should be the wilting point (dry). For most urban land cover types, the field capacity (normal) value should be used for the initial soil content. For irrigated agricultural areas, the initial soil moisture content should be set equal to the saturated content value.

Subbasin 1		2.80						
MUSYM	Area	Area %	Initial	A*SM	Saturated	A*SM		
AaB	0.05	0.02	0.12	0.0064	0.41	0.02187	Initial	0.132955
As	0.02	0.01	0.15	0.00352	0.44	0.01033	Saturated	0.437665
CaD	0.07	0.02	0.28	0.01824	0.49	0.03192		
Ly	0.09	0.03	0.16	0.01404	0.44	0.03861		
TdE	0.01	0.00	0.27	0.00298	0.48	0.0053		
TIB	0.08	0.03	0.13	0.01035	0.44	0.03502		
s403	1.61859	0.58	0.1	0.16186	0.44	0.71218		
s381	0.859067	0.31	0.18	0.15463	0.43	0.3694		
s368	0.00555	0.00	0.13	0.00072	0.43	0.00239		
				0.37275		1.22702		

JE FULLER define•communicate•solve

Project Name:	Haystack CM Roadway Crossi **Made By:**	CBR **Date:**	CBR
Project No.:	P4373.01 **Checked By:**	NDV **Date:**	NDV
Reference:	Arizona Department of Transportation: Highway Drainage Design Manual - Hydrology 2014		

Subbasin 2		2.19						
MUSYM	Area	Area %	Initial	A*SM	Saturated	A*SM		
AaB	0.18	0.08	0.12	0.02112	0.41	0.07215	Initial	0.174641
AeB	0.03	0.01	0.15	0.00456	0.43	0.01308	Saturated	0.450678
As	0.01	0.01	0.15	0.00215	0.44	0.0063		
AvD	0.09	0.04	0.27	0.0253	0.48	0.04498		
AyC	0.07	0.03	0.22	0.01445	0.46	0.03022		
CaD	0.02	0.01	0.28	0.00469	0.49	0.00821		
FlE	0.17	0.08	0.12	0.01989	0.44	0.07293		
FlF	0.10	0.04	0.12	0.01165	0.44	0.0427		
LwD	0.13	0.06	0.15	0.02021	0.44	0.05929		
Ly	0.26	0.12	0.16	0.04116	0.44	0.1132		
PmB	0.06	0.03	0.15	0.009	0.44	0.0264		
SlB	0.08	0.04	0.3	0.02389	0.5	0.03981		
TdE	0.43	0.19	0.27	0.11499	0.48	0.20443		
TlB	0.24	0.11	0.13	0.03102	0.44	0.10499		
TmD	0.04	0.02	0.16	0.00676	0.47	0.01987		
TnF	0.25	0.12	0.11	0.02774	0.44	0.11095		
s403	0.041059	0.02	0.1	0.00411	0.44	0.01807		
				0.38269		0.98758		

Project Name:	Haystack CM Roadway Crossi	**Made By:**	CBR	**Date:**	CBR
Project No.:	P4373.01	**Checked By:**	NDV	**Date:**	NDV
Reference:	Arizona Department of Transportation: Highway Drainage Design Manual - Hydrology 2014				

Subbasin 3		2.75							
MUSYM	Area	Area %	Initial	A*SM	Saturated	A*SM			
AeB	0.569204	0.20735	0.15	0.08538	0.43	0.24476		Initial	0.157941
As	0.007174	0.00261	0.15	0.00108	0.44	0.00316		Saturated	0.43476
BmF	0.002988	0.00109	0.08	0.00024	0.42	0.00125			
CaD	0.011124	0.00405	0.28	0.00311	0.49	0.00545			
FIF	0.047841	0.01743	0.12	0.00574	0.44	0.02105			
JaD	0.008288	0.00302	0.3	0.00249	0.5	0.00414			
LwD	0.353462	0.12876	0.15	0.05302	0.44	0.15552			
Ly	0.303936	0.11072	0.16	0.04863	0.44	0.13373			
TIB	0.377977	0.13769	0.13	0.04914	0.44	0.16631			
TnF	0.094582	0.03445	0.11	0.0104	0.44	0.04162			
s381	0.968544	0.35282	0.18	0.17434	0.43	0.41647			
				0.43357		1.19347			

HEC-RAS Summary Output

Global Summary Results for Run "Run 10yr03h"

Project: Haystack CM   Simulation Run: Run 10yr03h

Start of Run: 23May2024, 00:00   Basin Model: Basin 1
End of Run: 24May2024, 00:00   Meteorologic Model: Met 03hr-10-yr
Compute Time: 02Oct2024, 09:48:25   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: IN ACRE-FT   Sorting: Watershed Explorer

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-2	2.2	265.8	23 May 2024, 03:05	0.42
Junction-1	5.0	517.9	23 May 2024, 03:00	0.33
Reach-1	5.0	485.8	23 May 2024, 03:25	0.33
Subbasin-1	2.8	255.3	23 May 2024, 02:55	0.26
Subbasin-3	2.8	384.4	23 May 2024, 02:45	0.34
Junction-2	7.7	737.0	23 May 2024, 03:05	0.33

Global Summary Results for Run "Run 25yr03H"

Project: Haystack CM   Simulation Run: Run 25yr03H

Start of Run: 23May2024, 00:00   Basin Model: Basin 1
End of Run: 24May2024, 00:00   Meteorologic Model: Met 03hr-25-yr
Compute Time: 02Oct2024, 09:48:37   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: IN ACRE-FT   Sorting: Watershed Explorer

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-2	2.2	487.9	23 May 2024, 03:05	0.78
Junction-1	5.0	1034.9	23 May 2024, 03:00	0.66
Reach-1	5.0	1003.4	23 May 2024, 03:15	0.66
Subbasin-1	2.8	554.1	23 May 2024, 02:55	0.57
Subbasin-3	2.8	764.1	23 May 2024, 02:45	0.67
Junction-2	7.7	1603.9	23 May 2024, 03:00	0.66

Global Summary Results for Run "Run 100y03h"

Project: Haystack CM   Simulation Run: Run 100y03h

Start of Run: 23May2024, 00:00   Basin Model: Basin 1
End of Run: 24May2024, 00:00   Meteorologic Model: Met 03hr
Compute Time: 02Oct2024, 09:48:32   Control Specifications: Control 1

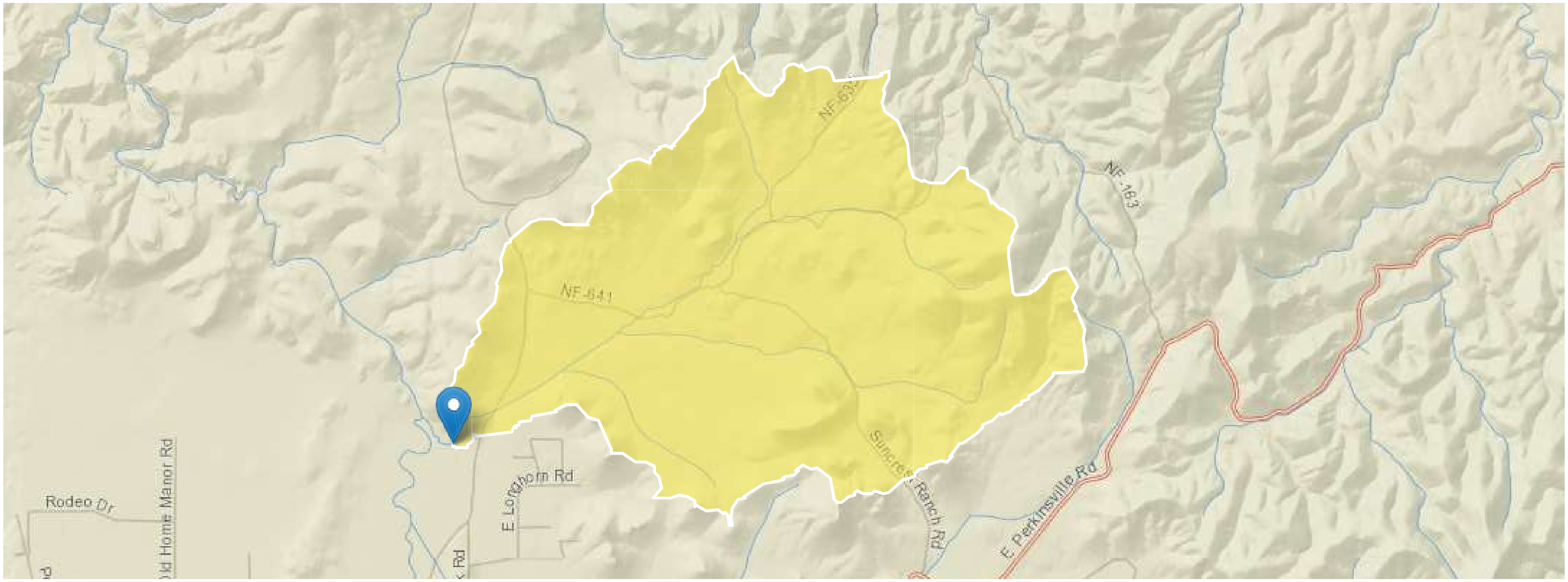
Show Elements: All Elements   Volume Units: IN ACRE-FT   Sorting: Watershed Explorer

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-2	2.2	882.9	23 May 2024, 03:05	1.42
Junction-1	5.0	2008.4	23 May 2024, 03:00	1.28
Reach-1	5.0	1973.6	23 May 2024, 03:10	1.28
Subbasin-1	2.8	1138.1	23 May 2024, 02:55	1.17
Subbasin-3	2.8	1479.4	23 May 2024, 02:45	1.29
Junction-2	7.7	3227.9	23 May 2024, 02:55	1.28

STREAMSTATS CALCULATIONS

StreamStats Report

Region ID: AZ
Workspace ID: AZ20240516183816434000
Clicked Point (Latitude, Longitude): 34.78880, -112.37911
Time: 2024-05-16 11:38:48 -0700



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
CONTDA	Area that contributes flow to a point on a stream	8.02	square miles
ELEV	Mean Basin Elevation	4966.962	feet
PRECIP	Mean Annual Precipitation	14.3	inches

Peak-Flow Statistics

Peak-Flow Statistics Parameters [Peak Region 4 Central Highland 2014 5211]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
CONTDA	Contributing Drainage Area	8.02	square miles	0.059	18044
ELEV	Mean Basin Elevation	4966.962	feet	3274	7451
PRECIP	Mean Annual Precipitation	14.3	inches	10.8	33.5

Peak-Flow Statistics Flow Report [Peak Region 4 Central Highland 2014 5211]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIL	PIU	ASEp
50-percent AEP flood	218	ft^3/s	53.8	883	101
20-percent AEP flood	475	ft^3/s	193	1170	57
10-percent AEP flood	729	ft^3/s	382	1390	40.3
4-percent AEP flood	1150	ft^3/s	716	1850	29
2-percent AEP flood	1560	ft^3/s	1000	2430	27.1
1-percent AEP flood	2040	ft^3/s	1310	3180	27.1
0.5-percent AEP flood	2590	ft^3/s	1580	4250	28.9
0.2-percent AEP flood	3510	ft^3/s	1990	6200	35

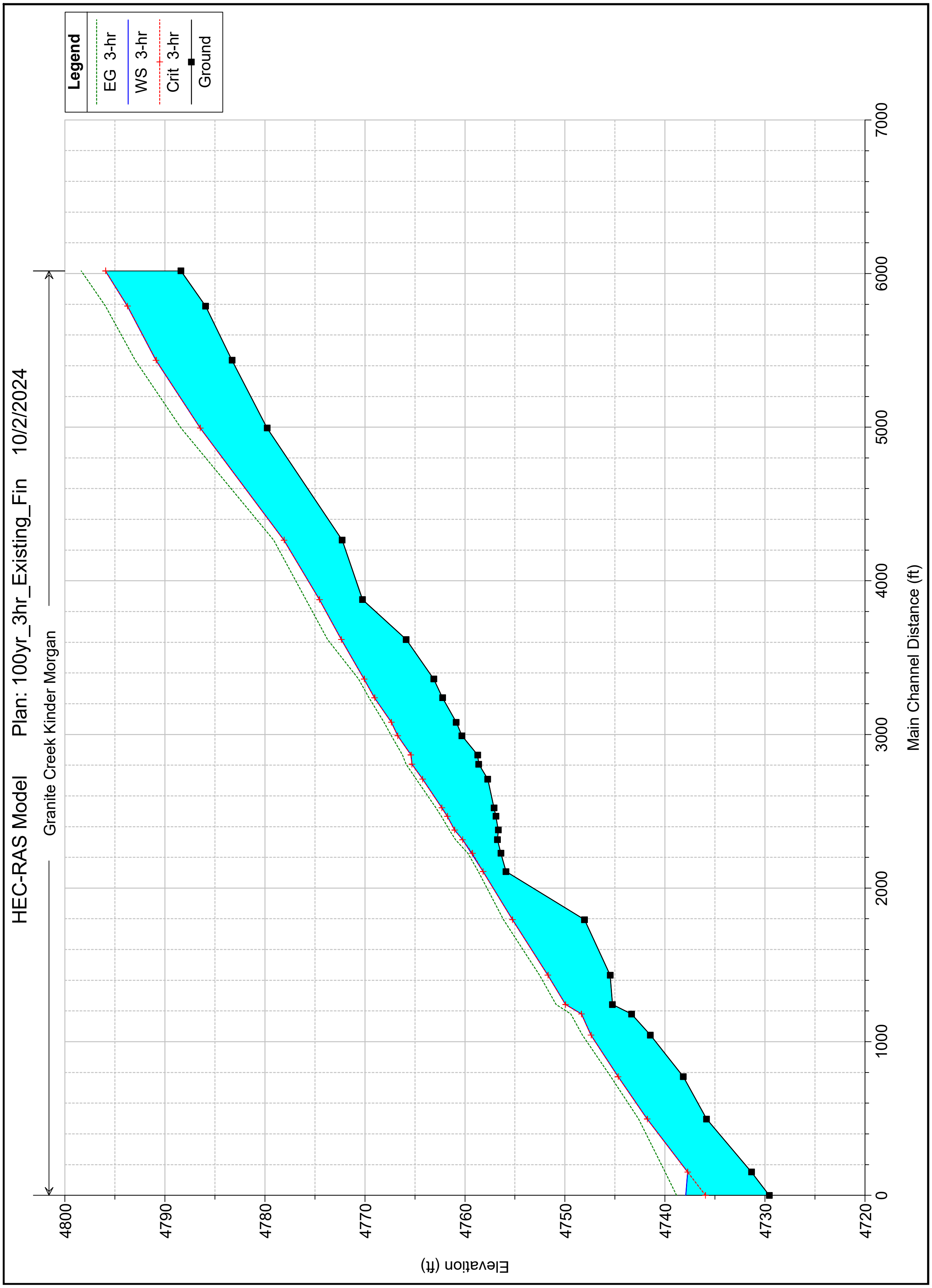
Peak-Flow Statistics Citations

Paretti, N.V., Kennedy, J.R., Turney, L.A., and Veilleux, A.G.,2014, Methods for estimating magnitude and frequency of floods in Arizona, developed with unregulated and rural peak-flow data through water year 2010: U.S. Geological Survey Scientific Investigations Report 2014-5211, 61 p., http://dx.doi.org/10.3133/sir20145211. (http://pubs.usgs.gov/sir/2014/5211/)

