



**FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION**

*All sections must be addressed, or the application will be considered invalid*



**I. APPLICANT INFORMATION**

A. Applicant Name: Big Hole Watershed Committee, Ben LaPorte

Mailing Address: P.O. Box 21

City: Divide State: MT Zip: 59727

Telephone: 303-808-5911 E-mail: blaporte@bhwc.org

B. Contact Person (if different than applicant): \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Telephone: \_\_\_\_\_ E-mail: \_\_\_\_\_

C. Landowner and/or Lessee Name (if different than applicant): Peter Kamperschroer

Mailing Address: 66031 MT HWY 43

City: Wise River State: MT Zip: 59762

Telephone: 406-832-3334 E-mail: \_\_\_\_\_

**II. PROJECT INFORMATION**

A. Project Name: Kamperschroer Spring Creek Spawning and Rearing Enhancements

River, stream, or lake: Unnamed tributary to the Big Hole River

Location: Township: 1N Range: 11W Section: 26, 35

Latitude: 45.7990038°N Longitude: 112.9352627°W *Within project (decimal degrees)*

County: Beaverhead

B. Purpose of Project: *(high level, focus on why the project is important)*

The purpose of this project is to enhance the spawning potential of a spring-fed tributary to the Big Hole River at Wise River.

- C. Brief Project Description (attach additional information to end of application). Please include the anticipated construction schedule:
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The Big Hole River has seen significant trout population declines over the past six years. Additional sources of high-quality spawning and rearing habitat could help to reverse the declining trout population declines. The Kamperschroer Spring Creek located on private property near the town of Wise River, Beaverhead County (Figure 1) has high quality and quantity of water, however, the stream lacks suitable spawning habitat. The existing channel dimensions are not adequate to flush fine sediment from the system. Further, where suitable flows and depth are present for spawning, the substrates are too large or too suffocated with fines for redd construction.

**Hydrology:** The spring creek has 2 sources of water. Baseflows are made up of springs that primarily originate from the base of a large terrace and feed into an excavated pond. These flows are roughly 5 cfs throughout the winter. During the irrigation season surface flows from the Wise River are also diverted into the system and used for flood irrigation. The irrigation water flows into the same pond and the diversion for the flood irrigation is adjacent to the outflow of the creek. The spring creek therefore fluctuates in flow from a base flow of roughly 5 cfs to over 20 cfs when supplemented with irrigation water.

The Spring Creek flows roughly 3,500 feet from the pond outlet to the confluence with the Big Hole River. The creek has been enhanced previously which has resulted in the existing configuration of the channel (Figure 2). The area where the channel is present has a robust riparian area with mature willows and heavily sodded banks. The stream and riparian area are excluded from grazing. It is unknown if the hydrology of the creek has changed through time or what the objectives were at the time the creek was enhanced more than 20 years ago; however, the current stream configuration does not maximize spawning potential. The channel is over widened throughout most of its length resulting in poor fine sediment transport potential and significant deposition of fine sediment throughout (Figure 3). A few short steep riffles maintain scour potential and have clean gravels that trout from the Big Hole River readily use for spawning (Figure 4). A redd count, completed by FWP in 2022, found only 2 redds (beavers had blocked passage into the creek). Redd counts performed in 2023 found 29 redds after the beaver dams were removed. Estimates of existing spawning habitat were roughly 130 ft of the total length of the stream.

The objectives of this project are to increase the spawning and rearing habitat in the Kamperschroer Spring Creek. Tetra Tech has prepared a design for this work. This design calls for the narrowing of more than 1,600 ft of stream channel in specific areas along the stream to create the proper velocities and depths for spawning brown and rainbow trout from the Big Hole River. The channel configuration has been designed to transport fine sediment over the range of flows the creek experiences but not result in velocities that would scour the gravels. To narrow the stream, stream bed material would be imported or excavated from the channel and placed along one side of the stream. Locally salvaged sod mats would be placed on top of the stream bed material (see attached design drawings for details). In some cases, a mid-channel island would be used to create 2 narrow channels on either side of the island. The newly narrowed channel would be filled with appropriately sized (2-inch minus), clean spawning gravels to a minimum depth of 1 ft. Trout rearing habitat would be enhanced between the spawning riffles through the addition of mature willow transplants into the outside banks of existing pools of 720 ft of stream. These mature willows would protrude into the stream channel 4-8 ft and provide complex habitats and cover for juvenile fish to rear before migrating out to the Big Hole River.

The Kamperschroer Spring Creek is the largest spring-fed tributary to the Big Hole River. It holds a much higher potential for a spawning tributary than is currently present. We believe the proposed project will significantly enhance the spawning and rearing potential of the creek, which could greatly benefit the trout of the Big Hole River. FWP maintains a long-term fisheries population monitoring site in the Big Hole River, only a mile downstream of the stream, so the potential benefits of this project should be readily observable through normal FWP monitoring.

D. What was the cause of habitat degradation and how will the project correct the cause?

Either a change in hydrology through time (i.e., conversion of land to sprinkler rather than flood irrigation) resulting in lower base flow conditions of the creek or a poor initial creek design that left the stream channel over widened and unable to transport fine sediments under base-flow conditions. Beavers have also contributed to the sedimentation of the stream system. Active beaver management is now occurring and will occur into the future.

E. Length of stream or size of lake that will be treated (project extent): 2,390 ft of streambank  
 Length/size of impact, if larger than project extent (e.g., stream miles opened): \_\_\_\_\_

F. Project Budget Summary:

<b>Grant Request (Dollars):</b>	<b>\$ 63,076.00</b>
Matching Dollars:	<b>\$ 10,000.00</b>
Matching In-Kind Services:*	<b>\$ 33,800.00</b>
<small>*salaries of government employees are <u>not</u> considered matching contributions</small>	
Other Contributions (not part of this app)	\$ _____
<b>Total Project Cost:</b>	<b>\$ \$106,876.00</b>

G. Attach itemized (line item) budget – see *budget template*

H. Attach project location map(s) that include:

- Extent of the project, including context (relation to major landmark or town)
- Indication of public and private property (design sheet G-1)
- Riparian buffer locations and widths (if applicable) and grazing locations

I. Attach project plans:

- Detailed sketches or plan views with the location and proposed restoration
- Pre-project photographs (GPS location strongly recommended)
- If water leasing or water salvage is involved, attach a supplemental questionnaire (<https://myfwp.mt.gov/getRepositoryFile?objectID=36110>)

J. Attach support letters or statements of (e.g., landowner consent, community or public support). For FWP statement, attach provided template. List any other project partners:

Jim Olsen FWP Statement attached.

III. MAINTENANCE AND MONITORING (attach additional information to end of application):

A. A 20-year maintenance commitment is required\*. Please confirm that you will ensure this protection and describe your approach. Attach any relevant maintenance plans. Yes  No   
\*If it is a water leasing project, describe the length of the agreement.

The primary maintenance tool required will be the upkeep of the riparian fence and beaver management to ensure the channel is open to fish and the habitat is not impounded by dams.



- B. Will grazing be part of or adjacent to the project? If so, describe or attach land management plans, including short term and long term grazing regimes. If the landowner is not the applicant, please describe their involvement in the project. *If you want assistance with grazing plan development, note your need.*

The area is currently excluded from grazing by a riparian fence.

- C. Will the project be monitored to determine if goals were met? If so, what are the short-term and long-term plans to assess benefits and lessons learned? Were pre-project data collected? Will monitoring information be shared with FWP?

Yes. FWP has begun annual redd counts in the creek. FWP also maintains a long-term population monitoring section less than 1 mile downstream from the confluence of the spring creek with the Big Hole River.

**IV. PROJECT BENEFITS** (attach additional information to end of application):

- A. What species of fish will benefit from this project?

It is anticipated that this spring creek will enhance the recruitment of juvenile brown and rainbow trout to the Big Hole River. The amount of available spawning habitat will increase 10 times, and rearing habitat will be enhanced. It is anticipated that the creek will become one of the main producers of juvenile fish in the area. There is very limited spawning habitat in the Big Hole River in this area. The river is narrow and fast with predominantly small boulder substrate.

- B. How will the project protect or enhance wild fish habitat?

The intent of this project is to enhance the spawning habitat for wild fish from the Big Hole River.

- C. What is the expected improvement to fish populations, both short term and long term? How might the project translate to angler success?

The brown and rainbow trout populations were at all-time lows in the Big Hole River in 2023. One of the main drivers for the population decline is the lack of juvenile recruitment. Poor juvenile recruitment appears to be closely associated with flow when in low flow years juvenile fish survival suffers greatly. A spring creek should be buffered from the effects of flow and should be consistent producer of cold consistent water. With the proposed spawning enhancements, the Kamperschroer Spring Creek could supply a significant number of juvenile fish to the Big Hole River.

- D. Will the project increase public fishing opportunity for wild fish and, if so, how? Is public fishing allowed onsite? Is it allowed by permission? If not, describe how the public would benefit.

Yes, this creek is being enhanced for the sole purpose of spawning and juvenile rearing habitat. It is anticipated that the fish produced in the creek will migrate to the Big Hole River to mature and eventually return to the creek to spawn.

E. Aside from angling, what local or large-scale public benefits will be realized from this project?

F. Will the project interfere with water or property rights of adjacent landowners? (explain):

No.

G. Will the project result in the development of commercial recreational use on the site (including paid access)? Explain:

No. The Complete Flyfisher (located adjacent to Kamperschroer property) currently leases cabins near the creek, but no fishing occurs on the creek.

H. Is this project associated with the reclamation of past mining activity?

No

**Each approved project applicant must enter into a written agreement with Montana Fish, Wildlife & Parks specifying terms and duration of the project. The applicant must obtain all applicable permits prior to project construction. A competitive bid process must be followed when using State funds.**

**V. AUTHORIZING STATEMENT**

I (we) hereby declare that the information and all statements to this application are true, complete, and accurate to the best of my (our) knowledge and that the project or activity complies with rules of the Future Fisheries Improvement Program.

Applicant Signature: Ben Sabonte Date: 5/15/2024

Submittal: **Applications must be signed and received on or before November 15 and May 15 to be considered for the subsequent funding period.** Late or incomplete applications will be rejected.

Mail to: FWP Future Fisheries Fish Habitat Bureau PO Box 200701 Helena, MT 59620-0701	Email: Future Fisheries Coordinator <a href="mailto:FWPFFIP@mt.gov">FWPFFIP@mt.gov</a> (electronic submissions must be signed) For files over 10MB, use <a href="https://transfer.mt.gov">https://transfer.mt.gov</a> and send to <a href="mailto:mmcgree@mt.gov">mmcgree@mt.gov</a>
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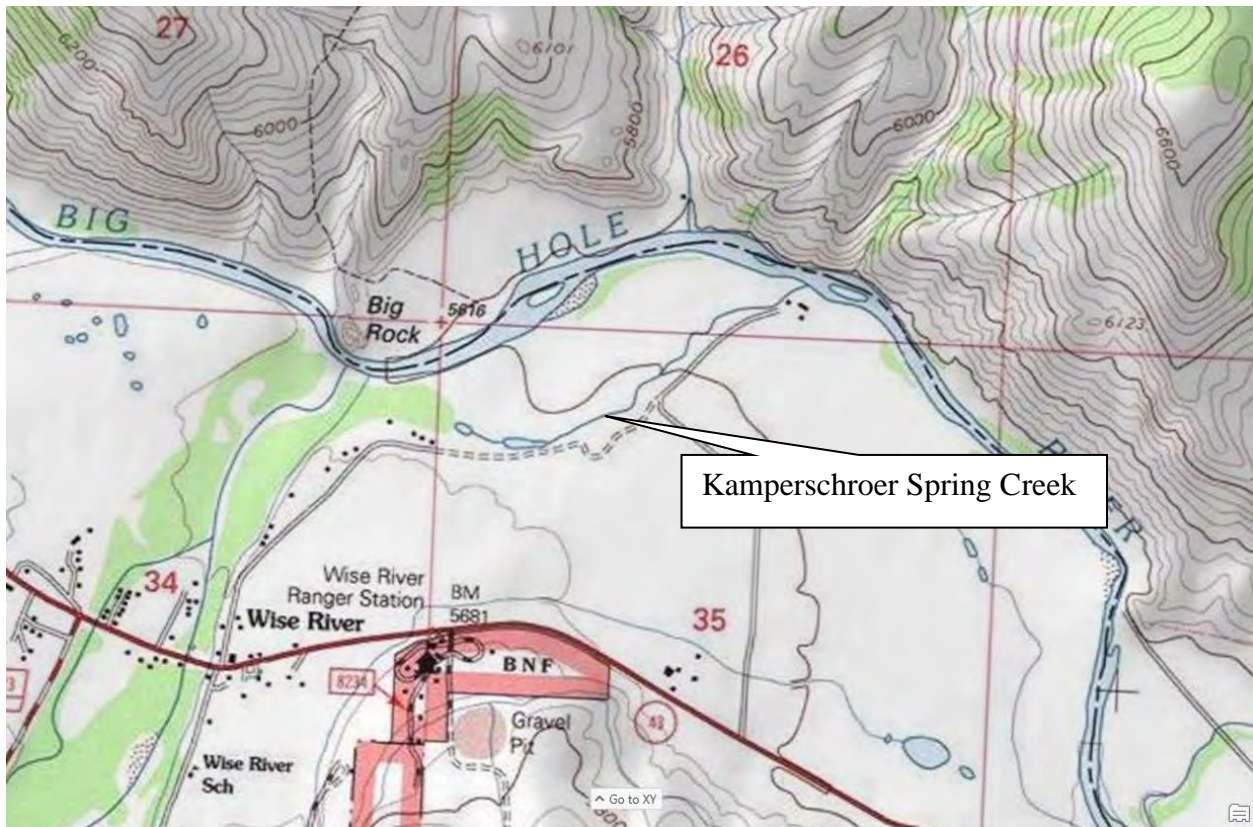


Figure 1. Kamperschroer Spring Creek immediately northeast of the town of Wise River.



Figure 2. Aerial photo showing existing condition of spring creek and extensive riparian area that is protected from grazing with a riparian fence shown in yellow.





Figure 4. Spring Creek where channel is too wide and shallow to produce scouring velocities and the channel has become heavily silted.



Figure 3 Kamperschroer Spring Creek, where channel is narrow and produces correct velocity and depth suitable for spawning habitat.

**Kamperschroer Spring Creek Spawning Enhancement**  
**BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS**

024-2024

Both tables must be completed or the application will be returned

PROJECT COSTS					CONTRIBUTIONS			
WORK ITEMS (Itemize by Category)	NUMBER OF UNITS	UNIT DESCRIPTION*	COST/UNIT	TOTAL COST	FUTURE FISHERIES REQUEST	MATCH (Cash or Services)**	OTHER (Not part of this application)	TOTAL
<b>Personnel***</b>								
Survey				\$ -				\$ -
Design				\$ -				\$ -
Engineering Firm-Bidding and Contracting Support	50	HR	\$100.00	\$ 5,000.00	5,000.00			\$ 5,000.00
BHWC Contacting	30	HR	\$50.00	\$ 1,500.00	1,500.00			\$ 1,500.00
BHWC Permitting	20	HR	\$50.00	\$ 1,000.00	1,000.00			\$ 1,000.00
BHWC Oversight	50	HR	\$50.00	\$ 2,500.00	2,500.00			\$ 2,500.00
Engineering Firm Oversight	100	HR	\$100.00	\$ 10,000.00	10,000.00			\$ 10,000.00
Maintenance				\$ -				\$ -
			Sub-Total	\$ 20,000.00	\$ 20,000.00	\$ -	\$ -	\$ 20,000.00
<b>Travel</b>								
BHWC Mileage	1600	miles	\$0.66	\$ 1,056.00	1,056.00			\$ 1,056.00
Per diem				\$ -				\$ -
			Sub-Total	\$ 1,056.00	\$ 1,056.00	\$ -	\$ -	\$ 1,056.00
<b>Construction Materials****</b>								
Willow Tranplant Clumps	60	EA	\$250.00	\$ 15,000.00		15,000.00		\$ 15,000.00
Wetland Sod Mats	21780	SF	\$0.50	\$ 10,890.00		10,890.00		\$ 10,890.00
Spawning Gravel (2.0- inch minus, well graded and washed)	220	CY	\$10.00	\$ 2,200.00		2,200.00		\$ 2,200.00
Fill	1142	CY	\$5.00	\$ 5,710.00		5,710.00		\$ 5,710.00
				\$ -				\$ -
				\$ -				\$ -
				\$ -				\$ -
				\$ -				\$ -
			Sub-Total	\$ 33,800.00	\$ -	\$ 33,800.00	\$ -	\$ 33,800.00
<b>Equipment, Labor, and Mobilization</b>								
Mobilization, Bonding, and General Requirments	1	LS	\$7,000.00	\$ 7,000.00	7,000.00			\$ 7,000.00
Surface Water Management	1	LS	\$4,000.00	\$ 4,000.00	4,000.00			\$ 4,000.00
Sod Mat and Willow Salvage	1	AC	\$6,000.00	\$ 6,000.00	6,000.00			\$ 6,000.00
Spawning Gravel Screen and Borrow	220	CY	\$16.00	\$ 3,520.00	3,520.00			\$ 3,520.00
Sod Mat Fill and Placement	1,500	CY	\$8.00	\$ 12,000.00	12,000.00			\$ 12,000.00
Willow Transplant Clumps Placement	850	LF	\$15.00	\$ 12,750.00	12,750.00			\$ 12,750.00
Site Restoration and Seeding	1.5	AC	\$4,500.00	\$ 6,750.00	6,750.00			\$ 6,750.00
				\$ -				\$ -
				\$ -				\$ -
				\$ -				\$ -
				\$ -				\$ -
			Sub-Total	\$ 52,020.00	\$ 52,020.00	\$ -	\$ -	\$ 52,020.00
<b>TOTALS</b>				\$ 106,876.00	\$ 73,076.00	\$ 33,800.00	\$ -	\$ 106,876.00

**OTHER REQUIREMENTS:**

**All of the columns in the budget table and the matching contribution table MUST be completed appropriately or the application will be invalid.** Please see the example budget sheet for additional clarification.

\*Units = feet, hours, inches, etc. Do not use lump sum unless there is no other way to describe the costs.

\*\*Can include in-kind materials. Justification for in-kind labor (e.g. hourly rates used). Do not use government salaries as match. Describe here or in text.

\*\*\*The Review Panel suggests that design and oversight costs associated with a proposed project not exceed 15% of the total project budget. If design and oversight costs are in excess of 15%, applications may require a justification or minimum of two competitive bids for the cost of undertaking the project. For projects that include a maintenance request, it must not exceed 10% of the total project cost.

\*\*\*\*The Review Panel recommends a maximum fencing cost of \$1.50 per foot. Additional costs may be the responsibility of the applicant and/or partners.

Additional details:

<b>APPLICATION MATCHING CONTRIBUTIONS</b>				
(do not include requested funds or contributions not associated with the application)				
CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
Pete Kamperschroer (Landowner)	\$ 33,400.00	\$ -	\$ 33,400.00	Yes
GGTU	\$ -	\$ 10,000.00	\$ 10,000.00	No
	\$ -			
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
<b>TOTALS</b>	\$ 33,400.00	\$ 10,000.00	\$ 43,400.00	

<b>OTHER CONTRIBUTIONS</b>				
(contributions not associated with the application)				
CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
<b>TOTALS</b>	\$ -	\$ -	\$ -	

# MONTANA FISH, WILDLIFE & PARKS

## Future Fisheries Improvement Program

### *Appendix: FWP Statement*

Project Title: Kamperschroer Spring Creek Spawning and Rearing Enhancements.

Please describe the potential impact of the project, including the priorities of the Fisheries Division and the importance to Montana's anglers.

This spring creek restoration project has the potential to significantly enhance recruitment of juvenile brown and rainbow trout in the Big Hole River near Wise River. The Big Hole has seen significant population declines over the past 6 years, resulting in the lowest brown trout abundances since population estimates were performed starting in the late 1960's. Low water conditions and perhaps other factors have led to poor juvenile fish recruitment. The proposed project could significantly enhance juvenile fish recruitment to the Big Hole River and could significantly aid in the recovery of the fishery. Anecdotal evidence suggests that the creek used to be an important spawning area for trout from the Big Hole. However, through time, the spawning potential of the creek has declined significantly, and only a few short riffles have now produced adequate spawning habitat.

The declines in the Big Hole have garnered national attention and have become a high priority for the Fisheries Division. Significant research efforts are ongoing to understand the recent declines and how FWP can manage to help the fishery recover as quickly as possible. We currently know that water is an important driver of juvenile fish recruitment. While this project will not result in additional water to the Big Hole, it does have the potential to boost recruitment to the river, regardless of water conditions. This project will not solve the issues on the Big Hole right now, but it has the potential to significantly impact recruitment at the local level. FWP maintains a long-term population monitoring site at Jerry Creek less than a mile downstream from the confluence of the spring creek. Therefore, if the results of the project are an increase in spawning in the creek, these increases may be observable in the Jerry Creek Section of the Big Hole River.

Name of FWP Biologist Jim Olsen Date: 5/13/24

*Please attach to the FFIP application and materials and submit according to listed deadlines.*





# Memo

**To:** Jim Olsen, Montana Fish, Wildlife, & Parks (FWP)

**Cc:** Big Hole Watershed Committee (BHWC); File

**From:** Matt Barnes, PE, CFM  
Denise Williams, EIT

**Date:** May 1, 2024

**Subject:** Kamperschroer Spring Creek – Design Memo

## 1.0 INTRODUCTION

The Big Hole River has seen significant trout population declines over the past six years. Additional sources of high-quality spawning and rearing habitat could help to reverse the declining trout population declines. The Kamperschroer Spring Creek located on private property near the town of Wise River, Beaverhead County has high quality and quantity of water, however, the stream lacks suitable spawning habitat. The existing channel dimensions are not adequate to flush fine sediment from the system. Further, where suitable flows and depth are present for spawning, the substrates are too large or too suffocated with fines for Redd construction.

FWP has hired Tetra Tech to design spring creek channel modifications to maximize the potential amount of spawning and rearing habitat for brown and rainbow trout, adjust the width-to-depth ratio and/or grade to maintain spawning habitat, replace oversized substrates with suitable sized spawning gravels where spawning areas are created, create juvenile rearing habitat consisting of shallow pools (not to exceed 2.5 ft) with submerged brush cover, and determine if a deep-water discharge from the pond to the creek would provide colder water to the stream if available. This memo provides documentation of the design analysis and results for the draft restoration design.

## 2.0 EXISTING CONDITIONS

The existing site conditions include the spring creek that was constructed by previous landowners in the 1980s, access roads, irrigation headgates, pipelines, two interconnected ponds, a driveway bridge to landowner's house, and the Big Hole River south bank. Flows in the spring creek originate from groundwater and irrigation diversion from the Wise River. Diverted water flows from a headgate on Wise River and can be directed by adjusting headgates either to hay fields to the north or south of the spring creek; or through the two ponds and down the spring creek, back to the Big Hole River.

Survey was completed for the project site on 4/1/2024 using GPS and drone equipment to collect topographic data and aerial imagery. FWP provide depth survey points of the lower pond, these points were converted to an elevation by subtracting them from the water surface elevation surveyed with GPS on 4/1/24. LiDAR data published in February 2024 is also available for the entire project area. All three data sets were used to compile a complete topographic/bathymetric surface of the project area.



## Kamperschroer Spring Creek – Design Memo

FWP provided the 2022 flow hydrograph data collected on the spring creek, the hydrograph provided is attached to this memo. Flows during irrigation season appear to be between 10-20 cfs and flows outside the irrigation season appear to be between 5-2 cfs.

The existing spring creek project length from the lower pond outlet to the Big Hole River is about 3500 lineal feet. The existing channel average dimensions are included in Table 1.

