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Final

Middle Rosewood Creek Restoration Project – Area A Design Report

May 2012 Cardno ENTRIX Project No. 31228060

Prepared for
Nevada Tahoe Conservation District

Valley & Mountain Consulting
Wood Rodgers

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List of Acronyms

ARS-NSL	U.S. Department of Agriculture Agricultural Research Service, National Sedimentation Laboratory
BMPs	best management practices
BSTEM	U.S. Department of Agriculture Agricultural Research Service, National Sedimentation Laboratory Bank Stability and Toe Erosion model
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
DRI	Desert Research Institute
FEMA	Federal Emergency Management Agency
ft	foot/feet
Mainstream	Mainstream Restoration, Inc.
NNHP	Nevada Natural Heritage Program
NTCD	Nevada Tahoe Conservation District
Project	Middle Rosewood Creek Restoration Project – Area A
SEZ	Stream Environment Zone
TAG	Technical Advisory Group
TRPA	Tahoe Regional Planning Agency
USFS	U.S. Department of Agriculture Forest Service
USFWS	U.S. Fish and Wildlife Service

Chapter 1

Introduction

1.1 Project Goals

The Middle Rosewood Creek Restoration Project – Area A (the Project) is intended to restore channel and riparian corridor functions, reduce future channel bed and bank erosion, provide protection from flooding, improve forest health and wildlife habitat, enhance aquatic habitat, improve fish passage, pre-treat urban stormwater, and improve fish access.

The proposed Project would prevent continued streambed and streambank erosion that generates sediment transported downstream. The proposed Project would increase the opportunities for sediment conveyed into the area to settle out and be sequestered on a functional, vegetated floodplain within the reach. These measures would reduce sediment loads to lower Rosewood Creek, Third Creek, and Lake Tahoe.

Project goal statements were developed based on the December 19, 2008 Technical Advisory Group[1] (TAG) discussion and follow-up discussions and research by the TAG members and the Project Team (Valley & Mountain Consulting, ENTRIX, Inc. [now Cardno ENTRIX], and Wood Rodgers, Inc.).

A meeting with Tahoe Regional Planning Agency (TRPA) staff on March 5, 2009 provided additional clarification and hierarchy for the proposed Project goals. TRPA is charged with protecting the Lake Tahoe Basin as a national treasure for the benefit of current and future generations. The TRPA vision is a lake and environment that is clean, healthy, and sustainable for the community and future generations. The Middle Rosewood Creek Restoration Project goals are based on one of the TRPA Core Values:

> *"Environmental Protection: Serving as stewards of Lake Tahoe and attaining environmental thresholds while sustaining the ecological, social, and economic well being of the Tahoe Region."*

The Project goals, listed in priority order (high to low), are as follows:

1. Restore channel and riparian corridor functions

   Channel capacity would be reduced and floodplain connectivity would be restored relative to the existing deeply incised and oversized condition. The restoration would reconstruct a low-flow channel with (1) the appropriate size, slope, and

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[1] Technical Advisory Group members for the Middle Rosewood Creek Restoration Project include all the funding, planning, and regulatory agencies: Nevada Tahoe Conservation District, Washoe County, U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, Nevada Division of Environmental Protection, Nevada Division of State Lands, Nevada Division of Wildlife, Nevada Department of Transportation, and the Tahoe Regional Planning Agency.

materials to convey the bankfull flow and sediment; and (2) bank heights and overbank topography that provide for a small, but connected active floodplain[2] throughout the entire Project reach. The restoration design is focused on creation of a stable stream channel with a connected and functioning floodplain to enhance the riparian habitat corridor through structural species diversity.

2. Improved stream water quality

   The flow in the stream channel in the Project reach would reach the top of bank and overflow onto the floodplain at a frequency and duration typical of a functional stream (i.e., at least several days every couple of years). This would facilitate water quality improvement because of:

   a. Reduced stream channel erosion (lower sediment and fine sediment particle production); and

   b. Increased floodplain sediment, fine sediment particle, and nutrient trapping.

3. Protection from flooding

   No change to the Federal Emergency Management Agency (FEMA) 500-year (0.2 percent annual chance of occurrence) floodplain boundary would result, and any change to the FEMA 100-year (1 percent annual chance of occurrence) floodplain boundary or water elevation would not increase flood hazards to existing developed property in the Project reach or in adjacent upstream/downstream reaches.

4. Improved forest health/wildlife habitat

   Riparian and upland plant communities in the Project Area would have lower risk of catastrophic wildfire, would provide enhanced wildlife, improved riparian species recruitment, and removal of known noxious/invasive weeds.

5. Enhanced aquatic habitat

   The stream channel morphology and stream bed materials in the Project reach would be improved to enhance physical habitat for potential resident fish and benthic macroinvertebrates, such that areas now designated by TRPA as “resident marginal” would be considered “resident good” fish habitat. The proposed box culvert will be constructed with slotted weirs and a step-pool entrance to improve fish passage, and biotechnical erosion control techniques will improve backwater potential and stream channel shading. Additionally, improved food production in the Project Area would benefit aquatic habitat downstream.

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[2] The active floodplain is defined herein as the area that would be wet relatively ‘regularly’ every couple of years; it would begin to be inundated by all flows that exceed the channel design capacity (4 cfs) and would primarily be limited to the area inundated by the 5-year peak flow (16 cfs).

6. Improved fish passage

   Stream channel characteristics in the Project reach would be modified to improve fish passage conditions and to enhance passage for potential migratory fish, such that areas now designated by TRPA as "migratory marginal" would be considered "migratory good."

7. Pre-treated urban stormwater

   Project design would be coordinated with best management practices (BMPs) to be provided by landowners and located outside the Stream Environment Zone (SEZ). These measures would pre-treat the volume of stormwater and the loads of fine sediment particles, suspended solids, nutrients, and petrochemicals.

8. Improved fish access

   The Project Team will coordinate with project sponsors on adjacent downstream reaches (lower Rosewood Creek and Third Creek) to improve potential future access for migratory fish into the Project reach from the downstream reaches.

1.2 Incorporation of Previous Studies

Stabilization of Rosewood Creek was identified in prior watershed studies as an important erosion control priority (Watershed Restoration Associates 1999, Swanson 2000). In 2005, the Nevada Tahoe Conservation District (NTCD) supervised preparation of a comprehensive geomorphic and riparian assessment of the middle reach of Rosewood Creek (Mainstream 2005). Individual restoration opportunities and an overall restoration concept for the entire middle reach of Rosewood Creek, including Area A, were presented by Mainstream Restoration, Inc. (Mainstream) based on several data sources and factors. The Mainstream 2005 analysis summarized and screened conceptual restoration approaches developed by prior studies in the area (Swanson 2000, ENTRIX 2001, Corps 2004), and presented suggestions and priorities for restoration of all portions of the middle reach of Rosewood Creek.

Based on the results of that assessment, NTCD retained the Project Team to prepare a conceptual design for restoration of the middle reach of Rosewood Creek. Detailed engineering and implementation plans of specific sub-reaches (known as "areas") were initiated, starting upstream with Area F and continuing to Area A.

Alternatives featuring various types and degrees of treatments, such as stabilization, reconstruction, and relocation within the existing floodplain, were considered during the 2005–2006 conceptual design and implementation plan phase. A Concept Plan and Implementation Plan (Valley & Mountain Consulting 2006a, 2006b) integrated data and recommendations from prior studies, new field assessments, and additional design analyses to further develop and evaluate restoration options for the entire middle reach of Rosewood Creek, including Area A. The results of this planning step were the basis for 30-percent and 50-percent design plans.

1.3 Key Terms and References

The following Key Terms are used in this report:

- Study Area. The Study Area consists of the entire middle reach of Rosewood Creek from State Route 28 to the downstream side of State Route 431).
- Project Area. The Project Area is Area A, also referred to as "Implementation Area A," as described below.
- Implementation Area. The middle reach of Rosewood Creek consists of discrete Implementation Areas (A though I), as presented in the *Middle Rosewood Creek SEZ Restoration, Implementation Plan* (Valley & Mountain Consulting 2006b). Implementation Area A is the subject of this report. Its boundaries are approximately 100 feet south of State Route 28 and 200 feet north of Northwood Boulevard**.**
- Project Team. The Project Team consists of Valley & Mountain Consulting, Cardno ENTRIX, and Wood Rodgers, Inc.

As noted above, this report incorporates the results of earlier studies. The descriptions of existing conditions are based primarily on the following documents, supplemented by additional field studies as noted:

- The *Middle Rosewood Creek Geomorphic and Riparian Assessment* was prepared by Mainstream Restoration, Inc. in November 2005. It is referenced in this report as the "Mainstream 2005" report.
- The *Middle Rosewood Creek SEZ Restoration, Concept Plan* was prepared by Valley & Mountain Consulting in April 2006. It is referenced in this report as the "Concept Plan."
- The *Middle Rosewood Creek SEZ Restoration Project, Implementation Plan* was prepared by Valley & Mountain Consulting in April 2006. It is referenced in this report as the "Implementation Plan."

Chapter 2

Hydrology

2.1 Peak Flow Estimates

Rosewood Creek does not have a long-term gaging record from which hydrological analysis can be performed. Thus, the hydrological analysis on Rosewood Creek was based on a comparison of regional flood-frequency curves from the nearby gaged watersheds of Incline, Third, First, and Wood Creeks. The Mainstream 2005 presents the initial results of this analysis (Table 2-1). Mainstream calculated the unit discharge per watershed area from these four creeks with linear regressions relating watershed area and recurrence intervals. The Project Team updated the Mainstream 2005 analysis by adding several more years of peak flow data available from the Third Creek and Incline Creek gages, and by adding additional recurrence interval flows. The new results are plotted in Figure 2-1, which shows the peak annual recurrence interval against the drainage area. A comparison of the last two rows in Table 2-1 shows that updating the data with additional flow years did not appreciably change the values when compared to the Mainstream 2005 report.

In addition, the Project Team compared the methodology and results of the peak flow data for this Project to those of the Third Creek Restoration Project. The Third Creek Restoration Project was located in Incline Village, Nevada, south of the Project site and near the confluence of Rosewood Creek and Third Creek and was implemented summer 2009. The methodology and results for the Third Creek Restoration Project are comparable to the methodology and peak flow estimates for this Project, thus providing a greater level of certainty.

The final row in Table 2-1 lists the estimated recurrence interval flows for Rosewood Creek at State Route 28 based on the same watershed comparison analysis generated for the Third Creek Restoration in 2009. The estimated recurrence intervals range from 3.8 cubic feet per second (cfs) at the 1.5-year flow to approximately 49 cfs at the 100-year flow.

Table 2-1 Flood Frequency Estimates for Rosewood Creek at State Route 28

Gage Name	Gage Number / Source	Period of Record (water years)	Years of Data	Watershed Area (square miles)	1.5-year (cfs)	2-year (cfs)	5-year (cfs)	10-year (cfs)	25-year (cfs)	50-year (cfs)	100-year (cfs)
Incline Creek near Crystal Bay	USGS Gage 10336700	1970–1973, 1975, 1988–2009	22	6.74	22	31	61	88	131	170	215
Third Creek near Crystal Bay	USGS Gage 10336698	1970–1973, 1975, 1978–2009	32	6.05	41	56	99	130	174	208	244
Wood Creek at Mouth near Crystal Bay	USGS Gage 10336694	1970–1974, 1991–2000	10	1.97	7	10	19	27	38	47	57
First Creek near Crystal Bay	USGS Gage 10336688	1970–1974, 1991–2000	15	1.07	4	6	14	22	34	45	57
Rosewood Creek	MACTEC 2003	N/A	N/A	1.15	N/A	12	24	35	N/A	N/A	98
Rosewood Creek	Mainstream 2005	N/A	N/A	1.15	N/A	6	16	23	N/A	N/A	40–60
Rosewood Creek	This study	N/A	N/A	1.15	3.8	6	14	21	31	40	48

Notes:

cfs = cubic feet per second.
N/A = Not applicable.
USGS = U.S. Geological Survey.

Flood frequency estimates are based on a drainage basin area comparison of four adjacent watersheds with gage records, including previous (MACTEC 2003, Mainstream 2005) flood frequency estimates.

Source: Table 1 in Mainstream 2005.

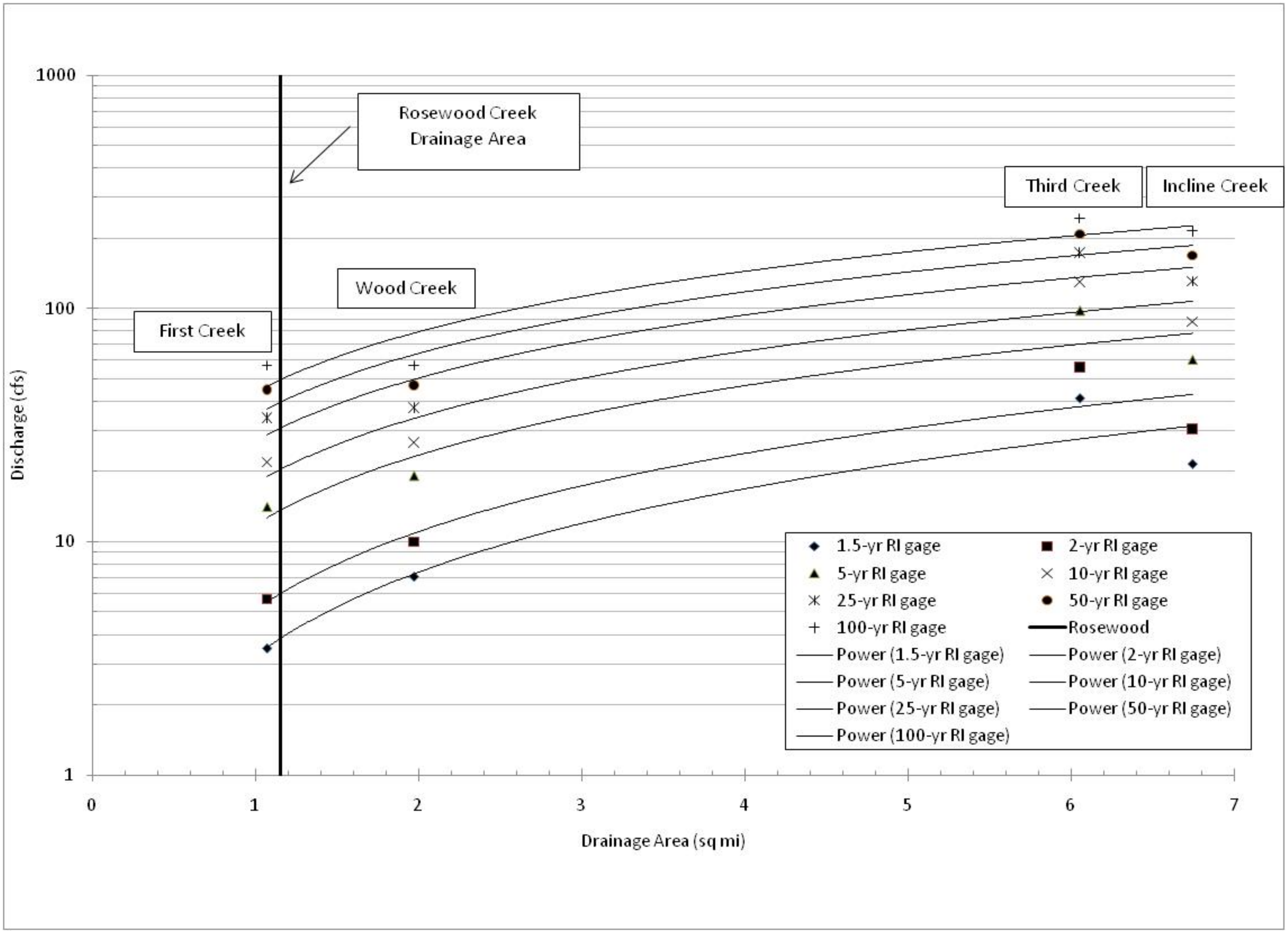

Figure 2-1 Comparison of Drainage Area and Peak Annual Recurrence Interval (RI) Flows for Gaged Streams near Rosewood Creek

2.2 Design Flows

The peak annual recurrence interval flows reported in the last row of Table 2-1 were used to guide selection of the design flows for the Project. The selected 100-year flow used in the design was 48 cfs. To ensure that the Project would not increase flood risk on adjacent properties, the Project Team evaluated the 100-year flow in both the existing condition hydraulic model (to determine the existing flood extent) and proposed condition hydraulic model (to determine how the flood extent would change with the proposed design). The 100-year flow also was analyzed to determine the magnitude of shear stresses on the floodplain and channel under proposed conditions. This analysis assessed the risk of floodplain erosion and helped to identify the substrate sizes needed to construct a stable new channel. Analysis of the 100-year flow and lower magnitude flows, such as the 5- and 10-year flows, played a key role in designing the elevations and width of the new active floodplain.

In addition to the large magnitude, infrequently occurring 100-year flow, the 1.5- to 2-year flow was used as the bankfull, or channel capacity flow. According to Table 2-1, the 1.5-year flow for Rosewood Creek is 3.8 cfs, and the 2-year flow is 6 cfs. These statistics were derived by refining long-term gage records for the local watersheds based on several years of data collected specifically on Rosewood Creek.

As part of monitoring for the lower Rosewood Creek restoration project, pressure transducers were installed to record stage on 10-minute intervals at locations on Rosewood Creek in 2003. The site downstream of State Route 28, upstream of the confluence of Rosewood Creek with Third Creek, is closely representative of flow in the Area A project reach. The streamflow monitoring data for 2003–2009 were made available to the Project Team by Rick Susfalk at the Desert Research Institute (DRI). Data from the 2008–2009 water years were largely incomplete and were excluded from the analysis. DRI measured discharge at the site downstream of State Route 28 to develop a stage/discharge rating curve for the site. Based on the DRI data, a flow of 4 cfs was exceeded in three of the five years of record, and a 6 cfs flow was exceeded in two of the five years. Conversion of the 10-minute interval readings to day time steps allowed calculation of days/year durations. Based on the DRI data, flows would exceed 4 cfs for 2.4 days/year; a 6 cfs flow would be exceeded for 0.9 days/year (Table 2-2). A channel capacity of 4 cfs was selected for the Project design. This conclusion is consistent with the 1.5-year flow calculated from the watershed comparison analyses.

Table 2-2 Exceedance of 4 cfs and 6 cfs Flows on Rosewood Creek Downstream of State Route 28

	4 cfs Flow		6 cfs Flow	
Water Year	# 10-Minute Readings Exceeded	Days/Year	# 10-Minute Readings Exceeded	Days/ Year
2003	8	0.06	4	0.03
2004	13	0.09	0	0.00
2005	0	0.00	0	0.00
2006	1704	11.83	649	4.51
2007	0	0.00	0	0.00
	Average	2.4		0.9

Notes:

cfs = cubic feet per second.

The number of days per year that 4 cfs and 6 cfs flows were exceeded on Rosewood Creek downstream of State Route 28 was based on measured flow data from 2003 to 2007, provided by Rick Susfalk at the Desert Research Institute. Data from the 2008–2009 water years are largely incomplete and were excluded from our analysis.

Chapter 3

Field Data Collection

3.1 Topographic Survey

The initial efforts of the Middle Rosewood Creek Restoration Project included a boundary survey and aerial topography of the entire middle reach Study Area (State Route 28 to the downstream side of State Route 431), with additional cross-sectional ground-surveys at several locations. This preliminary survey information was adequate to develop an overall concept restoration plan for the Study Area. It did not, however, provide adequate information to develop final design plans and construction documents required for each Implementation Area. As part of the final design process for Implementation Area A, detailed topographic and planimetric surveys were completed in fall 2008.

The detailed topographic and planimetric surveys were combined with the preliminary boundary survey and aerial survey to compile a complete basemap for the Project. The complete basemap includes all of the existing features in the Project Area and provided the necessary information to develop design plans, HEC-RAS modeling, and construction documents.

3.2 Vegetation Community Mapping

In September 2006, ENTRIX conducted a literature review and field assessment of the Study Area (extending from State Route 28 to its intersection with State Route 431) to assess potential terrestrial and aquatic wildlife habitat. A Mainstream plant ecologist conducted initial field surveys of the Study Area in late June through mid-July 2005 to characterize the riparian communities. Sensitive plant surveys were conducted as part of the riparian study and are included in the Mainstream 2005 report (Plates 1–6). Wood Rodgers also conducted a special-status plant species and invasive/noxious weed survey for Implementation Area A in 2009 and 2010 (Wood Rodgers 2009, 2010). A U.S. Army Corps of Engineers (Corps) delineation of jurisdictional wetlands and waters of the United States in the Study Area was conducted on September 14, 15, and 26, 2006. A jurisdictional determination was issued on January 26, 2007 (Regulatory Branch 200600942).

Database queries were submitted to the Nevada Natural Heritage Program (NNHP) and the U.S. Fish and Wildlife Service (USFWS) Reno, Nevada office to determine the potential occurrence of special-status plant species in Implementation Area A. The USFWS (February 2010) and NNHP (January 2010) have determined that no state or federally listed threatened or endangered plant species are known to occur in the Project Area. Information on state and federally listed threatened, endangered, and candidate species; USFWS Sensitive Species; and TRPA Species of Special Interest with the potential to occur in the Project Area was obtained from the TRPA, USFS, NNHP and USFWS (USBOR 2010). Based on field studies completed to date, Implementation Area A does not support any threatened, endangered, or sensitive vegetation or wildlife species.

Field studies identified two noxious weeds in the Project Area. Two Priority Invasive Weed species of the Tahoe Basin were documented as occurring in the Project Area, including 12 stems of teasel (*Dipsacus fullonum* – Group 1: Watch for, Report, Eradicate Immediately [present as small populations that would be eradicated]) and eight stems of bull thistle (*Cirsium vulgare* – Group 2: Manage Infestations with a Goal of Eradication [isolated populations would be targeted for eradication]) (Wood Rodgers 2010). The locations of the two invasive weed species are shown on the Project Plans, Sheet P-1, and treatment is addressed in the Project Special Technical Specifications (Provided separately).

3.3 Geotechnical Analysis

A geotechnical investigation (Wood Rodgers 2009, see Appendix A) was conducted for Implementation Area A that included specific bank sampling at locations representative of the proposed new channel alignment and potential grade control structures. Fifteen hand-augured exploration sites were collected and analyzed by a Wood Rodgers geologist in 2008 and 2009 to obtain soil samples from various depths down to 5 feet (ft) below the ground surface. The laboratory testing included particle size analysis, permeability testing, and Atterberg limits. Soils were found to be composed of interfingered layers of poorly graded sand, silty sand, and clayey sand. The predominant types are interbedded with moderately to highly plastic silt and clay layers. The surface layer has a substantial amount of organic material (suitable for topsoil salvage). Several layers may contain varying amounts of gravel, cobbles, and boulders (less than 4 ft in diameter).

In addition, close coordination and sharing of geotechnical information has occurred with the U.S. Department of Agriculture Agricultural Research Service, National Sedimentation Laboratory (ARS-NSL). The ARS-NSL collected data in 2007 on the existing streambanks and streambed throughout Rosewood Creek as part of an analysis in support of the Lake Tahoe total maximum daily load process. These data were used to guide selection of parameters for bank stability modeling.

Chapter 4

Existing Conditions

4.1 Channel and Floodplain Morphology

The existing morphologic conditions of Rosewood Creek are described in the Mainstream 2005 report. The creek is in a steep, mountainous setting with a valley slope in Implementation Area A (referred to as “Reach A” in the Mainstream 2005 report) of 6 percent. The valley alluvium is largely comprised of fine-grained sand and silt particles with low cohesion. Rosewood Creek has been highly altered from its natural condition. The alterations include direct channel disturbances, such as channelization of the lower portion of the channel in Area A and modification of the channel’s base level at the State Route 28 culvert, and watershed-scale alterations of hydrology and sediment loads due to urbanization of the drainage.

These alterations have led to substantial morphologic degradation of Rosewood Creek in previous decades. The negative response of the channel to the alterations is exacerbated by the steep valley slope and poorly cohesive alluvium whereby the channel flows in a high-energy environment through highly erodible bed and bank materials. For most of the reach, the channel is incised several feet into the valley alluvium. Downcutting and incision of the channel led to oversteepening of the channel’s banks, resulting in bank failure and channel overwidening. The flow conveyance capacity of the existing channel is up to 25 times larger than pre-disturbance conditions. Most of the channel in Area A is completely disconnected from its former floodplain. The former floodplain is now a terrace that never receives overbank flow from the creek. At many locations, the channel is over 6 ft deep and from 20 to 30 ft wide. Incipient floodplain has formed at some locations within the entrenched channel, but in many areas, the creek still flows through narrow sections with nearly vertical banks several feet tall on both sides of the channel. Several nickpoints throughout the reach suggest that the channel is still responding to previous disturbances and that additional downcutting, overwidening, and bank collapse will continue into the future if unchecked.

4.2 Riparian Vegetation

Implementation Area A is characterized by a riparian corridor adjacent to Rosewood Creek within a Sierra mixed conifer forest community dominated by Jeffrey pine (*Pinus jeffreyi*) and white fir (*Abies concolor*). Dominant overstory riparian vegetation is provided by mountain alder (*Alnus incana* ssp. *tenuifolia*), Scouler’s willow (*Salix scouleriana*), and Pacific willow (*S. lucida* ssp. *lasiandra*). A shrub layer is typically noncontiguous along the streambank, except for discrete occurrences of red osier dogwood (*Cornus sericea*), Wood’s rose (*Rosa woodsii*), and Lemmon’s willow (*S. lemonnii*). The herbaceous understory varies from dense cover of mesic gramionoids like small-fruit bulrush (*Scirpus microcarpus*) and sedges (*Carex* spp.) and dry graminoids like blue wildrye (*Elymus glaucus*) to an understory composed of forbs, including western brackenfern (*Pteridium aquilinum*), stinging nettle (*Urtica dioica*), and Anderson’s thistle (*Cirsium andersonii*).

Although Implementation Area A is described as a “riparian community type” in the Mainstream 2005 report and is designated by TRPA as an SEZ, the channel is completely disconnected from its former floodplain through a majority of the reach. The former floodplain is now a terrace that never receives overbank flow from the creek. This results in a localized depression of groundwater levels in and adjacent to the creek. Thus, the riparian species are strongly tied to the in-channel floodplain and some low-elevation areas within the disconnected floodplain that accumulate precipitation. The alterations to the watershed hydrology and geomorphology discussed in Section 4.1 are reflected in the current vegetation composition that includes establishment of second- and third-growth forests.

Vegetation conforms to two vegetation series: the Jeffrey Pine Series and the Mountain Alder Series. Overstory health, canopy cover, and age class are variable; but most of Implementation Area A evidences conifer encroachment and some lack of riparian vegetation recruitment, senescence (aging of vegetation strands). In general, mountain alder and willow species greater than 20 ft from the top of bank in the incised reaches tend toward senescence, while the root systems of well established older trees on the bank and in the channel are healthy due to their proximity to more consistent soil moisture. A shrub layer is typically noncontiguous along the streambank, except for discrete occurrences of redosier dogwood, Wood’s rose, and Lemmon’s willow. The herbaceous understory varies from dense cover of mesic and dry graminoids (drier soil conditions) to an understory composed of forbs that reflect soil moisture conditions ranging from dry to depressional area soil moisture. The Mainstream 2005 analysis of vegetation cross sections (Reaches 1, 2, 3, and 4) through Implementation Area A resulted in their characterization as an early seral (drying) riparian complex.

Within Implementation Area A, 32 special-status plant species (including TRPA Species of Special Interest) were identified by USFWS as potentially occurring (Wood Rodgers 2010). However, none of these 32 plant species were found to occur in the Project Area due to range, elevation, and habitat range limitations. An Environmental Assessment prepared for the U.S. Bureau of Reclamation (Wood Rodgers 2010) documents the information in the following discussion.

Approximately 0.17 acre of jurisdictional waters of the Unites States and 1.06 acres of existing jurisdictional wetland are located in Implementation Area A. Rosewood Creek is also within a TRPA-recognized SEZ, with perennial runoff. Floodplain and SEZ in the Lake Tahoe Basin is highly valued habitat; the floodplain processes provide the potential for infiltration of storm flows when they are functional. The SEZ boundary, verified by TRPA in January of 2008, within Implementation Area A contains approximately 6.48 acres of SEZ.

To facilitate floodplain restoration, removal of fire fuels and to enhance habitat structural and species diversity, it will be necessary to remove trees to construct the proposed restoration project. Through coordination with TRPA Forester, Mike Vollmer (T.C.R. 10/20/2010), the Project EA and FONSI (Wood Rodgers, Inc. 2010) documented that the Preferred Alternative design will limit disturbance to that necessary for access and construction and will protect healthy existing vegetation and trees 10-inches or greater in diameter. Existing down and dead fuels within the areas of proposed project disturbance would be removed.

To meet the proposed project goals, the construction access, excavation of the low flow channel, and grading of the floodplain topography, removal of fill and related activities would require removal of existing riparian vegetation and conifer trees within the disturbance footprint. Although the project feature locations have been optimized to minimize the need for conifer removal, the project will require removal of a total of 65 conifer trees, 32 of which are between 6 and 12 inches in diameter, 24 of which are between 13 and 24 inches in diameter, and nine (9) conifer trees that are 25 to 36 inches in diameter. Restoration would also result in riparian vegetation removal, ranging from understory shrubs to decadent tree-form willow and alder specimens that would be salvaged where possible. Salvage operations would reuse removed willow and alder stakes, willow and alder root wads (when less than 3 feet in diameter, fallen trees, sod, and any other reusable vegetation resource.

Through our discussions with TRPA the following "Rule of Thumb" was applied as a constraint during development of the Final design:

- Any grading that results in cut within a tree drip line or disturbance that results in greater than or equal to 25 percent root removal, that tree would be designated for removal as it would not survive that degree of disturbance in the short term post construction.
- Any grading that results in fill that will be of any depth that will be immediately adjacent to the base of the trunk, that tree would be designated for removal as it would not survive that degree of disturbance in the short term post construction.

The project team and TRPA Forester agreed that in the spring prior to construction, TRPA will evaluate the project site and designate trees to be removed due to poor health or condition. In addition, the project team will mark trees that need to be removed to meet the project goals for TRPA to evaluate and provide a determination on removal or preservation.

In accordance with the project goals, revegetation treatments have been designed to address all areas disturbed by construction activities to enhance species structural diversity (due to the degraded existing conditions) and to provide short term and long term site stabilization. After project completion, improved soil moisture conditions would restore opportunities for native wetland and riparian plant species to become reestablished and increase in occurrence and/or vigor. Over the long-term, the vegetation community would remain largely similar to what currently exists, but improvements in structural diversity would result.

4.3 Aquatics

On September 27 and 28, 2006, ENTRIX biologists walked the length of the Middle Reach of Rosewood Creek and noted specific habitat types and features. All observed wildlife was noted, and separate field notes were taken for each Implementation Area.

The survey involved walking from downstream to upstream within the creek as much as possible, or on the bank when dense riparian vegetation or woody debris limited access. Habitat was classified as riffle, pool, or cascade. Surveying from downstream to upstream was important as it afforded a much higher chance of spotting fishes or other aquatic organisms before they sought shelter from the survey crew. The low-flow condition prevented the use of snorkeling as a survey tool; however, a dip net was used to sample some of the deeper and more discrete units. A small amount of marginal habitat occurs within the channel in Area A (ENTRIX 2006).

No fish species were found during the 2006 terrestrial and aquatic surveys of Implementation Area A. Based on the habitat types noted, however, the following fish species have the potential to occur in the Project Area: brook trout (*Salvelinus frontalis*), rainbow trout (*Oncorhynchus mykiss*), speckled dace (*Rhinichthys osculus*), and Lahontan redside shiner (*Richardsonius egregious*). None of these species are listed as threatened or endangered. There are two known fish passage barriers in the Project Area, at least one fish passage barrier upstream, and at least one fish passage barrier downstream (Mainstream 2005).

4.4 Culverts

Two culverts cross under Northwood Boulevard through a thick embankment fill. On the east (left downstream view) is an arched corrugated metal pipe (CMP) culvert with a 4.5-foot (ft) span and a 2.8-ft rise. On the west (right downstream view) is a 4-ft diameter circular CMP culvert. Taken together these culverts have the capacity to convey the design storm event flows shown in Table 2-1. Because of their slope, length, and outfall configuration (a small jump without a pool), however, the culverts likely represent a fish passage barrier.

State Route 28 has a single arched CMP culvert with a 6.8-ft span and 4.75-ft rise. This culvert has the capacity to convey the design storm event flows shown in Table 2-1. Given the low slope and culvert characteristics, the culvert itself is not considered to be a significant fish passage barrier. However, debris blockage at the downstream outfall (potentially related to winter snow storage in the right-of-way) may impair use of the resting pool for upstream migrants.

Chapter 5

Existing Conditions Hydraulic Modeling

5.1 Model Set-Up and Assumptions

The Corps HEC-RAS software (version 4.0) was used to model the hydraulics of existing conditions in Rosewood Creek in Area A. The ground topography surveyed in 2008 (as described in Section 3.1) was used to create the geometry file for the model. Bed slopes within the reach range from less than 1 percent in small sections to over 10 percent in the steepest sections. The reach average slope is approximately 6 percent. Within Area A, 110 cross sections were established from downstream of State Route 28 to upstream of Northwood Boulevard, with an average spacing of 20 ft. The cross-section spacing is not intended to be dense enough to capture all of the local hydraulic changes associated with the numerous nickpoints and morphologic bedforms (e.g., step-pool features and cascades) throughout Area A that result in rapidly varying flow conditions. To do so would have required thousands of cross sections. Instead, the cross-section spacing is dense enough to capture reach-averaged conditions. The culverts at the two roads (Northwood Boulevard and State Route 28) were included in the model.

Manning's "n" roughness values for the floodplain were determined from published literature relating vegetation type, height, and density with influence on flow resistance (Chow 1959). The channel roughness values are based on research that relates channel bed slope with flow resistance at the reach scale (Yochum and Bledsoe 2010, Montgomery and Buffington 1997). For example, in step-pool morphology, the abruptly changing flow resistances associated with high energy loss at channel steps and relatively low energy loss in pools is averaged out for the entire bedform unit. This reachaveraging of flow resistance enables use of HEC-RAS to hydraulically model rapidly varying flow by essentially reducing the channel complexity to gradually varied flow. Thus, the modeled water surface elevations do not show the detail of every channel step, but they do show reach-averaged water surface elevations that can be used to evaluate reach-average conditions.

5.2 Results

The model results support the field observations that the conveyance capacity of Rosewood Creek is several times greater than its pre-disturbed condition. The 100-year event (48 cfs) results from HEC-RAS were analyzed in HEC-GeoRAS software in GIS to map flow depths and inundation extent (Figure 5-1). The mapping shows that, except for a small section of the creek near the middle of the reach, the 100-year flow is entirely contained within the entrenched channel. The vast majority of the terrace (former floodplain) never receives any surface water flooding from the creek overtopping its banks. Flow depths in the channel are typically 2–3 ft and can exceed 4 ft. A longitudinal profile showing the elevation relationship of the 2-year (6 cfs) and 100-year (48 cfs) water surface elevations and the left and right top of bank elevations is displayed in Figure 5-2. This plot reaffirms the substantial incision and overwidening the channel has experienced that has led to near confinement of the largest magnitude, most infrequent flood events. The longitudinal profile shows that the existing culverts at State Route

28 and Northwood Boulevard can adequately convey the 100-year flood without overtopping or backwatering.

The key result of the hydraulic modeling analysis of existing conditions was quantification of the extent of disconnection between the channel and its former floodplain. The vertical difference between the water surface elevation at the 100-year flow and the broader valley floor (former floodplain) is typically several feet. Field observations indicate that Rosewood Creek is developing incipient floodplain in some reaches. This floodplain is typically only from one to two channel widths wide and several feet beneath the valley floor. While this incipient floodplain will continue to develop naturally, it will do so by continuing to erode the tall, oversteepened banks, thus delivering more fine sediment to the channel that eventually will be delivered to Lake Tahoe. Since the base level of the creek in Area A at the State Route 28 culvert is a fixed elevation, the long-term evolution of the reach is likely continued bank erosion and incipient floodplain development, resulting in further disconnect with the former floodplain.

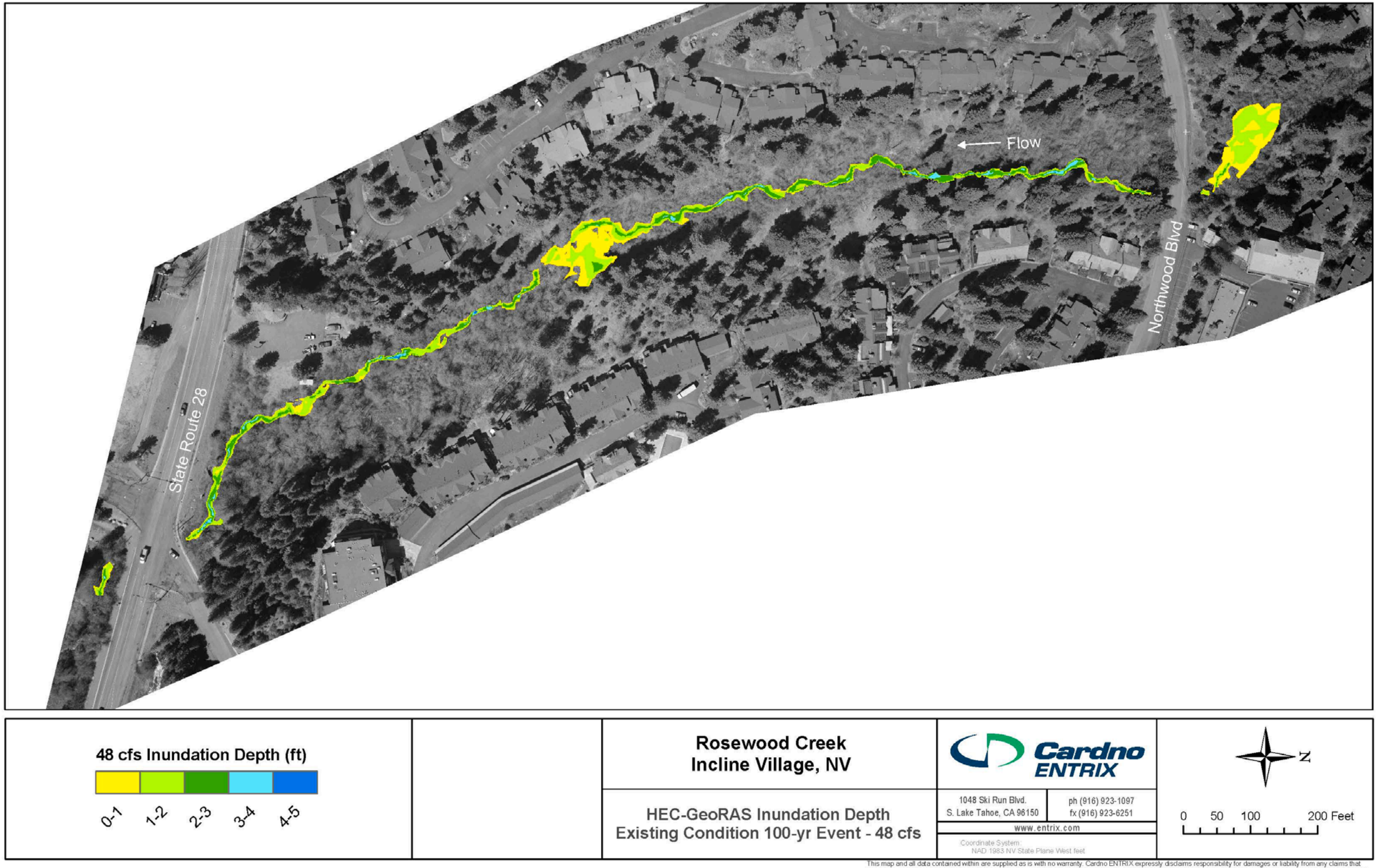

Figure 5-1 Modeled Inundation Depths at the 100-Year Recurrence Interval Event of 48 cfs under Existing Conditions

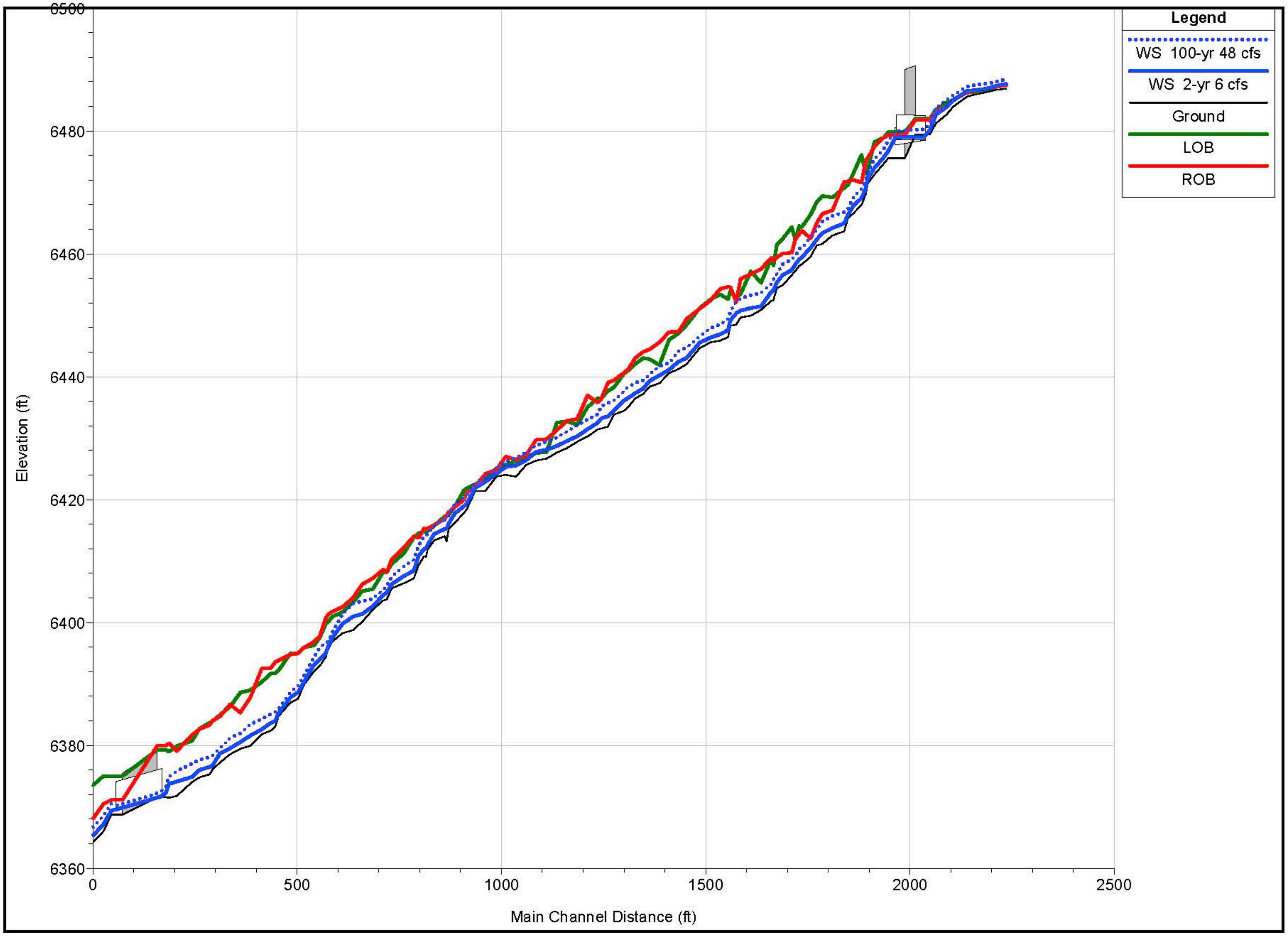

Figure 5-2 Comparison of the 2-Year (6 cfs) and 100-Year (48 cfs) Event Water Surfaces and Left and Right Top-of-Bank Elevations under Existing Conditions

Chapter 6

Restoration Design

6.1 Channel Capacity and Restoration of Floodplain Connectivity

The Project design includes several specific elements that are consistent with the Project goals of reducing channel capacity and restoring floodplain connectivity relative to the existing deeply incised and oversized condition. The restoration would reconstruct a low-flow channel with (1) the appropriate size, slope, and materials to convey the bankfull flow and sediment; and (2) bank heights and overbank topography that provide for a small, but connected active floodplain throughout the entire Project reach. The active floodplain would receive water from flows exceeding the bankfull design flow (4 cfs) and would be expected to accommodate the 5-year and 10-year flows without excessive depths, velocities, or shear stress. The proposed new channel capacity and regraded floodplain topography would result in overtopping onto the active floodplain for one (1) to two and half (2.5) days per year, assuming that future hydrologic conditions are similar to the historical record.

The measures to raise the streambed and water surface elevation under normal seasonal flows and small to moderate flood flows would also raise the surface elevation of major flood flows (including the 100-year event) and spread it out across portions of the existing SEZ/terrace that would return to the function of an active floodplain. Therefore, the Project design must balance the primary benefits of restored channel capacity and floodplain connectivity with the commitment to prevent any adverse changes in flood hazards. The proposed changes to the low-flow channel and floodplain topography or materials were iteratively modeled during design development (see Chapter 8) to ensure that a 100-year flood event (1 percent annual chance of occurrence) would not expand the FEMA Special Flood Hazard areas to include any structures not already so mapped.

The proposed Project conditions will allow flows that exceed the 4 cfs bankfull capacity onto the active floodplain, including large flood flows. The channel is intended to experience some natural dynamics in terms of seasonal to interannual movement, transport, and sorting of bed material and changes in bed form and surface particle sizes, along with small changes in planform or bank stability for flows up to and including the 10-year peak flows. However, the overall channel position should remain within the designed channel sub-bed alignment (~<two channel widths from centerline), excessive surface erosion (e.g., rills or gullies) should not occur on the active floodplain, and the channel bed changes should not exceed the placed bed material thickness over this same range of flows. Additionally, at peak flows in excess of the 10-year event increasing up to the 100-year event, the overall channel position may shift more, but would be expected to remain within active floodplain as defined by the buried grade control structures.

The design includes a system of several vertical grade controls along the Project reach of appropriate width (i.e., both valley wide and spanning just the active floodplain) at locations along the valley and channel profile to protect against the worst-case risk of scour or incision and nickpoint migration up to the 100-year flow (48 cfs). The framework provided by these grade control structures would ensure that, even if minor channel bed and bank dynamics result from moderate to large floods (i.e., 20-year to 100-year events), the effects would be localized and contained between grade control structures (both channel and valley-wide). Potential changes to the channel bed and bank would be limited to changes between the grade control structures, with each grade control structure providing upstream and/or downstream limits to potential erosion. The grade control structures can accommodate and protect against upstream or downstream migration of any local instability.

The geomorphic observations, geotechnical study, and hydraulic modeling of the Project reach indicate that the steepness of the valley slope; fine-textured, loosely consolidated soil materials; and irregular existing topography could combine to increase the risks of soil erosion on the floodplain during large storm events (i.e., 50-year to 100-year events). Therefore, the design incorporates re-contouring to smooth the floodplain topography and revegetation patterns that improve soil cohesion and floodplain roughness without adversely routing or converging flows.

The design allows for naturally dynamic channel margins and a connected active floodplain within contiguous short sub-reaches that are each protected from instability by adjoining (upstream/downstream) valley-wide and channel grade control structures.

6.2 Defining New Channel Alignment and Profile

The restoration design proposes a relocated stream channel within the SEZ that incorporates some former channel remnants and provides a stream length and profile that is suitable for the existing valley topography. The relocated stream channel would meet the existing downstream culvert (State Route 28) at grade, and its design incorporates replacement of the upstream culverts (Northwood Boulevard) that would improve natural functions and satisfy utility and maintenance constraints.

The alignment of the new channel is based on a combination of field inspection and map interpretation of the topography, remnant channel features on the abandoned floodplain (i.e., terrace), landowner knowledge of the historical channel positions, and iterative hydraulic modeling to minimize 100-year flood flow extent, depths, and velocities. The proposed alignment is generally west of the existing channel in the upstream portion of the Project reach and east of the existing channel in the downstream portion of the Project Area. This alignment limits crossing of the existing channel by the new channel to one location and takes advantage of the existing abandoned floodplain (terrace) surfaces as restored SEZ. The valley is relatively narrow, particularly in the middle of the Project reach, and required iterative adjustments of proposed grading to limit maximum water depths for the 100-year flood. The topography slopes down to the east in the lower portion of the Project reach, in the headwaters of a small secondary drainage (or historic remnant channel), which required iterative adjustments of the channel location and elevation to avoid excessive water depths or extent in existing wetlands.

Iterative hydraulic modeling was used to optimize the channel profile, channel alignment, and width and slope of the active floodplain in the first round of the 90-percent design. Channel profile adjustments were made to limit in-channel shear stress over the entire range of design flows, up to the 100-year event. The down-valley and cross-valley (toward the channel) slopes on the active floodplain also were refined to limit out-of-channel shear stress over the entire range of design flows, up to the 100-year event. The highest mean in-channel and active floodplain shear stresses were grouped (Table 6-1) as an initial guide to the use of specific soil types, rock sizes, vegetation, or bioengineering treatments for channel and floodplain surface stability at particular design flows (following standard permissible shear stress guidelines).

Table 6-1 Channel and Active Floodplain Guidelines for Rosewood Creek Area A

Channel Feature	Channel Type 1	Channel Type 2	Channel Type 3	Channel Type 4
In-Channel				
Highest mean shear stress for 2-, 5-, and 10-year flows (lbs/ft^2)*	1.5	2.6	3.5	5.0
Highest mean shear stress for100-year flow (lbs/ft^2)*	1.9	4.0	4.8	6.0
Active Floodplain				
Highest mean shear stress for all flows for 2-,5-, and 10-year flows (lbs/ft^2)*	0.6	1.2	2.0	3.5
Highest mean shear stress for 100-year flow (lbs/ft^2)*	1.5	2.0	2.5	3.9

lbs/ft^2 = Pounds per square foot.

The 90-percent and final design channel alignment, profile, and active floodplain slopes were further refined by additional iterative hydraulic modeling once incipient motion analyses and bank stability modeling (as described in other sections) produced target channel dimensions for each slope range (channel type which was determined based on these slope ranges). The resulting channel profile generally matches the varied existing valley slope. Additionally, the finished grade of the floodplain is smoothed (including shallow excavation or fill 1 to 3 ft) to minimize topographic irregularities and ensure the lowest in-channel and over-bank shear stress while having channel bank heights appropriate for each channel type and slope.

Transitions along the new channel between prescribed channel types will occur gradually over a distance of ten feet, overlapping the ‘higher, more resistant’ channel type details onto the lower gradient side of each transition point. Where the channel profile change is less than ten feet long, no change in channel type prescription is made.

6.3 Developing New Channel Cross-Section Dimensions

The size and shape of the proposed active (low-flow) channel are based on several considerations:

a. Statistical analysis of measured hydrology data from Rosewood Creek (tributary to) Third Creek and available streamflow records on neighboring watersheds that guided selection of a 4 cfs bankfull design flow (as described in Chapter 2, “Hydrology”).

b. Empirical data from a representative sub-reach (existing creek stations EX 10+60 through EX 12+00 and above station EX 20+50) that has reasonably stable channel condition and a functioning floodplain connection with Rosewood Creek (based on the field survey described in Chapter 3, "Field Data Collection").

c. Iterative hydraulic modeling (at-a-station HEC-RAS) and bank stability analyses (ARS-NSL Bank Stability and Toe Erosion [BSTEM] model) to select the appropriate range of channel bed widths and bank angles that meet the target bankfull capacity (4 cfs) while limiting shear stresses on the bed and bank. The preferred conditions were selected such that rock sizes and vegetative materials consistent with natural local stable channel segments (i.e., not large rock/ riprap) would be sufficient for stability.

All of the channel types are designed to meet the bankfull design capacity of 4 cfs, but the size and shape of the proposed channel are varied to mimic natural channels and match the range of valley slopes. The channel in steeper sections (Type 4) would be narrowest and deepest. The channel in moderate sections (Types 2 and 3) would be slightly wider and shallower. The channel in the lowest slope sections (Type 1) would be the shallowest (Table 6-2 and Figure 6-1).

Table 6-2 New Channel Dimensions in Rosewood Creek Area A

Channel Feature	Channel Type 1	Channel Type 2	Channel Type 3	Channel Type 4
Channel slope range (ft/ft)	>0.03	0.03 to 0.05	0.05 to 0.07	0.07 to 0.12*
Maximum depth (ft)	0.70	0.90	0.90	1.20
Top (bank-full) width (ft)	3.3	3.3	3.3	2.4
Bed width (ft)	1.9	1.5	1.5	1.2
Cross-section area (ft^2)	2.0	1.9	1.9	2.2

ft = Feet.

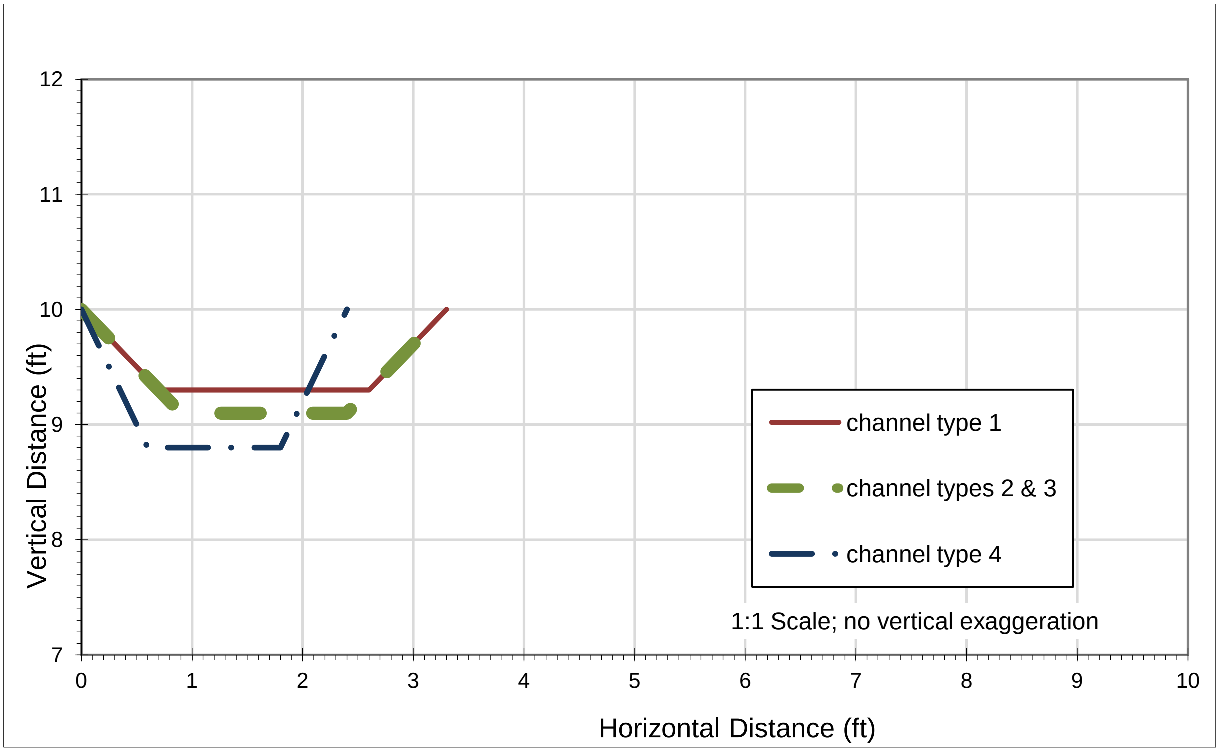

Figure 6-1 Schematic Representation of Channel Dimensions for Proposed Channel Types

6.4 Northwood Boulevard Culvert Replacement

The Project will replace the aging and poorly aligned culverts under Northwood Boulevard. The new culvert is designed to improve the stream profile, reconnect adjoining areas to the active floodplain on both sides of the road fill embankment, improve fish passage conditions, and take advantage of the opportunity to remove placed fill material within the SEZ on the upstream side of Northwood Boulevard.

The geotechnical investigation described in Chapter 3 (Wood Rodgers 2009; see Appendix A) indicated the approximate depth and extent of placed fill, which served as a guide to target elevations for the restored active floodplain on the upstream side of Northwood Boulevard.

The proposed culvert alignment, slope, inlet/outlet elevations, and hydraulic capacity meet several criteria, including:

a. New elevation and alignment that facilitates reconnection of remnant channels downstream on the terrace that will be reactivated as floodplain;

b. Increase hydraulic capacity to allow open-channel flow up to 48 cfs, the 100-year design flow; and

c. Reestablish fish passage conditions by installing culvert fitted with slotted weirs, natural roughness at the entrance and exit, and a downstream pool to control water surface elevation at the entrance.

The replacement culvert type and materials were selected to meet Washoe County Department of Public works regulations, policies, and requirements. The selected culvert is a concrete box culvert that will have custom modifications for fish passage wiers. The culvert was designed to meet several requirements, including the following:

- Clearance between sanitary sewers (minimum 1 ft vertical clearance/separation),
- Open clearance (height) of the culvert (minimum 5 ft vertical from channel bottom to the top of the culvert opening), and
- Maintaining the flow of the creek channel and exiting culverts (without encroachment into the active channel).

The culvert is more precisely described as a 5' x 5' wide opening concrete box culvert with an overall height (top to bottom) of approximately seven feet (7.2'). At each end of the culvert, cast-in-place wing-walls and headwalls (NDOT specifications) will be constructed and installed to allow for grading of the adjacent ground providing proper reconstruction of the proposed roadway prism above the culvert. Based on the large and complex nature of the culvert installation, the culvert is anticipated to be installed in a two phase process. Half of the culvert will be installed followed by the other half of the culvert. This will allow for the proper protection and temporary relocation of the existing 12 inch diameter water transmission main and the existing six-inch sanitary sewer main. Furthermore, during the construction of the culvert, all improvements within the culvert (weirs and cobble entrance and exit points) shall be completed concurrently with the culvert placement.

6.5 Backfilled Existing Channel

The proposed backfilling of the existing incised channel will restore natural-appearing valley topography. The design includes some variations to help ensure that flows from major floods are not routed over the backfilled channel, limiting the potential for recapture of the existing alignment or profile.

Because the native soils of the existing oversized channel have been eroded away and transported downstream of the reach, imported earth materials, or materials excavated from onsite efforts (native backfill), will be needed to raise the existing elevation to meet the adjoining surfaces. For areas eroded deeper than approximately 1.5 ft below finished grade, the imported material composition (lithology), size distribution, and physical layering/compaction need to achieve engineering purposes for stability and restored groundwater levels and reasonable flow rates (i.e., neither restricted or accelerated). The backfilled channel will be filled as shown on sheet D-4 of the Project Plans, as depicted in detail number 2. Any native backfill will be screened material (to ensure that no large or organic materials are present). If materials generated from Phase 1 efforts are used, they would be stockpiled and stored by the Contractor at an offsite location (as the Project does not provide for stockpiling of this material in the Project Area). For the areas within approximately 0.5ft of finished grade, the imported material needs to provide suitable soil profile characteristics for revegetation success, including texture, porosity, permeability, organic material, and microorganisms.

Protection of the backfilled existing channel from possible surface erosion due to flooding is provided by the combination of topographic grading that prevents access of flood waters to these areas; the valley-wide grade control structures that are designed to function up to and including the 100-year peak flow to prevent incision at the old alignment; and the revegetated surfaces, including enhanced roughness at strategic locations and a range of more mesic species in areas that will be farthest from the new channel and active floodplain.

The backfilled channel will provide benefits to groundwater levels and flows, because it will reestablish sediments and soils with groundwater storage and transmission properties in the location of the existing eroded channel. The specifications for particle sizes, porosity, and permeability are intended to avoid restricting groundwater, similar to the existing condition in the rest of the valley. Conversely, protection of the backfilled channel alignment against locally high groundwater flow rates at key locations will be ensured by installation of low permeability channel fill (see detail 1/D-1) to regulate (but not entirely dam/prevent) down-valley groundwater movement. Where Phase III work disturbs the temporary buried protection (geomembrane), the temporary buried protection will be removed.

Given a lack of groundwater monitoring data upon which to base quantitative design, the number and location of permanent buried protection have been proposed based on professional judgment and knowledge of the local setting, acknowledging the expected raising of groundwater elevations in response to backfilling.

Chapter 7

Proposed Revegetation Design

7.1 Revegetation Approach

The restoration design is focused on creation of a stable stream channel with a connected and functioning floodplain to enhance the riparian habitat corridor through structural species diversity. The Project design was based on the results of bank stability modeling to guide the use of optimal soil material, bank angles, and vegetation treatments that would match various channel types for slope ranges in the reach. The proposed design would be geotechnically stable and would resist hydraulic forces by using only rock and vegetation treatments. Therefore, to the furthest extent possible, the proposed revegetation design does not include the use of erosion control blankets for initial protection. In addition, the proposed Order of Work (see the Project Special Technical Specifications; provided separately), maximum duration of construction, and ability to use off-channel construction will provide for up to two complete growing seasons for revegetation to establish on the banks of the new channel, the frequently inundated floodplain, and wetlands prior to the channel being rewetted. These provisions, along with the dewatering proposed in all three phases of the Project (see the Storm Water Pollution Prevention Plan for descriptions of the dewatering process) negate the need for erosion control blankets except at tie-in locations. At these locations, woody vegetation seeding, root wads, wetland sod and willow staking will be used in combination with an erosion control blanket to afford a higher level of immediate short-term protection.

7.2 Revegetation Establishment and Seasoning

The Order of Work for implementation of restoration provides for a minimum of one growing season and a maximum of two complete growing seasons for revegetation to establish in and around the new channel to provide site stability. Seasoning of the new channel and surrounding floodplain will not be considered complete until revegetation establishment can provide sufficient stability to accept stream and floodplain flow. This will be a collective decision be the Design Engineer, Washoe County, NTCD, TRPA, Nevada Division of State Lands, and the Nevada Department of Environmental Protection and shall be based on monitoring reports submitted to permitting agencies as required..

The determination of site stability to support introduction of flow into the new channel will be based on documentation of 95 percent combined cover by seeded species and mulch in upland and backfilled channel areas, and 95 percent coverage by seeded species and live replanted root wads in the new channel and adjacent floodplain areas such that there is no evidence of rills, gullies or other evidence of erosion. Revegetation establishment shall be assessed twice on an annual basis at the beginning (June) and end (September) of each growing season subsequent to each revegetation implementation. Cover assessment shall be documented in accordance with the monitoring plan and methods as approved by the Corps of Engineers Nationwide Permit 27 conditions (pending). The recommended monitoring plan is as follows:

Upon completion of Phase 1, Year 1 construction and revegetation of the new channel alignment the following monitoring techniques shall be established using as built survey. Please refer to the Order of Work contained in the Special Technical Provisions and Design Report.

NTCD shall establish up to twelve (12) permanent photographic monitoring points that shall include at a minimum:

- 3 "tie-in" locations
- 3 wetland enhancement locations
- 3 wetland impact avoidance and enhancement locations, and
- 3 restoration locations.

In addition, NTCD shall establish four (4) valley-wide transects on which vegetation cover data shall be collected and from which relative species composition can be calculated.

Monitoring for revegetation success and wetland mitigation success shall be assessed twice on an annual basis at the beginning (June) and end (September) of each growing season subsequent to each revegetation implementation. Revegetation monitoring shall be conducted for an additional minimum two years post completion of the project construction and revegetation activities.

A report documenting monitoring data collected shall be prepared and submitted to permitting agencies within 60 days of completion of monitoring.

7.3 Revegetation Types

Revegetation types have been designed based on the physical and hydraulic attributes of the new channel, new active floodplain, and backfill channel areas. The anticipated shear stresses in the channel and on the floodplain (Table 6-1) provided guidance for selecting the range of vegetation treatments that would provide adequate hydraulic resistance (based on comparison to standard engineering tables of 'permissable' shear). Additional guidance for bank treatment vegetation was obtained from the BSTEM analysis and the species, age, density rooting cohesion benefits data imbedded within that software package. The revegetation design is focused largely on providing roughness to protect both the new channel banks and the new active floodplain. Revegetation types also include those to facilitate wetland enhancement, restoration, and creation, and to stabilize sites used for construction access and staging areas.

The proposed revegetation types, their characteristics, and the applicable areas are summarized in Table 7-1.

Table 7-1 Proposed Revegetation Types and Characteristics

Type	Description	Applicable Area
A	Wetland herbaceous and riparian woody species	New channel bank, restored/ created/enhanced wetland, wetland portions of old channel backfill, restored floodplain
B	Wetland herbaceous species only	Restored/ created/enhanced wetland
C	Installation of willow stakes	Low on new channel bank or active floodplain and at toe of new channel bank, as directed
D	Installation of willow stakes in channel, and top of bank armored with root wads amid rock armor	New channel banks (particularly in steeper areas and at grade control structures)
E	High-density riparian woody species for enhanced roughness	Specific locations along margins of active floodplain (near old channel alignment and/or areas with high potential shear under flood flows)
F	Floodplain mesic species site stabilization	Restored floodplain fringe
G	Mesic species site stabilization	Upland areas – miscellaneous areas outside Revegetation Type F, access and staging areas in upland
H	Erosion control blanket	At tie-in locations, to be combined with other types of revegetation for immediate stability.
I	Propagated wetland mat	At tie-in locations for immediate stability
J	Wood Chip	Application for foot path

Chapter 8

Hydraulic Model Evaluation of Restoration Design

8.1 Channel Capacity and Floodplain Connectivity Performance

HEC-RAS software was used to evaluate the proposed channel and floodplain restoration design. The modeling effort had several objectives:

1. Evaluate how the design would affect the inundation depth and extent of the 100-year flow and prevent changed flood risk to nearby properties;
2. Evaluate the flow conveyance capacity of the new channel to ensure that it overbanks at the desired frequency, as described in section 6 of this report;
3. Analyze overbanking to ensure that the lateral extent of flooding on the new floodplain is largely consistent, without major expansions and constrictions throughout the reach;
4. Assess channel shear stresses over a range of flow magnitudes to determine the size material needed to construct a stable channel in which the key framework sediment would be immobile at the highest flows;
5. Analyze floodplain shear stresses to ensure that the proposed revegetation on the floodplain can withstand the erosive energy of flood flows; and
6. Evaluate the performance of the new Northwood Boulevard culvert for both flood conveyance and fish passage.

The new design ground elevation surface generated in AutoCAD (valley wide cross-sections of the proposed surface generated at approximately 25-foot intervals) were input into the HEC-RAS model. The same guidelines used to determine Manning’s “n” roughness values for the existing condition model were used in the proposed design model. Floodplain roughness values were based on the vegetation treatment types described in Chapter 7 and as shown on the Project Plans (Revegetation Sheets R-1 through R-4; provided separately), and assumed that vegetation is established. Similar to the existing condition model, the proposed design model does not include all of the micro-detail associated with the individual bedforms in the reach. For example, all of the abrupt elevation changes of a step-pool section of channel are not included in the model because this would be impractical over such a long modeling reach. Instead, reach-averaged Manning’s “n” values were assigned to the cross sections to account for the average flow resistance of the reach. Therefore, the model simulates reach-averaged conditions.

Hydraulic modeling of the proposed design was an iterative process. After each model run, the results were analyzed to evaluate design performance. The limitations of the design step highlighted by the modeling were then changed via modified proposed grading and final ground surface elevations in AutoCAD and re-run in HEC-RAS. Iterative design changes were made until the design satisfactorily met all the Project objectives outlined above. Some of the major design changes related to balancing floodplain regrading with channel alignment and elevation changes until the desired channel capacity, slopes, and floodplain overbanking were achieved without 100-year floodplain boundaries, depths, or velocities of concern. Iterations continued to be made to ensure the minimal potential tree removal requirements and reduce the project footprint for valley wide grade controls to the degree practicable.

Chapter 9

Refinement of Channel Design Based on Hydraulic Modeling Analysis

9.1 Channel Materials and Bank Vegetation for Channel Treatment Types

The selection of channel bed and bank materials and vegetation is intended to match or mimic the naturally occurring conditions for local channels while providing adequate initial and long-term stability for the channel boundaries.

Bed material sizing for each channel type was determined by an approach that combined empirical bed material data from stable mountain streams in the channel slope ranges (Montgomery & Buffington 1997), critical grain size calculations from the HEC-RAS model of the proposed uniform channel dimension, and specific calculations of critical particle diameter. The critical particle diameter calculations used the total shear stress at the maximum channel slope of each channel type, for a channel constructed to meet the proposed standard channel dimensions for that channel type (Table 6-2).

These data informed the selection of appropriate particle size distributions, characterized by the particle diameters for key points on the target cumulative particle size distribution (which is a description of the percent of particles by weight, smaller than a specific diameter).[3] The average between the empirical stable channel d50 size and the calculated critical diameter for the maximum shear at bankfull design flow (4 cfs) was used to guide the proposed d50 (Table 9-1). The average between the empirical stable channel d84 size and the calculated critical diameter for the maximum shear at the 100-year flow (48 cfs) was use to guide the proposed d84 (Table 9-1). The largest bed particle diameter for each channel type was estimated to be the greater of either the calculated critical diameter for the maximum shear at the 100-year flow or the size of rock available at local material suppliers (TNT and Pombo) with a size class containing the d84 particle size.

The desired particle size distribution for each channel type was prescribed in the plan detail drawings (Sheets D-3 and D-4 of the Project Plans) and specification as the necessary mixtures (by weight) of screened particle size intervals available from regional material suppliers to achieve the bed material particle diameter cumulative distribution targets listed in Table 9-1.

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[3] When sediment samples are collected and analyzed, a particle size distribution is created by calculating the cumulative percent of the sediment finer than a given grain size. At certain points on the cumulative scale, the particle size can be significant to geomorphic processes. For example, the d10 is the particle size where 10 percent of the sediment is finer than the d10 particle size. Similarly, the d50 refers to the median particle size where 50 percent of the sediment is finer than the d50 particle size and indicates the mid-point in the size distribution of particles in a sample.

Bed material thickness below finished grade was selected to be the greater of either one full channel depth or twice the diameter of the d50 particle size for each respective channel type.

Bed material width was determined to be a minimum of two channel bottom widths, or 1 foot wider than the top width on each side (maximum of the two), to allow for minor planform adjustments. These bed material widths and overall channel dimensions and structure are shown on the Project Plans (Sheets D-3 and D-4).

To help ensure that interstitial spaces of the placed bed material will be filled reasonably quickly and will support surface water within the channel, a layer of medium to coarse angular sand and ¾” minus angular shot rock will be placed about half way below finished grade in all of the placed bed material in all channel treatment types. There is little detailed quantitative information on future sediment characteristics or supply from upstream, but observations after construction of Area F support this approach, which provides a partial filling of pore spaces at the time of construction that would be supplemented by natural processes during channel seasoning and the initial wetting of the new channel.

Table 9-1 New Channel Bed Materials by Channel Type

Channel Feature	Channel Type 1	Channel Type 2	Channel Type 3	Channel Type 4
Channel slope range (ft/ft)	<0.03	0.03 to 0.05	0.05 to 0.07	0.07 to 0.12
Median (d50) bed material particle diameter (in)	3.0	4.5	5.8	7.2
D84 bed material particle diameter (in)	6.9	9.2	11.6	14.0
Largest bed material particle diameter (in)	8.0	12.0	12.0	18.0
Smallest bed material particle diameter (in)	1.5	3.0	3.0	3.0
Minimum bed material thickness (in)	8.4	10.8	11.6	14.4

ft = Feet.
in = Inches.

Bank angles, bank soil composition, and bank treatments—including top-of-bank, bank face, and toe-of-bank vegetation, rock, or other protective materials—were determined through iterative use of the hydraulic modeling (HEC-RAS) data on proposed slopes and water stage in representative bank stability modeling with the BSTEM model.

Initial BSTEM bank stability analyses used the geotechnical characteristics of the existing native materials (from the geotechnical investigation discussed in Chapter 3) and tested whether the desired bank angles (0.5:1 or 1:1) would be stable immediately as constructed, if protected, or once vegetation had established. The results of these BSTEM scenarios indicated that, while the proposed vegetation types could provide adequate geotechnical stability for the weakly cohesive native materials, the top-of-bank vegetation would not achieve this condition until it matured for at least 2–5 years, depending on the species types and mix. Therefore, the constructed channel dimensions and shape might be vulnerable to bank failures from internal weakness during the channel seasoning or the initial year or two of active flow if native, in-situ bank materials were used. Surface protections on the bank would not eliminate this small risk (primarily a risk of losing the shape and size of the desired small channel, but also the risk of a minor amount of mobilized sediment) because the driving forces were internal geotechnical properties. BSTEM iterations showed that lowering the bank angle (2:1) or increasing the cohesion of the bank materials could solve the initial instability. Lowered bank angles were not considered representative of the desired long-term natural channel shape and were not preferred. However, the bank heights are so low (~1 ft) that the volume of imported soil required to provide soil materials more cohesive than the native materials would not be impractical. Therefore, the selected solution to possible short-term initial geotechnical bank failures is the proposed import and placement of soil that is moderately cohesive.

The BSTEM toe erosion analyses were updated to assume the use of imported moderately cohesive material and the range of potential bank angles (0.5:1 and 1:1), with iterative analysis of bankfull flows for varied durations and over the full range of channel slopes proposed. Combinations of bank face and toe (lower one-third of the 1-ft banks) treatments were tested to ensure that neither the recommended living vegetation nor the rock material sizes would result in any toe erosion. Vegetation treatments for each of the channel types (1–4) were customized to include appropriately increasing proportions of deep-rooted, high roughness woody vegetation in the steeper areas, as indicated in Table 9-2 and discussed in Chapter 7.

Table 9-2 New Channel Bank Treatments by Channel Type

Channel Feature	Channel Type 1	Channel Type 2	Channel Type 3	Channel Type 4
Channel slope range (ft/ft)	<0.03	0.03 to 0.05	0.05 to 0.07	0.07 to 0.12[a]
Bank angle (rise: run)	1:1	1:1	1:1	0.5:1
Bank composition	Moderate/resistant silt	Moderate/resistant silt	Moderate/resistant silt	Resistant silt
Bank face material	Live fascine	Live fascine	Live fascine	Live fascine (< 0.08 slopes); 10-inch diameter rock (>0.08 slopes)
Bank toe[b] material	Live fascine or 3.0-inch diameter gravel	6.4-inch diameter cobble (0.03–0.04 slopes); 10-inch diameter rock (0.05 slopes)	10-inch diameter rock	10-inch diameter rock
Top-of-bank vegetation[c]	Wet meadow	Wet meadow and/or woody riparian	Wet meadow and/or woody riparian	Woody riparian

Notes:

[a] Nearly all treatment areas of Channel Type 4 are between 0.07 to 0.09 channel slopes, but the bed material sizing has used worst-case slope of 0.12 as the guide for sizing bed material.

[b] The toe of the bank is only the lower 3–4 inches of the bank; if the rock treatment size diameter is larger than 4 inches, calculations assume that the remainder of rock is buried below the toe, not extending up into the rooting zone at the top of bank.

[c] Vegetation must be 2 years old for wet meadow species and 5 years old for woody riparian species to achieve full bank cohesion benefits.

9.2 Valley-Wide and Channel Grade Control Structures

The Project includes two types of grade control structures to provide a vertical and lateral stability framework: (1) valley-wide grade control features that span the 100-year floodplain (including the new channel, active floodplain, and backfilled existing channel); and (2) channel grade control features that span the new channel and active floodplain. These elements of the design would be installed largely below finished grade (except for exposure where they cross the new channel bed) and are intended to be static (immobile) at all flows up to and including the 100-year peak flow (48 cfs). The structures are comprised of rock material similar to larger elements that occur naturally in the vicinity, but would be buried. The structures would be constructed of placed individual rock that meets design criteria sizing, grouping and chinking. Engineering and geomorphic principles formed the basis for the grade control design guidelines (Table 9-3).

Table 9-3 Design Guidelines for Grade Control Structures

Width (across Valley)	Location (in Plan and Profile)	Depth below Surface (ft)	Material Sizing
Valley-Wide Grade Controls			
Larger of the following: 20 ft (horizontal/plan) from the top of existing channel bank; 20 ft (horizontal/plan) from the top of proposed channel bank; 1 ft (vertically/elevation) above 100-year flood elevation; or 10 ft (horizontal/plan) beyond the boundary of the 100-year floodplain (48 cfs).	At distinct changes in valley orientation and profile slope; At key locations to avoid recapture of the backfilled existing channel alignment; and Along profile to meet 0.02 slope guide for grade control spacing that provides knickpoint migration protection.	At least two particle diameters of the sized boulders but no deeper than 3 ft; and Along profile to meet 0.02 slope guide for grade control spacing that provides knickpoint migration protection.	Critical particle diameter for maximum shear stress at the 100-year peak flow (48 cfs); calculated for all grade control cross sections, selected a conservative18-inch diameter as a typical specification.
Channel Grade Controls			
Larger of the following: Twice the channel width from the outside edge of the new active floodplain (16 cfs); or, 4 ft (horizontal/plan) from the top of existing channel bank	At distinct changes in channel orientation and profile slope; At key locations to avoid recapture of the backfilled existing channel alignment; and Along profile to meet 0.02 slope guide for grade control spacing that provides knickpoint migration protection.	At least two particle diameters of the sized boulders but no deeper than 3 ft; and Along profile to meet 0.02 slope guide for grade control spacing that provides knickpoint migration protection.	Critical particle diameter for maximum shear stress at the 100-year peak flow (48 cfs); calculated for all grade control cross sections, selected a conservative18-inch diameter as a typical specification.

cfs = Cubic feet per second.
ft = Feet.

The widths of the grade control structures were determined relative to the floodplain that each type protects: the valley-wide grade control widths are based on the 100-year floodplain, and the channel grade control widths are based on the active (e.g., 5-year) floodplain.

Proposed locations of the grade control structures throughout the Project reach (in plan and profile, as shown on Sheets P-1 through PR-4 and sheet TI-13 and TI-14) were selected to minimize or arrest potentially destructive geomorphic changes. The initial positioning for draft 90-percent design located structures at distinct changes in the valley orientation and profile, and at key locations that would prevent flow routing toward the backfilled existing channel. The valley-wide grade controls are oriented nearly perpendicular to the anticipated floodplain flow direction, and the edges of these structures are also shaped to smoothly connect to adjoining upland topography.

The location, number, and orientation of all grade control structures were refined during 90-percent design relative to the channel profile. The performance goal was to ensure that potential vertical or lateral channel instability between structures could not propagate upstream or downstream. The method used was to project a 0.02 bed slope upstream from each proposed channel and valley wide grade control (as a conservative estimate of the deepest potential channel profile in the event that incision was re-initiated) and then use that projected elevation as the minimum depth for the next upstream grade control feature. The grade control structure locations and spacing along the profile were adjusted so that the buried rock would not need to be greater than 3 ft at any structure while connecting at the 0.02 minimum projected slope continuously throughout the Project reach.

The rock sizing for the valley-wide and channel grade control structures is designed to resist predicted shear stresses up to the 100-year event.

The design approach for the grade control structures limits risk from future channel movement and bed erosion overall throughout the reach, but allows for some natural channel adjustments in planform and profile of the new channel between structures.

Both the channel and valley grade controls are located and designed to withstand and perform under adverse flood conditions up to the 100-year event, without any specific maintenance requirements. Inspections would be recommended after moderate to large storm events (e.g., 20-year or larger) to ensure that no unexpected damage to the buried structures occurred. As a definition, “unexpected damage” is assumed to be a massive headcut or other failure that creates a channel incision deeper than the depth of the channel or valley-wide grade control structures or a shift in the planform of the channel greater than two channel widths from the proposed location.

Additionally, no routine maintenance should be required for the restored channel and active floodplain between structures. The only potential maintenance of the channel would be the inspections as described earlier in this section of this report and removal of any major deadfall or channel obstructions which could alter the channel planform or slope during storm event flows. The channel bed and banks are designed to be stable for flows at least as large as the 10-year peak flow event. For streamflow events greater than the 10-year peak flow, inspections would be recommended to ensure that no unexpected damage occurred. Small changes in bed and bank erosion could result for flows exceeding the 10-year peak flow and would be considered normal. The design would accommodate such dynamics for the sub-reaches between grade control structures without a requirement for maintenance or repair.

9.3 Hec Ras Modeling Results

The hydraulic model outputs for both the existing and proposed conditions for all modeled flows are included in Appendix B, including: perspective graphics of the entire modeled reach; all individual cross sections; profiles showing channel bed, banks, and water surfaces, graphs of velocity and shear stress under the 100-year flow, and complete tabular output (elevations, discharge, wetted area, hydraulic depth, velocity and shear) for the channel and any active overbank areas for all flows.

Chapter 10

Other Features Included in the Design

10.1 Construction Phasing

A multi-year, multi-phased approach is required to allow for proper construction of the Project and the effective introduction of flows to the new channel and floodplain. The phasing of the Project also takes into account property owner concerns, along with the regulatory requirements for work within the Lake Tahoe Basin. The construction phasing of the Project is described in detail in the Order of Work (see Project Special Technical Specifications) and is generally described below.

Phase 1:

Phase 1 of the Project generally consists of construction of the new channel and floodplain, except for three areas where the existing and proposed channels cross or meet. In association with the new channel construction, Phase 1 will also construct all of the channel grade control structures, along with the portions of the valley-wide grade control structures within the disturbance area of Phase 1. Phase 1 efforts will further include installing the new culvert, along with revegetation of all areas disturbed during Phase 1. These efforts include establishment of project-specific BMPs to provide temporary erosion control and to provide a safe working environment for both the Contractor and the surrounding public.

The duration of Phase 1 will be one construction season. Work efforts will be initiated after seasonal high flows have diminished and will be focused on periods of historical low channel flow (August). Phase 1 work will be completed prior to the deadline for completing grading (October 15).

Phase 2:

Phase 2 of the Project generally consists of providing a seasoning period for the new channel and floodplain revegetation work performed in Phase 1. The objective of the Phase 2 time period and effort is to allow for successful plant and revegetation establishment to occur, without flows being introduced to the channel or floodplain.

The duration of Phase 2 will depend on the success of plant and revegetation establishment, and will require between one and two complete growing seasons after completion of the Phase 1 efforts.

Phase 3:

Phase 3 of the Project generally consists of construction of the existing and new channel tie-ins, removal of roadway fill along Northwood Boulevard, and placement of the creek flows in the new channel. The work associated with this phase will be performed through diversion of the creek (see Section 10.3). Phase 3 work also will include construction of the remainder of the valley-wide grade control structures (within the area of disturbance of Phase 3 work) and backfilling of the existing channel along with revegetation of all disturbed areas. These efforts include establishment of project-specific BMPs to provide temporary erosion control and to provide a safe working environment for both the Contractor and the surrounding public.

The duration of Phase 3 is one construction season. Work efforts will be initiated after seasonal high flows have diminished and will take place during periods of historical low channel flow (August). Phase 3 will be completed prior to the deadline for completing grading (October 15). After completion of Phase 3 the County will receive a two (2) year revegetation maintenance bond from the Contractor to assure that all of the revegetation and irrigation installed as part of the Project are within the success criteria specified and maintained for two years from completion of construction.

10.2 Staging and Access

The Contractor will need to store and stage equipment and materials in the vicinity of the Project Area. Because the Project is located off county and state rights-of-way and affords no paved or covered areas for staging or access, access will be required onto private property off of the roadways. (Washoe County and NTCD will attain a Right-of-Entry for all work.) Because the Project will be constructed in phases, the storage/staging and access also will be phased, with different areas and access being used for each phase. The staging and access locations have been strategically determined for each phase to avoid long-term disturbance on private or public parcels and to avoid repeat disturbance to restored/revegetated areas. The staging, storage and access and traffic plans for the Project are depicted on Sheets TC-1i through S-1 of the Project Plans.

Phase 1, Storage and Staging:
Construction of the Project will require the Contractor to store both materials and equipment, along with providing parking for construction employees. These areas are to be located as close to the Project work areas as feasible, and therefore the following areas have been identified for use by the Contractor:

1. Third Creek Homeowners Association (parking lot by activity center); and
2. North side of Northwood Boulevard (where existing fill is located, on the west side of the existing creek).

In addition to these storage and staging areas, the Contractor will use a “moving” storage and staging area, which will be the general location (within the disturbance footprint) where work is occurring at that time. This area will be different on a weekly basis, as the Contractor’s work operations progress.

Each staging and storage area outside the contiguous disturbance limits will be constructed to ensure that dirt and debris do not leave the staging and storage site (through installation of a construction entrance), and each location will have adequate traffic control signage to alert local traffic in the vicinity to the presence of the storage and staging areas. Additionally, at each staging and storage area outside of the contiguous disturbance limits temporary erosion controls and construction limit fencing will be installed to provide both environmental and public safety controls.

Phase 1, Access:
The access necessary for proper construction of Phase 1 improvements will require access to both the southern and northern work areas (south and north of the existing and new channel crossing).

The southern access point will be near the intersection of State Route 28 and Northwood Boulevard, along Northwood Boulevard. This access point will be constructed in an environmentally sensitive area and requires installation of an access road that protects existing wetlands prior to access being allowed. Upon completion of the southern area of the Phase 1 efforts, the access road will be removed and the area will be restored to existing (pre-construction) conditions.

The northern access point will be west of the existing creek crossing of Northwood Boulevard. This access point will provide the Contractor with access to the northern work area of Phase 1 along with access to the open-bottom concrete culvert to be constructed for the creek crossing of Northwood Boulevard.

Each access will be constructed to ensure that dirt and debris do not leave the access site (through installation of a construction entrance), and each location will have adequate traffic control signage to alert local traffic in the vicinity to the presence of the access points.

Phase 2, Storage and Staging:
The work associated with the Phase 2 efforts is generally limited in (see Section 10.1 for a description of the Phase 2 work effort) and does not require extensive equipment or materials. To reduce project impacts, the Phase 2 storage and staging area is limited to the Third Creek Homeowners Association (parking lot by activity center).

This staging and storage area will be constructed to ensure that dirt and debris do not leave the staging and storage site (through installation of a construction entrance), and the area will have adequate traffic control signage to alert local traffic in the vicinity to the presence of the storage and staging area. Additionally, temporary erosion controls and construction limit fencing will be installed to provide both environmental and public safety controls.

Phase 2, Access:
Access for the Phase 2 work efforts will be required only by foot and only for the use of hand equipment; therefore, no formal access points are to be provided as part of the Project. Because the work associated with the Phase 2 efforts is plant and revegetation establishment, the use of motorized equipment and equipment with ground pressure is not allowed, as it would jeopardize and reduce the likelihood of revegetation establishment.

Phase 3, Storage and Staging:
Construction of Phase 3 of the Project will require the Contractor to store both materials and equipment, along with providing parking for construction employees. These areas are to be located as close to the Project work areas as feasible; therefore, the following areas have been identified for use by the Contractor:

1. Third Creek Homeowners Association (parking lot by activity center);
2. Washoe County ROW on the north side of Northwood Blvd, east of Rosewood Creek; and
3. Rear (northerly) portion of the Robinson parking area.

In addition to these storage and staging areas, the Contractor will use a “moving” storage and staging area within the Project Area, which will be the general location where work is occurring at that time. This area will vary on a weekly basis, as the Contractor’s work operations proceed.

Each staging and storage area will be constructed to ensure that dirt and debris do not leave the area and tracked onto the County and/or Private roadway (through installation of a construction entrance), and each location will have adequate traffic control signage to alert local traffic in the vicinity to the presence of the storage and staging areas. Additionally, the Project SWPPP details the procedures to be implemented by the contractor to clean any tracked materials from both the County and Private roadways (i.e. street sweeping). Furthermore, temporary erosion controls and construction limit fencing will be installed at each area to provide both environmental and public safety controls.

Phase 3, Access:
Construction of the Phase 3 improvements will require access to both the southern and northern work areas (south and north of the existing and new channel crossing), along with another northern access point for the work to be performed north of Northwood Boulevard.

One southern access point will be west of the intersection of State Route 28 and Northwood Boulevard, through the driveway/parking area of the “Robinson” property. This location will facilitate access to the existing channel to be backfilled downstream of its crossing with the new channel. The second southern access point will be the same point off of Northwood Boulevard near SR 28 used during Phase 1, requiring re-installation of a protective surface across existing wetlands.

Two access points will provide the Contractor access to the northern work area of Phase 3 south of Northwood Boulevard. The first is within the Third Creek condominium complex east of Rosewood Creek. The second is off Northwood Boulevard (to the south), west of the existing creek channel.

Access for the northern work area of Phase 3 north of Northwood Boulevard will be at the existing creek crossing of Northwood Boulevard. This access point will provide the Contractor access to the northern work area of Phase 3 (north of Northwood Boulevard) along with access for the backfill of the existing channel downstream of Northwood Boulevard and removal of the existing culverts at Northwood Boulevard.

Each access will be constructed to ensure that dirt and debris do not leave the access site (through installation of a construction entrance), and each location will have adequate traffic control signage to alert local traffic in the vicinity to the presence of the access points.

10.3 Creek Diversion/Channel Tie-Ins

Construction of the two tie-ins to the existing channel (the upstream and downstream ends of the Project) and the crossings of the existing and new channels require the flows in the creek to be diverted around these distinct construction areas. A Project-specific diversion plan has been developed (as part of the Storm Water Pollution Prevention Plan [SWPPP]) for the Project. The SWPPP (provided separately) describes in detail all of the specific features, requirements, and construction processes to be followed that are generally as described in this section.

Diversions of the creek and construction of the tie-ins will be constructed from the most downstream tie-in/diversion to the most upstream tie-in/diversion. The Contractor will not be permitted to initiate the next upstream tie-in/diversion until the Engineer and all regulatory agencies having jurisdiction over the Project have approved completion of the current tie-in/diversion. These approvals will provide a level of protection to reduce the risk for an effluent discharge or failure during construction. Furthermore, all of the tie-in/diversion work will be performed during periods of historically low flow (after August 1 and before October 15) to further reduce this risk.

Each channel tie-in and diversion is additionally detailed and portrayed on the Project Plans (see sheets DIV-1 through DIV-3 and TI-1 through TI-19). These sheets depict the reinforcement of these tie-ins in order to provide immediate protection from bank erosion from creek flows. This level of protection is necessary as these areas of the channel will not have the seasoning allowed for plant establishment in the other areas of the new channel. Key reinforcement features of these tie-in locations include use of “clean” stone in the lower portions (up to the 16 cfs flow) and revegetation with erosion control blankets for the upper areas.

The diversions have been designed, and are specified in the SWPPP, to provide a dewatered work area for each tie-in location. This will provide the Contractor with a workable area, to allow for the most efficient construction process. Furthermore, the SWPPP specifies that the diversions have adequate capacity to provide bypass conveyance for the flows anticipated to be seen in the creek during the time period of these diversions. This information was obtained from monitoring gage data in downstream reaches of Rosewood Creek and is deemed to be slightly conservative, as the contributing watershed at the monitoring gage is larger than the contributing watershed at each of the Project diversions.

Finally, each diversion will remain in place until construction of all of the tie-ins has been completed (all three operating at one time). After acceptance of all of the tie-ins by the Engineer and regulatory agencies with jurisdiction over the Project, the flows will be introduced into the new channel at the upstream tie-in, by removal of the upstream diversion. During this wetting of the new channel, water quality monitoring (turbidity) will be conducted at the downstream end of the Project to ensure that effluent standards are met. Water Quality of discharge shall meet the NDEP standard for turbidity of 10 NTU, or the baseline turbidity value established prior to construction, whichever is higher. In the event that discharge occurs above the regulated constituent level, the creek will be dewatered downstream of the State Route 28 culvert and pumped into a “dirtbag” for infiltration into adjacent ground. The effluent will be observed and monitored until the effluent appears (visually) to have improved. At this time, when the effluent is within the regulated constituent limits, the supplemental dewatering and treatment will cease.

10.4 Temporary BMPs/SWPPP Measures

The Project is a complex restoration project within the highly regulated Lake Tahoe Basin. Similar to all projects of this size and type, a Project-specific SWPPP has been developed (provided separately) that describes specific construction controls to be implemented in order to reduce the risk of an effluent discharge or other violation of the National Pollutant Discharge Elimination System requirements. In addition to the typical temporary BMPs for projects of this nature, the Project includes a detailed diversion plan for the diversion of the creek (as described in the section above and in detail in the SWPPP). Standard temporary controls for the Project include the following:

- Reinforced silt fence;
- Water-filled berm;
- Gravel construction entrances;
- Coir logs and wattles;
- Inlet and sediment trap protection;
- Construction fencing; and
- Revegetation warning signs.

These items are generally depicted on the Project Plan Temporary Erosion Control Sheets (Sheets EC-1 through EC-4) and are described in detail in the Project SWPPP.

10.5 Temporary Buried Protection

The Temporary Erosion Control Plan Sheets (Sheets EC-1 through EC-4) identify several locations where “temporary buried protection” shall be installed in Phase 1. This is a temporary protection of the new channel and floodplain from effects due to the existing channel and potential high flows that could occur during Phase 2 or Phase 3. The temporary buried protection will be installed during Phase 1 of the Project and will be removed during the Phase 3 of the Project. These features involve installing sheet pile in specific locations to a depth below the existing channel flowline and to the existing ground surface. The areas to be protected in this manner are locations where the existing channel, and existing channel forces, have a potential to impact the new channel or floodplain (and revegetation) during Phase 2.

The following design criteria and guidance were used in determining the locations where the temporary buried protection would be installed:

- Locations where the existing and proposed channel are within 20 ft of one another and the existing channel planimetry is in the general direction of the new channel;
- In the vicinity of the existing secondary channel;
- Locations where Phase 1 work is within 10 ft of the existing channel;
- Upstream and downstream of new and existing channel crossings; and
- Upstream of the downstream tie-in.

Chapter 11

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Chapter 12

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Appendix A

Geotechnical Report

Geotechnical Exploration
for
NTCD
Middle Rosewood Creek
Rehabilitation Project
Incline Village, Nevada

Prepared for:

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Distribution

1.0 INTRODUCTION AND SCOPE

This report presents the results of our geotechnical exploration for the proposed Middle Rosewood Creek Restoration Project – Area A. The proposed project is located along a branch of Third Creek, within Incline Village, Nevada. (Rosewood Creek was formerly known as the West Branch of Third Creek (Glancy, 1988).) The general project location is shown on the Vicinity Map (Figure 1).

For this project, the middle reach of Rosewood Creek is the channel section north of State Route 28 (SR28) extending roughly 1700 feet to a point about 100 feet north of Northwood Boulevard. The channel has been incised up to 8 feet deep with large head cuts. The incised sections are predominately located within the lower (extending northward about 450 feet from SR28) and upper portions (extending southward approximately 750 feet from Northwood Boulevard) of the middle reach.

The intent of this project is to minimize creek bed degradation and reduce sediment transfer into Lake Tahoe. The proposed approach involves constructing sections of new geomorphically functional channel, then deactivating and filling old incised channel sections. The completed project will dramatically reduce bank and bed erosion in the project area. Project-specific goals and objectives are currently being developed. The physical and hydraulic design of the restoration project will be determined in the future. The purpose of our geotechnical exploration is to provide subsurface information along the middle reach for use in developing mitigation/restoration alternatives and to provide preliminary guidelines for site grading operations including reuse of native and existing fill materials as a backfill source. For purposes of our study, we understand earthwork will be limited to the creation of the new channel and backfill of the old, incised channel. No permanent improvements, such as structures, utilities, etc will be supported or constructed in areas to be backfilled. The backfilled channel area will be revegetated and returned to a natural condition.

We provided the following scope of services.

- Hand excavated and logged 15 explorations sites along the channel alignment. Exploration sites were advanced to a maximum depth of 5 feet below existing grade. Field activities were conducted by a Wood Rodgers' geologist; whom obtained soil samples at various depths.
- Performed laboratory testing to characterize the soils encountered at the exploration sites. Testing included measurements of moisture content, particle size distribution, Atterberg limit (plasticity), compaction, and permeability
- Prepared this report that summarizes the results of our exploration, including a summary of the subsurface conditions encountered at the exploration sites, and laboratory test results. This report also presents a site plan with exploration locations, exploration logs, and preliminary guidelines for site grading/earthworks.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Investigation

We conducted our subsurface soils exploration from November 21 to 22, 2008. Our efforts included hand excavating 15 exploration pits to a maximum depth of 5 feet. Exploration locations are presented on Figure 2. Exploration locations were located using a Trimble GeoExplorer 2005 series handheld GPS unit. (The accuracy of the GPS locations was influenced by the over-story vegetation canopy.)

During field activities, a Wood Rodgers' geologist logged the soil conditions exposed at each of the exploration sites and collected soil samples for further laboratory testing. The exposed soil conditions are presented on the Exploration Logs (Figures 3 through 17). Subsurface conditions were classified in accordance with the Unified Soil Classification System (ASTM D2487-00) presented on Figure 18.

2.2 Laboratory Testing

Soil samples were taken to our laboratory for further testing. Laboratory testing included: moisture content, particle size distribution, Atterberg limit (plasticity), compaction, and constant head permeability. A summary of laboratory index test results is provided in Table 1 below.

TABLE 1
Index Test Results

Site	Depth (ft)	MC (%)	%-200 Sieve	PI
B-2	1.3	19.2	22	-
B-2	2.1	26.6	48	-
B-2	3.0	22.7	16	-
B-3	1.0	-	55	39
B-3	2.5	46.1	35	-
B-3	2.7	41.7	-	-
B-3	3.8	-	32	14
B-4	1.7	41.6	-	32
B-4	2.0	18.8	25	-
B-4	4.0	-	19	-
B-5	2.1	7.3	7	-
B-5	3.7	31.2	-	-
B-6	1.3	44.4	5	-
B-7	1.5	18.0	12	-
B-7	2.8	19.8	10	-
B-8	2.2	5.4	18	-
B-8	2.7	-	21	-
B-9	0.7	-	33	10
B-9	1.7	-	-	12
B-9	2.8	7.2	14	-
B-10	0.5	7.9	33	-
B-10	2.3	7.2	14	-
B-10	3.4	5.5	18	-
B-11	2.2	9.1	15	-
B-11	3.3	5.5	18	-
B-12	2.3	7.6	25	-
B-12	3.0	14.1	34	-
B-13	3.0	31.4	36	-
B-13	4.1	9.5	7	-
B-14	2.0	4.6	14	-

(MC = moisture content; PI = Plastic Index (Atterberg limit))

Compaction curves were performed on two select samples collected at Sites B-4 (at 0.0 to 1.5 feet) and B-12 (at 0.0 to 1.5 feet).. The compaction curves were performed per ASTM D1557. The compaction curves yielded the following results.

TABLE 2
Compaction Test Results

Site	Depth (ft)	USCS Symbol	Maximum Density (pcf)	Optimum Moisture Content
B-4	0.0 to 1.5	SM	115.0	13.5
B-12	0.0 to 1.5	SM	101.0	18.5

Constant head permeability tests were performed on both remolded and relatively undisturbed (Shelby tube) samples. Permeability test for remolded samples were performed at relative compactions between 92 and 93% to simulate an average value for a compacted fill.

TABLE 3
Permeability Test Results

Site	Depth (ft)	USCS Symbol	Dry Density (pcf)	Initial Moisture Content	Final Moisture Content	Sample Condition	Permeability (cm/sec)
B-4	0.0 to 1.5	SM	106.7	13.6	19.4	Remolded	5.05E-06
B-7	0.0 to 1.6	ML	70.5	24.0	37.1	Undisturbed	8.75E-06
B-12	0.0 to 1.5	SM	93.2	18.6	24.9	Remolded	1.41E-05
B-13	0.3 to 1.1	SC	78.8	23.6	35.8	Undisturbed	5.97E-07

Additional laboratory results are presented in Appendix A.

3.0 SURFACE AND SUBSURFACE SOIL CONDITIONS

3.1 Surface Conditions

The study reach is undeveloped but has been modified from its natural state through past logging, grazing, fire exclusion, and urban development. Skeletal reminders (rotting stumps and fallen trees) of past logging and thunderstorm-related flash floods are present along the creek alignment and within the creek banks.

The study area is bordered by residential developments to the east and west, SR28 to the south, and Northwood Boulevard to the north. Sections of the reach have been modified (stream rerouting), channeled beneath SR28 and Northwood Boulevard. The creek channel is incised north of SR28 and south of Northwood Boulevard. Large head cuts and pitch points have evolved along the creek alignment.

Over-story vegetation adjacent to the creek consists of mountain alder and Scouler and Pacific willow. The over-story health, canopy cover, and age class are variable, with a lack of riparian vegetation recruitment, senescence (aging of vegetation stands) and conifer encroachment. The shrub layer is typically discontinuous. The herbaceous under-story varies from a moderate to dense cover of bulrush, sedge, nettle, thistle, and bedstraw (Mainstream Restoration, Inc., 2005). Photographs of site conditions at the time of our exploration are provided in Appendix B.

3.2 Subsurface Conditions

3.2.1 Geology and Soil Resources

A review of the *Marlette Lake Quadrangle Geologic Map* (Grose, 1986) indicates the study reach is underlain by: *"Qoa –older sandy gravel and gravely sand alluvium"* composed of granitic and volcanic clasts."

The *Geologic Map of the Lake Tahoe Basin, California and Nevada* (Saucedo, 2005) indicates the creek bed is located on a broad glacial outwash sheet consisting of two large and contemporaneous alluvial fans. "The opposing flanks of these gently sloping glacial outwash fans confine the channel location to its geomorphic position. The eastern fan is composed of layers and lenses of alluvial sand and gravel derived from the late Pleistocene alpine glaciers in the Third Creek watershed to the northeast. The western fan is composed of similar alluvial deposits derived from Wood Creek (U.S. Department of the Interior, 2007)."

Soils in the subject reach are mapped as Inville Stony Coarse Sandy Loam. These soils are described as more than 50% sand, mostly coarse sand, 20% or granitic and volcanic rocks 10 inches or more in diameter, with lesser amounts of clay and silt. These soils are moderately well to well drained (ibid.).

3.2.2 Subsurface Conditions

Subsurface conditions consist predominately of interfingered layers of poorly graded sand, silty sand and clayey sand. These predominant types are interbedded with moderately to highly plastic silt and clay layers. These materials may be weathered remnants of volcanic ash deposits. The silt and clay layers appear to be more abundant in the central reach of the project, particularly in the area of Sites B-6, B-7 and B-8. More extensive deposits of similar highly plastic and fine-grained soils have been observed in the Dollar Point area on the north shore of Lake Tahoe.

Many of the soils contain substantial organic debris, especially near the existing ground surface. Several strata contain varying amounts of gravel, cobbles, and boulders (less than 4 feet in diameter).

A more detailed description of subsurface soil conditions is presented on the exploration logs (Figures 3 through 17).

4.0 PRELIMINARY RECOMMENDATIONS

4.1 Site Preparation

We have developed initial earthwork guidelines for consideration in the project development. These guidelines assume that the project will not include any engineered structures that will be supported within the backfill areas of the old channel. In general, all materials excavated from the new channel may be reused to backfill and regrade the old stream bed. Some soil types encountered at the exploration sites may be more prone to erosion. Notably the poorly graded sands as well as the moderately plastic silts. These materials could be placed in the deeper fill areas and then capped with the silty sands and clayey sand materials.

Alternatively, the materials could be blended into a more homogeneous material which could be characterized as a very silty to clayey sand. In addition, the upper soils are rich in organic material. We suggest this material be stockpiled and reused as the final cover to facilitate the revegetation process.

4.1.1 Stripping and Grubbing

Prior to beginning backfilling, the old channel area should be stripped of the existing surface vegetation, stumps, fallen trees, roots, and organic soils. Stripping and clearing should be sufficient to allow access for earthmoving and compaction equipment The estimated average depth of stripping is approximately 4 to 12 inches to remove most subsurface vegetative material. Deeper stripping or grubbing of stumps, buried logs, organic soils, roots, etc., will be required in localized areas.

The stripped organic soil is unsuitable for backfill and should be limited to reuse as surface growth medium.

Our geotechnical engineer should be present during site preparation to evaluate variations in soil conditions, which may require special consideration or modification of the recommendations of this report.

4.2.2 Channel Fill Criteria

Soils used as channel fill should be clean, native materials derived from the new channel area. These materials should be free of organics, other perishable material, and construction debris. We expect that almost all of the materials derived from the new channel may be reused as channel fill material. Some oversized cobbles and boulders may be encountered. These particles should be set aside and not placed in the channel fill. These materials could be reused in other applications on the project site. In addition, they should meet the following criteria.

Sieve Size	Percent Passing (by dry weight)
4”	100
¾”	70-100
No. 40	10-85
No. 200	8-45
Liquid Limit	60% max.
Plasticity Index	30% max.

Any material that deviates from the above criteria should have written approval from the geotechnical engineer prior to use as engineered fill.

The existing fill materials identified during our field investigation (Sites B-1 and B-15) are suitable for reuse as channel fill. The native silty and clayey sand soils which predominate most of the site are suitable as channel fill. Some portions of these soils may be saturated and will require drying prior to placement in the old channel area.

The native fine-grained plastic silts and clays are also acceptable as channel fill (Sites B-6, B-7 and B-8), but are anticipated to be moisture sensitive and may be difficult to uniformly place and compact. The plastic silts and clays are scattered in thin lenses at other locations as well. However, we expect that mixing of the various soil types in the excavation and compaction process will reduce the impact of these thin layers.

For the moisture sensitive soil areas (Sites B-6 through B-8) possible treatments include placement of these materials in the deeper fill sections and capping with silty and clayey sand materials. Alternatively, these materials could be blended with sandier materials.

As discussed above, organic rich soils should be segregated and stockpiled for reuse in areas to be revegetated. Organic rich soils should not be placed in deeper fills and areas subject to concentrated runoff.

Since support of future improvements are not a consideration on this project, we believe that all of the materials encountered in the exploration locations may be reused as channel fill.

4.2.3 Channel Fill Placement

Prior to the placement of fill materials, exposed subgrade soils should be scarified to a minimum depth of 8 inches, moisture conditioned to nearoptimum moisture content and recompacted to between 85 and 90% relative compaction[1]. Overcompaction should be avoided as this will reduce the effectiveness of the revegetation process.

Channel fill should be placed in lifts not exceeding 12 inches (loose thickness), moisture conditioned to near optimum moisture content, and compacted to between 85 and 90% relative compaction as well.

No frozen fill should be placed. No fill should be placed on frozen ground, in areas of standing water, or on soft, spongy ground. Placement and compaction of the channel fill should be accomplished under full-time observation and testing.

---

[1] Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material as determined by the ASTM D1557-00 laboratory test procedure. Optimum moisture content is the moisture content corresponding to the maximum dry density.

5.0 ADDITIONAL ENGINEERING SERVICES

It is important that during construction, the following operations be performed under our observation:

1. Site preparation and grading;
2. Suitability of onsite and imported fill materials; and
3. Engineered fill placement and Compaction.

Observation of these operations will allow us to check that soil conditions are consistent with this geotechnical investigation and to evaluate variations in soil conditions, which may require special consideration or modification of the recommendations.

In the Summer 2009, two soil samples locations require investigation in accordance with TRPA's Chapter 64 Soils/Hydrologic Investigation requirements. These two locations (B-1 and B-15) are comprised of non native fill material that may be subject to a maximum excavation of 5 feet below existing ground surface.

6.0 LIMITATIONS

Preliminary recommendations contained in this report are based on our field exploration, laboratory tests, and our understanding of the proposed project. The study was performed using a mutually agreed upon scope of work.

The soils data used in the preparation of this report were obtained from soil samples located for this investigation. It is possible that variations in soils exist between the points explored. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at this site, which are different from those described in this report, our firm should be immediately notified so that we may make any necessary revisions to our recommendations.

This report has been prepared solely for design purposes specific to the proposed Middle Rosewood Creek Restoration Project Area A. The findings, recommendations and professional opinions presented in this report were prepared in accordance with generally accepted professional engineering practice at this time in Washoe County, Nevada. This report does not constitute a warranty, either expressed or implied.

Other standards or documents referenced in any given standard cited in this report, or otherwise relied upon by the authors of this report, are only mentioned in the given standard; they are not incorporated into it or "included by reference," as that latter term is used relative to contracts or other matters of law.

This report may be used only by the Client and only for the purposes stated within a reasonable time from its issuance, but in no event later than <u>three</u> years from the date of the report. Land or facility use, on and off-site conditions, regulations, or other factors may change over time, and additional work may be required with the passage of time.

It is the CLIENT'S responsibility to see that all parties to the project including the Contractor, Subcontractors, etc., are made aware of this report in its entirety.

The use of information contained in this report for bidding purposes should be done at the Contractor's option and risk.

7.0 REFERENCES

EPA, 1980, *Design Manual, Onsite Wastewater Treatment and Disposal Systems*, United States Environmental Protection Agency, EPS 625/1-80-012.

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Saucedo, G.J., 2005, *Geologic Map of the Lake Tahoe Basin, California and Nevada, California Geological Survey Regional Geologic Map Series*, Map No. 4.

U.S. Department of the Interior, 2007, *Draft Environmental Assessment, Middle Rosewood Creek Restoration, Implementation Area F*, Bureau of Reclamation, Mid-Pacific Region.

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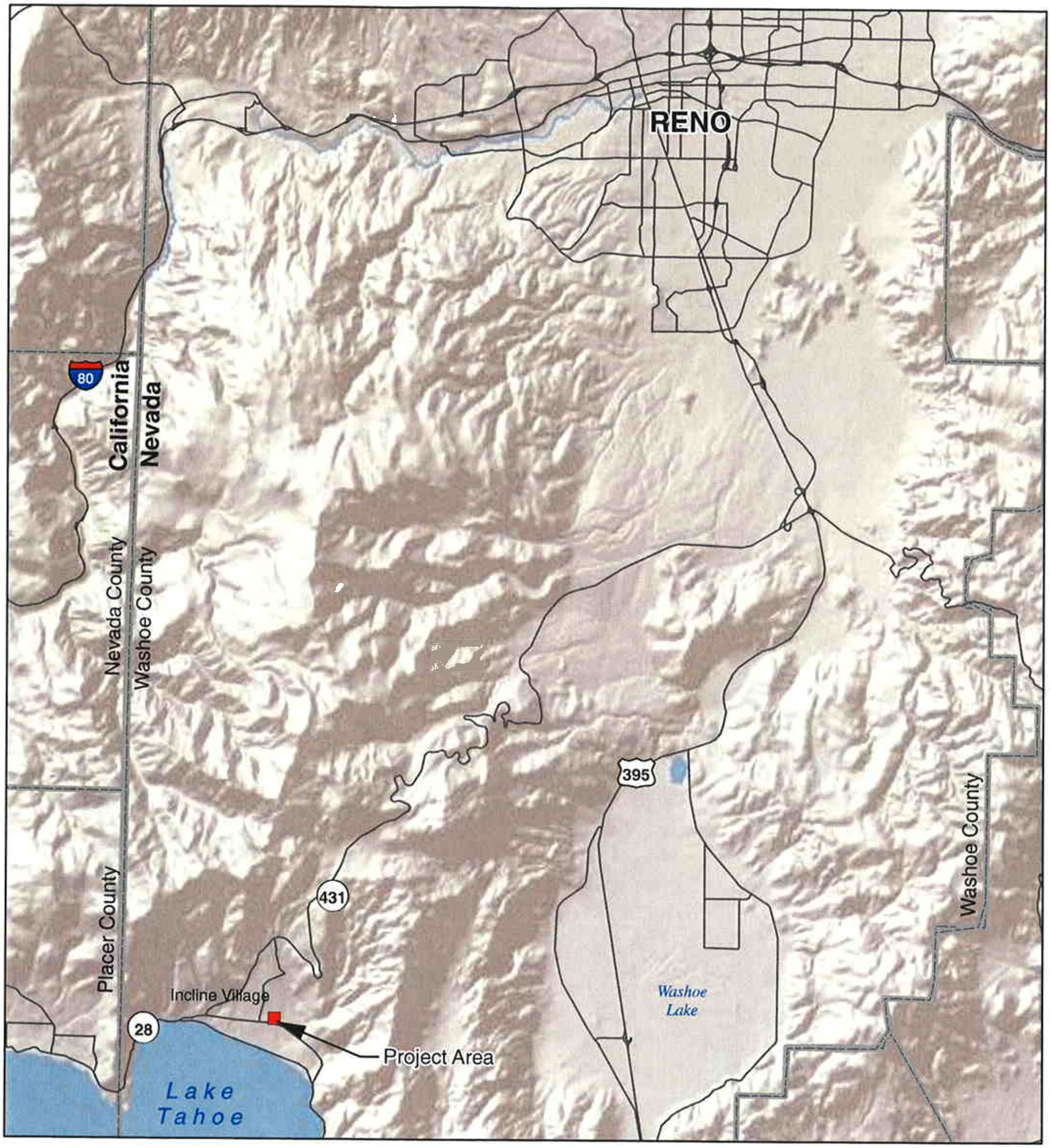
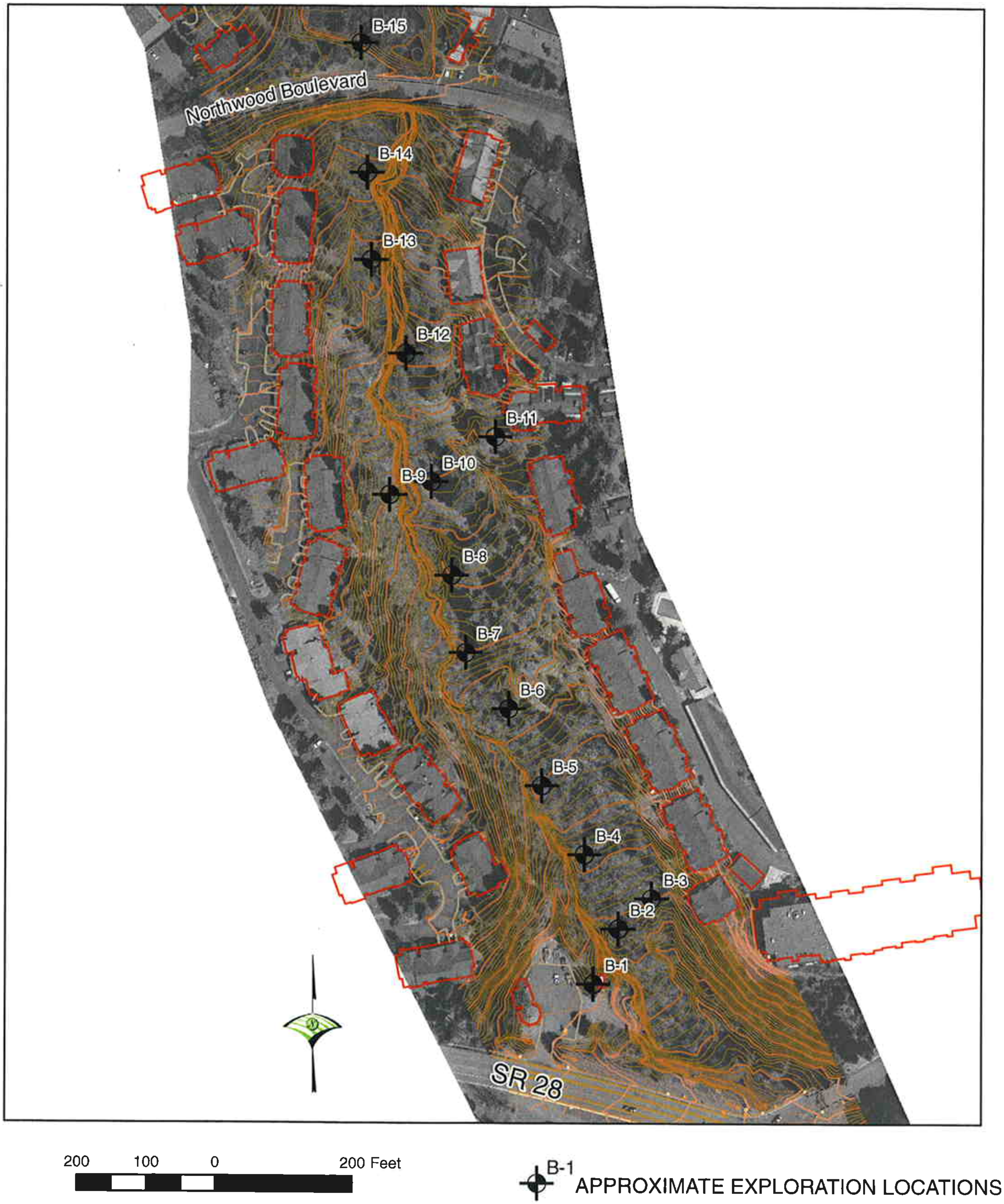


WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS

EXPLORATION LOCATIONS
Nevada Tahoe Conservation District
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
1

DRAWN BY ELF
JOB NUMBER 8393.001
APPROVED BY MJD
DATE November 2008



WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS

EXPLORATION LOCATIONS
NTCD
Rosewood Creek Rehabilitation Project
Incline Village, Nevada

FIGURE
2

DRAWN BY ELF
JOB NUMBER 8393.001
APPROVED BY MJD
DATE November 2008

EXPLORATION LOG

SURF. EL. :	WATER EL. :	DEPTH : 4.1 FEET	LOCATION : See Exploration Locations Figure 2

EQUIPMENT : Hand Auger

DEPTH, Ft.	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	LABORATORY TESTING
0–2	▨	☒	0-24", 5YR 3/3, DARK REDDISH -BROWN SILTY SAND WITH SOME GRAVEL (SM); moist, low plastic fines, fine grained sand, gravel 1 1/4" in diameter rounded to subangular, 30% fines	
2–3.25	▨	☒	24"-39", 5YR 6/4, LIGHT REDDISH-BROWN SILTY SAND WITH SOME GRAVEL (SM); moist, low plastic fines, 25% fines, fine grained sand, subangular gravels 1" in diameter sand becoming coarser	
3.25–4.1	▨	☒	39"-50", 5YR 4/6, YELLOWISH-RED SILTY SAND WITH SOME GRAVEL (SM); moist, low plastic fines, 30% fines, mica flakes, coarse grained sand, subangular gravel 3/4" in diameter	
4.1–10			Boring terminated at 50" on large boulders or gravels.	

REMARKS :

FIELD ENG. : CD	WATER DEPTH @ COMPL. : None	DATE : 12-02-08

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LOG AT SITE B-1
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

BORING LOG 8393.01_ROSEWOOD CREEK.GPJ WOOD RODGERS.GDT 3/16/09

EXPLORATION LOG

SURF. EL. :

WATER EL. :

DEPTH : 4.2 FEET

LOCATION : See Exploration Locations Figure 2

EQUIPMENT : Hand Auger

DEPTH, Ft.	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% PASSING #200 SIEVE	MOISTURE CONTENT (%)	LABORATORY TESTING
			0"-3", 5YR 3/3, DARK REDDISH BROWN ORGANICS (OL); leaves, roots, and low plastic fines			
			3"-12", 5YR 3/3, DARK REDDISH BROWN SILTY SAND (SM); moist, approximately 30% low plastic fines, fine grained sand, approximately 5% organic material			
1			12"-14", 5YR 3/4, DARK REDDISH-BROWN SANDY SILT (ML-MH); moist, approximately 80% moderately plastic fines, fine sand, trace mottling			
			14"-34", 5 YR 2.5/2, DARK REDDISH-BROWN CLAYEY SAND (SC); moist, approximately 40% low plastic fines, fine grained sand, frequent mica	22.0	19.2	
2			some medium to coarse grained sand, cut through a small root approximately 2.5" in dia.			
				48.0	26.6	
			practical refusal @ 34", moved over approximately 15" and started a second excavation			
3			34"-37" 5YR 3/1, VERY DARK GRAY SILTY SAND (SM); moist, approximately 25% non to low plastic fines, fine grained sand, frequent mica, approximately 5% organics, some mottling	16.7	22.7	
			37"-50" 5YR 4/2, DARK GREY SILTY SAND (SM); slightly moist to moist, approximately 20% non-plastic fines, fine to coarse grained sand, trace organics, frequent mottling			
4			predominately fine grained sand			
5						
6						
7						
8						
9						
10						

REMARKS :

FIELD ENG. : MD

WATER DEPTH @ COMPL. : None

DATE : 11-22-08

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LOG AT SITE B-2
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

EXPLORATION LOG

SURF. EL. :	WATER EL. : 3.4 FEET	DEPTH : 5.1 FEET	LOCATION : See Exploration Locations Figure 2
EQUIPMENT : Hand Auger			

DEPTH, Ft.	SOIL DESCRIPTION	% PASSING #200 SIEVE	LIQUID LIMIT(%)	PLASTICITY INDEX (%)	MOISTURE CONTENT (%)	LABORATORY TESTING
	0-2", 5YR 3/2, DARK REDDISH-BROWN ORGANICS (OL); moist, leaves and small roots					
1	2"-13", 5YR 3/2, DARK REDDISH-BROWN SANDY SILT (ML-MH); moist, approximately 60% moderately plastic fines, fine grained sand, approximately 5% organics					
	13"-20", 5YR 3/1, VERY DARK GREY SANDY SILTY CLAY (CH); moist, approximately 80% moderately to highly plastic fines, fine grained sand, frequent mica, approximately 5% organics (fine roots)	55.0	71	39		
2	20"-31", 5YR 4/1, DARK GREY CLAYEY SAND (SC); approximately 30% plastic fines, fine grained sand, mottling, less than 5% organics (fine roots), frequent mica very moist to wet, moderate plasticity fines	35.0			46.1	
3	31"-41", 5YR 4/1, DARK GREY CLAYEY SAND (SC); moist to wet, approximately 30% low plastic fines, fine to coarse grained sand, frequent mica, less 5% organics (fine roots)				41.7	
4	41"-54", 5YR 4/1, DARK GREY CLAYEY SAND (SC); moist to wet, approximate 35% low plastic fines, fine to coarse sand, wet (free water), frequent mottling	32.0	35	14		
5	54"-61", GLEY 1/4, DARK GREY SILTY SAND (SM); wet, approximately 20% low plastic fines, fine to coarse grained sand, frequent mica					
6						
7						
8						
9						
10						

REMARKS :
Free water at 41"

FIELD ENG. : MD	WATER DEPTH @ COMPL. : 3.4 FEET	DATE : 11-22-08

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LOG AT SITE B-3
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

BORING LOG 8393.01_ROSEWOOD CREEK.GPJ WOOD RODGERS.GDT 3/16/09

EXPLORATION LOG

SURF. EL. :	WATER EL. :	DEPTH : 4 FEET	LOCATION : See Exploration Locations Figure 2
EQUIPMENT : Hand Auger			

DEPTH, Ft.	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% PASSING #200 SIEVE	LIQUID LIMIT(%)	PLASTICITY INDEX (%)	MOISTURE CONTENT (%)	LABORATORY TESTING
			0-2", 5YR 3/3, DARK REDDISH BROWN ORGANICS (OL); low plastic fines, fine roots and leaves					
1			2"-23", 5YR 3/3, DARK REDDISH-BROWN SANDY SILT (MH); moist, approximately 70% highly plastic fines, fine grained sand, frequent mica, less than 5% organics (fine roots)					
			5YR 3/1 very dark grey, approximately 10% organics (root pieces)		90	32	41.6	
2			23"-32", 5YR 3/2, DARK REDDISH-BROWN CLAYEY SAND (SC); moist, approximately 30% low plastic fines, fine grained sand, frequent mottling, frequent mica	25.0			18.8	
3			32"-40", 5YR 4/3, REDDISH BROWN SILTY SAND (SM); approximately 20% non-plastic fines, fine grained sand, frequent mottling, less than 5% organics frequent lenses of organic matter					
			40"-44", 5YR 3/1, VERY DARK GREY SILT (ML); moist, approximately 80% low plastic fines, some fine grained sand, approximately 10% organics					
4			44"-49", 5YR 3/2, DARK REDDISH BROWN VERY SILTY SAND (SM); moist, approximately 50% low plastic fines, fine grained sand, frequent mica, approximately 5% organics (fine roots)	19.0				
5			49"-54", 5YR 3/2, DARK REDDISH BROWN SILTY SAND (SM); moist, approximately 30% non-plastic fines, fine to coarse grained sand, trace fine subrounded gravel, less than 5% organics					
6								
7								
8								
9								
10								

REMARKS :

FIELD ENG. : MD	WATER DEPTH @ COMPL. : None	DATE : 11-22-08

BORING LOG 8393.01_ROSEWOOD CREEK.GPJ WOOD RODGERS.GDT 3/16/09

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LOG AT SITE B-4
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

EXPLORATION LOG

SURF. EL. :	WATER EL. :	DEPTH : 4 FEET	LOCATION : See Exploration Locations Figure 2
EQUIPMENT : Hand Auger			

DEPTH, Ft.	SOIL DESCRIPTION	% PASSING #200 SIEVE	MOISTURE CONTENT (%)	LABORATORY TESTING
0–1	0-15", 5YR 3/2, DARK REDDISH BROWN SILTY SAND (SM); moist, approximately 30% non-plastic fines, fine grained sand, mica, less than 5% organics (fine roots) lenses of fine grained sand roots up to 1" in diameter, mottling			
1–2	15"-23", 7.5YR, STRONG BROWN SILTY SAND (SM); moist, approximately 20% non-plastic fines, fine to coarse grained sand, frequent redox/mottling			
2–3	23"-37", 5YR 4/3, REDDISH-BROWN SLIGHTLY SILTY SAND (SM-SW); moist, approximately 25% non-plastic fines, fine sand, lenses of silt, frequent mica	7.0	7.3	
3–4	37"-44", 5YR 3/2, DARK REDDISH-BROWN SILTY SAND (SM); moist, low plastic fines, mica, approximately 5% organics approximately 20% organics (fine roots)			
4	44"-49", 5YR 2.5/1, BLACK SILT (ML-MH); moist to wet, moderately plastic fines, mica, approximately 10% organics		31.2	
4–5	49"-60", 3YR 2.5/1, BLACK SILTY SAND (SM); wet, approximately 20% low plastic fines, fine to coarse grained sand, frequent mica			
6				
7				
8				
9				
10				

REMARKS :
Wet soil conditions below approximately 49 inches

FIELD ENG. : MD	WATER DEPTH @ COMPL. : None	DATE : 11-22-08

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LOG AT SITE B-5
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
7

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

EXPLORATION LOG

SURF. EL. :

WATER EL. : 1.6 FEET

DEPTH : 4 FEET

LOCATION : See Exploration Locations Figure 2

EQUIPMENT : Hand Auger

DEPTH, Ft.	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% PASSING #200 SIEVE	MOISTURE CONTENT (%)	LABORATORY TESTING
		☒	0-6", 5YR 2.5/1, BLACK SANDY SILT (ML); wet, approximately 70% low plastic fines, fine grained sands, approximately 20% organics, fine roots			
1		☒	6"-13", 5YR 3/3, DARK REDDISH BROWN SILTY SAND (SM); wet, approximately 30% low plastic fines, fine to coarse grained sand, approximate 20% organics, frequent mottling			
		☒	13"-40", 5YR 4/6, YELLOWISH-RED SLIGHTLY SILTY SAND (SP-SM); wet, free water approximately 10% non-plastic fines, fine to coarse grained sand, frequent mica, approximately 5% organics	5.0	44.4	
2 3		☒ ☒	Gley 1 3/1- very dark greenish grey, approximately 10% organics, organics smell			
4		☒	40"-48", 5YR 2.5/1, BLACK SILTY SAND (SM); wet, low plastic fines, high organics content, organic smell			
5 6 7 8 9 10						

REMARKS :
Water level measured at 19 inches below existing grade

FIELD ENG. : MD

WATER DEPTH @ COMPL. : 1.6 FEET

DATE : 11-22-08

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LOG AT SITE B-6
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
8

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

EXPLORATION LOG

SURF. EL. :	WATER EL. : 3 FEET	DEPTH : 4 FEET	LOCATION : See Exploration Locations Figure 2
EQUIPMENT : Hand Auger			

DEPTH, Ft.	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% PASSING #200 SIEVE	MOISTURE CONTENT (%)	LABORATORY TESTING
		☒	0-2", 5YR 3/2, DARK REDDISH-BROWN ORGANICS (OL); non-plastic fines, fine roots and leaves			
1		☒	2"-15", 5YR 3/2, DARK REDDISH-BROWN SANDY SILT (ML); moist, approximately 60%, low plastic fines, fine grained sand, approximately 10% organics (fine roots)			
2		☒	15"-31", 5YR 3/2, DARK REDDISH BROWN SILTY SAND (SM); moist, approximately 10-15% non-plastic fines, fine to coarse grained sand, approximately 5% organics moist to wet, approximately 25% fines, frequent mica, frequent mottling	12.0	18.0	
3		☒	31"-44", Gley 1 3/1, VERY DARK GREY SLIGHTLY SILTY SAND (SW-SM); wet, approximately 10%, non-plastic fines, fine to coarse grained sand, frequent redox/mottling, frequent mica some subrounded gravels up to 1" in diameter no gravels below 42", running sands	10.0	19.8	
4						
5						
6						
7						
8						
9						
10						

REMARKS :
Water level measured at 3 feet below existing grade

FIELD ENG. : MD	WATER DEPTH @ COMPL. : 3 FEET	DATE : 11-22-08

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LOG AT SITE B-7
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
9

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

EXPLORATION LOG

SURF. EL. :	WATER EL. :	DEPTH : 4 FEET	LOCATION : See Exploration Locations Figure 2
EQUIPMENT : Hand Auger			

DEPTH, Ft.	SOIL DESCRIPTION	% PASSING #200 SIEVE	MOISTURE CONTENT (%)	LABORATORY TESTING
	0-4", 5YR 3/3, ORGANICS (OL); moist, non-plastic silt, pine needles			
	4"-14", 5YR 3/3, DARK REDDISH BROWN SANDY SILT (ML); moist, approximately 80% low plastic fines, fine grained sand, approximately 10% organics some coarse sand			
1	14"-36", 5YR 3/3, DARK REDDISH BROWN SILTY SAND (SM); moist, approximately 40% non to low plastic fines, fine to coarse grained sand, trace subrounded gravel up to 1/2" dia, some mottling, approximately 5% organics (roots) 5YR 4/3 reddish brown			
2	frequent mica, predominately fine grained sand, frequently mottling	18.0	5.4	
	some fine subrounded gravel up to 1/2" in dia.	21.0		
3	heavy mottling, refusal on a boulder			
4				
5				
6				
7				
8				
9				
10				

REMARKS :

FIELD ENG. : MD	WATER DEPTH @ COMPL. : None	DATE : 11-22-08

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LOG AT SITE B-8
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
10

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

EXPLORATION LOG

SURF. EL. :	WATER EL. :	DEPTH : 4 FEET	LOCATION : See Exploration Locations Figure 2
EQUIPMENT : Hand Auger			

DEPTH, Ft.	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% PASSING #200 SIEVE	LIQUID LIMIT(%)	PLASTICITY INDEX (%)	MOISTURE CONTENT (%)	LABORATORY TESTING
			0-4", ORGANICS (OL); moist, low plastic fines, pine needles					
		☒	4"-18", 5YR 3/2, DARK REDDISH BROWN SILTY SAND (SM); slightly moist to moist, approximately 35%, low plastic fines, fine grained sand, approximately 5% organics (fine roots and pine needles)	33.0	40	10		
1		☒	increasing sand content some subangular gravel up to 1/2" in dia.					
2		☒	18"-40", 5YR 4/3, REDDISH BROWN SANDY SILT (MH); approximately 60% highly plastic fines, fine to coarse grained sand, mottling, some subangular gravel up to 1/2" in dia. one gravel up to 1" dia frequent mottling		51	12		
3		☒	less than 5% organics (fine roots)	14.0			7.2	
		☒	slightly moist to moist, increasing sand content					
4		☒	40"-48", 5YR 5/2, REDDISH GRAY SILTY SAND (SM); slightly moist to moist approximately 25% non-plastic, fine to coarse grained sand, trace fine gravel, approximately 5% organics (fine roots) some silt balls, refusal on a boulder					
5								
6								
7								
8								
9								
10								

REMARKS :

FIELD ENG. : MD	WATER DEPTH @ COMPL. : None	DATE : 11-22-08

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LOG AT SITE B-9
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
11

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

BORING LOG 8393.01_ROSEWOOD CREEK.GPJ WOOD RODGERS.GDT 3/16/09

EXPLORATION LOG

SURF. EL. :	WATER EL. :	DEPTH : 4 FEET	LOCATION : See Exploration Locations Figure 2
EQUIPMENT : Hand Auger			

DEPTH, Ft.	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% PASSING #200 SIEVE	MOISTURE CONTENT (%)	LABORATORY TESTING
			0-5", 5YR 3/2, DARK REDDISH BROWN VERY SILTY SAND (SM); moist, approximately 40% low plastic fines, fine grained sand, trace organics			
1			5"-15", 5YR 4/4, REDDISH BROWN VERY SILTY SAND (SM); slightly moist to moist, approximately 50% low plastic fines, predominately fine grained sand, trace of coarse grained sand	33.0	7.9	
			15"-38", 5YR 3/3, DARK REDDISH BROWN VERY SILTY SAND (SM); moist, approximately 40% low plastic fines, fine grained sand, approximately 5% organics			
2			increasing sand content, mottling	14.0	7.2	
3			some silt balls, mica, predominately fine grained sand			
			38"-44", 5YR 3/2, DARK REDDISH BROWN SILTY SAND (SM); moist, approximately 20% low plastic fines, fine sand, mica, less than 5% organics	18.0	5.5	
4			44"-53", 5YR 3/2, DARK REDDISH BROWN SILT (ML); slightly moist to moist, low plastic fines, approximately 20% organic materials some fine grained sand			
5			53"-61", 5YR 3/3, REDDISH BROWN VERY SILTY SAND (SM); slightly moist to moist, approximately 40% low plastic fines, fine grained sand, approximately 5% organics, trace of subrounded gravel up to 1/2" in dia.			
6						
7						
8						
9						
10						

REMARKS :

FIELD ENG. : MD	WATER DEPTH @ COMPL. : None	DATE : 11-22-08

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LOG AT SITE B-10
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
12

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

EXPLORATION LOG

SURF. EL. :	WATER EL. :	DEPTH : 4.8 FEET	LOCATION : See Exploration Locations Figure 2
EQUIPMENT : Hand Auger			

DEPTH, Ft.	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% PASSING #200 SIEVE	MOISTURE CONTENT (%)	LABORATORY TESTING
		☒	0-3", 5YR 2.5/2, DARK REDDISH-BROWN ORGANICS (OL); low plastic fines, roots, plant material			
1		☒	3"-13", 5YR 3/3, DARK REDDISH-BROWN SANDY SILT (MH); moist, approximately 70% highly plastic fines, approximately 5% organics roots at 11"			
2		☒	13"-37", 5YR 4/4, REDDISH-BROWN SILTY SAND WITH SOME GRAVEL (SM); moist, approximately 15% low plastic fines, sand becoming coarser, gravel up to 1/2" in dia, approximately 5% organics increasing gravel content, no organics 1/2" diameter roots at 24" large rock at 26", executed new hole at approximately 18" to the southeast	15.0	9.1	
3 4		☒	37"-58", 5YR 4/6, STRONG BROWN SILTY SAND WITH GRAVEL (SM); moist, approximately 25% low plastic fines, gravel to 1/2" in diameter minor mottling at 39"	18.0	5.5	
5 6 7 8 9 10						

REMARKS :

FIELD ENG. : CD	WATER DEPTH @ COMPL. : None	DATE : 11-24-08

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LOG AT SITE B-11
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
13

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

EXPLORATION LOG

SURF. EL. :

WATER EL. :

DEPTH : 5 FEET

LOCATION : See Exploration Locations Figure 2

EQUIPMENT : Hand Auger

DEPTH, Ft.	SOIL DESCRIPTION	% PASSING #200 SIEVE	MOISTURE CONTENT (%)	LABORATORY TESTING
	0-2", 5YR 4/4, REDDISH-BROWN ORGANICS (OL)			
	2"-7", 5YR 4/4, REDDISH-BROWN VERY SILTY SAND (SM); moist, approximately 40% low plastic fines, approximately 5% organics			
1	7"-17", 5YR 5/4, REDDISH-BROWN SILTY SAND (SM); moist, low plasticity fines, approximately 30% fines, approximately 5% organics including roots up to 1/4" in diameter, some mottling			
2	17"-32", 5YR 4/3, REDDISH-BROWN SILTY SAND (SM); approximately 20% low plastic fines, moist, less than 5% organics sand becoming coarser below 23"	25.0	7.6	
3	32"-40", 5YR 3/2, DARK REDDISH BROWN CLAYEY SAND (SC); moist, approximately 30% moderate plastic fines, approximately 5-10% organics including roots up to 1/4" in diameter	34.0	14.1	
4	40"-60", 5YR 5/2, REDDISH GREY SILTY SAND (SM); moist, approximately 20% low plastic fines, less than 1% organics			
5				
6				
7				
8				
9				
10				

REMARKS :

FIELD ENG. : CD

WATER DEPTH @ COMPL. : None

DATE : 11-24-08

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LOG AT SITE B-12
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
14

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

EXPLORATION LOG

SURF. EL. :	WATER EL. :	DEPTH : 4.5 FEET	LOCATION : See Exploration Locations Figure 2
EQUIPMENT : Hand Auger			

SOIL DESCRIPTION	% PASSING #200 SIEVE	MOISTURE CONTENT (%)	LABORATORY TESTING
0-3", 5YR 3/2, DARK REDDISH-BROWN ORGANICS (OL)			
3"-9", 5YR 3/2, DARK REDDISH BROWN CLAYEY SAND (SC); moist, approximately 30% moderate plastic fines, approximately 5% organics			
9"-17", 5YR 3/2, DARK REDDISH BROWN CLAYEY SAND (SC); moist, approximately 30% moderate plastic fines, 5% organics			
17"-30", 5YR 5/4, REDDISH BROWN SILTY SAND (SM); moist, approximately 15% low plastic fines, no organics, coarse grained sand root at 30"			
30"-34", 5YR 2.5/2, DARK REDDISH BROWN SANDY SILT (MH-ML); moist, approximately 60% moderate plastic fines, approximately 5% organic roots			
34"-47", 5YR 3/3, DARK REDDISH BROWN SILTY SAND (SM); moist, approximately 30% low plastic fines, no organics	36.0	31.4	
47"-54", 5YR 3/3, DARK REDDISH BROWN GRAVELLY SILTY SAND (SW-SM); moist, coarse grained sand, gravel to 3/4" in diameter refusal in gravel at 54"	7.0	9.5	

DEPTH, Ft.: 1 2 3 4 5 6 7 8 9 10

REMARKS :

FIELD ENG. : CD	WATER DEPTH @ COMPL. : None	DATE : 11-24-08

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LOG AT SITE B-13
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
15

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

EXPLORATION LOG

SURF. EL. :	WATER EL. :	DEPTH : 3 FEET	LOCATION : See Exploration Locations Figure 2
EQUIPMENT : Hand Auger			

DEPTH, Ft.	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% PASSING #200 SIEVE	MOISTURE CONTENT (%)	LABORATORY TESTING
			0-2", 5YR 4/4, REDDISH-BROWN ORGANICS (OL)			
			2"-13", 5YR 4/4, REDDISH BROWN SILTY SAND (SM); approximately 30% low to moderate plastic fines, approximately 2% organics			
1						
			13"-17", 5YR 4/6, YELLOWISH RED SILTY SAND (SM); moist, approximately 15% low plastic fines, no organics mottling at 17"			
			17"-25", 5YR 3/3, DARK REDDISH BROWN SILTY SAND (SM); moist, approximately 30% low plastic fines, no organics			
2			25"-36", 5YR 4/4, REDDISH BROWN SILTY SAND (SM); dry, low approximately 10-15% low plastic fines, no organics, coarse grained sand	14.0	4.6	
3			flowing sand prevented the excavation from being advanced below 36"			
4						
5						
6						
7						
8						
9						
10						

REMARKS :

FIELD ENG. : CD	WATER DEPTH @ COMPL. : None	DATE : 11-24-08

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LOG AT SITE B-14
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
16

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

BORING LOG 8393.01_ROSEWOOD CREEK.GPJ WOOD RODGERS.GDT 3/16/09

EXPLORATION LOG

SURF. EL. :

WATER EL. :

DEPTH : 0.58 FEET

LOCATION : See Exploration Locations Figure 2

EQUIPMENT : Hand Auger

DEPTH, Ft.	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	LABORATORY TESTING
0	▨	☒	0-58", 1" OF RED VOLCANIC ROCK (FILL) 5YR 3/2, DARK REDDISH-BROWN SILTY SAND WITH SOME GRAVEL (SM); moist, low plasticity, approximately 30% fines, fine grained sand, subangular gravel up to 1"	
1				
2			Refusal on what is either lava rocks or pavement section. Tried seven different location up to 20' from orignal boring. Same result each time.	
3				
4				
5				
6				
7				
8				
9				
10				

REMARKS :

FIELD ENG. : CD

WATER DEPTH @ COMPL. : None

DATE : 12-02-08

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LOG AT SITE B-15
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

FIGURE
17

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001	CS			

UNIFIED SOIL CLASSIFICATION - ASTM D2487 - 00

MAJOR DIVISIONS					TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	**GRAVELS** MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	●	WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
			GP	○	POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM	○	SILTY GRAVELS, SILTY GRAVELS WITH SAND
			GC	▨	CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	⁘	WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
			SP	⁘	POORLY GRADED SANDS WITH OR WITHOUT GRAVELS, LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM	⁘	SILTY SANDS WITH OR WITHOUT GRAVEL
			SC	▨	CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	**SILTS AND CLAYS** LIQUID LIMIT 50% OR LESS		ML	▥	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS
			CL	▨	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS
			OL	☰	ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH	▥	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	▨	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	≋	ORGANIC CLAYS OR CLAYS OF MEDIUM TO HIGH PLASTICITY
	HIGHLY ORGANIC SOILS		PT	⁂	PEAT AND OTHER HIGHLY ORGANIC SOILS

M(80)	—	Moisture Content (%)
DD(105)	—	Dry Density (pcf)
Perm	—	Permeability
Consol	—	Consolidation
LL	—	Liquid Limit (%)
PI	—	Plastic Index (%)
G_s	—	Specific Gravity
MA	—	Particle Size Analysis
OC	—	Organic Content
R-Value	—	Resistance Value
CBR	—	California Bearing Ratio
■	—	"Undisturbed Sample"
☒	—	Bulk or Classification Samples

	Shear Strength (psf)	Confining Pressure	
TxUU	3200	(2600)	— Unconsolidated Undrained Triaxial Shear
(FM) or (S)			(field moisture or saturated)
TxCU	3200	(2600)	— Consolidated Undrained Triaxial Shear
(P)			(with or without pore pressure measurement)
TxCD	3200	(2600)	— Consolidated Drained Triaxial Shear
SSCU	3200	(2600)	— Simple Shear Consolidated Undrained
(P)			(with or without pore pressure measurement)
SSCD	3200	(2600)	— Simple Shear Consolidated Drained
DSCD	2700	(2000)	— Consolidated Drained Direct Shear
DSCU	2000	(1000)	— Consolidated Undrained Direct Shear
UC	470		— Unconfined Compression
LVS	700		— Laboratory Vane Shear
DSUU			— Unconsolidated Undrained Direct Shear

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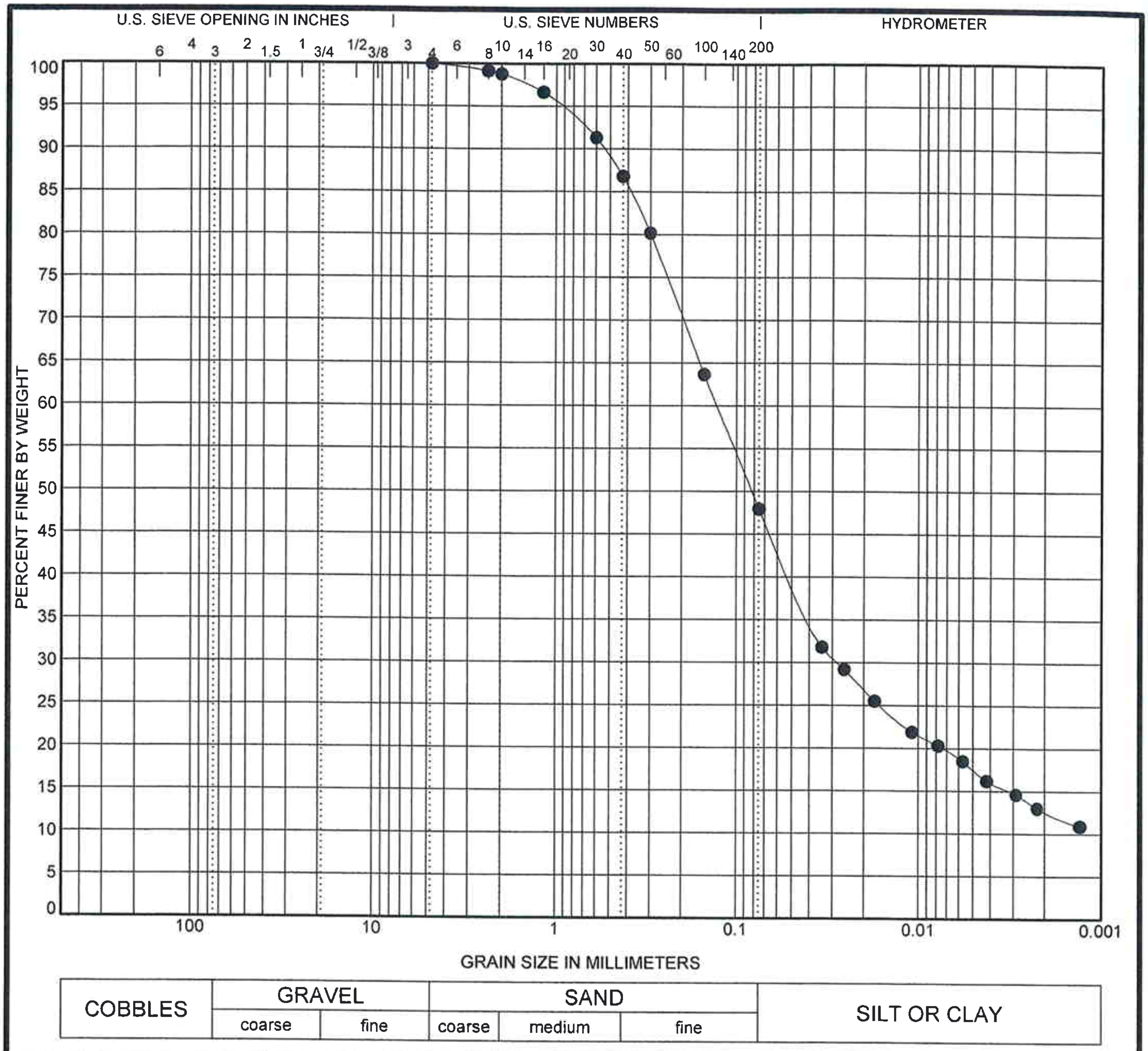
SOIL CLASSIFICATION CHART
AND TEST DATA KEY
MIDDLE ROSEWOOD CREEK
RESTORATION AREA A
INCLINE VILLAGE, NEVADA

FIGURE
18

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
ALH	8393.001		11-23-08		

SOIL CLASSIFICATION 8393.01_ROSEWOOD CREEK.GPJ WOOD RODGERS.GDT 3/16/09



Specimen Identification (ft)		Classification	LL	PL	PI	Cc	Cu
●	B-2 2.5	DARK REDDISH-BROWN CLAYEY SAND (SC)					

Specimen Identification (ft)		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-2 2.5	4.75	0.128	0.028		0.0	52.1	30.4	17.5

US GRAIN SIZE 8393.001 MIDDLE ROSEWOOD.GPJ WOOD RODGERS.GDT 1/19/09

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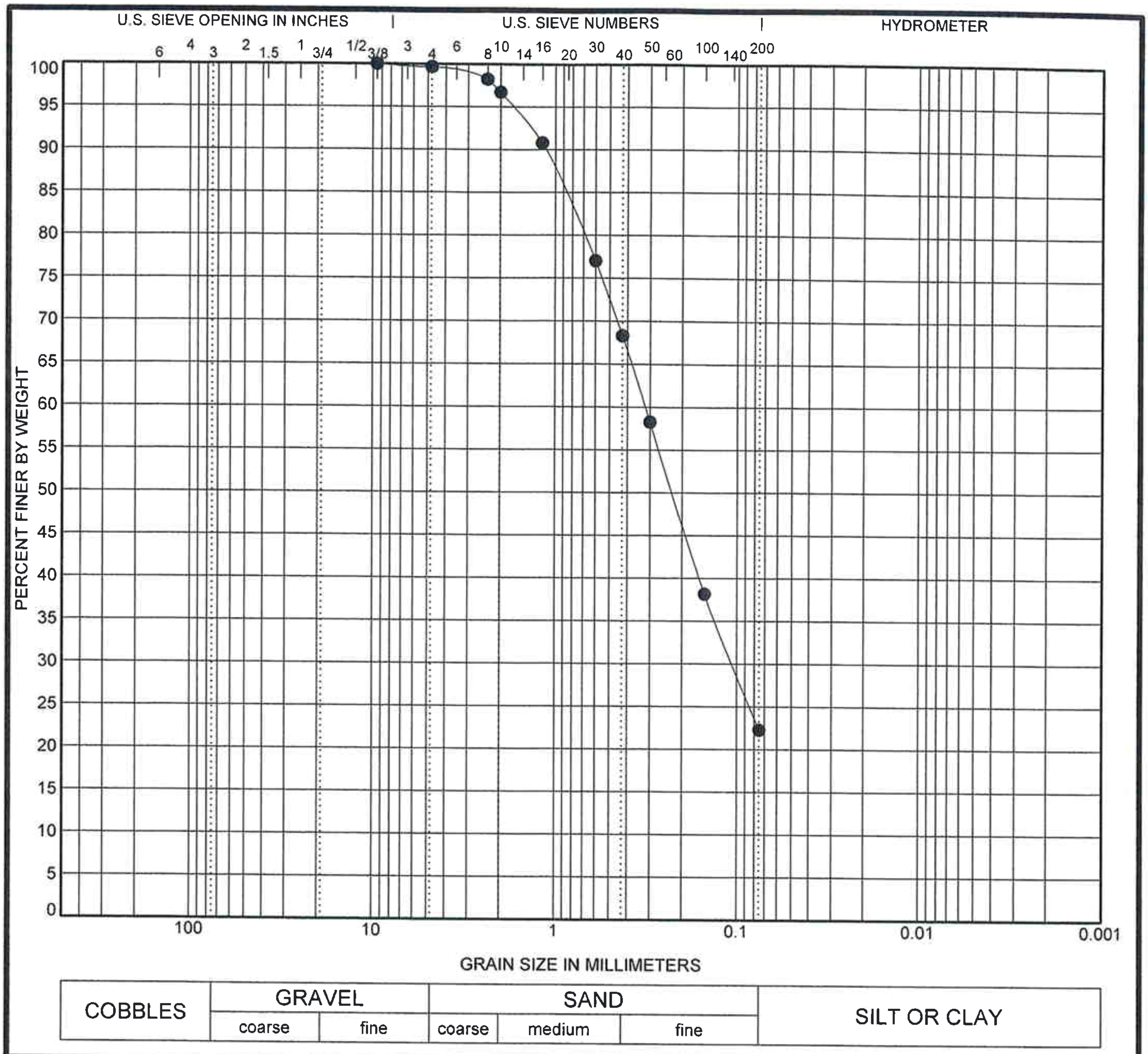
GRAIN SIZE DISTRIBUTION

Project: Middle Rosewood Creek Restoration Area A

Location: Incline Village, Nevada

Number: 8393.001



	Specimen Identification (ft)		Classification	LL	PL	PI	Cc	Cu
●	**B-2a**	**2.0**	**DARK REDDISH-BROWN SILTY SAND (SM)**					

	Specimen Identification (ft)		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-2a**	**2.0**	**9.5**	**0.318**	**0.105**		**0.3**	**77.4**	**22.3**	

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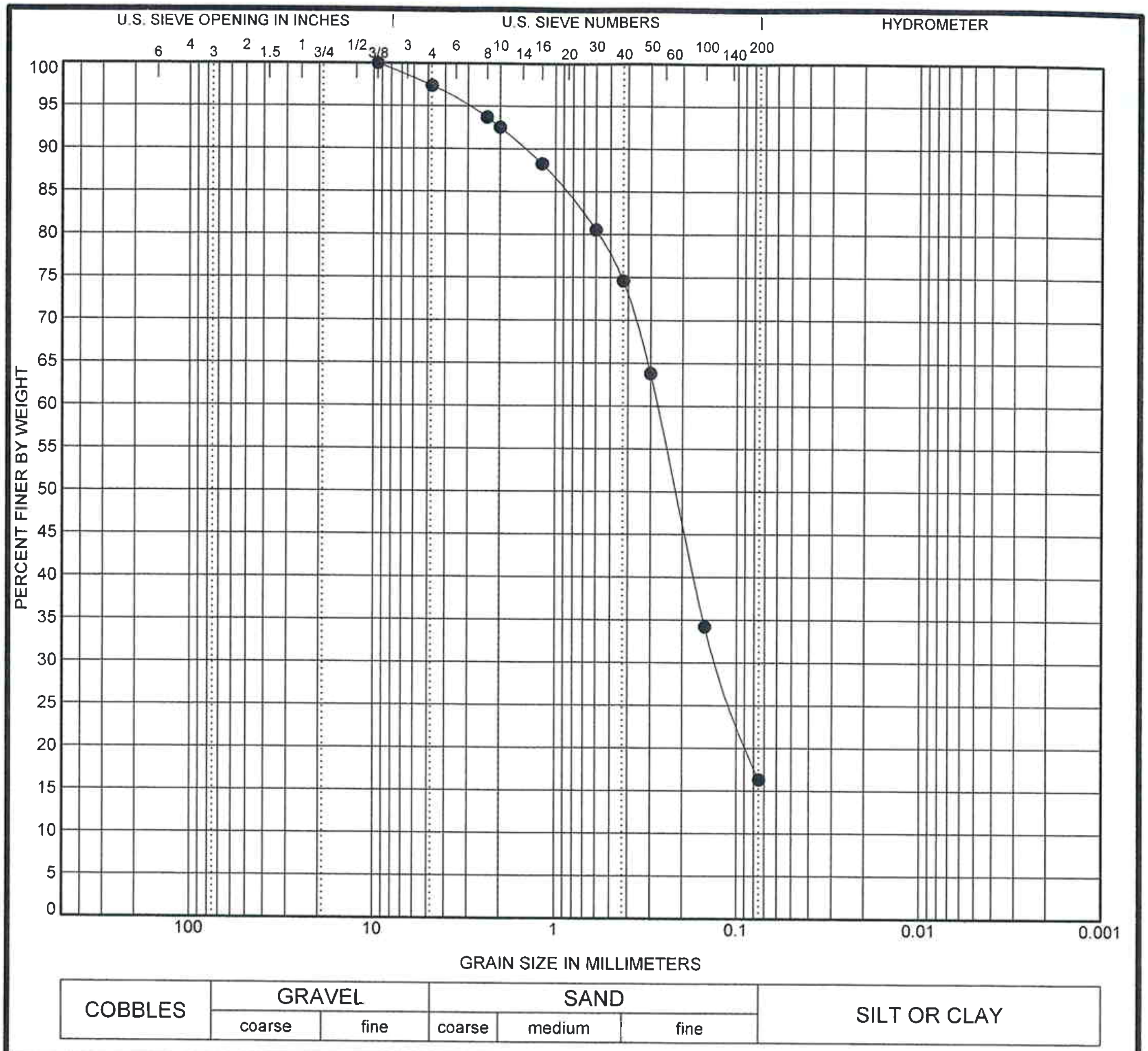
GRAIN SIZE DISTRIBUTION