Application Version: 4.20.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

HEC-RAS OUTPUT

EXISTING CONDITIONS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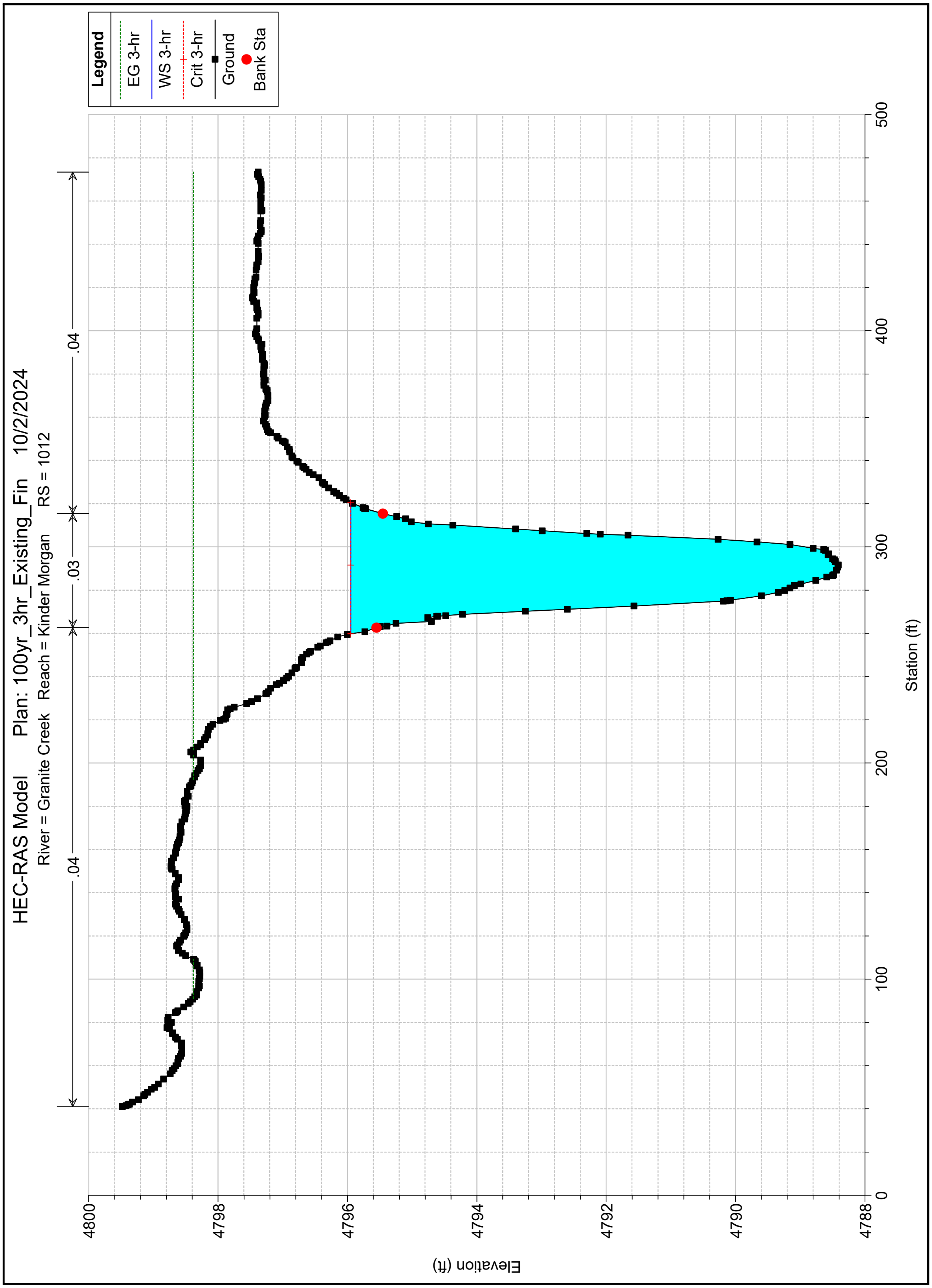
Granite Creek Kinder Morgan
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Elevation (ft)
Main Channel Distance (ft)
4720
4730
4740
4750
4760
4770
4780
4790
4800
0
1000
2000
3000
4000
5000
6000
7000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Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
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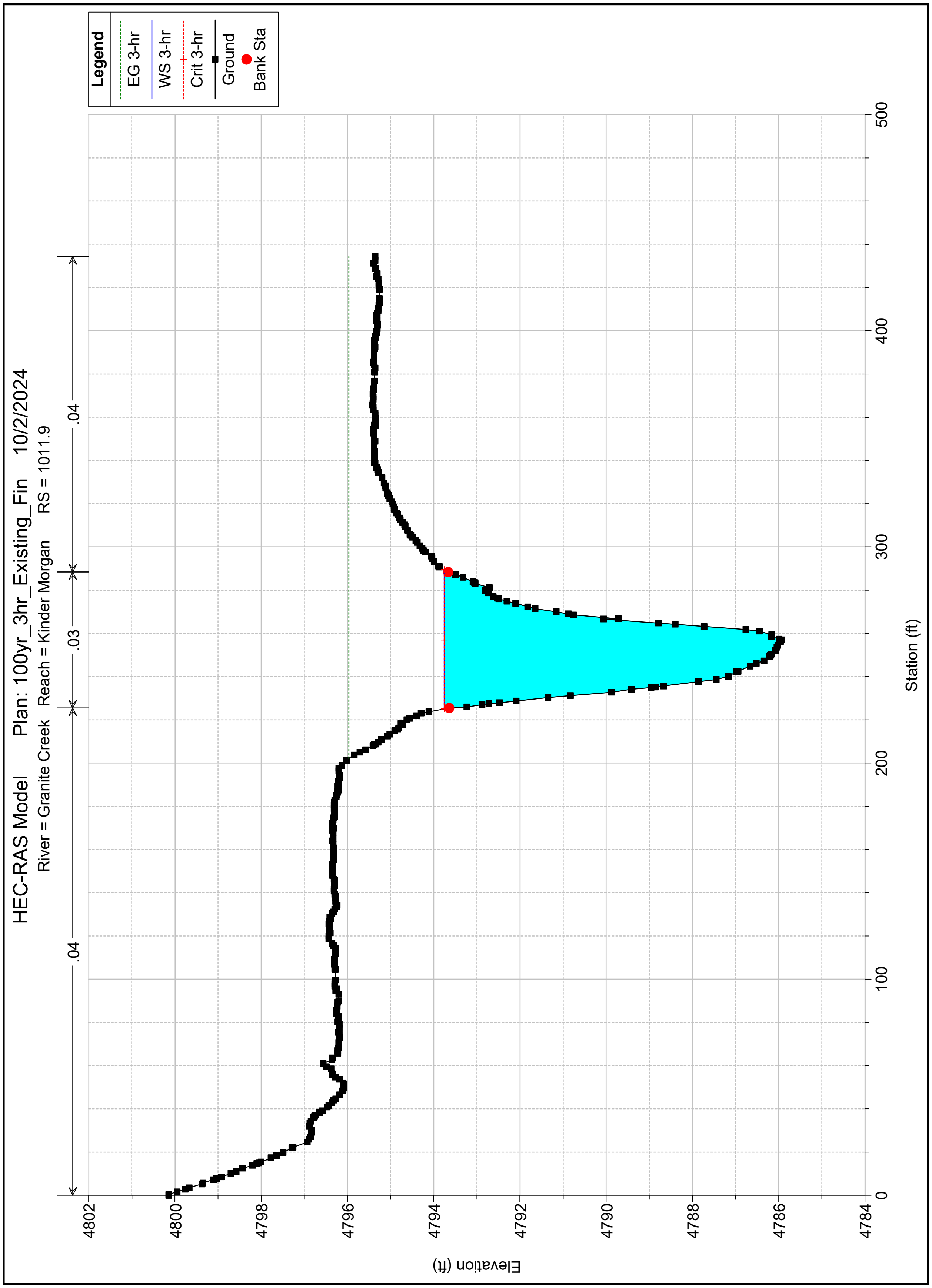
4798
4796
4794
4792
4790
4788
0
100
200
300
400
500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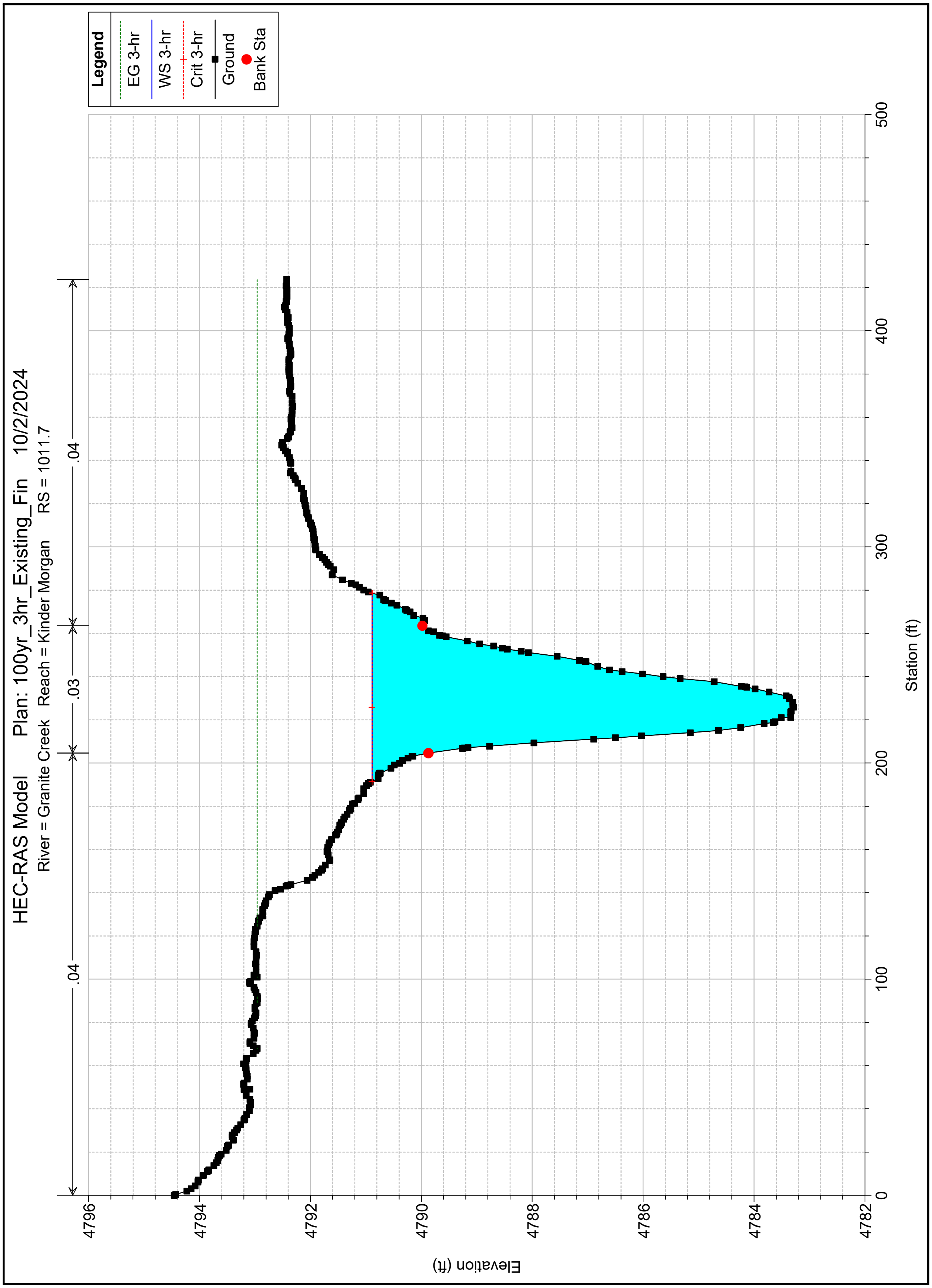
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
4802
4800
4798
4796
4794
4792
4790
4788
4786
4784
Station (ft)
0
100
200
300
400
500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Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
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4794
4792
4790
4788
4786
4784
4782
0
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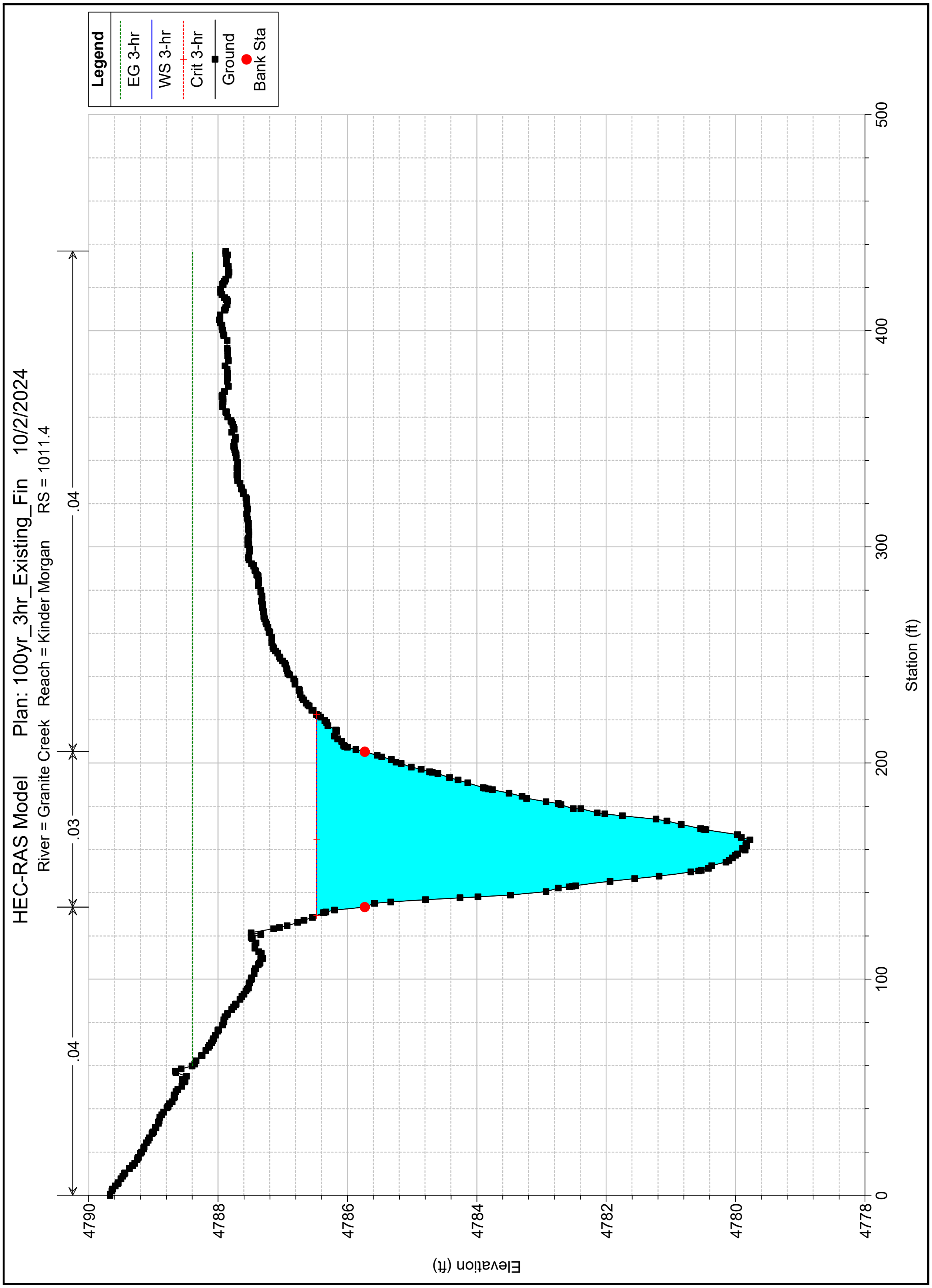
200
300
400
500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Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
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4788
4786
4784
4782
4780
4778
0
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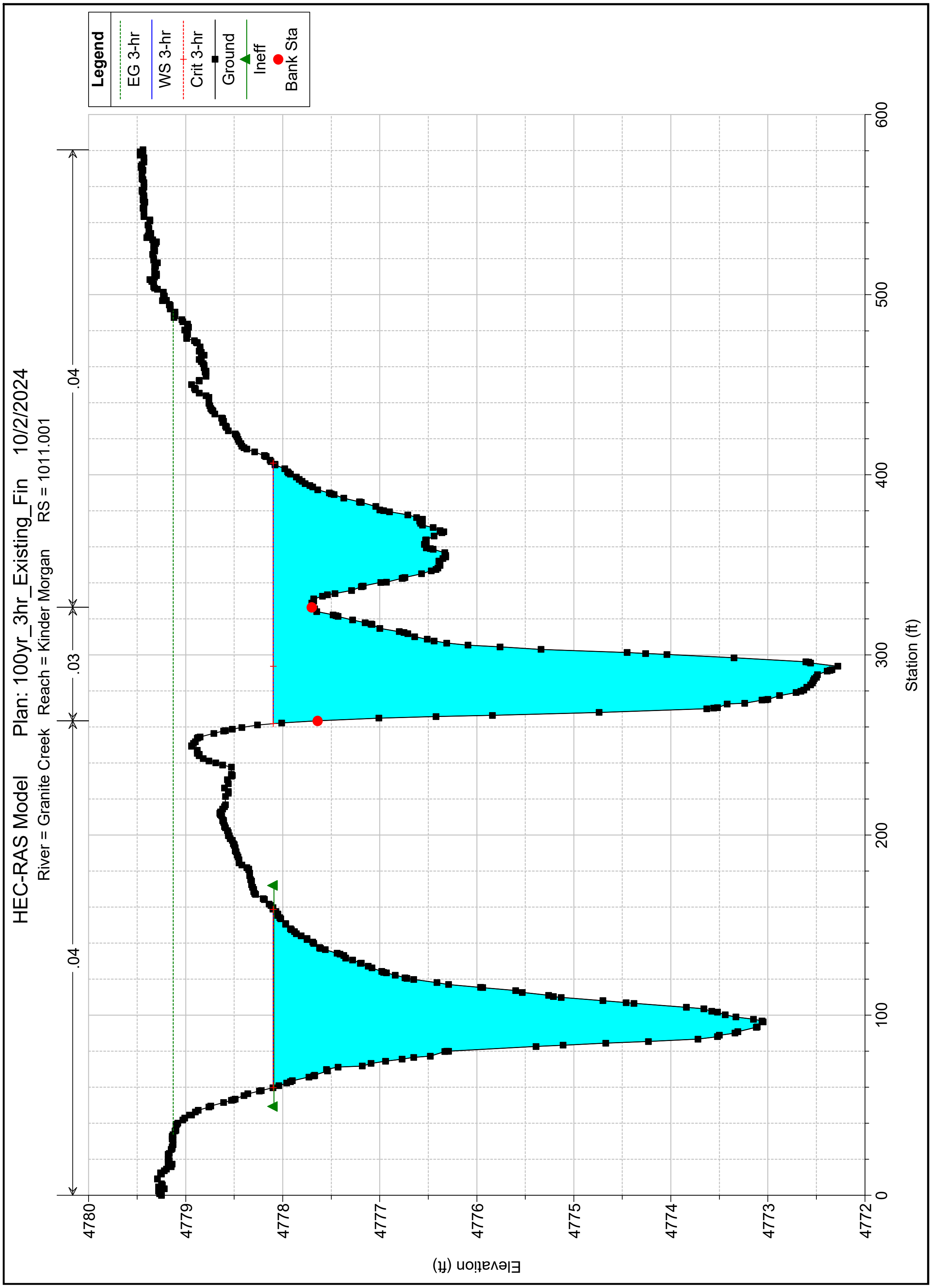
200
300
400
500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WS 3-hr
Crit 3-hr
Ground
Ineff
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
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4778
4777
4776
4775
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4772
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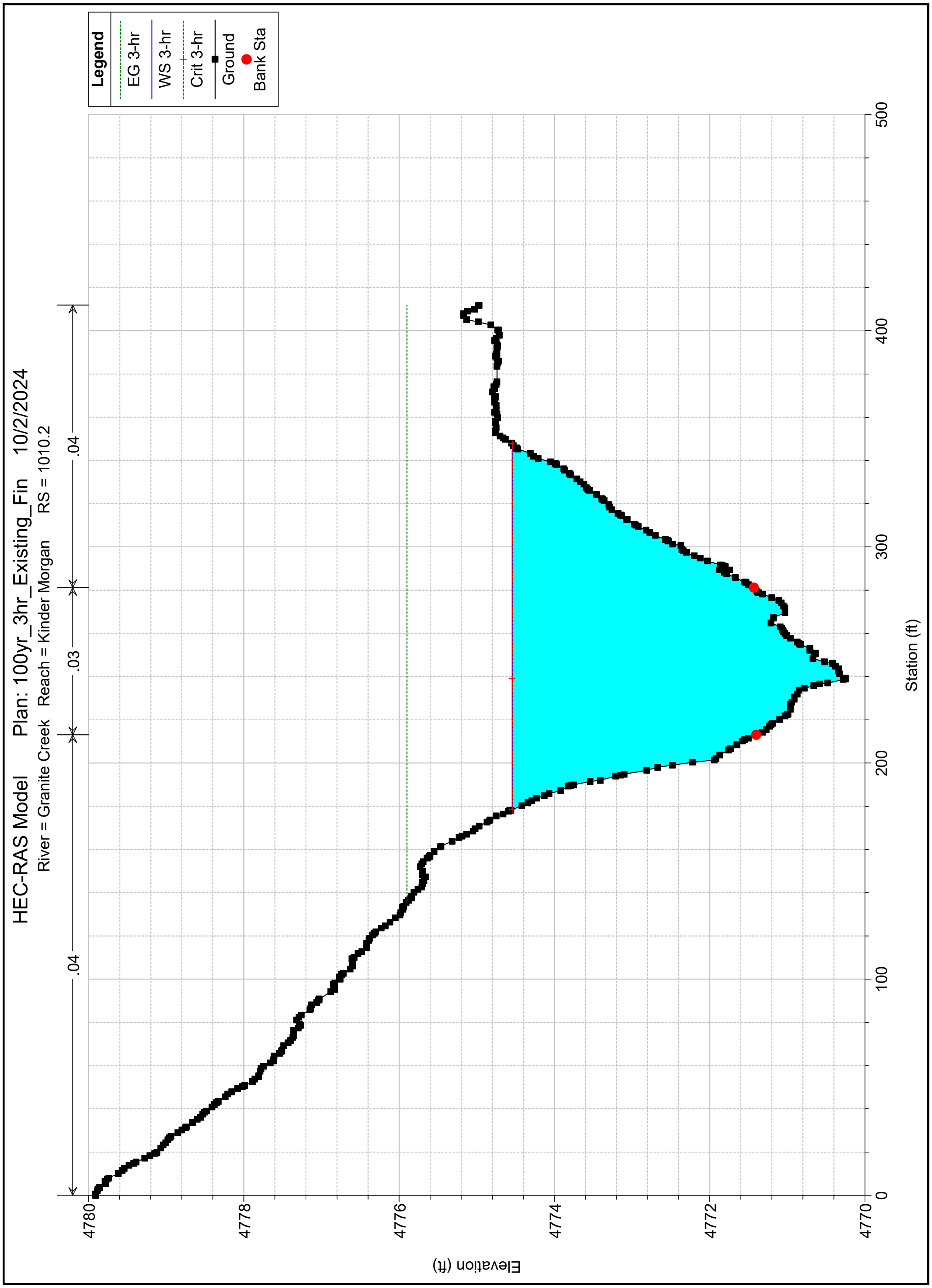
200
300
400
500
600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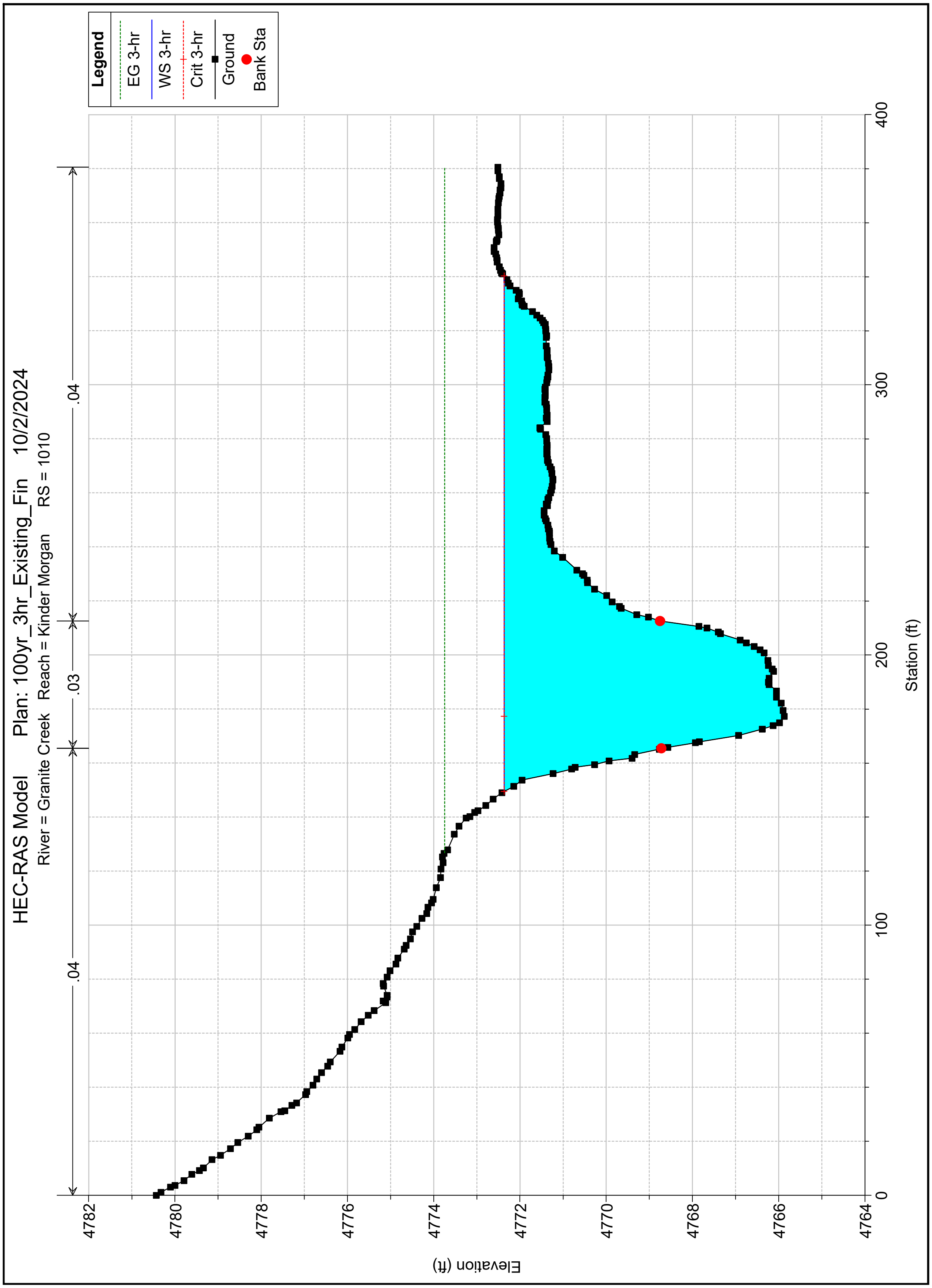
.04
.03
.04
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
Elevation (ft)
Station (ft)
4780
4778
4776
4774
4772
4770
0
100
200
300
400
500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Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
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4778
4776
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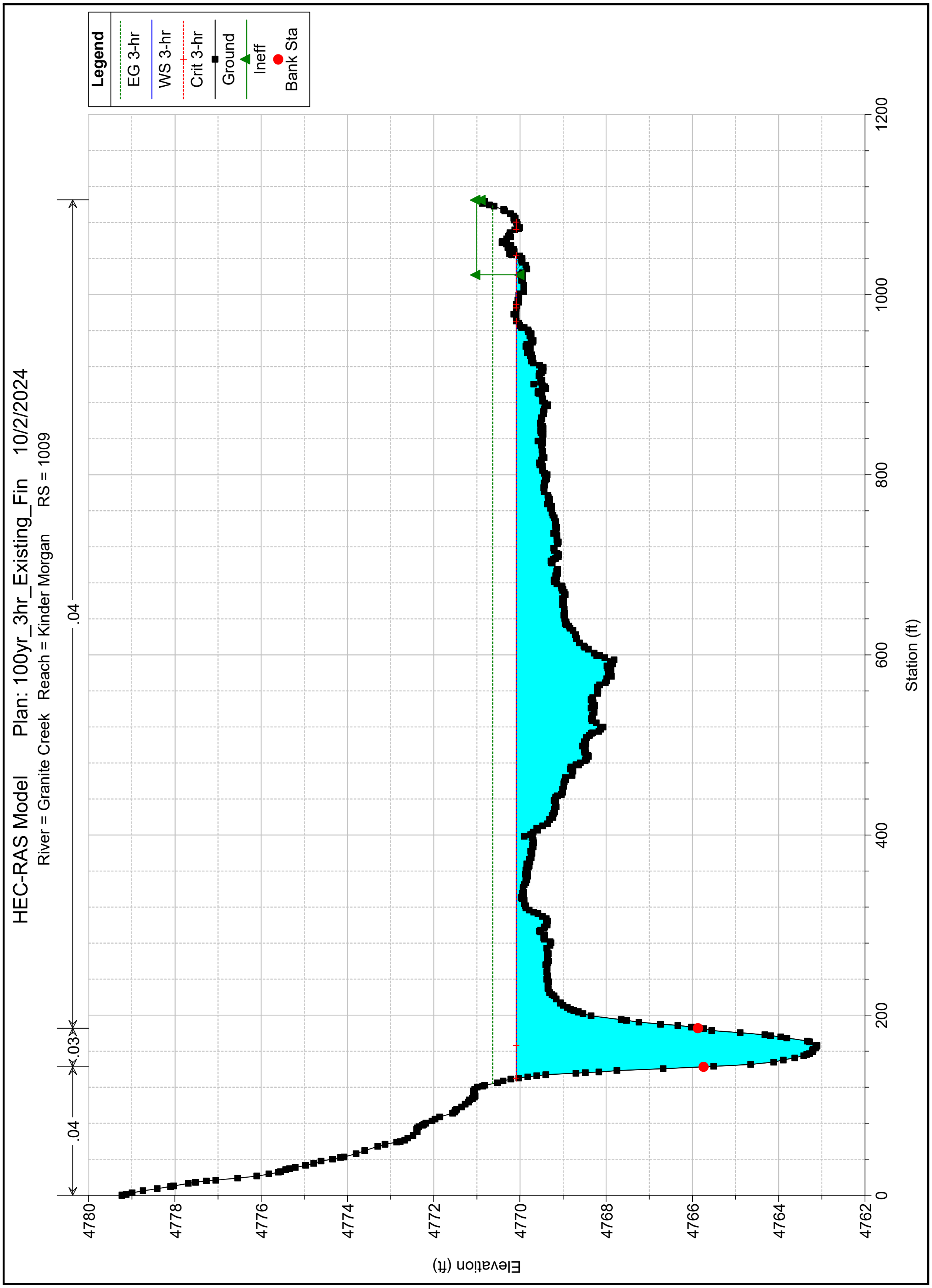
200
300
400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Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Ineff
Bank Sta
.04
.03
.04
Elevation (ft)