*Table 1 – Existing Kamperschroer Channel Dimensions*

<b>Feature</b>	<b>Mean Dimension</b>
Slope	0.4 %
Top Width	22.6 ft
Depth	1.33 ft
W/D Ratio	16.9
Sinuosity	1.22

Typical conditions, including beaver dams, are shown on Figure 1 and Figure 2. Design sheet G-1 shows the existing site map and project extents. Several beaver dams and recent beaver activity signs were present during the survey, though FWP is actively working to remove beavers and beaver dams. Several redds, 5-10 were observed. These redds were typically location in very short reaches, 10-20 lineal feet, where the local stream width and/or slope were steepened and narrowed respectively. Most other areas of the stream channel bed were covered with a complete layer of fines and silts, sometimes deep enough to make walking difficult.



*Figure 1 – Kamperschroer Spring Creek from south terrace looking northeast*



Figure 2 – Typical stream channel conditions on 4/1/24

Pebble counts were completed in five locations on the stream channel length. The pebble count locations are shown on G-1 and results summarized in Table 2.

Table 2 – Pebble Count Summary

	PC1 (mm)	PC2 (mm)	PC3 (mm)	PC4 (mm)	PC5 (mm)	AVG (mm)
D <sub>16</sub>	13.7	23.9	8.7	0.1	9.1	11.1
D <sub>35</sub>	25.2	35.1	16.0	10.6	19.0	21.2
D <sub>50</sub>	37.3	42.9	23.4	15.8	29.4	29.8
D <sub>65</sub>	52.2	57.3	39.4	21.4	50.2	44.1
D <sub>84</sub>	89.6	94.8	87.1	34.7	84.4	78.1
D <sub>95</sub>	161.8	230.7	256.0	254.1	167.0	213.9

Generally, the riparian areas adjacent to the stream channel contain robust riparian vegetation. A coupled areas are more impacted from livestock grazing or water access at times, though these areas were minor and did not appear to be continually in use.

The small areas of the existing gravel substrate appear to be appropriate for trout spawning if it were more available and cleaner. However, most of the channel areas are either clogged with fines and silt or oversized for optimal trout spawning. The large substrate and effects of the beaver dams and very high W/D ratio appear to be the primary drivers that limit spawning habitat. A moderate number of adult and juvenile trout were observed during the survey. There appeared to be mostly rainbow trout present, with a few brown and brook trout also seen.



## 3.0 DESIGN

### 3.1 DESIGN CRITERIA

Literature review and discussions with FWP outlined the following design criteria for spawning areas.

- Gravel substrate with  $D_{100}$  no greater than 50 mm (2”), well-graded (uniform mix of rock sizes below  $D_{100}$ ) and relatively free of fines or silts.
- Channel depth between 0.5’ to 2.0’.
- Velocity between 2 feet per second and 4 feet per second.
- The existing stream slopes would not be easily adjusted a meaningful amount, without major reconstruction of the stream, pond, or both.

Juvenile rearing habitats located between spawning areas will largely be left in existing conditions with improvements added to pools in increase cover and potential for pool scour/formation during higher flows.

### 3.2 HYDRAULIC ANALYSIS

HEC-RAS one-dimensional modeling was completed for the existing conditions and several design iterations to determine the effects of narrowing the existing channel and location where narrowing would be most effective.

Based on this analysis of flows from 2 to 40 cfs, a channel width of 6-8 feet wide and depth to contain 15-20 cfs provide sufficient velocity and shear stress to keep gravel substrate clean, while not increasing velocity too high to scour gravels or prevent trout spawning use.

The hydraulic results in Figure 3 and Figure 4 were used to verify improvements to velocity and the channel ability to self-maintain cleaner gravel substrates. The areas of higher velocities and mobile particles size all correspond to areas of design spawning riffles. The areas of lower values between the spawning riffles are indicative of existing conditions. These areas are suitable to juvenile rearing habitat improvements.

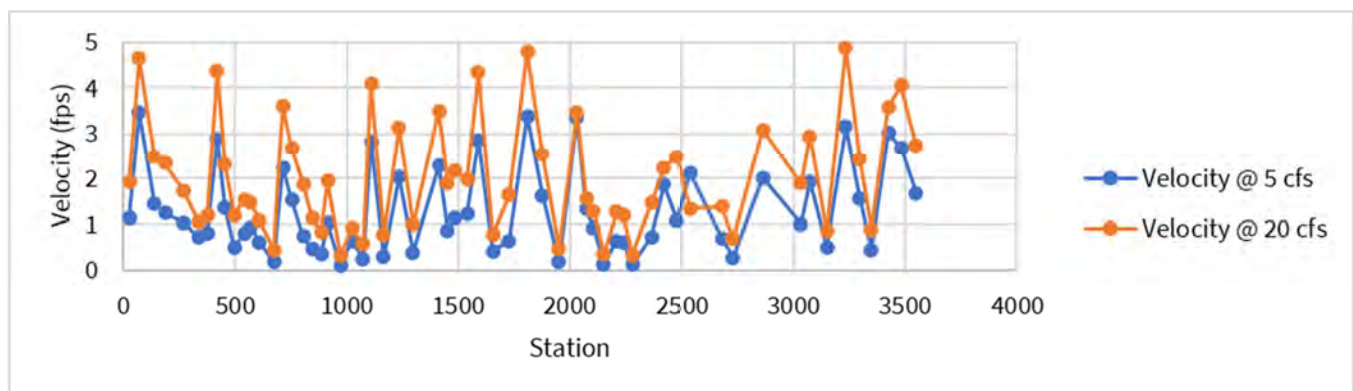


Figure 3 – Channel Velocity Profile for Design

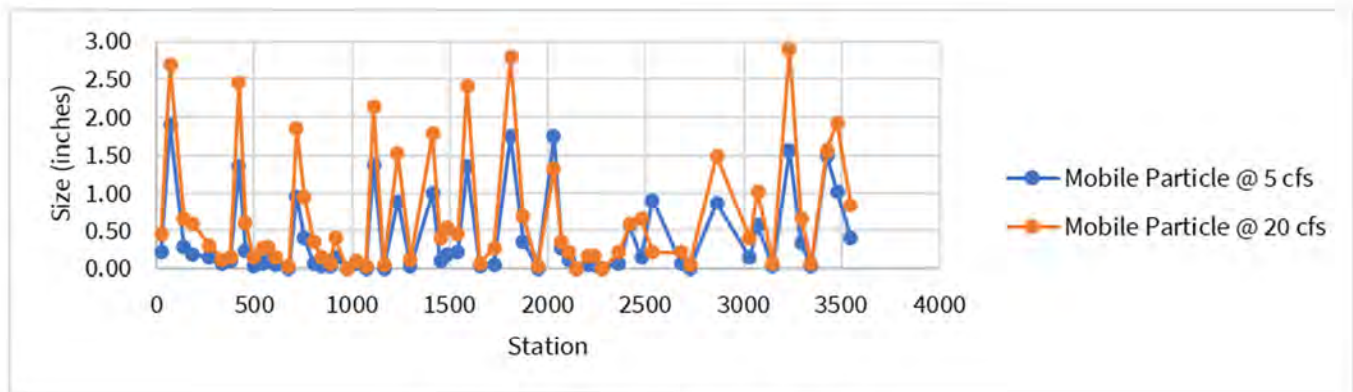


Figure 4 – Mobile Particle Size Profile for Design

Hydraulic profiles, cross sections, and results tables of the project design analysis in HEC-RAS are attached to this memo.

### 3.3 RESTORATION DESIGN

All restoration design described in this memo is dependent on beaver and beaver dam removal.

Restoration design of the spring creek will rely on narrowing the channel width to increase hydraulic energy at the range of design flows. This will improve the ability to self-maintain cleaner gravel substrate suitable for trout spawning. Narrowing the channel is designed by using salvaged earth materials, sod mats, willow plants, and willow cuttings. All these materials are available onsite near the channel. The channel will be filled on one side or an island create in mid-channel to narrow the channel width and preserve at least one streambank with quality vegetation, see example in Figure 5.

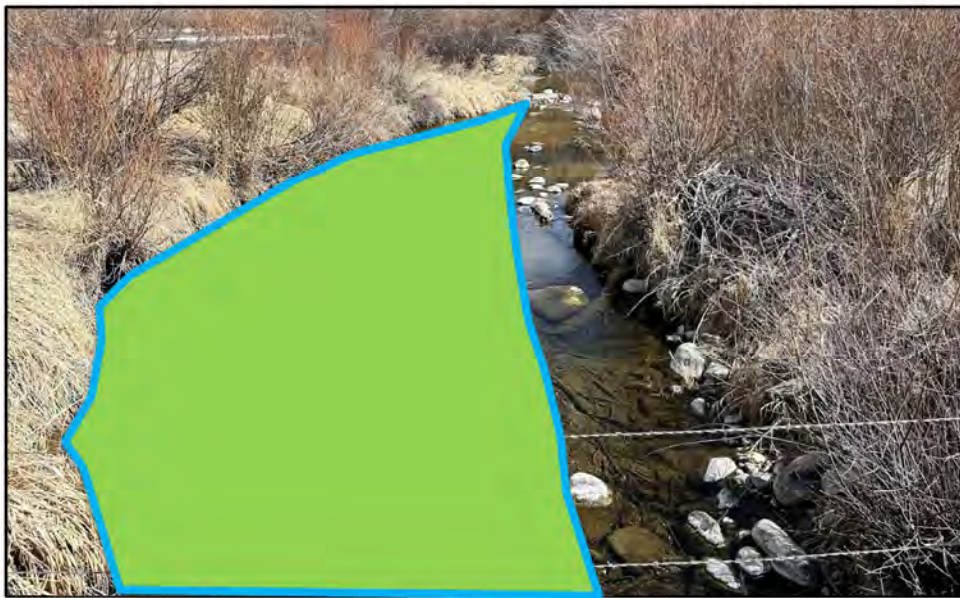


Figure 5 – Streambank Fill Example



To improve juvenile rearing habitat between spawning riffles, willow plants salvage from adjacent areas will be used to increase bank complexity and brush cover. This increase in complexity and intermittent narrowing will also help form and maintain local scour pools during higher flows in the channel. Willow plants will be salvaged and placed at an irregular spacing on streambanks that lack existing brush cover and keyed into the bankline to protrude into the channel. See example in Figure 6.



Figure 6 – Willow Habitat Bank Example

### 3.4 POND LOW LEVEL OUTLET

FWP is also interested in the potential to add an outlet system that can provide flow to the stream from the bottom of the pond. This could help reduce stream water temperatures during water months. The existing stream only draws water from the top of the pond, where in most lakes or ponds, water temperatures are highest.

Both a siphon and gravity low level outlet were considered. However, siphon outlets require much more attention and are much less adjustable compared to gravity outlets, with little to no cost savings. A gravity outlet system is included in the draft design on sheet C-4 for consideration. FWP is still evaluating if the water temperatures at the pond bottom are low enough to warrant this design feature and cost. The outlet rating curve calculated for the draft design is also attached to this memo.

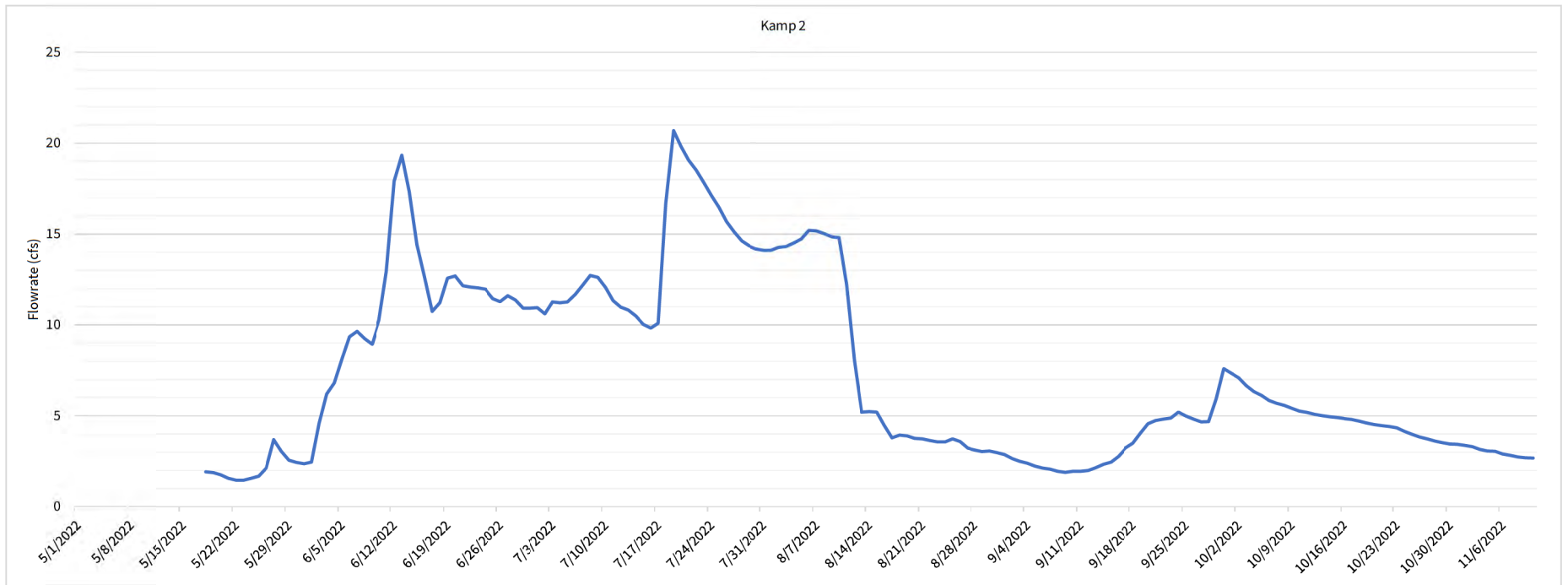
## 4.0 REFERENCES

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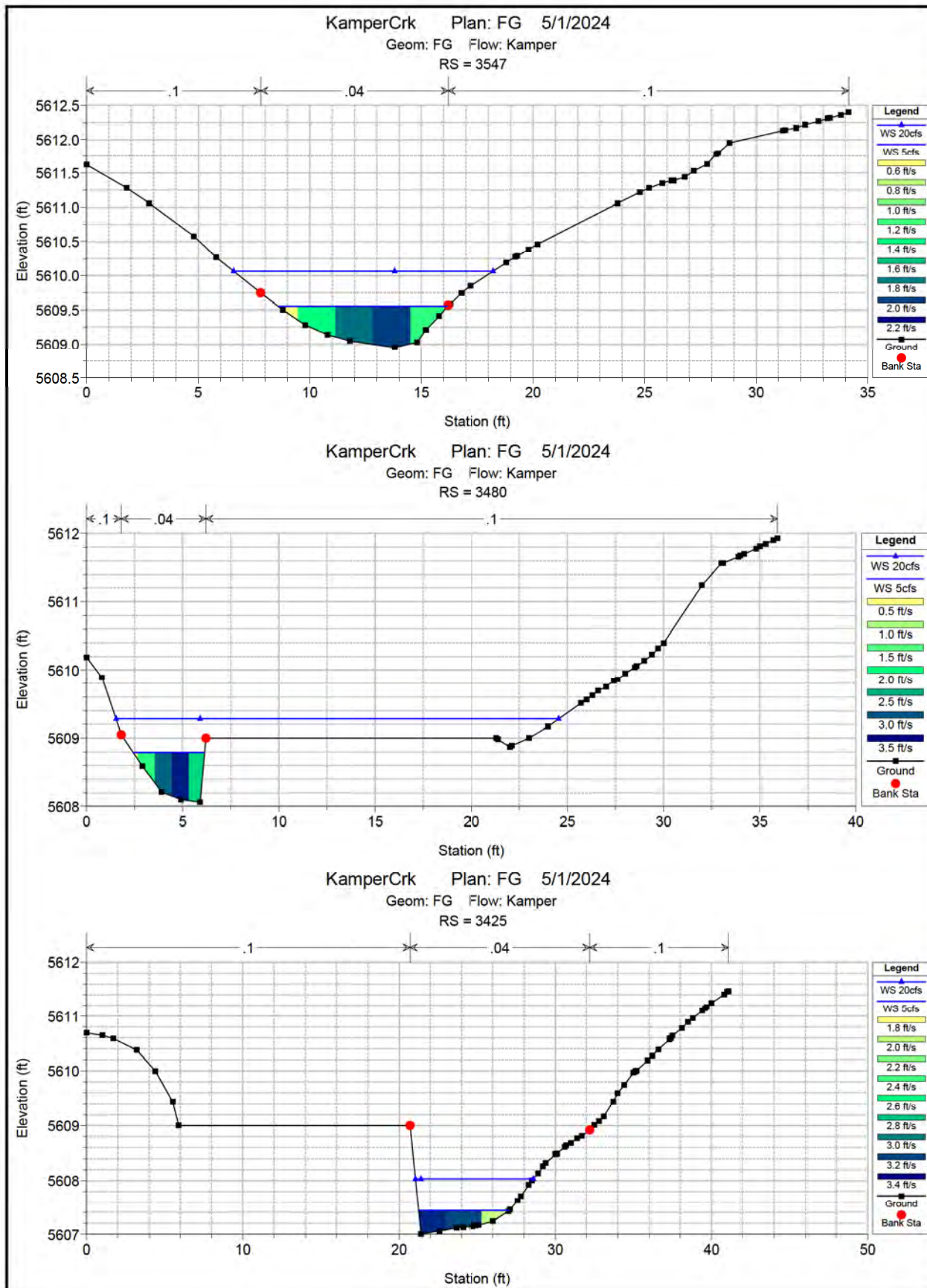
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## 5.0 ATTACHMENTS

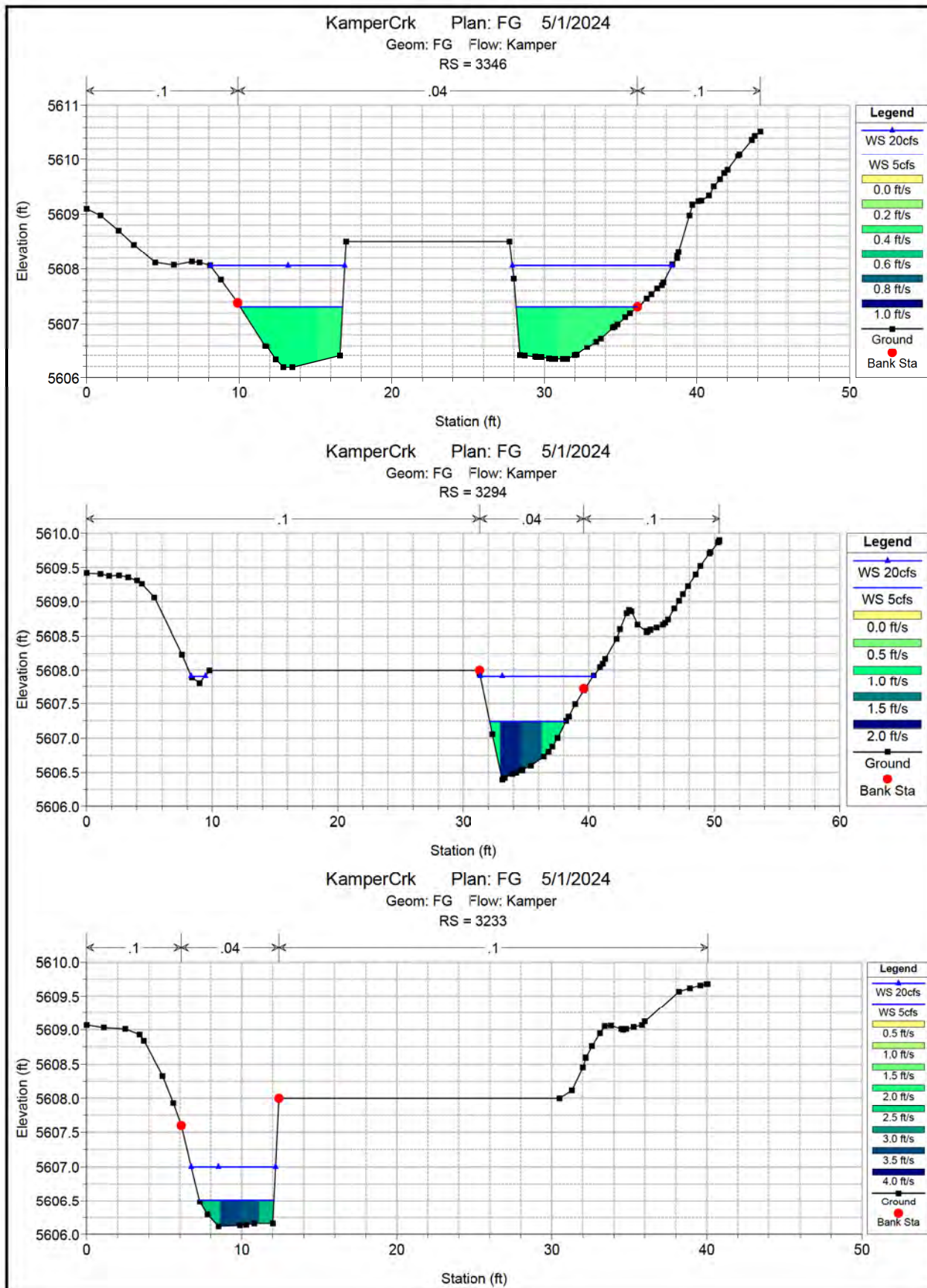
- Kamperschroer Spring Creek 2022 Hydrograph
- HEC-RAS Cross Sections, Profile, and Results Table
- Low Level Pond HEC-RAS Rating Curve
- Draft Design Drawings
- Draft Construction Cost Estimate