Project: Middle Rosewood Creek Restoration Area A
Location: Incline Village, Nevada
Number: 8393.001



Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	B-2b	3.1	DARK GRAY SILTY SAND (SM)					

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-2b	3.1	9.5	0.274	0.127		2.6	81.1	16.3	

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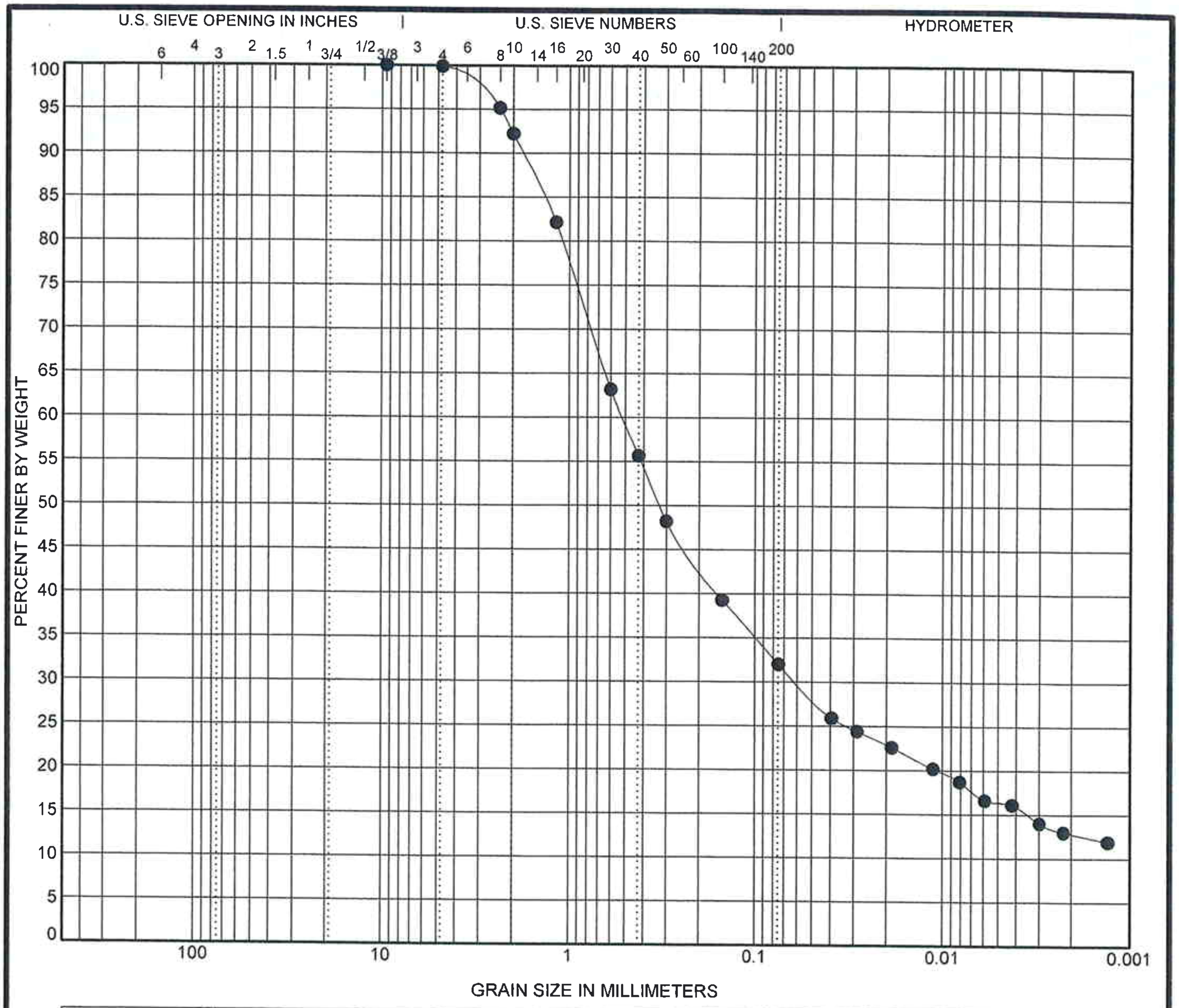
GRAIN SIZE DISTRIBUTION

Project: Middle Rosewood Creek Restoration Area A
Location: Incline Village, Nevada
Number: 8393.001

US GRAIN SIZE 8393.001 MIDDLE ROSEWOOD.GPJ WOOD RODGERS.GDT 1/13/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification (ft)		Classification	LL	PL	PI	Cc	Cu
● B-3	**4.0**	**DARK GRAY CLAYEY SAND (SC)**	**35**	**21**	**14**		

Specimen Identification (ft)		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-3	**4.0**	**9.5**	**0.519**	**0.061**		**0.1**	**67.9**	**15.6**	**16.4**

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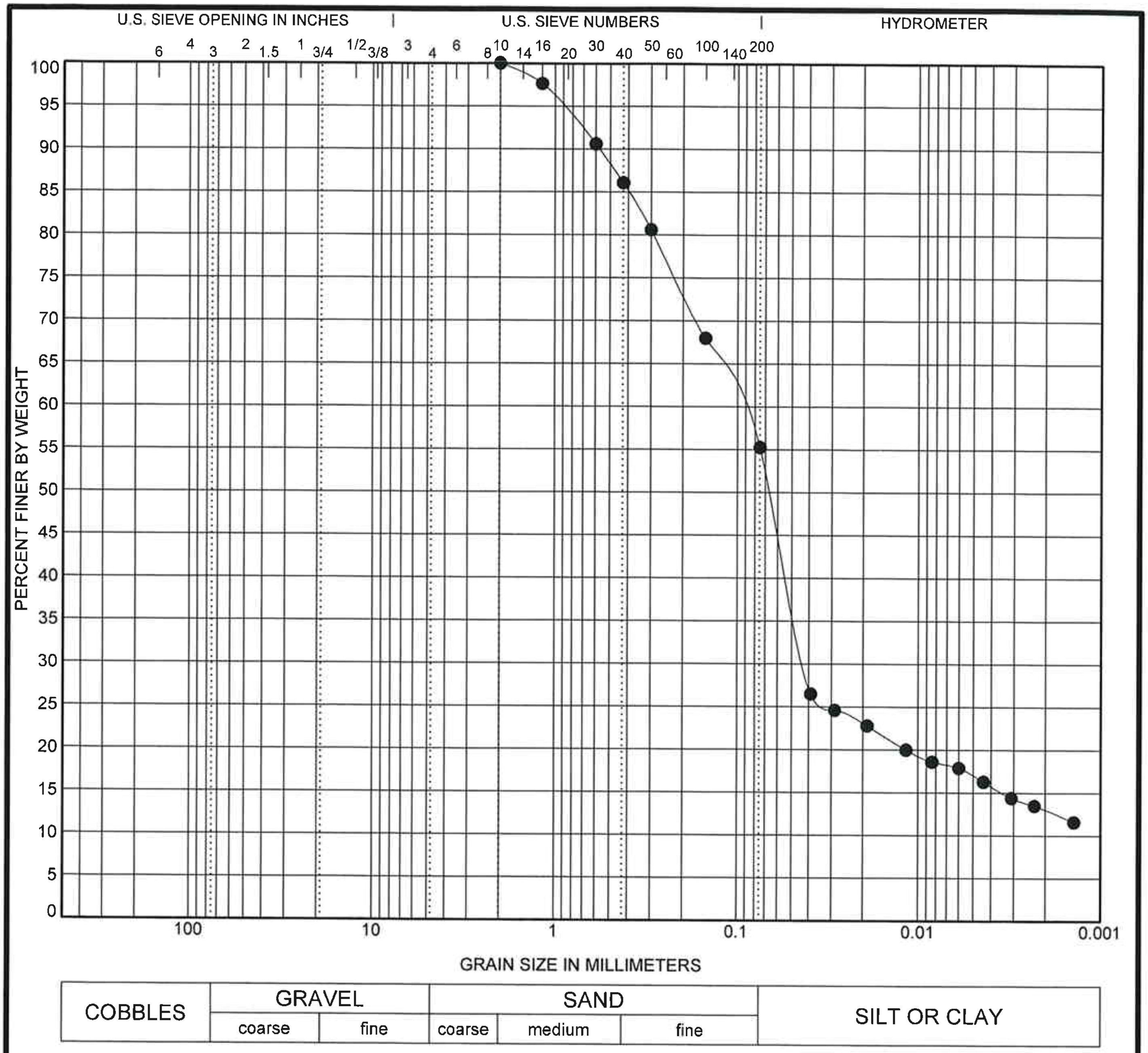
GRAIN SIZE DISTRIBUTION

Project: Middle Rosewood Creek Restoration Area A

Location: Incline Village, Nevada

Number: 8393.001

US GRAIN SIZE 8393.001 MIDDLE ROSEWOOD.GPJ WOOD RODGERS.GDT 1/13/09



Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	**B-3a**	**1.6**	**DARK GRAY SANDY SILTY CLAY (CH)**	**71**	**32**	**39**		

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-3a**	**1.6**	**2**	**0.097**	**0.042**		**0.0**	**44.7**	**38.3**	**17.0**

US GRAIN SIZE 8393.001 MIDDLE ROSEWOOD.GPJ WOOD RODGERS.GDT 3/16/09

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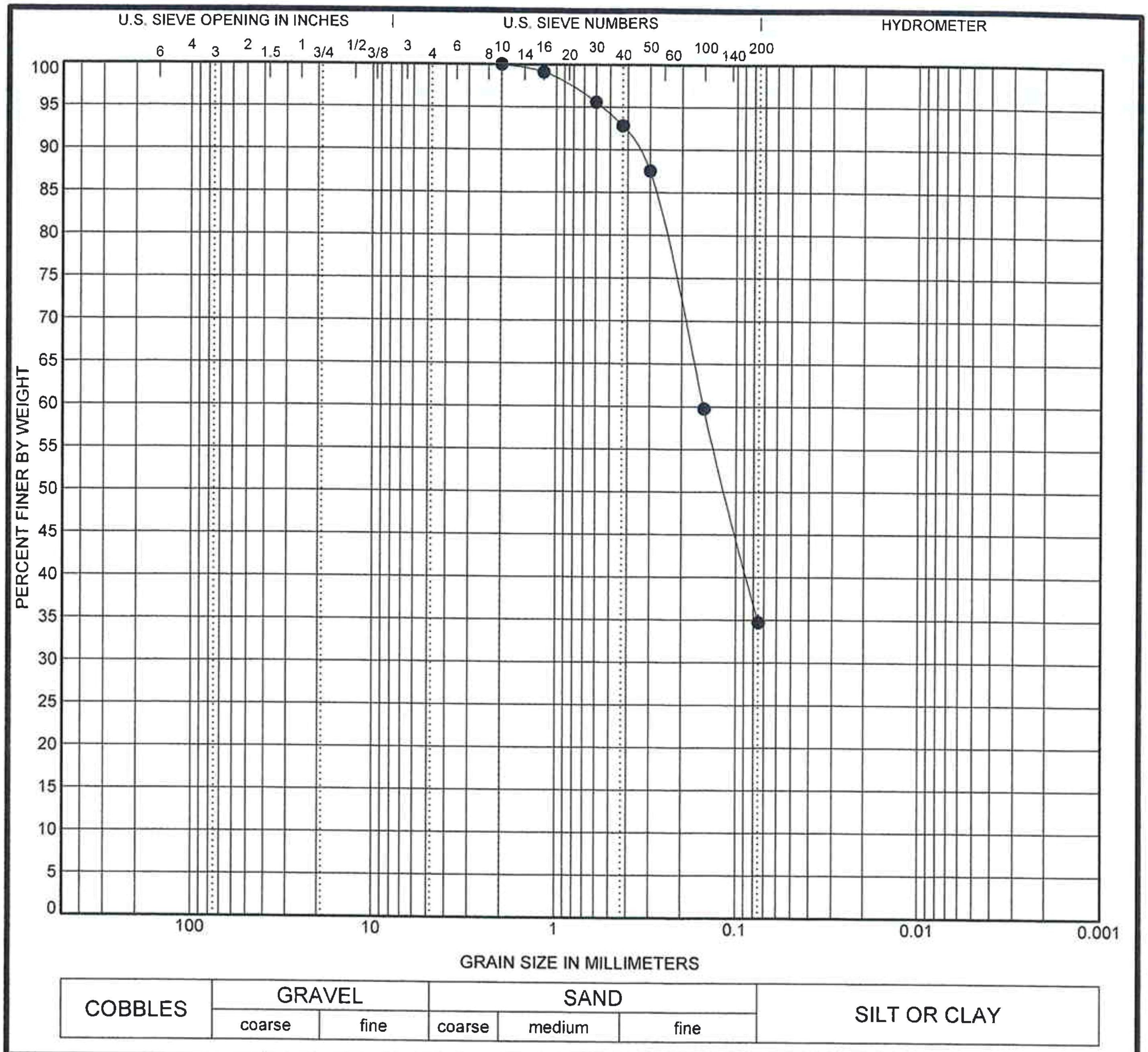
GRAIN SIZE DISTRIBUTION

Project: Middle Rosewood Creek Restoration Area A
Location: Incline Village, Nevada
Number: 8393.001



Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	B-3b	2.6	DARK GRAY SILTY SAND (SM)					

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-3b	2.6	2	0.151			0.0	65.3	34.7	

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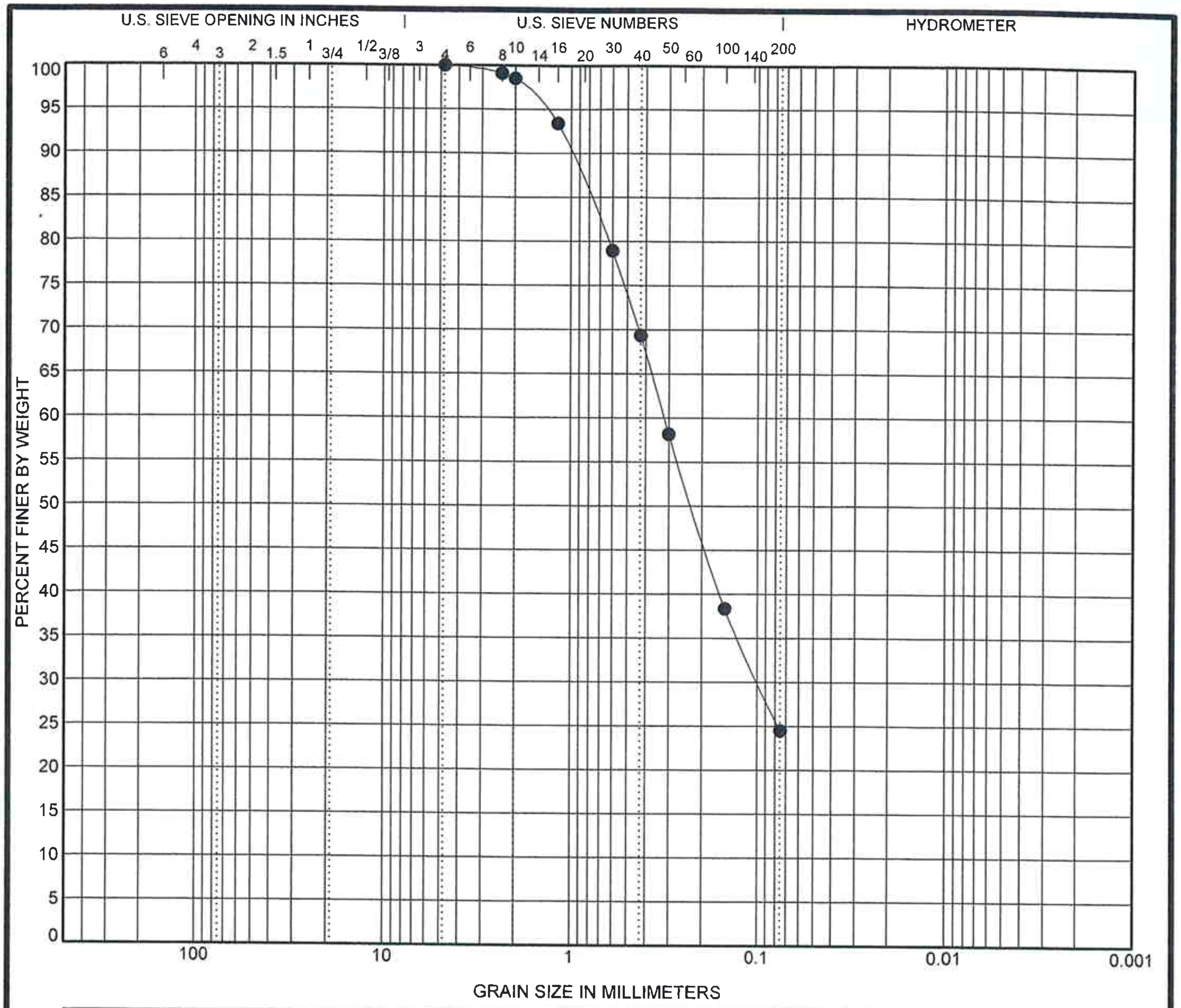
GRAIN SIZE DISTRIBUTION

Project: Middle Rosewood Creek Restoration Area A

Location: Incline Village, Nevada

Number: 8393.001



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	**B-4**	**2.1**	**DARK REDDISH-BROWN CLAYEY SAND (SC)**					

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-4**	**2.1**	**4.75**	**0.318**	**0.099**		**0.0**	**75.5**	**24.5**	

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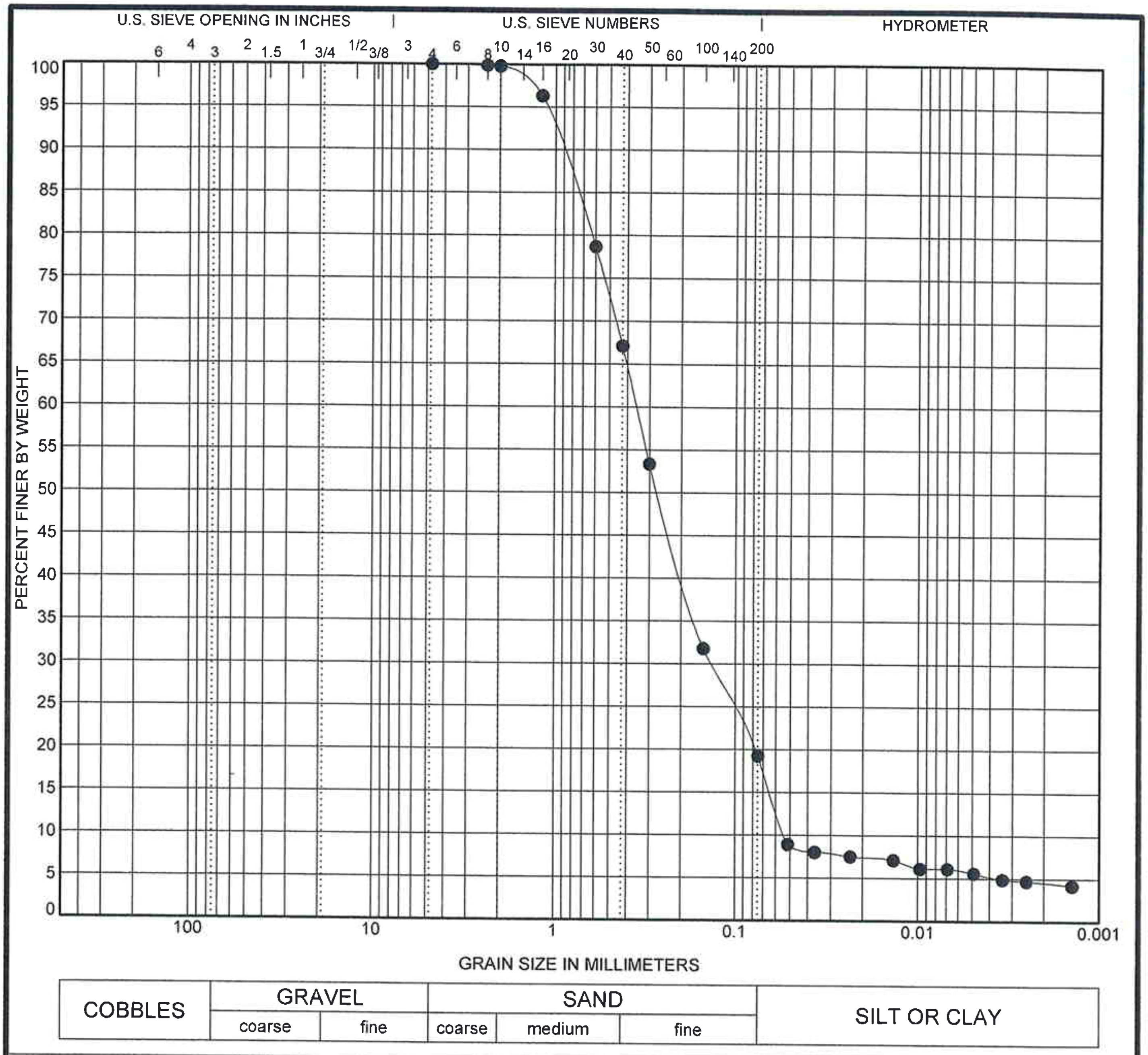
GRAIN SIZE DISTRIBUTION

Project: Middle Rosewood Creek Restoration Area A
Location: Incline Village, Nevada
Number: 8393.001

US GRAIN SIZE 8393.001 MIDDLE ROSEWOOD.GPJ WOOD RODGERS.GDT 1/13/09



Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	B-4a	4.0	DARK REDDISH-BROWN SILTY SAND (SM)				0.97	6.65

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-4a	4.0	4.75	0.355	0.136	0.053	0.0	80.8	13.6	5.6

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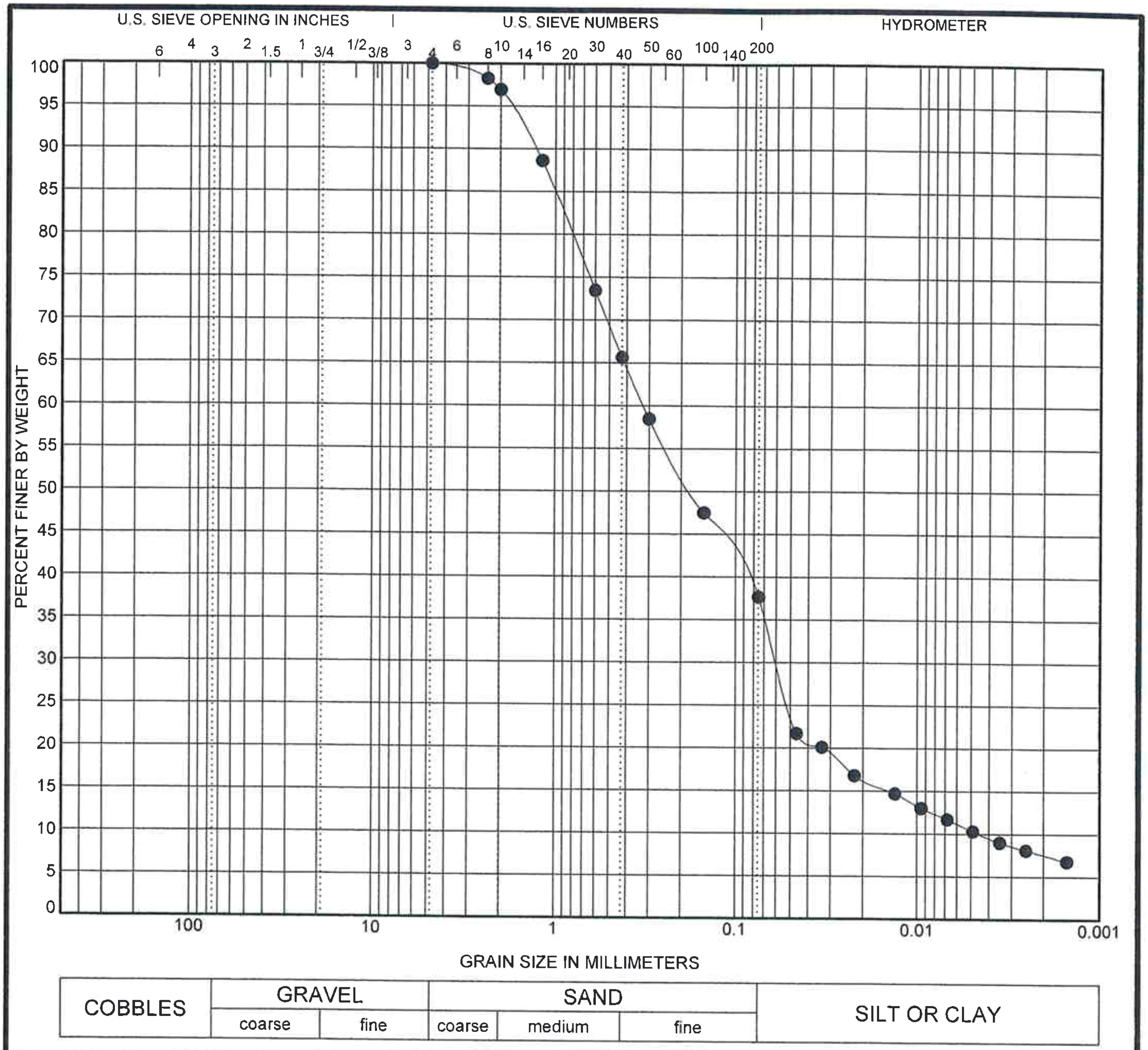
GRAIN SIZE DISTRIBUTION

Project: Middle Rosewood Creek Restoration Area A

Location: Incline Village, Nevada

Number: 8393.001



	Specimen Identification (ft)		Classification	LL	PL	PI	Cc	Cu
●	**B-5**	**3.6**	**DARK REDDISH-BROWN SILTY SAND (SM)**				**2.41**	**71.32**

	Specimen Identification (ft)		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-5**	**3.6**	**4.75**	**0.323**	**0.059**	**0.005**	**0.0**	**62.4**	**27.3**	**10.4**

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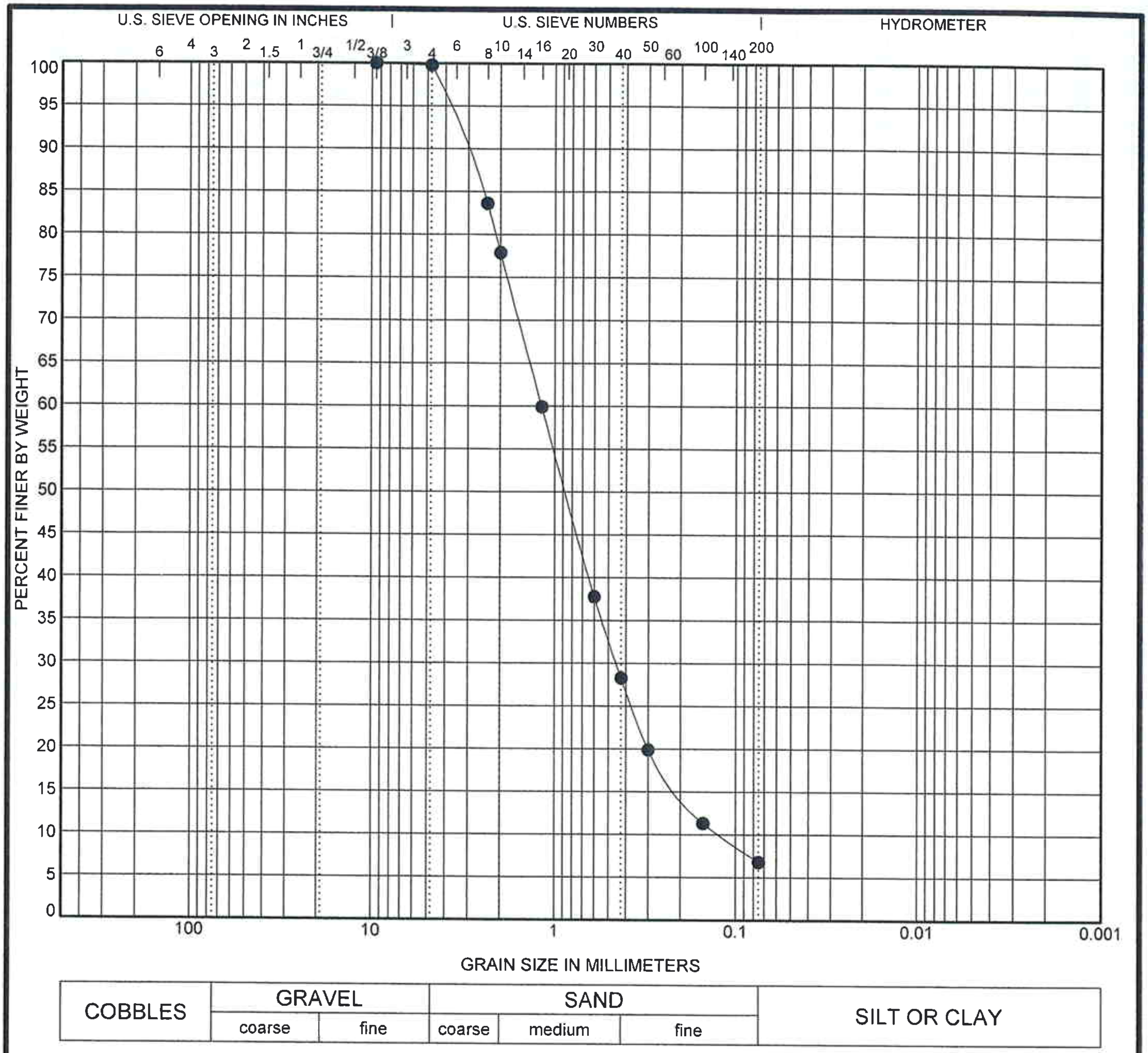
GRAIN SIZE DISTRIBUTION

Project: Middle Rosewood Creek Restoration Area A
Location: Incline Village, Nevada
Number: 8393.001



Specimen Identification (ft)		Classification	LL	PL	PI	Cc	Cu
● **B-5a**	**2.6**	**REDDISH-BROWN SLIGHTLY SILTY SAND (SM-SW)**				**1.41**	**9.66**

Specimen Identification (ft)		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-5a**	**2.6**	**9.5**	**1.183**	**0.452**	**0.122**	**0.2**	**93.0**	**6.8**	

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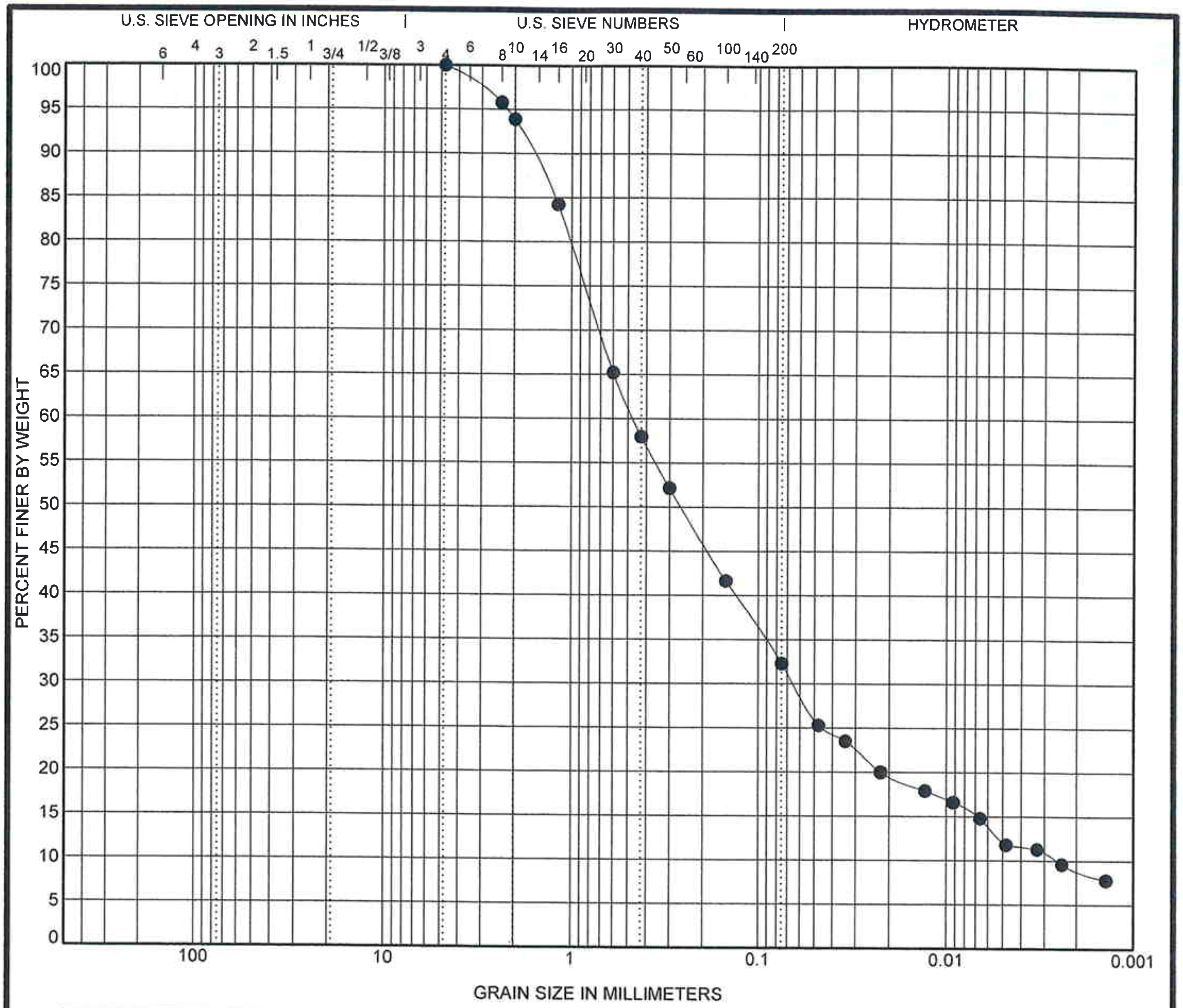
Project: Middle Rosewood Creek Restoration Area A

Location: Incline Village, Nevada

Number: 8393.001



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	B-6	4.0	BLACK SILTY SAND (SM)				3.44	181.01

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6	4.0	4.75	0.468	0.065	0.003	0.0	67.7	20.1	12.2

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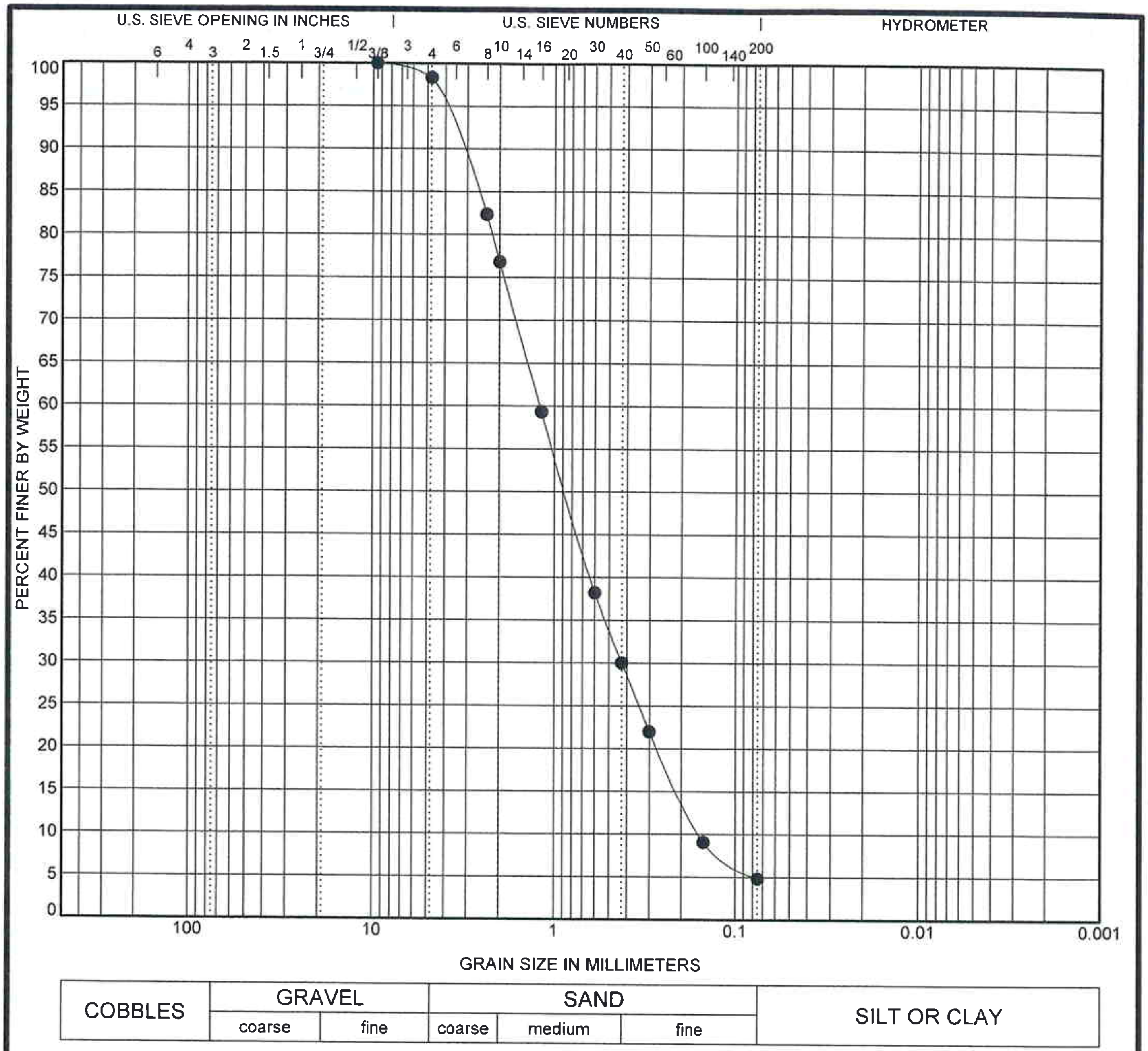
Project: Middle Rosewood Creek Restoration Area A
Location: Incline Village, Nevada
Number: 8393.001



Specimen Identification (ft)		Classification	LL	PL	PI	Cc	Cu
● **B-6a**	**2.3**	**YELLOW-RED SLIGHTLY SILTY SAND (SP-SM)**				**0.95**	**7.64**

Specimen Identification (ft)		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-6a**	**2.3**	**9.5**	**1.204**	**0.425**	**0.158**	**1.6**	**93.5**	**4.8**	

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Location: Incline Village, Nevada

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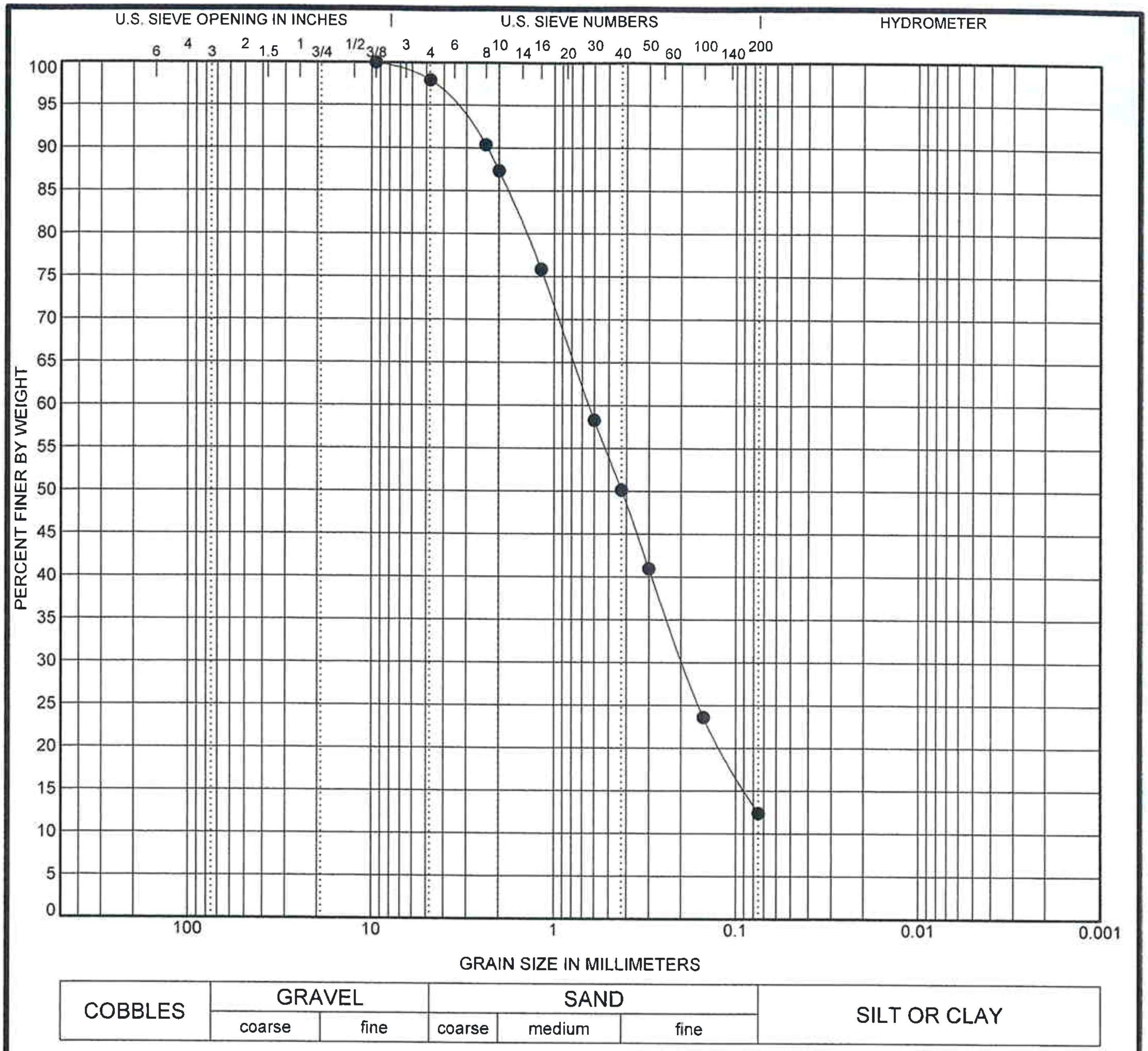
US GRAIN SIZE 8393.001 MIDDLE ROSEWOOD.GPJ WOOD RODGERS.GDT 1/13/09



	Specimen Identification (ft)		Classification	LL	PL	PI	Cc	Cu
●	B-7	2.1	**DARK REDDISH-BROWN SILTY SAND (SM)**				**0.90**	**9.91**

	Specimen Identification (ft)		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-7	2.1	**9.5**	**0.641**	**0.194**		**2.0**	**85.6**	**12.4**	

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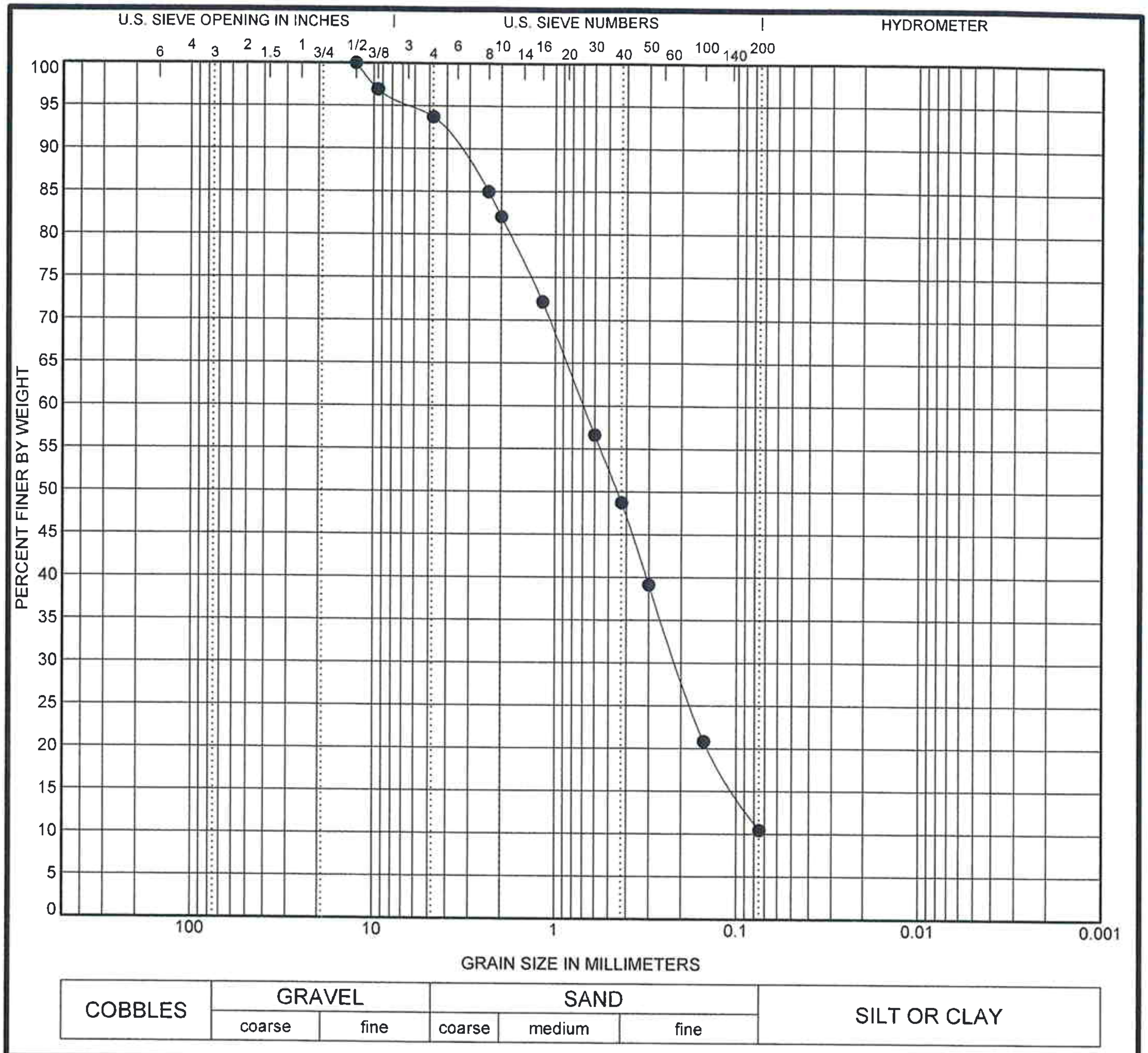
Location: Incline Village, Nevada
Number: 8393.001



Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	B-7a	3.0	DARK GRAY SLIGHTLY SILT SAND (SW-SM)				0.89	9.55

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-7a	3.0	12.5	0.695	0.212		6.3	83.3	10.4	

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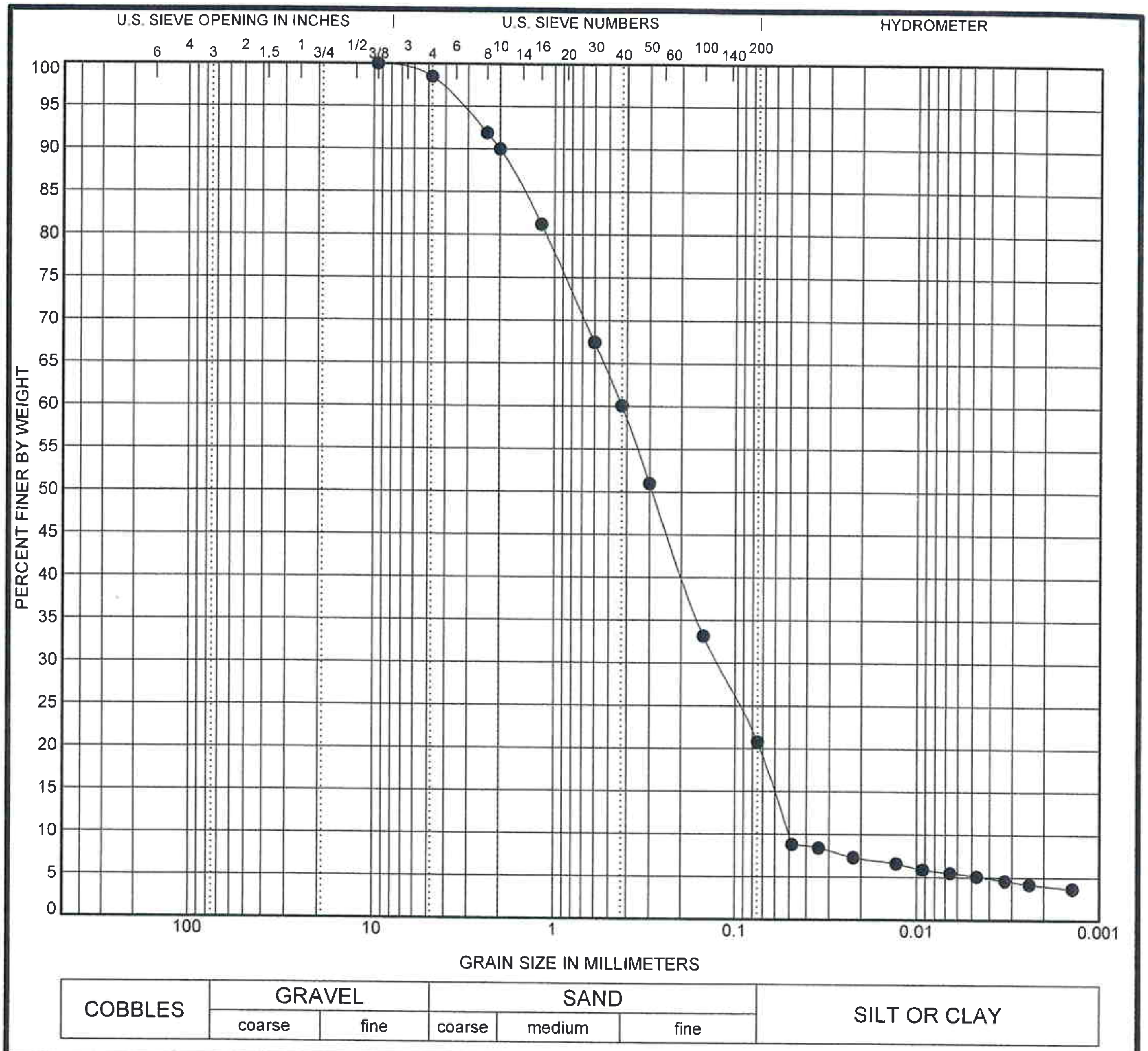
Project: Middle Rosewood Creek Restoration Area A

Location: Incline Village, Nevada

Number: 8393.001



Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	**B-8**	**2.6**	**DARK REDDISH-BROWN SILTY SAND (SM)**				**0.74**	**8.41**

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-8**	**2.6**	**9.5**	**0.424**	**0.126**	**0.05**	**1.5**	**77.7**	**15.6**	**5.2**

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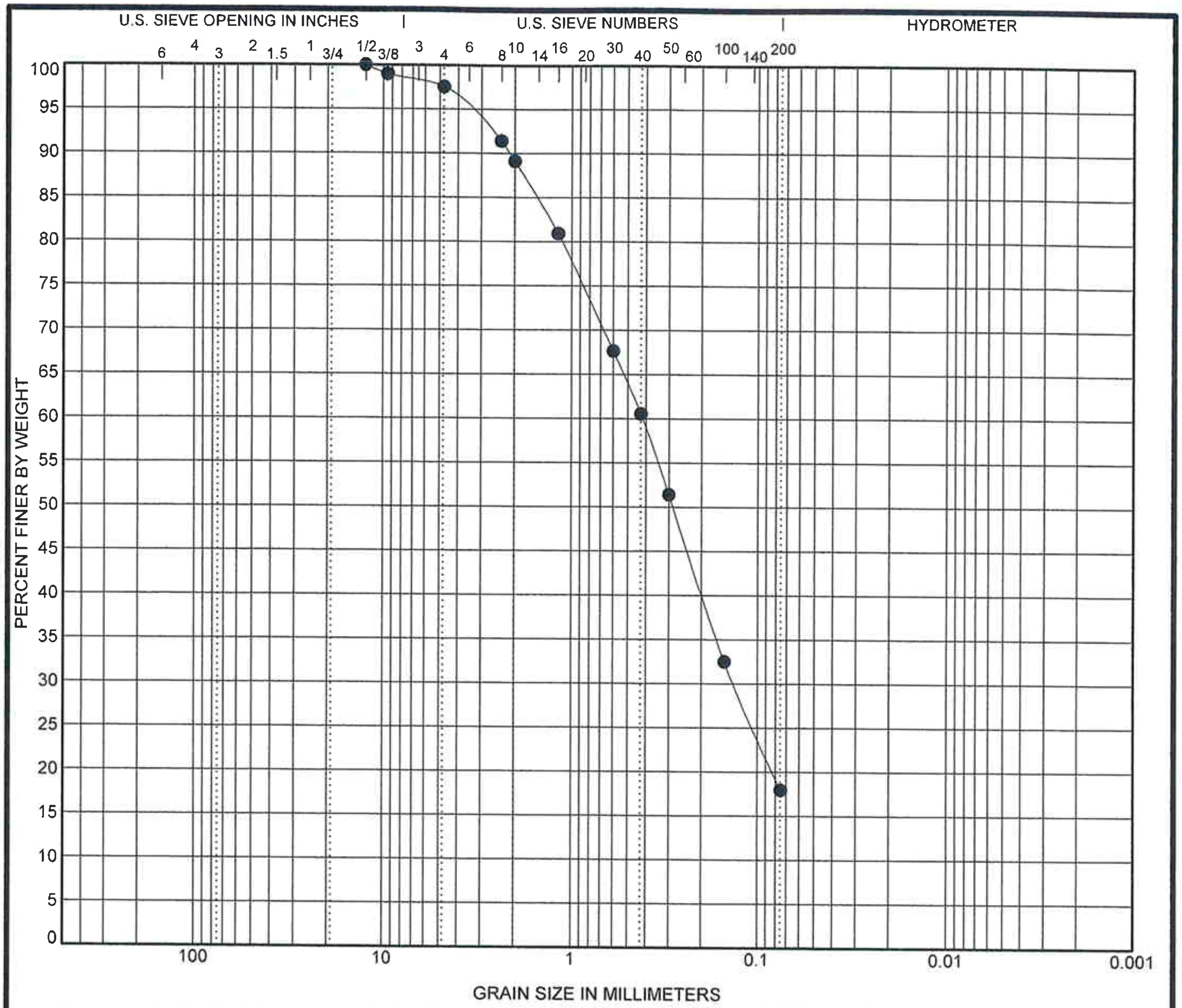
Location: Incline Village, Nevada
Number: 8393.001

US GRAIN SIZE 8393.001 MIDDLE ROSEWOOD.GPJ WOOD RODGERS.GDT 1/13/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	B-8a	2.3	DARK REDDISH-BROWN SILTY SAND (SM)					

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-8a	2.3	12.5	0.416	0.133		2.5	79.6	18.0	

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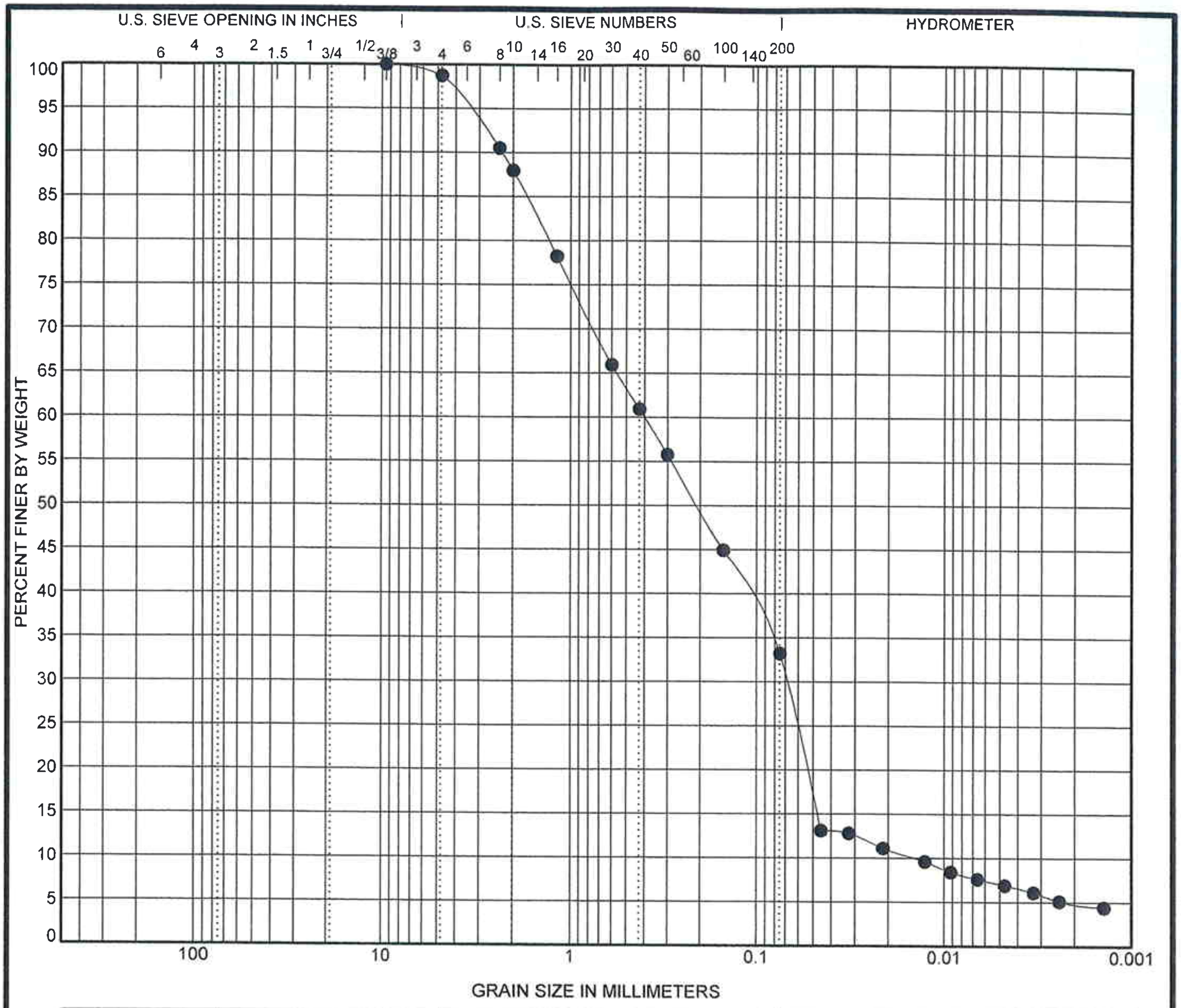
Location: Incline Village, Nevada
Number: 8393.001



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	B-10	0.9	REDDISH-BROWN SILTY SAND (SM)	40	30	10	0.82	27.39

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-10	0.9	9.5	0.399	0.069	0.015	1.3	65.5	26.2	7.0

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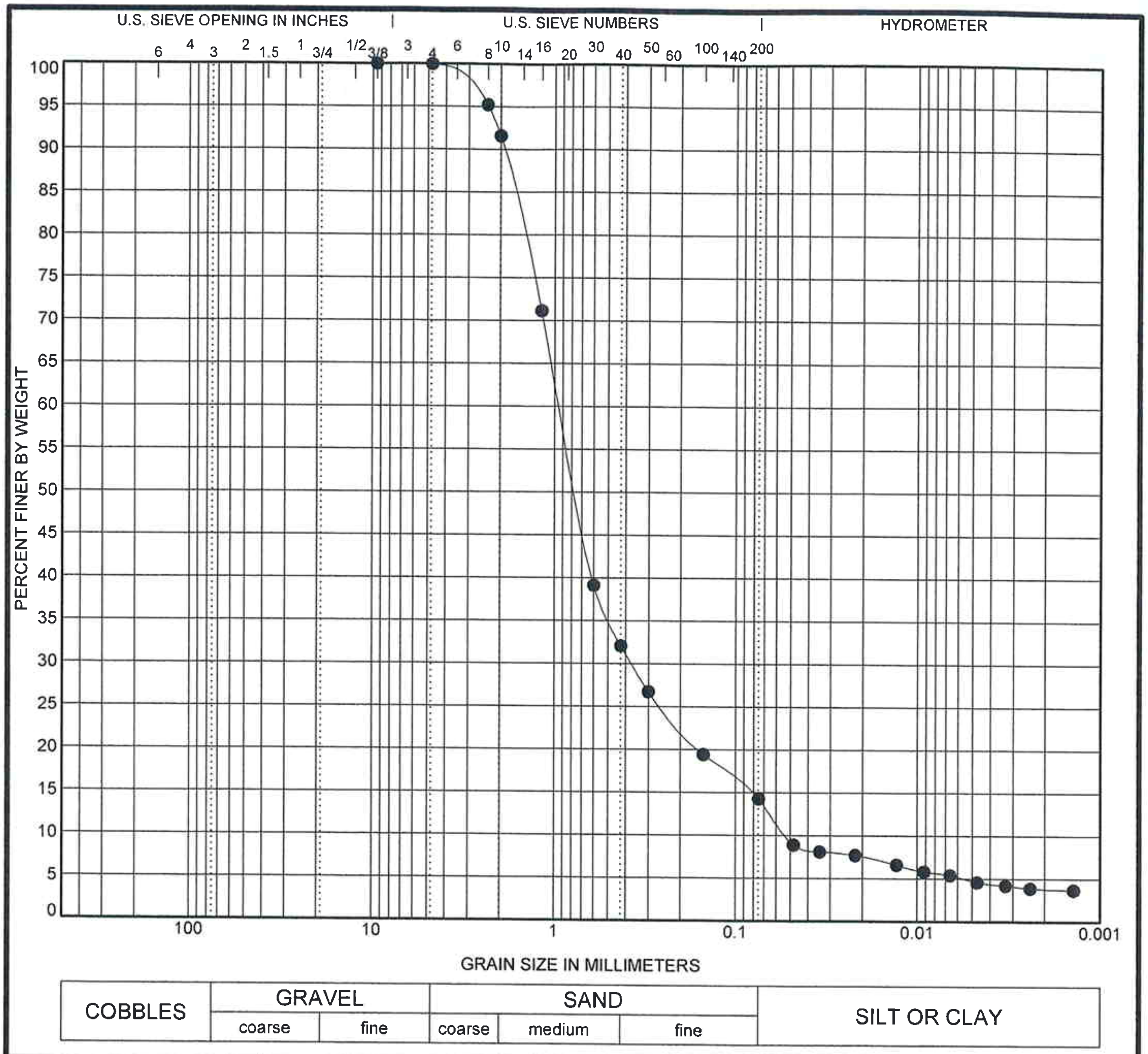
US GRAIN SIZE 8393.001 MIDDLE ROSEWOOD.GPJ WOOD RODGERS.GDT 1/13/09



Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	**B-10**	**2.4**	**REDDISH-BROWN SILTY SAND (SM)**	**51**	**39**	**12**	**2.81**	**17.73**

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-10**	**2.4**	**9.5**	**0.933**	**0.371**	**0.053**	**0.0**	**85.7**	**9.5**	**4.7**

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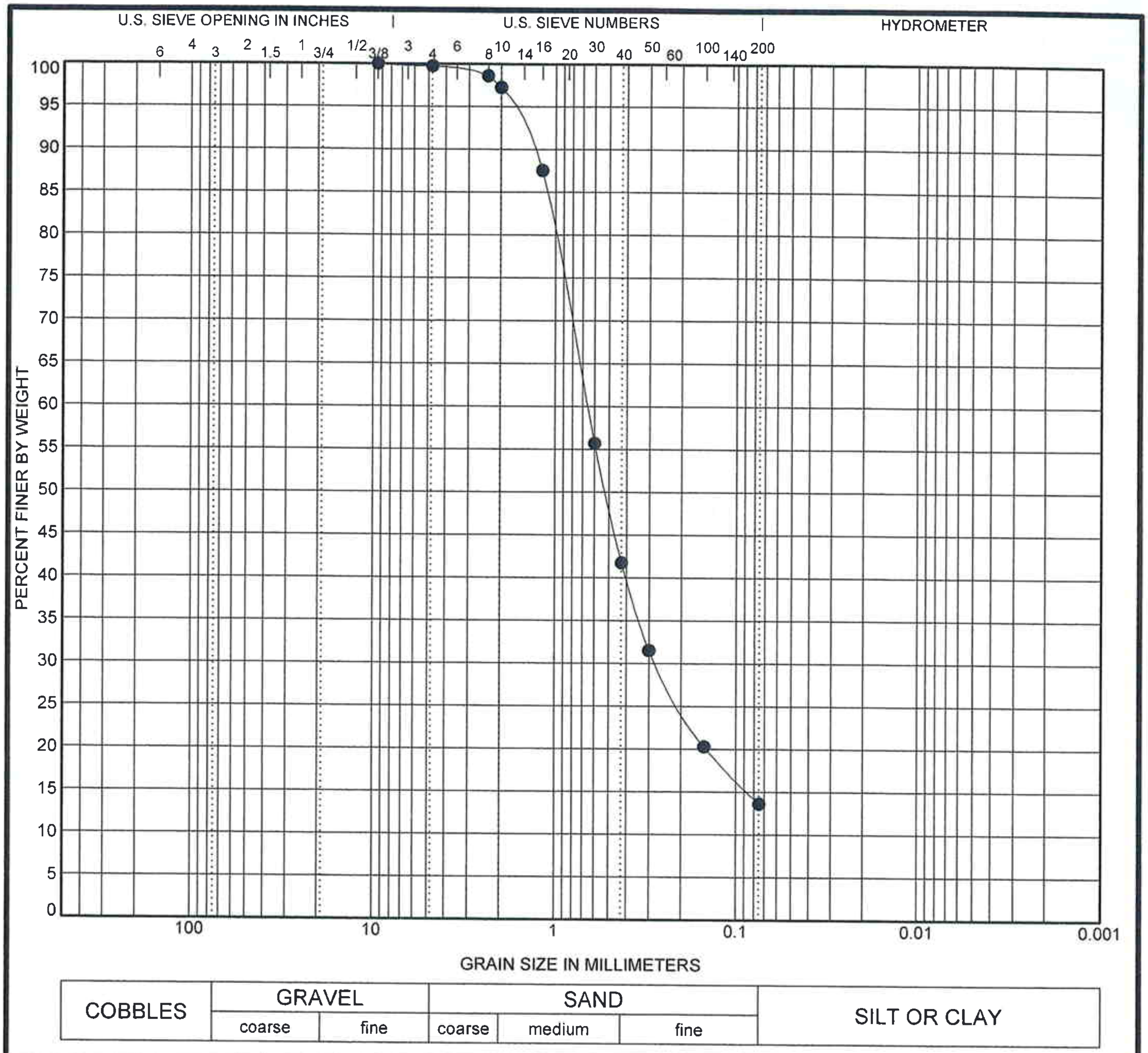

Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	**B-10a**	**3.1**	**DARK REDDISH-GRAY SILTY SAND (SM)**					

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-10a**	**3.1**	**9.5**	**0.657**	**0.273**		**0.3**	**86.1**	**13.6**	

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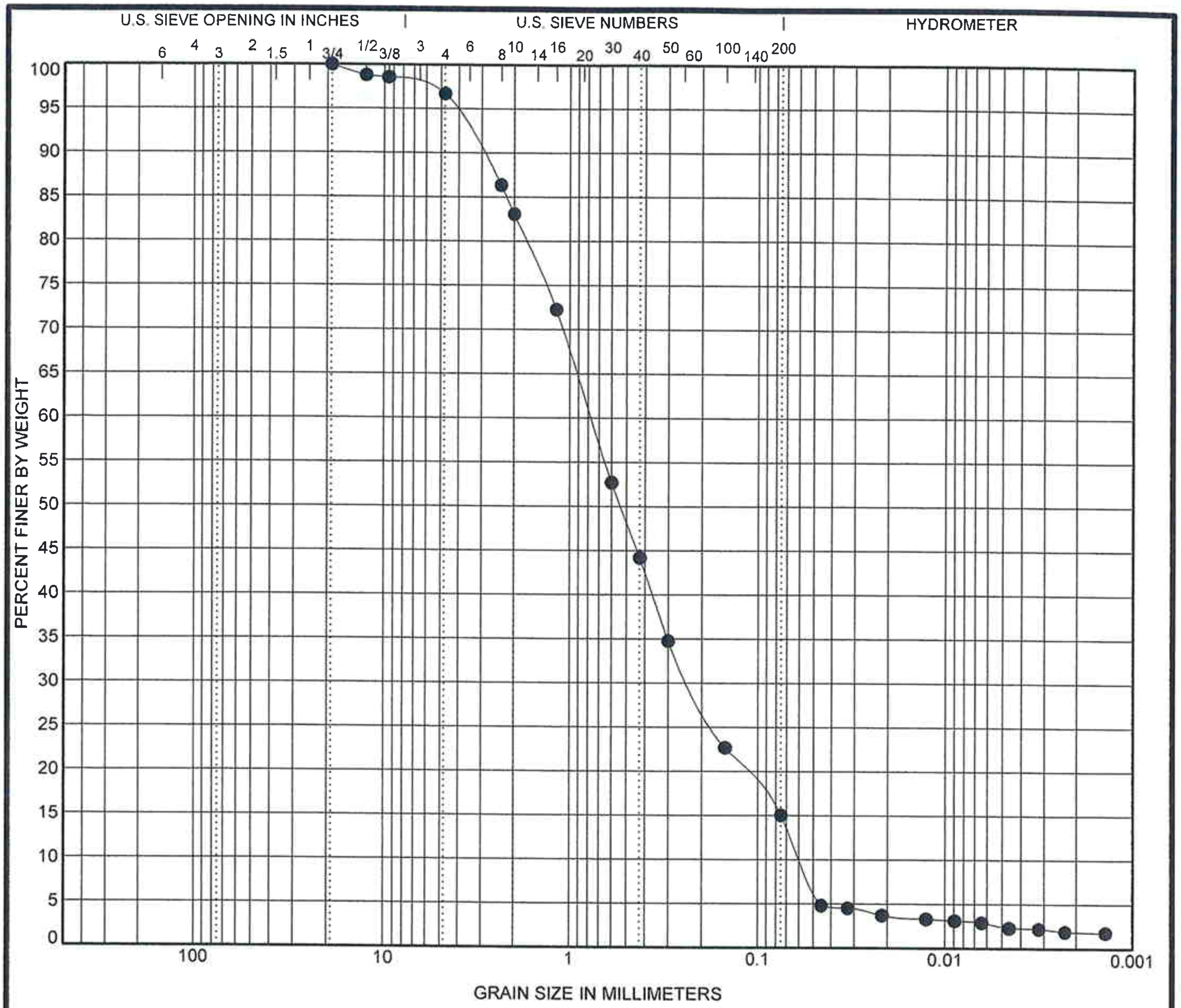

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	B-11	2.4	REDDISH-BROWN SILTY SAND (SM)				1.15	13.21

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-11	2.4	19	0.772	0.228	0.058	3.3	81.7	12.6	2.5

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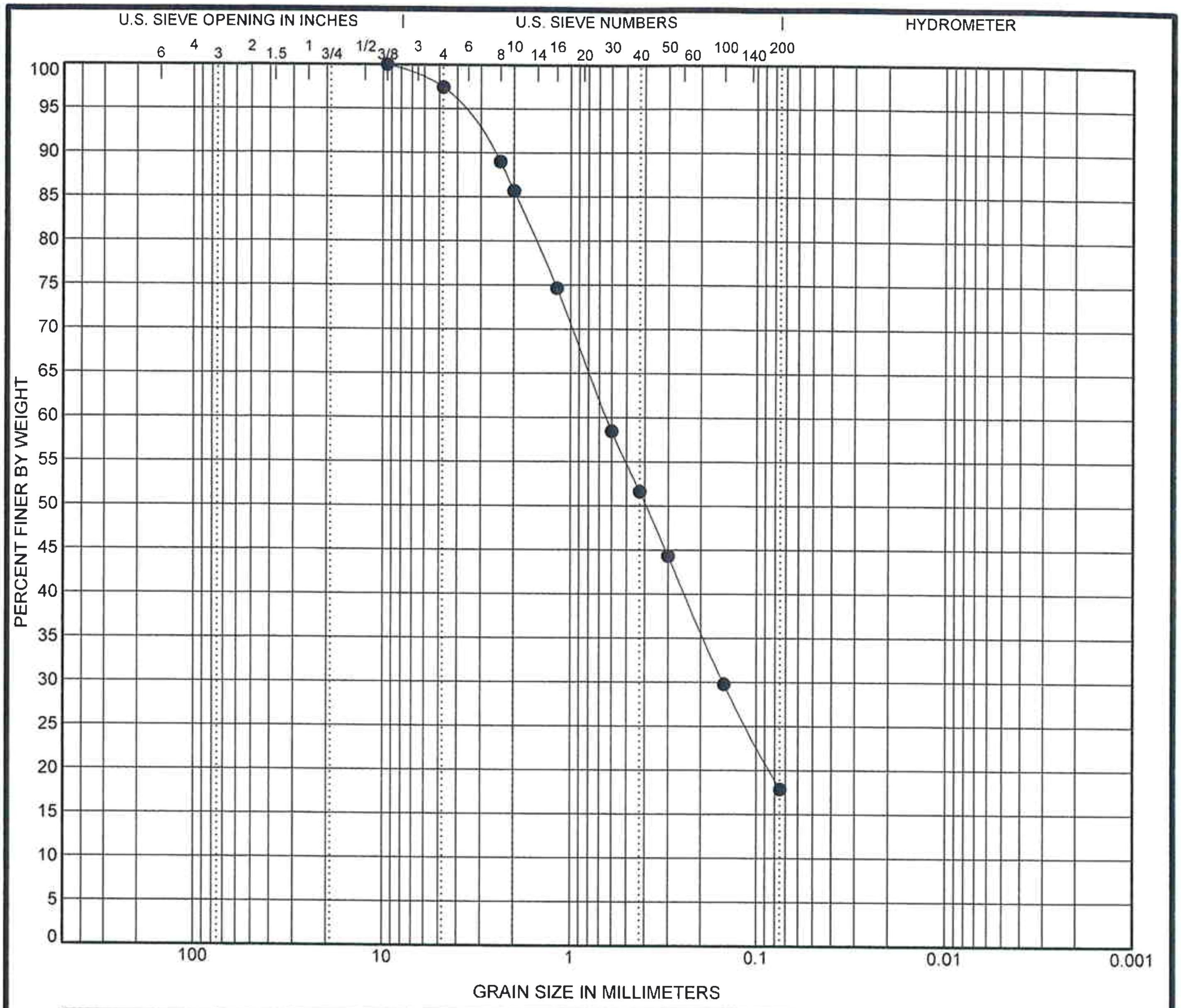

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	B-11a	3.8	STRONG BROWN SILTY SAND (SM)					

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-11a	3.8	9.5	0.64	0.152		2.6	79.6	17.9	

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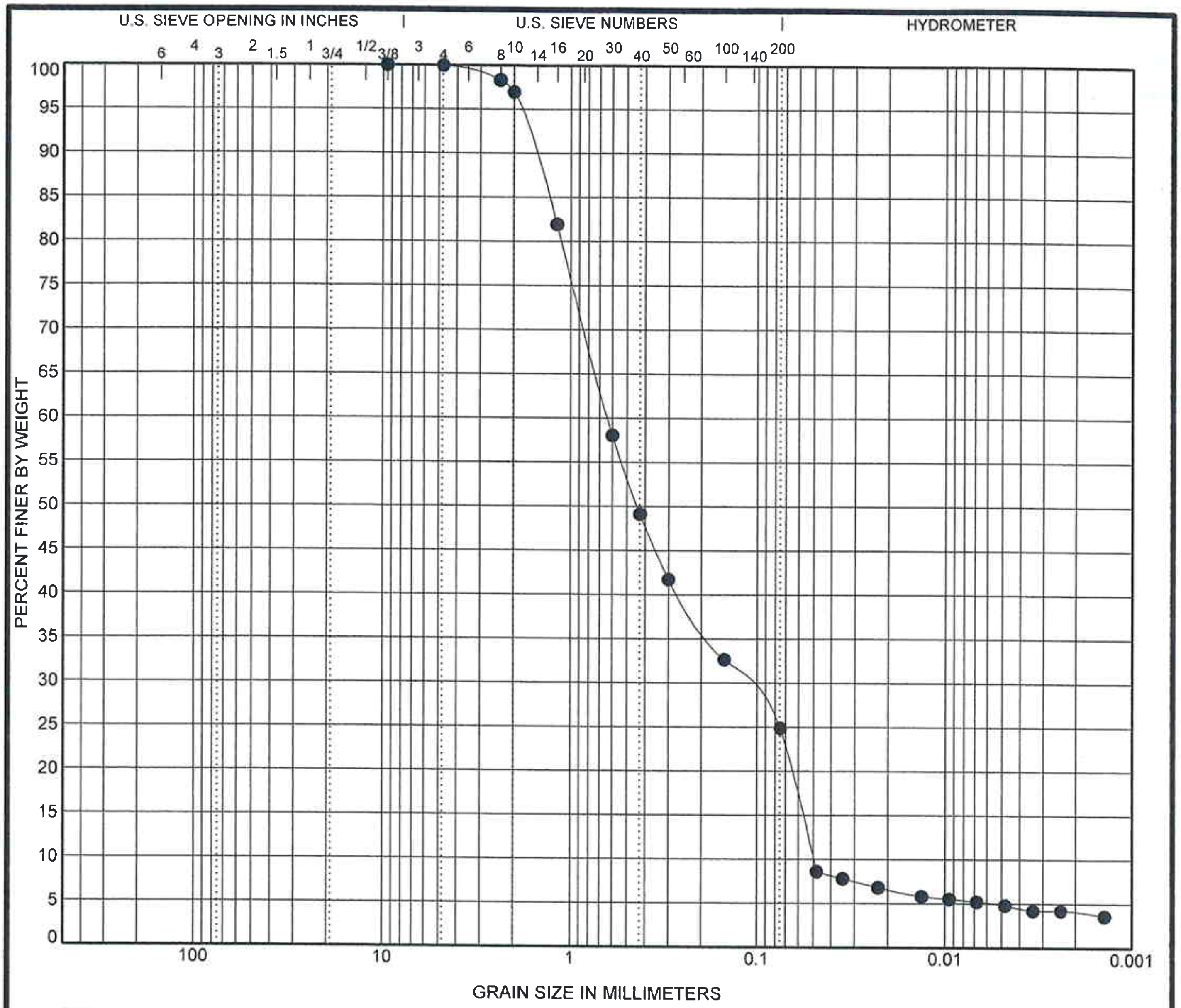

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	B-12	2.3	REDDISH-BROWN SILTY SAND (SM)				0.44	12.76

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-12	2.3	9.5	0.634	0.118	0.05	0.0	75.1	20.0	4.8

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Location: Incline Village, Nevada

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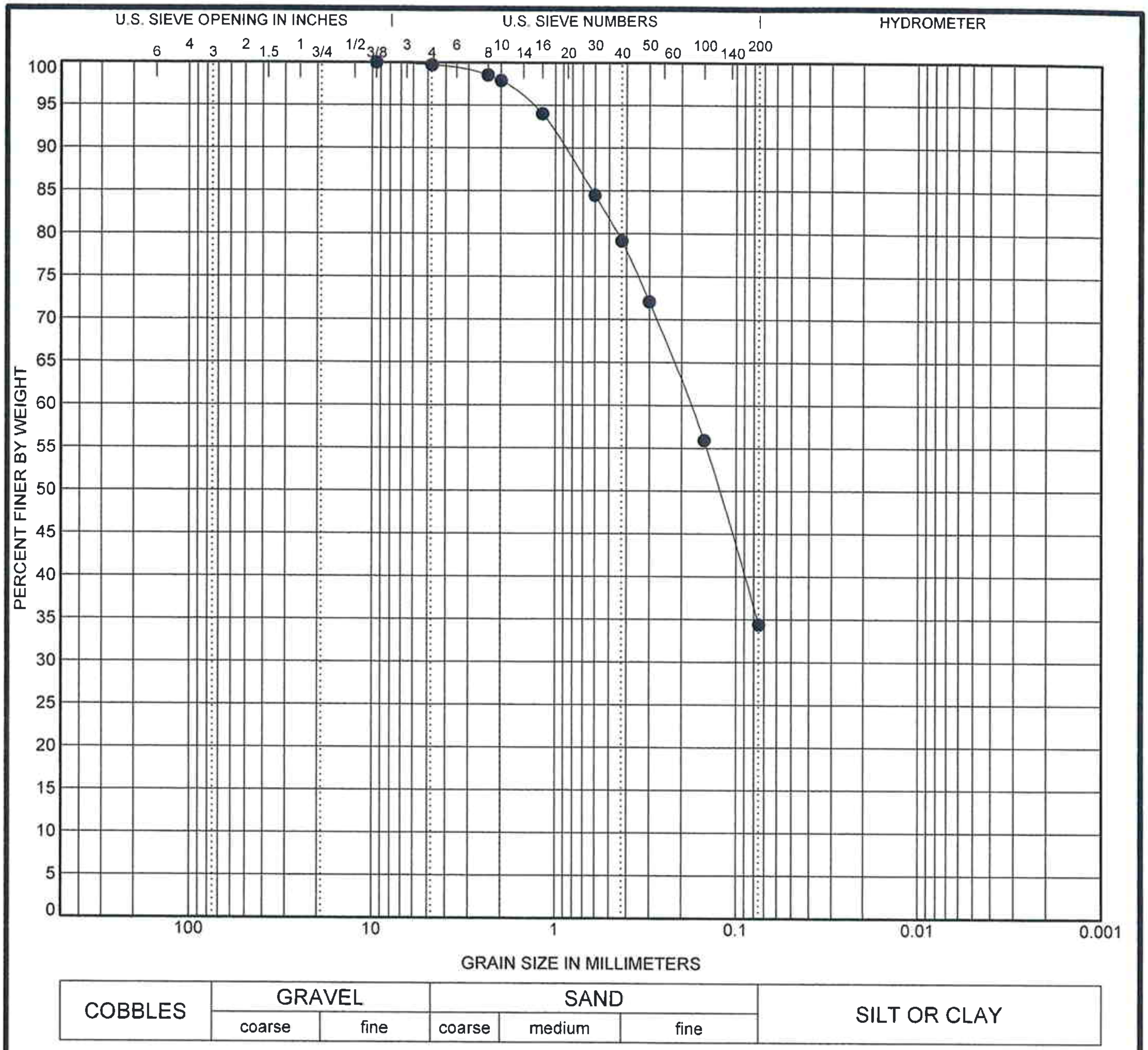

Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	**B-12a**	**3.3**	**DARK REDDISH-BROWN CLAYEY SAND (SC)**					

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-12a**	**3.3**	**9.5**	**0.179**			**0.3**	**65.3**	**34.4**	

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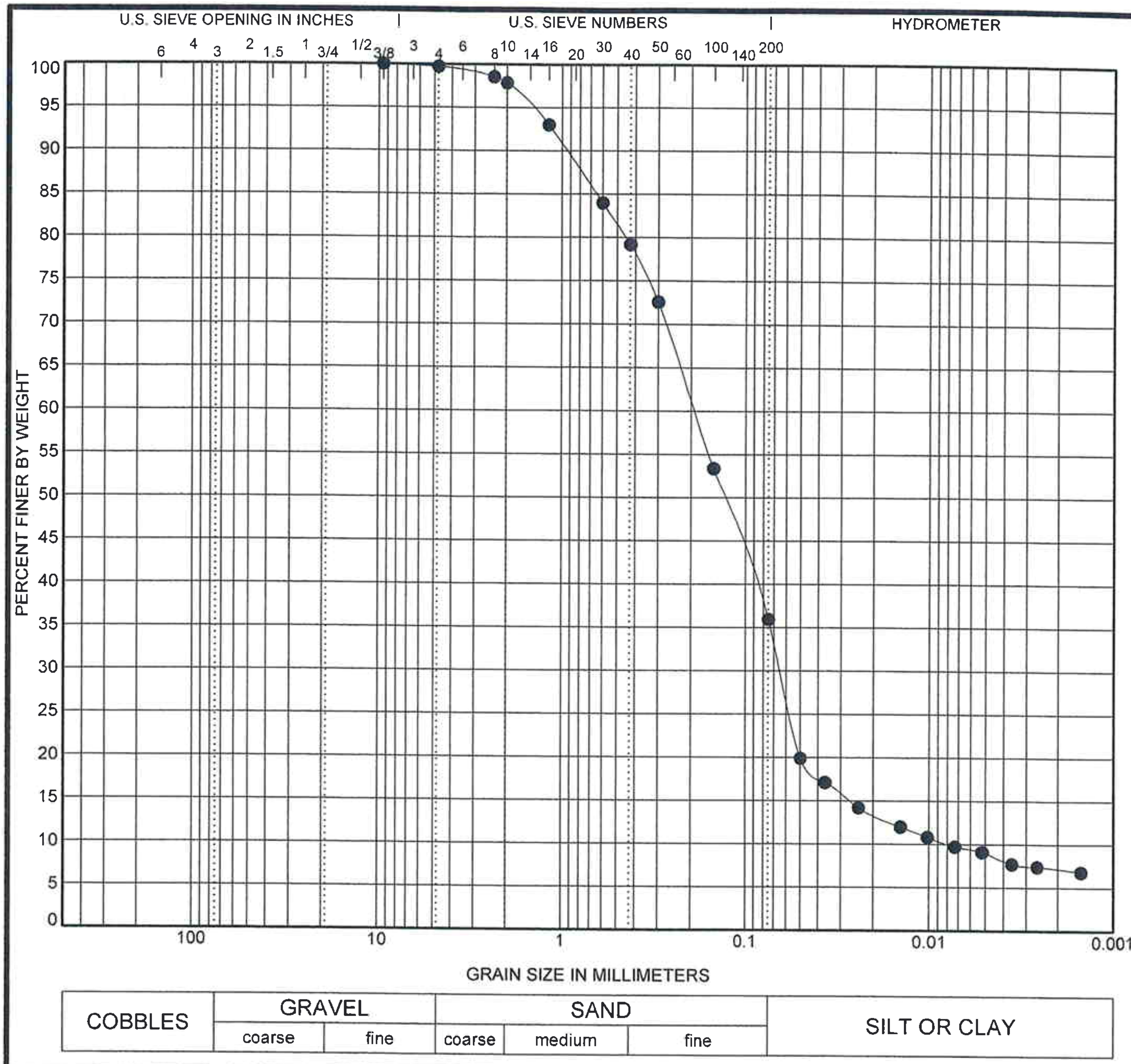
US GRAIN SIZE 8393.001 MIDDLE ROSEWOOD.GPJ WOOD RODGERS.GDT 1/19/09



Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	**B-13**	**3.0**	**DARK REDDISH-BROWN SILTY SAND (SM)**				**2.73**	**23.83**

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-13**	**3.0**	**9.5**	**0.191**	**0.064**	**0.008**	**0.3**	**63.8**	**27.0**	**9.0**

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Project: Middle Rosewood Creek Restoration Area A

Location: Incline Village, Nevada

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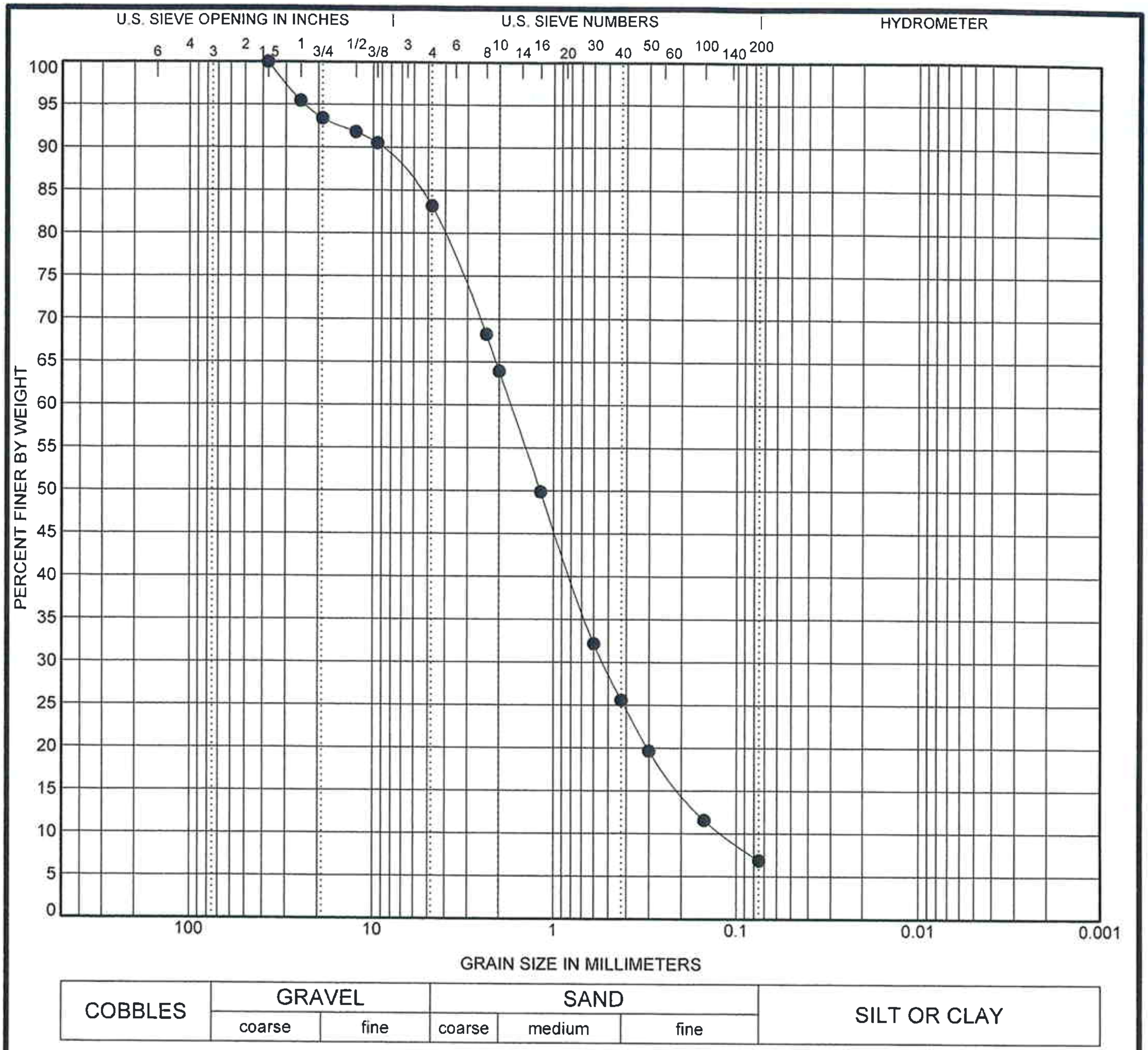

Specimen Identification (ft)	Classification	LL	PL	PI	Cc	Cu
● B-13a 4.2	DK REDDISH-BRN SILTY SAND W/GRAVEL (SW-SM)				1.40	14.47

Specimen Identification (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-13a 4.2	37.5	1.724	0.536	0.119	16.8	76.3	6.9	

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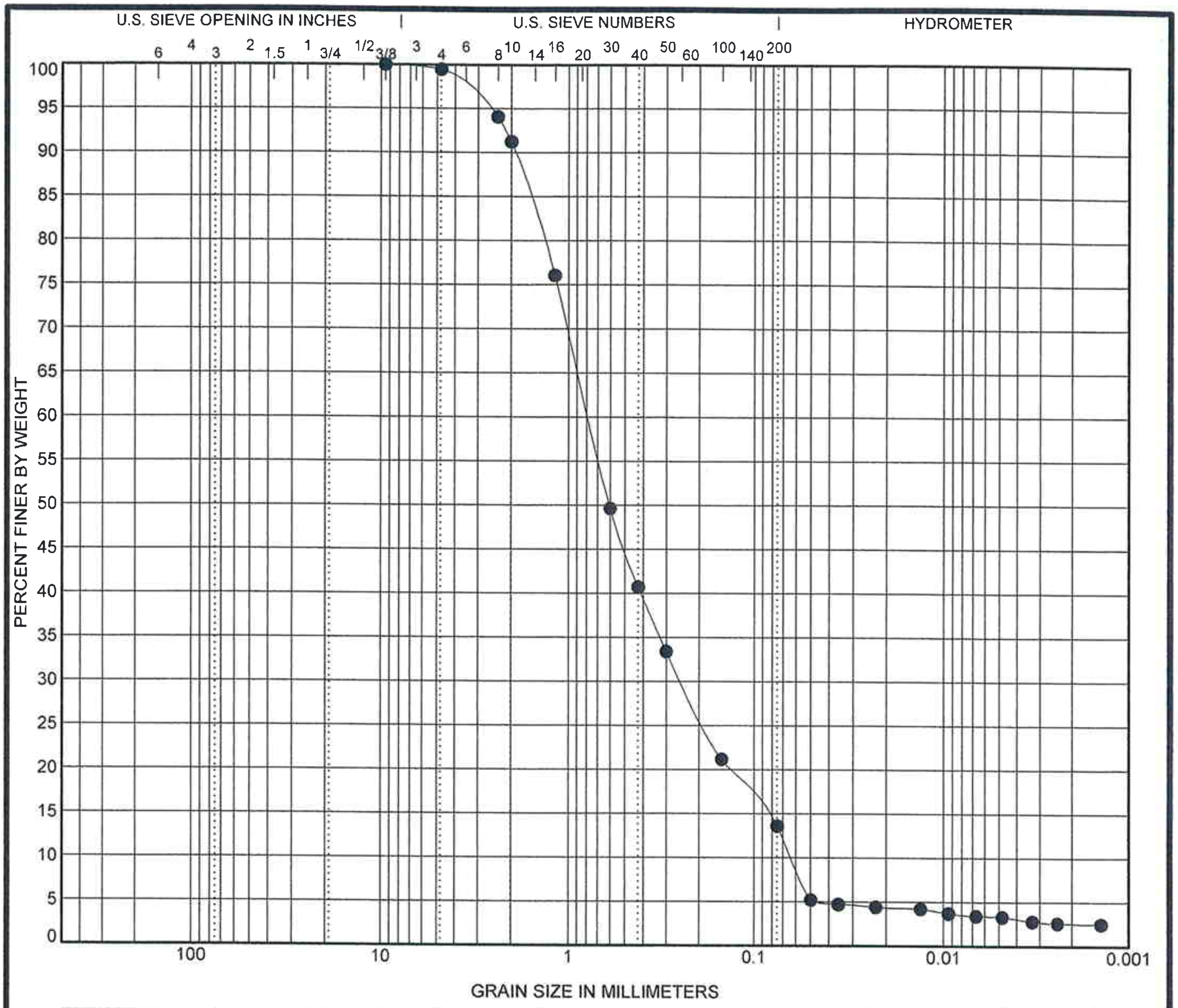

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification (ft)			Classification	LL	PL	PI	Cc	Cu
●	**B-14**	**2.1**	**REDDISH-BROWN SILTY SAND (SM)**				**1.24**	**12.44**

Specimen Identification (ft)			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-14**	**2.1**	**9.5**	**0.782**	**0.248**	**0.063**	**0.5**	**85.9**	**10.3**	**3.3**

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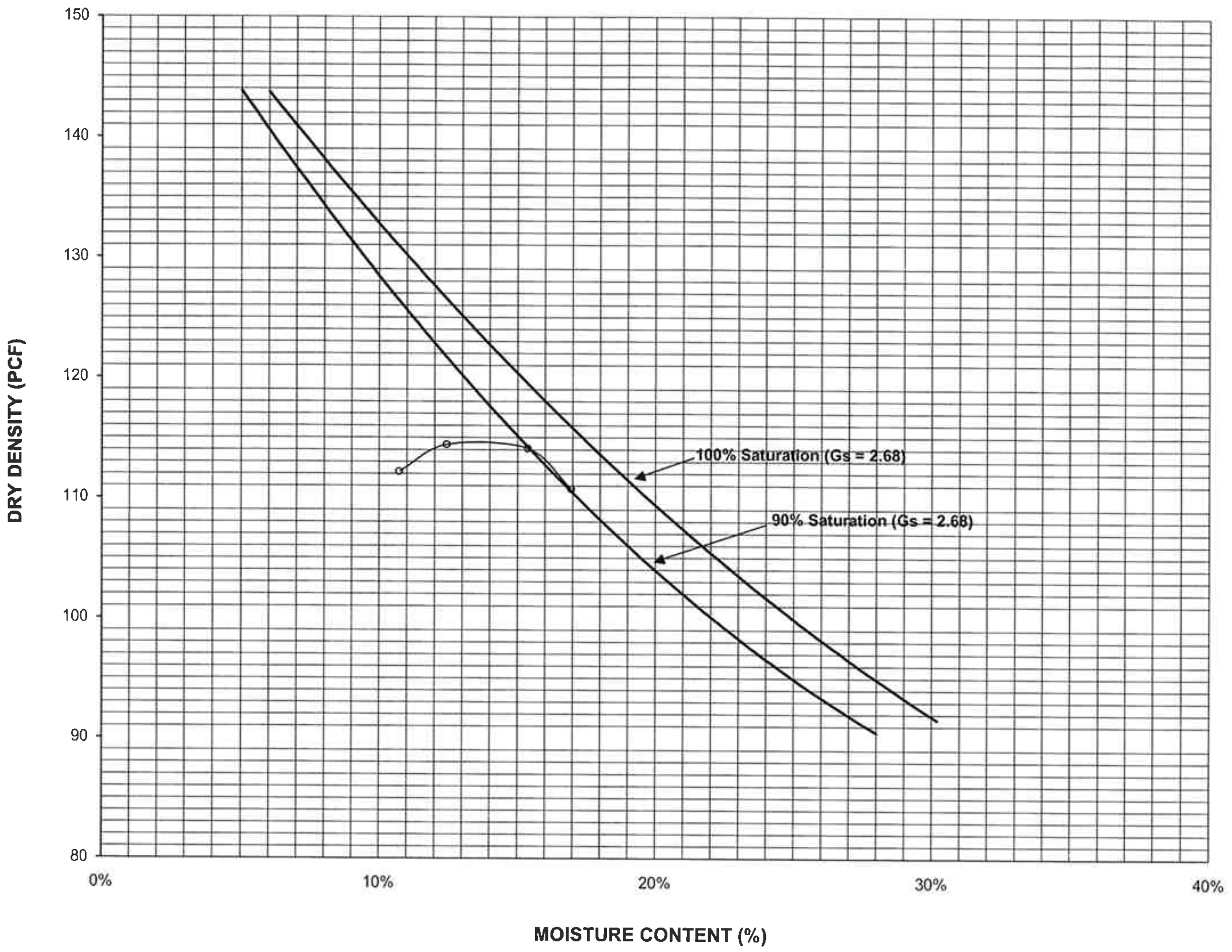


D 1557-02 Symbol	Sample Source	Classification (Description)	Maximum Dry Density (pcf)	Optimum Moisture Content (percent)
°	Site B-4 at 0.0 to 1.5-Feet	Silty Sand (SM) (Visual Classification Only)	115.0	13.5

TEST PROCEDURE: D 1557-02
METHOD: A
LAYERS: 5
BLOWS: 25

MOLD (inches): 4
HAMMER (lbs.) 10
FALL (inches): 18

COMPACTION EQUIPMENT
MANUAL: ______
MECHANICAL: X

POINT NO.	MOISTURE	DRY DENSITY (pcf)
1	10.7%	112.2
2	12.4%	114.4
3	15.4%	114.1
4	16.9%	110.7
5		

PERCENT PASSING SIEVE SIZE
3/4" ______
3/8" ______
No. 4 97

SPECIFIC GRAVITY
ASSUMED: ______
ASTM C 127: ______
ABSORPTION (%): ______

SAMPLE INFORMATION
SAMPLE BULK NO: 900
DATE SAMPLED: 12/17/08
DATE RECEIVED/TESTED: 12/18/08

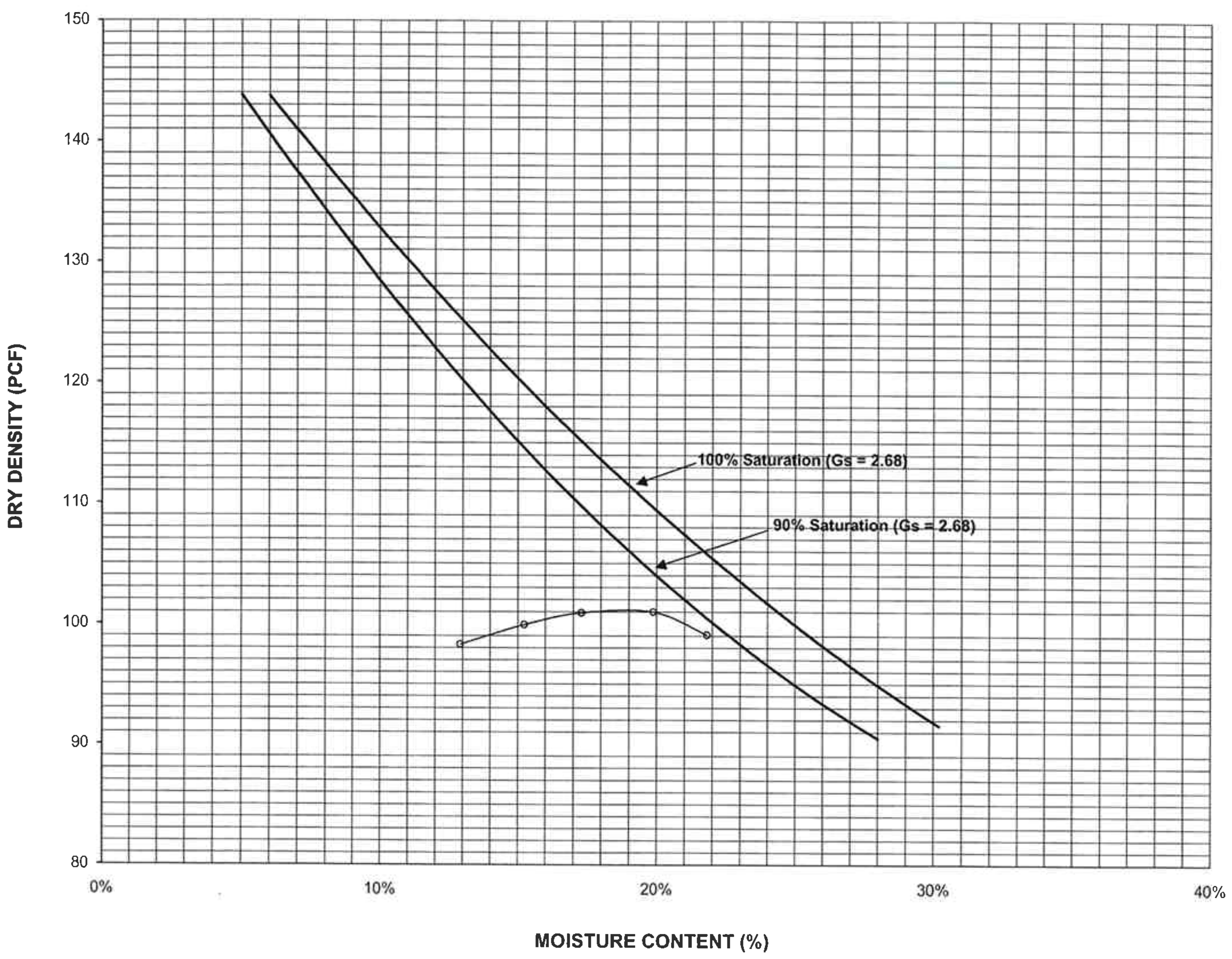
SAMPLE PREPARATION METHOD:
DRY: ______ WET: X

WOOD RODGERS, INC.
8995 Double Diamond Parkway, Building C3
Reno, Nevada 89521
Phone (775) 823-4068 Fax (775) 823-4066

WOOD RODGERS

COMPACTION CURVE TEST REPORT
Valley Mountain Consulting
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED	DATE
BSC	8393.001		12/23/08		



D 1557-02 Symbol	Sample Source	Classification (Description)	Maximum Dry Density (pcf)	Optimum Moisture Content (percent)
○	Site B-12 at 0.0 - 1.5-Feet	Silty Sand (SM) with Organics (Visual Classification Only)	101.0	18.5

TEST PROCEDURE: D 1557-02
METHOD: A
LAYERS: 5
BLOWS: 25

MOLD (inches): 4
HAMMER (lbs.) 10
FALL (inches): 18

COMPACTION EQUIPMENT
MANUAL:
MECHANICAL: X

POINT NO.	MOISTURE	DRY DENSITY (pcf)
1	12.9%	98.3
2	15.2%	99.9
3	17.3%	100.9
4	19.9%	101.0
5	21.8%	99.1

PERCENT PASSING SIEVE SIZE
3/4"
3/8"
No. 4 100

SPECIFIC GRAVITY
ASSUMED:
ASTM C 127:
ABSORPTION (%):

SAMPLE INFORMATION
SAMPLE BULK NO: 900
DATE SAMPLED: 12/17/08
DATE RECEIVED/TESTED: 12/18/08

SAMPLE PREPARATION METHOD:
DRY: WET: X

WOOD RODGERS, INC.
8995 Double Diamond Parkway, Building C3
Reno, Nevada 89521
Phone (775) 823-4068 Fax (775) 823-4066

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COMPACTION CURVE TEST REPORT

Valley Mountain Consulting
Middle Rosewood Creek Restoration Area A
Incline Village, Nevada

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED	DATE
BSC	8393.001		12/23/08		

HYDRAULIC CONDUCTIVITY TEST REPORT

SAMPLE DATA

Sample Identification: B-4
Sample Depth, ft.: 0-1.5'
Visual Description: N/A
Sample Type: Remold
Remarks: Sample remolded between 92% and 93% relative compaction at optimum moisture content

TEST RESULTS

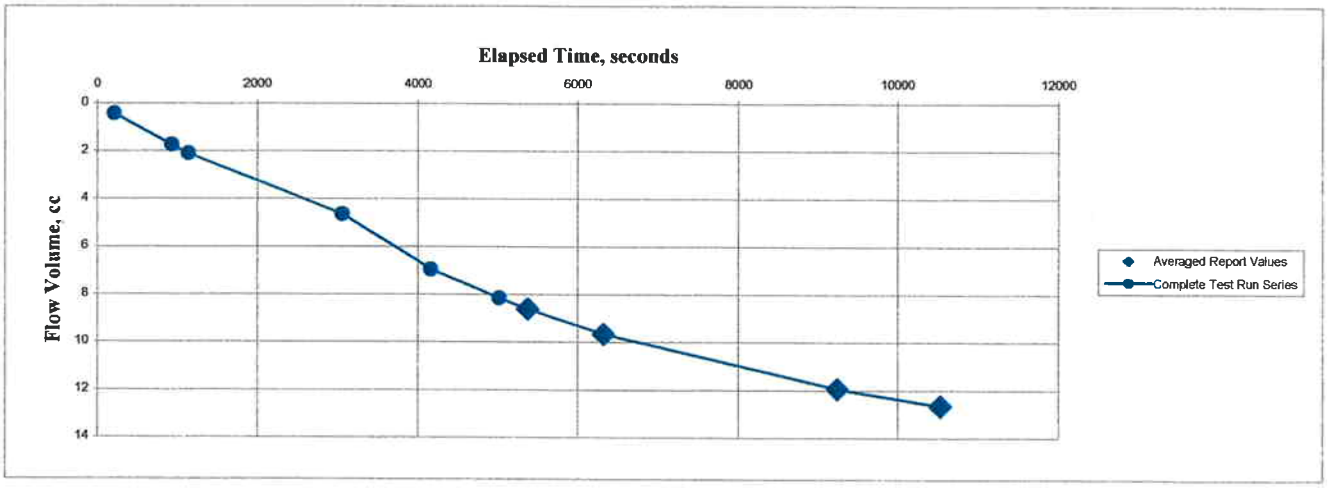
Permeability, cm/sec.: 5.05E-06
Average Hydraulic Gradient: 5.8

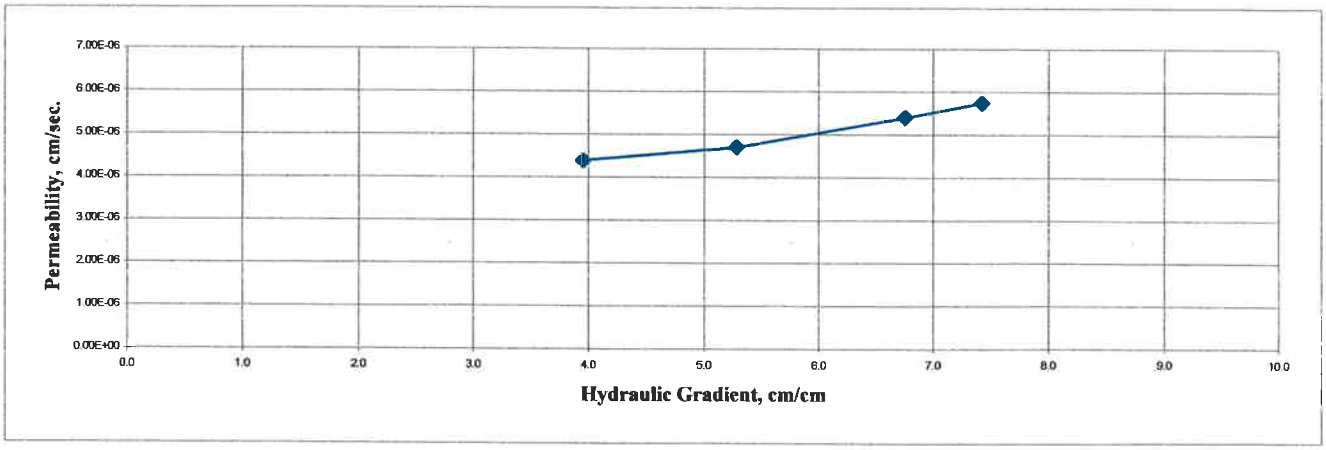
Effective Cell Pressure, psi: 10

TEST SAMPLE DATA

Before Test
Specimen Height, cm: 7.57
Specimen Diameter, cm: 6.17
Dry Unit Weight, pcf: 106.7
Moisture Content, % 13.6
Specific Gravity, Assumed
Percent Saturation:

After Test
Specimen Height, cm: 7.57
Specimen Diameter, cm: 6.17
Dry Unit Weight, pcf: 105.8
Moisture Content, % 19.4





Test Method: ASTM D5084 Method C

PROJECT NUMBER: 09-104 January 8, 2009

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

5040 Robert J. Mathews Blvd., El Dorado Hills, CA 95762
Phone: (916) 939-3460 FAX: (916) 939-3507

Middle Rosewood Creek
Project Number: 8393.001

HYDRAULIC CONDUCTIVITY TEST REPORT

SAMPLE DATA

Sample Identification: B-7
Visual Description: N/A
Remarks:

Sample Depth, ft.: 0-19"
Sample Type: Sample Liner

TEST RESULTS

Permeability, cm/sec.: 8.75E-06

Average Hydraulic Gradient: 7.0

Effective Cell Pressure, psi: 10

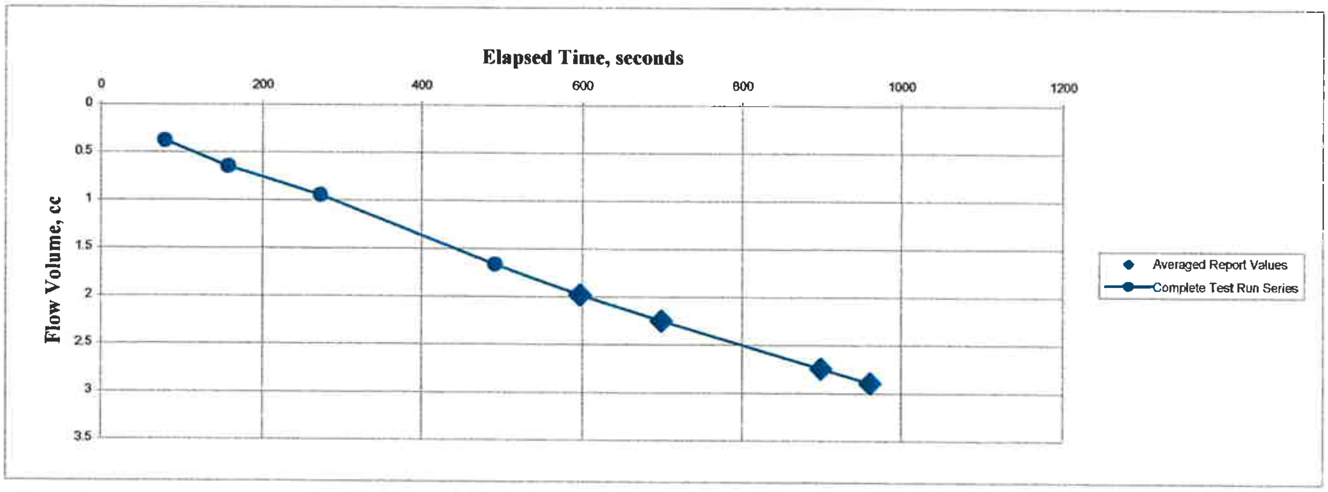
TEST SAMPLE DATA

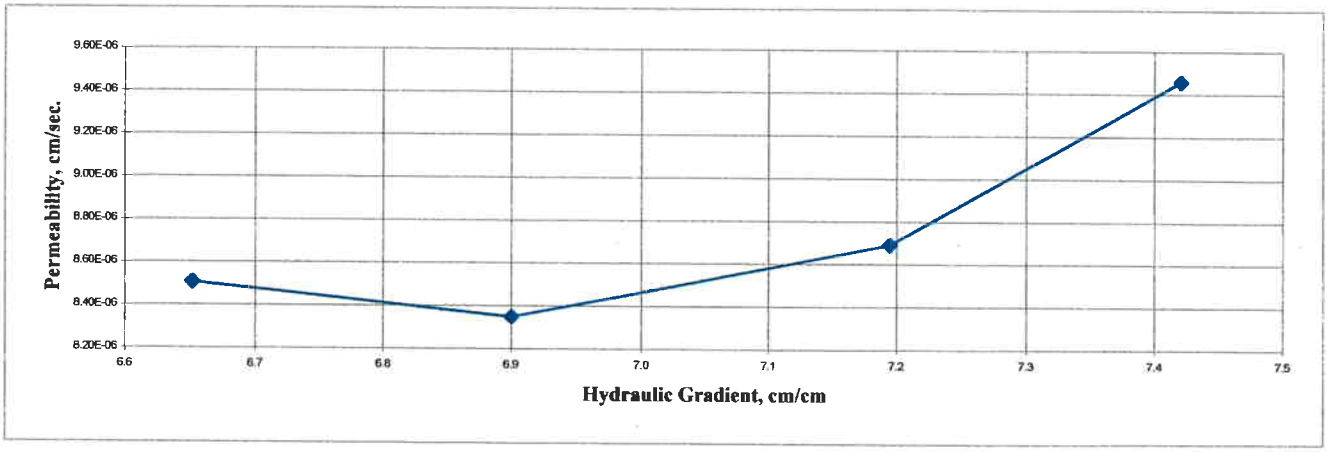
Before Test

Specimen Height, cm: 9.17
Specimen Diameter, cm: 7.29
Dry Unit Weight, pcf: 70.5
Moisture Content, % 24.0
Specific Gravity, Assumed
Percent Saturation:

After Test

Specimen Height, cm: 8.66
Specimen Diameter, cm: 7.29
Dry Unit Weight, pcf: 71.6
Moisture Content, % 37.1





Test Method: ASTM D5084 Method C

PROJECT NUMBER: 09-104 January 8, 2009

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

5040 Robert J. Mathews Blvd., El Dorado Hills, CA 95762
Phone: (916) 939-3460 FAX: (916) 939-3507

Middle Rosewood Creek
Project Number: 8393.001

HYDRAULIC CONDUCTIVITY TEST REPORT

SAMPLE DATA

Sample Identification: B-12
Sample Depth, ft.: 0-1.5'
Visual Description: N/A
Sample Type: Remold
Remarks: Sample remolded between 92% and 93% relative compaction at optimum moisture content

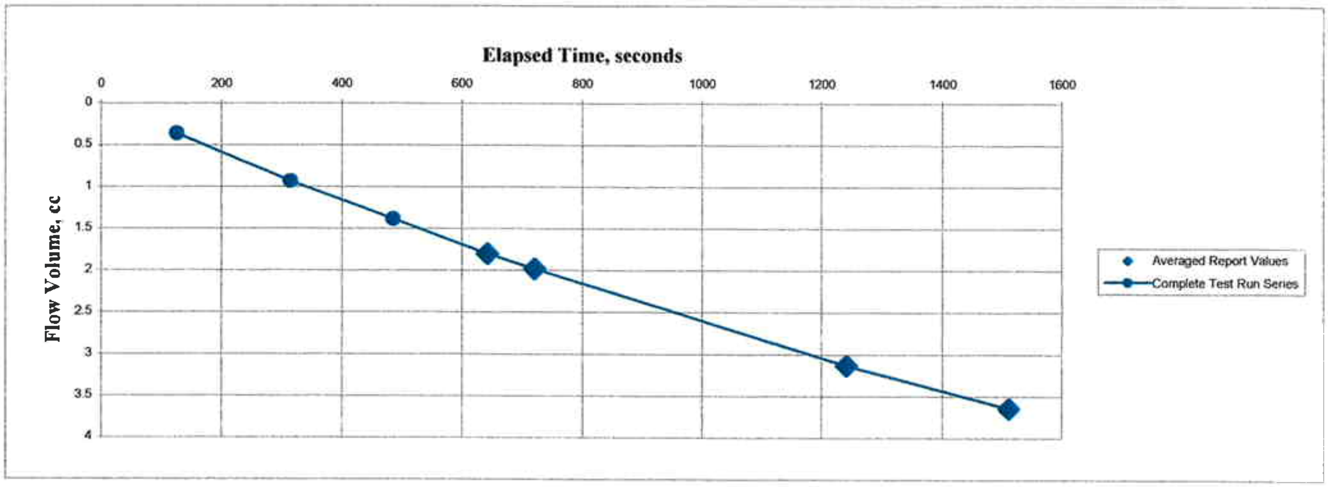
TEST RESULTS

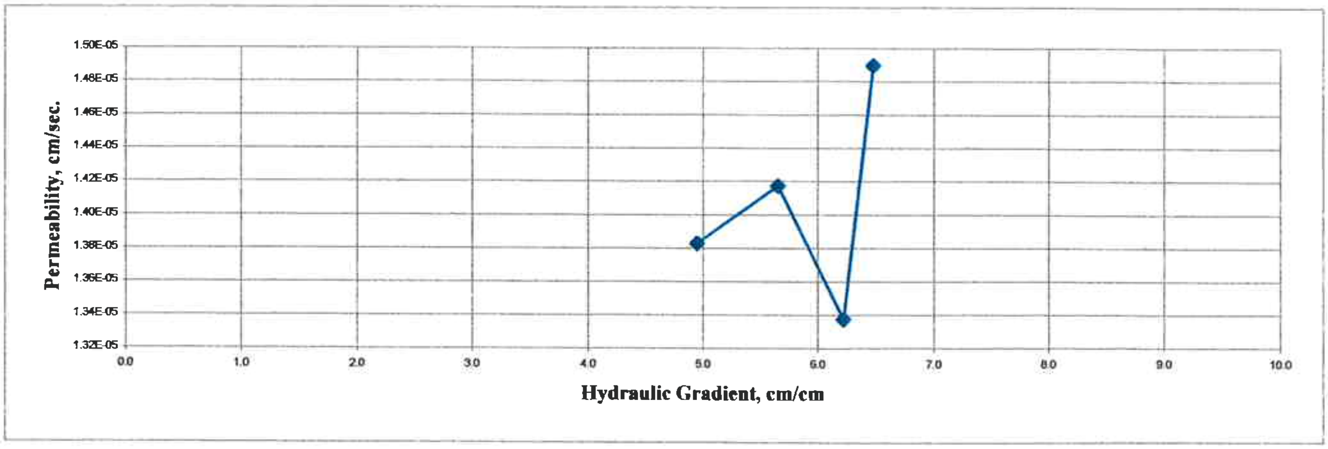
Permeability, cm/sec.: 1.41E-05
Average Hydraulic Gradient: 5.8

Effective Cell Pressure, psi: 10

TEST SAMPLE DATA

Before Test		**After Test**	
Specimen Height, cm:	7.65	Specimen Height, cm:	7.85
Specimen Diameter, cm:	6.17	Specimen Diameter, cm:	6.17
Dry Unit Weight, pcf:	93.2	Dry Unit Weight, pcf:	90.8
Moisture Content, %	18.6	Moisture Content, %	24.9
Specific Gravity, Assumed			
Percent Saturation:			





Test Method: ASTM D5084 Method C

PROJECT NUMBER: **09-104** January 8, 2009

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

5040 Robert J. Mathews Blvd., El Dorado Hills, CA 95762
Phone: (916) 939-3460 FAX: (916) 939-3507

Middle Rosewood Creek
Project Number: 8393.001

HYDRAULIC CONDUCTIVITY TEST REPORT

SAMPLE DATA

Sample Identification: B-13
Visual Description: N/A
Remarks:

Sample Depth, ft.: 4-27"
Sample Type: Sample Liner

TEST RESULTS

Permeability, cm/sec.: 5.97E-07

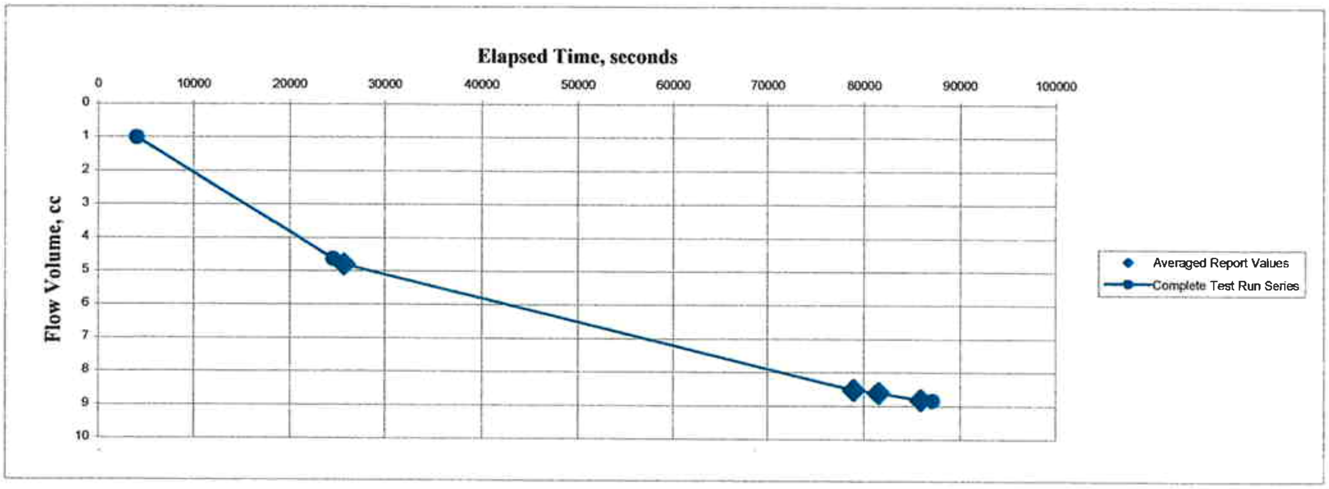
Average Hydraulic Gradient: 2.9

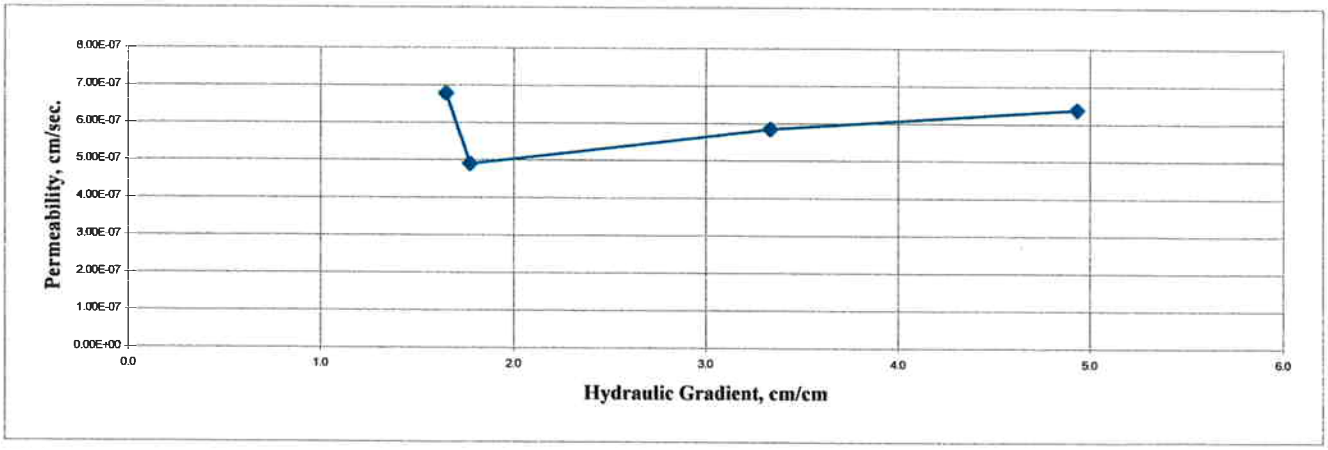
Effective Cell Pressure, psi: 10

TEST SAMPLE DATA

Before Test
Specimen Height, cm: 8.26
Specimen Diameter, cm: 7.29
Dry Unit Weight, pcf: 78.8
Moisture Content, % 23.6
Specific Gravity, Assumed
Percent Saturation:

After Test
Specimen Height, cm: 8.13
Specimen Diameter, cm: 7.29
Dry Unit Weight, pcf: 78.4
Moisture Content, % 35.8





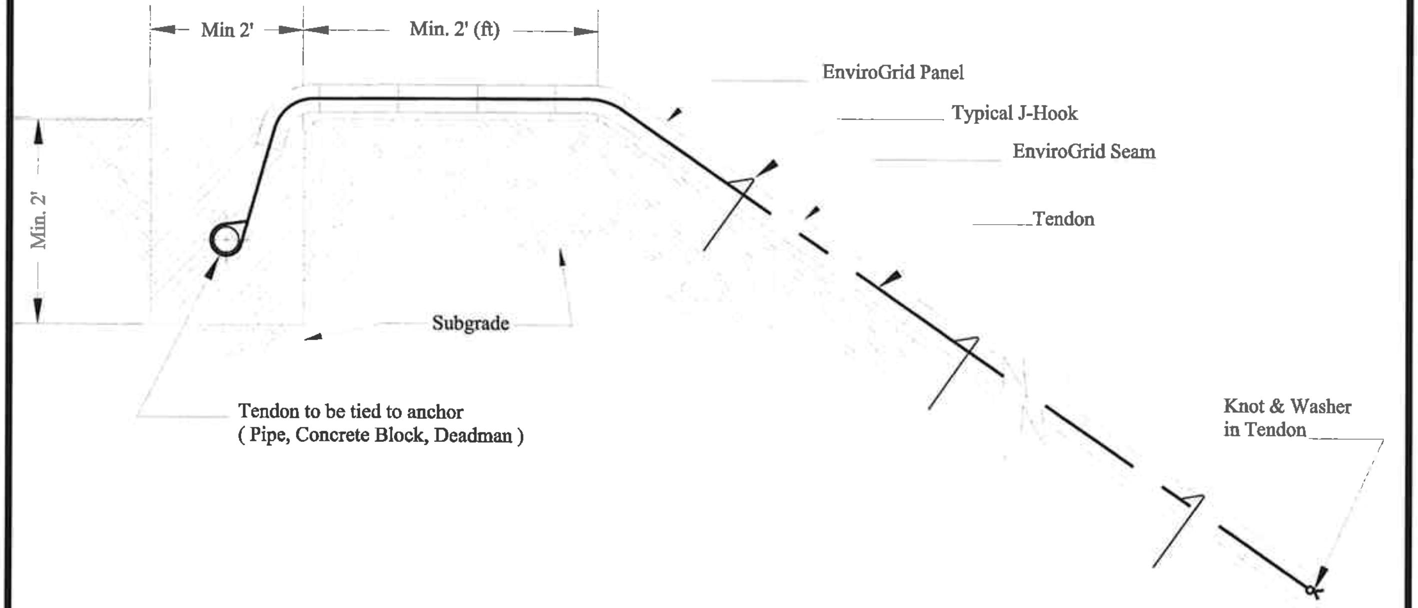
Test Method: ASTM D5084 Method C

PROJECT NUMBER: 09-104 January 8, 2009

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

5040 Robert J. Mathews Blvd., El Dorado Hills, CA 95762
Phone: (916) 939-3460 FAX: (916) 939-3507

Middle Rosewood Creek
Project Number: 8393.001



NOTES:

Over Subgrade

ENVIROGRID provides this information only as an accommodation to our customers. No warranty or other representation regarding the suitability of the above application procedure is made due to the fact that each installation has specific requirements that may not have been considered in this generalized procedure. ENVIROGRID makes no warranties or representations regarding the suitability of its ENVIROGRID products for specific uses or applications. Our liability is limited to furnishing, without charge, a replacement for any ENVIROGRID section that is proven defective under normal use or service.

ENVIROGRID™

By TKP	**Typical Slope Application**	Rev # 0
Scale: None	Date: 11-01-02	Drawing No. EnvStd-014

DISTRIBUTION

Geotechnical Investigation
NTCD Middle Rosewood Creek
Rehabilitation Project
Incline Village, Nevada

March 13, 2009

Copies 1-4: Ms. Virginia Mahacek
Valley & Mountain Consulting
1034 Emerald Bay Road, No. 434
South Lake Tahoe, California 96150

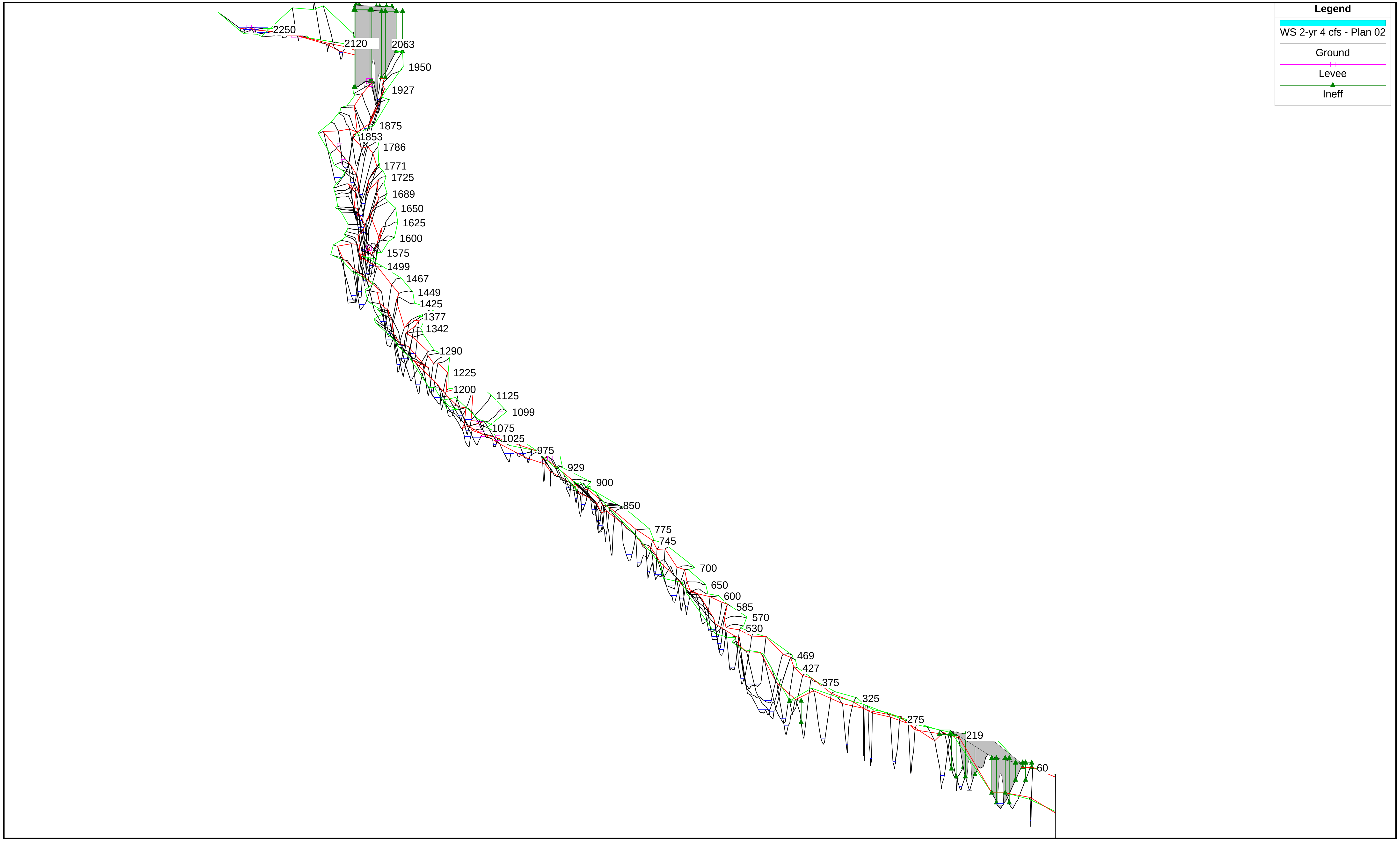
Copy 5: Job File

Copy 6: Bound Report File

Appendix B

A-1 HEC-RAS Output, Existing Conditions
A-2 HEC-RAS Output, Proposed Conditions

A-1 HEC-RAS Output, Existing Conditions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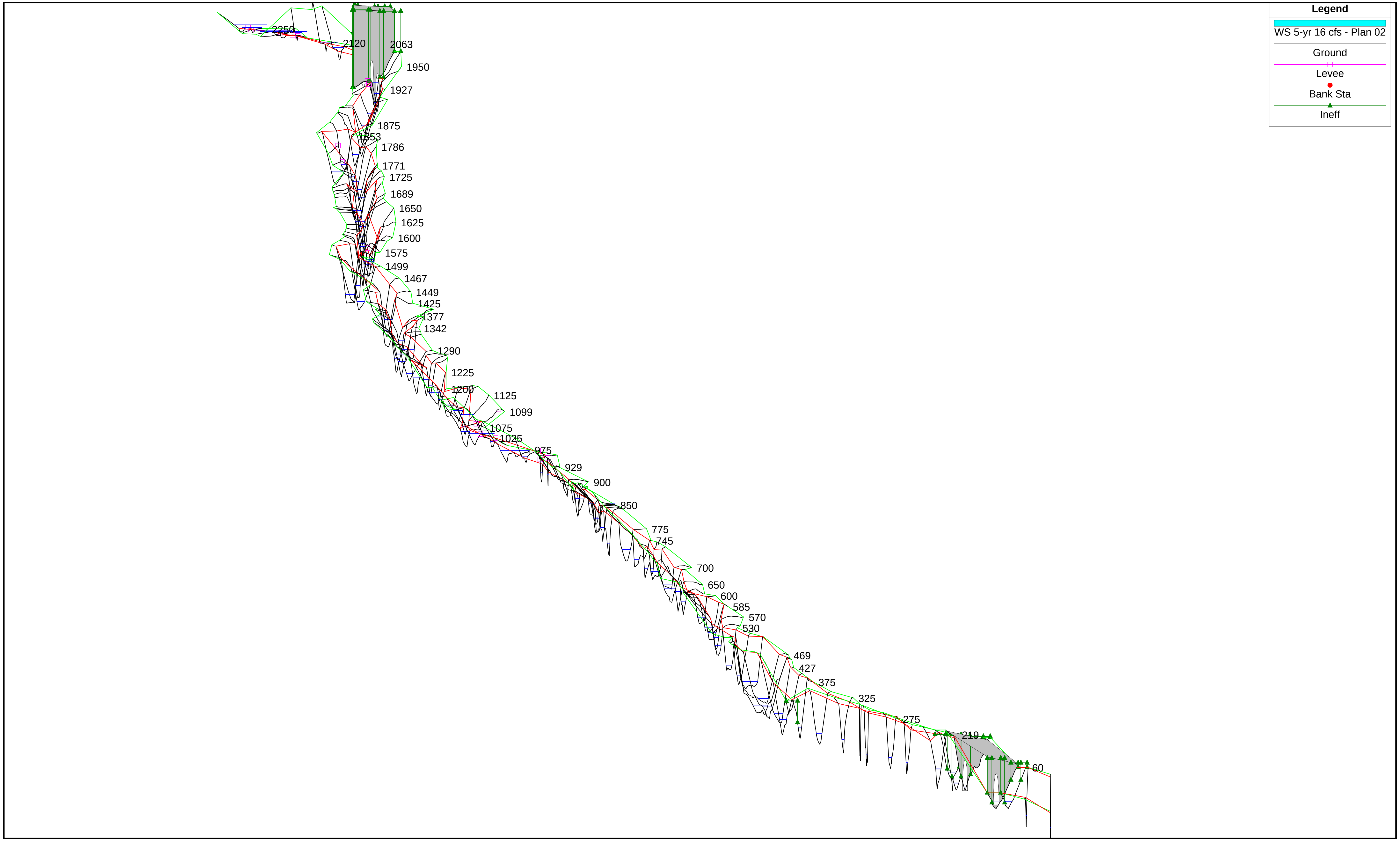
2120
2063
1950
1927
1875
1853
1786
1771
1725
1689
1650
1625
1600
1575
1499
1467
1449
1425
1377
1342
1290
1225
1200
1125
1099
1075
1025
975
929
900
850
775
745
700
650
600
585
570
530
469
427
375
325
275
219
60
Legend
WS 2-yr 4 cfs - Plan 02
Ground
Levee
Ineff


Legend
WS 5-yr 16 cfs - Plan 02
Ground
Levee
Bank Sta
Ineff
2250
2120
2063
1950
1927
1875
1853
1786
1771
1725
1689
1650
1625
1600
1575
1499
1467
1449
1425
1377
1342
1290
1225
1200
1125
1099
1075
1025
975
929
900
850
775
745
700
650
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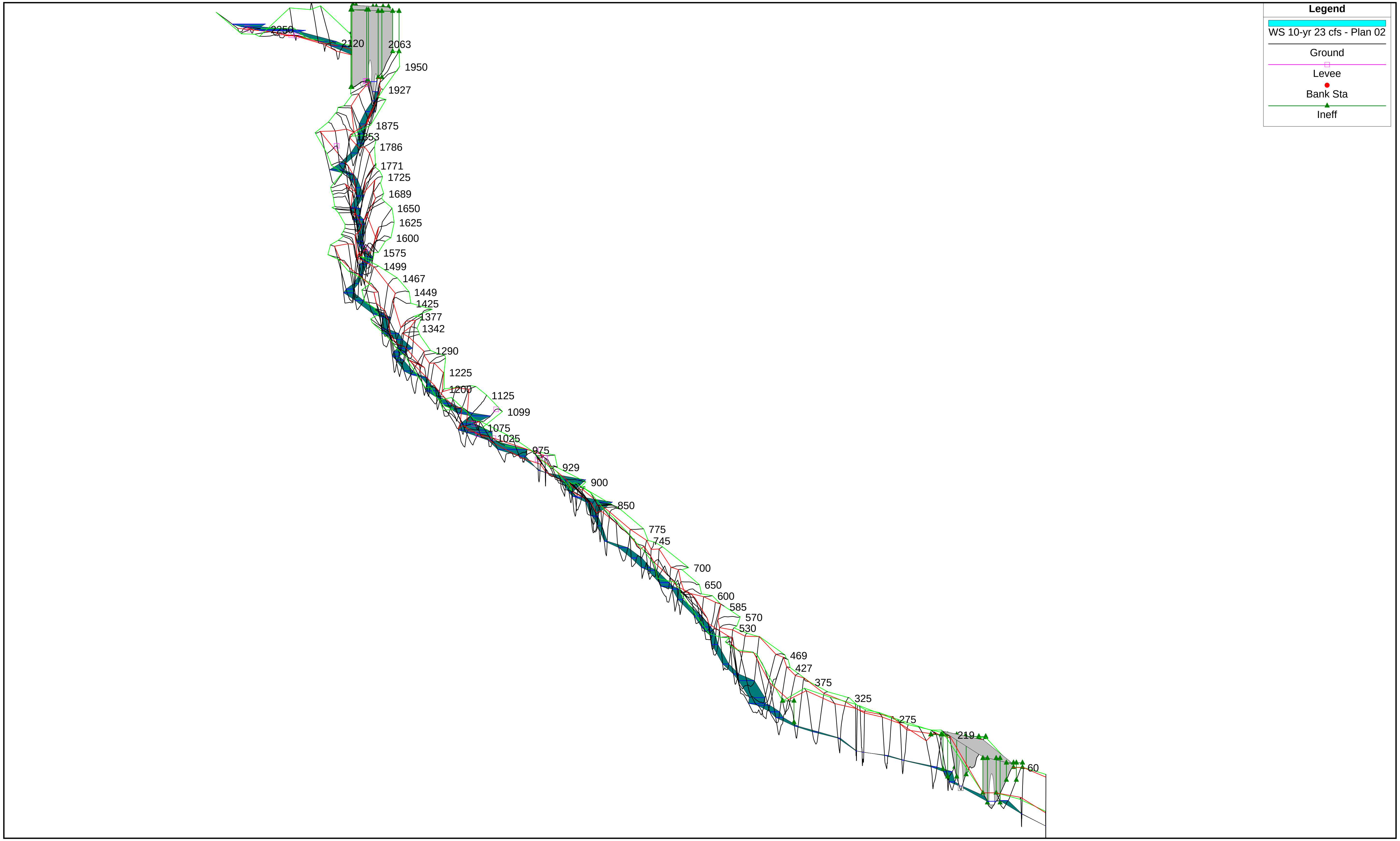
585
570
530
469
427
375
325
275
219
60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2120
2063
1950
1927
1875
1853
1786
1771
1725
1689
1650
1625
1600
1575
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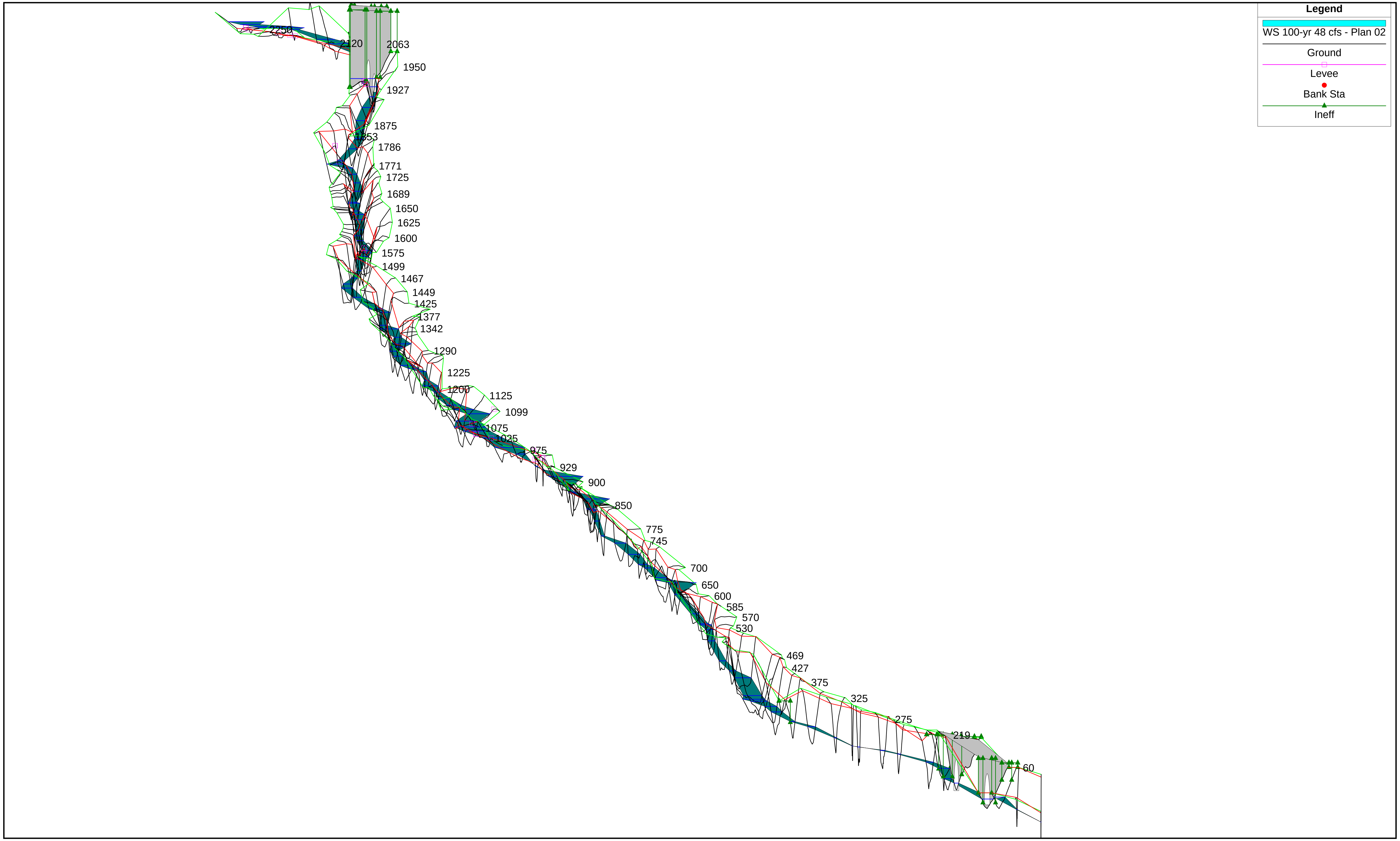
1467
1449
1425
1377
1342
1290
1225
1200
1125
1099
1075
1025
975
929
900
850
775
745
700
650
600
585
570
530
469
427
375
325
275
219
60
Legend
WS 10-yr 23 cfs - Plan 02
Ground
Levee
Bank Sta
Ineff