4780
4778
4776
4774
4772
4770
4768
4766
4764
4762
Station (ft)
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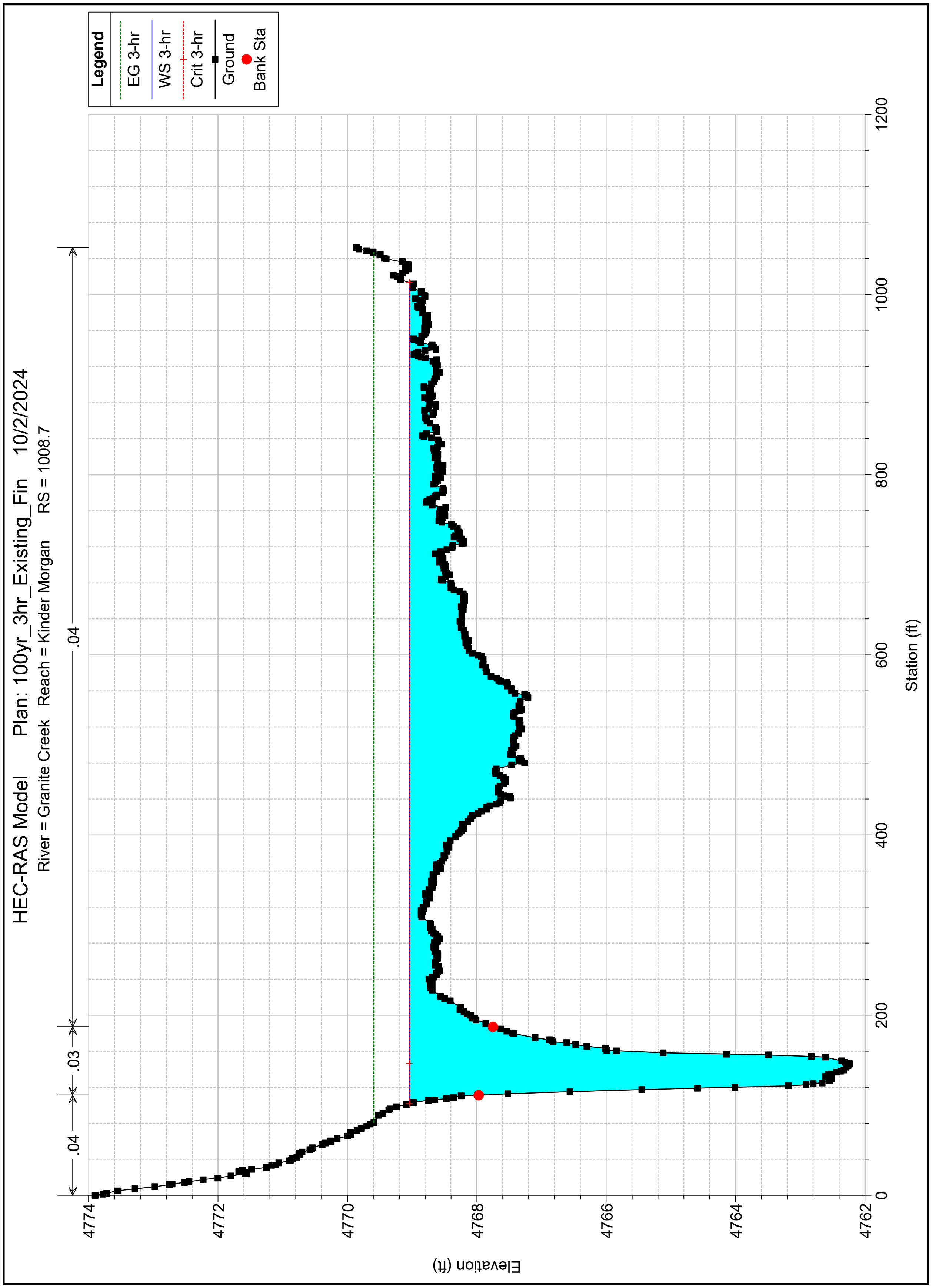
200
400
600
800
1000
1200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WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
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4772
4770
4768
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4764
4762
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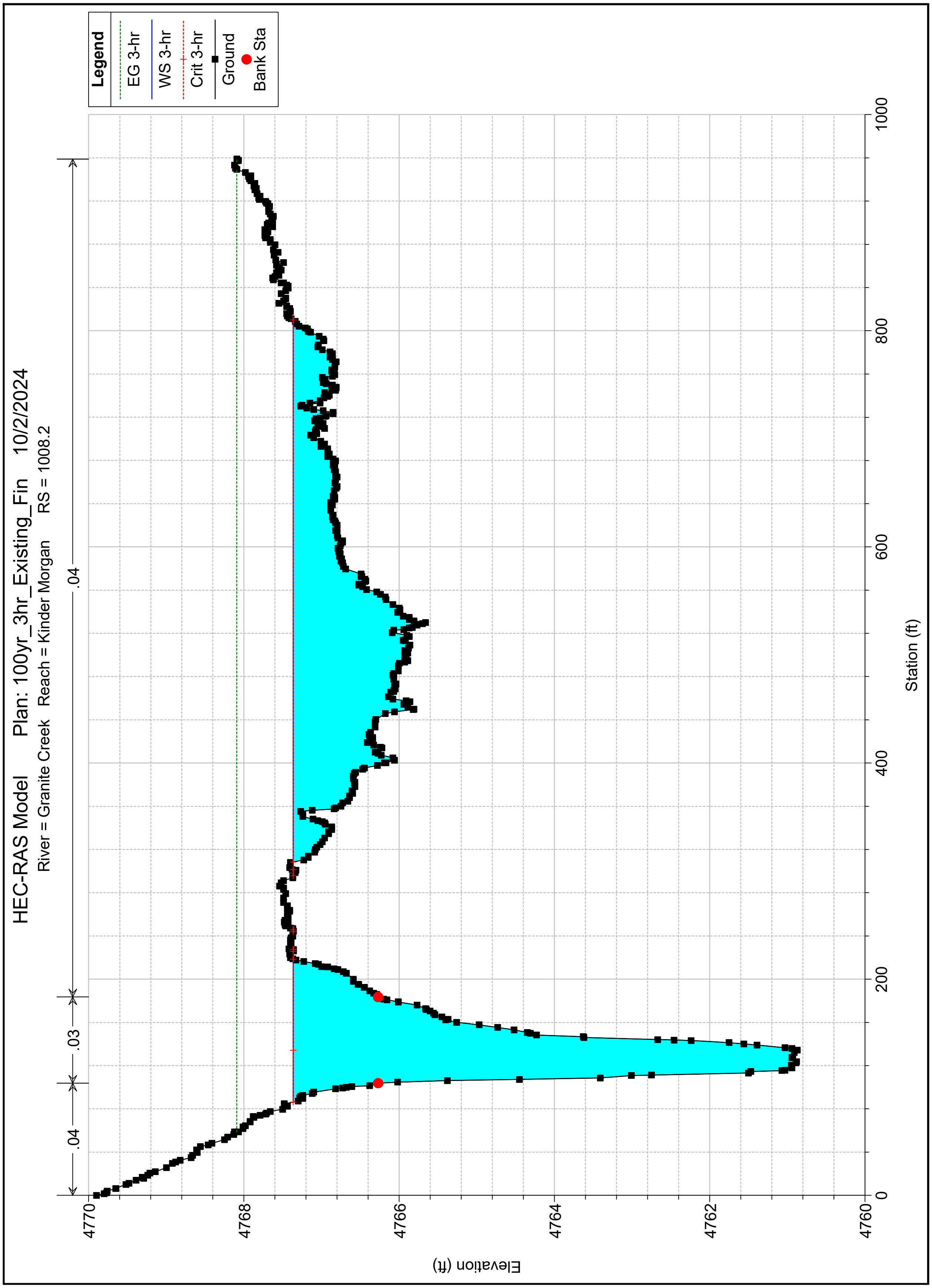
200
400
600
800
1000
1200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Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
4770
4768
4766
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Station (ft)
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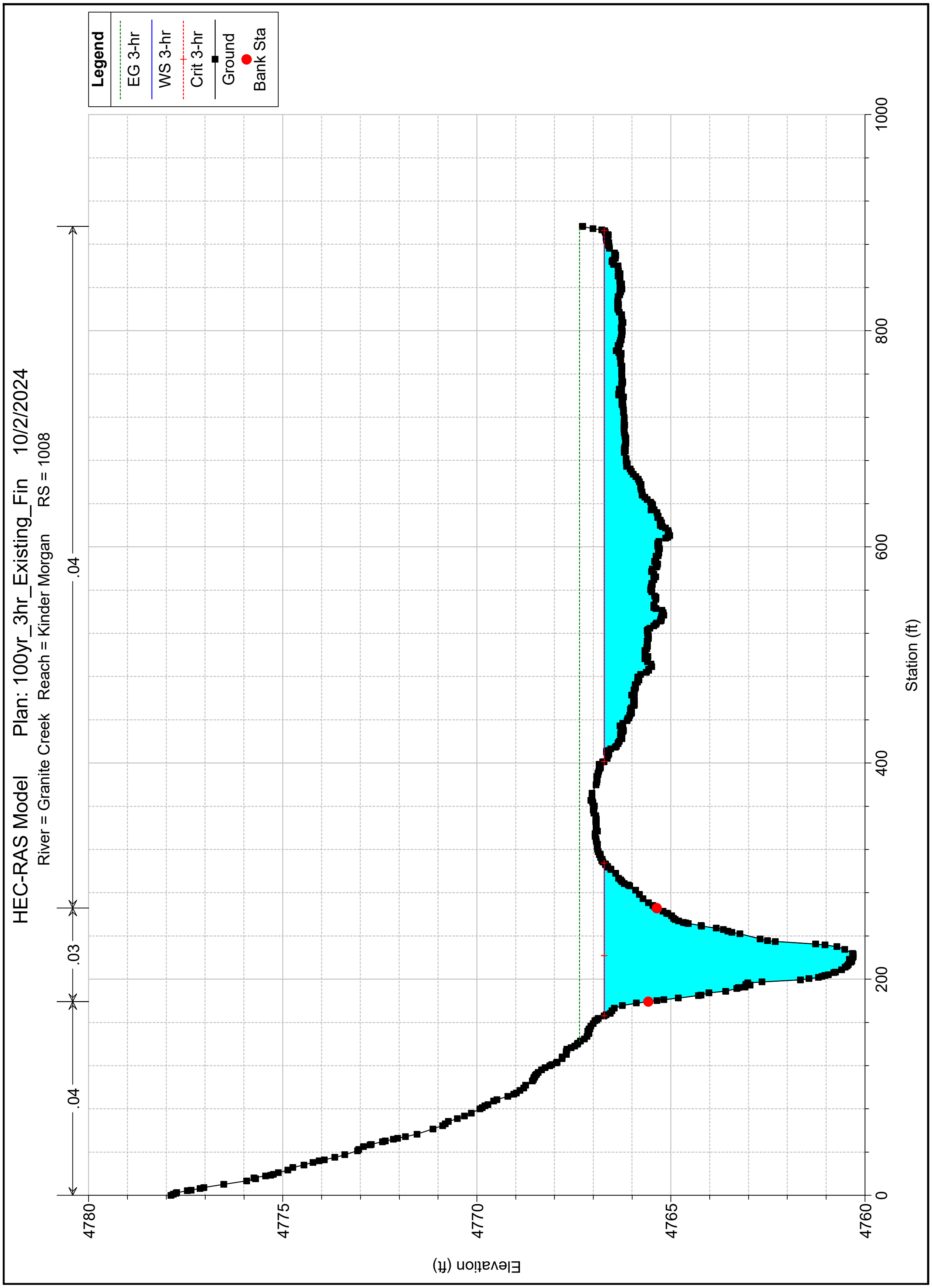
200
400
600
800
1000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Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
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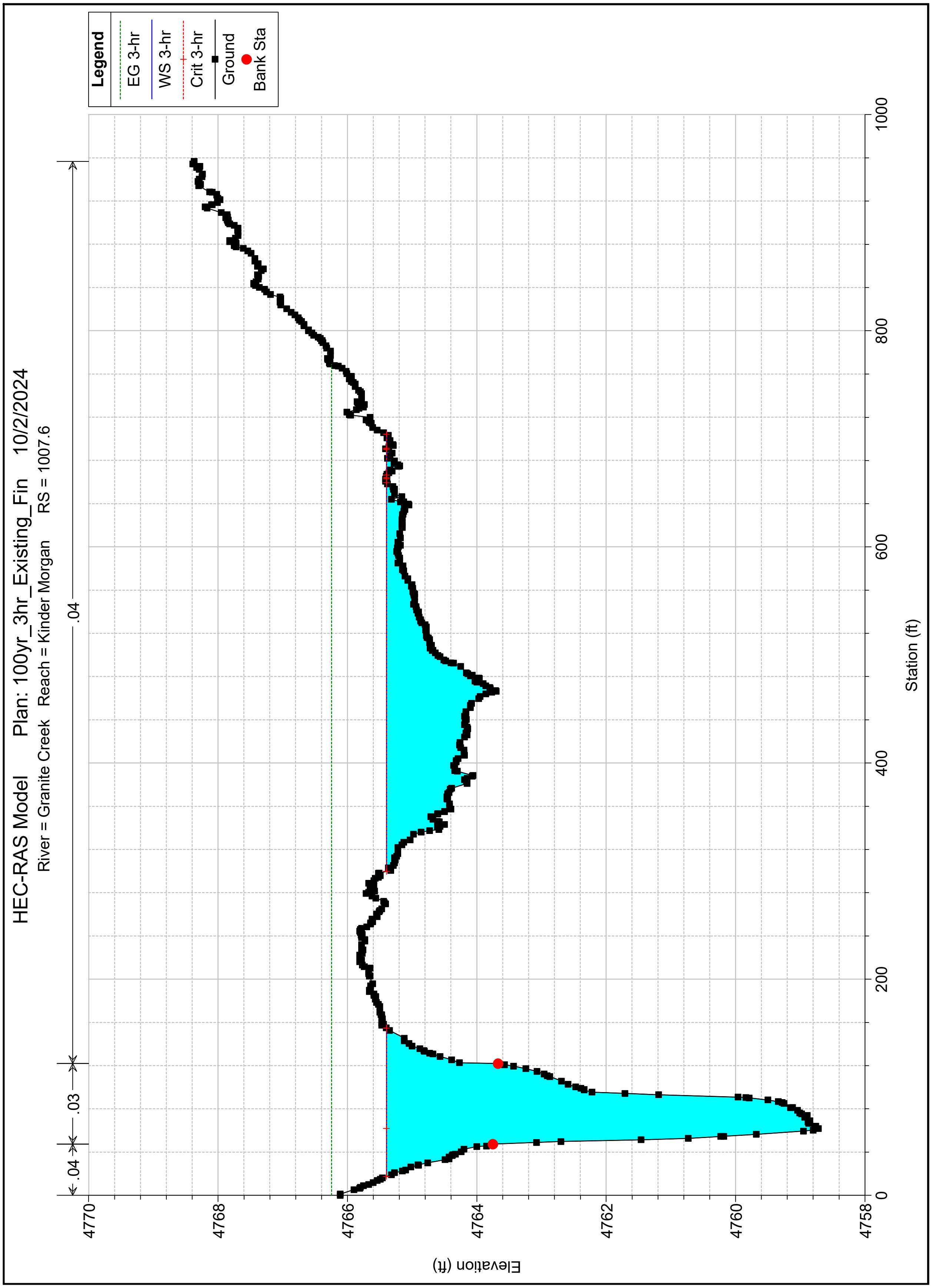
400
600
800
1000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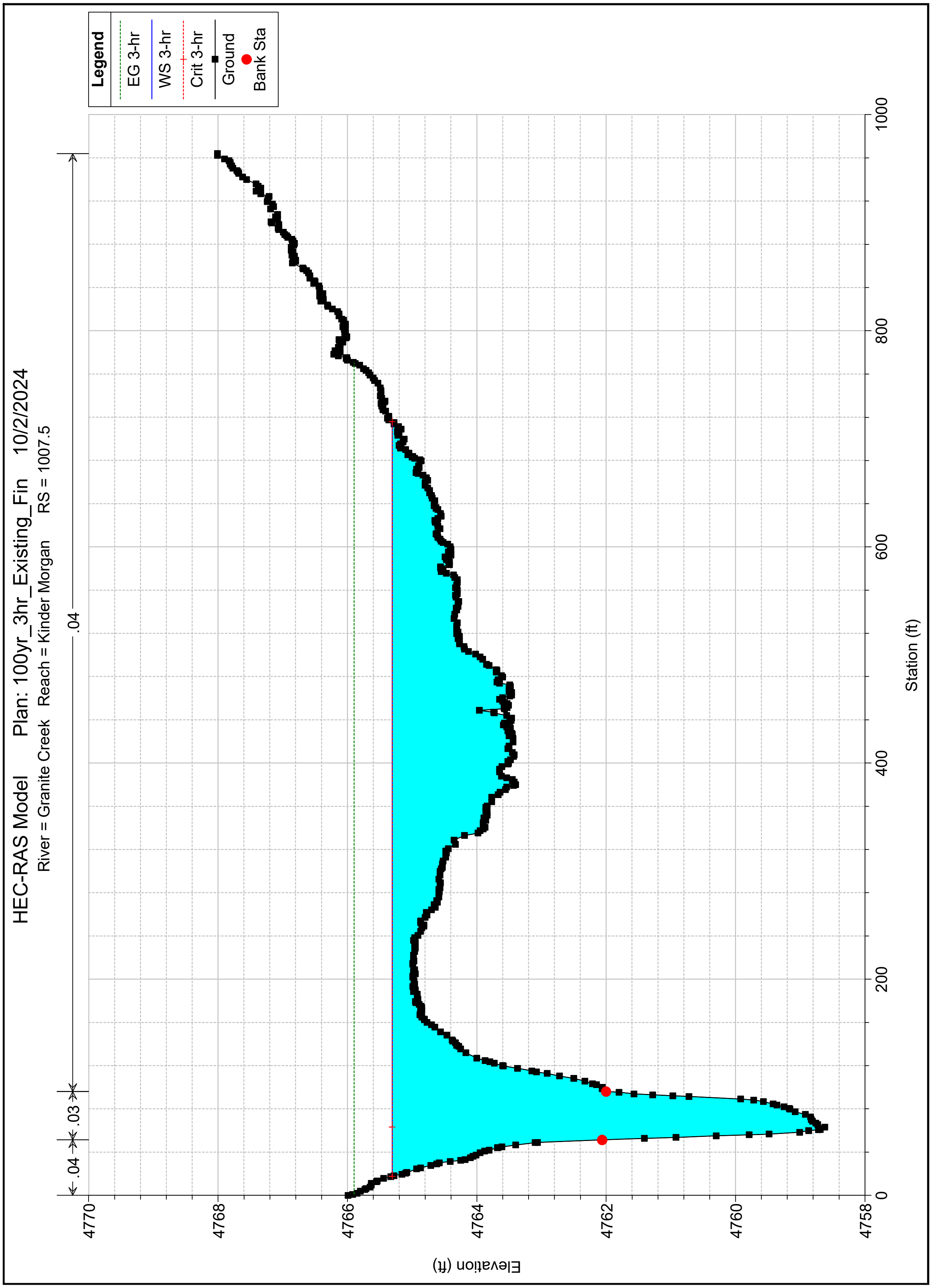
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
4770
4768
4766
4764
4762
4760
4758
Station (ft)
0
200
400
600
800
1000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WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
4770
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4762
4760
4758
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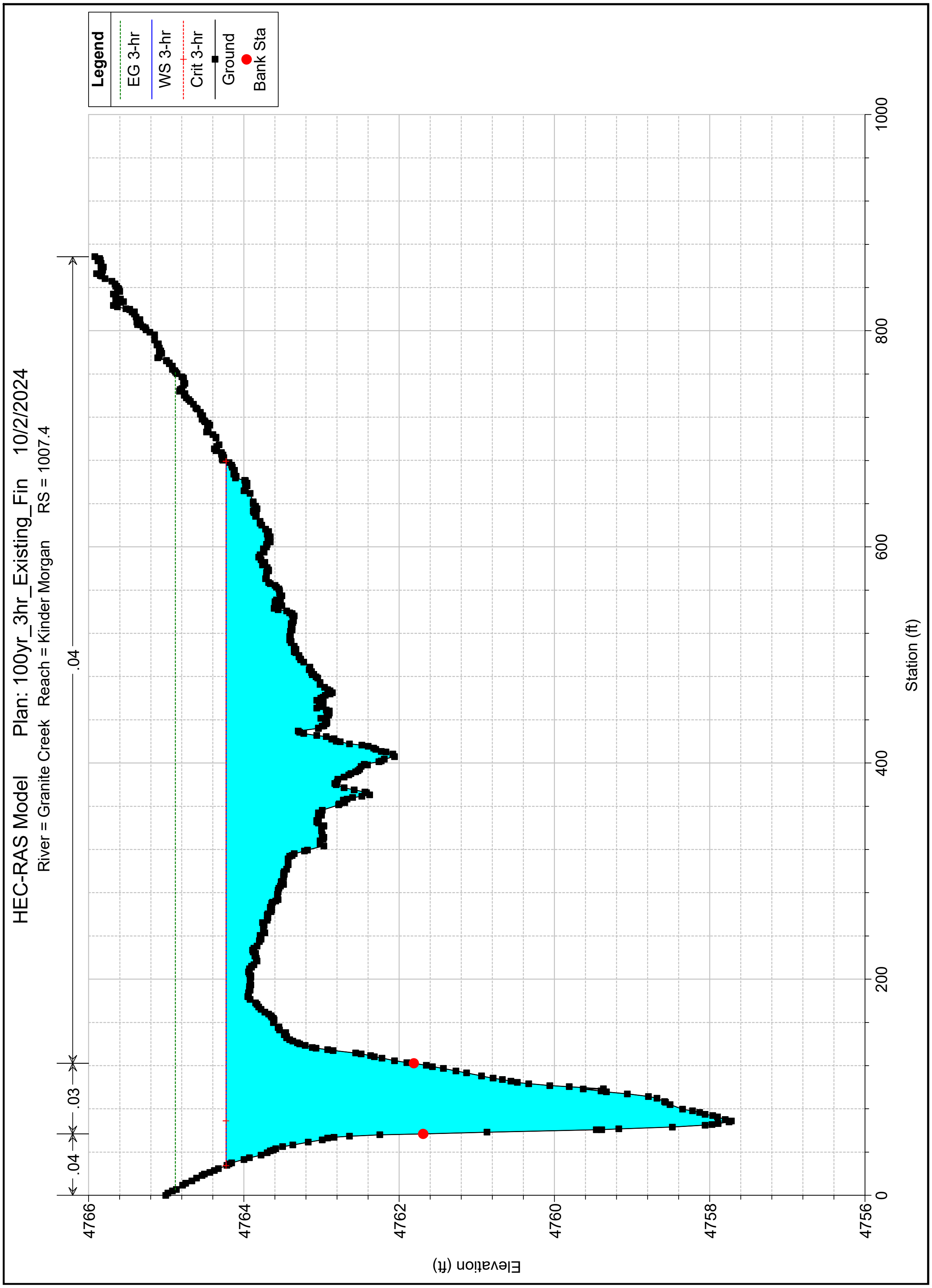
400
600
800
1000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WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
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4760
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800
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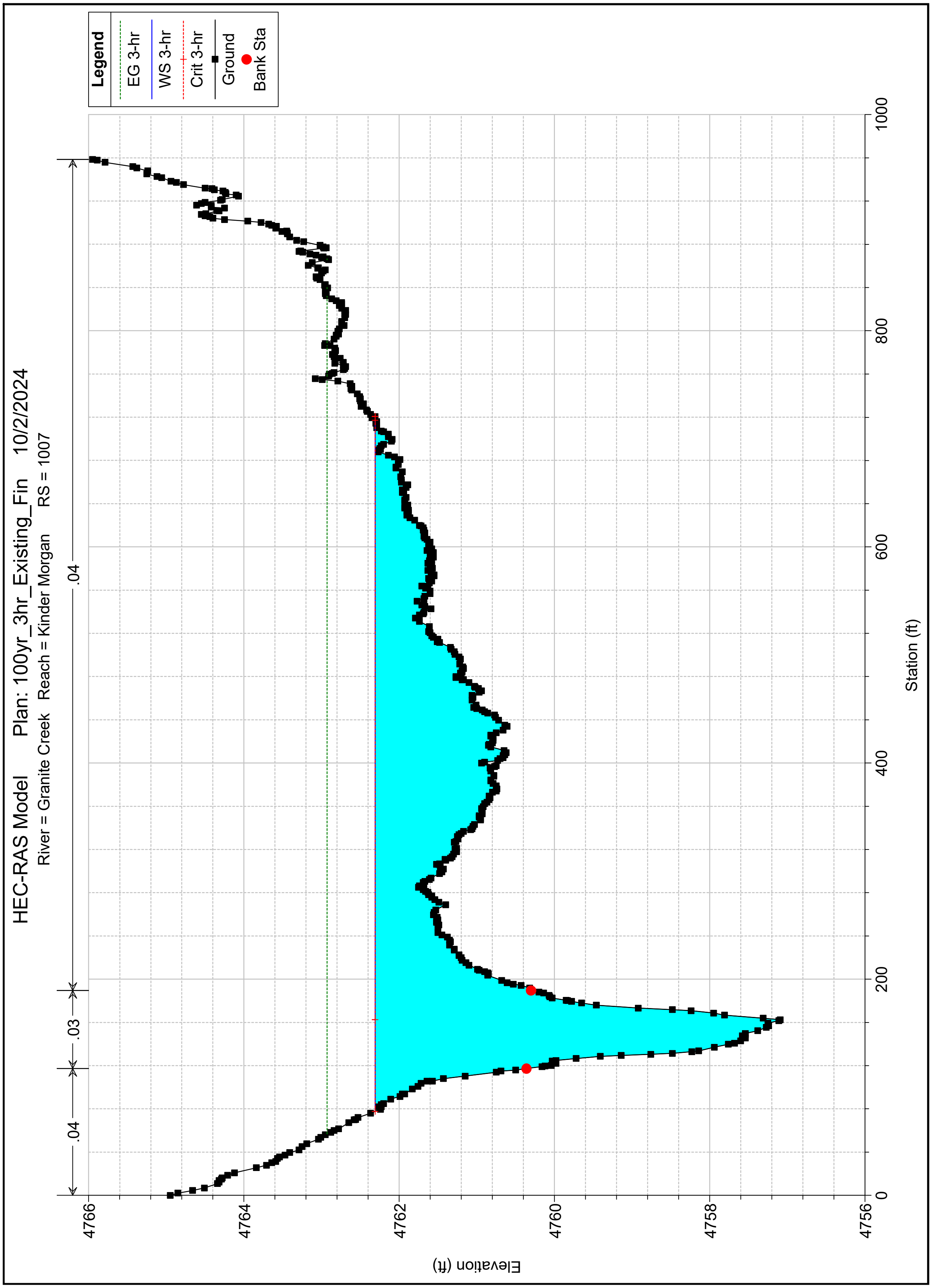
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WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
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4758
4756
0
200
400
600
800
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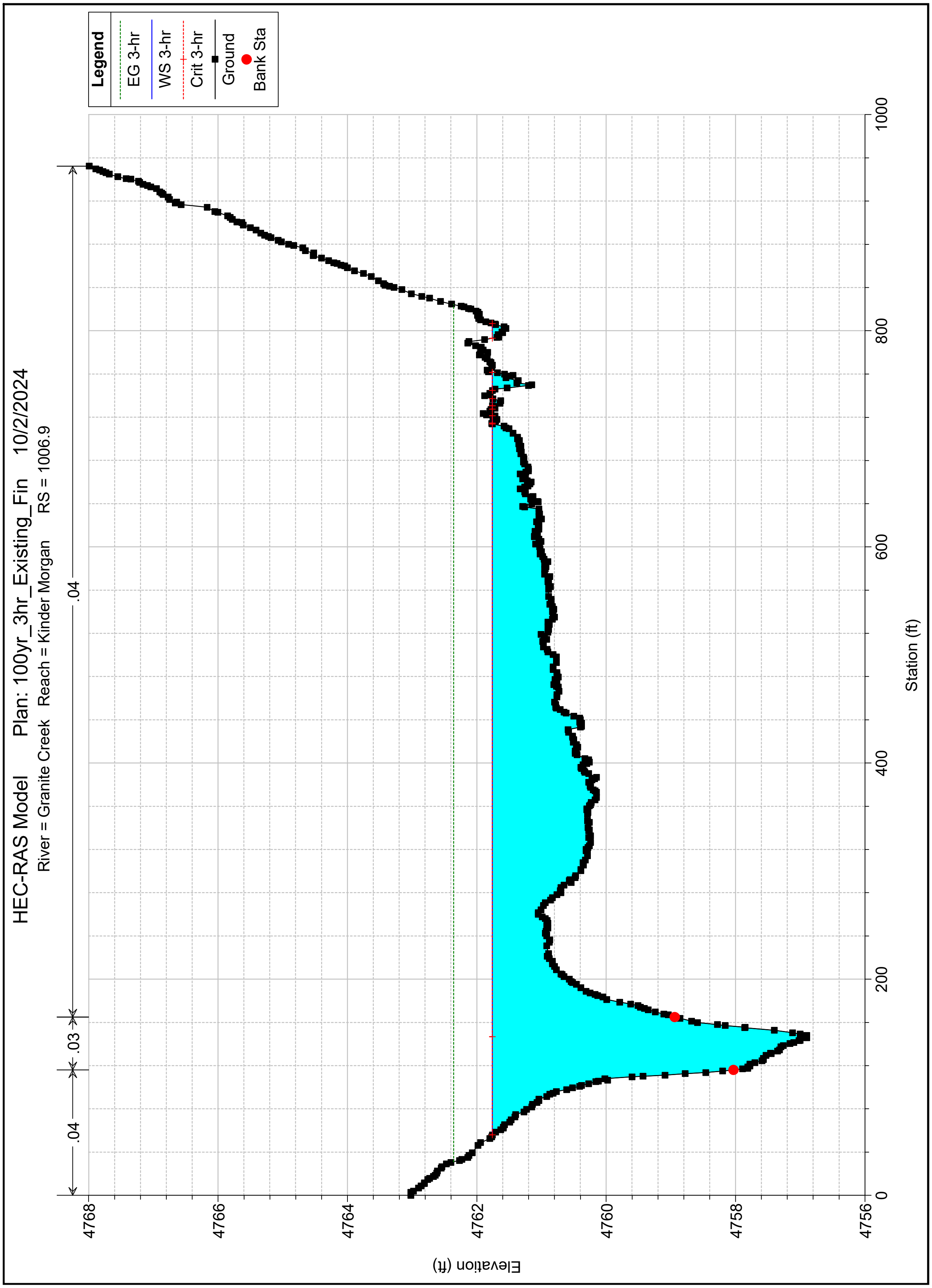
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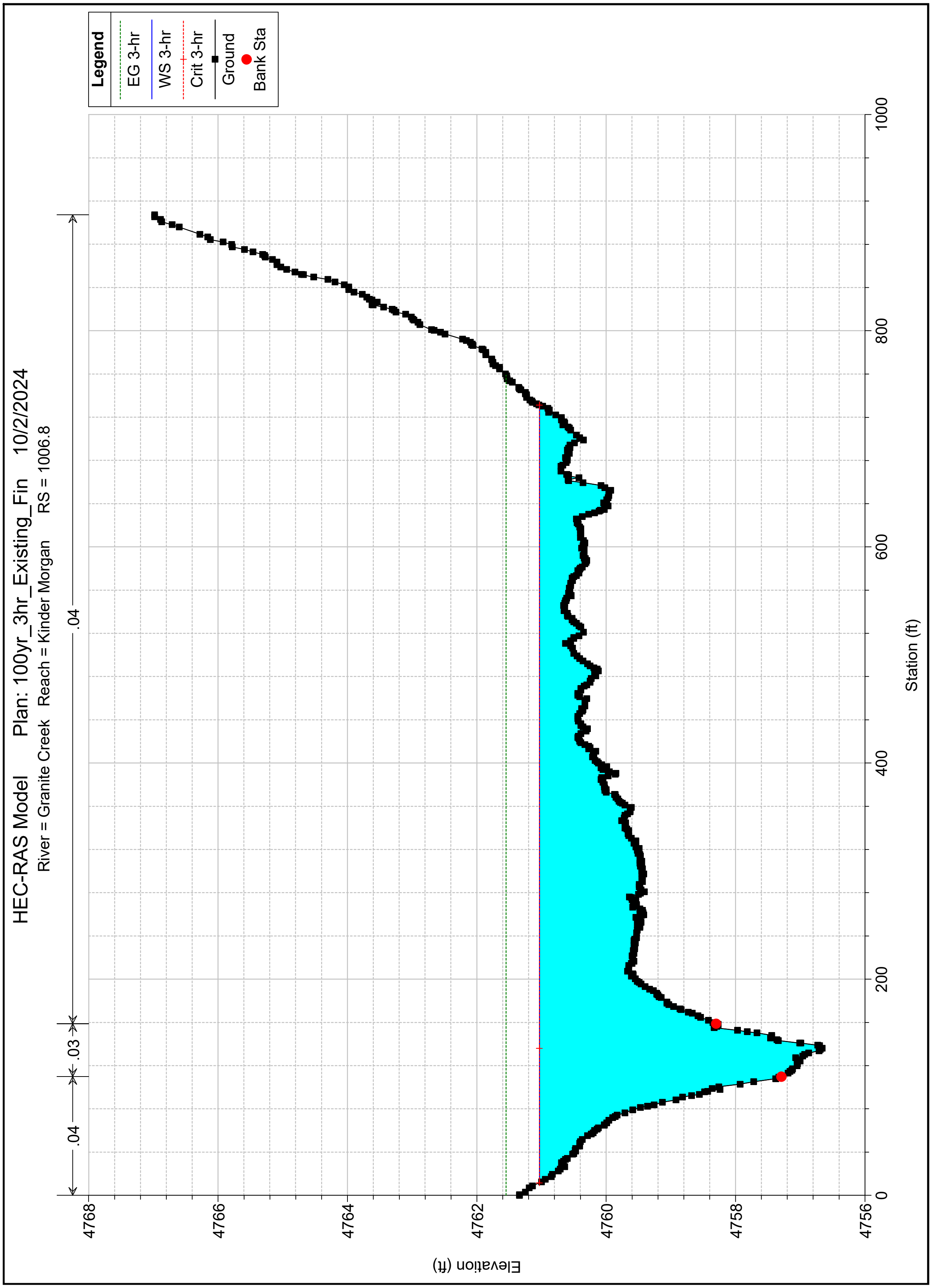
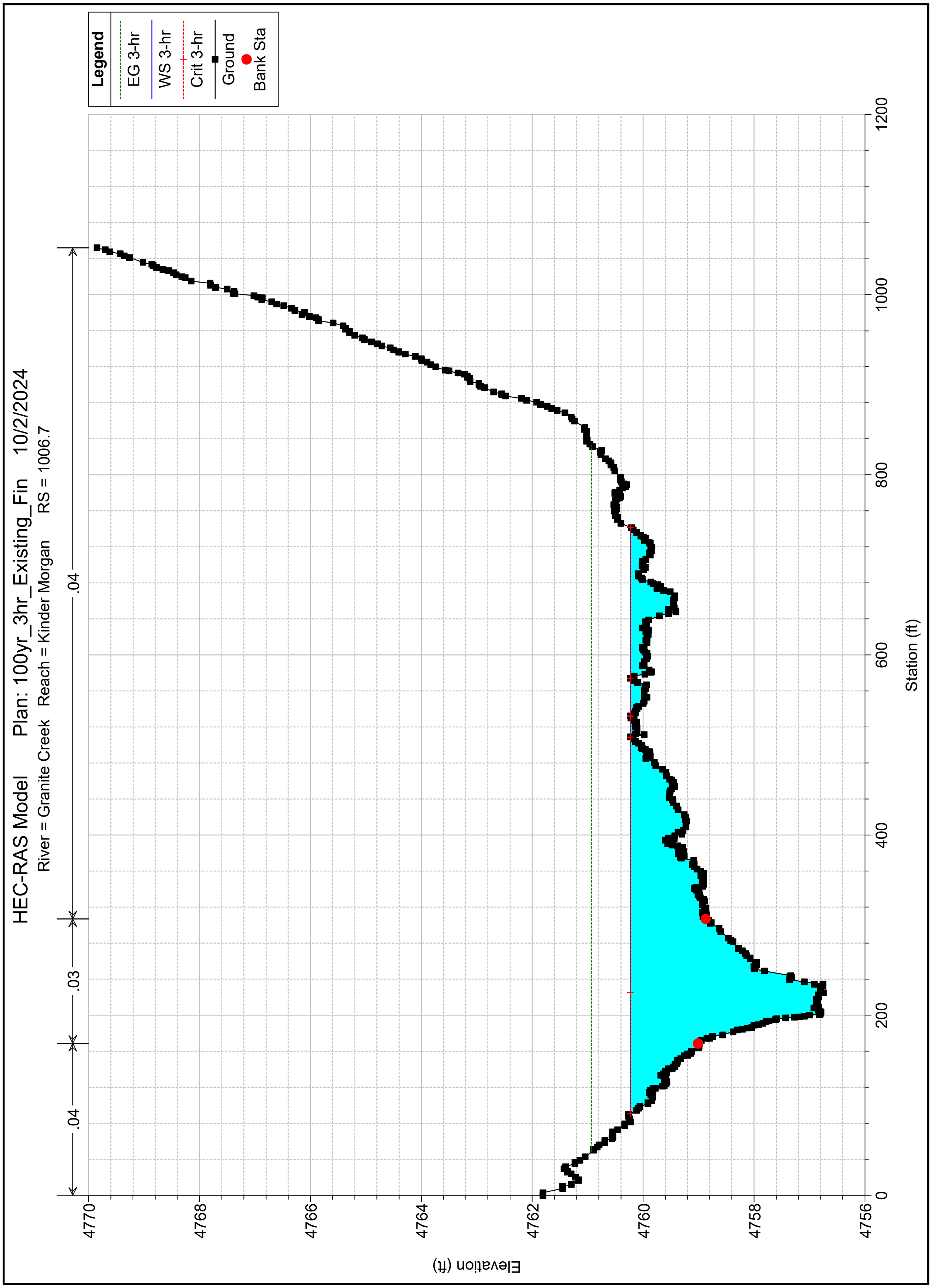
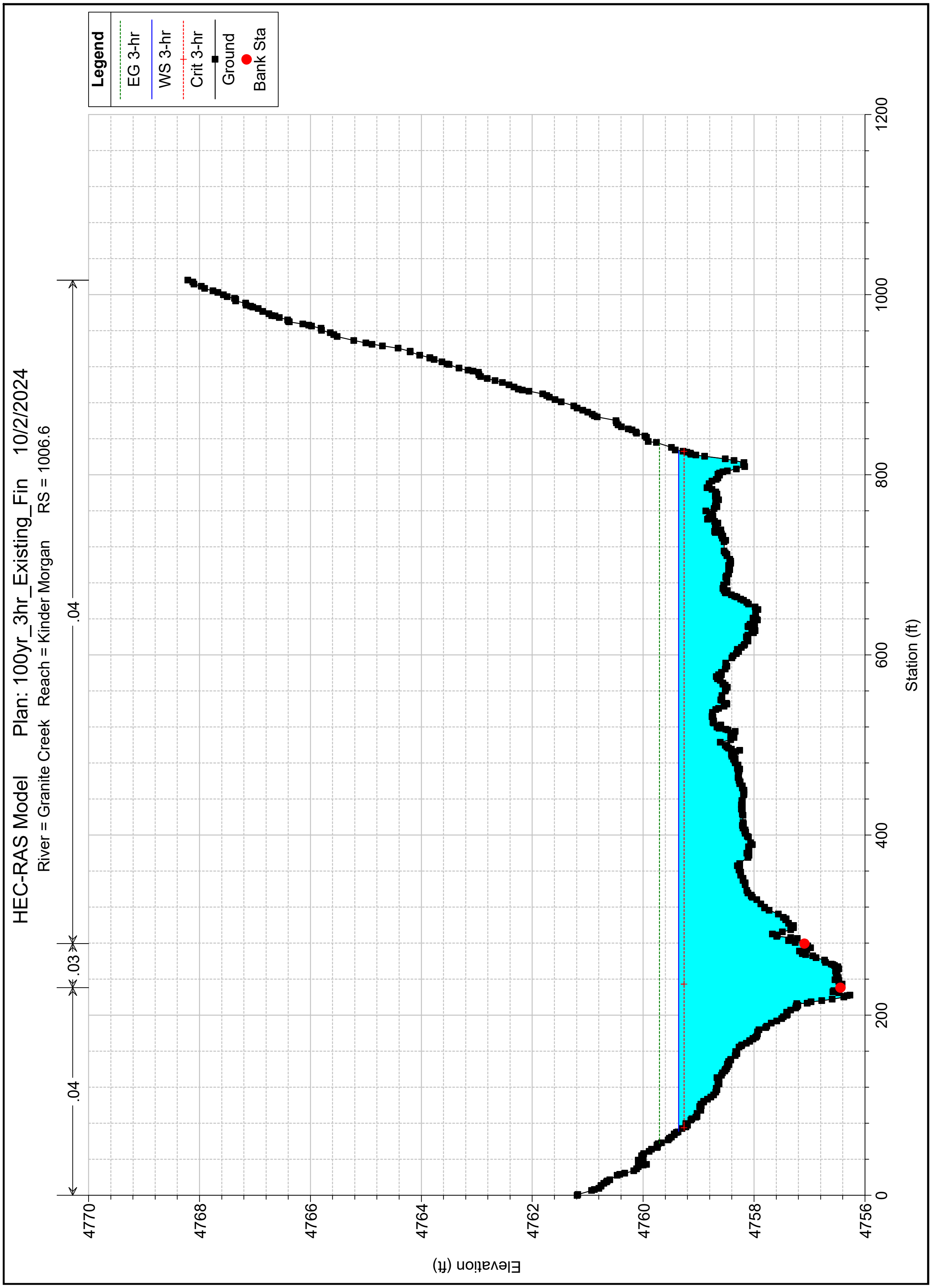
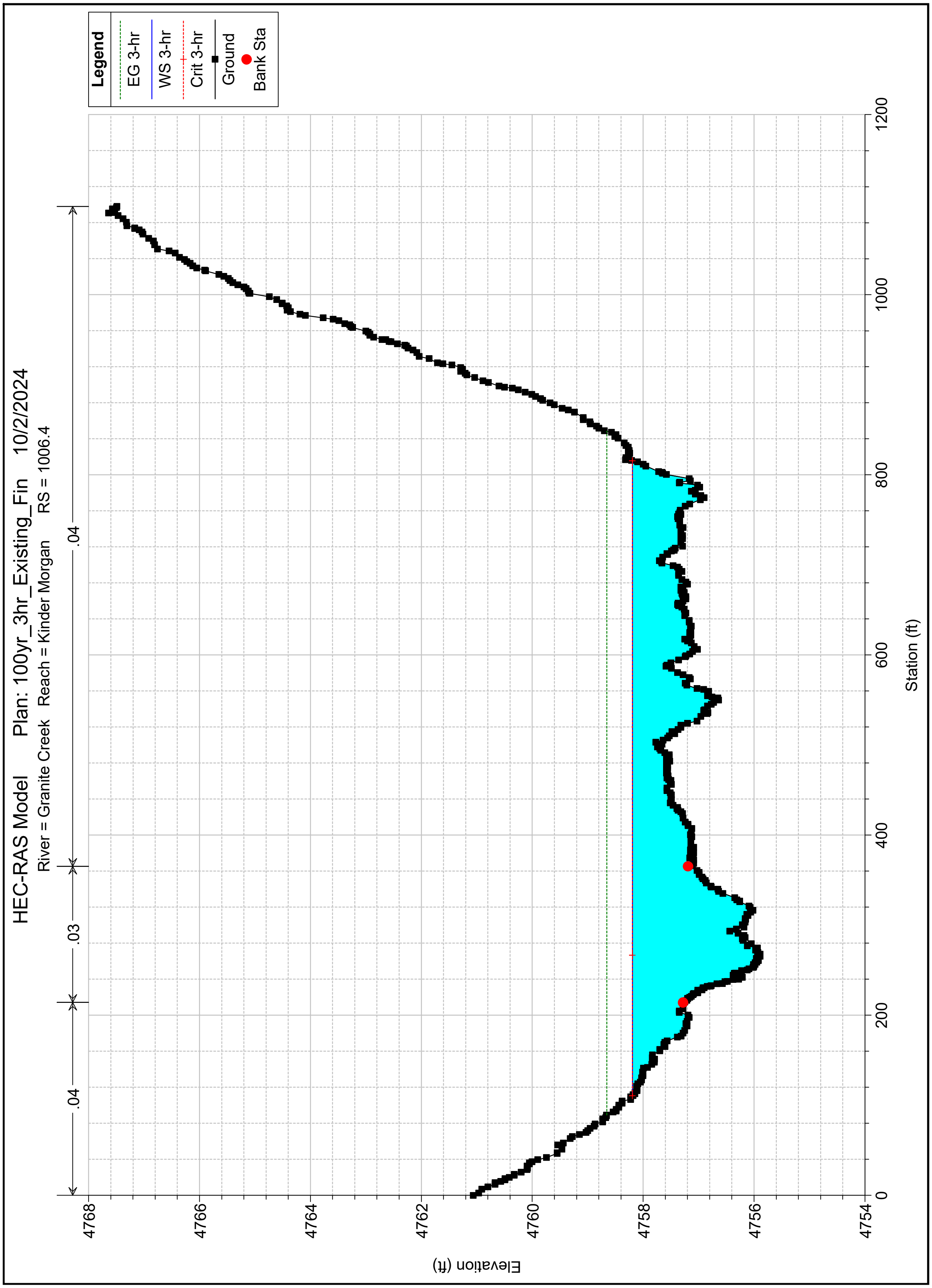
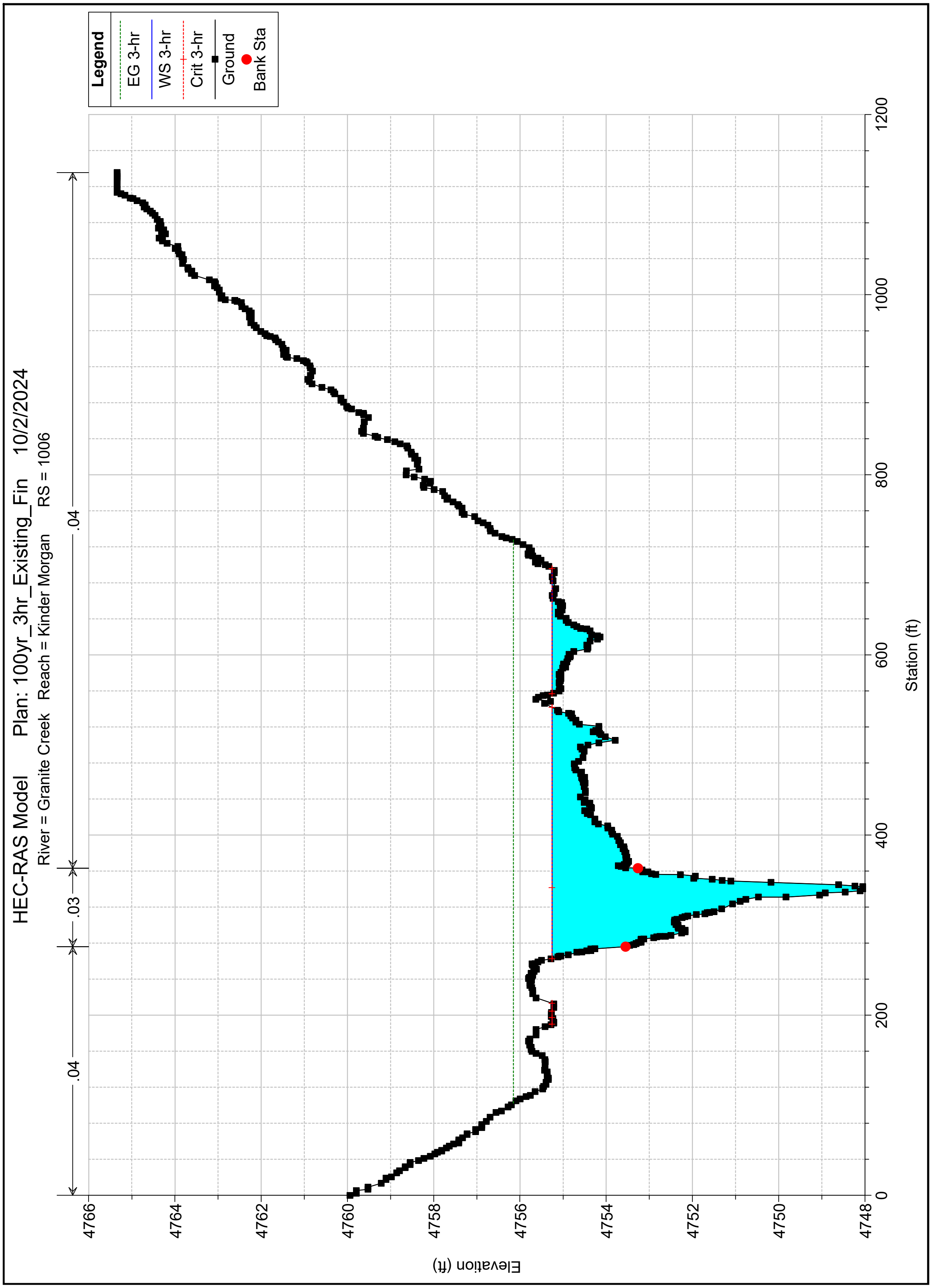
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
4756
4758
4760
4762
4764
4766
4768
0
200
400
600
800
1000