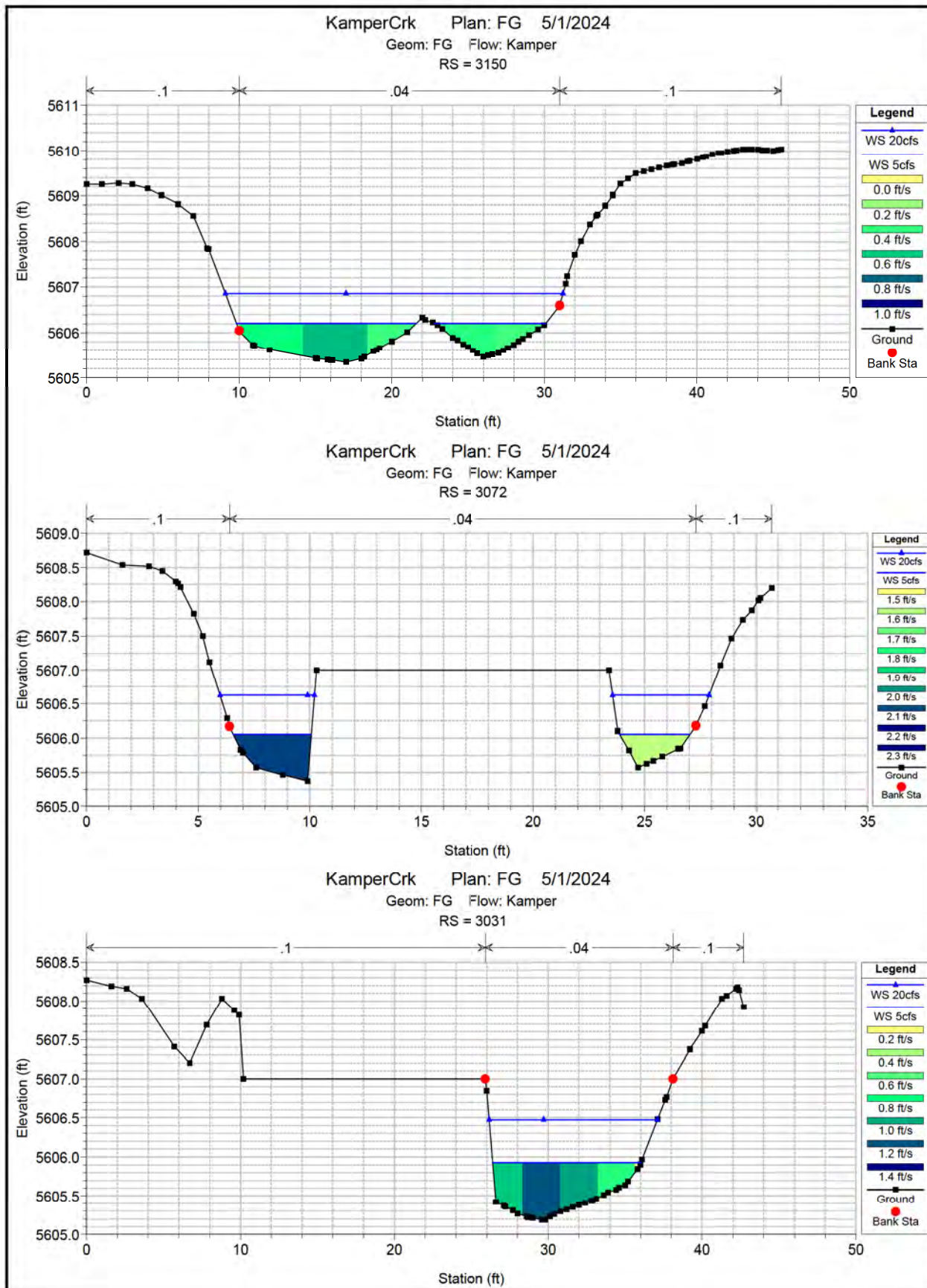




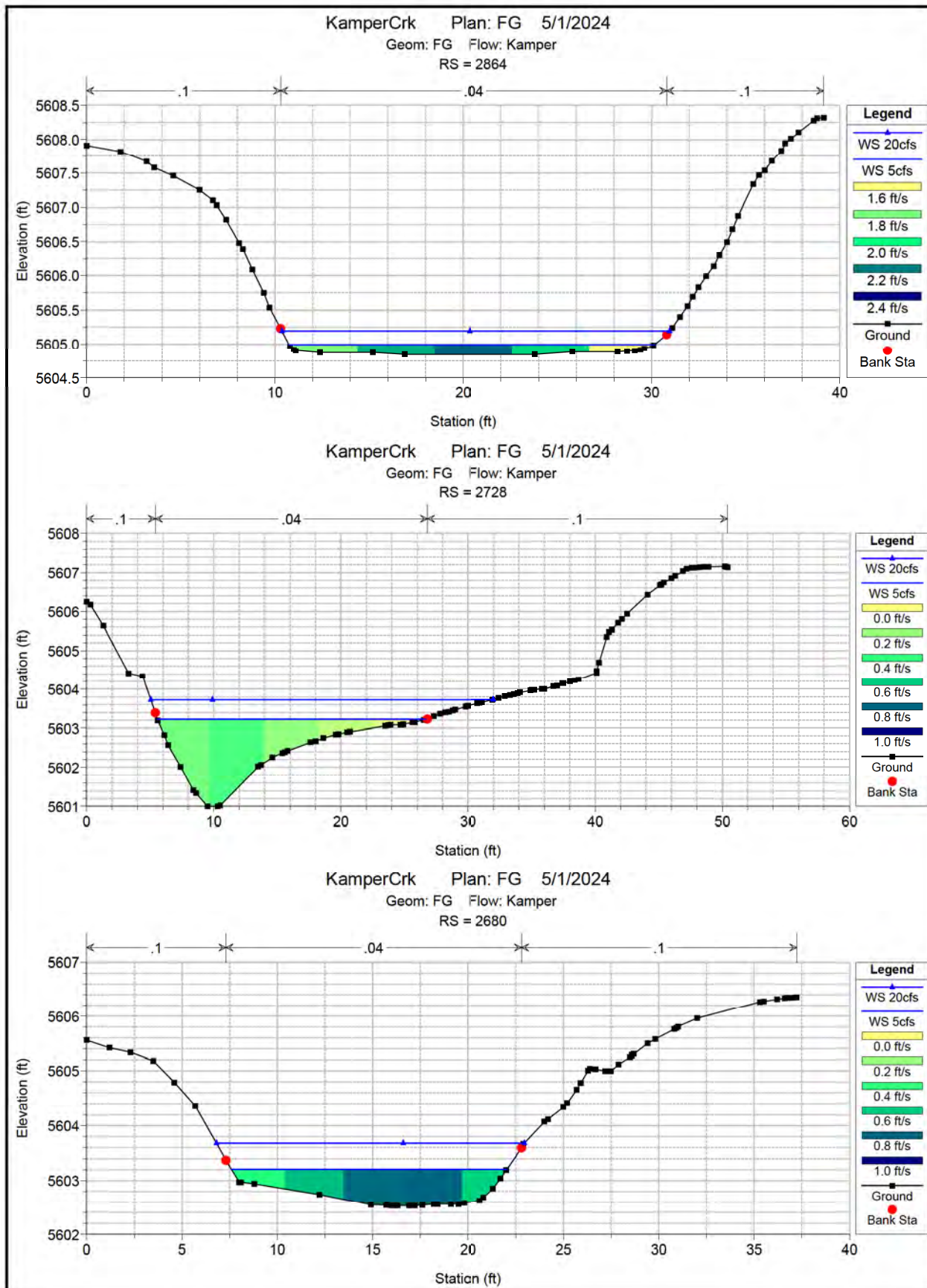


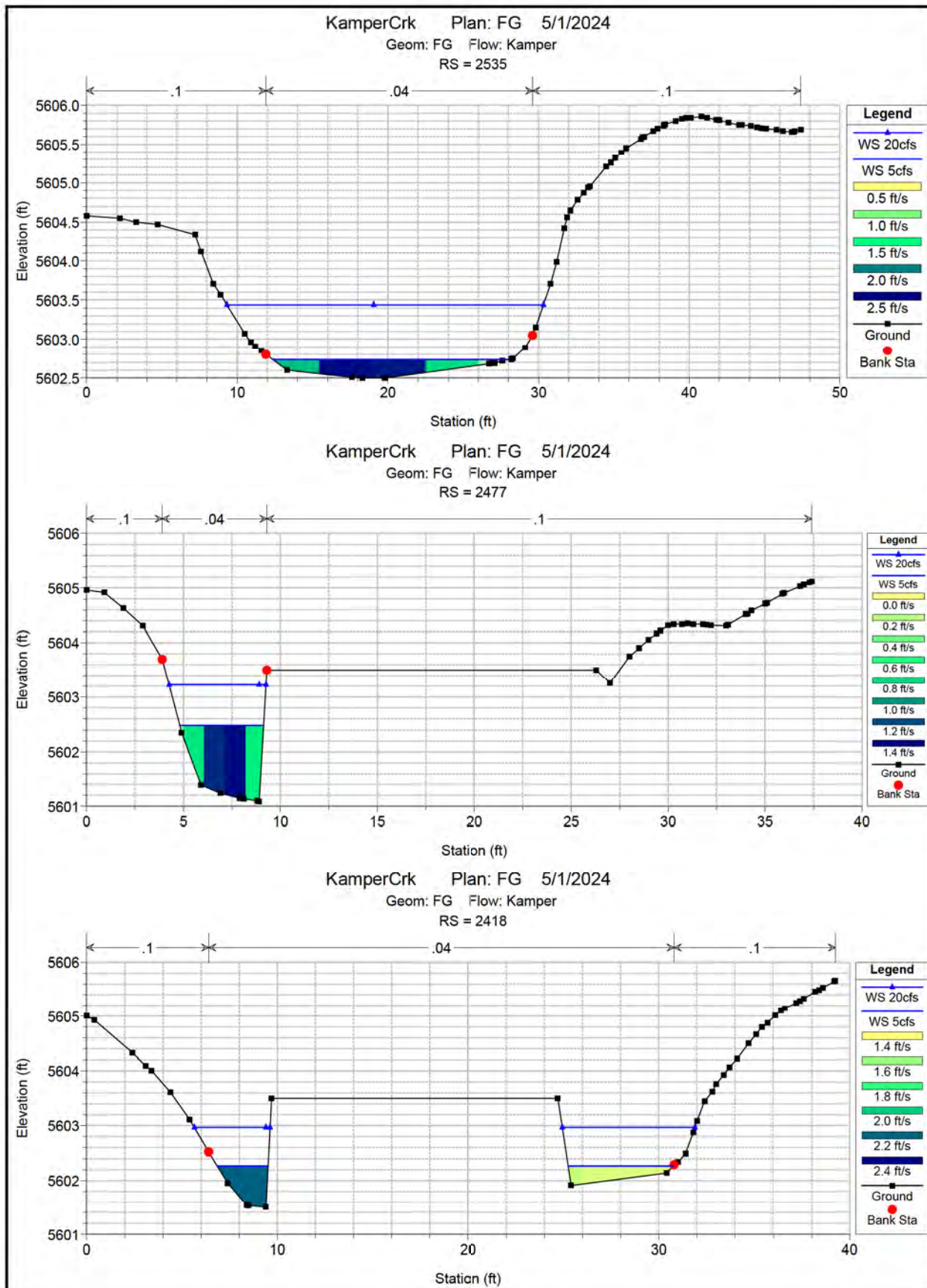




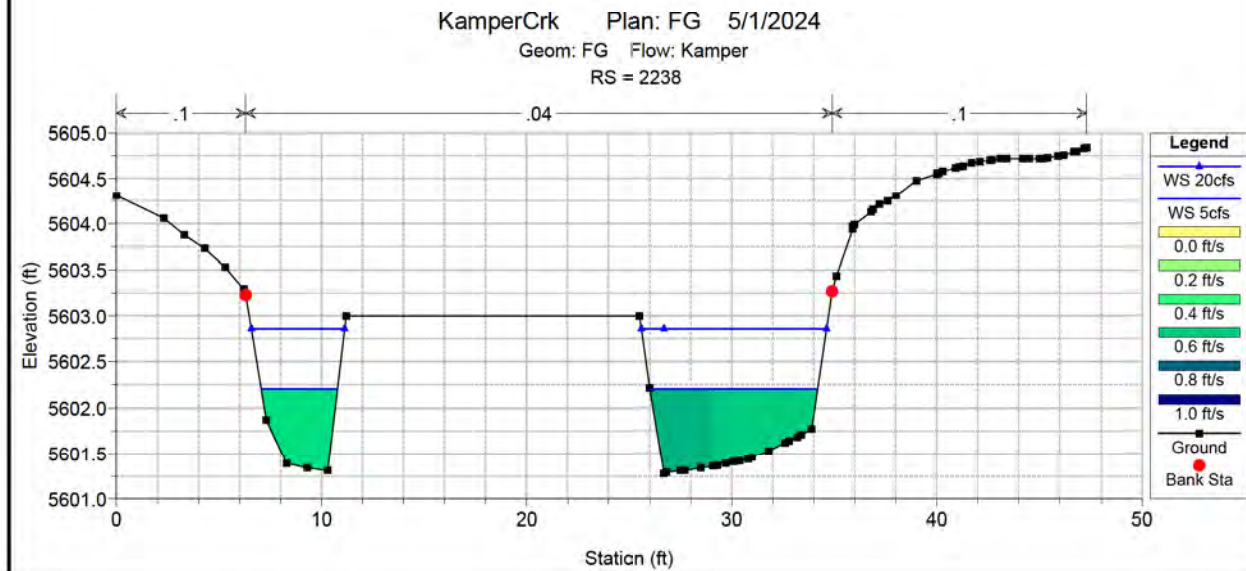
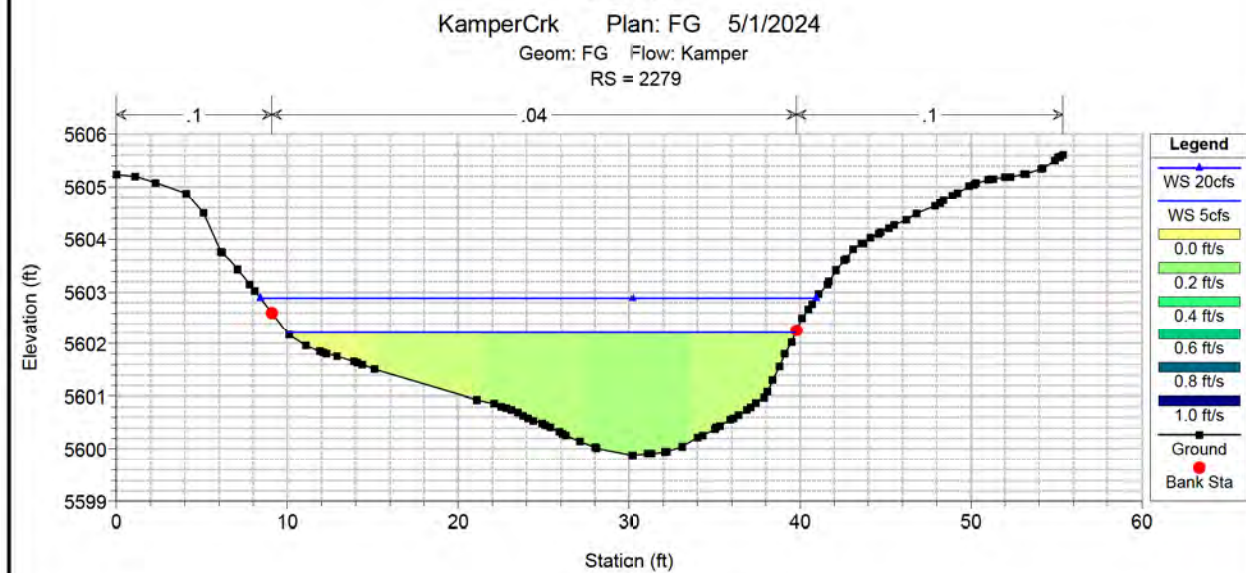
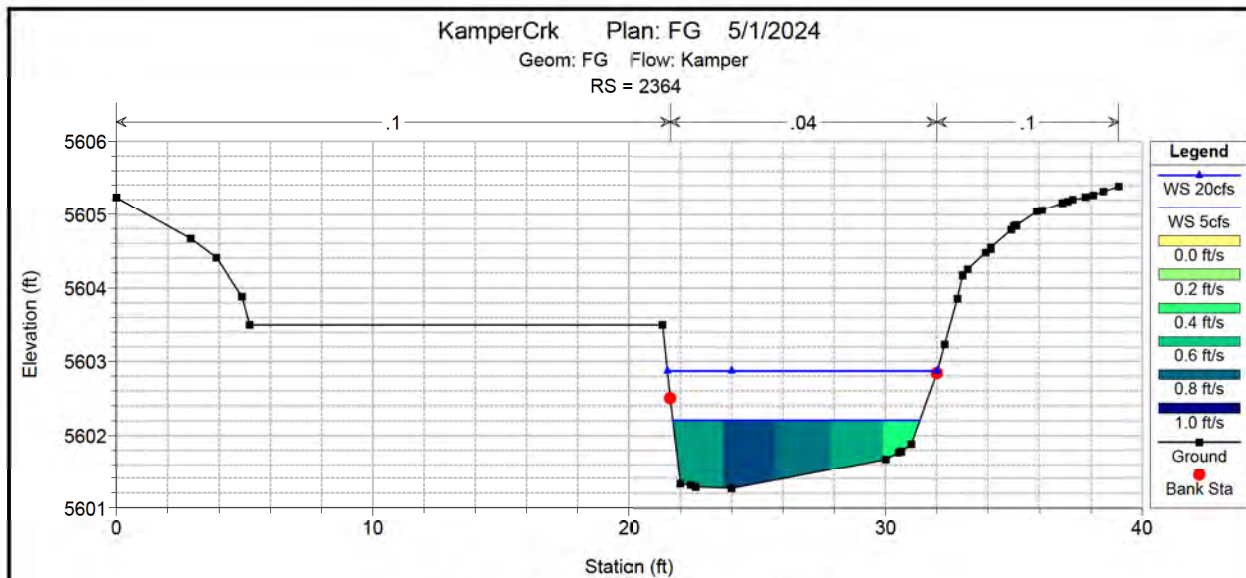