Legend
WS 100-yr 48 cfs - Plan 02
Ground
Levee
Bank Sta
Ineff
2250
2120
2063
1950
1927
1875
1853
1786
1771
1725
1689
1650
1625
1600
1575
1499
1467
1449
1425
1377
1342
1290
1225
1200
1125
1099
1075
1025
975
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850
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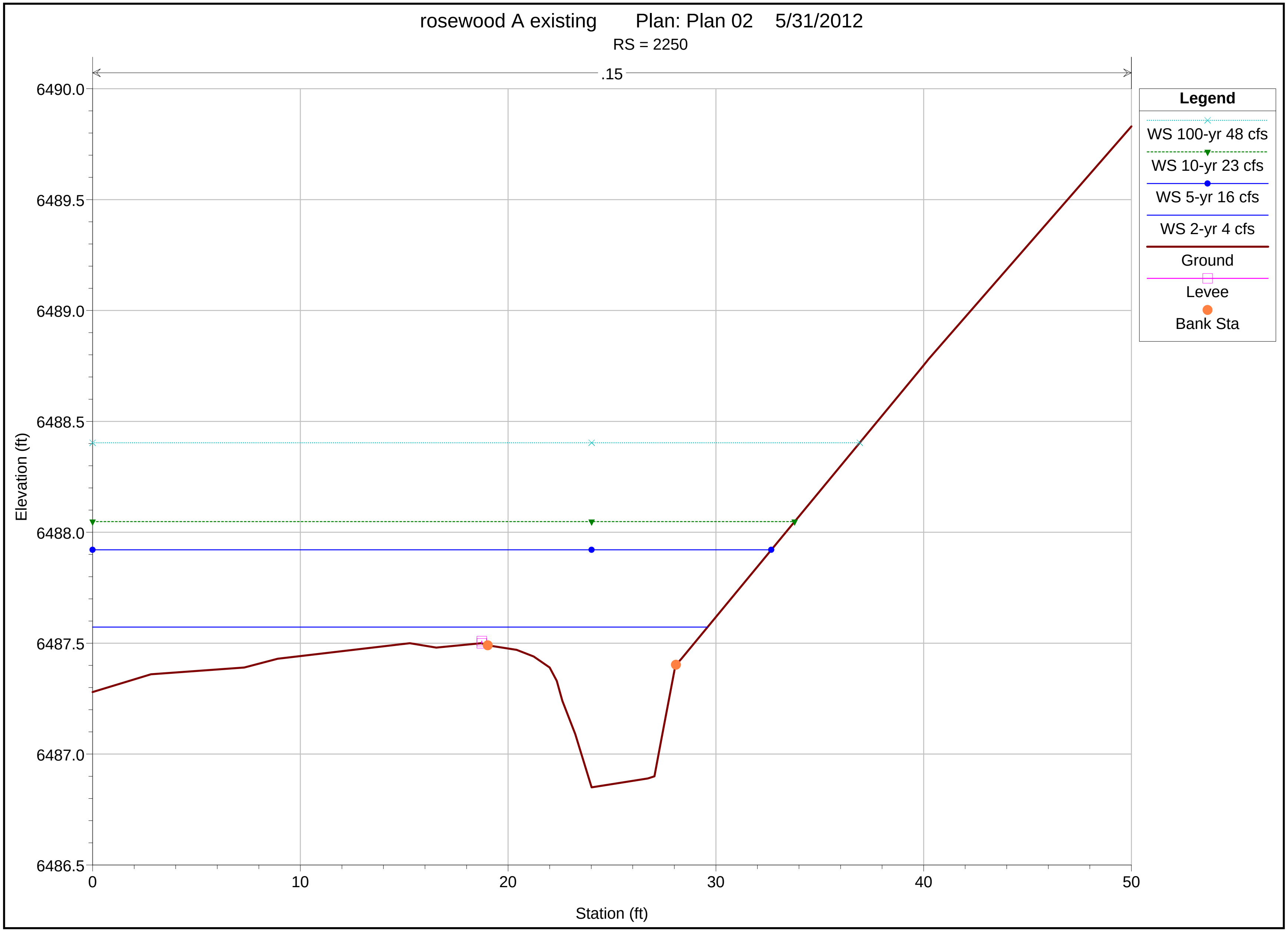
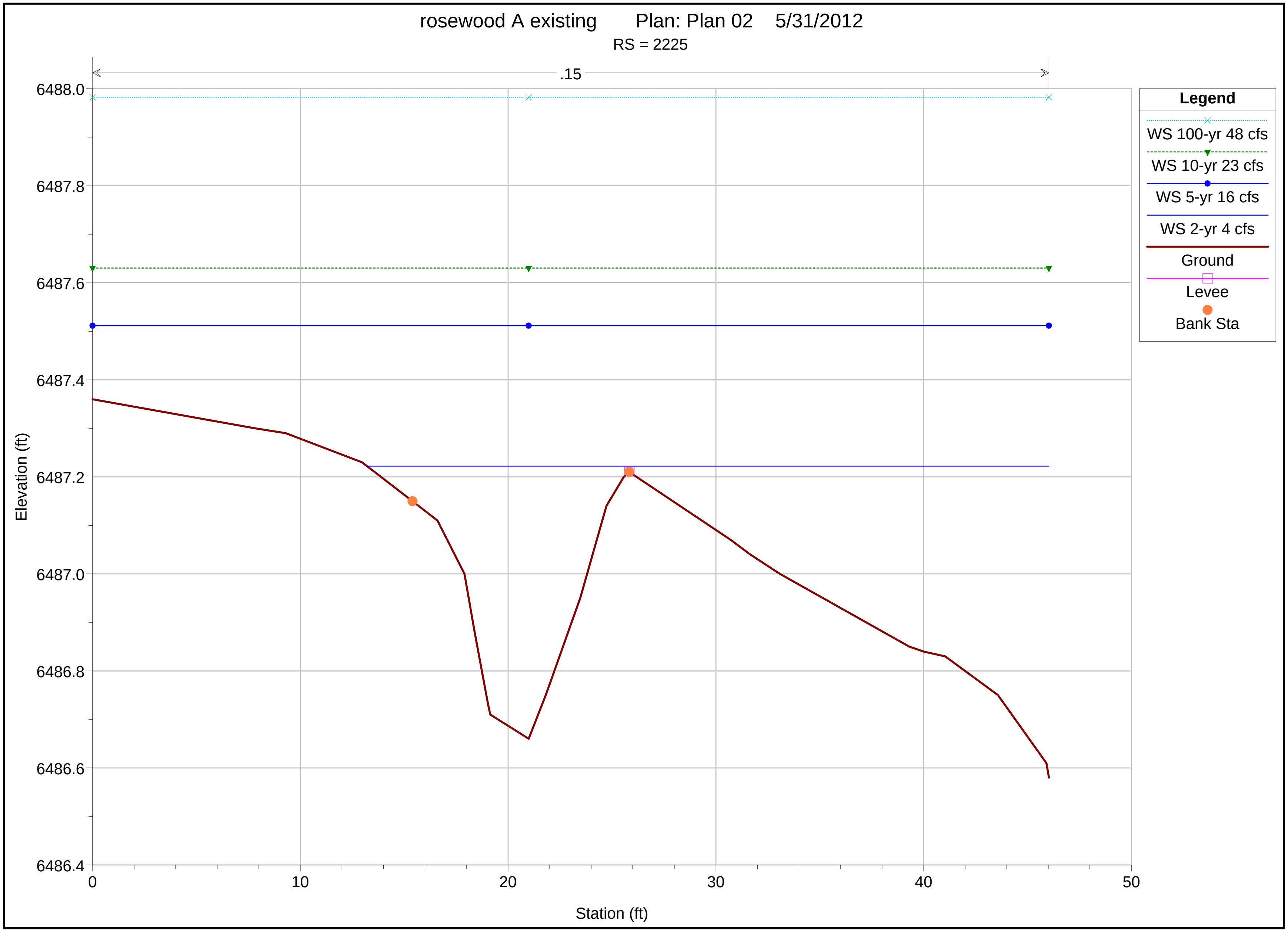
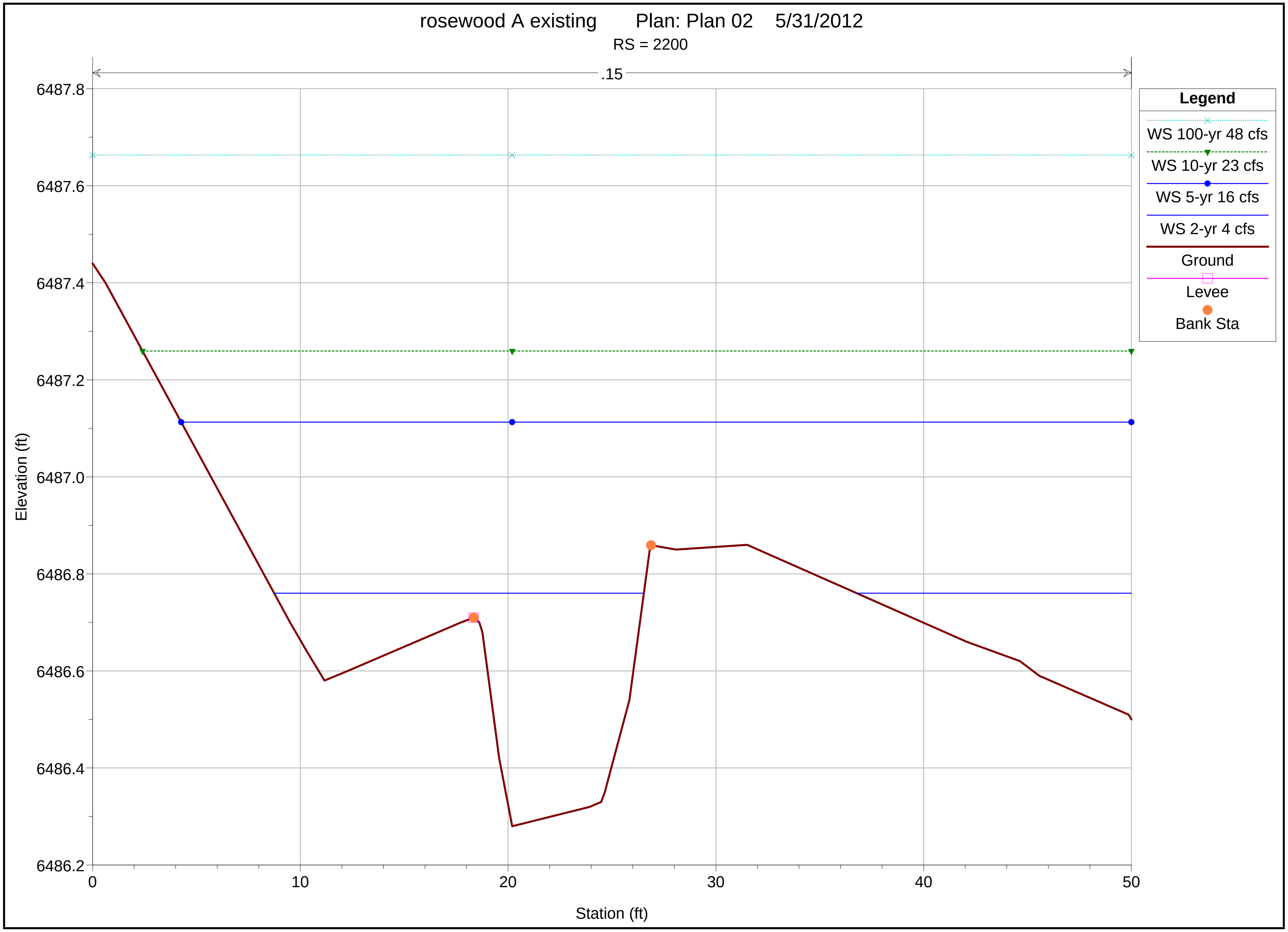
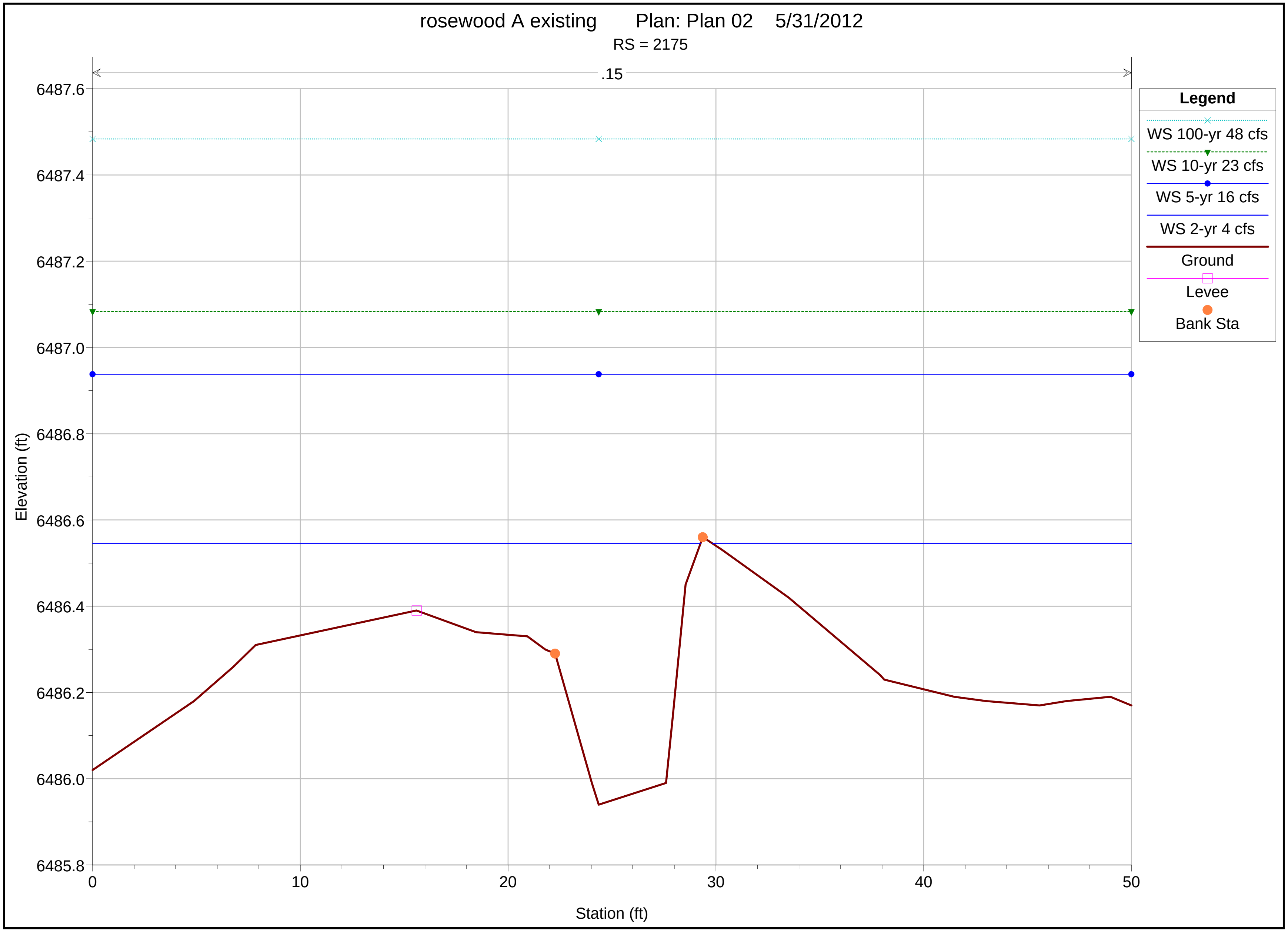
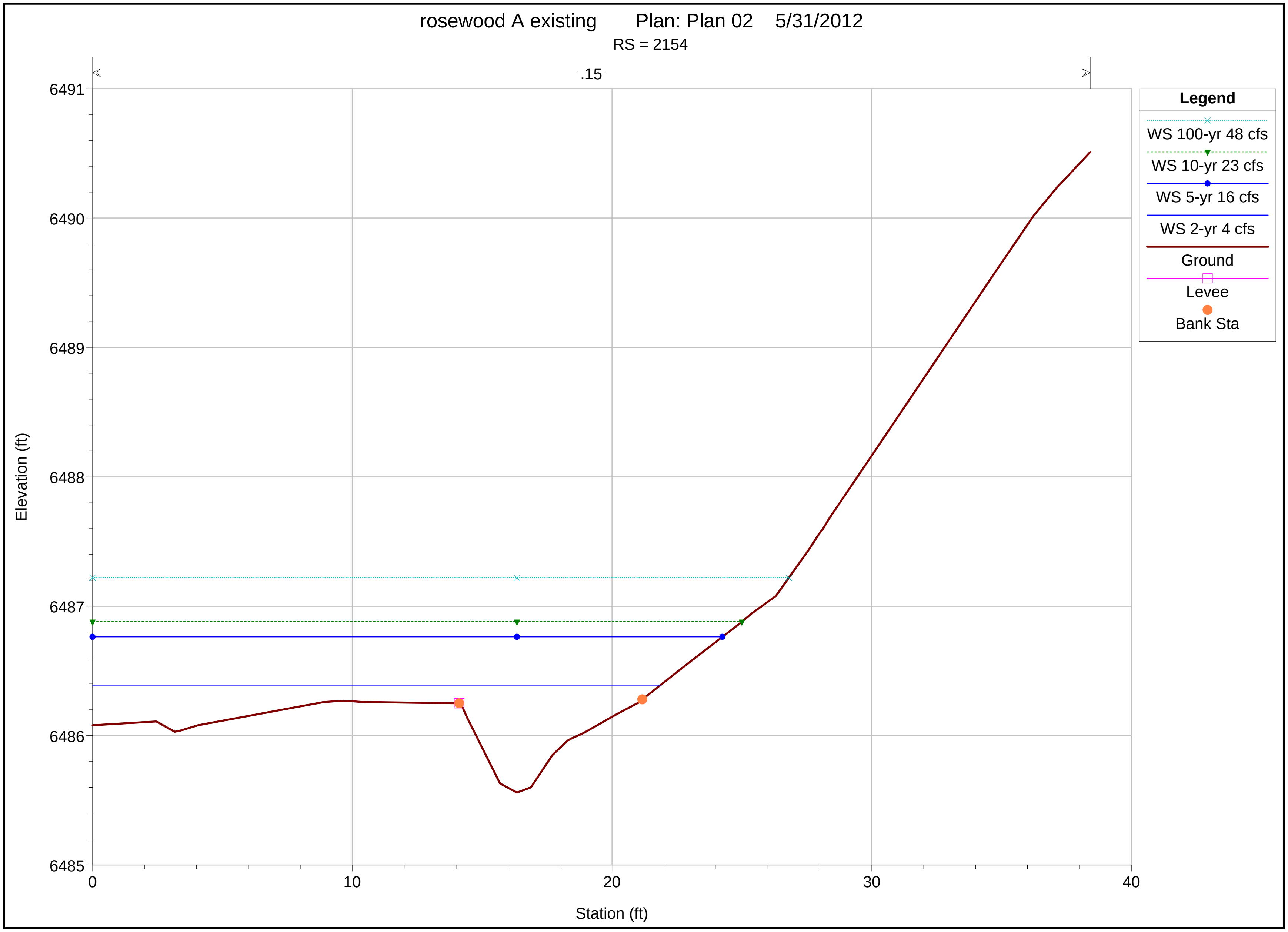
700
650
600
585
570
530
469
427
375
325
275
219
60


rosewood A existing Plan: Plan 02 5/31/2012
RS = 2250
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6490.0
6489.5
6489.0
6488.5
6488.0
6487.5
6487.0
6486.5
0
10
20
30
40
50
Station (ft)

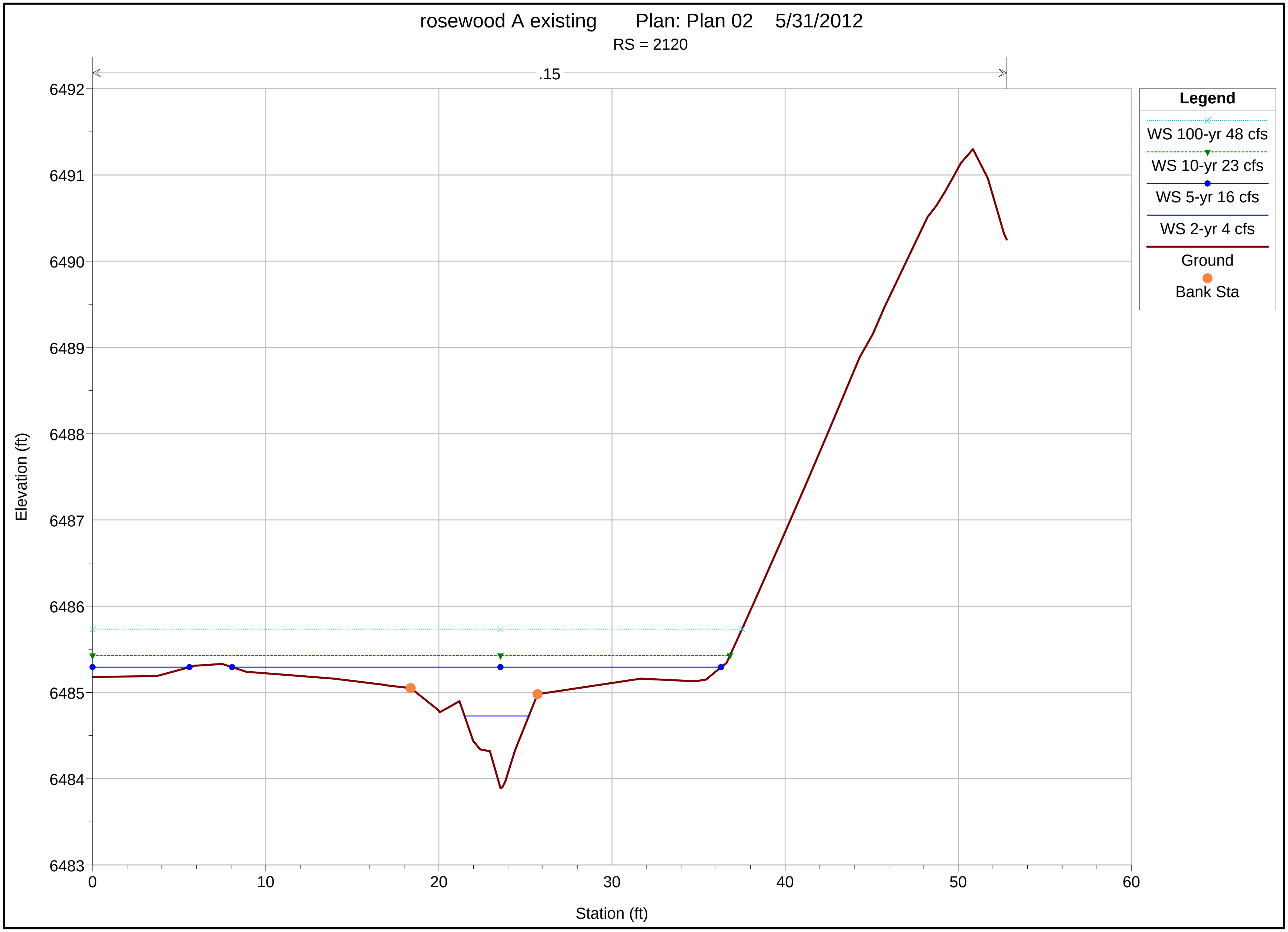

rosewood A existing Plan: Plan 02 5/31/2012
RS = 2225
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6488.0
6487.8
6487.6
6487.4
6487.2
6487.0
6486.8
6486.6
6486.4
Station (ft)
0
10
20
30
40
50

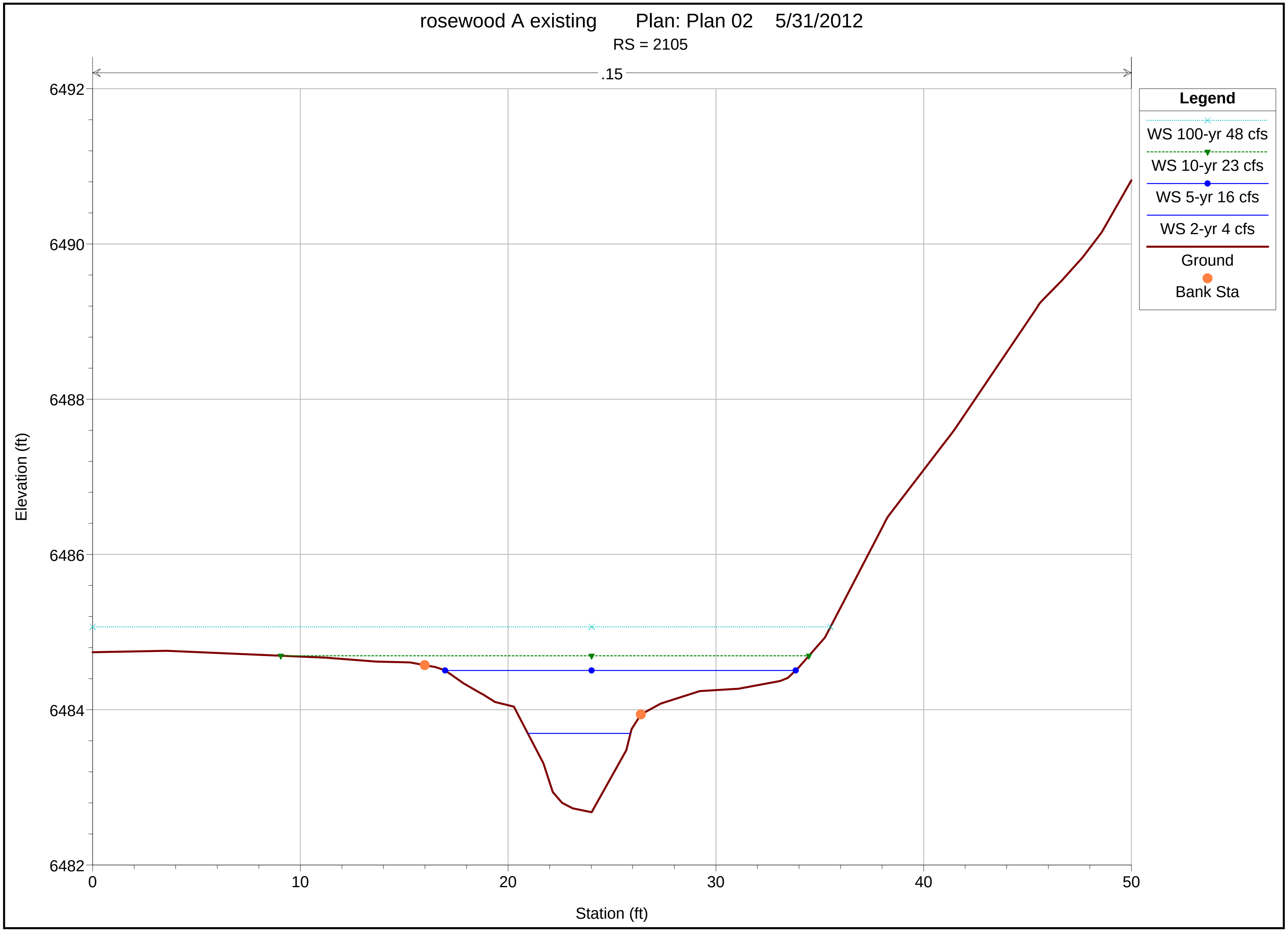

rosewood A existing Plan: Plan 02 5/31/2012
RS = 2200
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6487.8
6487.6
6487.4
6487.2
6487.0
6486.8
6486.6
6486.4
6486.2
0
10
20
30
40
50
Station (ft)

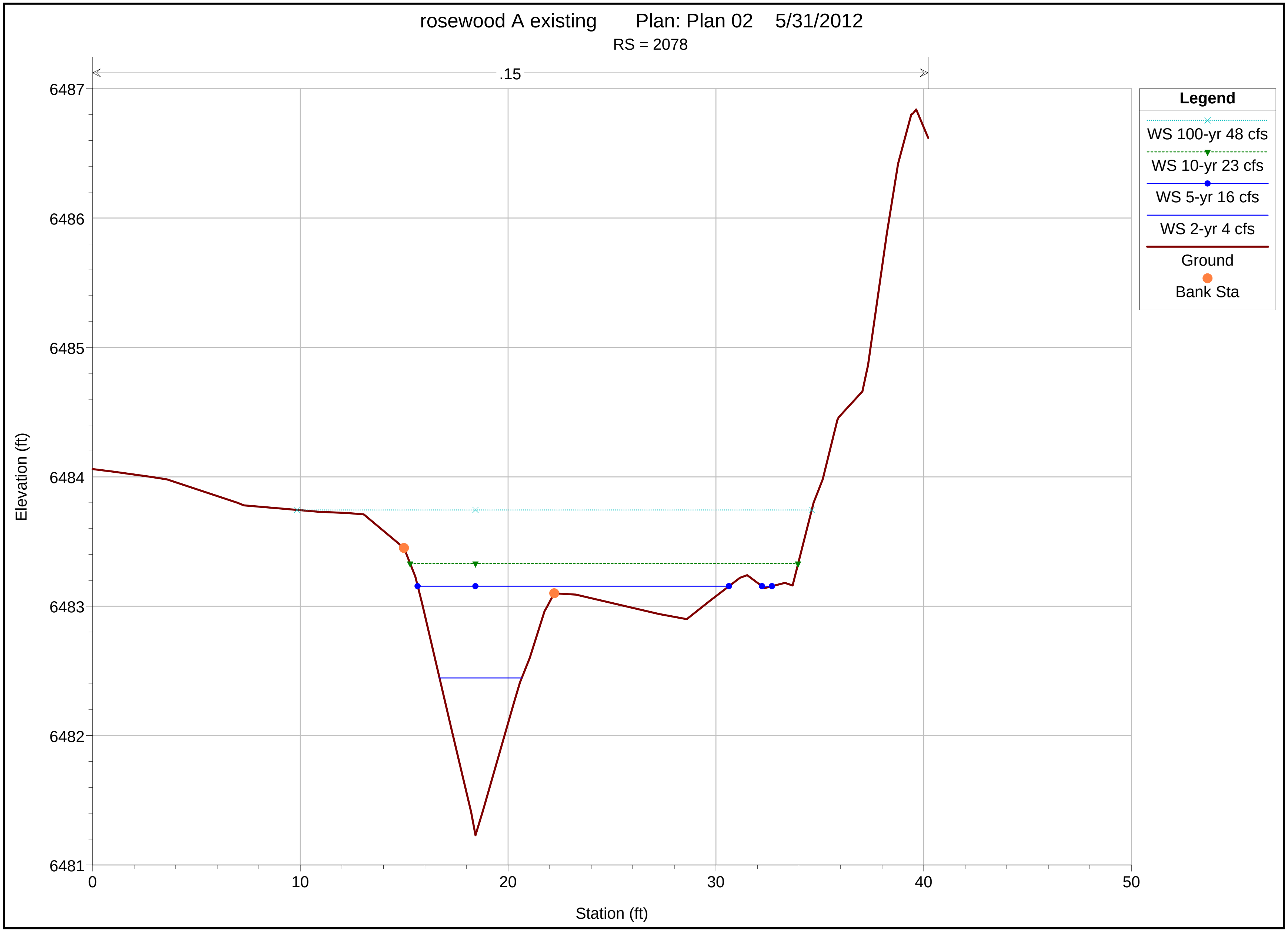
rosewood A existing Plan: Plan 02 5/31/2012
RS = 2175
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6487.6
6487.4
6487.2
6487.0
6486.8
6486.6
6486.4
6486.2
6486.0
6485.8
0
10
20
30
40
50
Station (ft)



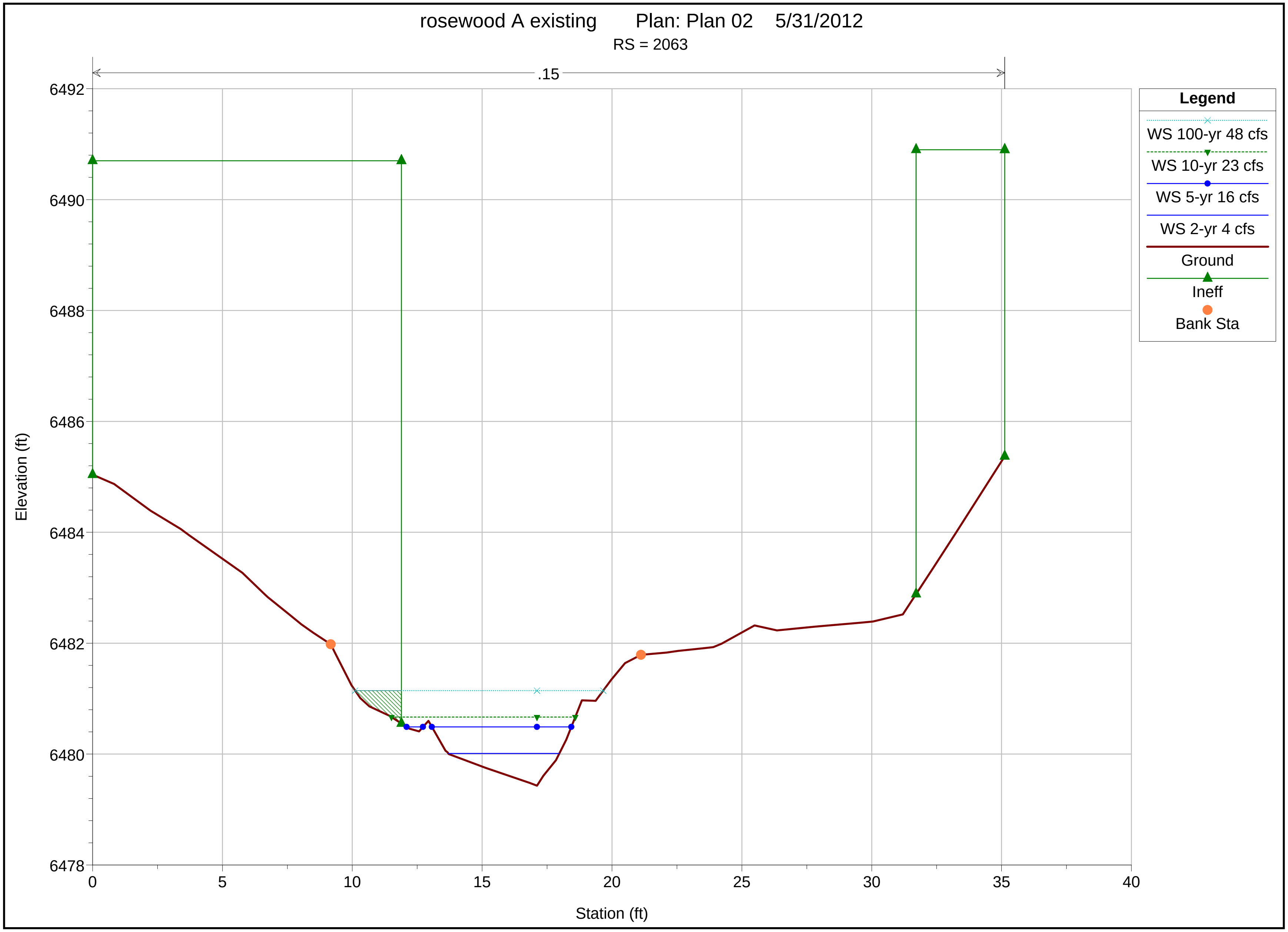
rosewood A existing Plan: Plan 02 5/31/2012
RS = 2154
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6491
6490
6489
6488
6487
6486
6485
Station (ft)
0
10
20
30
40

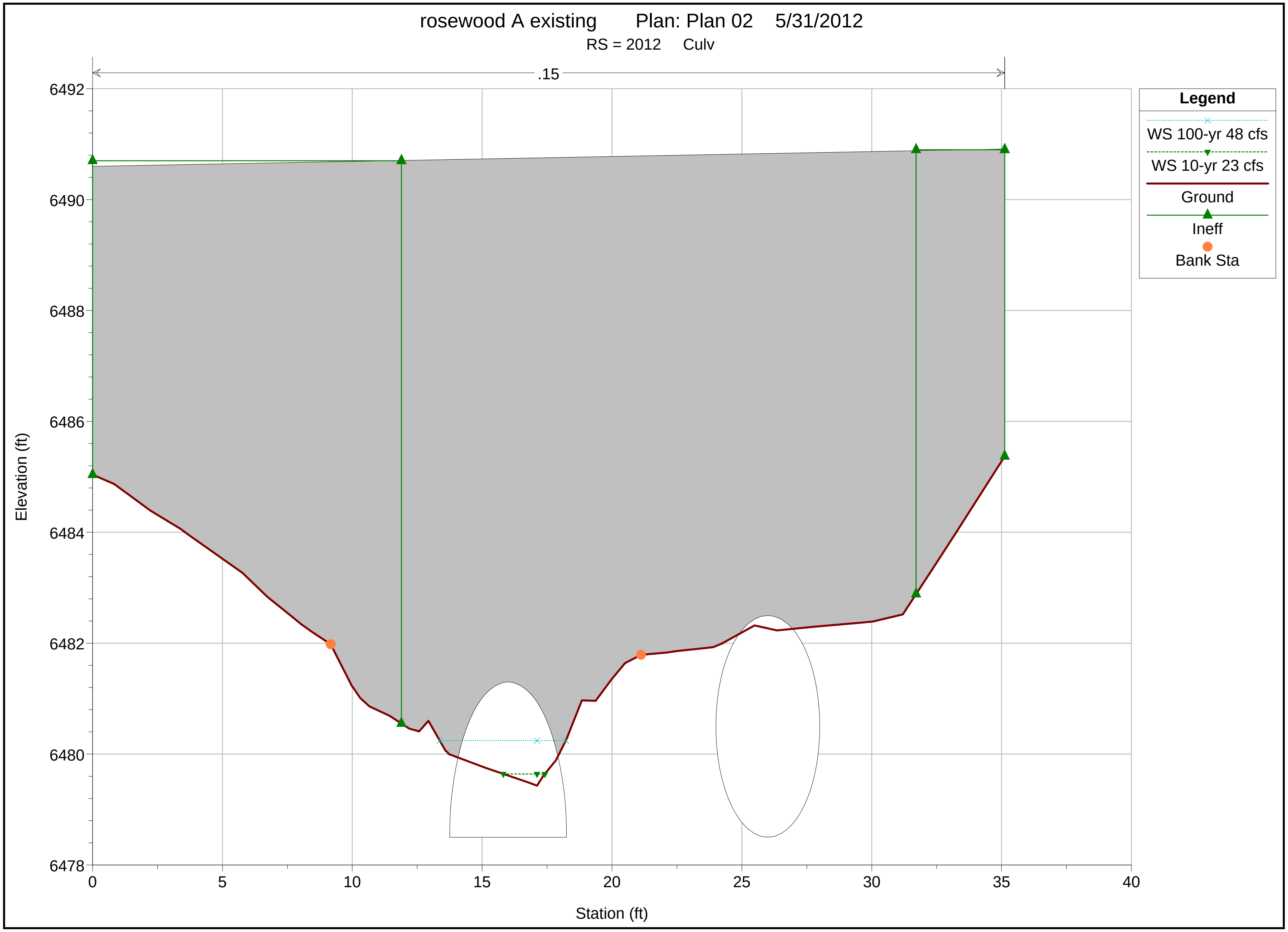

rosewood A existing Plan: Plan 02 5/31/2012
RS = 2120
.15
Elevation (ft)
6492
6491
6490
6489
6488
6487
6486
6485
6484
6483
Station (ft)
0
10
20
30
40
50
60
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta

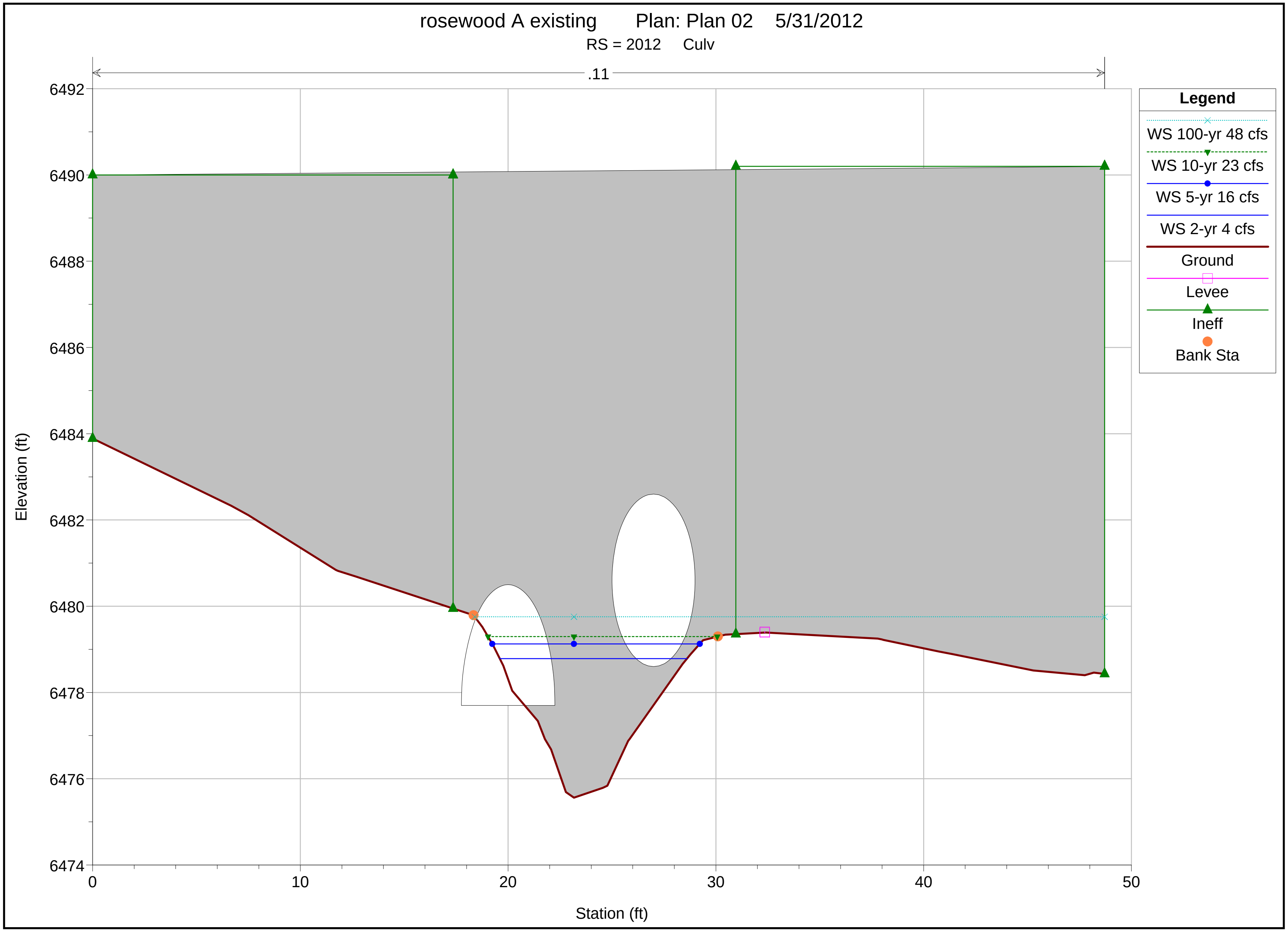

rosewood A existing Plan: Plan 02 5/31/2012
RS = 2105
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6492
6490
6488
6486
6484
6482
0
10
20
30
40
50
Station (ft)

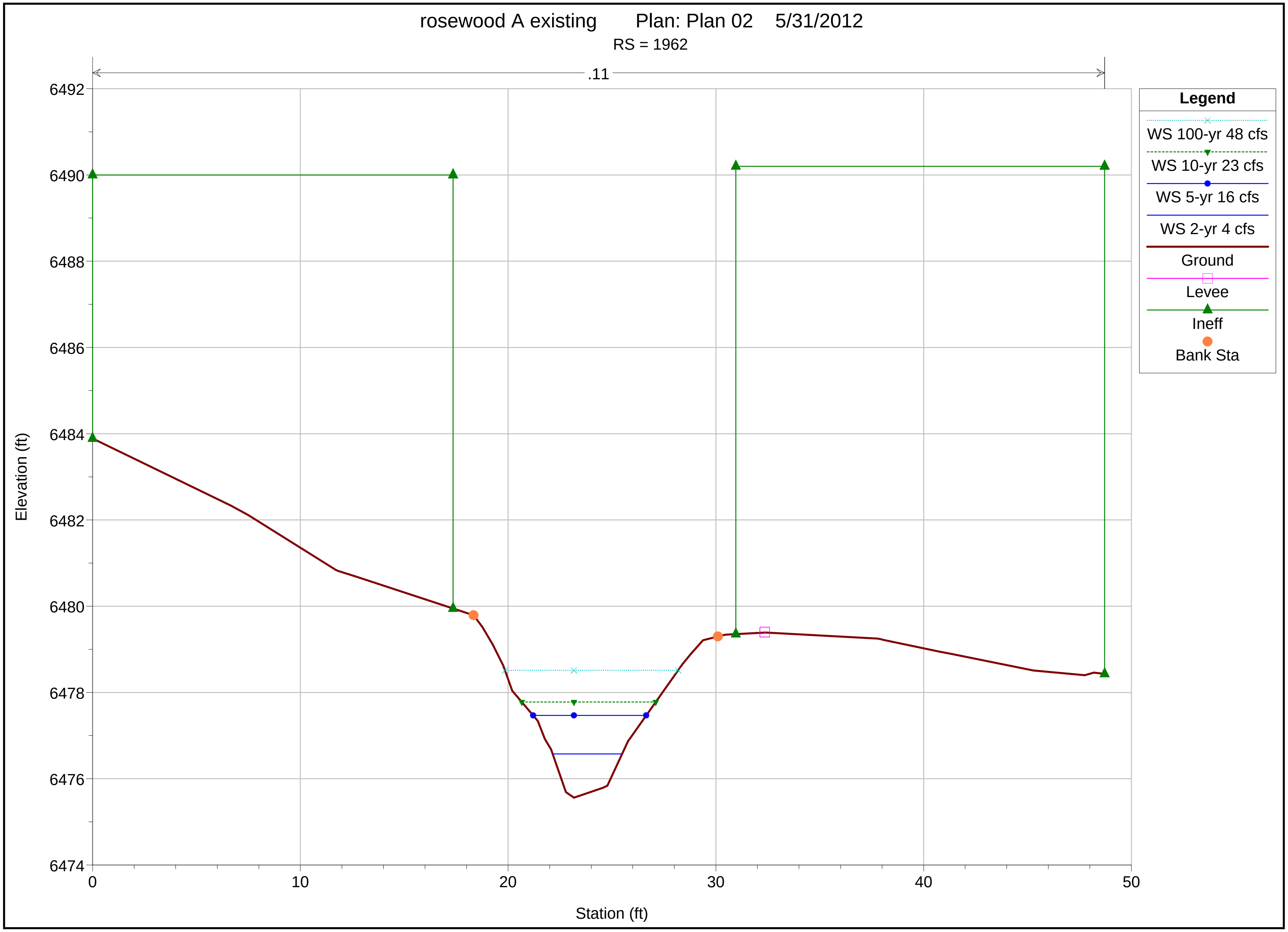


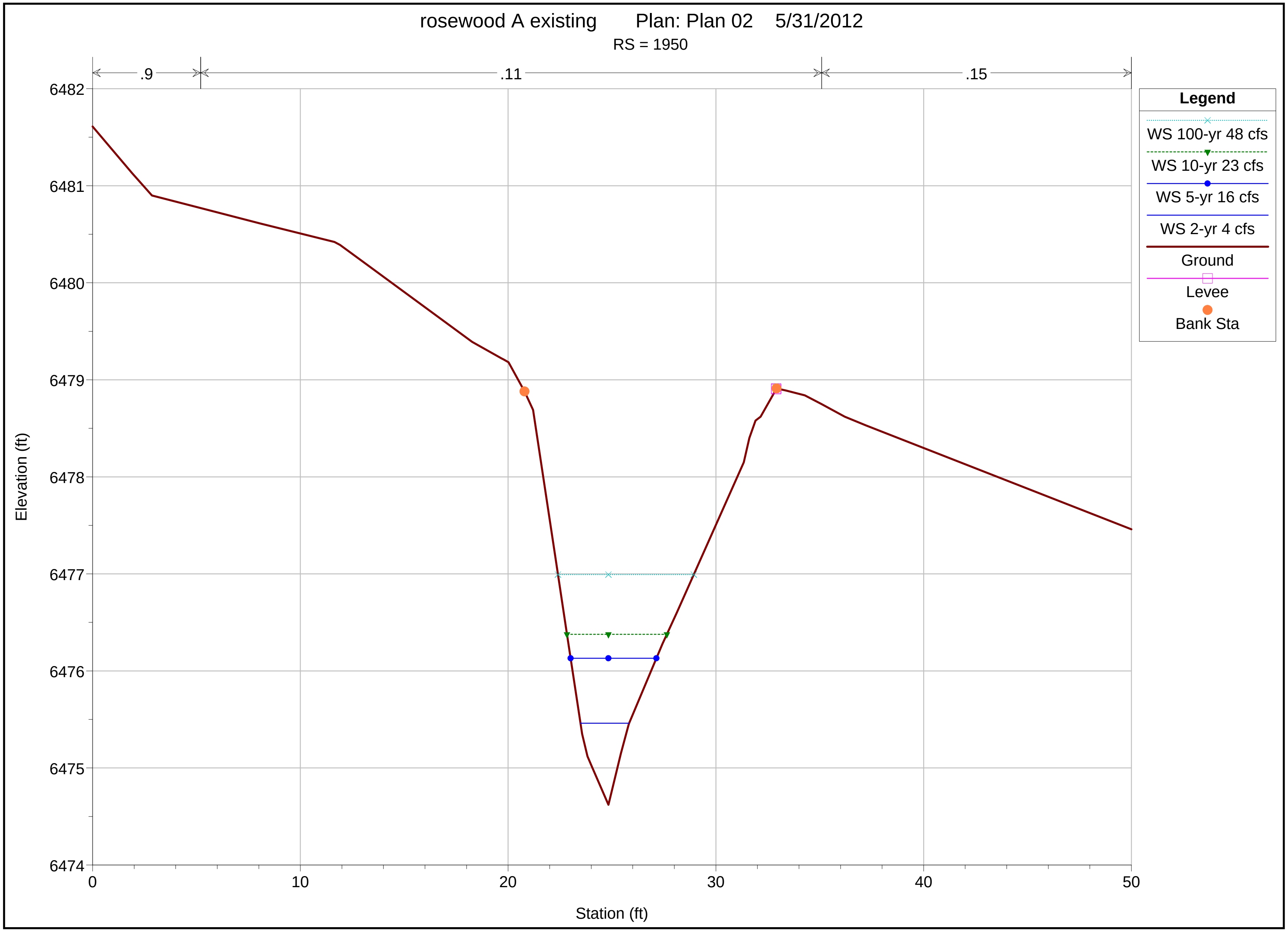
rosewood A existing Plan: Plan 02 5/31/2012
RS = 2078
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6487
6486
6485
6484
6483
6482
6481
Station (ft)
0
10
20
30
40
50

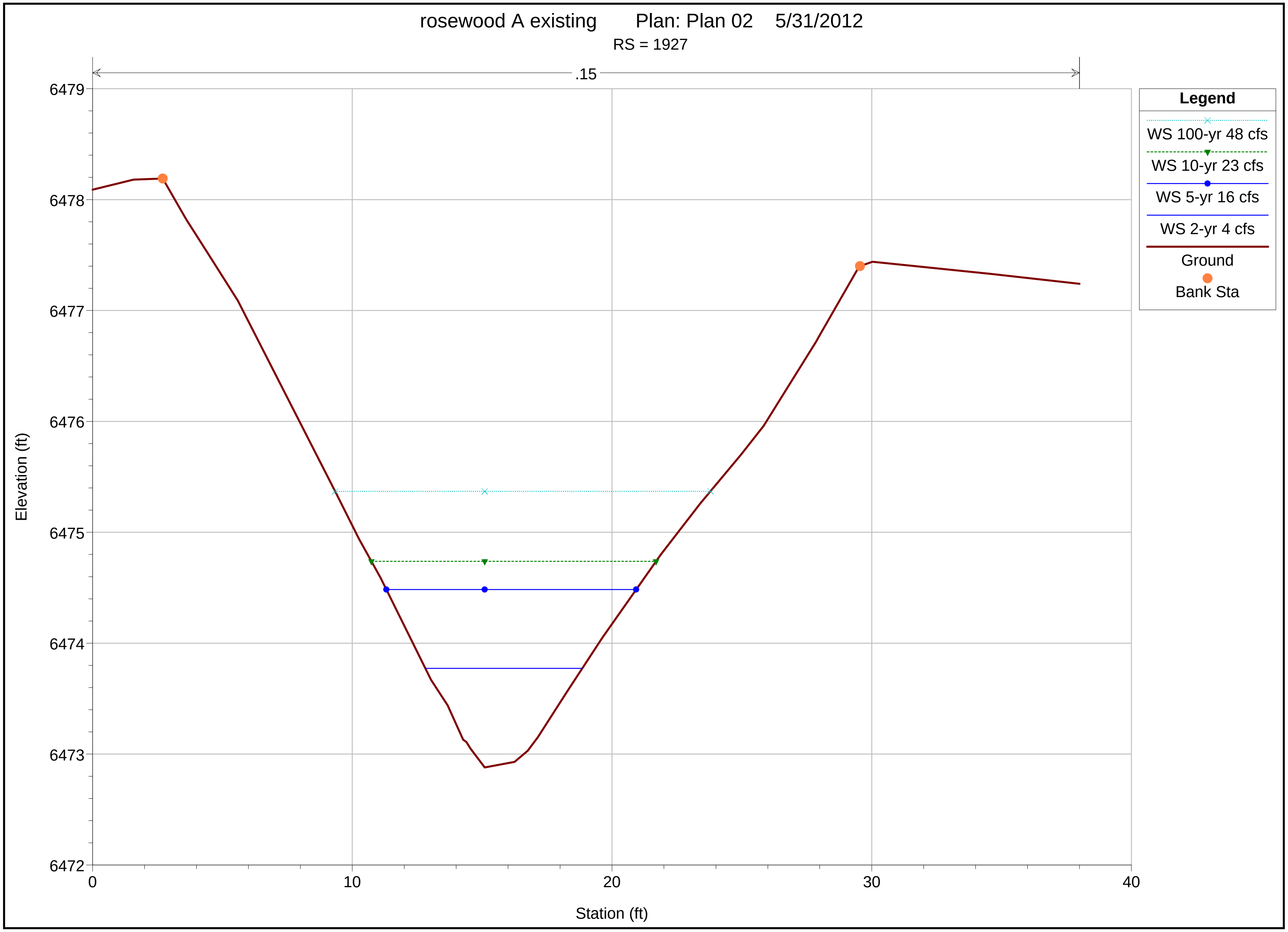

rosewood A existing Plan: Plan 02 5/31/2012
RS = 2063
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
6492
6490
6488
6486
6484
6482
6480
6478
0
5
10
15
20
25
30
35
40


rosewood A existing Plan: Plan 02 5/31/2012
RS = 2012 Culv
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6492
6490
6488
6486
6484
6482
6480
6478
Station (ft)
0
5
10
15
20
25
30
35
40


rosewood A existing Plan: Plan 02 5/31/2012
RS = 2012 Culv
.11
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
6492
6490
6488
6486
6484
6482
6480
6478
6476
6474
0
10
20
30
40
50
Station (ft)

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1962
.11
Elevation (ft)
6492
6490
6488
6486
6484
6482
6480
6478
6476
6474
Station (ft)
0
10
20
30
40
50
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Ineff
Bank Sta


rosewood A existing Plan: Plan 02 5/31/2012
RS = 1950
.9
.11
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6482
6481
6480
6479
6478
6477
6476
6475
6474
Station (ft)
0
10
20
30
40
50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RS = 1927
.15
Legend
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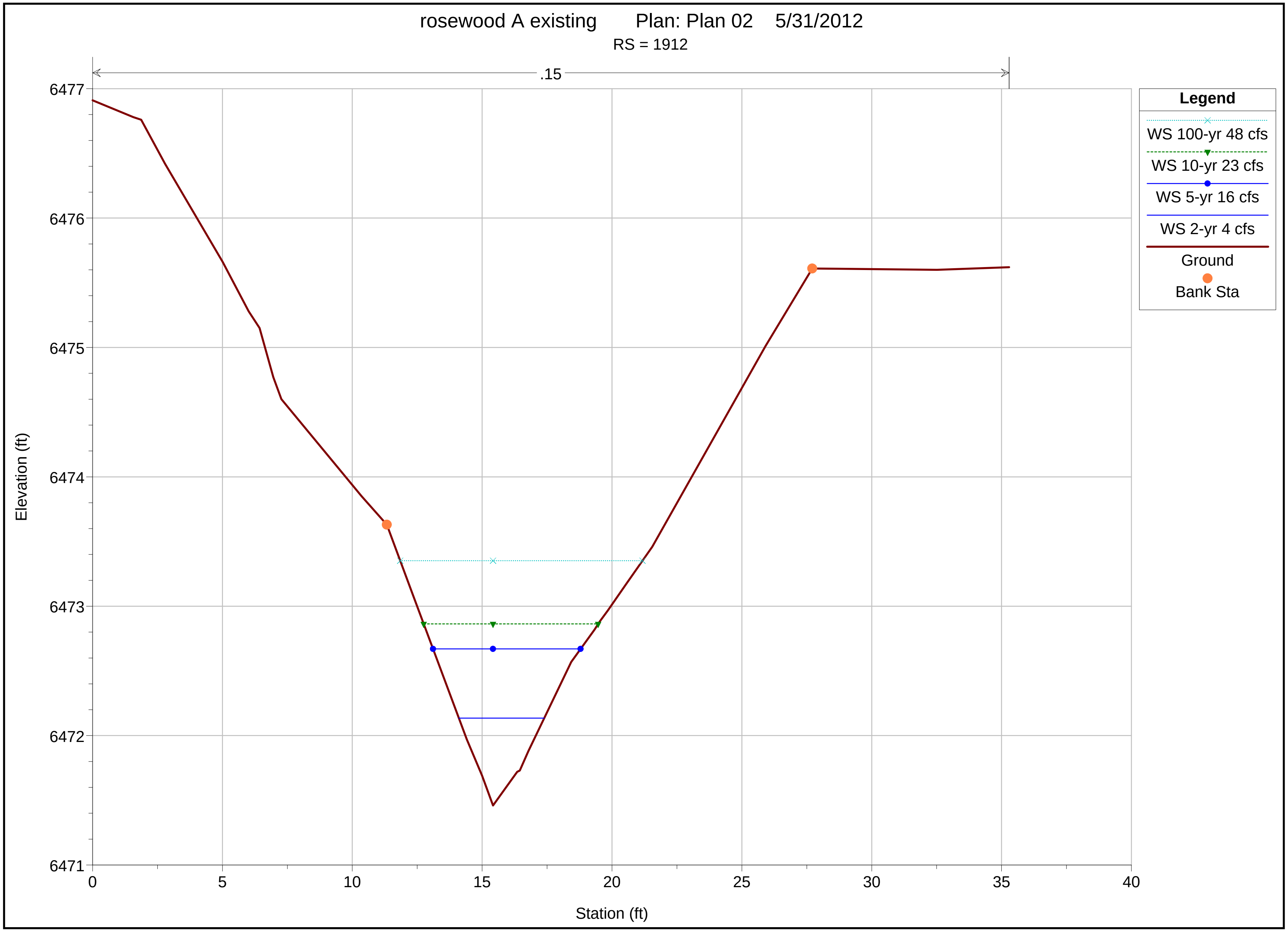
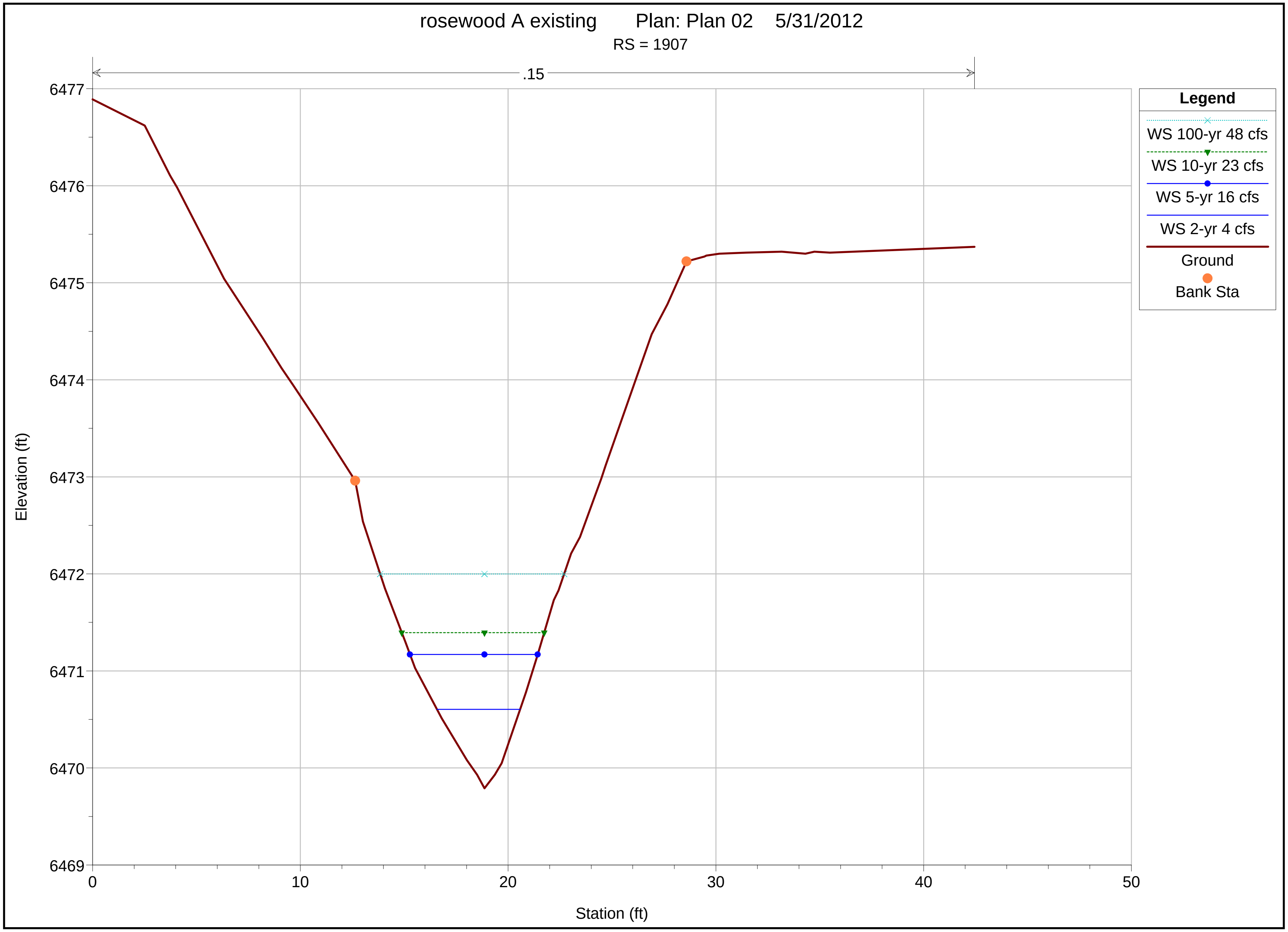
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6479
6478
6477
6476
6475
6474
6473
6472
0
10
20
30
40
Station (ft)


rosewood A existing Plan: Plan 02 5/31/2012
RS = 1912
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6477
6476
6475
6474
6473
6472
6471
Station (ft)
0
5
10
15
20
25
30
35
40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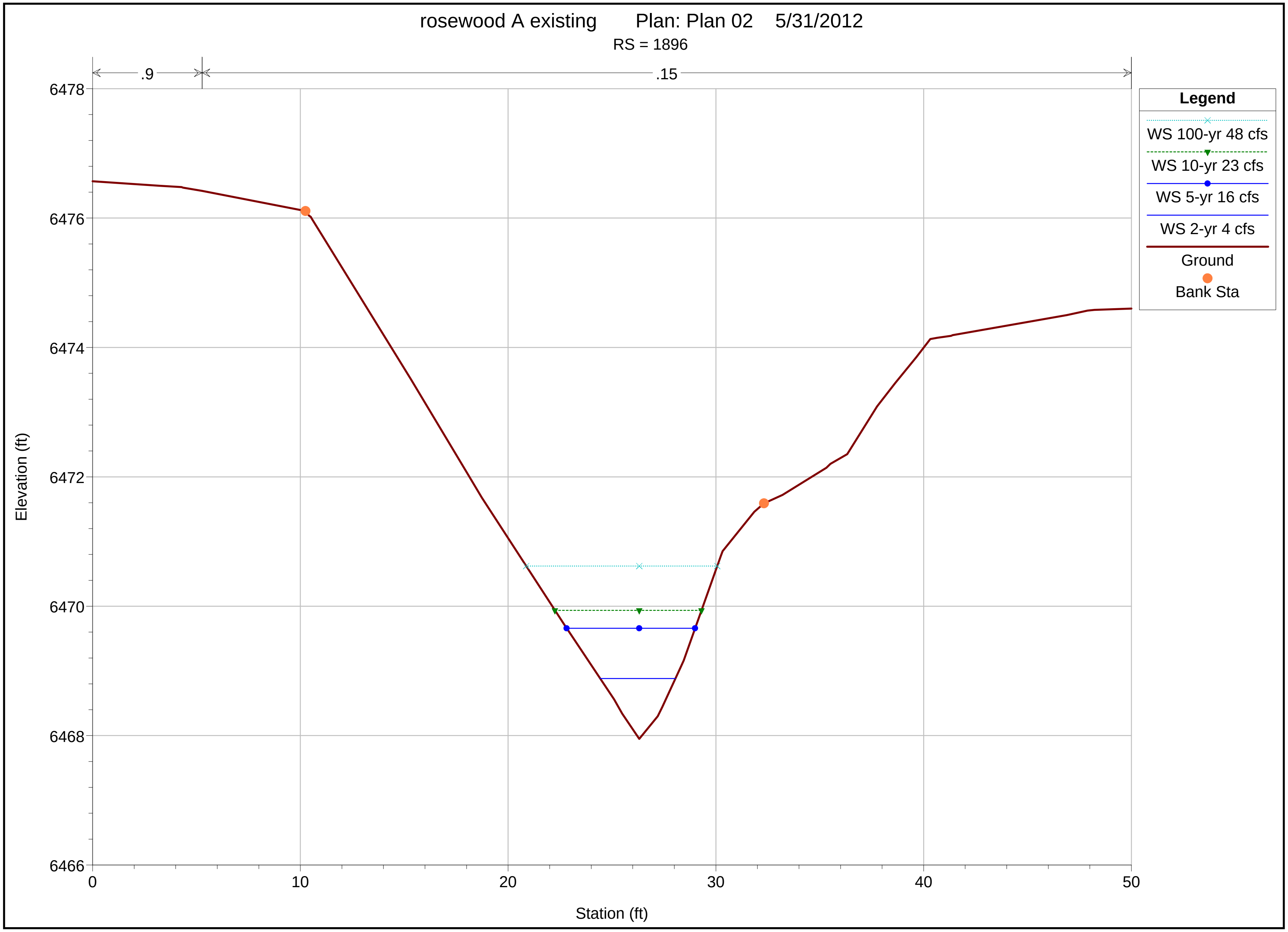
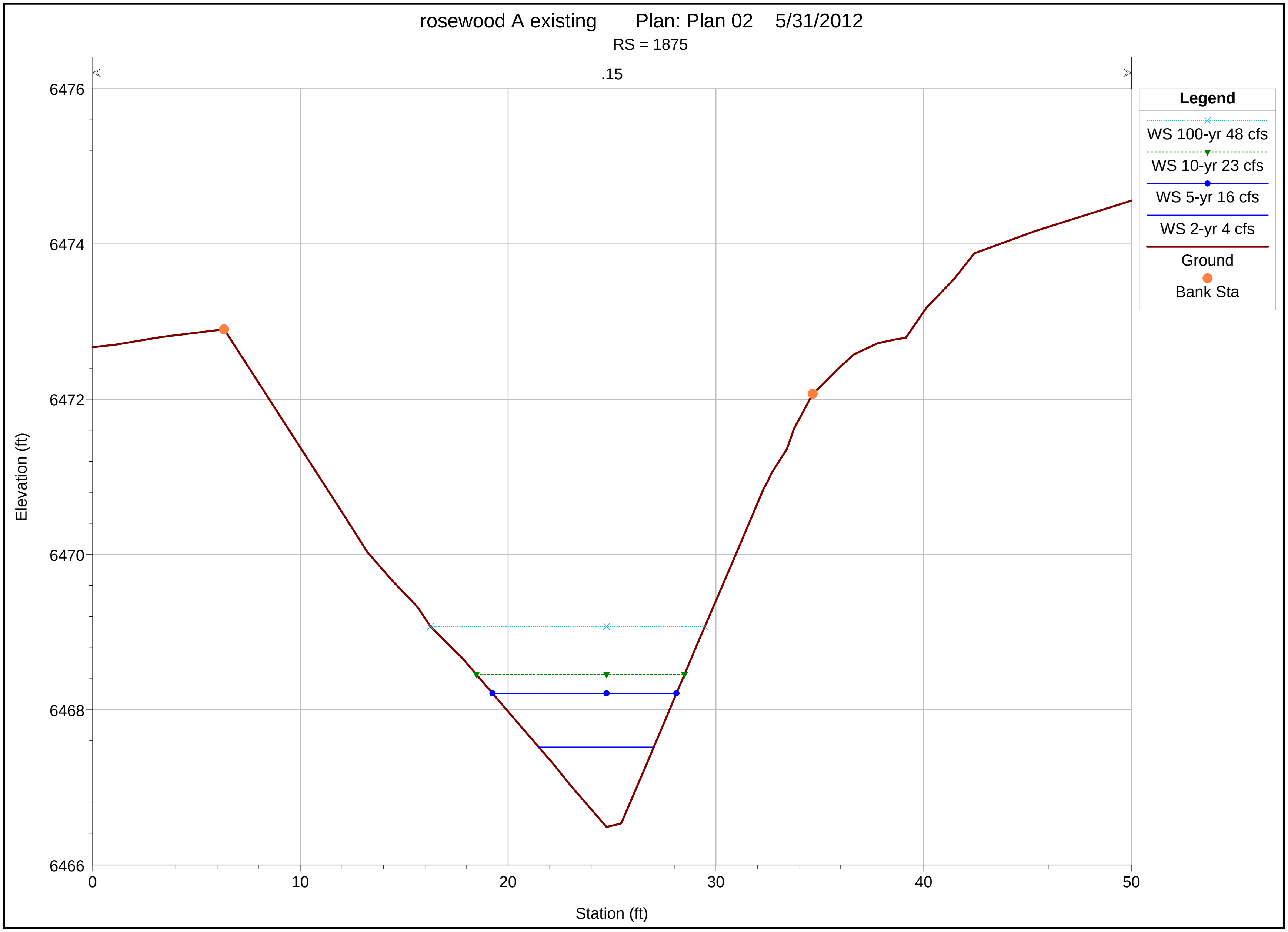
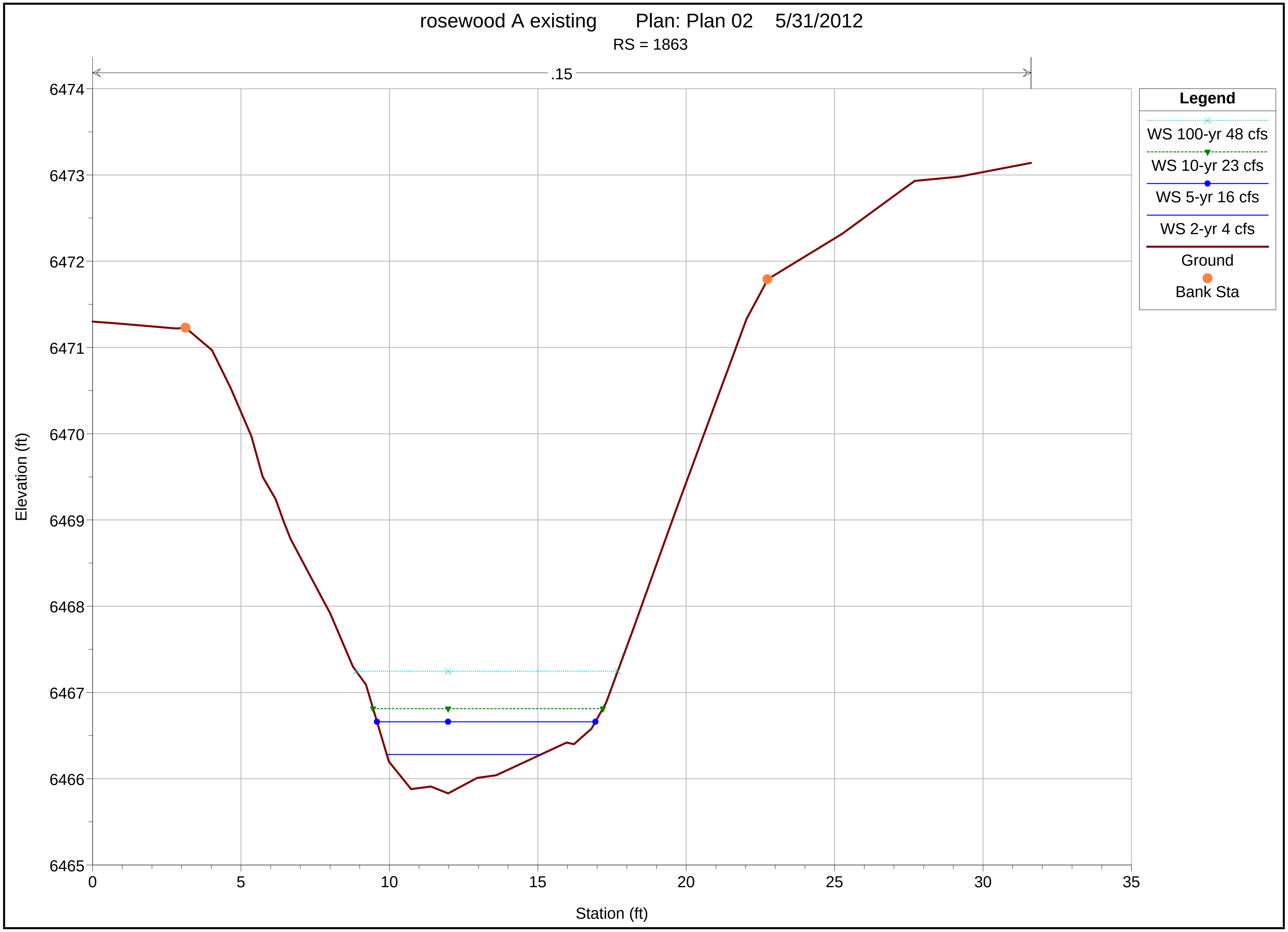
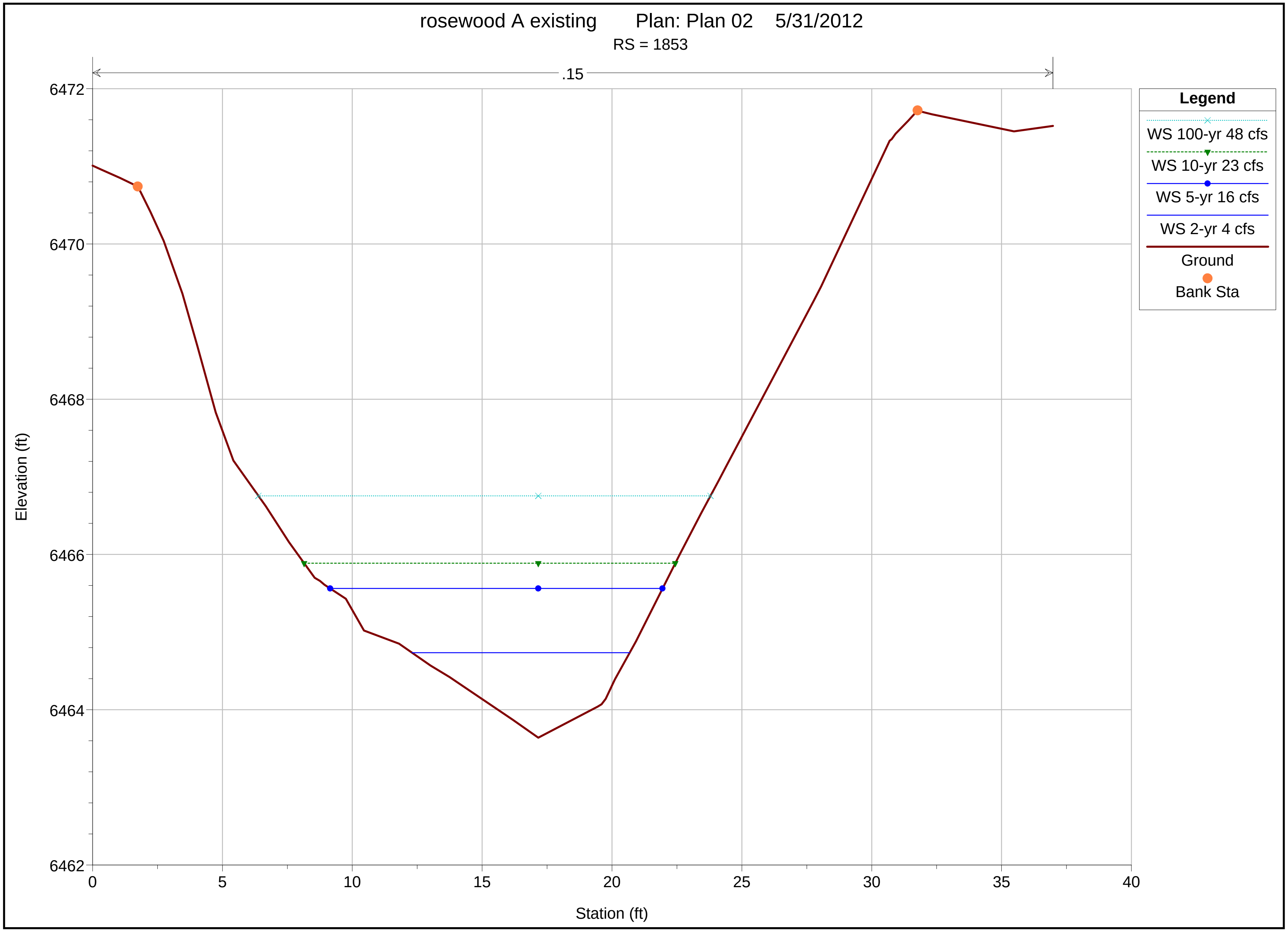
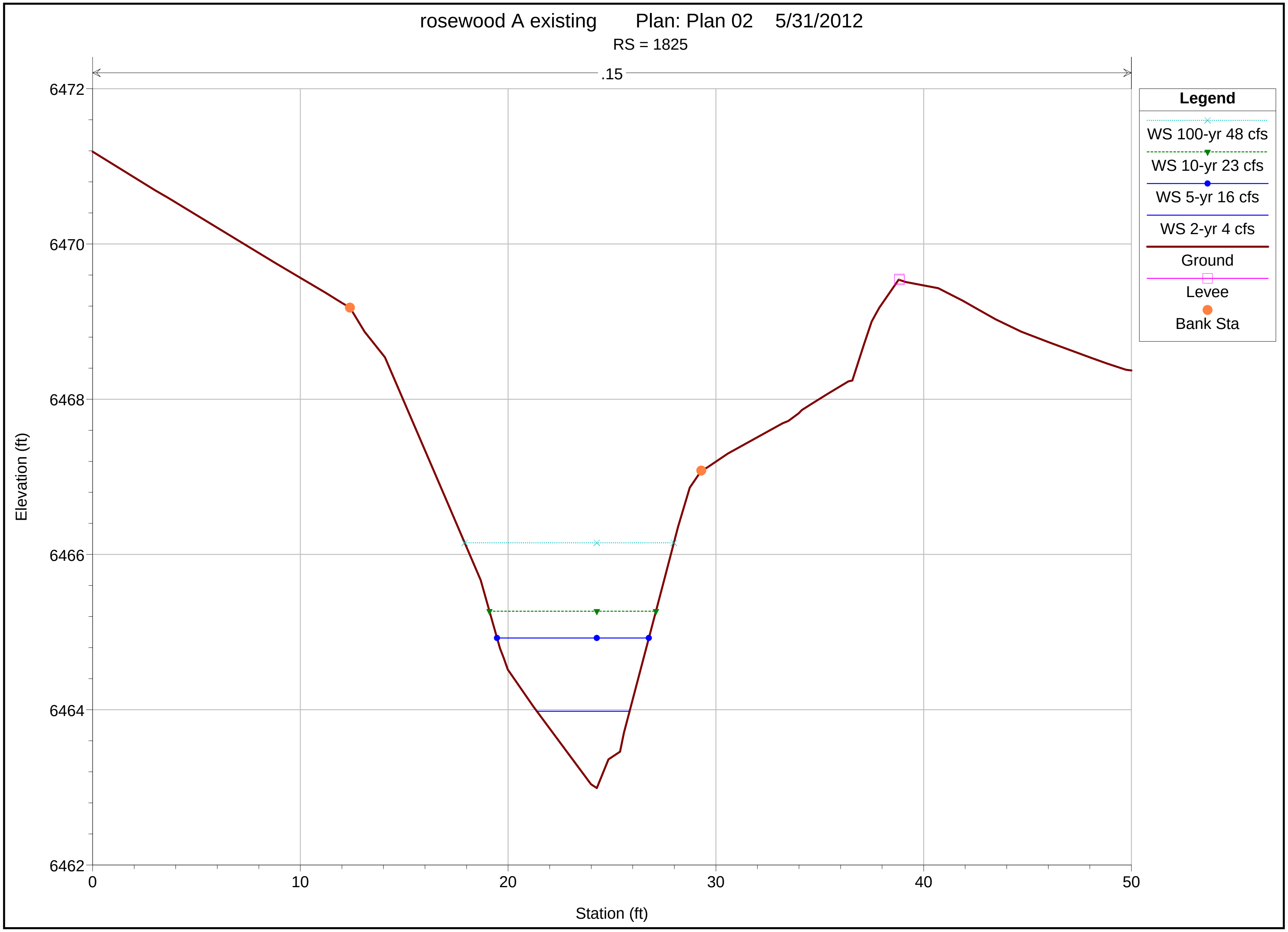
Plan: Plan 02
5/31/2012
RS = 1907
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6477
6476
6475
6474
6473
6472
6471
6470
6469
Station (ft)
0
10
20
30
40
50

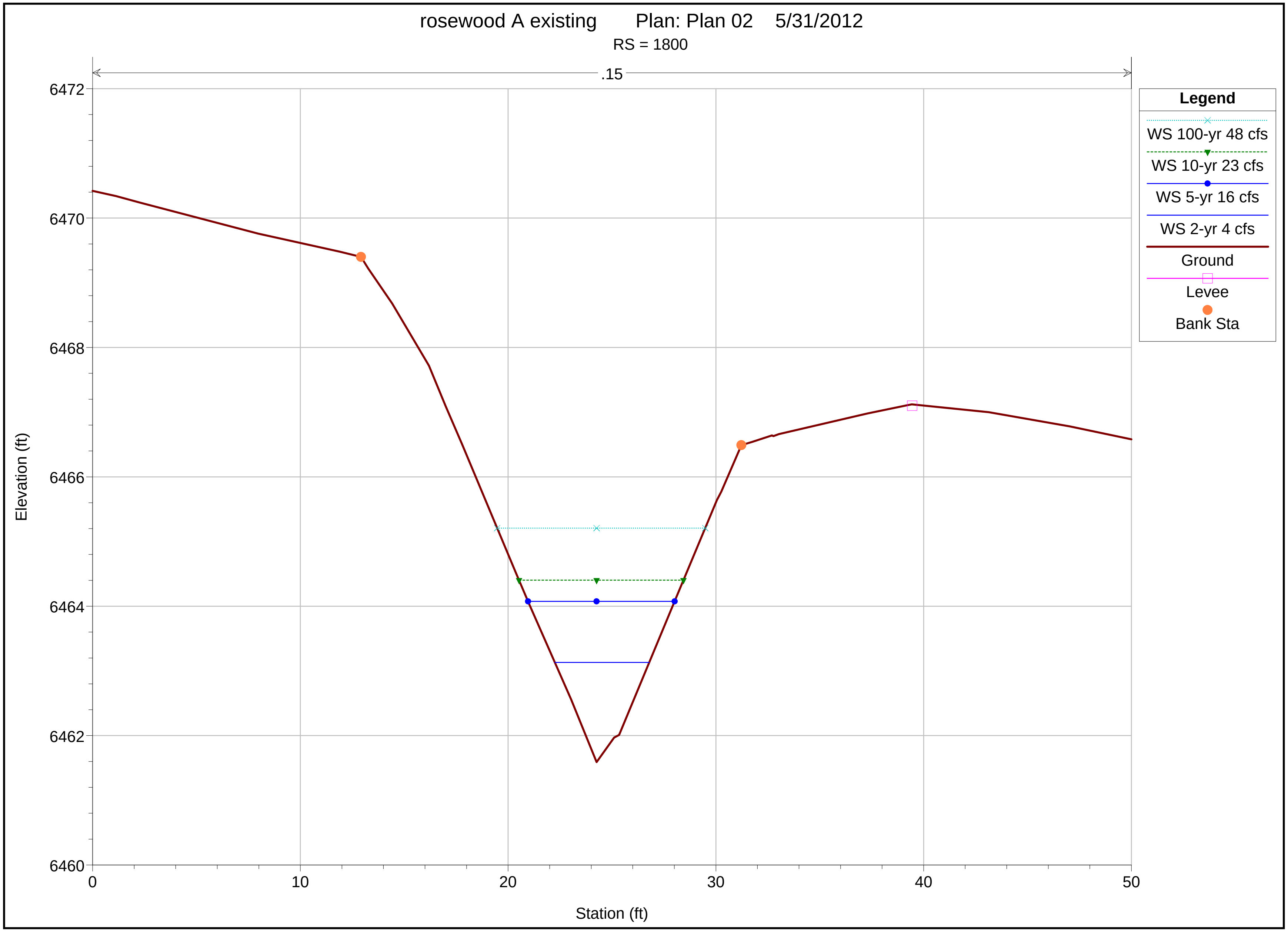

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1896
.9
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6478
6476
6474
6472
6470
6468
6466
0
10
20
30
40
50
Station (ft)


rosewood A existing Plan: Plan 02 5/31/2012
RS = 1875
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6476
6474
6472
6470
6468
6466
0
10
20
30
40
50
Station (ft)


rosewood A existing Plan: Plan 02 5/31/2012
RS = 1863
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6474
6473
6472
6471
6470
6469
6468
6467
6466
6465
0
5
10
15
20
25
30
35
Station (ft)

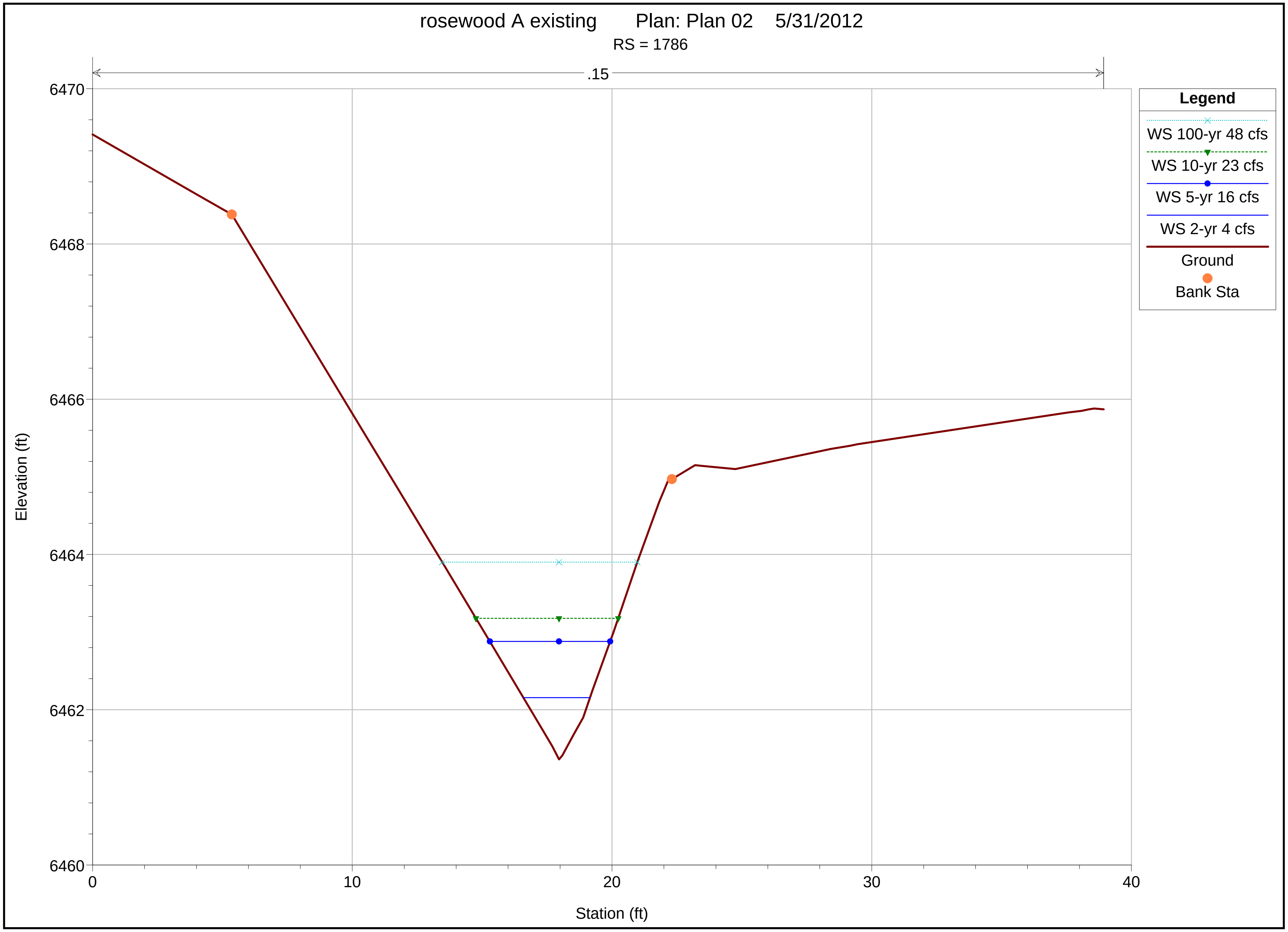

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1853
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6472
6470
6468
6466
6464
6462
0
5
10
15
20
25
30
35
40
Station (ft)

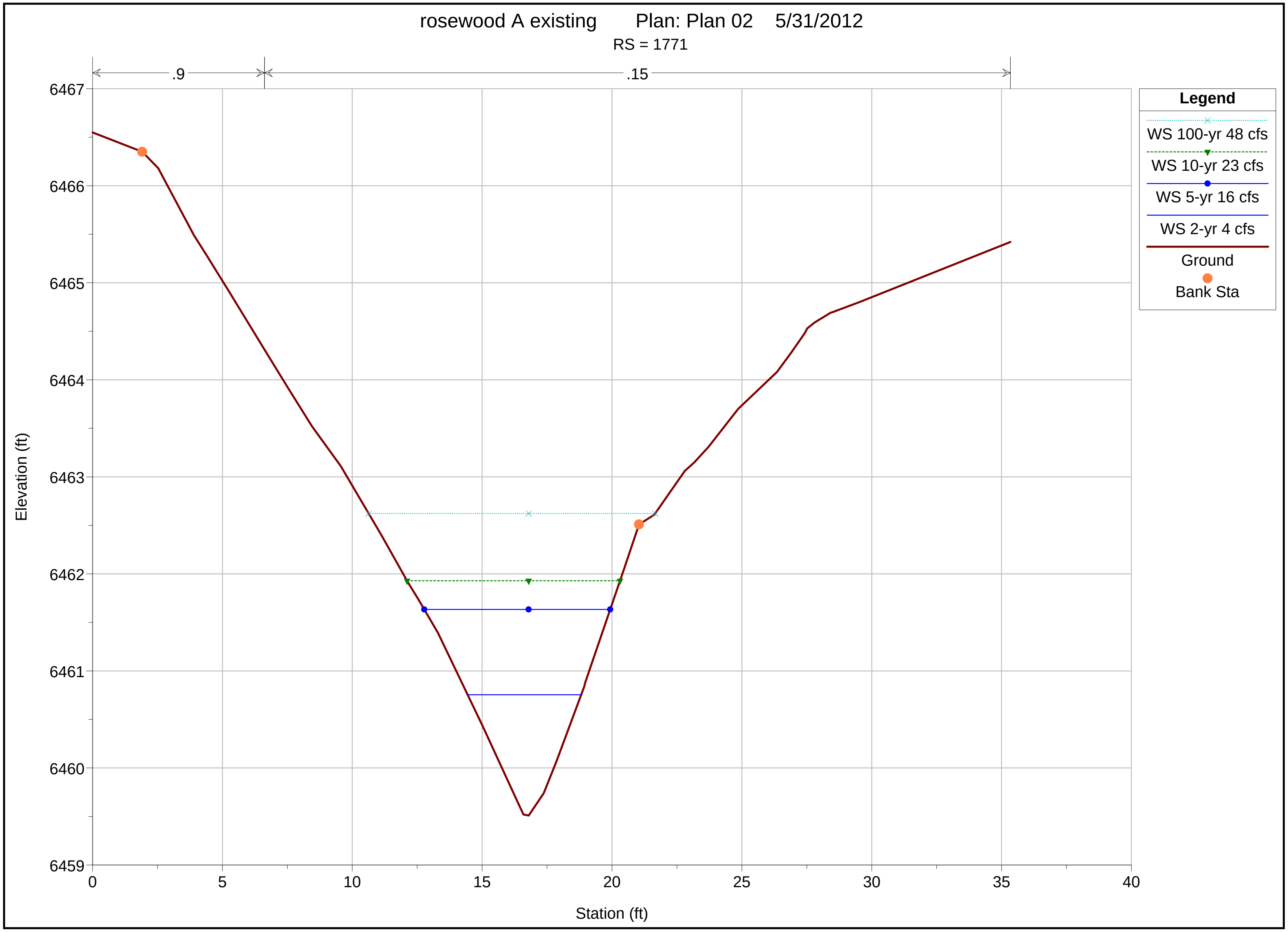

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1825
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6472
6470
6468
6466
6464
6462
0
10
20
30
40
50
Station (ft)



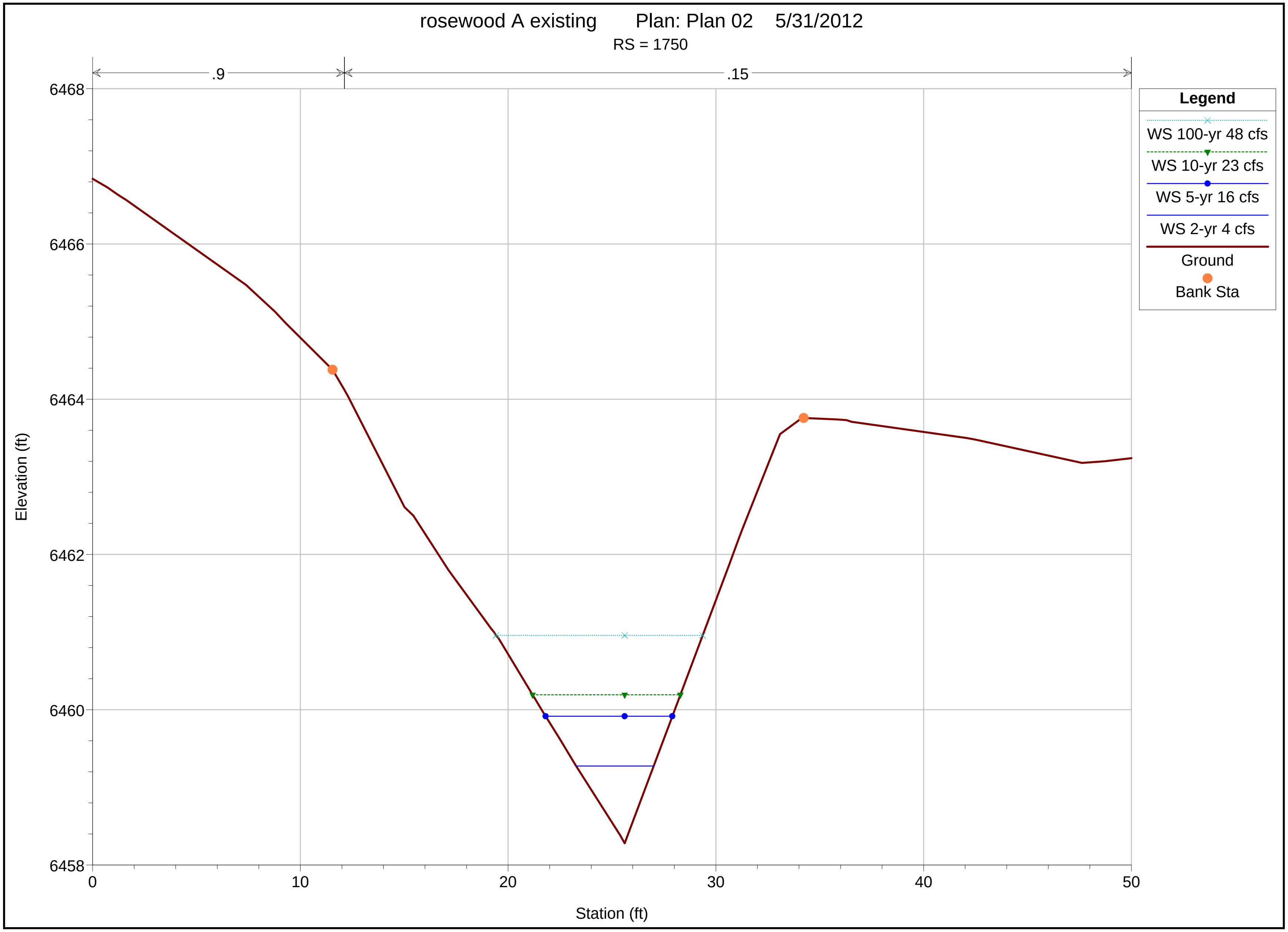
rosewood A existing Plan: Plan 02 5/31/2012

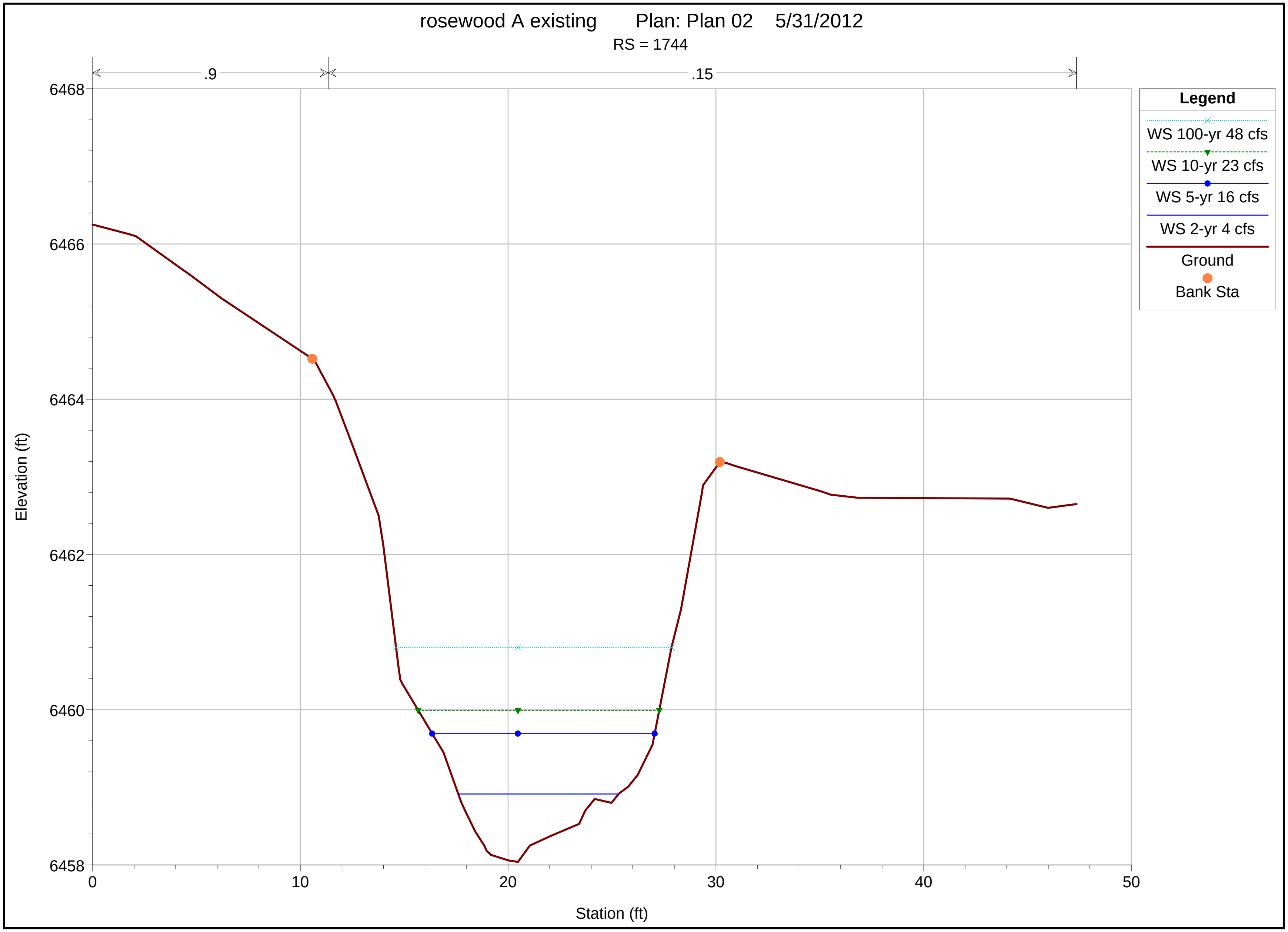
RS = 1800

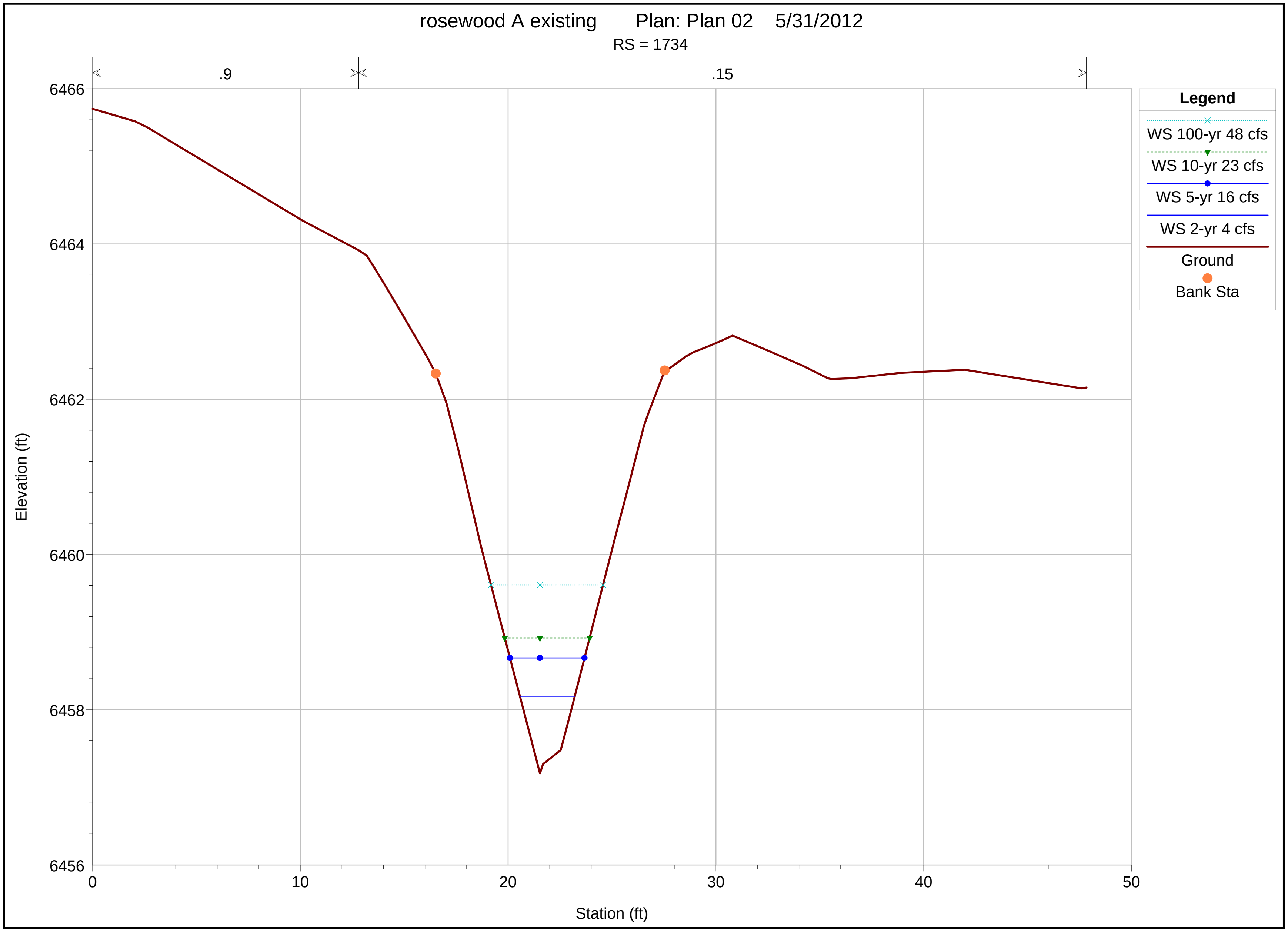

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1786
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6470
6468
6466
6464
6462
6460
Station (ft)
0
10
20
30
40

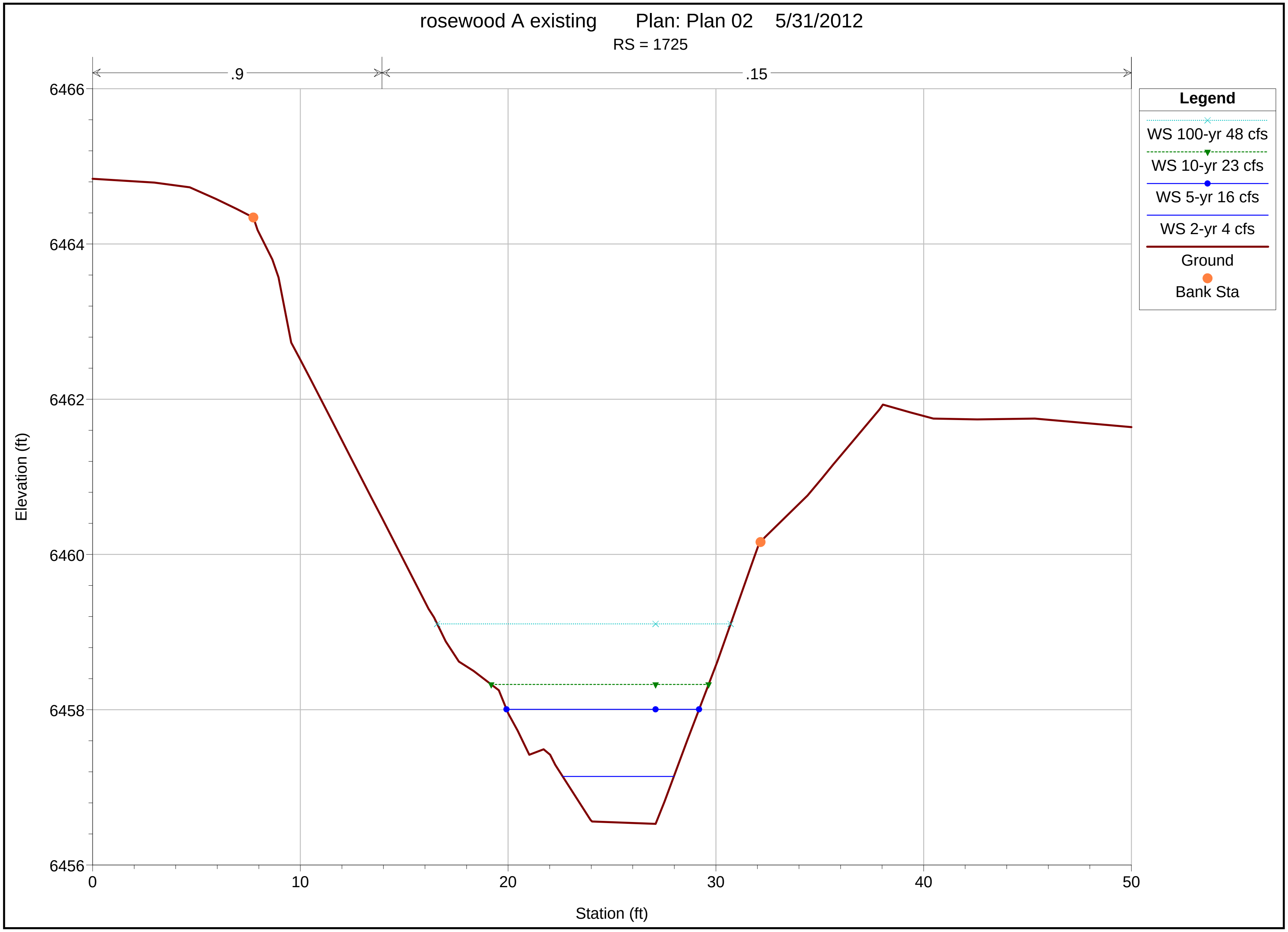


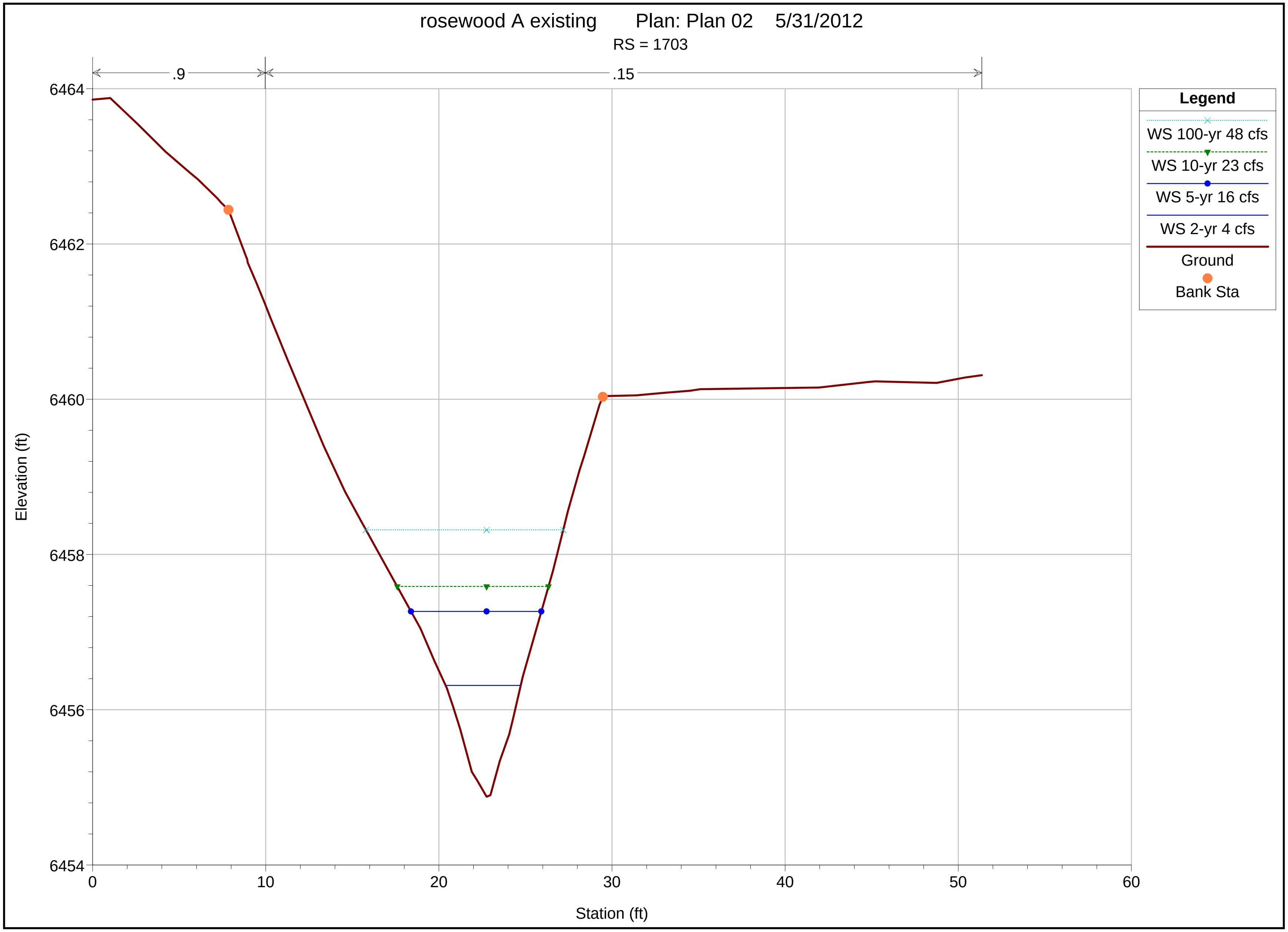
rosewood A existing Plan: Plan 02 5/31/2012
RS = 1771
.9
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6467
6466
6465
6464
6463
6462
6461
6460
6459
Station (ft)
0
5
10
15
20
25
30
35
40

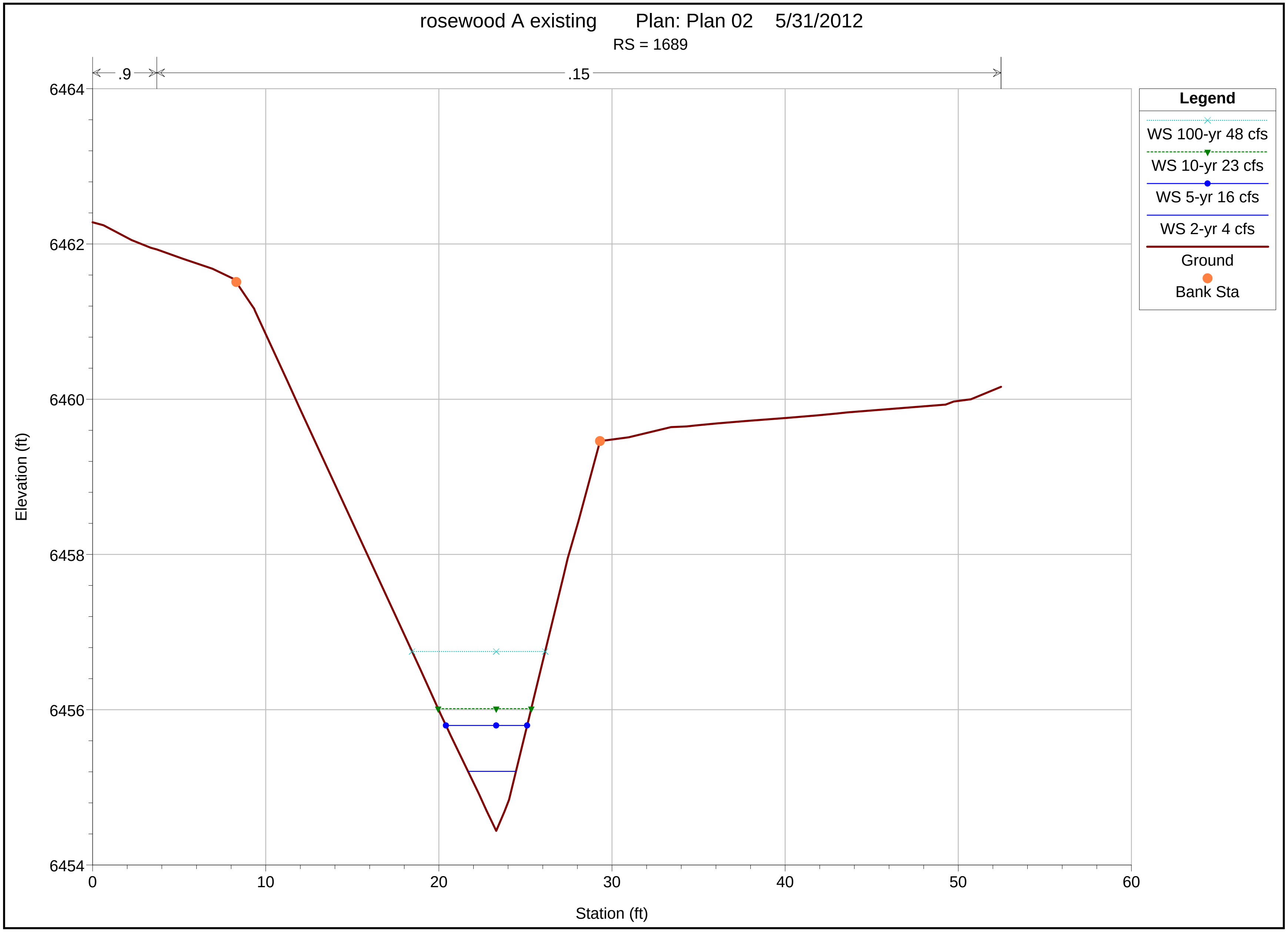

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1750
.9
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6468
6466
6464
6462
6460
6458
Station (ft)
0
10
20
30
40
50

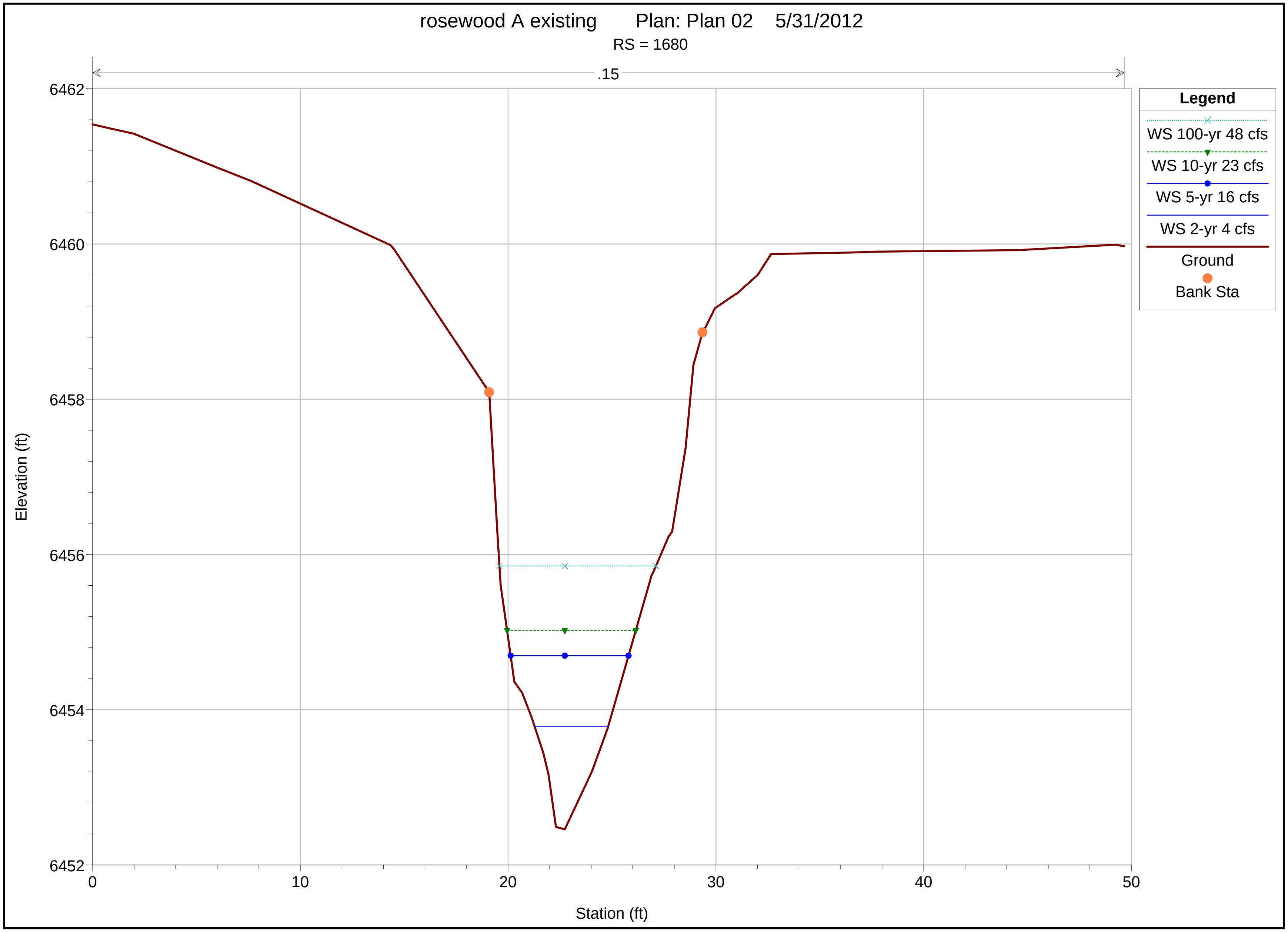

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1744
.9
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6468
6466
6464
6462
6460
6458
0
10
20
30
40
50
Station (ft)

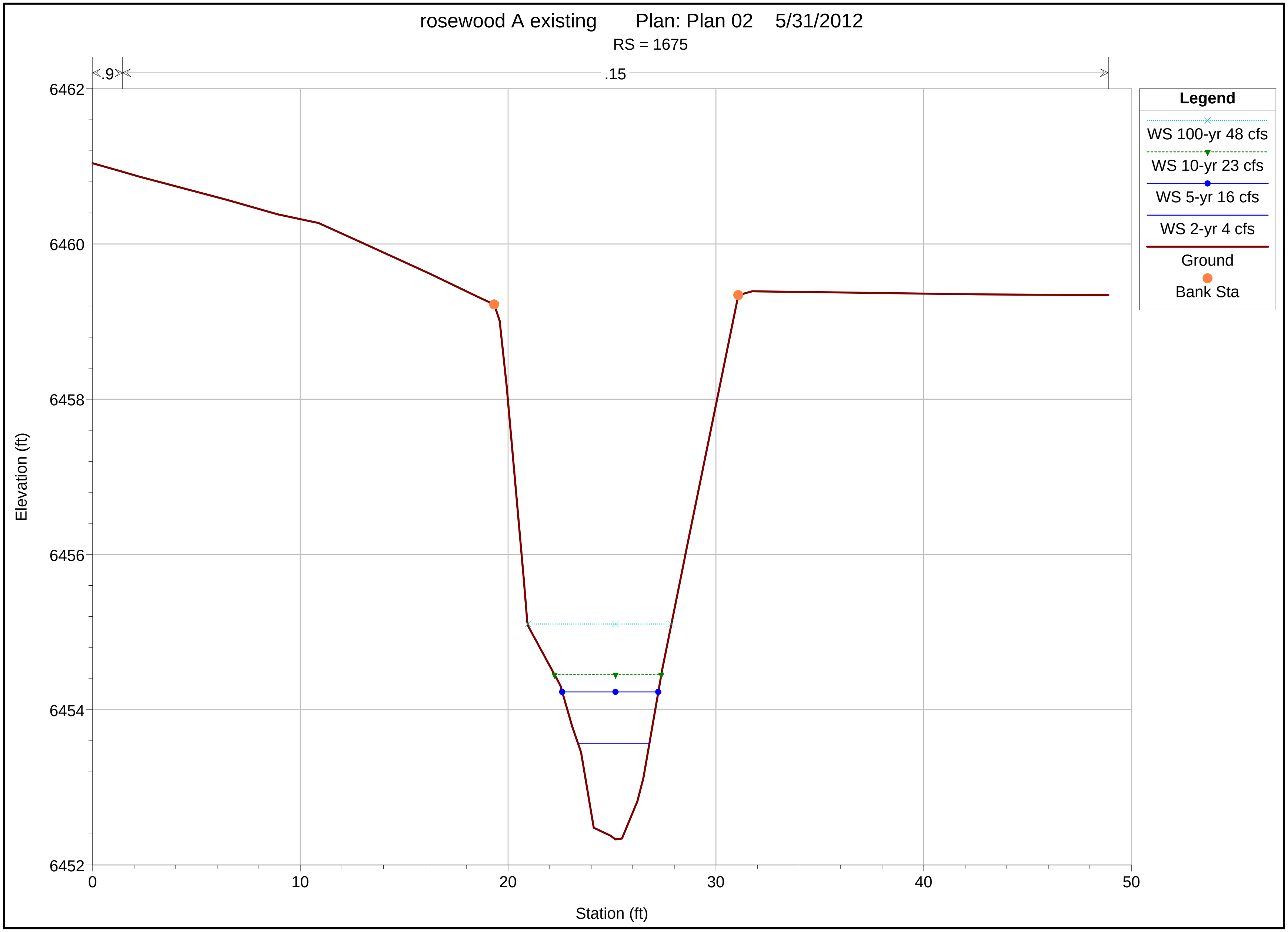

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1734
.9
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6466
6464
6462
6460
6458
6456
Station (ft)
0
10
20
30
40
50

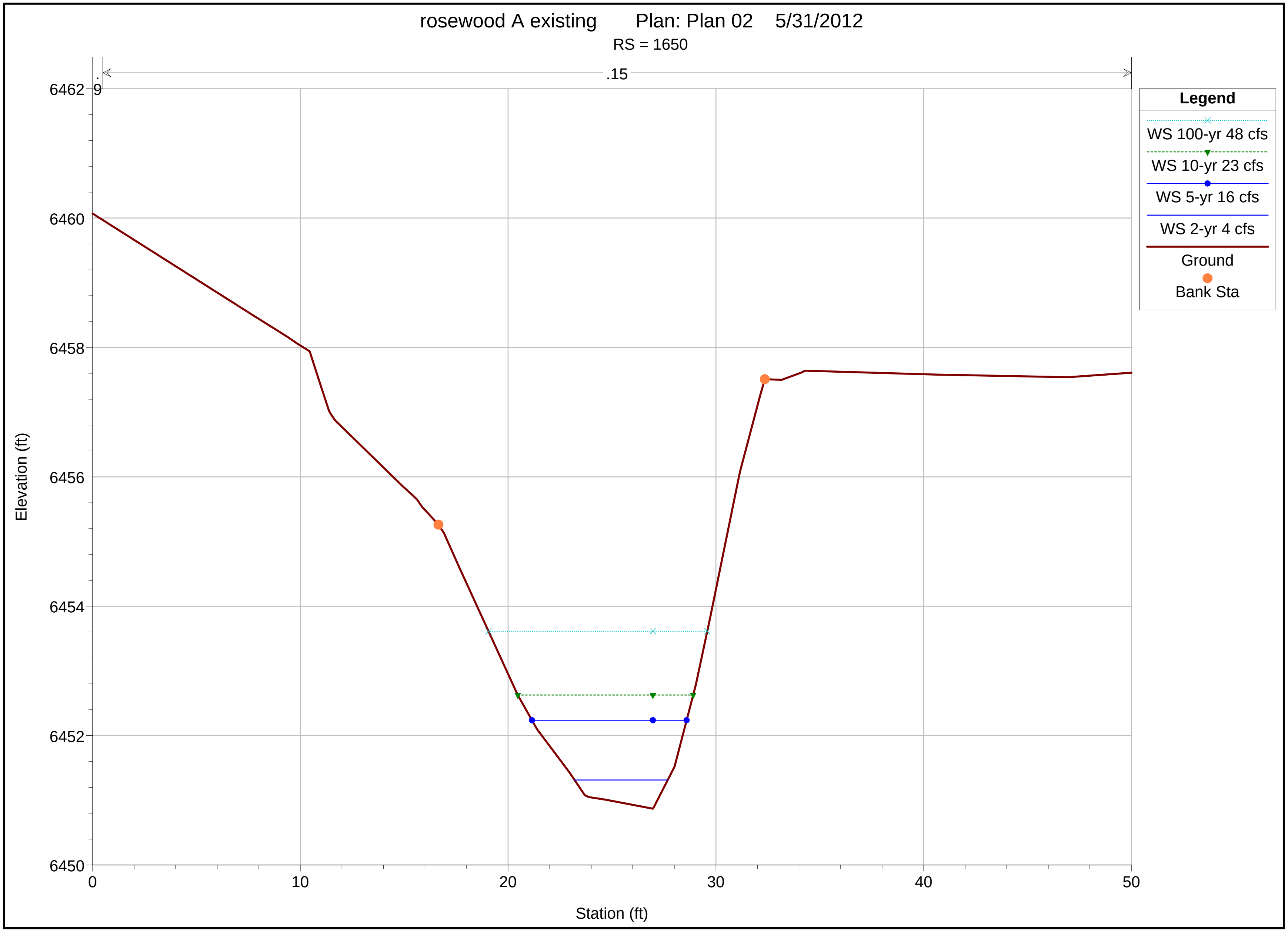

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1725
.9
.15
Elevation (ft)
6466
6464
6462
6460
6458
6456
Station (ft)
0
10
20
30
40
50
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta

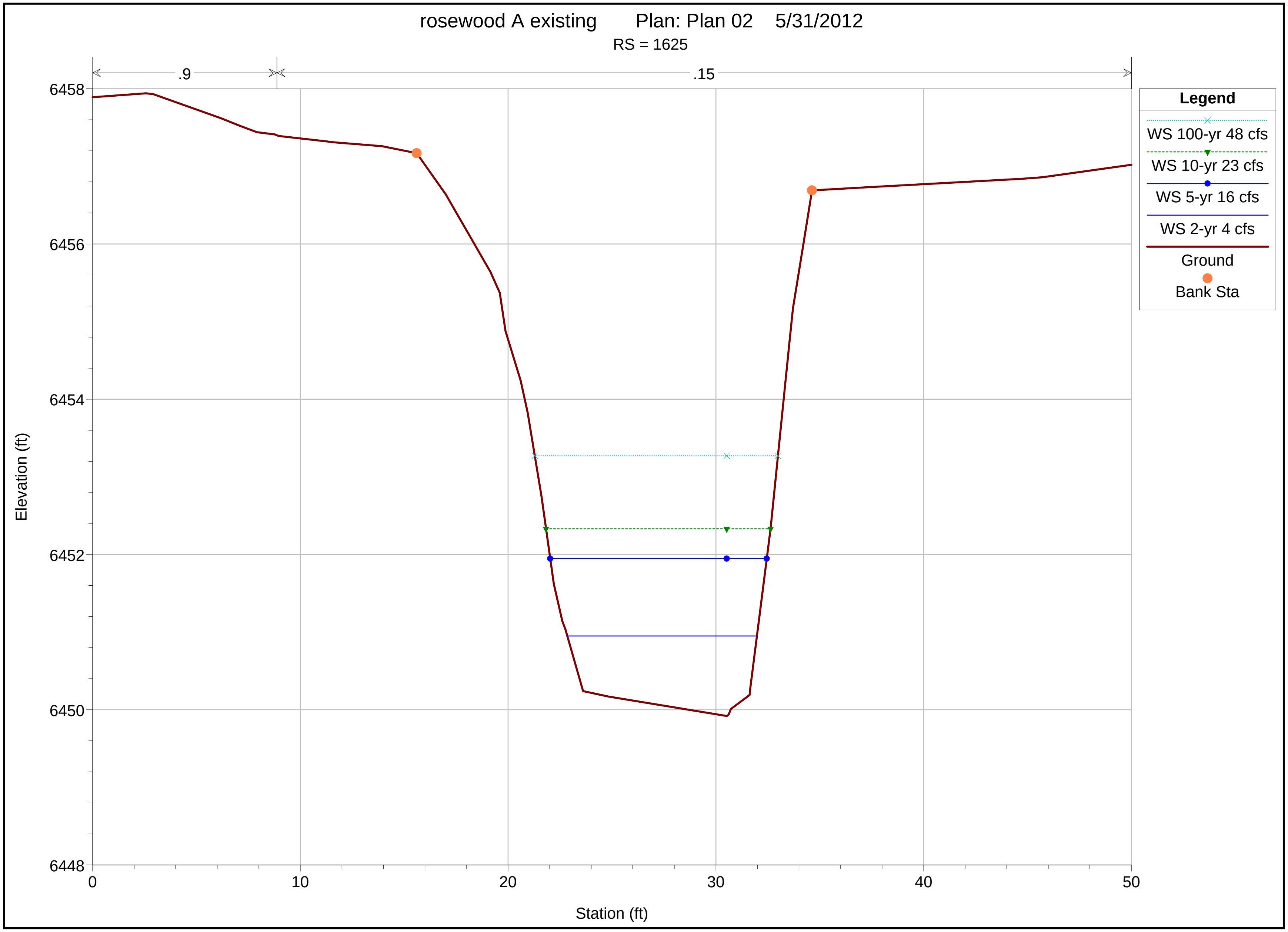

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1703
.9
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6464
6462
6460
6458
6456
6454
0
10
20
30
40
50
60
Station (ft)

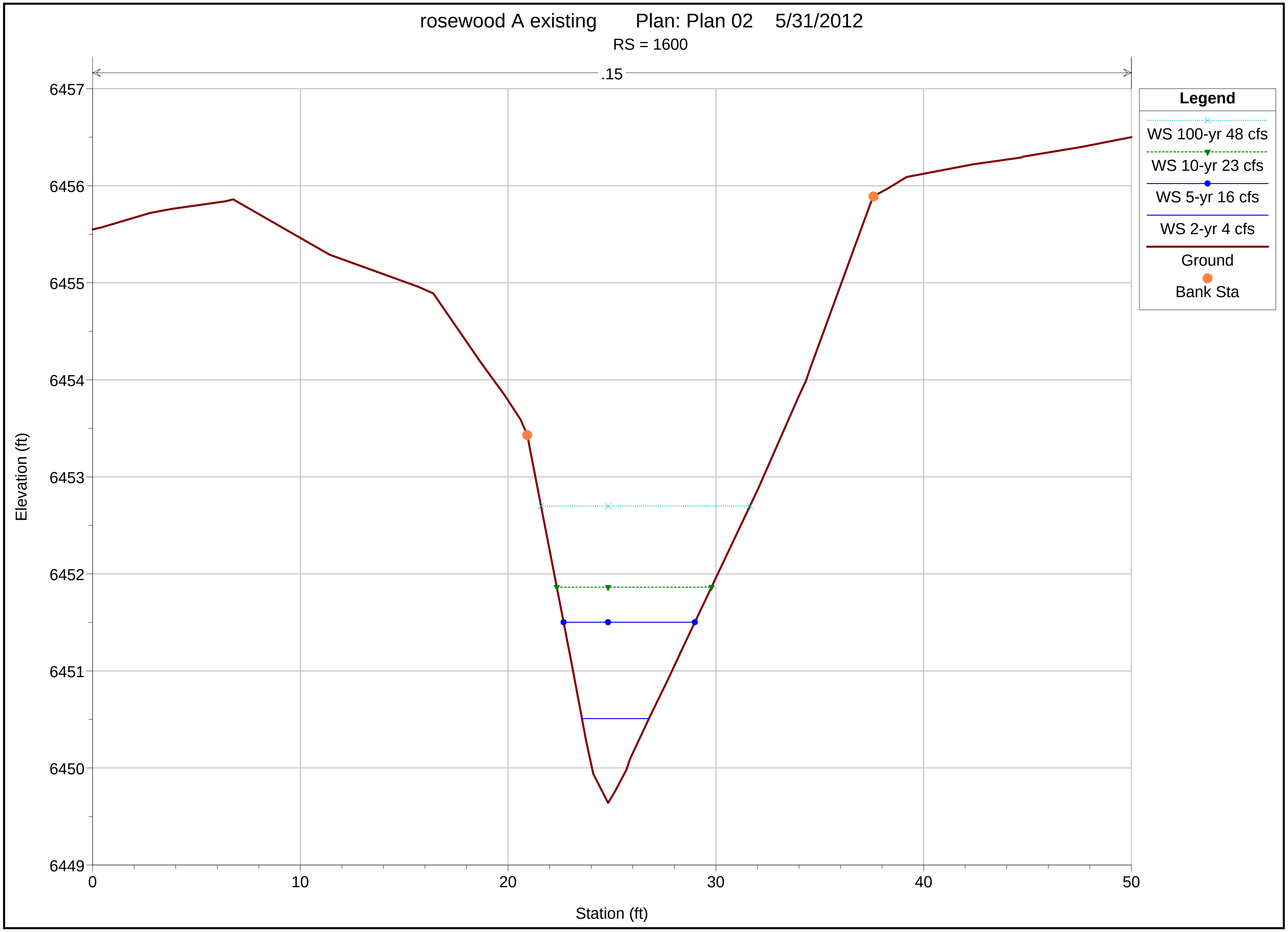

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1689
.9
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6464
6462
6460
6458
6456
6454
Station (ft)
0
10
20
30
40
50
60

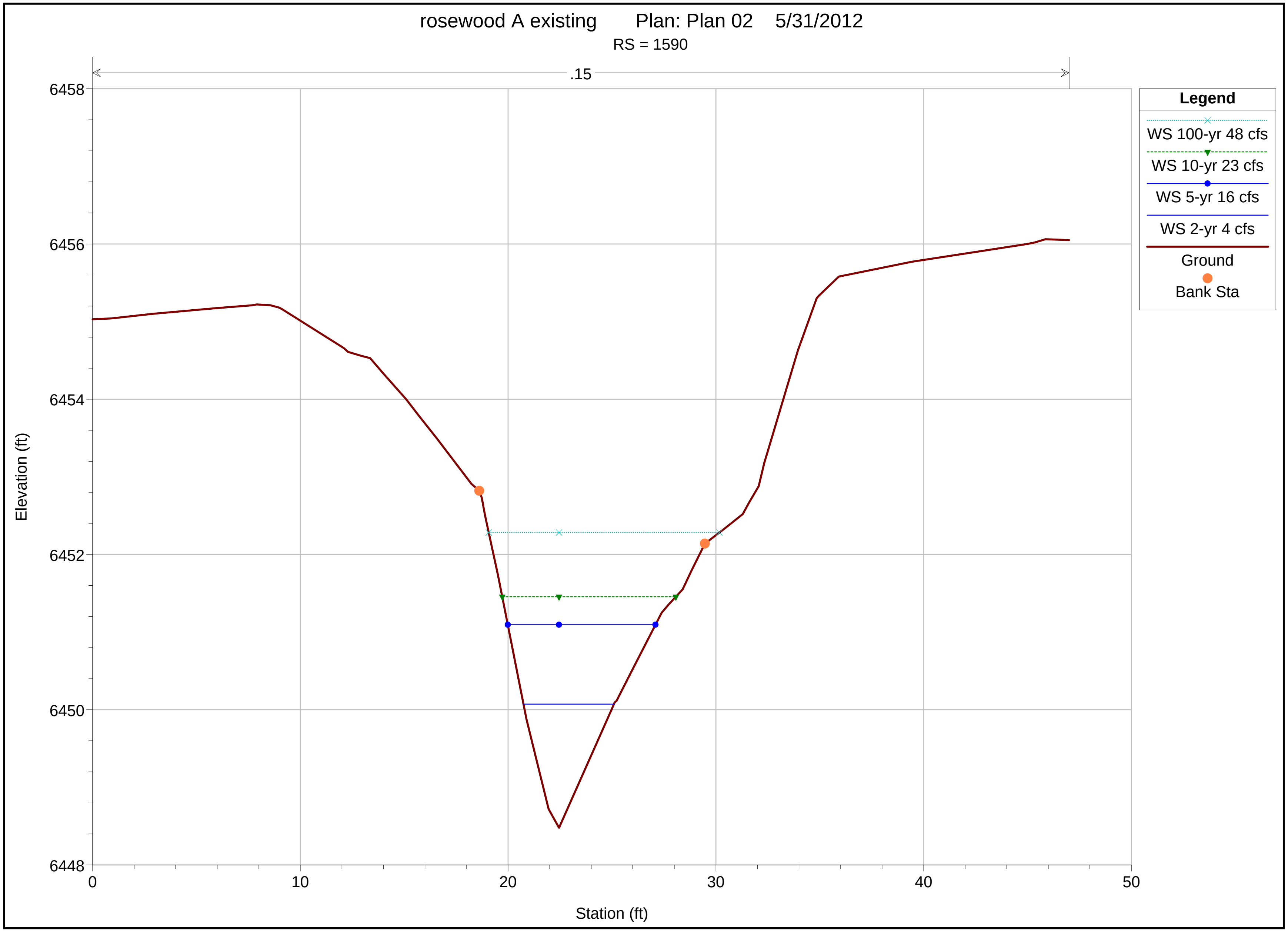

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1680
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6462
6460
6458
6456
6454
6452
0
10
20
30
40
50
Station (ft)

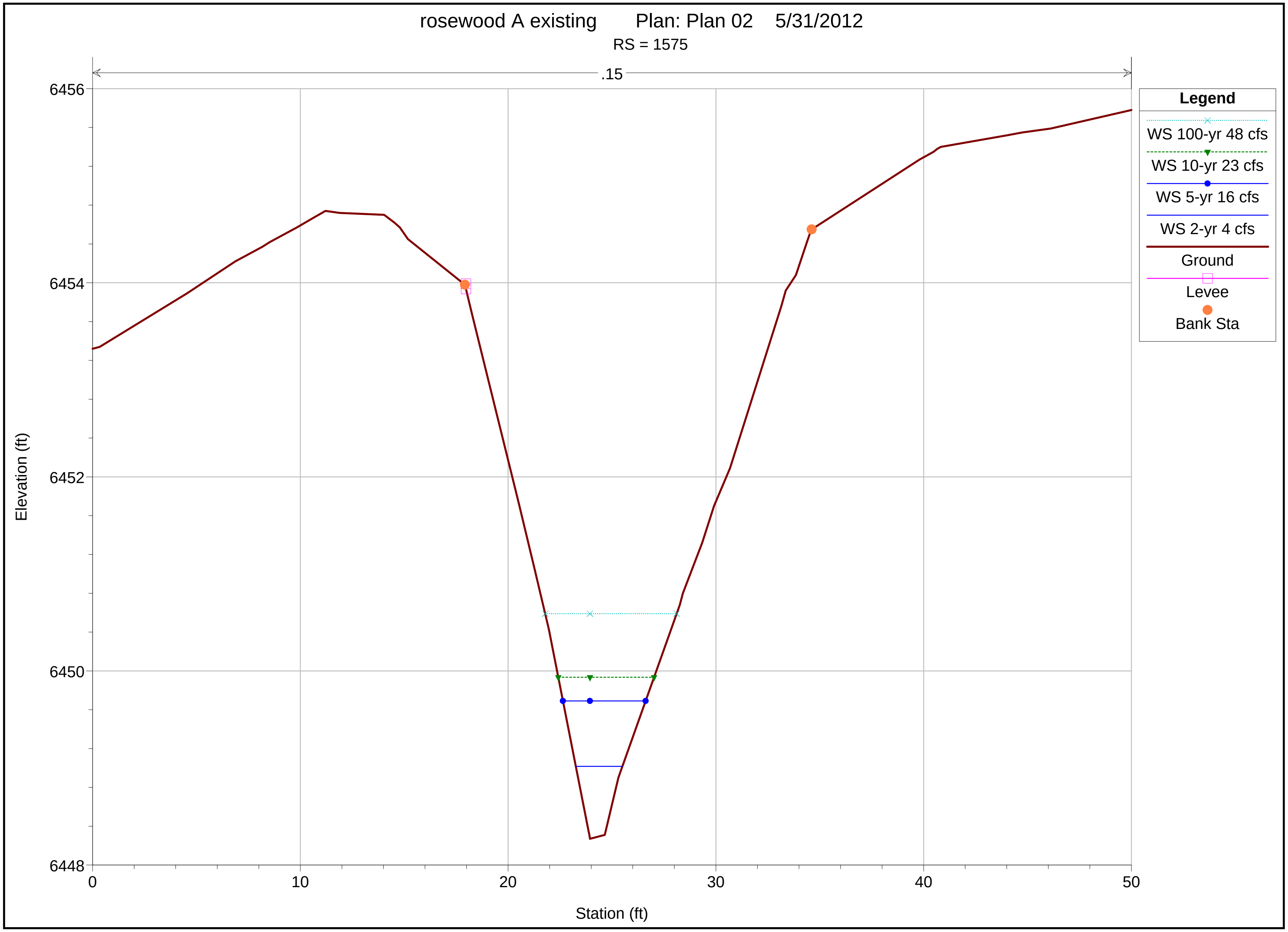

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1675
.9
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6462
6460
6458
6456
6454
6452
0
10
20
30
40
50
Station (ft)

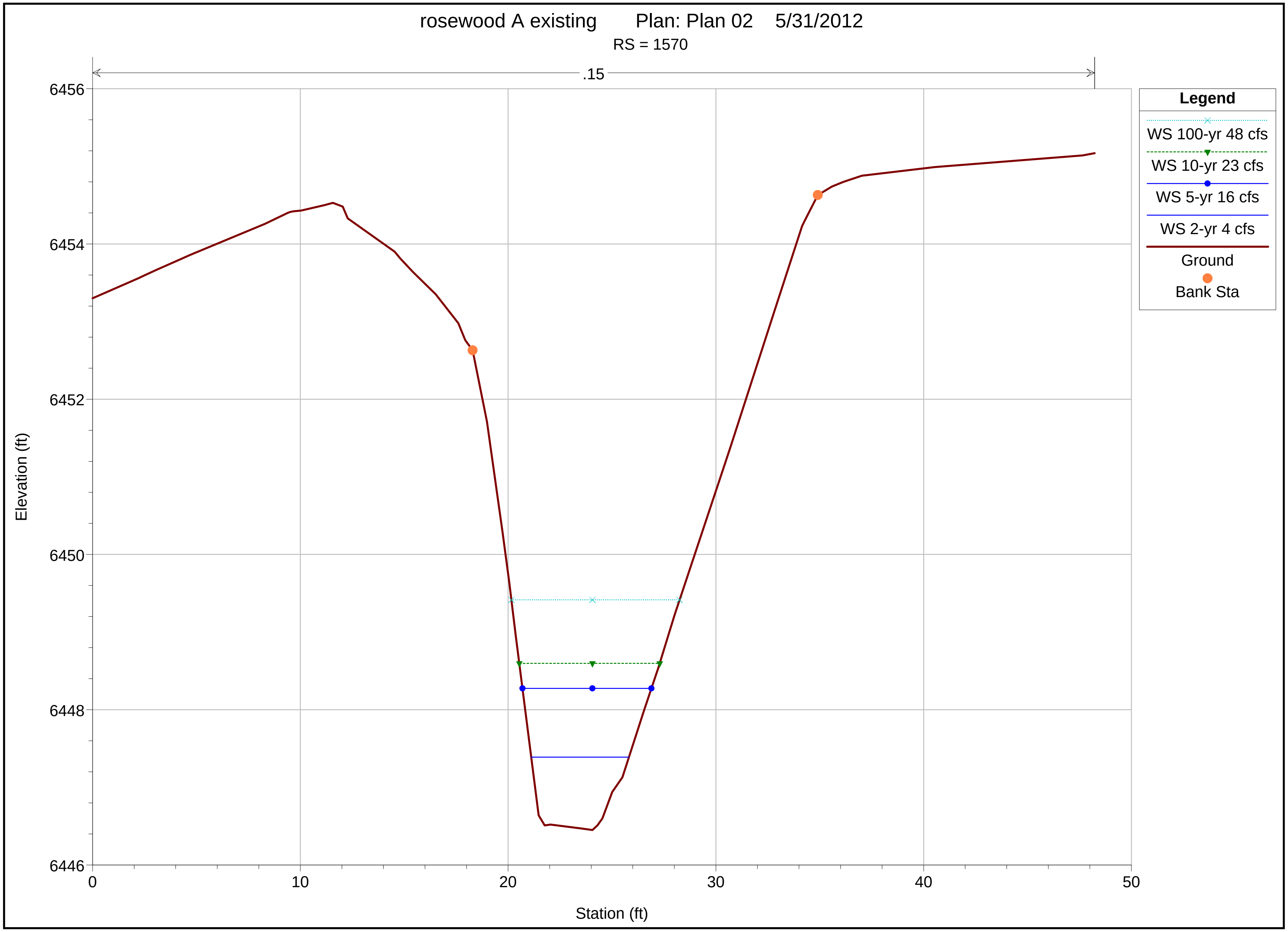

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1650
.9
.15
6462
6460
6458
6456
6454
6452
6450
Elevation (ft)
0
10
20
30
40
50
Station (ft)
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta

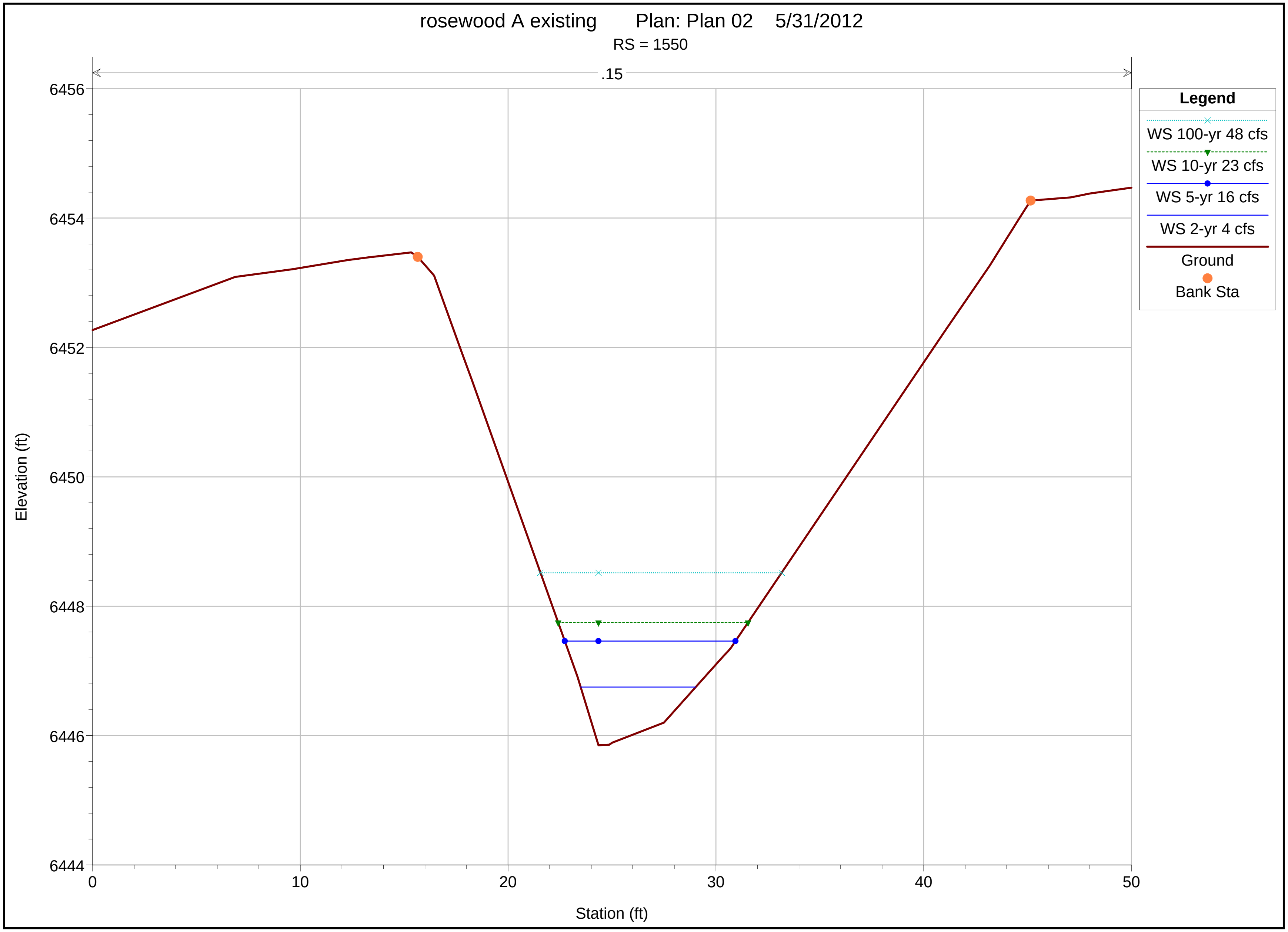

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1625
.9
.15
6458
6456
6454
6452
6450
6448
0
10
20
30
40
50
Station (ft)
Elevation (ft)
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta


rosewood A existing Plan: Plan 02 5/31/2012
RS = 1600
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6457
6456
6455
6454
6453
6452
6451
6450
6449
0
10
20
30
40
50
Station (ft)


rosewood A existing Plan: Plan 02 5/31/2012
RS = 1590
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6458
6456
6454
6452
6450
6448
0
10
20
30
40
50
Station (ft)

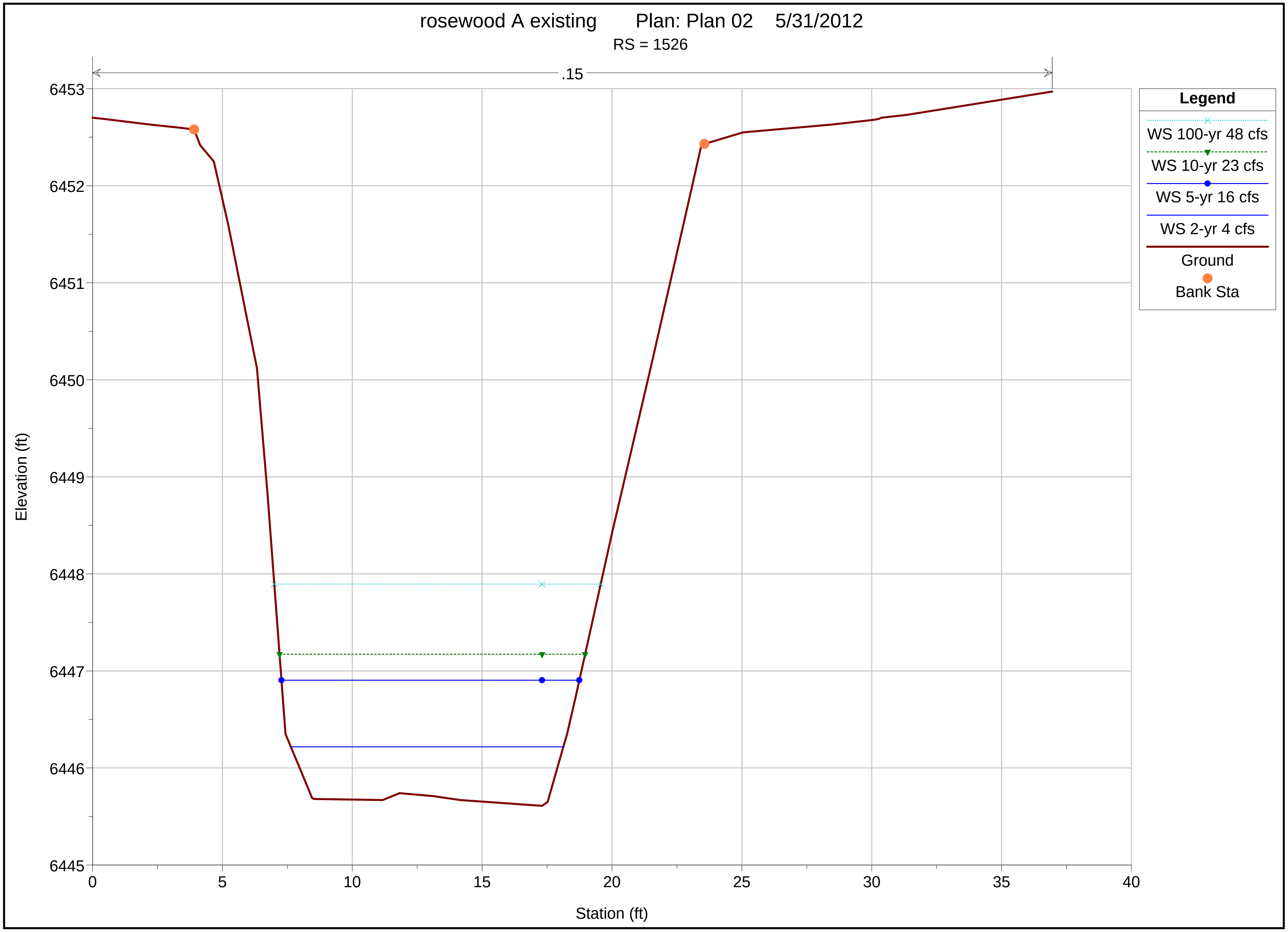

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1575
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6456
6454
6452
6450
6448
0
10
20
30
40
50
Station (ft)

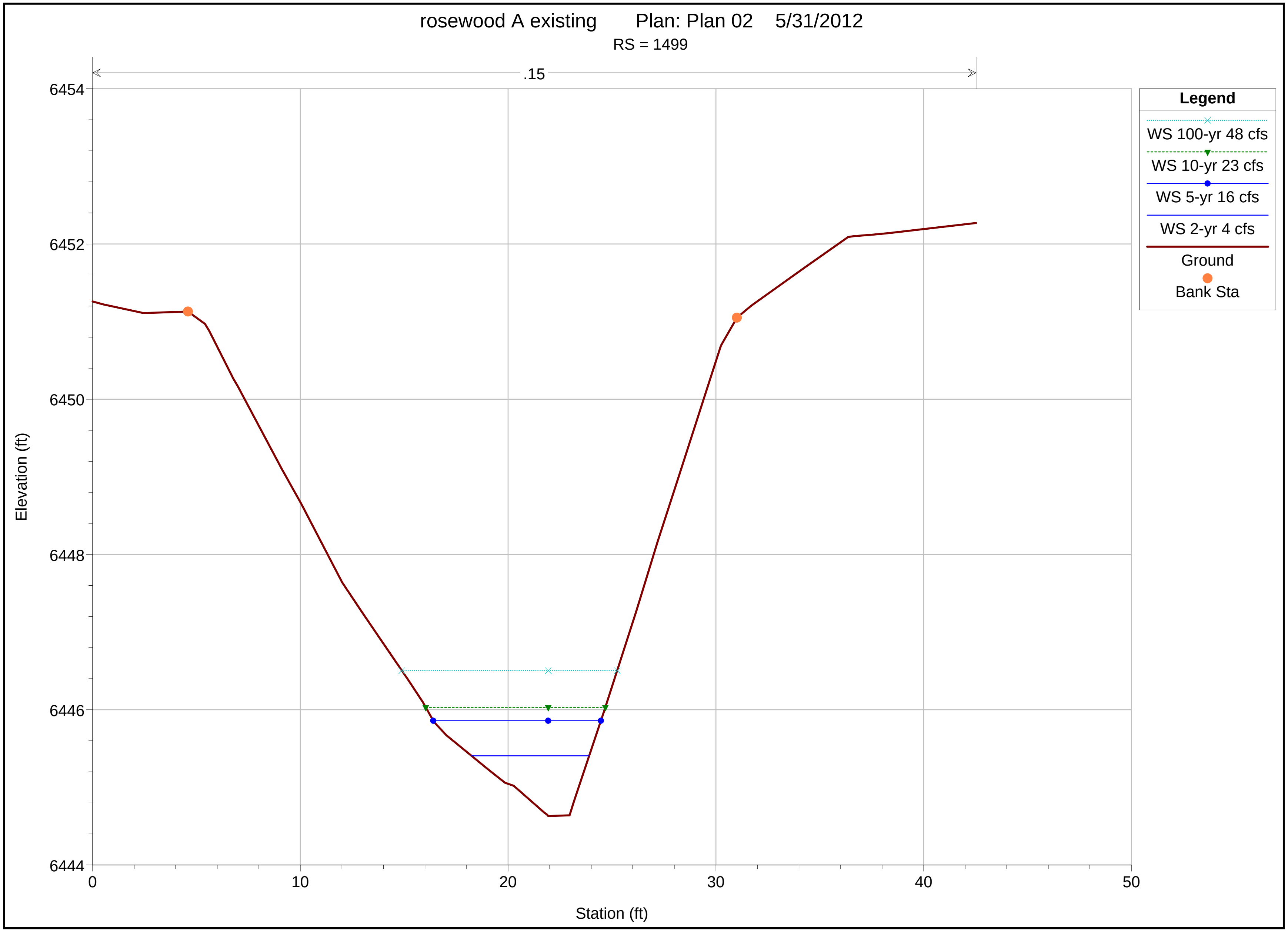

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1570
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6456
6454
6452
6450
6448
6446
Station (ft)
0
10
20
30
40
50