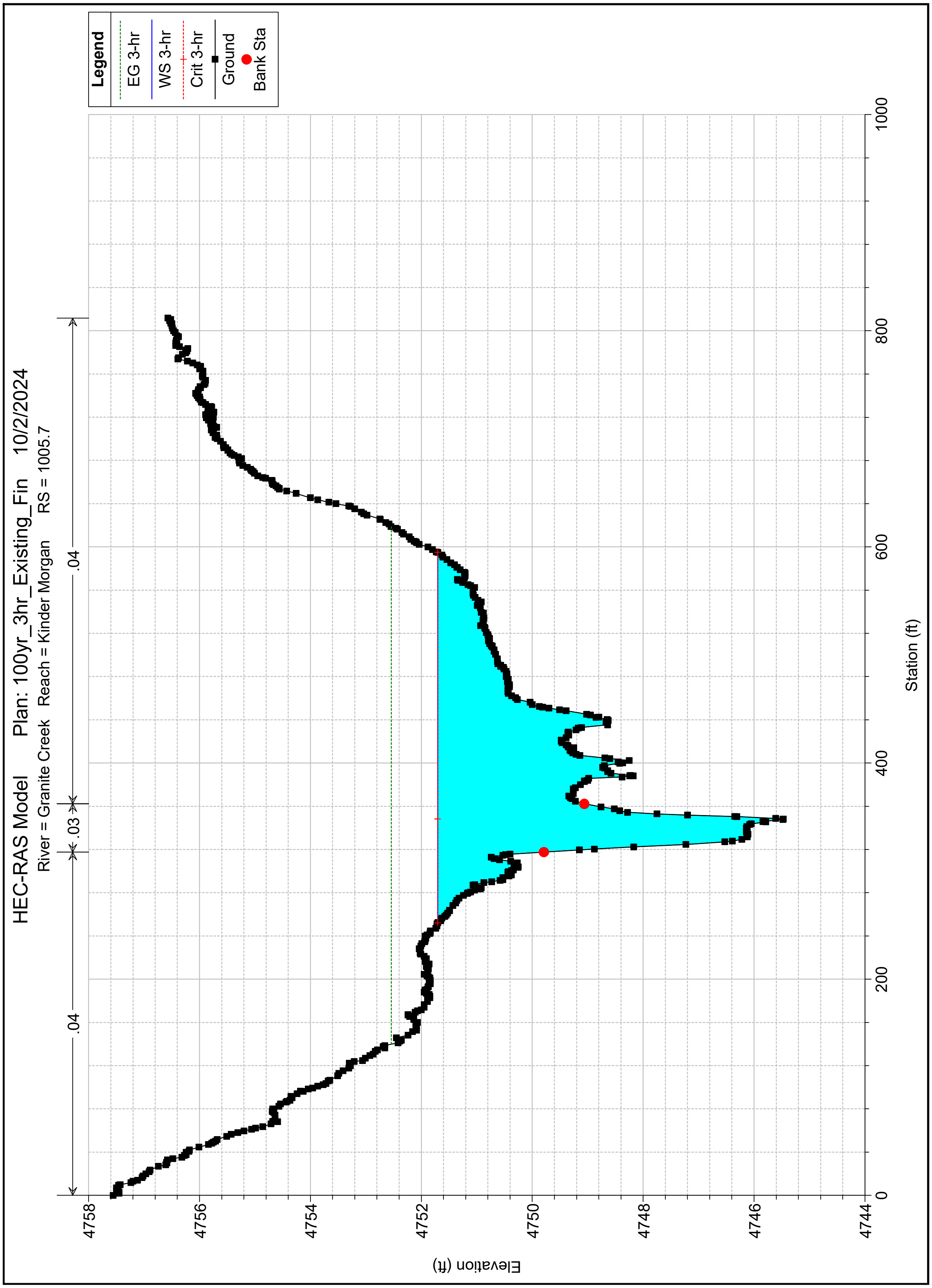

HEC-RAS Model   Plan: 100yr_3hr_Existing_Fin   10/2/2024
River = Granite Creek   Reach = Kinder Morgan   RS = 1006.8
.04
.03
.04
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
Elevation (ft)
4768
4766
4764
4762
4760
4758
4756
Station (ft)
0
200
400
600
800
1000

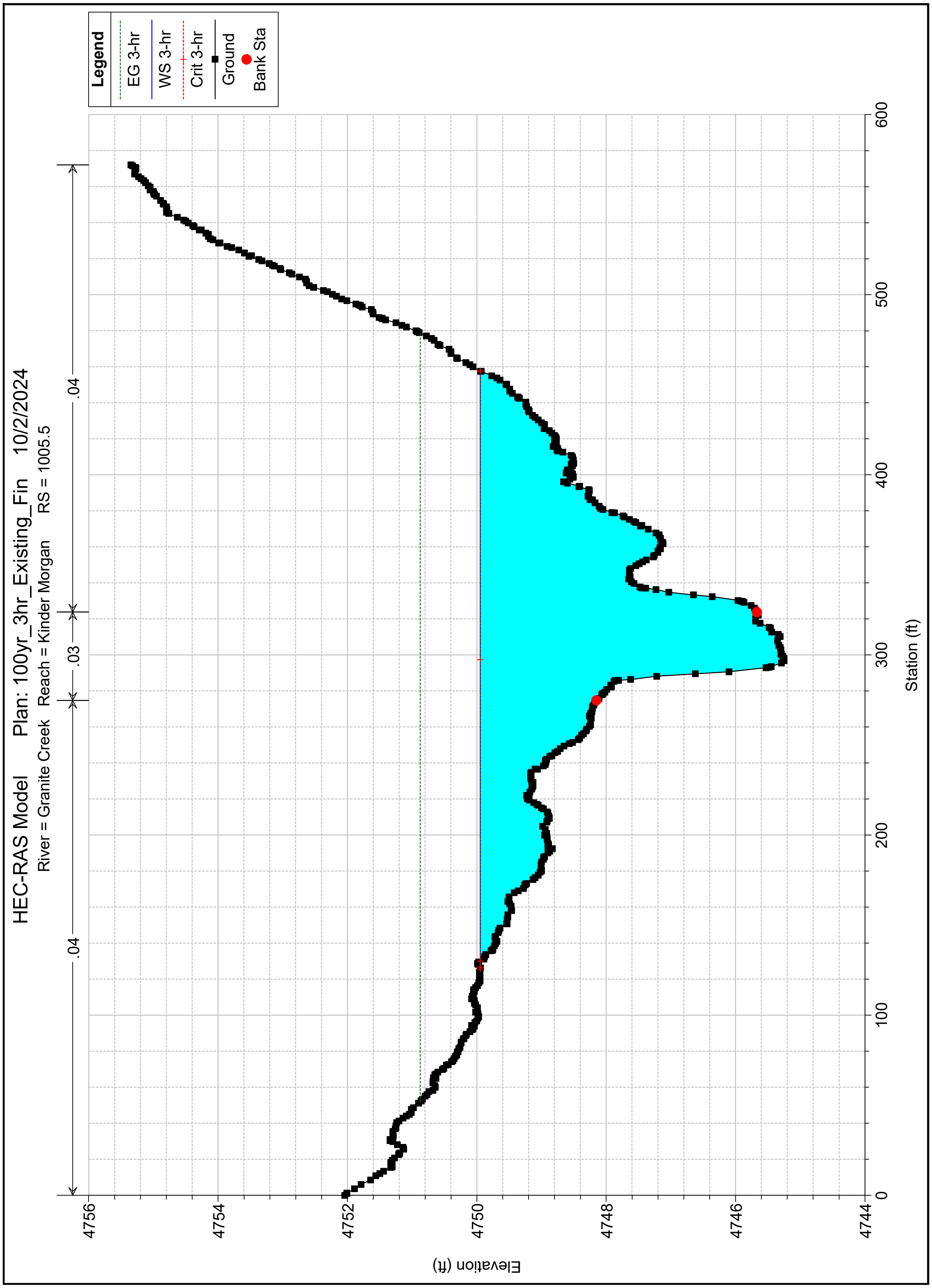

HEC-RAS Model Plan: 100yr_3hr_Existing_Fin 10/2/2024
River = Granite Creek Reach = Kinder Morgan RS = 1006.7
.04
.03
.04
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
Elevation (ft)
4770
4768
4766
4764
4762
4760
4758
4756
Station (ft)
0
200
400
600
800
1000
1200

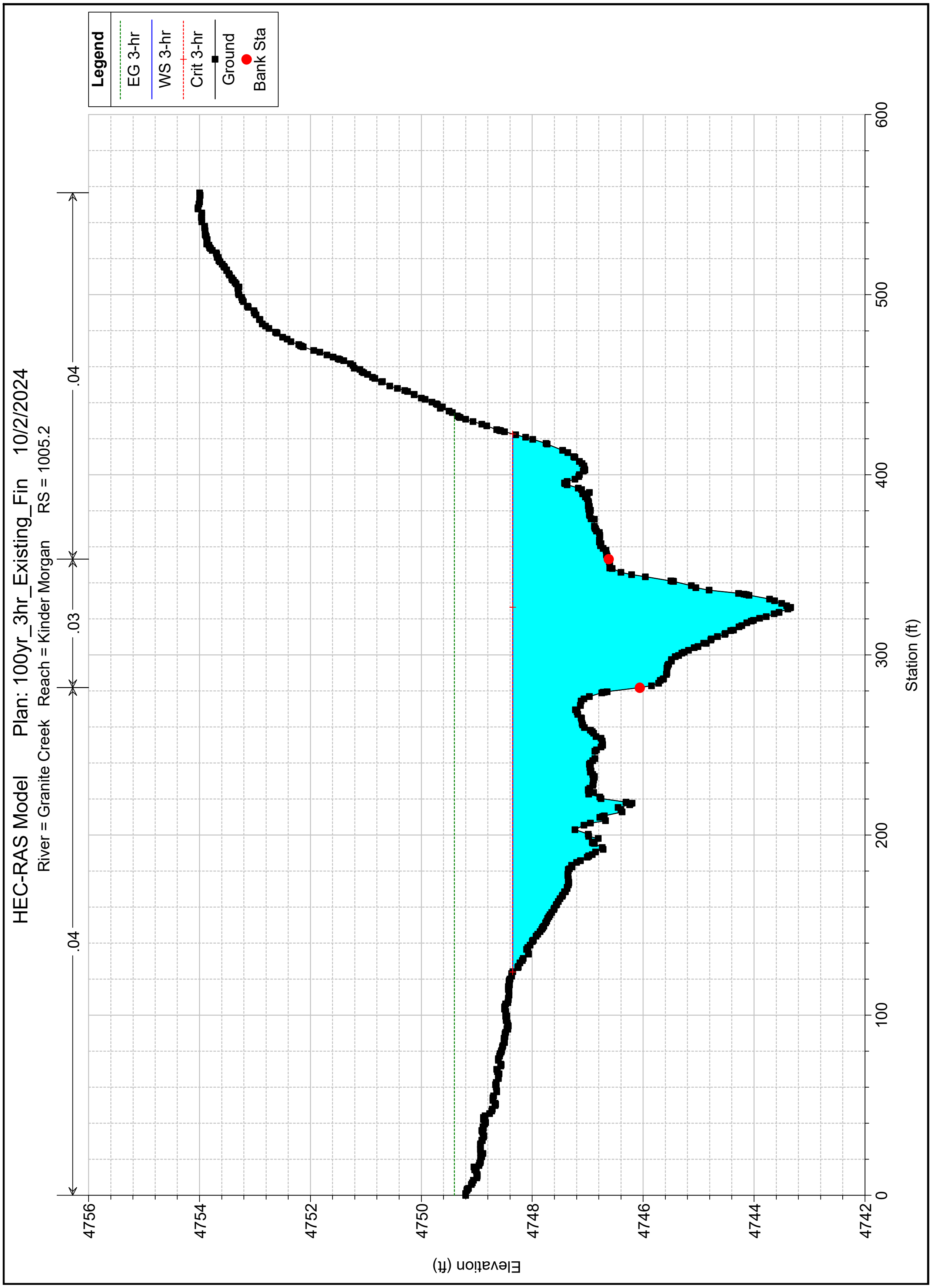

HEC-RAS Model Plan: 100yr_3hr_Existing_Fin 10/2/2024
River = Granite Creek Reach = Kinder Morgan RS = 1006.6
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
4770
4768
4766
4764
4762
4760
4758
4756
0
200
400
600
800
1000
1200

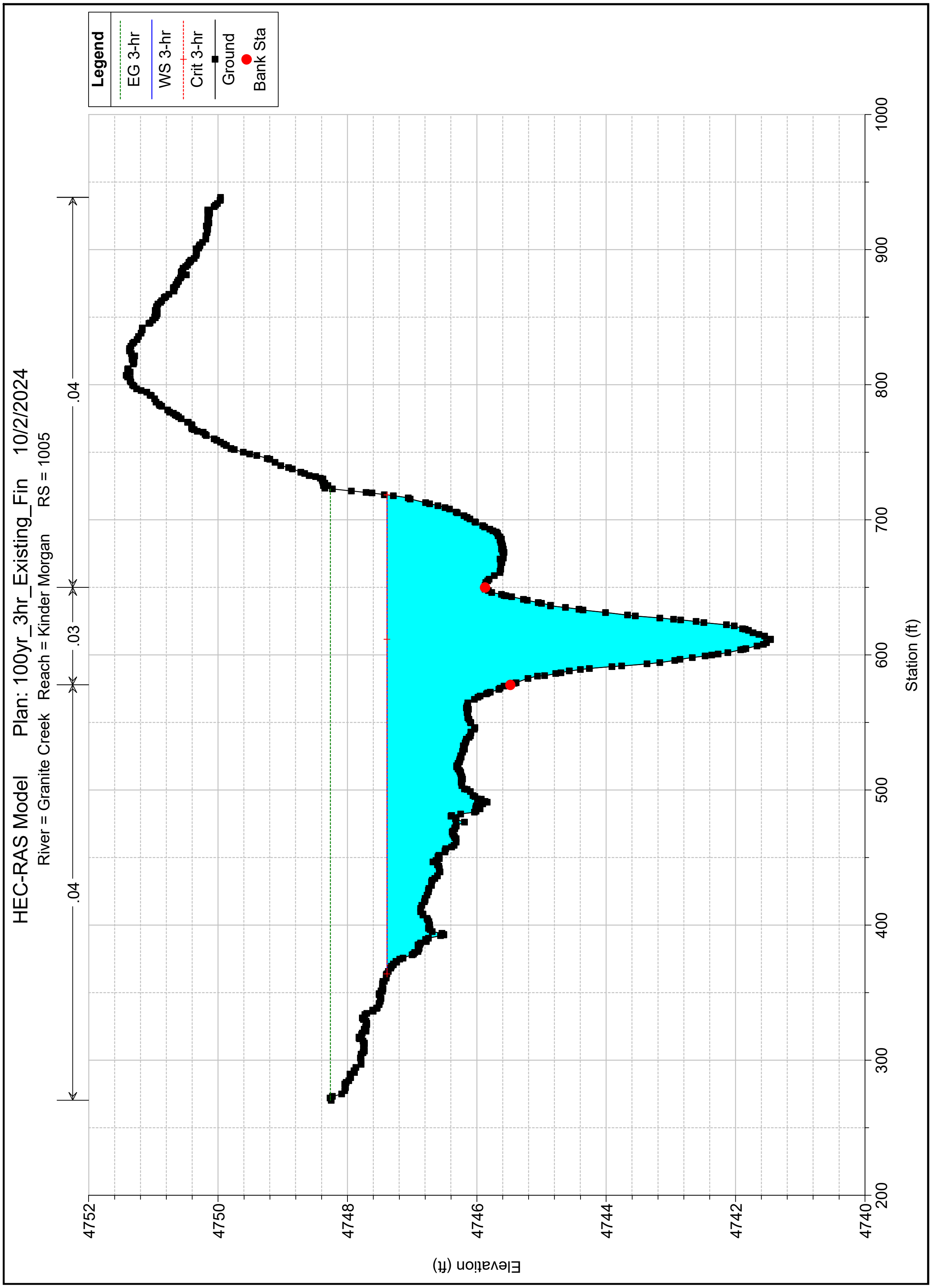

HEC-RAS Model Plan: 100yr_3hr_Existing_Fin 10/2/2024
River = Granite Creek Reach = Kinder Morgan RS = 1006.4
.04
.03
.04
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
Elevation (ft)
Station (ft)
4768
4766
4764
4762
4760
4758
4756
4754
0
200
400
600
800
1000
1200

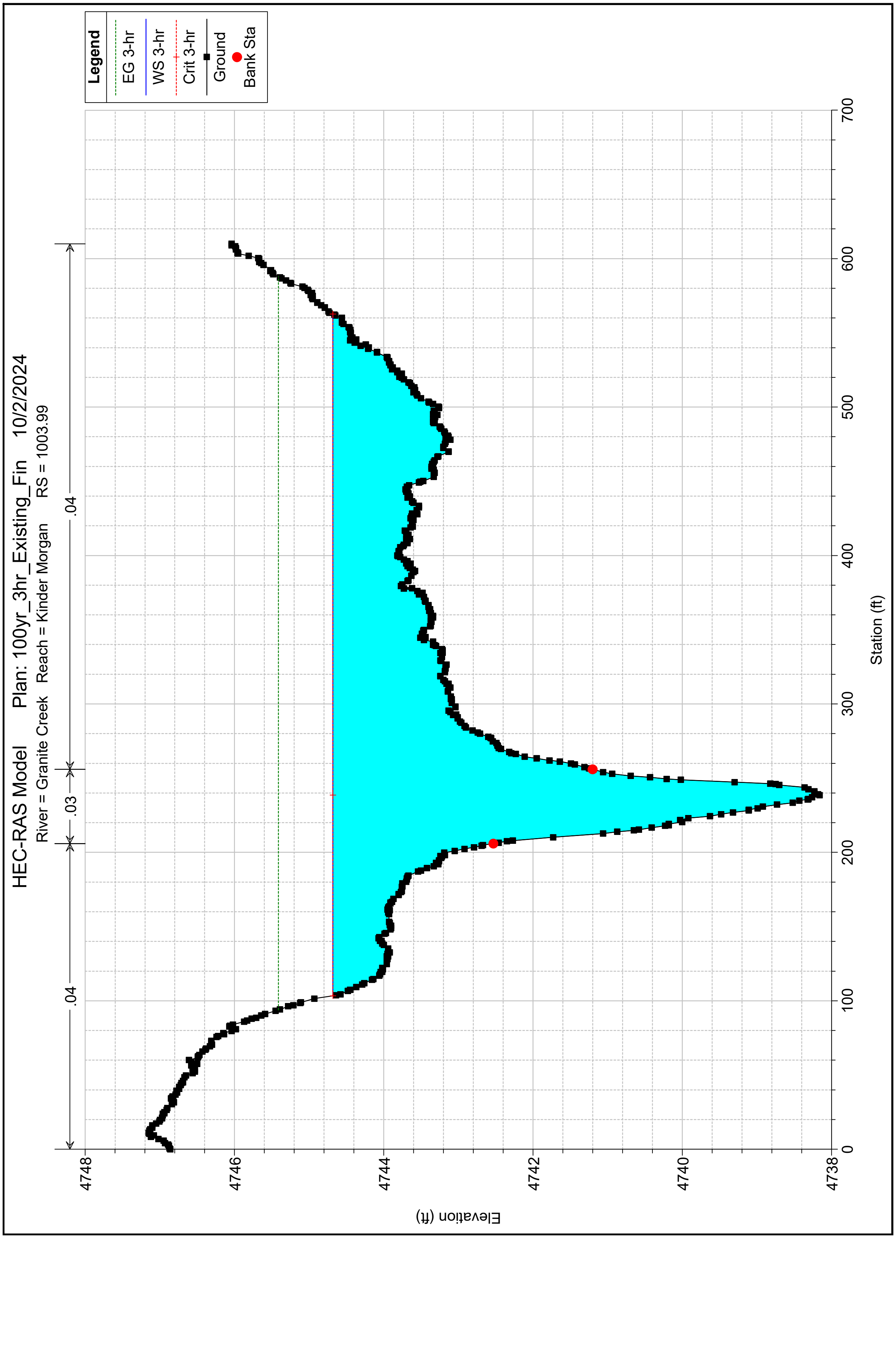

HEC-RAS Model Plan: 100yr_3hr_Existing_Fin 10/2/2024
River = Granite Creek Reach = Kinder Morgan RS = 1006
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
4748
4750
4752
4754
4756
4758
4760
4762
4764
4766
0
200
400
600
800
1000
1200

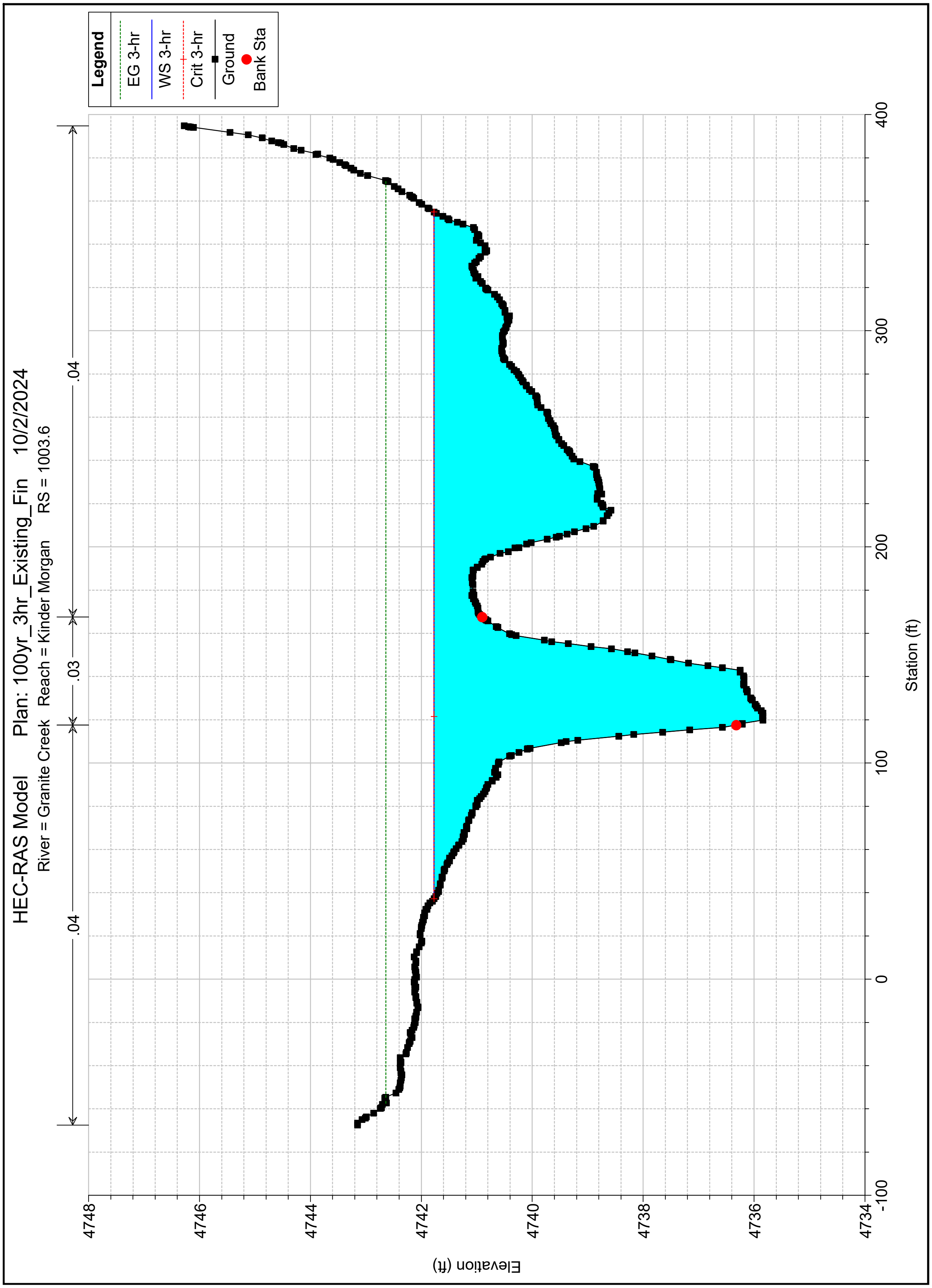

HEC-RAS Model Plan: 100yr_3hr_Existing_Fin 10/2/2024
River = Granite Creek Reach = Kinder Morgan RS = 1005.7
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
4758
4756
4754
4752
4750
4748
4746
4744
Station (ft)
0
200
400
600
800
1000

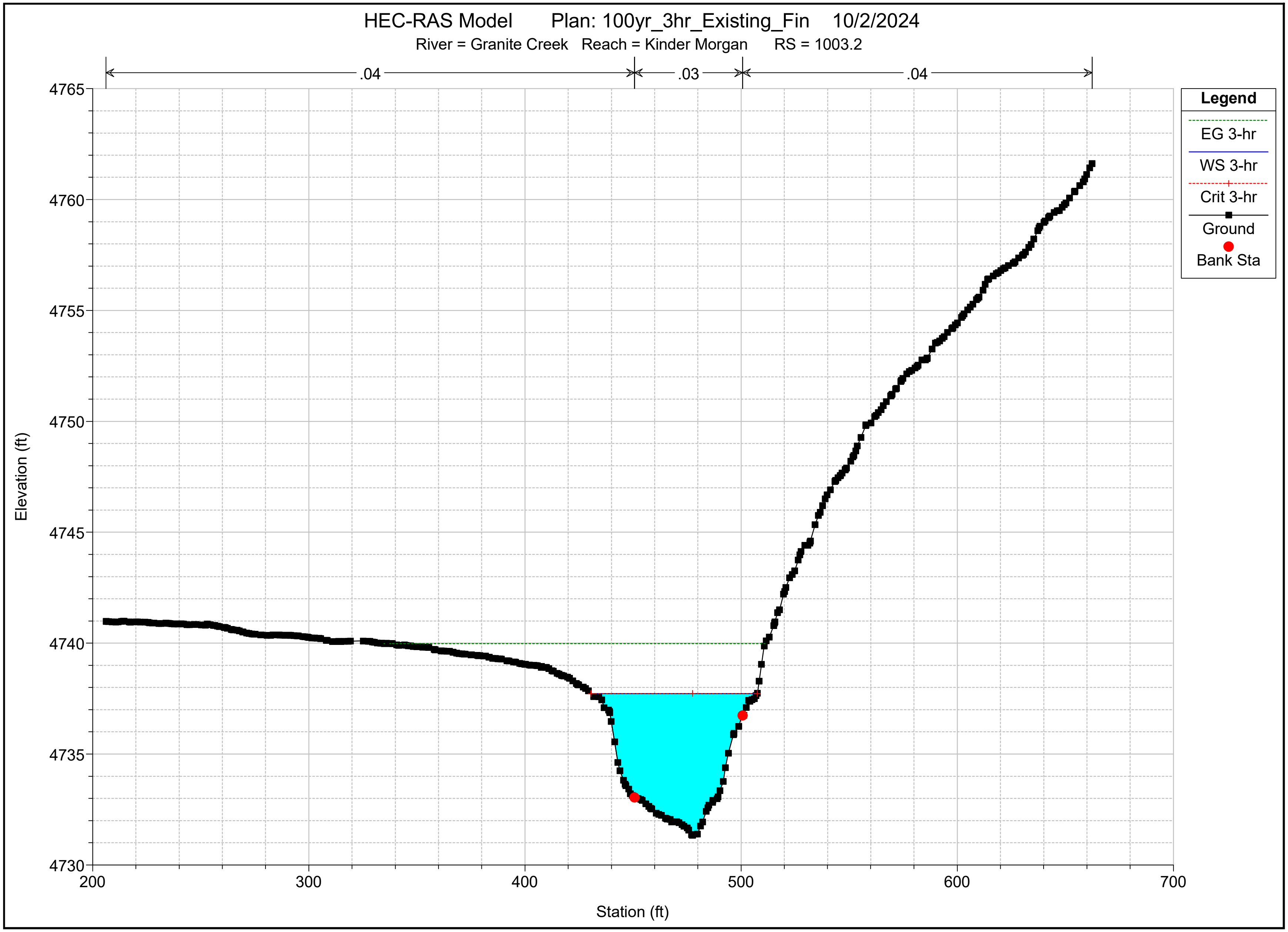

HEC-RAS Model   Plan: 100yr_3hr_Existing_Fin   10/2/2024
River = Granite Creek   Reach = Kinder Morgan   RS = 1005.5
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
4744
4746
4748
4750
4752
4754
4756
0
100
200
300
400
500
600