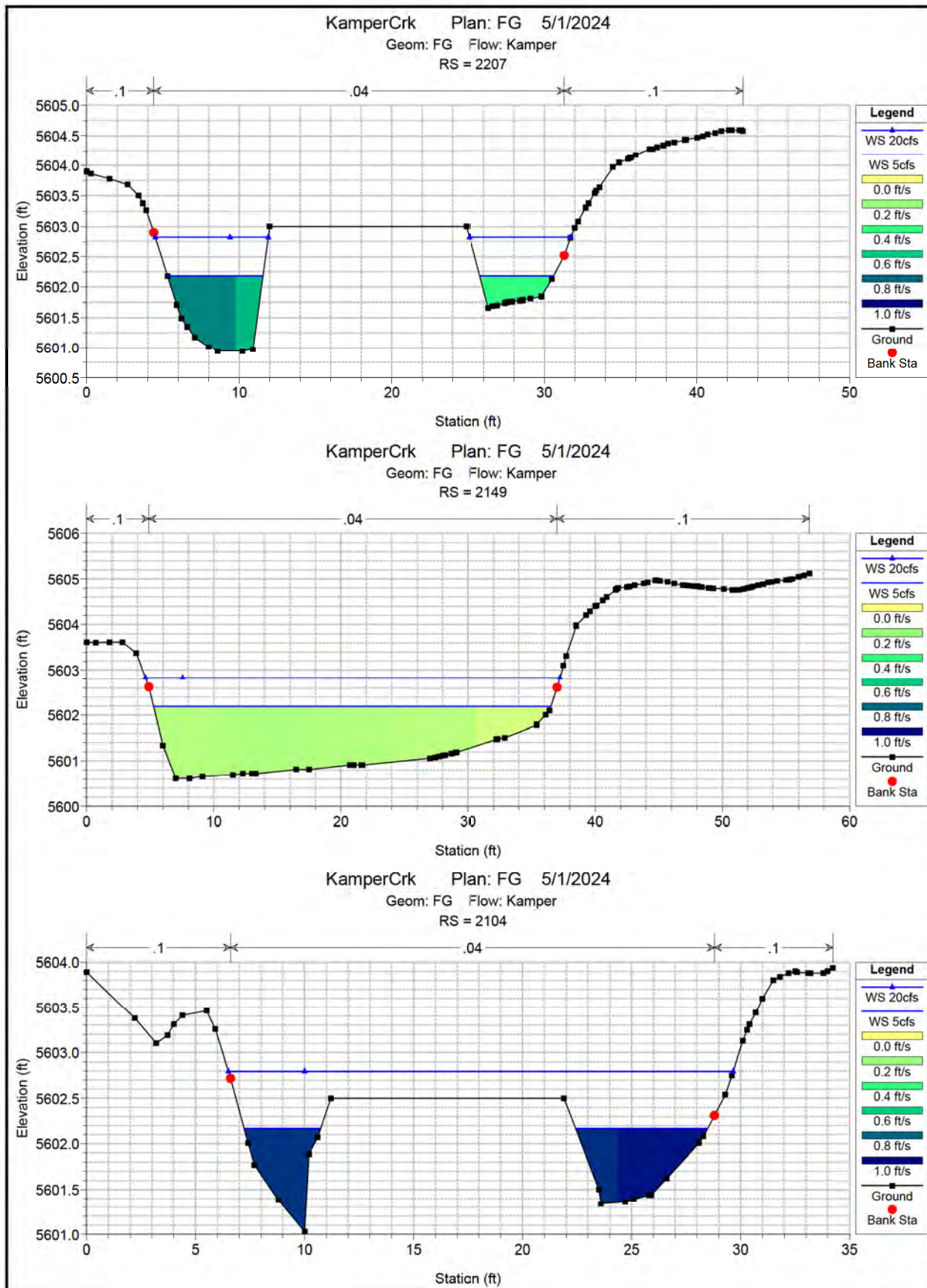




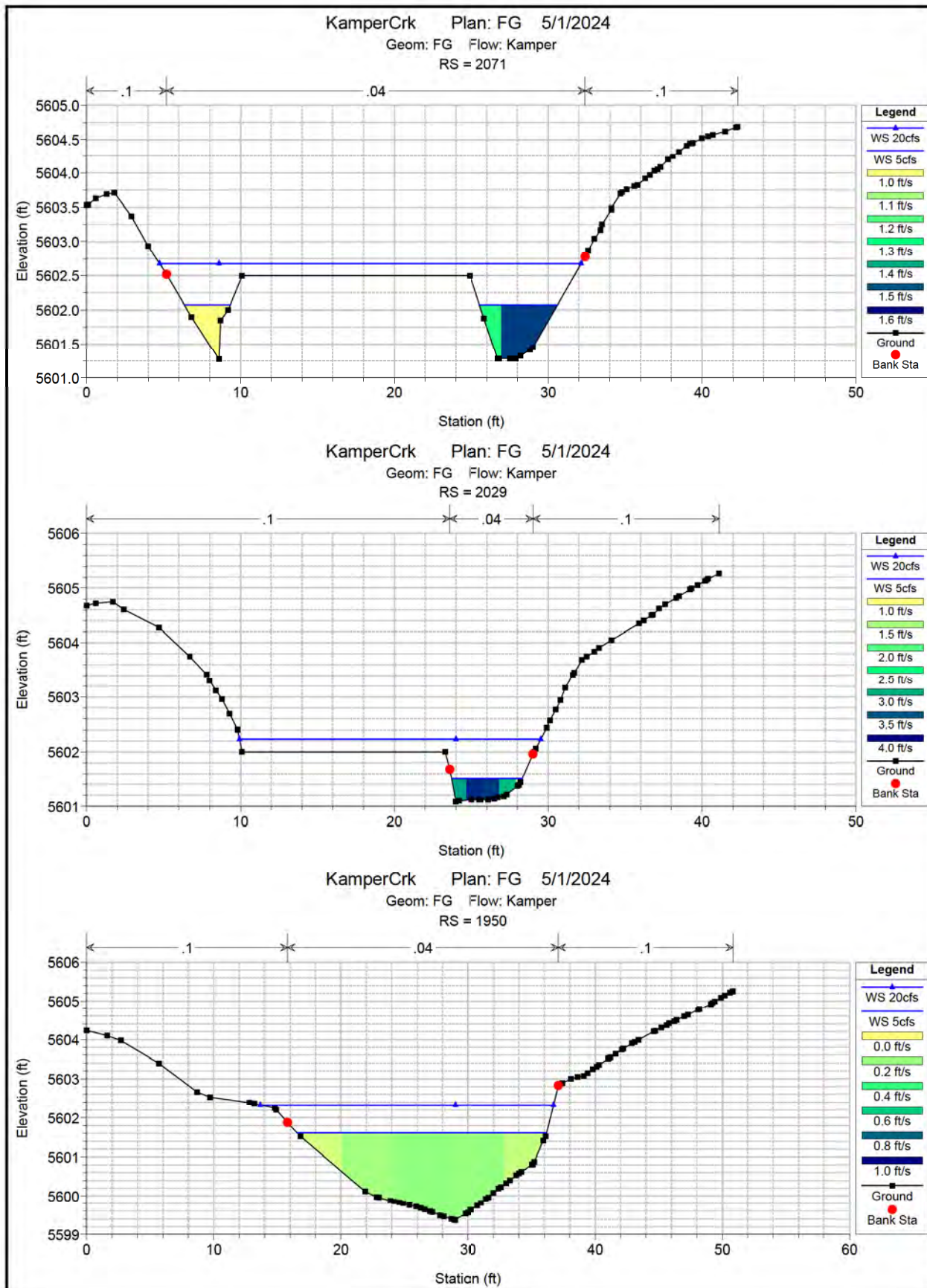


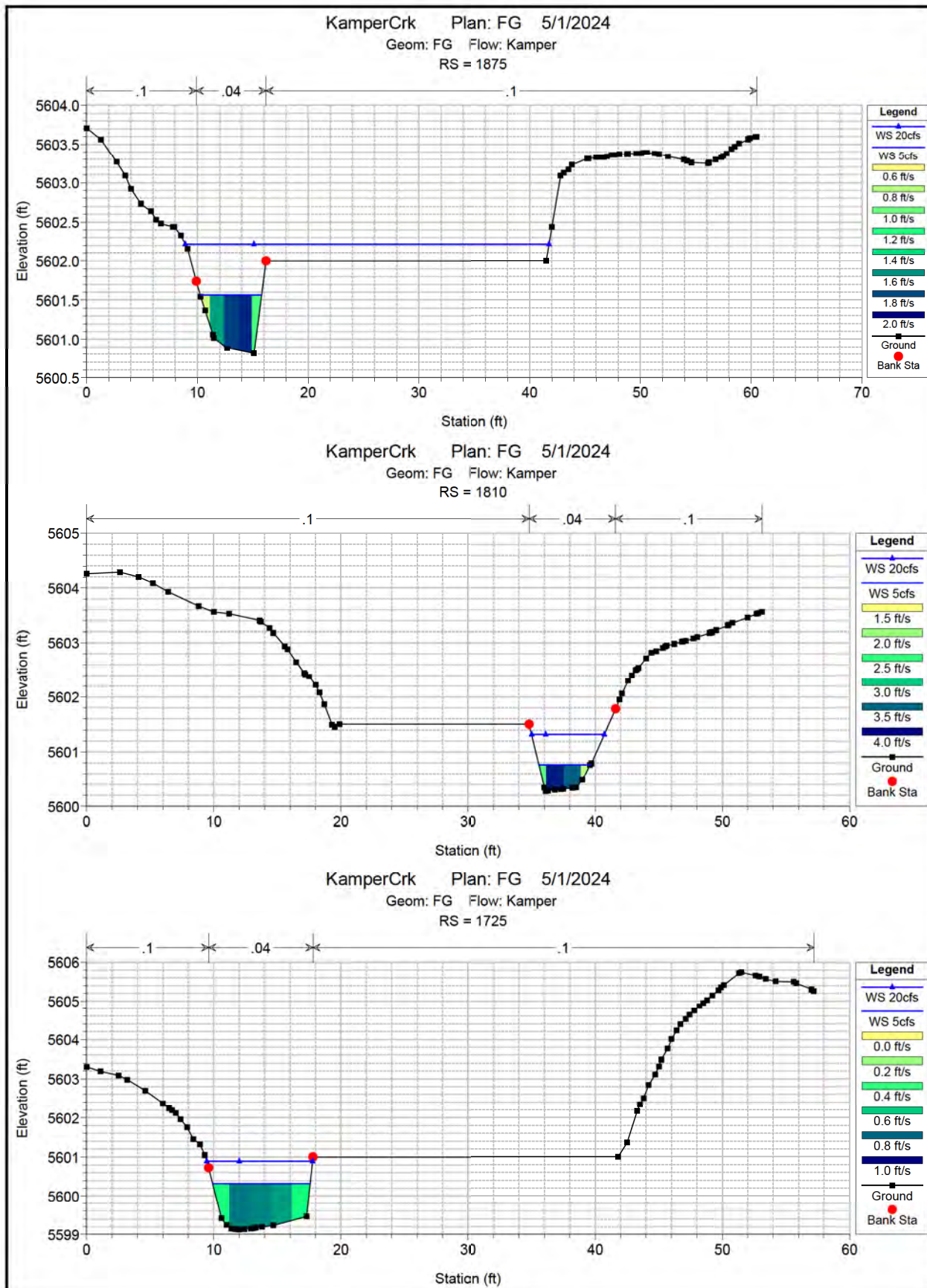




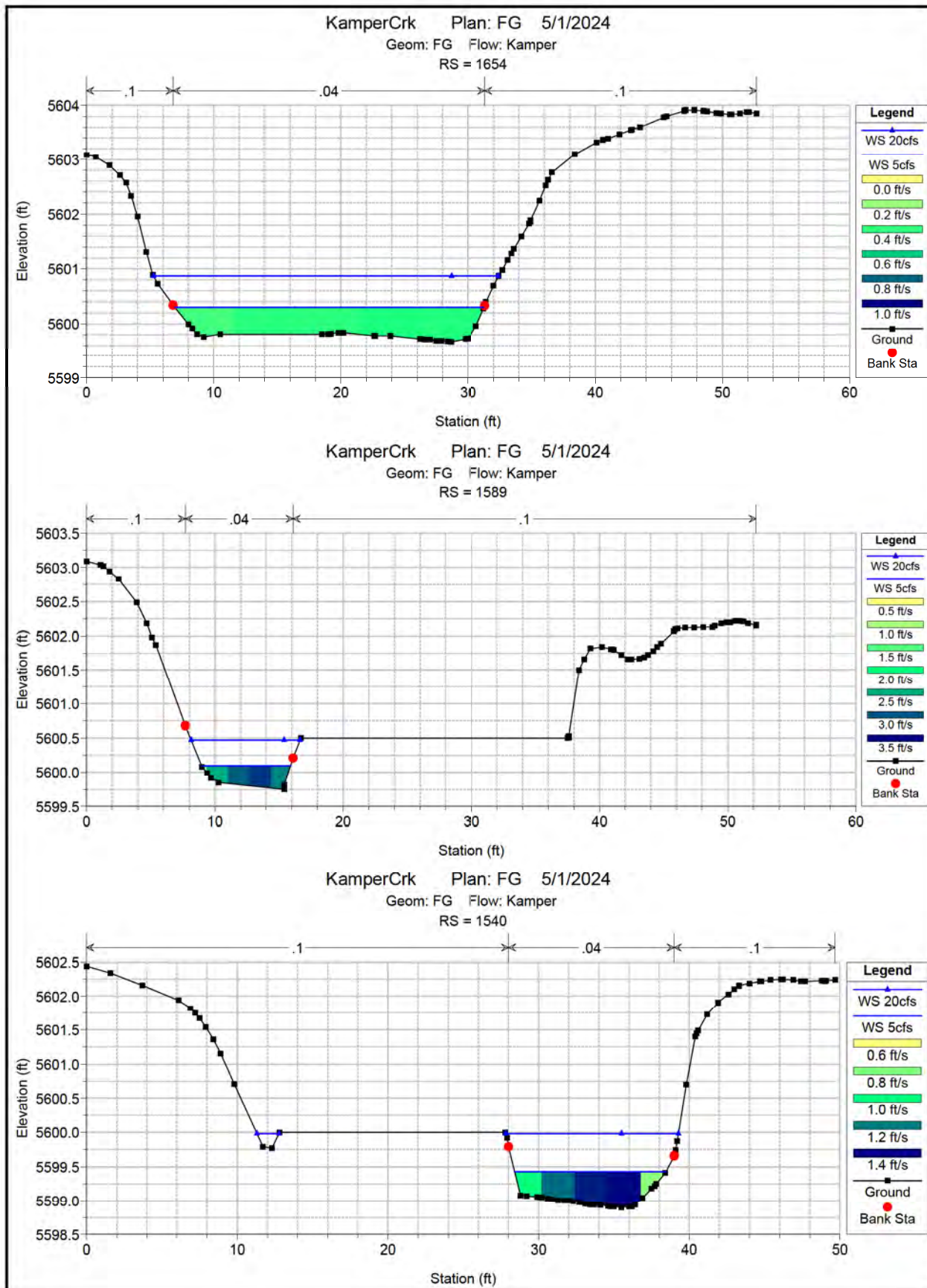


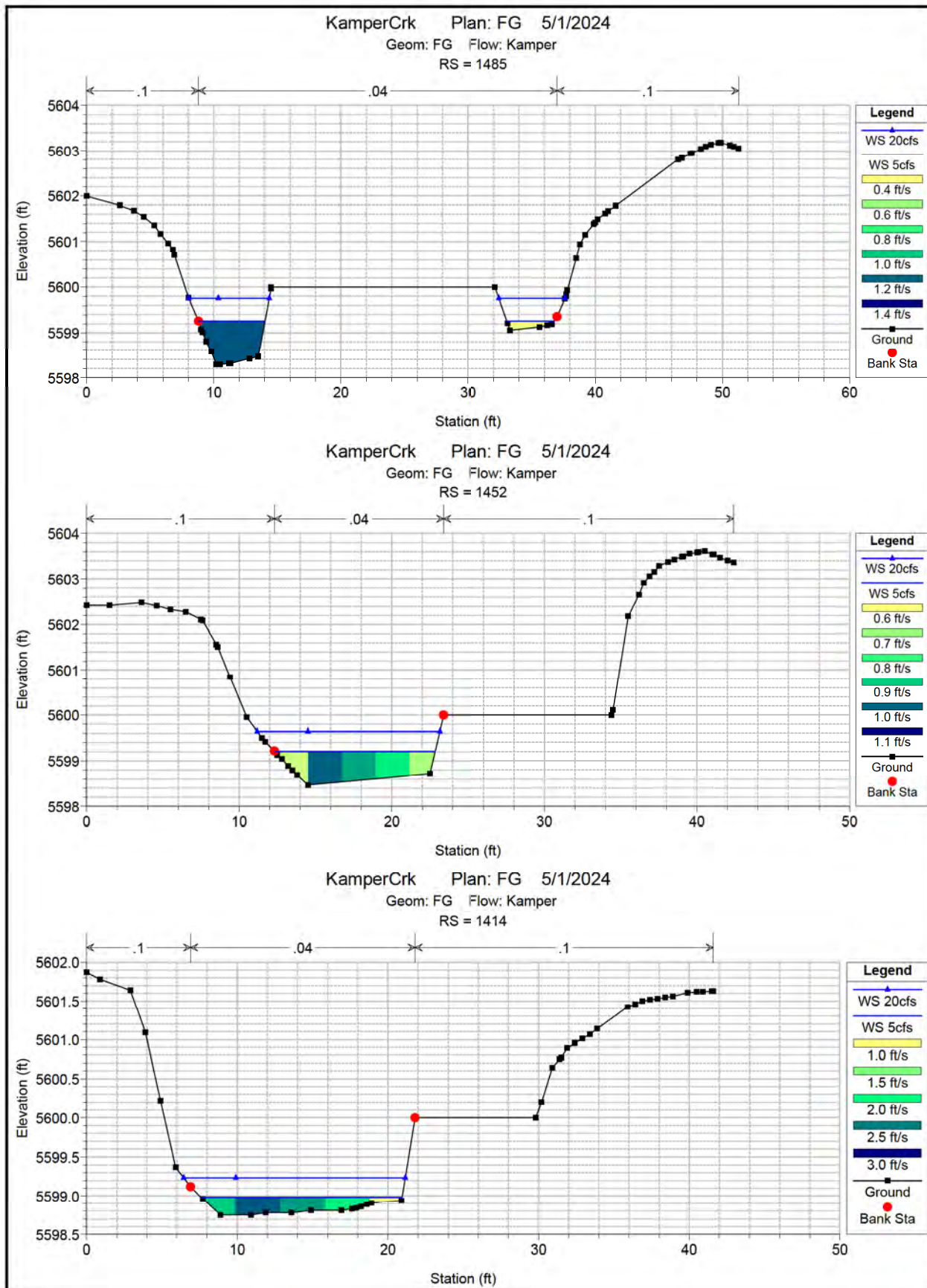




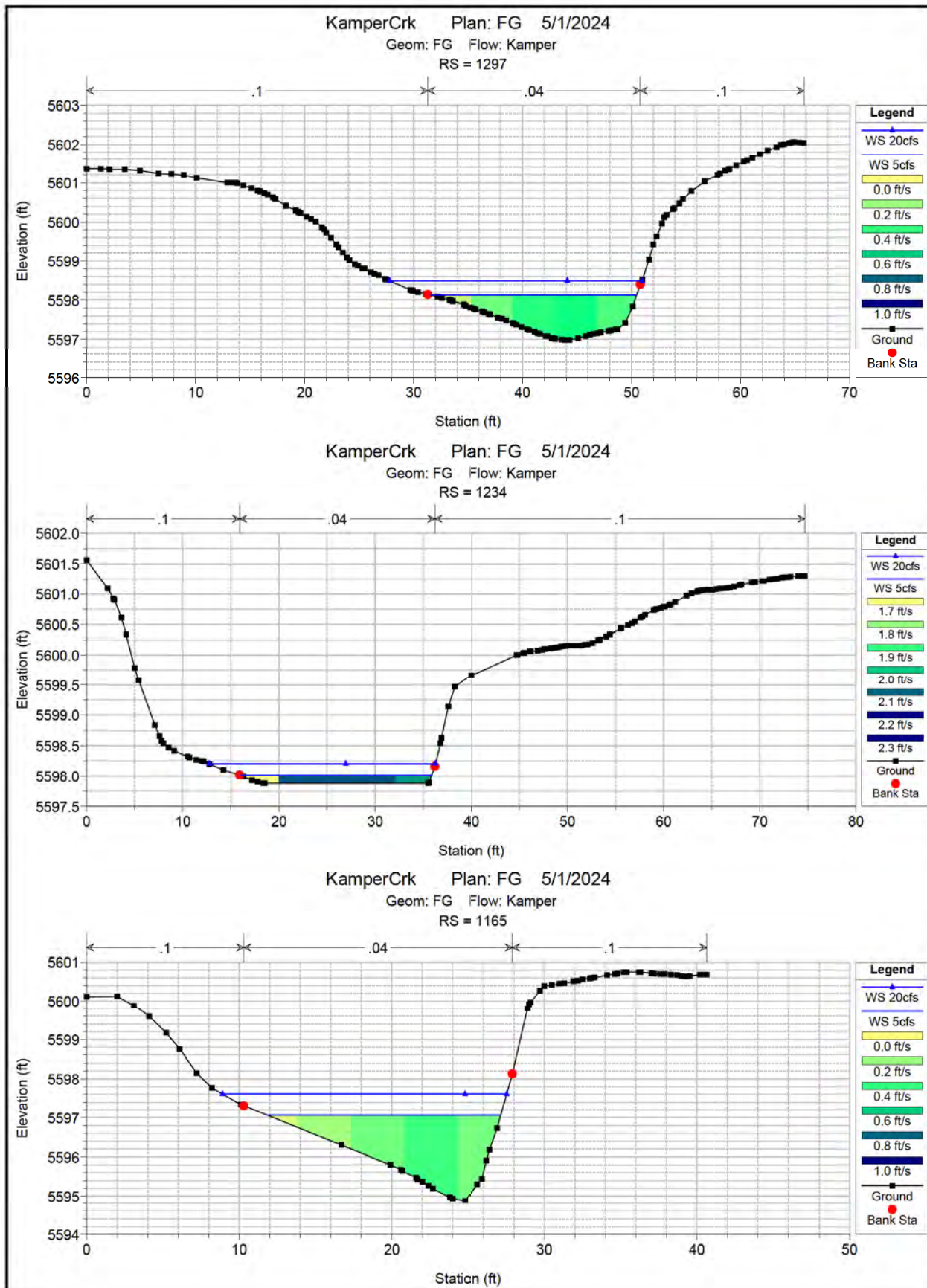


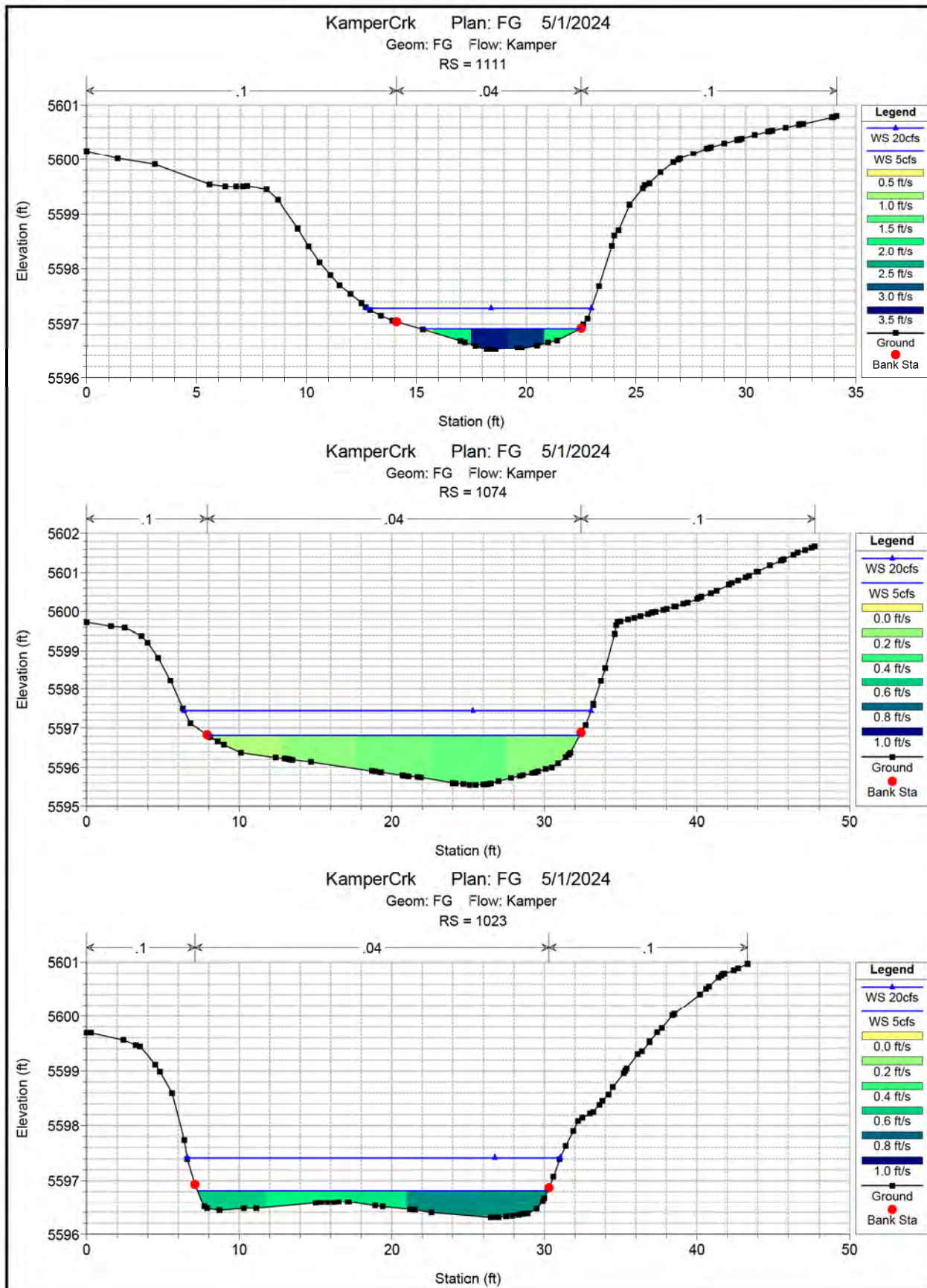




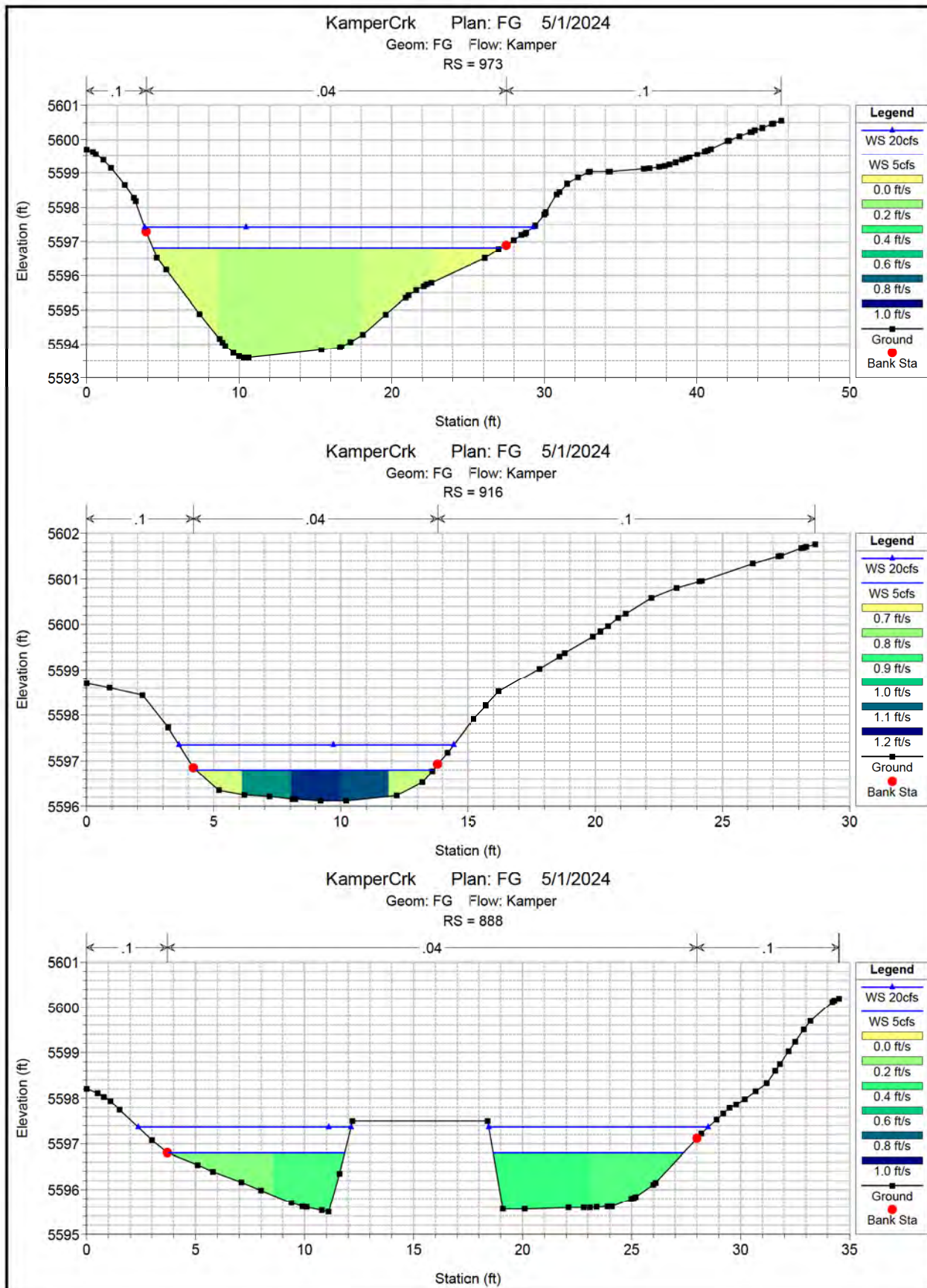


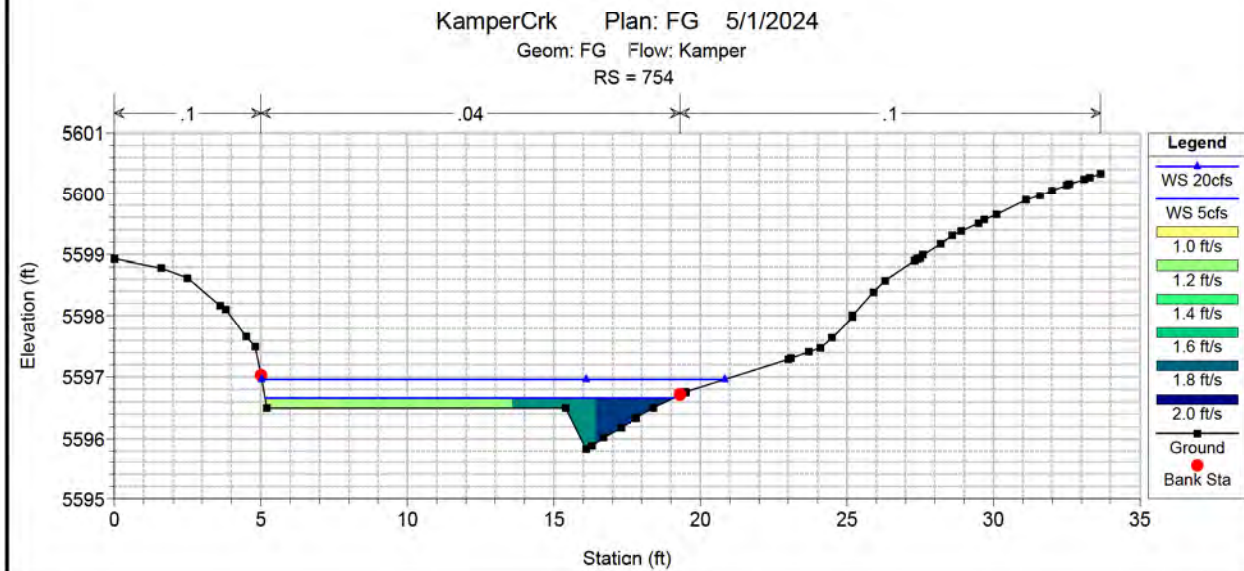
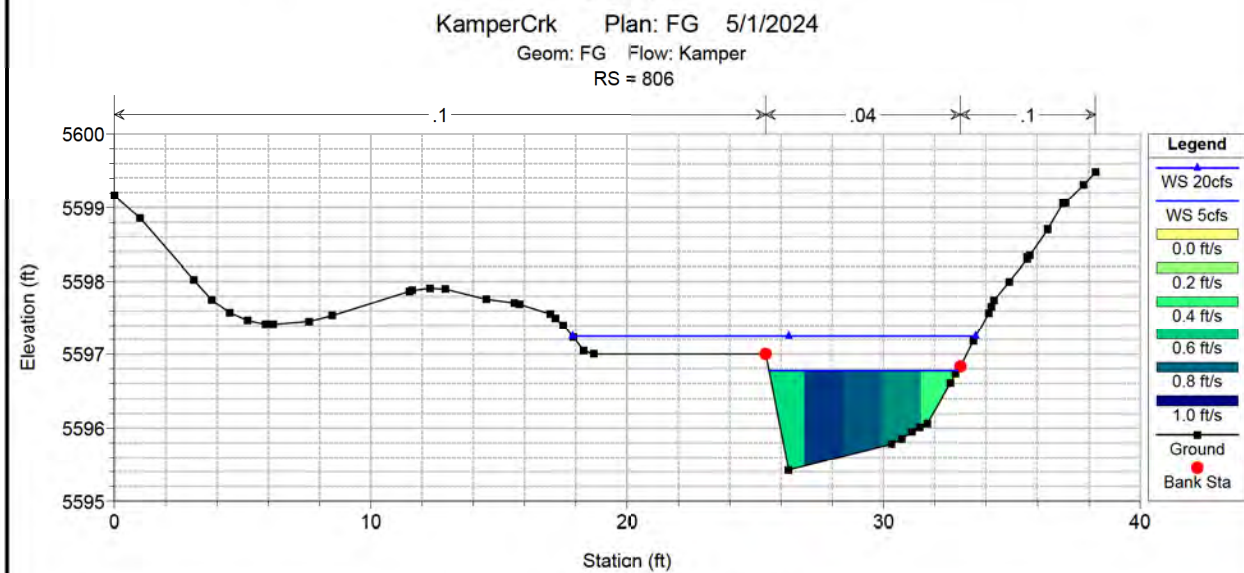
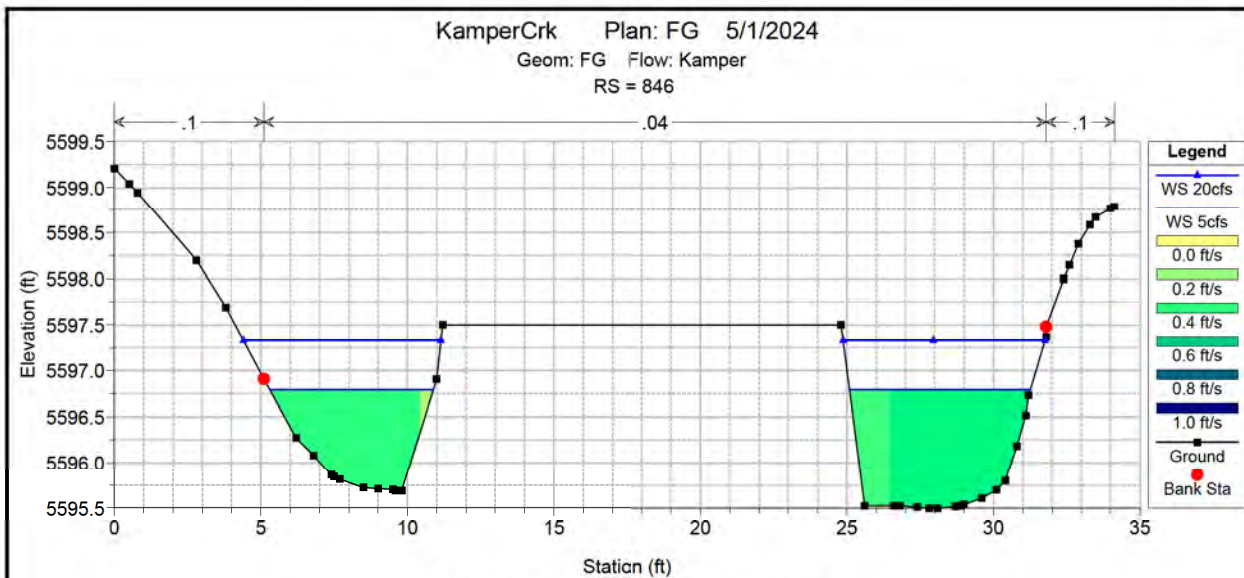