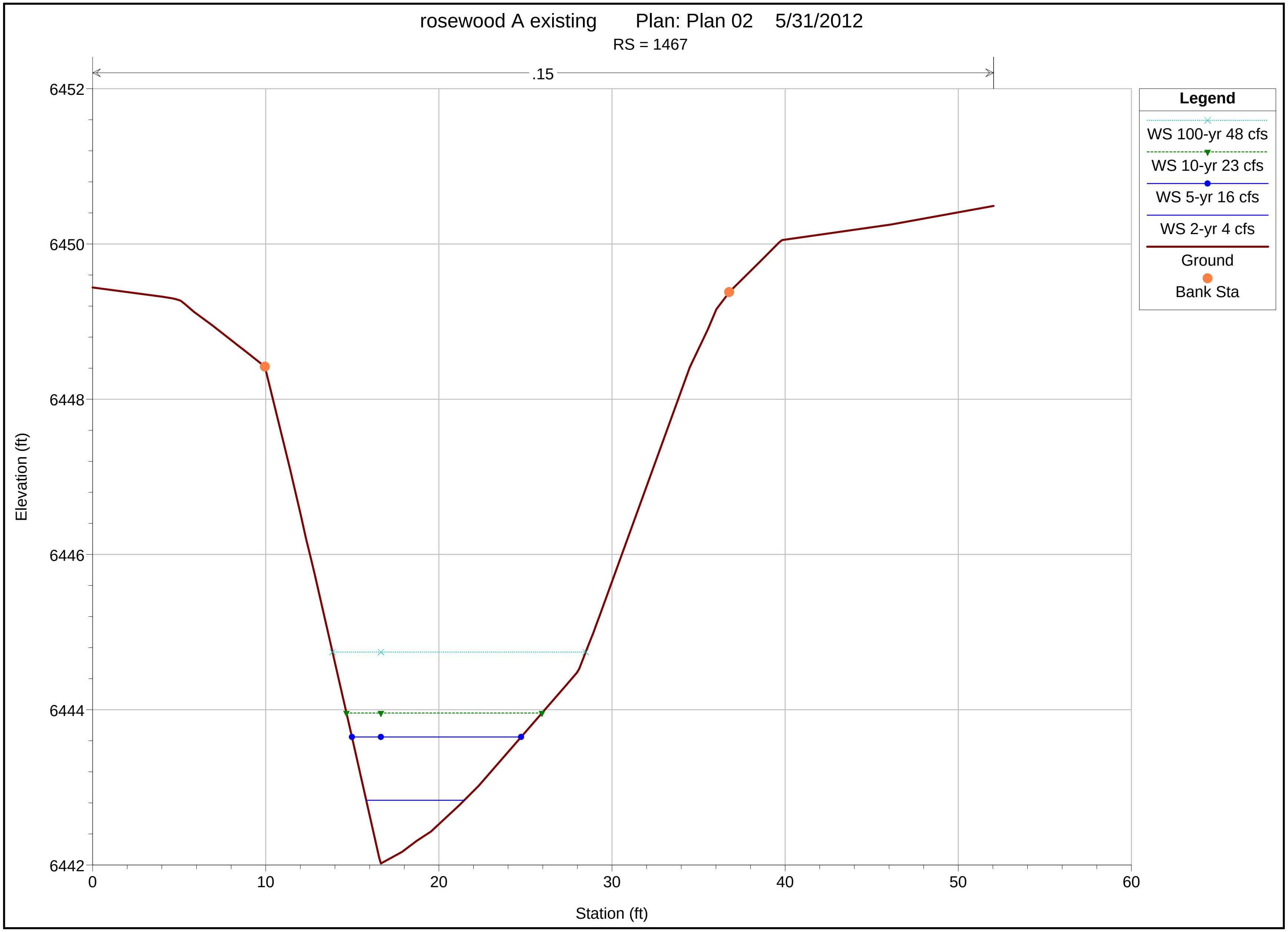


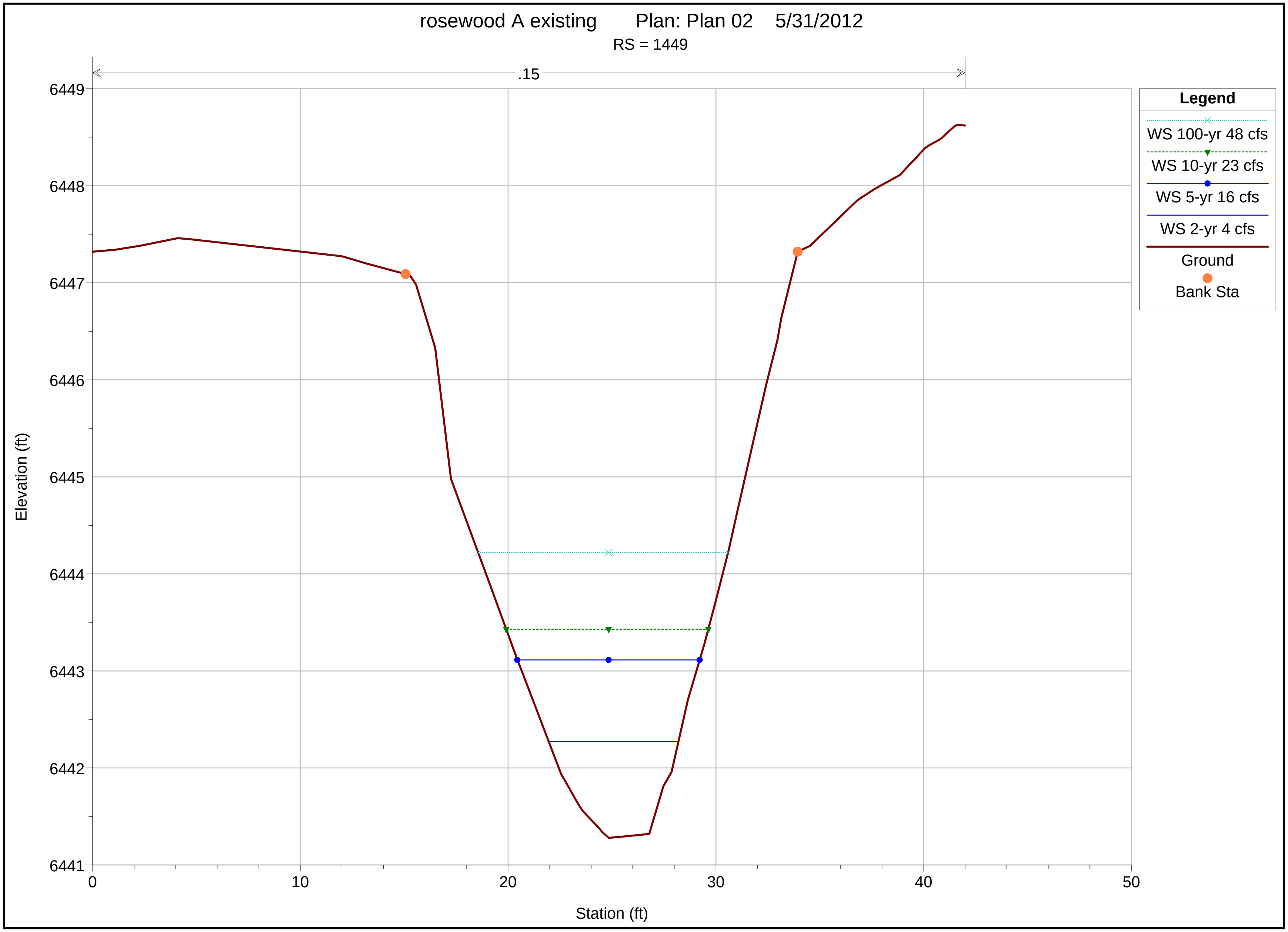
rosewood A existing Plan: Plan 02 5/31/2012

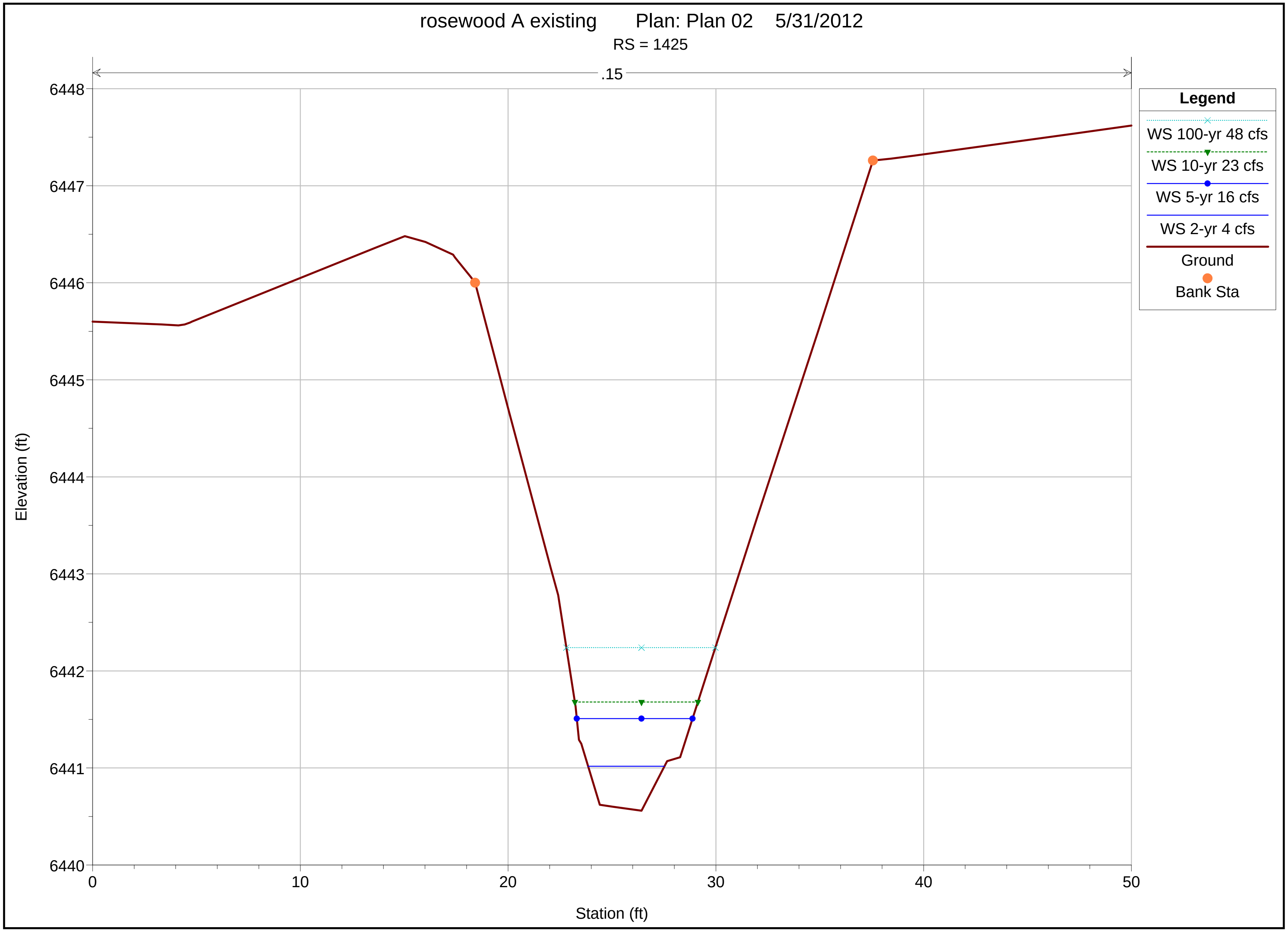
RS = 1550

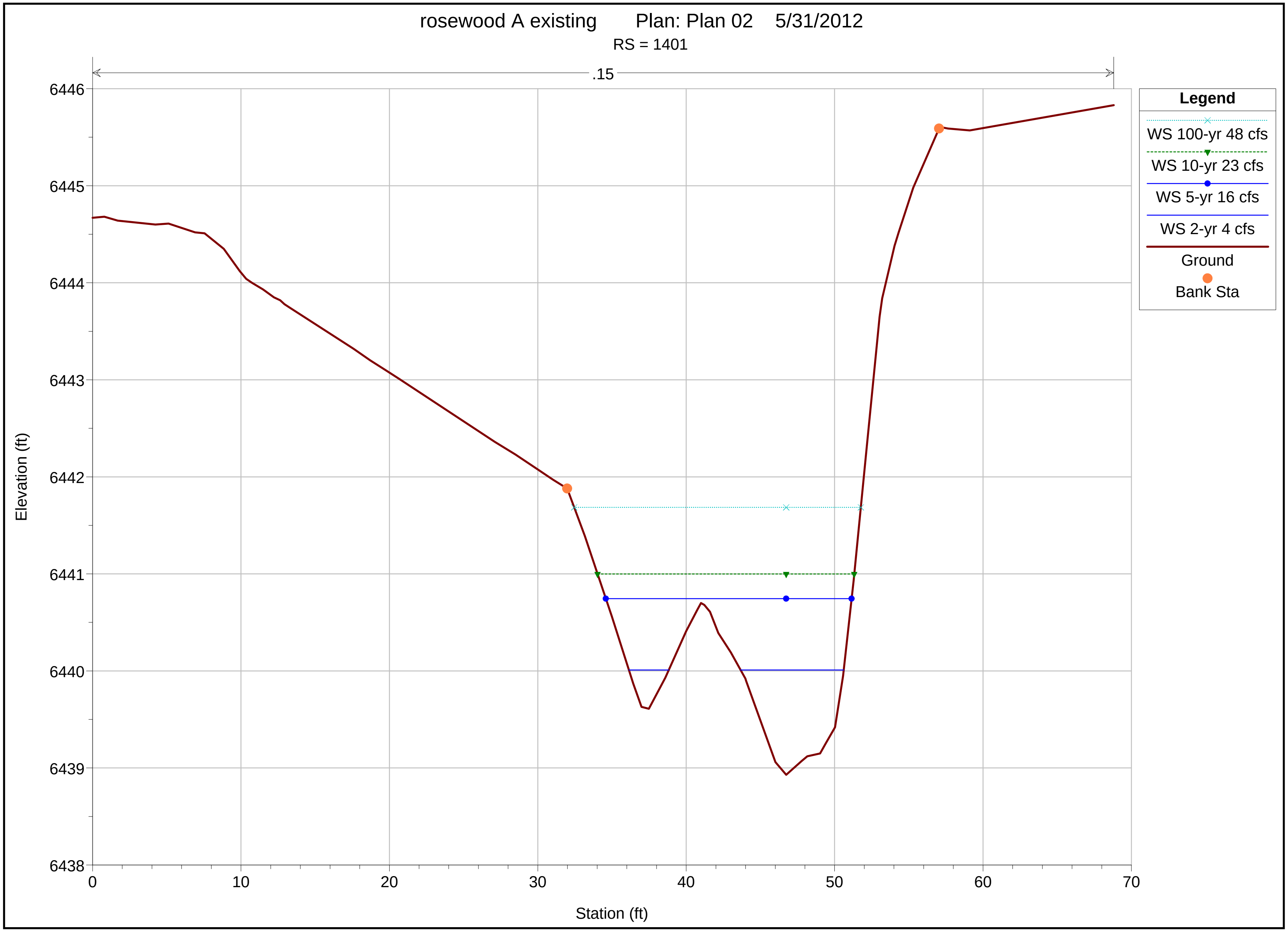

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1526
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6453
6452
6451
6450
6449
6448
6447
6446
6445
Station (ft)
0
5
10
15
20
25
30
35
40


rosewood A existing Plan: Plan 02 5/31/2012
RS = 1499
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6454
6452
6450
6448
6446
6444
Station (ft)
0
10
20
30
40
50

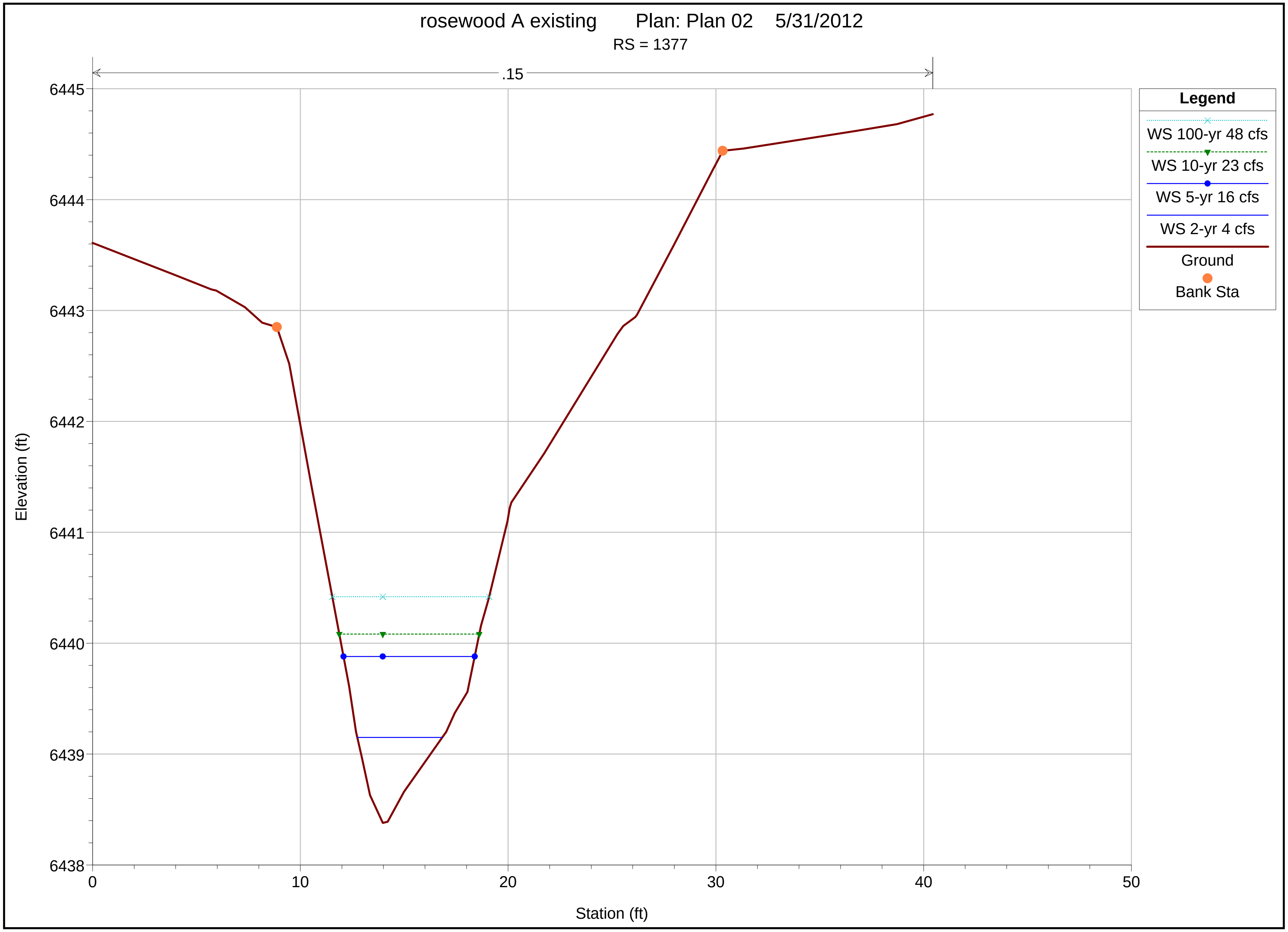

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1467
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6452
6450
6448
6446
6444
6442
Station (ft)
0
10
20
30
40
50
60

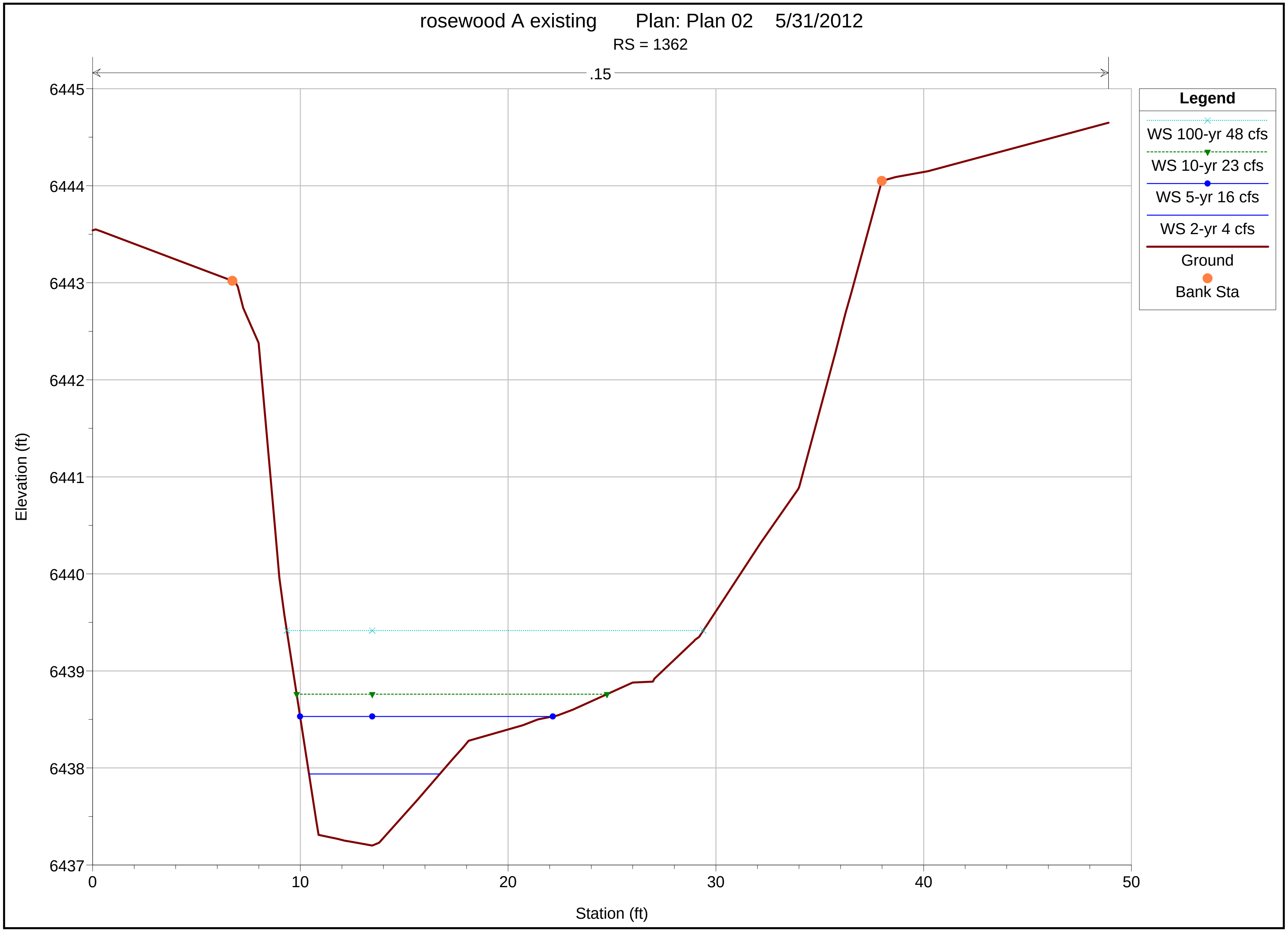

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1449
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6449
6448
6447
6446
6445
6444
6443
6442
6441
0
10
20
30
40
50
Station (ft)

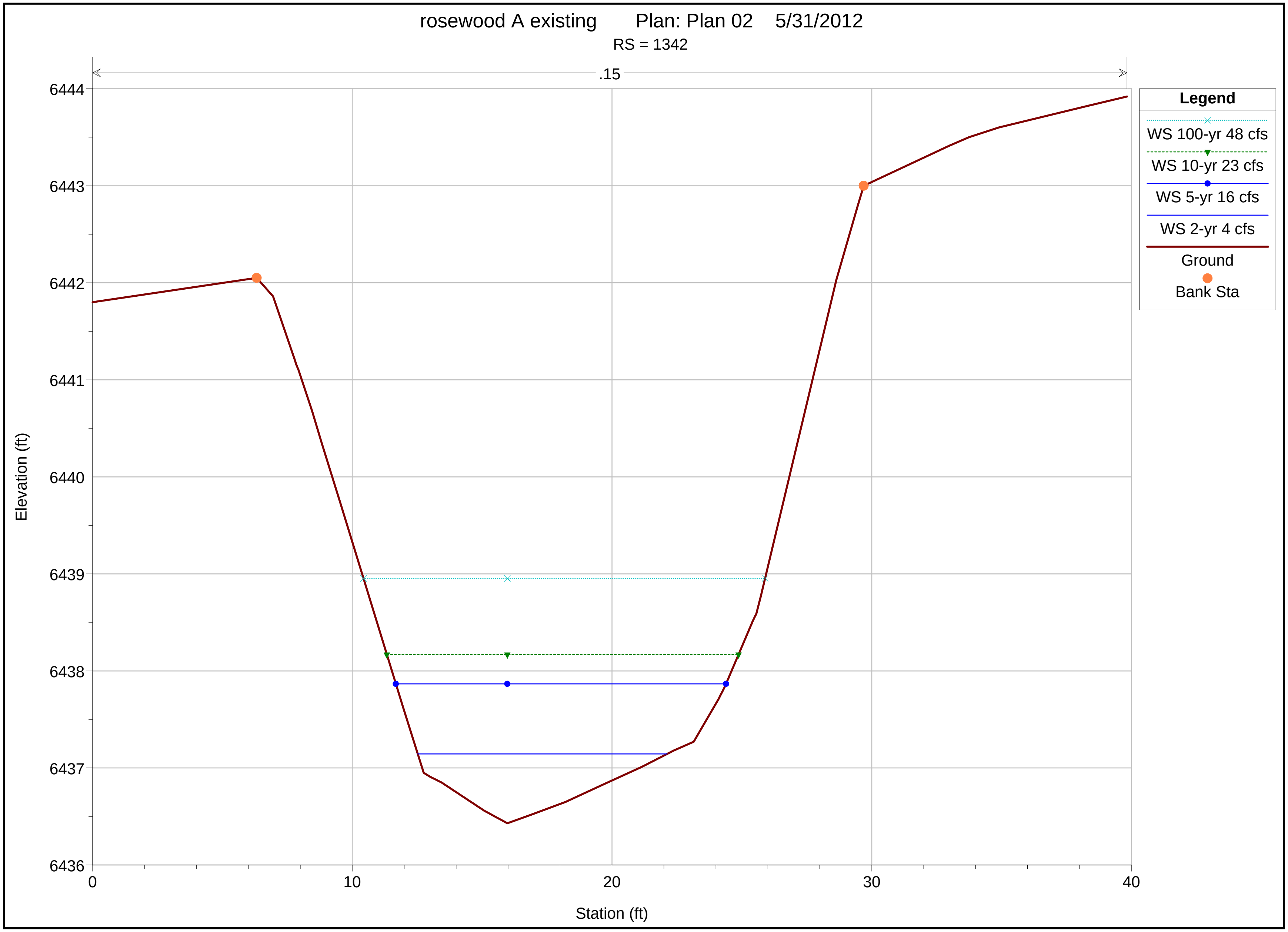

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1425
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6448
6447
6446
6445
6444
6443
6442
6441
6440
0
10
20
30
40
50
Station (ft)

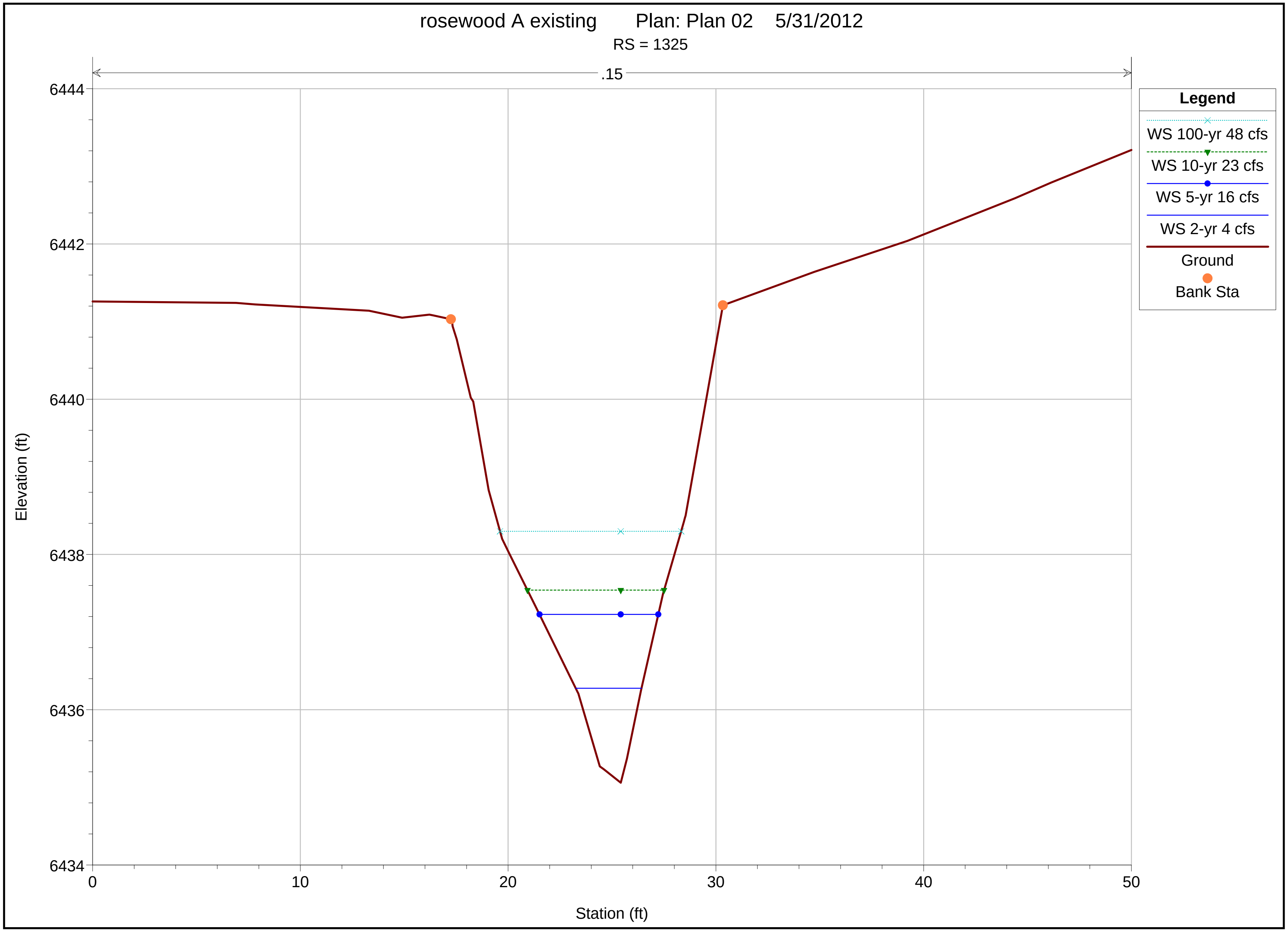


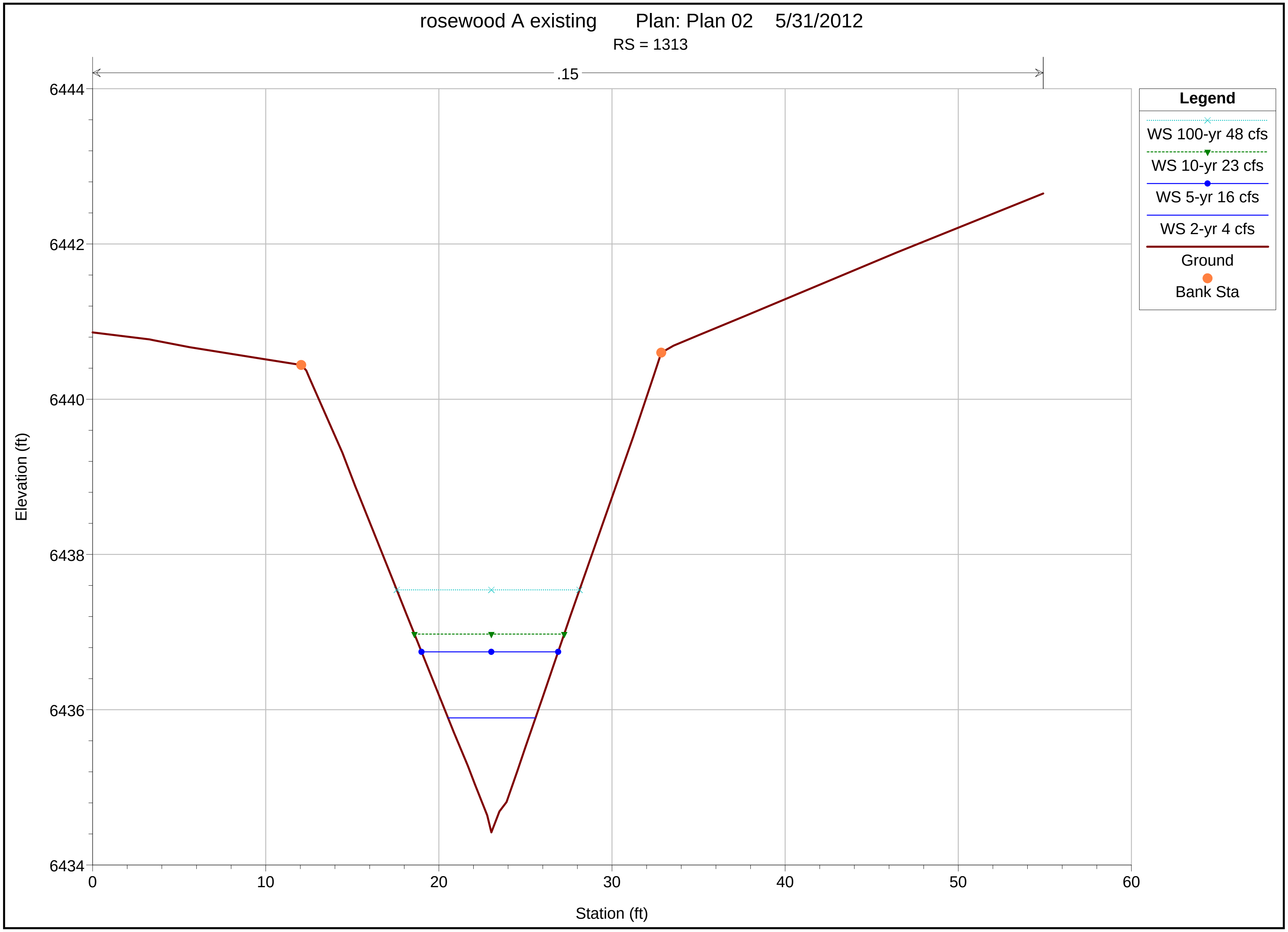
rosewood A existing Plan: Plan 02 5/31/2012
RS = 1401
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6446
6445
6444
6443
6442
6441
6440
6439
6438
Station (ft)
0
10
20
30
40
50
60
70

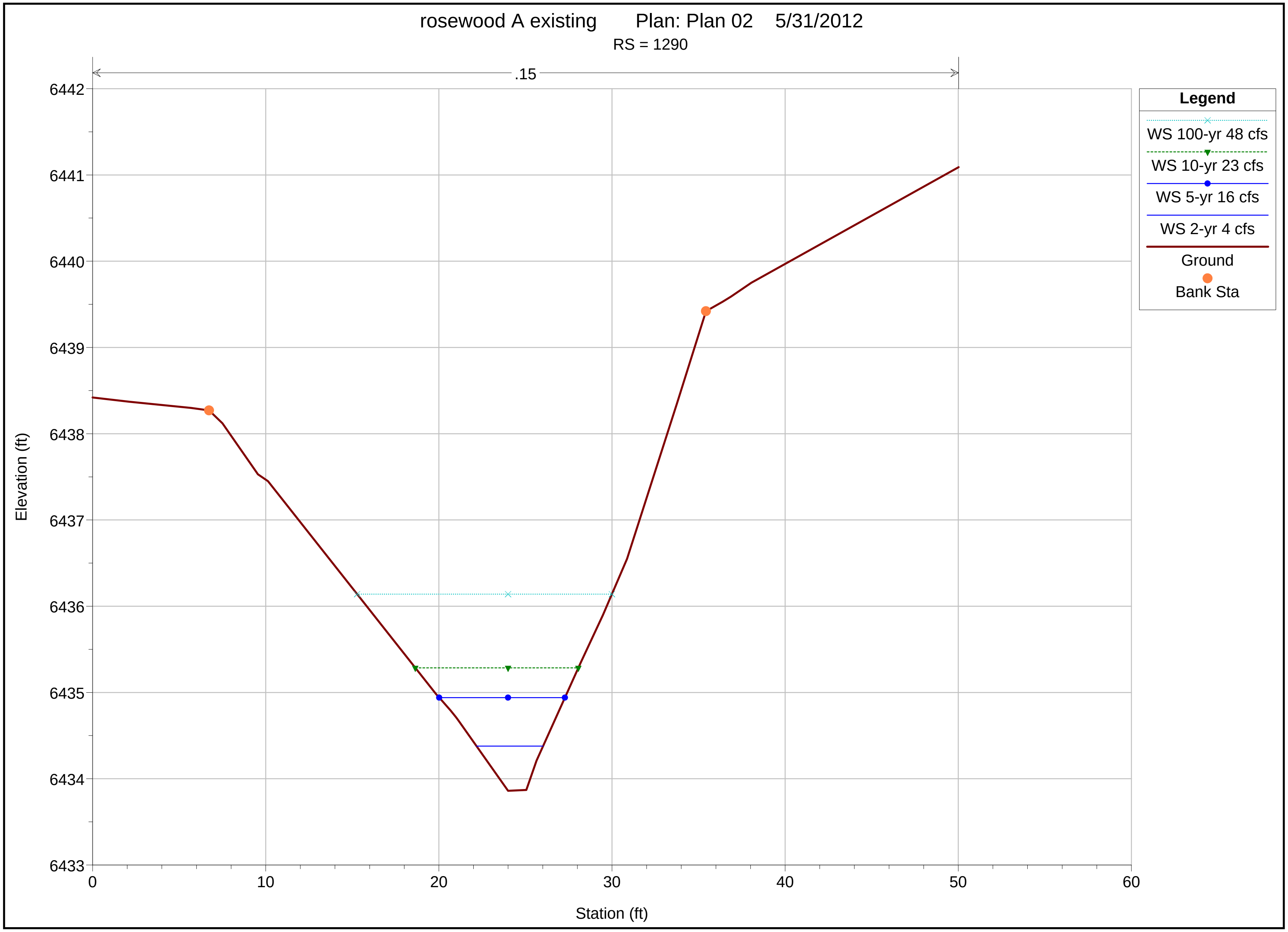

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1377
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6445
6444
6443
6442
6441
6440
6439
6438
Station (ft)
0
10
20
30
40
50

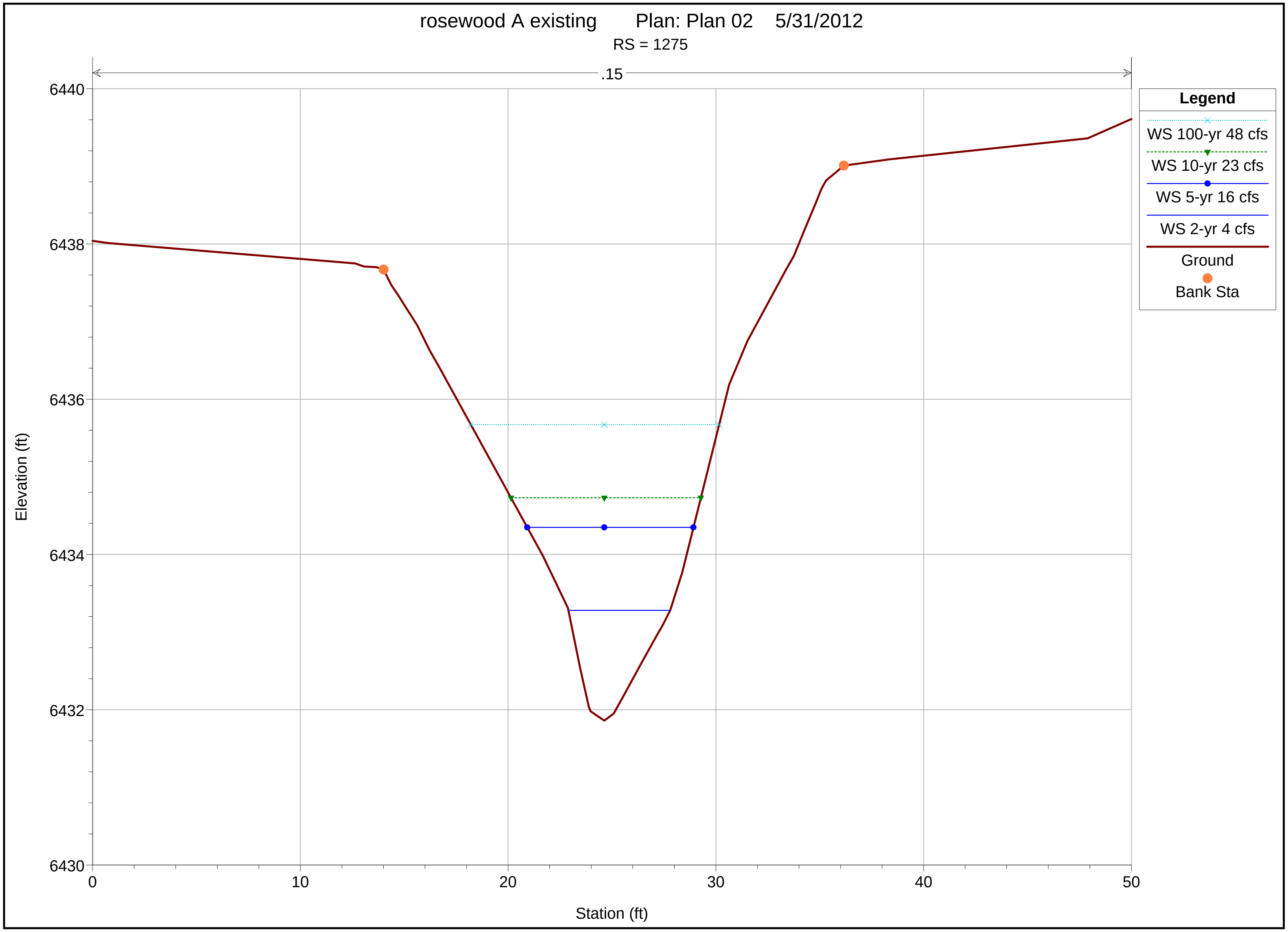

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1362
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6445
6444
6443
6442
6441
6440
6439
6438
6437
0
10
20
30
40
50
Station (ft)

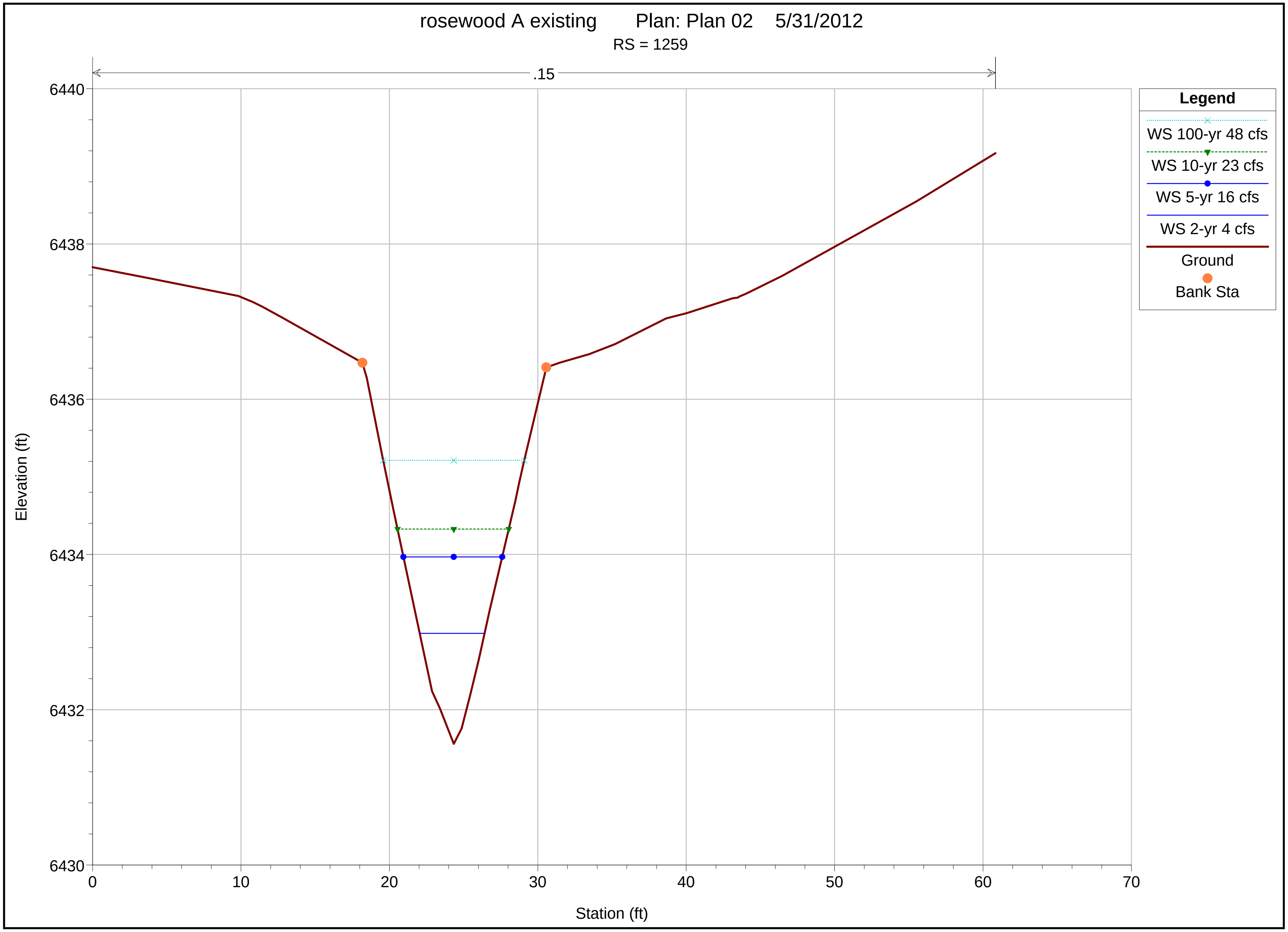

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1342
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6444
6443
6442
6441
6440
6439
6438
6437
6436
0
10
20
30
40
Station (ft)

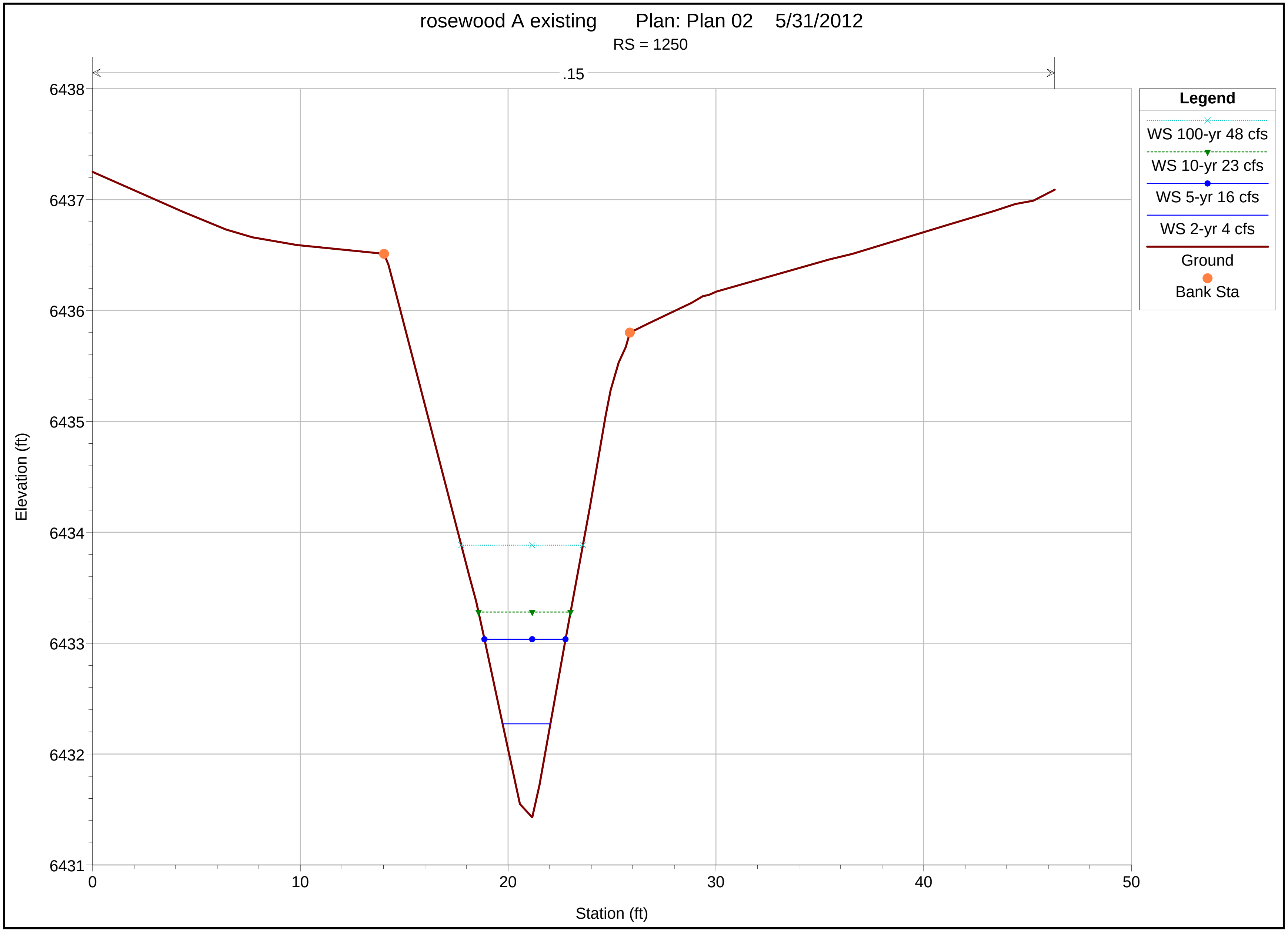

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1325
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6444
6442
6440
6438
6436
6434
Station (ft)
0
10
20
30
40
50

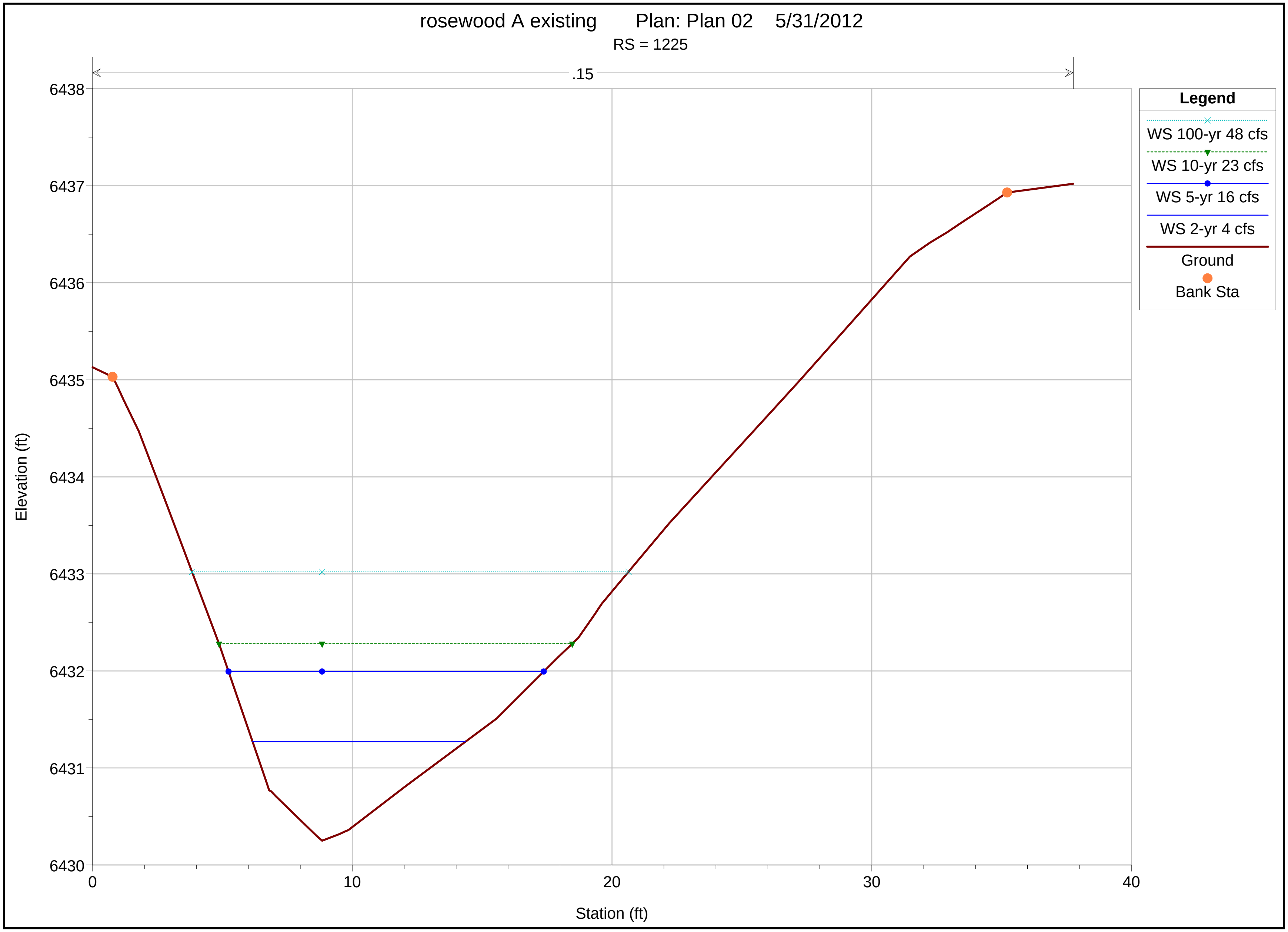

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1313
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6444
6442
6440
6438
6436
6434
0
10
20
30
40
50
60
Station (ft)

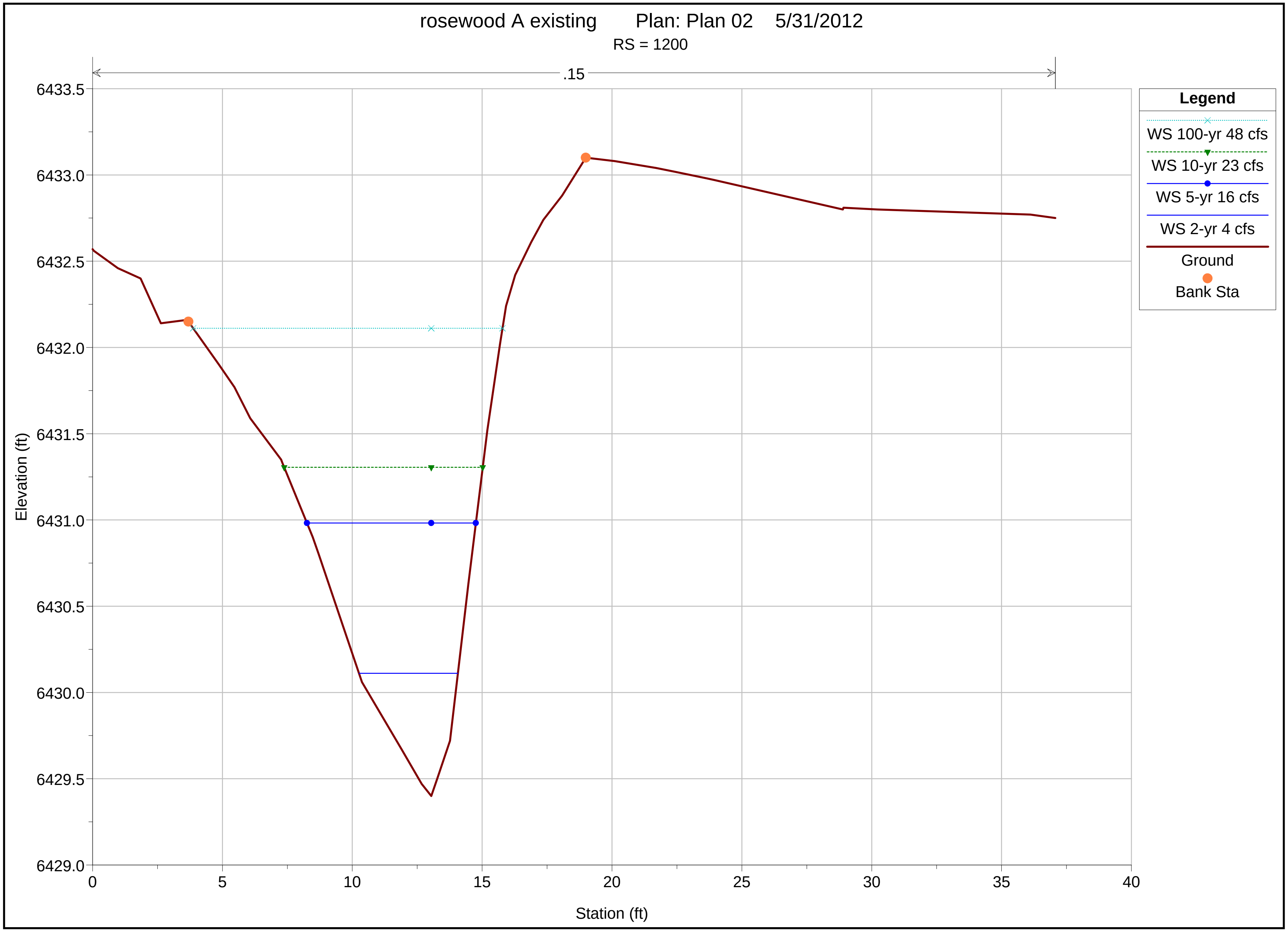

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1290
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6442
6441
6440
6439
6438
6437
6436
6435
6434
6433
0
10
20
30
40
50
60
Station (ft)

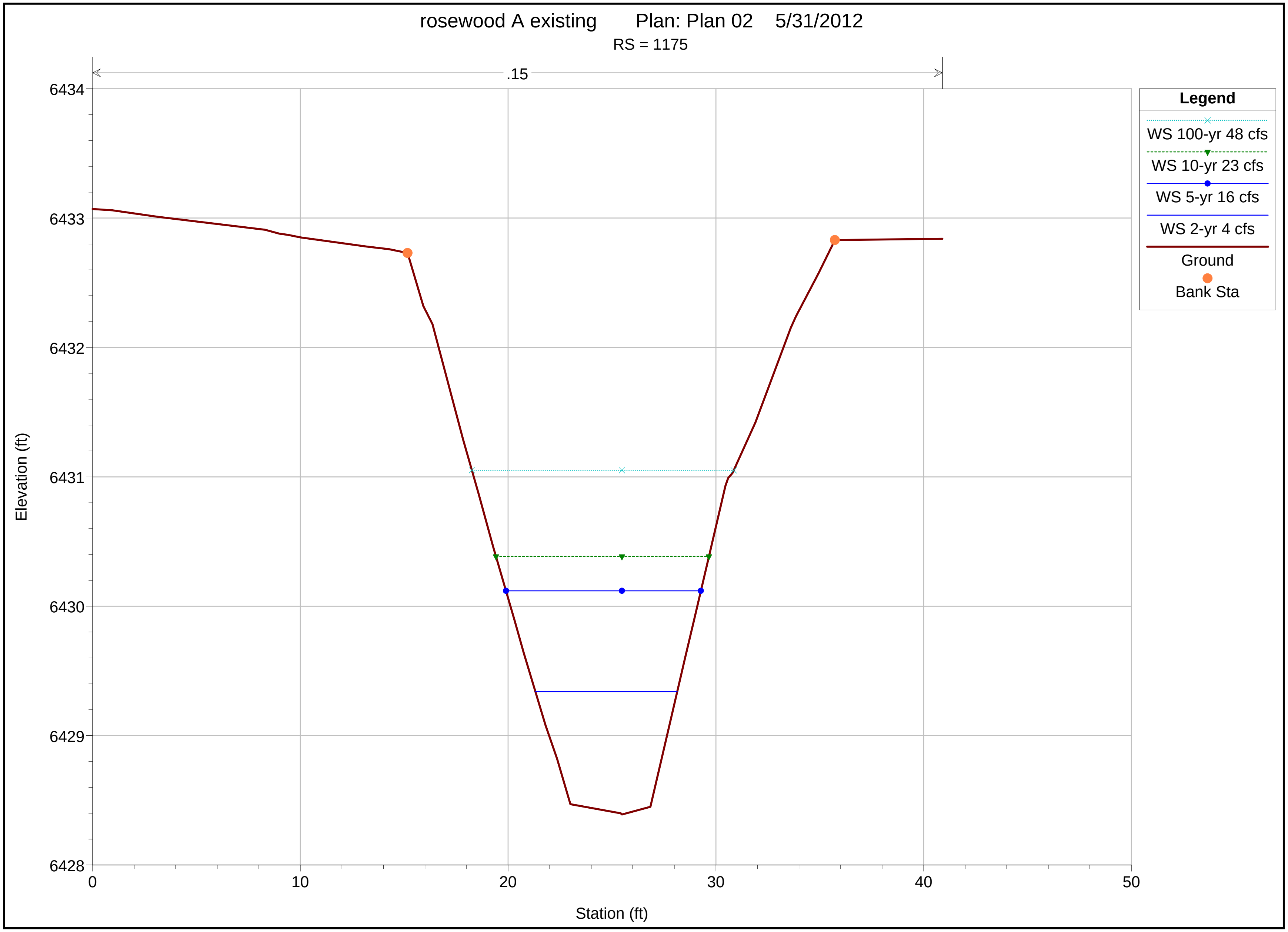

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1275
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6440
6438
6436
6434
6432
6430
Station (ft)
0
10
20
30
40
50

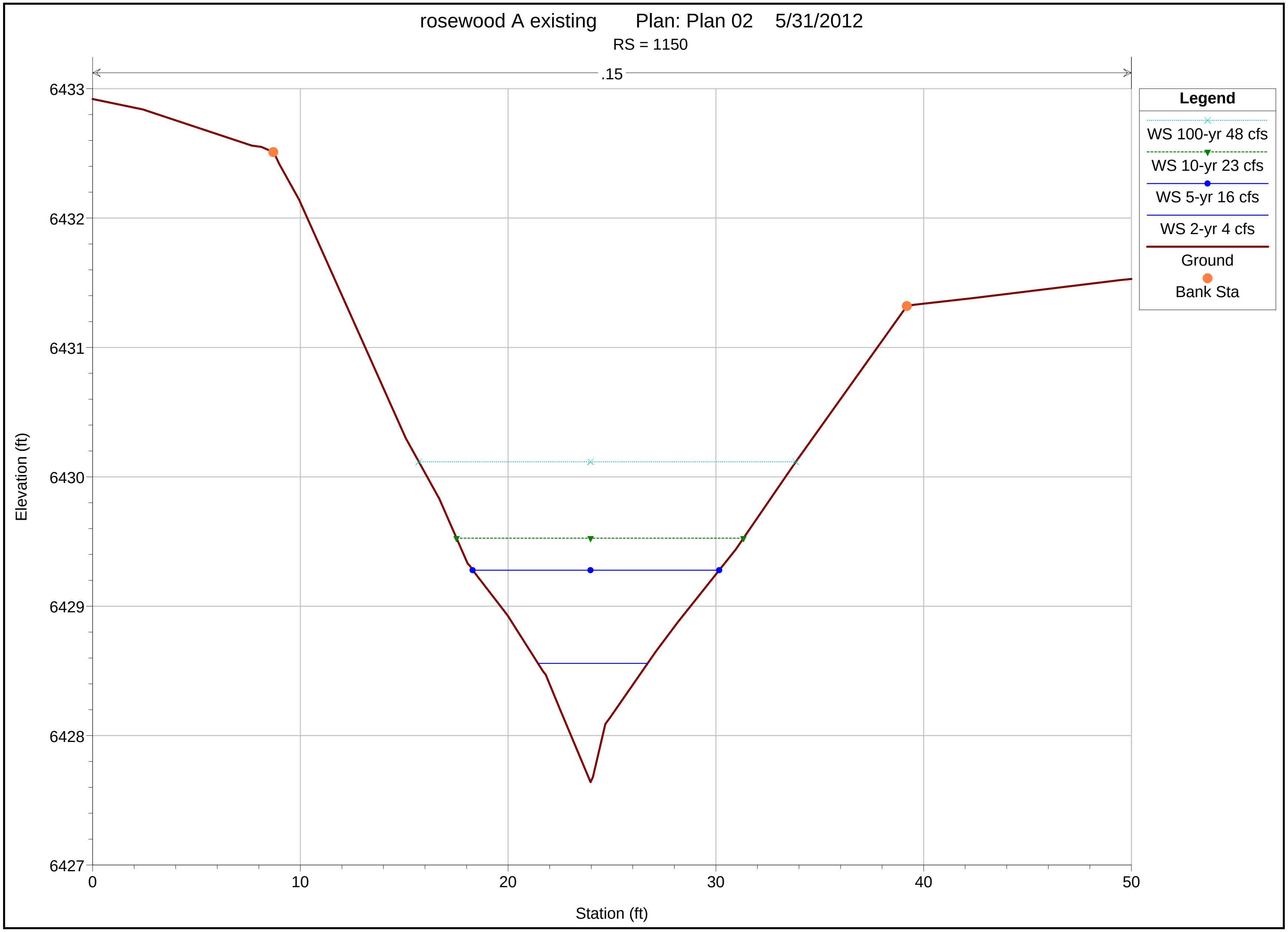

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1259
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6440
6438
6436
6434
6432
6430
Station (ft)
0
10
20
30
40
50
60
70

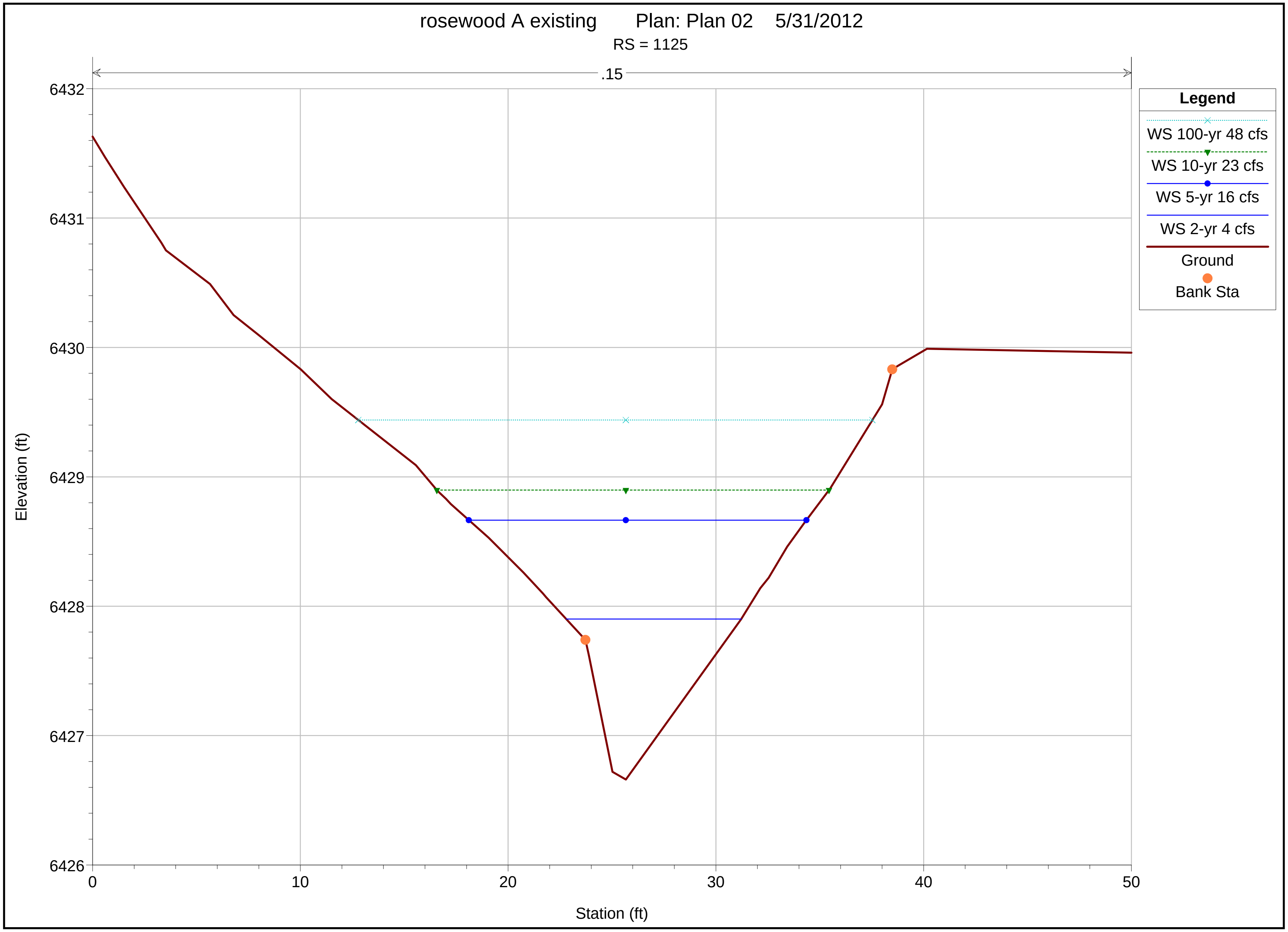

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1250
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6438
6437
6436
6435
6434
6433
6432
6431
0
10
20
30
40
50
Station (ft)

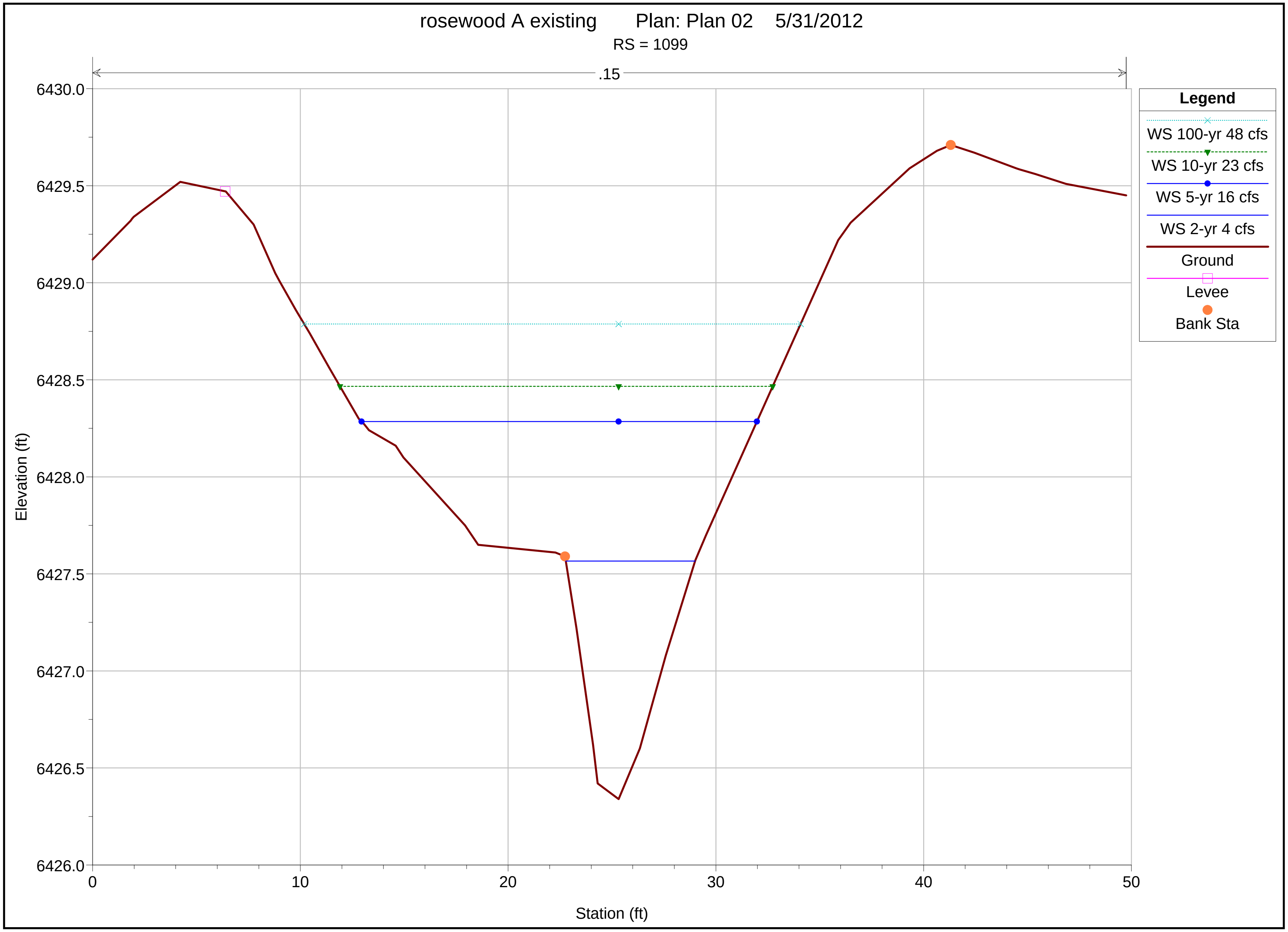

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1225
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6438
6437
6436
6435
6434
6433
6432
6431
6430
Station (ft)
0
10
20
30
40

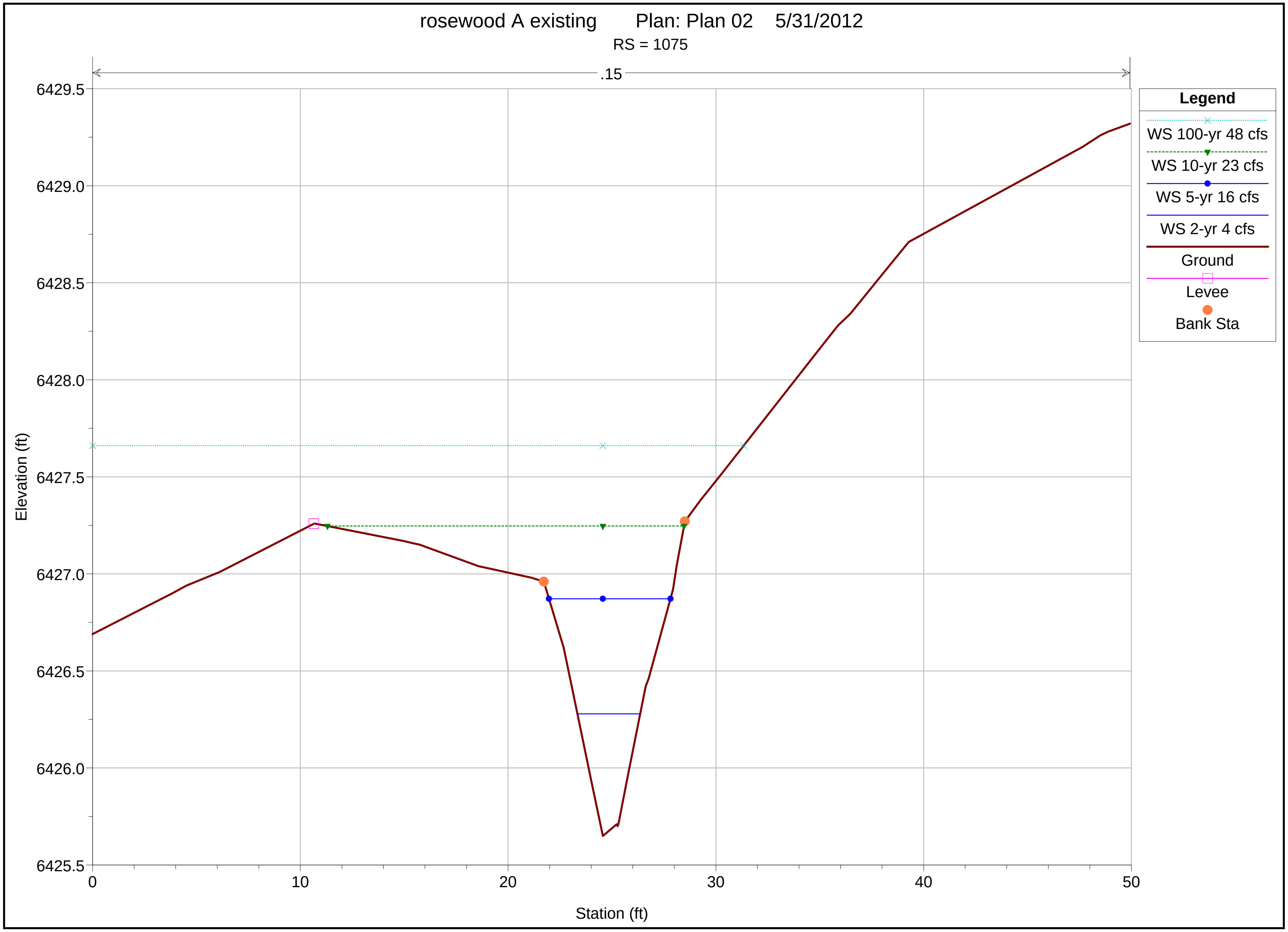

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1200
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6433.5
6433.0
6432.5
6432.0
6431.5
6431.0
6430.5
6430.0
6429.5
6429.0
Station (ft)
0
5
10
15
20
25
30
35
40


rosewood A existing Plan: Plan 02 5/31/2012
RS = 1175
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6434
6433
6432
6431
6430
6429
6428
Station (ft)
0
10
20
30
40
50

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1150
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6433
6432
6431
6430
6429
6428
6427
Station (ft)
0
10
20
30
40
50

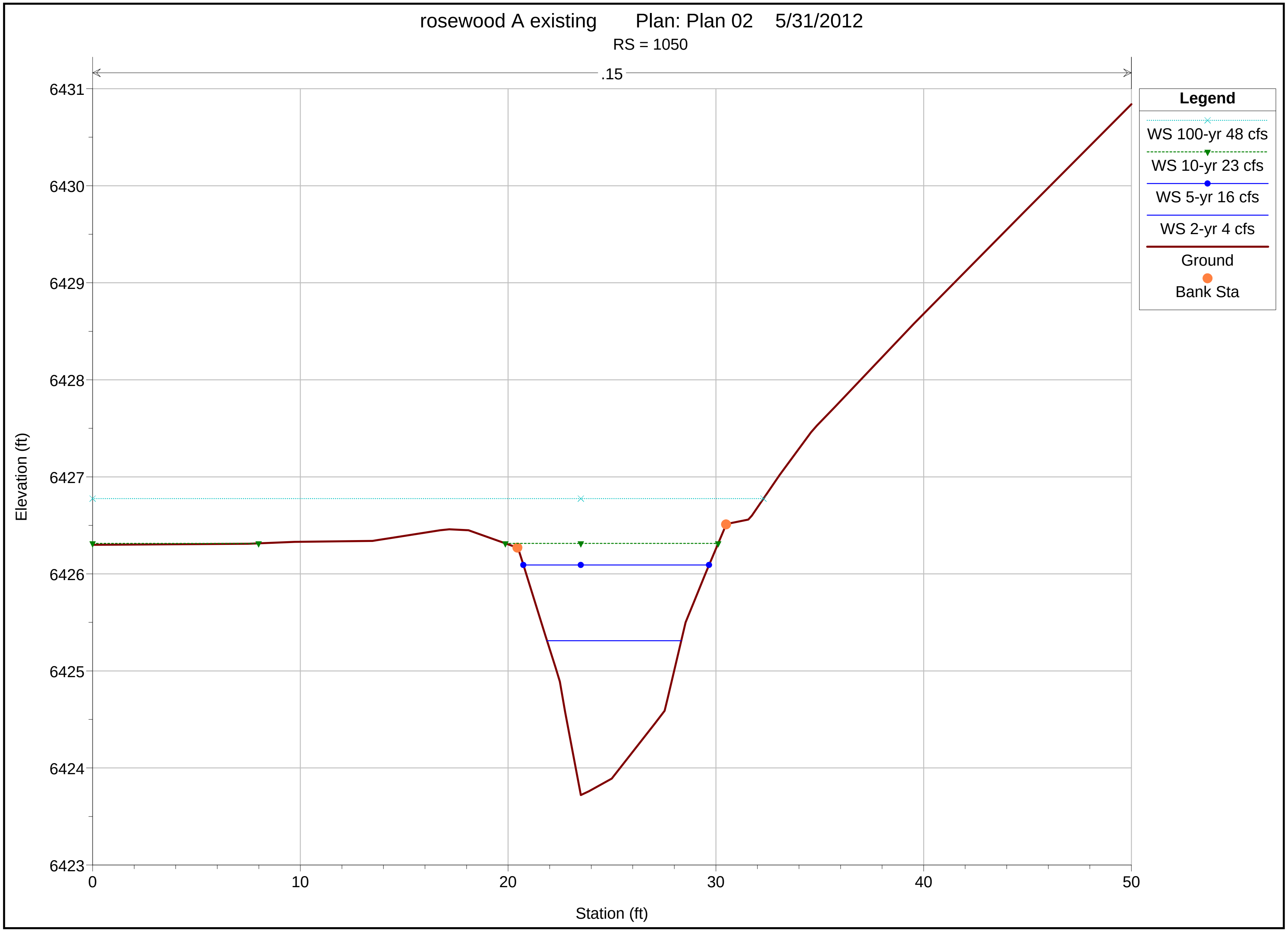

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1125
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6432
6431
6430
6429
6428
6427
6426
Station (ft)
0
10
20
30
40
50


rosewood A existing Plan: Plan 02 5/31/2012
RS = 1099
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6430.0
6429.5
6429.0
6428.5
6428.0
6427.5
6427.0
6426.5
6426.0
Station (ft)
0
10
20
30
40
50

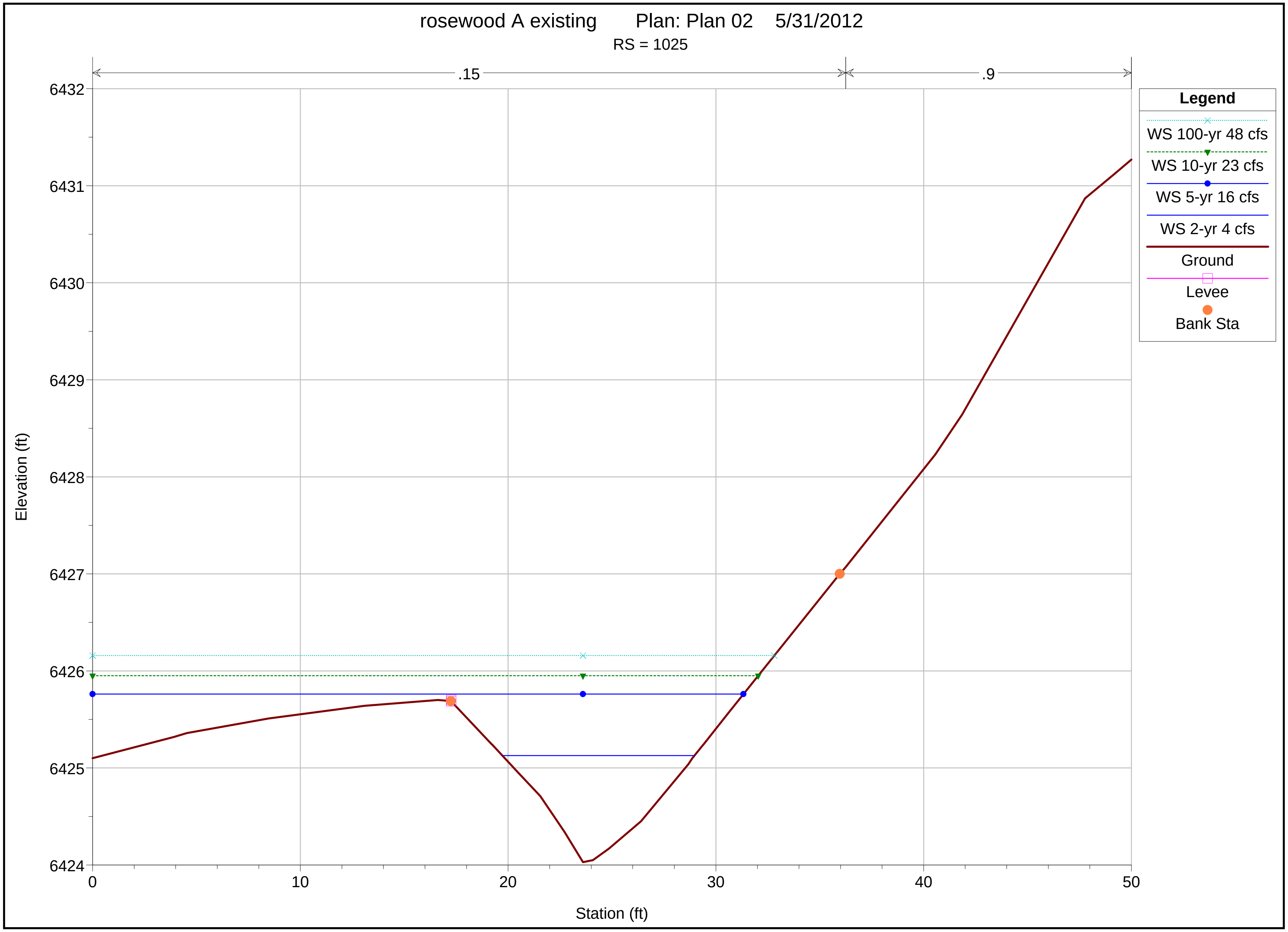


rosewood A existing Plan: Plan 02 5/31/2012

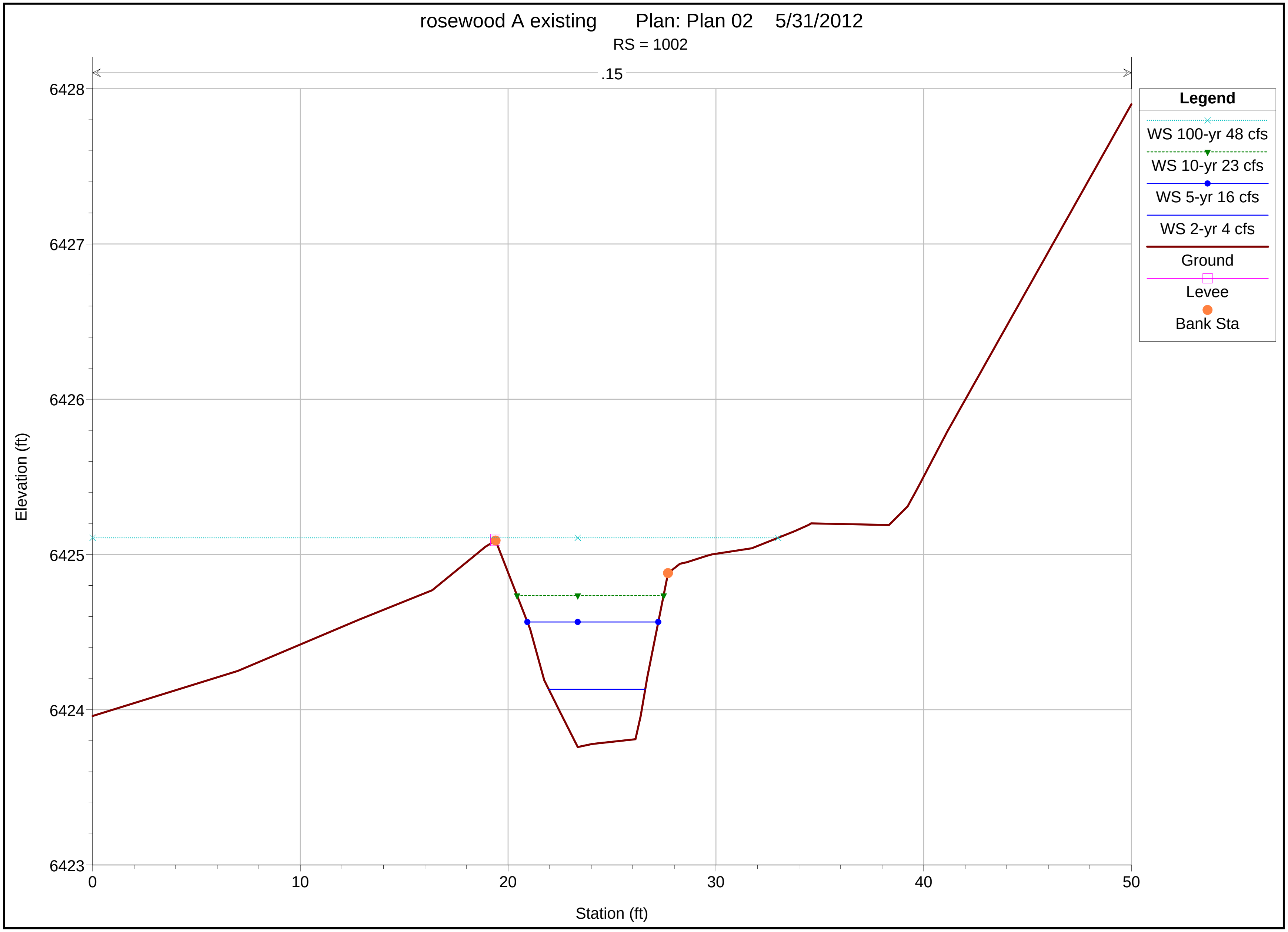
RS = 1075

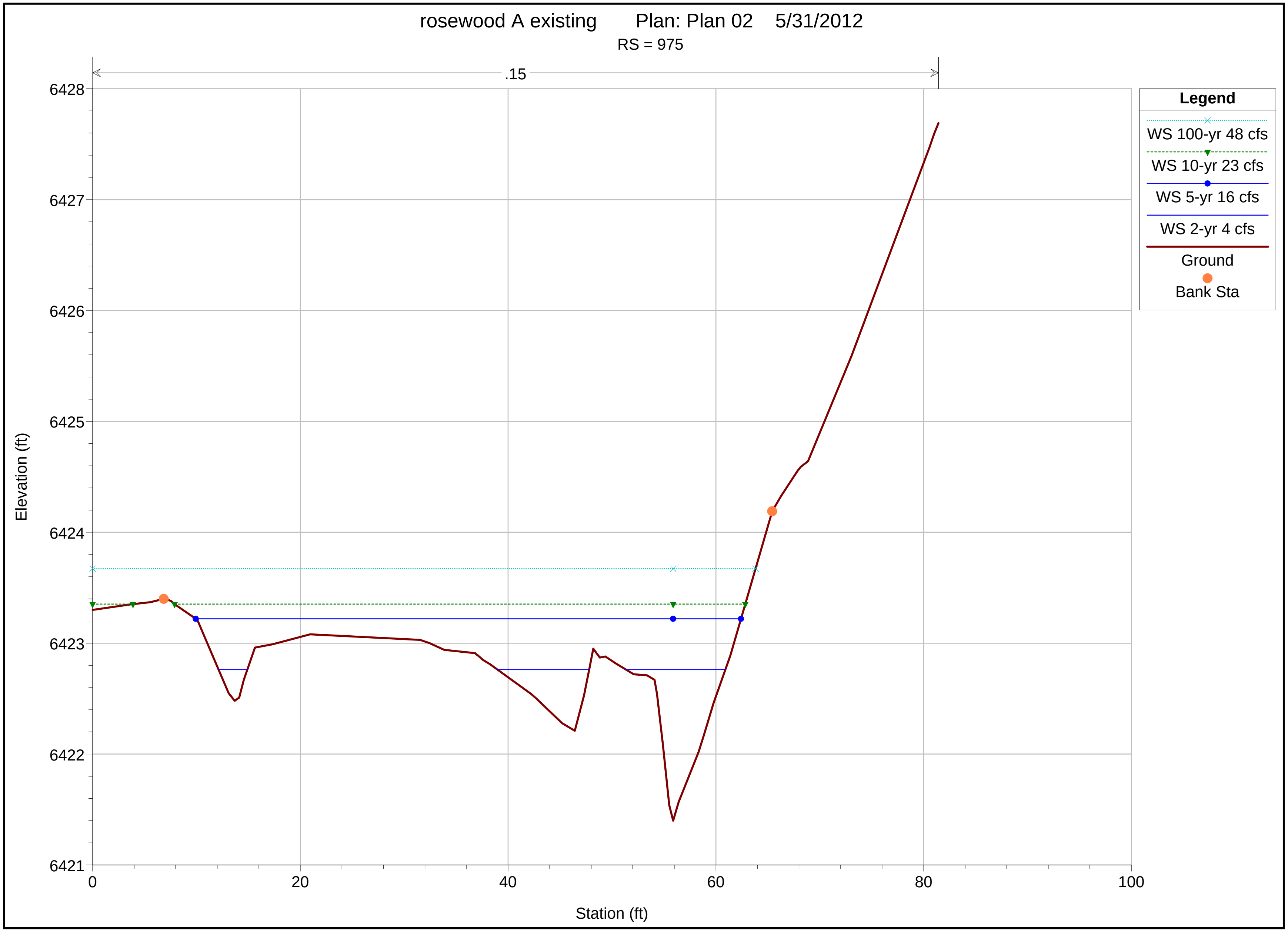


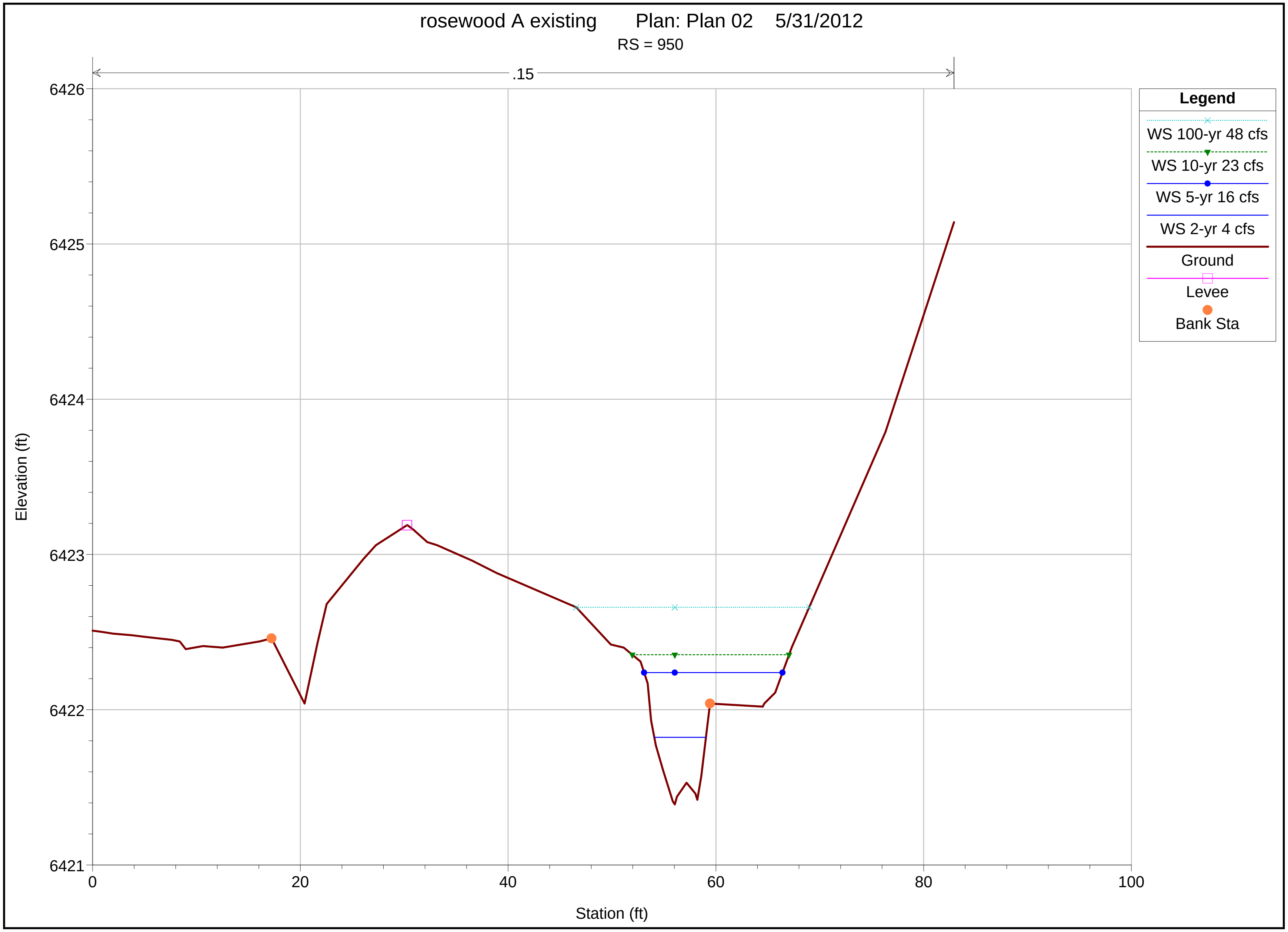
rosewood A existing Plan: Plan 02 5/31/2012
RS = 1050
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6431
6430
6429
6428
6427
6426
6425
6424
6423
0
10
20
30
40
50
Station (ft)

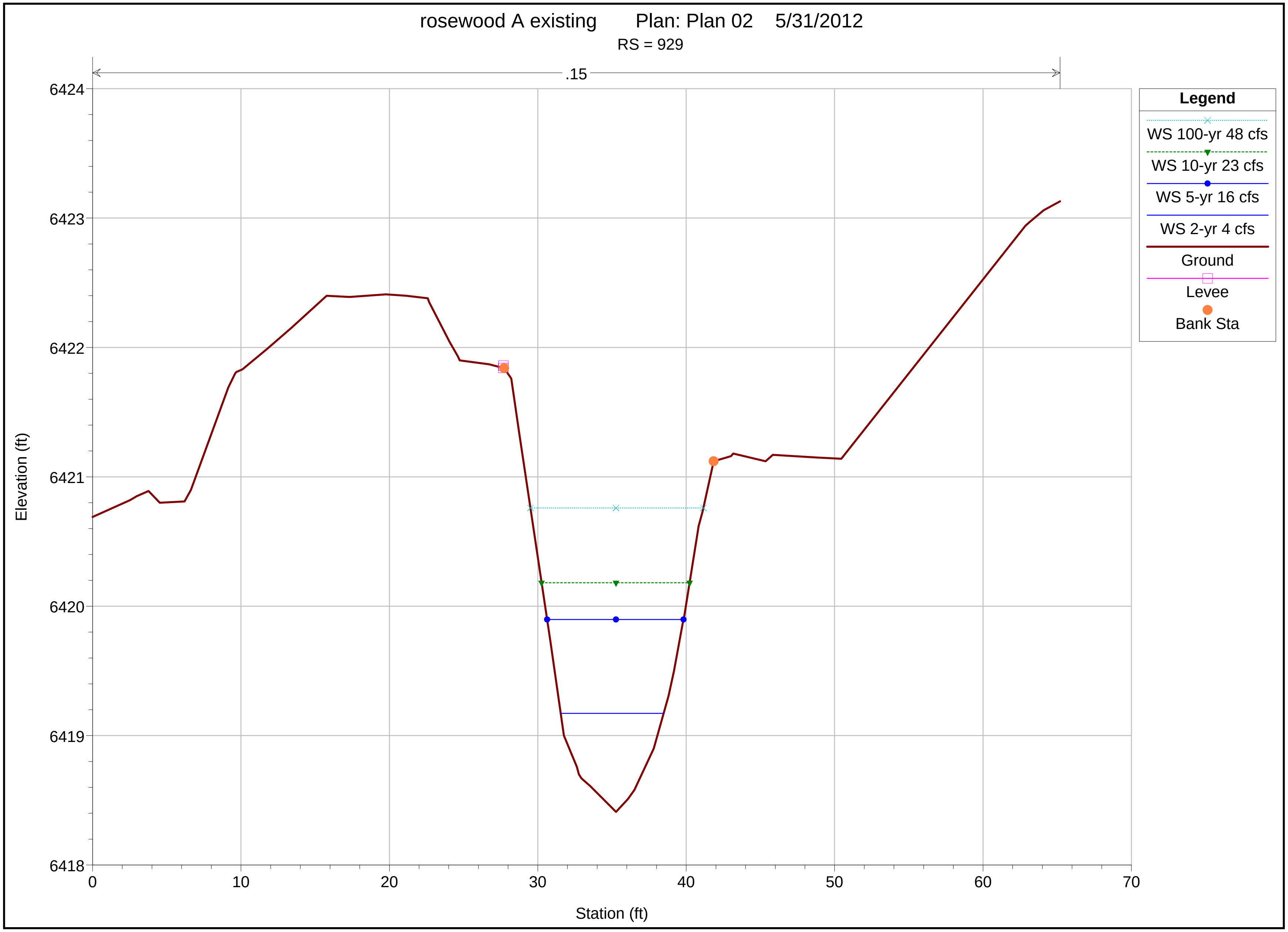


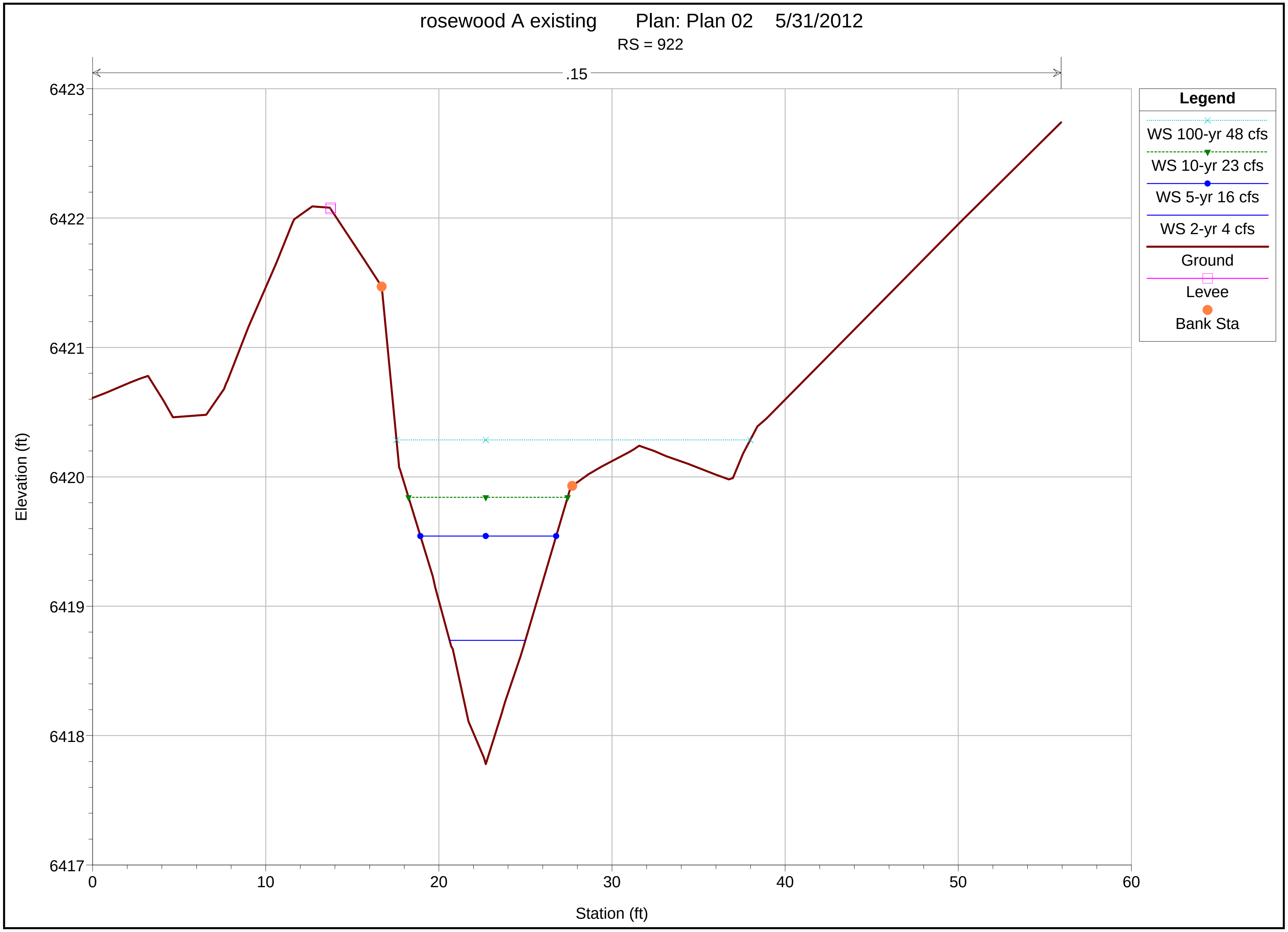
rosewood A existing Plan: Plan 02 5/31/2012
RS = 1025
.15
.9
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6432
6431
6430
6429
6428
6427
6426
6425
6424
0
10
20
30
40
50
Station (ft)

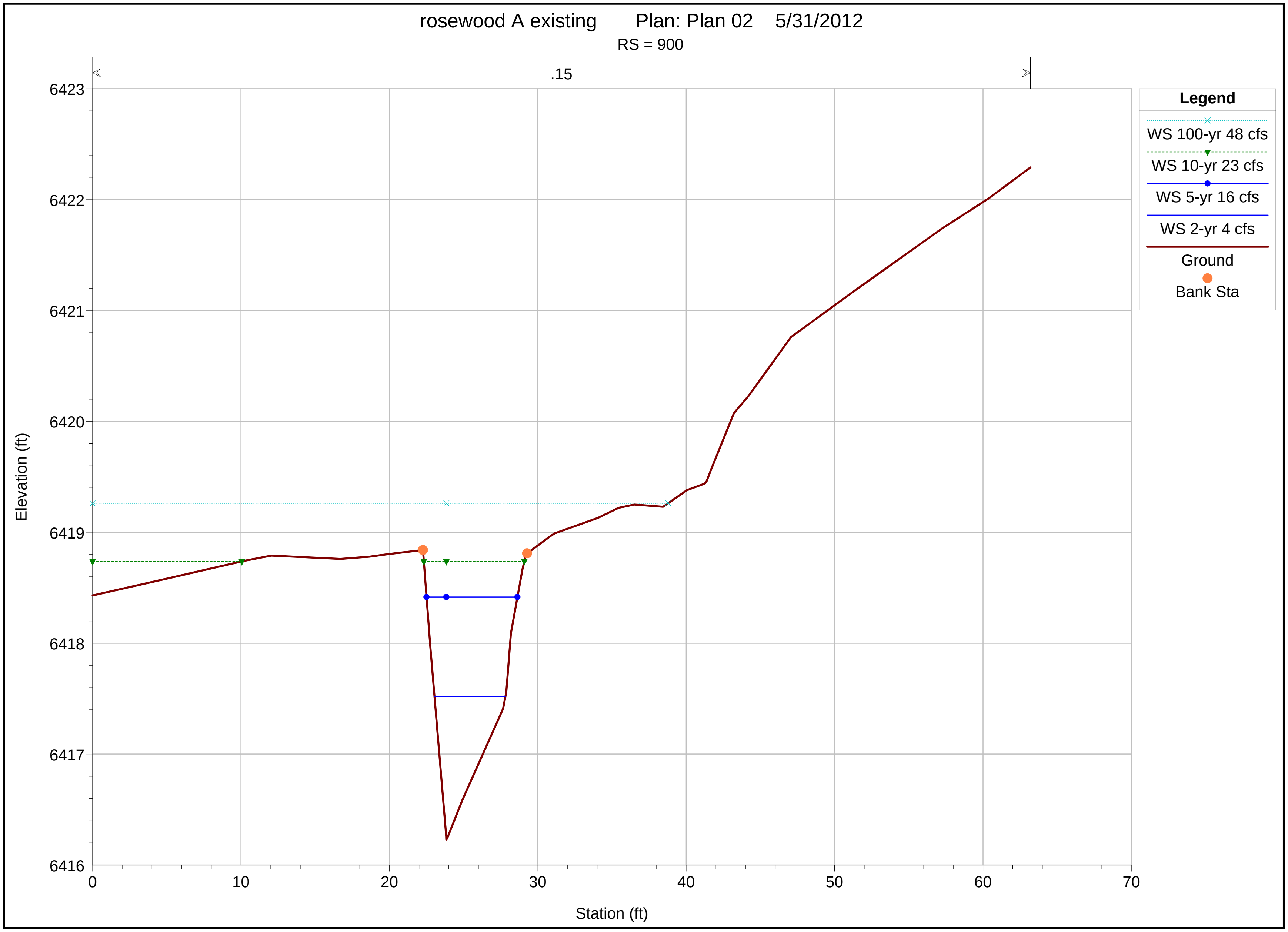

rosewood A existing Plan: Plan 02 5/31/2012
RS = 1002
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6428
6427
6426
6425
6424
6423
Station (ft)
0
10
20
30
40
50

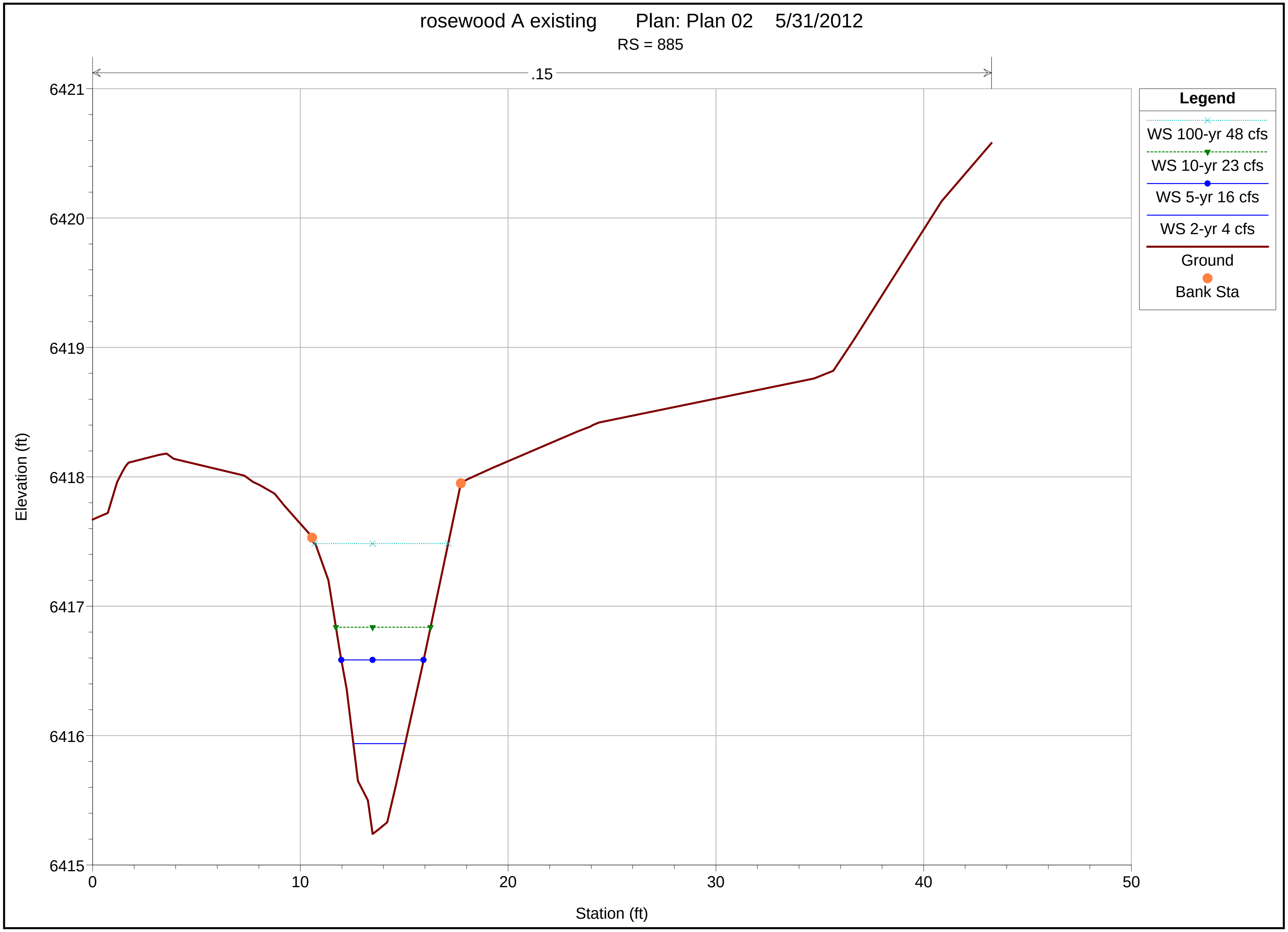

rosewood A existing Plan: Plan 02 5/31/2012
RS = 975
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6428
6427
6426
6425
6424
6423
6422
6421
0
20
40
60
80
100
Station (ft)

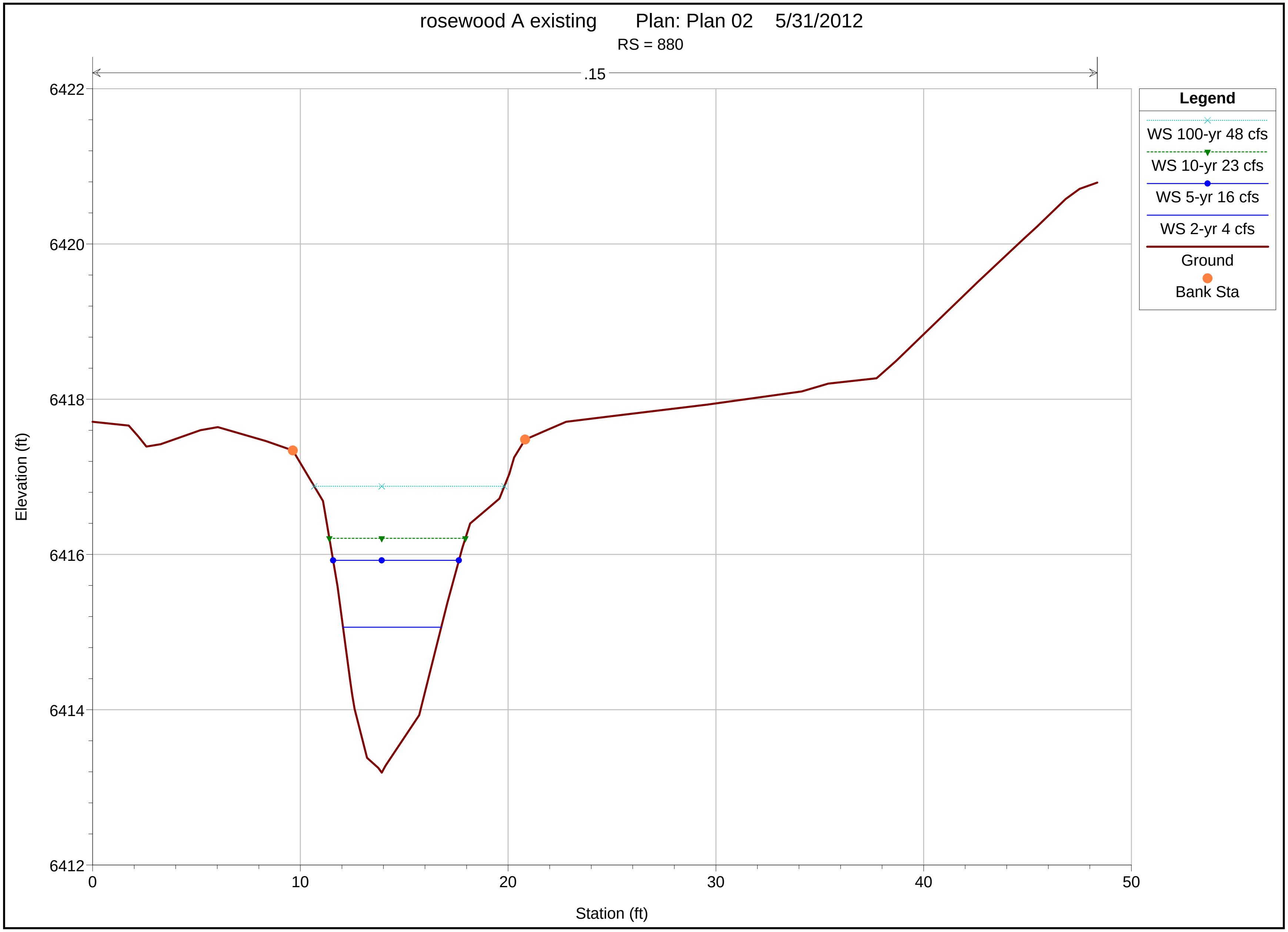

rosewood A existing Plan: Plan 02 5/31/2012
RS = 950
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6426
6425
6424
6423
6422
6421
0
20
40
60
80
100
Station (ft)

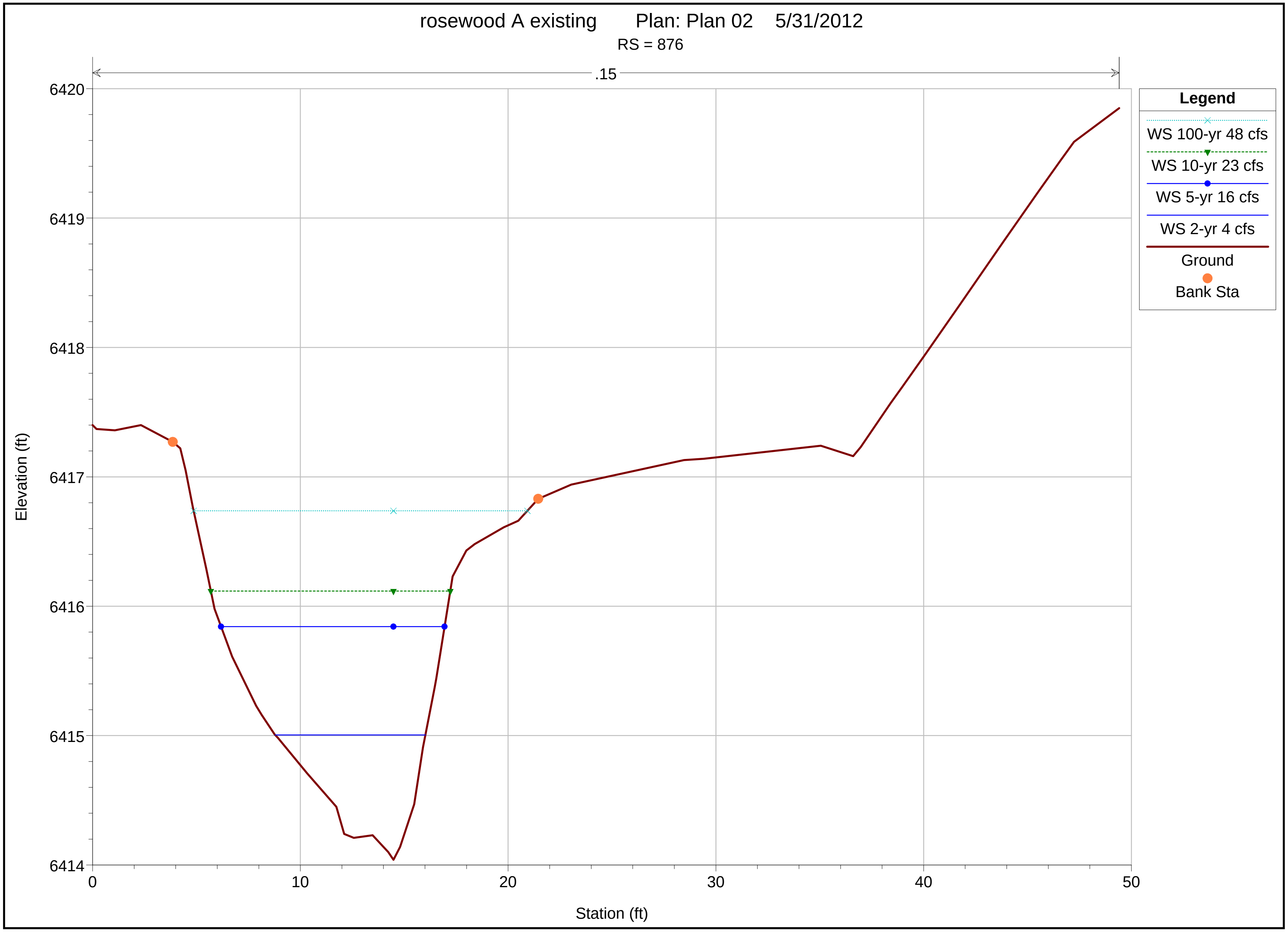

rosewood A existing Plan: Plan 02 5/31/2012
RS = 929
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6424
6423
6422
6421
6420
6419
6418
Station (ft)
0
10
20
30
40
50
60
70

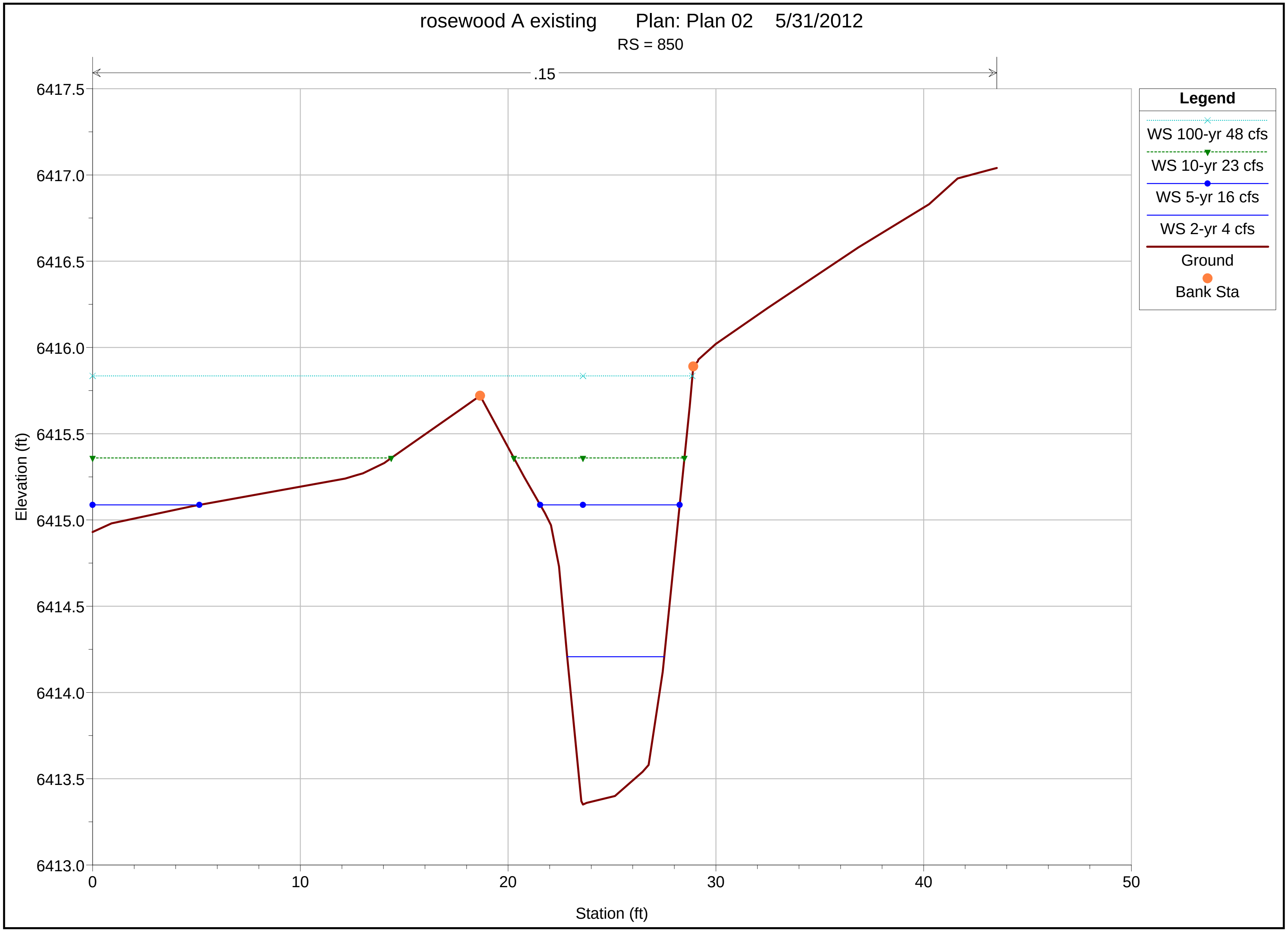

rosewood A existing Plan: Plan 02 5/31/2012
RS = 922
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6423
6422
6421
6420
6419
6418
6417
Station (ft)
0
10
20
30
40
50
60

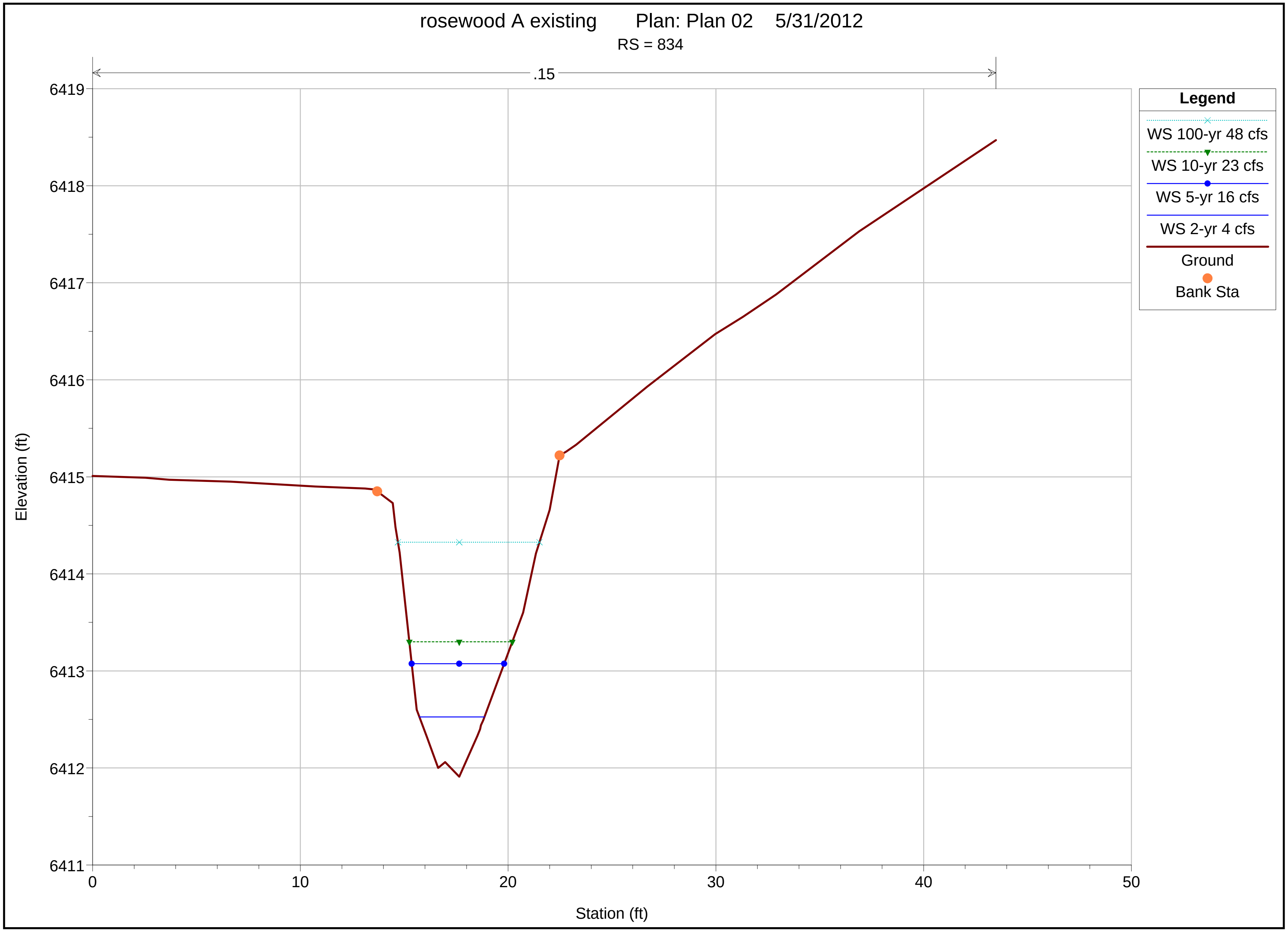

rosewood A existing Plan: Plan 02 5/31/2012
RS = 900
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6423
6422
6421
6420
6419
6418
6417
6416
Station (ft)
0
10
20
30
40
50
60
70

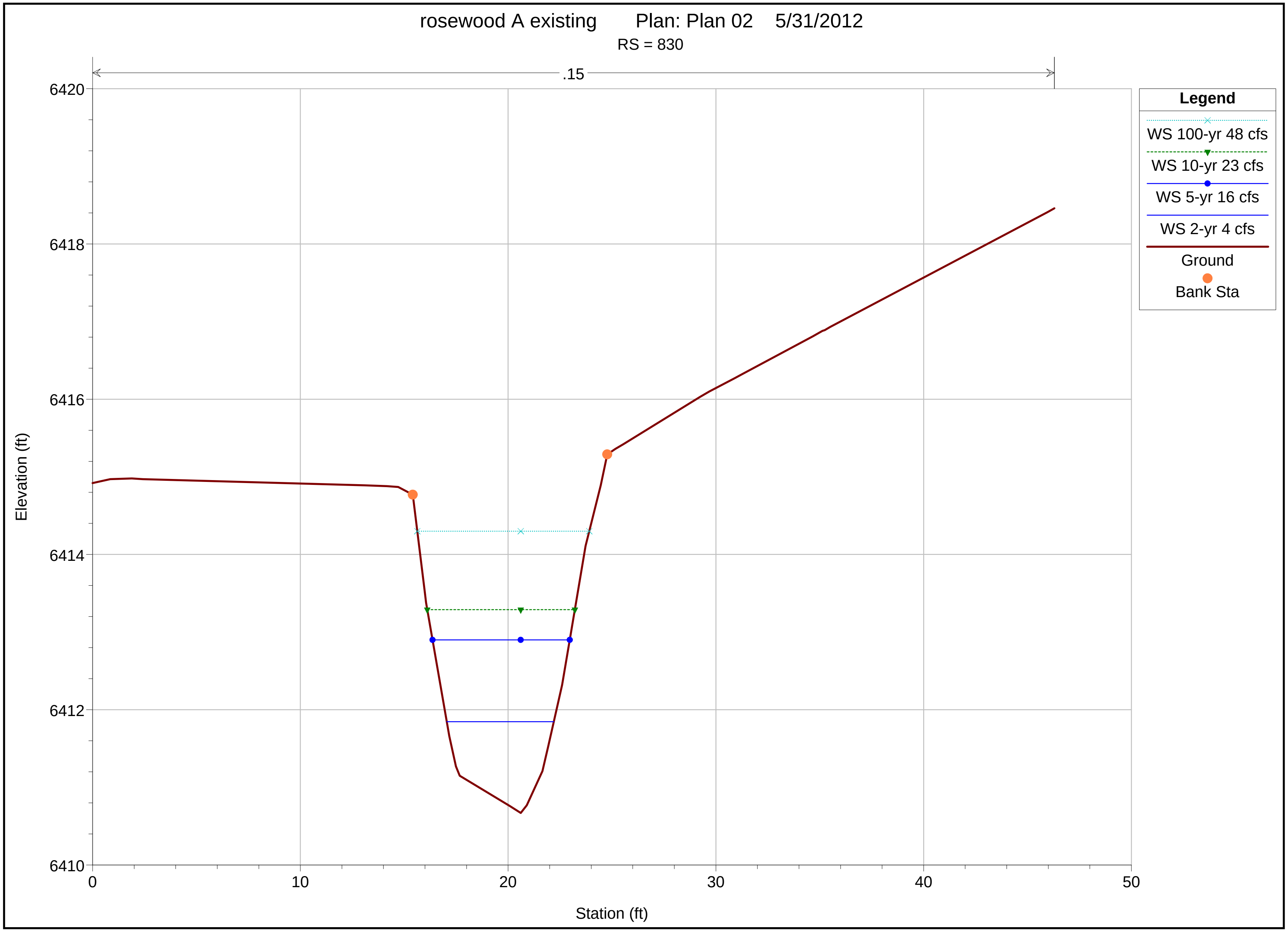

rosewood A existing Plan: Plan 02 5/31/2012
RS = 885
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6421
6420
6419
6418
6417
6416
6415
Station (ft)
0
10
20
30
40
50

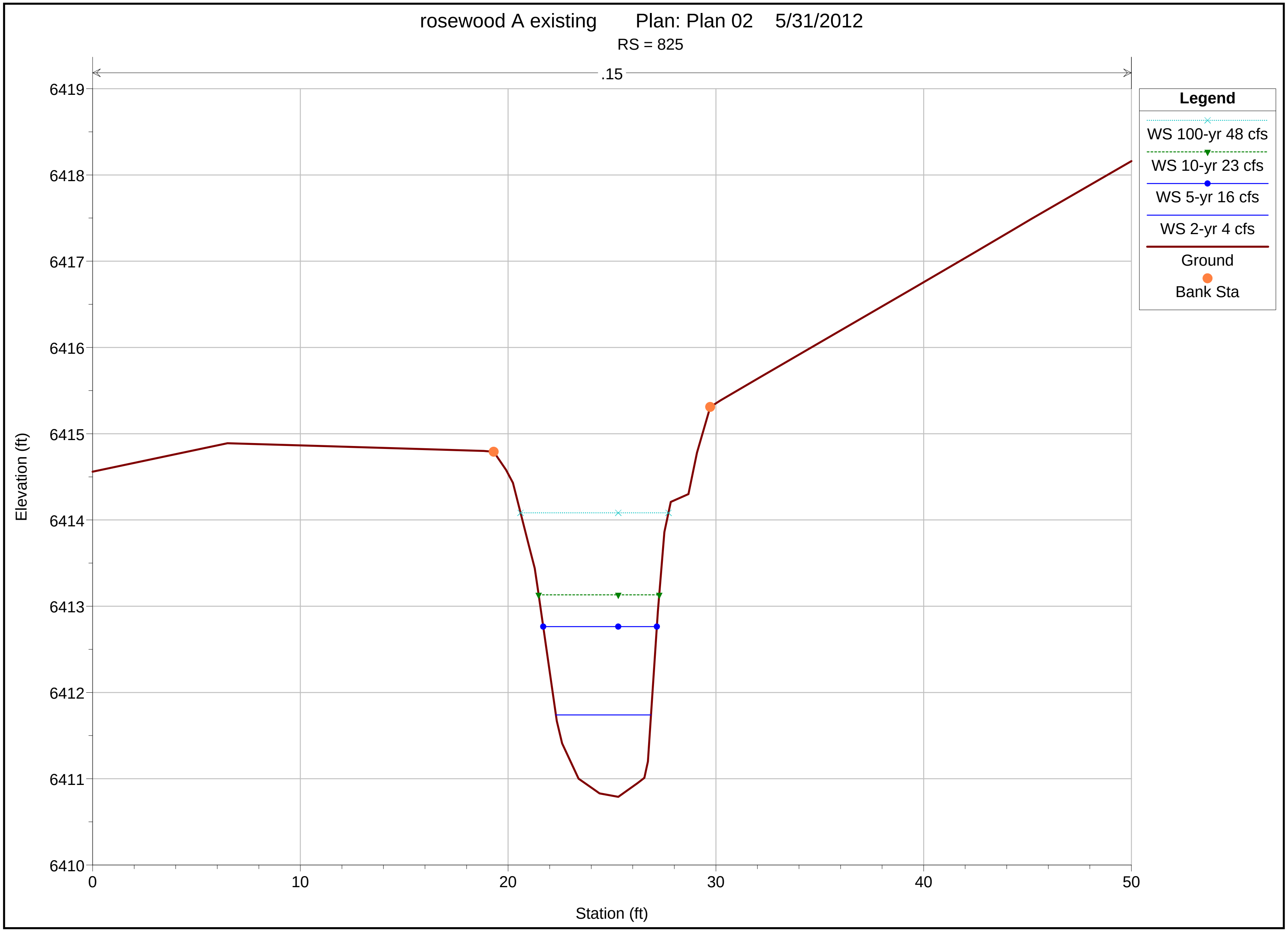

rosewood A existing Plan: Plan 02 5/31/2012
RS = 880
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6422
6420
6418
6416
6414
6412
0
10
20
30
40
50
Station (ft)

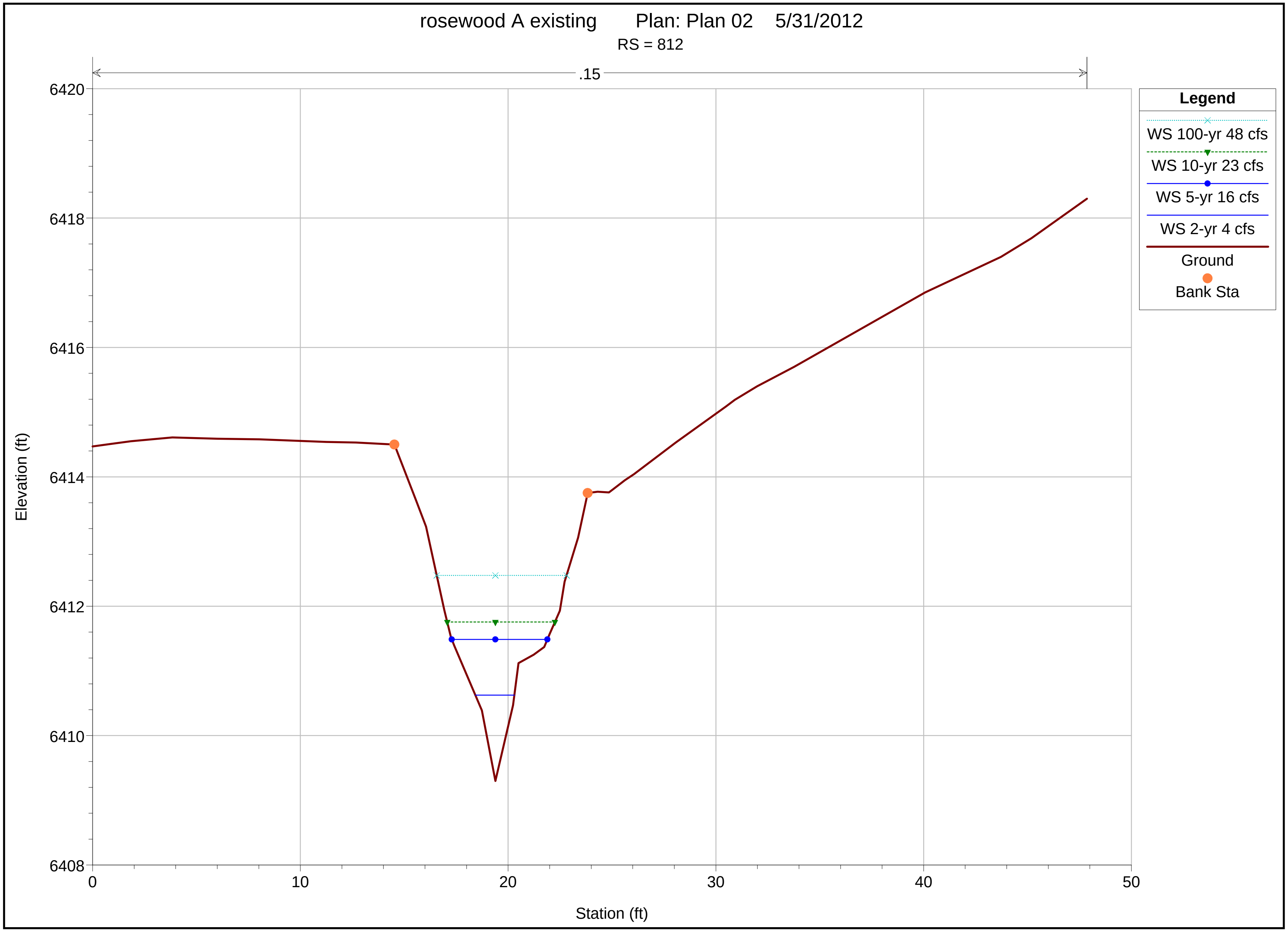

rosewood A existing Plan: Plan 02 5/31/2012
RS = 876
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6420
6419
6418
6417
6416
6415
6414
Station (ft)
0
10
20
30
40
50


rosewood A existing Plan: Plan 02 5/31/2012
RS = 850
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6417.5
6417.0
6416.5
6416.0
6415.5
6415.0
6414.5
6414.0
6413.5
6413.0
Station (ft)
0
10
20
30
40
50

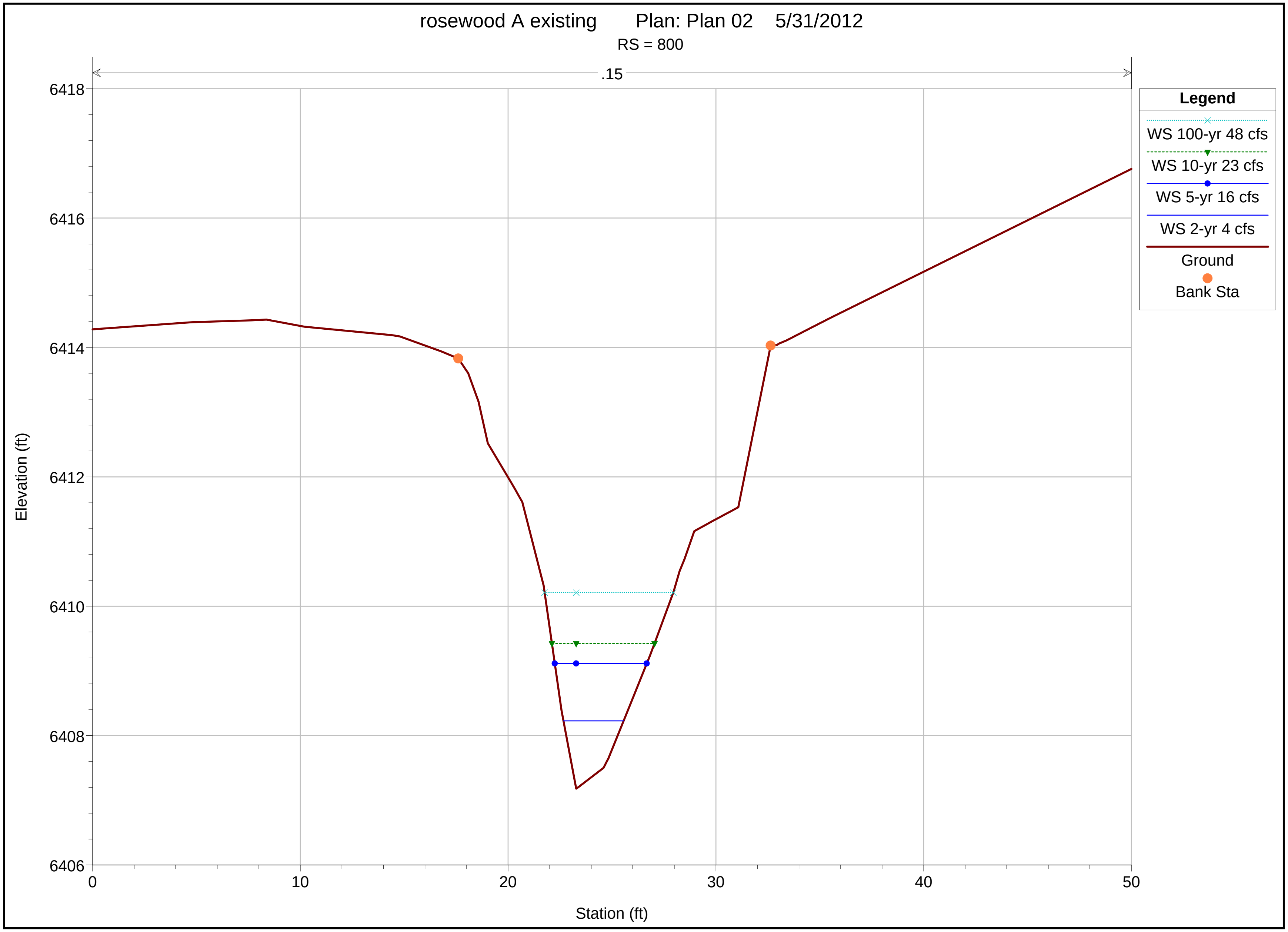

rosewood A existing Plan: Plan 02 5/31/2012
RS = 834
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6419
6418
6417
6416
6415
6414
6413
6412
6411
Station (ft)
0
10
20
30
40
50

rosewood A existing Plan: Plan 02 5/31/2012
RS = 830
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6420
6418
6416
6414
6412
6410
0
10
20
30
40
50
Station (ft)


rosewood A existing Plan: Plan 02 5/31/2012
RS = 825
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6419
6418
6417
6416
6415
6414
6413
6412
6411
6410
Station (ft)
0
10
20
30
40
50

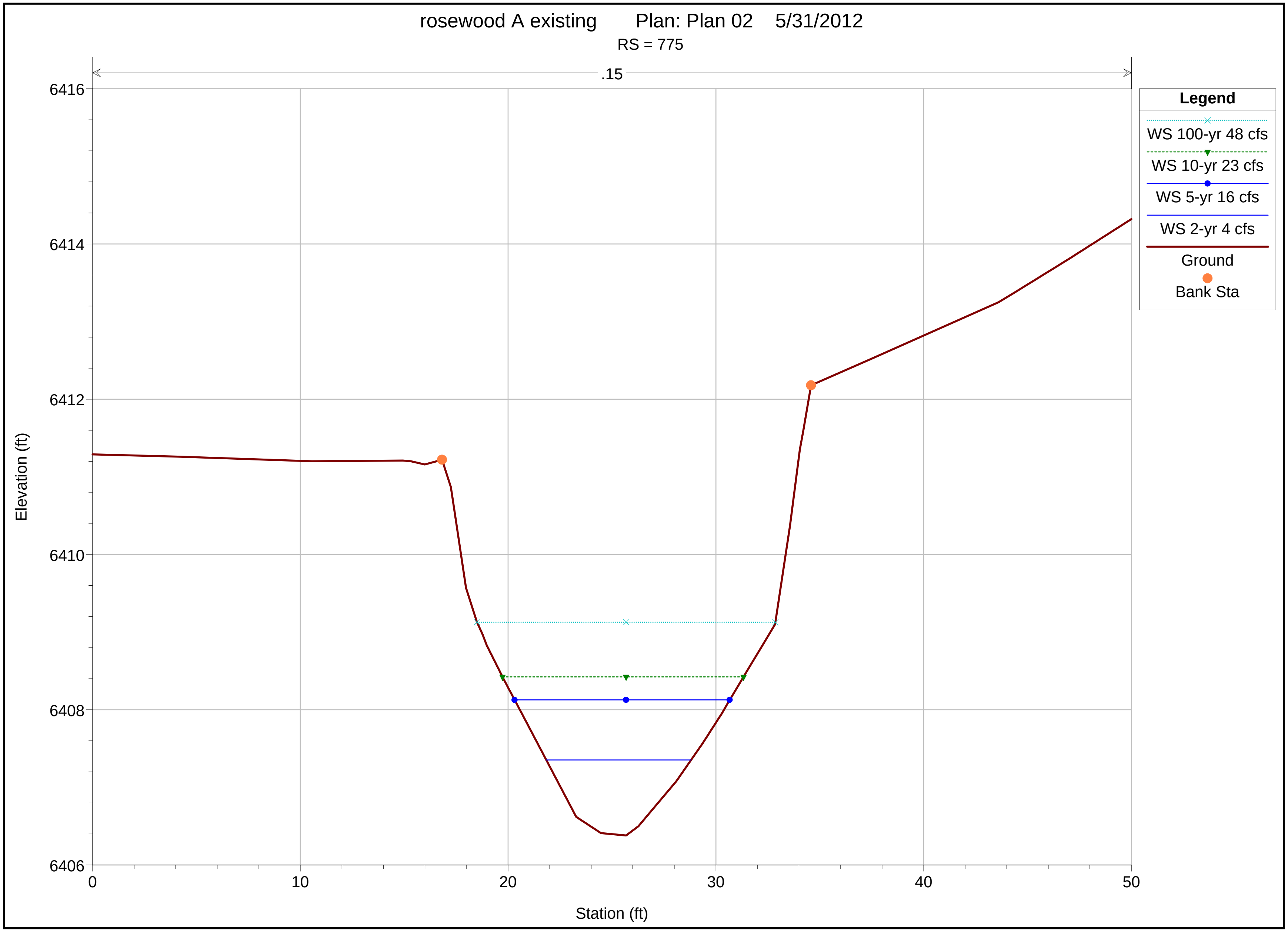


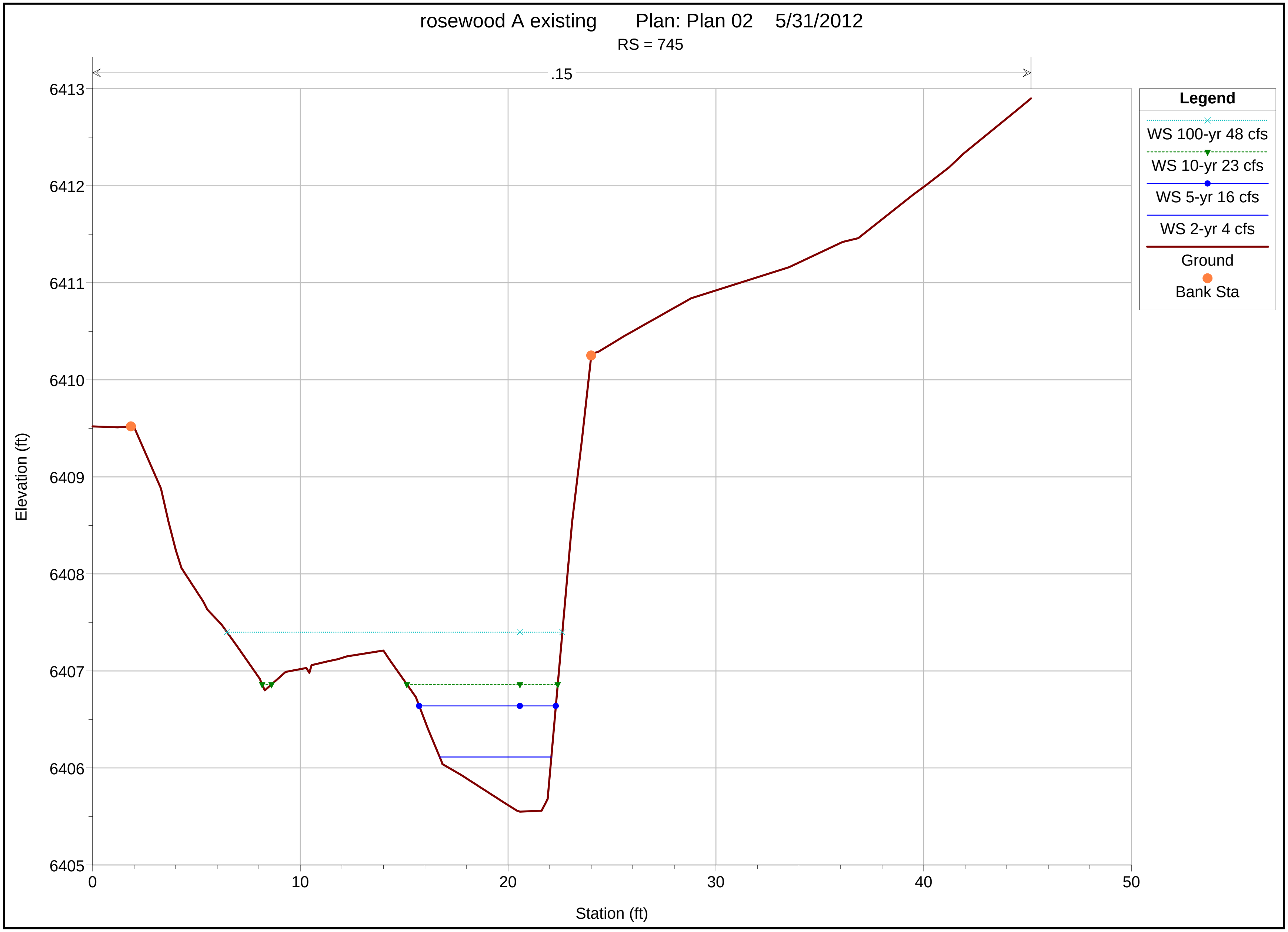
rosewood A existing Plan: Plan 02 5/31/2012
RS = 812
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6420
6418
6416
6414
6412
6410
6408
Station (ft)
0
10
20
30
40
50

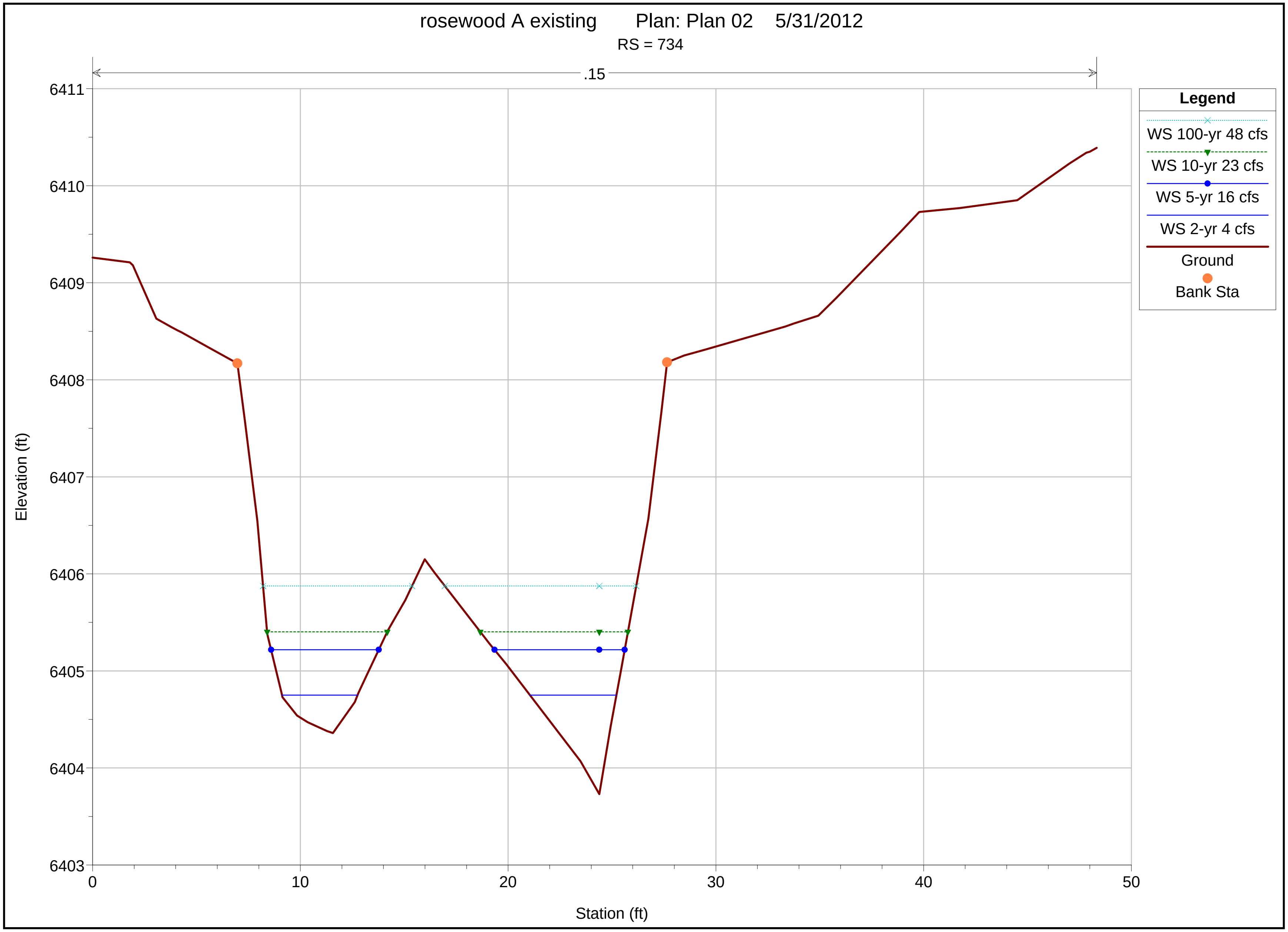


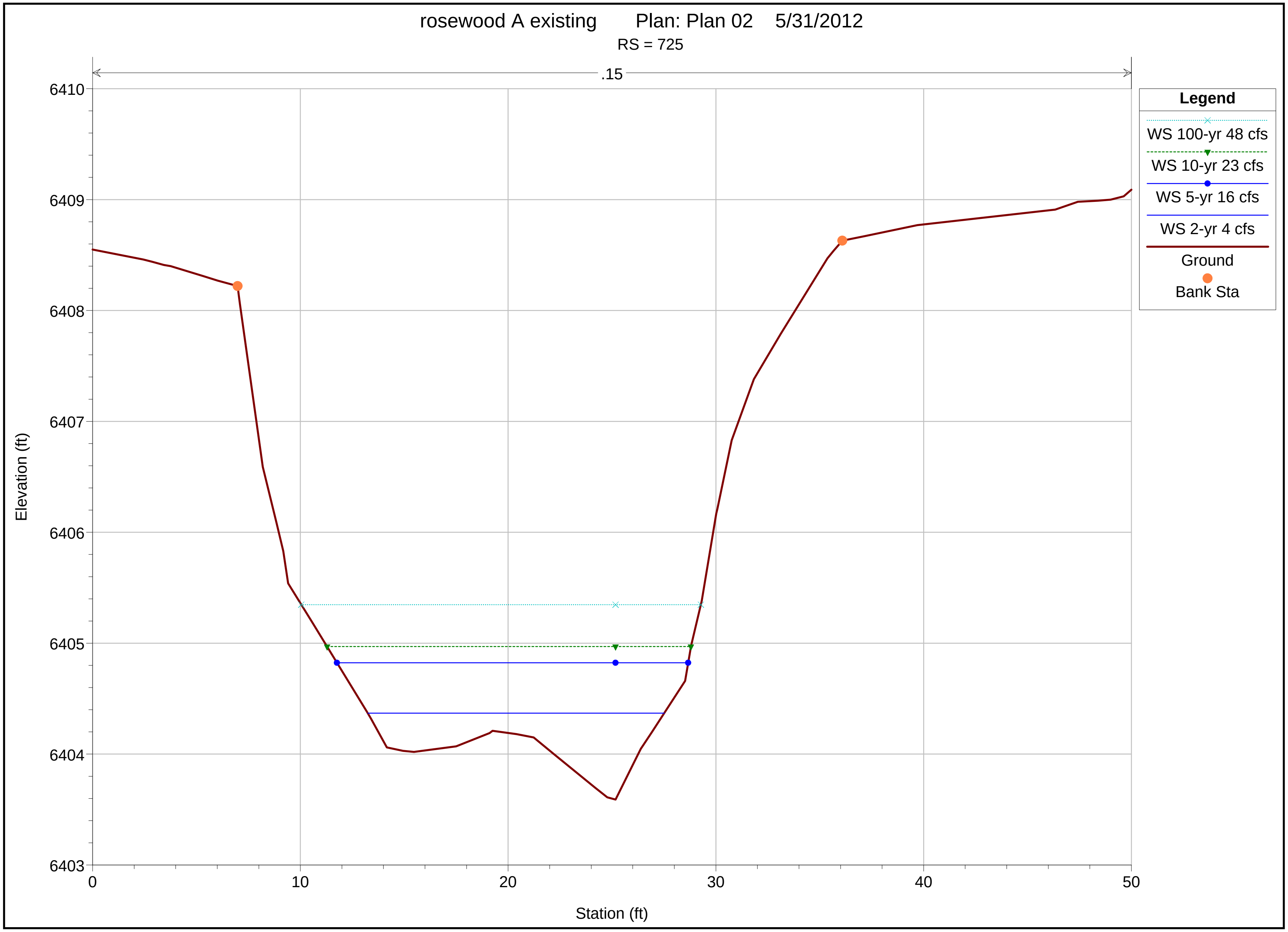
rosewood A existing Plan: Plan 02 5/31/2012