HEC-RAS Model Plan: 100yr_3hr_Existing_Fin 10/2/2024
River = Granite Creek Reach = Kinder Morgan RS = 1005.2
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
4756
4754
4752
4750
4748
4746
4744
4742
0
100
200
300
400
500
600

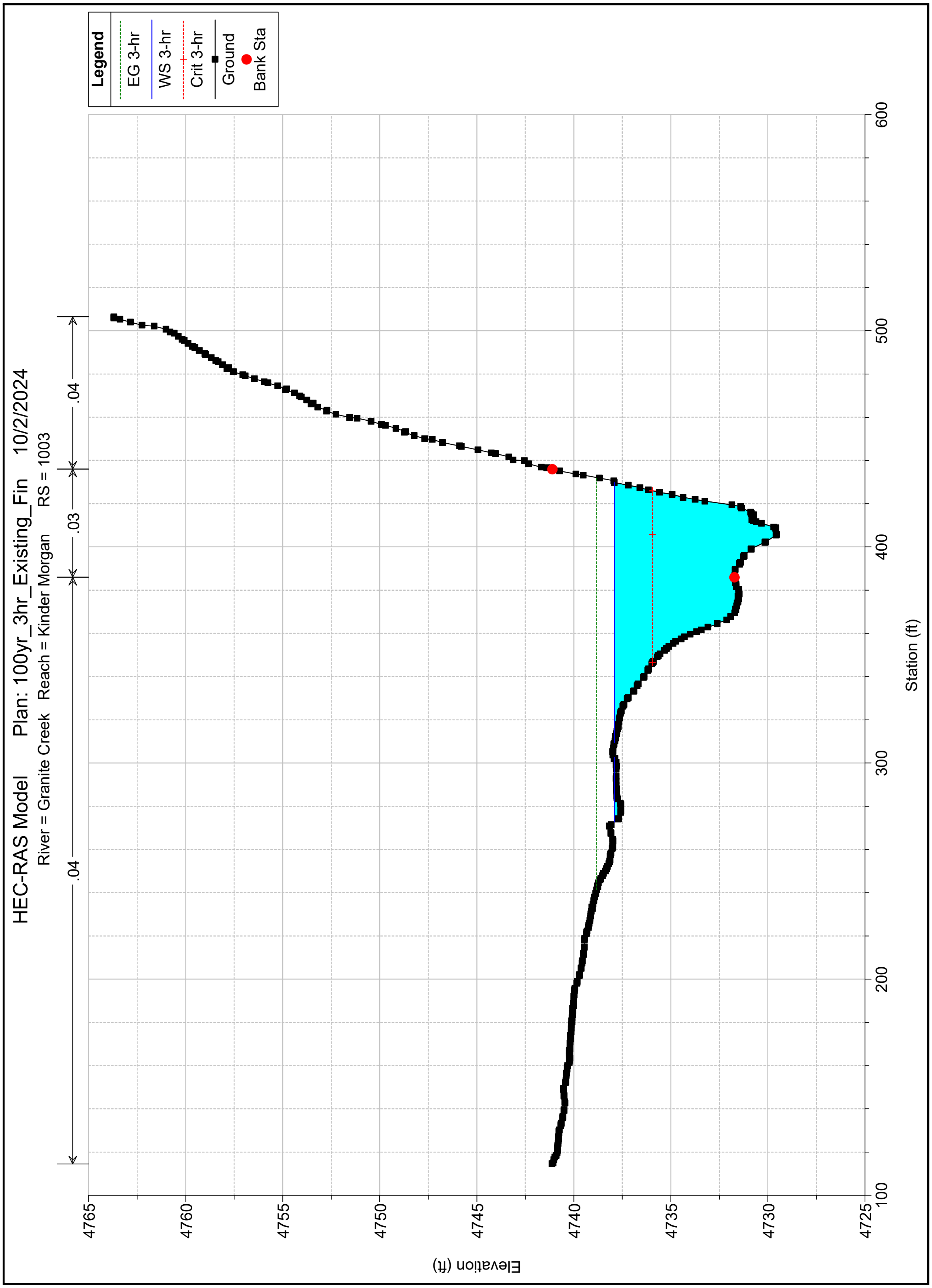

HEC-RAS Model Plan: 100yr_3hr_Existing_Fin 10/2/2024
River = Granite Creek Reach = Kinder Morgan RS = 1005
.04
.03
.04
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
Elevation (ft)
Station (ft)
4752
4750
4748
4746
4744
4742
4740
200
300
400
500
600
700
800
900
1000


HEC-RAS Model   Plan: 100yr_3hr_Existing_Fin   10/2/2024
River = Granite Creek   Reach = Kinder Morgan   RS = 1003.99
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
4748
4746
4744
4742
4740
4738
0
100
200
300
400
500
600
700


HEC-RAS Model   Plan: 100yr_3hr_Existing_Fin   10/2/2024
River = Granite Creek   Reach = Kinder Morgan   RS = 1003.6
.04
.03
.04
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
Elevation (ft)
4748
4746
4744
4742
4740
4738
4736
4734
Station (ft)
-100
0
100
200
300
400



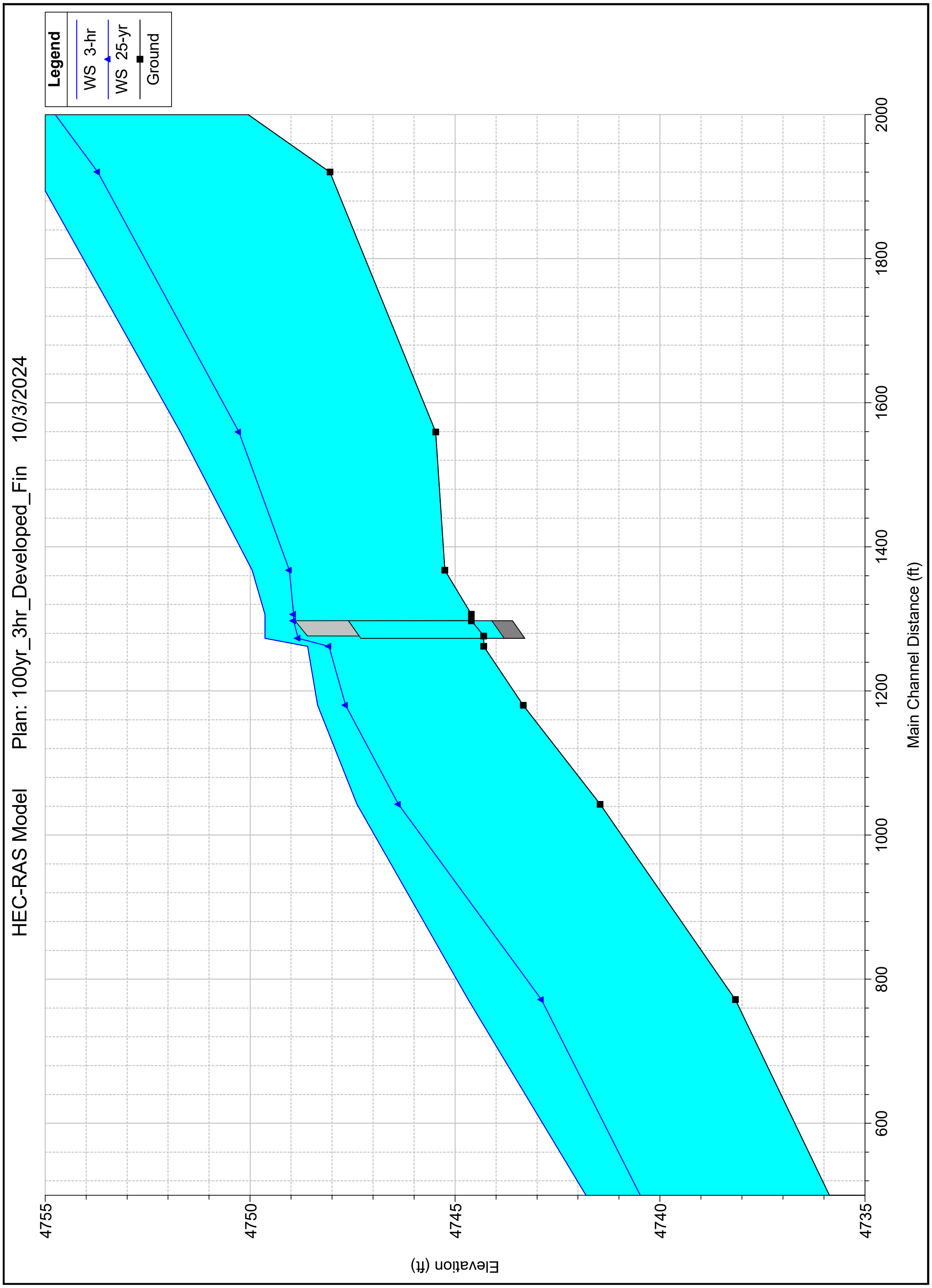
HEC-RAS Model Plan: 100yr_3hr_Existing_Fin 10/2/2024
River = Granite Creek Reach = Kinder Morgan RS = 1003.2
.04
.03
.04
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
Elevation (ft)
Station (ft)
4765
4760
4755
4750
4745
4740
4735
4730
200
300
400
500
600
700

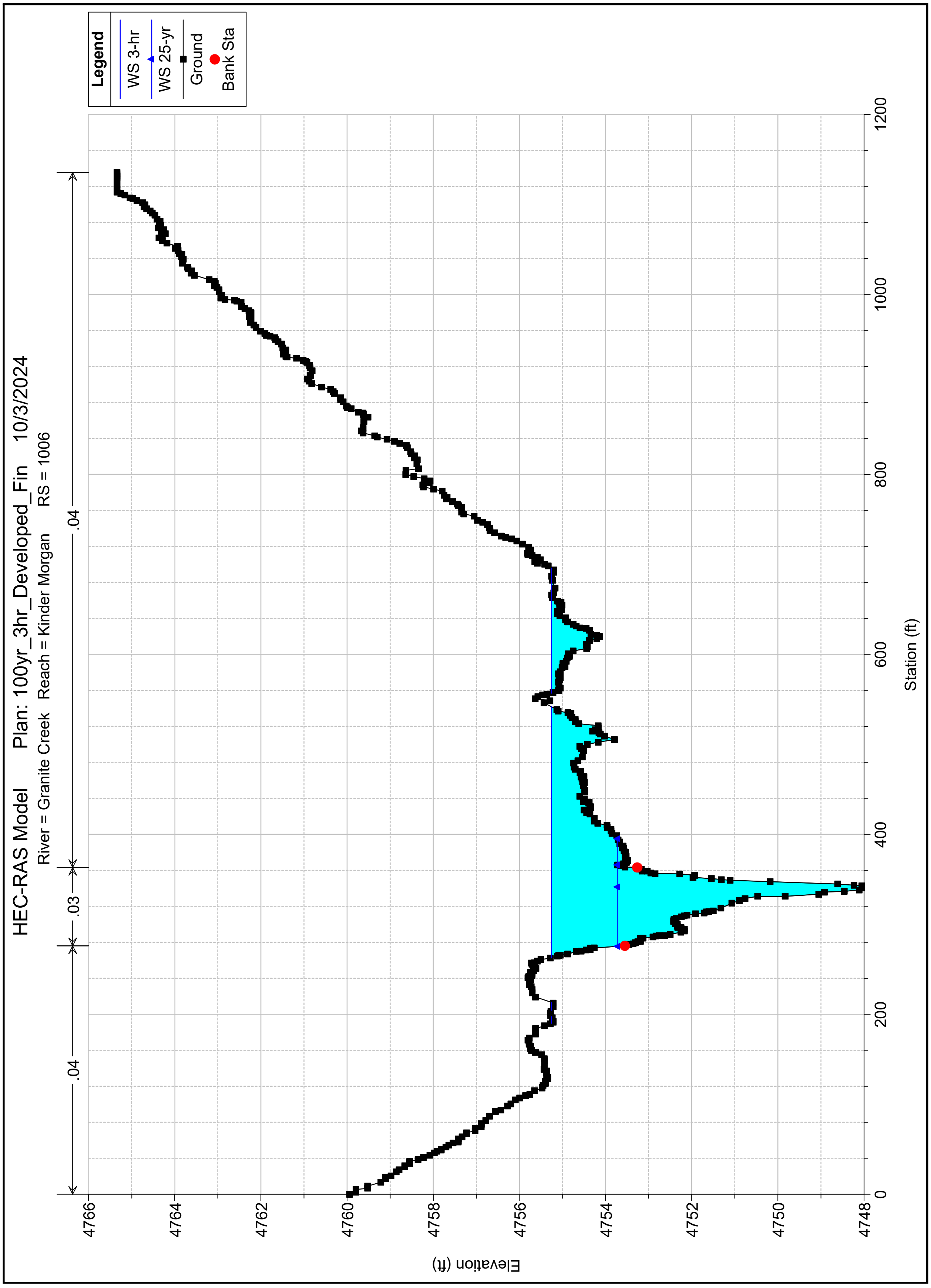

HEC-RAS Model Plan: 100yr_3hr_Existing_Fin 10/2/2024
River = Granite Creek Reach = Kinder Morgan RS = 1003
Legend
EG 3-hr
WS 3-hr
Crit 3-hr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
4765
4760
4755
4750
4745
4740
4735
4730
4725
100
200
300
400
500
600

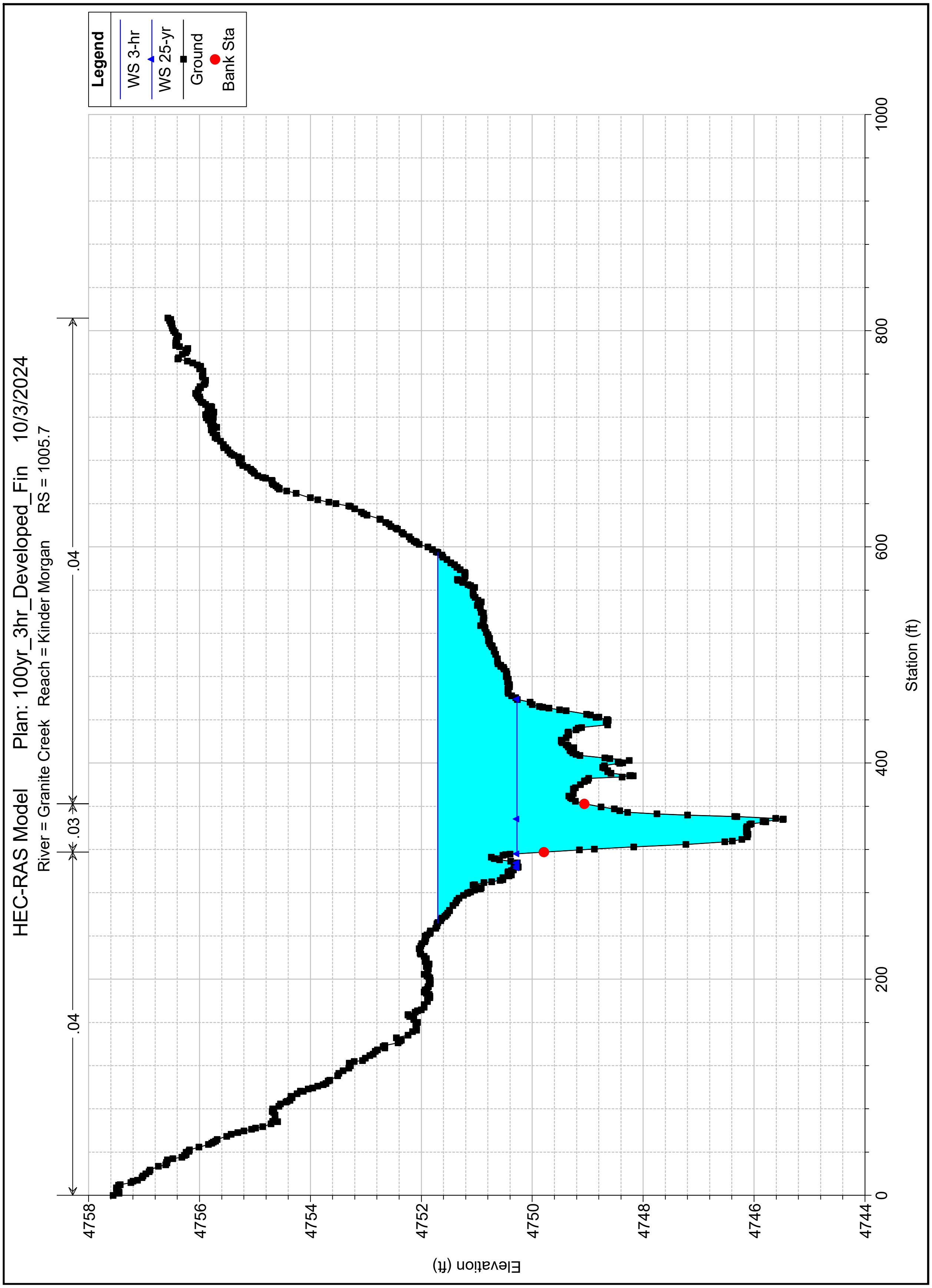
DEVELOPED CONDITIONS

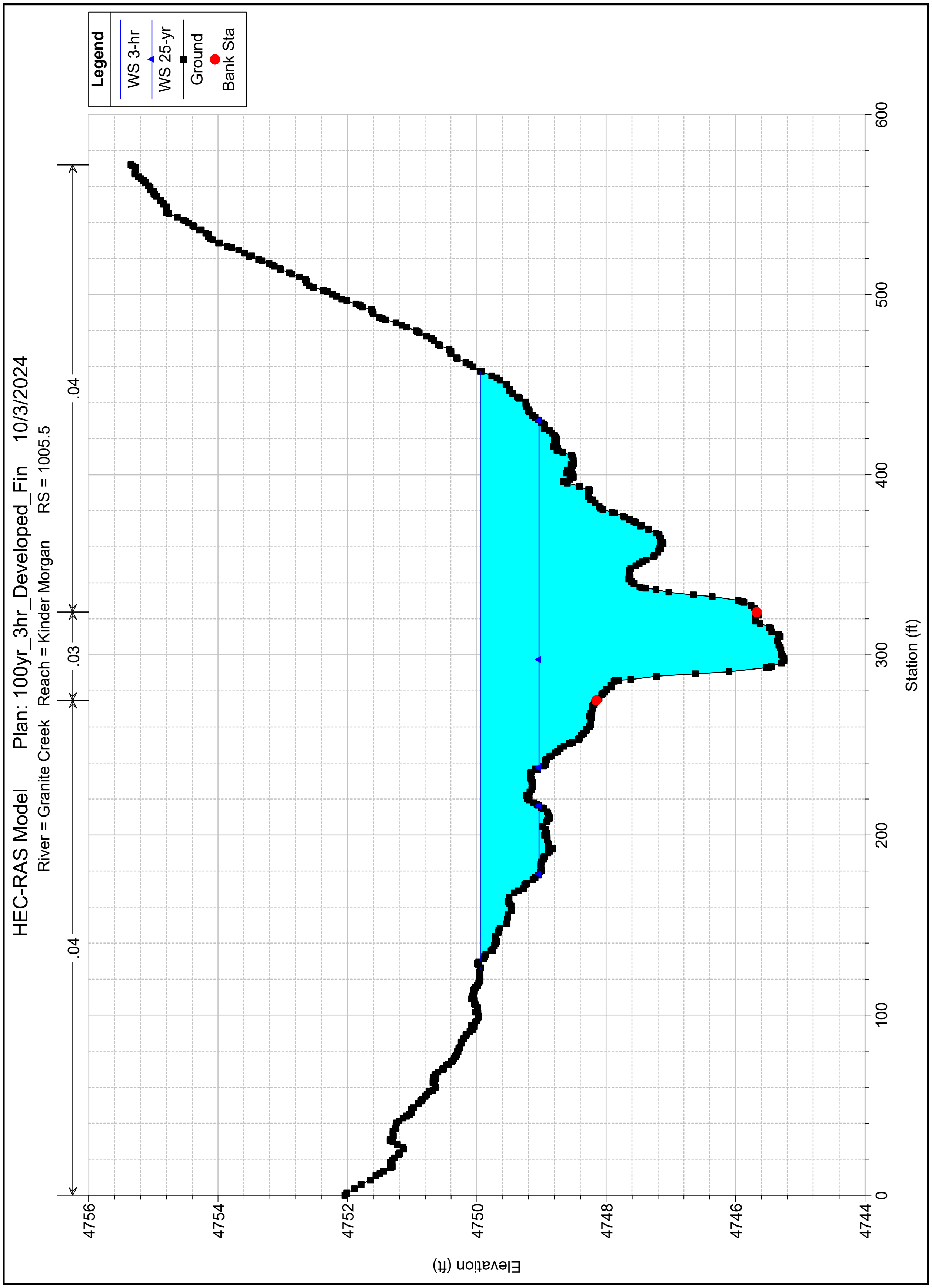
HEC-RAS Plan: DEV_100y_FIN River: Granite Creek Reach: Kinder Morgan

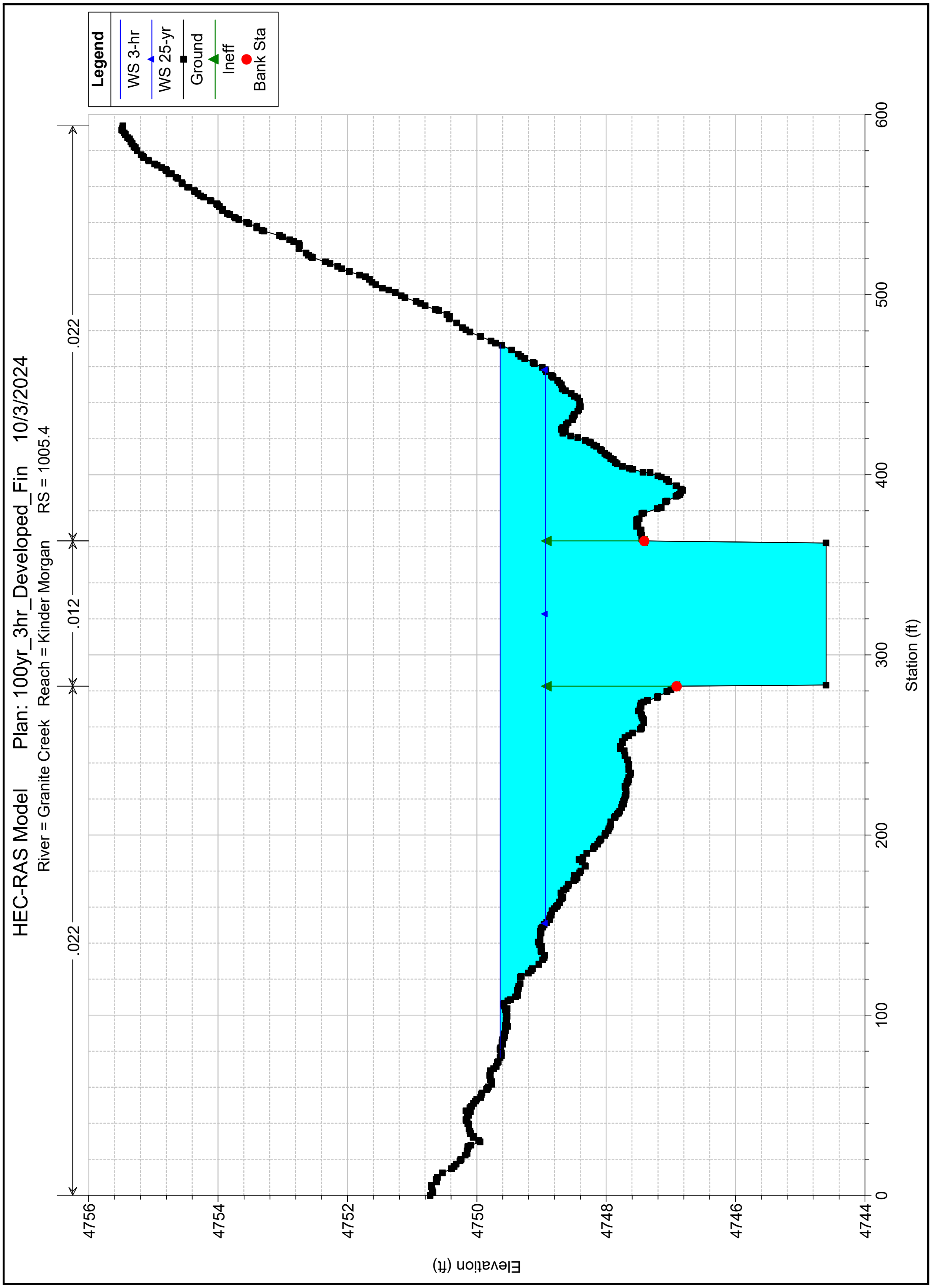
Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
Kinder Morgan	1005.35 Culvert #1	3-hr	4750.17	4749.64	4750.03	4750.17	4748.91	1792.17	1435.83	1.04	8.00	8.00
Kinder Morgan	1005.35 Culvert #1	25-yr	4749.16	4748.94	4748.72	4749.16	4748.91	1486.19	117.82	0.86	6.63	6.63

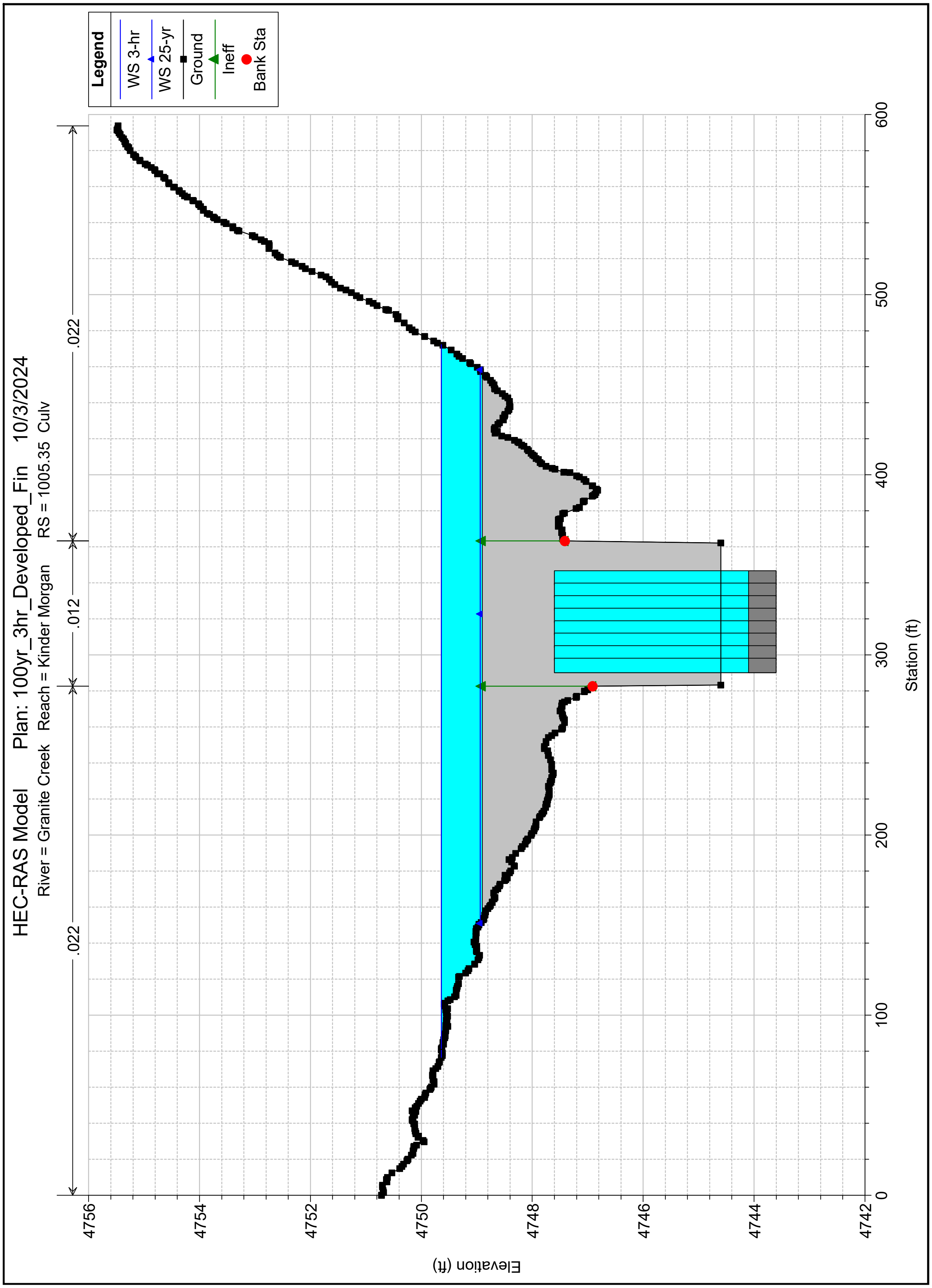

HEC-RAS Model Plan: 100yr_3hr_Developed_Fin 10/3/2024
Legend
WS 3-hr
WS 25-yr
Ground
Elevation (ft)
4755
4750
4745
4740
4735
Main Channel Distance (ft)
600
800
1000
1200
1400
1600
1800
2000