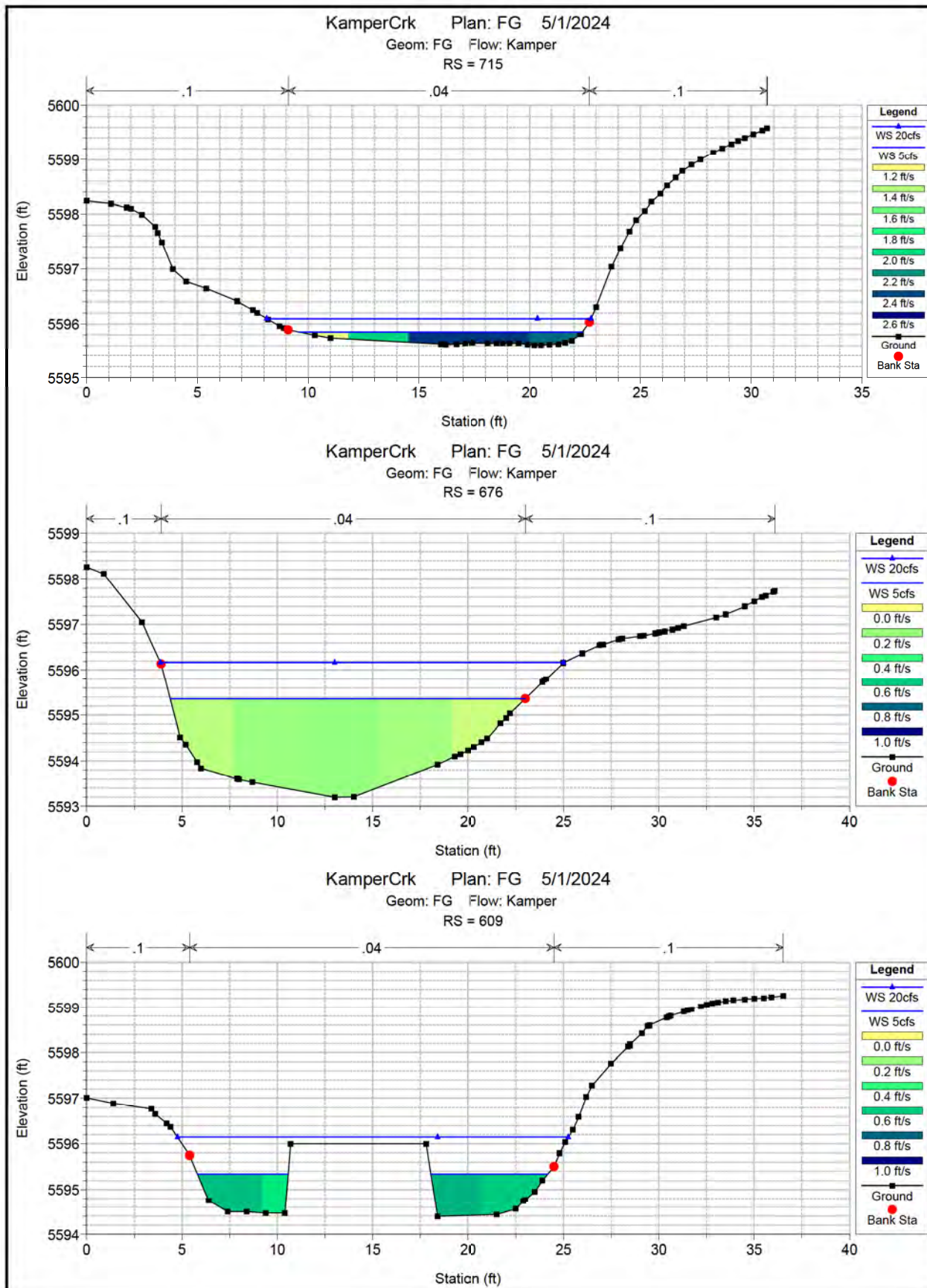


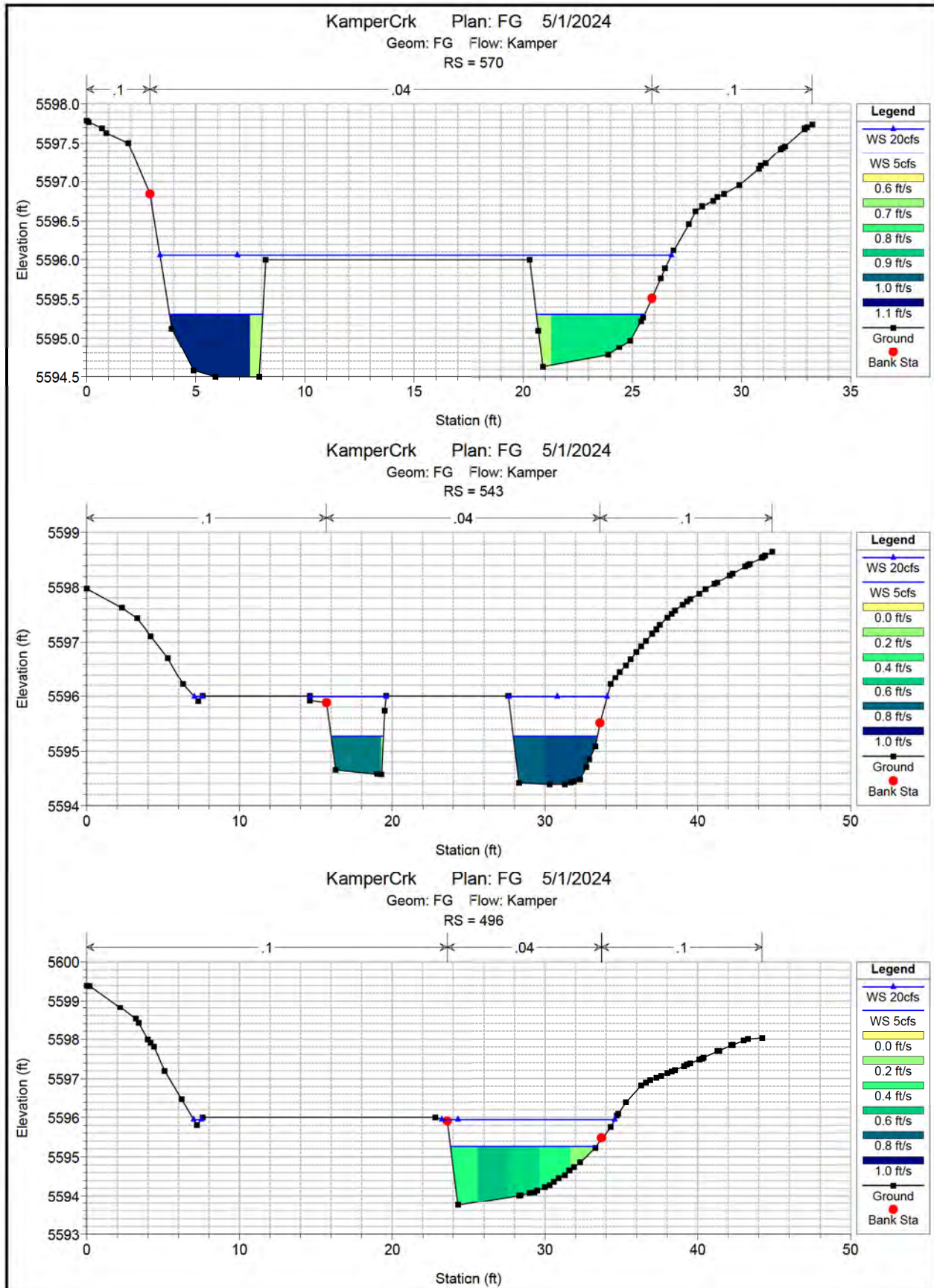




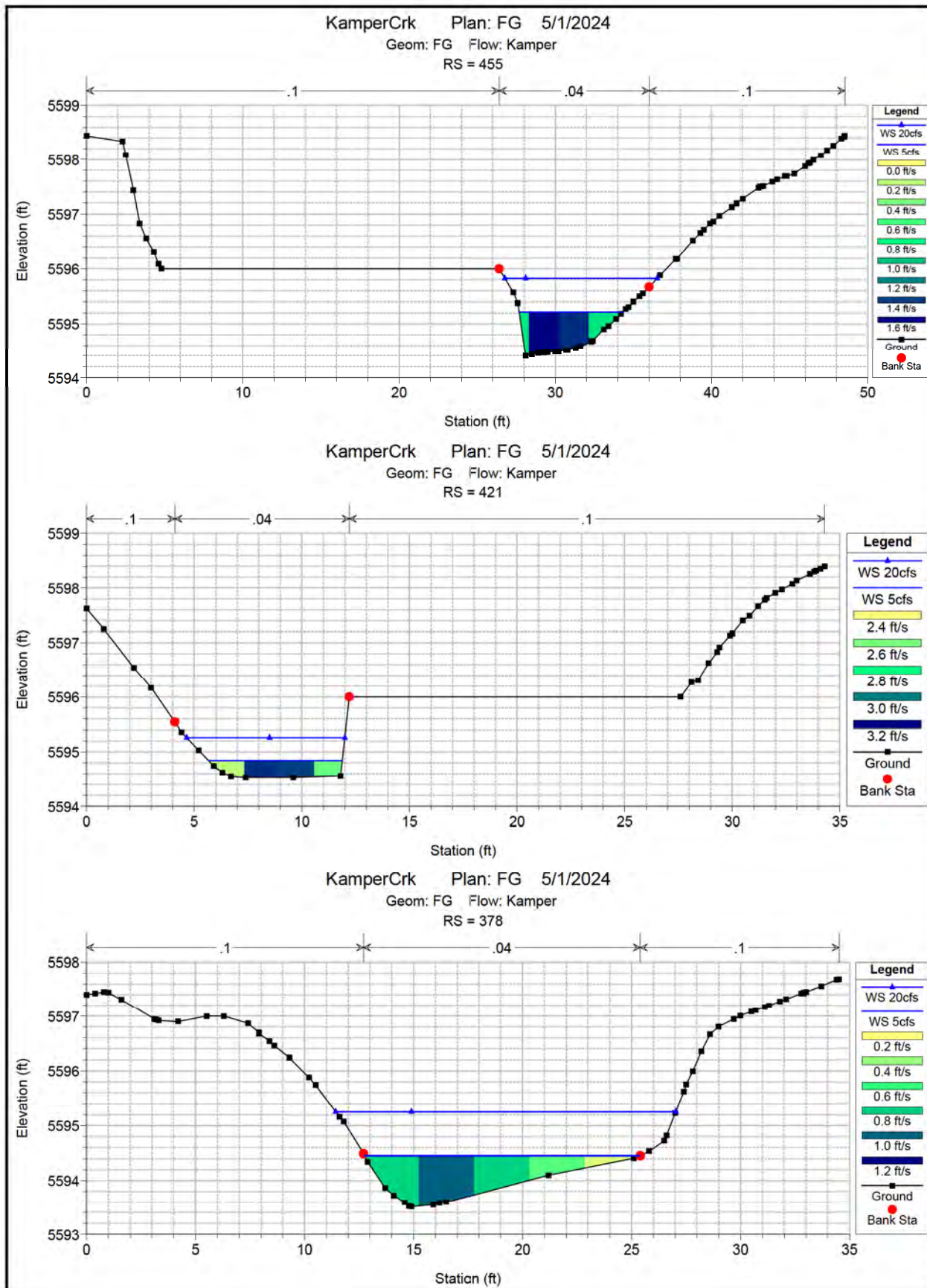


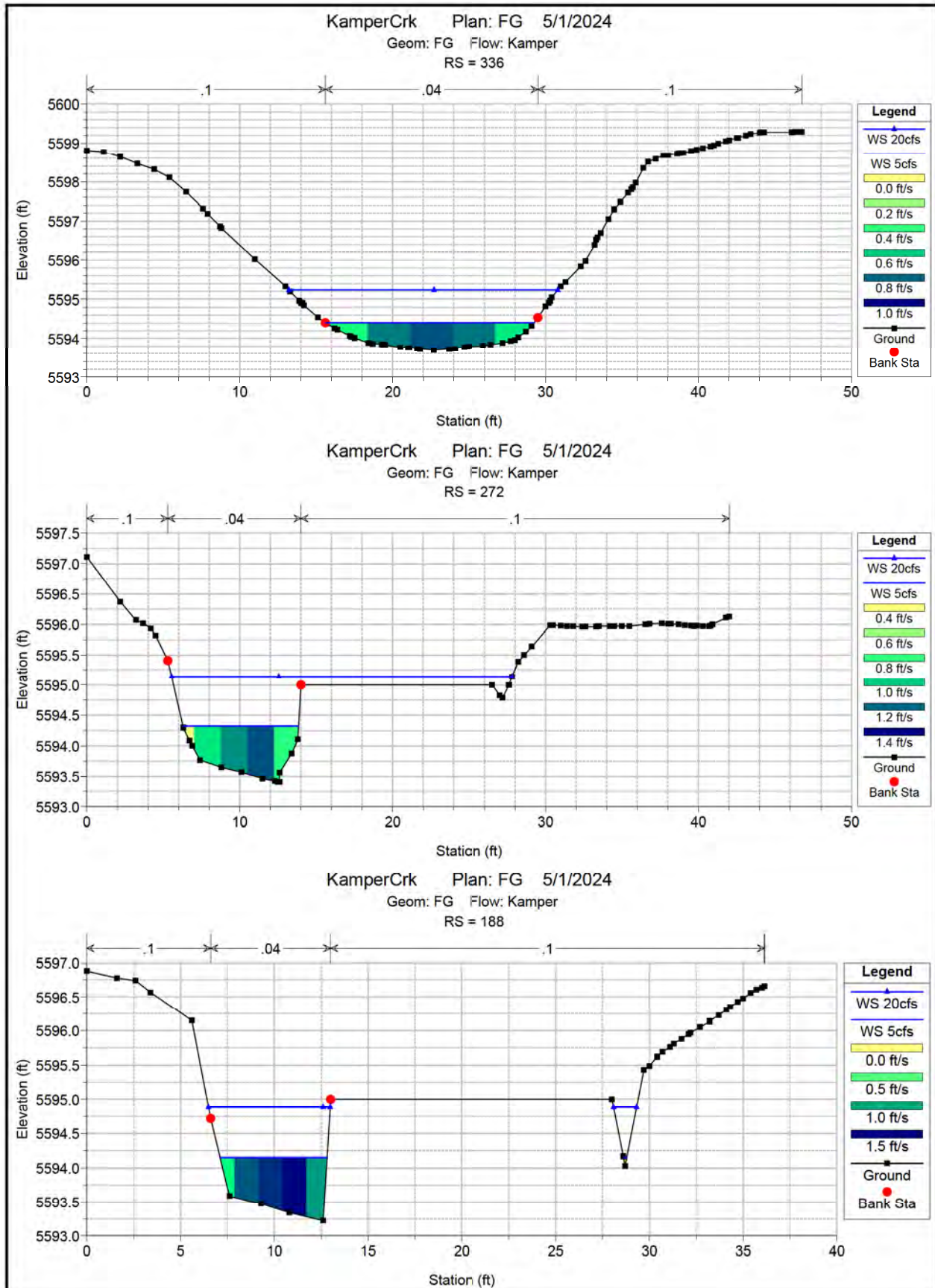




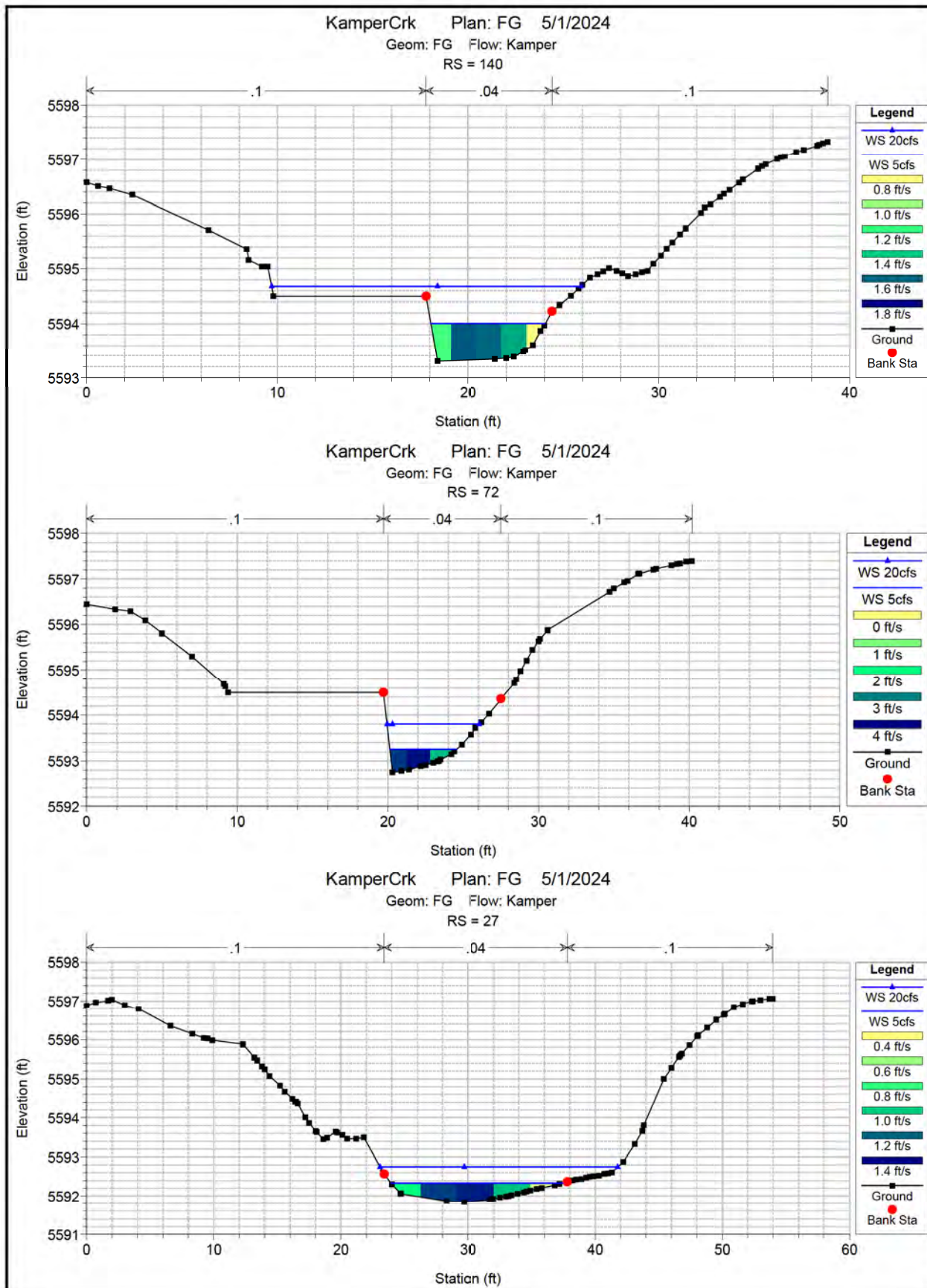




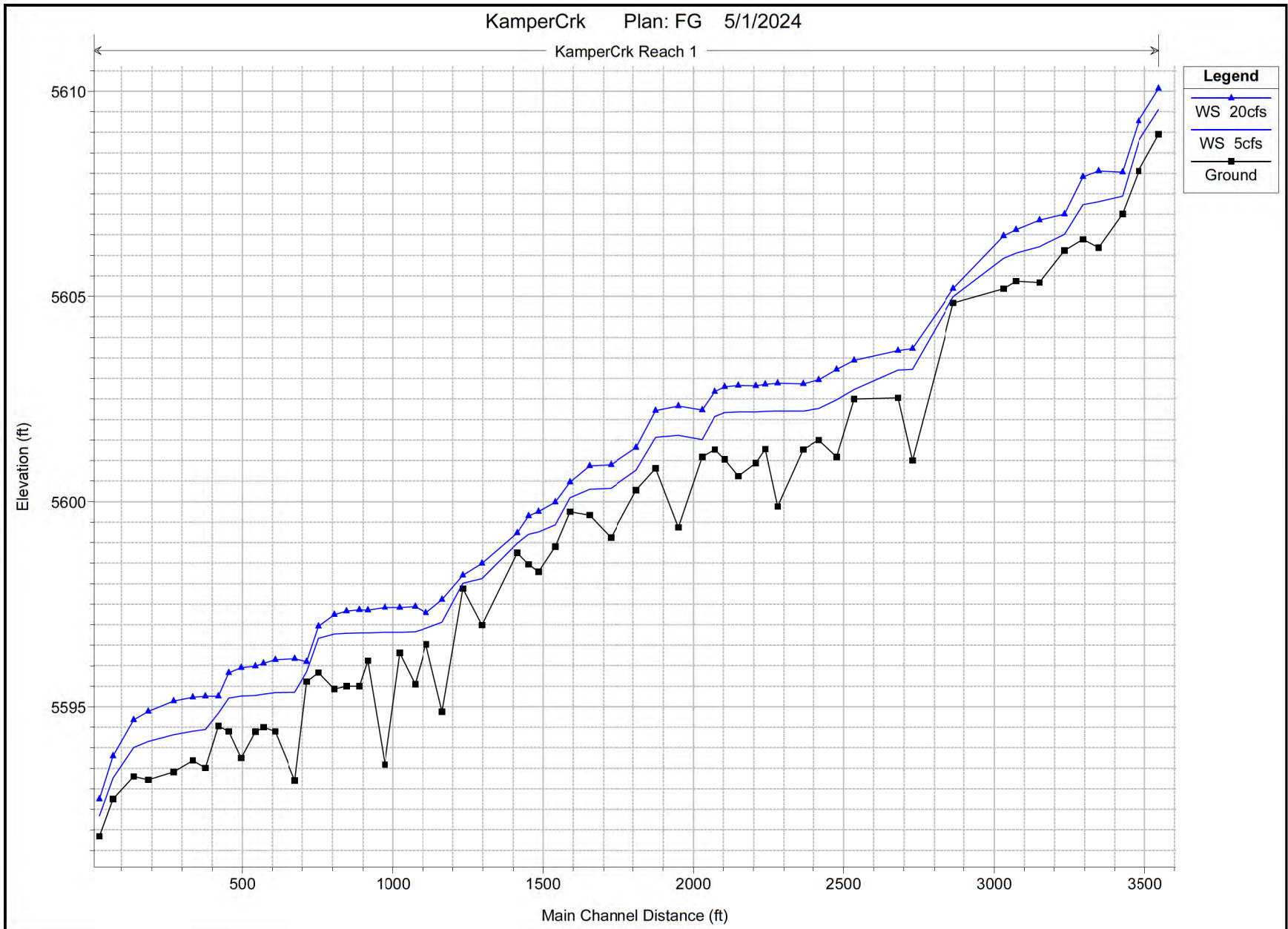












# Kamperschroer Spring Creek Spawning Enhancement

024-2024

HEC-RAS Plan: FG River: KamperCrk Reach: Reach 1 Profile: 5cfs

Reach	River Sta	Profile	Q Total (cfs)	W.S. Elev (ft)	Max Chl Dpth (ft)	E.G. Slope (ft/ft)	Frctn Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Hydr Radius C (ft)	Hydr Depth C (ft)	S'hear Chan (lb/sq ft)	Shear Total (lb/sq ft)	Power Chan (lb/ft s)	Q Channel (cfs)	Froude # Chl
Reach 1	3547	5cfs	5.00	5609.55	0.60	0.007243	0.010442	1.68	2.98	7.57	0.39	0.39	0.17	0.17	0.25	5.00	0.47
Reach 1	3480	5cfs	5.00	5608.79	0.73	0.016343	0.023833	2.69	1.86	3.70	0.43	0.50	0.44	0.44	1.17	5.00	0.67
Reach 1	3425	5cfs	5.00	5607.44	0.43	0.037957	0.000859	3.02	1.65	5.79	0.27	0.29	0.64	0.64	1.93	5.00	1.00
Reach 1	3346	5cfs	5.00	5607.31	1.12	0.00251	0.000659	0.45	11.06	14.66	0.67	0.75	0.01	0.01	0.00	5.00	0.09
Reach 1	3294	5cfs	5.00	5607.24	0.85	0.004541	0.009795	1.56	3.20	6.06	0.49	0.53	0.14	0.14	0.22	5.00	0.38
Reach 1	3233	5cfs	5.00	5606.51	0.39	0.034686	0.001388	3.15	1.59	4.81	0.31	0.33	0.67	0.67	2.10	5.00	0.97
Reach 1	3150	5cfs	5.00	5606.21	0.87	0.000428	0.001199	0.50	10.05	19.10	0.52	0.53	0.01	0.01	0.01	5.00	0.12
Reach 1	3072	5cfs	5.00	5606.06	0.69	0.011188	0.003813	1.93	2.59	6.65	0.34	0.39	0.24	0.24	0.46	5.00	0.55
Reach 1	3031	5cfs	5.00	5605.93	0.74	0.001901	0.005259	1.01	4.95	9.64	0.49	0.51	0.06	0.06	0.06	5.00	0.25
Reach 1	2864	5cfs	5.00	5604.99	0.15	0.046388	0.000266	2.02	2.47	19.41	0.13	0.13	0.37	0.37	0.75	5.00	1.00
Reach 1	2728	5cfs	5.00	5603.22	2.22	0.000072	0.000175	0.28	18.07	21.12	0.82	0.86	0.00	0.00	0.00	5.00	0.05
Reach 1	2680	5cfs	5.00	5603.21	0.68	0.000905	0.002745	0.70	7.19	14.45	0.49	0.50	0.03	0.03	0.02	5.00	0.17
Reach 1	2535	5cfs	5.00	5602.73	0.23	0.041043	0.003569	2.13	2.35	15.59	0.15	0.15	0.39	0.39	0.82	5.00	0.97
Reach 1	2477	5cfs	5.00	5602.48	1.39	0.001228	0.002881	1.09	4.58	4.33	0.77	1.06	0.06	0.06	0.06	5.00	0.19
Reach 1	2418	5cfs	5.00	5602.27	0.77	0.013138	0.001795	1.86	2.68	8.18	0.29	0.33	0.24	0.24	0.44	5.00	0.57
Reach 1	2384	5cfs	5.00	5602.20	0.93	0.000675	0.000024	0.73	6.85	9.64	0.66	0.71	0.03	0.03	0.02	5.00	0.15
Reach 1	2279	5cfs	5.00	5602.21	2.33	0.000007	0.000024	0.12	40.60	29.72	1.34	1.37	0.00	0.00	0.00	5.00	0.02
Reach 1	2238	5cfs	5.00	5602.20	0.92	0.000507	0.000530	0.61	8.26	11.90	0.62	0.69	0.02	0.02	0.01	5.00	0.13
Reach 1	2207	5cfs	5.00	5602.18	1.24	0.000555	0.000037	0.64	7.80	11.12	0.63	0.70	0.02	0.02	0.01	5.00	0.13
Reach 1	2149	5cfs	5.00	5602.19	1.57	0.000012	0.000041	0.14	35.82	31.23	1.12	1.15	0.00	0.00	0.00	5.00	0.02
Reach 1	2104	5cfs	5.00	5602.17	1.14	0.001601	0.002445	0.93	5.40	9.58	0.49	0.56	0.05	0.05	0.05	5.00	0.22
Reach 1	2071	5cfs	5.00	5602.07	0.80	0.004186	0.009519	1.33	3.75	8.05	0.41	0.47	0.11	0.11	0.14	5.00	0.34
Reach 1	2029	5cfs	5.00	5601.51	0.42	0.039323	0.000665	3.35	1.49	4.59	0.31	0.33	0.75	0.75	2.52	5.00	1.04
Reach 1	1950	5cfs	5.00	5601.62	2.24	0.000017	0.000060	0.18	27.09	19.62	1.33	1.38	0.00	0.00	0.00	5.00	0.03
Reach 1	1875	5cfs	5.00	5601.57	0.76	0.004679	0.010052	1.63	3.07	5.55	0.51	0.55	0.15	0.15	0.24	5.00	0.39
Reach 1	1810	5cfs	5.00	5600.77	0.48	0.035210	0.001226	3.40	1.47	4.06	0.34	0.36	0.75	0.75	2.54	5.00	0.99
Reach 1	1725	5cfs	5.00	5600.32	1.20	0.000373	0.000353	0.65	7.66	7.67	0.87	1.00	0.02	0.02	0.01	5.00	0.12