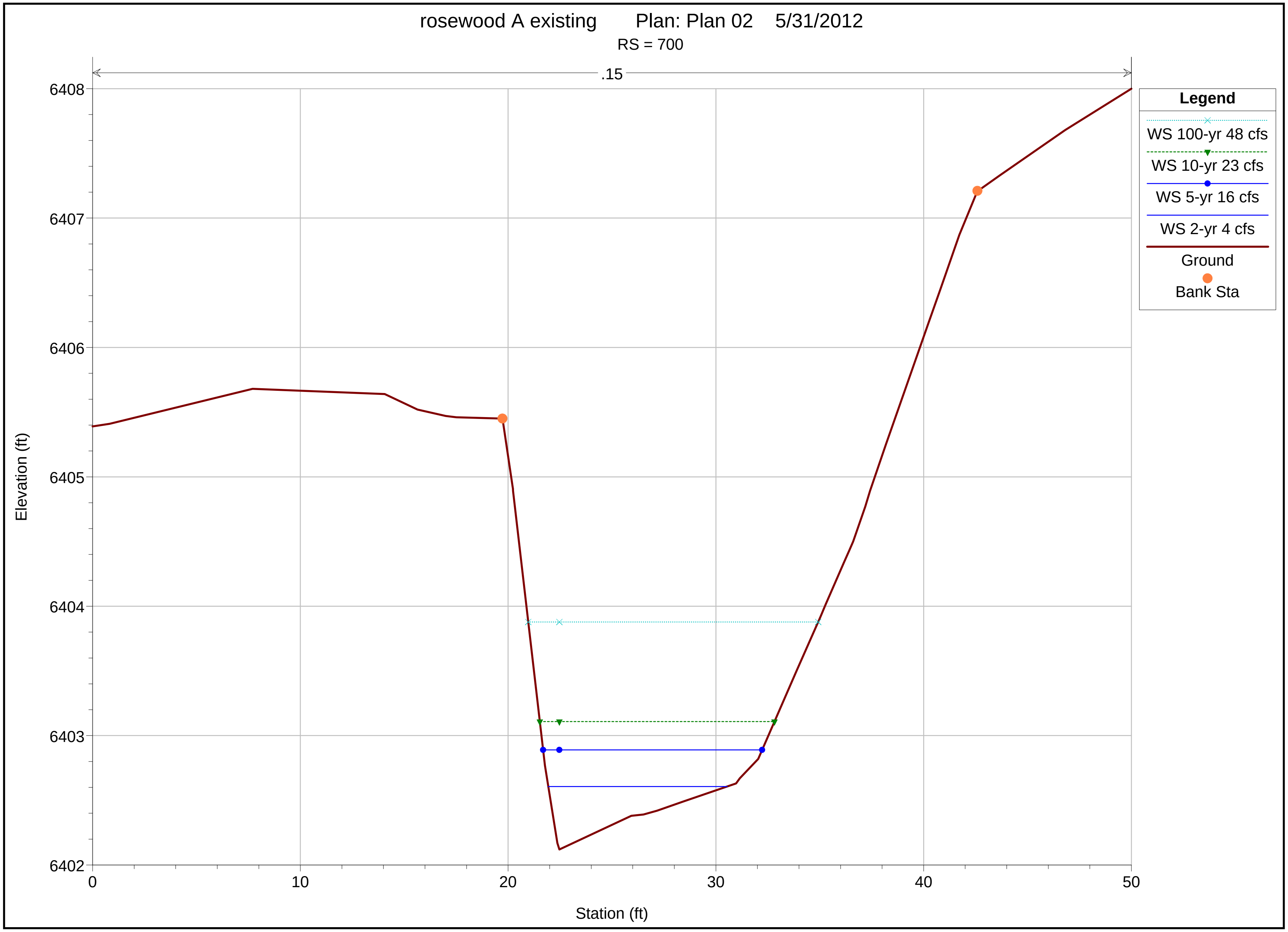
RS = 800


rosewood A existing Plan: Plan 02 5/31/2012
RS = 775
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6416
6414
6412
6410
6408
6406
0
10
20
30
40
50
Station (ft)


rosewood A existing Plan: Plan 02 5/31/2012
RS = 745
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6413
6412
6411
6410
6409
6408
6407
6406
6405
Station (ft)
0
10
20
30
40
50

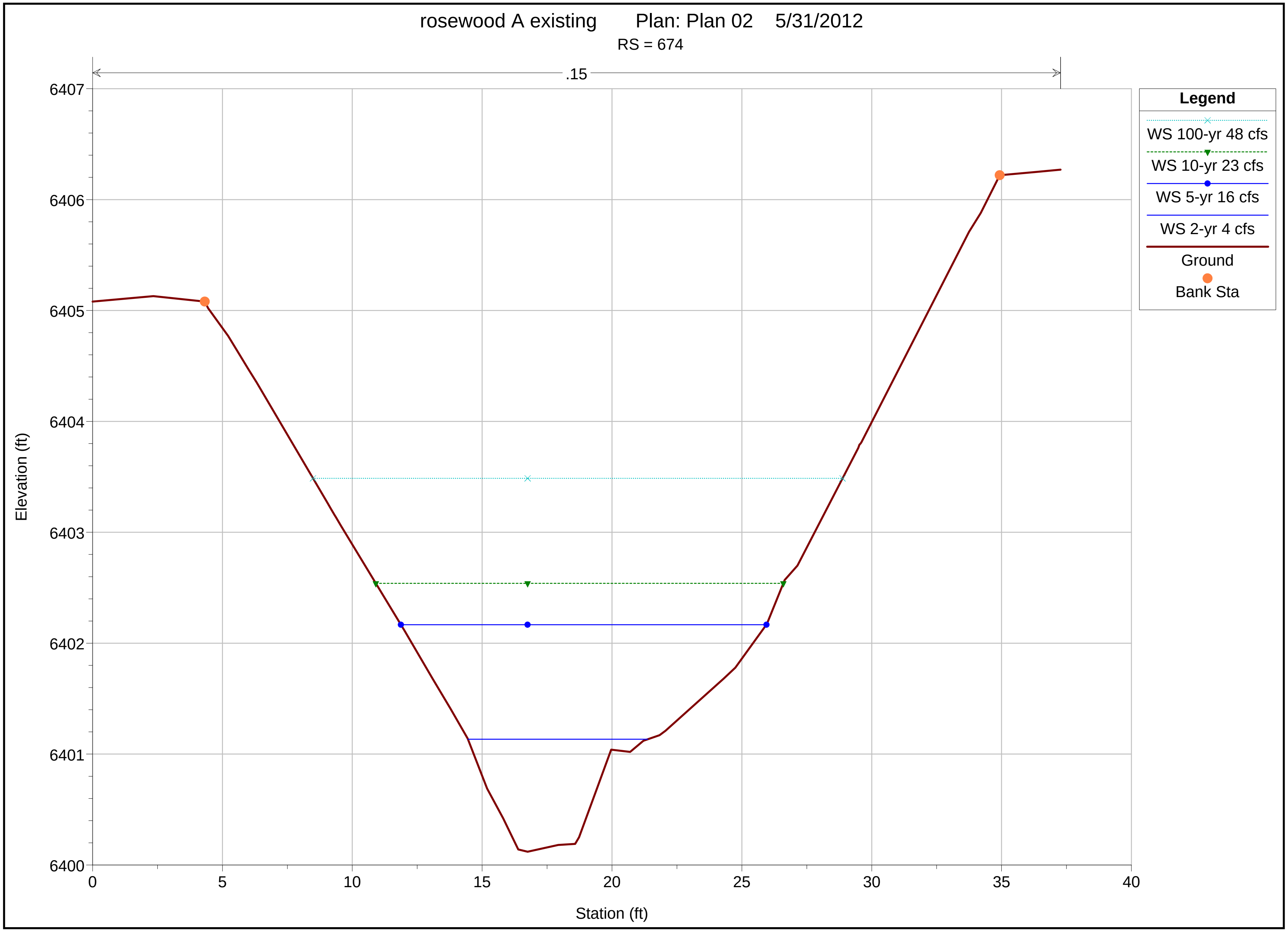

rosewood A existing Plan: Plan 02 5/31/2012
RS = 734
.15
Elevation (ft)
6411
6410
6409
6408
6407
6406
6405
6404
6403
Station (ft)
0
10
20
30
40
50
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta

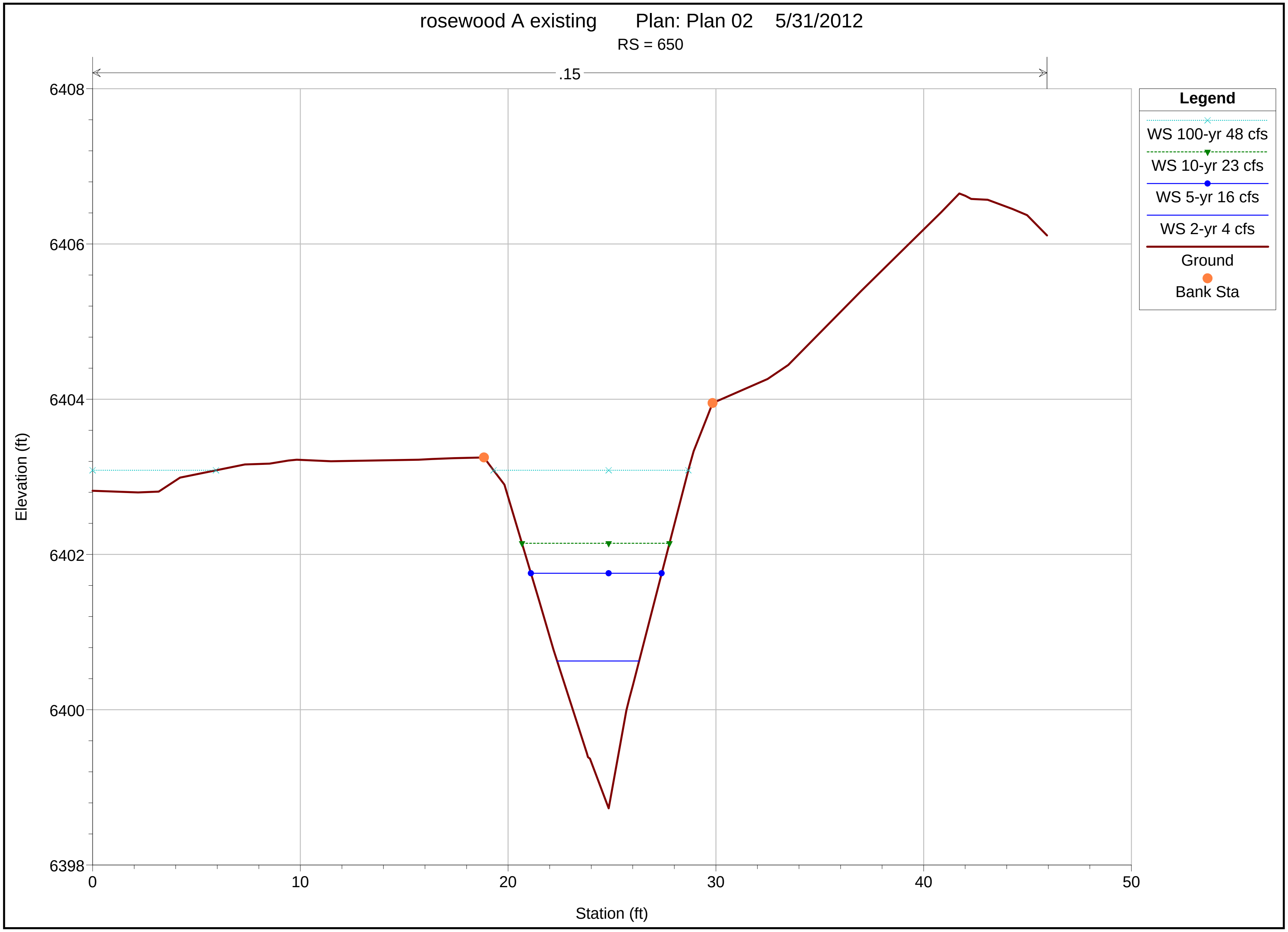

rosewood A existing Plan: Plan 02 5/31/2012
RS = 725
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6410
6409
6408
6407
6406
6405
6404
6403
Station (ft)
0
10
20
30
40
50



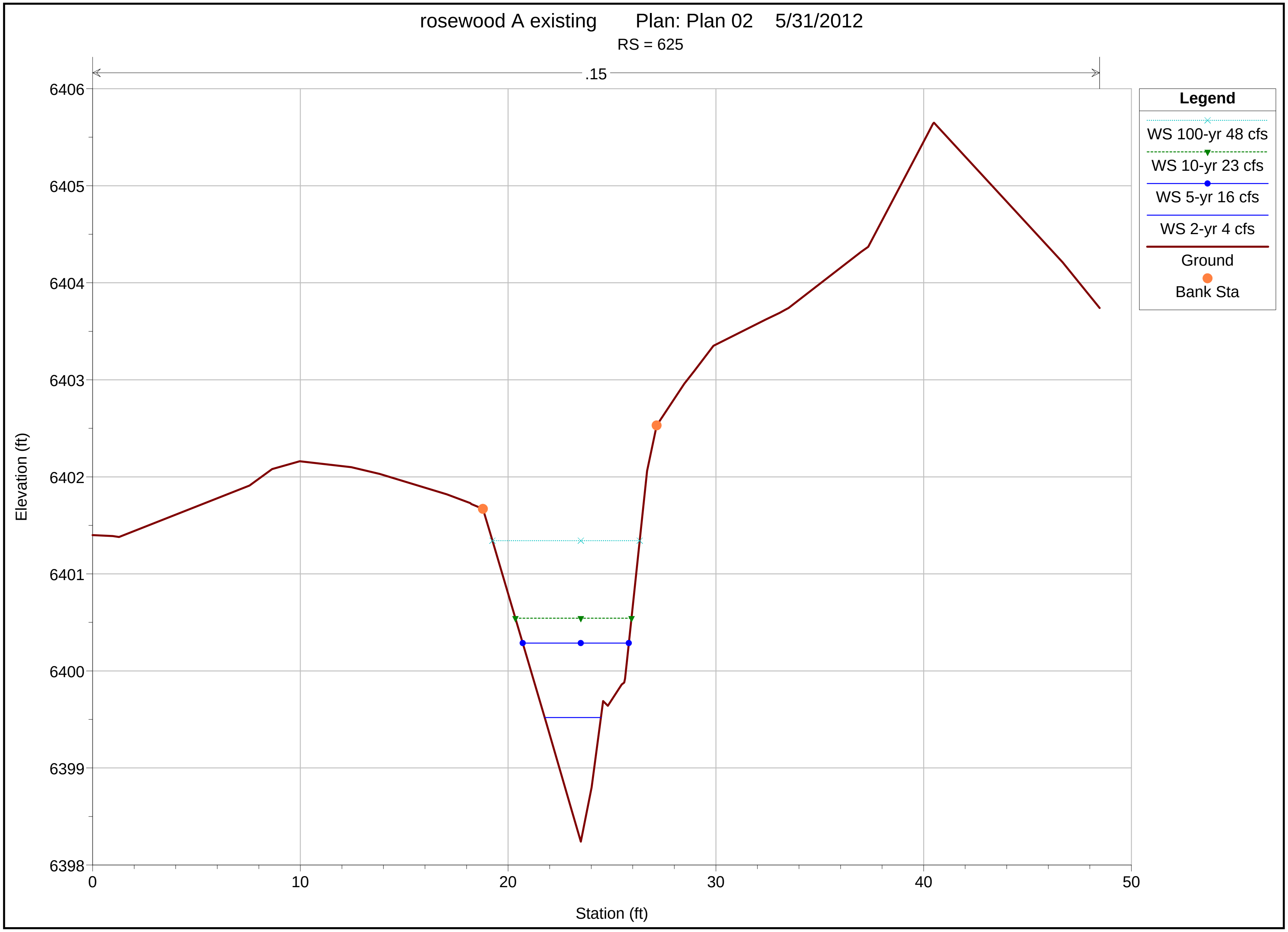
rosewood A existing Plan: Plan 02 5/31/2012

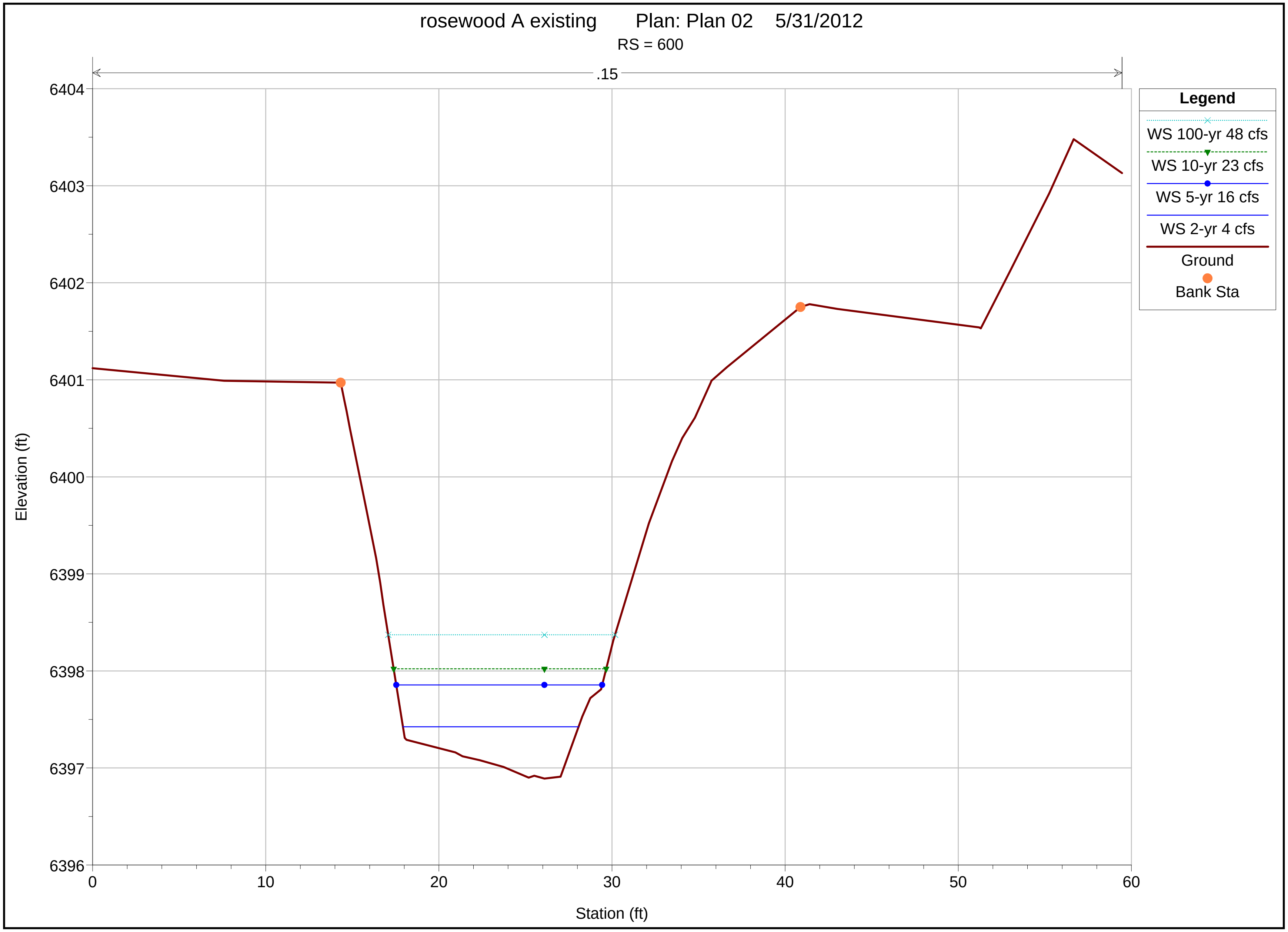
RS = 700

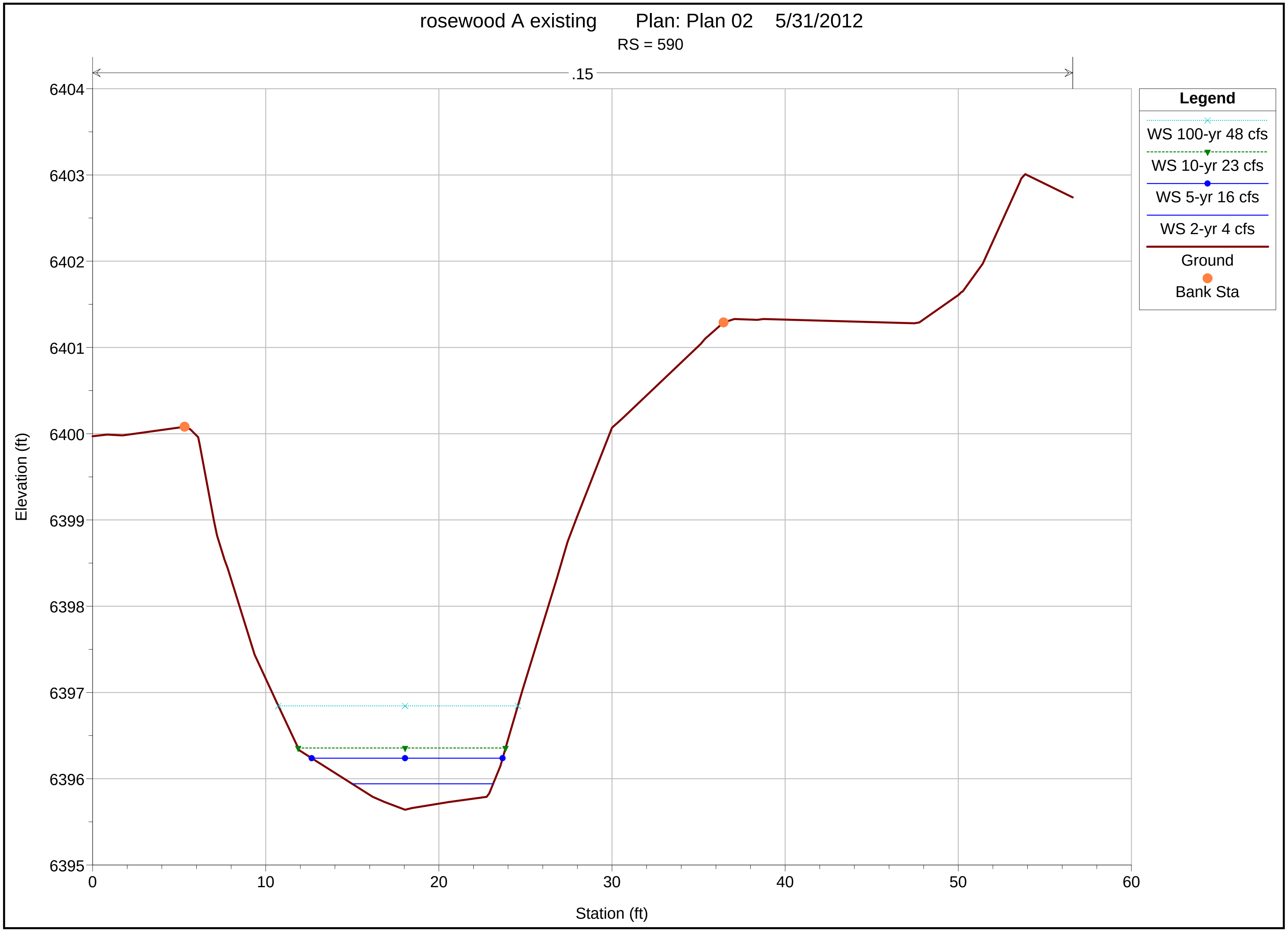

rosewood A existing Plan: Plan 02 5/31/2012
RS = 674
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6407
6406
6405
6404
6403
6402
6401
6400
0
5
10
15
20
25
30
35
40
Station (ft)



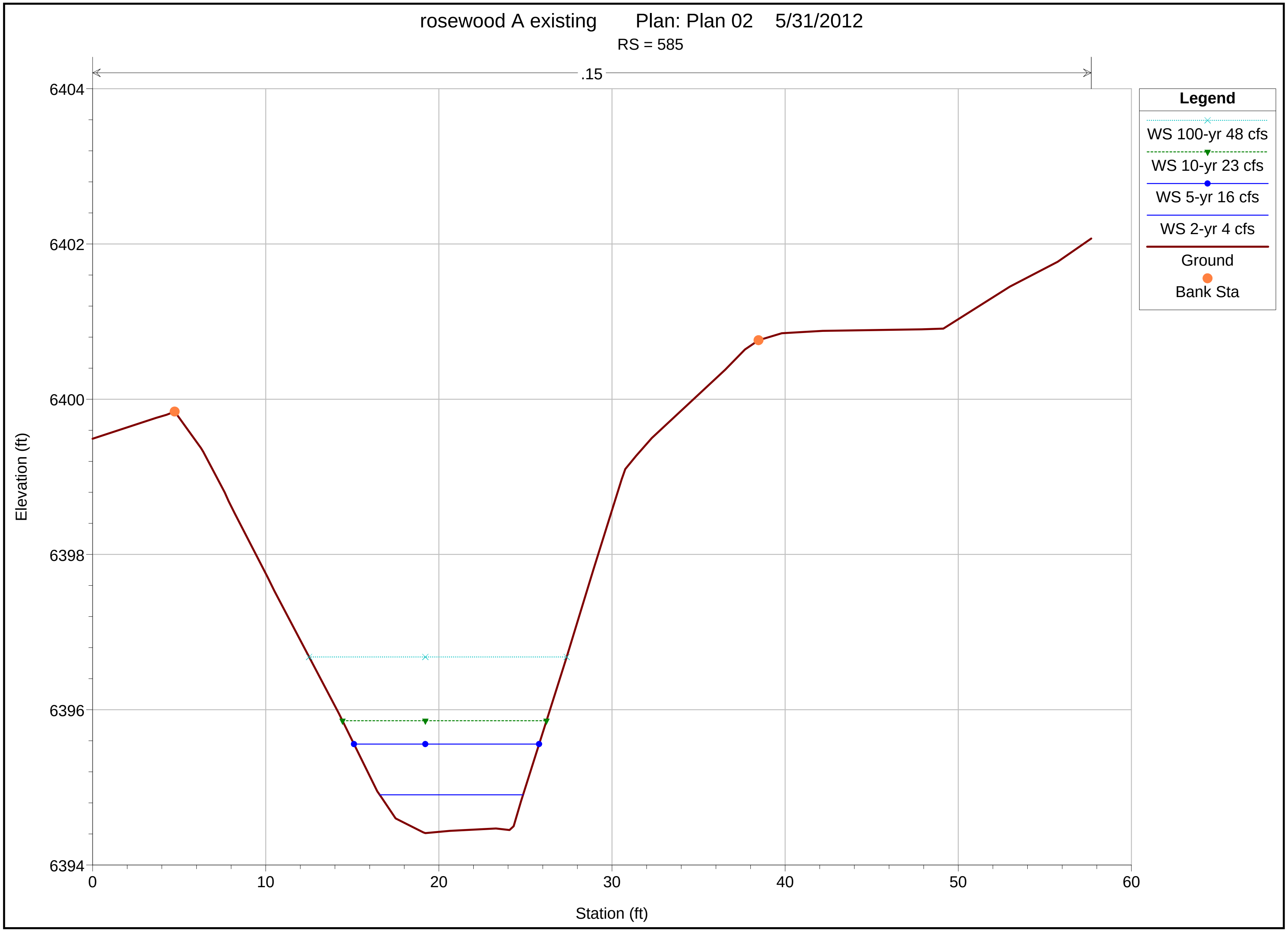
rosewood A existing Plan: Plan 02 5/31/2012
RS = 650
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6408
6406
6404
6402
6400
6398
Station (ft)
0
10
20
30
40
50

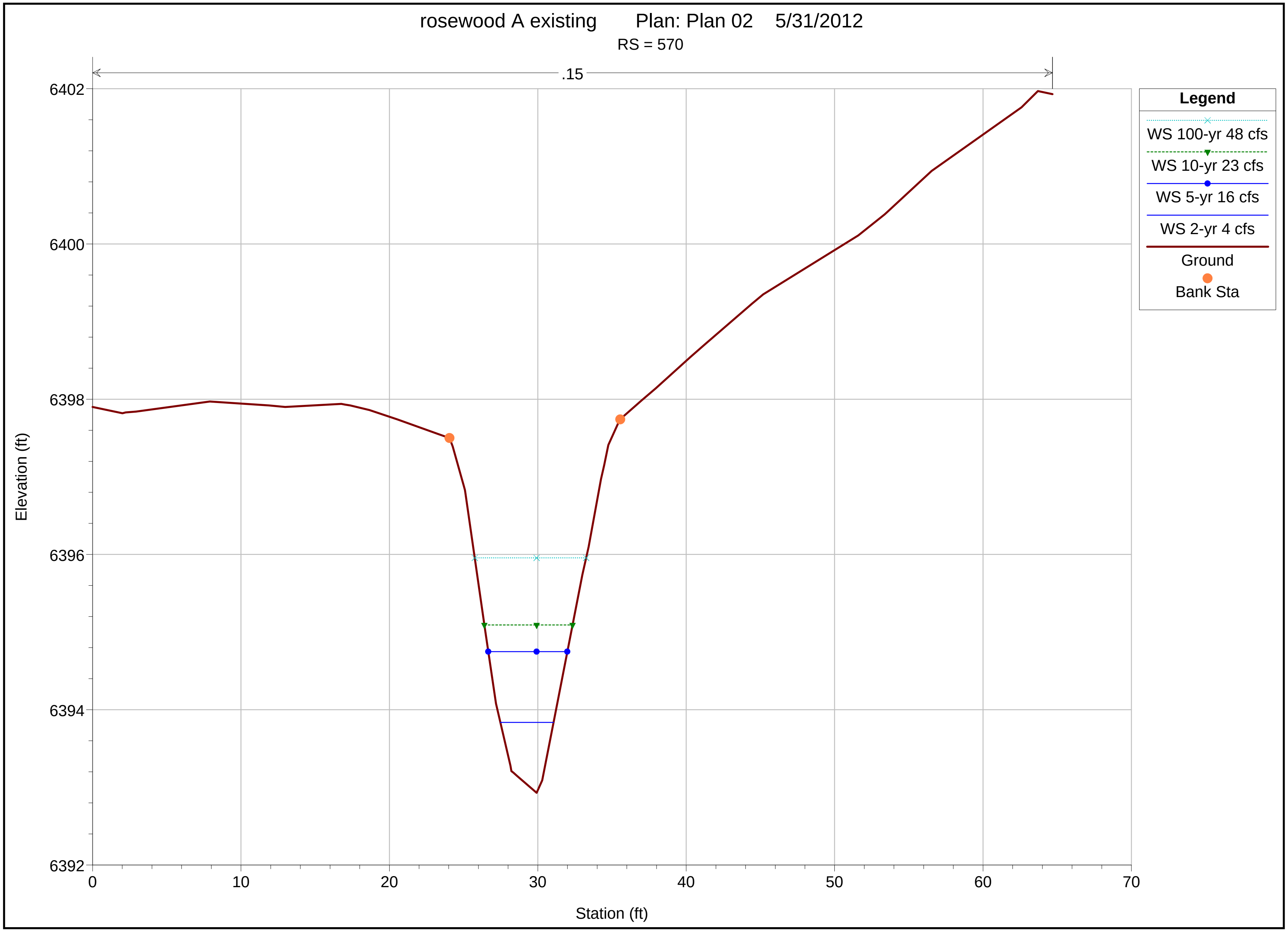

rosewood A existing Plan: Plan 02 5/31/2012
RS = 625
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6406
6405
6404
6403
6402
6401
6400
6399
6398
Station (ft)
0
10
20
30
40
50

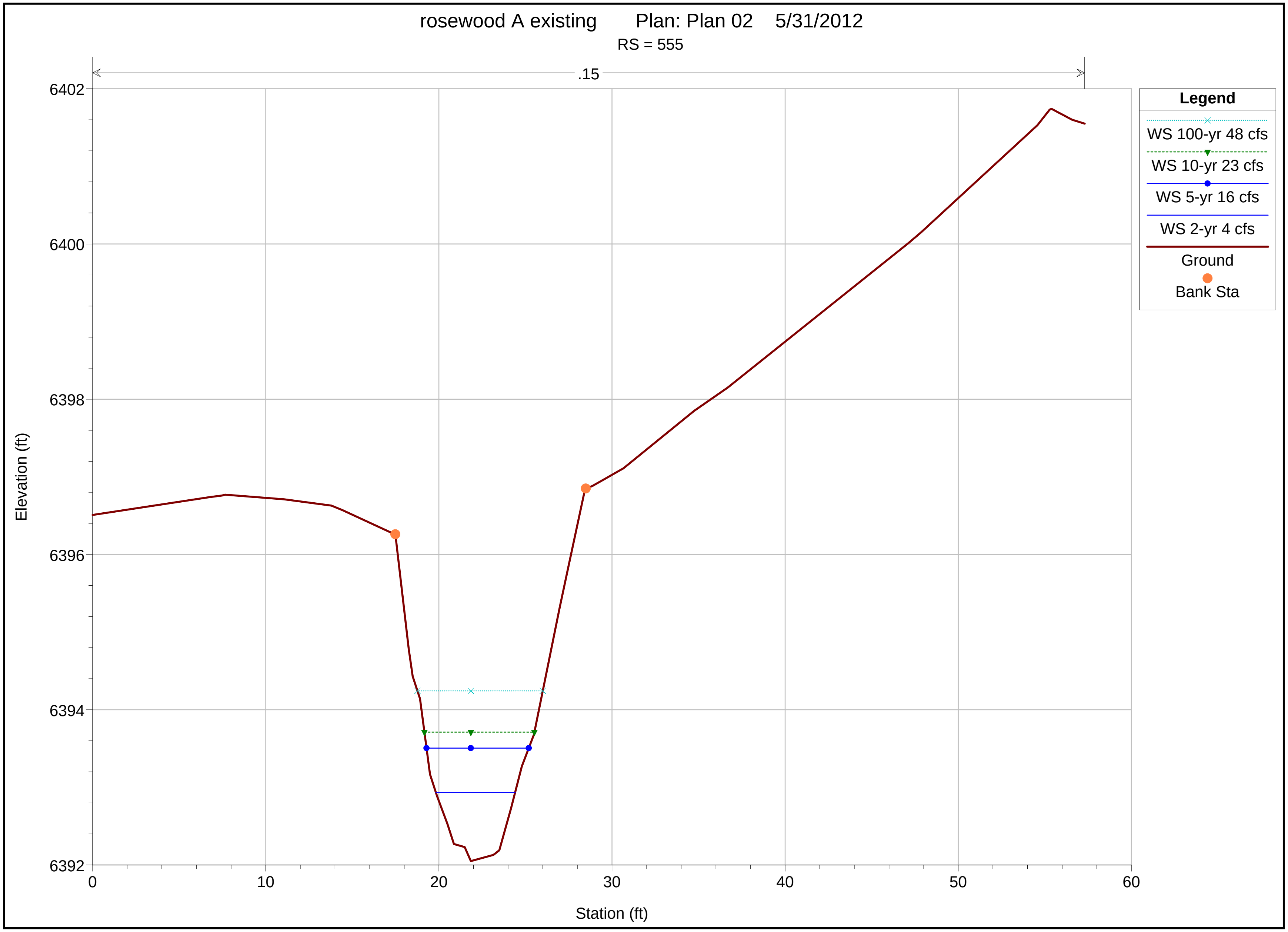

rosewood A existing Plan: Plan 02 5/31/2012
RS = 600
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6404
6403
6402
6401
6400
6399
6398
6397
6396
Station (ft)
0
10
20
30
40
50
60

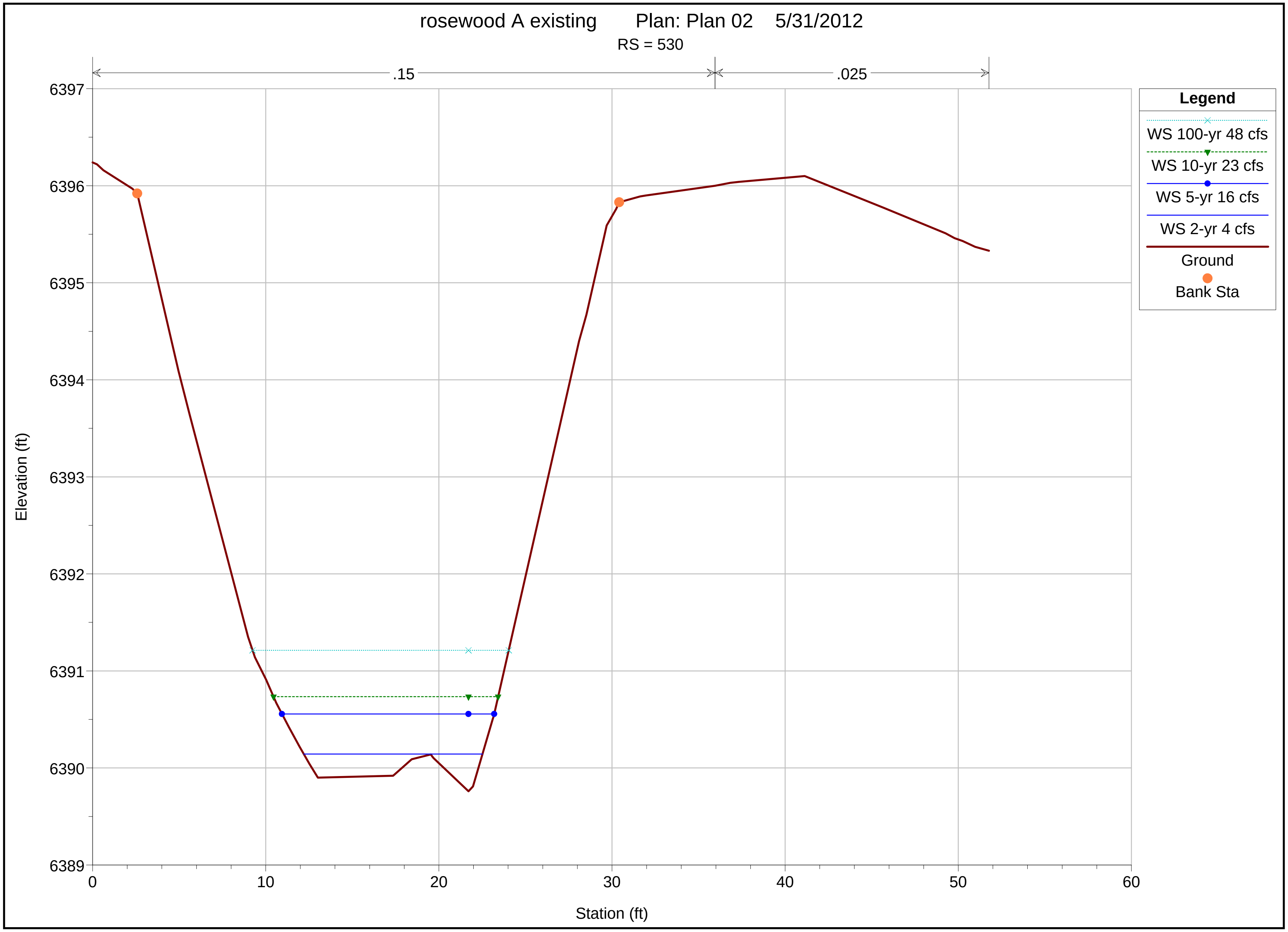


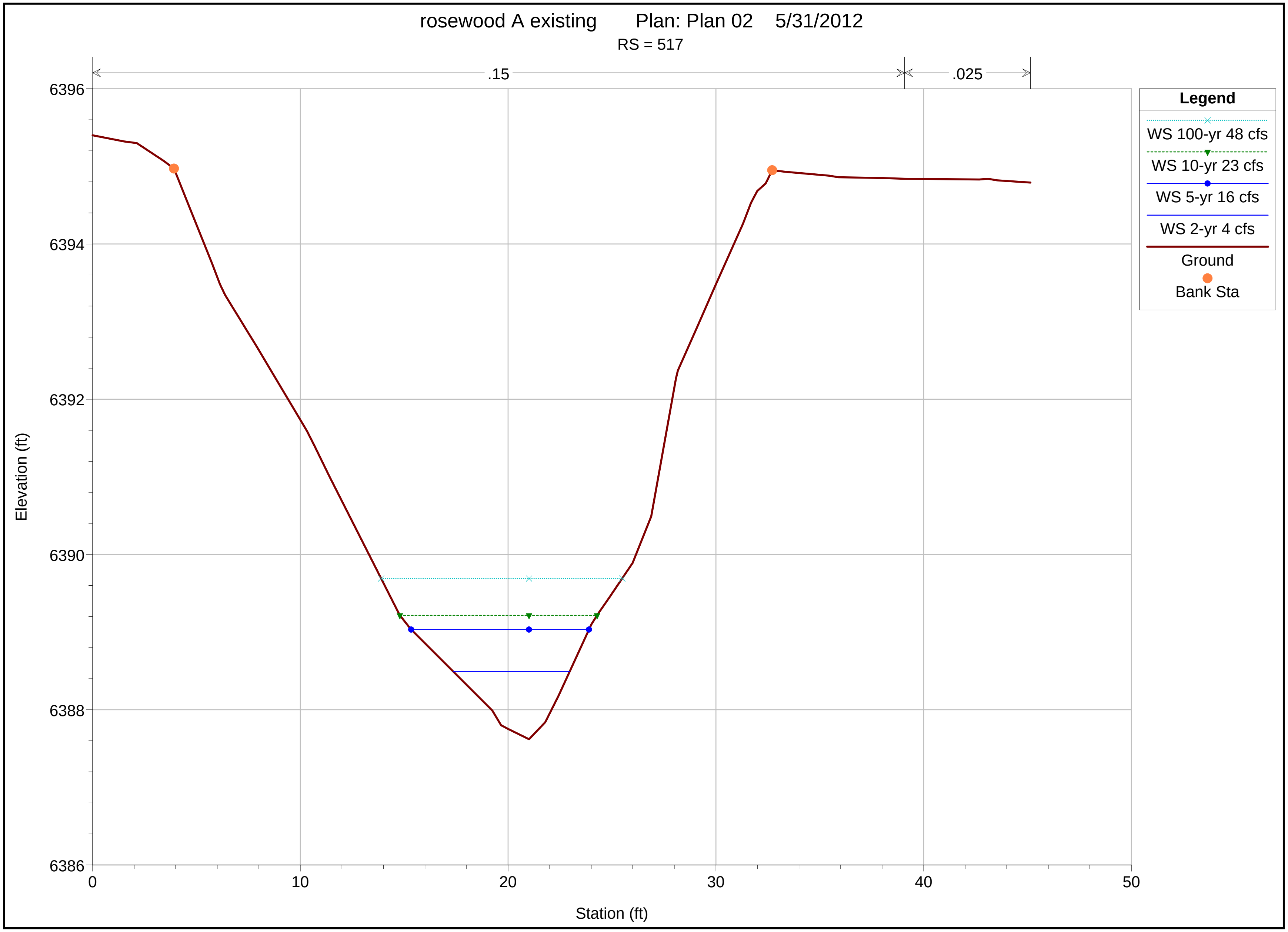
rosewood A existing Plan: Plan 02 5/31/2012
RS = 590
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6404
6403
6402
6401
6400
6399
6398
6397
6396
6395
Station (ft)
0
10
20
30
40
50
60

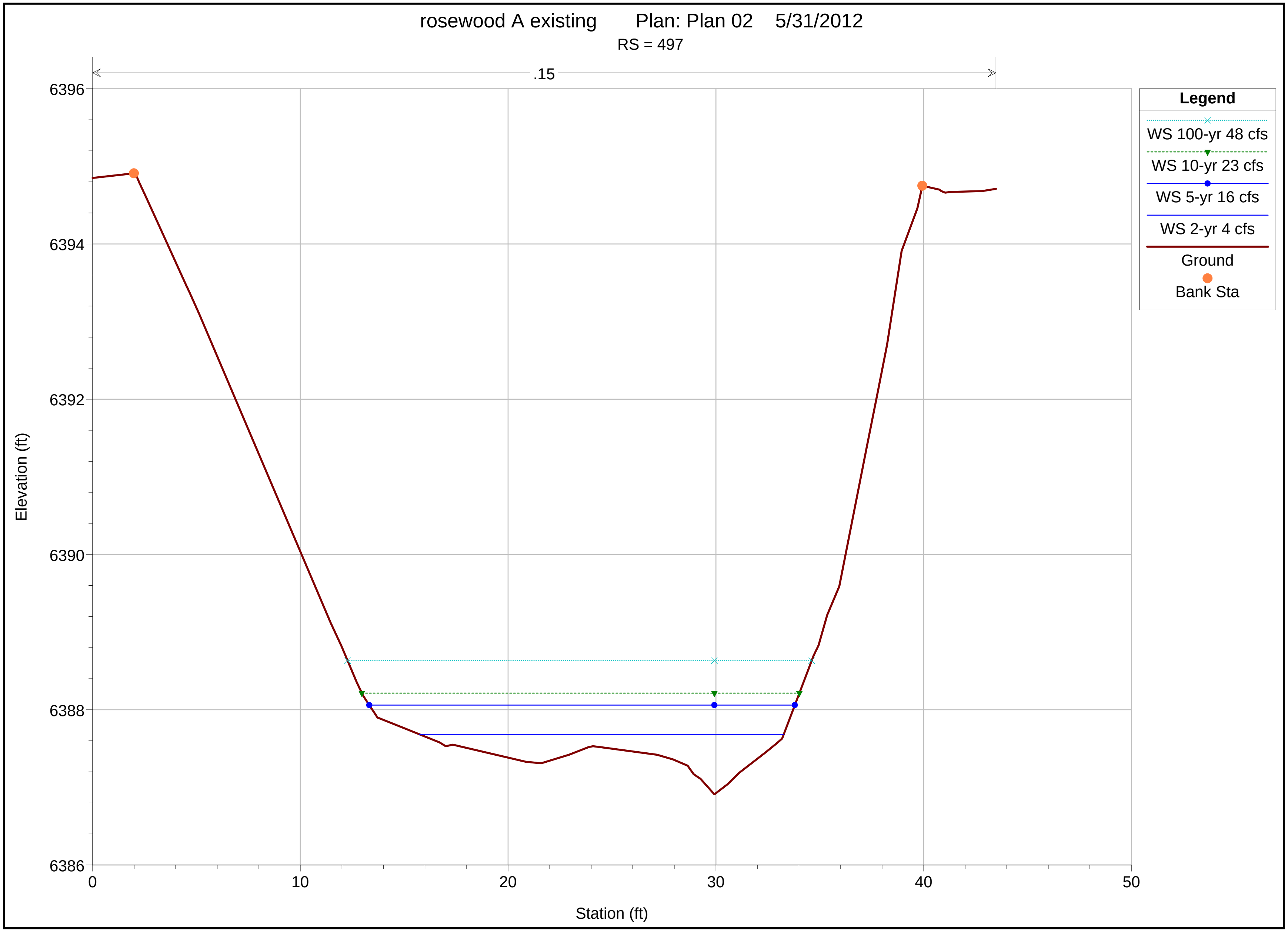

rosewood A existing Plan: Plan 02 5/31/2012
RS = 585
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6404
6402
6400
6398
6396
6394
Station (ft)
0
10
20
30
40
50
60

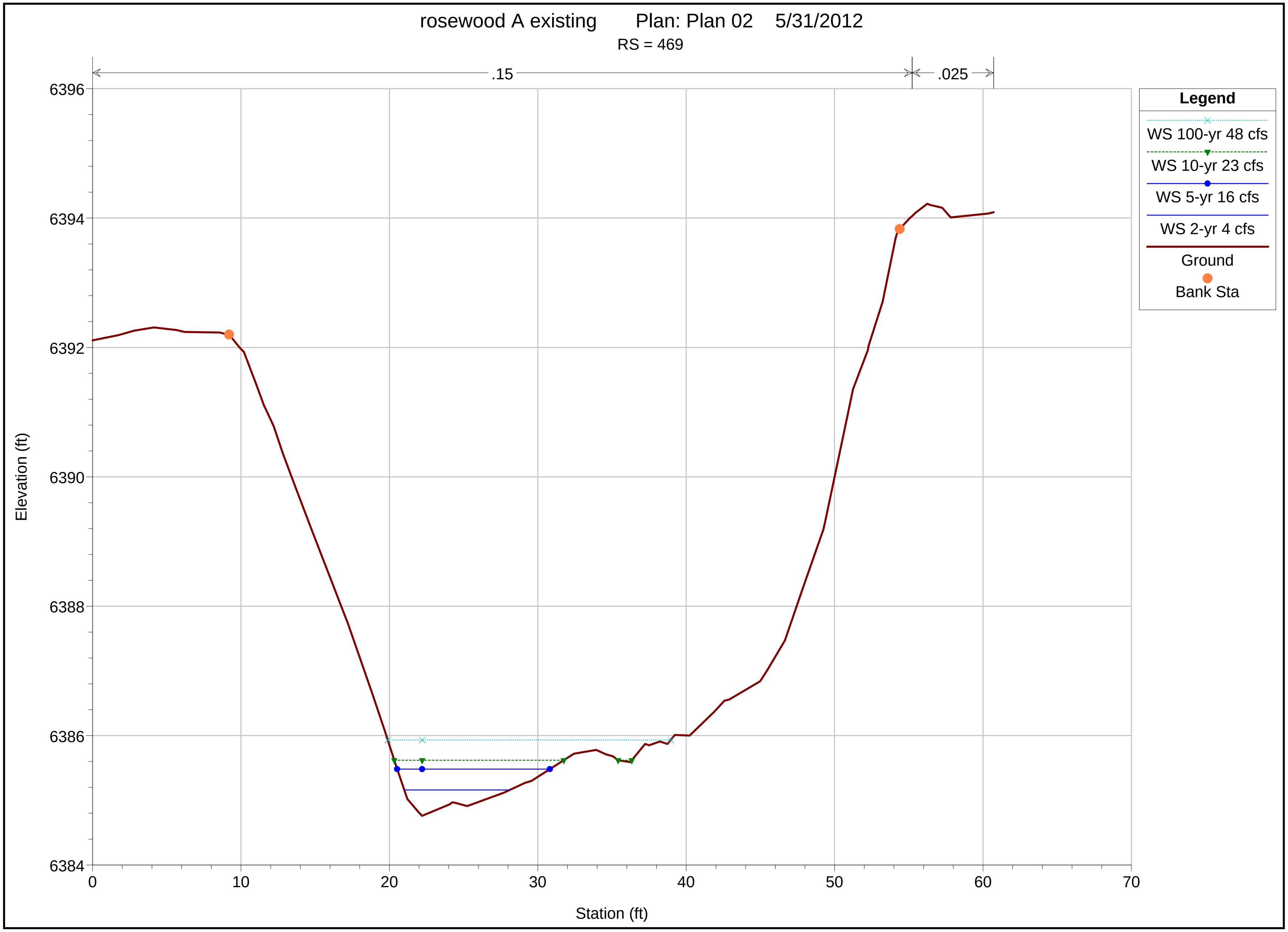

rosewood A existing Plan: Plan 02 5/31/2012
RS = 570
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6402
6400
6398
6396
6394
6392
0
10
20
30
40
50
60
70
Station (ft)

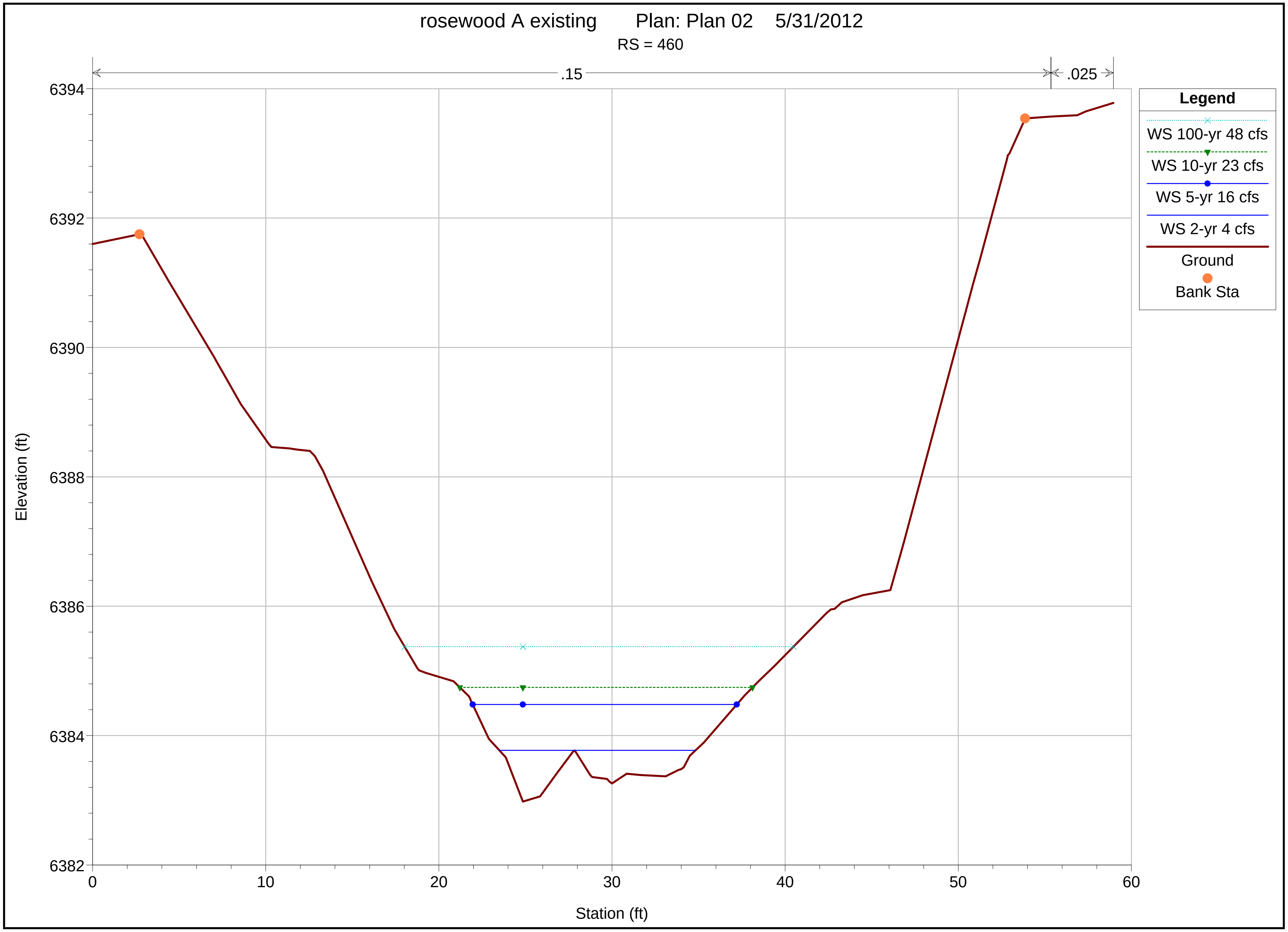

rosewood A existing Plan: Plan 02 5/31/2012
RS = 555
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6402
6400
6398
6396
6394
6392
Station (ft)
0
10
20
30
40
50
60

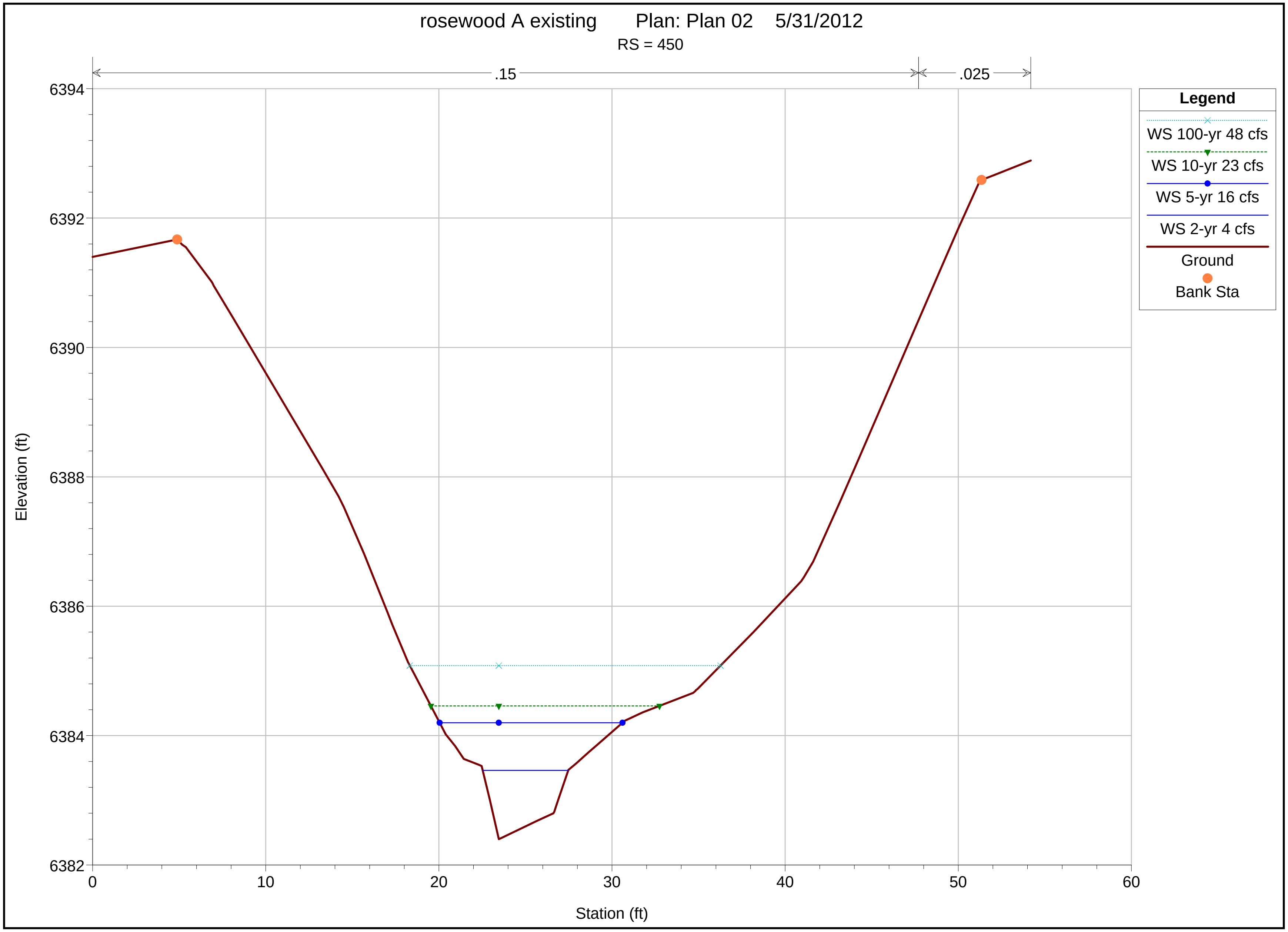
rosewood A existing Plan: Plan 02 5/31/2012
RS = 530
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6397
6396
6395
6394
6393
6392
6391
6390
6389
Station (ft)
0
10
20
30
40
50
60

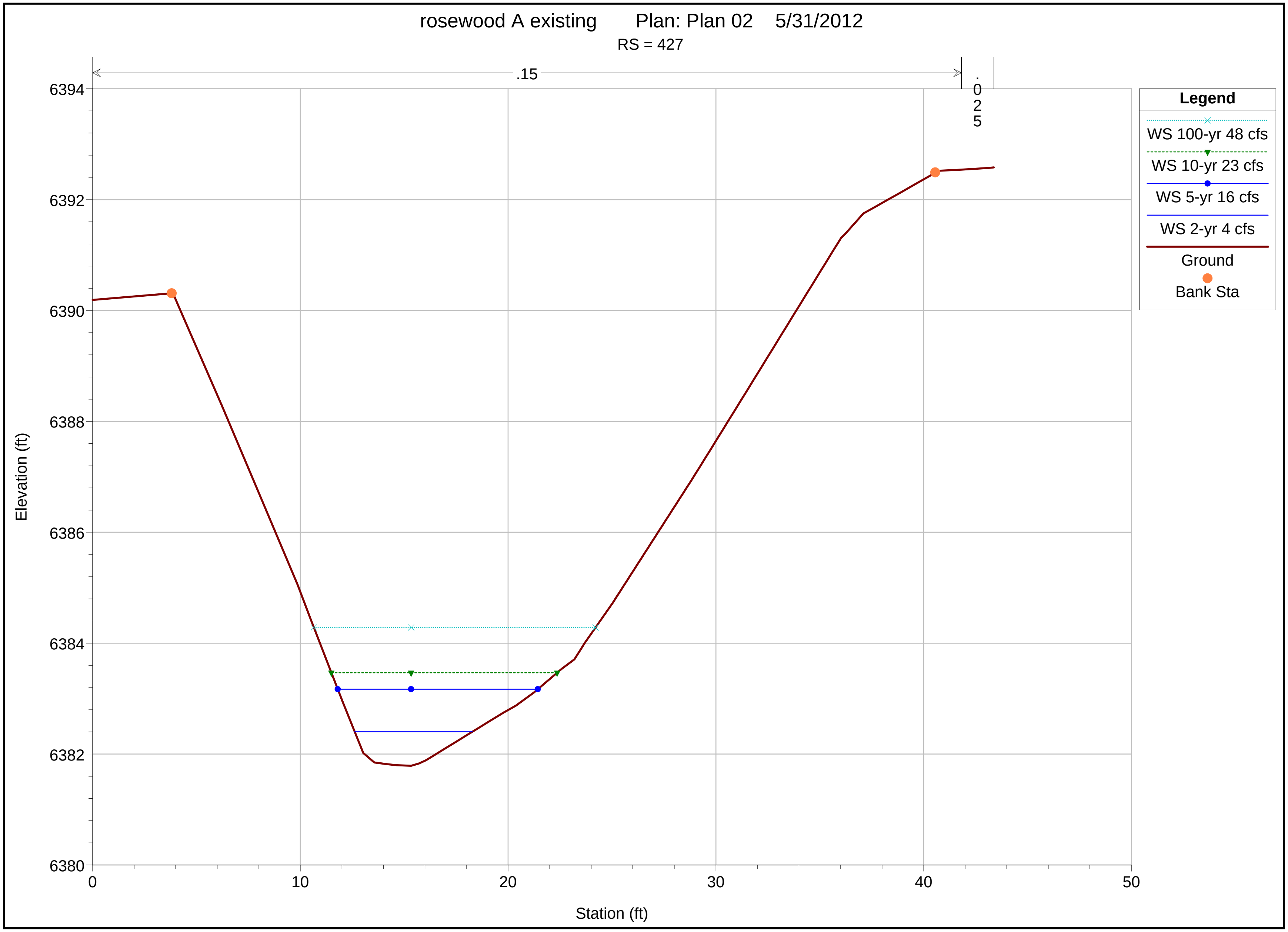

rosewood A existing Plan: Plan 02 5/31/2012
RS = 517
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6396
6394
6392
6390
6388
6386
0
10
20
30
40
50
Station (ft)

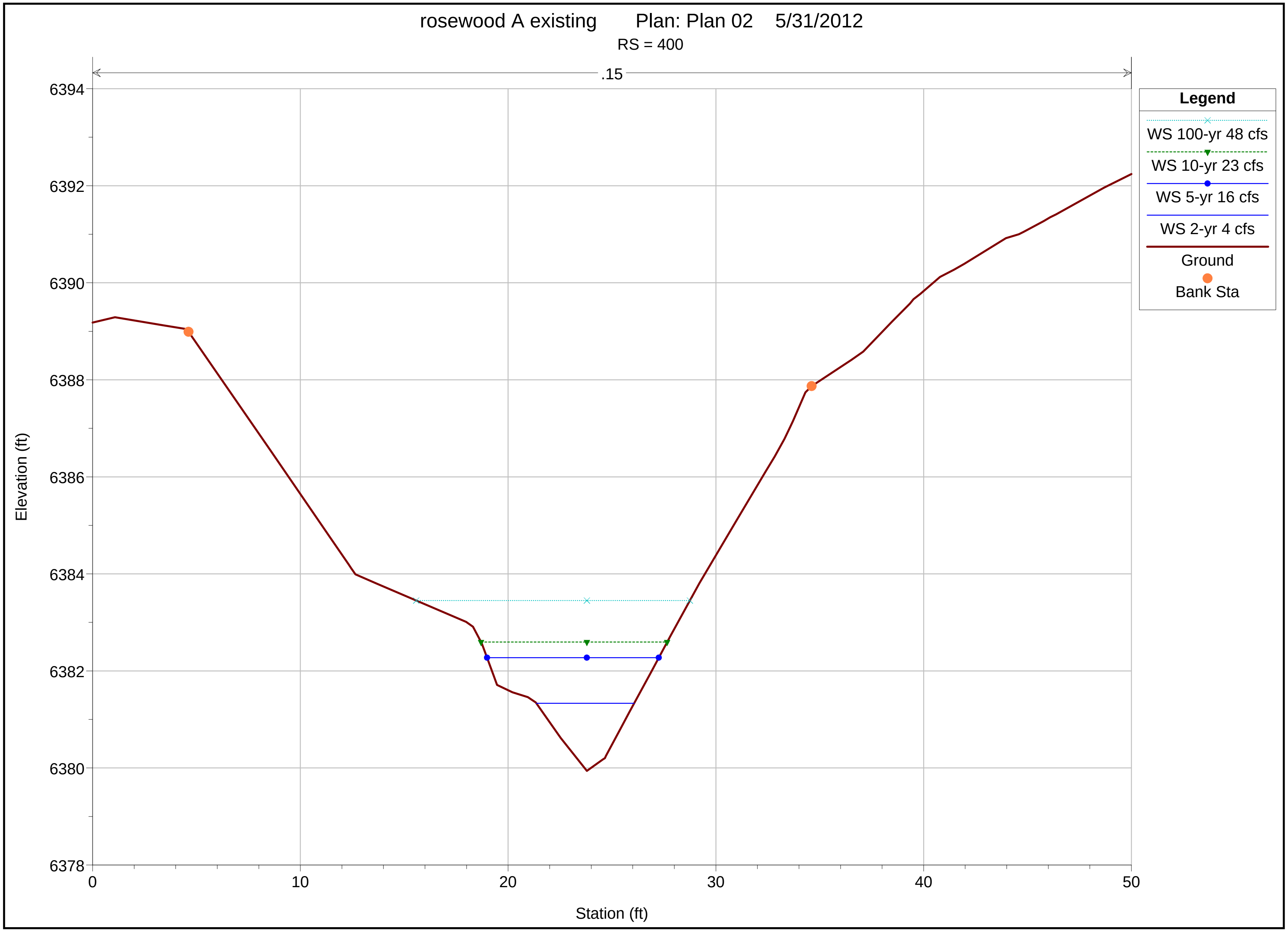

rosewood A existing Plan: Plan 02 5/31/2012
RS = 497
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6396
6394
6392
6390
6388
6386
Station (ft)
0
10
20
30
40
50

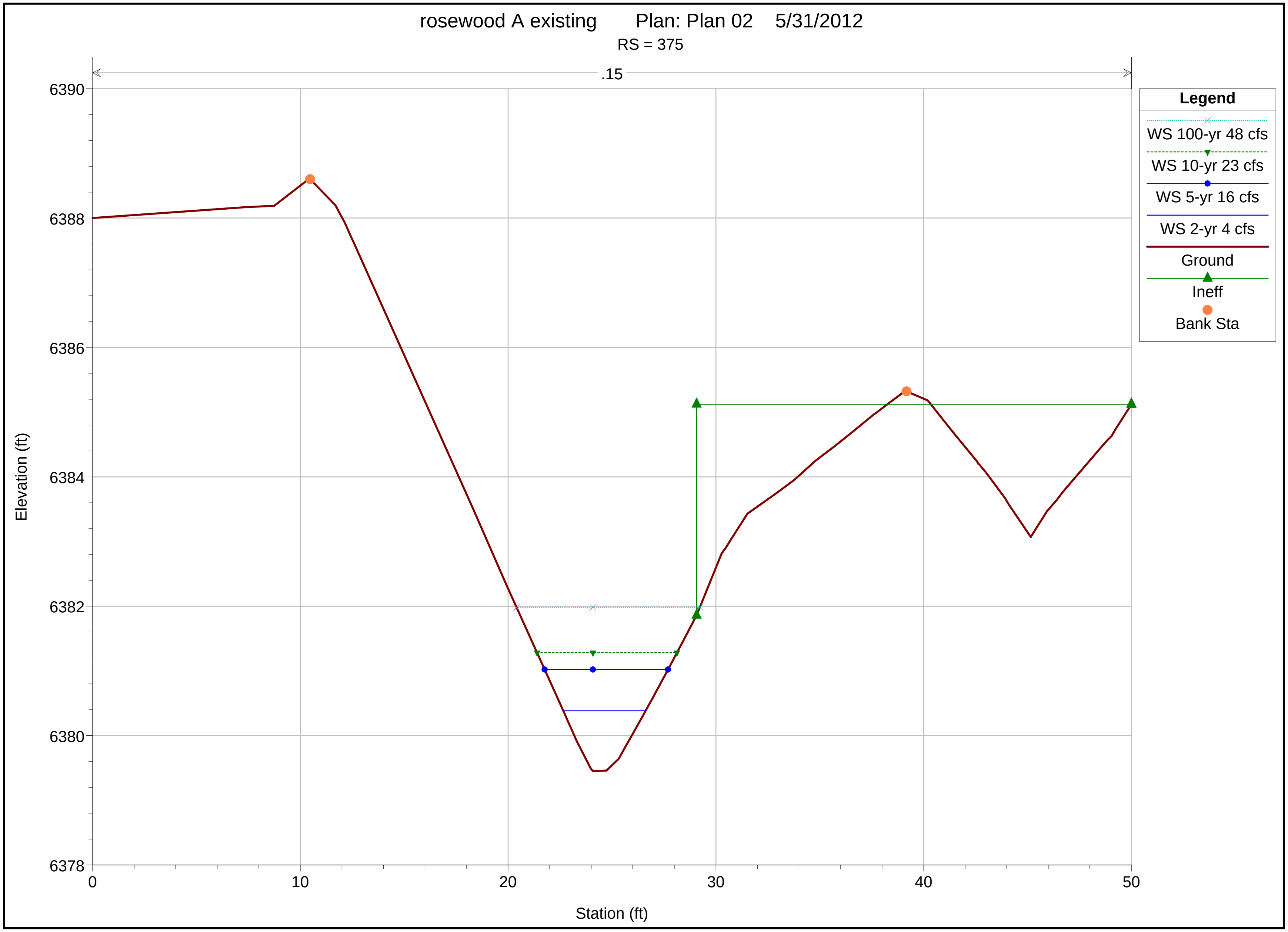

rosewood A existing Plan: Plan 02 5/31/2012
RS = 469
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6396
6394
6392
6390
6388
6386
6384
Station (ft)
0
10
20
30
40
50
60
70

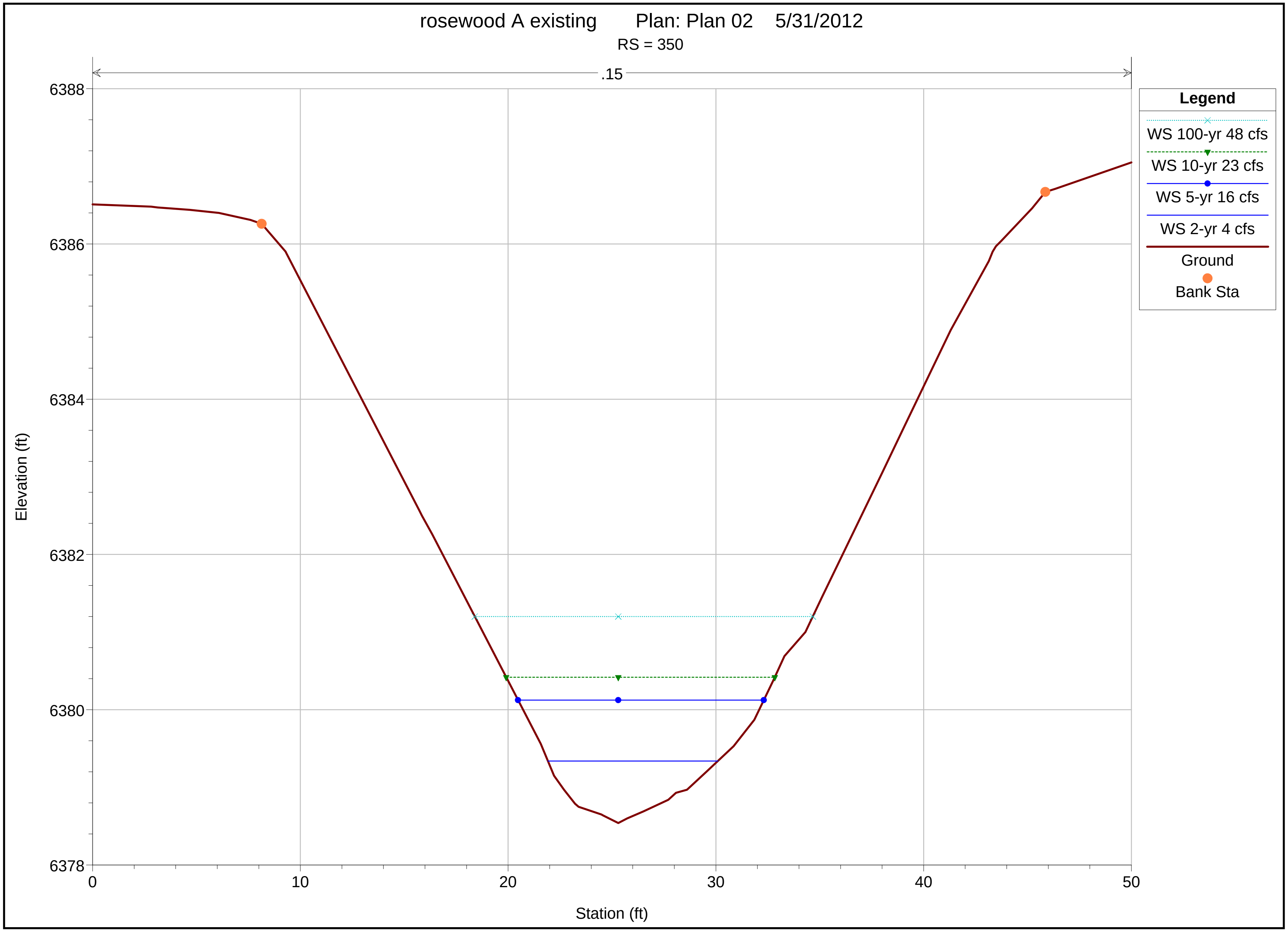

rosewood A existing Plan: Plan 02 5/31/2012
RS = 460
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6394
6392
6390
6388
6386
6384
6382
0
10
20
30
40
50
60
Station (ft)

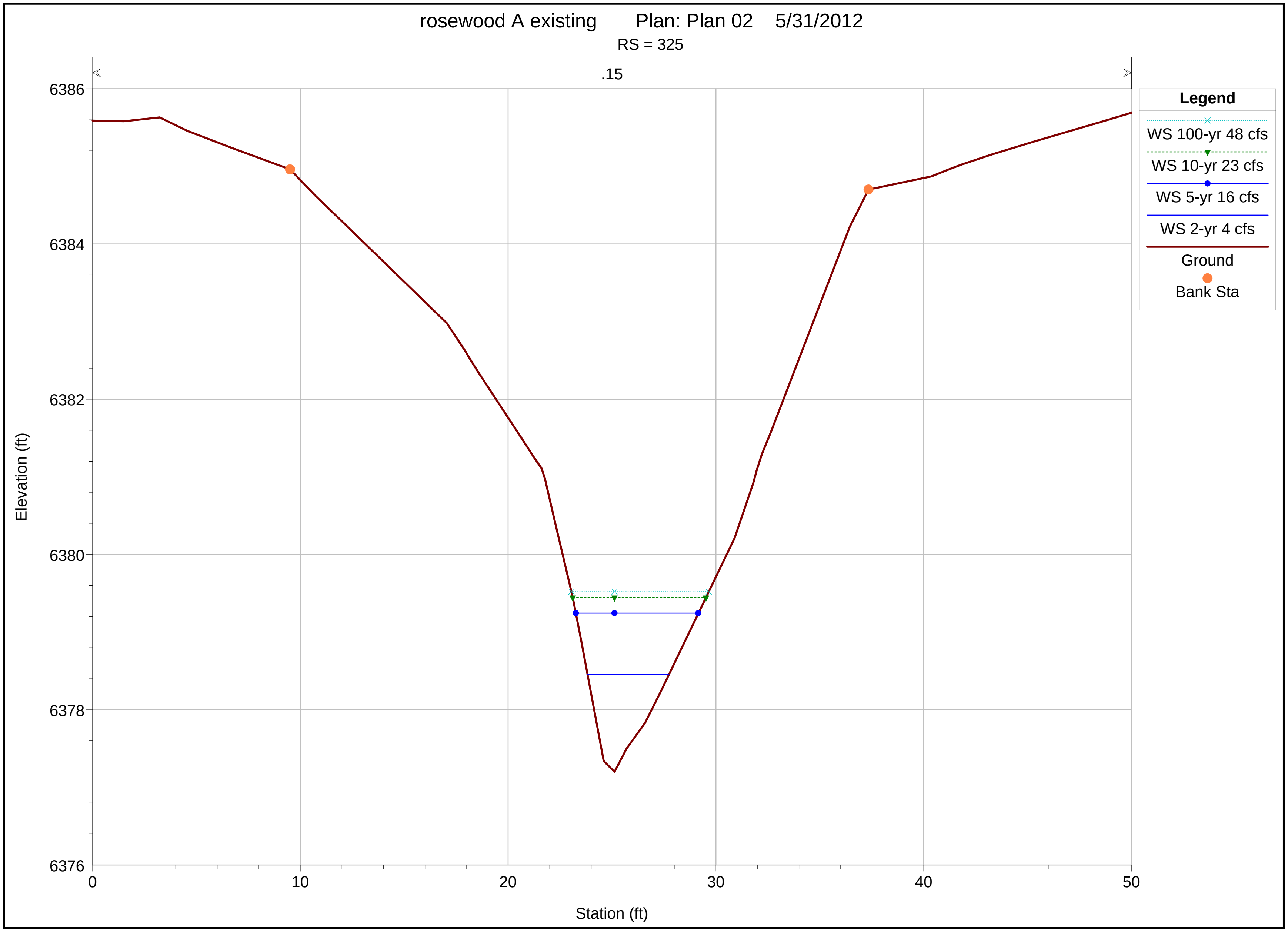

rosewood A existing Plan: Plan 02 5/31/2012
RS = 450
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6394
6392
6390
6388
6386
6384
6382
0
10
20
30
40
50
60
Station (ft)

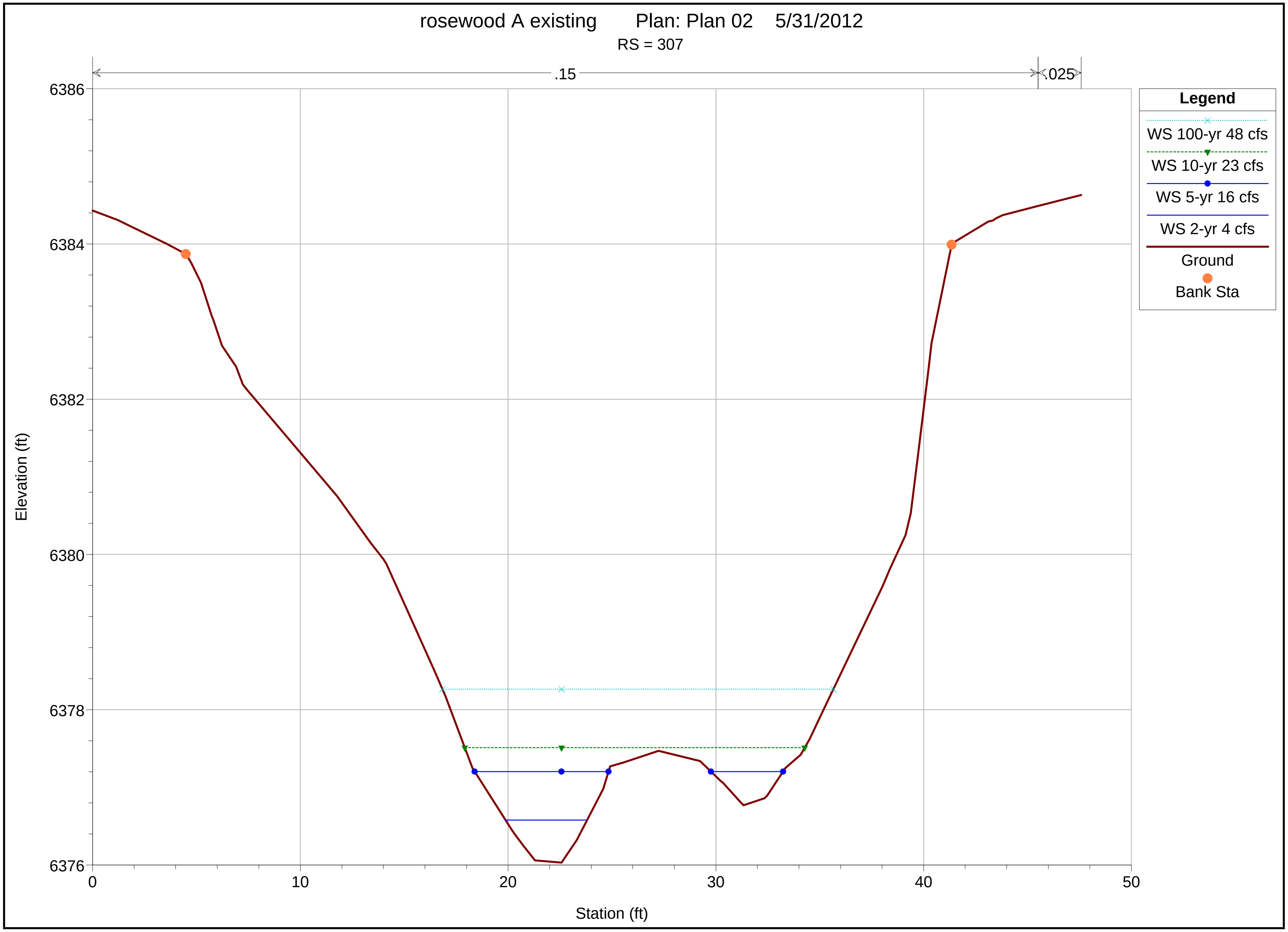

rosewood A existing Plan: Plan 02 5/31/2012
RS = 427
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6394
6392
6390
6388
6386
6384
6382
6380
0
10
20
30
40
50
Station (ft)

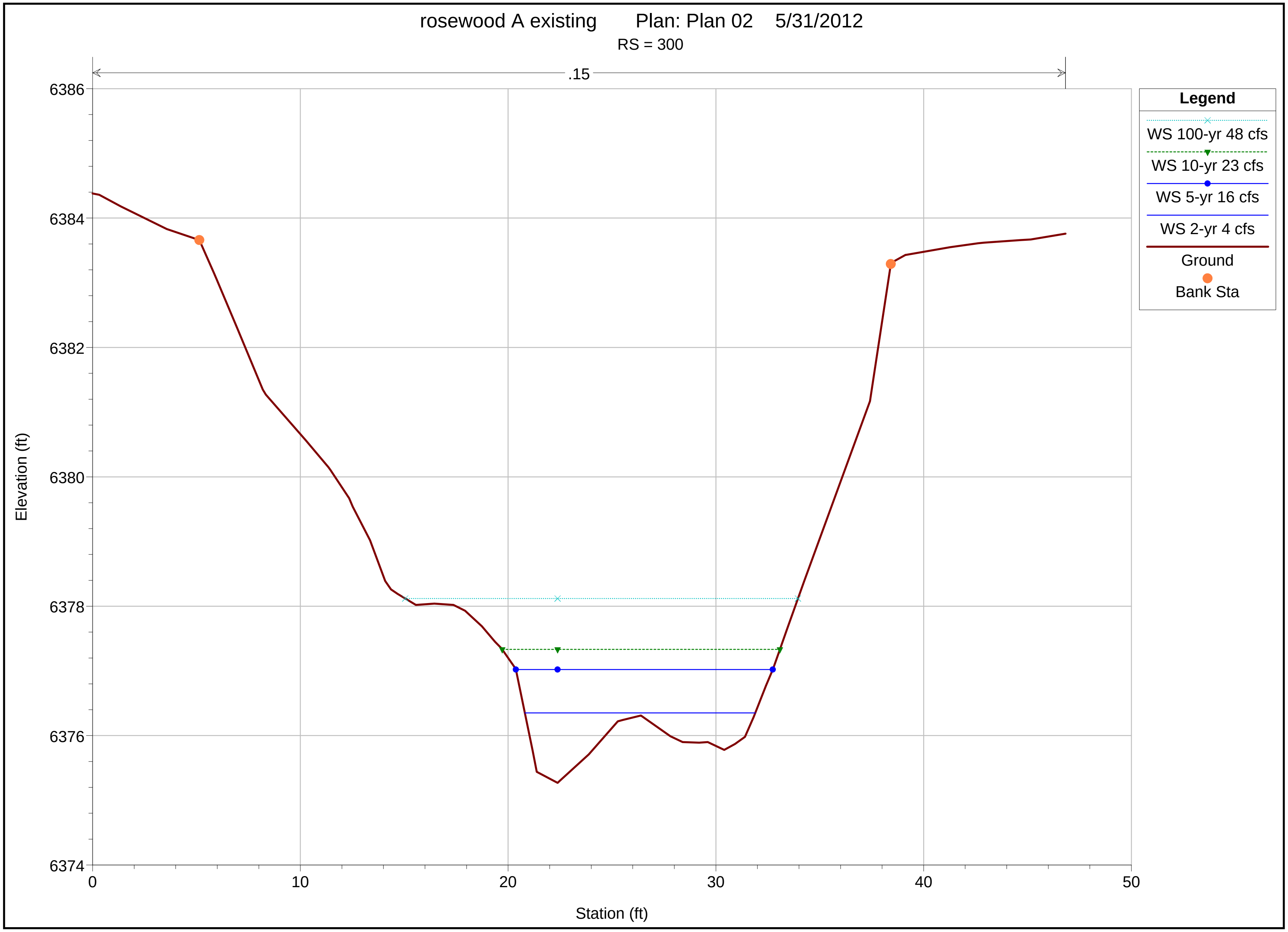
rosewood A existing Plan: Plan 02 5/31/2012
RS = 400
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6394
6392
6390
6388
6386
6384
6382
6380
6378
Station (ft)
0
10
20
30
40
50

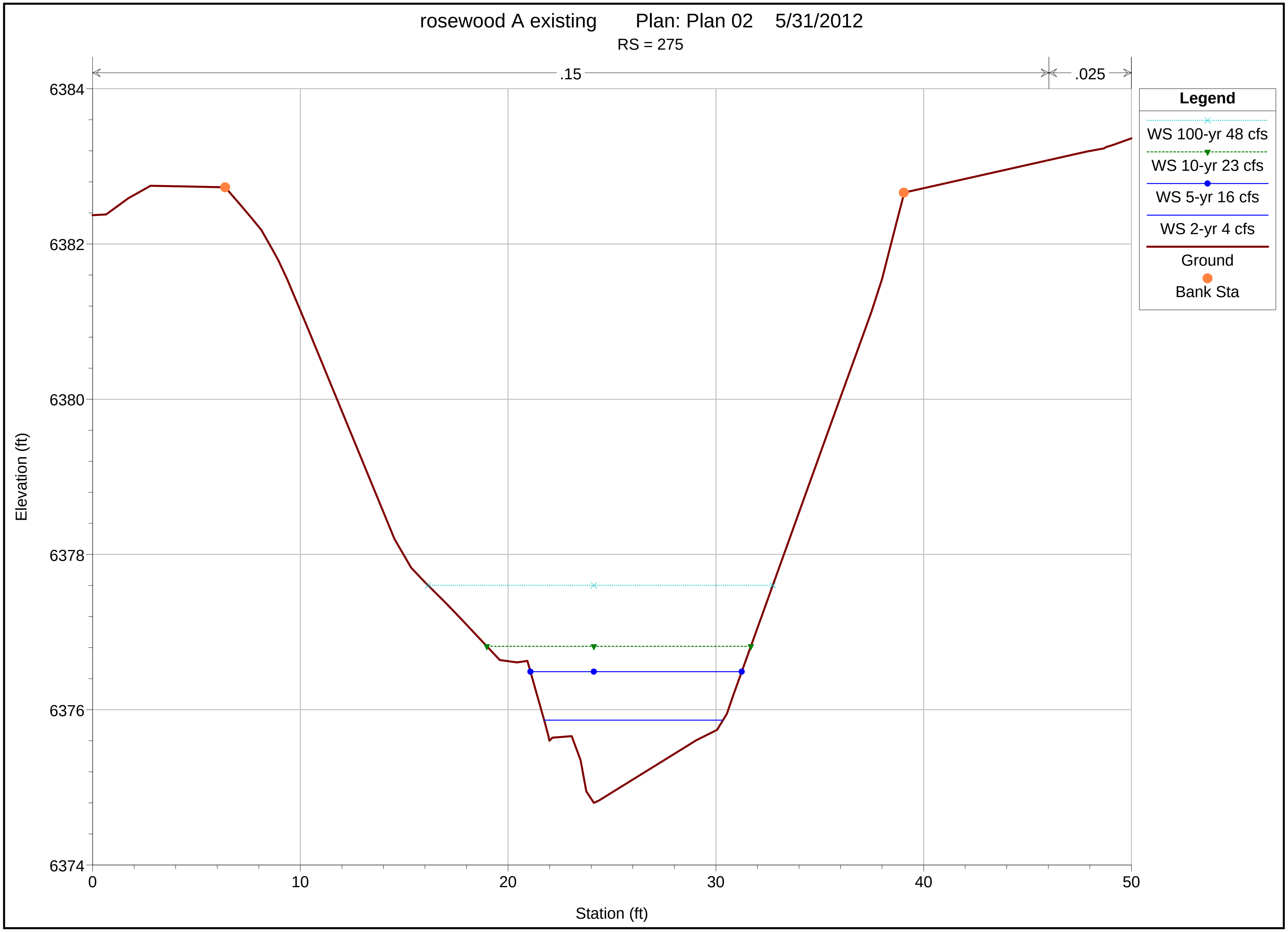

rosewood A existing Plan: Plan 02 5/31/2012
RS = 375
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6390
6388
6386
6384
6382
6380
6378
Station (ft)
0
10
20
30
40
50

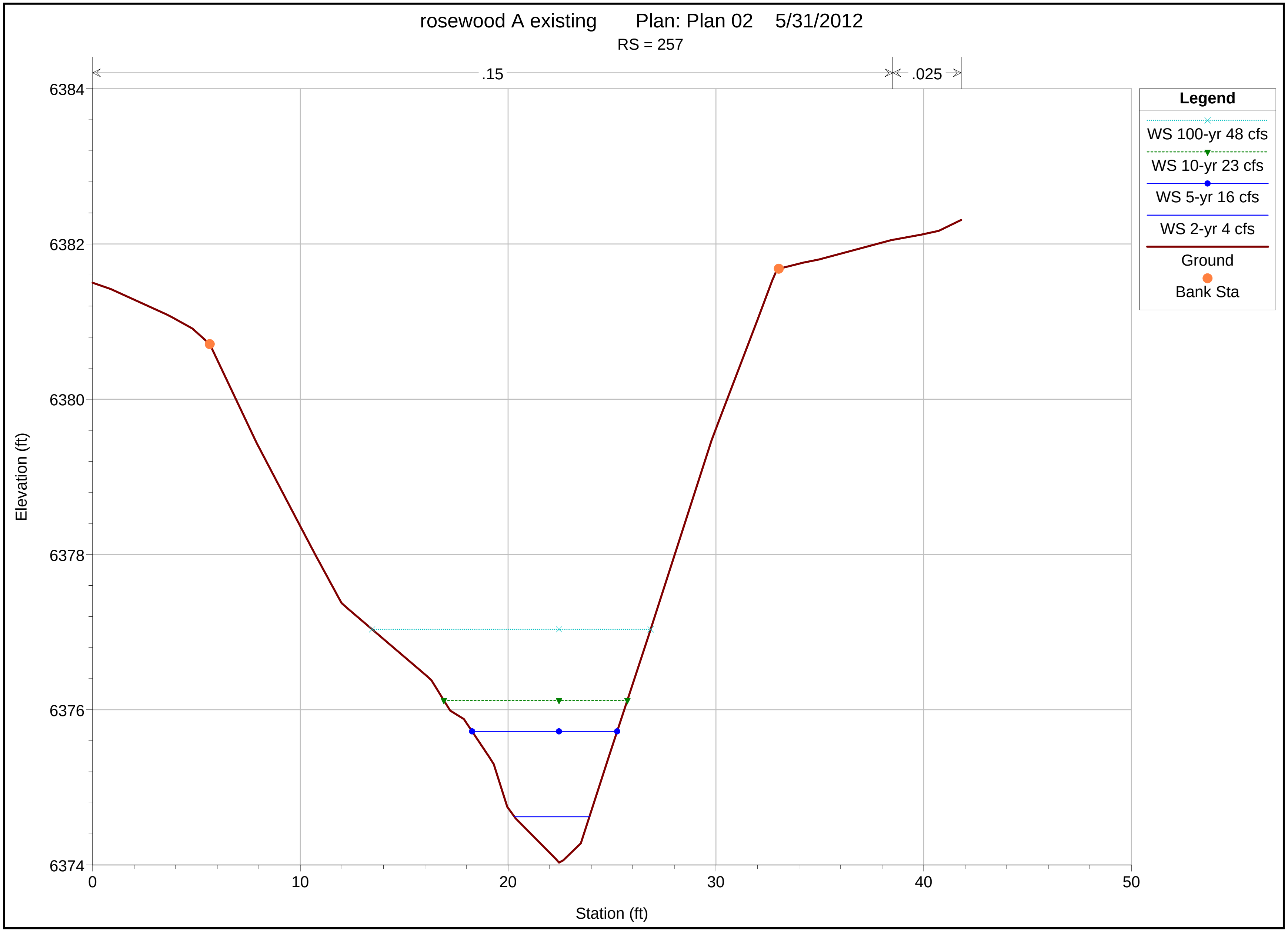

rosewood A existing Plan: Plan 02 5/31/2012
RS = 350
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6388
6386
6384
6382
6380
6378
Station (ft)
0
10
20
30
40
50


rosewood A existing Plan: Plan 02 5/31/2012
RS = 325
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6386
6384
6382
6380
6378
6376
0
10
20
30
40
50
Station (ft)

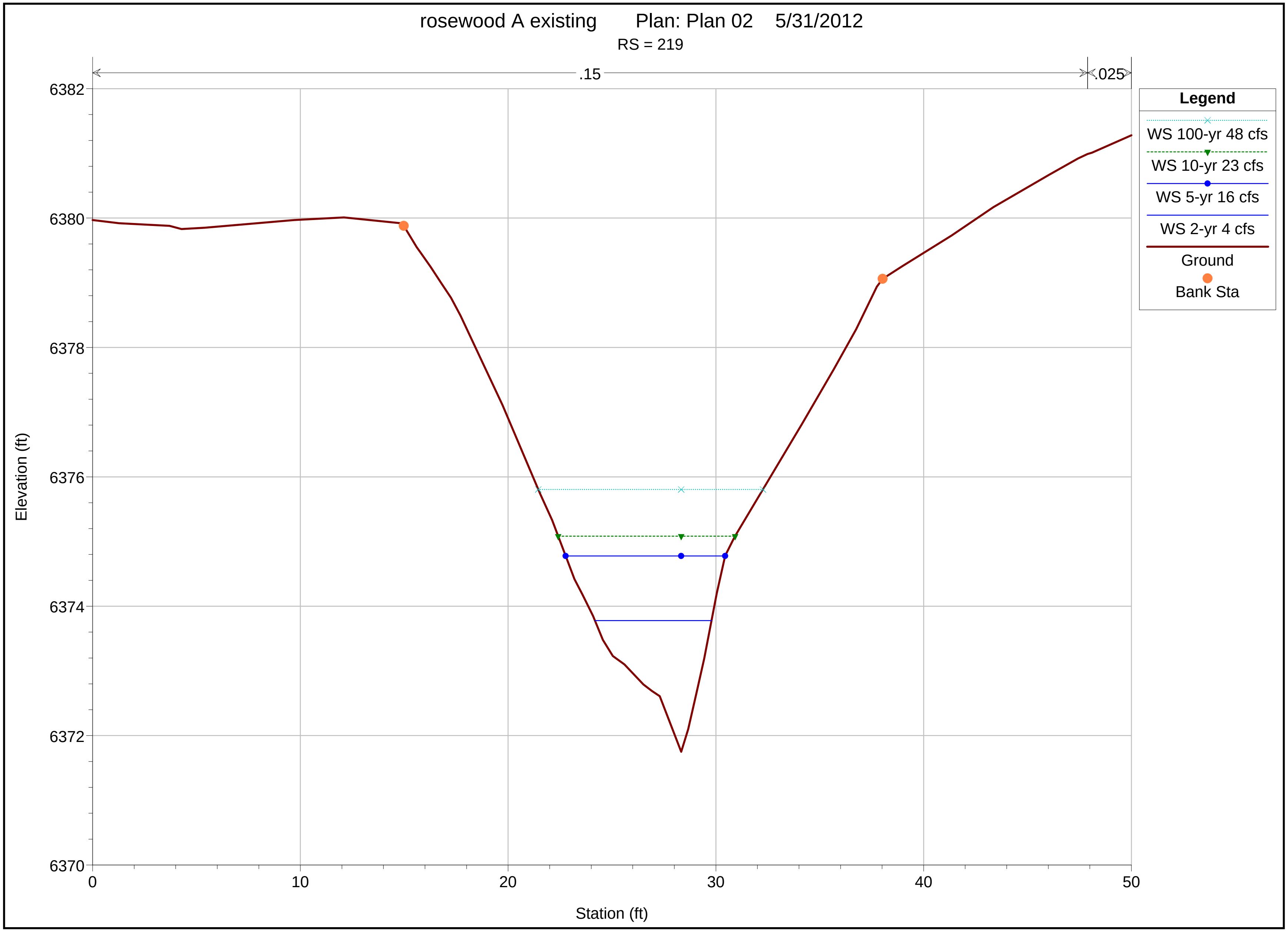

rosewood A existing Plan: Plan 02 5/31/2012
RS = 307
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6386
6384
6382
6380
6378
6376
Station (ft)
0
10
20
30
40
50

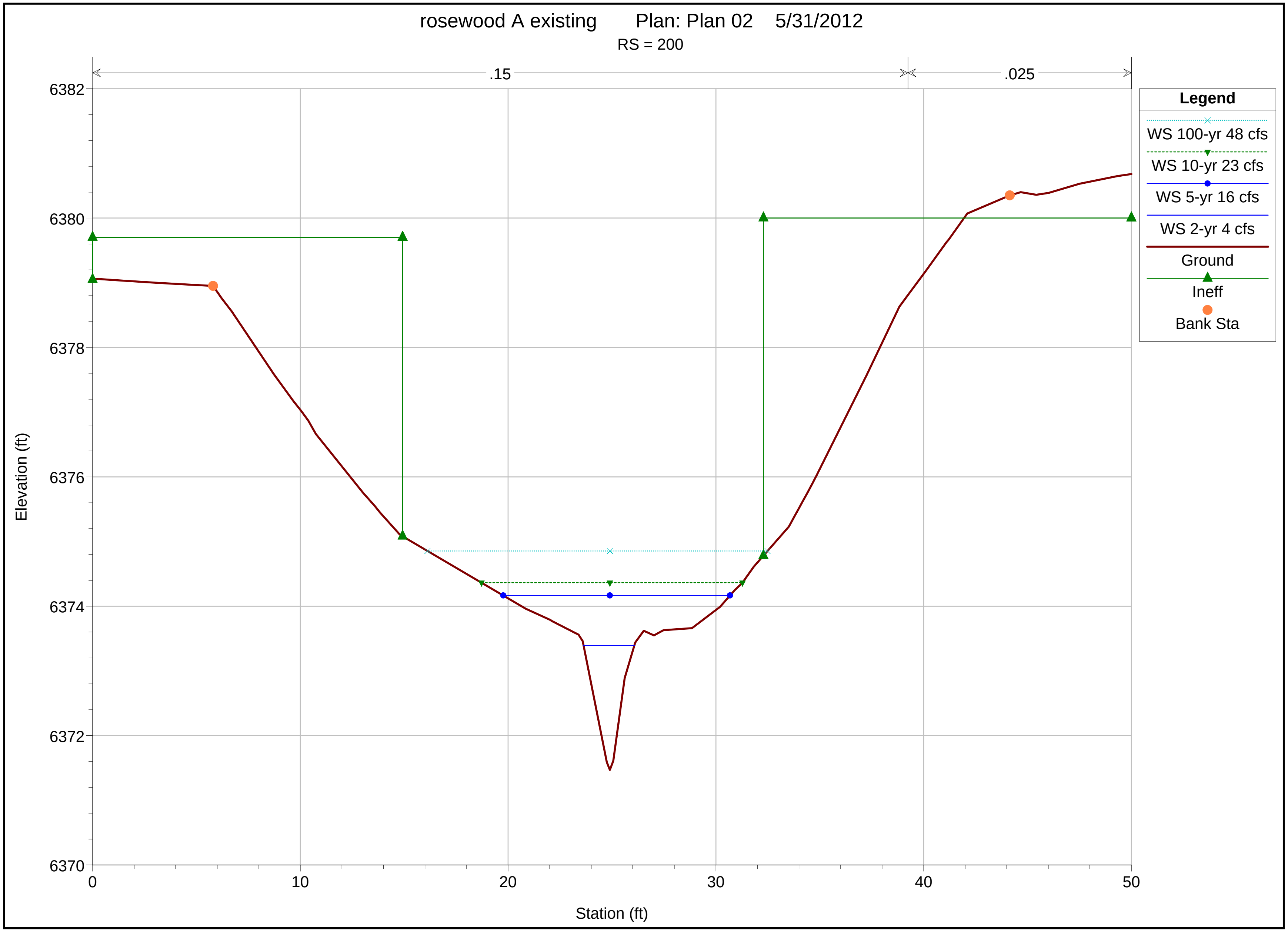
rosewood A existing Plan: Plan 02 5/31/2012
RS = 300
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6386
6384
6382
6380
6378
6376
6374
0
10
20
30
40
50
Station (ft)

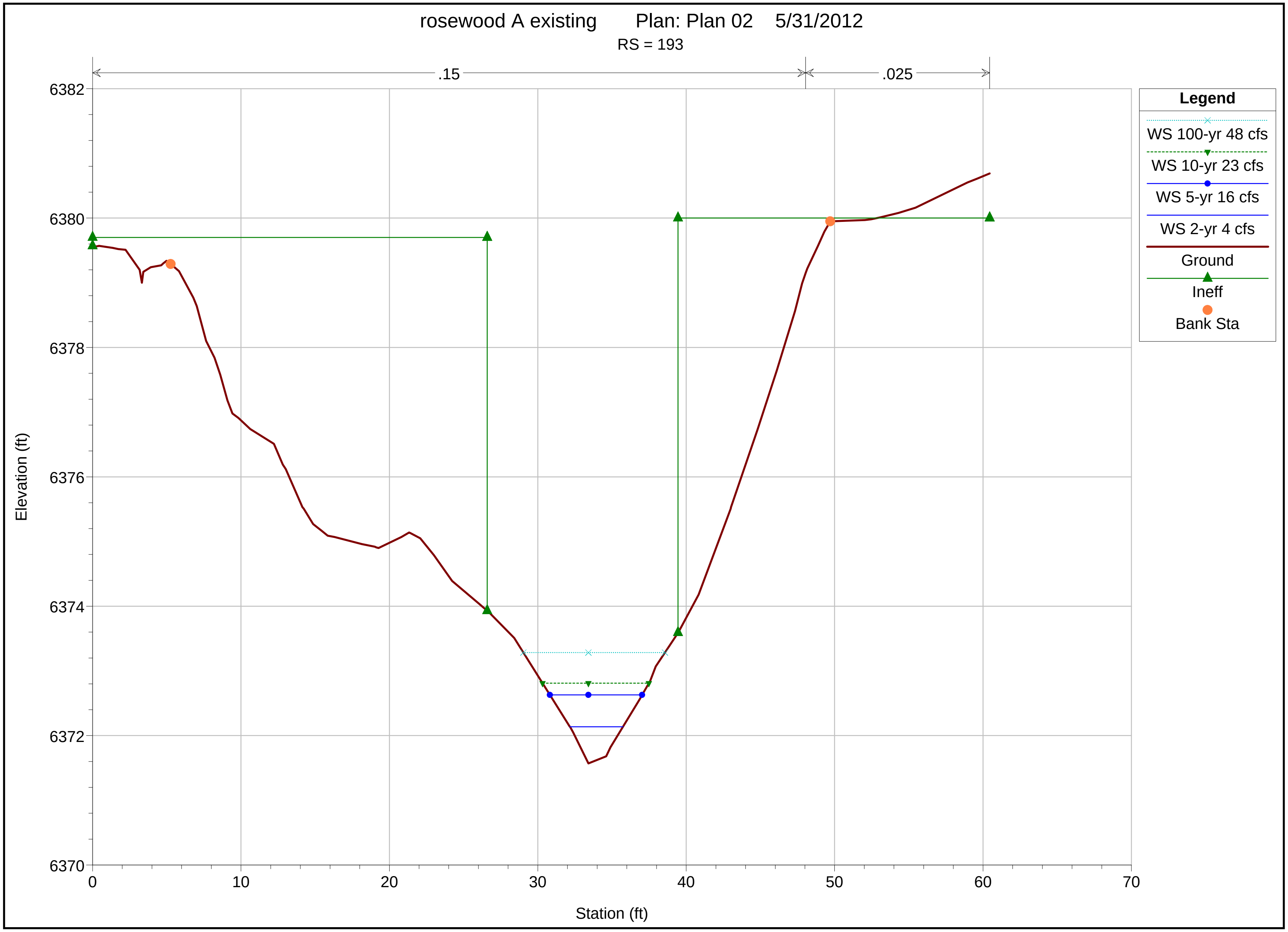
rosewood A existing Plan: Plan 02 5/31/2012
RS = 275
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6384
6382
6380
6378
6376
6374
0
10
20
30
40
50
Station (ft)

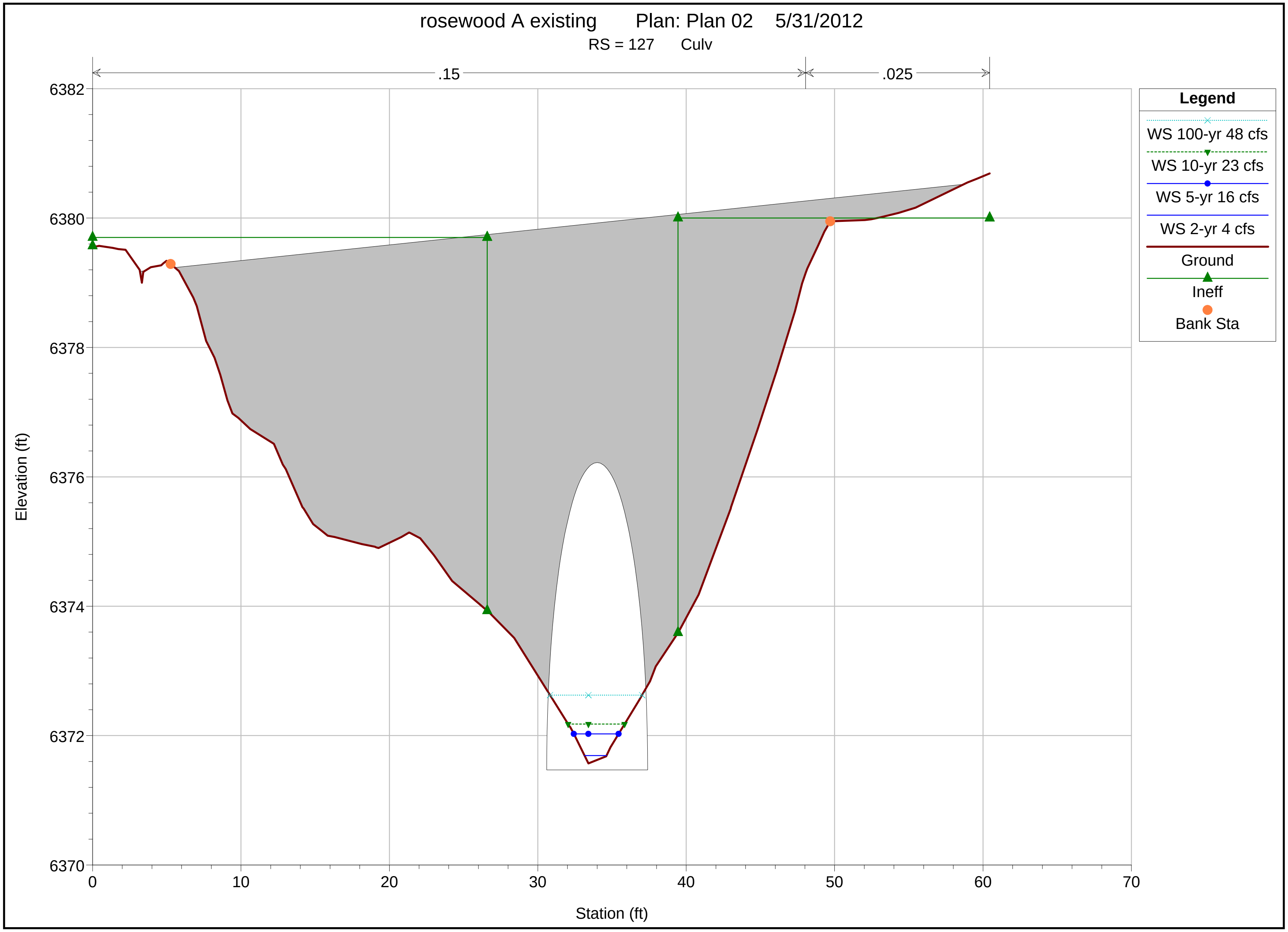


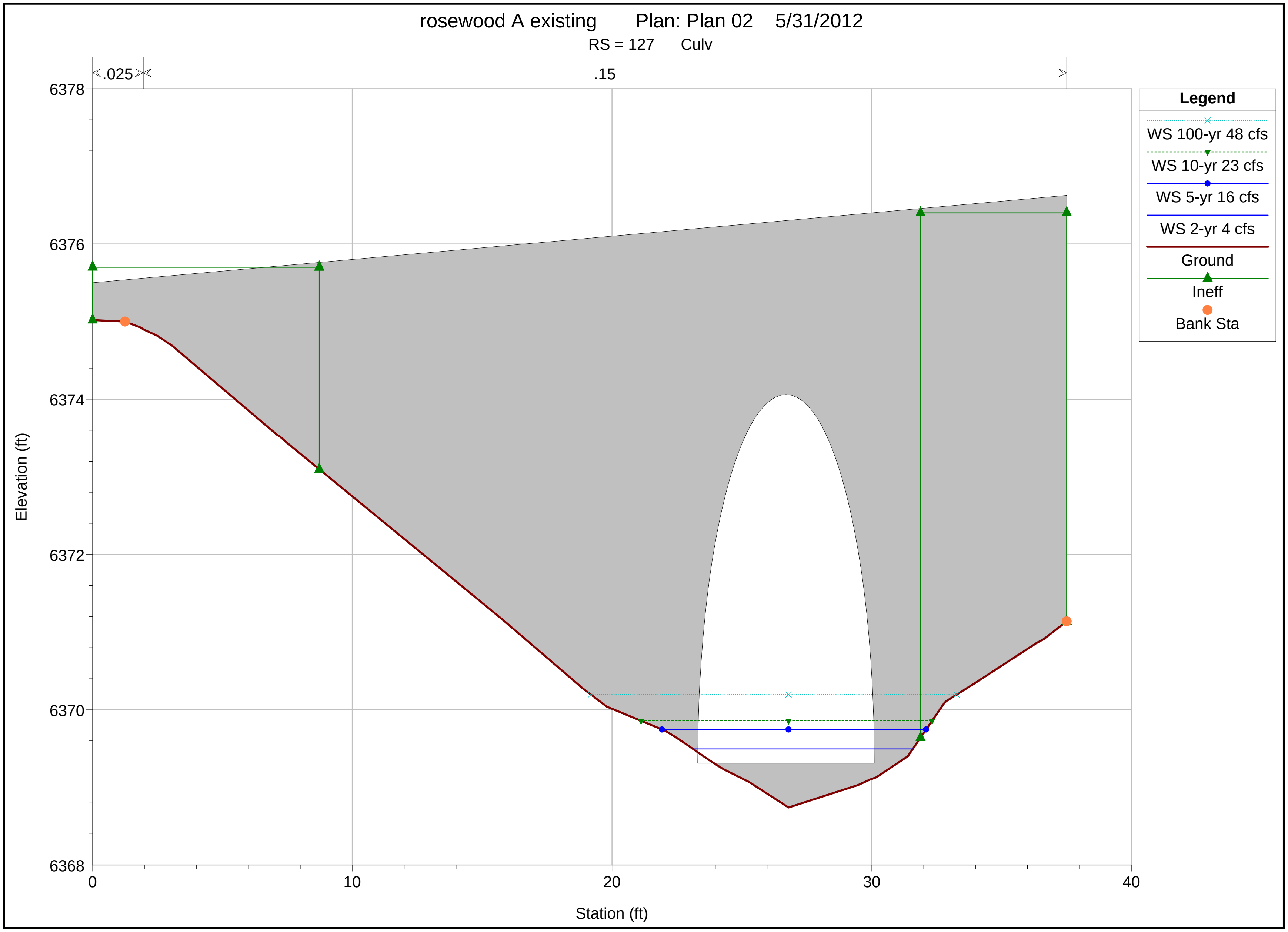
rosewood A existing Plan: Plan 02 5/31/2012
RS = 257
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6384
6382
6380
6378
6376
6374
Station (ft)
0
10
20
30
40
50

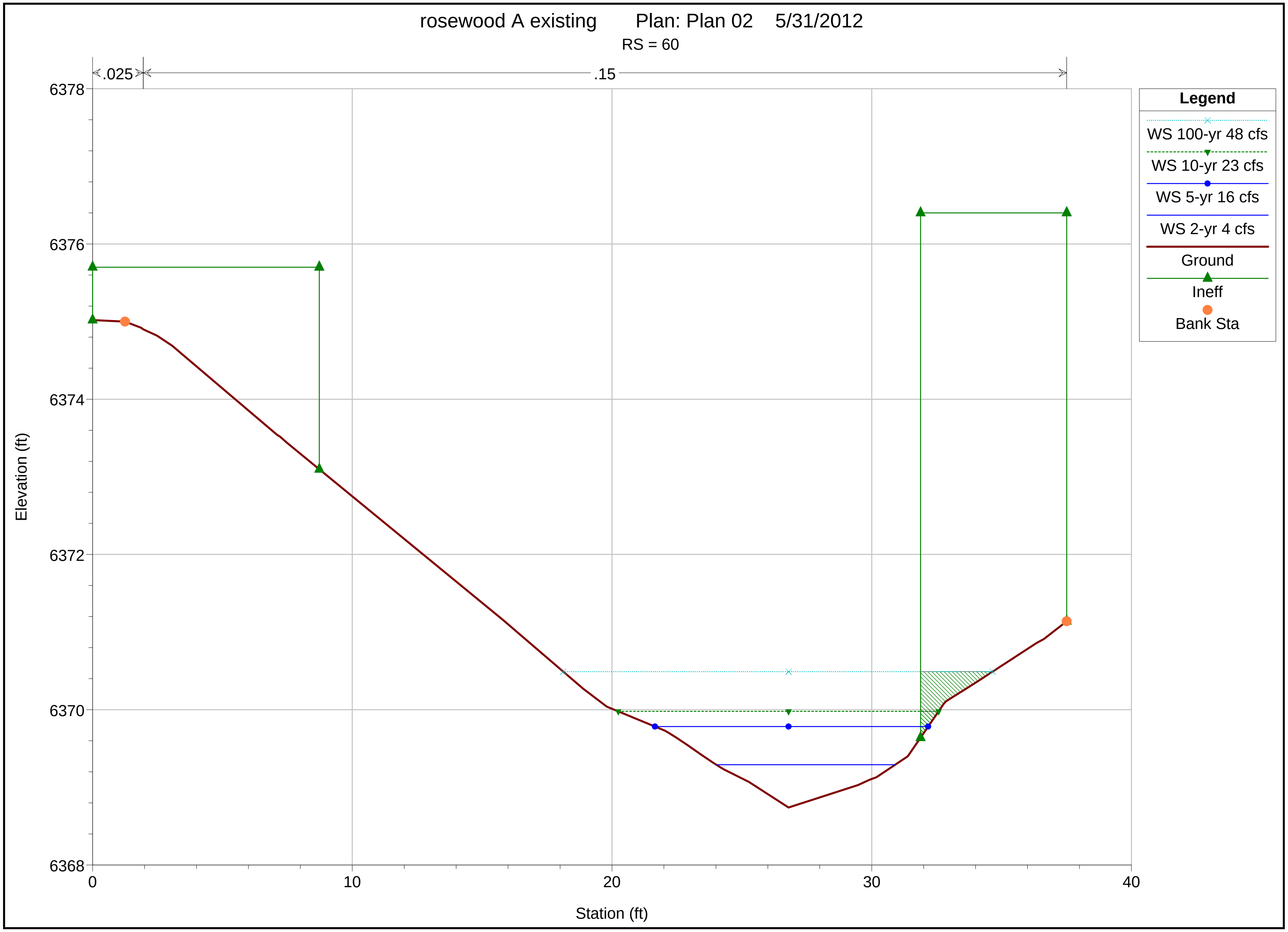

rosewood A existing Plan: Plan 02 5/31/2012
RS = 219
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6382
6380
6378
6376
6374
6372
6370
Station (ft)
0
10
20
30
40
50


rosewood A existing Plan: Plan 02 5/31/2012
RS = 200
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6382
6380
6378
6376
6374
6372
6370
Station (ft)
0
10
20
30
40
50

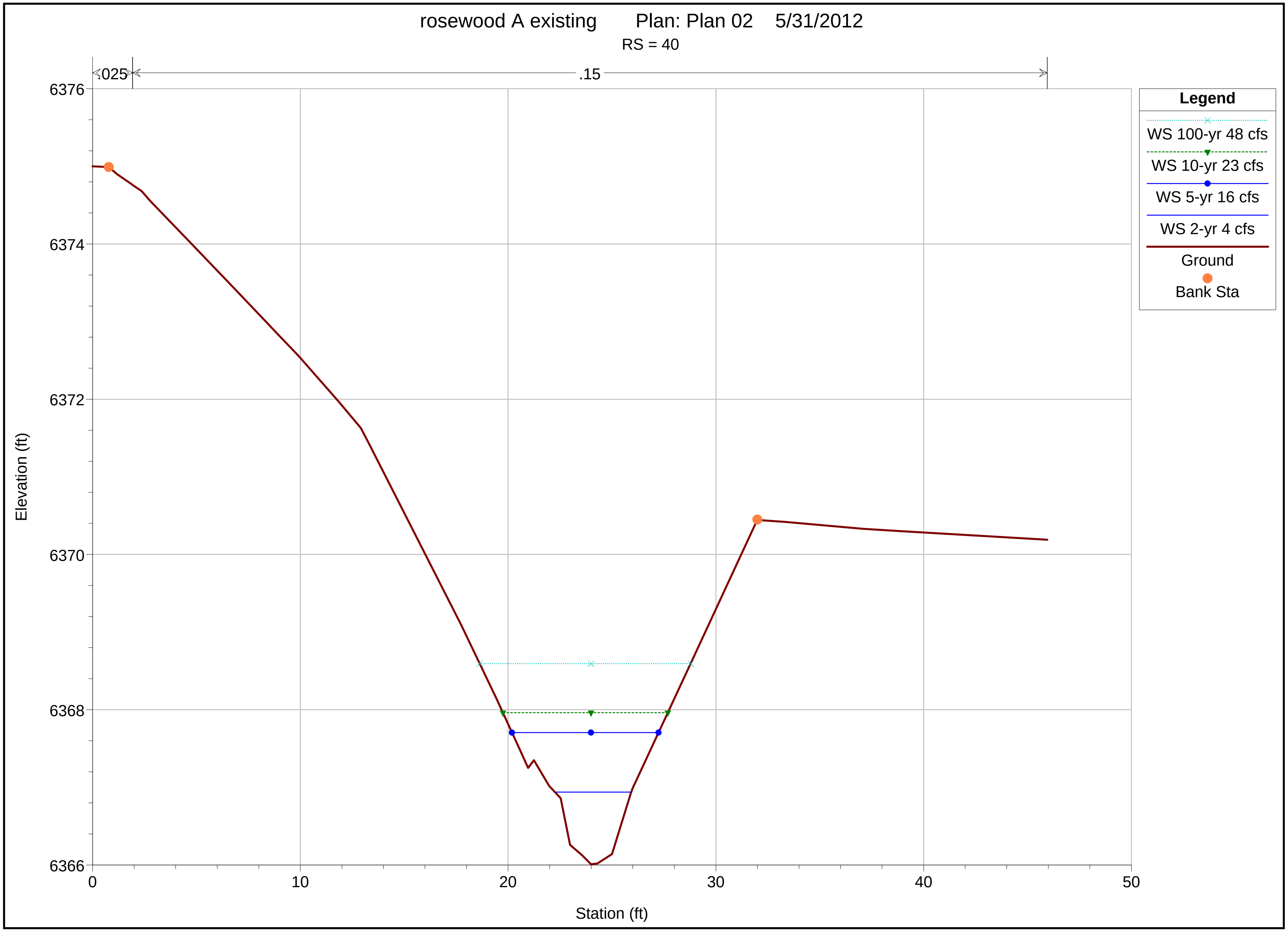

rosewood A existing Plan: Plan 02 5/31/2012
RS = 193
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6382
6380
6378
6376
6374
6372
6370
Station (ft)
0
10
20
30
40
50
60
70


rosewood A existing Plan: Plan 02 5/31/2012
RS = 127 Culv
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6382
6380
6378
6376
6374
6372
6370
Station (ft)
0
10
20
30
40
50
60
70


rosewood A existing Plan: Plan 02 5/31/2012
RS = 127 Culv
.025
.15
6378
6376
6374
6372
6370
6368
Elevation (ft)
0
10
20
30
40
Station (ft)
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta

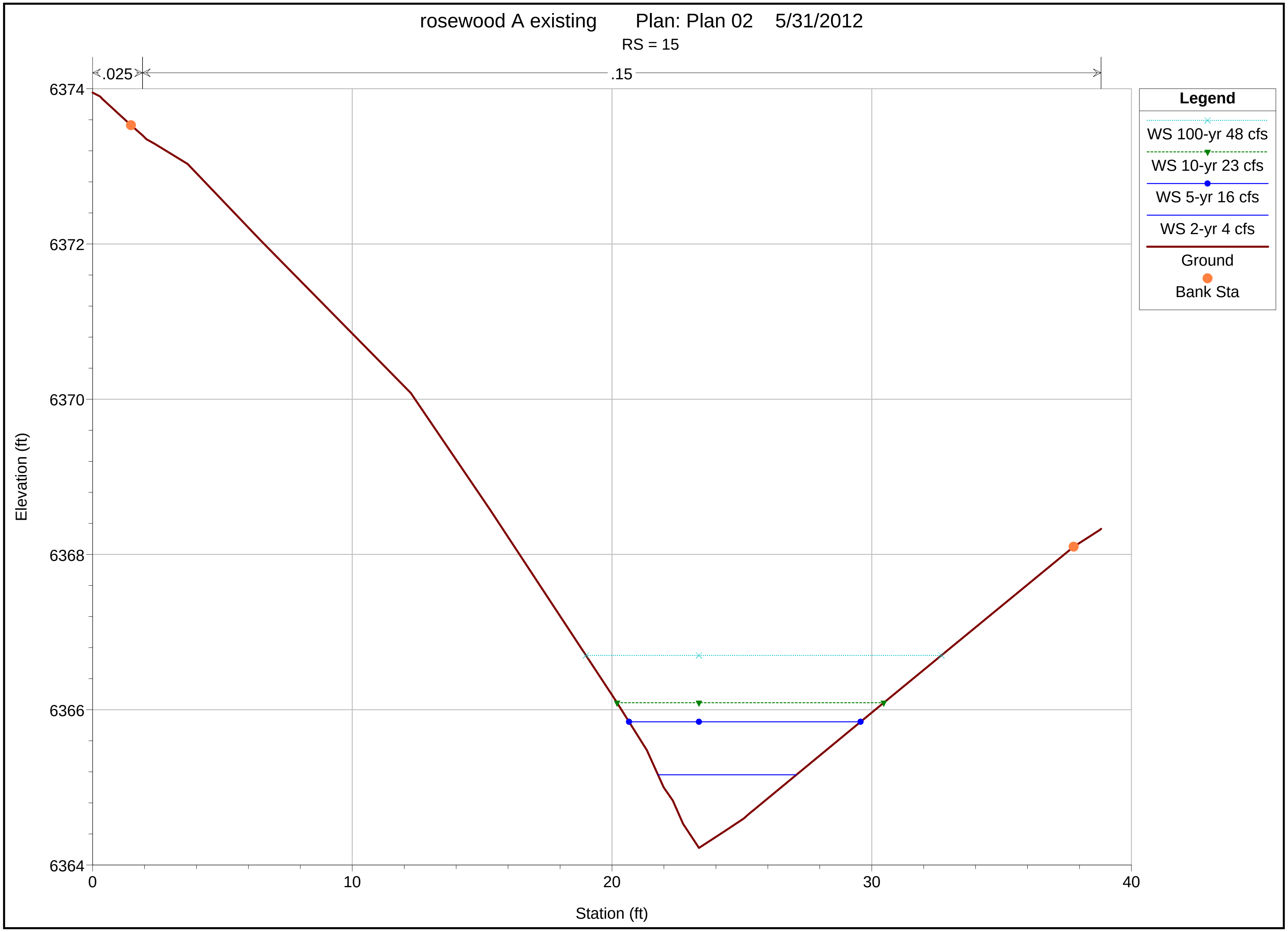


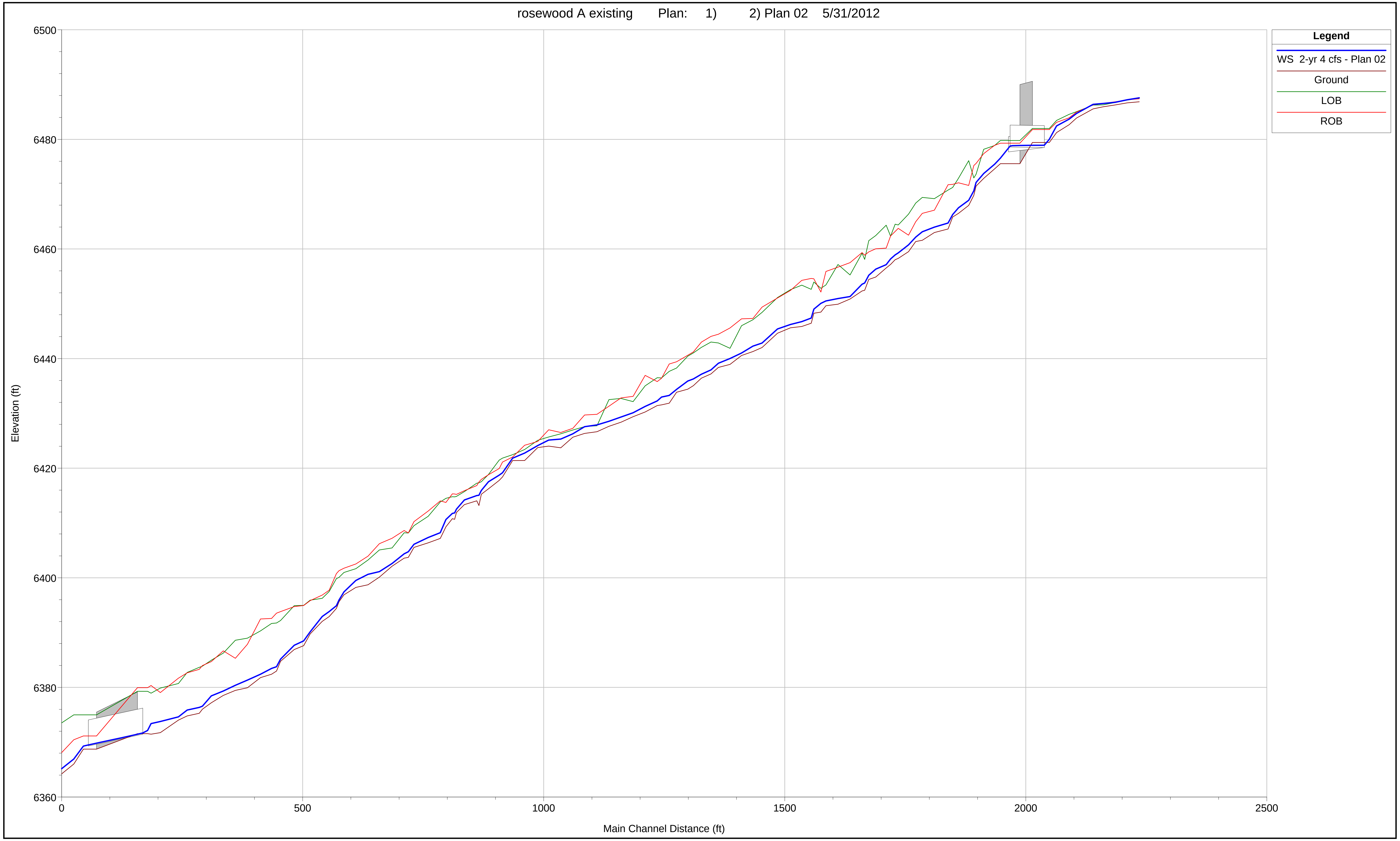
rosewood A existing Plan: Plan 02 5/31/2012
RS = 60
.025
.15
6378
6376
6374
6372
6370
6368
Elevation (ft)
0
10
20
30
40
Station (ft)
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta

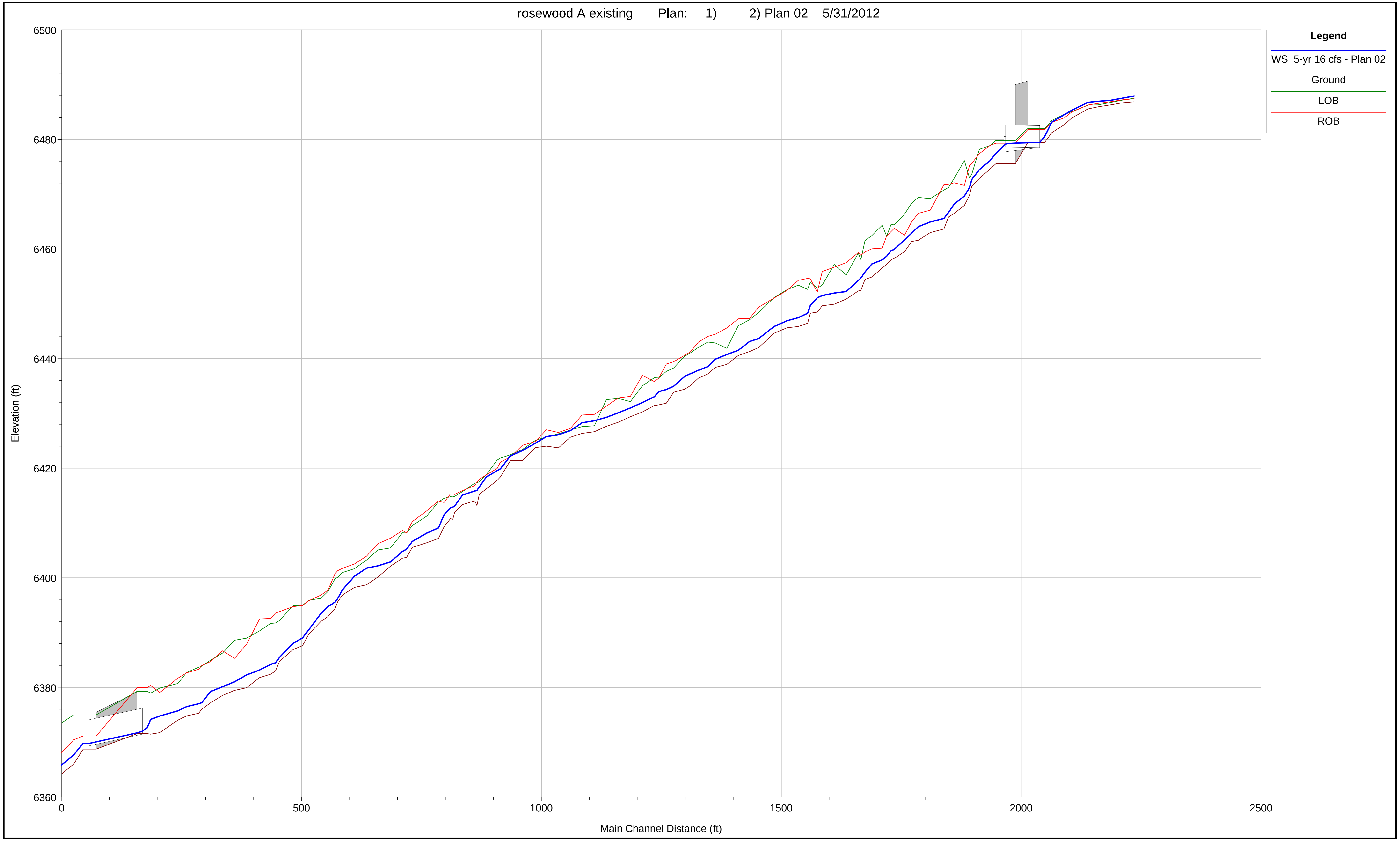


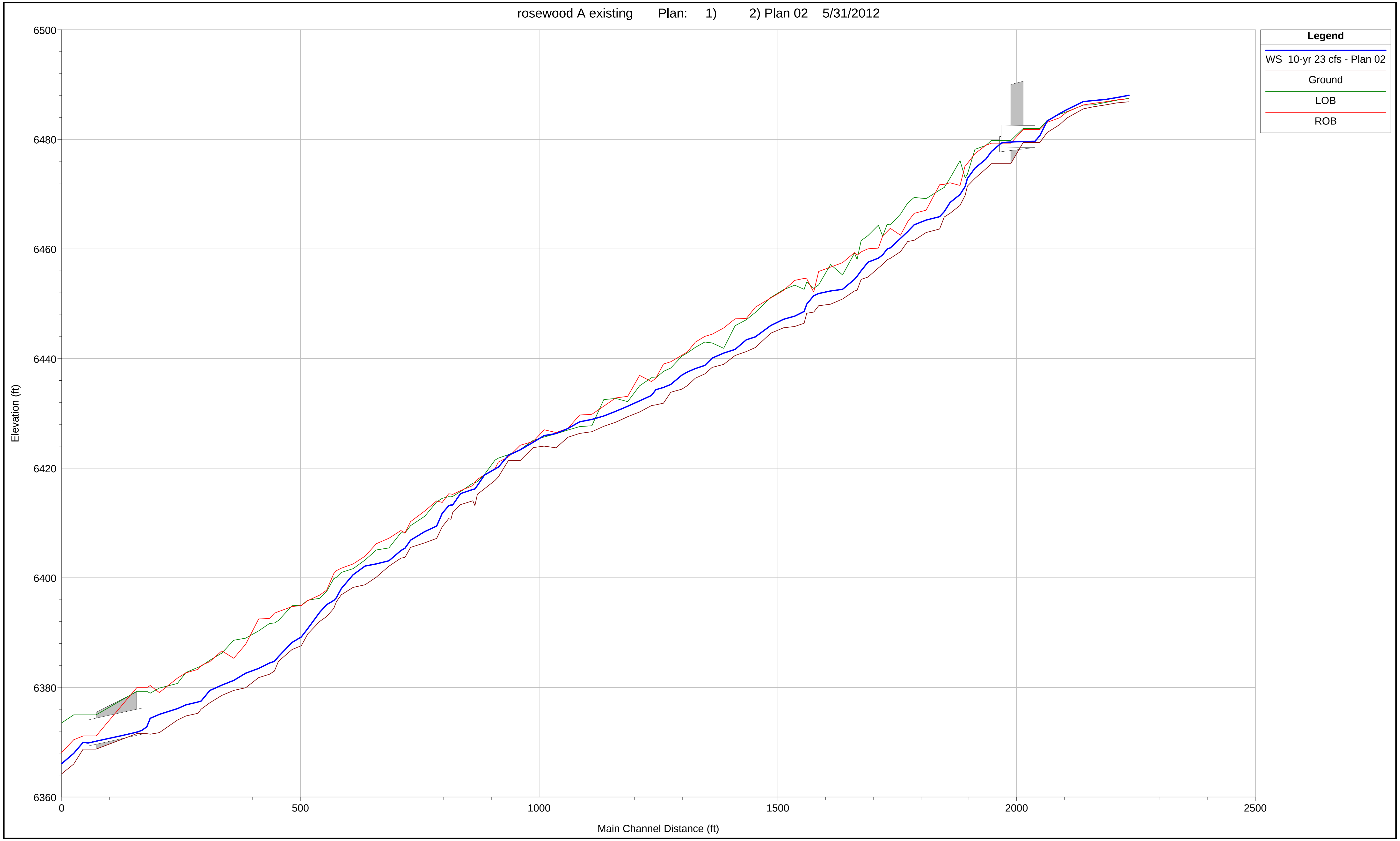
rosewood A existing Plan: Plan 02 5/31/2012

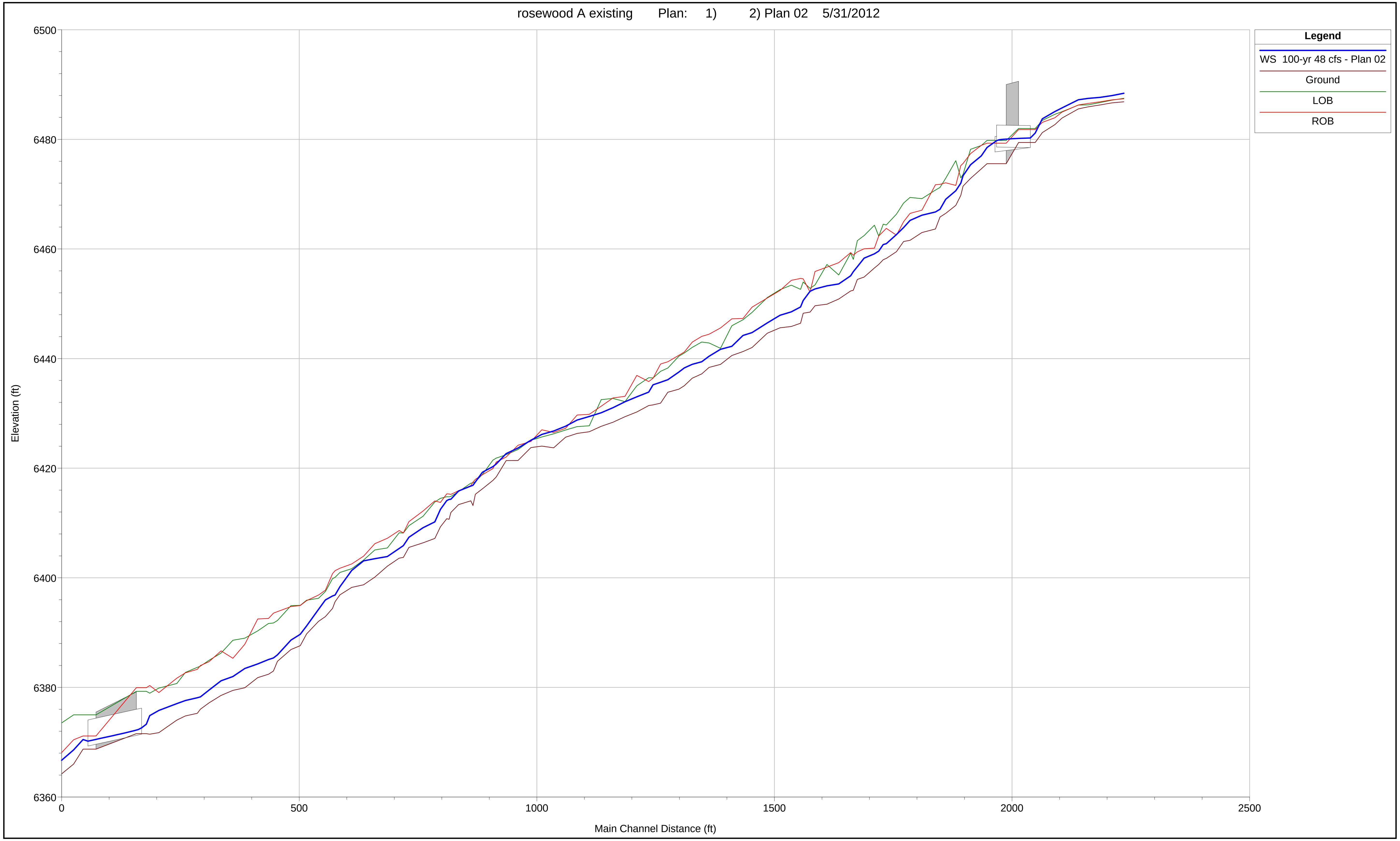
RS = 40


rosewood A existing Plan: Plan 02 5/31/2012
RS = 15
.025
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6374
6372
6370
6368
6366
6364
Station (ft)
0
10
20
30
40

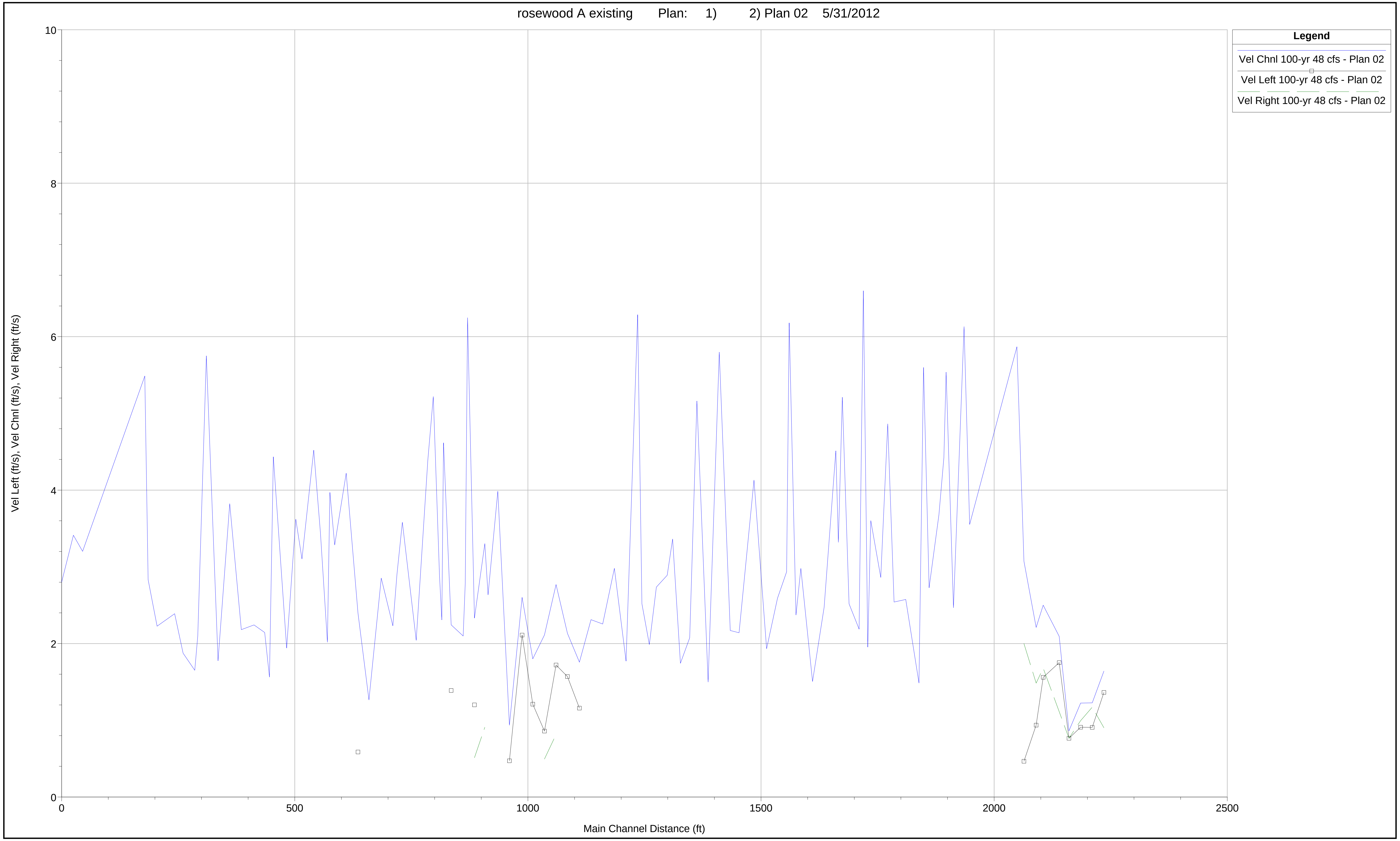

rosewood A existing Plan: 1) 2) Plan 02 5/31/2012
Legend
WS 2-yr 4 cfs - Plan 02
Ground
LOB
ROB
Elevation (ft)
6500
6480
6460
6440
6420
6400
6380
6360
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

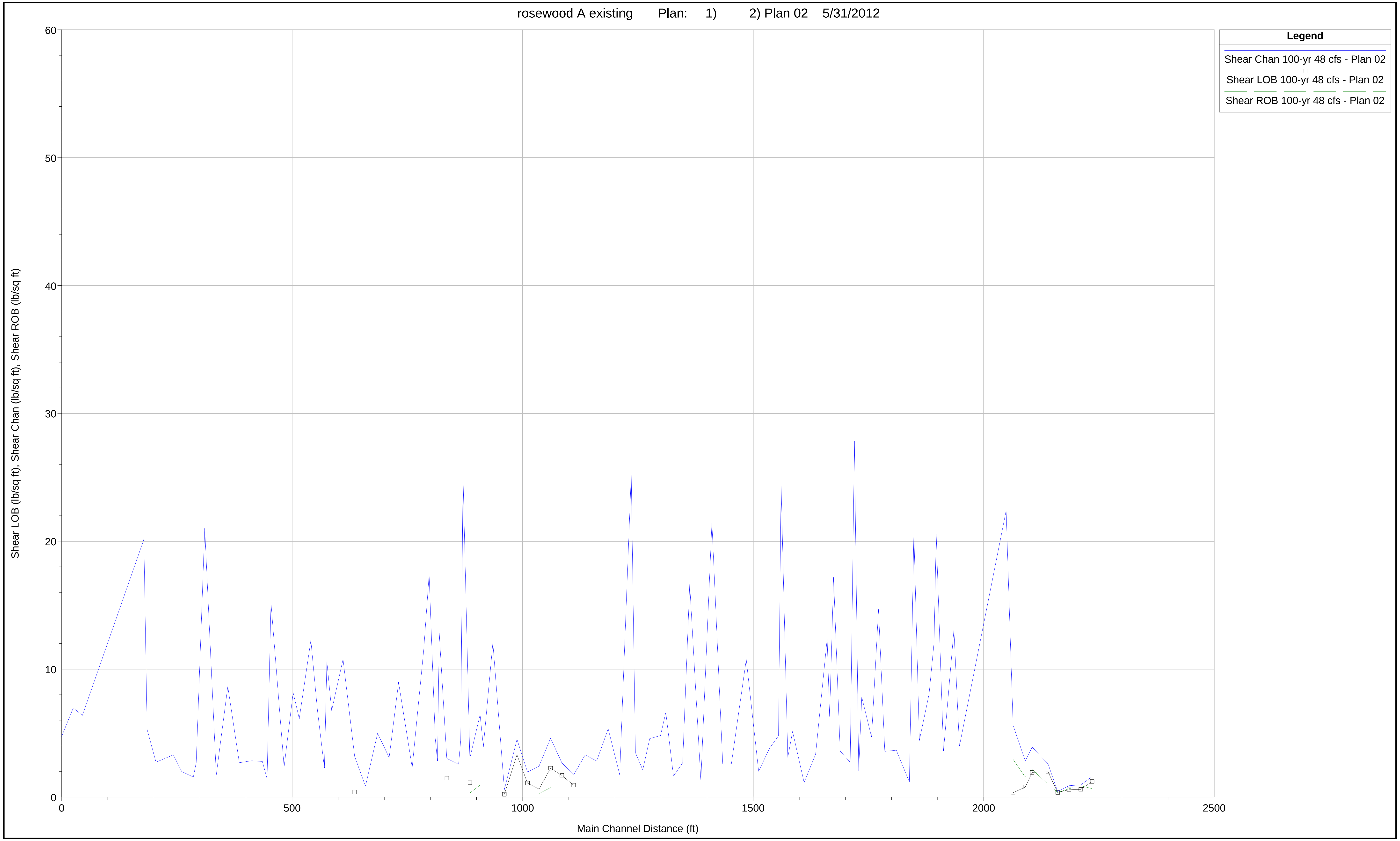
rosewood A existing Plan: 1) 2) Plan 02 5/31/2012
Legend
WS 5-yr 16 cfs - Plan 02
Ground
LOB
ROB
Elevation (ft)
6500
6480
6460
6440
6420
6400
6380
6360
0
500
1000
1500
2000
2500
Main Channel Distance (ft)


rosewood A existing Plan: 1) 2) Plan 02 5/31/2012
Legend
WS 10-yr 23 cfs - Plan 02
Ground
LOB
ROB
Elevation (ft)
6500
6480
6460
6440
6420
6400
6380
6360
Main Channel Distance (ft)
0
500
1000
1500
2000
2500



rosewood A existing Plan: 1) 2) Plan 02 5/31/2012
Elevation (ft)
6500
6480
6460
6440
6420
6400
6380
6360
0
500
1000
1500
2000
2500
Main Channel Distance (ft)
Legend
WS 100-yr 48 cfs - Plan 02
Ground
LOB
ROB


rosewood A existing Plan: 1) 2) Plan 02 5/31/2012
Legend
Vel Chnl 100-yr 48 cfs - Plan 02
Vel Left 100-yr 48 cfs - Plan 02
Vel Right 100-yr 48 cfs - Plan 02
Vel Left (ft/s), Vel Chnl (ft/s), Vel Right (ft/s)
Main Channel Distance (ft)
0
2
4
6
8
10
0
500
1000
1500
2000
2500


rosewood A existing Plan: 1) 2) Plan 02 5/31/2012
Legend
Shear Chan 100-yr 48 cfs - Plan 02
Shear LOB 100-yr 48 cfs - Plan 02
Shear ROB 100-yr 48 cfs - Plan 02
Shear LOB (lb/sq ft), Shear Chan (lb/sq ft), Shear ROB (lb/sq ft)
60
50
40
30
20
10
0
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