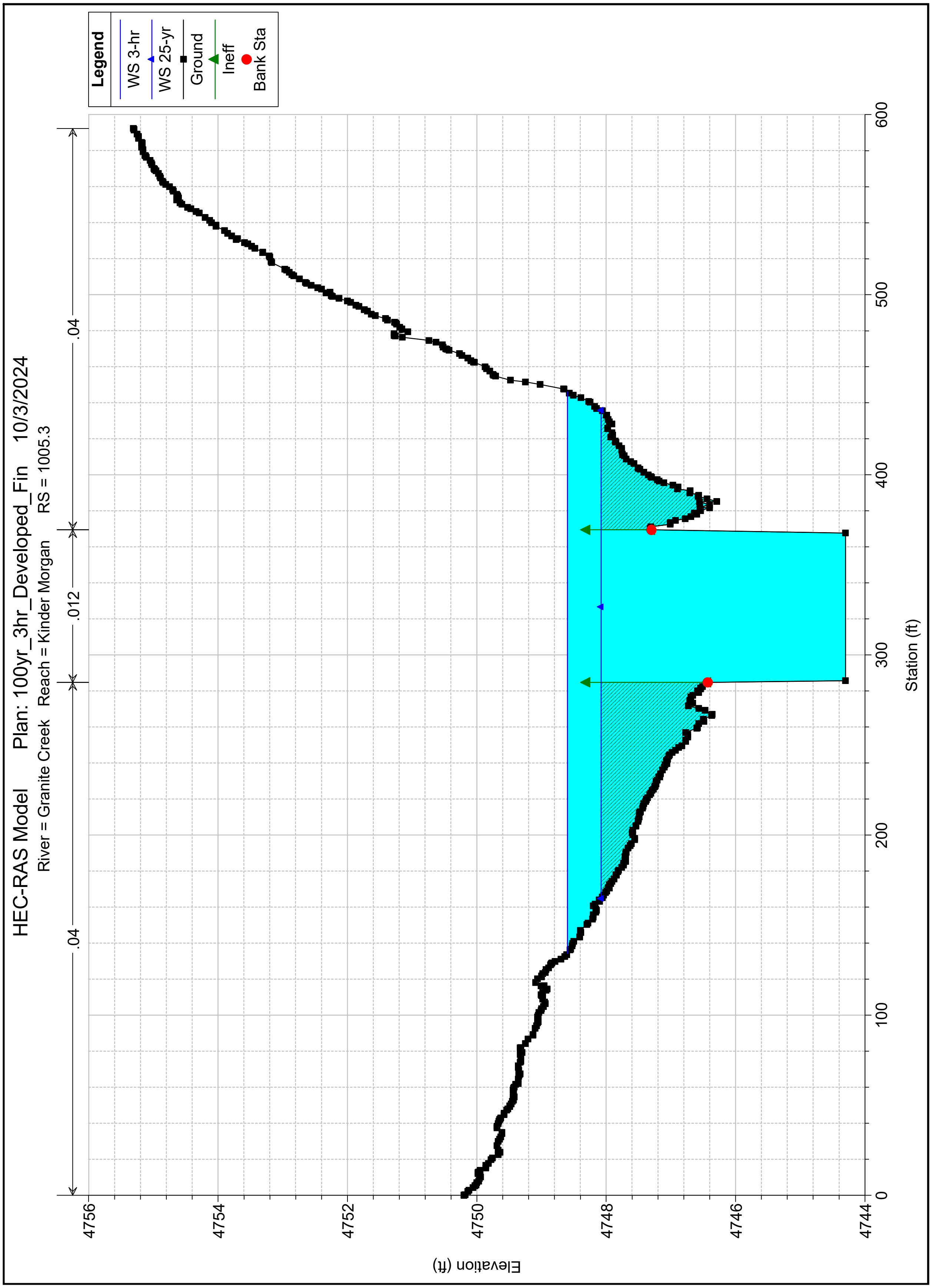

HEC-RAS Model   Plan: 100yr_3hr_Developed_Fin   10/3/2024
River = Granite Creek   Reach = Kinder Morgan   RS = 1006
.04
.03
.04
Legend
WS 3-hr
WS 25-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
4766
4764
4762
4760
4758
4756
4754
4752
4750
4748
0
200
400
600
800
1000
1200

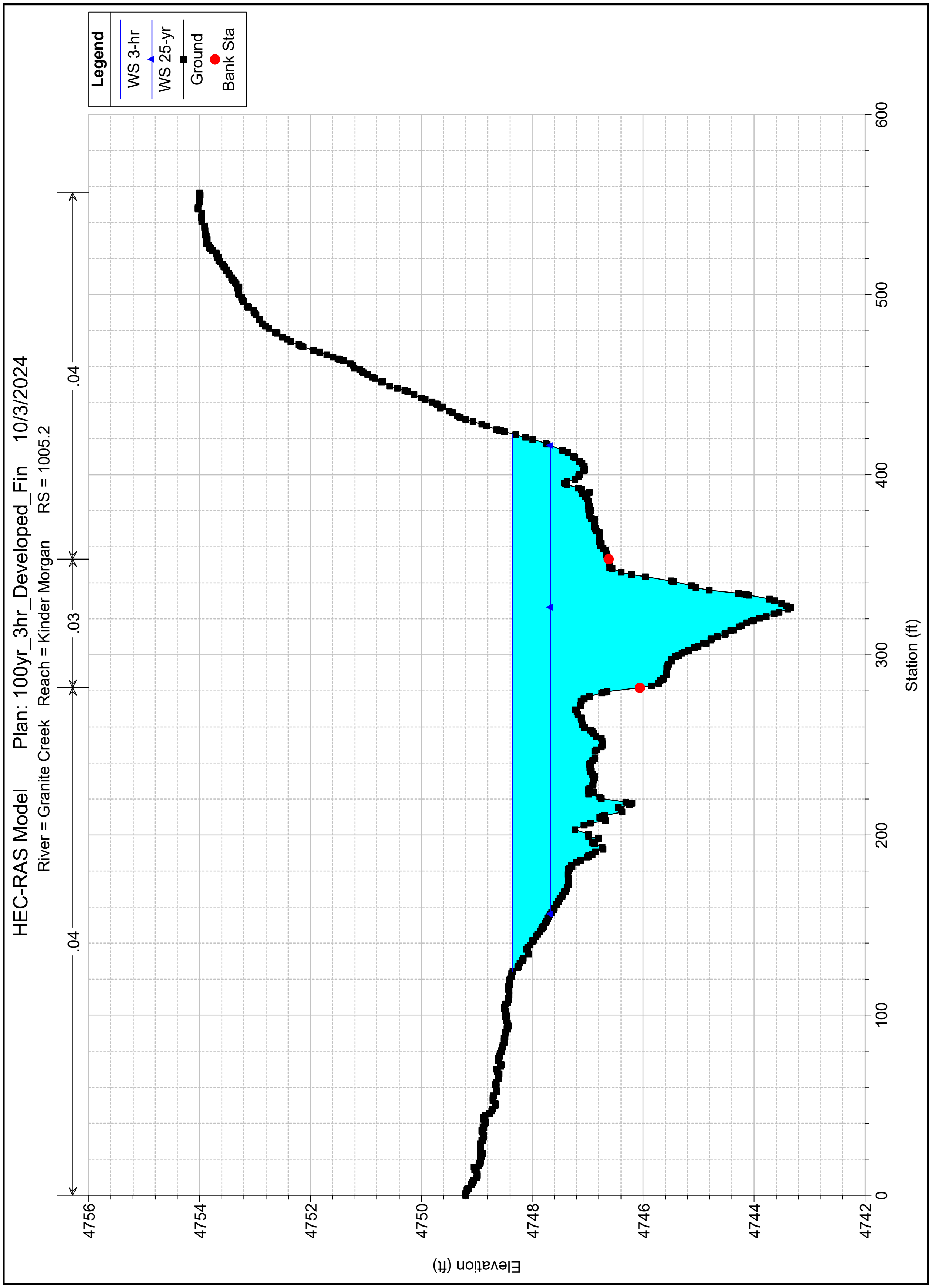

HEC-RAS Model   Plan: 100yr_3hr_Developed_Fin   10/3/2024
River = Granite Creek   Reach = Kinder Morgan   RS = 1005.7
Legend
WS 3-hr
WS 25-yr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
Station (ft)
4758
4756
4754
4752
4750
4748
4746
4744
0
200
400
600
800
1000

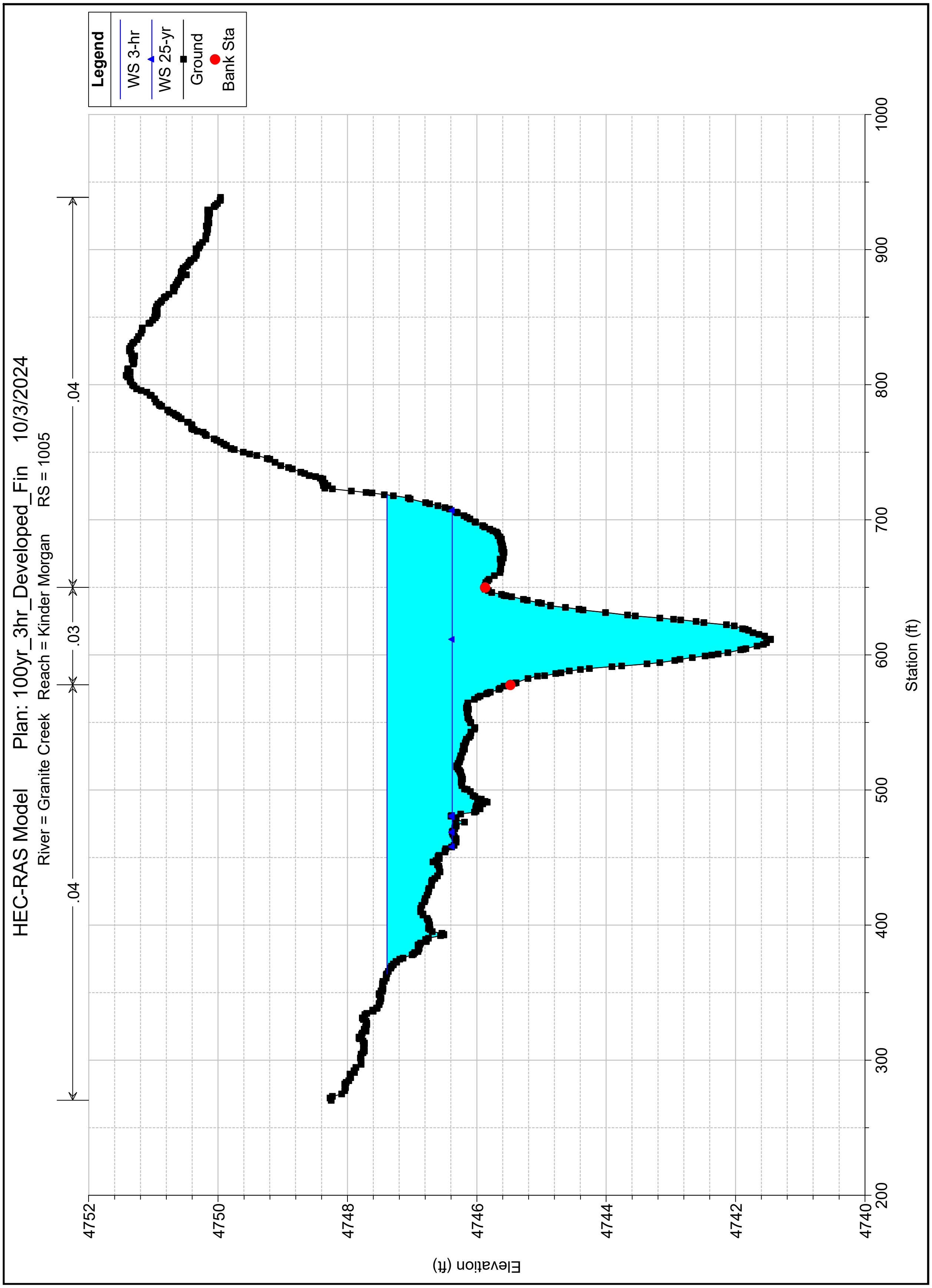

HEC-RAS Model Plan: 100yr_3hr_Developed_Fin 10/3/2024
River = Granite Creek Reach = Kinder Morgan RS = 1005.5
Legend
WS 3-hr
WS 25-yr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
4744
4746
4748
4750
4752
4754
4756
Station (ft)
0
100
200
300
400
500
600

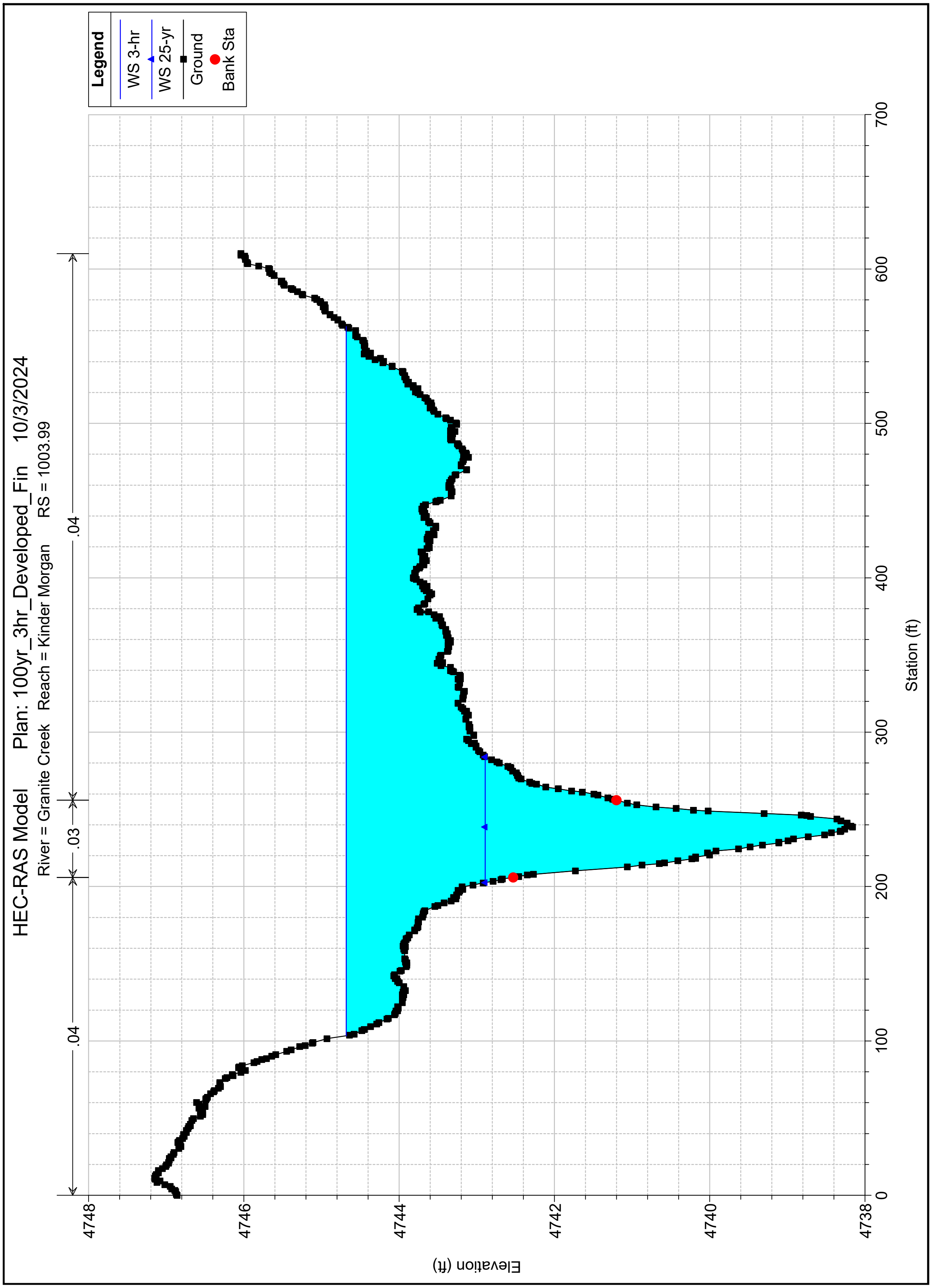

HEC-RAS Model   Plan: 100yr_3hr_Developed_Fin   10/3/2024
River = Granite Creek   Reach = Kinder Morgan   RS = 1005.4
Legend
WS 3-hr
WS 25-yr
Ground
Ineff
Bank Sta
.022
.012
.022
Elevation (ft)
Station (ft)
4756
4754
4752
4750
4748
4746
4744
0
100
200
300
400
500
600


HEC-RAS Model   Plan: 100yr_3hr_Developed_Fin   10/3/2024
River = Granite Creek   Reach = Kinder Morgan   RS = 1005.35 Culv
Legend
WS 3-hr
WS 25-yr
Ground
Ineff
Bank Sta
.022
.012
.022
Elevation (ft)
Station (ft)
4756
4754
4752
4750
4748
4746
4744
4742
0
100
200
300
400
500
600


HEC-RAS Model Plan: 100yr_3hr_Developed_Fin 10/3/2024
River = Granite Creek Reach = Kinder Morgan RS = 1005.3
Legend
WS 3-hr
WS 25-yr
Ground
Ineff
Bank Sta
.04
.012
.04
Elevation (ft)
Station (ft)
4756
4754
4752
4750
4748
4746
4744
0
100
200
300
400
500
600


HEC-RAS Model Plan: 100yr_3hr_Developed_Fin 10/3/2024
River = Granite Creek Reach = Kinder Morgan RS = 1005.2
Legend
WS 3-hr
WS 25-yr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
4756
4754
4752
4750
4748
4746
4744
4742
Station (ft)
0
100
200
300
400
500
600


HEC-RAS Model   Plan: 100yr_3hr_Developed_Fin   10/3/2024
River = Granite Creek   Reach = Kinder Morgan   RS = 1005
Legend
WS 3-hr
WS 25-yr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
4740
4742
4744
4746
4748
4750
4752
Station (ft)
200
300
400
500
600
700
800
900
1000


HEC-RAS Model Plan: 100yr_3hr_Developed_Fin 10/3/2024
River = Granite Creek Reach = Kinder Morgan RS = 1003.99
Legend
WS 3-hr
WS 25-yr
Ground
Bank Sta
.04
.03
.04
Elevation (ft)
4748
4746
4744
4742
4740
4738
Station (ft)
0
100
200
300
400
500
600
700

EROSION HAZARD SETBACK CALCULATIONS

EHS

Proiect Name:	Haystack CM				
Project Number # :	P4373.01	Made by	CBR	Date	10/3/24
Reference:	SS 5-96	Checked By	JDE	Date	10/3/24

Erosion Hazard SetbackCalculation

General Equations

1) $SB = 1.0(Q_{p100})^{.5}$ straight channel reaches

2) $SB = 2.5(Q_{p100})^{.5}$ channels reaches with cuves

	Reach	Qp100 (cfs)	Equation Number	Setback (ft)
3-hr	Unnamed Trib	3228	1	56.8

SCOUR CALCULATIONS

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT

Date: 10/3/2024
(form rev. 06/01/09)

MAXIMUM ANTICIPATED SCOUR DEPTH (Z_T) FOR SIMPLE CURVED AND STRAIGHT REACHES OF NON-REGIONAL SAND BED CONVEYANCES
WITH LOCAL SCOUR AT ABUTMENTS AND BRIDGE PIERS
W/O LOCAL SCOUR AT DROPS OR LONG TERM DEGRADATION

Project Address: Haystack Wash Crossing
Data Sheet Preparer: JE Fuller - CBR
Conveyance Subsection: N/A, N/A, N/A, N/A, N/A

Step 1. **Enter Project Information.**

									Description
Step 2. **Bend Scour? Enter N if no bend scour.**	SEC =	1005.5	1005.4	1005.3	1005.2	0			
If Yes, Enter α.	α =	N	N	N	N	N		(deg)	Bend angle (See **BENDS** tab)
Step 3a. **Abutment scour per SMDDFM? Enter N if no.**	a_e =	N	N	N	N	N		(ft)	Length of abutment projected normal to flow
If Yes, Enter a_e & $θ_a$.	$θ_a$ =	N	N	N	N	N		(deg)	Slope angle of abutment face from horizontal
Step 3b. **Abutment scour per HEC-18 (FHWA NHI 01-001 5/01)?**	L' =	N	N	N	N	N		(ft)	Length of abutment projected normal to flow
Enter N if no local abutment scour.	K_1 =	N	N	N	N	N		(dim)	Coefficient for abutment shape (See **ABUTMENTS** tab)
If Yes, Enter L', K_1, & θ.	θ =	N	N	N	N	N		(deg)	Abutment angle wrt bank (See **ABUTMENTS** tab)
Step 4a. **Pier scour per SMDDFM?**	b_p =	N	N	N	N	N		(ft)	Pier width, including anticipated debris blockage
Enter N if no local pier scour.	L =	N	N	N	N	N		(ft)	Length of pier wall
If Yes, enter Y_1, b_p, L, $Φ_p$ & RF.	Y_1 =	N	N	N	N	N		(ft)	Flow depth upstream of pier (blank = max depth)
	RF =	N	N	N	N	N		(dim)	Reduction factor for nose shape (See **PIERS** tab)
	$Φ_p$ =	N	N	N	N	N		(deg)	Angle of approach flow in relationship to pier wall
Step 4b. **Pier scour per HEC-18 (FHWA NHI 01-001 5/01)?**	a =	N	N	N	N	N		(ft)	Pier width, including anticipated debris blockage
Enter N if no local pier scour.	L =	N	N	N	N	N		(ft)	Length of pier wall
If Yes, enter a, L, K_1, K_3, $Φ_p$, Y_1, D_{50}, & D_{95}.	K_1 =	N	N	N	N	N		(dim)	Correction factor for nose shape (See **PIERS** tab)
	K_3 =	N	N	N	N	N		(dim)	Correction factor for bed condition (See **PIERS** tab)
	$Φ_p$ =	N	N	N	N	N		(deg)	Flow direction with respect to pier wall
	Y_1 =	N	N	N	N	N		(ft)	Flow depth upstream of pier (blank = max depth)
	D_{50} =	N	N	N	N	N		(mm)	Grain size for which 50% of bed material is finer
	D_{95} =	N	N	N	N	N		(mm)	Grain size for which 95% of bed material is finer
Step 5. **Enter safety factor for local (pier, abutment) scour.**	SF =	1.3	1.3	1.3	1.3	1.3		(dim)	Blank = 1.3; text = 0

Step 6. **Enter hydraulic characteristics for up to 5 sections in the blue fields below. HEC-RAS output may be pasted into RAS OUT tab to facilitate data entry**

	INPUT HYDRAULIC CHARACTERISTICS OF CONVEYANCE						*CALCULATED CHARACTERISTICS*					*CALCULATED INDIVIDUAL SCOUR COMPENENTS (ft)*								
S	V	A	T	WSL	ELMN	S_E	Q	Y_H	Y_{MAX}	F_u	r_c/T	Z_{GS}	Z_{BS}	Z_A	Z_{LSP}	Z_{LSE}	Z_{LSP}	Z_{LSE}	Z_{LF}	Z_T
E	(fps)	(ft^2)	(ft)	(ft)	(ft)	(dim)	(cfs)	(ft)	(ft)	(dim)	(dim)	SMDDFM	SMDDFM	SMDDFM	SMDDFM	SMDDFM	HEC-18	HEC-18		(ft)
C							V*A	A/T	wsl-elmn	Eq 8.3		Eq 6.4	Eq 6.6	Eq 6.5	Eq 6.9	6.11/6.12	Eq 6.1	Eq 7.1/7.2		Eq 6.3
1005.5	**5.8**	**555.1**	**328.6**	**4750.0**	**4745.3**	**0.007**	3231	1.7	4.7	**0.8**	0.0	0.1	0.0	0.5	0.0	0.0	0.00	0.0	**1.0**	**2.1**
1005.4	**4.0**	**817.4**	**394.8**	**4749.6**	**4744.6**	**0.000**	3229	2.1	5.0	**0.5**	0.0	3.5	0.0	0.2	0.0	0.0	0.00	0.0	**1.0**	**6.1**
1005.3	**5.2**	**618.4**	**311.9**	**4748.6**	**4744.3**	**0.001**	3228	2.0	4.3	**0.7**	0.0	3.2	0.0	0.4	0.0	0.0	0.00	0.0	**1.0**	**6.0**
1005.2	**6.4**	**506.0**	**298.7**	**4748.4**	**4743.3**	**0.007**	3228	1.7	5.0	**0.9**	0.0	0.3	0.0	0.6	0.0	0.0	0.00	0.0	**1.0**	**2.4**
0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.000**	0	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	**0.0**	**0.0**

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT

MAXIMUM ANTICIPATED SCOUR DEPTH (Z_T) FOR CURVED AND STRAIGHT REACHES OF NON-REGIONAL SAND BED CONVEYANCES
WITH LOCAL SCOUR AT ABUTMENTS AND AT BRIDGE PIERS
WITHOUT LOCAL SCOUR AT DROPS AND LONG TERM DEGRADATION

Thursday, October 3, 2024
(form rev. 11/05/08)

Area to Paste Output from HEC-RAS or Other Backwater / Hydraulic Analysis Program for Input into Scour Spreadsheet

Reach	River Sta	Profile	Velocity (ft/s)	Area (ft^2)	Top Width (ft)	W.S. Elev (ft)	Min Elev (ft)	E.G. Slope (ft/ft)
Trib Granite CK	1005.5	3-hr 100-yr	5.82	555.1	328.6	4750.0	4745.3	0.0066
Trib Granite CK	1005.4	3-hr 100-yr	3.95	817.4	394.8	4749.6	4744.6	0.0003
Trib Granite CK	1005.3	3-hr 100-yr	5.22	618.4	311.9	4748.6	4744.3	0.0007
Trib Granite CK	1005.2	3-hr 100-yr	6.38	506.0	298.7	4748.4	4743.3	0.0075

JE FULLER	Client:	Kinder Morgan	Prepared by:	CBR
	Project Name:	Haystack CS	Date:	10/3/2024
	Concentration Point:	**At-Grade Crossing**	Job #:	P4373.01
		Sheet #: 1 of 1		

Splash Pad Computation Sheet

Design computations for splash pad dimensions using the COT methodology descibed in Section 6.7 of "Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona", (revised 1998)

Outlet Apron Sizing Equations:

Scour Hole Length (ft):	L_{sc} = D * DSG	
Dimensionless Scour Geometry:	DSG = a * (Qr / (g^0.5 * D^0.5))^b * 0.09^b	*Eqn. 6.17, COT Manual*
Representative Discharge (cfs):	Q_r = Q100/2 * (1 + ((Tr - 10) / Tr))	*Eqn. 6.18, COT Manual*
Equivalent Depth (ft):	Y_e = (A/2)^0.5	*Eqn. 6.19, COT Manual*

Where:

D =	Culvert diameter (ft)	*Substitute Y_e for D for non-circular outlets*
Q_{100} =	100-year peak discharge in cfs	
A =	area of flow at outlet in s.f.	
g =	32.2 fps/s	*acceleration of gravity*
a =	12.77	*Table 6.2C, COT Manual*
b =	0.41	*Table 6.2C, COT Manual*
T_r =	13.6 min.	*for 5 min T_c, per PC/COT Stormwater Retention/Detention Manual*

Rock Riprap Sizing Equations:

Median Rock Diameter, D_{50} (ft):	D_{50} = 0.02 * (D_c^2/TW) * R^1.33	*Eqn. 6-VI, PC Channel Design Manual*
	R = Q / D_c^2.5	*for circular culverts*
	R = q / D_c^1.5	*for other shapes*

Where:

D_c =	Culvert Diameter or Flow Depth (ft)	
TW =	Tailwater Depth (ft)	*Use 0.5 * D_c unless actual TW is known*
Q =	Design discharge (cfs)	
q =	Q / flow width (cfs)	

Computations:

Splash Pad Location:	Q_{des} (cfs):	D_c (ft): or	Culvert Width (ft)	Culvert Height (ft)	A (sf):	Y_e (ft):	Q_r (cfs)	R	DSG:	Minimum L_{sc} (ft):	**Des. Splash Pad Length (ft):**	Min. Rock Size, D_{50} (in):	**Design Size D_{50} (in):**
Crossing 1	200	--	10	5	50	5.00	126.5	1.8	12.21	61.1	**62.0**	5.20	**6****

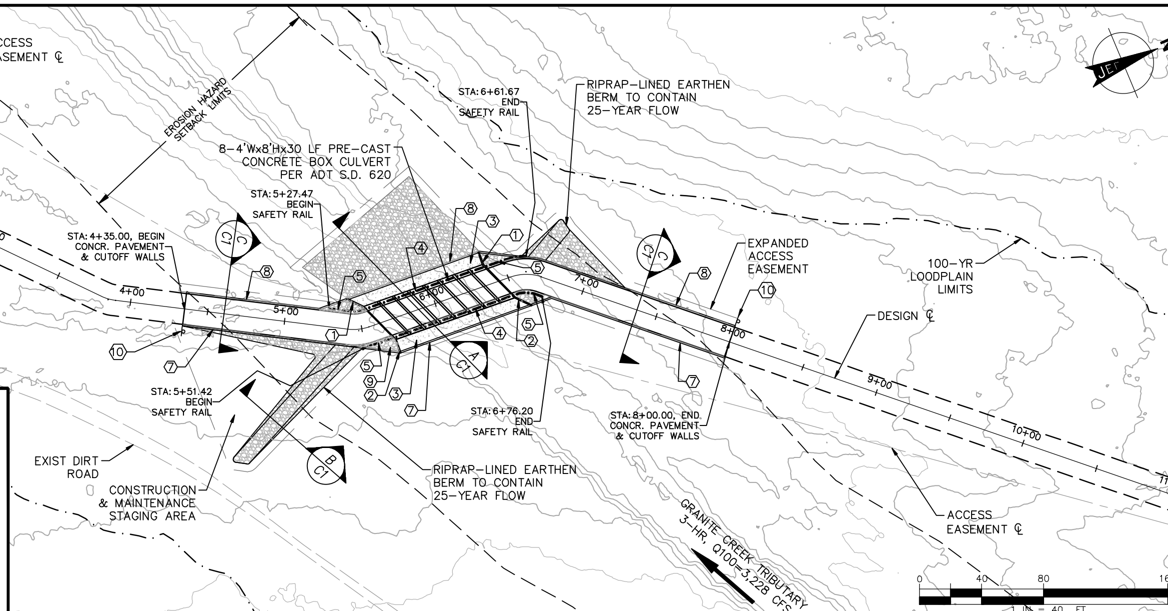
* Design Discharge is based on the total peak discharge divided by the number of boxes. (Q25 = 1603 cfs)
** Rock to be place in a Reno Matress

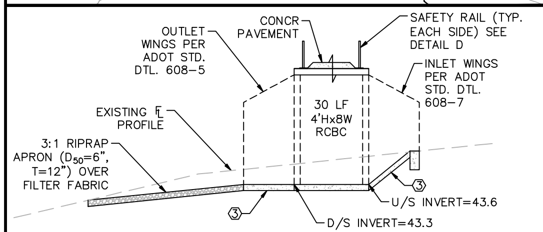
Appendix B
Hydraulic Models

(Download from Link In Table of Contents)