Reach 1	1654	5cfs	5.00	5600.30	0.63	0.000335	0.001118	0.42	11.91	24.31	0.49	0.49	0.01	0.01	0.00	5.00	0.11
Reach 1	1589	5cfs	5.00	5600.09	0.34	0.037783	0.008731	2.85	1.76	6.92	0.25	0.25	0.58	0.58	1.66	5.00	1.00
Reach 1	1540	5cfs	5.00	5599.43	0.53	0.003782	0.003208	1.23	4.06	10.05	0.40	0.40	0.09	0.09	0.12	5.00	0.34
Reach 1	1485	5cfs	5.00	5599.26	0.97	0.002755	0.001797	1.14	4.38	8.95	0.45	0.49	0.08	0.08	0.09	5.00	0.29
Reach 1	1452	5cfs	5.00	5599.20	0.73	0.001263	0.003680	0.87	5.78	10.50	0.53	0.55	0.04	0.04	0.04	5.00	0.21
Reach 1	1414	5cfs	5.00	5598.99	0.23	0.042764	0.000671	2.29	2.18	13.36	0.16	0.16	0.43	0.43	1.00	5.00	1.00
Reach 1	1297	5cfs	5.00	5598.12	1.13	0.000191	0.000677	0.39	12.78	18.89	0.67	0.68	0.01	0.01	0.00	5.00	0.08
Reach 1	1234	5cfs	5.00	5598.01	0.13	0.049337	0.000234	2.04	2.45	19.85	0.12	0.12	0.38	0.38	0.77	5.00	1.03
Reach 1	1165	5cfs	5.00	5597.06	2.18	0.000063	0.000232	0.30	16.76	15.26	1.02	1.10	0.00	0.00	0.00	5.00	0.05
Reach 1	1111	5cfs	5.00	5596.91	0.39	0.039258	0.000215	2.84	1.76	7.27	0.24	0.24	0.59	0.59	1.67	5.00	1.02
Reach 1	1074	5cfs	5.00	5596.83	1.28	0.000058	0.000157	0.25	20.22	24.37	0.82	0.83	0.00	0.00	0.00	5.00	0.05
Reach 1	1023	5cfs	5.00	5596.81	0.50	0.001252	0.000014	0.64	7.83	22.94	0.34	0.34	0.03	0.03	0.02	5.00	0.19
Reach 1	973	5cfs	5.00	5596.82	3.23	0.000004	0.000015	0.11	44.64	22.86	1.85	1.95	0.00	0.00	0.00	5.00	0.01
Reach 1	916	5cfs	5.00	5596.80	0.68	0.001812	0.000317	1.02	4.92	9.33	0.51	0.53	0.06	0.06	0.06	5.00	0.25
Reach 1	888	5cfs	5.00	5596.80	1.30	0.000127	0.000159	0.35	14.32	16.80	0.76	0.85	0.01	0.01	0.00	5.00	0.07
Reach 1	846	5cfs	5.00	5596.79	1.29	0.000206	0.000309	0.46	10.94	11.75	0.79	0.93	0.01	0.01	0.00	5.00	0.08
Reach 1	806	5cfs	5.00	5596.77	1.34	0.000517	0.001424	0.74	6.80	7.36	0.81	0.92	0.03	0.03	0.02	5.00	0.13
Reach 1	754	5cfs	5.00	5596.67	0.84	0.012348	0.019975	1.53	3.27	13.94	0.23	0.23	0.17	0.17	0.27	5.00	0.56
Reach 1	715	5cfs	5.00	5595.85	0.24	0.037676	0.000052	2.24	2.23	12.80	0.17	0.17	0.41	0.41	0.92	5.00	0.95
Reach 1	676	5cfs	5.00	5595.35	2.15	0.000014	0.000040	0.18	28.48	18.60	1.45	1.53	0.00	0.00	0.00	5.00	0.03
Reach 1	609	5cfs	5.00	5595.35	0.95	0.000496	0.000816	0.61	8.15	10.90	0.64	0.75	0.02	0.02	0.01	5.00	0.13
Reach 1	570	5cfs	5.00	5595.31	0.81	0.001588	0.001210	0.93	5.35	9.22	0.50	0.50	0.05	0.05	0.05	5.00	0.22
Reach 1	543	5cfs	5.00	5595.28	0.89	0.000953	0.000398	0.80	6.25	8.94	0.58	0.70	0.03	0.03	0.03	5.00	0.17
Reach 1	496	5cfs	5.00	5595.26	1.51	0.000217	0.000549	0.51	9.78	9.55	0.90	1.02	0.01	0.01	0.01	5.00	0.09
Reach 1	455	5cfs	5.00	5595.21	0.81	0.003272	0.007667	1.36	3.68	6.62	0.51	0.56	0.10	0.10	0.14	5.00	0.32
Reach 1	421	5cfs	5.00	5594.84	0.31	0.034815	0.003516	2.88	1.74	6.22	0.27	0.28	0.58	0.58	1.68	5.00	0.96
Reach 1	378	5cfs	5.00	5594.45	0.94	0.001242	0.001068	0.81	6.21	12.62	0.48	0.49	0.04	0.04	0.03	5.00	0.20
Reach 1	336	5cfs	5.00	5594.41	0.71	0.000927	0.001192	0.72	6.96	13.62	0.51	0.51	0.03	0.03	0.02	5.00	0.18
Reach 1	272	5cfs	5.00	5594.32	0.91	0.001589	0.001890	1.04	4.80	7.56	0.59	0.63	0.06	0.06	0.06	5.00	0.23
Reach 1	188	5cfs	5.00	5594.15	0.93	0.002286	0.002799	1.25	4.00	5.88	0.59	0.70	0.08	0.08	0.11	5.00	0.26
Reach 1	140	5cfs	5.00	5594.01	0.71	0.003507	0.008519	1.44	3.48	6.01	0.53	0.58	0.12	0.12	0.17	5.00	0.33
Reach 1	72	5cfs	5.00	5593.26	0.51	0.043714	0.010025	3.47	1.44	4.44	0.30	0.33	0.81	0.81	2.82	5.00	1.07
Reach 1	27	5cfs	5.00	5592.34	0.50	0.004333		1.15	4.36	13.52	0.32	0.32	0.09	0.09	0.10	5.00	0.36

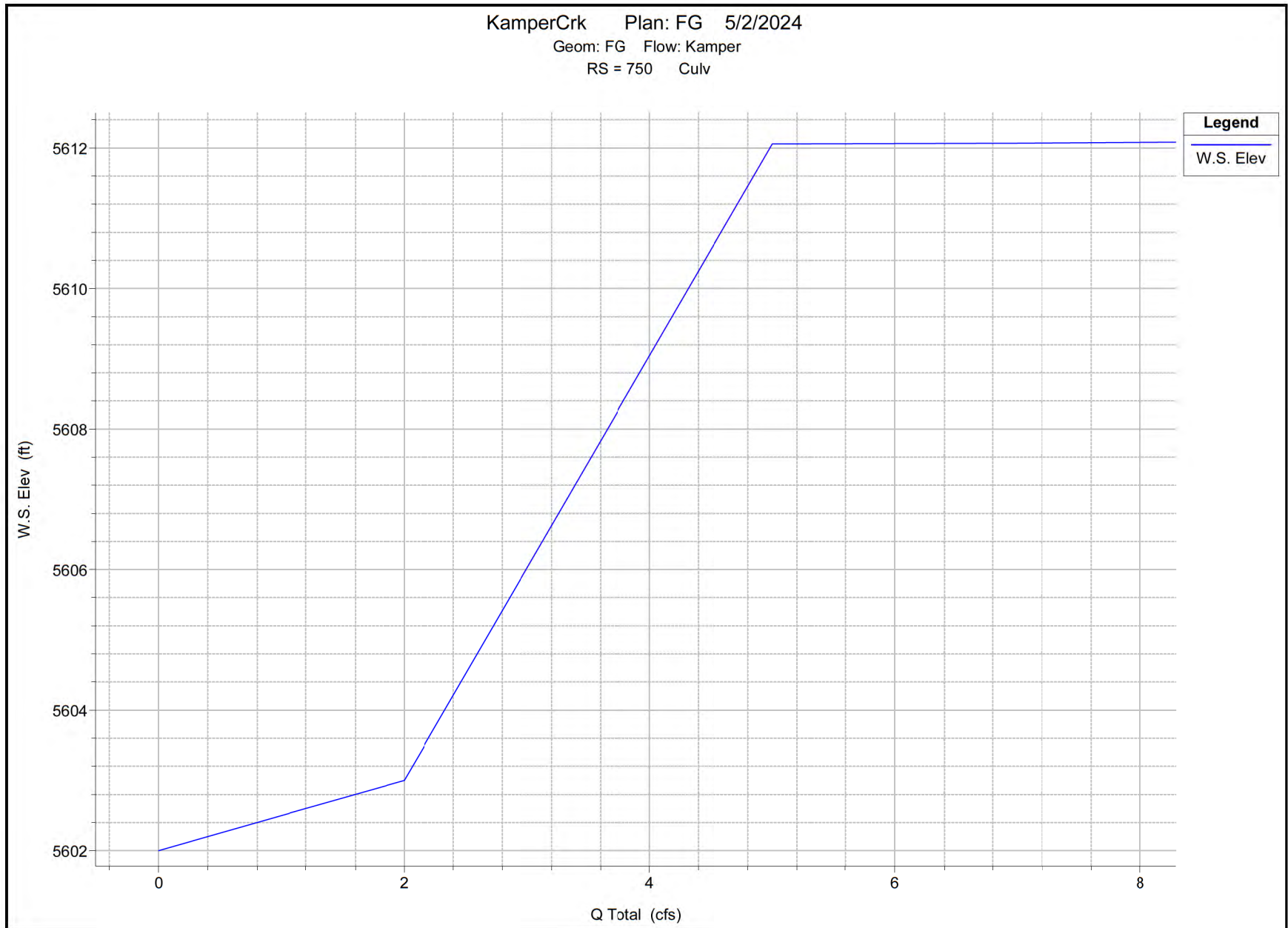
# Kamperschroer Spring Creek Spawning Enhancement