HEC-RAS results for the estimated 100-year event with total discharge of 48 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
2250	6,487.49	6,486.85	6,487.40	6,488.40	18.54	25.45	4.00	36.92	9.06	19.02	8.84	1.25	0.98	0.50	1.64	1.36	0.90	1.60	1.21	0.65
2225	6,487.15	6,486.66	6,487.21	6,487.98	13.52	9.71	24.77	46.03	10.43	15.40	20.20	1.06	0.69	1.05	1.23	0.91	1.17	0.94	0.60	0.88
2200	6,486.71	6,486.28	6,486.86	6,487.66	13.00	13.28	21.72	50.00	8.53	18.35	23.12	1.24	0.80	0.94	1.22	0.91	0.99	0.89	0.57	0.65
2175	6,486.29	6,485.94	6,486.56	6,487.48	8.45	20.53	19.02	50.00	7.11	22.26	20.63	1.38	1.20	1.20	0.86	0.77	0.77	0.43	0.36	0.36
2154	6,486.25	6,485.56	6,486.28	6,487.22	19.11	25.79	3.10	26.81	7.05	14.12	5.64	1.29	1.04	0.49	2.09	1.75	1.11	2.58	1.98	1.00
2120	6,485.05	6,483.89	6,484.98	6,485.74	20.92	15.43	11.66	37.50	7.32	18.38	11.80	1.14	0.54	0.59	2.50	1.56	1.68	3.90	1.92	2.15
2105	6,484.58	6,482.68	6,483.94	6,485.07	32.43	5.57	10.00	35.52	10.40	15.99	9.13	1.41	0.37	0.74	2.21	0.94	1.48	2.83	0.78	1.56
2078	6,483.45	6,481.23	6,483.10	6,483.74	31.55	0.17	16.27	24.76	7.23	5.14	12.39	1.42	0.07	0.66	3.07	0.47	2.00	5.60	0.33	2.94
2063	6,481.98	6,479.43	6,481.79	6,481.15	48.00			7.77	7.77			1.05			5.87			22.40		
1962	6,479.79	6,475.56	6,479.30	6,478.51	48.00			8.33	8.33			1.62			3.55			3.97		
1950	6,478.88	6,474.62	6,478.91	6,476.99	48.00			6.54	6.54			1.20			6.13			13.09		
1927	6,478.19	6,472.88	6,477.40	6,475.37	48.00			14.45	14.45			1.35			2.47			3.58		
1912	6,473.63	6,471.46	6,475.61	6,473.35	48.00			9.33	9.33			0.93			5.54			20.53		
1907	6,472.96	6,469.79	6,475.22	6,472.00	48.00			8.85	8.85			1.23			4.42			12.09		
1896	6,476.11	6,467.95	6,471.59	6,470.62	48.00			9.20	9.20			1.42			3.68			8.06		
1875	6,472.90	6,466.49	6,472.07	6,469.07	48.00			13.20	13.20			1.33			2.73			4.42		
1863	6,471.23	6,465.83	6,471.79	6,467.25	48.00			8.81	8.81			0.97			5.60			20.73		
1853	6,470.74	6,463.64	6,471.72	6,466.75	48.00			17.40	17.40			1.86			1.49			1.17		
1825	6,469.18	6,462.99	6,467.08	6,466.15	48.00			10.07	10.07			1.85			2.57			3.66		
1800	6,469.40	6,461.59	6,466.49	6,465.21	48.00			10.01	10.01			1.89			2.54			3.57		
1786	6,468.38	6,461.36	6,464.97	6,463.90	48.00			7.51	7.51			1.31			4.86			14.66		
1771	6,466.35	6,459.51	6,462.51	6,462.62	47.99		0.01	11.03	10.41		0.62	1.61		0.06	2.86		0.35	4.68		0.20
1750	6,464.38	6,458.28	6,463.76	6,460.96	48.00			9.95	9.95			1.34			3.60			7.83		
1744	6,464.52	6,458.04	6,463.19	6,460.80	48.00			13.26	13.26			1.85			1.95			2.06		
1734	6,462.33	6,457.18	6,462.37	6,459.61	48.00			5.39	5.39			1.35			6.60			27.84		
1725	6,464.34	6,456.53	6,460.16	6,459.11	48.00			14.13	14.13			1.55			2.19			2.71		
1703	6,462.44	6,454.88	6,460.03	6,458.32	48.00			11.39	11.39			1.67			2.52			3.59		
1689	6,461.51	6,454.44	6,459.46	6,456.75	48.00			7.68	7.68			1.20			5.21			17.16		
1680	6,458.09	6,452.46	6,458.86	6,455.85	48.00			7.53	7.53			1.92			3.32			6.30		
1675	6,459.22	6,452.33	6,459.34	6,455.10	48.00			6.91	6.91			1.54			4.51			12.38		
1650	6,455.26	6,450.87	6,457.51	6,453.61	48.00			10.53	10.53			1.84			2.47			3.36		
1625	6,457.17	6,449.92	6,456.69	6,453.27	48.00			11.70	11.70			2.72			1.51			1.13		
1600	6,453.43	6,449.64	6,455.89	6,452.70	48.00			10.06	10.06			1.60			2.98			5.12		
1590	6,452.82	6,448.48	6,452.14	6,452.28	47.98		0.02	11.10	10.40		0.70	1.94		0.07	2.37		0.30	3.10		0.14
1575	6,453.98	6,448.27	6,454.55	6,450.59	48.00			6.33	6.33			1.23			6.18			24.56		
1570	6,452.63	6,446.45	6,454.63	6,449.42	48.00			8.09	8.09			2.02			2.94			4.79		
1550	6,453.40	6,445.85	6,454.27	6,448.52	48.00			11.61	11.61			1.60			2.59			3.81		
1526	6,452.58	6,445.61	6,452.43	6,447.90	48.00			12.57	12.57			1.98			1.93			2.01		
1499	6,451.13	6,444.63	6,451.05	6,446.50	48.00			10.37	10.37			1.12			4.13			10.75		
1467	6,448.42	6,442.02	6,449.38	6,444.74	48.00			14.63	14.63			1.53			2.14			2.61		

HEC-RAS results for the estimated 100-year event with total discharge of 48 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
1449	6,447.09	6,441.28	6,447.32	6,444.22	48.00			12.03	12.03			1.84			2.17			2.56		
1425	6,446.00	6,440.56	6,447.26	6,442.24	48.00			7.17	7.17			1.15			5.80			21.44		
1401	6,441.88	6,438.93	6,445.59	6,441.69	48.00			19.31	19.31			1.66			1.50			1.25		
1377	6,442.85	6,438.38	6,444.44	6,440.42	48.00			7.55	7.55			1.23			5.16			16.65		
1362	6,443.02	6,437.20	6,444.05	6,439.42	48.00			20.05	20.05			1.15			2.08			2.67		
1342	6,442.05	6,436.43	6,443.00	6,438.95	48.00			15.46	15.46			1.78			1.74			1.64		
1325	6,441.03	6,435.06	6,441.21	6,438.30	48.00			8.72	8.72			1.64			3.36			6.61		
1313	6,440.44	6,434.42	6,440.60	6,437.54	48.00			10.56	10.56			1.57			2.89			4.81		
1290	6,438.27	6,433.86	6,439.42	6,436.14	48.00			14.72	14.72			1.19			2.74			4.57		
1275	6,437.67	6,431.86	6,439.01	6,435.67	48.00			11.95	11.95			2.02			1.99			2.12		
1259	6,436.47	6,431.56	6,436.41	6,435.21	48.00			9.50	9.50			2.00			2.52			3.47		
1250	6,436.51	6,431.43	6,435.80	6,433.88	48.00			5.85	5.85			1.30			6.29			25.24		
1225	6,435.03	6,430.25	6,436.93	6,433.02	48.00			16.80	16.80			1.61			1.77			1.74		
1200	6,432.15	6,429.40	6,433.10	6,432.11	48.00			11.91	11.91			1.35			2.98			5.33		
1175	6,432.73	6,428.39	6,432.83	6,431.05	48.00			12.60	12.60			1.69			2.26			2.82		
1150	6,432.51	6,427.64	6,431.32	6,430.12	48.00			18.14	18.14			1.14			2.31			3.29		
1125	6,427.74	6,426.66	6,429.83	6,429.44	37.81	10.19		24.75	13.81	10.93		1.56	0.80		1.76	1.16		1.72	0.92	
1099	6,427.59	6,426.34	6,429.71	6,428.79	32.30	15.70		23.90	11.34	12.56		1.33	0.80		2.13	1.57		2.69	1.70	
1075	6,426.96	6,425.65	6,427.27	6,427.66	24.69	22.87	0.44	31.34	6.79	21.72	2.83	1.31	0.61	0.19	2.77	1.72	0.82	4.60	2.25	0.73
1050	6,426.27	6,423.72	6,426.51	6,426.78	40.23	7.60	0.17	32.29	10.04	20.45	1.80	1.90	0.43	0.19	2.11	0.86	0.49	2.41	0.63	0.27
1025	6,425.69	6,424.03	6,427.00	6,426.16	33.75	14.25		32.81	15.56	17.25		1.20	0.68		1.80	1.21		1.96	1.08	
1002	6,425.09	6,423.76	6,424.88	6,425.11	20.03	27.64	0.33	32.99	8.30	19.40	5.29	0.93	0.68	0.10	2.60	2.11	0.62	4.51	3.30	0.52
975	6,423.40	6,421.40	6,424.19	6,423.67	46.94	1.06		63.82	56.96	6.86		0.88	0.33		0.94	0.47		0.59	0.21	
950	6,422.46	6,421.39	6,422.04	6,422.66	31.01		16.99	22.43	12.88		9.55	0.60		0.50	3.99		3.56	12.06		10.18
929	6,421.84	6,418.41	6,421.12	6,420.76	48.00			11.65	11.65			1.56			2.64			3.94		
922	6,421.47	6,417.78	6,419.93	6,420.29	46.31		1.69	20.43	10.16		10.28	1.38		0.18	3.30		0.91	6.44		0.93
900	6,418.84	6,416.23	6,418.81	6,419.26	32.03	15.22	0.75	38.79	7.02	22.26	9.51	1.96	0.57	0.15	2.33	1.20	0.51	3.03	1.12	0.31
885	6,417.53	6,415.24	6,417.95	6,417.48	48.00			6.43	6.43			1.20			6.25			25.18		
880	6,417.34	6,413.19	6,417.48	6,416.88	48.00			9.15	9.15			1.88			2.78			4.41		
876	6,417.27	6,414.04	6,416.83	6,416.74	48.00			16.06	16.06			1.42			2.10			2.56		
850	6,415.72	6,413.35	6,415.89	6,415.84	32.22	15.78		28.87	10.22	18.65		1.41	0.61		2.24	1.39		3.02	1.47	
834	6,414.85	6,411.91	6,415.22	6,414.33	48.00			6.81	6.81			1.53			4.62			12.81		
830	6,414.77	6,410.67	6,415.29	6,414.30	48.00			8.28	8.28			2.51			2.31			2.81		
825	6,414.79	6,410.79	6,415.31	6,414.08	48.00			7.12	7.12			2.34			2.89			4.59		
812	6,414.50	6,409.30	6,413.75	6,412.48	48.00			6.25	6.25			1.47			5.22			17.40		
800	6,413.83	6,407.18	6,414.03	6,410.21	48.00			6.19	6.19			1.77			4.39			11.50		
775	6,411.22	6,406.38	6,412.18	6,409.13	48.00			14.36	14.36			1.64			2.04			2.31		
745	6,409.52	6,405.55	6,410.25	6,407.40	48.00			16.14	16.14			0.83			3.58			8.96		
734	6,408.17	6,403.73	6,408.18	6,405.88	48.00			16.38	16.38			1.01			2.90			5.56		
725	6,408.22	6,403.59	6,408.63	6,405.35	48.00			19.23	19.23			1.12			2.23			3.09		

HEC-RAS results for the estimated 100-year event with total discharge of 48 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
700	6,405.45	6,402.12	6,407.21	6,403.88	48.00			13.96	13.96			1.21			2.85			4.98		
674	6,405.08	6,400.12	6,406.22	6,403.49	48.00			20.39	20.39			1.86			1.27			0.85		
650	6,403.25	6,398.73	6,403.95	6,403.08	47.33	0.67		15.32	9.37	5.94		2.10	0.19		2.40	0.59		3.18	0.38	
625	6,401.67	6,398.24	6,402.53	6,401.34	48.00			7.09	7.09			1.60			4.22			10.77		
600	6,400.97	6,396.89	6,401.75	6,398.37	48.00			13.10	13.10			1.12			3.29			6.76		
590	6,400.08	6,395.64	6,401.29	6,396.84	48.00			13.83	13.83			0.87			3.97			10.59		
585	6,399.84	6,394.41	6,400.76	6,396.68	48.00			14.88	14.88			1.60			2.02			2.27		
570	6,397.50	6,392.93	6,397.74	6,395.96	48.00			7.51	7.51			1.86			3.44			6.73		
555	6,396.26	6,392.05	6,396.85	6,394.24	48.00			7.24	7.24			1.47			4.52			12.25		
530	6,395.92	6,389.76	6,395.83	6,391.21	48.00			14.79	14.79			1.05			3.10			6.13		
517	6,394.97	6,387.62	6,394.95	6,389.69	48.00			11.60	11.60			1.14			3.62			8.16		
497	6,394.91	6,386.91	6,394.75	6,388.63	48.00			22.34	22.34			1.11			1.94			2.34		
469	6,392.20	6,384.76	6,393.83	6,385.93	48.00			19.07	19.07			0.57			4.43			15.22		
460	6,391.75	6,382.98	6,393.54	6,385.38	48.00			22.45	22.45			1.37			1.56			1.42		
450	6,391.67	6,382.40	6,392.59	6,385.08	48.00			17.95	17.95			1.25			2.14			2.78		
427	6,390.31	6,381.79	6,392.49	6,384.28	48.00			13.56	13.56			1.58			2.24			2.84		
400	6,388.99	6,379.94	6,387.87	6,383.45	48.00			13.17	13.17			1.67			2.18			2.68		
375	6,388.60	6,379.45	6,385.32	6,381.98	48.00			8.66	8.66			1.45			3.82			8.65		
350	6,386.26	6,378.54	6,386.67	6,381.20	48.00			16.27	16.27			1.66			1.78			1.73		
325	6,384.96	6,377.20	6,384.70	6,379.52	48.00			6.61	6.61			1.26			5.75			21.00		
307	6,383.87	6,376.03	6,383.99	6,378.27	48.00			18.82	18.82			1.21			2.10			2.69		
300	6,383.66	6,375.27	6,383.29	6,378.12	48.00			18.90	18.90			1.54			1.65			1.56		
275	6,382.73	6,374.80	6,382.66	6,377.60	48.00			16.59	16.59			1.54			1.87			1.99		
257	6,380.71	6,374.03	6,381.68	6,377.04	48.00			13.41	13.41			1.50			2.39			3.29		
219	6,379.88	6,371.75	6,379.06	6,375.81	48.00			10.81	10.81			1.99			2.23			2.72		
200	6,378.95	6,371.47	6,380.35	6,374.85	48.00			16.17	16.17			1.05			2.83			5.28		
193	6,379.29	6,371.57	6,379.95	6,373.28	48.00			9.54	9.54			0.92			5.49			20.14		
Ave					44.47	13.72	8.18	16.04	11.95	15.82	9.52	1.46	0.63	0.48	3.04	1.16	1.10	6.73	1.16	1.47
Median					48.00	14.74	3.55	13.17	10.43	17.80	9.32	1.42	0.65	0.50	2.59	1.18	0.91	3.90	1.00	0.69
Max					48.00	27.64	24.77	63.82	56.96	22.26	23.12	2.72	1.20	1.20	6.60	2.11	3.56	27.84	3.30	10.18
Min					8.45	0.17	0.01	5.39	5.39	5.14	0.62	0.57	0.07	0.06	0.86	0.47	0.30	0.43	0.21	0.14

HEC-RAS results for the estimated 10-year event with total discharge of 23 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
2250	6,487.49	6,486.85	6,487.40	6,488.05	10.15	11.65	1.19	33.79	9.06	19.02	5.71	0.89	0.63	0.32	1.26	0.98	0.65	1.05	0.72	0.39
2225	6,487.15	6,486.66	6,487.21	6,487.63	7.02	3.09	12.89	46.03	10.43	15.40	20.20	0.70	0.34	0.70	0.95	0.59	0.92	0.65	0.31	0.62
2200	6,486.71	6,486.28	6,486.86	6,487.26	7.70	5.42	9.87	47.59	8.53	15.94	23.12	0.84	0.47	0.54	1.07	0.73	0.79	0.78	0.44	0.49
2175	6,486.29	6,485.94	6,486.56	6,487.08	4.36	9.67	8.97	50.00	7.11	22.26	20.63	0.98	0.80	0.80	0.63	0.54	0.54	0.25	0.20	0.20
2154	6,486.25	6,485.56	6,486.28	6,486.88	10.18	12.01	0.81	25.00	7.05	14.12	3.83	0.96	0.70	0.30	1.51	1.21	0.70	1.49	1.06	0.47
2120	6,485.05	6,483.89	6,484.98	6,485.43	14.30	4.39	4.32	36.81	7.32	18.38	11.11	0.84	0.23	0.31	2.34	1.03	1.26	3.78	1.11	1.50
2105	6,484.58	6,482.68	6,483.94	6,484.70	19.29	0.09	3.63	25.42	10.40	6.93	8.09	1.04	0.05	0.43	1.79	0.25	1.04	2.05	0.11	0.91
2078	6,483.45	6,481.23	6,483.10	6,483.33	19.34		3.66	18.67	6.93		11.74	1.05		0.27	2.65		1.17	4.62		1.35
2063	6,481.98	6,479.43	6,481.79	6,480.67	23.00			6.70	6.70			0.71			4.81			17.06		
1962	6,479.79	6,475.56	6,479.30	6,477.78	23.00			6.45	6.45			1.25			2.86			2.81		
1950	6,478.88	6,474.62	6,478.91	6,476.38	23.00			4.81	4.81			0.90			5.31			10.78		
1927	6,478.19	6,472.88	6,477.40	6,474.74	23.00			10.96	10.96			1.04			2.01			2.59		
1912	6,473.63	6,471.46	6,475.61	6,472.86	23.00			6.72	6.72			0.71			4.85			17.25		
1907	6,472.96	6,469.79	6,475.22	6,471.40	23.00			6.85	6.85			0.89			3.76			9.67		
1896	6,476.11	6,467.95	6,471.59	6,469.94	23.00			7.06	7.06			1.06			3.08			6.20		
1875	6,472.90	6,466.49	6,472.07	6,468.46	23.00			10.02	10.02			1.04			2.20			3.12		
1863	6,471.23	6,465.83	6,471.79	6,466.81	23.00			7.74	7.74			0.65			4.60			15.89		
1853	6,470.74	6,463.64	6,471.72	6,465.89	23.00			14.29	14.29			1.30			1.24			0.91		
1825	6,469.18	6,462.99	6,467.08	6,465.27	23.00			8.01	8.01			1.34			2.14			2.80		
1800	6,469.40	6,461.59	6,466.49	6,464.40	23.00			7.92	7.92			1.47			1.97			2.33		
1786	6,468.38	6,461.36	6,464.97	6,463.18	23.00			5.48	5.48			0.95			4.44			13.63		
1771	6,466.35	6,459.51	6,462.51	6,461.93	23.00			8.20	8.20			1.25			2.24			3.11		
1750	6,464.38	6,458.28	6,463.76	6,460.19	23.00			7.11	7.11			0.96			3.37			7.68		
1744	6,464.52	6,458.04	6,463.19	6,459.99	23.00			11.60	11.60			1.24			1.60			1.56		
1734	6,462.33	6,457.18	6,462.37	6,458.93	23.00			4.08	4.08			0.99			5.69			22.86		
1725	6,464.34	6,456.53	6,460.16	6,458.33	23.00			10.46	10.46			1.16			1.90			2.26		
1703	6,462.44	6,454.88	6,460.03	6,457.59	23.00			8.74	8.74			1.34			1.96			2.36		
1689	6,461.51	6,454.44	6,459.46	6,456.01	23.00			5.38	5.38			0.82			5.21			19.44		
1680	6,458.09	6,452.46	6,458.86	6,455.02	23.00			6.20	6.20			1.42			2.62			4.29		
1675	6,459.22	6,452.33	6,459.34	6,454.45	23.00			5.14	5.14			1.30			3.43			7.63		
1650	6,455.26	6,450.87	6,457.51	6,452.63	23.00			8.45	8.45			1.19			2.29			3.28		
1625	6,457.17	6,449.92	6,456.69	6,452.33	23.00			10.80	10.80			1.97			1.08			0.63		
1600	6,453.43	6,449.64	6,455.89	6,451.86	23.00			7.45	7.45			1.18			2.61			4.35		
1590	6,452.82	6,448.48	6,452.14	6,451.46	23.00			8.35	8.35			1.48			1.87			2.10		
1575	6,453.98	6,448.27	6,454.55	6,449.94	23.00			4.61	4.61			0.91			5.48			21.36		
1570	6,452.63	6,446.45	6,454.63	6,448.60	23.00			6.76	6.76			1.52			2.24			3.01		
1550	6,453.40	6,445.85	6,454.27	6,447.75	23.00			9.14	9.14			1.15			2.18			3.00		
1526	6,452.58	6,445.61	6,452.43	6,447.17	23.00			11.77	11.77			1.36			1.44			1.23		
1499	6,451.13	6,444.63	6,451.05	6,446.03	23.00			8.65	8.65			0.82			3.23			7.24		
1467	6,448.42	6,442.02	6,449.38	6,443.96	23.00			11.29	11.29			1.07			1.90			2.31		

HEC-RAS results for the estimated 10-year event with total discharge of 23 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
1449	6,447.09	6,441.28	6,447.32	6,443.43	23.00			9.73	9.73			1.39			1.70			1.72		
1425	6,446.00	6,440.56	6,447.26	6,441.68	23.00			5.92	5.92			0.78			4.99			17.88		
1401	6,441.88	6,438.93	6,445.59	6,441.00	23.00			17.30	17.30			1.13			1.18			0.88		
1377	6,442.85	6,438.38	6,444.44	6,440.08	23.00			6.74	6.74			1.02			3.33			7.35		
1362	6,443.02	6,437.20	6,444.05	6,438.76	23.00			14.94	14.94			0.75			2.04			2.96		
1342	6,442.05	6,436.43	6,443.00	6,438.17	23.00			13.54	13.54			1.19			1.43			1.25		
1325	6,441.03	6,435.06	6,441.21	6,437.54	23.00			6.58	6.58			1.29			2.72			4.70		
1313	6,440.44	6,434.42	6,440.60	6,436.97	23.00			8.65	8.65			1.29			2.06			2.62		
1290	6,438.27	6,433.86	6,439.42	6,435.29	23.00			9.42	9.42			0.77			3.19			7.19		
1275	6,437.67	6,431.86	6,439.01	6,434.73	23.00			9.14	9.14			1.56			1.62			1.53		
1259	6,436.47	6,431.56	6,436.41	6,434.33	23.00			7.49	7.49			1.54			2.00			2.37		
1250	6,436.51	6,431.43	6,435.80	6,433.28	23.00			4.43	4.43			1.02			5.07			17.80		
1225	6,435.03	6,430.25	6,436.93	6,432.28	23.00			13.60	13.60			1.16			1.45			1.30		
1200	6,432.15	6,429.40	6,433.10	6,431.31	23.00			7.65	7.65			1.08			2.78			5.04		
1175	6,432.73	6,428.39	6,432.83	6,430.39	23.00			10.25	10.25			1.34			1.67			1.67		
1150	6,432.51	6,427.64	6,431.32	6,429.53	23.00			13.81	13.81			0.82			2.02			2.82		
1125	6,427.74	6,426.66	6,429.83	6,428.90	19.76	3.24		18.87	11.72	7.15		1.25	0.56		1.35	0.81		1.10	0.51	
1099	6,427.59	6,426.34	6,429.71	6,428.47	17.08	5.92		20.83	10.00	10.83		1.17	0.58		1.46	0.95		1.32	0.69	
1075	6,426.96	6,425.65	6,427.27	6,427.25	21.52	1.48		17.16	6.75	10.41		0.90	0.13		3.52	1.05		8.43	1.38	
1050	6,426.27	6,423.72	6,426.51	6,426.31	22.99	0.01		18.23	9.66	8.57		1.50	0.01		1.59	0.07		1.48	0.01	
1025	6,425.69	6,424.03	6,427.00	6,425.95	17.61	5.39		32.04	14.79	17.25		1.05	0.48		1.13	0.66		0.81	0.36	
1002	6,425.09	6,423.76	6,424.88	6,424.74	23.00			7.05	7.05			0.68			4.78			16.87		
975	6,423.40	6,421.40	6,424.19	6,423.35	22.99	0.01		58.82	54.93	3.89		0.58	0.03		0.72	0.09		0.39	0.02	
950	6,422.46	6,421.39	6,422.04	6,422.35	17.80		5.20	15.09	7.48		7.61	0.61		0.28	3.91		2.41	11.67		5.65
929	6,421.84	6,418.41	6,421.12	6,420.18	23.00			9.97	9.97			1.20			1.92			2.26		
922	6,421.47	6,417.78	6,419.93	6,419.84	23.00			9.19	9.19			1.05			2.38			3.67		
900	6,418.84	6,416.23	6,418.81	6,418.74	22.11	0.89		16.83	6.77	10.05		1.49	0.15		2.20	0.57		2.95	0.39	
885	6,417.53	6,415.24	6,417.95	6,416.84	23.00			4.55	4.55			0.92			5.47			21.09		
880	6,417.34	6,413.19	6,417.48	6,416.21	23.00			6.54	6.54			1.85			1.90			2.11		
876	6,417.27	6,414.04	6,416.83	6,416.12	23.00			11.53	11.53			1.27			1.57			1.49		
850	6,415.72	6,413.35	6,415.89	6,415.36	20.54	2.46		22.58	8.21	14.37		1.20	0.23		2.08	0.75		2.74	0.60	
834	6,414.85	6,411.91	6,415.22	6,413.30	23.00			4.95	4.95			0.87			5.33			20.05		
830	6,414.77	6,410.67	6,415.29	6,413.29	23.00			7.10	7.10			1.83			1.77			1.78		
825	6,414.79	6,410.79	6,415.31	6,413.13	23.00			5.80	5.80			1.82			2.18			2.79		
812	6,414.50	6,409.30	6,413.75	6,411.76	23.00			5.18	5.18			0.97			4.56			15.09		
800	6,413.83	6,407.18	6,414.03	6,409.43	23.00			4.94	4.94			1.33			3.50			7.95		
775	6,411.22	6,406.38	6,412.18	6,408.42	23.00			11.60	11.60			1.24			1.61			1.56		
745	6,409.52	6,405.55	6,410.25	6,406.86	23.00			7.72	7.72			0.86			3.46			8.35		
734	6,408.17	6,403.73	6,408.18	6,405.40	23.00			12.89	12.89			0.75			2.39			4.16		
725	6,408.22	6,403.59	6,408.63	6,404.97	23.00			17.51	17.51			0.83			1.58			1.70		

HEC-RAS results for the estimated 10-year event with total discharge of 23 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
700	6,405.45	6,402.12	6,407.21	6,403.11	23.00			11.29	11.29			0.63			3.24			7.89		
674	6,405.08	6,400.12	6,406.22	6,402.54	23.00			15.69	15.69			1.32			1.11			0.73		
650	6,403.25	6,398.73	6,403.95	6,402.14	23.00			7.10	7.10			1.70			1.90			2.15		
625	6,401.67	6,398.24	6,402.53	6,400.54	23.00			5.59	5.59			1.13			3.64			8.96		
600	6,400.97	6,396.89	6,401.75	6,398.02	23.00			12.28	12.28			0.83			2.26			3.52		
590	6,400.08	6,395.64	6,401.29	6,396.36	23.00			11.97	11.97			0.48			3.96			12.77		
585	6,399.84	6,394.41	6,400.76	6,395.86	23.00			11.78	11.78			1.09			1.79			2.02		
570	6,397.50	6,392.93	6,397.74	6,395.09	23.00			5.94	5.94			1.37			2.82			4.93		
555	6,396.26	6,392.05	6,396.85	6,393.71	23.00			6.35	6.35			1.11			3.27			6.96		
530	6,395.92	6,389.76	6,395.83	6,390.73	23.00			12.97	12.97			0.68			2.61			4.97		
517	6,394.97	6,387.62	6,394.95	6,389.22	23.00			9.49	9.49			0.87			2.79			5.30		
497	6,394.91	6,386.91	6,394.75	6,388.21	23.00			21.06	21.06			0.74			1.47			1.53		
469	6,392.20	6,384.76	6,393.83	6,385.62	23.00			12.34	12.34			0.47			3.94			12.79		
460	6,391.75	6,382.98	6,393.54	6,384.75	23.00			16.91	16.91			1.07			1.28			1.03		
450	6,391.67	6,382.40	6,392.59	6,384.46	23.00			13.21	13.21			0.94			1.85			2.28		
427	6,390.31	6,381.79	6,392.49	6,383.47	23.00			10.87	10.87			1.04			2.03			2.65		
400	6,388.99	6,379.94	6,387.87	6,382.60	23.00			8.96	8.96			1.44			1.78			1.89		
375	6,388.60	6,379.45	6,385.32	6,381.28	23.00			6.73	6.73			1.05			3.24			6.91		
350	6,386.26	6,378.54	6,386.67	6,380.42	23.00			12.93	12.93			1.21			1.47			1.32		
325	6,384.96	6,377.20	6,384.70	6,379.45	23.00			6.41	6.41			1.23			2.92			5.48		
307	6,383.87	6,376.03	6,383.99	6,377.51	23.00			16.36	16.36			0.59			2.40			4.45		
300	6,383.66	6,375.27	6,383.29	6,377.33	23.00			13.37	13.37			1.28			1.35			1.10		
275	6,382.73	6,374.80	6,382.66	6,376.82	23.00			12.71	12.71			1.11			1.63			1.68		
257	6,380.71	6,374.03	6,381.68	6,376.12	23.00			8.83	8.83			1.14			2.28			3.29		
219	6,379.88	6,371.75	6,379.06	6,375.08	23.00			8.51	8.51			1.71			1.58			1.45		
200	6,378.95	6,371.47	6,380.35	6,374.36	23.00			12.56	12.56			0.79			2.33			3.96		
193	6,379.29	6,371.57	6,379.95	6,372.81	23.00			7.17	7.17			0.67			4.76			16.80		
Ave					21.91	4.38	5.62	12.58	9.71	12.97	12.45	1.09	0.36	0.44	2.57	0.69	1.05	5.51	0.53	1.29
Median					23.00	3.24	4.32	9.49	8.65	14.12	11.11	1.07	0.34	0.32	2.20	0.73	0.92	2.96	0.44	0.62
Max					23.00	12.01	12.89	58.82	54.93	22.26	23.12	1.97	0.80	0.80	5.69	1.21	2.41	22.86	1.38	5.65
Min					4.36	0.01	0.81	4.08	4.08	3.89	3.83	0.47	0.01	0.27	0.63	0.07	0.54	0.25	0.01	0.20

HEC-RAS results for the estimated 5-year event with total discharge of 16 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
2250	6,487.49	6,486.85	6,487.40	6,487.92	7.60	7.75	0.64	32.67	9.06	19.02	4.59	0.76	0.50	0.26	1.10	0.82	0.54	0.84	0.54	0.29
2225	6,487.15	6,486.66	6,487.21	6,487.51	5.11	1.51	9.38	46.03	10.43	15.40	20.20	0.59	0.22	0.58	0.84	0.44	0.81	0.53	0.20	0.50
2200	6,486.71	6,486.28	6,486.86	6,487.11	6.08	3.56	6.36	45.74	8.53	14.09	23.12	0.69	0.37	0.39	1.03	0.68	0.70	0.76	0.41	0.43
2175	6,486.29	6,485.94	6,486.56	6,486.94	3.18	6.65	6.17	50.00	7.11	22.26	20.63	0.83	0.66	0.66	0.54	0.45	0.45	0.20	0.15	0.15
2154	6,486.25	6,485.56	6,486.28	6,486.76	7.46	8.13	0.41	24.25	7.05	14.12	3.08	0.84	0.59	0.24	1.26	0.98	0.55	1.08	0.74	0.32
2120	6,485.05	6,483.89	6,484.98	6,485.29	12.53	1.42	2.05	33.84	7.32	15.91	10.61	0.70	0.11	0.18	2.44	0.78	1.05	4.38	0.77	1.24
2105	6,484.58	6,482.68	6,483.94	6,484.51	14.49		1.51	16.87	9.42		7.45	0.94		0.27	1.63		0.75	1.78		0.55
2078	6,483.45	6,481.23	6,483.10	6,483.16	15.07		0.93	15.46	6.57		8.89	0.93		0.13	2.47		0.77	4.17		0.70
2063	6,481.98	6,479.43	6,481.79	6,480.49	16.00			6.00	6.00			0.60			4.41			15.11		
1962	6,479.79	6,475.56	6,479.30	6,477.47	16.00			5.44	5.44			1.14			2.59			2.38		
1950	6,478.88	6,474.62	6,478.91	6,476.13	16.00			4.13	4.13			0.78			4.95			9.83		
1927	6,478.19	6,472.88	6,477.40	6,474.48	16.00			9.62	9.62			0.92			1.81			2.20		
1912	6,473.63	6,471.46	6,475.61	6,472.67	16.00			5.68	5.68			0.62			4.51			15.57		
1907	6,472.96	6,469.79	6,475.22	6,471.17	16.00			6.15	6.15			0.76			3.43			8.50		
1896	6,476.11	6,467.95	6,471.59	6,469.66	16.00			6.18	6.18			0.91			2.84			5.54		
1875	6,472.90	6,466.49	6,472.07	6,468.21	16.00			8.85	8.85			0.92			1.96			2.59		
1863	6,471.23	6,465.83	6,471.79	6,466.66	16.00			7.36	7.36			0.52			4.16			13.86		
1853	6,470.74	6,463.64	6,471.72	6,465.56	16.00			12.80	12.80			1.10			1.13			0.81		
1825	6,469.18	6,462.99	6,467.08	6,464.92	16.00			7.31	7.31			1.11			1.98			2.53		
1800	6,469.40	6,461.59	6,466.49	6,464.08	16.00			7.06	7.06			1.31			1.74			1.88		
1786	6,468.38	6,461.36	6,464.97	6,462.88	16.00			4.63	4.63			0.79			4.36			13.90		
1771	6,466.35	6,459.51	6,462.51	6,461.63	16.00			7.16	7.16			1.12			2.00			2.58		
1750	6,464.38	6,458.28	6,463.76	6,459.92	16.00			6.10	6.10			0.82			3.21			7.31		
1744	6,464.52	6,458.04	6,463.19	6,459.69	16.00			10.70	10.70			1.03			1.46			1.37		
1734	6,462.33	6,457.18	6,462.37	6,458.67	16.00			3.58	3.58			0.85			5.25			20.37		
1725	6,464.34	6,456.53	6,460.16	6,458.01	16.00			9.27	9.27			0.97			1.78			2.10		
1703	6,462.44	6,454.88	6,460.03	6,457.27	16.00			7.53	7.53			1.21			1.76			1.96		
1689	6,461.51	6,454.44	6,459.46	6,455.80	16.00			4.69	4.69			0.71			4.81			17.40		
1680	6,458.09	6,452.46	6,458.86	6,454.70	16.00			5.67	5.67			1.20			2.34			3.59		
1675	6,459.22	6,452.33	6,459.34	6,454.23	16.00			4.62	4.62			1.22			2.85			5.36		
1650	6,455.26	6,450.87	6,457.51	6,452.24	16.00			7.44	7.44			0.93			2.31			3.58		
1625	6,457.17	6,449.92	6,456.69	6,451.95	16.00			10.42	10.42			1.65			0.93			0.49		
1600	6,453.43	6,449.64	6,455.89	6,451.50	16.00			6.32	6.32			1.00			2.54			4.33		
1590	6,452.82	6,448.48	6,452.14	6,451.10	16.00			7.11	7.11			1.35			1.67			1.74		
1575	6,453.98	6,448.27	6,454.55	6,449.69	16.00			3.98	3.98			0.79			5.08			19.24		
1570	6,452.63	6,446.45	6,454.63	6,448.28	16.00			6.21	6.21			1.32			1.95			2.39		
1550	6,453.40	6,445.85	6,454.27	6,447.46	16.00			8.22	8.22			0.98			1.99			2.61		
1526	6,452.58	6,445.61	6,452.43	6,446.90	16.00			11.47	11.47			1.13			1.24			0.97		
1499	6,451.13	6,444.63	6,451.05	6,445.86	16.00			8.07	8.07			0.70			2.81			5.79		
1467	6,448.42	6,442.02	6,449.38	6,443.65	16.00			9.77	9.77			0.91			1.81			2.21		

HEC-RAS results for the estimated 5-year event with total discharge of 16 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
1449	6,447.09	6,441.28	6,447.32	6,443.11	16.00			8.78	8.78			1.21			1.51			1.41		
1425	6,446.00	6,440.56	6,447.26	6,441.51	16.00			5.57	5.57			0.65			4.41			14.73		
1401	6,441.88	6,438.93	6,445.59	6,440.75	16.00			16.56	16.56			0.92			1.06			0.75		
1377	6,442.85	6,438.38	6,444.44	6,439.88	16.00			6.31	6.31			0.88			2.86			5.68		
1362	6,443.02	6,437.20	6,444.05	6,438.53	16.00			12.16	12.16			0.67			1.97			2.87		
1342	6,442.05	6,436.43	6,443.00	6,437.87	16.00			12.71	12.71			0.95			1.32			1.14		
1325	6,441.03	6,435.06	6,441.21	6,437.23	16.00			5.72	5.72			1.14			2.45			3.97		
1313	6,440.44	6,434.42	6,440.60	6,436.75	16.00			7.89	7.89			1.17			1.73			1.90		
1290	6,438.27	6,433.86	6,439.42	6,434.94	16.00			7.26	7.26			0.60			3.69			10.50		
1275	6,437.67	6,431.86	6,439.01	6,434.35	16.00			8.00	8.00			1.37			1.46			1.30		
1259	6,436.47	6,431.56	6,436.41	6,433.97	16.00			6.65	6.65			1.35			1.78			1.96		
1250	6,436.51	6,431.43	6,435.80	6,433.04	16.00			3.90	3.90			0.90			4.55			14.97		
1225	6,435.03	6,430.25	6,436.93	6,431.99	16.00			12.13	12.13			1.00			1.32			1.12		
1200	6,432.15	6,429.40	6,433.10	6,430.98	16.00			6.50	6.50			0.92			2.68			4.91		
1175	6,432.73	6,428.39	6,432.83	6,430.12	16.00			9.38	9.38			1.19			1.44			1.28		
1150	6,432.51	6,427.64	6,431.32	6,429.28	16.00			11.87	11.87			0.69			1.96			2.80		
1125	6,427.74	6,426.66	6,429.83	6,428.67	14.35	1.65		16.25	10.64	5.61		1.13	0.45		1.20	0.66		0.89	0.37	
1099	6,427.59	6,426.34	6,429.71	6,428.29	12.76	3.24		19.03	9.24	9.79		1.08	0.45		1.28	0.74		1.04	0.46	
1075	6,426.96	6,425.65	6,427.27	6,426.87	16.00			5.85	5.85			0.63			4.32			14.22		
1050	6,426.27	6,423.72	6,426.51	6,426.09	16.00			8.93	8.93			1.39			1.29			1.00		
1025	6,425.69	6,424.03	6,427.00	6,425.76	13.60	2.40		31.33	14.08	17.25		0.91	0.29		1.06	0.49		0.74	0.23	
1002	6,425.09	6,423.76	6,424.88	6,424.57	16.00			6.30	6.30			0.58			4.35			14.71		
975	6,423.40	6,421.40	6,424.19	6,423.22	16.00			52.49	52.49			0.48			0.64			0.33		
950	6,422.46	6,421.39	6,422.04	6,422.24	13.72		2.28	13.32	6.33		6.98	0.60		0.19	3.64		1.74	10.18		3.36
929	6,421.84	6,418.41	6,421.12	6,419.90	16.00			9.19	9.19			1.01			1.73			1.94		
922	6,421.47	6,417.78	6,419.93	6,419.54	16.00			7.84	7.84			0.91			2.25			3.45		
900	6,418.84	6,416.23	6,418.81	6,418.42	16.00			6.13	6.13			1.30			2.00			2.55		
885	6,417.53	6,415.24	6,417.95	6,416.59	16.00			3.96	3.96			0.79			5.11			19.36		
880	6,417.34	6,413.19	6,417.48	6,415.92	16.00			6.05	6.05			1.70			1.55			1.44		
876	6,417.27	6,414.04	6,416.83	6,415.84	16.00			10.76	10.76			1.08			1.38			1.21		
850	6,415.72	6,413.35	6,415.89	6,415.09	15.88	0.12		11.85	6.71	5.14		1.17	0.07		2.02	0.33		2.63	0.18	
834	6,414.85	6,411.91	6,415.22	6,413.08	16.00			4.45	4.45			0.73			4.91			17.94		
830	6,414.77	6,410.67	6,415.29	6,412.90	16.00			6.61	6.61			1.57			1.54			1.42		
825	6,414.79	6,410.79	6,415.31	6,412.76	16.00			5.47	5.47			1.55			1.88			2.17		
812	6,414.50	6,409.30	6,413.75	6,411.49	16.00			4.60	4.60			0.81			4.29			14.21		
800	6,413.83	6,407.18	6,414.03	6,409.11	16.00			4.42	4.42			1.15			3.13			6.65		
775	6,411.22	6,406.38	6,412.18	6,408.13	16.00			10.36	10.36			1.07			1.44			1.32		
745	6,409.52	6,405.55	6,410.25	6,406.64	16.00			6.58	6.58			0.78			3.13			7.07		
734	6,408.17	6,403.73	6,408.18	6,405.22	16.00			11.44	11.44			0.64			2.17			3.60		
725	6,408.22	6,403.59	6,408.63	6,404.82	16.00			16.91	16.91			0.71			1.33			1.26		

HEC-RAS results for the estimated 5-year event with total discharge of 16 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
700	6,405.45	6,402.12	6,407.21	6,402.89	16.00			10.55	10.55			0.45			3.39			9.67		
674	6,405.08	6,400.12	6,406.22	6,402.17	16.00			14.08	14.08			1.08			1.05			0.70		
650	6,403.25	6,398.73	6,403.95	6,401.76	16.00			6.29	6.29			1.51			1.68			1.75		
625	6,401.67	6,398.24	6,402.53	6,400.29	16.00			5.11	5.11			0.97			3.24			7.42		
600	6,400.97	6,396.89	6,401.75	6,397.86	16.00			11.89	11.89			0.68			1.96			2.82		
590	6,400.08	6,395.64	6,401.29	6,396.24	16.00			11.03	11.03			0.40			3.60			11.23		
585	6,399.84	6,394.41	6,400.76	6,395.56	16.00			10.69	10.69			0.89			1.69			1.92		
570	6,397.50	6,392.93	6,397.74	6,394.75	16.00			5.33	5.33			1.17			2.57			4.30		
555	6,396.26	6,392.05	6,396.85	6,393.51	16.00			5.90	5.90			0.98			2.78			5.20		
530	6,395.92	6,389.76	6,395.83	6,390.56	16.00			12.26	12.26			0.54			2.43			4.67		
517	6,394.97	6,387.62	6,394.95	6,389.03	16.00			8.56	8.56			0.77			2.42			4.16		
497	6,394.91	6,386.91	6,394.75	6,388.06	16.00			20.49	20.49			0.61			1.29			1.25		
469	6,392.20	6,384.76	6,393.83	6,385.48	16.00			10.29	10.29			0.42			3.70			11.68		
460	6,391.75	6,382.98	6,393.54	6,384.48	16.00			15.25	15.25			0.91			1.16			0.90		
450	6,391.67	6,382.40	6,392.59	6,384.20	16.00			10.56	10.56			0.89			1.71			1.99		
427	6,390.31	6,381.79	6,392.49	6,383.17	16.00			9.63	9.63			0.86			1.93			2.55		
400	6,388.99	6,379.94	6,387.87	6,382.27	16.00			8.27	8.27			1.23			1.58			1.56		
375	6,388.60	6,379.45	6,385.32	6,381.02	16.00			5.94	5.94			0.92			2.94			5.94		
350	6,386.26	6,378.54	6,386.67	6,380.13	16.00			11.83	11.83			1.01			1.33			1.15		
325	6,384.96	6,377.20	6,384.70	6,379.24	16.00			5.90	5.90			1.12			2.41			3.84		
307	6,383.87	6,376.03	6,383.99	6,377.20	16.00			9.92	9.92			0.56			2.86			6.45		
300	6,383.66	6,375.27	6,383.29	6,377.02	16.00			12.36	12.36			1.06			1.22			0.97		
275	6,382.73	6,374.80	6,382.66	6,376.49	16.00			10.17	10.17			1.02			1.55			1.56		
257	6,380.71	6,374.03	6,381.68	6,375.72	16.00			6.98	6.98			0.99			2.31			3.54		
219	6,379.88	6,371.75	6,379.06	6,374.78	16.00			7.68	7.68			1.58			1.32			1.04		
200	6,378.95	6,371.47	6,380.35	6,374.17	16.00			10.91	10.91			0.69			2.11			3.44		
193	6,379.29	6,371.57	6,379.95	6,372.63	16.00			6.22	6.22			0.58			4.42			15.21		
Ave					15.38	3.64	3.30	11.03	8.75	13.86	11.73	0.94	0.37	0.32	2.37	0.64	0.82	4.98	0.41	0.84
Median					16.00	2.82	2.05	8.22	7.53	14.76	8.89	0.92	0.41	0.26	1.98	0.67	0.75	2.59	0.39	0.50
Max					16.00	8.13	9.38	52.49	52.49	22.26	23.12	1.70	0.66	0.66	5.25	0.98	1.74	20.37	0.77	3.36
Min					3.18	0.12	0.41	3.58	3.58	5.14	3.08	0.40	0.07	0.13	0.54	0.33	0.45	0.20	0.15	0.15

HEC-RAS results for the estimated 2-year event with total discharge of 4 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft/s)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (lb/sq ft)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank
2250	6,487.49	6,486.85	6,487.40	6,487.57	2.86	1.10	0.03	29.60	9.06	19.02	1.52	0.42	0.15	0.09	0.76	0.39	0.27	0.49	0.18	0.10
2225	6,487.15	6,486.66	6,487.21	6,487.22	1.42	0.01	2.57	32.82	10.43	2.19	20.20	0.30	0.04	0.29	0.46	0.11	0.44	0.20	0.02	0.19
2200	6,486.71	6,486.28	6,486.86	6,486.76	2.77	0.45	0.77	31.02	8.19	9.61	13.22	0.36	0.11	0.13	0.95	0.43	0.47	0.80	0.25	0.28
2175	6,486.29	6,485.94	6,486.56	6,486.55	1.11	1.49	1.40	49.44	7.00	22.26	20.18	0.45	0.27	0.27	0.35	0.25	0.25	0.11	0.06	0.06
2154	6,486.25	6,485.56	6,486.28	6,486.39	2.58	1.42	0.01	21.87	7.05	14.12	0.70	0.47	0.21	0.06	0.78	0.47	0.19	0.51	0.23	0.06
2120	6,485.05	6,483.89	6,484.98	6,484.73	4.00			3.71	3.71			0.41			2.63			6.16		
2105	6,484.58	6,482.68	6,483.94	6,483.70	4.00			4.94	4.94			0.65			1.25			1.19		
2078	6,483.45	6,481.23	6,483.10	6,482.45	4.00			3.96	3.96			0.60			1.69			2.27		
2063	6,481.98	6,479.43	6,481.79	6,480.01	4.00			4.28	4.28			0.30			3.13			9.51		
1962	6,479.79	6,475.56	6,479.30	6,476.58	4.00			3.34	3.34			0.70			1.71			1.22		
1950	6,478.88	6,474.62	6,478.91	6,475.46	4.00			2.34	2.34			0.46			3.75			6.73		
1927	6,478.19	6,472.88	6,477.40	6,473.77	4.00			6.04	6.04			0.54			1.22			1.19		
1912	6,473.63	6,471.46	6,475.61	6,472.14	4.00			3.29	3.29			0.36			3.41			10.70		
1907	6,472.96	6,469.79	6,475.22	6,470.60	4.00			4.00	4.00			0.44			2.28			4.45		
1896	6,476.11	6,467.95	6,471.59	6,468.88	4.00			3.62	3.62			0.50			2.21			4.08		
1875	6,472.90	6,466.49	6,472.07	6,467.52	4.00			5.54	5.54			0.57			1.26			1.25		
1863	6,471.23	6,465.83	6,471.79	6,466.28	4.00			5.19	5.19			0.27			2.91			8.45		
1853	6,470.74	6,463.64	6,471.72	6,464.73	4.00			8.38	8.38			0.61			0.78			0.46		
1825	6,469.18	6,462.99	6,467.08	6,463.98	4.00			4.46	4.46			0.53			1.68			2.31		
1800	6,469.40	6,461.59	6,466.49	6,463.13	4.00			4.54	4.54			0.82			1.07			0.83		
1786	6,468.38	6,461.36	6,464.97	6,462.16	4.00			2.57	2.57			0.42			3.74			12.60		
1771	6,466.35	6,459.51	6,462.51	6,460.75	4.00			4.37	4.37			0.68			1.35			1.39		
1750	6,464.38	6,458.28	6,463.76	6,459.28	4.00			3.73	3.73			0.49			2.17			3.96		
1744	6,464.52	6,458.04	6,463.19	6,458.91	4.00			7.71	7.71			0.48			1.08			0.96		
1734	6,462.33	6,457.18	6,462.37	6,458.18	4.00			2.63	2.63			0.58			2.64			5.79		
1725	6,464.34	6,456.53	6,460.16	6,457.14	4.00			5.35	5.35			0.47			1.59			2.11		
1703	6,462.44	6,454.88	6,460.03	6,456.31	4.00			4.34	4.34			0.80			1.15			0.96		
1689	6,461.51	6,454.44	6,459.46	6,455.21	4.00			2.76	2.76			0.40			3.59			11.63		
1680	6,458.09	6,452.46	6,458.86	6,453.79	4.00			3.55	3.55			0.73			1.55			1.86		
1675	6,459.22	6,452.33	6,459.34	6,453.56	4.00			3.43	3.43			0.85			1.37			1.38		
1650	6,455.26	6,450.87	6,457.51	6,451.31	4.00			4.49	4.49			0.30			2.97			8.52		
1625	6,457.17	6,449.92	6,456.69	6,450.95	4.00			9.13	9.13			0.81			0.54			0.20		
1600	6,453.43	6,449.64	6,455.89	6,450.51	4.00			3.23	3.23			0.48			2.56			5.55		
1590	6,452.82	6,448.48	6,452.14	6,450.07	4.00			4.35	4.35			0.85			1.09			0.85		
1575	6,453.98	6,448.27	6,454.55	6,449.02	4.00			2.24	2.24			0.47			3.81			12.83		
1570	6,452.63	6,446.45	6,454.63	6,447.39	4.00			4.70	4.70			0.72			1.19			1.06		
1550	6,453.40	6,445.85	6,454.27	6,446.75	4.00			5.53	5.53			0.57			1.27			1.28		
1526	6,452.58	6,445.61	6,452.43	6,446.22	4.00			10.49	10.49			0.51			0.75			0.46		
1499	6,451.13	6,444.63	6,451.05	6,445.41	4.00			5.66	5.66			0.45			1.57			2.09		
1467	6,448.42	6,442.02	6,449.38	6,442.83	4.00			5.66	5.66			0.45			1.58			2.13		

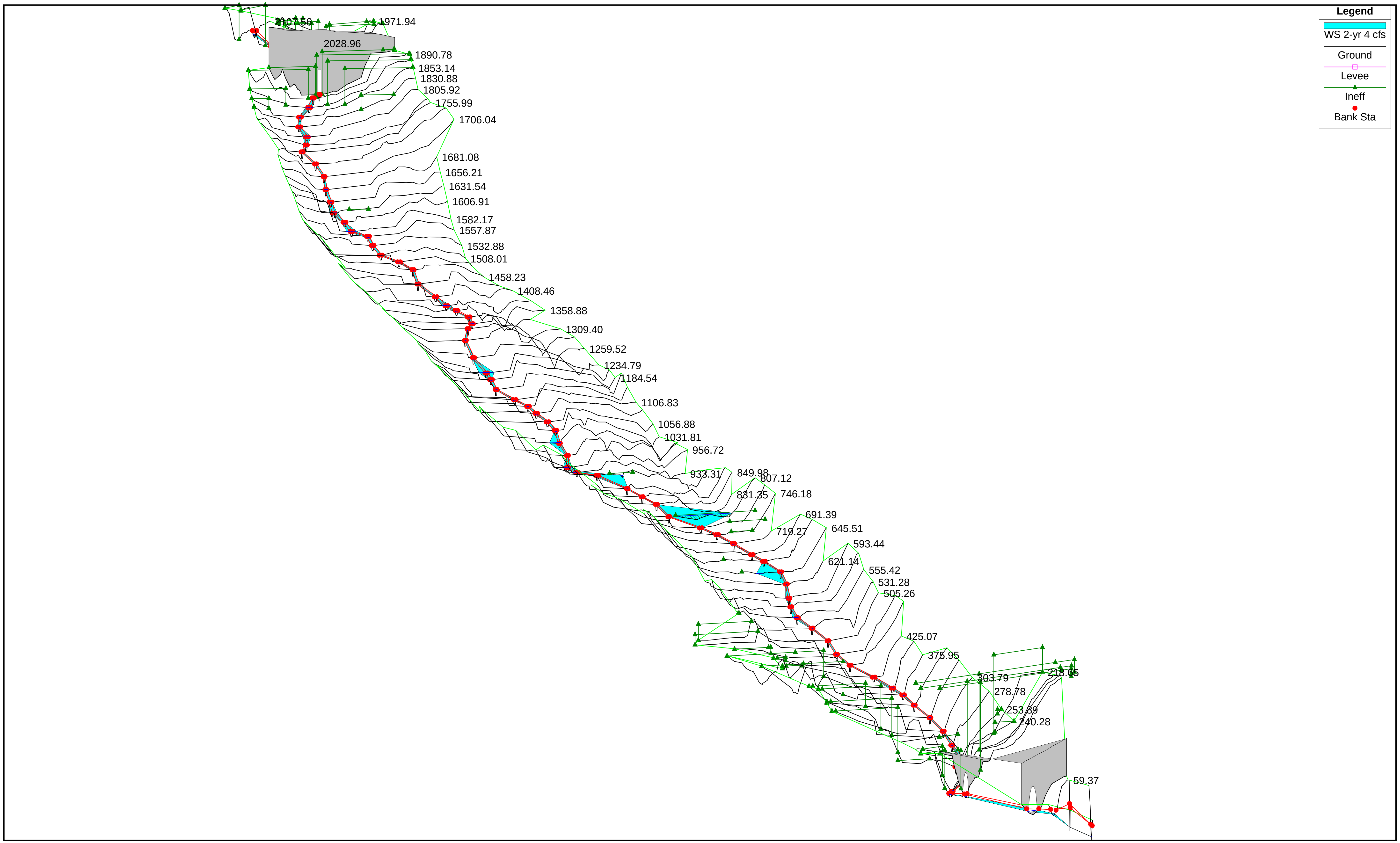
HEC-RAS results for the estimated 2-year event with total discharge of 4 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft/s)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (lb/sq ft)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank
1449	6,447.09	6,441.28	6,447.32	6,442.27	4.00			6.25	6.25			0.69			0.93			0.64		
1425	6,446.00	6,440.56	6,447.26	6,441.02	4.00			3.68	3.68			0.33			3.27			9.99		
1401	6,441.88	6,438.93	6,445.59	6,440.01	4.00			9.63	9.63			0.57			0.73			0.41		
1377	6,442.85	6,438.38	6,444.44	6,439.15	4.00			4.09	4.09			0.41			2.39			5.01		
1362	6,443.02	6,437.20	6,444.05	6,437.94	4.00			6.29	6.29			0.51			1.25			1.28		
1342	6,442.05	6,436.43	6,443.00	6,437.15	4.00			9.60	9.60			0.40			1.04			0.94		
1325	6,441.03	6,435.06	6,441.21	6,436.28	4.00			3.17	3.17			0.73			1.73			2.31		
1313	6,440.44	6,434.42	6,440.60	6,435.90	4.00			5.06	5.06			0.74			1.07			0.84		
1290	6,438.27	6,433.86	6,439.42	6,434.38	4.00			3.84	3.84			0.32			3.22			9.78		
1275	6,437.67	6,431.86	6,439.01	6,433.28	4.00			4.90	4.90			0.83			0.98			0.69		
1259	6,436.47	6,431.56	6,436.41	6,432.98	4.00			4.37	4.37			0.81			1.12			0.92		
1250	6,436.51	6,431.43	6,435.80	6,432.27	4.00			2.30	2.30			0.50			3.47			10.45		
1225	6,435.03	6,430.25	6,436.93	6,431.27	4.00			8.19	8.19			0.58			0.85			0.56		
1200	6,432.15	6,429.40	6,433.10	6,430.11	4.00			3.81	3.81			0.39			2.66			6.34		
1175	6,432.73	6,428.39	6,432.83	6,429.34	4.00			6.83	6.83			0.70			0.83			0.51		
1150	6,432.51	6,427.64	6,431.32	6,428.56	4.00			5.27	5.27			0.40			1.92			3.25		
1125	6,427.74	6,426.66	6,429.83	6,427.90	3.99	0.01		8.42	7.50	0.92		0.68	0.08		0.78	0.19		0.45	0.06	
1099	6,427.59	6,426.34	6,429.71	6,427.57	4.00			6.22	6.22			0.71			0.91			0.61		
1075	6,426.96	6,425.65	6,427.27	6,426.28	4.00			3.02	3.02			0.37			3.54			11.44		
1050	6,426.27	6,423.72	6,426.51	6,425.31	4.00			6.46	6.46			0.99			0.62			0.26		
1025	6,425.69	6,424.03	6,427.00	6,425.13	4.00			9.25	9.25			0.58			0.74			0.43		
1002	6,425.09	6,423.76	6,424.88	6,424.13	4.00			4.64	4.64			0.28			3.09			9.42		
975	6,423.40	6,421.40	6,424.19	6,422.76	4.00			21.13	21.13			0.37			0.51			0.23		
950	6,422.46	6,421.39	6,422.04	6,421.82	4.00			4.97	4.97			0.28			2.87			8.08		
929	6,421.84	6,418.41	6,421.12	6,419.17	4.00			6.93	6.93			0.49			1.18			1.14		
922	6,421.47	6,417.78	6,419.93	6,418.74	4.00			4.38	4.38			0.50			1.83			2.75		
900	6,418.84	6,416.23	6,418.81	6,417.52	4.00			4.78	4.78			0.66			1.27			1.25		
885	6,417.53	6,415.24	6,417.95	6,415.94	4.00			2.49	2.49			0.43			3.77			12.76		
880	6,417.34	6,413.19	6,417.48	6,415.06	4.00			4.73	4.73			1.20			0.71			0.33		
876	6,417.27	6,414.04	6,416.83	6,415.01	4.00			7.23	7.23			0.54			1.02			0.83		
850	6,415.72	6,413.35	6,415.89	6,414.21	4.00			4.67	4.67			0.65			1.31			1.32		
834	6,414.85	6,411.91	6,415.22	6,412.53	4.00			3.13	3.13			0.37			3.46			10.94		
830	6,414.77	6,410.67	6,415.29	6,411.85	4.00			5.15	5.15			0.80			0.97			0.67		
825	6,414.79	6,410.79	6,415.31	6,411.74	4.00			4.58	4.58			0.73			1.19			1.06		
812	6,414.50	6,409.30	6,413.75	6,410.63	4.00			1.88	1.88			0.63			3.39			10.31		
800	6,413.83	6,407.18	6,414.03	6,408.23	4.00			2.90	2.90			0.64			2.15			3.74		
775	6,411.22	6,406.38	6,412.18	6,407.35	4.00			6.97	6.97			0.62			0.92			0.64		
745	6,409.52	6,405.55	6,410.25	6,406.11	4.00			5.37	5.37			0.36			2.05			3.81		
734	6,408.17	6,403.73	6,408.18	6,404.75	4.00			7.80	7.80			0.37			1.39			1.76		
725	6,408.22	6,403.59	6,408.63	6,404.37	4.00			14.27	14.27			0.34			0.82			0.61		

HEC-RAS results for the estimated 2-year event with total discharge of 4 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft/s)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (lb/sq ft)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank
700	6,405.45	6,402.12	6,407.21	6,402.61	4.00			8.62	8.62			0.23			2.05			4.41		
674	6,405.08	6,400.12	6,406.22	6,401.13	4.00			6.93	6.93			0.58			1.00			0.78		
650	6,403.25	6,398.73	6,403.95	6,400.63	4.00			3.95	3.95			0.95			1.07			0.83		
625	6,401.67	6,398.24	6,402.53	6,399.52	4.00			2.70	2.70			0.66			2.23			4.07		
600	6,400.97	6,396.89	6,401.75	6,397.42	4.00			10.14	10.14			0.34			1.16			1.24		
590	6,400.08	6,395.64	6,401.29	6,395.94	4.00			8.15	8.15			0.19			2.52			6.97		
585	6,399.84	6,394.41	6,400.76	6,394.90	4.00			8.28	8.28			0.39			1.23			1.32		
570	6,397.50	6,392.93	6,397.74	6,393.84	4.00			3.59	3.59			0.59			1.88			2.81		
555	6,396.26	6,392.05	6,396.85	6,392.93	4.00			4.57	4.57			0.60			1.45			1.65		
530	6,395.92	6,389.76	6,395.83	6,390.14	4.00			10.32	10.32			0.19			2.09			4.90		
517	6,394.97	6,387.62	6,394.95	6,388.49	4.00			5.61	5.61			0.49			1.44			1.70		
497	6,394.91	6,386.91	6,394.75	6,387.68	4.00			17.53	17.53			0.29			0.78			0.58		
469	6,392.20	6,384.76	6,393.83	6,385.16	4.00			7.10	7.10			0.21			2.69			7.77		
460	6,391.75	6,382.98	6,393.54	6,383.77	4.00			11.31	11.31			0.38			0.94			0.78		
450	6,391.67	6,382.40	6,392.59	6,383.46	4.00			4.94	4.94			0.71			1.14			0.98		
427	6,390.31	6,381.79	6,392.49	6,382.40	4.00			5.66	5.66			0.42			1.70			2.50		
400	6,388.99	6,379.94	6,387.87	6,381.33	4.00			4.71	4.71			0.77			1.10			0.89		
375	6,388.60	6,379.45	6,385.32	6,380.38	4.00			3.96	3.96			0.58			1.75			2.44		
350	6,386.26	6,378.54	6,386.67	6,379.34	4.00			8.18	8.18			0.49			1.00			0.81		
325	6,384.96	6,377.20	6,384.70	6,378.45	4.00			3.92	3.92			0.70			1.45			1.62		
307	6,383.87	6,376.03	6,383.99	6,376.58	4.00			3.93	3.93			0.36			2.80			7.14		
300	6,383.66	6,375.27	6,383.29	6,376.35	4.00			11.09	11.09			0.47			0.77			0.49		
275	6,382.73	6,374.80	6,382.66	6,375.87	4.00			8.61	8.61			0.52			0.89			0.65		
257	6,380.71	6,374.03	6,381.68	6,374.62	4.00			3.61	3.61			0.33			3.32			10.30		
219	6,379.88	6,371.75	6,379.06	6,373.78	4.00			5.61	5.61			0.98			0.73			0.37		
200	6,378.95	6,371.47	6,380.35	6,373.39	4.00			2.45	2.45			0.95			1.71			2.35		
193	6,379.29	6,371.57	6,379.95	6,372.14	4.00			3.58	3.58			0.34			3.31			10.24		
Ave					3.91	0.75	0.96	6.97	5.81	11.35	11.16	0.54	0.14	0.17	1.72	0.31	0.32	3.36	0.13	0.14
Median					4.00	0.78	0.77	4.94	4.94	11.87	13.22	0.50	0.13	0.13	1.37	0.32	0.27	1.38	0.12	0.10
Max					4.00	1.49	2.57	49.44	21.13	22.26	20.20	1.20	0.27	0.29	3.81	0.47	0.47	12.83	0.25	0.28
Min					1.11	0.01	0.01	1.88	1.88	0.92	0.70	0.19	0.04	0.06	0.35	0.11	0.19	0.11	0.02	0.06

A-2 HEC-RAS Output, Proposed Conditions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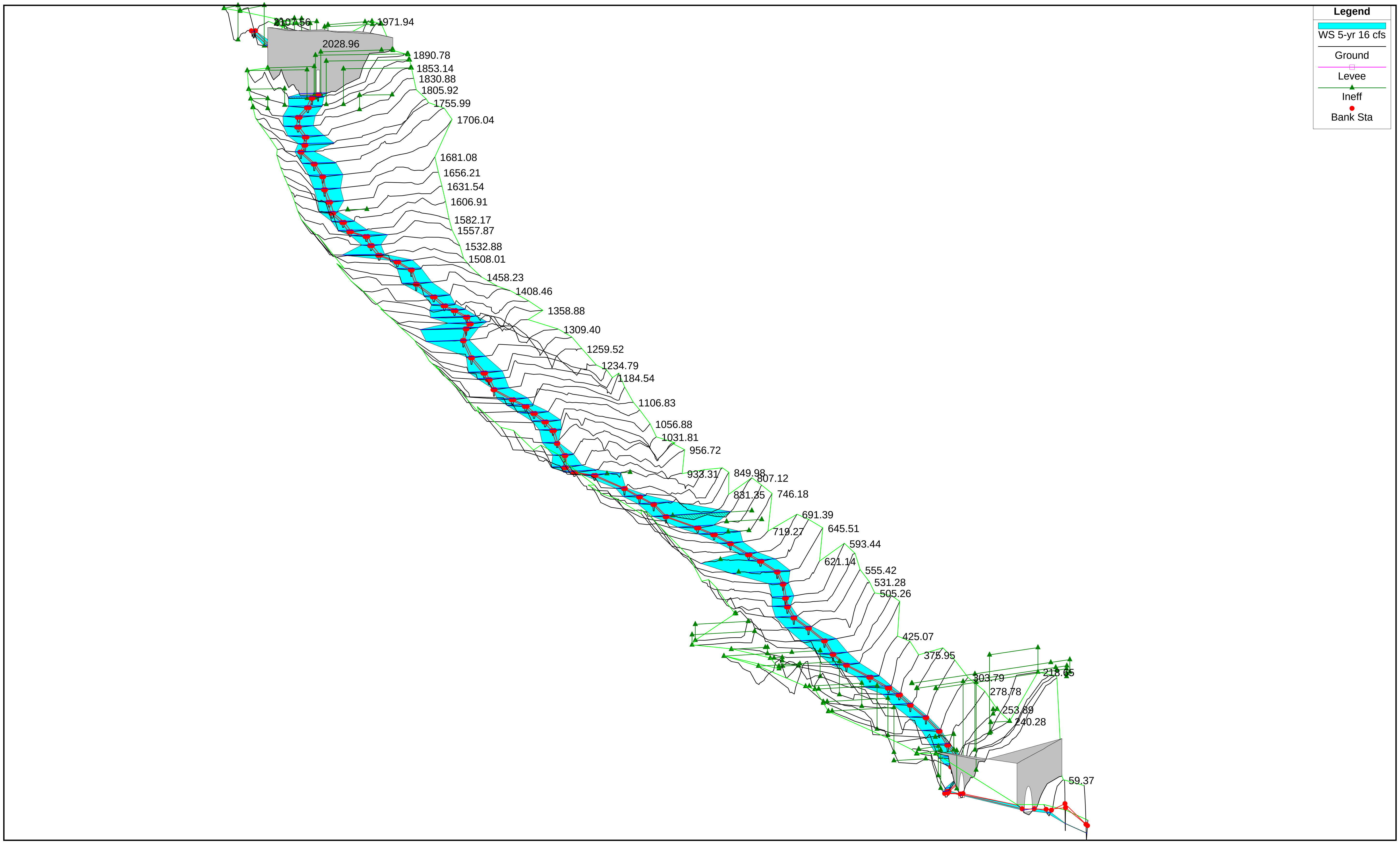
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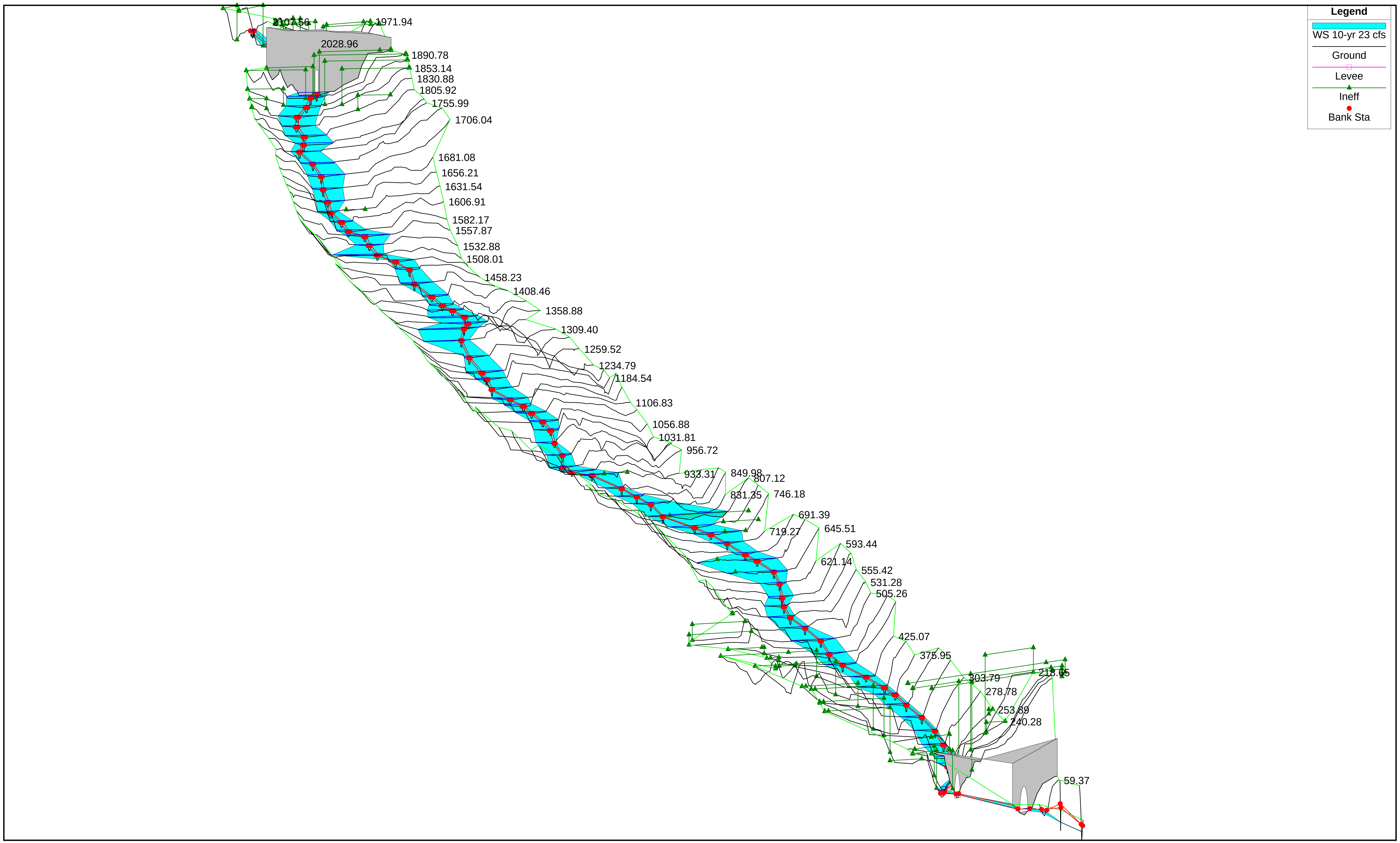Legend
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Levee
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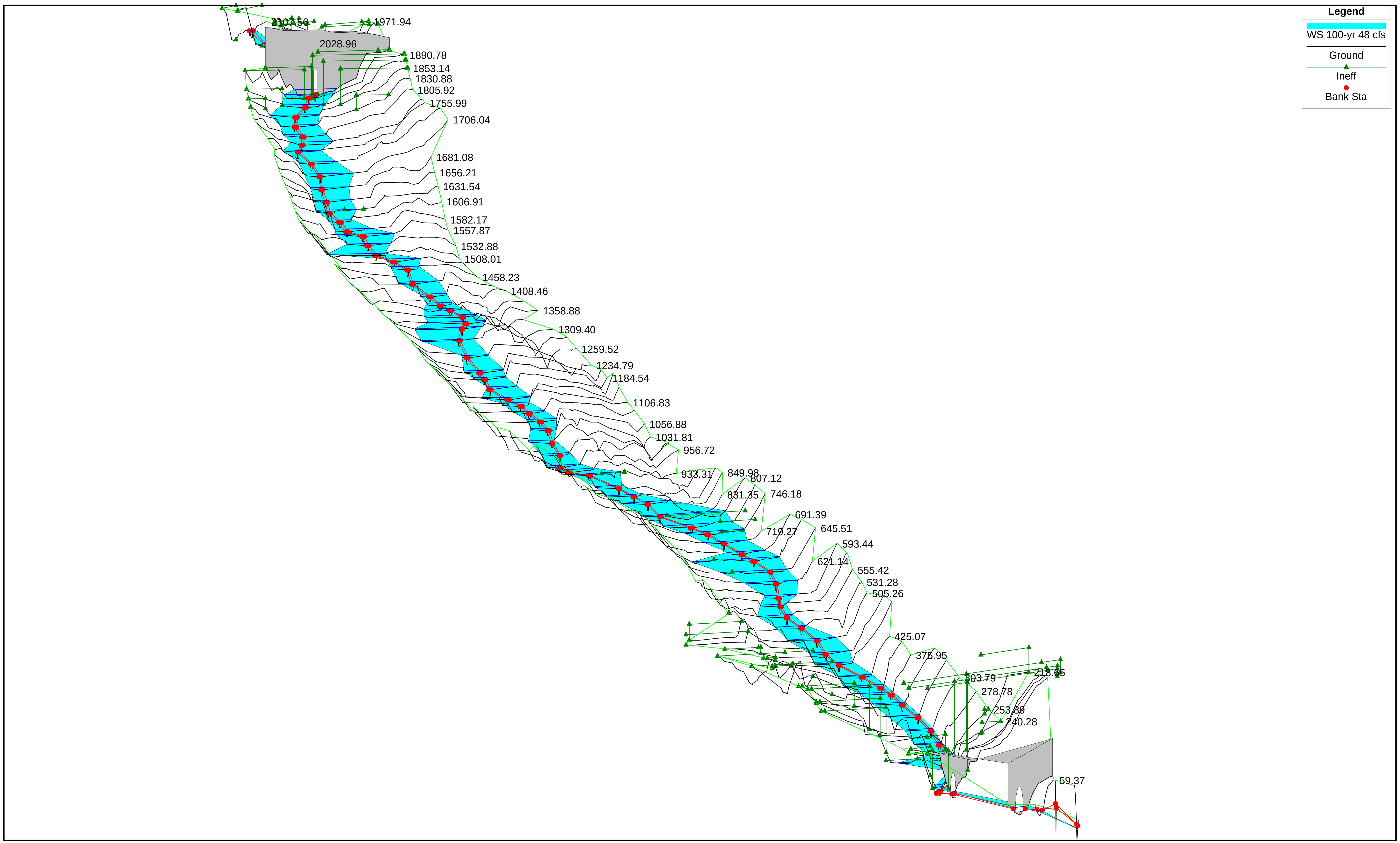
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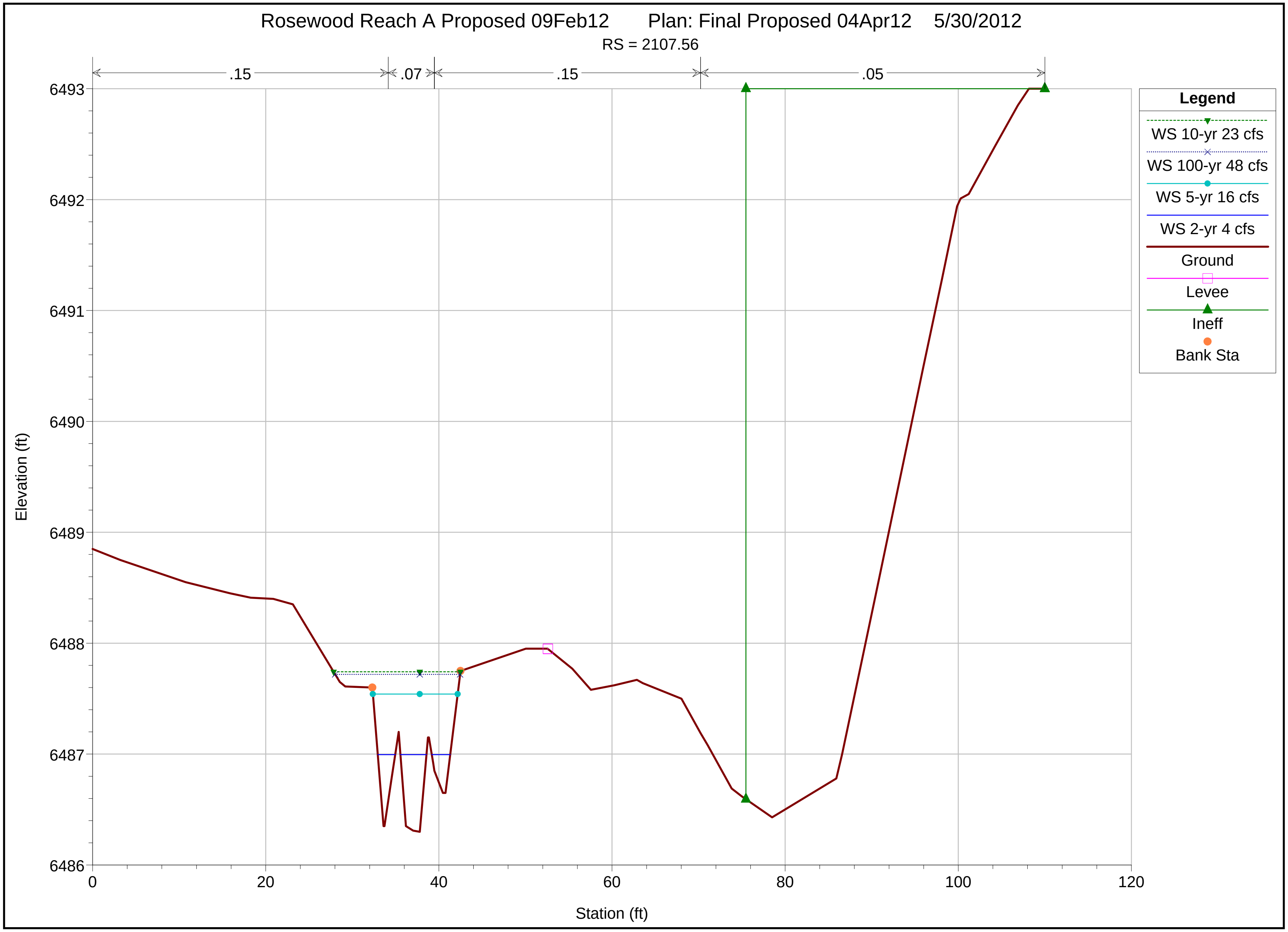
Legend
WS 100-yr 48 cfs
Ground
Ineff
Bank Sta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WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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20
40
60
80
100
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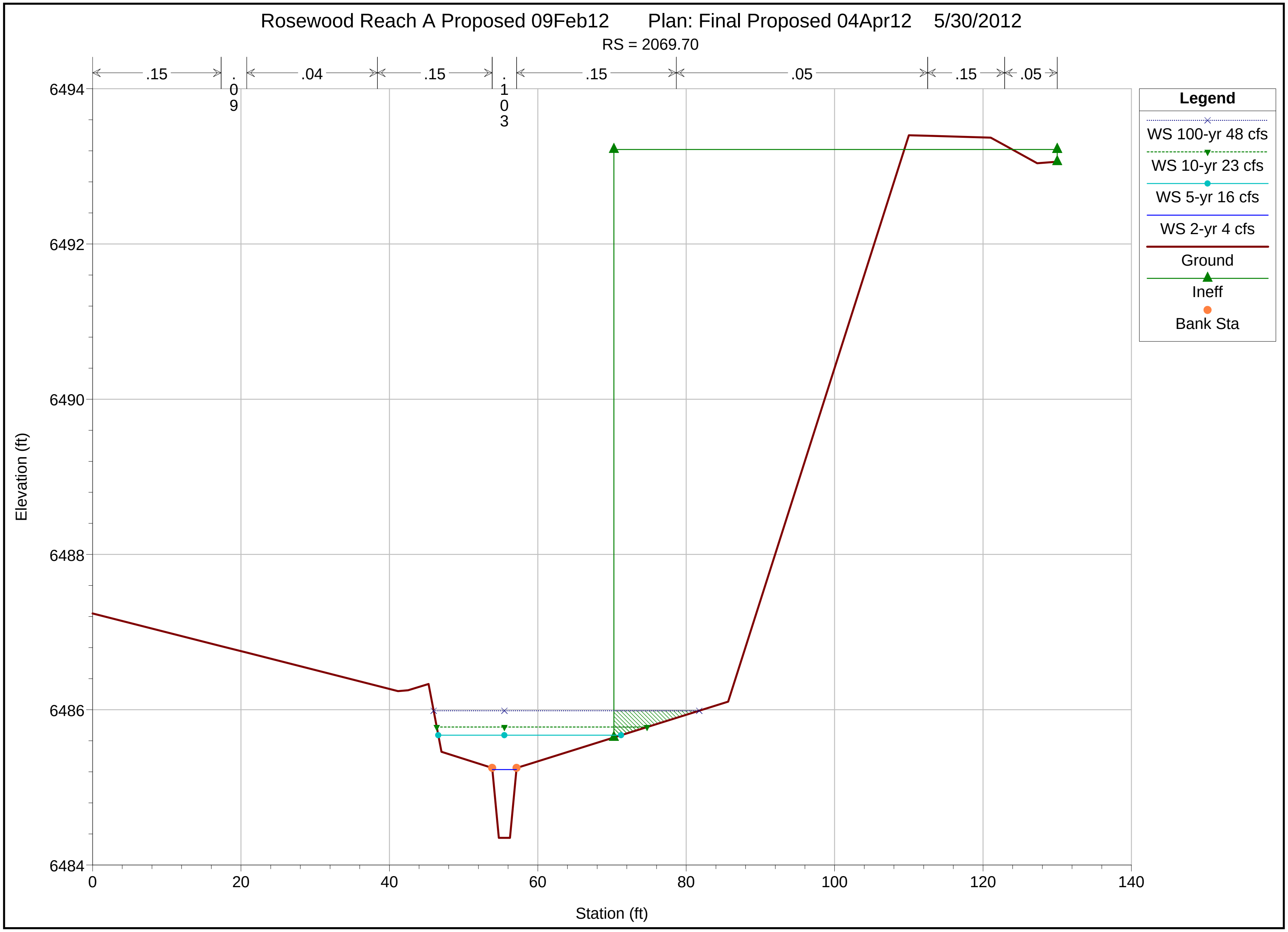
Station (ft)



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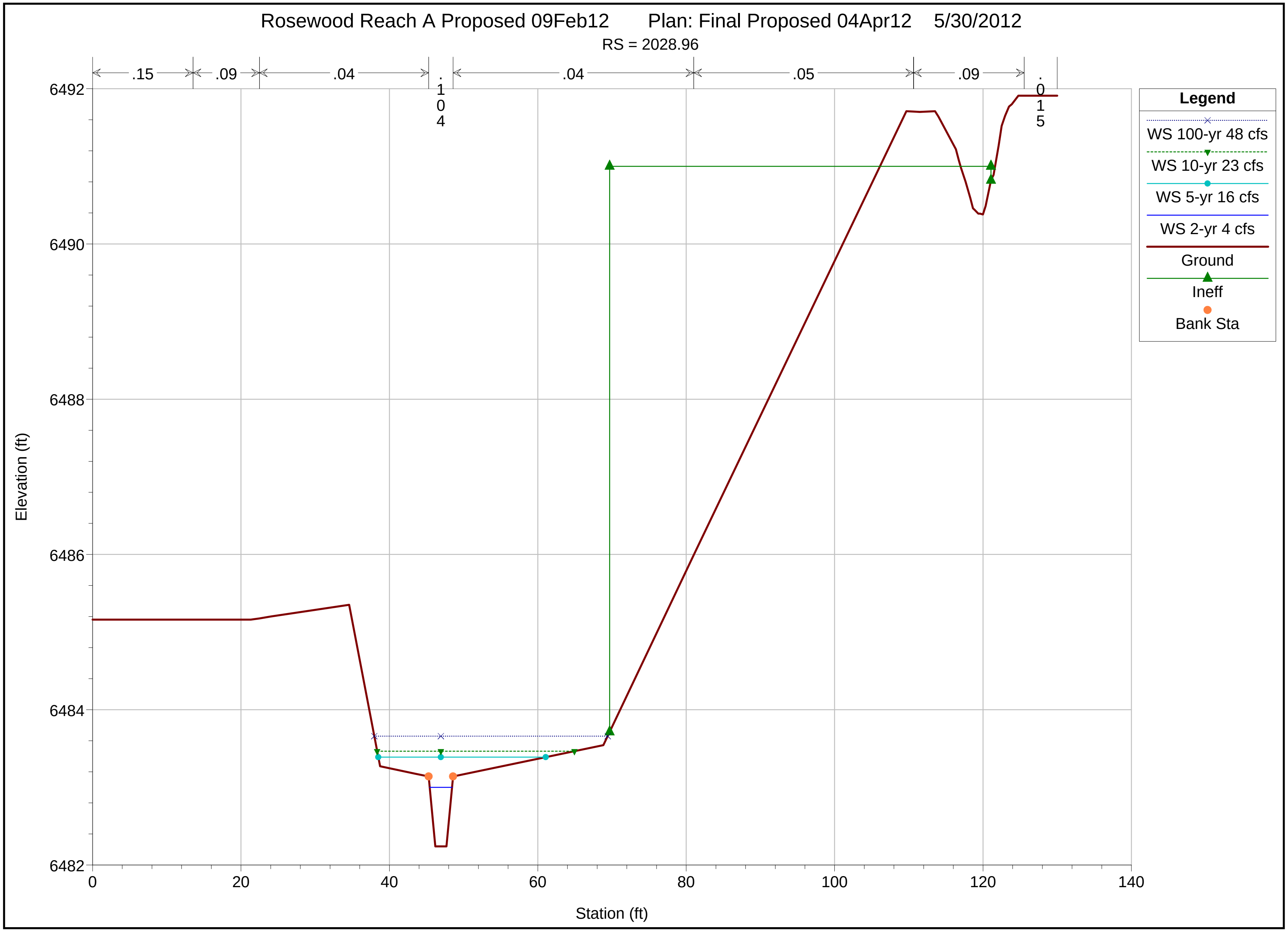
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Ground
Ineff
Bank Sta
Elevation (ft)
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6488
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Station (ft)
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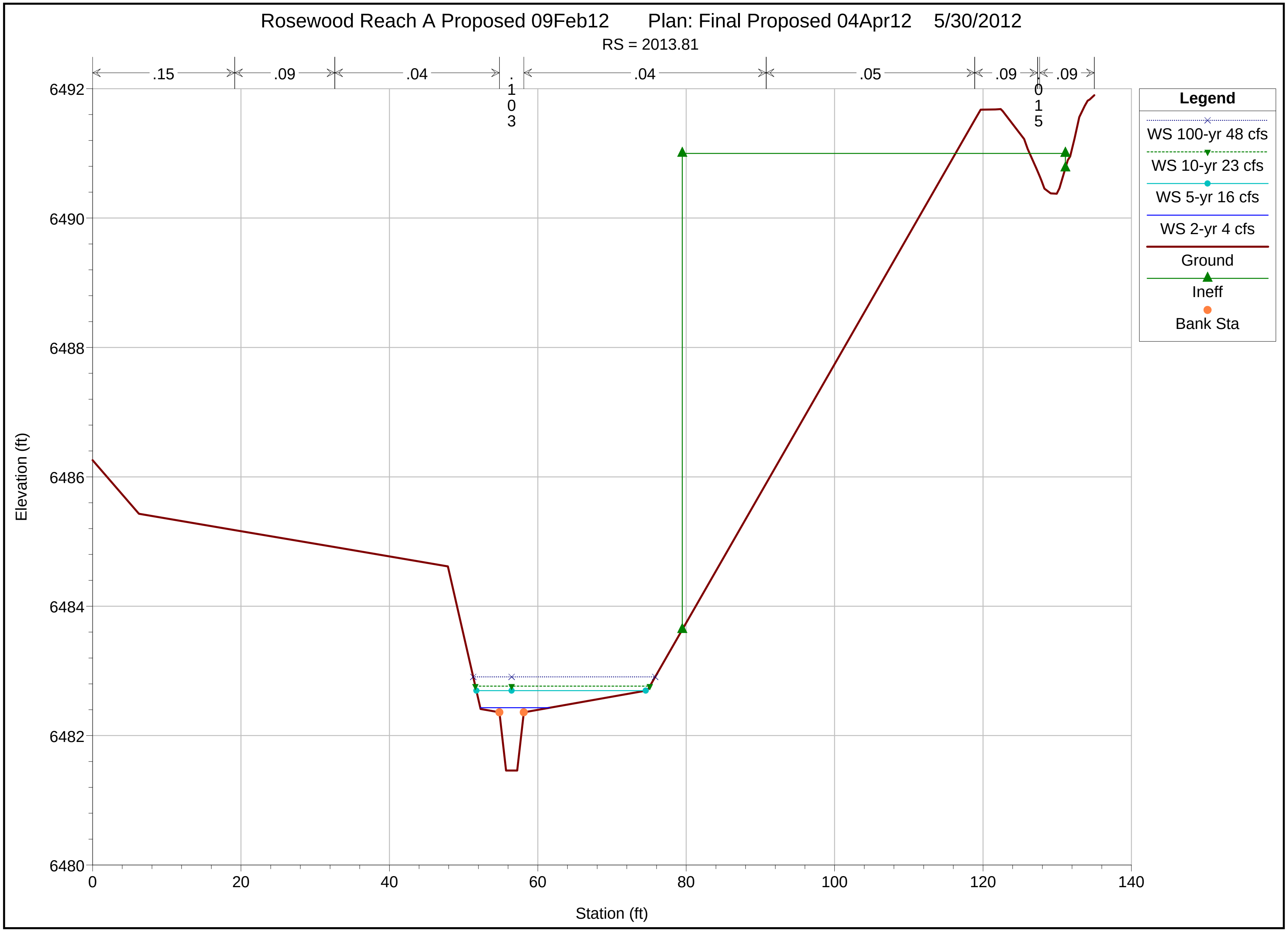

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WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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20
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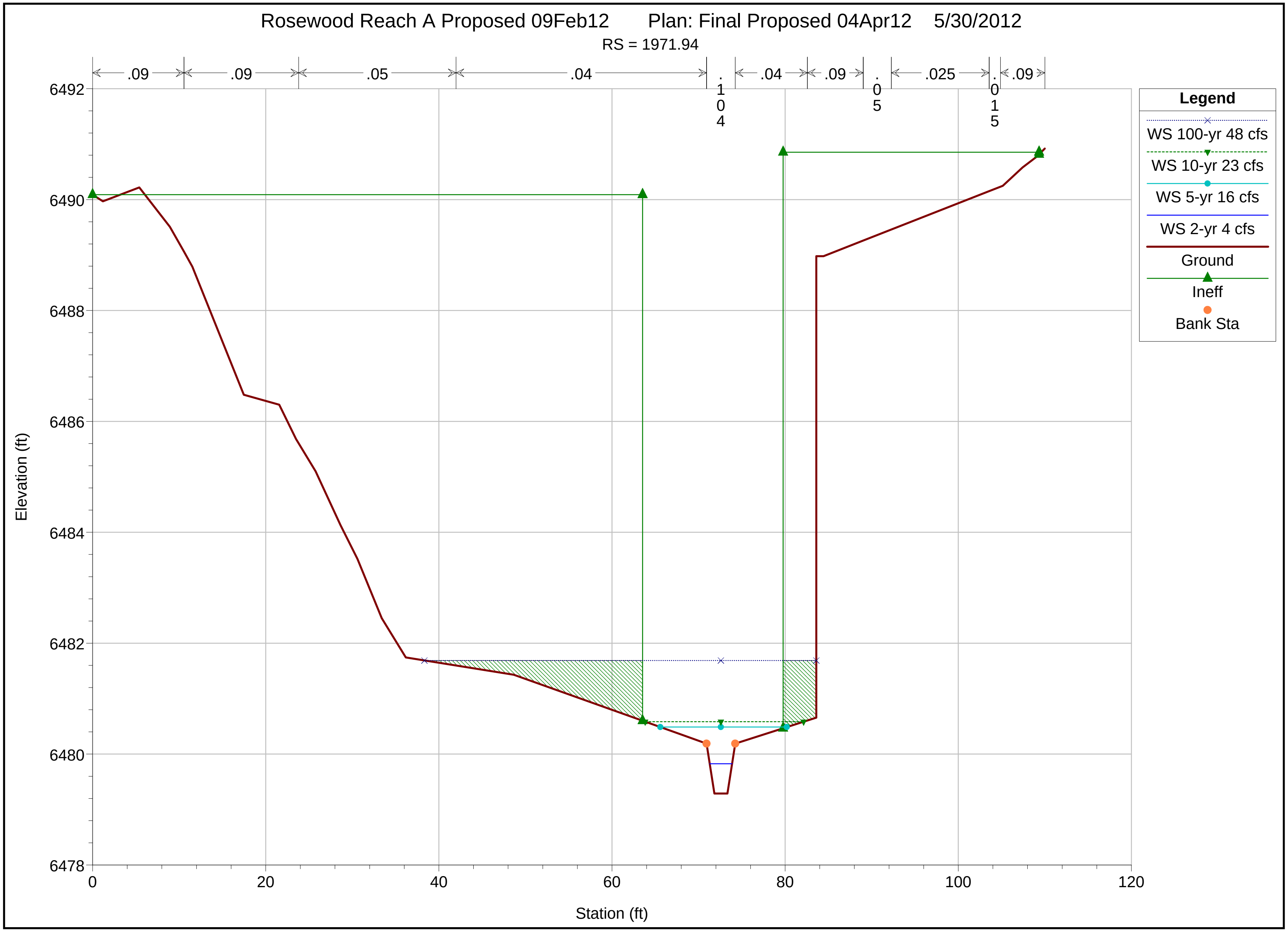
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WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
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6488
6486
6484
6482
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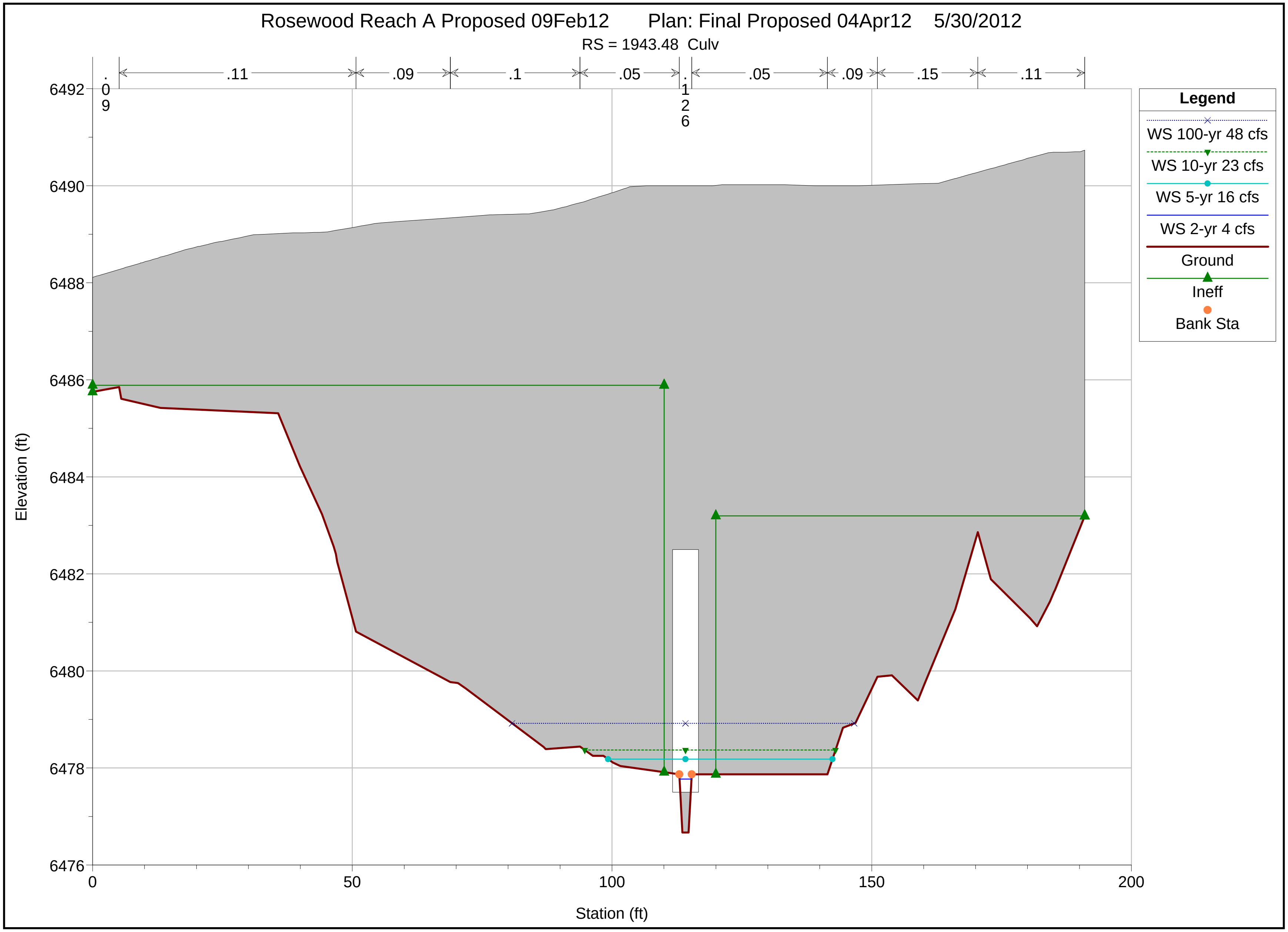
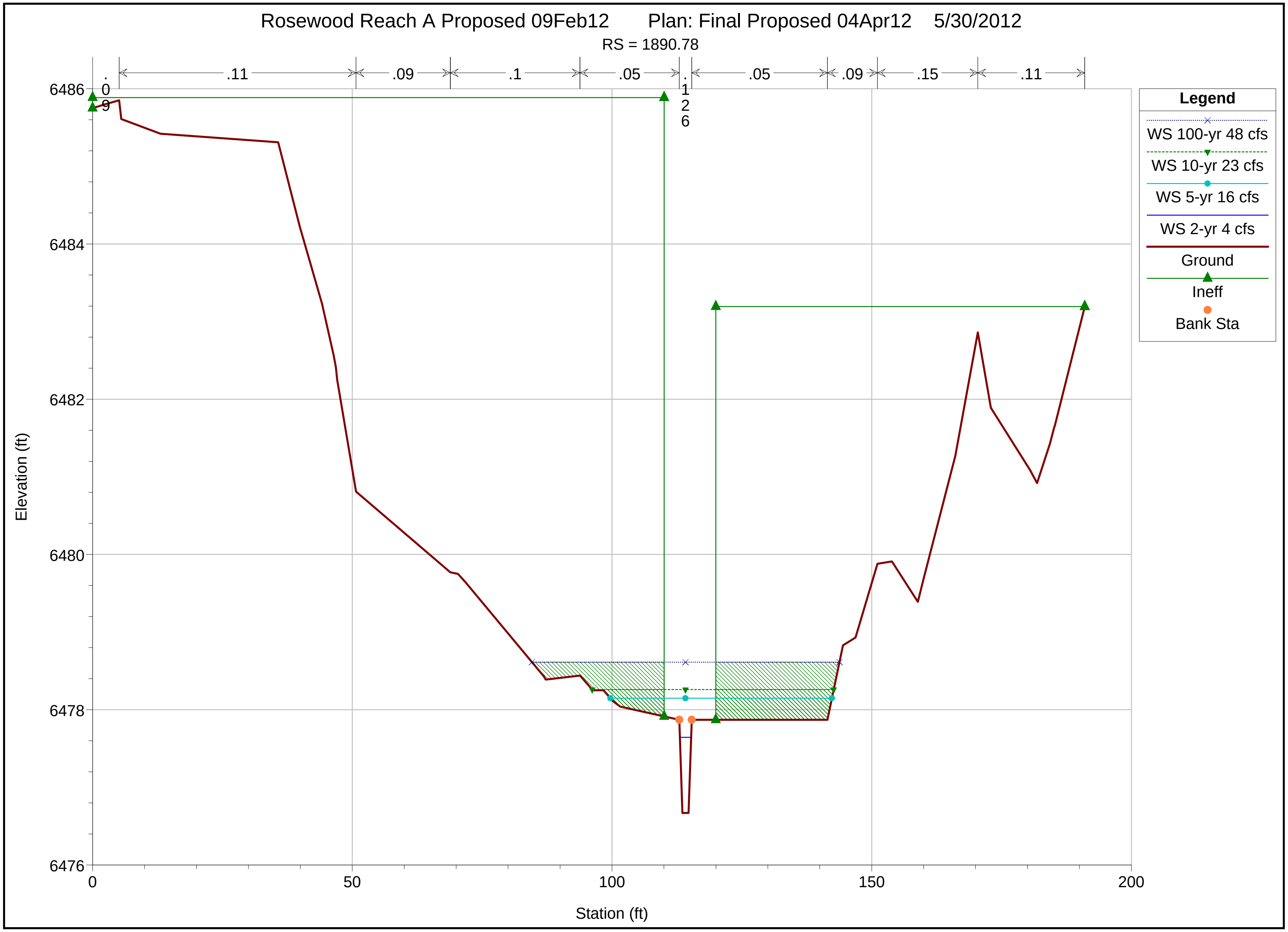
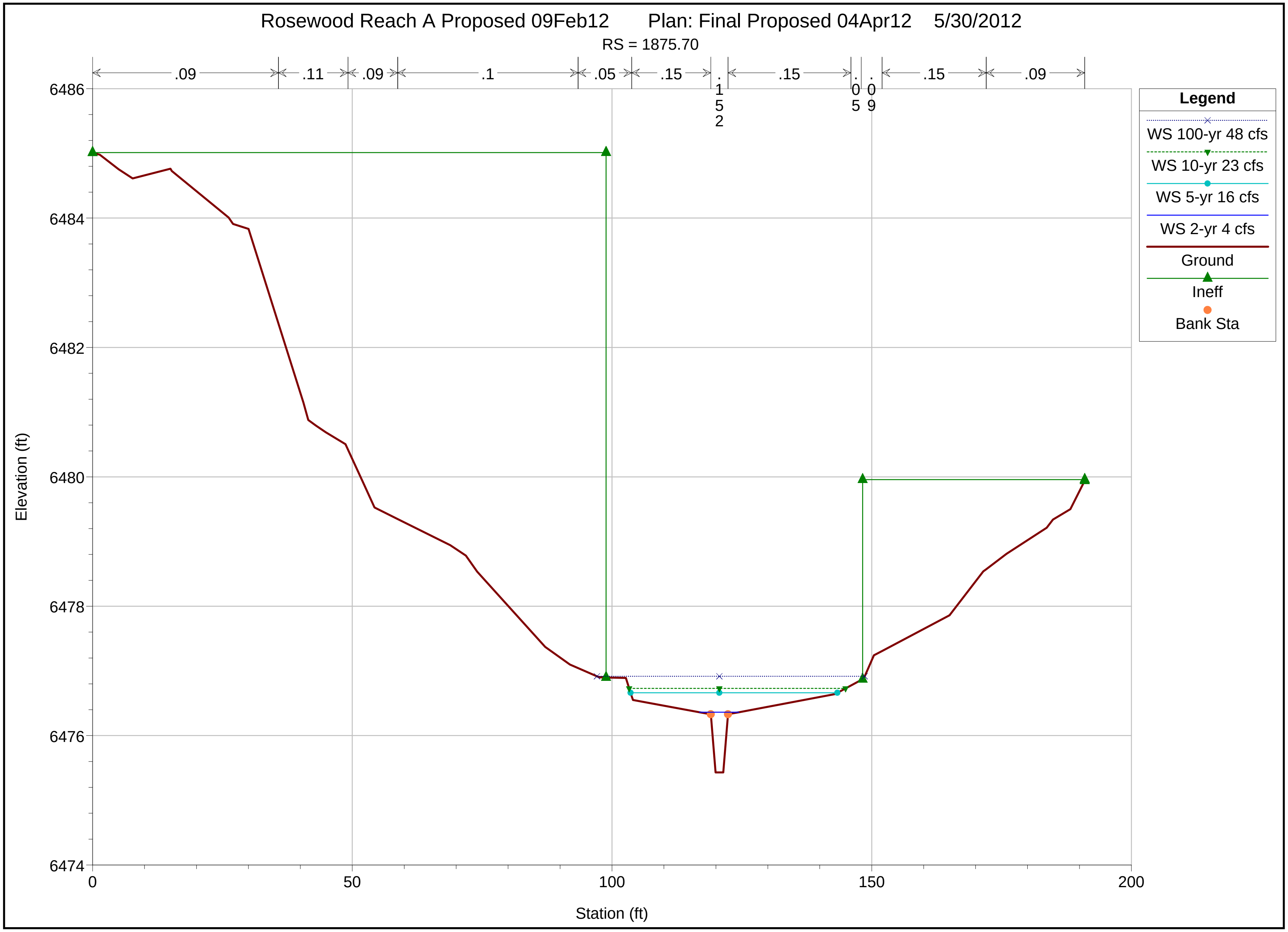
Station (ft)

Rosewood Reach A Proposed 09Feb12   Plan: Final Proposed 04Apr12   5/30/2012

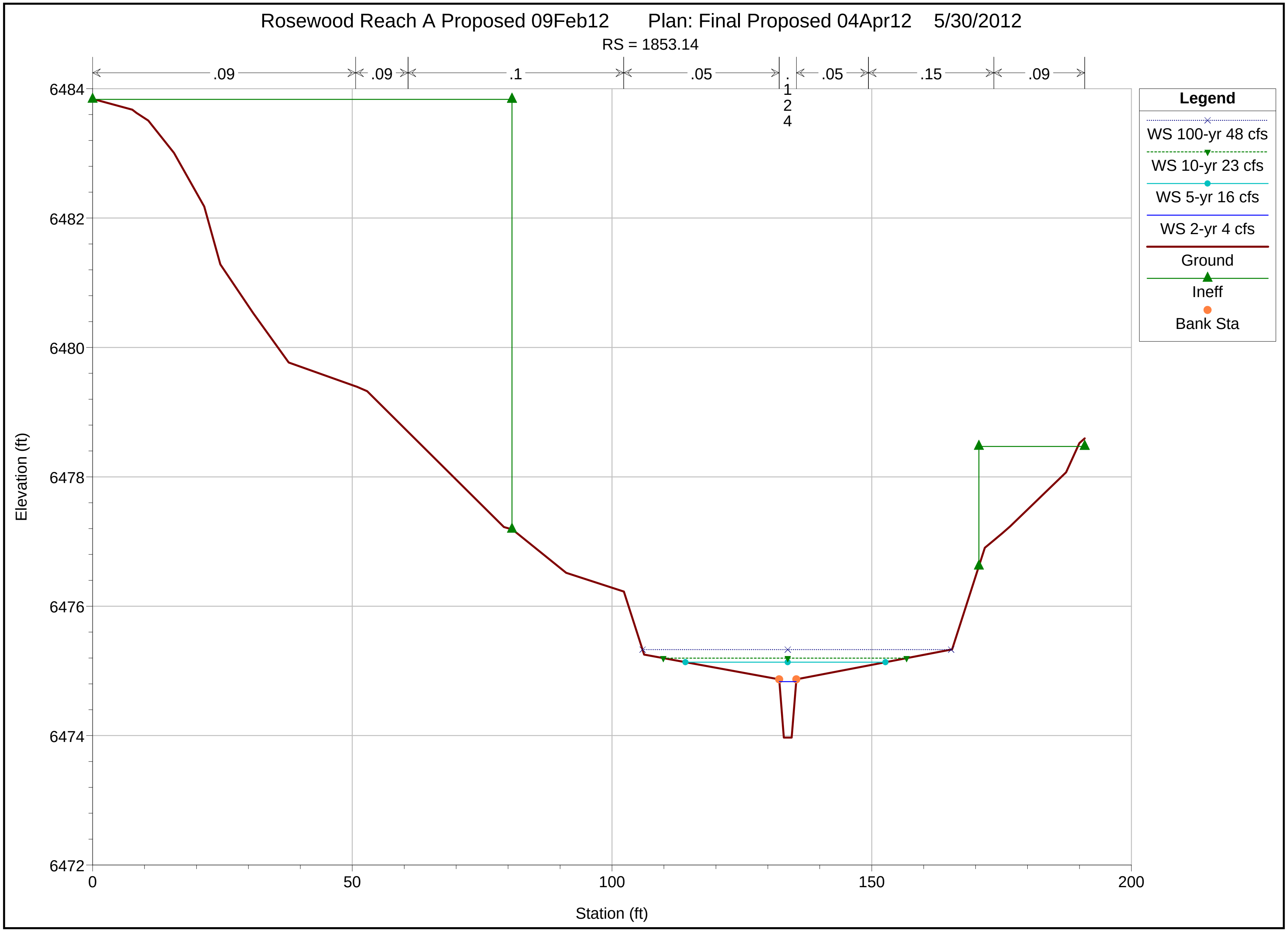
RS = 1943.48 Culv

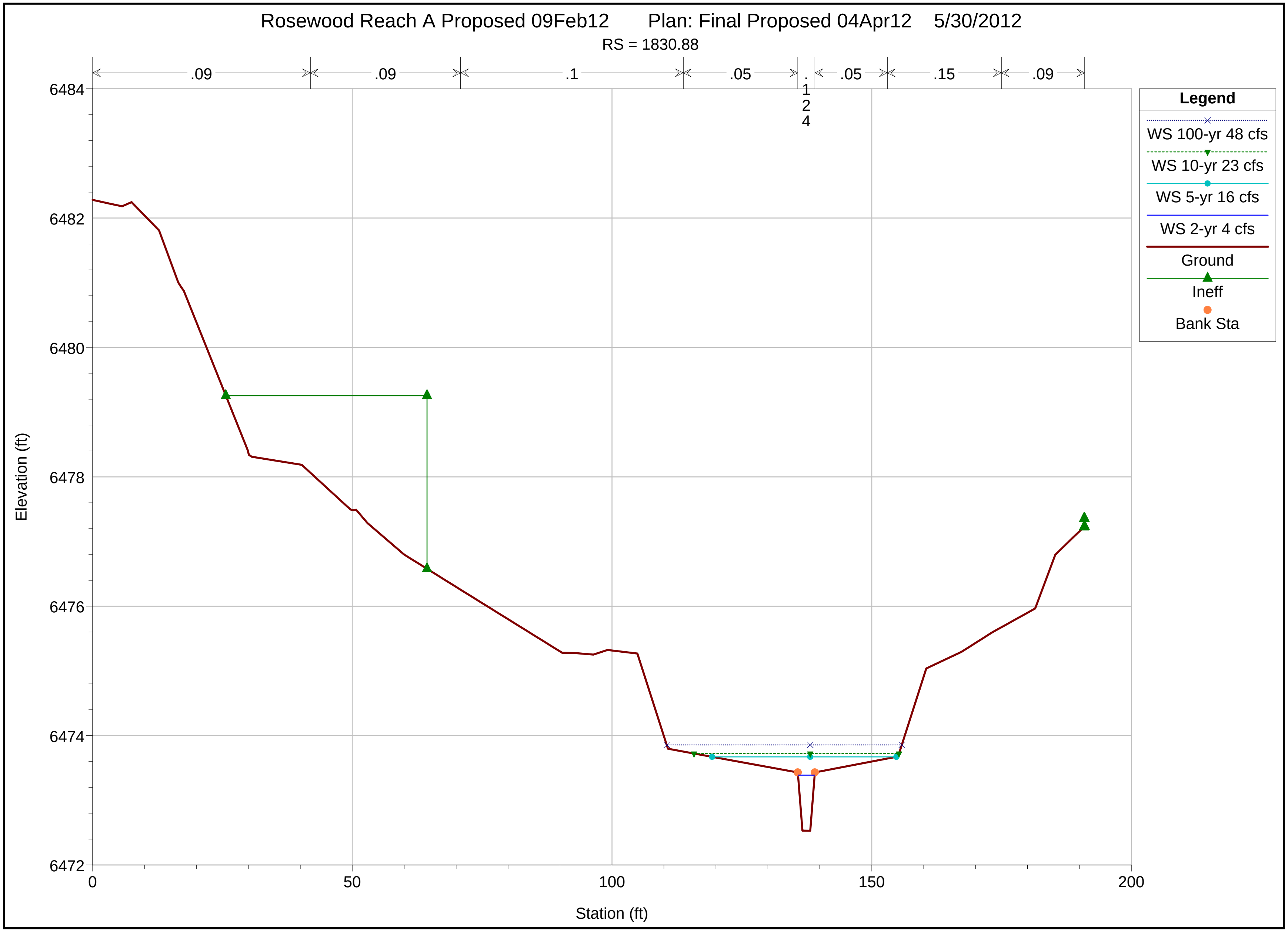

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1943.48 Culv
.09
.11
.09
.1
.05
.126
.05
.09
.15
.11
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6492
6490
6488
6486
6484
6482
6480
6478
6476
Station (ft)
0
50
100
150
200

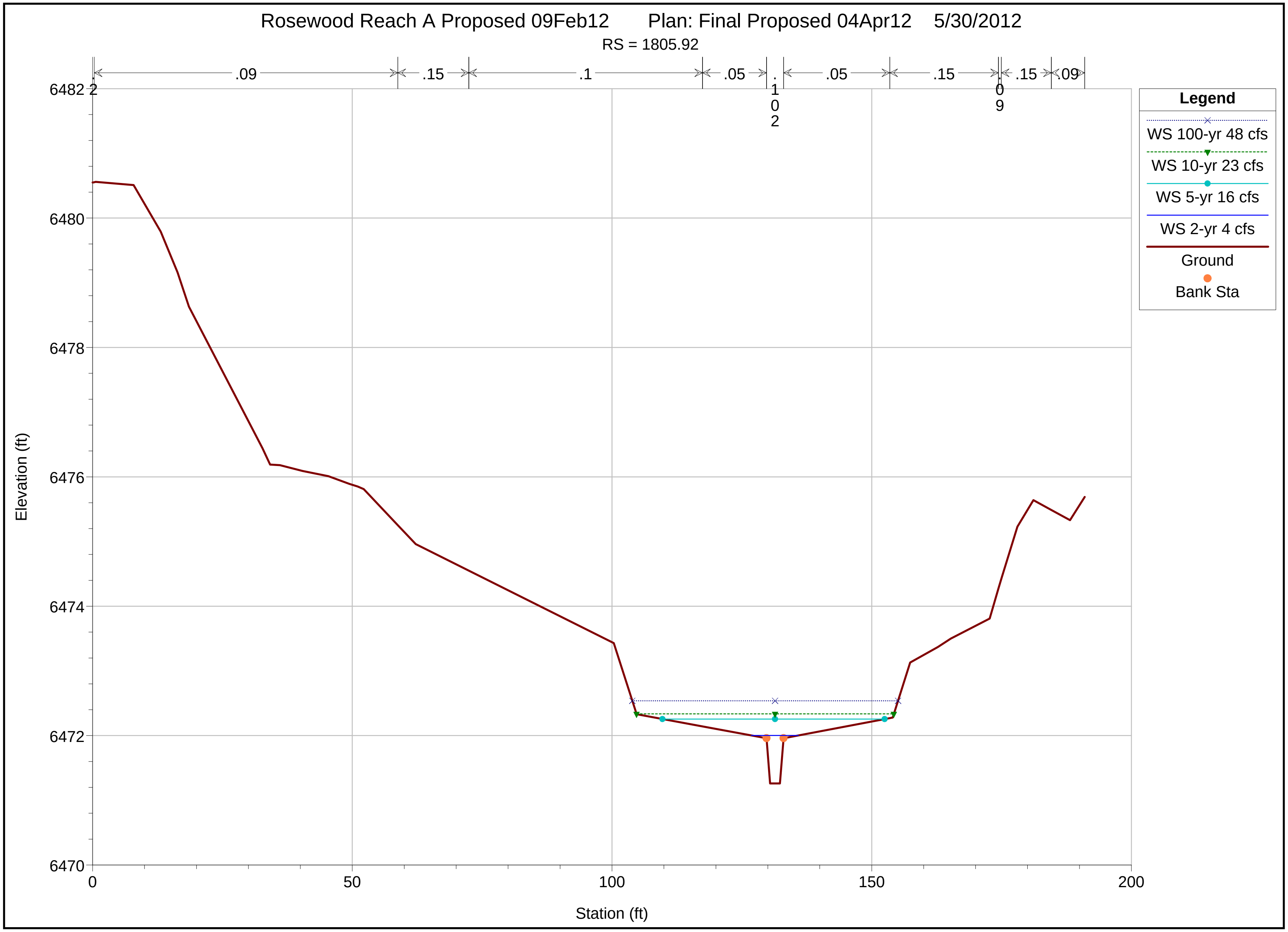

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1890.78
.09
.11
.09
.1
.05
.126
.05
.09
.15
.11
6486
6484
6482
6480
6478
6476
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta

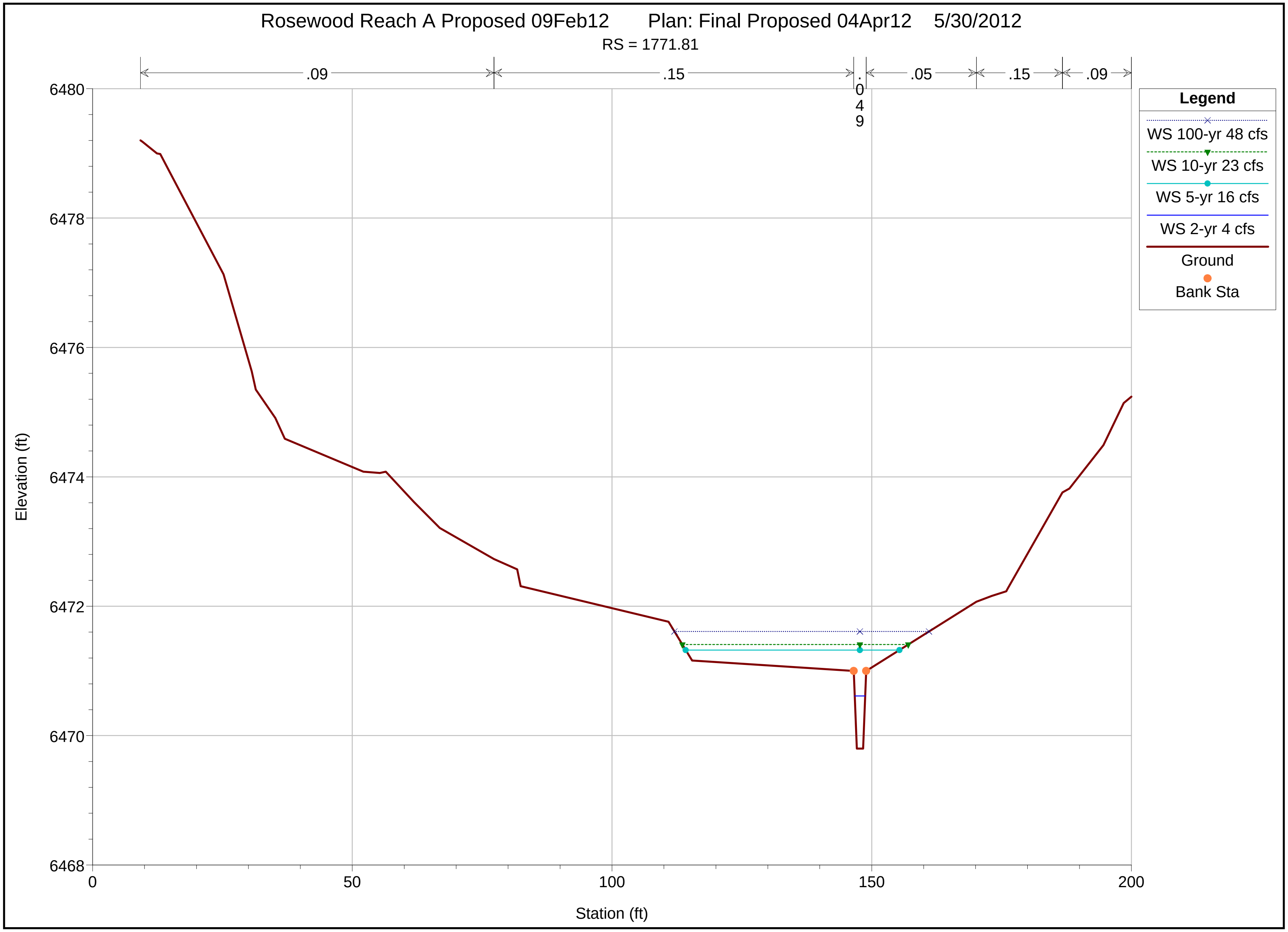

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

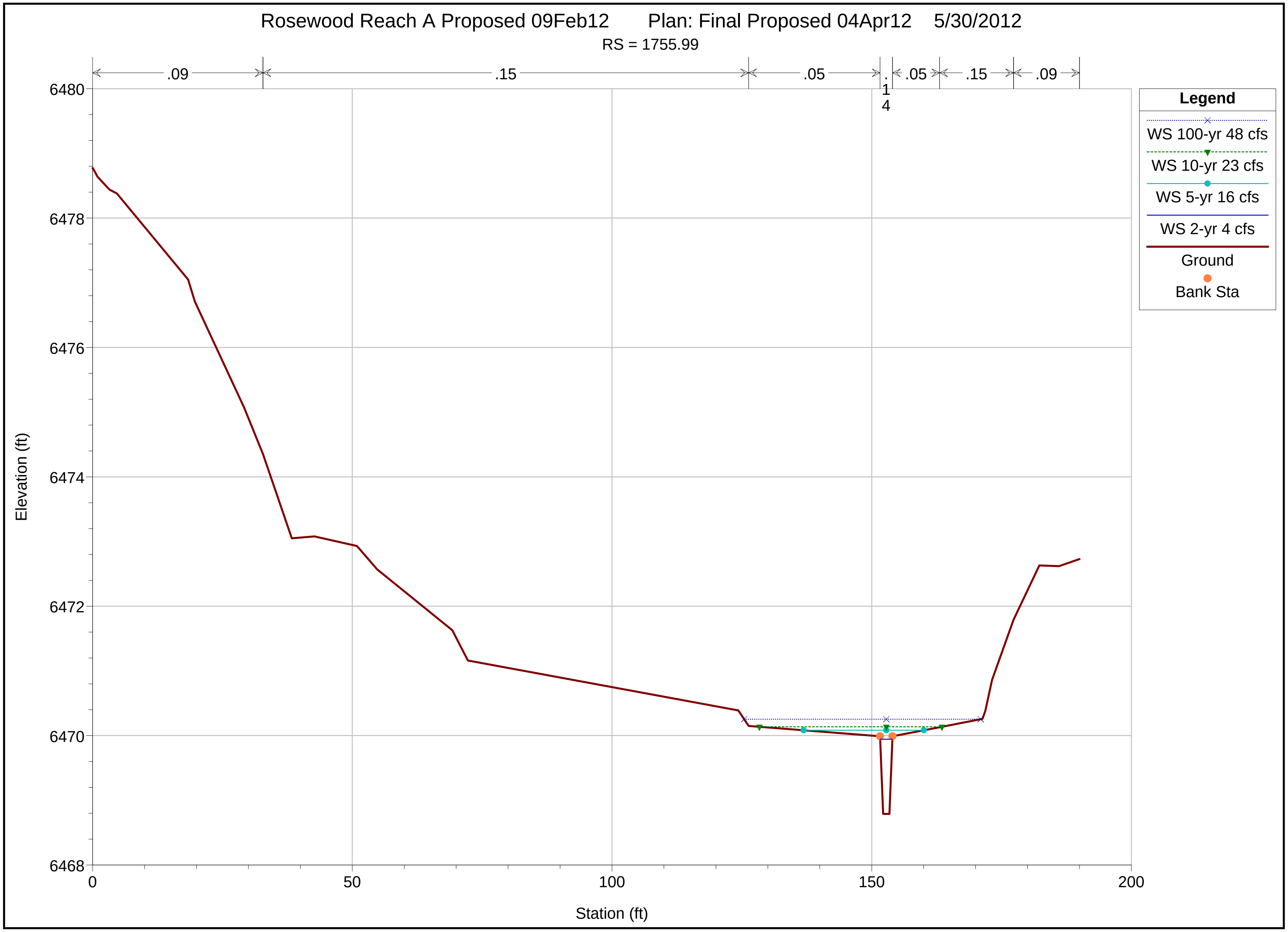
RS = 1875.70

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1853.14
.09
.09
.1
.05
.124
.05
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6484
6482
6480
6478
6476
6474
6472
Station (ft)
0
50
100
150
200

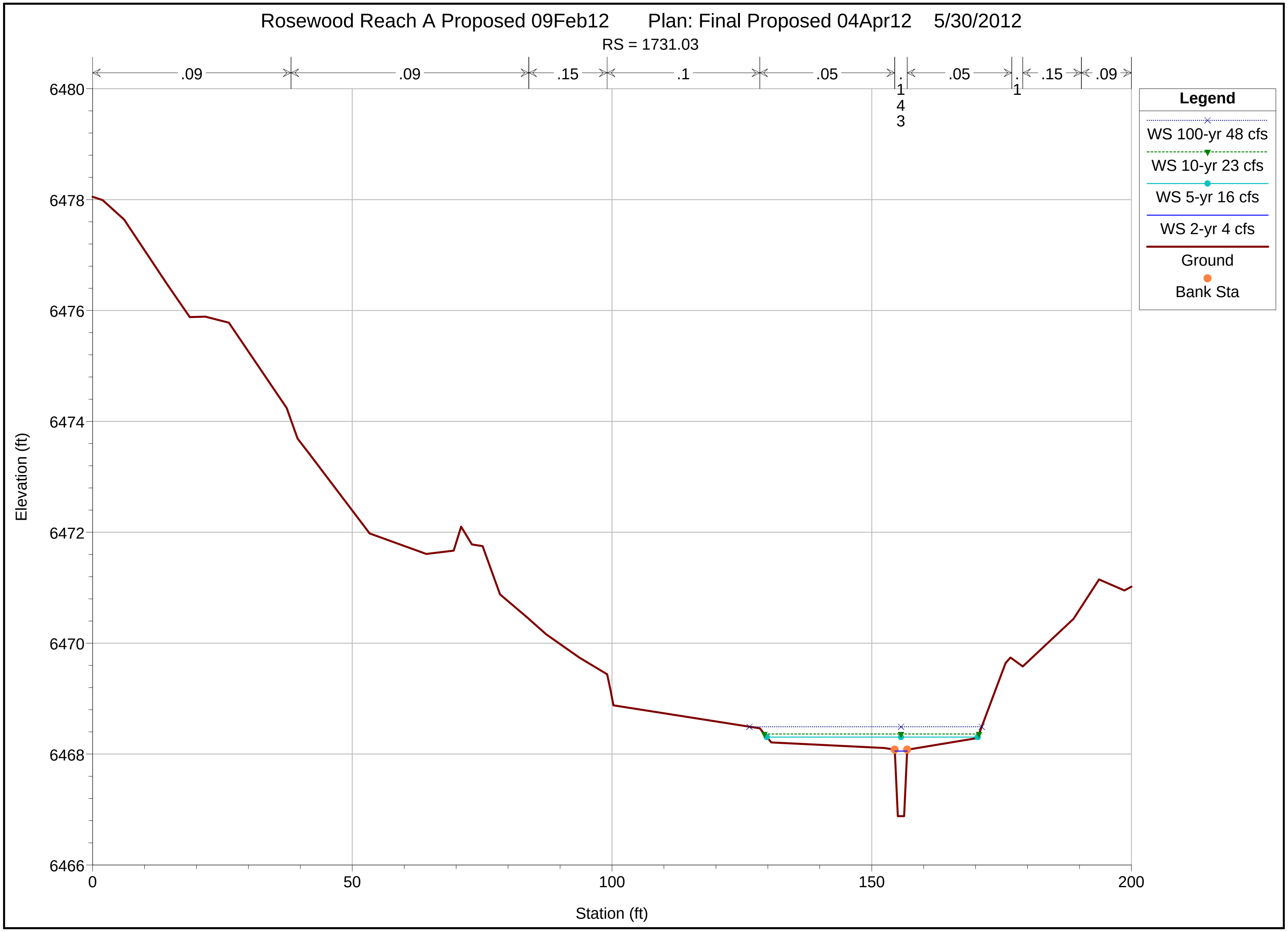

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1830.88
.09
.09
.1
.05
.124
.05
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6484
6482
6480
6478
6476
6474
6472
Station (ft)
0
50
100
150
200


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1805.92
.2
.09
.15
.1
.05
.102
.05
.15
.09
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6482
6480
6478
6476
6474
6472
6470
Station (ft)
0
50
100
150
200

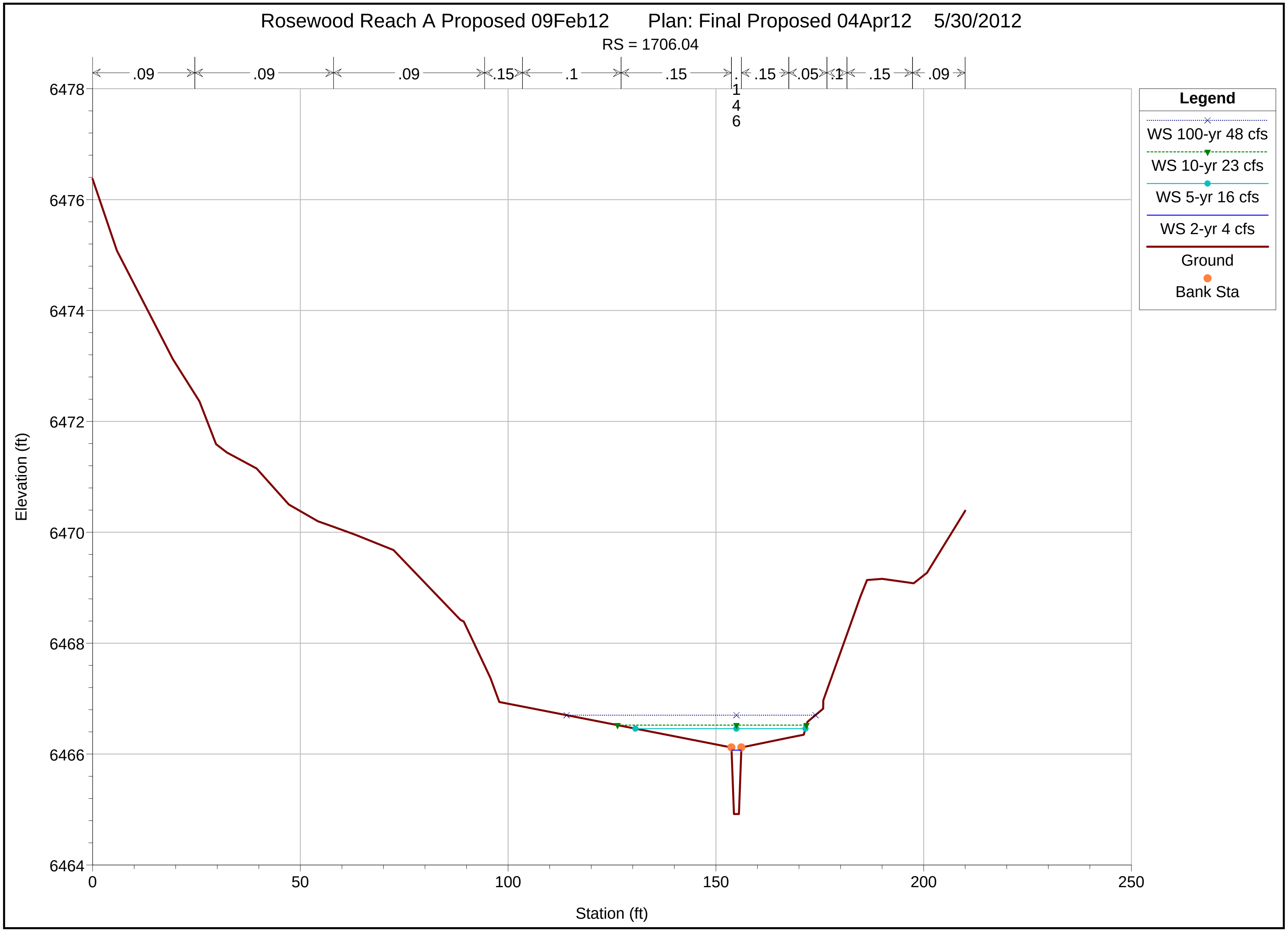

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1771.81
.09
.15
.049
.05
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6480
6478
6476
6474
6472
6470
6468
Station (ft)
0
50
100
150
200



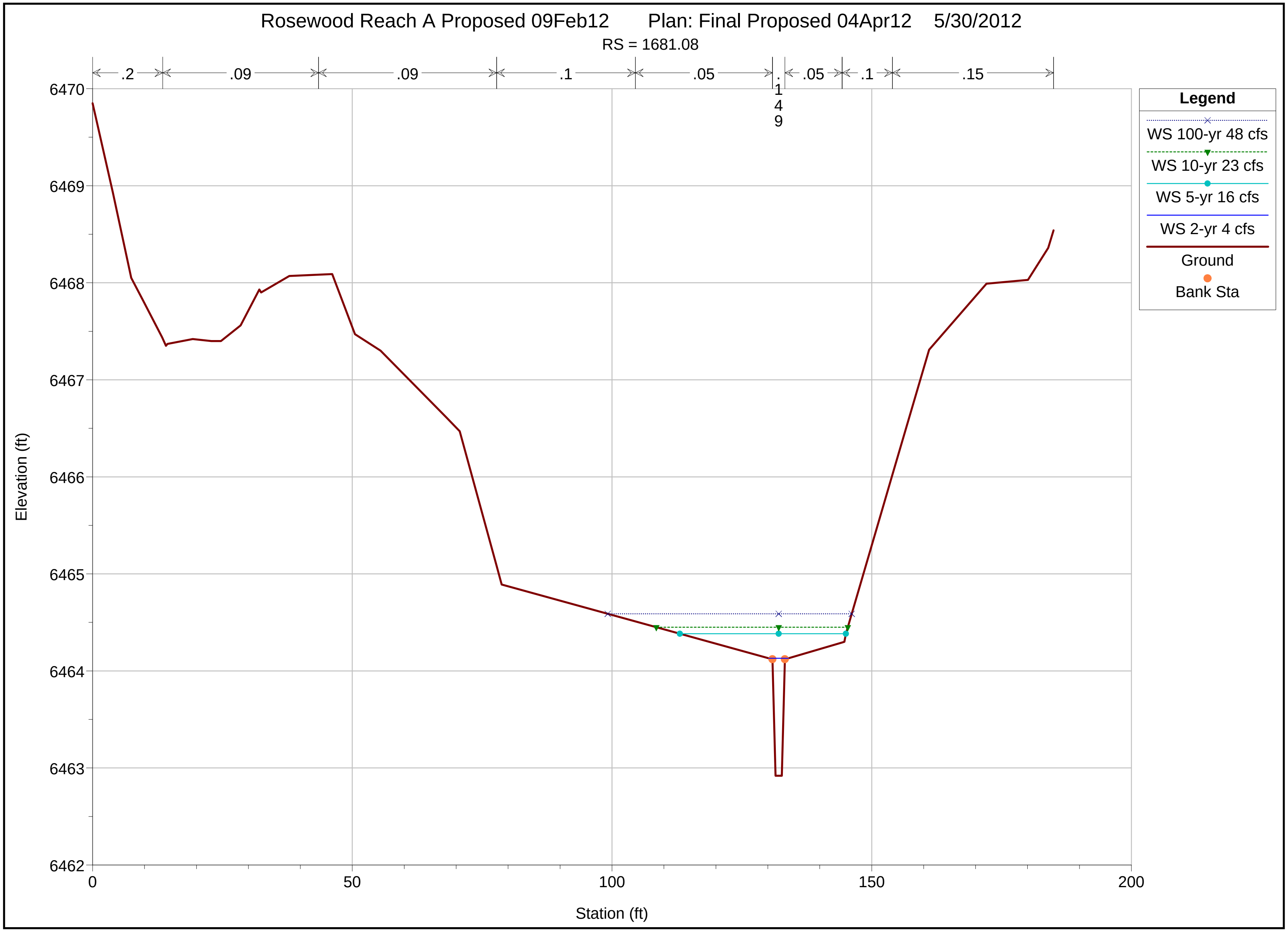
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1755.99
.09
.15
.05
.
1
4
.05
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6480
6478
6476
6474
6472
6470
6468
0
50
100
150
200
Station (ft)

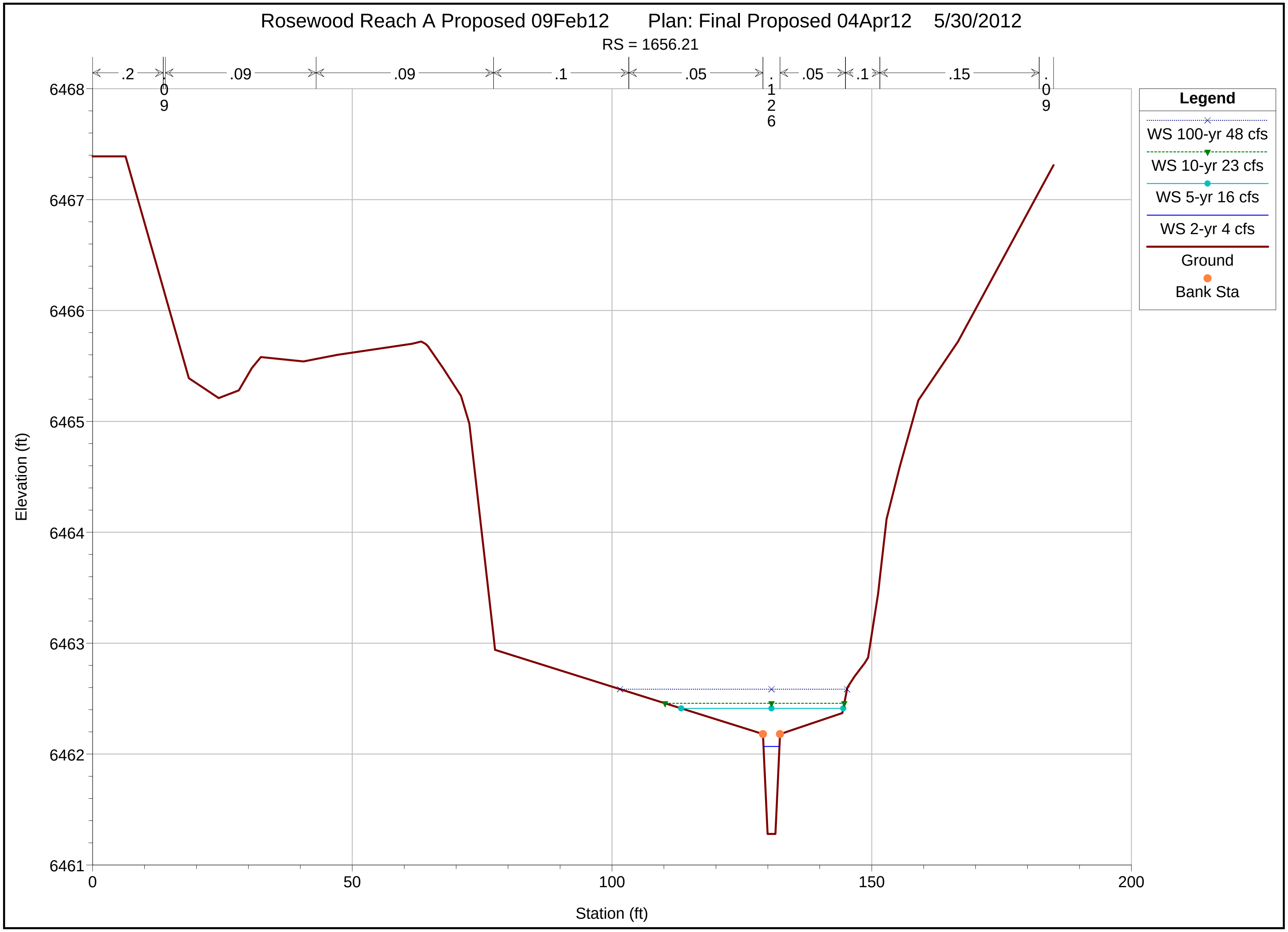

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

RS = 1731.03



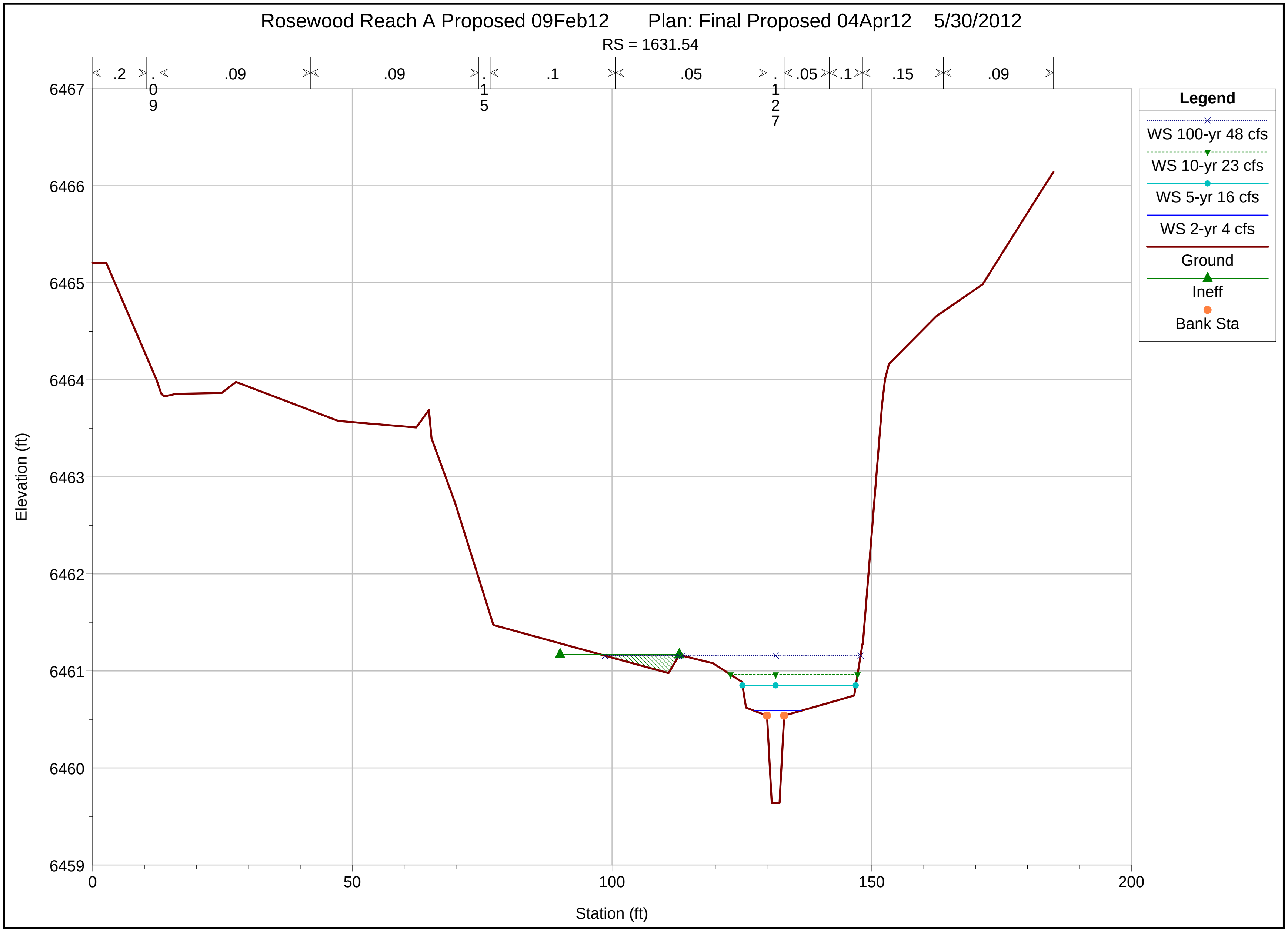
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1706.04
.09
.09
.09
.15
.1
.15
.146
.15
.05
.1
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6478
6476
6474
6472
6470
6468
6466
6464
Station (ft)
0
50
100
150
200
250

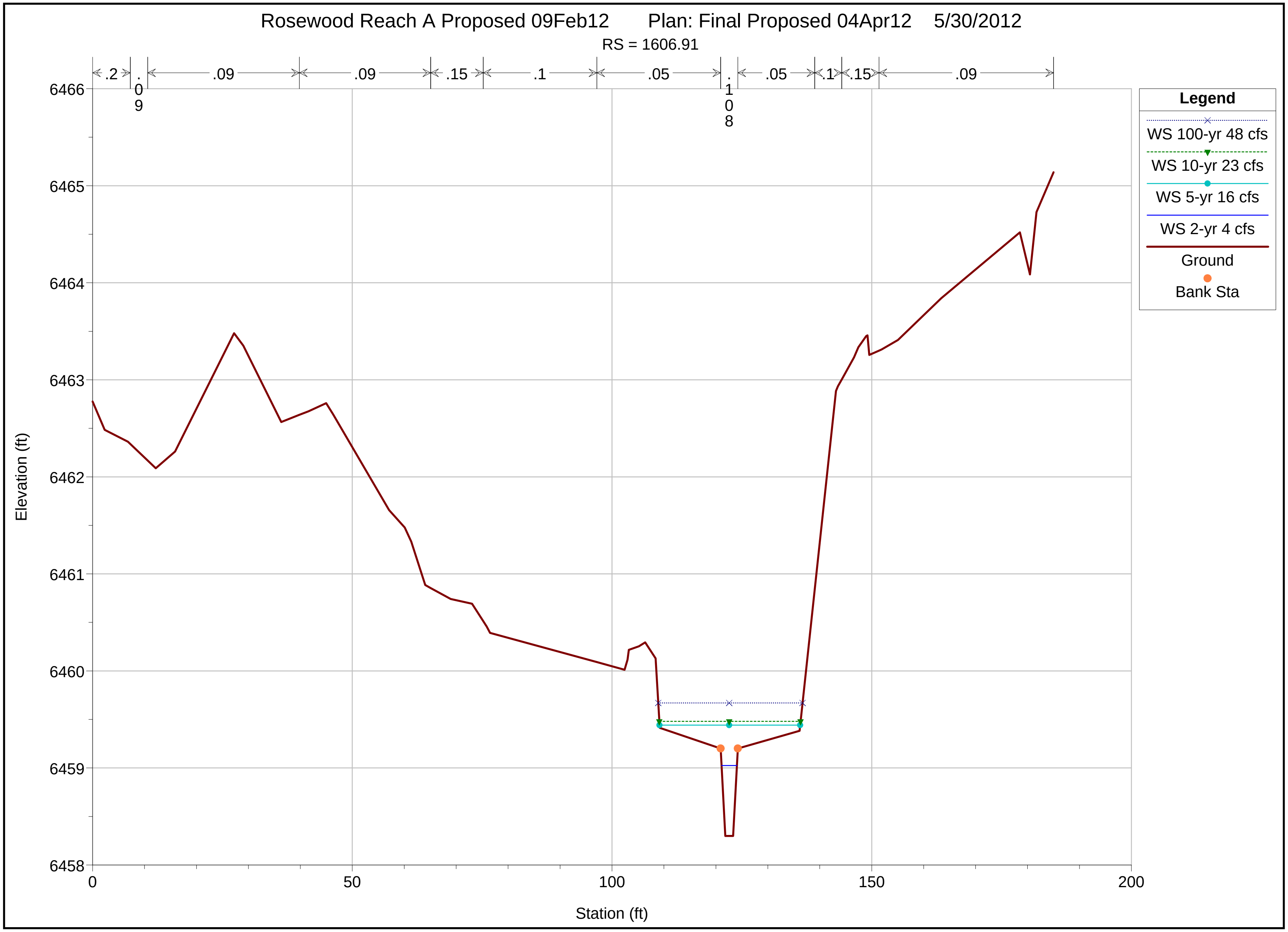

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1681.08
.2
.09
.09
.1
.05
.149
.05
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6470
6469
6468
6467
6466
6465
6464
6463
6462
Station (ft)
0
50
100
150
200

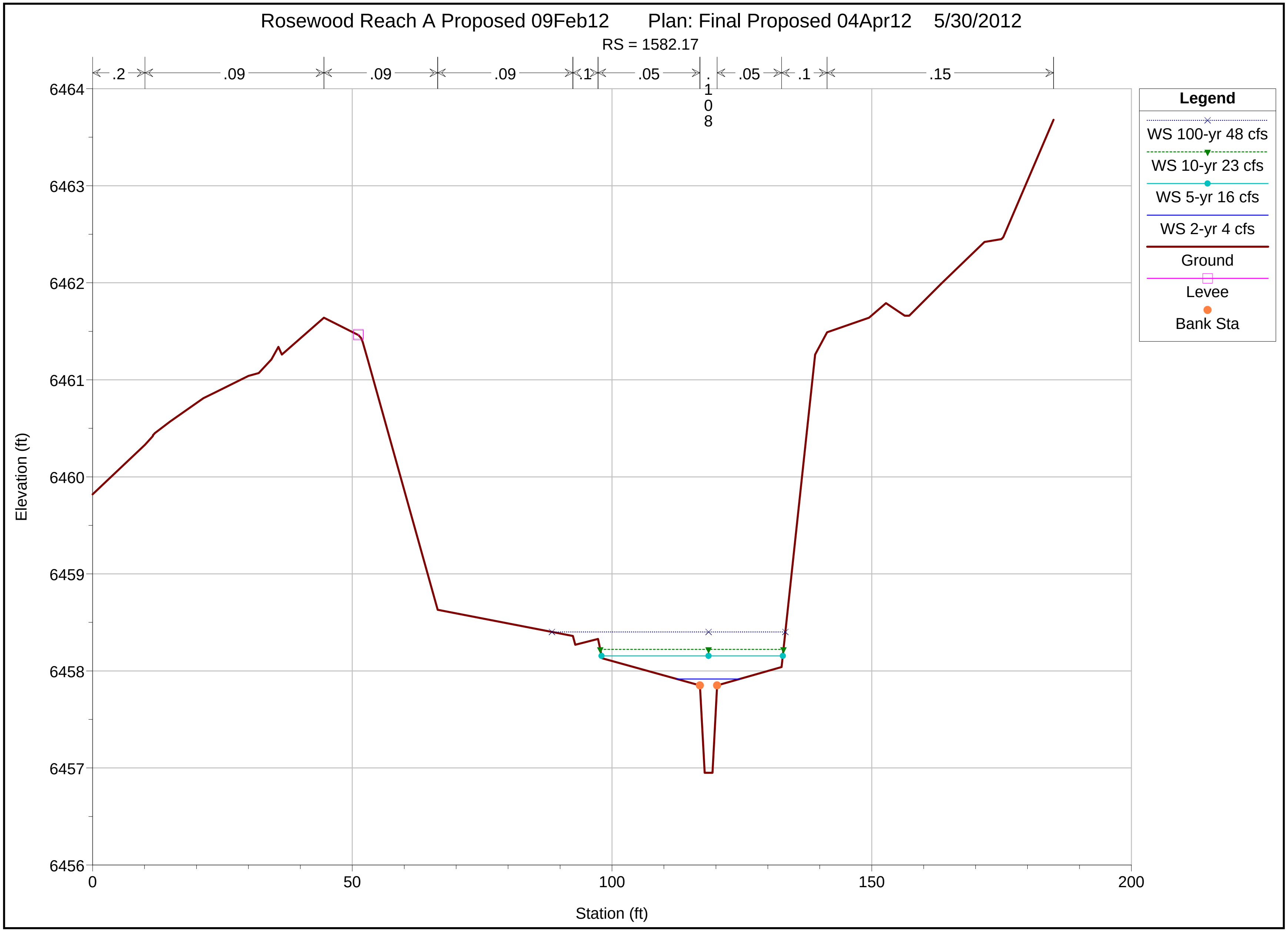


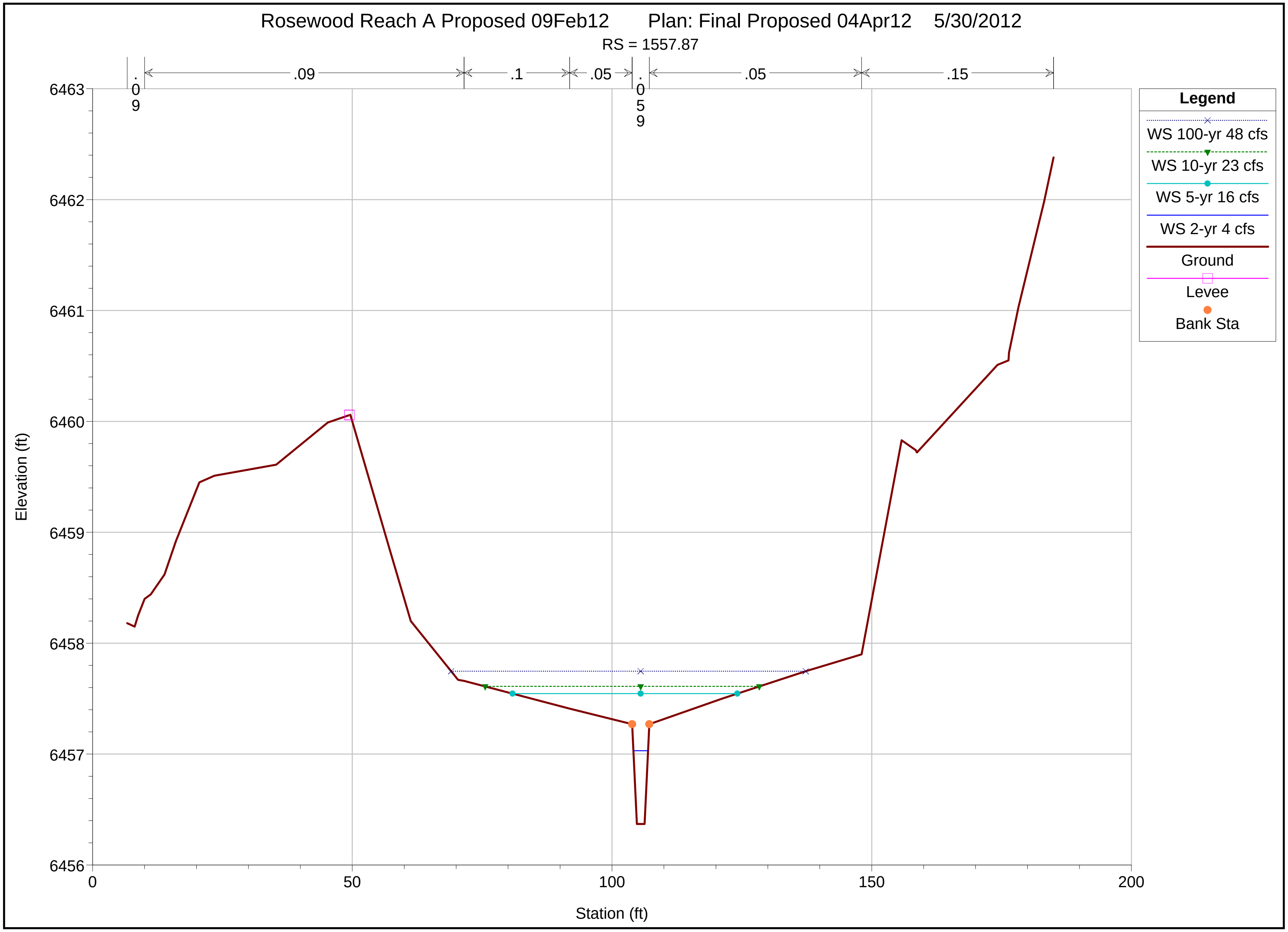
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