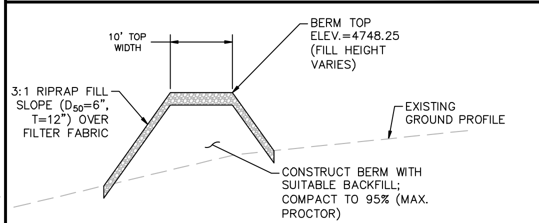
Appendix C

Crossing Design Plan

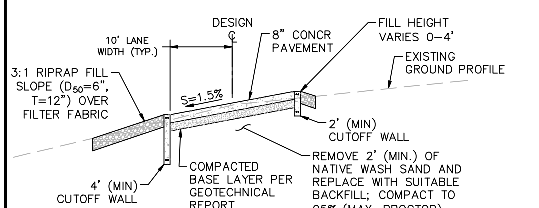




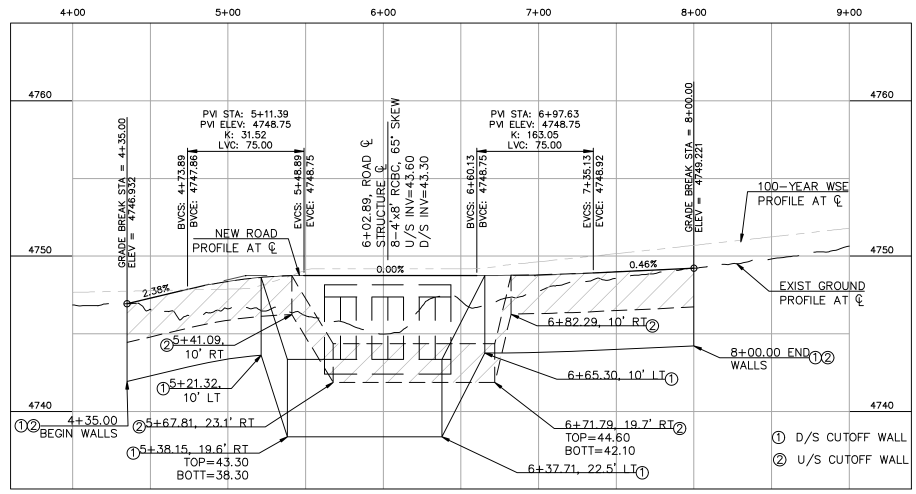
A CULVERT CROSSING SECTION
8CELL, 4'x8' PRE-CAST OR CAST-IN-PLACE RCBC — NOT TO SCALE



B CONTAINMENT BERM SECTION
LEVEL WITH BRIDGE DECK TO CONTAIN 25-YR FLOOD — NOT TO SCALE



C ROADWAY APPROACH SECTION
FORD CROSSING AND CUTOFF WALLS PER MAG STD. DTL. 552 — NOT TO SCALE



KEYNOTES:

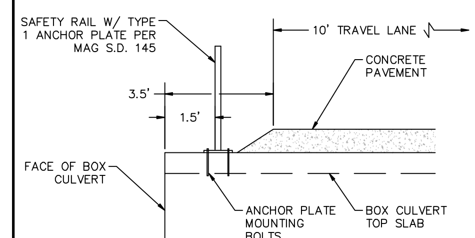
1. OUTLET WINGS PER ADOT S.D. 608.5
2. INLET WINGS PER ADOT S.D. 608.7
3. 6" THK. REINF. CONCRETE APRON
4. SAFETY RAIL W/ TYPE 1 ANCHOR PLATE PER MAG S.D. 145
5. SAFETY RAIL W/ TYPE 4 CONCRETE BASE PER MAG S.D. 145
6. NOT USED
7. UPSTREAM CUTOFF WALL, 1'W x 2.5'W REINF. CONCRETE
8. DOWNSTREAM CUTOFF WALL, 1'W x.5'W REINF. CONCRETE
9. RIPRAP BEHIND HEADWALL ABOVE CUTOFF WALL (D_{50}=6", T=12") OVER FILTER FABRIC (TYP. APPLIES TO FOUR LOCATIONS)
10. "NARROW BRIDGE" WARNING SIGN PER MUTCD W5-2, STEEL CHANNEL POST & TYPE 'B' BASE PER MAG S.D. 131

NARROW BRIDGE

11. "DO NOT ENTER WHEN FLOODED" WARNING SIGN PER ADOT S.D. W8-103, STEEL CHANNEL POST & TYPE 'B' BASE PER MAG S.D. 131

DO NOT ENTER WHEN FLOODED

NOTE: AN ADDITIONAL "DO NOT ENTER WHEN FLOODED" WARNING SIGN SHALL BE PLACED BY CONTRACTOR ON THE EAST SIDE OF THE 100-YEAR FLOODPLAIN.AT LOCATION TO BE PROVIDED BY ENGINEER.



D BOX CULVERT SAFETY RAIL DETAIL
BOTH SIDES OF BOX CULVERT PER MAG STD. DTL. 145 — NOT TO SCALE

ESTIMATED QUANTITIES*:

	QUANTITY	UNIT
①	2	EA
②	2	EA
③	174	SY
④	165	LF
⑤	85	LF
⑦	362	LF
⑧	368	LF
⑩	2	EA
⑪	2	EA
RIPRAP, D_{50}=6"	310	CY
FILTER FABRIC	930	SY

* CONTRACTOR MUST VERIFY ALL QUANTITIES

PRELIMINARY NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	BY
REVISIONS			

JE FULLER define•communicate•solve
40 E Helen St
Tucson, AZ 85705
520 623 3112
www.jefuller.com

HAYSTACK COMPRESSOR STATION
KINDER MORGAN INCORPORATED - APN 800-20-027Z

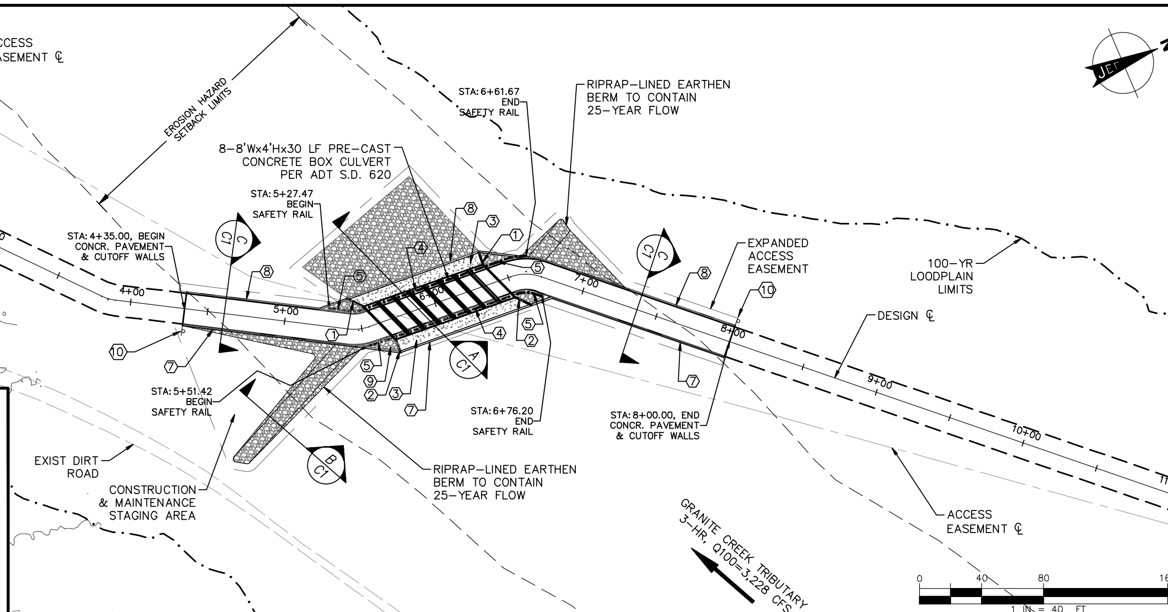
JOB NO: P4373.01
DATE: SEP 24
SCALE: 1"=40FT
DRAWN: GWH
DESIGN: GWH
CHECKED:

DRAINAGE CROSSING
STABILIZED ACCESS ROAD

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

DRAWING NO. C1
SHT NO. 1 OF 1

PLOTTED: Sep 11, 2024-2:46pm
FILE: X:\Kinder_Morgan\P4373.01 - Haystack CS All-Weather Crossing\CAD\KMI Haystack Crossing.dwg <<C30_Imperial>>



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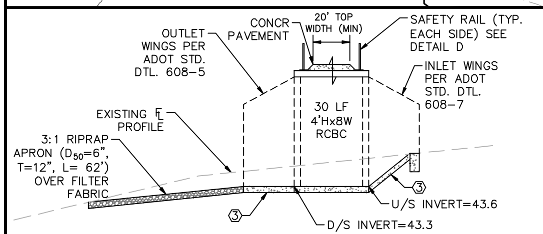
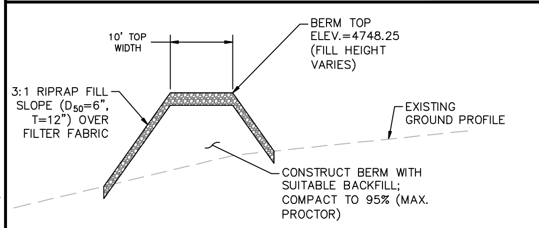
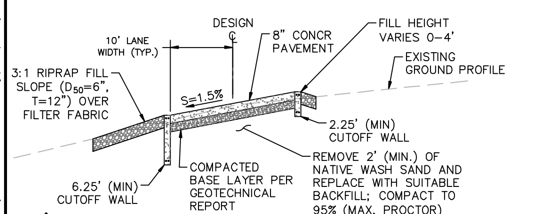


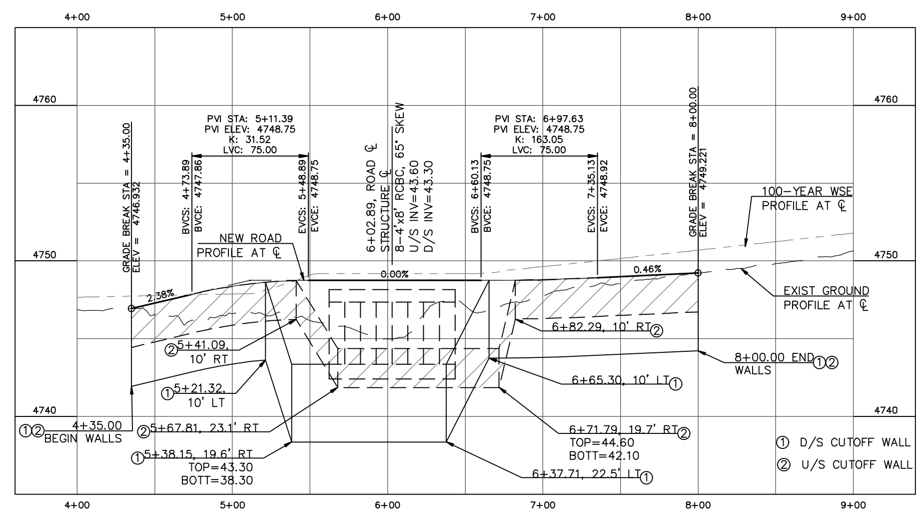
CULVERT CROSSING SECTION (A)
8CELL, 4'x8' PRE–CAST OR CAST–IN–PLACE RCBC — NOT TO SCALE

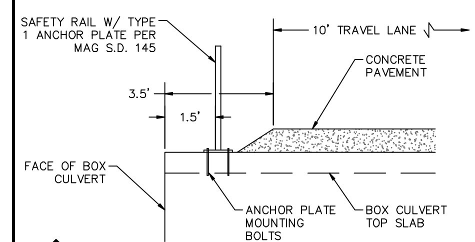


CONTAINMENT BERM SECTION (B)
LEVEL WITH BRIDGE DECK TO CONTAIN 25–YR FLOOD — NOT TO SCALE



ROADWAY APPROACH SECTION (C)
FORD CROSSING AND CUTOFF WALLS PER MAG STD. DTL. 552 — NOT TO SCALE





BOX CULVERT SAFETY RAIL DETAIL (D)
BOTH SIDES OF BOX CULVERT PER MAG STD. DTL. 145 — NOT TO SCALE

ESTIMATED QUANTITIES*:

	QUANTITY	UNIT
1	2	EA
2	2	EA
3	174	SY
4	165	LF
5	85	LF
7	362	LF
8	368	LF
10	2	EA
11	2	EA
RIPRAP, D_{50}=6"	310	CY
FILTER FABRIC	930	SY

* CONTRACTOR MUST VERIFY ALL QUANTITIES

Registered Professional Engineer — CERTIFICATE NO. 33426 — GEOFF W. HARRIS

NO.	DESCRIPTION	DATE	BY
	REVISIONS		

JE FULLER — define•communicate•solve
40 E Helen St
Tucson, AZ 85705
520 623 3112
www.jefuller.com

HAYSTACK COMPRESSOR STATION
KINDER MORGAN INCORPORATED - APN 800-20-027Z

JOB NO: P4373.01
DATE: OCT 24
SCALE: 1"=40FT
DRAWN: GWH
DESIGN: GWH
CHECKED: CBR

DRAINAGE CROSSING
STABILIZED ACCESS ROAD

Call at least two full working days before you begin excavation. ARIZONA811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

DRAWING NO. C1
SHT NO. 1 OF 1

PLOTTED: Oct 03, 2024–8:01am

FILE: X:\Kinder_Morgan\P4373.01 – Haystack CS All–Weather Crossing\CAD\KMI Haystack Crossing.dwg <<C30_imperial>>

3. Describe mitigation measures that would be provided to ensure flow and erosion prevention at the ephemeral swale proposed to be crossed by the access road.

Response:

The Drainage Report described in EPNG's Response to Data Request No. 2 above includes a hydrologic analysis of the ephemeral swale to be crossed by the access road and provides a design for a stabilized roadway crossing. The crossing was designed to use concrete reinforced box culverts to allow runoff from a 100-year flood event to pass over the crossing while allowing for the conveyance of runoff from a 25-year flood event through the concrete culverts. To ensure the long-term stability of the crossing, the roadway surface will be concrete lined and riprap armoring will be used to prevent scouring on the embankments and downstream of the culvert. A detailed analysis of the floodplain crossing is contained in the Drainage Report.

Response prepared by or under the supervision of:

Raul Ronquillo
Project Manager
Kinder Morgan Project Management
(719) 520-3771

Resource Report 4: Cultural Resources

4. Provide a copy of EPNG's April 30, 2024 consultation letter to Arizona State Parks, State Historic Preservation Office (SHPO).

Response:

EPNG's April 30, 2024 consultation letter to the Arizona State Parks, State Historical Preservation Office ("SHPO") is provided as Attachment 2 behind this response.

Response prepared by or under the supervision of:

Mike Bonar
Environmental Permitting Project Manager
Kinder Morgan EHS Project Permitting
719-520-4817

El Paso Natural Gas Company, L.L.C.
a Kinder Morgan company

April 30, 2024

SHPO-2024-0416 (174722) Rec: 04-30-24

Kathryn Leonard
State Historic Preservation Office
1100 West Washington Street
Phoenix, Arizona 85007

Re: El Paso Natural Gas Company Maricopa Lateral Expansion Project, Yavapai County/Federal Energy Regulatory Commission (FERC); NHPA Section 106 Review

Dear Ms. Leonard:

El Paso Natural Gas Company, L.L.C. (EPNG) proposes the construction of one new compressor station in Yavapai County, Arizona, identified as the Haystack Compressor Station, located along EPNG's existing Line from San Juan Line to Phoenix Area (Line No. 1203). The project would be authorized by the Federal Energy Regulatory Commission (FERC) under the Natural Gas Act blanket certificate program (Part 157, Subpart F) and would constitute a federal undertaking subject to review under Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations (36 Code of Federal Regulations [CFR] 800). To assist FERC in its Section 106 review responsibilities, EPNG sponsored a cultural resources survey of the project's area of potential effects (APE), which resulted in no findings of cultural properties that are listed in or eligible for listing in the National Register of Historic Places (NRHP). Therefore, EPNG seeks your concurrence that a No Historic Properties Affected finding is appropriate for this undertaking.

Project Area and Area of Potential Effects

The Area of Potential Effects (APE) for direct effects includes the rhomboidal compressor station site, measuring 570 × 550 feet [7.0 acres], and approximately 0.78 mile of 20-foot-wide access roads [1.89 acres of access roads] that mostly follow existing unimproved roads. All staging activities will take place within the compressor station site. The area where project activities would occur encompasses 8.89 acres of Arizona State Land Department (ASLD)-administered land. SWCA surveyed 40.9 acres, including the APE for direct effects and a sizable buffer surrounding it. The compressor station's potential to result in visual effects to historic properties was considered up to 1 mile from the compressor station site.

Identification of Historic Properties and Assessment of Effects

SWCA Environmental Consultants (SWCA) was contracted by Kinder Morgan, Inc., parent company of EPNG, to conduct a cultural resources survey of the 40.9-acre area of ASLD-administered land. Enclosed for your review is SWCA's survey report, *Cultural Resources Survey for the Maricopa Lateral Expansion Project, Yavapai County, Arizona*, dated April 11, 2024. EPNG submitted the report to the ASLD for their review on April 12, 2024.

Prior to conducting fieldwork, SWCA conducted a records review, which confirmed that the APE and buffer had not been previously surveyed for cultural resources and that it contained no previously recorded cultural resources. SWCA followed the records review with a pedestrian cultural resources survey of the APE and buffer.

The cultural resources survey resulted in the identification of one historic-era property, EPNG Line No. 1203. As in-use natural gas pipeline facilities on non-tribal lands, these properties are exempt from Section 106 review until at which time they are abandoned via a filing with FERC under Natural Gas Act Section 7b (*Federal Register* 67[66]:16364–16365).

The cultural resources survey of the 40.9-acre APE and buffer, resulted in the identification of no historic properties (i.e., cultural properties listed in or eligible for listing in the NRHP). EPNG respectfully requests your concurrence on the adequacy of the inventory effort and that a **No Historic Properties Affected** finding is appropriate for this undertaking. Additionally, EPNG requests your concurrence on the adequacy of the attached Unanticipated Discovery Plan.

Should you have any questions regarding the project, please contact Mike Bonar, EPNG Compliance and Permitting Specialist, by telephone at 719-520-4817 or by email at mike_bonar@kindermorgan.com. Questions regarding the survey results may be sent to Jerome Hesse, SWCA Cultural Resources Director, by telephone at 520-348-3237 or by email at jhesse@swca.com.

Respectfully submitted,

Mike Bonar, EHS - Project Permitting
2 North Nevada Ave.
Colorado Springs, CO 80903
Office: 719-520-4817|Cell: 719-466-3617
Email: Mike_Bonar@kindermorgan.com

Concur
No Historic Properties Affected
[signature]
22 May 2024
Arizona State Historic Preservation Office

Enclosures: Location Map
Cultural Resources Survey Report
Unanticipated Discovery Plan

5. Provide a copy of the SHPO comment letter dated May 22, 2024.

Response:

A copy of the SHPO consultation letter, dated May 22, 2024, is provided as Attachment 2 behind Response to Data Request No. 4 above. The SHPO's concurrence with "No Historic Properties Affect" is provided at the bottom of the consultation letter.

Response prepared by or under the supervision of:

Mike Bonar
Environmental Permitting Project Manager
Kinder Morgan EHS Project Permitting
719-520-4817

6. Respond to concerns raised by commenter Frank and Heather Fusari (accession number 20241016-0007 – page 5) regarding cultural resources.

Response:

As part of its application preparation for the Maricopa Lateral Expansion Project, EPNG contracted with SWCA Environmental Consultants ("SWCA") to perform a cultural resources survey of a total of 40.9 acres that included the area of direct effects and a surrounding buffer. The survey was completed by independent professional archaeologists under an Arizona Antiquities Permit issued by the Arizona State Museum. The results of the survey are summarized in Resource Report 4, and given the contents of the information the survey report was filed as privileged information. SWCA found that the Project will not affect cultural resources. Subsequently, after consulting with the SHPO, the SHPO concurred that with a National Historic Preservation Act Section 106 finding of No Historic Properties Affected to be appropriate (*See* Response to Data Request No. 5). The survey report was also submitted to the Arizona State Land Department ("ASLD") and the SHPO in support of the ASLD's review requirements under Arizona's State Historic Preservation Act. The ASLD reviewed the survey report and recommended no further cultural resources work would be required.

In addition, EPNG contacted ten Native American Tribes, including the Yavapai-Apache Nation, requesting identification of any known traditional cultural properties that may be affected by the Project. To date, EPNG has not received a response from any Native American Tribe indicating that traditional cultural properties have been identified.

Response prepared by or under the supervision of:

Mike Bonar
Environmental Permitting Project Manager
Kinder Morgan EHS Project Permitting
719-520-4817

Resource Report 5: Socioeconomics

8. Describe the average and peak number of construction workforce from initial clearing to final restoration; number of new permanent employment positions created for project operations and where these employees would be located; and the anticipated percentage of the workforce that would be local hires.

Response:

At the peak of the Project's construction, EPNG estimates that a work crew of up to 40 to 50 workers will be required to complete the Project. EPNG's construction contractor will seek to hire local labor to assist with construction of the Project facilities; however, the percentage of the work force ultimately hired will depend on availability of skilled labor at the time of construction. EPNG plans to hire a permanent Electronics & Controls Technician to assist with operating the facilities. The new employee will be based out of EPNG's operations office located in Williams, Arizona.

Response prepared by or under the supervision of:

Raul Ronquillo
Project Manager
Kinder Morgan Project Management
(719) 520-3771

9. Provide the number of units and vacancy rates for temporary housing (e.g., apartment rentals, hotels/motels, and campgrounds) and proximity to the project and construction area.

Response:

Tables 1 and 2 below provide the number of units and vacancy rates for temporary housing (e.g., apartment rentals, hotels/motels, and campgrounds) in proximity to the Project and construction area.

Table 1. Housing Characteristics in the Study Area

Geographical Area	Total Housing Units, 2022	Vacant Units	Vacancy Rate (%)	Vacant Units for Rent	Rental Vacancy Rate (%)	Median Monthly Rent ($)
Arizona	*3,097,768*	*358,632*	*11.6*	*49,288*	*5*	*1,308*
Yavapai County, Arizona	121,829	15,287	12.5	1,154	3.8	1,128
Chino Valley, Arizona	6,040	416	6.9	0	0.0	1,100
Prescott Valley, Arizona	21,105	1,332	6.3	80	1.4	1,348
Prescott, Arizona	68,97211.6	8,221	11.9	466	2.7	1,120

Sources: USCB (2022c).

Table 2. Temporary Lodging Characteristics in the Study Area

Geographical Area	Number of Hotels or Motels	Number of RV Parks or Campgrounds
Yavapai County, Arizona	159	31
Chino Valley, Arizona	2	3
Prescott Valley, Arizona	5	7
Prescott, Arizona	25	17

Source: Google Maps (2024).

Response prepared by or under the supervision of:

Mike Bonar
Environmental Permitting Project Manager
Kinder Morgan EHS Project Permitting
719-520-4817

10. Describe EPNG's outreach and consultation with local fire departments and emergency providers.

Response:

On September 16, 2024, EPNG's local area manager met with representatives from the Central Arizona Fire and Medical Authority ("CAFMA"), the Chino Valley Police Department, the Yavapai County Sheriff's Department, the Yavapai County Emergency Management, and the Prescott Regional Public Safety Communication Center to discuss the Project.

EPNG notes that the September 16, 2024 meeting was part of its annual emergency outreach efforts. During the meeting, agency attendees were provided with system maps, resources for pipeline safety training, EPNG contacts, and links to EPNG public awareness sites. In addition, a general Q&A session was conducted.

Additionally, these agencies also routinely receive public awareness mailings from EPNG and attend outreach meetings.

EPNG conducted additional agency outreach during a September 26, 2024 townhall meeting with local residents, the CAFMA Hazmat Battalion Chief, and Yavapai County Emergency Management representatives.

Response prepared by or under the supervision of:

Mike Bonar
Environmental Permitting Project Manager
Kinder Morgan EHS Project Permitting
719-520-4817

12. Identify specific traffic management measures that EPNG would use to minimize traffic impacts on local and private roadways, including Haystack Road and E. Perkinsville Road/Forest Service 354 Road.

Response:

Prior to construction, EPNG will install signage on Perkinsville Road, Haystack Road, and Forest Service Road 638 to warn motorists of construction vehicles traveling the roadway. Signs such as "Construction Entrance Ahead" will be posted along the roads. All signage will be maintained daily to preserve in good working order.

Crews will generally be on site prior to the 7:00 a.m. construction start time and will leave after the 7:00 p.m. end of construction time. This will prevent overlap with traffic from the Haystack Ranch community. EPNG inspection staff will remain in contact with representative from the Haystack Ranch community, and if traffic becomes as an issue, EPNG will work with its contractor to minimize traffic concerns.

EPNG will notify the Yavapai County Sheriff before starting construction and advise all workers of speed limits as a part of its on-site training that everyone receives prior to being allowed to work on the site.

Note: Forest Service Road 354 is incorrectly identified in Data Request No. 12. As noted in Figure 1A-2 in Resource Report 1, EPNG will utilize Forest Service Road 638.

Response prepared by or under the supervision of:

Raul Ronquillo
Project Manager
Kinder Morgan Project Management
(719) 520-3771

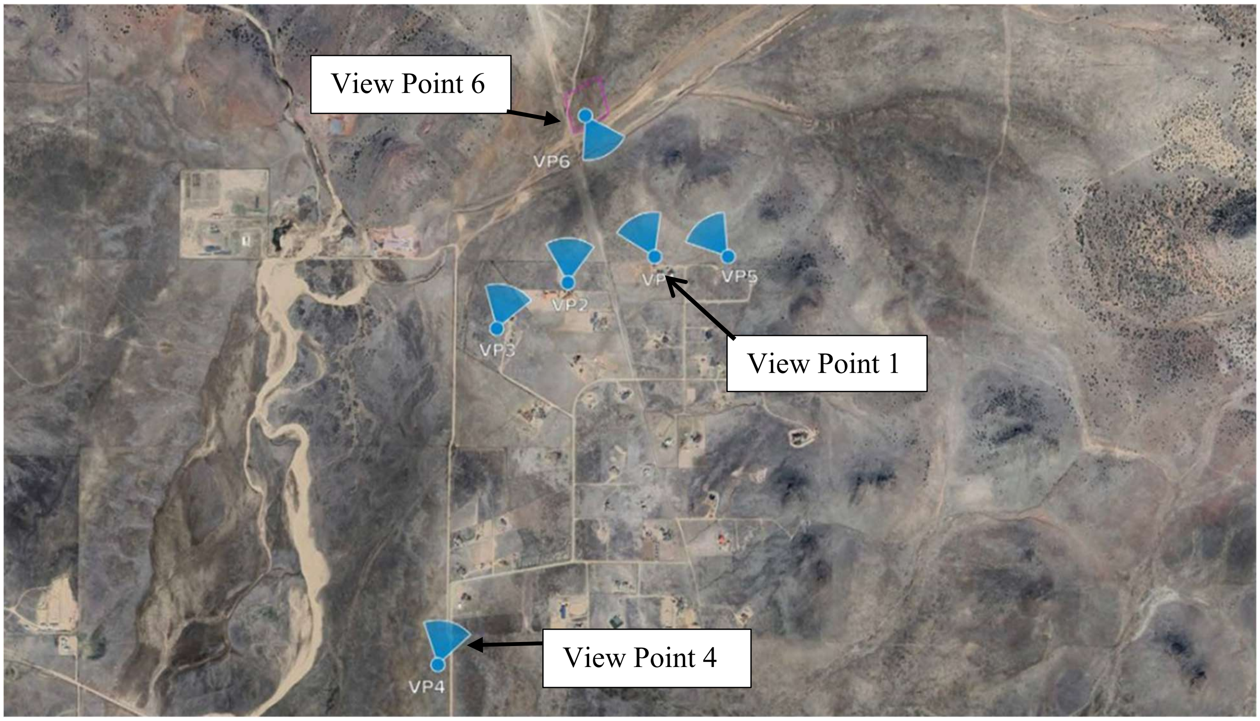
21. Provide a description of visual impacts (e.g. impacts from construction activities, presence of the new facilities) on sensitive receptors (e.g. nearby residences, users of nearby roadways, and users of nearby recreational areas, if any) during construction and operation of the facilities. Include the following (as applicable):

   e. Distance to the nearest residences within environmental justice communities from the compressor station. State whether the structure is visible and identify any existing screening between the structure and the residence.
   f. State whether the distance from nearest non-residential sensitive receptors within environmental justice communities and the compressor station is visible and identify any existing screening.
   g. Proposed visual screening that El Paso would install and maintain to minimize the visual impact of the facility (e.g., installing a combination of deciduous and evergreen trees).
   h. Provide a visual simulation of the proposed compressor station from the nearest residences.

Response:

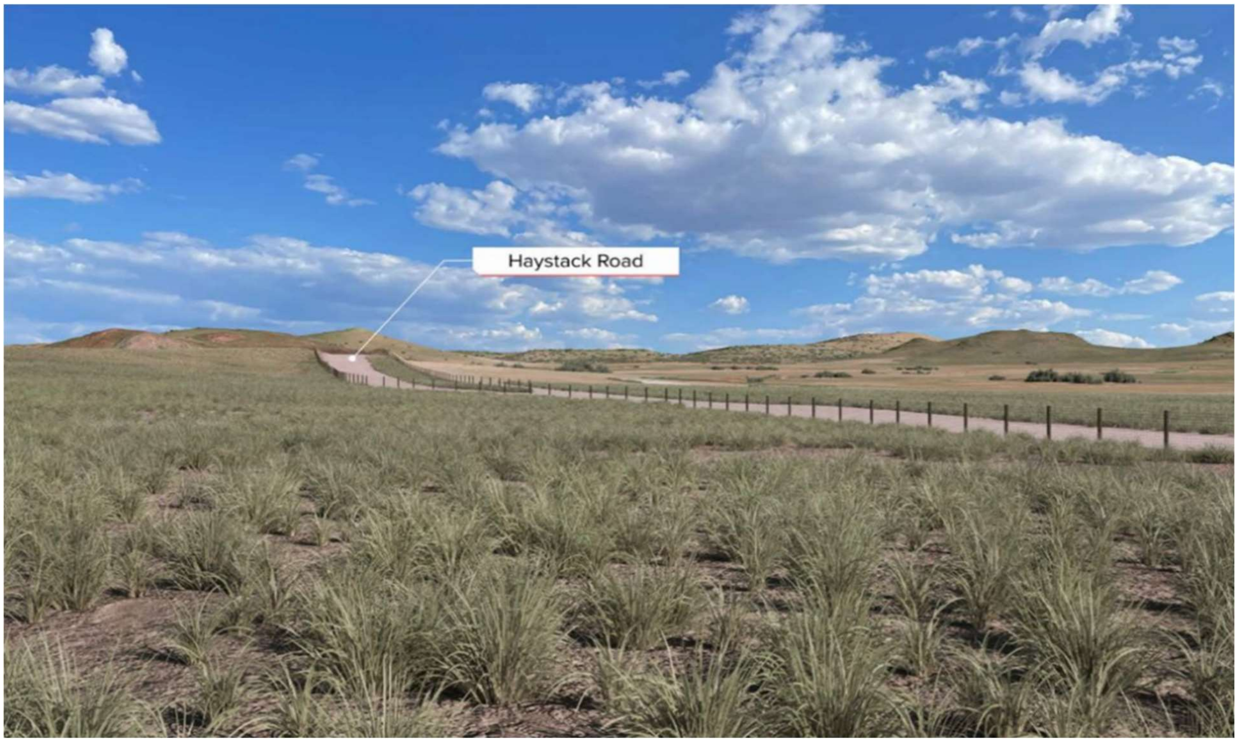
e. The nearest residence within Block Group 1, Census Tract 0002.07 (i.e., the environmental justice community) is located approximately 2,700 feet southeast of the Project. Based on visual simulations conducted by EPNG, the Project will not be visible from this residence. Below are some renderings that depict visual impacts to nearby residences and users of nearby roadways.