024-2024

HEC-RAS Plan: FG River: KamperCrk Reach: Reach 1 Profile: 20cfs

Reach	River Sta	Profile	Q Total (cfs)	W.S. Elev (ft)	Max Chl Dpth (ft)	E.G. Slope (ft/ft)	Frctn Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Hydr Radius C (ft)	Hydr Depth C (ft)	S'hear Chan (lb/sq ft)	Shear Total (lb/sq ft)	Power Chan (lb/ft s)	Q Channel (cfs)	Froude # Chl
Reach 1	3547	20cfs	20.00	5610.07	1.11	0.006849	0.010369	2.74	7.86	11.62	0.84	0.86	0.36	0.28	0.98	19.73	0.52
Reach 1	3480	20cfs	20.00	5609.28	1.22	0.017508	0.016773	4.05	8.94	23.01	0.75	0.89	0.82	0.41	3.30	15.88	0.76
Reach 1	3425	20cfs	20.00	5608.03	1.02	0.016082	0.001281	3.59	5.58	7.55	0.66	0.74	0.67	0.67	2.35	20.00	0.74
Reach 1	3346	20cfs	20.00	5608.06	1.87	0.000434	0.001030	0.89	23.87	19.27	1.23	1.46	0.03	0.03	0.03	19.74	0.13
Reach 1	3294	20cfs	20.00	5607.92	1.52	0.004877	0.010001	2.43	8.37	10.18	0.91	0.99	0.28	0.23	0.67	19.97	0.43
Reach 1	3233	20cfs	20.00	5607.00	0.88	0.030994	0.001487	4.87	4.11	5.44	0.64	0.75	1.24	1.24	6.06	20.00	0.99
Reach 1	3150	20cfs	20.00	5606.86	1.52	0.000469	0.001259	0.85	23.80	22.13	1.09	1.11	0.03	0.03	0.03	19.94	0.14
Reach 1	3072	20cfs	20.00	5606.63	1.25	0.009644	0.004953	2.95	6.98	8.55	0.73	0.89	0.44	0.39	1.25	19.90	0.55
Reach 1	3031	20cfs	20.00	5606.48	1.29	0.003007	0.007063	1.89	10.58	10.93	0.89	0.97	0.17	0.17	0.32	20.00	0.34
Reach 1	2864	20cfs	20.00	5605.19	0.35	0.032317	0.000827	3.09	6.47	20.58	0.32	0.32	0.64	0.63	1.97	20.00	0.97
Reach 1	2728	20cfs	20.00	5603.73	2.73	0.000244	0.000506	0.69	30.09	26.93	1.29	1.35	0.02	0.02	0.01	19.90	0.10
Reach 1	2680	20cfs	20.00	5603.68	1.15	0.001610	0.001639	1.39	14.41	16.15	0.91	0.92	0.09	0.09	0.13	19.99	0.26
Reach 1	2535	20cfs	20.00	5603.44	0.94	0.001668	0.002510	1.34	15.81	21.01	0.83	0.83	0.09	0.08	0.12	19.68	0.26
Reach 1	2477	20cfs	20.00	5603.22	2.13	0.004195	0.004598	2.49	8.04	5.00	1.05	1.61	0.28	0.28	0.68	20.00	0.35
Reach 1	2418	20cfs	20.00	5602.97	1.46	0.005061	0.002276	2.24	9.44	10.93	0.78	0.78	0.25	0.22	0.55	19.69	0.40
Reach 1	2384	20cfs	20.00	5602.87	1.60	0.001288	0.000095	1.47	13.59	10.54	1.16	1.30	0.09	0.09	0.14	20.00	0.23
Reach 1	2279	20cfs	20.00	5602.89	3.01	0.000032	0.000092	0.33	61.64	32.52	1.95	1.99	0.00	0.00	0.00	19.99	0.04
Reach 1	2238	20cfs	20.00	5602.86	1.58	0.001038	0.001100	1.20	16.65	13.59	1.01	1.23	0.07	0.07	0.06	20.00	0.19
Reach 1	2207	20cfs	20.00	5602.82	1.88	0.001168	0.000126	1.27	15.86	14.04	0.99	1.16	0.07	0.07	0.05	19.99	0.21
Reach 1	2149	20cfs	20.00	5602.83	2.21	0.000045	0.000138	0.35	56.39	32.60	1.70	1.76	0.00	0.00	0.00	20.00	0.05
Reach 1	2104	20cfs	20.00	5602.80	1.77	0.002172	0.003215	1.29	15.70	23.16	0.64	0.70	0.09	0.08	0.11	19.94	0.27
Reach 1	2071	20cfs	20.00	5602.68	1.41	0.005238	0.007157	1.57	12.75	27.40	0.45	0.47	0.15	0.14	0.23	19.99	0.40
Reach 1	2029	20cfs	20.00	5602.23	1.14	0.010361	0.000242	3.48	8.48	19.59	0.88	0.97	0.57	0.27	1.96	18.17	0.62
Reach 1	1950	20cfs	20.00	5602.33	2.96	0.000071	0.000225	0.48	42.05	23.06	1.89	2.00	0.01	0.01	0.00	19.99	0.06
Reach 1	1875	20cfs	20.00	5602.22	1.41	0.004627	0.009441	2.54	12.76	32.84	1.01	1.12	0.29	0.11	0.74	17.94	0.42
Reach 1	1810	20cfs	20.00	5601.32	1.04	0.028894	0.003922	4.78	4.18	5.72	0.66	0.73	1.19	1.19	5.68	20.00	0.99
Reach 1	1725	20cfs	20.00	5600.90	1.78	0.001473	0.000700	1.64	12.23	8.32	1.23	1.50	0.11	0.11	0.15	20.00	0.24
Reach 1	1654	20cfs	20.00	5600.87	1.20	0.000407	0.001304	0.77	26.52	27.14	1.04	1.05	0.03	0.02	0.02	19.91	0.13
Reach 1	1589	20cfs	20.00	5600.47	0.72	0.029364	0.007614	4.33	4.68	8.50	0.56	0.58	1.03	0.97	4.45	19.96	1.00
Reach 1	1540	20cfs	20.00	5599.98	1.08	0.003426	0.003934	1.99	10.27	12.93	0.88	0.91	0.19	0.16	0.37	19.94	0.37
Reach 1	1485	20cfs	20.00	5599.76	1.47	0.004565	0.003600	2.17	9.49	11.56	0.80	0.93	0.23	0.21	0.50	19.89	0.40
Reach 1	1452	20cfs	20.00	5599.65	1.18	0.002912	0.006816	1.89	10.78	11.98	0.92	0.97	0.17	0.15	0.32	19.93	0.34
Reach 1	1414	20cfs	20.00	5599.24	0.49	0.030845	0.002174	3.51	5.72	14.72	0.39	0.40	0.76	0.74	2.67	19.99	0.98
Reach 1	1297	20cfs	20.00	5598.49	1.50	0.000722	0.002198	1.00	20.62	23.15	1.00	1.02	0.05	0.04	0.05	19.91	0.17
Reach 1	1234	20cfs	20.00	5598.20	0.32	0.033556	0.000935	3.13	6.66	23.53	0.31	0.31	0.65	0.59	2.04	19.81	0.99
Reach 1	1165	20cfs	20.00	5597.61	2.73	0.000278	0.000912	0.77	26.15	18.63	1.39	1.50	0.02	0.02	0.02	19.98	0.11
Reach 1	1111	20cfs	20.00	5597.29	0.77	0.025549	0.000504	4.09	5.12	10.19	0.57	0.58	0.91	0.79	3.73	19.81	0.95
Reach 1	1074	20cfs	20.00	5597.44	1.89	0.000146	0.000270	0.57	36.01	26.68	1.42	1.44	0.01	0.01	0.01	19.94	0.08
Reach 1	1023	20cfs	20.00	5597.42	1.11	0.000666	0.000075	0.91	22.17	24.46	0.93	0.94	0.04	0.04	0.04	19.95	0.17
Reach 1	973	20cfs	20.00	5597.42	3.83	0.000027	0.000089	0.34	59.26	25.46	2.34	2.49	0.00	0.00	0.00	19.99	0.04
Reach 1	916	20cfs	20.00	5597.35	1.23	0.002621	0.000828	1.95	10.52	10.81	1.04	1.07	0.17	0.15	0.33	19.93	0.33
Reach 1	888	20cfs	20.00	5597.36	1.86	0.000400	0.000552	0.82	24.67	19.83	1.17	1.35	0.03	0.03	0.02	19.95	0.13
Reach 1	846	20cfs	20.00	5597.33	1.83	0.000810	0.001224	1.13	17.80	13.64	1.11	1.36	0.06	0.05	0.06	19.98	0.17
Reach 1	806	20cfs	20.00	5597.24	1.81	0.002059	0.004243	1.88	12.25	15.73	1.18	1.36	0.15	0.09	0.25	19.53	0.28
Reach 1	754	20cfs	20.00	5596.96	1.13	0.013320	0.019538	2.68	7.60	15.81	0.50	0.52	0.41	0.38	1.11	19.93	0.66
Reach 1	715	20cfs	20.00	5596.10	0.49	0.031394	0.000201	3.60	5.65	14.64	0.40	0.41	0.79	0.75	2.85	19.93	0.99
Reach 1	676	20cfs	20.00	5596.17	2.97	0.000054	0.000145	0.45	44.69	21.14	2.14	2.30	0.01	0.01	0.00	19.95	0.05
Reach 1	609	20cfs	20.00	5596.15	1.74	0.001064	0.001789	1.08	18.88	20.49	0.84	0.97	0.06	0.05	0.06	19.94	0.19
Reach 1	570	20cfs	20.00	5596.06	1.56	0.003616	0.002431	1.47	13.82	23.44	0.67	0.60	0.12	0.12	0.16	19.92	0.33
Reach 1	543	20cfs	20.00	5595.99	1.60	0.001746	0.001021	1.54	13.23	11.97	0.98	1.31	0.11	0.09	0.16	19.97	0.24
Reach 1	496	20cfs	20.00	5595.95	2.20	0.000669	0.001418	1.20	16.92	11.83	1.40	1.65	0.06	0.05	0.07	19.96	0.16
Reach 1	455	20cfs	20.00	5595.83	1.43	0.004793	0.009724	2.31	8.68	9.76	0.85	0.94	0.26	0.24	0.56	19.99	0.42
Reach 1	421	20cfs	20.00	5595.26	0.73	0.029351	0.002235	4.38	4.57	7.35	0.57	0.62	1.05	1.05	4.56	20.00	0.98
Reach 1	378	20cfs	20.00	5595.26	1.75	0.000752	0.000657	1.19	17.84	15.61	1.27	1.30	0.06	0.05	0.07	19.69	0.18
Reach 1	336	20cfs	20.00	5595.23	1.54	0.000579	0.000942	1.07	19.91	17.58	1.31	1.33	0.05	0.04	0.05	19.72	0.16
Reach 1	272	20cfs	20.00	5595.14	1.73	0.001793	0.002532	1.72	13.45	22.26	1.15	1.35	0.13	0.06	0.22	19.64	0.26
Reach 1	188	20cfs	20.00	5594.88	1.66	0.003845	0.004045	2.34	8.98	7.72	1.03	1.33	0.25	0.20	0.58	19.81	0.36
Reach 1	140	20cfs	20.00	5594.68	1.38	0.004260	0.008988	2.48	9.63	16.21	1.04	1.19	0.28	0.15	0.68	19.43	0.40
Reach 1	72	20cfs	20.00	5593.80	1.05	0.029981	0.009094	4.65	4.30	6.12	0.61	0.70	1.15	1.15	5.34	20.00	0.98
Reach 1	27	20cfs	20.00	5592.75	0.91	0.004330		1.93	11.16	18.69	0.70	0.71	0.19	0.16	0.37	19.64	0.40







# MONTANA FISH, WILDLIFE, & PARKS

## KAMPERSCHROER SPRING CREEK RESTORATION

### WISE RIVER, MONTANA

825 West Custer Ave.  
Helena, MT 59602  
+1 (406) 443-5210



**TETRA TECH**

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### SHEET INDEX

#### BASIS OF DESIGN NOTES:

SHEET NUMBER	SHEET TITLE
-	COVER
G-1	EXISTING SITE PLAN
C-1	STREAM PLAN & PROFILE
C-2	STREAM PLAN & PROFILE
C-3	STREAM PLAN & PROFILE
C-4	POND LOW LEVEL OUTLET PLAN & PROFILE
X-1	STREAM SECTIONS
D-1	STREAM DETAILS

**PROJECT LOCATION:**  
WISE RIVER, MT 59762  
BEAVERHEAD COUNTY

**CLIENT INFORMATION:**  
MONTANA FISH, WILDLIFE, & PARKS  
P.O. BOX 200701  
HELENA, MT 59620

**Tt PROJECT No.:**  
117-004359-24002

**CLIENT PROJECT No.:**  
FWP24-0145

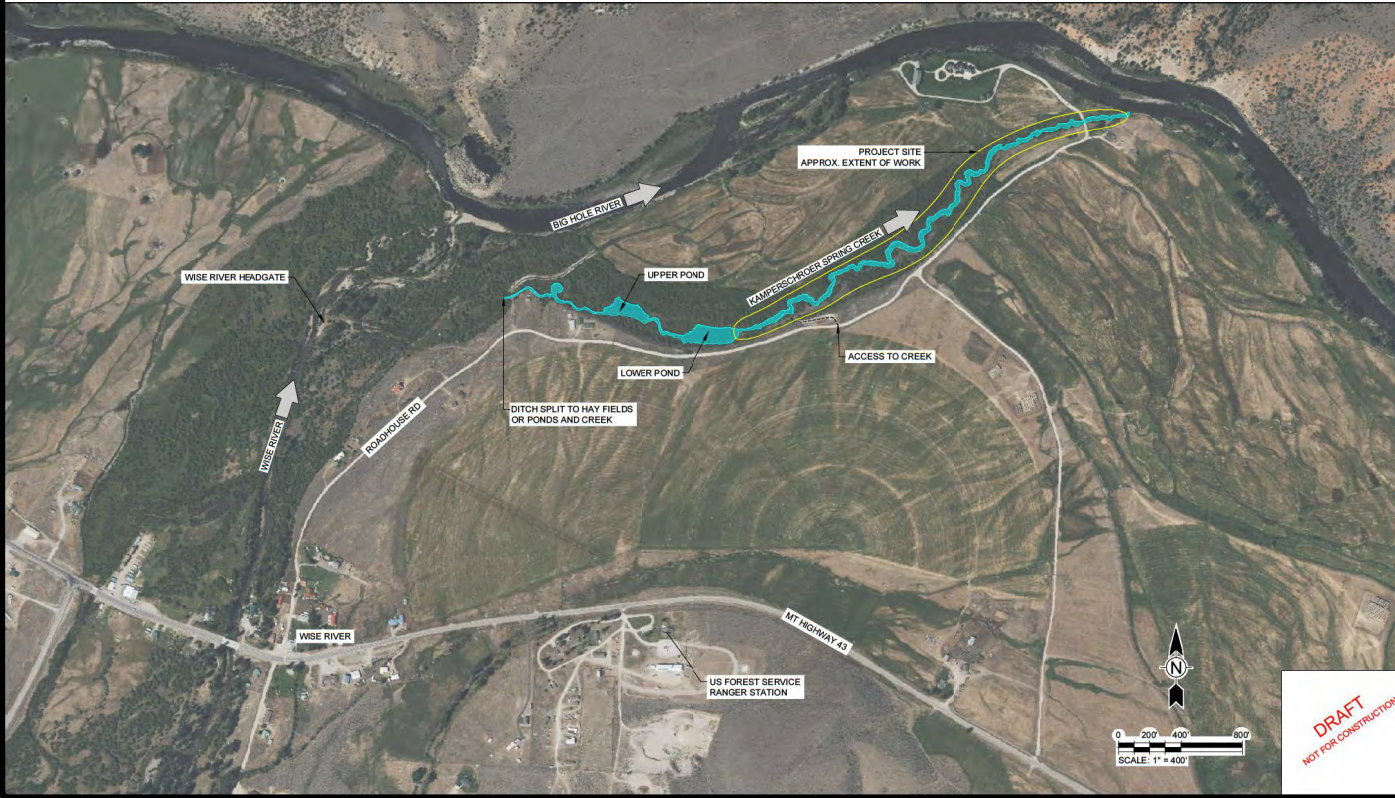
**PROJECT DESCRIPTION / NOTES:**  
THE OBJECTIVE OF THIS PROJECT IS TO IMPROVE SPAWNING AND REARING HABITAT FOR TROUT SPECIES IN THE BIG HOLE RIVER.

**ISSUED: MAY 2024**

DRAFT FOR REVIEW

**VICINITY MAP:**

**NOT TO SCALE**



**DRAFT**  
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**KAMPERSCHROER SPRING CREEK**  
LOOKING DOWNSTREAM (NORTHEAST)



**BEAVER DAM**  
LOOKING UPSTREAM (SOUTHWEST), STA 25+00

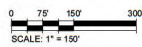
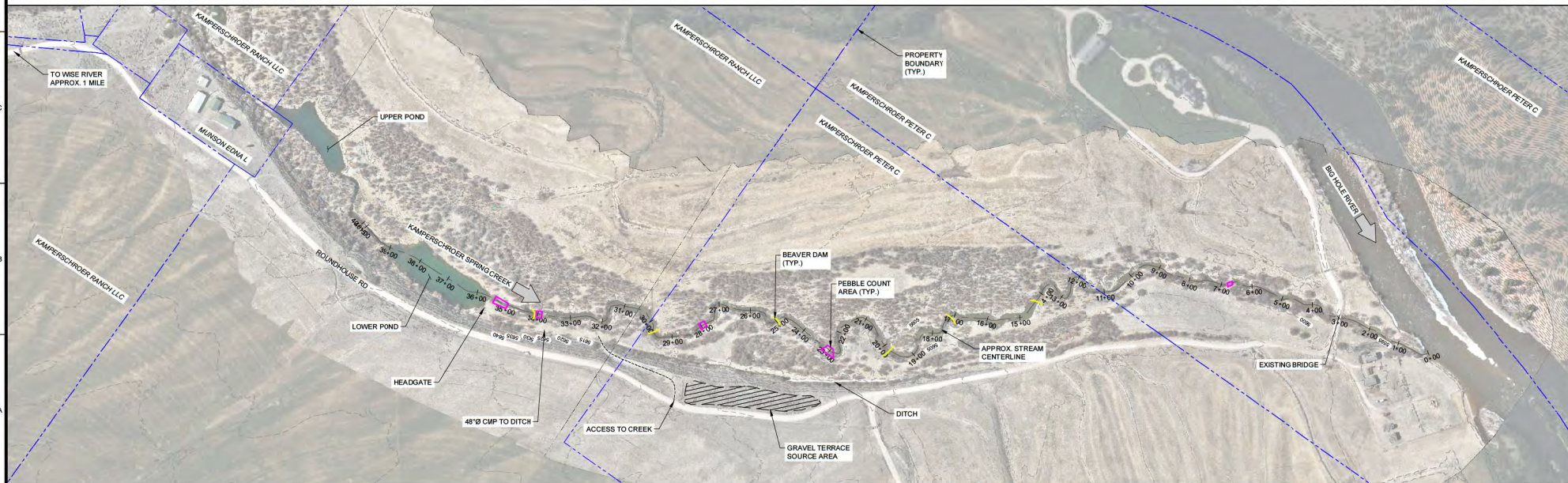


**BRIDGE NEAR CONFLUENCE**  
LOOKING UPSTREAM (SOUTHWEST), STA 2+00

**NOTES:**

1. COORDINATE SYSTEM = MT83IF, VERTICAL DATUM = NAVD88.
2. TOPOGRAPHY SHOWN ON DESIGN SHEETS HAS BEEN COMPILED FROM 2024 LIDAR, 2024 GPS SURVEY BY TETRA TECH, AND 2023 FWP BATHYMETRY SURVEY.
3. AERIAL IMAGERY COLLECTED BY TETRA TECH USING UAS (DRONE) EQUIPMENT ON 04/01/2024.
4. PROPERTY BOUNDARY INFORMATION SHOWN IS FROM MONTANA STATE LIBRARY ONLINE CADASTRAL SYSTEM ACCESSED MAY 2024.

5/20/24 10:32 AM - C:\HMMONTANA\FISH WILDLIFE AND PARKS\DEPT\117\040359-2402 - KAMPERSCHROER SPRING CREEK\07-CAD\SETFILES\G-1-OVERALL PLANNING.DWG



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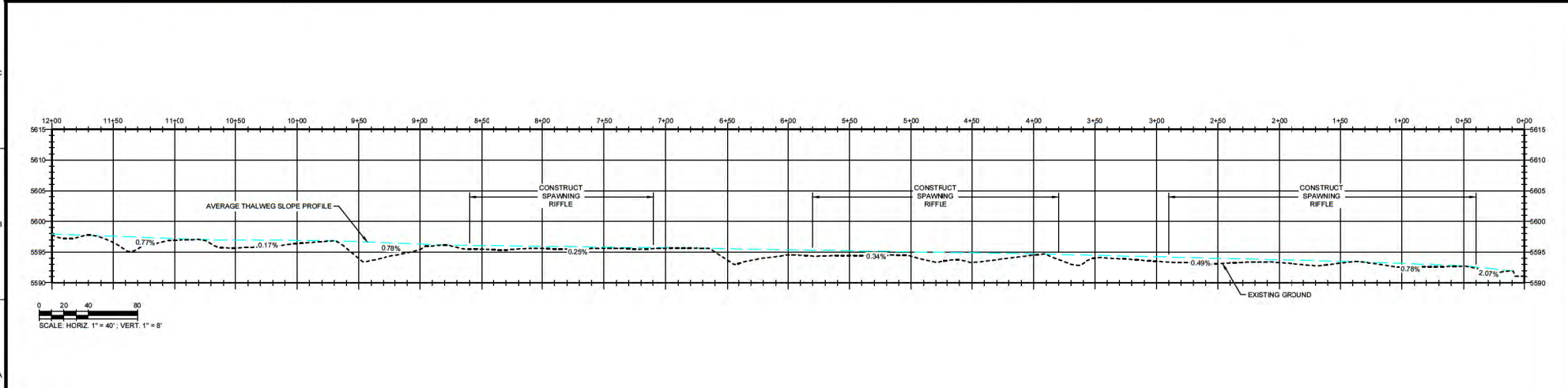
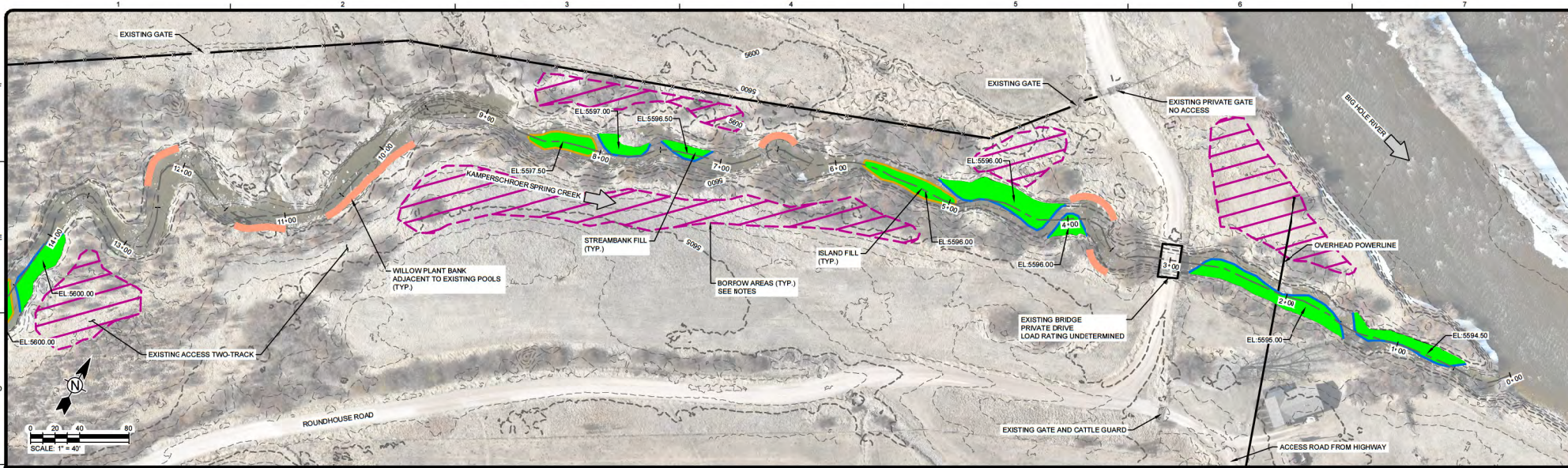
MONTANA FISH, WILDLIFE, & PARKS  
KAMPERSCHROER SPRING CREEK RESTORATION  
WISE RIVER, MONTANA  
  
**EXISTING SITE PLAN**

Project No.: 117-004359-24002  
Designed By: MDE  
Drawn By: DYW  
Checked By: ###

G-1

Bar Measures 1 inch





**NOTES:**

1. FINISH ELEVATION CALLOUTS ARE UNIQUE TO EACH WORK AREA. FINISH ELEVATIONS SHALL BE ± 0.2' AND FLAT FOR EACH AREA.
2. BORROW AREAS SHALL BE USED TO BORROW SOD MATS, WILLOW PLANTS, WILLOW CUTTINGS, AND TOP SOIL FOR PLACEMENT ON SURFACE OF STREAMBANK AND ISLAND FILL AREAS.
3. BARE AREAS SHALL NOT EXCEED 50 SQUARE FEET IN ONE LOCATION. BORROWING SHALL BE COMPLETED SOMEWHAT UNIFORMLY THROUGHOUT BORROW AREAS AND NO MORE THAN 50% OF A SINGLE BORROW AREA SHALL BE LEFT BARE OR DISTURBED.
4. NO BORROW IS ALLOWED WITHIN 20 LINEAL FEET OF ANY STREAM OR RIVER.
5. GENERAL FILL AND SPAWNING GRAVELS SHALL BE EXCAVATED FROM THE STREAMBED TO BE COVERED AND/OR THE GRAVEL TERRACE SOURCE. LARGE BOULDERS IN THE EXISTING AND FINAL STREAM BED MAY BE USED AS FILL WHEN APPROVED BY ENGINEER.