RS = 1656.21

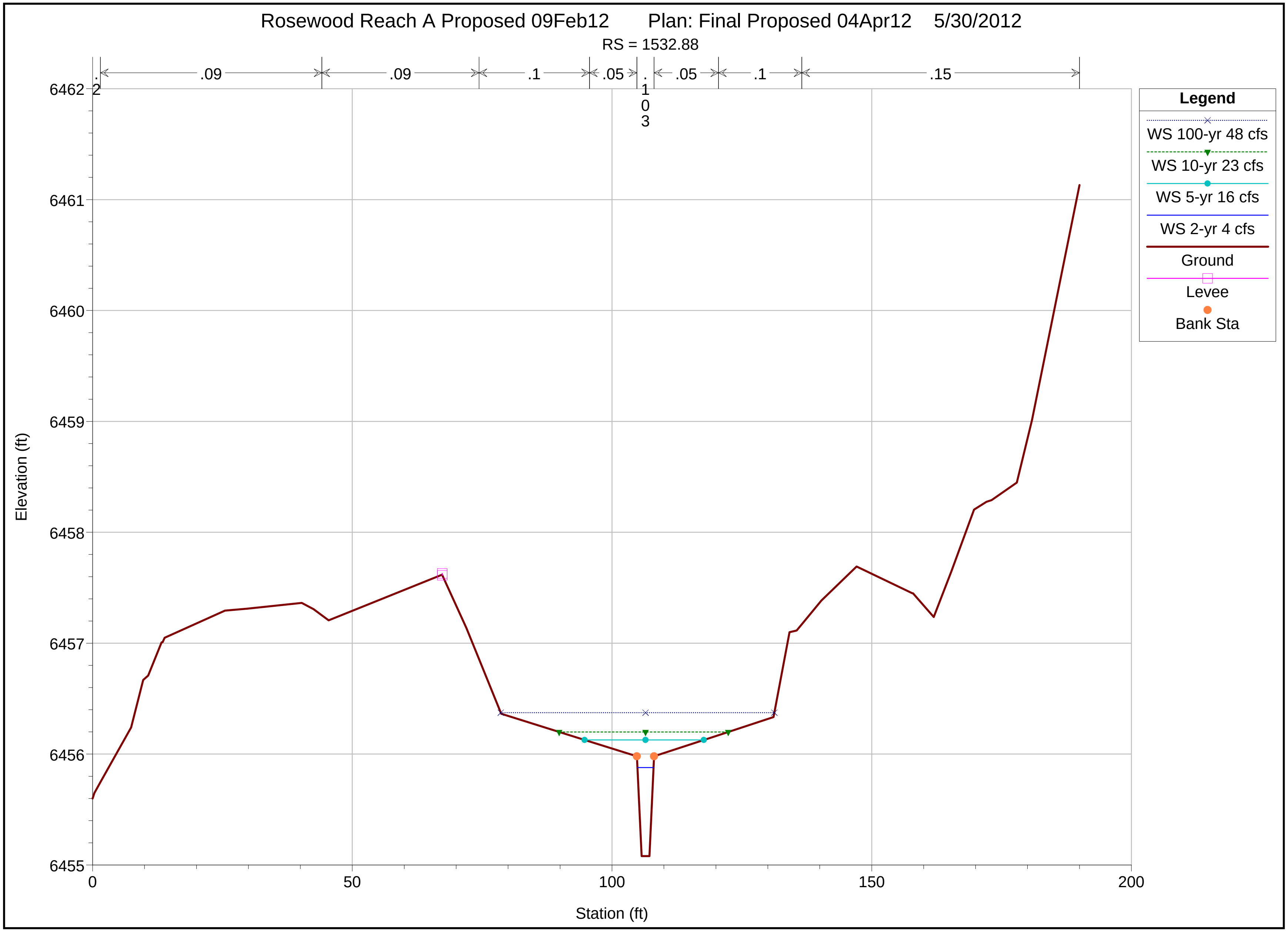

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1631.54
.2
.09
.09
.09
.15
.1
.05
.127
.05
.1
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6467
6466
6465
6464
6463
6462
6461
6460
6459
Station (ft)
0
50
100
150
200

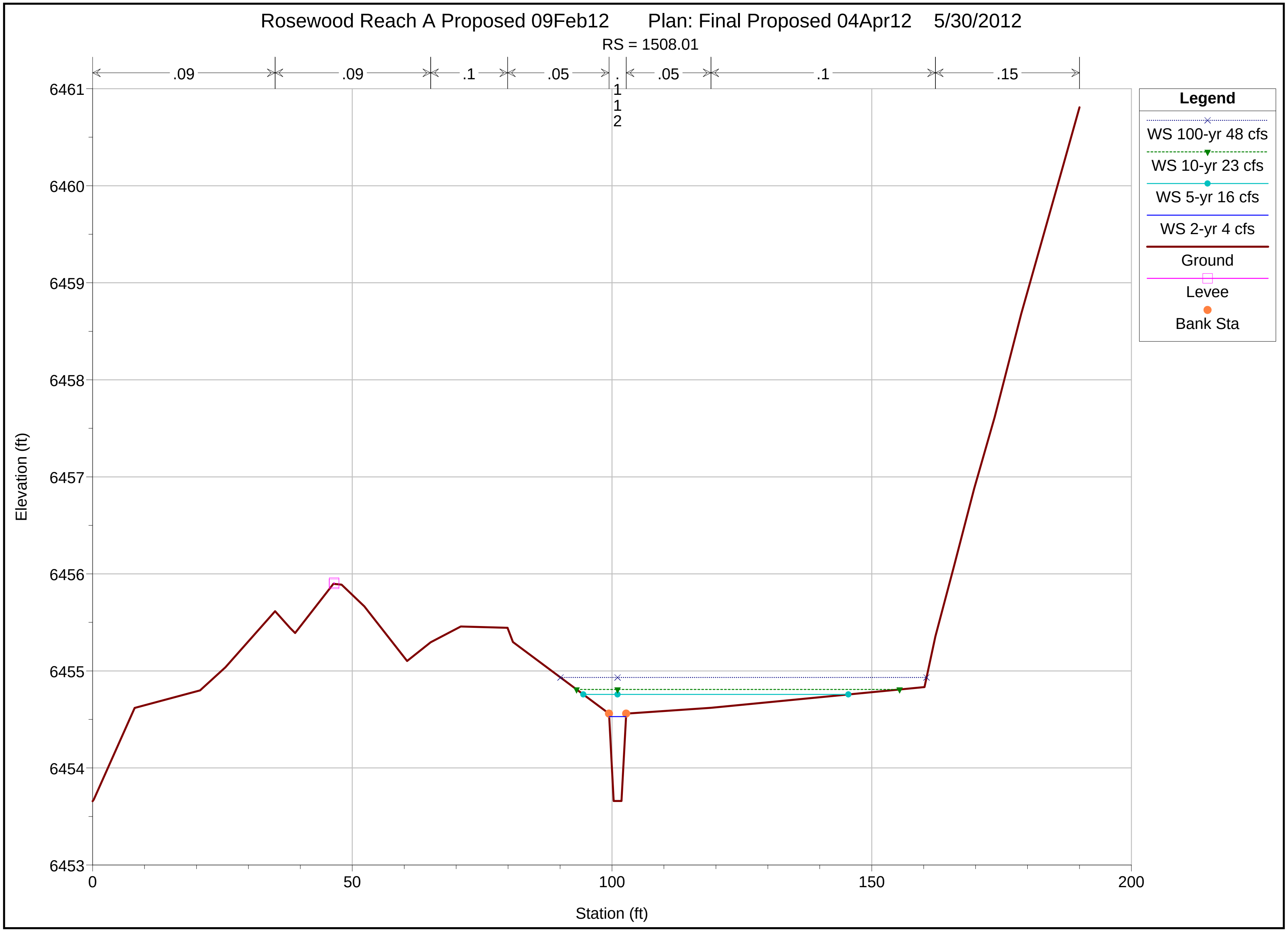

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1606.91
.2
.09
.09
.09
.15
.1
.05
.108
.05
.1
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6466
6465
6464
6463
6462
6461
6460
6459
6458
0
50
100
150
200
Station (ft)

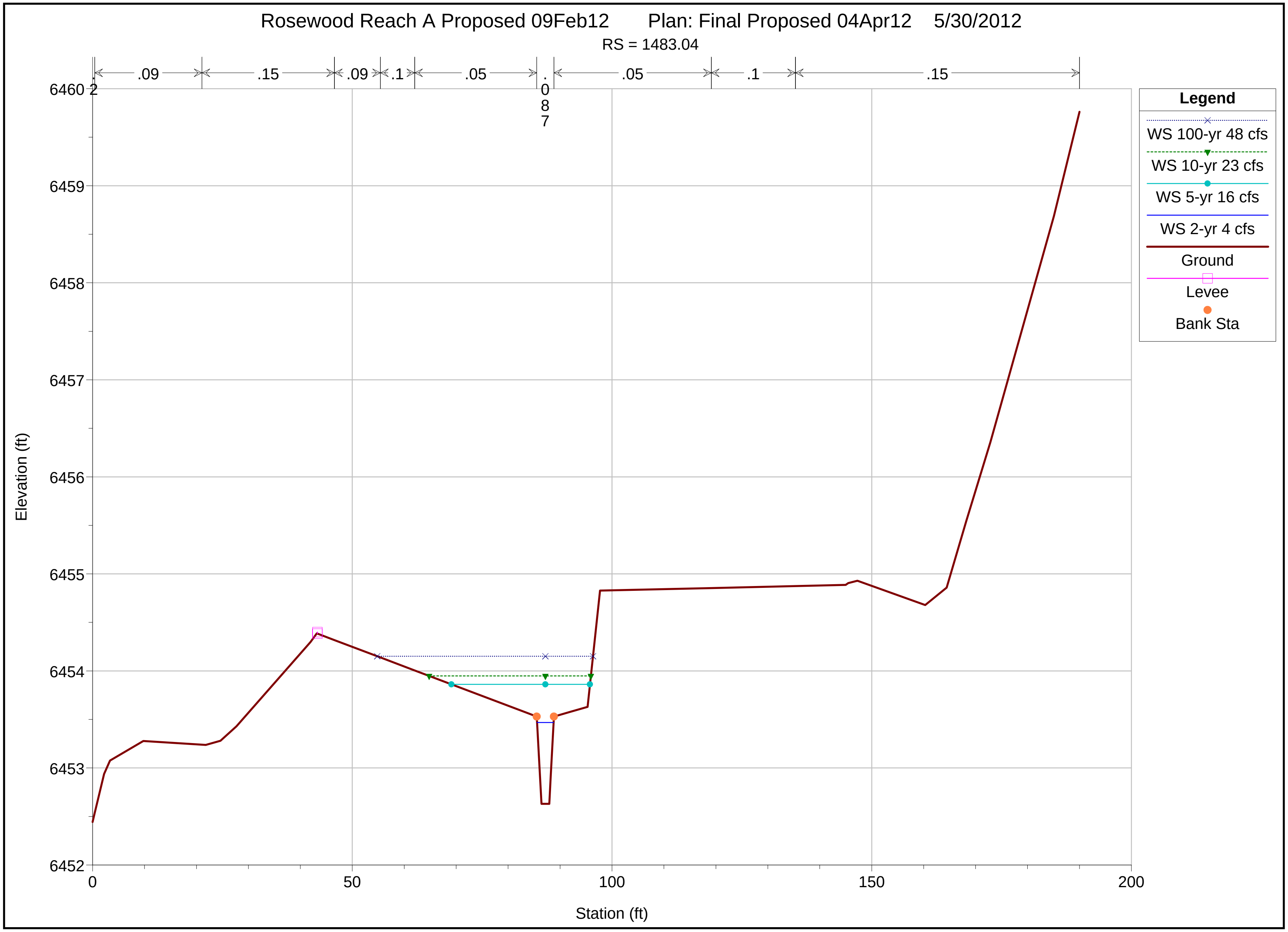

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1582.17
.2
.09
.09
.09
.1
.05
.108
.05
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6464
6463
6462
6461
6460
6459
6458
6457
6456
Station (ft)
0
50
100
150
200



Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1557.87
.09
.09
.1
.05
.059
.05
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6463
6462
6461
6460
6459
6458
6457
6456
Station (ft)
0
50
100
150
200

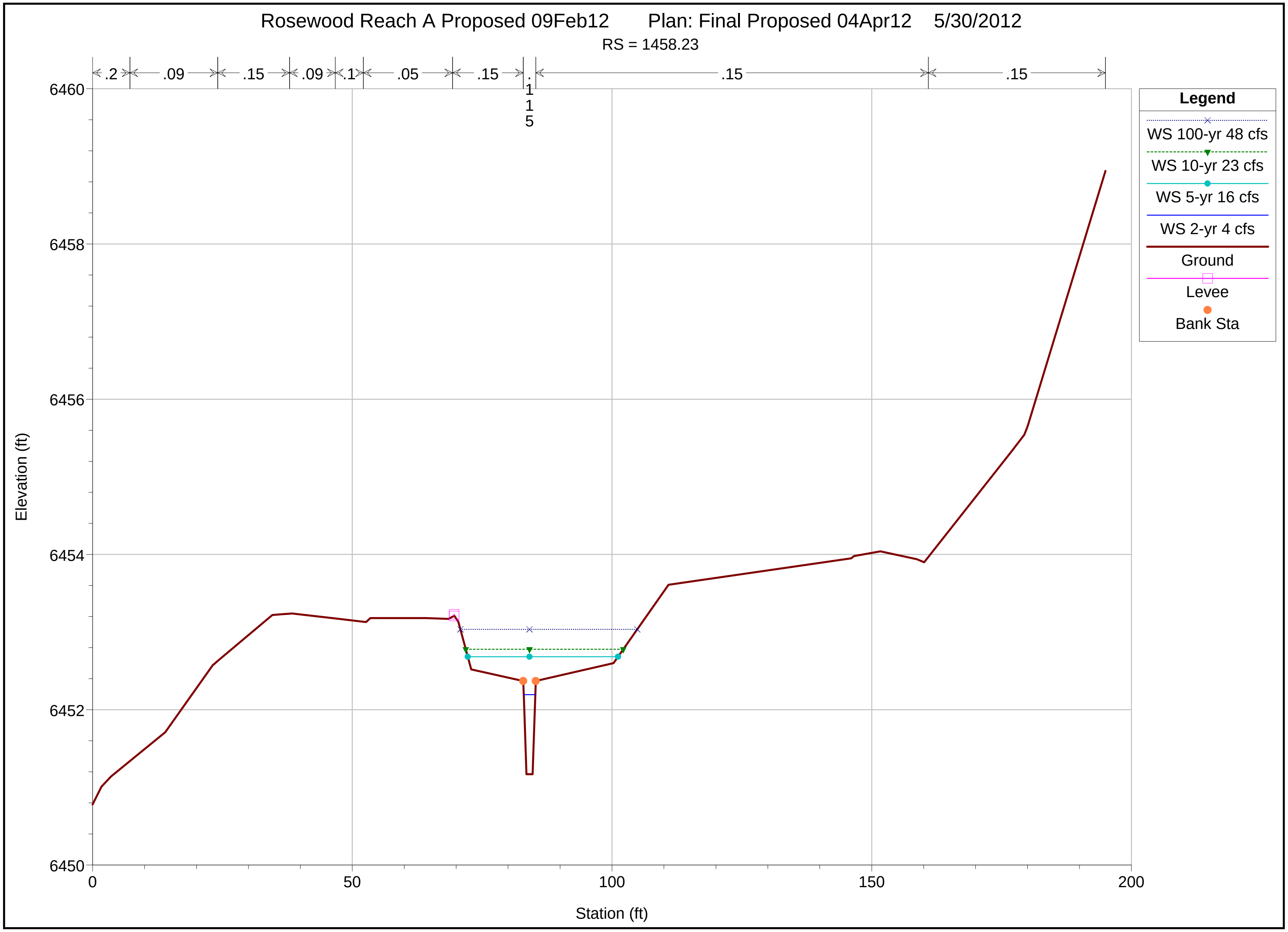

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1532.88
.2
.09
.09
.1
.05
.103
.05
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6462
6461
6460
6459
6458
6457
6456
6455
Station (ft)
0
50
100
150
200

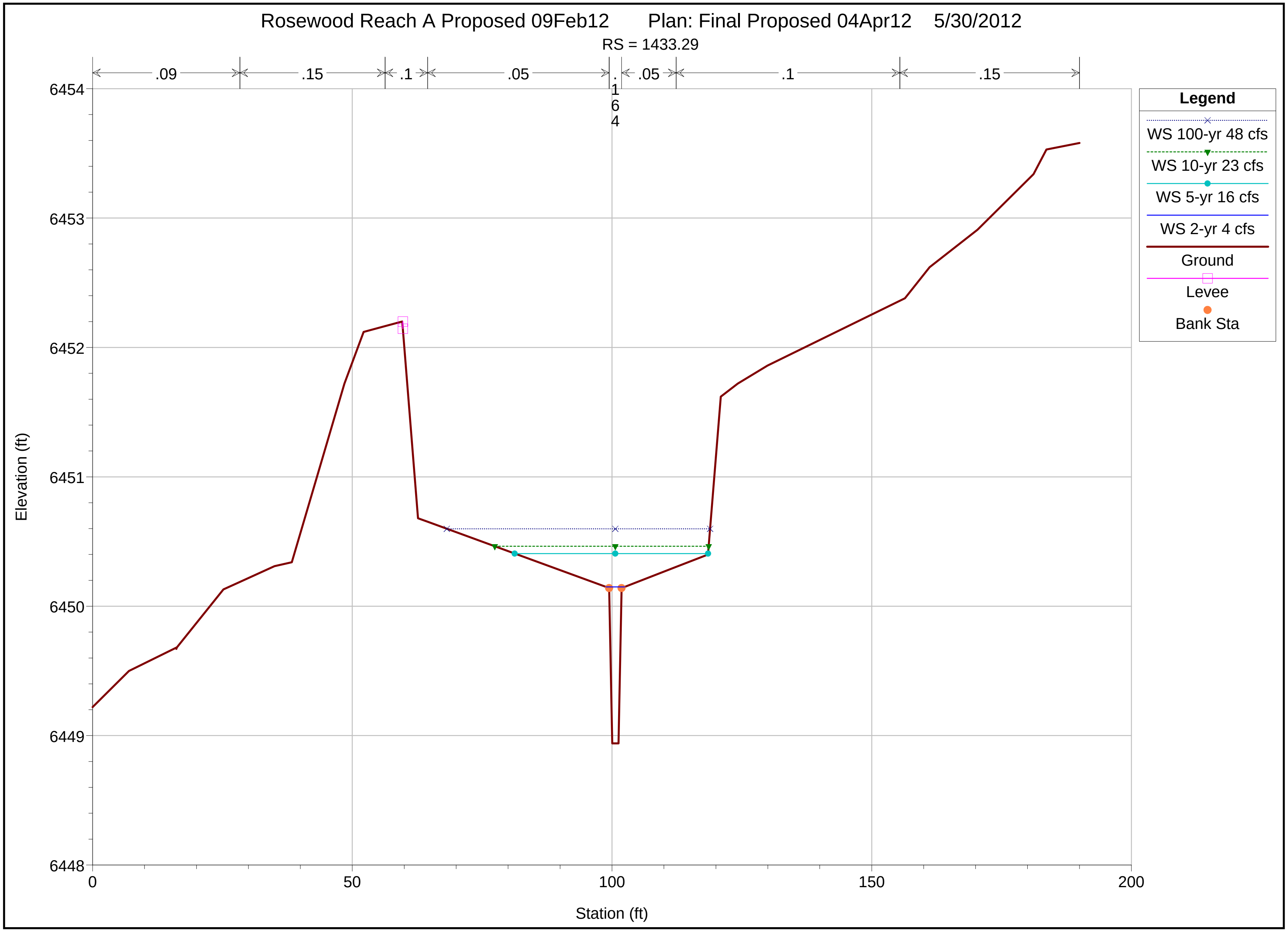

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1508.01
.09
.09
.1
.05
.112
.05
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6461
6460
6459
6458
6457
6456
6455
6454
6453
Station (ft)
0
50
100
150
200

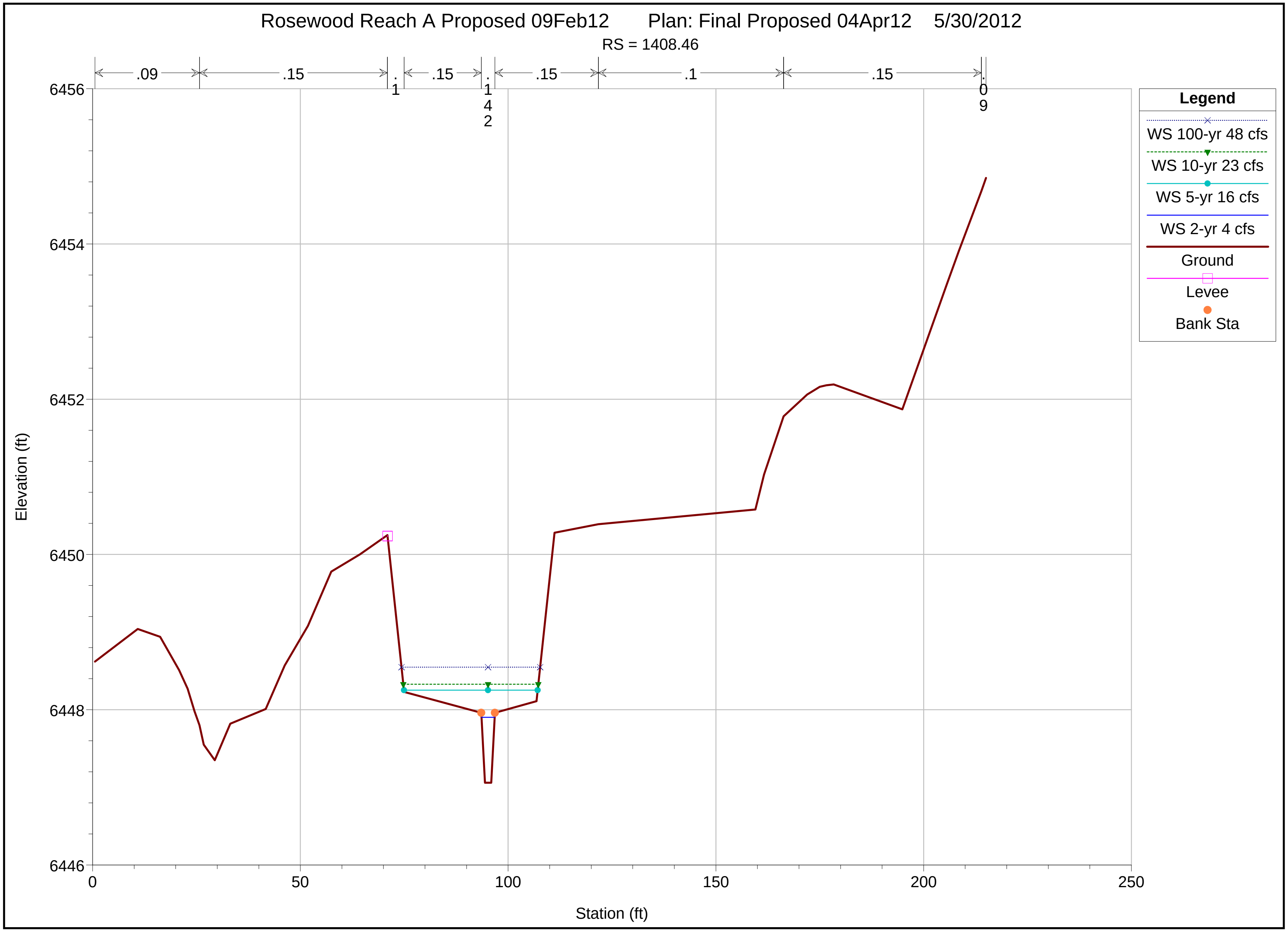


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

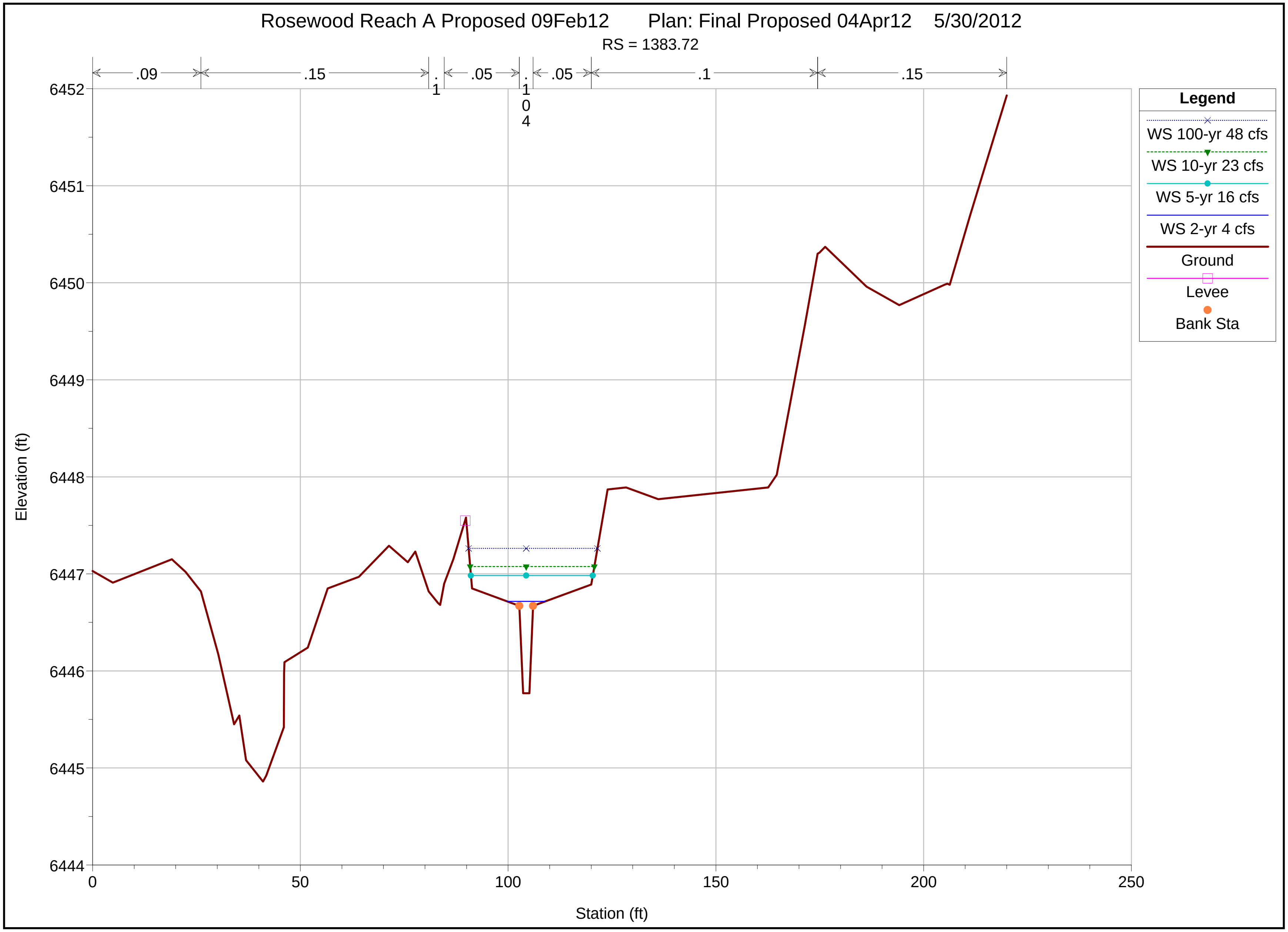
RS = 1483.04


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1458.23
.2
.09
.15
.09
.1
.05
.15
.115
.15
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6460
6458
6456
6454
6452
6450
Station (ft)
0
50
100
150
200


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1433.29
.09
.15
.1
.05
.164
.05
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6454
6453
6452
6451
6450
6449
6448
0
50
100
150
200
Station (ft)

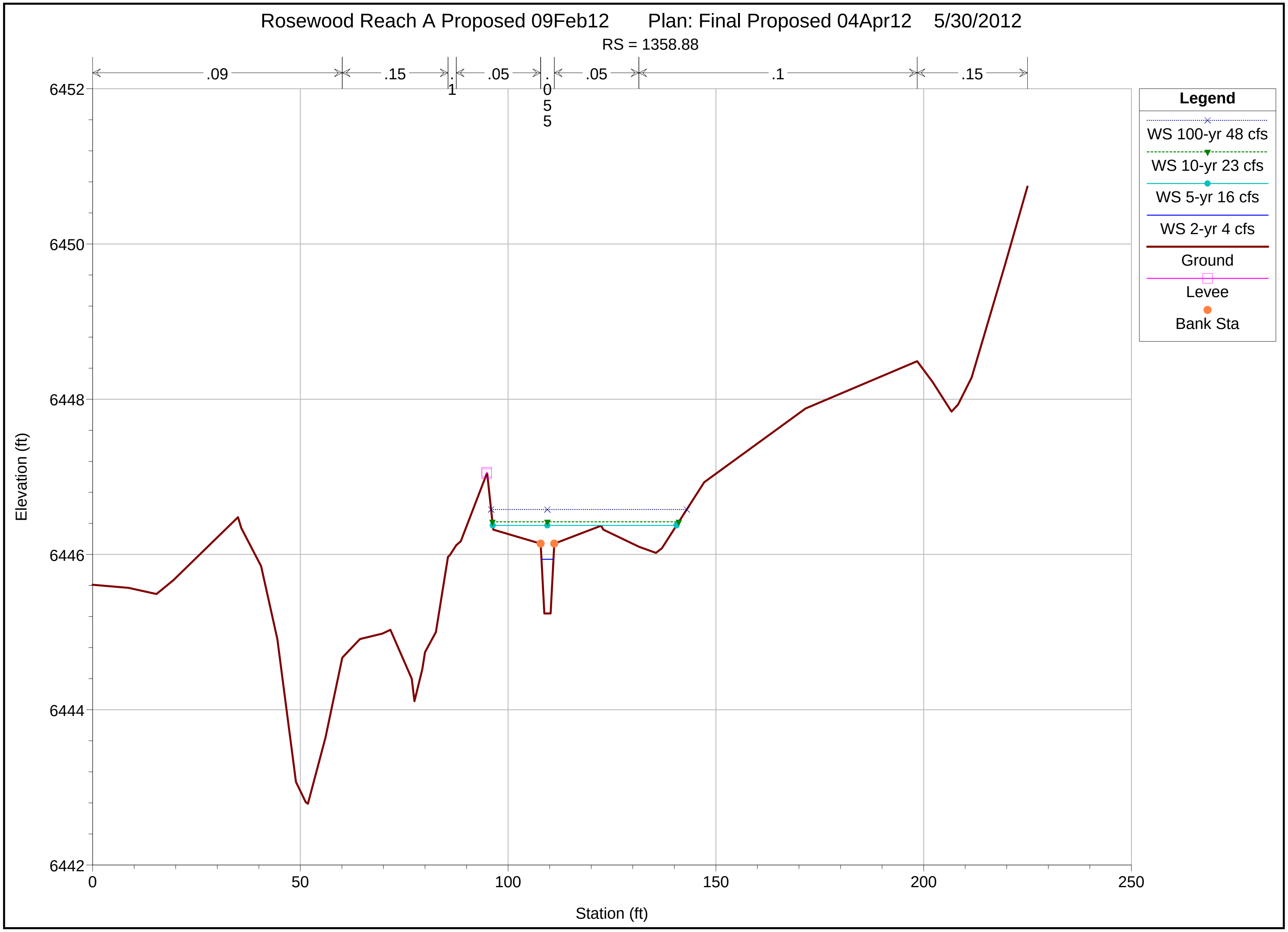

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

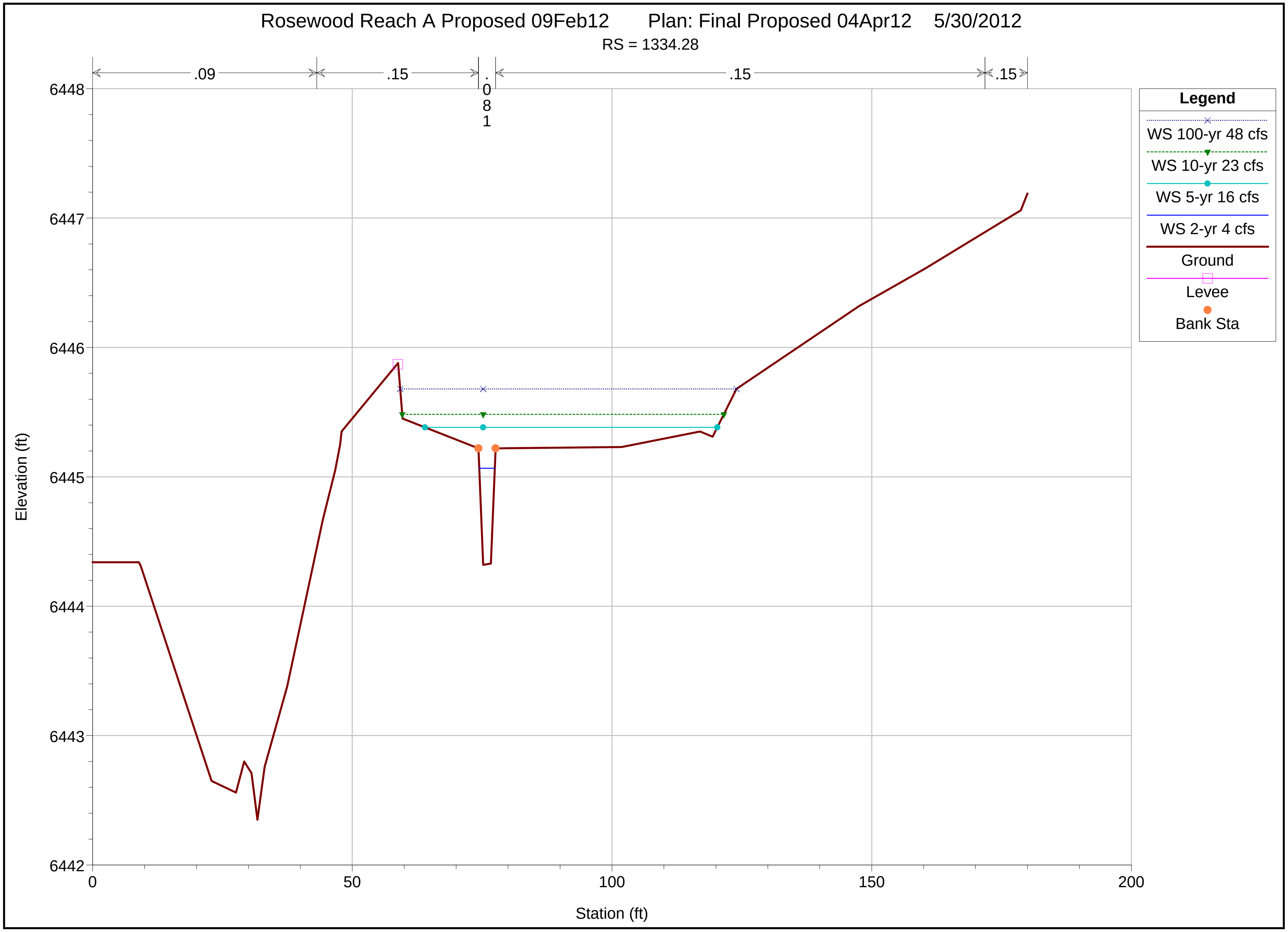
RS = 1408.46

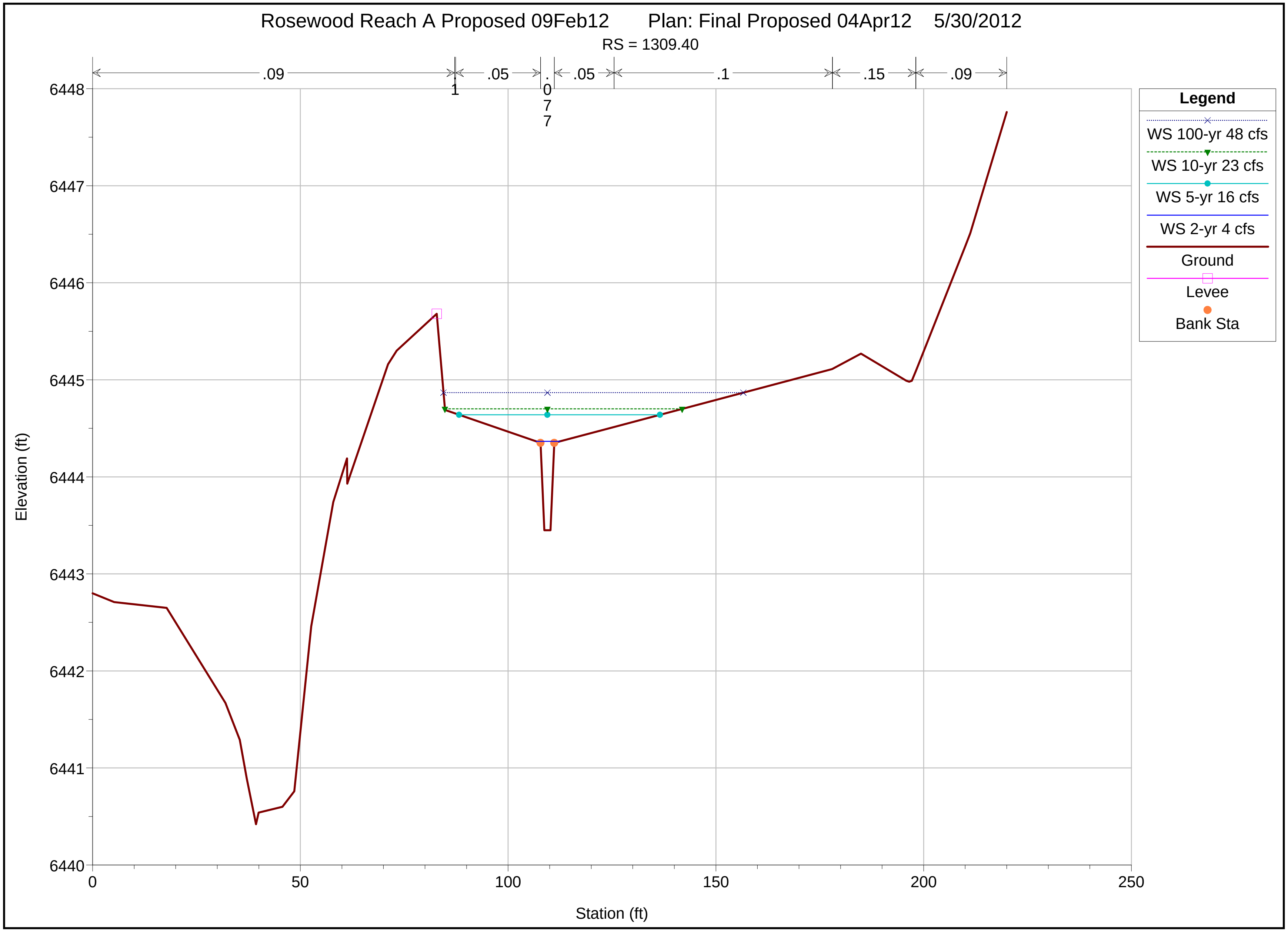


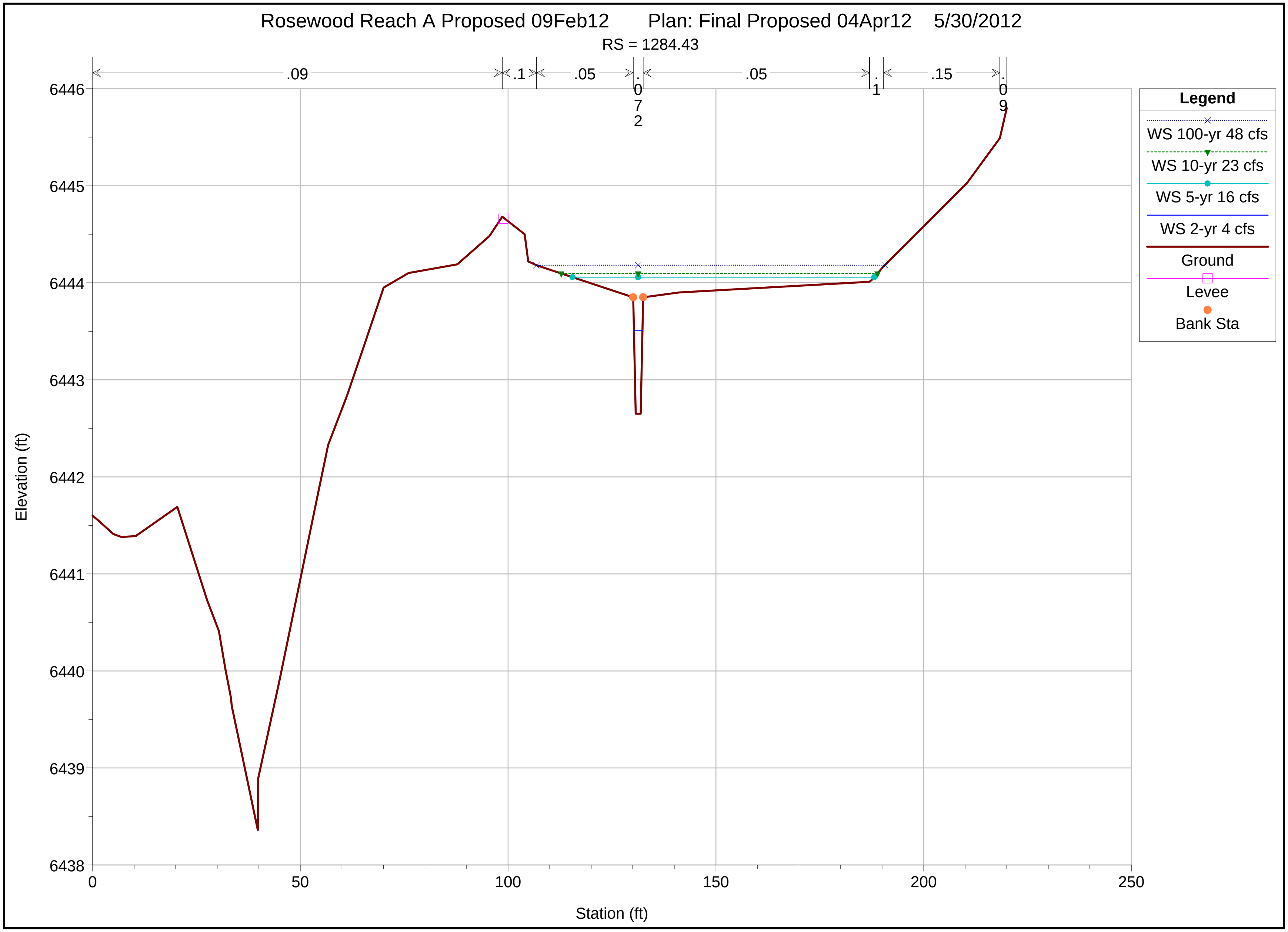
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

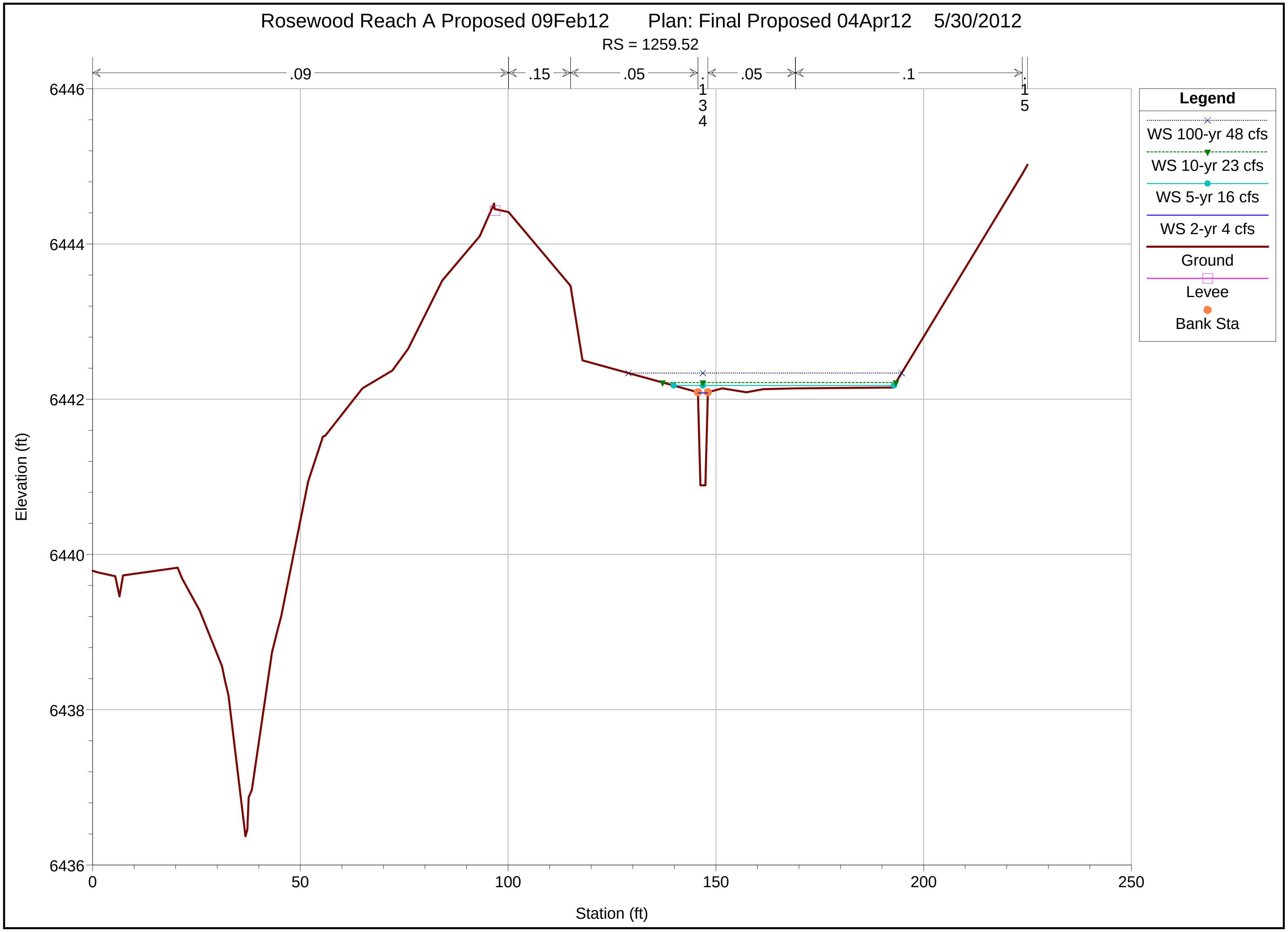
RS = 1383.72

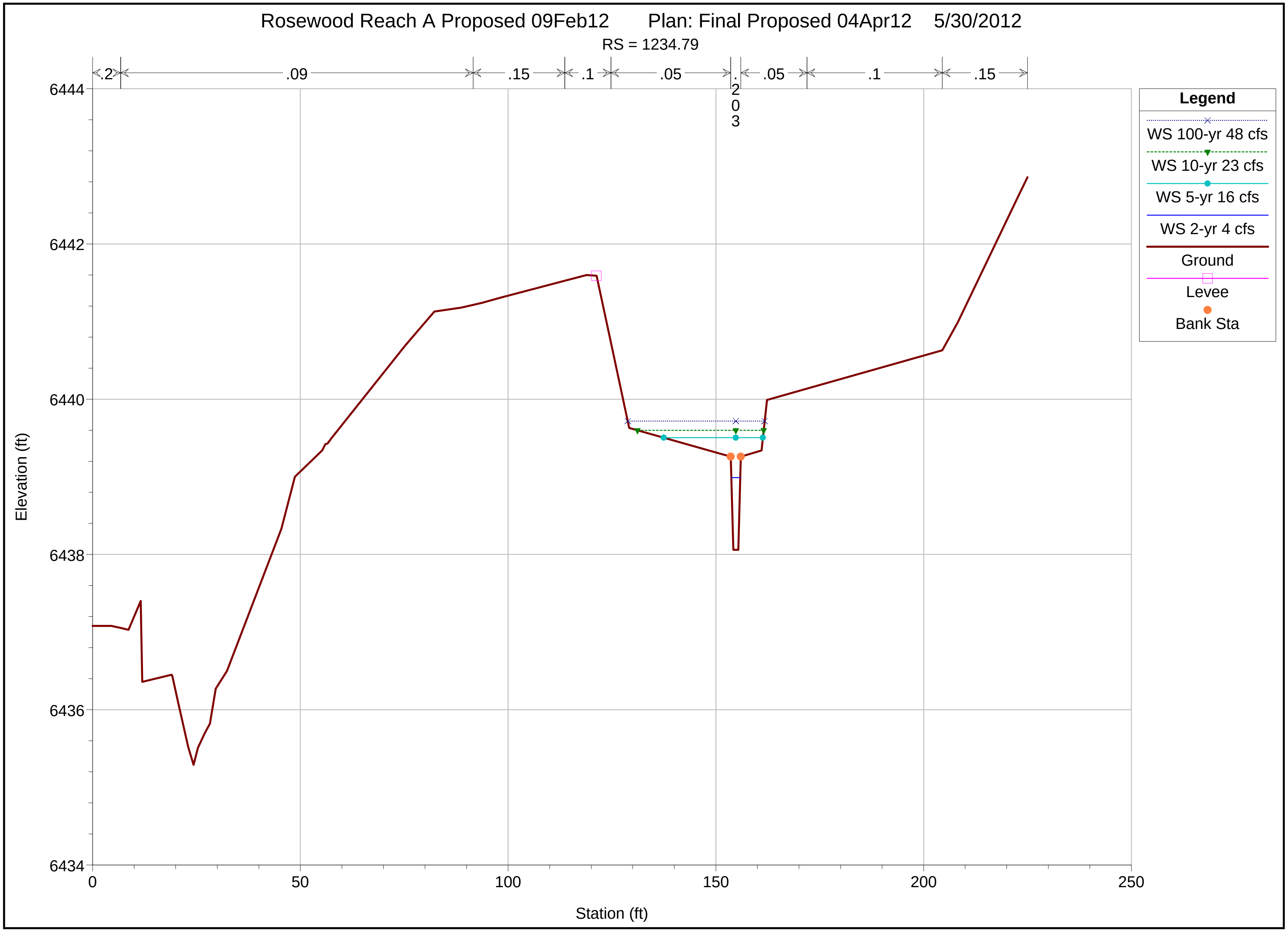

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1358.88
.09
.15
.1
.05
.055
.05
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6452
6450
6448
6446
6444
6442
Station (ft)
0
50
100
150
200
250

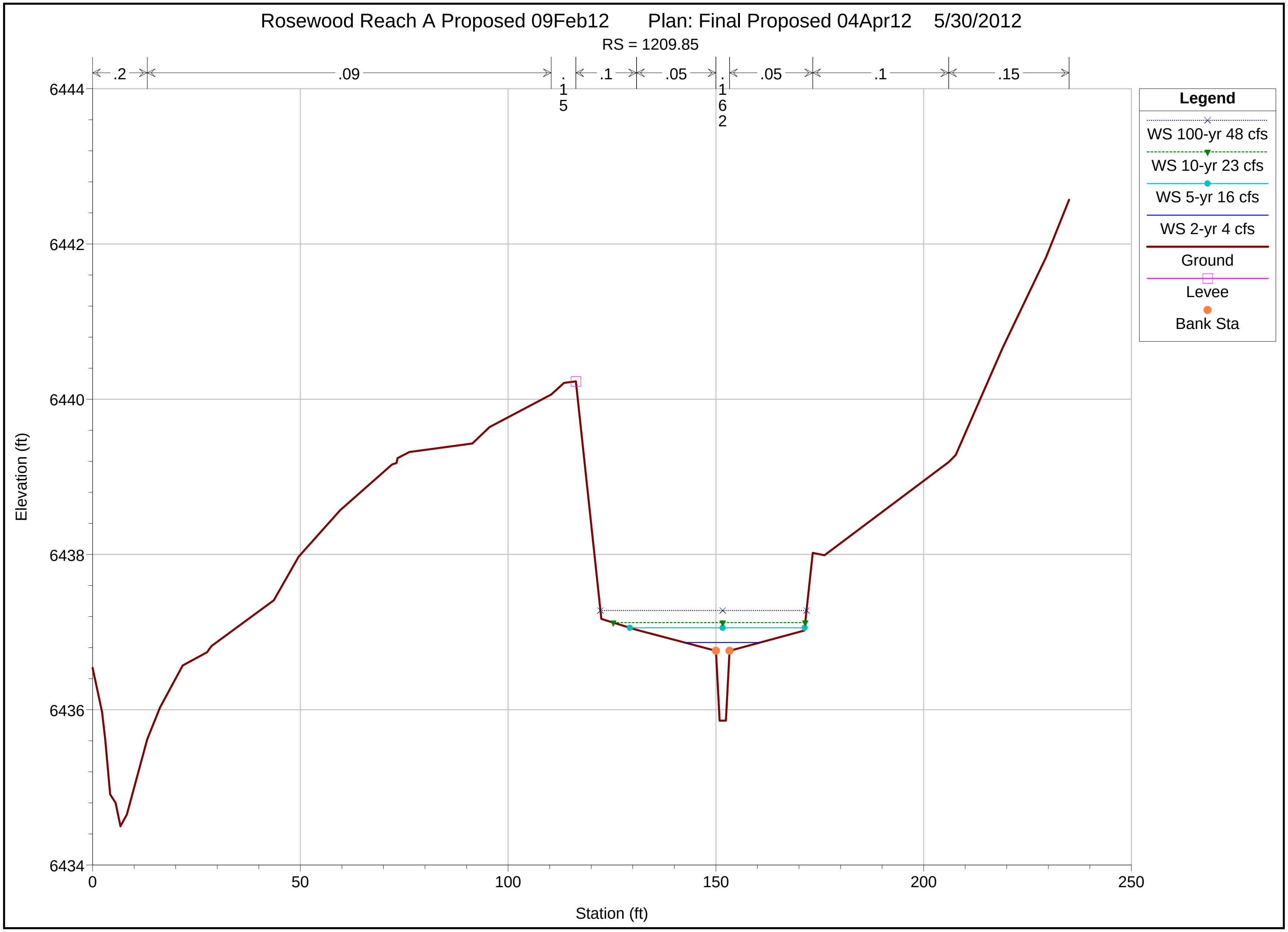

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1334.28
.09
.15
.081
.15
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6448
6447
6446
6445
6444
6443
6442
0
50
100
150
200
Station (ft)

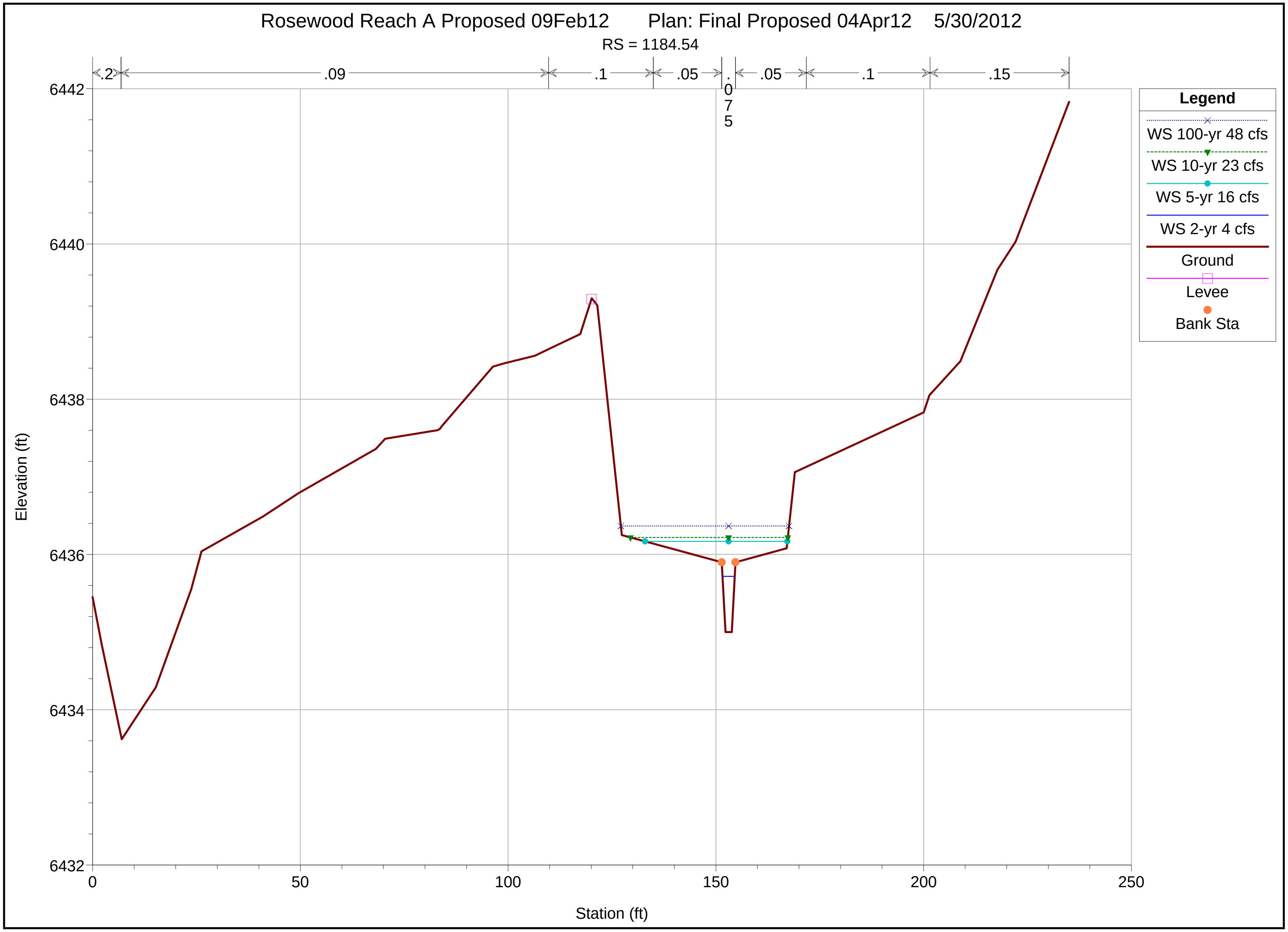

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1309.40
.09
.05
.
.05
.1
.15
.09
1
0
7
7
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6448
6447
6446
6445
6444
6443
6442
6441
6440
0
50
100
150
200
250
Station (ft)


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1284.43
.09
.1
.05
.072
.05
.1
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6446
6445
6444
6443
6442
6441
6440
6439
6438
Station (ft)
0
50
100
150
200
250


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1259.52
.09
.15
.05
.05
.1
.134
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6446
6444
6442
6440
6438
6436
Station (ft)
0
50
100
150
200
250

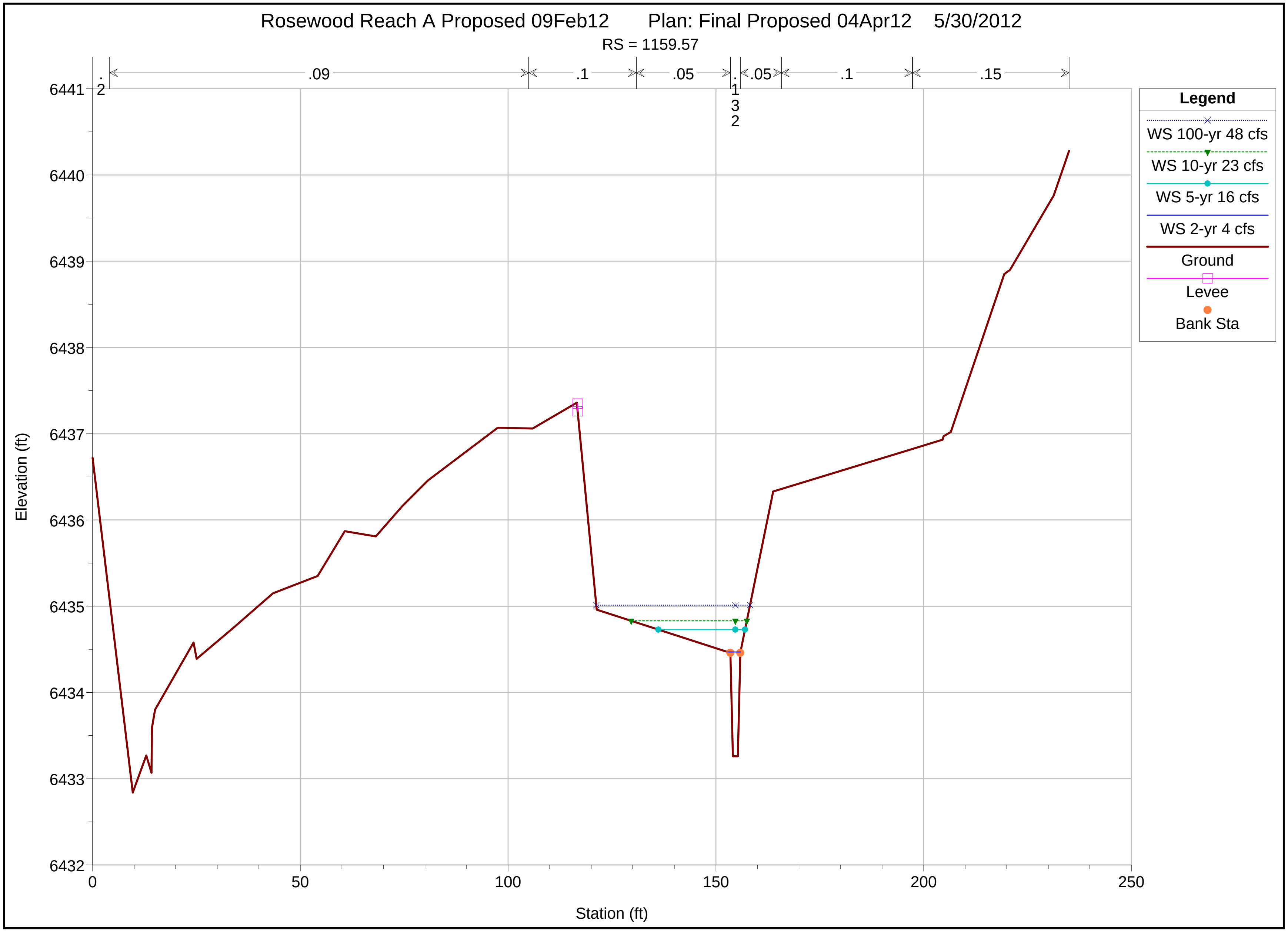

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1234.79
.2
.09
.15
.1
.05
.2
0
3
.05
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6444
6442
6440
6438
6436
6434
Station (ft)
0
50
100
150
200
250

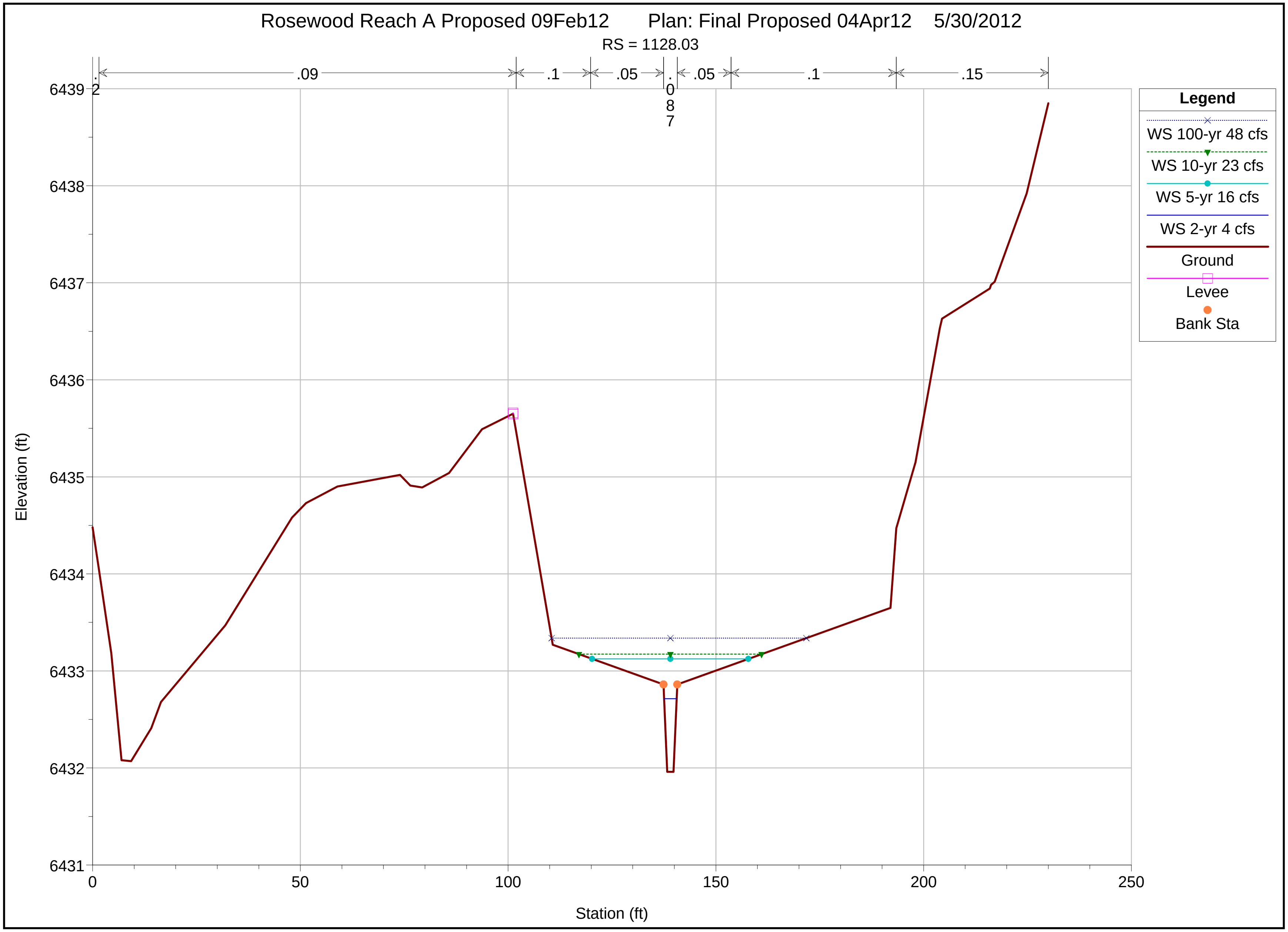

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1209.85
.2
.09
.15
.1
.05
.162
.05
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6444
6442
6440
6438
6436
6434
Station (ft)
0
50
100
150
200
250



Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

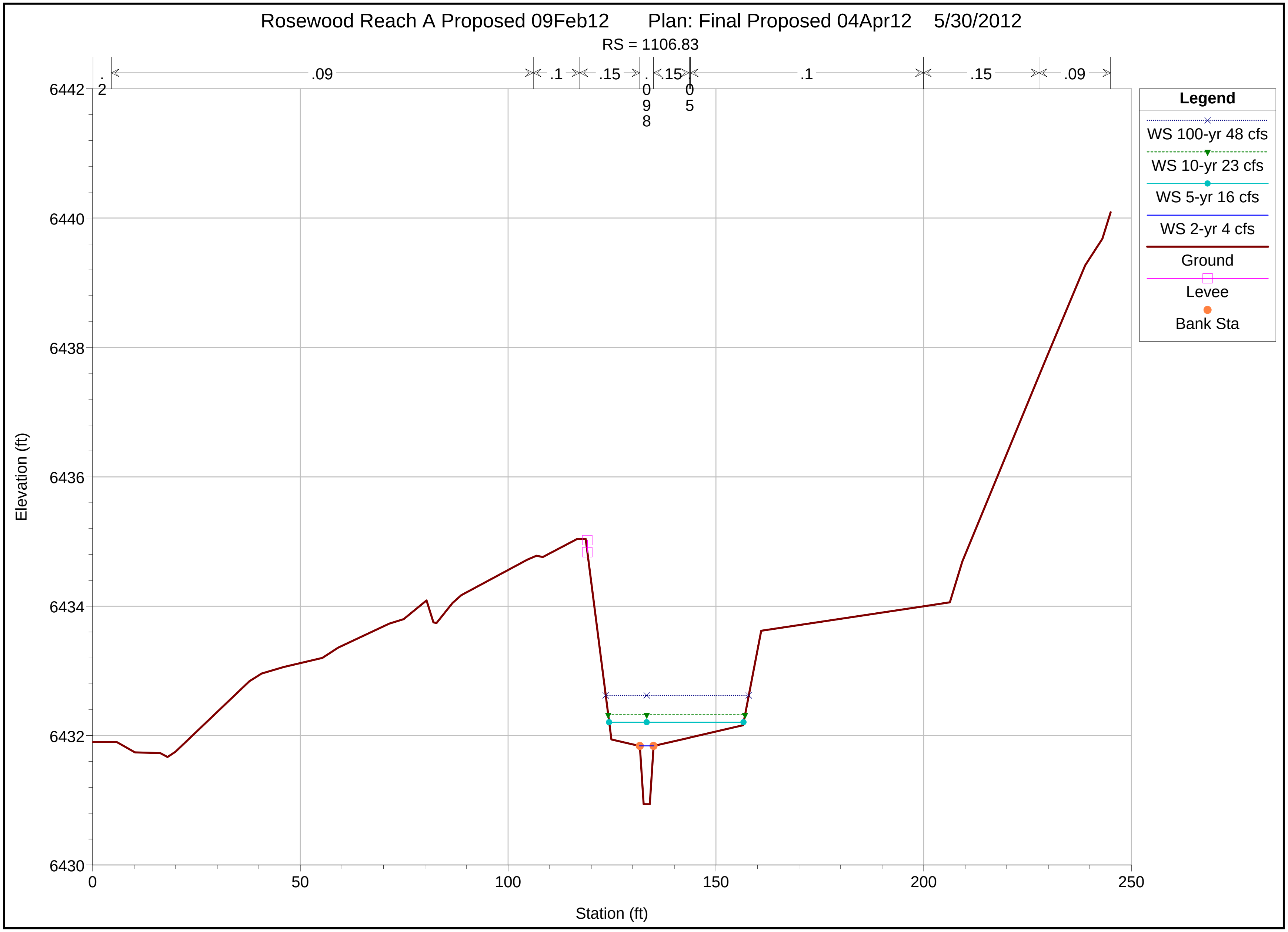
RS = 1184.54


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1159.57
.2
.09
.1
.05
.132
.05
.1
.15
Elevation (ft)
6441
6440
6439
6438
6437
6436
6435
6434
6433
6432
0
50
100
150
200
250
Station (ft)
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta



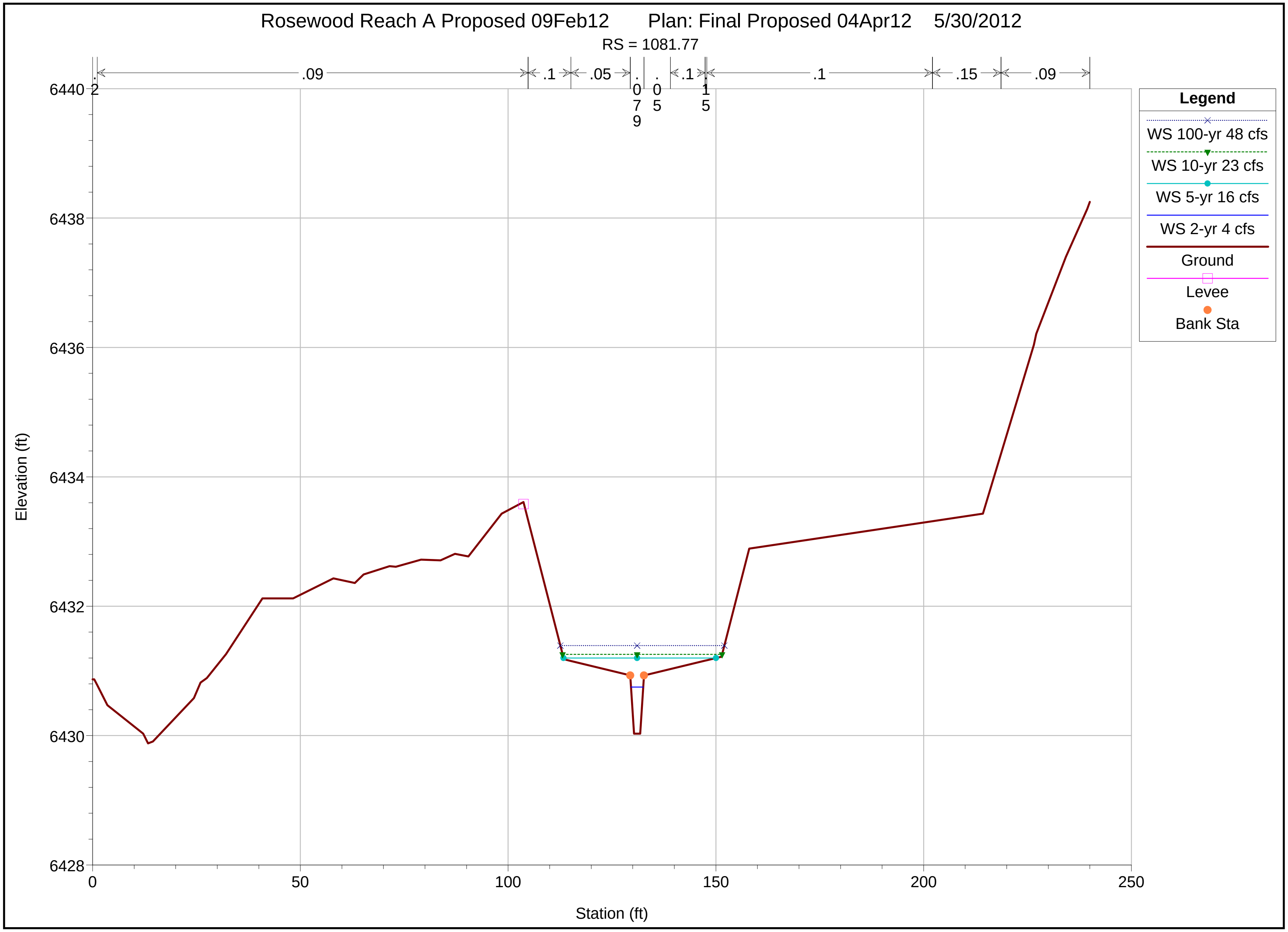
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

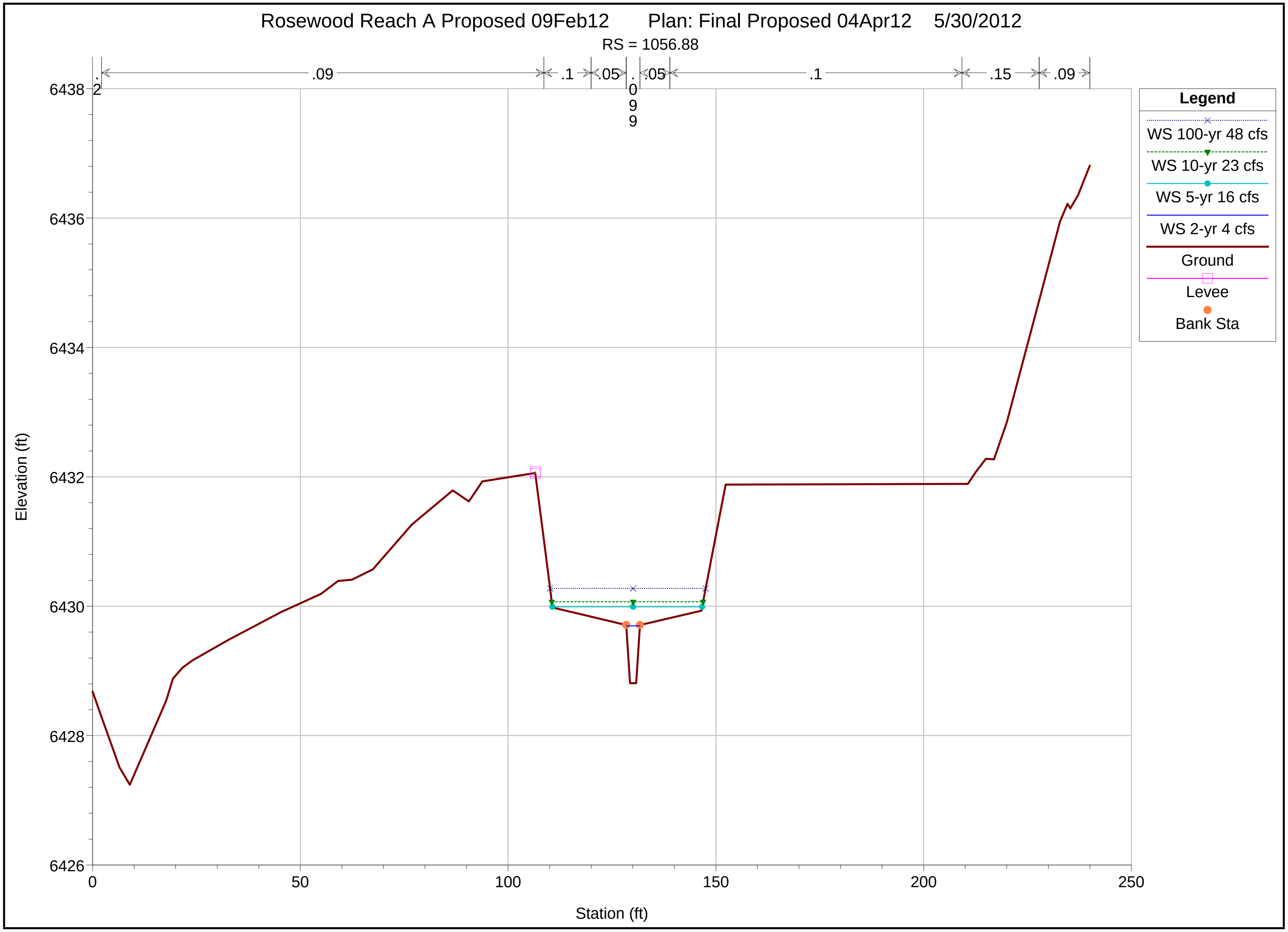
RS = 1128.03

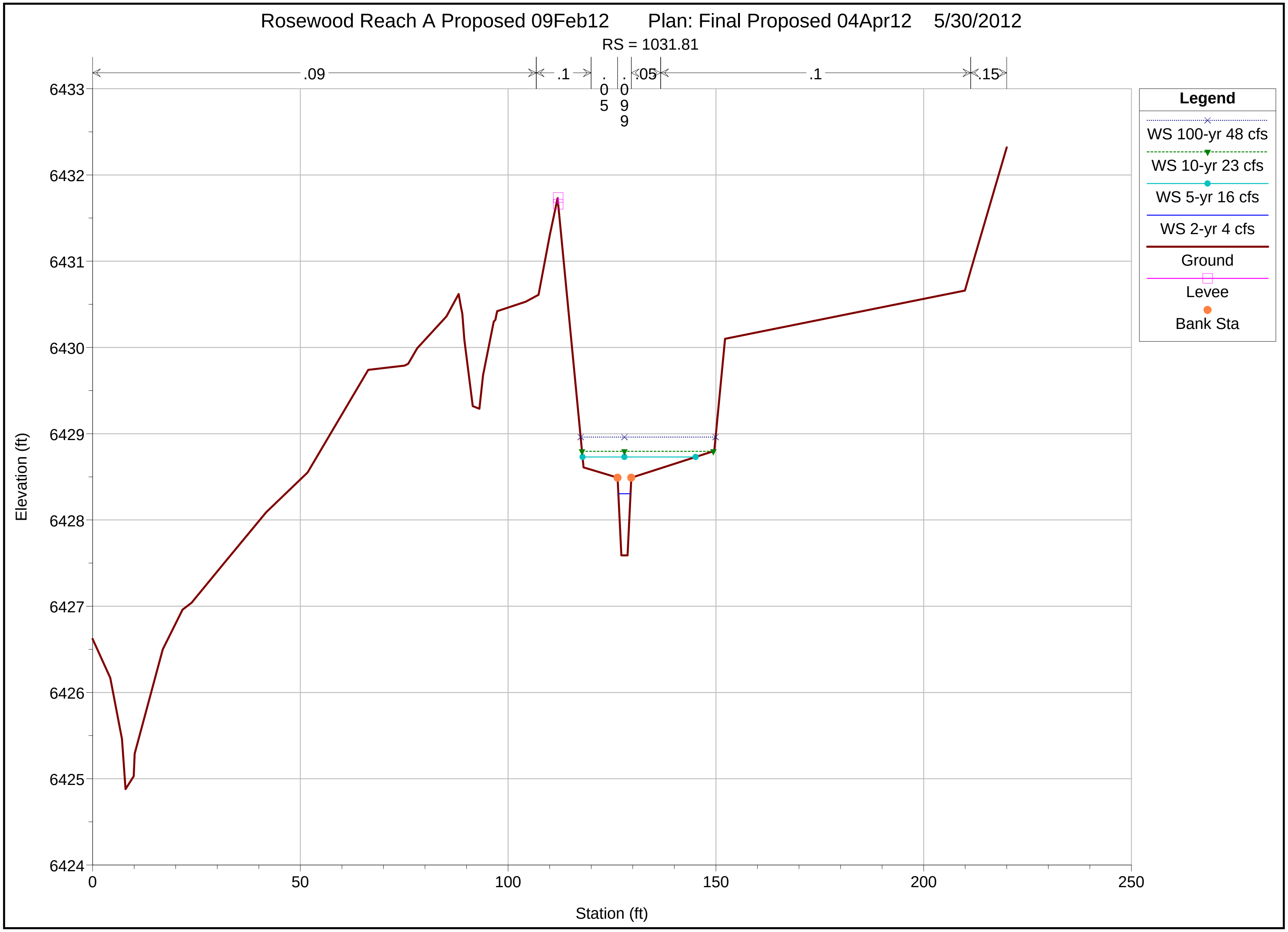


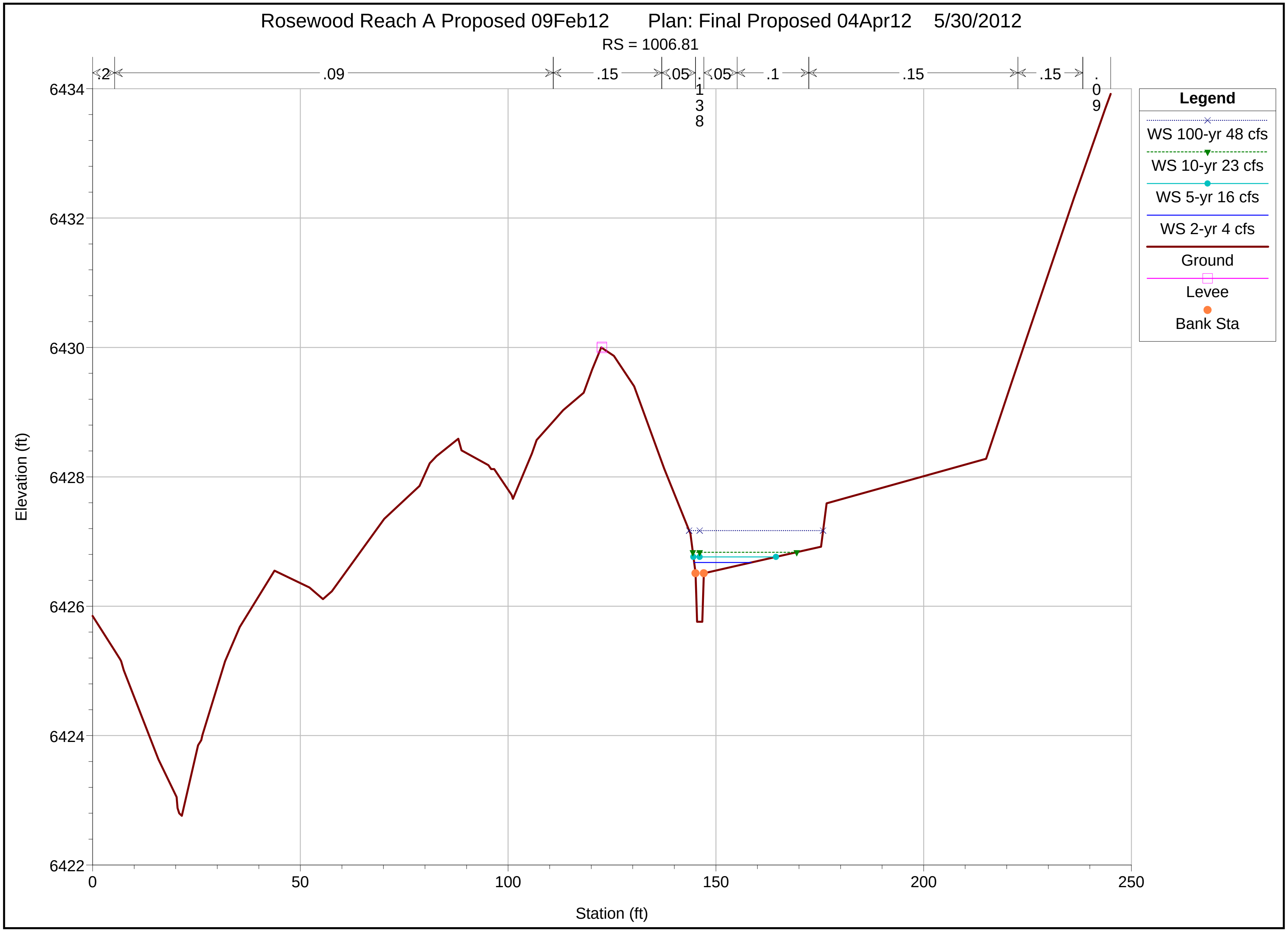
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

RS = 1106.83

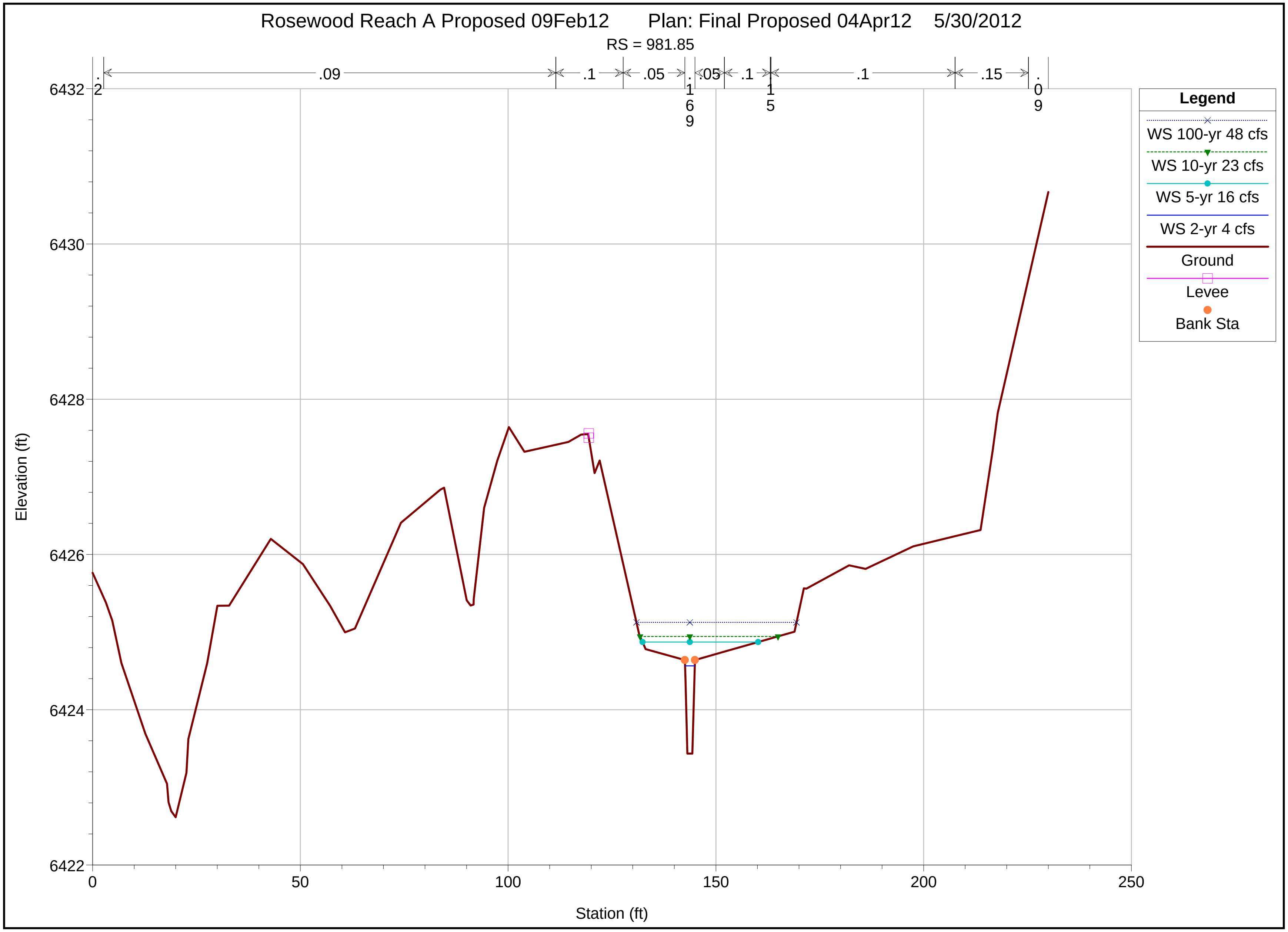

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1081.77
.2
.09
.1
.05
.079
.05
.1
.15
.1
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6440
6438
6436
6434
6432
6430
6428
Station (ft)
0
50
100
150
200
250


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1056.88
.2
.09
.1
.05
.099
.05
.1
.15
.09
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6438
6436
6434
6432
6430
6428
6426
0
50
100
150
200
250
Station (ft)


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 1031.81
.09
.1
.05
.099
.05
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6433
6432
6431
6430
6429
6428
6427
6426
6425
6424
Station (ft)
0
50
100
150
200
250

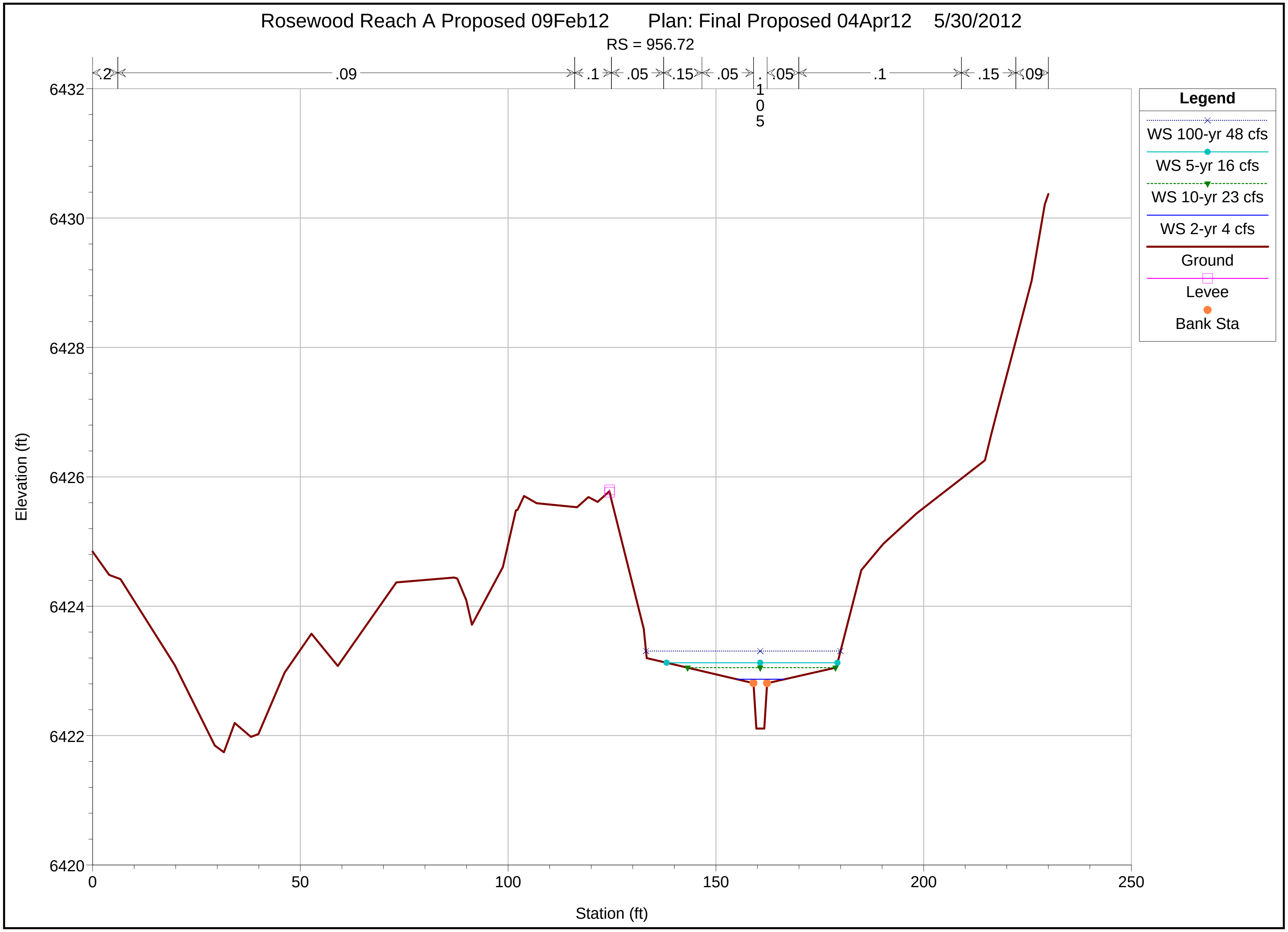

Rosewood Reach A Proposed 09Feb12   Plan: Final Proposed 04Apr12   5/30/2012

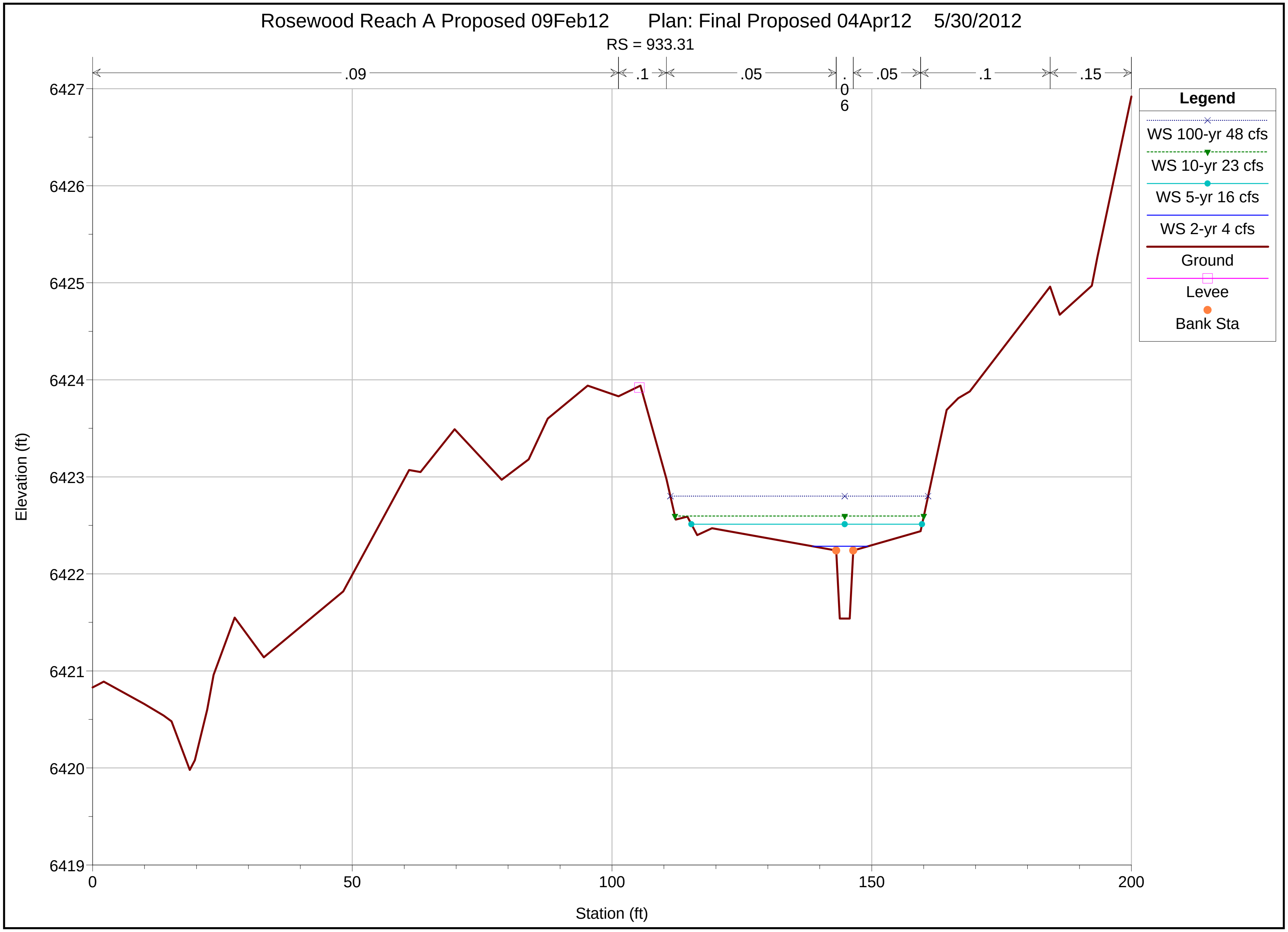
RS = 1006.81



Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

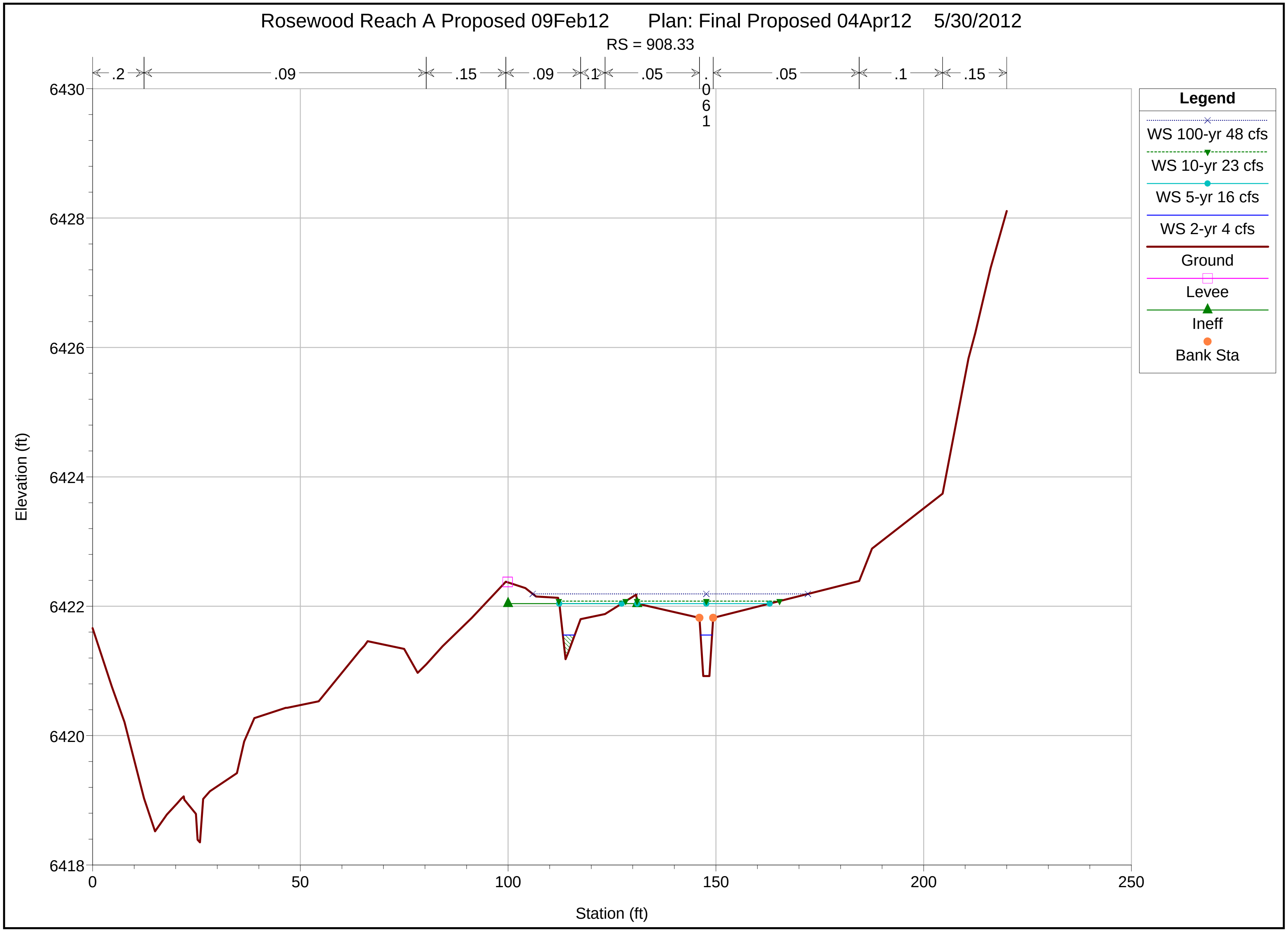
RS = 981.85


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 956.72
.2
.09
.1
.05
.15
.05
.105
.05
.1
.15
.09
Legend
WS 100-yr 48 cfs
WS 5-yr 16 cfs
WS 10-yr 23 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6432
6430
6428
6426
6424
6422
6420
Station (ft)
0
50
100
150
200
250



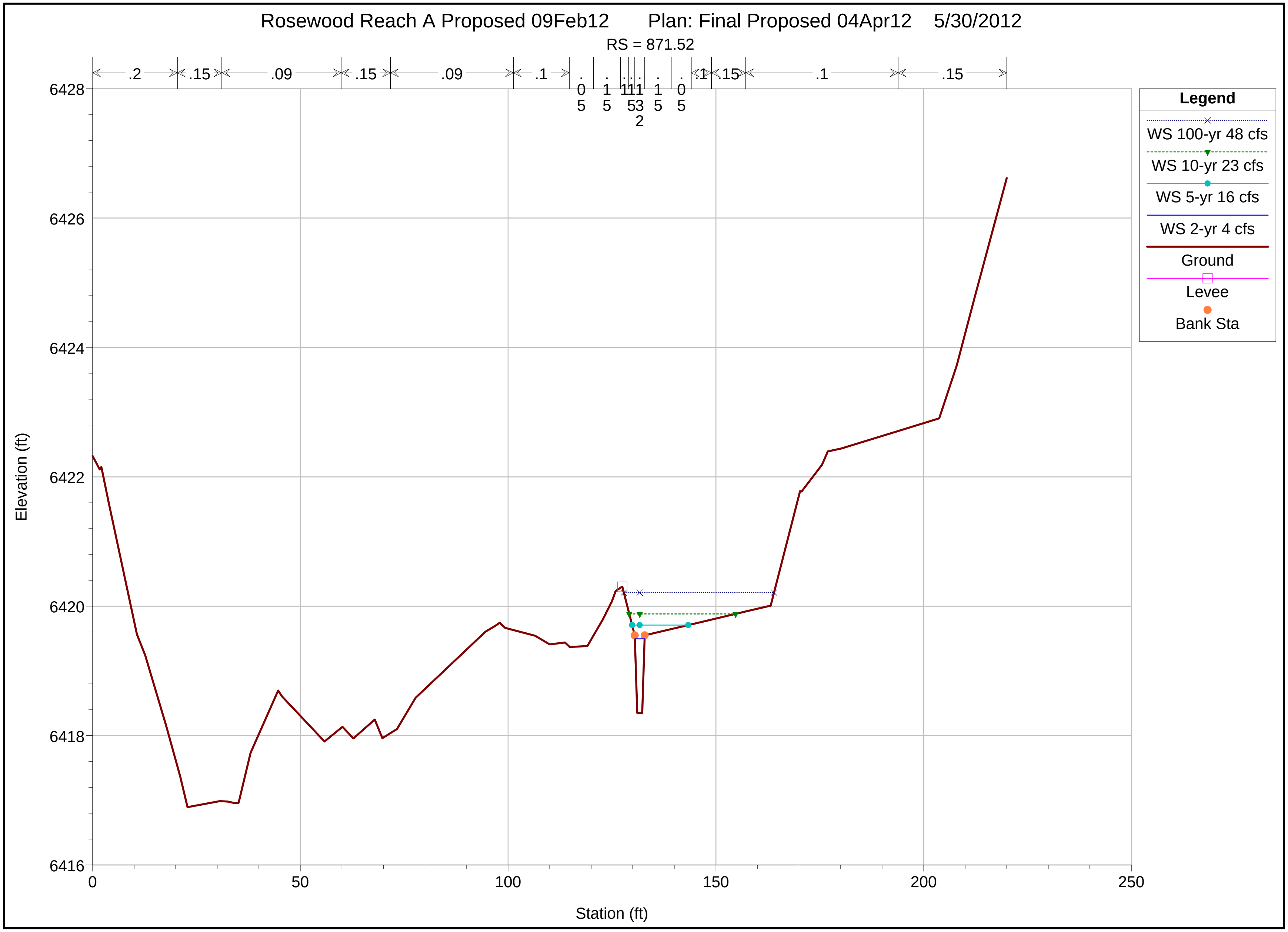
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

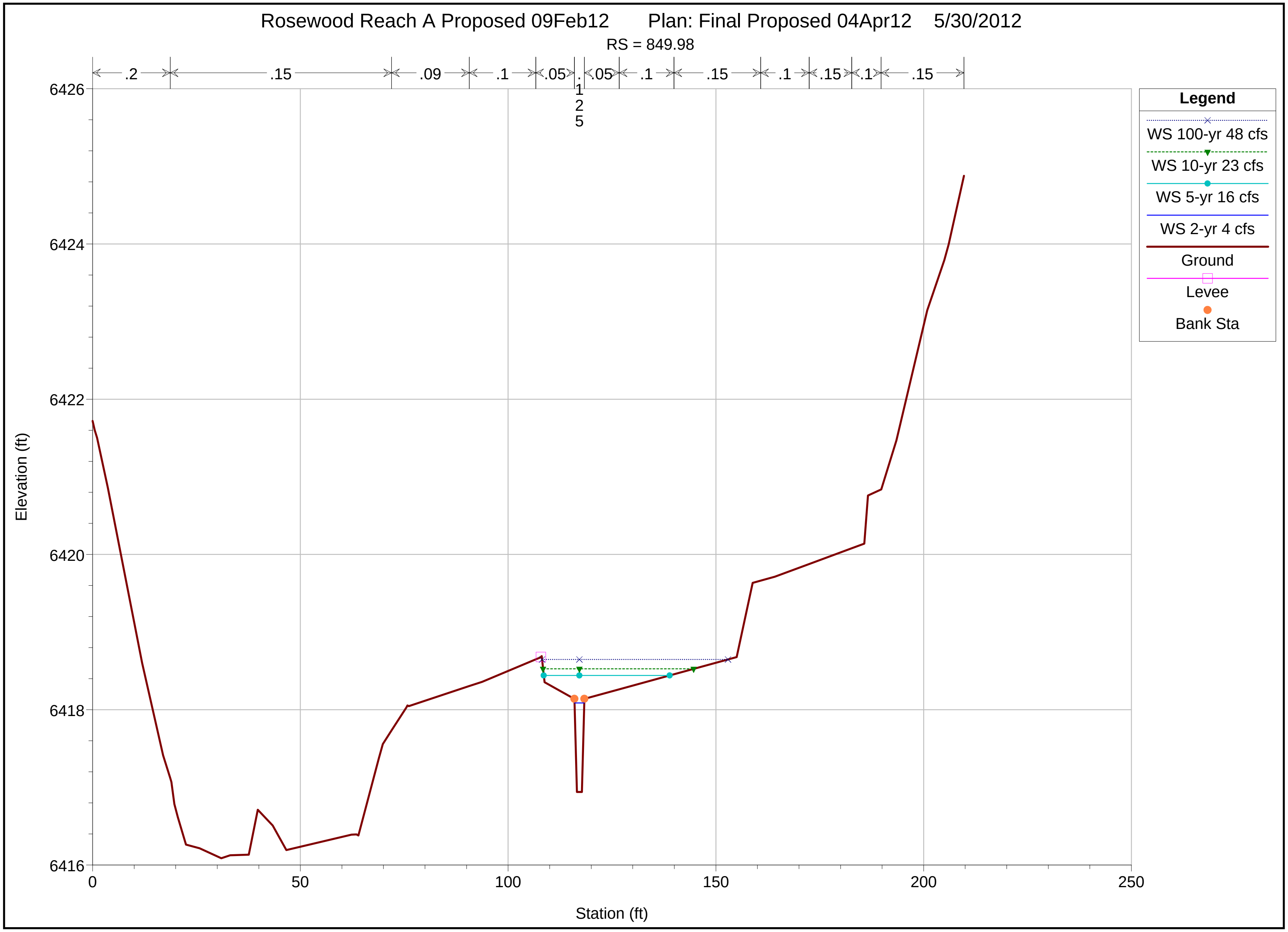
RS = 933.31

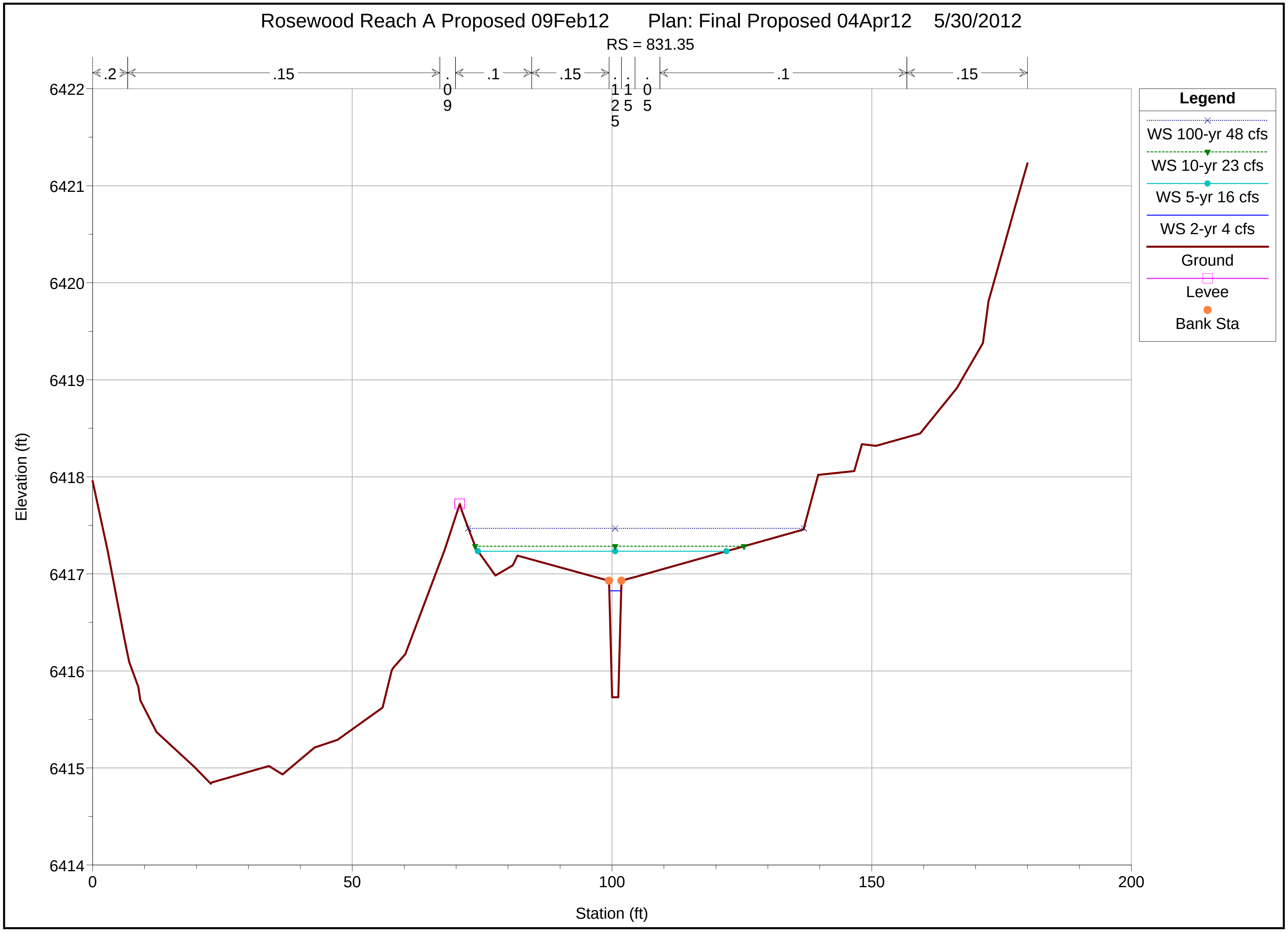


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

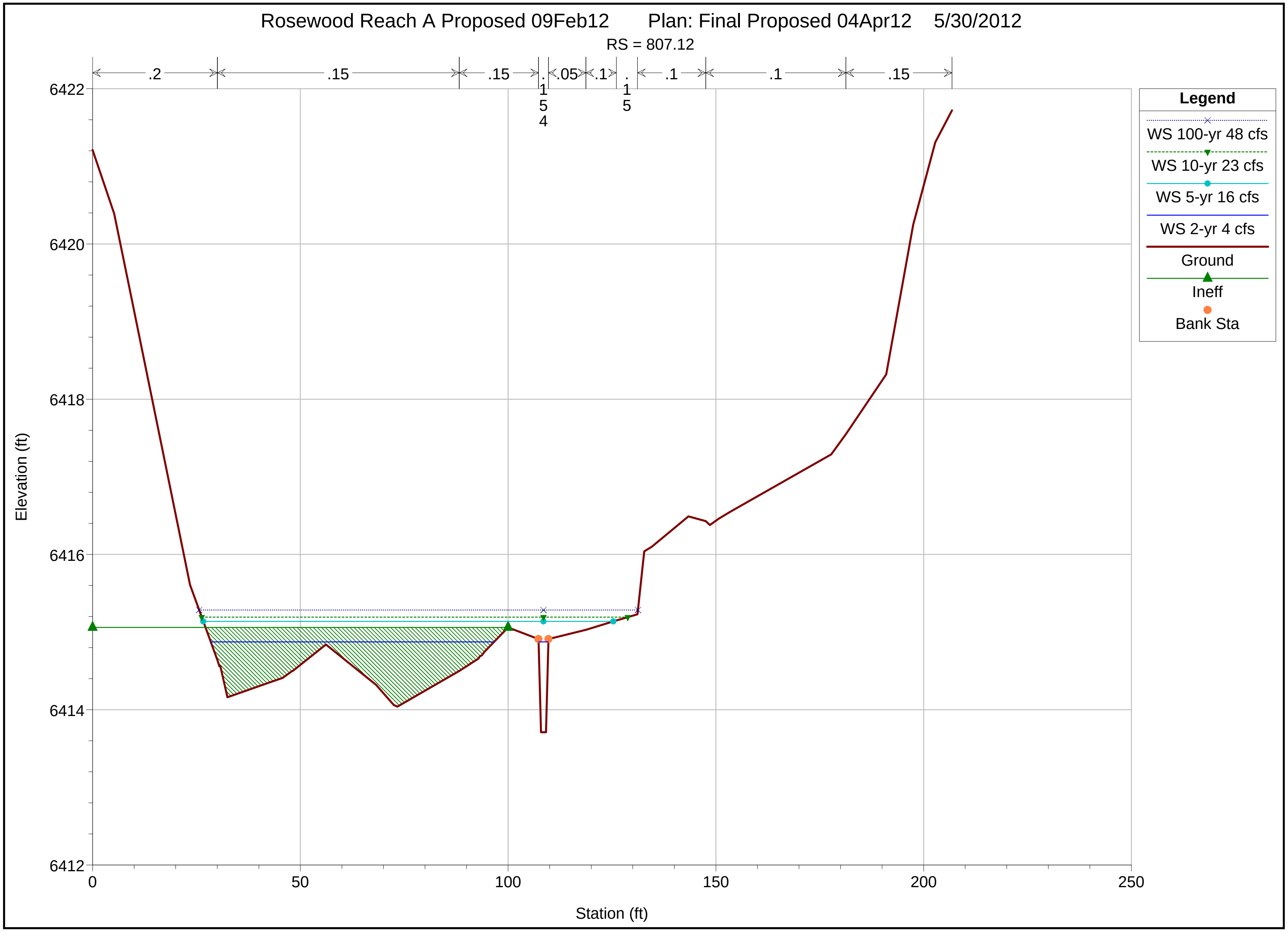
RS = 908.33

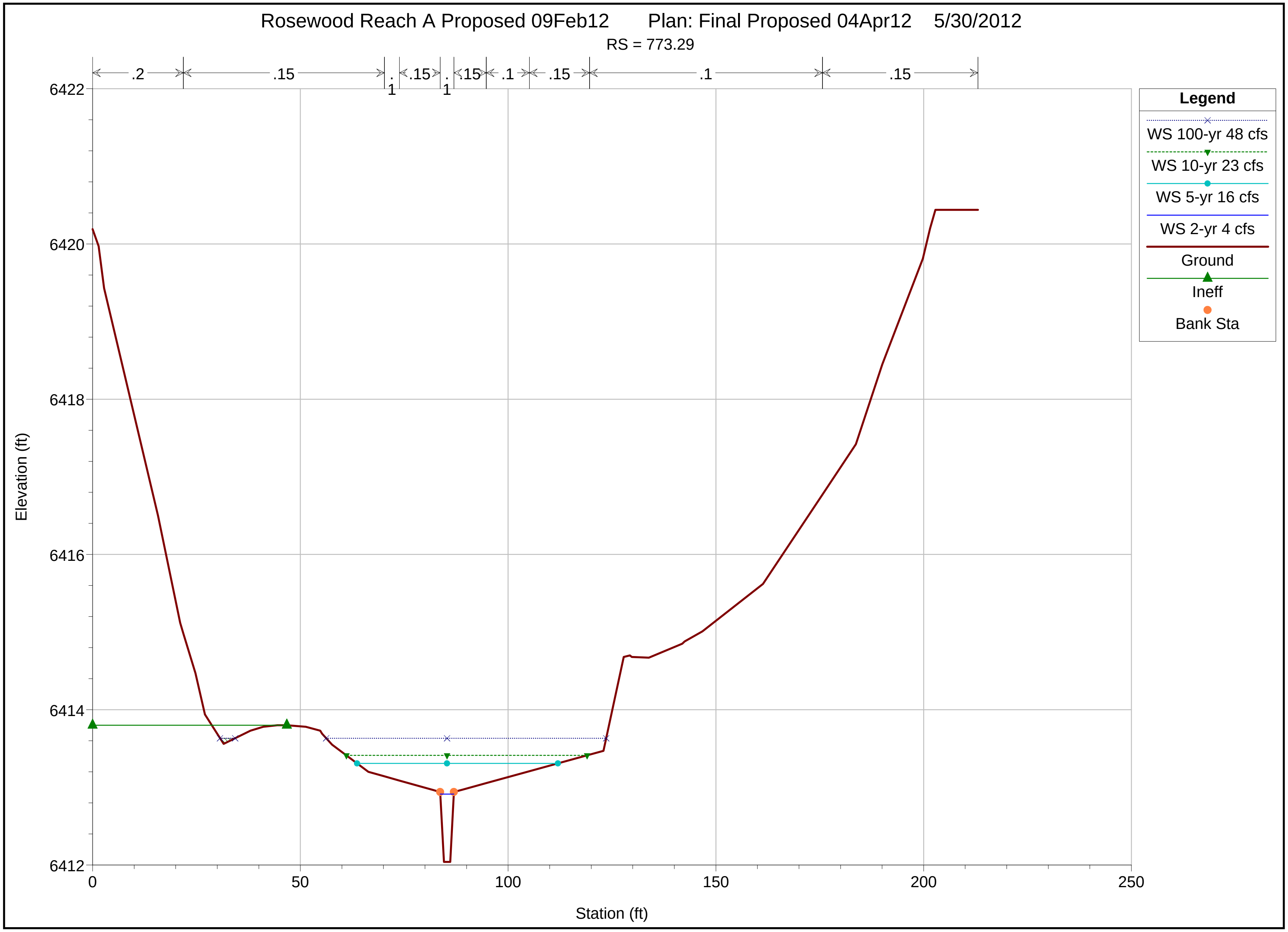

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 871.52
.2
.15
.09
.15
.09
.1
.05
.15
.1
.1
.15
.13
.12
.15
.05
.1
.15
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6428
6426
6424
6422
6420
6418
6416
Station (ft)
0
50
100
150
200
250


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 849.98
.2
.15
.09
.1
.05
.
1
2
5
.05
.1
.15
.1
.15
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6426
6424
6422
6420
6418
6416
0
50
100
150
200
250
Station (ft)



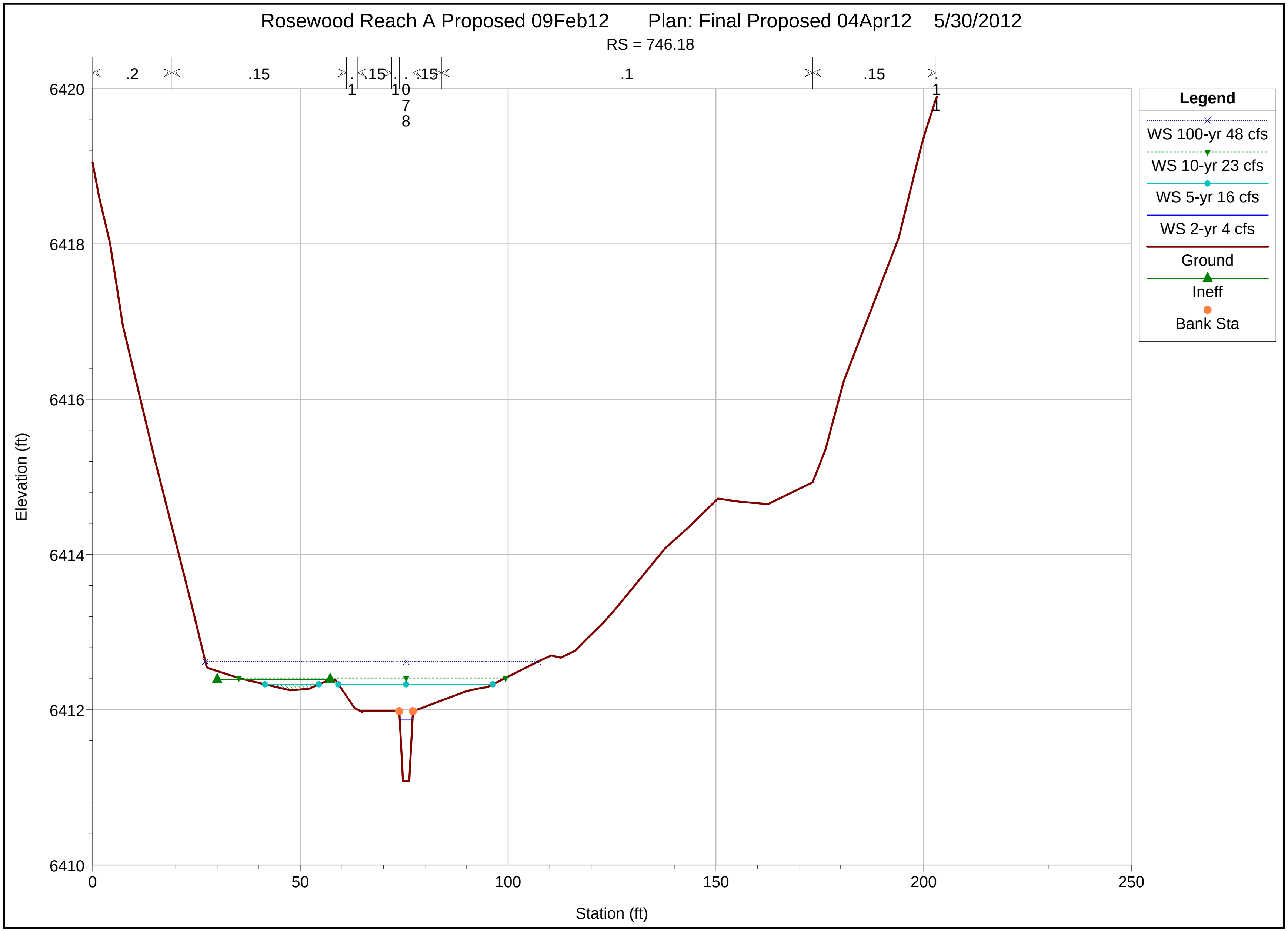
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 831.35
.2
.15
.09
.1
.15
.125
.15
.05
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6422
6421
6420
6419
6418
6417
6416
6415
6414
Station (ft)
0
50
100
150
200


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 807.12
.2
.15
.15
.154
.05
.1
.15
.1
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6422
6420
6418
6416
6414
6412
Station (ft)
0
50
100
150
200
250



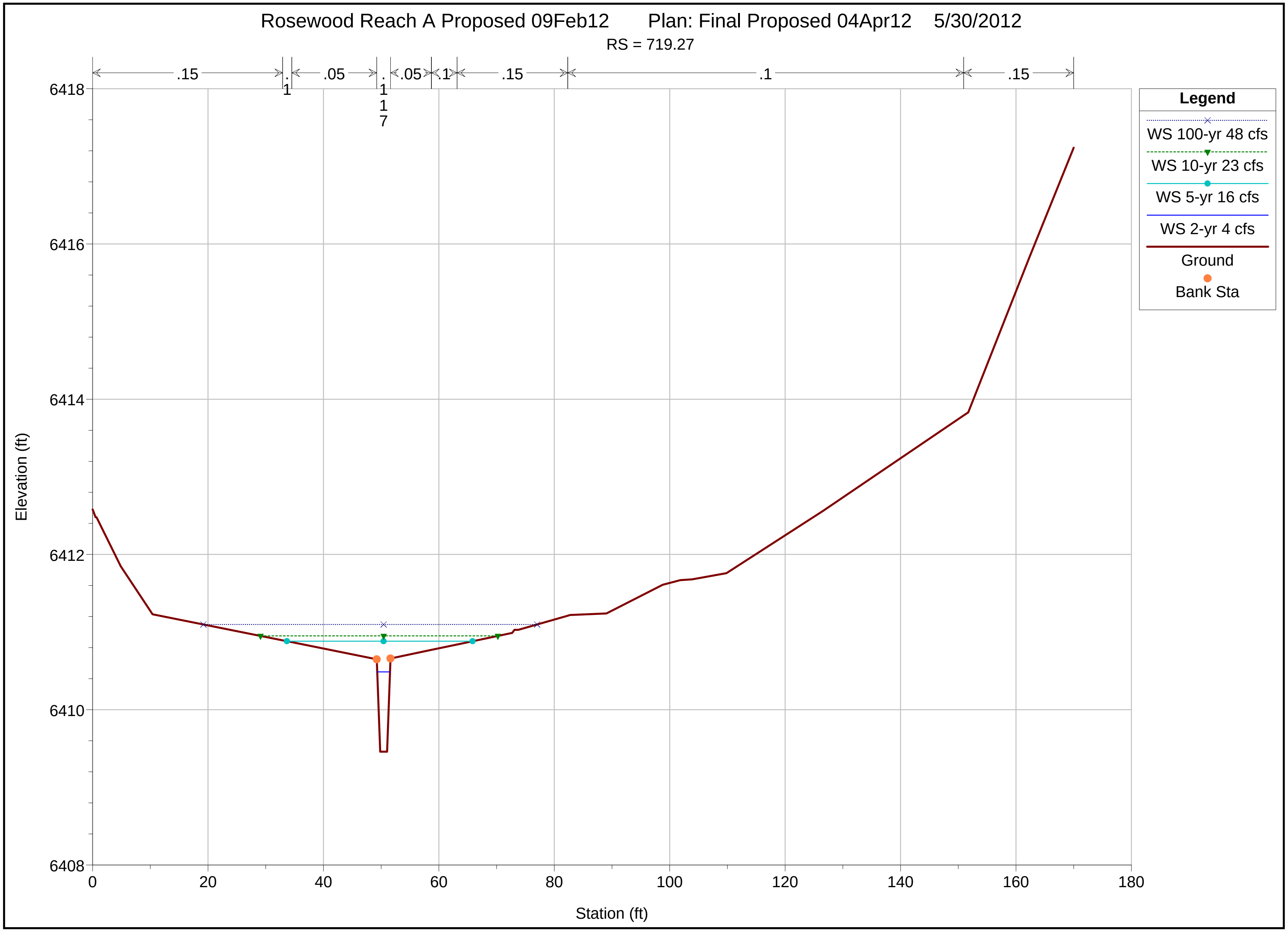
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

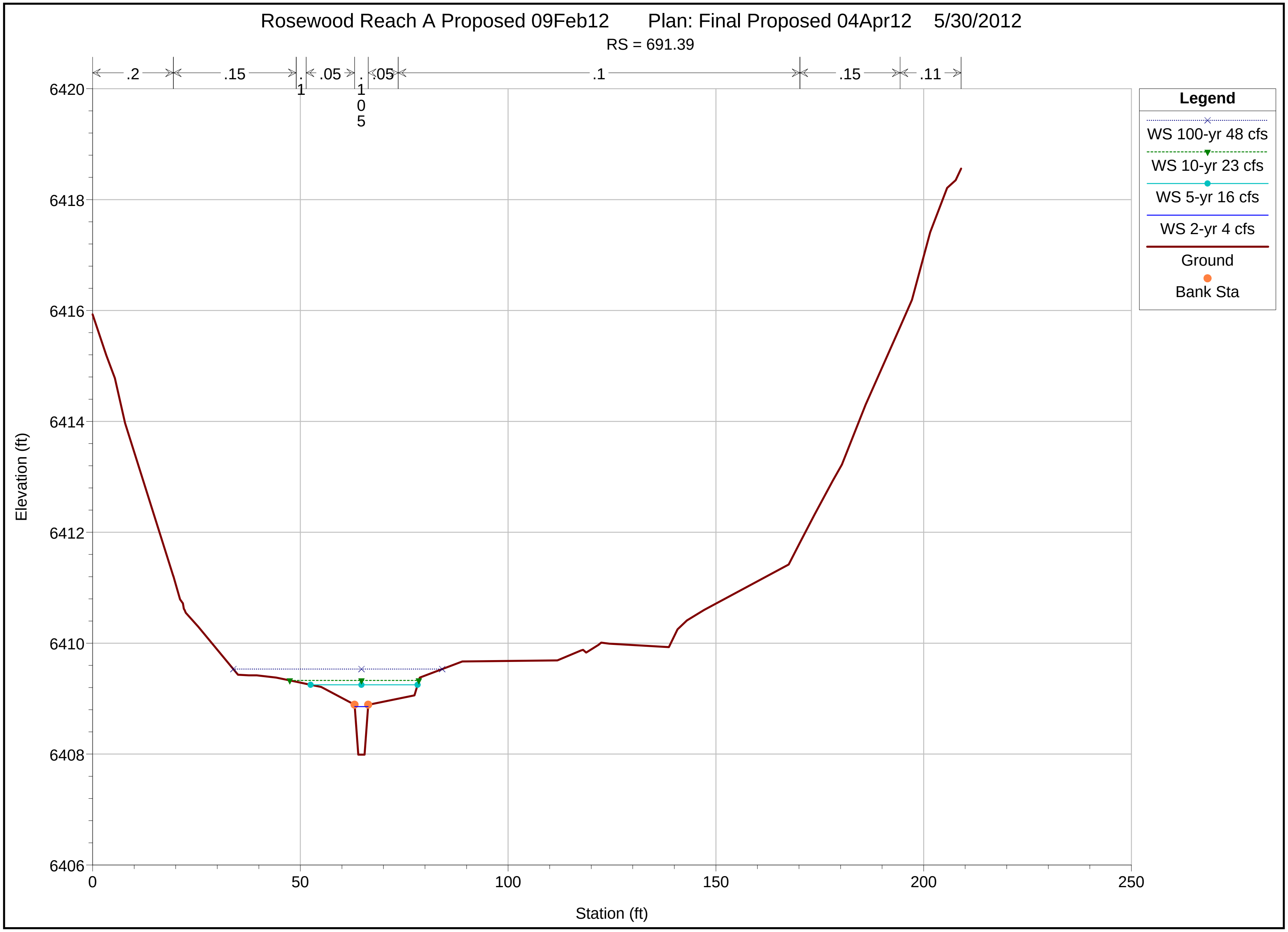
RS = 773.29



Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

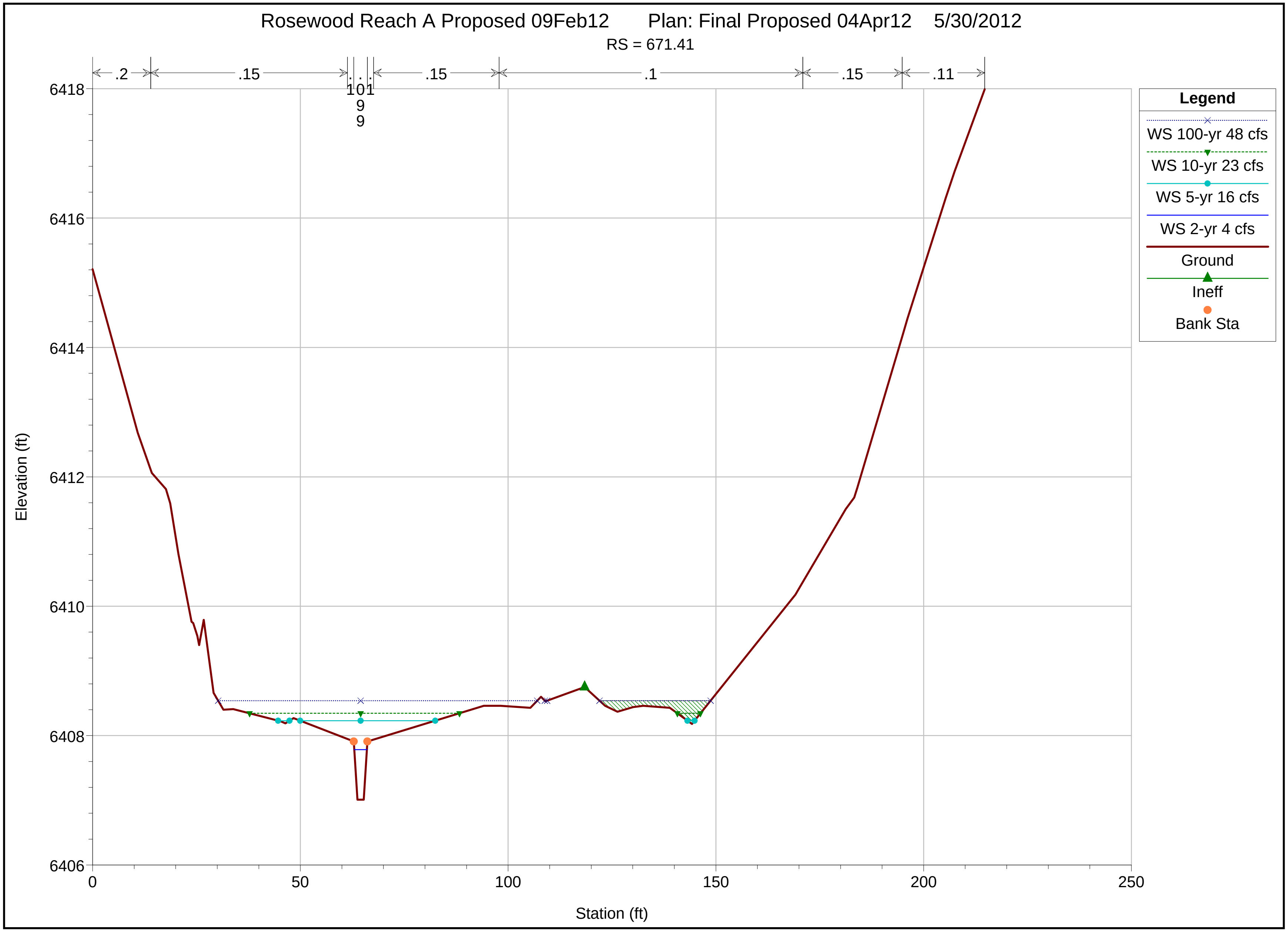
RS = 746.18

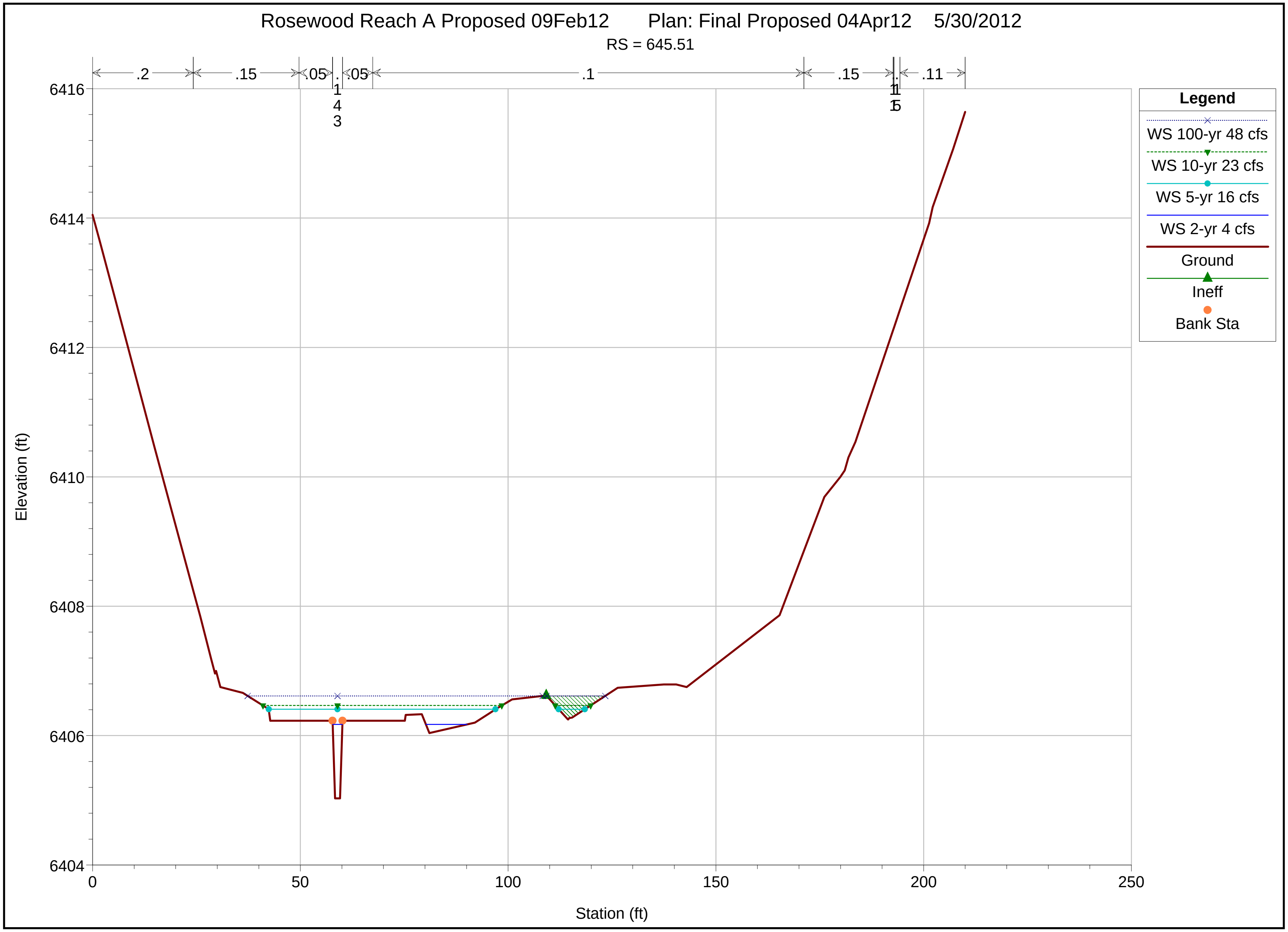

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 719.27
.15
.1
.05
.117
.05
.1
.15
.1
.15
Elevation (ft)
6418
6416
6414
6412
6410
6408
Station (ft)
0
20
40
60
80
100
120
140
160
180
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta



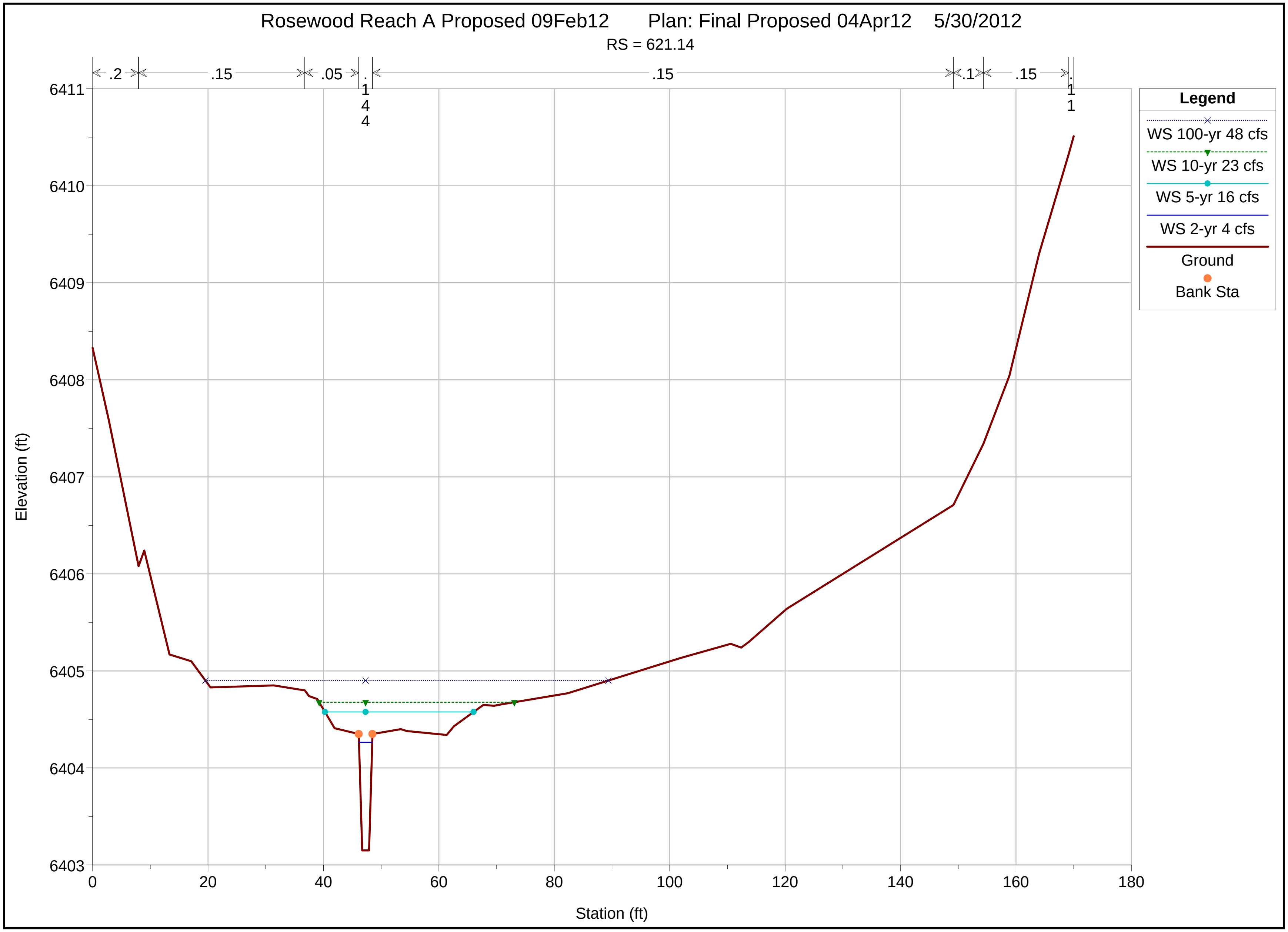
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

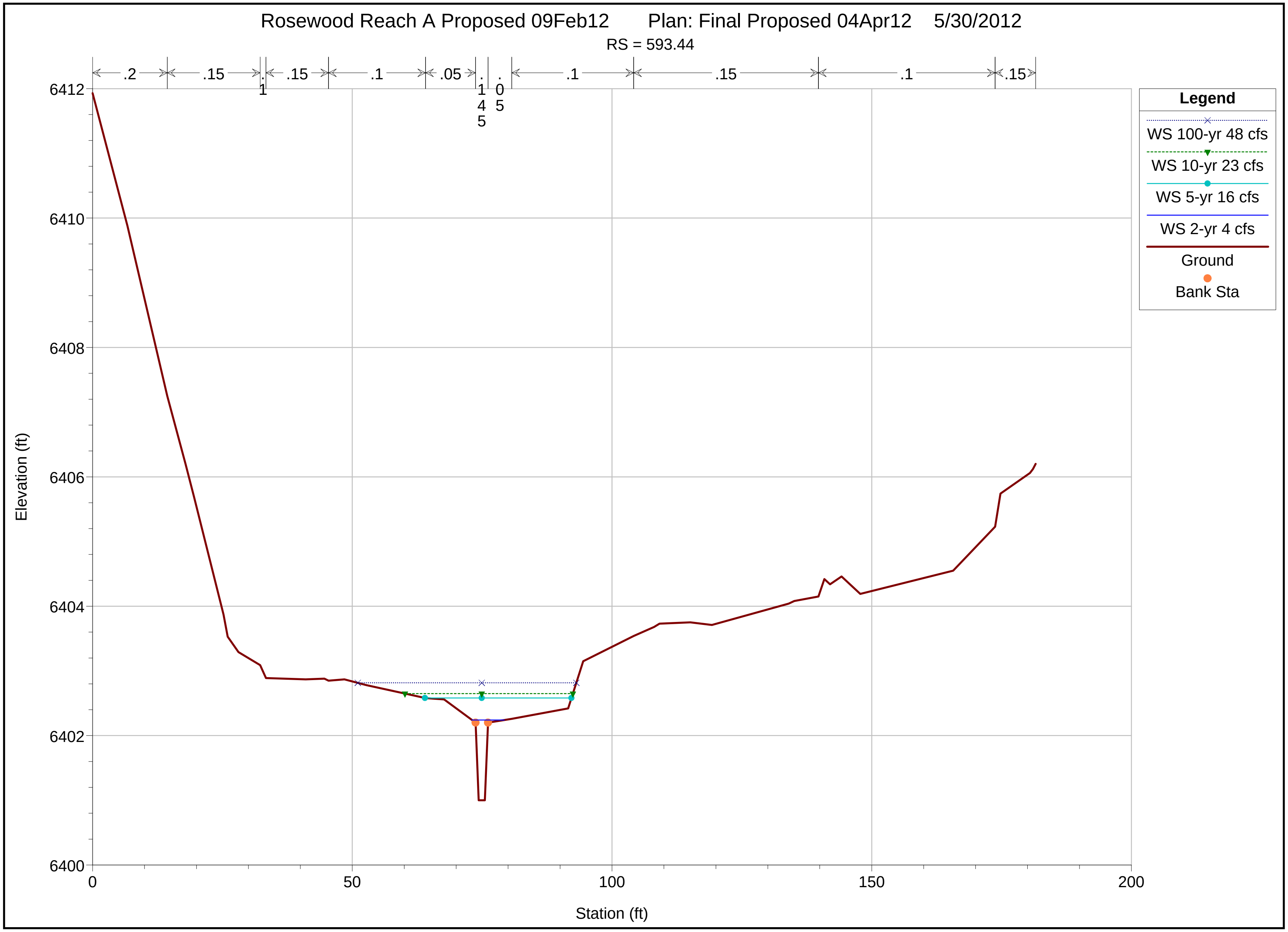
RS = 691.39

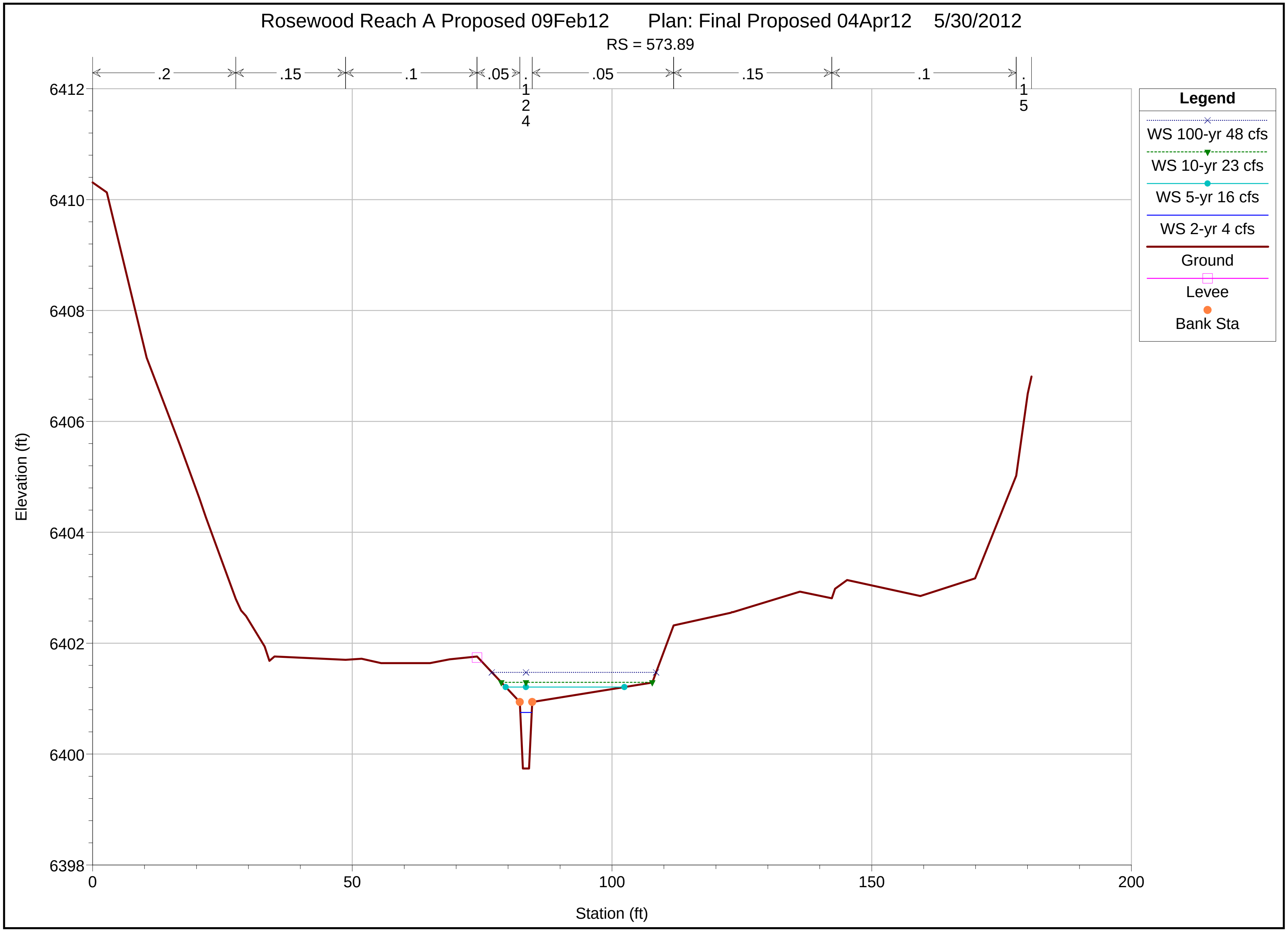

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 671.41
.2
.15
.15
.1
.15
.11
.
.
.
101
9
9
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6418
6416
6414
6412
6410
6408
6406
Station (ft)
0
50
100
150
200
250