View Point Map

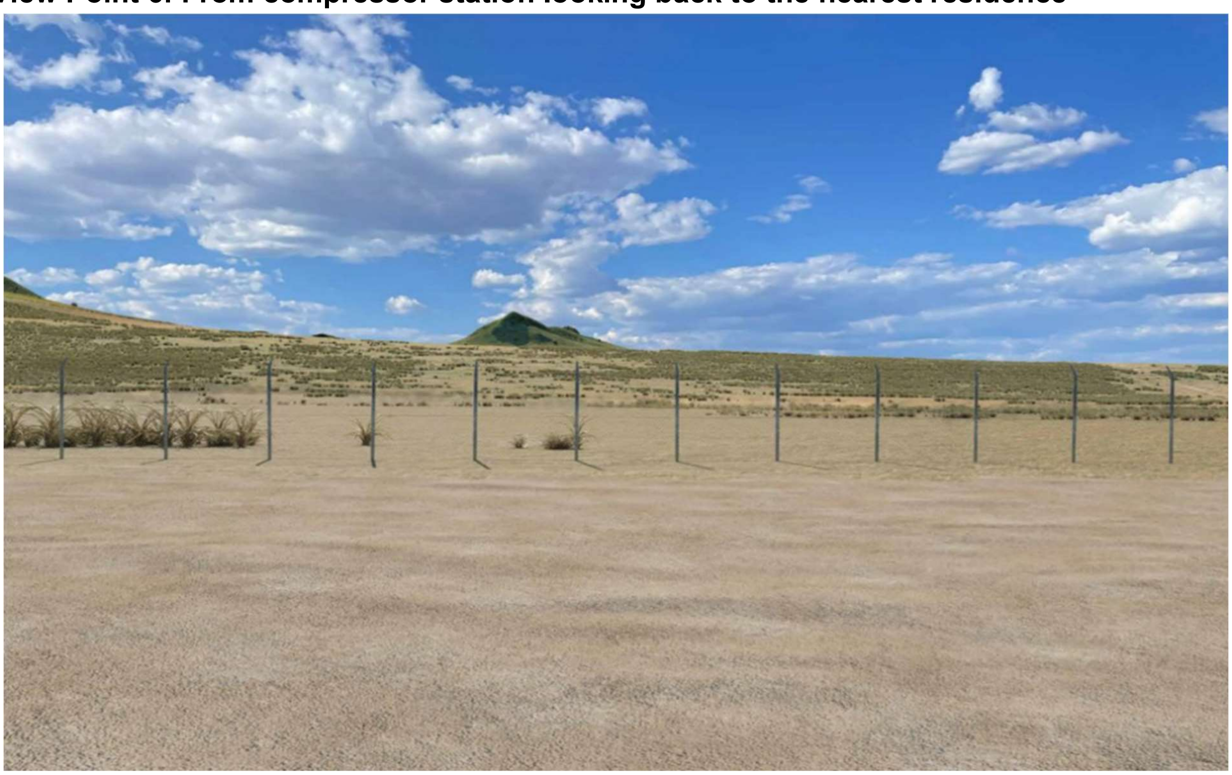


View Point 1: From residence closest to the proposed compressor station:

View Point 4: From Haystack Rd



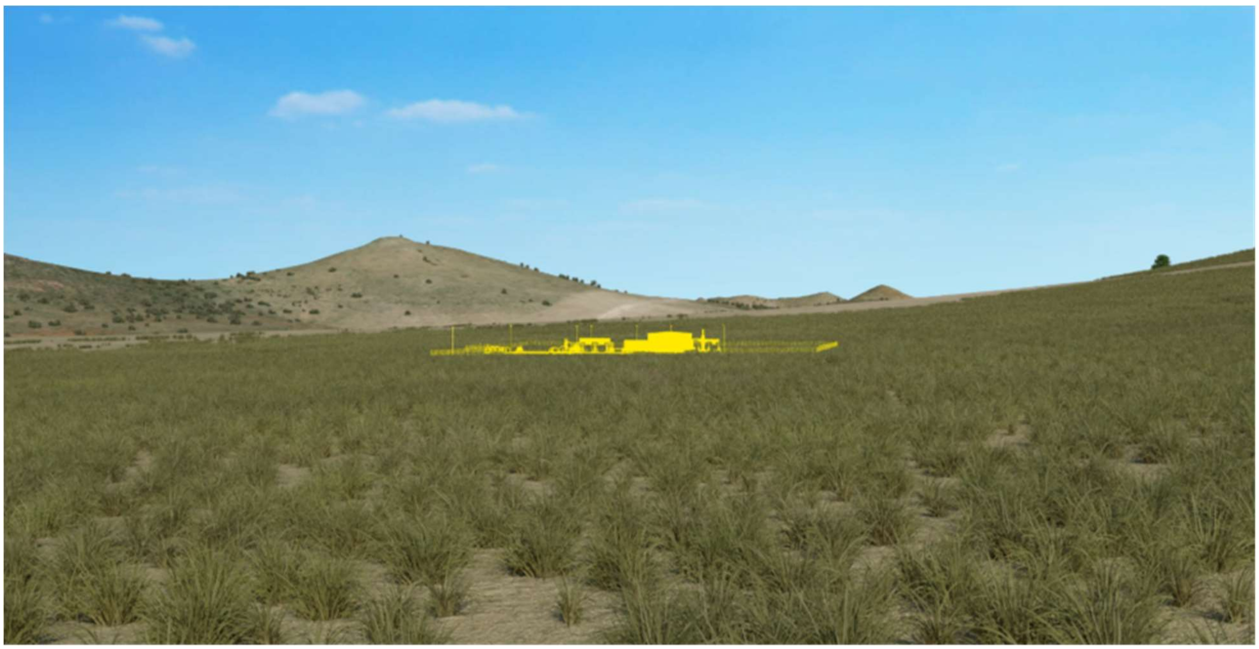
View Point 6: From compressor station looking back to the nearest residence



f. The nearest non-residential sensitive receptor occurs 2.4 miles southwest of the Project. The Project will not be visible at this receptor due to distance and topography.

g. The Project is not visible from either a residential or non-residential sensitive receptor. Therefore, EPNG is not proposing the installation of visual screening.

h. The attached photo simulation depicts the Project from the nearest residence. A ridge occurs between the Project and the nearest residence; the yellow outline identifies the Project as it sits below this ridge line and out of view from the residence.



Response prepared by or under the supervision of:

Raul Ronquillo
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(719) 520-3771

Resource Report 6: Geological Resources

22. Section 6.2.1 states that the Project is 1-2 miles from the active Little Chino fault. While the fault has a low slip rate, clarify what mitigation measures EPNG would employ to reduce the potential impact of seismicity on the Project.

Response:

As part of its permitting process, EPNG reached out to Yavapai County to determine whether any building codes or permits related to mitigating seismic risk apply to the installation of the Project. Yavapai County confirmed that no building codes or permits will apply to the construction of the proposed Project for seismic activity mitigation. Nonetheless, EPNG designed the Project to address potential natural gas releases that may be associated with seismicity (or other similar risks). Specifically, in the unlikely event that Project is affected by seismic activity, any natural gas released from the Project will be limited to a *de minimis* level by closing a remotely operated flow control valve. If a natural gas release occurs as a result of significant seismic activity in the area, existing mainline valves on EPNG's system located approximately 31 miles north (upstream) of the Project would also close. EPNG notes that the closest inhabited residential dwelling is located about 0.5 mile to the south of the Project.

Response prepared by or under the supervision of:

Mike Bonar
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Kinder Morgan EHS Project Permitting
719-520-4817

23. Section 6.4 states that no active hard rock mining operations are located within 3 miles of the Project area. Confirm that no abandoned mining operations or active oil/gas wells are located within 1 mile of the Project.

Response:

There are no abandoned mining operations within 1 mile of the Project (USGS 2024). There are no active oil/gas wells located within 1 mile of the Project. The closest such feature is located more than 9 miles to the northwest of the Project (ESRI 2024).

ESRI. 2024. Arizona oil and gas viewer. Available at: https://www.arcgis.com/apps/mapviewer/index.html?webmap=82f9e4e6096c4efa92e623acfd8f5728. Accessed October 2024.

U.S. Geological Survey (USGS). 2024. Active mines and mineral plants in the US. Available at: https://mrdata.usgs.gov/mineplant/. Accessed July and October 2024.

Response prepared by or under the supervision of:

Mike Bonar
Environmental Permitting Project Manager
Kinder Morgan EHS Project Permitting
719-520-4817

24. Section 6.4 states that an active sand and gravel mining operation is located approximately 0.5 mile to the southwest of the Project. Confirm the Project would not impact this mining operation.

Response:

On October 30, 2024, EPNG contacted the owners of the active sand and gravel mine to discuss the Project. The owners did not express any concerns that the Project would impact their mining operations.

Response prepared by or under the supervision of:

Mike Bonar
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Kinder Morgan EHS Project Permitting
719-520-4817

Resource Report 7: Soils

25. Provide the acreage of soils within the Project workspace that are:
   a. highly erodible by wind;
   b. highly erodible by water; and
   c. highly prone to soil compaction.

Response:

The below table provides the acreage of soils within the Project workspace that are (a.) highly erodible by wind, (b.) highly erodible by water; and (c.) highly prone to soil compaction.

Soil Type	Acres	Highly Erodible by Wind (acres)	Highly Erodible by Water (acres)	Highly Prone to Soil Compaction (acres)
Abra-Poley loam (AeB)	3.6	0	0	n/a
Lynx soils (LY)	5.6	0	0	n/a
Total	9.2	0	0	n/a

n/a – not available

Natural Resources Conservation Service (NRCS). 2024. Soil map generated using online database. Available at: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm. Accessed June 2024.

Response prepared by or under the supervision of:

Mike Bonar
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Kinder Morgan EHS Project Permitting
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Resource Report 8: Land Use, Recreation, and Aesthetics

26. Provide a description of how El Paso would notify landowners of construction activities, provide access to residences during construction activities, maintain traffic flow, reduce hazards when construction activities are not in progress, and minimize noise, lighting, and fugitive dust from construction activities.

Response:

Prior to construction, EPNG will install signage along the southeast bound and northwest bound lanes of East Perkinsville Road before the turnoff for Haystack Road/Forest Service Road 638 to warn motorists of construction vehicles entering the roadway. Signs such as "Construction Entrance Ahead" will be posted along the roads. All signage will be maintained daily to preserve in good working order. Further, EPNG will alert the local and state police and fire departments about the construction activities.

EPNG will require its Project contractor to abide by all state, federal, and local load requirements for movement of heavy equipment and supplies, including the Fugitive Dust Control Plan that will be provided as part of the Project's Environmental Compliance Management Plan. In addition, the contractor will be required to have a water truck on site to control dust throughout construction.

Compliance with local speed limits will be addressed as a part of the training that all employees receive prior to being allowed to work at the site. Speed limit reminders will be provided as part of the daily safety trainings, as necessary.

Mobile lighting towers will be equipped with shields to direct light down and toward work areas to ensure that construction activities do not result in light impacts beyond what is currently in the area.

Based on the noise survey provided in Resource Report 9, the noise levels during construction would not exceed 55 dba at the nearest NSA.

Other than seeing construction-related traffic on Haystack Road, access to the Haystack Ranch community will not be affected during the construction or operation of the Project. Access into and out of the neighborhood will remain open. If, for an unforeseen reason, access to the Haystack Ranch community is impeded, EPNG would work with the Haystack Ranch community representatives to minimize any impacts to the residents.

Implementation of these provisions will minimize hazards related to the construction of the Project.

Response prepared by or under the supervision of:

Raul Ronquillo
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Kinder Morgan Project Management
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25. Respond to concerns raised by commenters Jeff Polacek (accession number 20241007-0002 – page 2) Frank and Heather Fusari - page 2) regarding siting of the proposed compressor station.

Response:

In evaluating the preferred Project location, EPNG considered the following siting suitability considerations:

- Location of existing EPNG infrastructure (e.g., pipelines, meter stations, mainline valves).
- Landowner willingness to sell/lease land and parcel boundaries.
- Physical facility and workspace land requirements.
- Proximity to existing access points/roads.
- Obvious natural and human-made physical constraints (e.g., floodplains and roadways).
- Topography and geologic hazards.
- Sensitive environmental resources (e.g., designated critical habitat, cultural resource sites, streams, and wetlands).
- Proximity to residential areas.

EPNG's review of the siting criteria resulted in five site alternatives for the Project. The description below describes the alternative Project sites and their potential environmental impacts and addresses why each alternative site was evaluated but not selected. A map showing the location of each of the alternative sites was included as part of Environmental Resource Report 10 and is also being included as Attachment 3 behind this response.

The preferred Project site is located on lands currently owned and managed by the Arizona State Land Department. The site is approximately 0.5 mile from the nearest residence and is adjacent to Forest Service Road 638. Impacts to sensitive noise or visual receivers are not anticipated based on the topography in the area (i.e., the facilities will be situated behind an existing hill that will serve to minimize/block visual and noise impacts from facility operations).

Alternative Site No. 1 is a 10-acre site that is owned and managed by the Arizona State Land Department. This site is within 0.2 mile of a residence and is located on a high point above the residential area. This location was excluded from further consideration due to potential greater noise and visual impacts to the neighborhood.

Alternative Site No. 2 is a 10-acre privately owned parcel within 300 feet of a residence. The parcel was excluded from further consideration due to the potential visual and noise impacts.

Alternative Site No. 3 is a 10-acre privately owned parcel. EPNG contacted the landowner; however, the landowner was not willing to sell or lease the parcel to EPNG.

Alternative Site No. 4 is a 10-acre privately owned parcel located adjacent to Forest Service Road 354. EPNG contacted the landowner; however, the landowner was not willing to sell or lease the parcel to EPNG. In addition, development of this site would have required crossing the existing Transwestern Pipeline with suction and discharge lines.

Alternative Site No. 5 is a 10-acre privately owned parcel that occurs adjacent to an existing livestock auction facility. EPNG contacted the landowner; however, the landowner was not willing to sell or lease the parcel to EPNG.

EPNG also evaluated an alternative to the proposed Project that would have involved construction of approximately 75 miles of 24-inch-diameter pipeline loop of Line No. 1203 in lieu of the proposed greenfield compressor station, but the alternative design would have greater construction-related impacts, increased landowner impacts, significantly greater costs, and greater overall environmental effects.

EPNG's alternatives analysis indicated that all sites were relatively comparable; consequently, the deciding considerations were landowner willingness to sell or lease the required property and the proximity to sensitive noise and visual receivers. Because the alternative Project sites would be (i) situated closer to developed residential areas or existing businesses (within 0.3–0.5 mile), (ii) would be more visible to the surrounding community, and/or (iii) due to lack of landowner willingness to sell or lease property, the Project site was selected.

Response prepared by or under the supervision of:

Mike Bonar
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Kinder Morgan EHS Project Permitting
719-520-4817

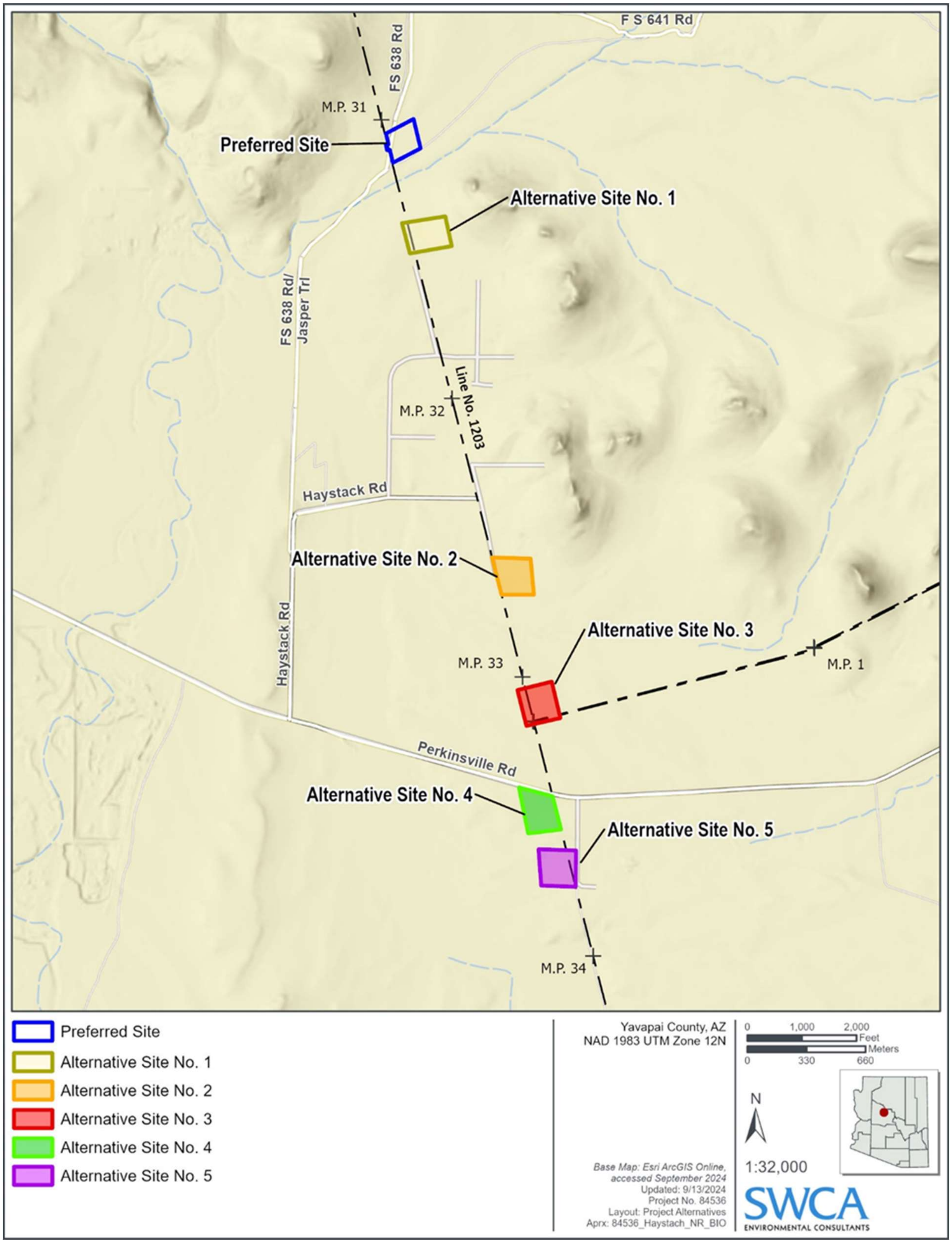

Figure 10.6-1. Locations of alternative sites considered.

Resource Report 9: Air Quality and Noise

27. Table 9.2-3 of RR9 provides one set of ambient concentrations of criteria pollutants (e.g., PM2.5 annual is identified as 9.5 ug/m3). Table 2-3 of the air dispersion modeling report in Appendix 9C of RR9 identifies different background concentration for criteria pollutants (e.g., PM2.5 annual is identified as 3.42 ug/m3). Clarify the discrepancy in background concentrations for all pollutants and provide updated modeling results as applicable.

Response:

EPNG evaluated eight (8) active monitor locations for background concentrations. The eventual selection is based on monitor location, nearby land use/surrounding sources, and data currentness. The Project is located 5 miles east of State Route 89 and the City of Chino Valley. The nearby surrounding area is rural. The monitor that closest matches these conditions is at Alamo Lake State Park due to it being located closer to the proposed Project and the nearby land use being more comparable to the Project area in terms of existing emission sources. Table 9.2-3 of the Resource Report 9 is revised to indicate the background concentration for the $PM_{2.5}$ annual has been updated to 3.4 $\mu g/m^3$ and the $PM_{2.5}$ 24-hour ambient concentration has been updated to 10.8 $\mu g/m^3$. Additionally, the PM_{10} 24-hour ambient concentration has been updated to 120.0 $\mu g/m^3$ as well. These updates reconcile the differences in the tables. The updated table is provided below:

Table 9.2-3. Available Ambient Monitoring Data

Pollutants (units)	Averaging Period	Measured Ambient Concentration [a]	Monitoring Station ID	Primary NAAQS
CO (ppm)	8-hour	2.3 ppm	040130019[b]	9 ppm
	1-hour	3.1 ppm		35 ppm
Pb ($\mu g/m^3$)	3-month			0.15 $\mu g/m^3$
NO_2 (ppb)	Annual	14.4 ppb		53 ppb
	1-hour	48.7 ppb		100 ppb
$PM_{2.5}$ ($\mu g/m^3$)	Annual	3.4 $\mu g/m^3$	040128000[c]	9 $\mu g/m^3$
	24-hour	10.8 $\mu g/m^3$		35 $\mu g/m^3$
PM_{10} ($\mu g/m^3$)	24-hour	120.0 $\mu g/m^3$	040128000[c]	150 $\mu g/m^3$
Ozone (ppm)	8-hour	0.071 ppm	040130019[b]	0.070 ppm
SO_2 (ppb)	1-hour	5.3 ppb	040133002[d]	75 ppb

[a] Numerical values for pollutants were obtained from EPA AirData (EPA 2023a). No ambient monitoring data was available for lead concentrations in the Project area.

[b] 1645 E Roosevelt St-Central Phoenix Station, Phoenix, AZ

[c] Alamo Lake State Park, La Paz County, AZ

[d] 3847 W Earll Dr-West Phoenix Station, Phoenix, AZ

Response prepared by or under the supervision of:

Weiwen Daly
EHS Engineer
Kinder Morgan Air Permitting and Compliance
303-914-7616

28. Section 1.7 of RR1 states that construction duration would occur for approximately 10 months. Section 9.2.3 of RR9 states that construction duration would span 4 months. Clarify the discrepancy and update your construction emissions as needed.

Response:

EPNG confirms that estimated construction duration for the Project is approximately 10 months.

Response prepared by or under the supervision of:

Raul Ronquillo
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Kinder Morgan Project Management
(719) 520-3771

29. File a Fugitive Dust Control Plan that identifies the procedures that EPNG commits to implement during construction to mitigate fugitive dust emissions.

Response:

A copy of EPNG's Fugitive Dust Control Plan is provided as Attachment 4 behind this response. EPNG notes that the attached Fugitive Dust Control Plan was provided as part of the Project's Environmental Compliance Management Plan previously submitted under Appendix 1C in Resource Report 1.

Response prepared by or under the supervision of:

Mike Bonar
Environmental Permitting Project Manager
Kinder Morgan EHS Project Permitting
719-520-4817

Docket No. CP24-520
Attachment 4

August 2024

Maricopa Lateral Expansion Project

FUGITIVE DUST CONTROL PLAN

El Paso Natural Gas Company, L.L.C.
a Kinder Morgan company

Contents

Abbreviations and Acronyms

ADEQ	Arizona Department of Environmental Quality
EI	environmental inspector
EPNG	El Paso Natural Gas Company, L.L.C.
Dth/d	dekatherms per day
Haystack	Haystack Compressor Station
PM	particulate matter
Project	Maricopa Lateral Expansion Project
ROW	right-of-way

Fugitive Dust Control Plan

1.0 Introduction

1.1 Project Overview

El Paso Natural Gas Company, L.L.C. ("EPNG"), is seeking authorization from the Federal Energy Regulatory Commission ("Commission" or "FERC") under the prior notice procedures of the Commission's blanket certificate regulations (Sections 157.205 and 157.208 of the Commission's regulations, 18 Code of Federal Regulations ["CFR"], §§ 157.205 and 157.208 [2024]), for approval of the Maricopa Lateral Expansion Project ("Project") located in Yavapai County, Arizona (Figure 1A-1 in Appendix 1A). The proposed Project involves the construction of one new compressor station, identified as the Haystack Compressor Station ("Haystack C.S."), located at Milepost 31 along EPNG's Maricopa Lateral line ("Line No. 1203") an existing 20-inch outside diameter pipeline originating from EPNG's San Juan Mainline in Yavapai County, Arizona, and connecting to the greater Phoenix area in Maricopa County, Arizona (Figure 1A-2 in Appendix 1A). The Project is designed to create an incremental annual average of 50,517 dekatherms per day ("Dth/d") of firm natural gas capacity on EPNG Line No. 1203.

The Haystack C.S. will consist of a new reciprocating CAT 3616 engine rated for 5,000 horsepower with an Ariel compressor unit along with auxiliary facilities, including cooling equipment and filter separators. Additionally, EPNG will install one 20-inch tie-in facility connecting the Haystack C.S. to EPNG's existing Line No. 1203 with suction and discharge lines and appurtenances immediately west of the new compressor station within EPNG's existing easement.

1.2 Plan Overview

The objective of this Fugitive Dust Control Plan is to identify potential dust emission sources associated with the Project, and to provide guidance to construction and field personnel on measures to control the generation of fugitive dust during construction activities associated with the Project. It would be the responsibility of Project contractors, working with a designated environmental inspector ("EI"), to identify all activities generating fugitive dust, to implement feasible control measures, and to ensure compliance with applicable fugitive dust regulations. The Fugitive Dust Control Plan identifies potential fugitive dust sources, describes any applicable regulatory requirements, specifies under what circumstances dust abatement would be undertaken, describes fugitive dust control measures, and specifies inspection, monitoring, and recordkeeping requirements for the Project.

2.0 Fugitive Dust Sources

Fugitive dust is airborne particulate matter ("PM"), which consists of microscopic solid particles that become airborne from many types of sources. PM is harmful to human health, has the potential to reduce visibility, to create driving hazards, and may be a public nuisance that can damage property and reduce the quality of life.

The ultimate source of fugitive dust is disturbed soil. If left alone, the soils of undisturbed desert land naturally bind together forming a crust. This crust resists wind and helps prevent dust from becoming airborne. When disturbed, small particles get into the air during high wind events.

Air quality impacts associated with construction of the Project will include temporary fugitive dust generated from off-road construction equipment use and by construction activities. Off-road construction equipment will access the site via an unimproved road and be used for site preparation, earth moving, and building and installation of facilities and equipment. The quantity of fugitive dust generated depends on the extent and duration of the disturbance, the intensity of construction activity, the silt and moisture contents of the soil, the wind speed, and the speed, weight, and volume of vehicular traffic.

The following construction activities have been identified as having the potential to generate fugitive dust:

- Vehicle and motorized equipment movement on unpaved access road(s) and in the Project area
- Vegetation removal
- Clearing and grading
- Topsoil segregation
- Trenching
- Backfilling
- Track-out onto roads
- Bulk material loading, hauling and unloading
- Use of material storage piles
- Use of parking, staging, and storage areas.

It is the responsibility of the Project contractor(s) and the designated EI to ensure that all sources of dust generation are identified.

3.0 Applicable Regulatory Requirements

Yavapai County does not have its own air pollution control program therefore the Arizona Department of Environmental Quality (ADEQ) is responsible for air quality management in the Project area. Because the Project is in an area of attainment with air quality standards, the ADEQ does not have oversight for temporary dust emissions generated by the Project's construction activities. However, EPNG has committed to reducing and minimizing the fugitive dust generated by the project by implementing one or more of the BMPs identified in this Fugitive Dust Control Plan.

4.0 Fugitive Dust Abatement

The Project area would be monitored for fugitive dust generation during construction. Abatement of fugitive dust would be required on the construction site when a visible plume of dust with an estimated opacity exceeding 20 percent (objects partially obscured) extends more than 300 feet from the source. Project contractors would be responsible for controlling dust by reducing travel speeds and/or applying dust suppressants (e.g., water). A listing of fugitive dust control measures that may be used during Project construction is included in Section 5 of this Fugitive Dust Control Plan.

5.0 Fugitive Dust Control Measures

The generation of fugitive dust during construction would be reduced through the application of appropriate control measures. Abatement measures would be utilized as needed and appropriate to a particular situation. Based on typical practices for natural gas facility installation, the following specific control measures would be used as needed to control fugitive dust emissions from the Project activities.

- Utilize existing public roads for access during construction. Use only Project approved roads for access.
- Reduce vehicle speeds on unpaved roads; speed limits may be set on unpaved roads.
- Clean up track-out and/or carry-out areas at paved road access points.
- Ensure that all haul truck cargo compartments are constructed and maintained so as to minimize spills and loss of materials. Cover haul truck loads or maintain at least 6 inches of freeboard space in each cargo compartment; cover haul truckloads of sand, gravel, solid trash, or other loose material.
- Apply water to affected unpaved roads, cleared temporary workspace and staging areas (when in use).
- Apply water to active construction areas as needed. Areas should be pre-watered and soils maintained in a stabilized condition where support equipment and vehicles would operate. Water disturbed soils would form a crust, reducing the potential for dust creation.
- Control water spray so that over-spraying and pooling would be avoided to the extent possible.
- For temporary surfaces during periods of inactivity, restrict vehicular access by means of either fencing or signage, and apply water to comply with the stabilized surface requirements.

Other fugitive dust control methods may be used during Project construction.

6.0 Inspection, Monitoring, and Recordkeeping

Project contractors would implement the fugitive dust control measures specified in this Fugitive Dust Control Plan. The EI would be primarily responsible for monitoring and enforcing the implementation of needed dust control measures. The EI would also be responsible for making sure that dust control is effective, and that proper documentation is maintained. Construction site personnel would be educated on the measures outlined in this plan.

Field inspection for dust control would occur daily. Project contractors and EI would be responsible for recording the following information on a daily basis:

- Weather conditions (temperature, wind speed, and direction).
- Number of water trucks in use.
- Cases where visible dust was of such a concentration that abatement measures were implemented.
- Condition of Project soils (crusted, damp, or unstable).
- Presence of track-out and when it was cleaned.
- Overall status of dust control compliance.

This information would be incorporated into the EI's daily report.