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 Helena, Montana 59602  
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MARK	DATE	DESCRIPTION	BY

MONTANA FISH, WILDLIFE, & PARKS  
 KAMPERSCHROER SPRING CREEK RESTORATION  
 WISE RIVER, MONTANA

Project No.: 117404399-04002  
 Designed By: MCB  
 Drawn By: DYW  
 Checked By: ###

**STREAM PLAN AND PROFILE**

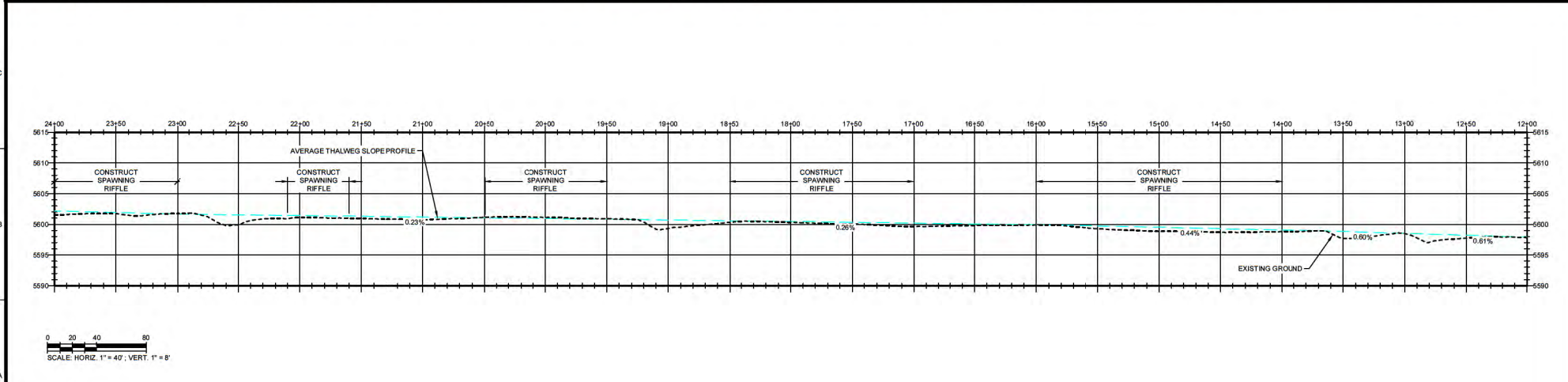
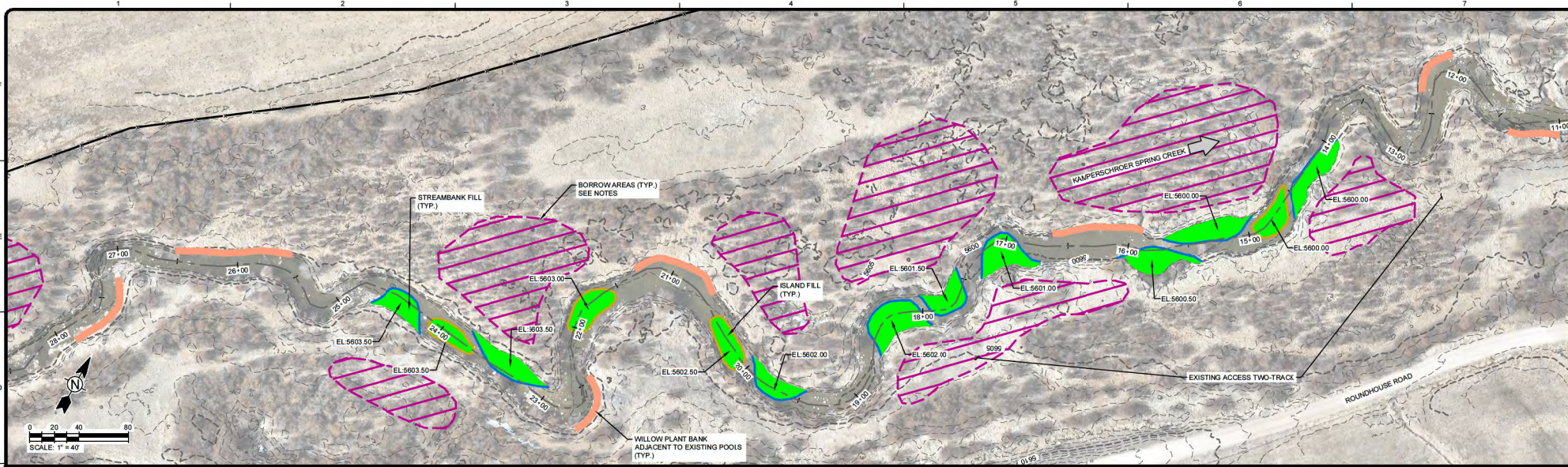
**C-1**

Bar Measures 1 inch

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**NOTES:**

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 WISE RIVER, MONTANA

Project No.: 117-004399-04002  
 Designed By: MDW  
 Drawn By: DYW  
 Checked By: ###

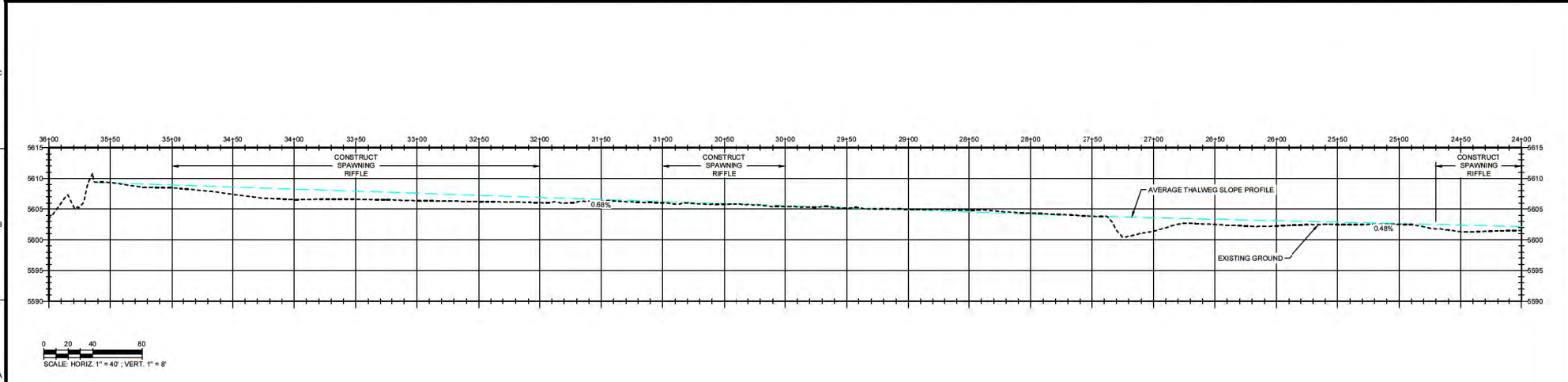
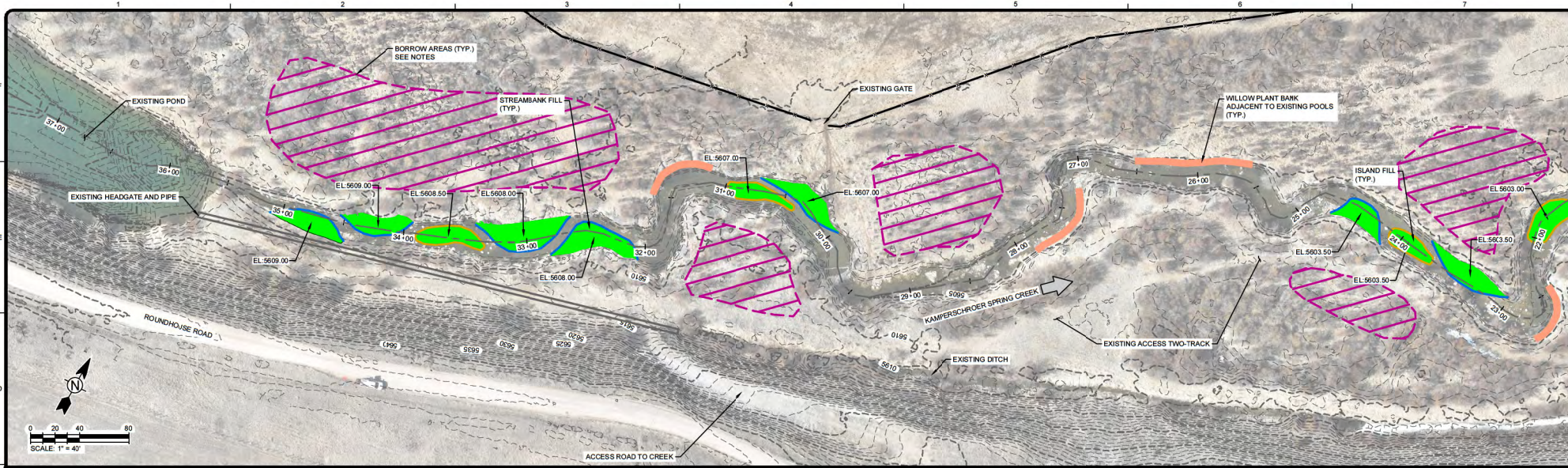
**STREAM PLAN AND PROFILE**

**C-2**

Bar Measures 1 Inch

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**NOTES:**

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4. NO BORROW IS ALLOWED WITHIN 20 LINEAL FEET OF ANY STREAM OR RIVER.
5. GENERAL FILL AND SPAWNING GRAVELS SHALL BE EXCAVATED FROM THE STREAMBED TO BE COVERED AND/OR THE GRAVEL TERRACE SOURCE. LARGE BOULDERS IN THE EXISTING AND FINAL STREAM BED MAY BE USED AS FILL WHEN APPROVED BY ENGINEER.

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MONTANA FISH, WILDLIFE, & PARKS  
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 WISE RIVER, MONTANA

Project No.: 117404399-24002  
 Designed By: MCB  
 Drawn By: DYW  
 Checked By: ###

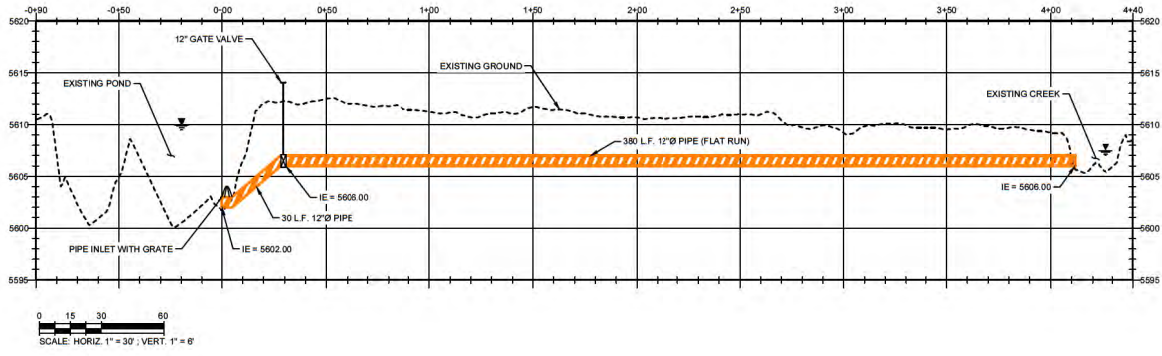
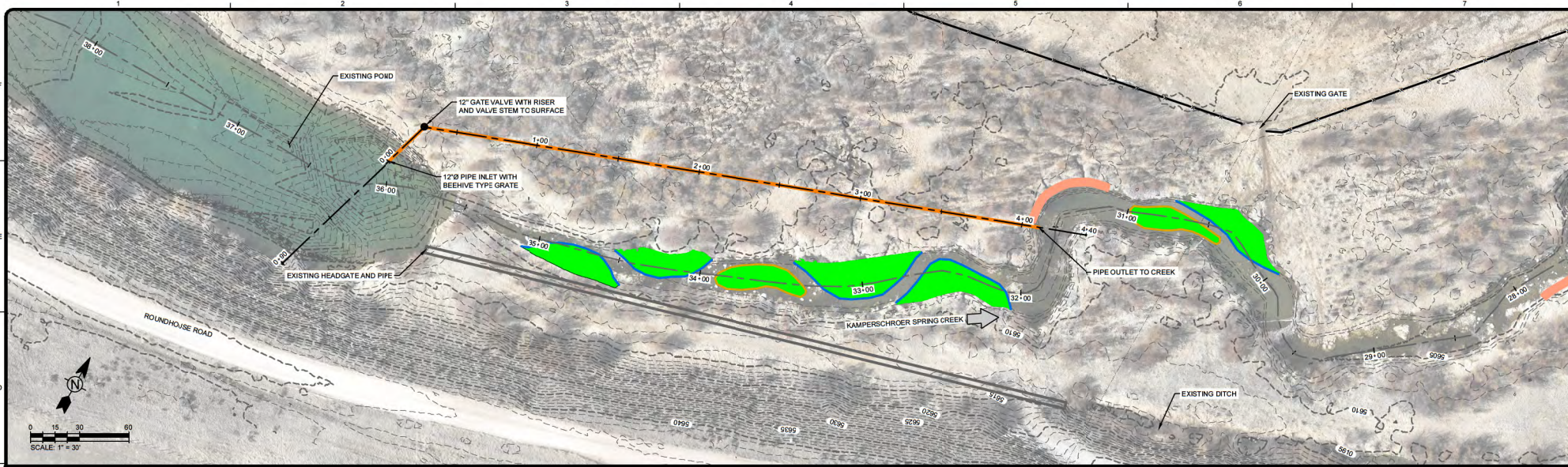
**STREAM PLAN AND PROFILE**

**C-3**

Bar Measures 1 inch

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**POND LOW LEVEL OUTLET  
 PLAN & PROFILE**

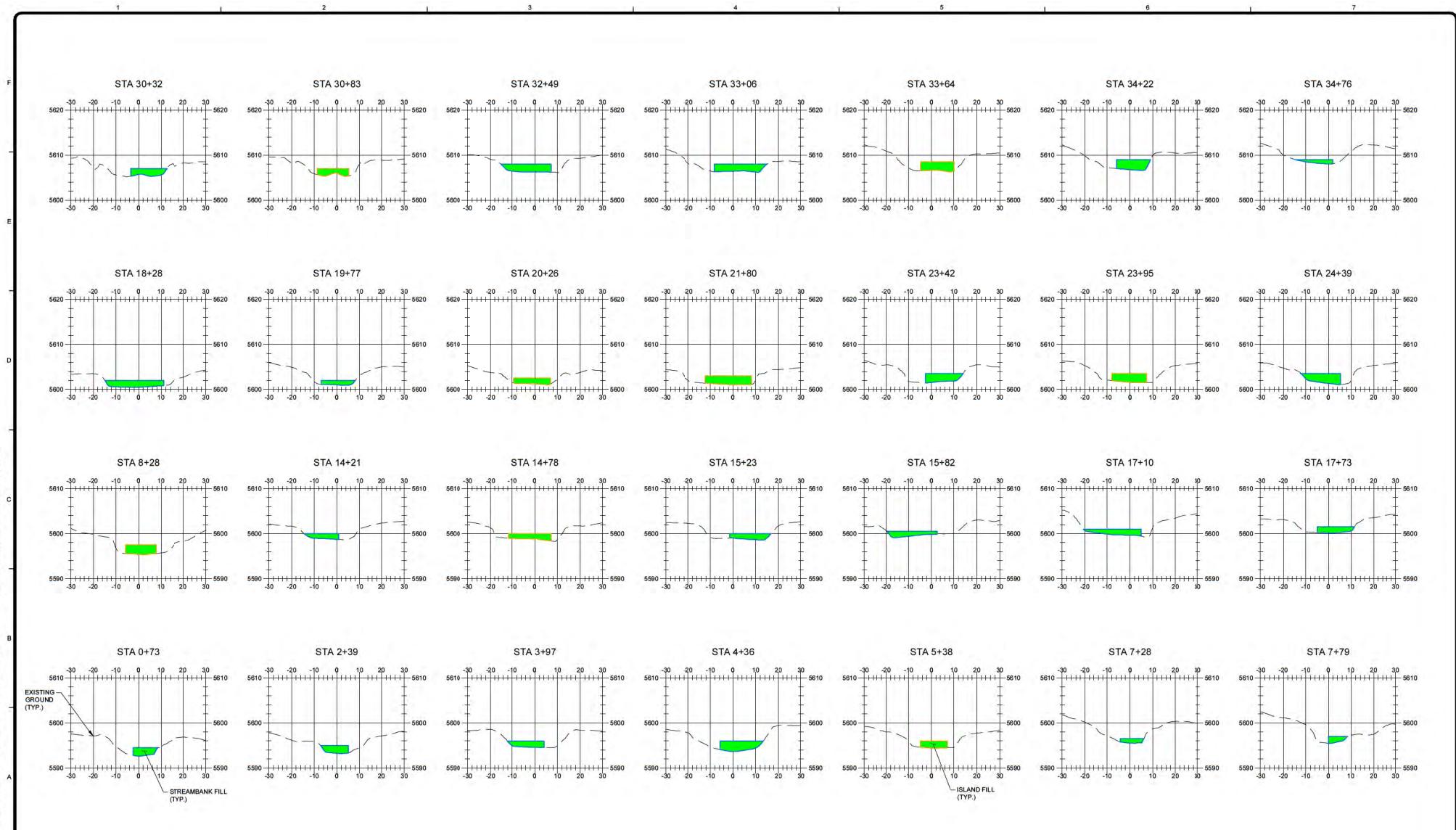
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**C-4**

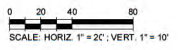
Bar Measures 1 inch

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- NOTES:**
1. SECTIONS ARE LOOKING UPSTREAM.
  2. DESIGN ELEVATIONS ARE FLAT FOR EACH STREAMBANK AND ISLAND FILL AREA.



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**MONTANA FISH, WILDLIFE, & PARKS**  
KAMPERSCHROER SPRING CREEK RESTORATION  
WISE RIVER, MONTANA

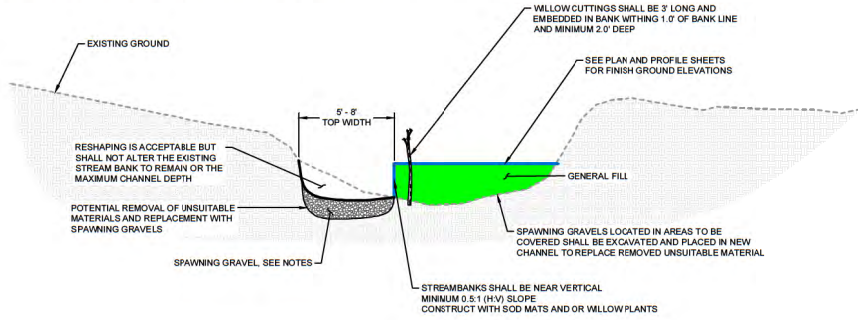
**STREAM SECTIONS**

Project No.:	117-004399-04002
Designed By:	MD6
Drawn By:	DYW
Checked By:	###
<b>X-1</b>	

5/20/24 10:33 AM - C:\H\MONTANA FISH WILDLIFE AND PARKS\DEPT\117 004399-24002 - KAMPERSCHROER SPRING CREEK CAD\STREAM SECTIONS.DWG

**NOTES:**

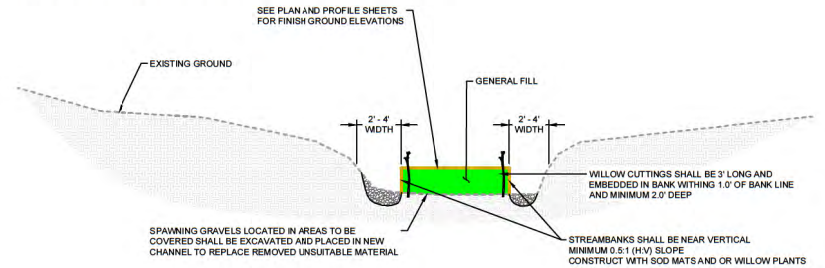
1. STREAMBANKS TALLER THAN 2.0' SHALL REQUIRE WILLOW PLANTS.
2. SOD MAT BANKS SHALL HAVE WILLOW CUTTINGS AT 3LF.
3. SPAWNING GRAVELS SHALL BE A 2.0-INCH MINUS, WELL GRADED, WASHED ROCK MATERIAL THAT IS RELATIVELY FREE OF FINES AND SILTS. GRAVEL BORROWED ON-SITE SHALL BE SCREENED AND/OR WASHED AS NEEDED. SPAWNING GRAVEL PLACEMENT SHALL BE MINIMUM 1.0' DEEP IN THE SPAWNING RIFFLES.



**1 STREAMBANK FILL AREAS**  
NOT TO SCALE

**NOTES:**

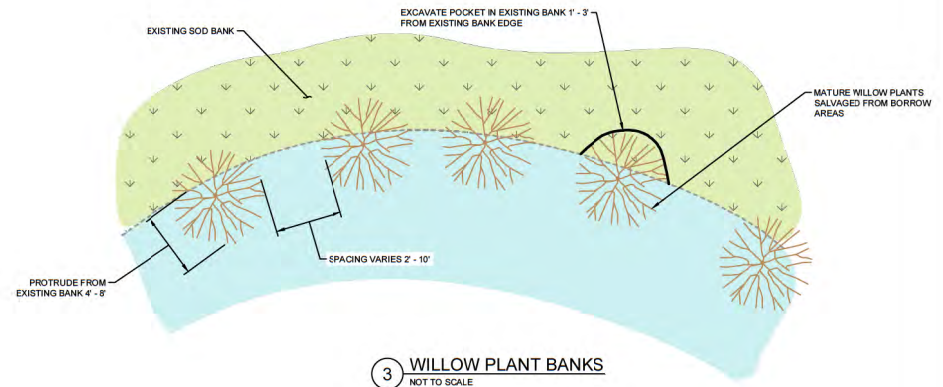
1. ISLAND BANKS TALLER THAN 2.0' SHALL REQUIRE WILLOW PLANTS.
2. SOD MAT BANKS SHALL HAVE WILLOW CUTTINGS AT 3LF.
3. SPAWNING GRAVELS SHALL BE A 2.0-INCH MINUS, WELL GRADED, WASHED ROCK MATERIAL THAT IS RELATIVELY FREE OF FINES AND SILTS. GRAVEL BORROWED ON-SITE SHALL BE SCREENED AND/OR WASHED AS NEEDED. SPAWNING GRAVEL PLACEMENT SHALL BE MINIMUM 1.0' DEEP IN THE SPAWNING RIFFLES.



**2 ISLAND FILL AREAS**  
NOT TO SCALE



**EXAMPLE STREAMBANK FILL**  
NOT TO SCALE



**3 WILLOW PLANT BANKS**  
NOT TO SCALE

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825 W. Custer Ave.  
Helena, Montana 59602  
PHONE: 406-443-5210 FAX: 406-442-7182

**DRAFT**  
NOT FOR CONSTRUCTION



MARK	DATE	DESCRIPTION	BY

MONTANA FISH, WILDLIFE, & PARKS  
KAMPERSCHROER SPRING CREEK RESTORATION  
WISE RIVER, MONTANA  
**STREAM DETAILS**

Project No.: 117-004399-240202  
Designed By: MCB  
Drawn By: DYW  
Checked By: ###  
**D-1**  
Copyright Tetra Tech  
Bar Measures 1 inch





<b>Engineer's Opinion of Construction Cost</b>	
Date:	5/14/2024
Project #:	117-004359-24002
Project Location:	Wise River, MT
Engineers:	M Barnes, D Williams

### Kamperschroer Spring Creek Restoration

Project Status: Draft Design

Item #	Item Description	Qty	Unit	Unit Price	Total Cost
101	Mobilization, Bonding, & General Requirements	1	LS	\$7,000	\$7,000
102	Surface Water Management	1	LS	\$4,000	\$4,000
103	Sod Mat & Willow Salvage	1.0	AC	\$6,000	\$6,000
104	Spawning Gravel Screen & Borrow	220	CY	\$16	\$3,520
105	Sod Mat & Fill Placement	1,500	CY	\$8	\$12,000
106	Willow Plant Placement	850	LF	\$15	\$12,750
107	Site Restoration & Seeding	1.5	AC	\$4,500	\$6,750

Subtotal	\$52,020
Bidding	\$5,000
Construction Inspection	\$10,000
<b>TOTAL</b>	<b>\$67,020</b>

<b>Optional Low Level Pond Outlet</b>					
200	12" Ø Low Level Pond Outlet Pipeline	410	LF	\$50	\$20,500
201	Low Level Pond Outlet Gate Valve	1	LS	\$15,000	\$15,000