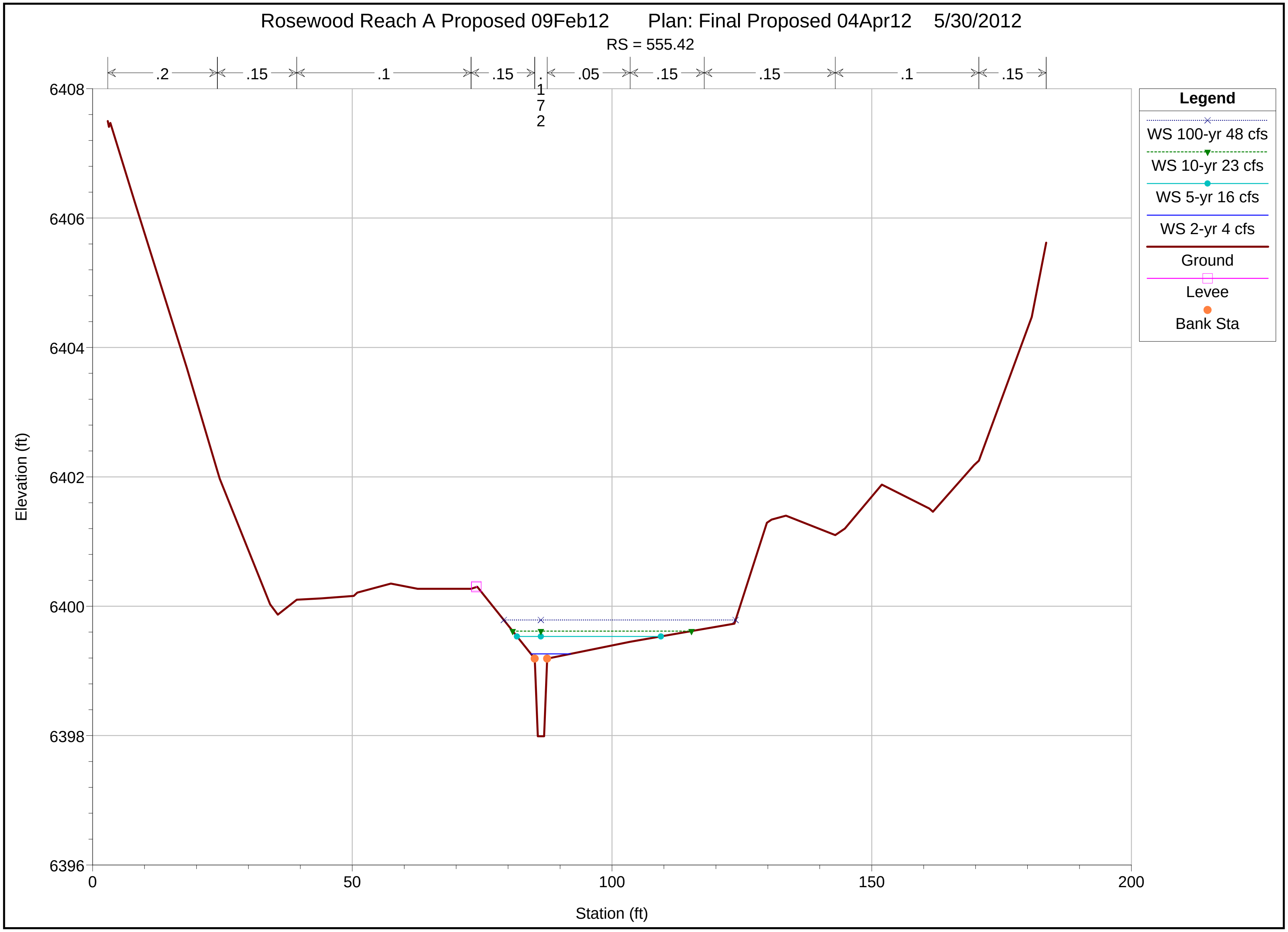

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

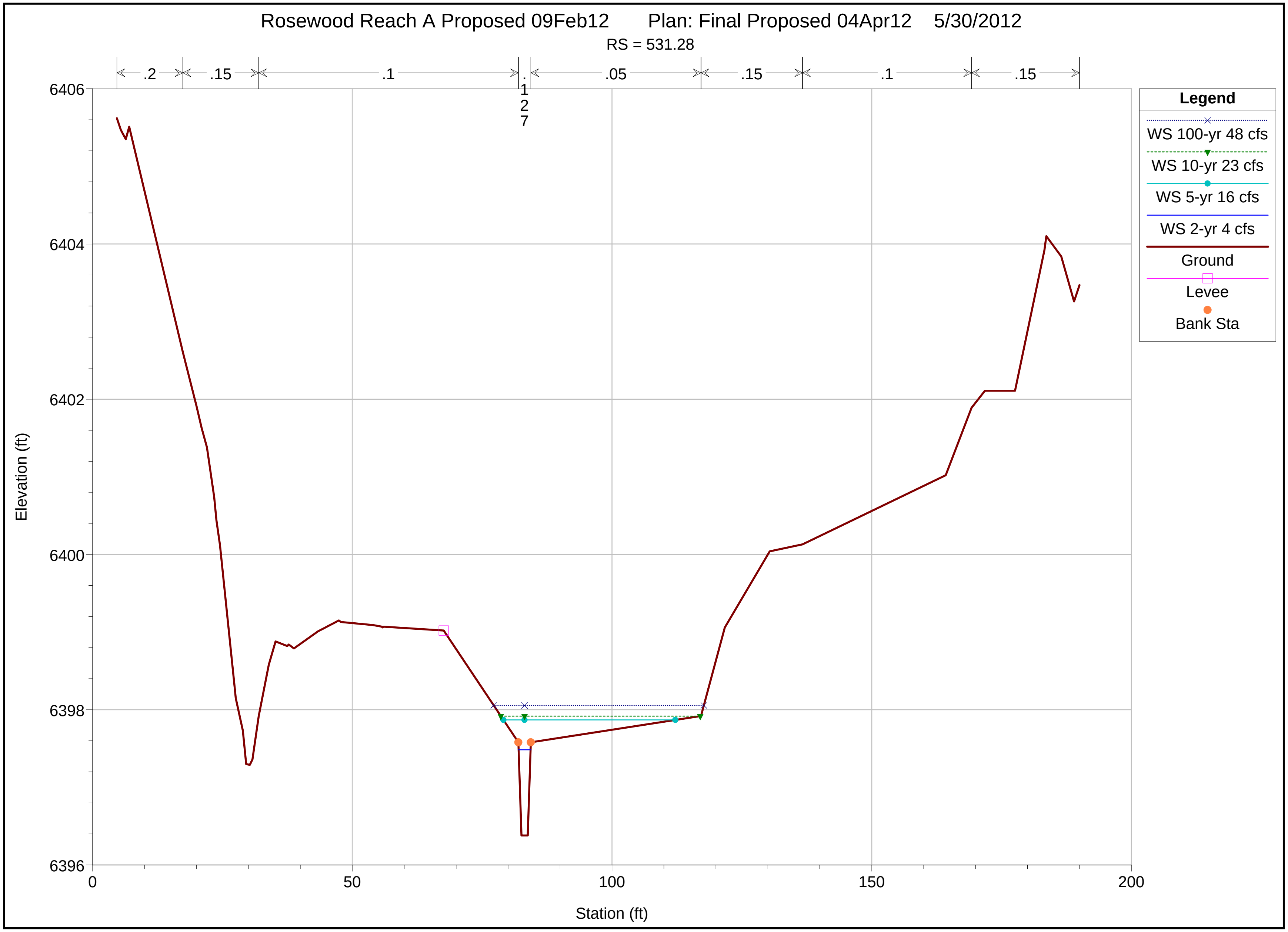
RS = 645.51


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 621.14
.2
.15
.05
.144
.15
.1
.15
.11
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6403
6404
6405
6406
6407
6408
6409
6410
6411
Station (ft)
0
20
40
60
80
100
120
140
160
180


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 593.44
.2
.15
.1
.15
.1
.05
.145
.05
.1
.15
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6412
6410
6408
6406
6404
6402
6400
Station (ft)
0
50
100
150
200

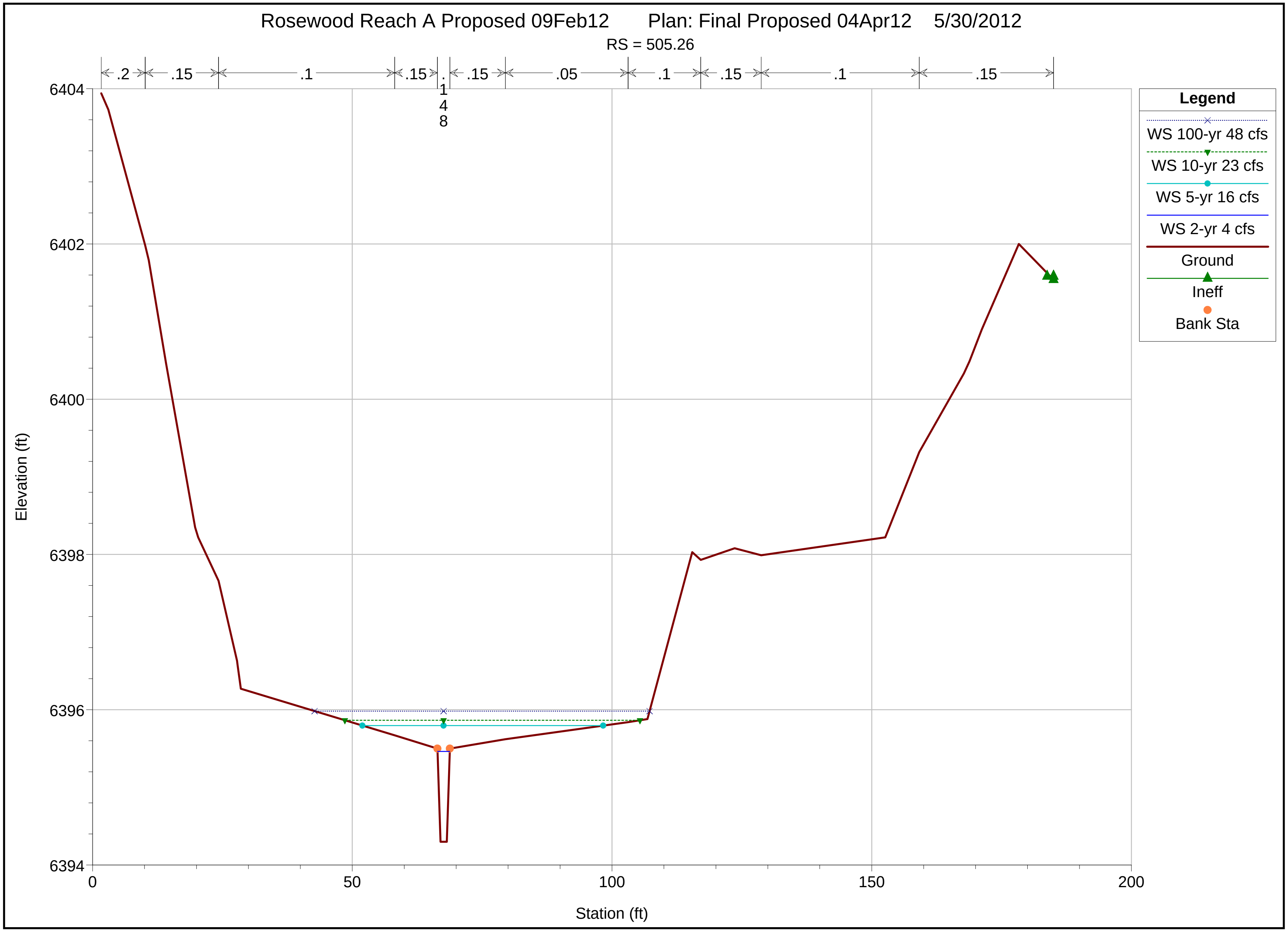

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 573.89
.2
.15
.1
.05
.124
.05
.15
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta
Elevation (ft)
6412
6410
6408
6406
6404
6402
6400
6398
0
50
100
150
200
Station (ft)


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 555.42
.2
.15
.1
.15
.172
.05
.15
.15
.1
.15
Elevation (ft)
6408
6406
6404
6402
6400
6398
6396
Station (ft)
0
50
100
150
200
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Levee
Bank Sta

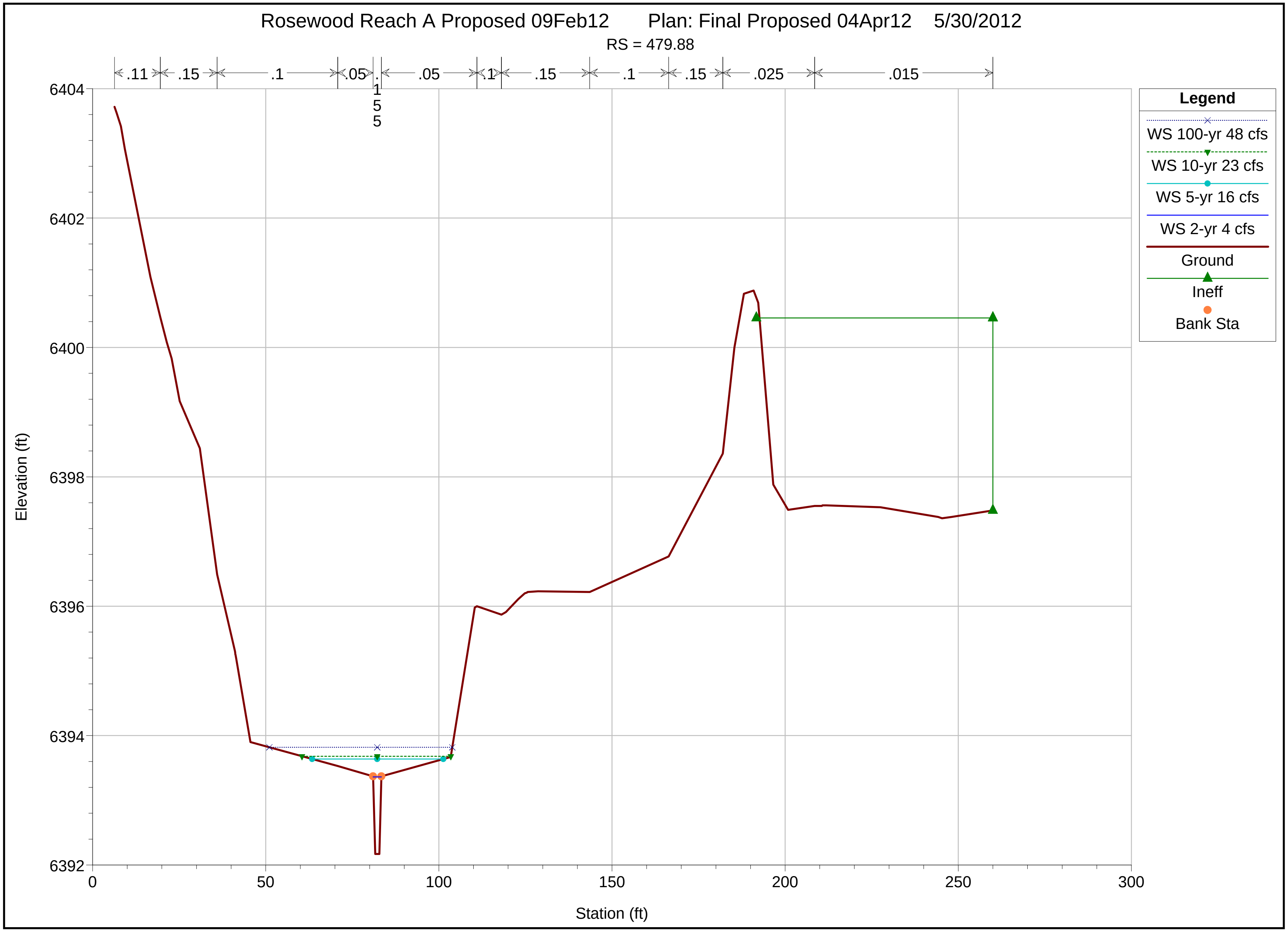


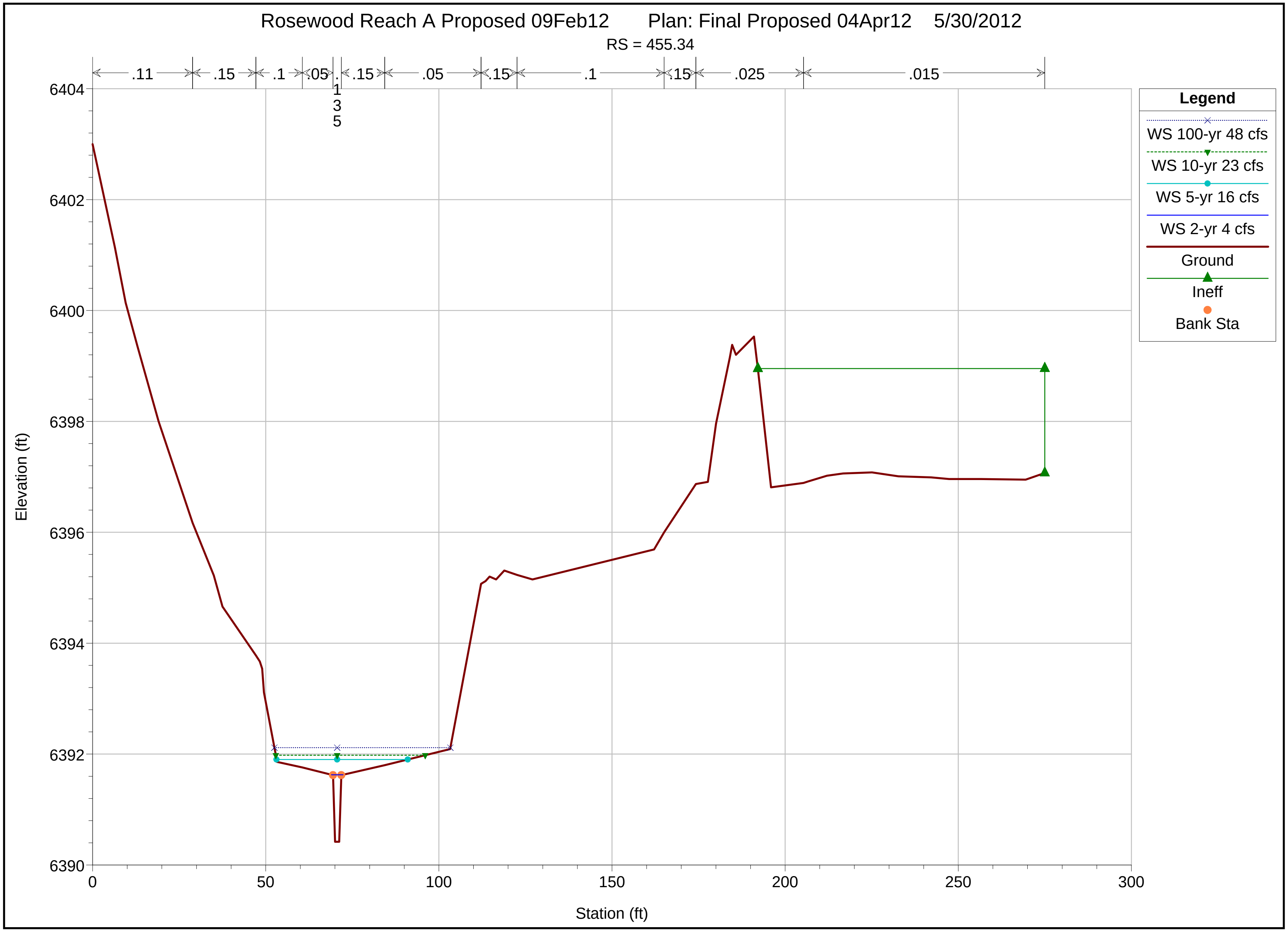
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

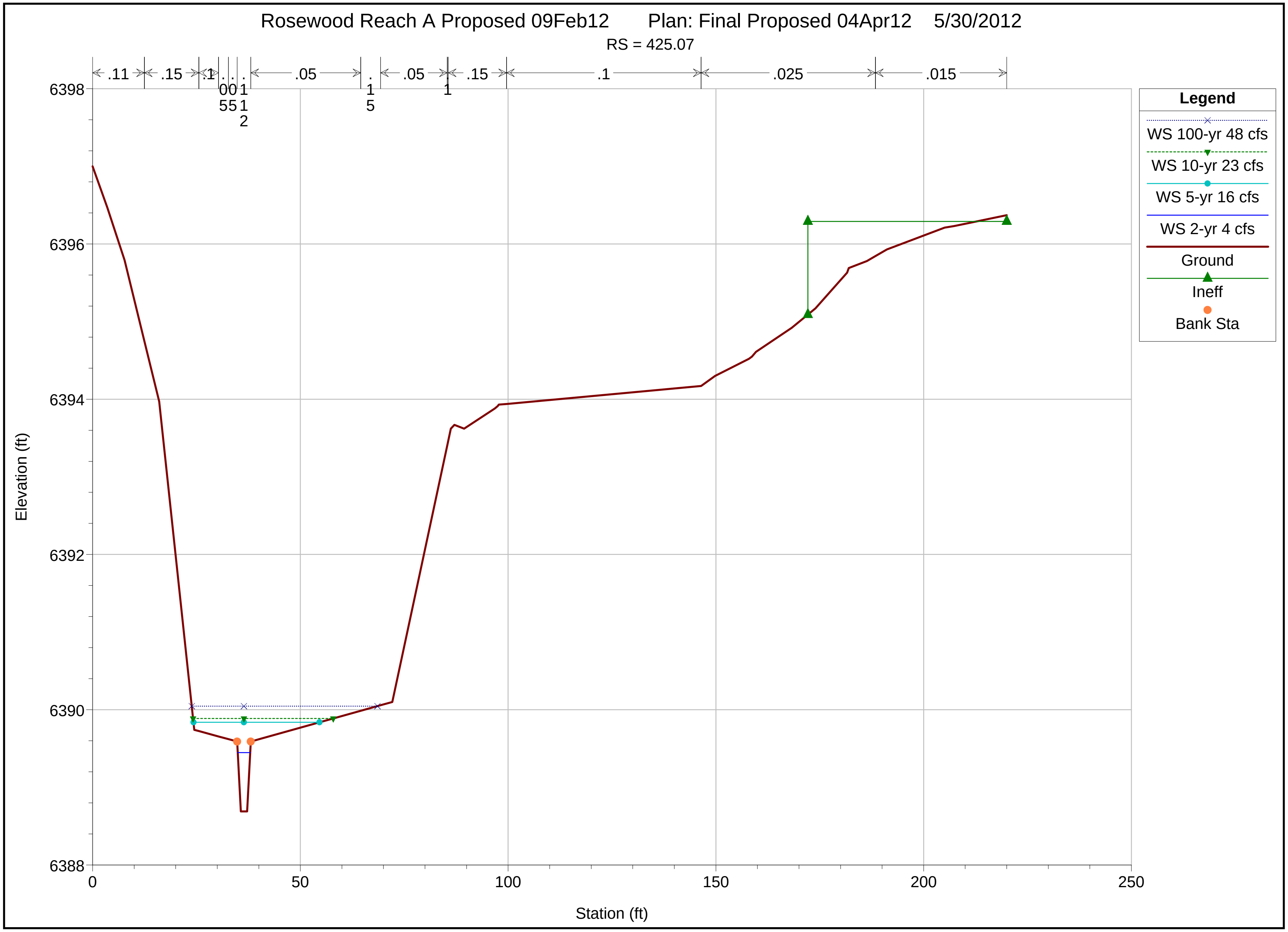
RS = 531.28

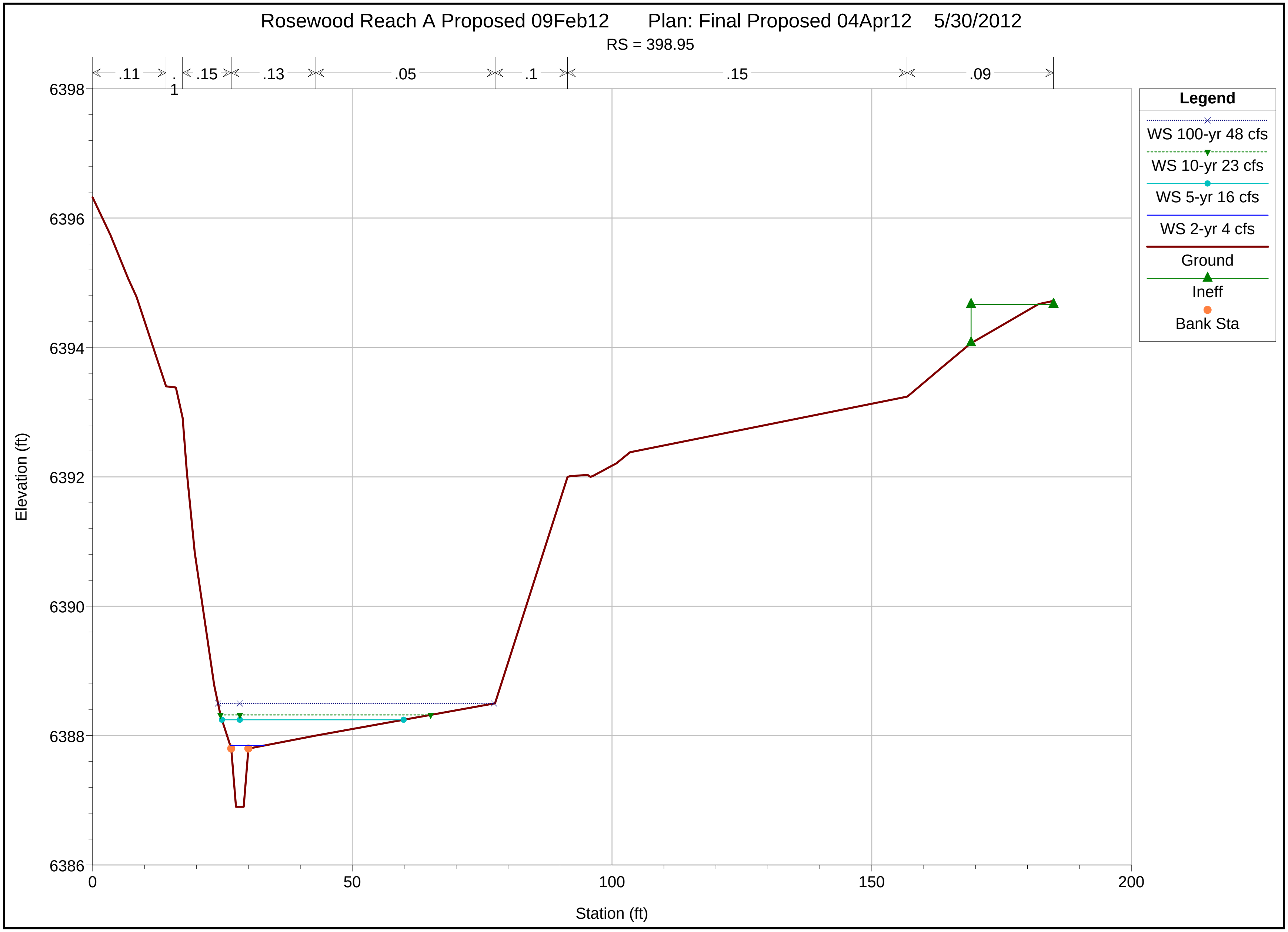


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 505.26
.2
.15
.1
.15
.148
.15
.05
.1
.15
.1
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6404
6402
6400
6398
6396
6394
0
50
100
150
200
Station (ft)


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 479.88
.11
.15
.1
.05
.155
.05
.1
.15
.1
.15
.025
.015
Elevation (ft)
6404
6402
6400
6398
6396
6394
6392
Station (ft)
0
50
100
150
200
250
300
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta

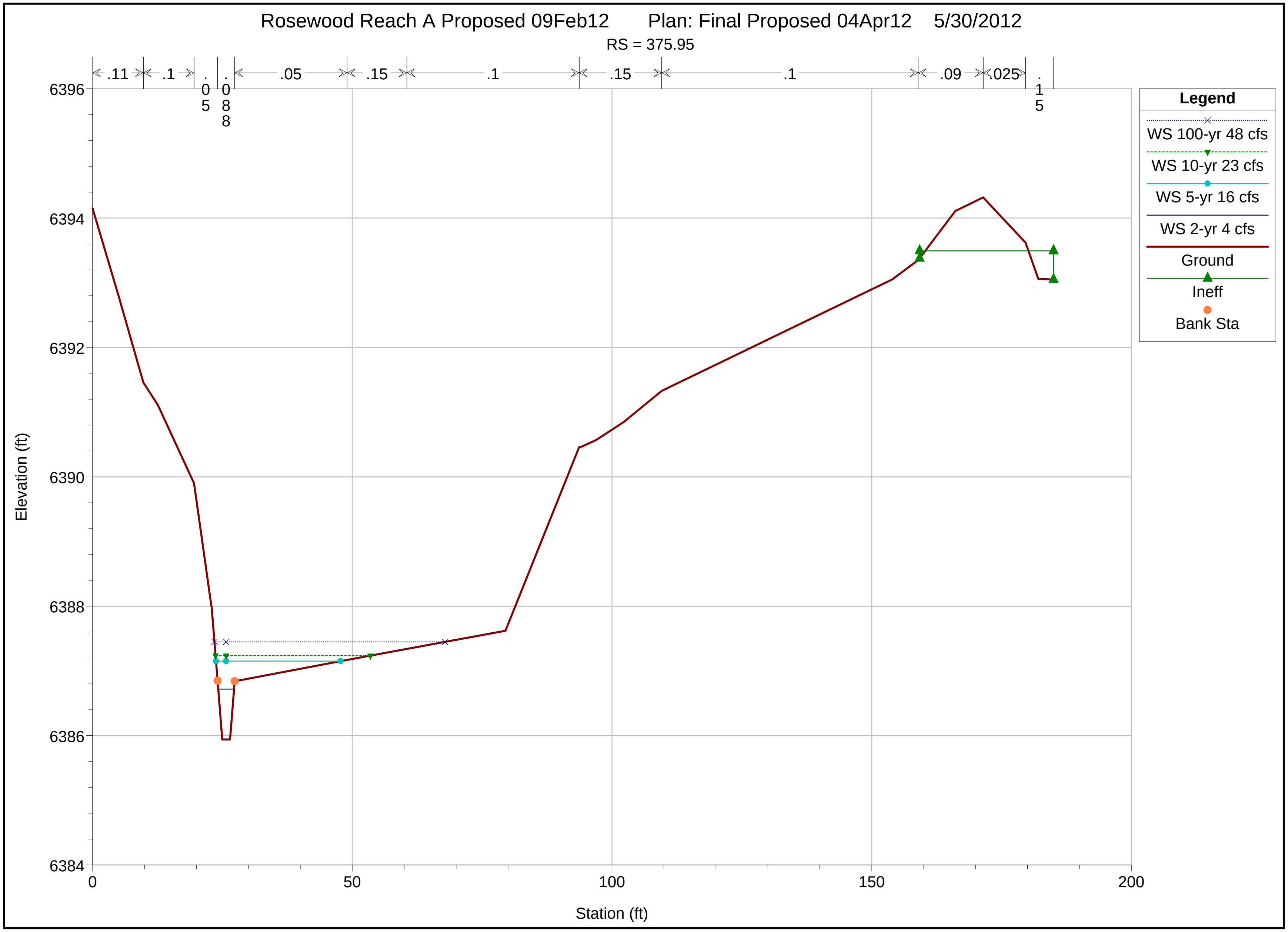

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 455.34
.11
.15
.1
.05
.
.15
.05
.15
.1
.15
.025
.015
1
3
5
Elevation (ft)
6404
6402
6400
6398
6396
6394
6392
6390
Station (ft)
0
50
100
150
200
250
300
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta

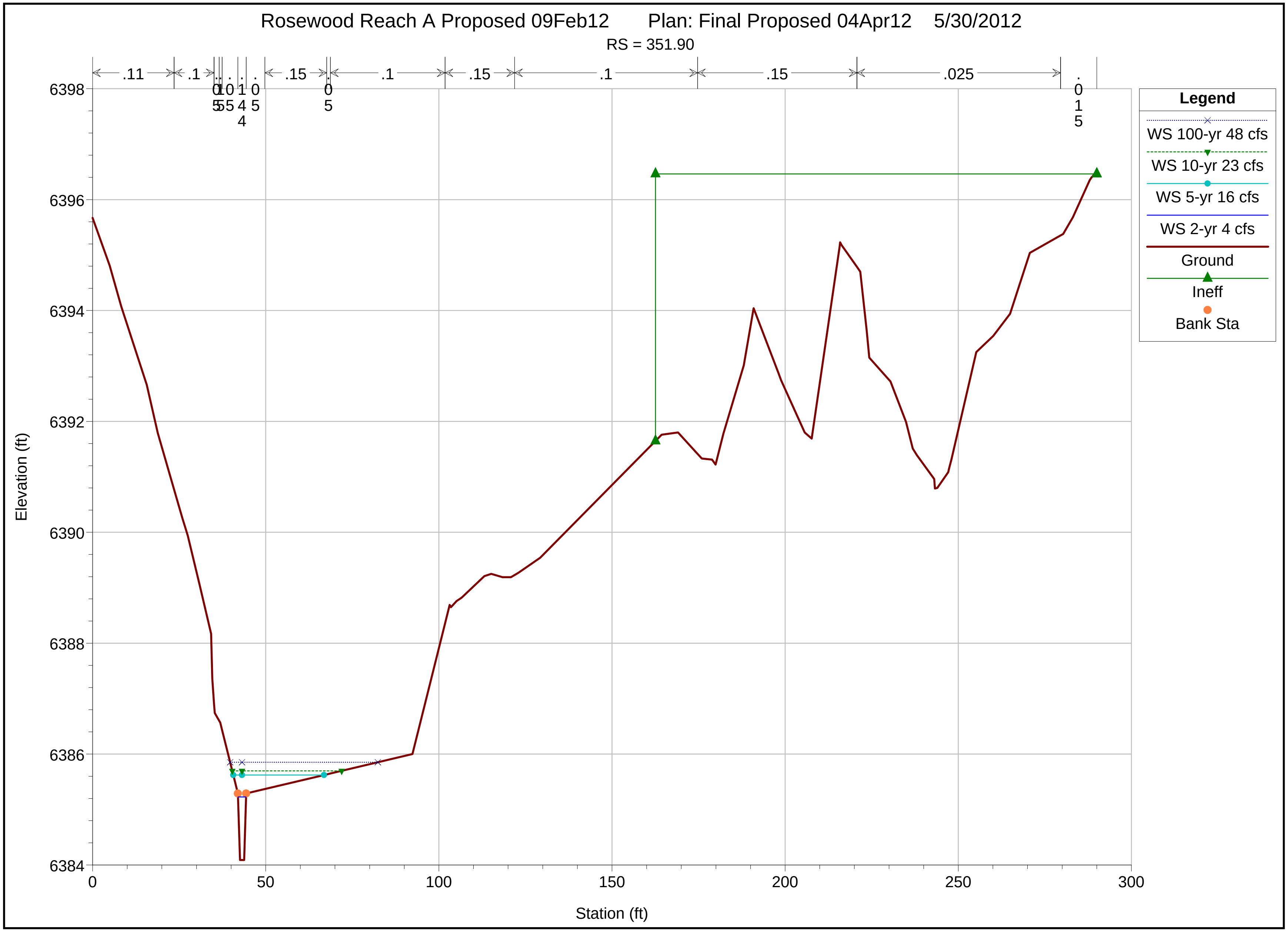

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 425.07
.11
.15
.1
.
0
5
.
0
5
.
1
1
2
.05
.
1
5
.05
.
1
.15
.1
.025
.015
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6398
6396
6394
6392
6390
6388
Station (ft)
0
50
100
150
200
250



Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

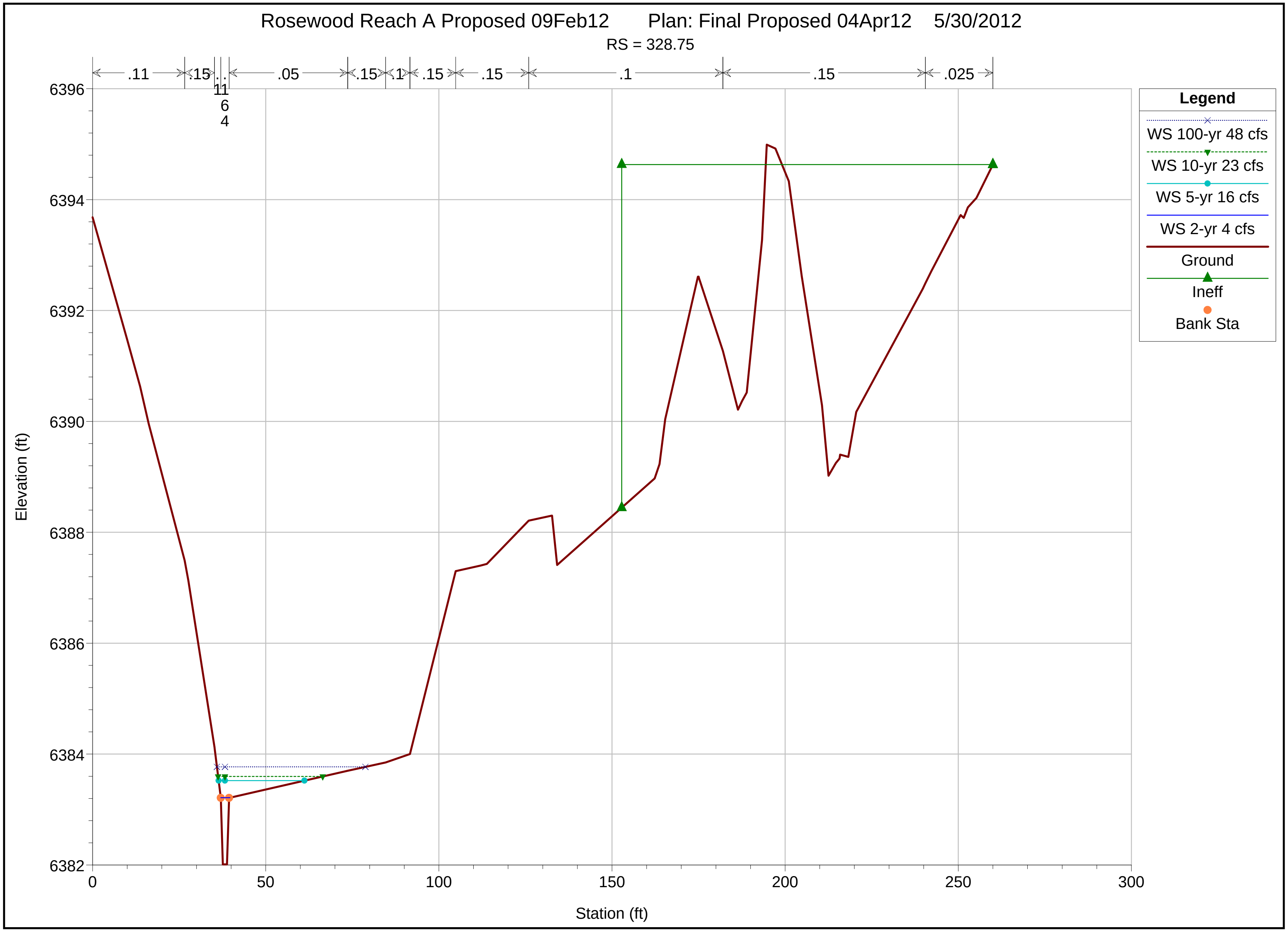
RS = 398.95


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 375.95
.11
.1
.05
.088
.05
.15
.1
.15
.1
.09
.025
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6396
6394
6392
6390
6388
6386
6384
0
50
100
150
200
Station (ft)



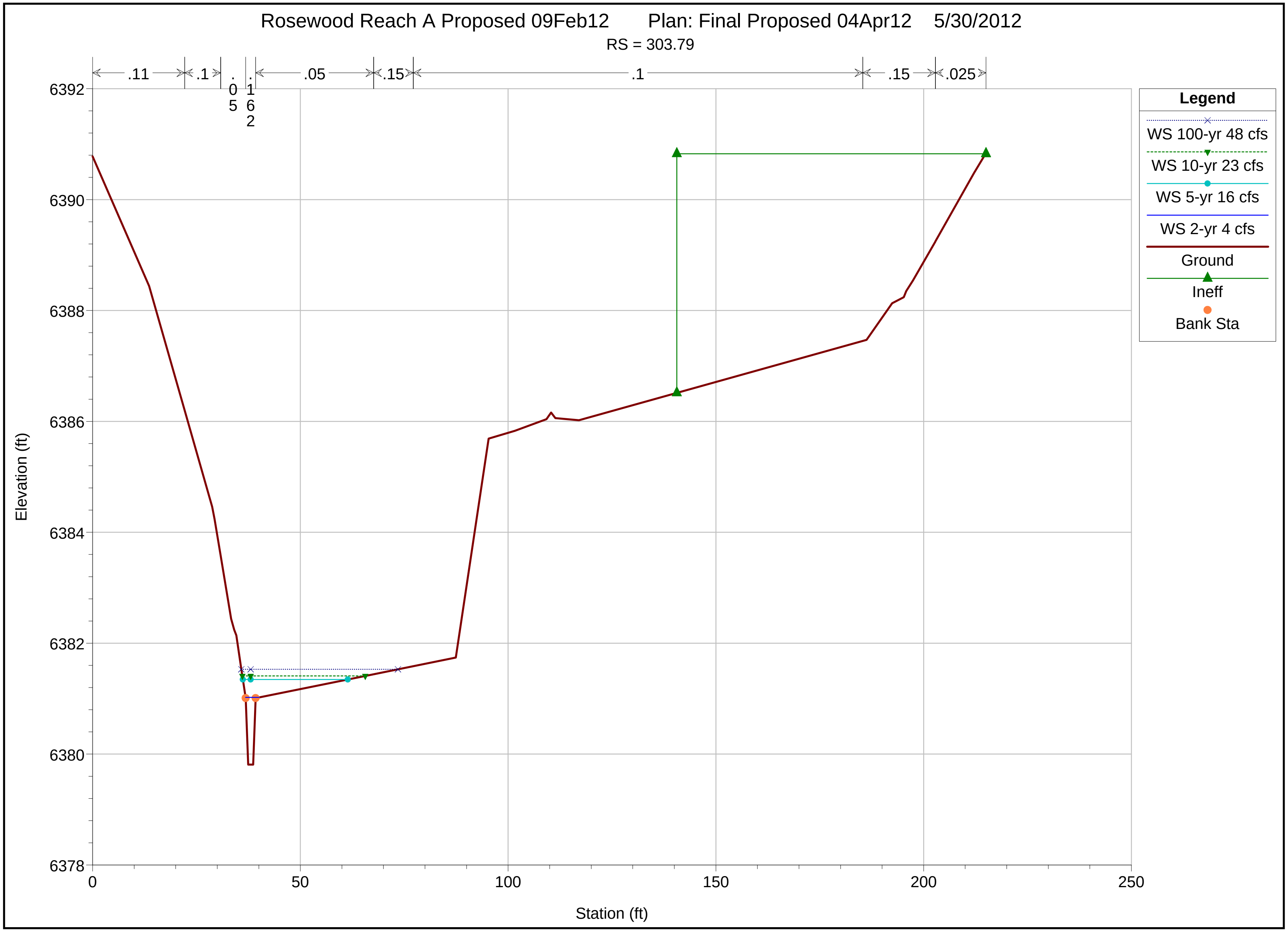
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

RS = 351.90



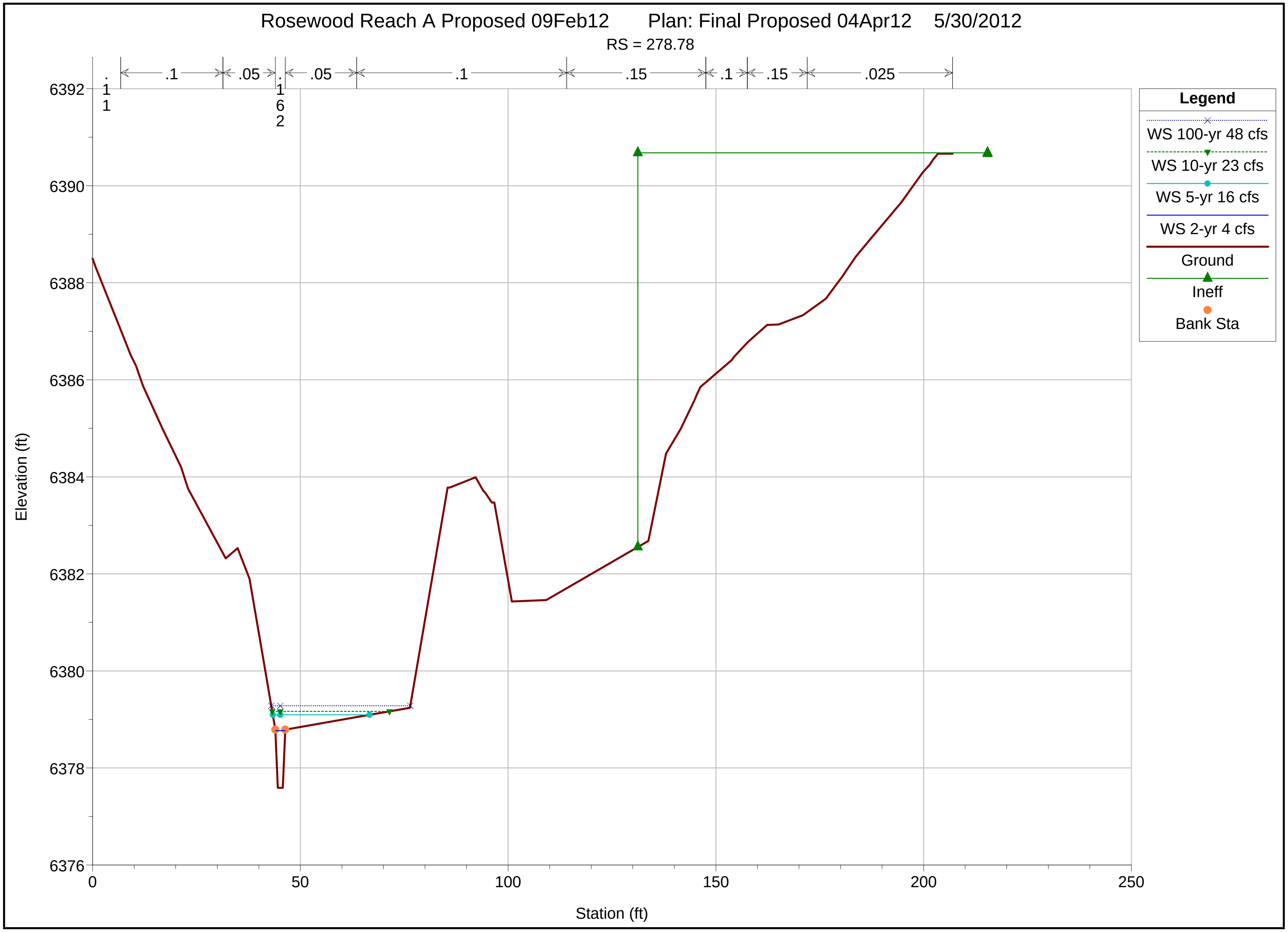
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

RS = 328.75



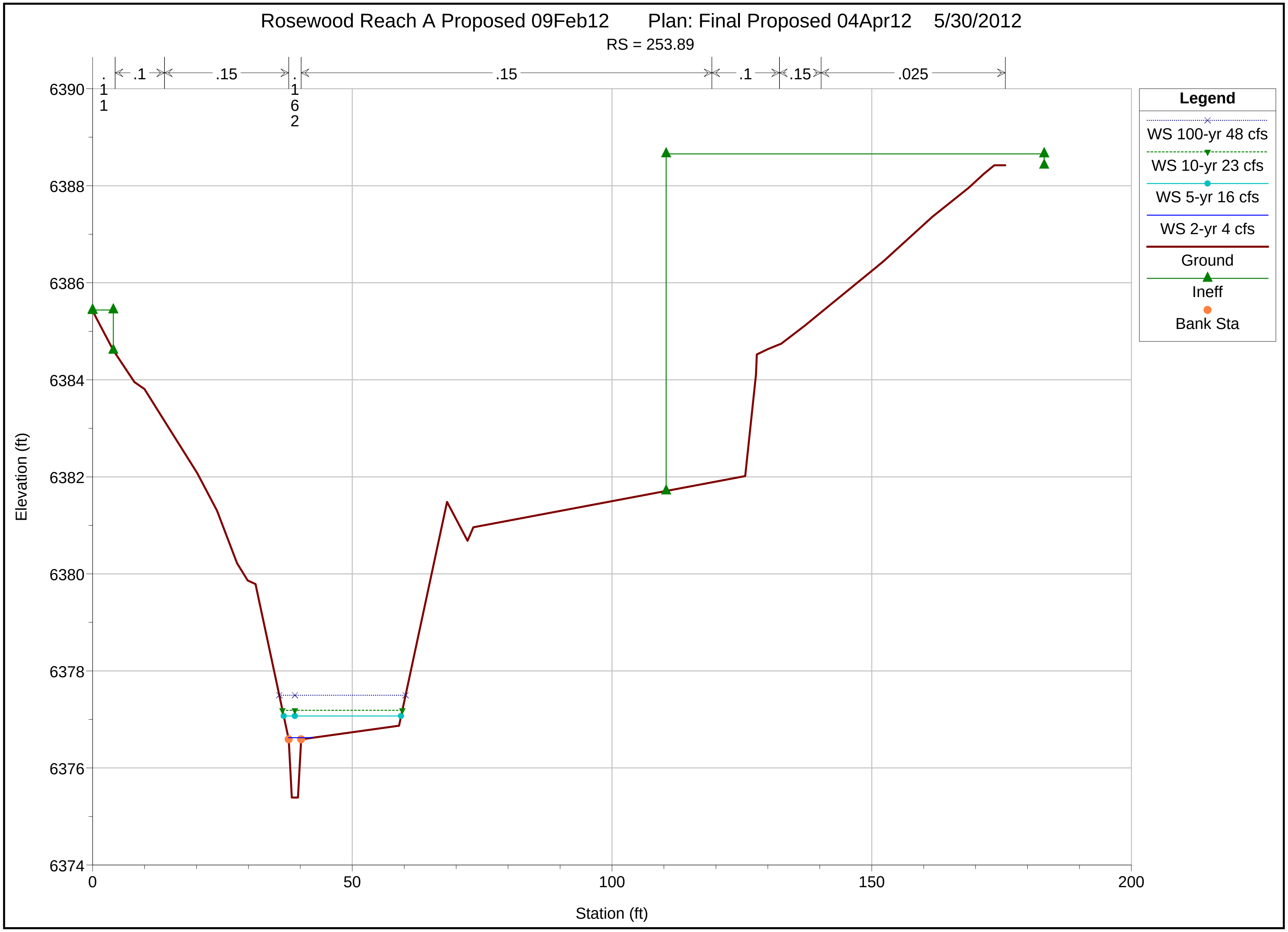
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

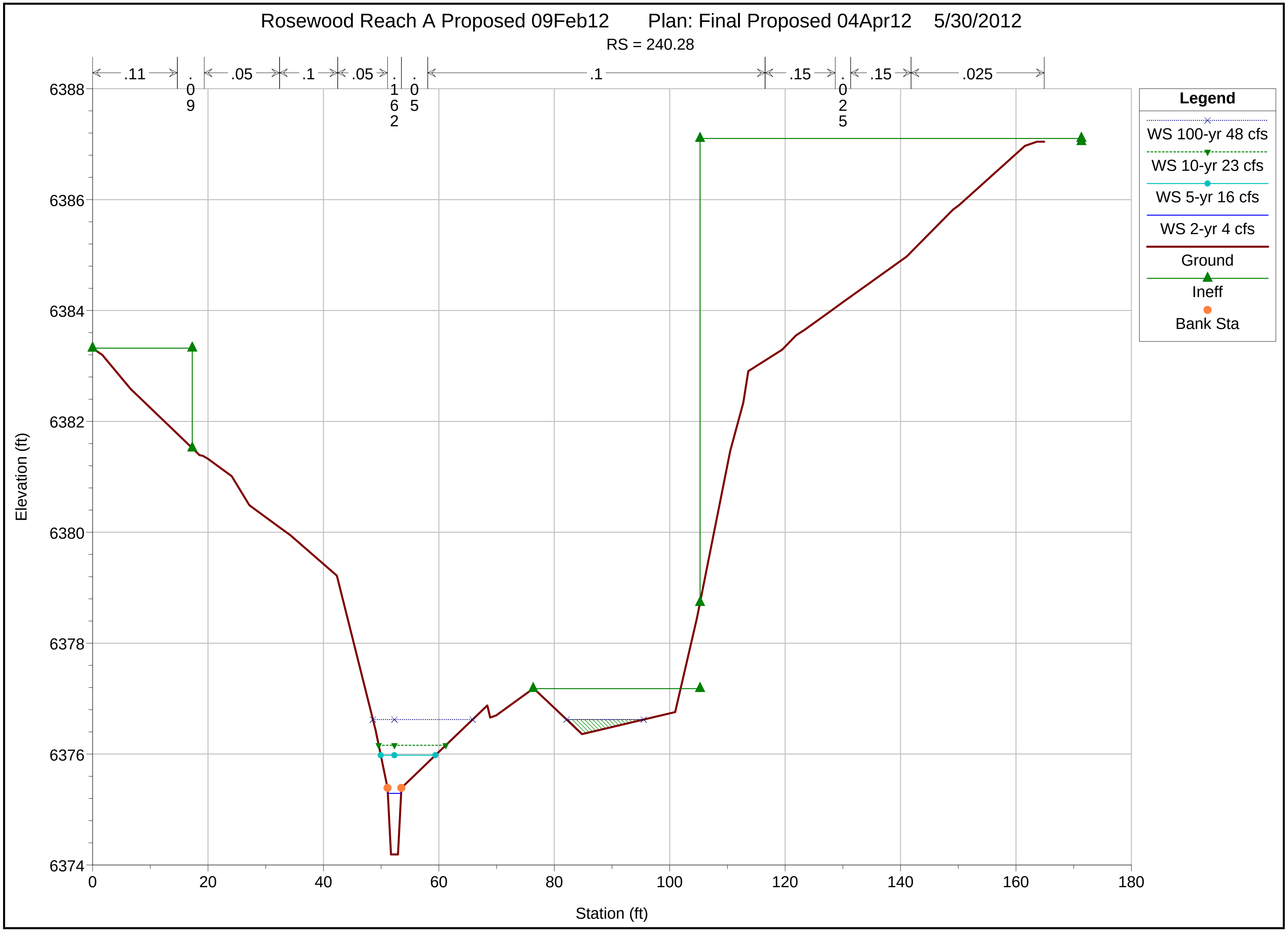
RS = 303.79

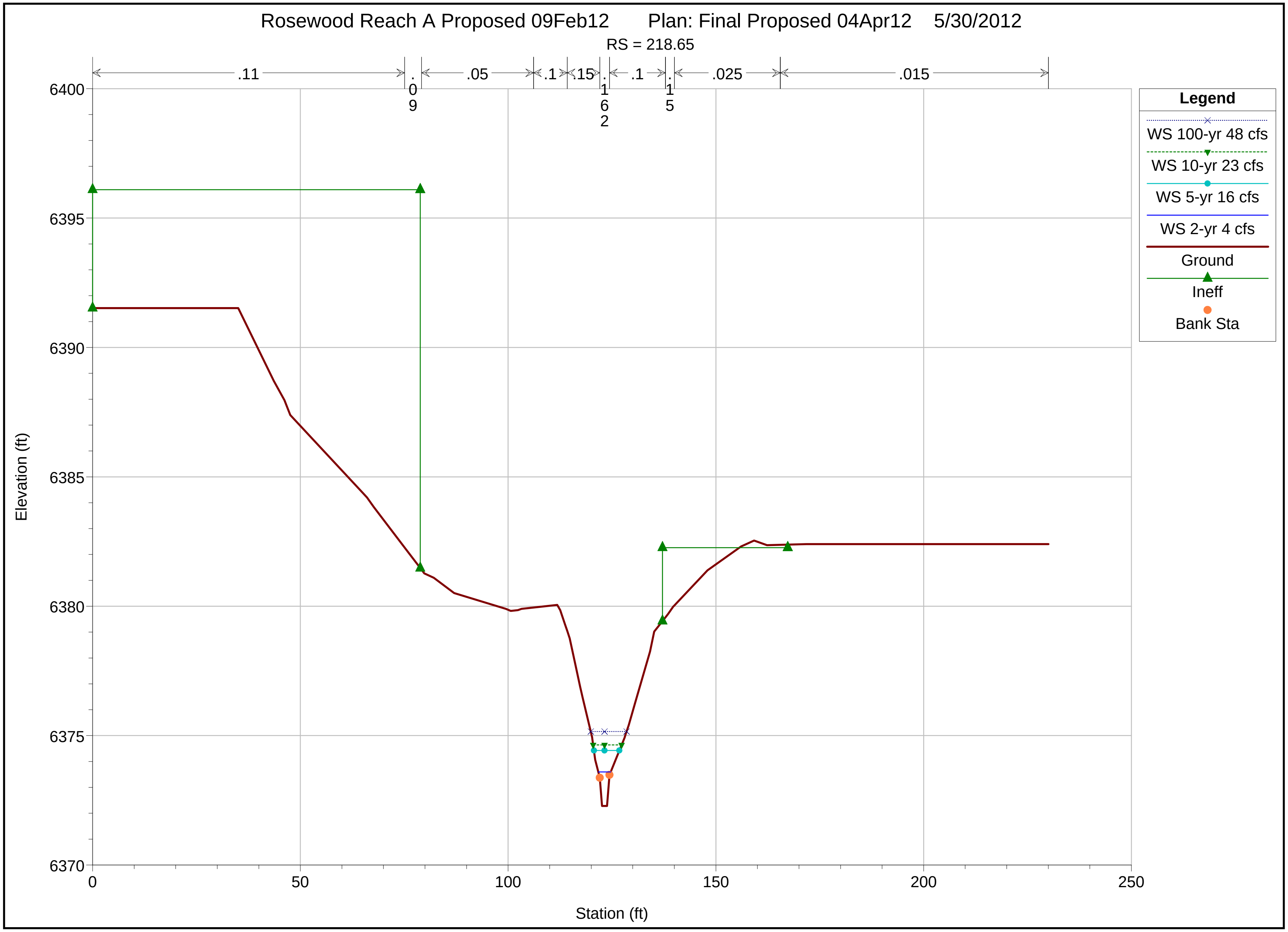


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

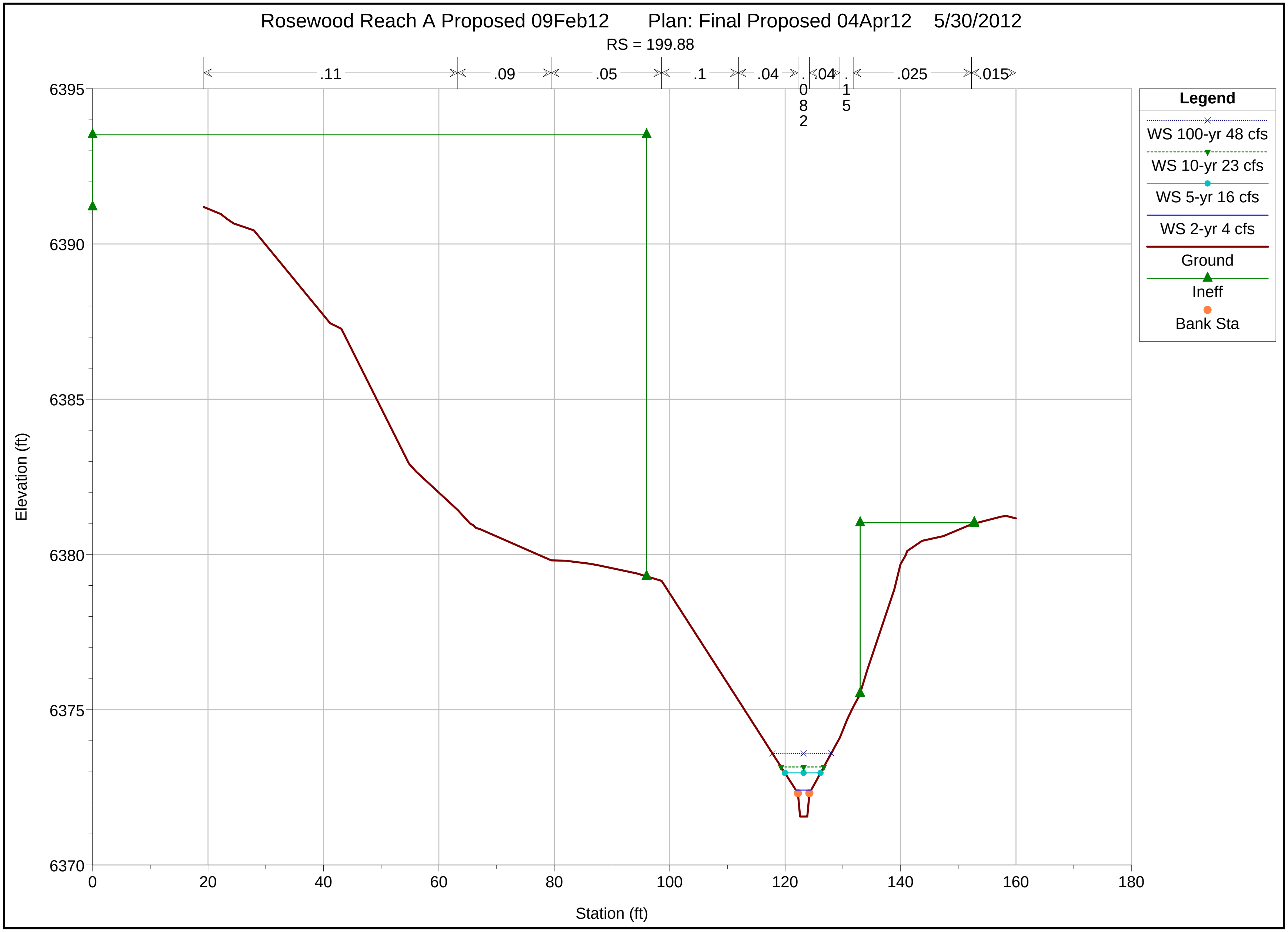
RS = 278.78

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 253.89
.11
.1
.15
.162
.15
.1
.15
.025
6390
6388
6386
6384
6382
6380
6378
6376
6374
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta

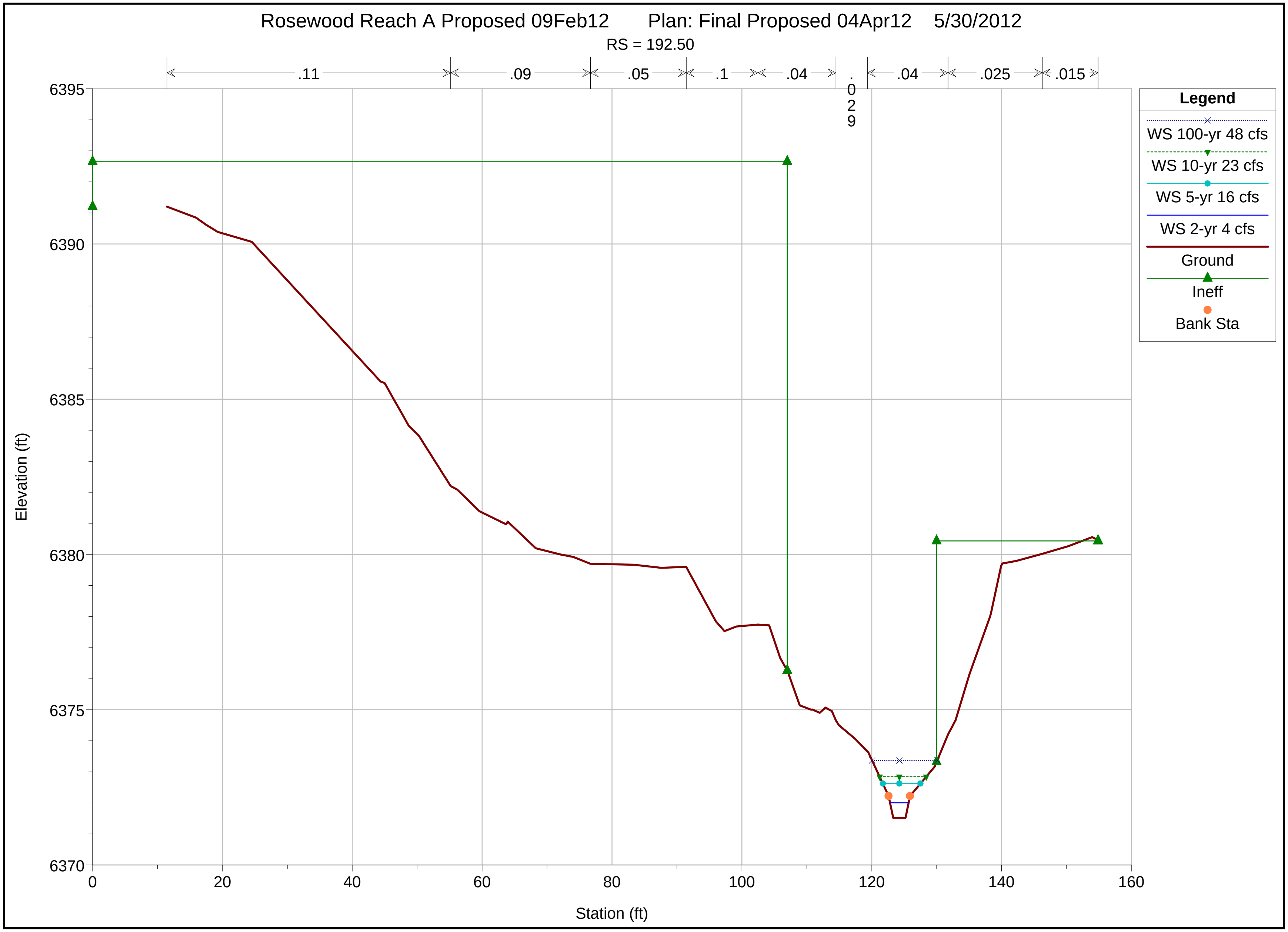

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 240.28
.11
.09
.05
.1
.05
.162
.05
.1
.15
.025
.15
.025
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6388
6386
6384
6382
6380
6378
6376
6374
Station (ft)
0
20
40
60
80
100
120
140
160
180


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012

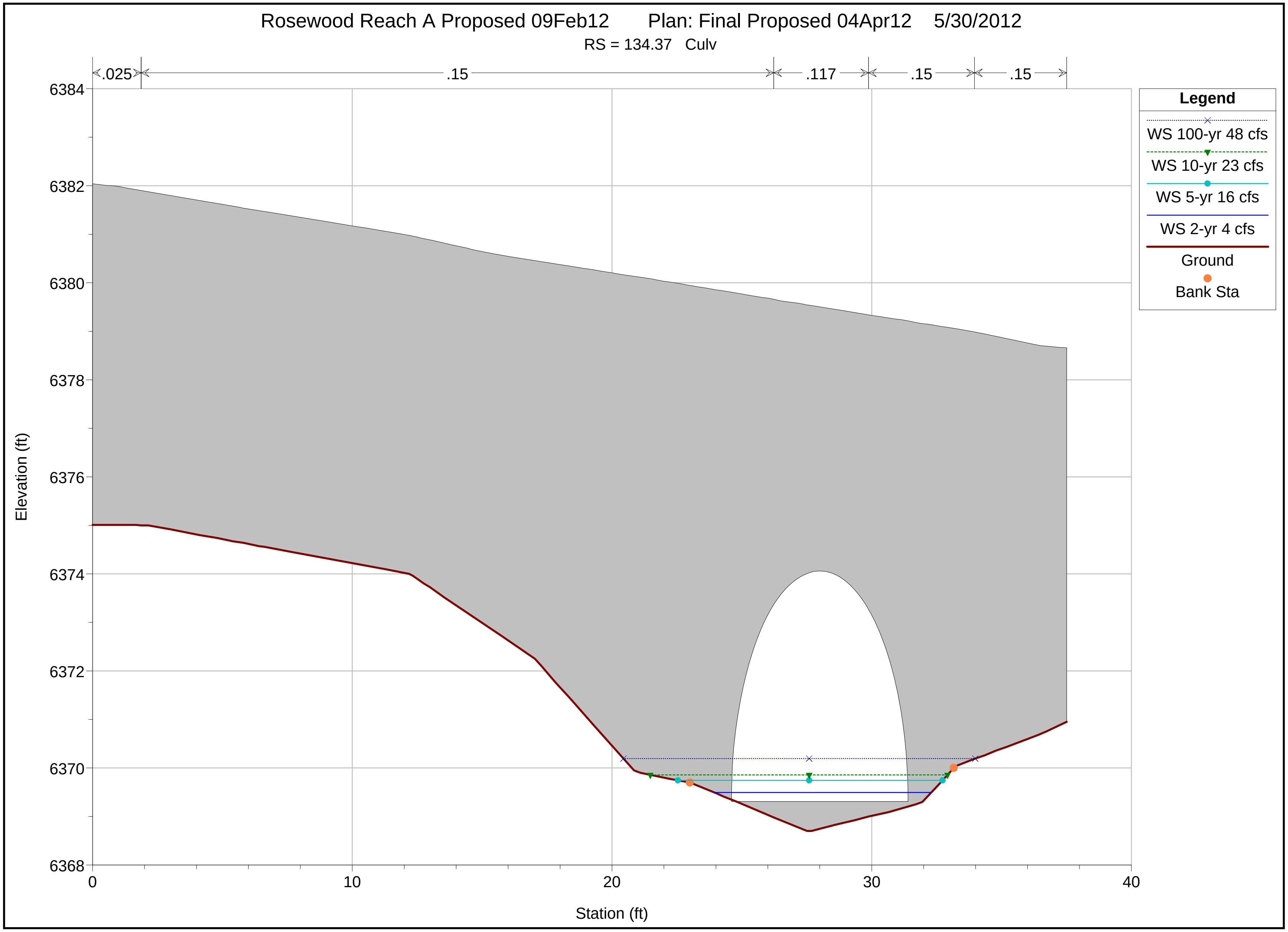
RS = 218.65

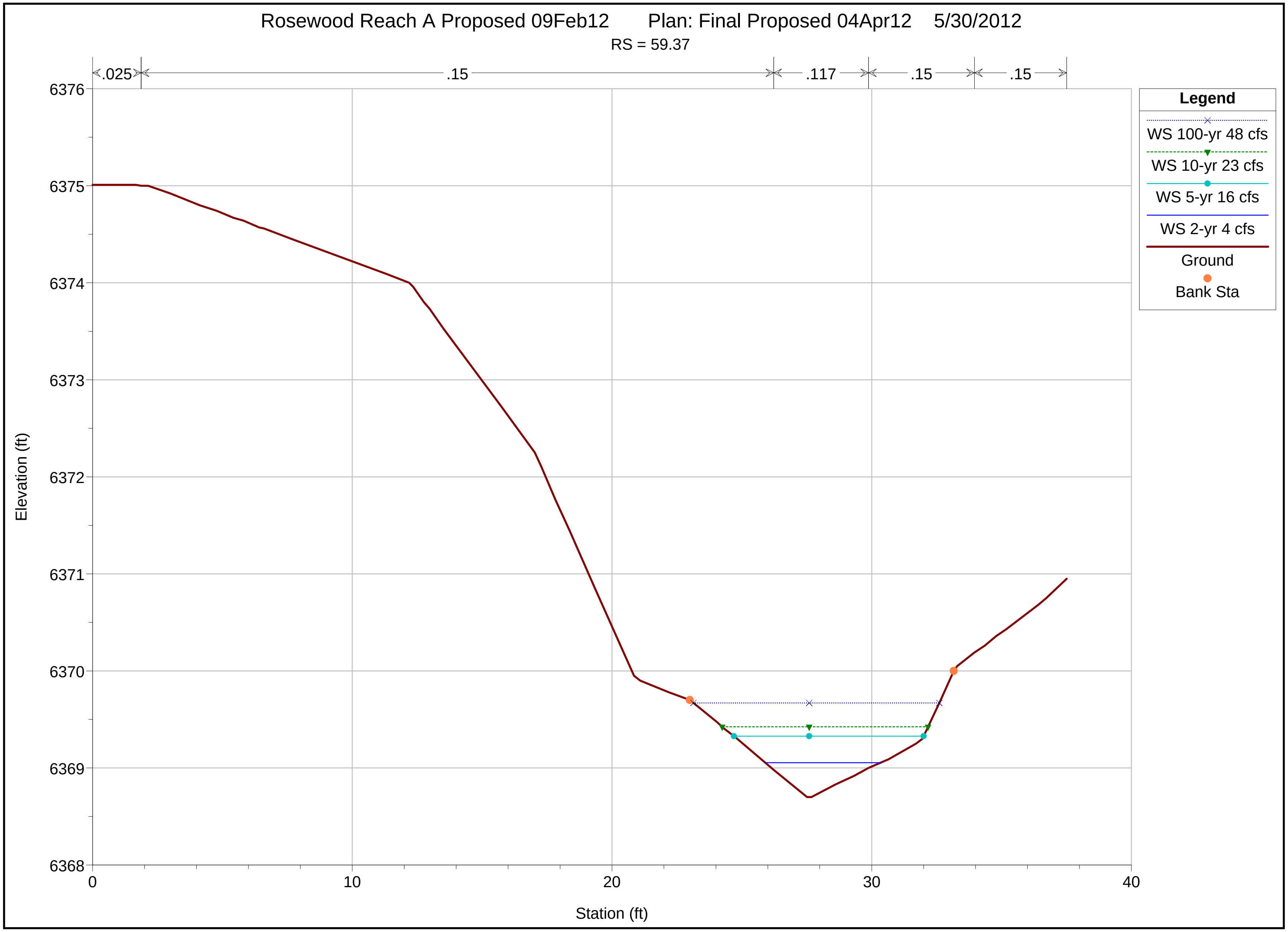


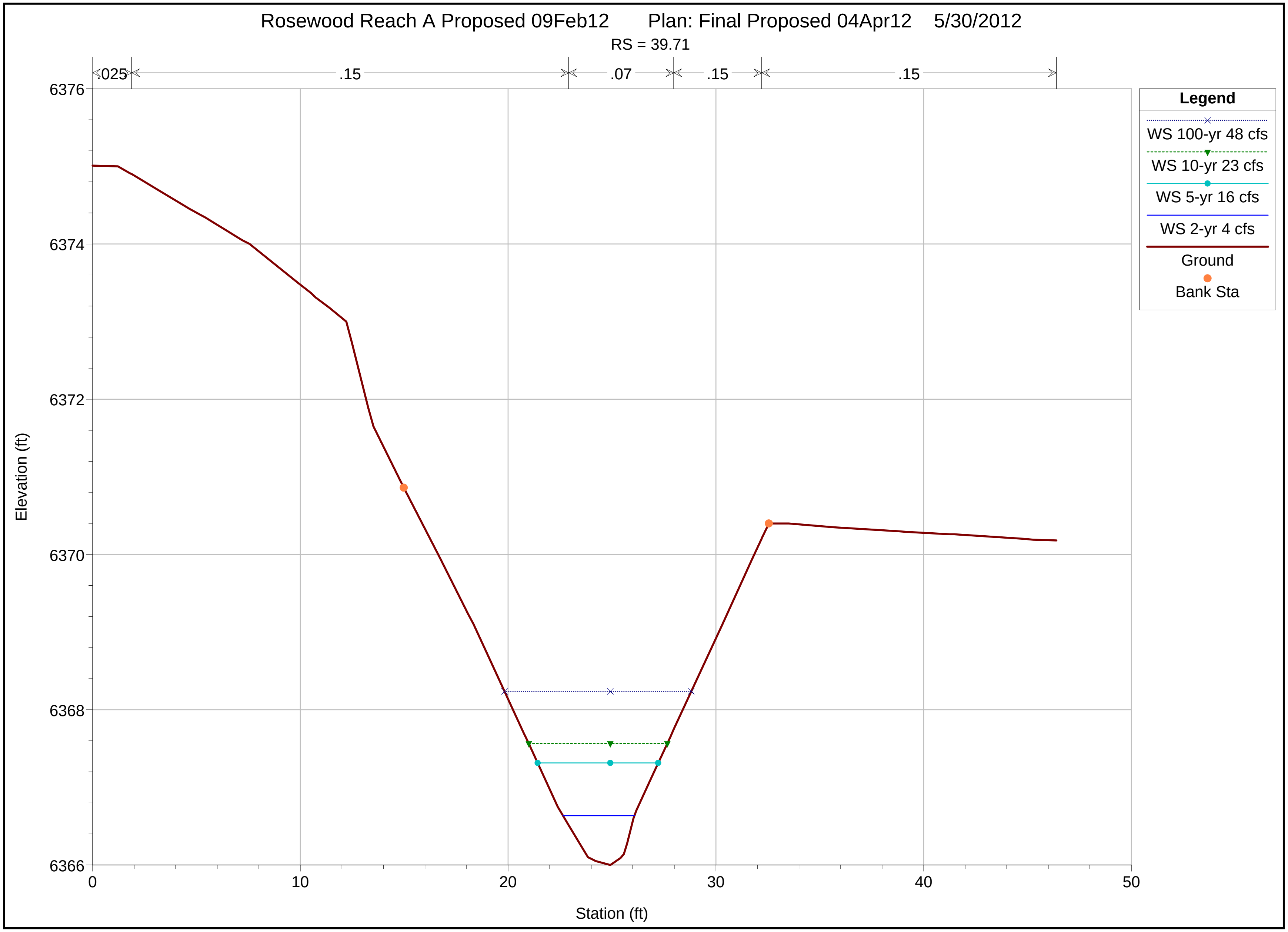
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 199.88
.11
.09
.05
.1
.04
.082
.04
.15
.025
.015
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
6395
6390
6385
6380
6375
6370
0
20
40
60
80
100
120
140
160
180
Station (ft)

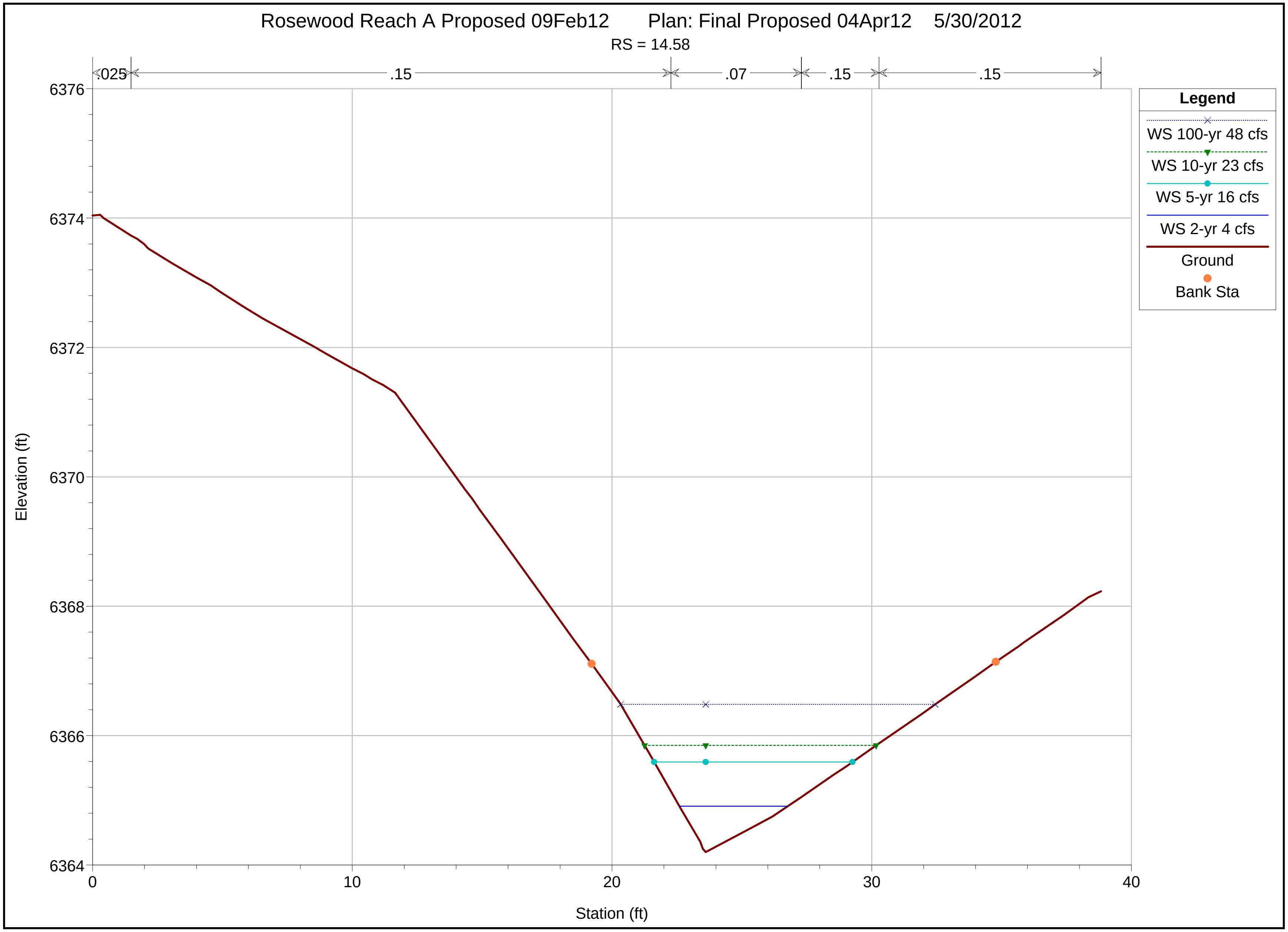

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 192.50
.11
.09
.05
.1
.04
.029
.04
.025
.015
Elevation (ft)
6395
6390
6385
6380
6375
6370
Station (ft)
0
20
40
60
80
100
120
140
160
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 134.37 Culv
.11
.09
.05
.1
.04
.029
.04
.025
.015
6395
6390
6385
6380
6375
6370
0
20
40
60
80
100
120
140
160
Elevation (ft)
Station (ft)
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Ineff
Bank Sta

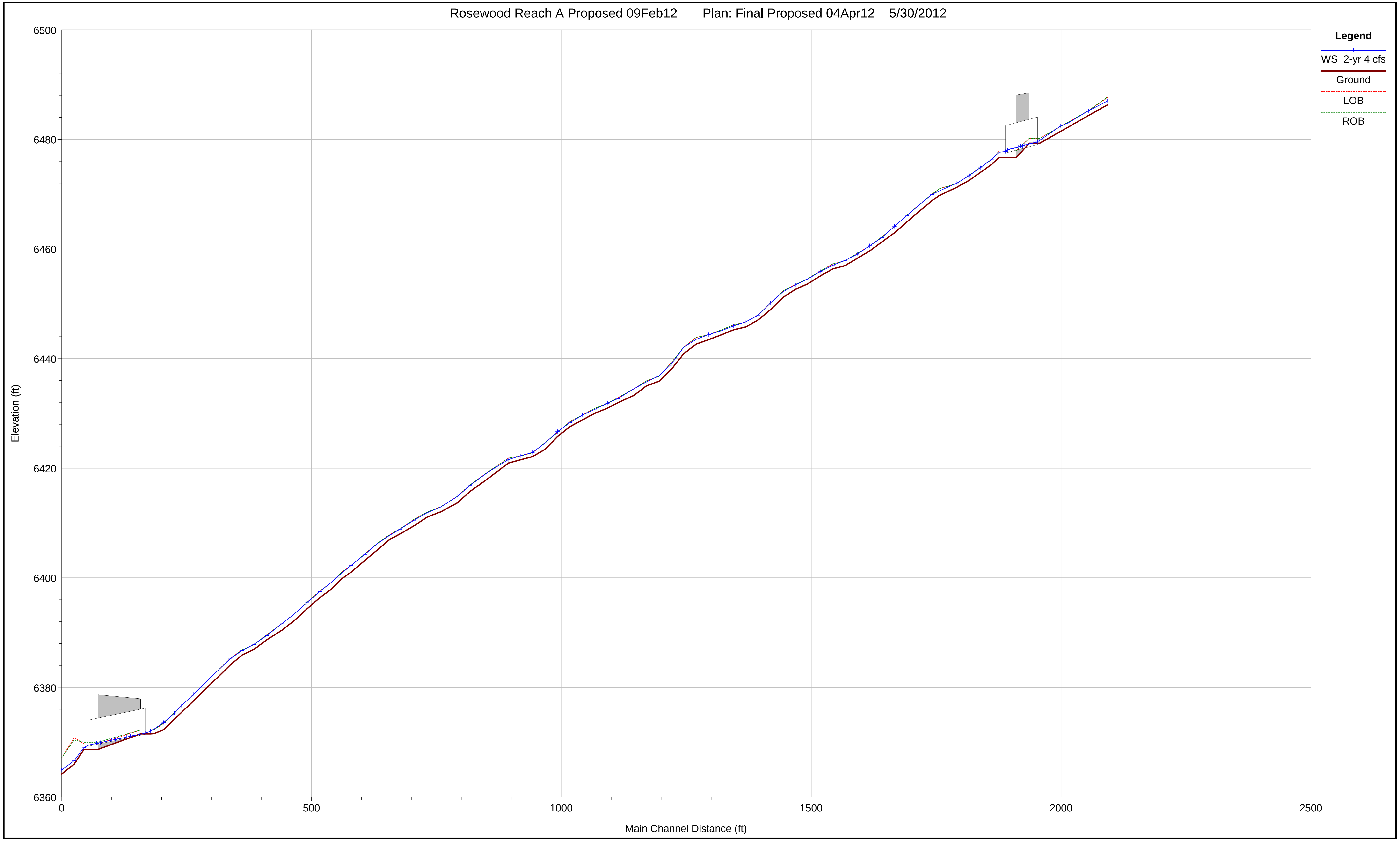

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 134.37 Culv
.025
.15
.117
.15
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6384
6382
6380
6378
6376
6374
6372
6370
6368
0
10
20
30
40
Station (ft)

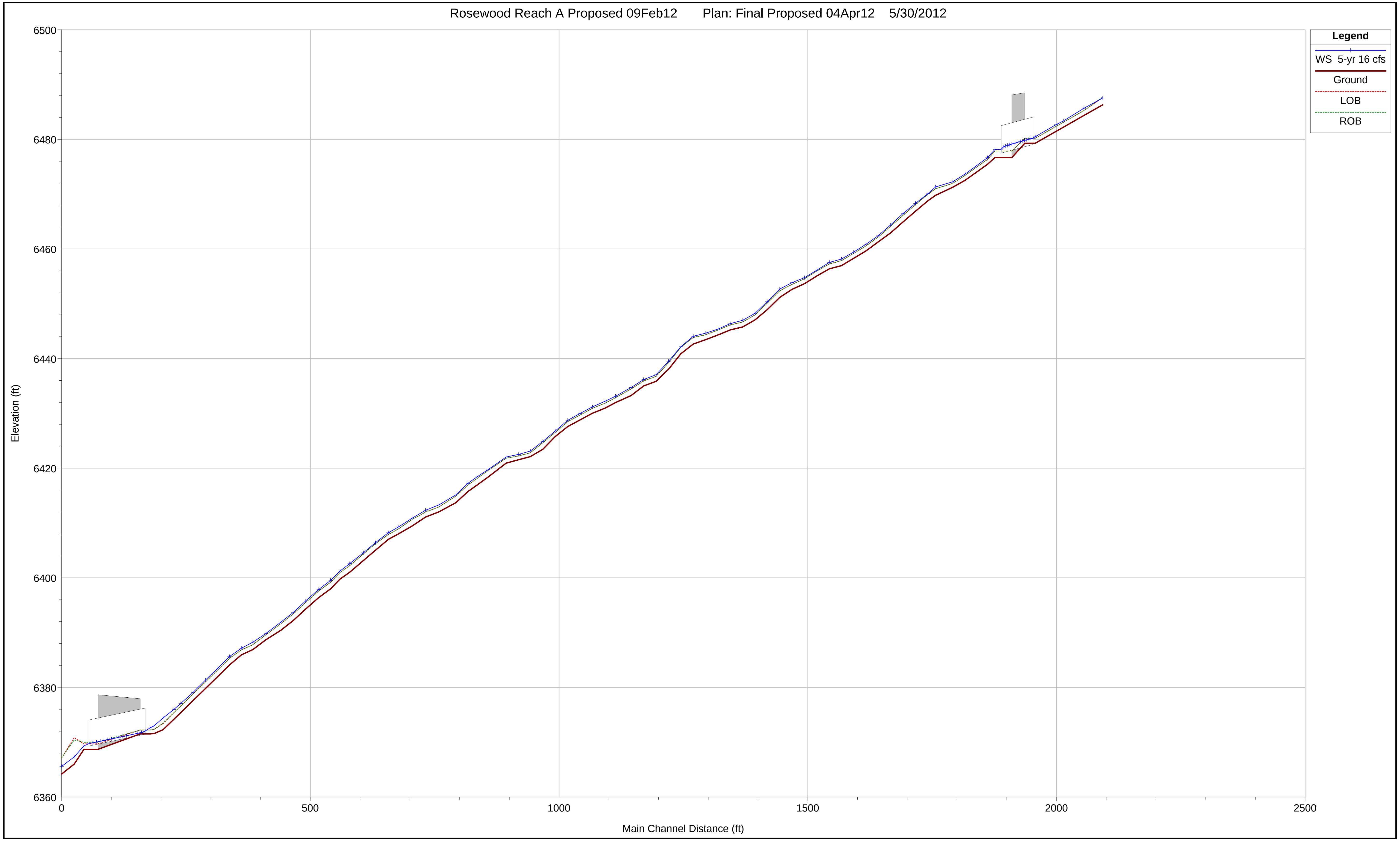

Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 59.37
.025
.15
.117
.15
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6376
6375
6374
6373
6372
6371
6370
6369
6368
Station (ft)
0
10
20
30
40


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 39.71
.025
.15
.07
.15
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6376
6374
6372
6370
6368
6366
Station (ft)
0
10
20
30
40
50

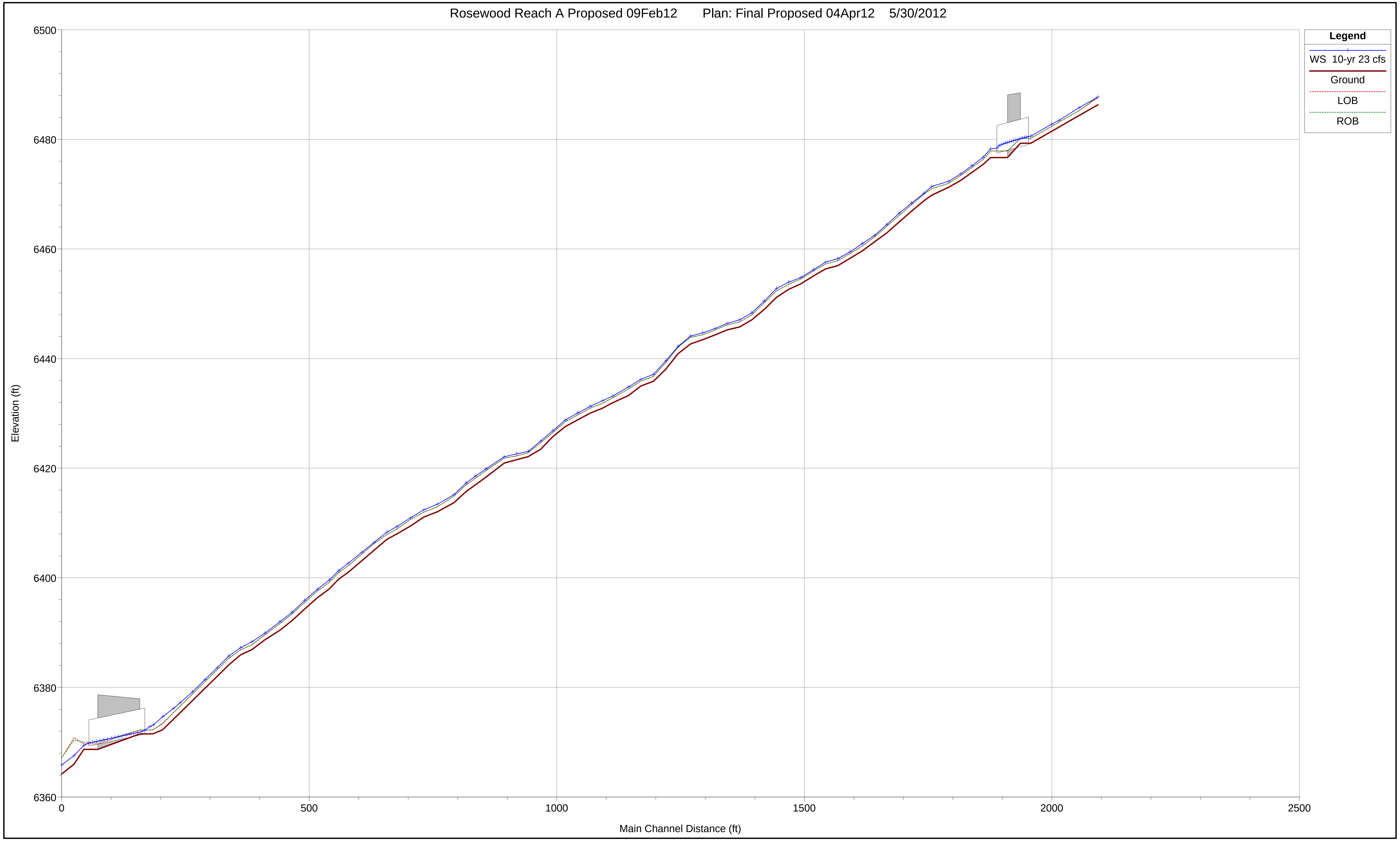


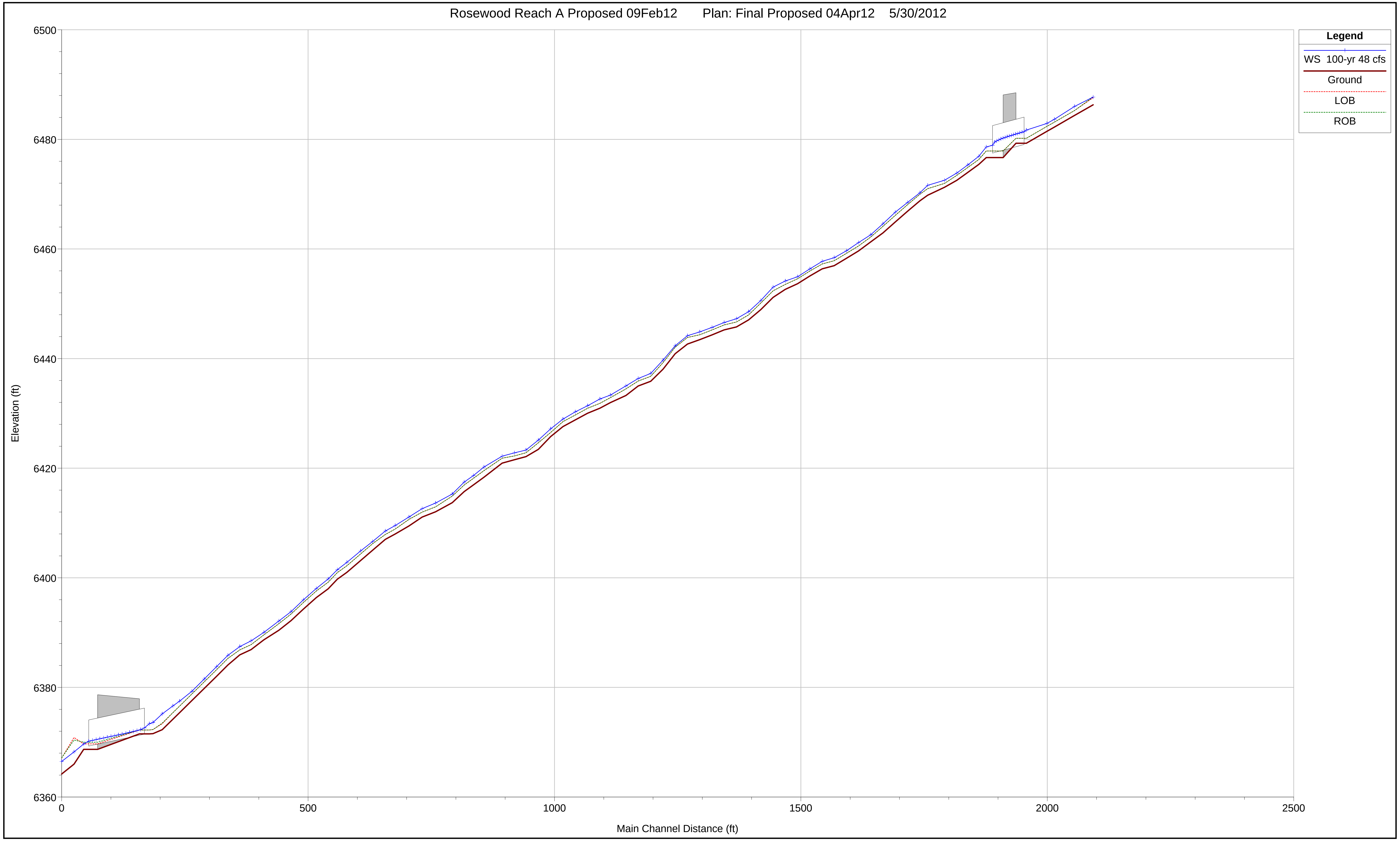
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
RS = 14.58
.025
.15
.07
.15
.15
Legend
WS 100-yr 48 cfs
WS 10-yr 23 cfs
WS 5-yr 16 cfs
WS 2-yr 4 cfs
Ground
Bank Sta
Elevation (ft)
6376
6374
6372
6370
6368
6366
6364
Station (ft)
0
10
20
30
40


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
Legend
WS 2-yr 4 cfs
Ground
LOB
ROB
Elevation (ft)
6500
6480
6460
6440
6420
6400
6380
6360
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

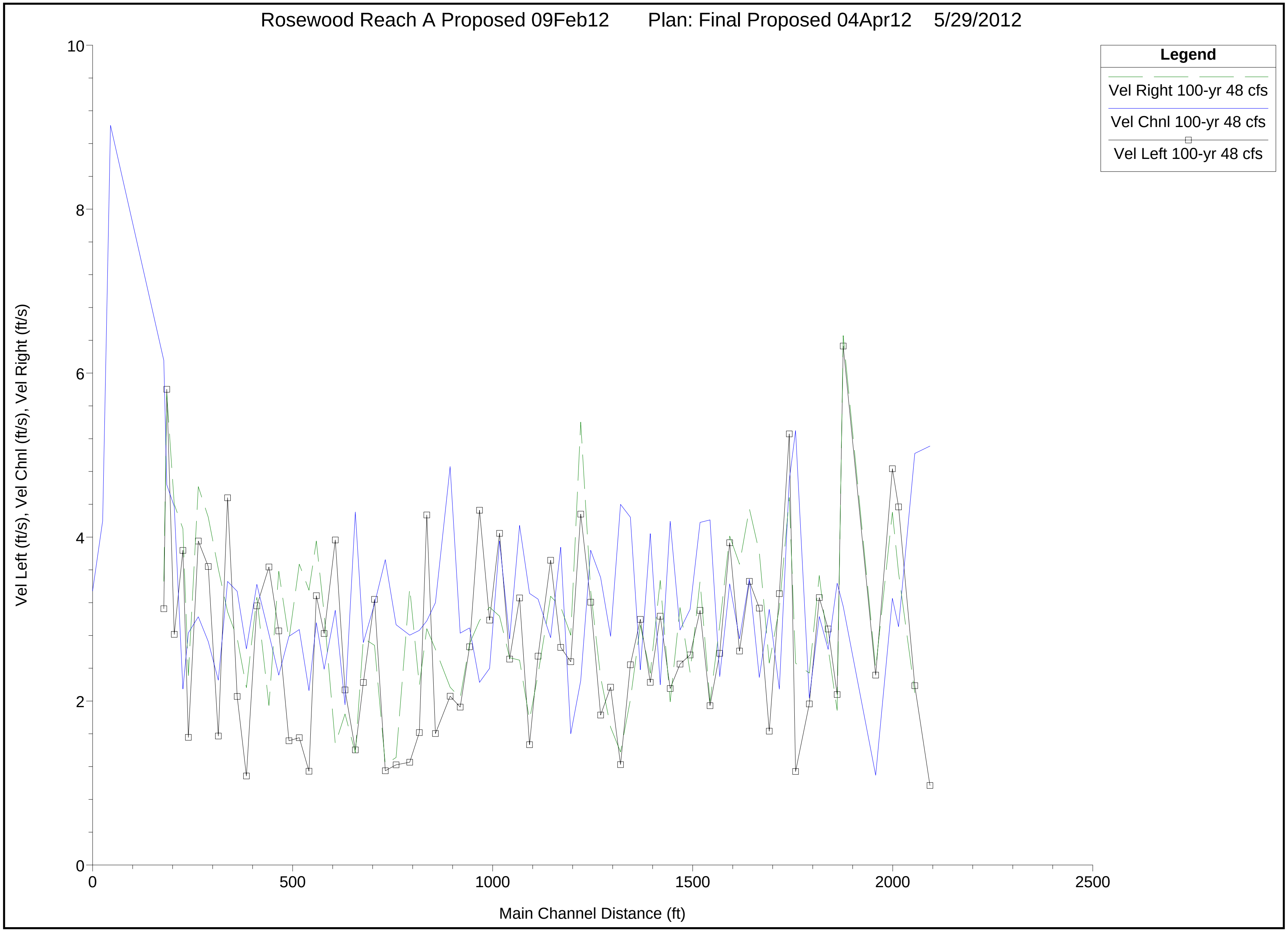


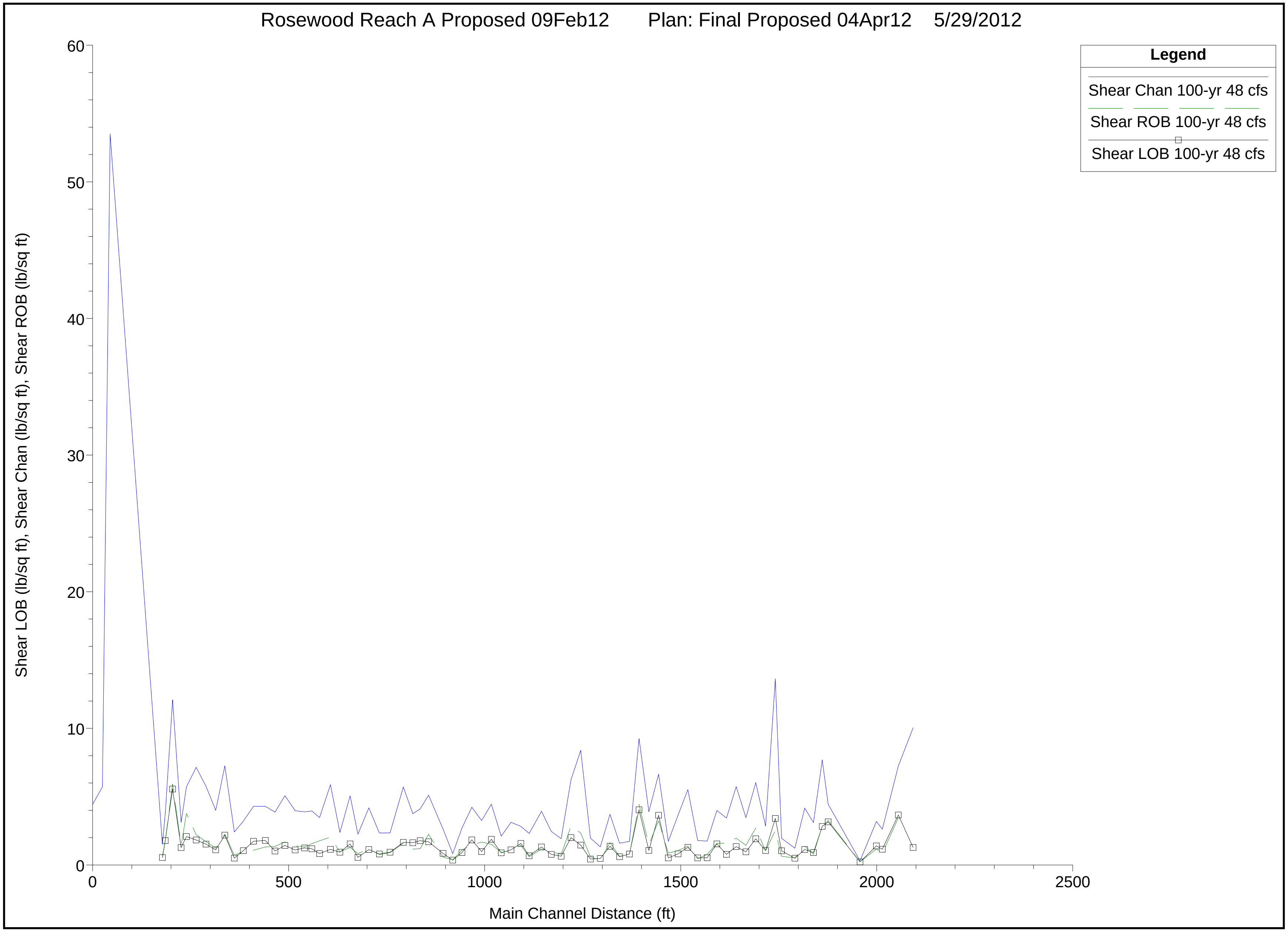
Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012
Legend
WS 10-yr 23 cfs
Ground
LOB
ROB
Elevation (ft)
6500
6480
6460
6440
6420
6400
6380
6360
Main Channel Distance (ft)
0
500
1000
1500
2000
2500



Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/30/2012


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/29/2012
Legend
Vel Right 100-yr 48 cfs
Vel Chnl 100-yr 48 cfs
Vel Left 100-yr 48 cfs
Vel Left (ft/s), Vel Chnl (ft/s), Vel Right (ft/s)
0
2
4
6
8
10
0
500
1000
1500
2000
2500
Main Channel Distance (ft)


Rosewood Reach A Proposed 09Feb12 Plan: Final Proposed 04Apr12 5/29/2012
Legend
Shear Chan 100-yr 48 cfs
Shear ROB 100-yr 48 cfs
Shear LOB 100-yr 48 cfs
Shear LOB (lb/sq ft), Shear Chan (lb/sq ft), Shear ROB (lb/sq ft)
60
50
40
30
20
10
0
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

HEC-RAS results for the estimated 100-year event with total discharge of 48 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
2,107.56	6,487.6	6,486.3	6,487.8	6,487.7	47.6	0.4		14.4	10.1	4.3		0.9	0.1		5.1	1.0		10.0	1.3	
2,069.70	6,485.3	6,484.4	6,485.3	6,486.0	23.1	10.1	14.9	24.3	3.3	7.9	13.1	1.4	0.6	0.5	5.0	2.2	2.1	7.3	3.7	3.5
2,028.96	6,483.1	6,482.2	6,483.1	6,483.7	11.3	13.7	23.1	31.5	3.3	7.3	20.8	1.2	0.4	0.3	2.9	4.4	3.6	2.6	1.2	0.9
2,013.81	6,482.4	6,481.5	6,482.4	6,482.9	12.9	7.6	27.5	24.5	3.3	3.5	17.7	1.2	0.4	0.4	3.3	4.8	4.3	3.2	1.4	1.2
1,971.94	6,480.2	6,479.3	6,480.2	6,481.7	7.8	22.2	18.1	16.2	3.3	7.4	5.5	2.2	1.3	1.4	1.1	2.3	2.4	0.3	0.2	0.2
1,890.78	6,477.9	6,476.7	6,477.9	6,478.6	12.4	13.3	22.3	10.0	2.4	2.9	4.6	1.6	0.7	0.7	3.2	6.3	6.5	4.5	3.2	3.3
1,875.70	6,476.3	6,475.4	6,476.3	6,476.9	14.1	15.6	18.3	49.4	3.3	20.2	25.9	1.2	0.4	0.4	3.4	2.1	1.9	7.7	2.8	2.9
1,853.14	6,474.9	6,474.0	6,474.9	6,475.3	9.7	20.2	18.1	59.4	3.3	26.3	29.8	1.1	0.3	0.2	2.6	2.9	2.6	3.1	0.9	0.8
1,830.88	6,473.4	6,472.5	6,473.4	6,473.9	10.8	19.8	17.4	45.3	3.3	25.2	16.7	1.1	0.2	0.3	3.0	3.3	3.5	4.2	1.1	1.4
1,805.92	6,472.0	6,471.3	6,472.0	6,472.5	7.6	19.5	20.9	51.2	3.3	25.8	22.0	1.1	0.4	0.4	2.0	2.0	2.3	1.2	0.5	0.5
1,771.81	6,471.0	6,469.8	6,471.0	6,471.6	19.2	19.7	9.1	49.0	2.4	34.5	12.1	1.5	0.5	0.3	5.3	1.1	2.5	2.0	1.0	0.6
1,755.99	6,470.0	6,468.8	6,470.0	6,470.3	13.1	24.8	10.1	45.6	2.4	26.2	17.0	1.2	0.2	0.1	4.7	5.3	4.5	13.6	3.4	2.5
1,731.03	6,468.1	6,466.9	6,468.1	6,468.5	6.8	27.9	13.3	44.7	2.4	28.0	14.3	1.3	0.3	0.3	2.2	3.3	3.1	2.9	1.1	1.0
1,706.04	6,466.1	6,464.9	6,466.1	6,466.7	11.1	18.8	18.1	59.9	2.4	39.7	17.8	1.5	0.3	0.4	3.1	1.6	2.5	6.0	1.9	2.7
1,681.08	6,464.1	6,462.9	6,464.1	6,464.6	7.5	23.3	17.2	47.0	2.4	31.7	12.9	1.4	0.2	0.4	2.3	3.1	3.8	3.5	1.0	1.4
1,656.21	6,462.2	6,461.3	6,462.2	6,462.6	12.2	19.2	16.6	43.7	3.3	27.5	12.9	1.1	0.2	0.3	3.5	3.5	4.4	5.7	1.3	2.0
1,631.54	6,460.5	6,459.6	6,460.5	6,461.2	11.6	10.1	26.4	34.3	3.3	16.3	14.7	1.3	0.2	0.5	2.8	2.6	3.7	3.4	0.8	1.6
1,606.91	6,459.2	6,458.3	6,459.2	6,459.7	12.7	16.9	18.4	27.8	3.3	12.0	12.5	1.1	0.4	0.4	3.4	3.9	4.0	4.0	1.5	1.6
1,582.17	6,457.9	6,457.0	6,457.9	6,458.4	9.2	21.9	17.0	45.0	3.3	28.5	13.1	1.2	0.3	0.4	2.3	2.6	2.9	1.8	0.5	0.8
1,557.87	6,457.3	6,456.4	6,457.3	6,457.8	15.7	18.2	14.1	68.3	3.3	34.9	30.1	1.1	0.3	0.2	4.2	1.9	2.0	1.8	0.5	0.5
1,532.88	6,456.0	6,455.1	6,456.0	6,456.4	14.5	16.3	17.2	52.7	3.3	26.2	23.2	1.1	0.2	0.2	4.2	3.1	3.5	5.5	1.3	1.4
1,508.01	6,454.6	6,453.7	6,454.6	6,454.9	10.6	4.5	33.0	70.5	3.3	9.3	57.8	1.0	0.2	0.2	3.1	2.6	2.4	3.7	0.8	1.1
1,483.04	6,453.5	6,452.6	6,453.5	6,454.2	12.1	23.4	12.5	41.5	3.3	30.7	7.5	1.3	0.3	0.5	2.9	2.5	3.1	1.7	0.5	0.9
1,458.23	6,452.4	6,451.2	6,452.4	6,453.0	15.7	13.9	18.4	34.0	2.4	12.1	19.5	1.6	0.5	0.5	4.2	2.2	2.0	6.6	3.6	3.2
1,433.29	6,450.1	6,448.9	6,450.1	6,450.6	7.2	21.7	19.1	50.7	2.4	31.3	17.0	1.4	0.2	0.3	2.2	3.0	3.5	3.9	1.1	1.5
1,408.46	6,448.0	6,447.1	6,448.0	6,448.6	16.6	19.0	12.5	33.4	3.3	19.2	10.9	1.2	0.4	0.5	4.0	2.2	2.3	9.3	4.0	4.4
1,383.72	6,446.7	6,445.8	6,446.7	6,447.3	9.8	17.7	20.5	31.0	3.3	12.2	15.5	1.3	0.5	0.5	2.4	3.0	2.9	1.7	0.8	0.8
1,358.88	6,446.1	6,445.2	6,446.1	6,446.6	15.3	9.9	22.8	47.1	3.3	11.9	31.9	1.1	0.3	0.4	4.2	2.4	2.0	1.6	0.6	0.6
1,334.28	6,445.2	6,444.3	6,445.2	6,445.7	16.1	6.2	25.7	64.8	3.3	15.1	46.4	1.1	0.3	0.4	4.4	1.2	1.4	3.7	1.4	1.6
1,309.40	6,444.4	6,443.5	6,444.4	6,444.9	10.8	17.4	19.8	72.2	3.3	23.4	45.5	1.2	0.3	0.3	2.8	2.2	1.7	1.3	0.5	0.4
1,284.43	6,443.9	6,442.7	6,443.9	6,444.2	10.4	7.1	30.6	83.8	2.4	23.3	58.1	1.2	0.2	0.2	3.5	1.8	2.3	2.0	0.4	0.6
1,259.52	6,442.1	6,440.9	6,442.1	6,442.3	10.6	6.6	30.8	65.7	2.4	16.7	46.6	1.2	0.1	0.2	3.8	3.2	3.4	8.4	1.5	2.3
1,234.79	6,439.3	6,438.1	6,439.3	6,439.7	7.3	28.6	12.1	33.0	2.4	24.8	5.8	1.4	0.3	0.4	2.3	4.3	5.4	6.3	2.0	2.8
1,209.85	6,436.8	6,435.9	6,436.8	6,437.3	6.2	22.0	19.8	49.6	3.3	27.8	18.5	1.2	0.3	0.4	1.6	2.5	2.8	1.9	0.6	0.8
1,184.54	6,435.9	6,435.0	6,435.9	6,436.4	14.4	18.7	14.9	40.5	3.3	24.3	12.9	1.1	0.3	0.4	3.9	2.7	3.2	2.5	0.8	1.0
1,159.57	6,434.5	6,433.3	6,434.5	6,435.0	9.7	36.2	2.1	37.0	2.4	32.3	2.3	1.5	0.3	0.3	2.8	3.7	3.3	3.9	1.3	1.2
1,128.03	6,432.9	6,432.0	6,432.9	6,433.3	12.1	18.6	17.3	61.3	3.3	26.9	31.1	1.1	0.3	0.2	3.2	2.6	2.3	2.3	0.7	0.6
1,106.83	6,431.8	6,430.9	6,431.8	6,432.6	15.7	8.0	24.3	34.4	3.3	8.2	22.9	1.4	0.7	0.6	3.3	1.5	1.8	2.8	1.6	1.4
1,081.77	6,430.9	6,430.0	6,430.9	6,431.4	15.3	17.8	14.9	39.5	3.3	16.8	19.3	1.1	0.3	0.3	4.1	3.3	2.5	3.1	1.1	1.1
1,056.88	6,429.7	6,428.8	6,429.7	6,430.3	11.1	19.4	17.5	37.4	3.3	18.3	15.8	1.2	0.4	0.4	2.8	2.5	2.5	2.1	0.9	0.9
1,031.81	6,428.5	6,427.6	6,428.5	6,429.0	14.7	14.1	19.2	32.5	3.3	8.9	20.3	1.1	0.4	0.3	4.0	4.1	3.0	4.5	1.9	1.5
1,006.81	6,426.5	6,425.8	6,426.5	6,427.2	6.1	1.3	40.6	32.2	2.0	1.5	28.7	1.3	0.3	0.5	2.4	3.0	3.1	3.3	1.0	1.7
981.85	6,424.6	6,423.4	6,424.6	6,425.1	7.4	18.9	21.7	38.5	2.4	11.7	24.5	1.4	0.4	0.3	2.2	4.3	3.0	4.2	1.8	1.5
956.72	6,422.8	6,422.1	6,422.8	6,423.3	10.0	20.7	17.3	46.8	3.3	25.8	17.7	1.1	0.3	0.4	2.9	2.7	2.7	2.7	0.9	1.1
933.31	6,422.2	6,421.5	6,422.2	6,422.8	10.4	24.9	12.7	49.6	3.3	31.9	14.4	1.1	0.4	0.4	2.8	1.9	2.0	0.8	0.4	0.4
908.33	6,421.8	6,420.9	6,421.8	6,422.2	16.4	22.4	9.2	66.2	3.3	40.1	22.8	1.0	0.3	0.2	4.9	2.1	2.2	2.6	0.9	0.6
871.52	6,419.6	6,418.4	6,419.6	6,420.2	12.0	1.4	34.6	36.2	2.4	2.6	31.1	1.6	0.3	0.4	3.2	1.6	2.6	5.1	1.7	2.2
849.98	6,418.1	6,416.9	6,418.1	6,418.7	10.1	12.7	25.3	44.8	2.4	7.8	34.6	1.4	0.4	0.3	3.0	4.3	2.9	4.1	1.8	1.2
831.35	6,416.9	6,415.7	6,416.9	6,417.5	9.9	16.9	21.2	64.6	2.4	27.1	35.1	1.4	0.4	0.3	2.9	1.6	2.2	3.8	1.6	1.2
807.12	6,414.9	6,413.7	6,414.9	6,415.3	8.6	23.4	16.0	105.6	2.4	81.7	21.5	1.3	0.2	0.2	2.8	1.3	3.4	5.7	1.7	1.6
773.29	6,412.9	6,412.0	6,412.9	6,413.6	13.0	14.7	20.3	67.4	3.3	27.4	36.7	1.4	0.4	0.4	2.9	1.2	1.3	2.4	0.9	0.9
746.18	6,412.0	6,411.1	6,412.0	6,412.6	15.9	19.4	12.7	80.0	3.3	46.7	30.1	1.3	0.4	0.3	3.7	1.2	1.2	2.3	0.8	0.8
719.27	6,410.7	6,409.5	6,410.7	6,411.1	10.2	21.8	16.0	57.8	2.4	30.0	25.4	1.3	0.2	0.2	3.2	3.2	2.7	4.2	1.1	1.2
691.39	6,408.9	6,408.0	6,408.9	6,409.5	11.6	17.0	19.4	50.3	3.3	29.2	17.8	1.3	0.3	0.4	2.7	2.2	2.8	2.3	0.6	0.8
671.41	6,407.9	6,407.0	6,407.9	6,408.5	18.3	14.7	15.1	77.3	3.3	32.6	41.4	1.3	0.3	0.3	4.3	1.4	1.4	5.1	1.6	1.3
645.51	6,406.2	6,405.0	6,406.2	6,406.6	6.0	13.6	28.4	71.0	2.4	20.4	48.2	1.3	0.3	0.3	2.0	2.1	1.8	2.4	0.9	1.0
621.14	6,404.4	6,403.2	6,404.4	6,404.9	10.8	18.4	18.8	69.8	2.4	26.6	40.9	1.5	0.2	0.3	3.1	4.0	1.5	5.9	1.1	2.0

HEC-RAS results for the estimated 100-year event with total discharge of 48 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
593.44	6,402.2	6,401.0	6,402.2	6,402.8	8.7	14.4	25.0	42.1	2.4	22.7	17.0	1.5	0.2	0.5	2.4	2.8	3.1	3.5	0.8	1.8
573.89	6,400.9	6,399.7	6,400.9	6,401.5	10.2	4.7	33.1	31.6	2.4	5.4	23.9	1.4	0.3	0.4	3.0	3.3	4.0	4.0	1.2	1.6
555.42	6,399.2	6,398.0	6,399.2	6,399.8	7.7	2.0	38.3	44.6	2.4	6.0	36.3	1.5	0.3	0.3	2.1	1.1	3.4	3.9	1.3	1.3
531.28	6,397.6	6,396.4	6,397.6	6,398.1	9.5	1.7	36.8	40.5	2.4	4.7	33.3	1.4	0.2	0.3	2.9	1.6	3.7	4.0	1.1	1.4
505.26	6,395.5	6,394.3	6,395.5	6,396.0	9.3	8.6	30.1	64.5	2.4	23.7	38.5	1.4	0.2	0.3	2.8	1.5	2.8	5.1	1.4	1.7
479.88	6,393.4	6,392.2	6,393.4	6,393.8	7.5	18.9	21.6	52.8	2.4	29.9	20.5	1.4	0.2	0.3	2.3	2.9	3.6	3.9	1.0	1.4
455.34	6,391.6	6,390.4	6,391.6	6,392.1	9.4	22.3	16.3	50.8	2.4	16.9	31.5	1.4	0.4	0.3	2.8	3.6	2.0	4.3	1.8	1.3
425.07	6,389.6	6,388.7	6,389.6	6,390.1	12.6	12.7	22.7	44.7	3.3	10.9	30.5	1.1	0.4	0.2	3.4	3.2	3.3	4.3	1.7	1.1
398.95	6,387.8	6,386.9	6,387.8	6,388.5	11.8	1.0	35.2	53.1	3.3	2.5	47.3	1.4	0.4	0.3	2.6	1.1	2.2	3.2	1.1	1.0
375.95	6,386.9	6,385.9	6,386.8	6,387.5	13.9	0.4	33.8	44.4	3.3	0.6	40.5	1.3	0.3	0.3	3.3	2.1	2.8	2.4	0.5	0.7
351.90	6,385.3	6,384.1	6,385.3	6,385.9	12.1	2.8	33.0	42.7	2.4	2.2	38.0	1.5	0.3	0.3	3.5	4.5	3.1	7.3	2.2	2.3
328.75	6,383.2	6,382.0	6,383.2	6,383.8	7.9	0.5	39.6	42.9	2.4	1.1	39.4	1.5	0.3	0.3	2.3	1.6	3.6	4.0	1.1	1.2
303.79	6,381.0	6,379.8	6,381.0	6,381.5	9.3	1.0	37.7	37.7	2.4	1.0	34.3	1.4	0.3	0.3	2.7	3.6	4.2	5.8	1.5	1.7
278.78	6,378.8	6,377.6	6,378.8	6,379.3	10.1	1.0	36.9	33.5	2.4	1.0	30.1	1.4	0.3	0.3	3.0	4.0	4.6	7.2	1.8	2.2
253.89	6,376.6	6,375.4	6,376.6	6,377.5	12.3	1.3	34.4	24.3	2.4	1.8	20.1	1.8	0.5	0.7	2.8	1.6	2.3	5.7	2.1	3.8
240.28	6,375.4	6,374.2	6,375.4	6,376.6	11.0	5.9	31.2	17.3	2.4	2.5	12.3	2.1	0.6	0.6	2.2	3.8	4.1	3.1	1.3	1.5
218.65	6,373.4	6,372.3	6,373.5	6,375.2	26.6	6.0	15.5	8.6	2.3	2.2	4.1	2.6	1.0	0.9	4.4	2.8	4.4	12.1	5.6	5.9
199.88	6,372.3	6,371.6	6,372.3	6,373.6	17.6	16.5	13.9	10.2	2.0	4.4	3.8	1.9	0.6	0.6	4.6	5.8	5.8	3.8	1.8	1.8
192.50	6,372.2	6,371.5	6,372.2	6,373.4	34.5	4.6	8.9	9.9	3.3	2.6	4.1	1.7	0.6	0.6	6.2	3.1	3.5	1.5	0.6	0.6
Ave					12.5	14.2	21.6	45.5	3.0	18.6	24.2	1.3	0.4	0.4	3.2	2.7	3.0	4.1	1.4	1.5
Median					11.1	16.4	19.2	44.7	3.3	18.8	21.5	1.3	0.3	0.3	3.0	2.6	2.9	3.8	1.1	1.3
Max					47.6	36.2	40.6	105.6	10.1	81.7	58.1	2.6	1.3	1.4	6.2	6.3	6.5	13.6	5.6	5.9
Min					6.0	0.4	2.1	8.6	2.0	0.6	2.3	0.9	0.1	0.1	1.1	1.0	1.2	0.3	0.2	0.2

HEC-RAS results for the estimated 10-year event with total discharge of 23 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
2,107.56	6,487.6	6,486.3	6,487.8	6,487.7	22.7	0.3		14.6	10.2	4.5		0.9	0.1		2.4	0.5		2.2	0.3	
2,069.70	6,485.3	6,484.4	6,485.3	6,485.8	13.8	4.0	5.2	23.9	3.3	7.5	13.1	1.2	0.4	0.3	3.6	1.4	1.2	3.8	1.6	1.3
2,028.96	6,483.1	6,482.2	6,483.1	6,483.5	9.6	6.2	7.2	26.6	3.3	6.9	16.4	1.0	0.3	0.2	3.0	3.6	2.7	2.9	0.9	0.6
2,013.81	6,482.4	6,481.5	6,482.4	6,482.8	8.8	3.7	10.5	23.5	3.3	3.2	17.0	1.1	0.3	0.2	2.5	3.4	2.7	2.0	0.8	0.5
1,971.94	6,480.2	6,479.3	6,480.2	6,480.6	12.3	4.9	5.9	15.9	3.3	7.1	5.5	1.1	0.2	0.3	3.5	3.5	4.1	4.1	0.9	1.2
1,890.78	6,477.9	6,476.7	6,477.9	6,478.3	9.5	4.9	8.6	10.0	2.4	2.9	4.6	1.3	0.4	0.4	3.1	4.6	4.8	4.5	2.1	2.2
1,875.70	6,476.3	6,475.4	6,476.3	6,476.7	10.3	6.4	6.3	41.7	3.3	15.7	22.6	1.1	0.3	0.2	3.0	1.5	1.2	6.1	2.0	1.6
1,853.14	6,474.9	6,474.0	6,474.9	6,475.2	7.7	7.5	7.8	46.9	3.3	22.3	21.2	1.0	0.2	0.2	2.4	2.1	2.2	2.7	0.5	0.5
1,830.88	6,473.4	6,472.5	6,473.4	6,473.7	9.0	6.9	7.2	39.5	3.3	20.0	16.2	1.0	0.2	0.2	2.9	2.4	2.6	3.9	0.7	0.9
1,805.92	6,472.0	6,471.3	6,472.0	6,472.3	6.4	8.3	8.3	49.5	3.3	25.0	21.2	0.9	0.2	0.2	2.1	1.7	1.8	1.4	0.3	0.4
1,771.81	6,471.0	6,469.8	6,471.0	6,471.4	12.9	7.5	2.7	43.5	2.4	33.0	8.1	1.3	0.3	0.2	4.1	0.7	1.6	1.2	0.5	0.3
1,755.99	6,470.0	6,468.8	6,470.0	6,470.1	14.1	6.3	2.6	35.1	2.4	23.2	9.5	1.1	0.1	0.1	5.6	3.7	3.8	20.2	2.3	2.3
1,731.03	6,468.1	6,466.9	6,468.1	6,468.4	5.6	12.1	5.3	41.3	2.4	25.1	13.8	1.2	0.2	0.2	2.0	2.4	2.2	2.5	0.7	0.6
1,706.04	6,466.1	6,464.9	6,466.1	6,466.5	9.0	6.2	7.8	45.5	2.4	27.4	15.7	1.3	0.2	0.3	2.9	1.1	1.8	5.3	1.3	1.9
1,681.08	6,464.1	6,462.9	6,464.1	6,464.5	6.3	8.5	8.1	36.9	2.4	22.4	12.1	1.2	0.2	0.2	2.2	2.3	2.9	3.2	0.7	1.0
1,656.21	6,462.2	6,461.3	6,462.2	6,462.5	9.7	6.7	6.7	34.5	3.3	18.8	12.4	0.9	0.1	0.2	3.2	2.6	3.0	4.9	0.9	1.2
1,631.54	6,460.5	6,459.6	6,460.5	6,461.0	7.8	4.4	10.9	24.5	3.3	7.0	14.1	1.1	0.3	0.3	2.2	2.4	2.5	2.3	0.7	0.8
1,606.91	6,459.2	6,458.3	6,459.2	6,459.5	10.7	5.7	6.6	27.2	3.3	11.8	12.1	0.9	0.2	0.2	3.5	2.8	2.9	4.3	1.0	1.1
1,582.17	6,457.9	6,457.0	6,457.9	6,458.2	7.1	8.4	7.5	35.3	3.3	19.2	12.8	1.0	0.2	0.3	2.1	1.9	2.2	1.6	0.4	0.5
1,557.87	6,457.3	6,456.4	6,457.3	6,457.6	11.1	7.0	4.9	52.8	3.3	28.3	21.2	1.0	0.2	0.2	3.4	1.4	1.4	1.2	0.3	0.3
1,532.88	6,456.0	6,455.1	6,456.0	6,456.2	13.4	5.0	4.6	32.6	3.3	15.0	14.3	0.9	0.1	0.1	4.7	3.0	2.9	7.3	1.1	1.1
1,508.01	6,454.6	6,453.7	6,454.6	6,454.8	8.5	1.5	13.0	62.2	3.3	6.2	52.7	0.9	0.1	0.1	2.9	2.0	1.9	3.2	0.5	0.6
1,483.04	6,453.5	6,452.6	6,453.5	6,454.0	9.3	7.6	6.1	31.2	3.3	20.7	7.1	1.1	0.2	0.4	2.6	1.8	2.5	1.5	0.4	0.6
1,458.23	6,452.4	6,451.2	6,452.4	6,452.8	11.5	5.2	6.2	30.3	2.4	11.1	16.9	1.3	0.3	0.3	3.7	1.5	1.4	5.4	2.1	1.8
1,433.29	6,450.1	6,448.9	6,450.1	6,450.5	6.0	8.5	8.5	41.2	2.4	22.0	16.8	1.2	0.2	0.2	2.0	2.4	2.7	3.5	0.7	0.9
1,408.46	6,448.0	6,447.1	6,448.0	6,448.3	11.9	6.2	4.9	32.5	3.3	18.7	10.4	1.0	0.2	0.3	3.5	1.4	1.6	7.5	2.1	2.6
1,383.72	6,446.7	6,445.8	6,446.7	6,447.1	7.0	7.6	8.4	29.9	3.3	11.9	14.8	1.1	0.3	0.3	2.0	2.1	2.0	1.3	0.5	0.4
1,358.88	6,446.1	6,445.2	6,446.1	6,446.4	11.2	3.4	8.4	44.9	3.3	11.6	30.0	0.9	0.2	0.2	3.6	1.6	1.3	1.2	0.3	0.3
1,334.28	6,445.2	6,444.3	6,445.2	6,445.5	12.1	1.6	9.4	61.9	3.3	14.7	44.0	0.9	0.2	0.2	4.0	0.7	1.0	3.3	0.6	1.0
1,309.40	6,444.4	6,443.5	6,444.4	6,444.7	8.6	6.4	8.0	57.1	3.3	23.0	30.8	1.0	0.2	0.2	2.6	1.5	1.5	1.2	0.3	0.3
1,284.43	6,443.9	6,442.7	6,443.9	6,444.1	7.9	2.7	12.4	76.1	2.4	17.3	56.4	1.2	0.1	0.2	2.9	1.3	1.5	1.3	0.2	0.3
1,259.52	6,442.1	6,440.9	6,442.1	6,442.2	11.9	1.5	9.7	56.2	2.4	8.5	45.3	1.0	0.1	0.1	4.8	2.8	2.6	13.8	1.4	1.8
1,234.79	6,439.3	6,438.1	6,439.3	6,439.6	5.8	11.0	6.3	30.4	2.4	22.5	5.5	1.2	0.2	0.3	1.9	2.9	4.0	4.8	1.1	1.7
1,209.85	6,436.8	6,435.9	6,436.8	6,437.1	5.1	9.1	8.8	46.2	3.3	24.7	18.2	1.0	0.2	0.2	1.5	2.0	2.1	1.8	0.4	0.5
1,184.54	6,435.9	6,435.0	6,435.9	6,436.2	10.5	6.5	6.0	37.9	3.3	22.0	12.6	1.0	0.2	0.2	3.3	1.9	2.1	1.8	0.4	0.5
1,159.57	6,434.5	6,433.3	6,434.5	6,434.8	8.8	13.3	0.8	27.8	2.4	23.9	1.6	1.3	0.2	0.2	2.9	3.0	2.9	4.5	1.1	1.0
1,128.03	6,432.9	6,432.0	6,432.9	6,433.2	10.1	6.4	6.5	44.0	3.3	20.4	20.3	1.0	0.2	0.2	3.2	2.0	2.1	2.3	0.5	0.5
1,106.83	6,431.8	6,430.9	6,431.8	6,432.3	11.2	3.5	8.4	32.9	3.3	7.6	22.0	1.1	0.4	0.3	3.0	1.1	1.2	2.5	1.1	0.9
1,081.77	6,430.9	6,430.0	6,430.9	6,431.3	10.6	6.6	5.8	38.4	3.3	16.3	18.8	1.0	0.2	0.2	3.3	2.1	1.7	2.0	0.5	0.5
1,056.88	6,429.7	6,428.8	6,429.7	6,430.1	8.5	7.5	7.1	36.4	3.3	17.9	15.2	1.0	0.2	0.2	2.5	1.9	1.9	1.9	0.5	0.6
1,031.81	6,428.5	6,427.6	6,428.5	6,428.8	10.7	5.8	6.6	31.6	3.3	8.6	19.7	1.0	0.2	0.2	3.4	2.8	2.2	3.4	1.0	0.7
1,006.81	6,426.5	6,425.8	6,426.5	6,426.8	7.3	0.4	15.3	25.0	2.0	0.7	22.4	0.9	0.2	0.2	3.9	4.0	4.2	9.5	2.2	2.4
981.85	6,424.6	6,423.4	6,424.6	6,424.9	6.8	8.0	8.2	33.2	2.4	10.8	20.0	1.2	0.2	0.2	2.3	3.5	2.7	4.9	1.4	1.0
956.72	6,422.8	6,422.1	6,422.8	6,423.1	11.2	5.9	5.9	35.6	3.3	15.9	16.4	0.8	0.1	0.1	4.3	3.1	3.0	6.5	1.2	1.2
933.31	6,422.2	6,421.5	6,422.2	6,422.6	8.5	9.1	5.4	47.9	3.3	31.0	13.6	0.9	0.2	0.3	2.8	1.4	1.6	0.9	0.2	0.3
908.33	6,421.8	6,420.9	6,421.8	6,422.1	10.2	10.1	2.7	50.4	3.3	31.2	16.0	0.9	0.2	0.1	3.4	1.5	1.3	1.3	0.4	0.2
871.52	6,419.6	6,418.4	6,419.6	6,419.9	13.3	0.3	9.4	25.6	2.4	1.3	21.9	1.2	0.2	0.2	4.5	1.4	2.6	10.9	2.3	2.4
849.98	6,418.1	6,416.9	6,418.1	6,418.5	6.9	5.5	10.6	36.2	2.4	7.5	26.3	1.3	0.3	0.2	2.2	2.7	2.1	2.4	0.8	0.6
831.35	6,416.9	6,415.7	6,416.9	6,417.3	8.5	6.5	8.0	51.8	2.4	25.8	23.6	1.3	0.2	0.2	2.8	1.2	1.9	3.8	1.1	0.9
807.12	6,414.9	6,413.7	6,414.9	6,415.2	6.7	9.0	7.4	102.5	2.4	81.0	19.1	1.2	0.1	0.2	2.4	0.8	2.6	4.1	0.8	0.8
773.29	6,412.9	6,412.0	6,412.9	6,413.4	9.7	6.0	7.3	57.9	3.3	22.6	32.1	1.1	0.3	0.2	2.6	0.9	1.0	2.0	0.6	0.5
746.18	6,412.0	6,411.1	6,412.0	6,412.4	11.7	7.1	4.2	64.2	3.3	38.6	22.3	1.1	0.2	0.2	3.3	0.9	0.9	1.9	0.4	0.5
719.27	6,410.7	6,409.5	6,410.7	6,411.0	8.6	8.1	6.4	41.1	2.4	20.1	18.6	1.2	0.2	0.2	3.0	2.7	2.4	3.8	0.8	0.8
691.39	6,408.9	6,408.0	6,408.9	6,409.3	8.6	5.1	9.3	31.1	3.3	15.6	12.2	1.1	0.2	0.3	2.4	1.9	2.3	1.8	0.4	0.7
671.41	6,407.9	6,407.0	6,407.9	6,408.4	13.3	4.5	5.2	50.5	3.3	25.1	22.1	1.1	0.2	0.2	3.7	1.0	1.1	4.0	0.8	1.0

HEC-RAS results for the estimated 10-year event with total discharge of 23 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
645.51	6,406.2	6,405.0	6,406.2	6,406.5	4.6	5.6	12.9	57.5	2.4	16.7	38.3	1.1	0.2	0.2	1.7	1.5	1.4	1.8	0.6	0.6
621.14	6,404.4	6,403.2	6,404.4	6,404.7	9.5	6.7	6.8	33.8	2.4	6.9	24.6	1.2	0.2	0.2	3.2	4.2	1.3	6.7	2.0	1.9
593.44	6,402.2	6,401.0	6,402.2	6,402.7	6.5	4.4	12.1	32.3	2.4	13.6	16.3	1.4	0.2	0.3	2.0	2.1	2.3	2.6	0.5	1.0
573.89	6,400.9	6,399.7	6,400.9	6,401.3	9.3	1.8	11.9	29.1	2.4	3.6	23.1	1.3	0.2	0.2	3.1	2.9	2.9	4.5	1.0	1.0
555.42	6,399.2	6,398.0	6,399.2	6,399.6	6.1	0.8	16.1	34.4	2.4	4.2	27.8	1.3	0.2	0.2	1.9	0.9	2.8	3.2	0.8	0.8
531.28	6,397.6	6,396.4	6,397.6	6,397.9	8.2	0.7	14.1	38.4	2.4	3.4	32.6	1.2	0.2	0.2	2.8	1.3	2.6	3.8	0.8	0.8
505.26	6,395.5	6,394.3	6,395.5	6,395.9	7.6	3.7	11.6	56.8	2.4	17.8	36.6	1.3	0.2	0.2	2.5	1.2	1.8	4.3	1.0	1.0
479.88	6,393.4	6,392.2	6,393.4	6,393.7	6.6	8.2	8.2	43.0	2.4	20.5	20.0	1.2	0.2	0.2	2.3	2.6	2.5	3.9	0.8	0.8
455.34	6,391.6	6,390.4	6,391.6	6,392.0	7.4	10.3	5.3	43.2	2.4	16.5	24.2	1.3	0.2	0.2	2.5	2.7	1.2	3.4	1.0	0.8
425.07	6,389.6	6,388.7	6,389.6	6,389.9	10.2	5.7	7.1	33.7	3.3	10.6	19.9	1.0	0.2	0.2	3.2	2.5	2.4	4.1	1.1	0.8
398.95	6,387.8	6,386.9	6,387.8	6,388.3	8.9	0.5	13.7	40.5	3.3	2.1	35.1	1.2	0.3	0.3	2.3	0.8	1.5	2.6	0.7	0.7
375.95	6,386.9	6,385.9	6,386.8	6,387.2	11.0	0.1	11.8	29.8	3.3	0.4	26.1	1.1	0.2	0.2	3.2	1.7	2.3	2.4	0.4	0.5
351.90	6,385.3	6,384.1	6,385.3	6,385.7	8.8	1.0	13.2	31.6	2.4	1.6	27.6	1.3	0.2	0.2	2.8	3.1	2.4	4.9	1.2	1.2
328.75	6,383.2	6,382.0	6,383.2	6,383.6	7.2	0.2	15.6	30.2	2.4	0.8	27.0	1.3	0.2	0.2	2.3	1.4	3.0	4.5	1.0	1.1
303.79	6,381.0	6,379.8	6,381.0	6,381.4	7.1	0.4	15.4	29.6	2.4	0.8	26.4	1.3	0.2	0.2	2.3	2.7	2.9	4.2	0.9	1.0
278.78	6,378.8	6,377.6	6,378.8	6,379.2	7.3	0.4	15.4	28.2	2.4	0.8	25.1	1.3	0.2	0.2	2.4	2.7	3.3	4.5	1.0	1.1
253.89	6,376.6	6,375.4	6,376.6	6,377.2	8.6	0.4	14.0	23.1	2.4	1.2	19.5	1.5	0.3	0.5	2.4	1.1	1.6	4.4	1.3	2.1
240.28	6,375.4	6,374.2	6,375.4	6,376.2	8.9	2.1	12.0	11.6	2.4	1.5	7.7	1.7	0.4	0.4	2.2	3.5	4.1	3.6	1.2	1.4
218.65	6,373.4	6,372.3	6,373.5	6,374.6	15.7	2.3	4.9	6.9	2.3	1.6	2.9	2.1	0.7	0.6	3.2	2.0	2.9	7.1	3.1	3.0
199.88	6,372.3	6,371.6	6,372.3	6,373.2	12.2	5.9	4.9	7.4	2.0	2.9	2.5	1.5	0.4	0.4	4.2	4.7	4.7	3.3	1.4	1.4
192.50	6,372.2	6,371.5	6,372.2	6,372.8	20.2	1.0	1.8	7.2	3.3	1.4	2.5	1.2	0.3	0.3	5.2	2.3	2.4	1.2	0.4	0.4
Ave					9.6	5.3	8.3	37.5	3.0	14.9	19.9	1.1	0.2	0.2	3.0	2.1	2.3	3.9	0.9	1.0
Median					8.9	5.8	7.8	35.2	3.3	15.3	19.1	1.1	0.2	0.2	2.9	2.0	2.3	3.4	0.8	0.8
Max					22.7	13.3	16.1	102.5	10.2	81.0	56.4	2.1	0.7	0.6	5.6	4.7	4.8	20.2	3.1	3.0
Min					4.6	0.1	0.8	6.9	2.0	0.4	1.6	0.8	0.1	0.1	1.5	0.5	0.9	0.9	0.2	0.2

HEC-RAS results for the estimated 5-year event with total discharge of 16 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
2,107.56	6,487.6	6,486.3	6,487.8	6,487.5	16.0			9.8	9.8			0.8			2.1			1.8		
2,069.70	6,485.3	6,484.4	6,485.3	6,485.7	11.1	2.3	2.6	23.7	3.3	7.3	13.1	1.1	0.3	0.2	3.1	1.1	0.9	3.1	1.1	0.8
2,028.96	6,483.1	6,482.2	6,483.1	6,483.4	8.8	3.6	3.6	22.6	3.3	6.8	12.5	0.9	0.2	0.1	2.9	3.0	2.3	2.9	0.7	0.5
2,013.81	6,482.4	6,481.5	6,482.4	6,482.7	7.7	2.5	5.8	22.8	3.3	3.1	16.4	1.0	0.3	0.2	2.3	2.9	2.1	1.8	0.6	0.4
1,971.94	6,480.2	6,479.3	6,480.2	6,480.5	10.9	2.4	2.8	14.2	3.3	5.4	5.5	1.0	0.2	0.2	3.5	3.0	3.1	4.0	0.8	0.8
1,890.78	6,477.9	6,476.7	6,477.9	6,478.2	8.3	2.7	5.0	10.0	2.4	2.9	4.6	1.2	0.3	0.3	2.9	3.7	3.9	4.2	1.5	1.6
1,875.70	6,476.3	6,475.4	6,476.3	6,476.7	8.7	3.8	3.5	39.8	3.3	15.5	21.1	1.0	0.2	0.2	2.7	1.1	1.0	5.0	1.4	1.1
1,853.14	6,474.9	6,474.0	6,474.9	6,475.1	7.1	4.4	4.5	38.5	3.3	18.0	17.2	0.9	0.1	0.1	2.3	1.8	2.0	2.6	0.5	0.5
1,830.88	6,473.4	6,472.5	6,473.4	6,473.7	8.0	4.0	4.0	35.5	3.3	16.5	15.7	0.9	0.1	0.1	2.7	2.0	2.1	3.5	0.6	0.6
1,805.92	6,472.0	6,471.3	6,472.0	6,472.3	6.3	5.2	4.6	42.8	3.3	20.0	19.5	0.9	0.2	0.2	2.2	1.7	1.6	1.6	0.3	0.3
1,771.81	6,471.0	6,469.8	6,471.0	6,471.3	10.6	4.1	1.3	41.1	2.4	32.3	6.4	1.2	0.2	0.2	3.6	0.5	1.3	1.0	0.3	0.2
1,755.99	6,470.0	6,468.8	6,470.0	6,470.1	13.3	1.9	0.8	23.1	2.4	14.7	6.0	1.0	0.1	0.1	5.6	2.8	2.8	20.4	1.5	1.5
1,731.03	6,468.1	6,466.9	6,468.1	6,468.3	5.5	7.6	3.0	40.6	2.4	24.6	13.6	1.1	0.2	0.1	2.0	2.1	1.8	2.7	0.6	0.5
1,706.04	6,466.1	6,464.9	6,466.1	6,466.5	7.7	3.6	4.6	40.9	2.4	23.1	15.4	1.2	0.2	0.2	2.6	0.9	1.4	4.5	1.0	1.3
1,681.08	6,464.1	6,462.9	6,464.1	6,464.4	6.1	4.9	5.0	32.0	2.4	17.8	11.7	1.2	0.1	0.2	2.2	2.1	2.5	3.3	0.6	0.8
1,656.21	6,462.2	6,461.3	6,462.2	6,462.4	8.3	3.8	3.9	31.2	3.3	15.7	12.2	0.9	0.1	0.1	2.8	2.1	2.3	4.0	0.7	0.8
1,631.54	6,460.5	6,459.6	6,460.5	6,460.9	7.0	3.0	6.0	21.8	3.3	4.7	13.8	1.0	0.3	0.2	2.2	2.6	2.1	2.4	0.7	0.6
1,606.91	6,459.2	6,458.3	6,459.2	6,459.4	8.8	3.3	4.0	27.1	3.3	11.8	12.0	0.9	0.1	0.2	3.0	2.1	2.2	3.2	0.6	0.7
1,582.17	6,457.9	6,457.0	6,457.9	6,458.2	6.4	4.8	4.8	34.9	3.3	18.9	12.7	1.0	0.2	0.2	2.0	1.6	1.8	1.5	0.3	0.4
1,557.87	6,457.3	6,456.4	6,457.3	6,457.6	9.4	4.0	2.7	43.3	3.3	23.0	17.0	0.9	0.1	0.1	3.1	1.2	1.2	1.0	0.2	0.2
1,532.88	6,456.0	6,455.1	6,456.0	6,456.1	12.6	1.8	1.6	22.9	3.3	10.1	9.6	0.8	0.1	0.1	4.8	2.4	2.3	7.8	0.9	0.9
1,508.01	6,454.6	6,453.7	6,454.6	6,454.8	7.6	0.8	7.6	51.1	3.3	5.0	42.8	0.9	0.1	0.1	2.7	1.7	1.7	2.9	0.4	0.5
1,483.04	6,453.5	6,452.6	6,453.5	6,453.9	8.0	4.1	3.9	26.7	3.3	16.4	6.9	1.0	0.2	0.3	2.5	1.5	2.1	1.4	0.3	0.5
1,458.23	6,452.4	6,451.2	6,452.4	6,452.7	10.0	2.9	3.1	28.9	2.4	10.7	15.8	1.2	0.2	0.2	3.4	1.2	1.1	4.8	1.5	1.2
1,433.29	6,450.1	6,448.9	6,450.1	6,450.4	5.6	5.1	5.3	37.3	2.4	18.2	16.7	1.2	0.1	0.1	2.0	2.1	2.3	3.4	0.6	0.6
1,408.46	6,448.0	6,447.1	6,448.0	6,448.3	10.1	3.1	2.8	32.2	3.3	18.6	10.3	1.0	0.2	0.2	3.2	1.1	1.3	6.5	1.3	1.8
1,383.72	6,446.7	6,445.8	6,446.7	6,447.0	6.5	4.6	4.9	29.3	3.3	11.7	14.4	1.0	0.2	0.2	2.0	1.8	1.7	1.4	0.4	0.4
1,358.88	6,446.1	6,445.2	6,446.1	6,446.4	9.1	1.9	5.0	44.2	3.3	11.5	29.4	0.9	0.1	0.2	3.1	1.2	1.0	0.9	0.2	0.2
1,334.28	6,445.2	6,444.3	6,445.2	6,445.4	11.5	0.5	4.1	56.3	3.3	10.3	42.7	0.8	0.1	0.1	4.3	0.6	0.8	3.9	0.5	0.7
1,309.40	6,444.4	6,443.5	6,444.4	6,444.6	7.6	3.5	4.9	48.3	3.3	19.6	25.4	0.9	0.1	0.1	2.4	1.2	1.3	1.1	0.2	0.2
1,284.43	6,443.9	6,442.7	6,443.9	6,444.1	7.1	1.6	7.3	72.6	2.4	14.6	55.7	1.1	0.1	0.1	2.7	1.1	1.2	1.2	0.2	0.2
1,259.52	6,442.1	6,440.9	6,442.1	6,442.2	11.7	0.6	3.7	53.1	2.4	5.9	44.8	1.0	0.0	0.0	4.9	2.3	2.0	14.6	1.0	1.0
1,234.79	6,439.3	6,438.1	6,439.3	6,439.5	6.3	5.6	4.1	23.9	2.4	16.1	5.3	1.1	0.1	0.2	2.3	2.9	3.9	6.8	1.2	1.9
1,209.85	6,436.8	6,435.9	6,436.8	6,437.1	5.0	5.6	5.5	42.1	3.3	20.7	18.1	1.0	0.2	0.2	1.6	1.8	1.8	2.0	0.4	0.4
1,184.54	6,435.9	6,435.0	6,435.9	6,436.2	8.8	3.6	3.6	34.3	3.3	18.5	12.5	0.9	0.1	0.2	2.9	1.5	1.6	1.5	0.3	0.3
1,159.57	6,434.5	6,433.3	6,434.5	6,434.7	9.1	6.5	0.4	20.8	2.4	17.3	1.1	1.2	0.1	0.1	3.2	2.8	2.7	5.8	1.1	1.0
1,128.03	6,432.9	6,432.0	6,432.9	6,433.1	8.6	3.5	3.9	37.6	3.3	17.2	17.1	0.9	0.1	0.1	2.8	1.6	1.7	1.9	0.3	0.3
1,106.83	6,431.8	6,430.9	6,431.8	6,432.2	9.7	2.1	4.2	32.3	3.3	7.4	21.7	1.0	0.3	0.2	2.9	1.0	0.9	2.4	0.9	0.6
1,081.77	6,430.9	6,430.0	6,430.9	6,431.2	8.9	3.7	3.4	36.7	3.3	16.1	17.3	0.9	0.1	0.1	2.9	1.6	1.5	1.7	0.3	0.3
1,056.88	6,429.7	6,428.8	6,429.7	6,430.0	7.6	4.3	4.2	36.0	3.3	17.8	15.0	0.9	0.2	0.2	2.5	1.6	1.6	1.8	0.4	0.4
1,031.81	6,428.5	6,427.6	6,428.5	6,428.7	9.1	3.4	3.5	27.2	3.3	8.4	15.5	0.9	0.2	0.1	3.1	2.3	1.9	2.9	0.7	0.5
1,006.81	6,426.5	6,425.8	6,426.5	6,426.8	6.8	0.2	8.9	19.9	2.0	0.5	17.4	0.9	0.1	0.1	4.0	3.6	4.1	10.1	1.9	2.2
981.85	6,424.6	6,423.4	6,424.6	6,424.9	6.7	4.7	4.6	27.9	2.4	10.2	15.3	1.1	0.2	0.1	2.5	3.0	2.6	5.5	1.2	0.9
956.72	6,422.8	6,422.1	6,422.8	6,423.1	5.7	5.3	5.0	41.1	3.3	20.9	16.9	0.9	0.2	0.2	2.0	1.6	1.5	1.4	0.3	0.4
933.31	6,422.2	6,421.5	6,422.2	6,422.5	8.0	5.0	3.1	44.4	3.3	27.9	13.2	0.8	0.1	0.2	2.9	1.2	1.4	1.0	0.2	0.2
908.33	6,421.8	6,420.9	6,421.8	6,422.0	8.0	6.6	1.5	46.9	3.3	30.0	13.6	0.9	0.2	0.1	2.8	1.1	1.0	0.9	0.2	0.1
871.52	6,419.6	6,418.4	6,419.6	6,419.7	14.6	0.1	1.4	13.5	2.4	0.6	10.5	1.1	0.1	0.1	5.7	1.2	1.6	18.7	2.2	2.3
849.98	6,418.1	6,416.9	6,418.1	6,418.4	6.6	3.3	6.2	30.3	2.4	7.4	20.5	1.2	0.2	0.2	2.3	2.3	2.0	2.5	0.7	0.5
831.35	6,416.9	6,415.7	6,416.9	6,417.2	7.2	3.8	5.0	47.9	2.4	25.2	20.2	1.2	0.2	0.2	2.5	0.9	1.6	3.1	0.7	0.6
807.12	6,414.9	6,413.7	6,414.9	6,415.1	6.8	4.4	4.8	98.7	2.4	80.7	15.6	1.1	0.1	0.1	2.5	0.6	2.6	4.8	0.6	0.8
773.29	6,412.9	6,412.0	6,412.9	6,413.3	8.6	3.4	3.9	48.4	3.3	20.0	25.1	1.0	0.2	0.2	2.6	0.8	0.9	2.0	0.5	0.4
746.18	6,412.0	6,411.1	6,412.0	6,412.3	9.8	4.1	2.1	37.2	3.3	14.6	19.2	1.0	0.3	0.2	3.0	1.0	0.7	1.6	0.6	0.3
719.27	6,410.7	6,409.5	6,410.7	6,410.9	8.3	4.1	3.6	32.2	2.4	15.6	14.2	1.1	0.1	0.1	3.1	2.3	2.3	4.2	0.7	0.7
691.39	6,408.9	6,408.0	6,408.9	6,409.3	7.4	2.5	6.1	25.8	3.3	10.6	11.9	1.0	0.2	0.3	2.2	1.5	1.9	1.6	0.3	0.5
671.41	6,407.9	6,407.0	6,407.9	6,408.2	11.5	2.0	2.5	35.2	3.3	15.6	16.3	1.0	0.1	0.2	3.6	1.0	1.0	3.8	0.7	0.8

HEC-RAS results for the estimated 5-year event with total discharge of 16 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (ft/s)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank (lb/sq ft)
645.51	6,406.2	6,405.0	6,406.2	6,406.4	4.2	3.5	8.3	54.6	2.4	15.4	36.8	1.1	0.2	0.2	1.6	1.3	1.2	1.7	0.5	0.5
621.14	6,404.4	6,403.2	6,404.4	6,404.6	8.7	3.4	4.0	25.8	2.4	5.8	17.5	1.1	0.2	0.2	3.2	3.5	1.3	6.8	1.6	1.8
593.44	6,402.2	6,401.0	6,402.2	6,402.6	5.7	2.1	8.2	28.2	2.4	9.7	16.1	1.3	0.1	0.3	1.9	1.6	1.9	2.2	0.4	0.8
573.89	6,400.9	6,399.7	6,400.9	6,401.2	8.9	0.9	6.2	22.9	2.4	2.7	17.8	1.2	0.1	0.1	3.2	2.6	2.6	4.9	0.9	0.9
555.42	6,399.2	6,398.0	6,399.2	6,399.5	5.8	0.5	9.7	27.7	2.4	3.4	21.9	1.2	0.2	0.2	1.9	0.8	2.7	3.4	0.8	0.7
531.28	6,397.6	6,396.4	6,397.6	6,397.9	7.1	0.4	8.5	33.1	2.4	2.9	27.8	1.2	0.1	0.1	2.5	1.1	2.1	3.1	0.6	0.6
505.26	6,395.5	6,394.3	6,395.5	6,395.8	7.6	2.3	6.2	46.4	2.4	14.4	29.5	1.2	0.2	0.1	2.6	1.1	1.5	4.8	1.0	0.9
479.88	6,393.4	6,392.2	6,393.4	6,393.6	5.8	5.2	5.0	37.9	2.4	17.6	17.9	1.2	0.1	0.1	2.1	2.3	2.1	3.2	0.6	0.6
455.34	6,391.6	6,390.4	6,391.6	6,391.9	7.2	6.2	2.7	37.9	2.4	16.3	19.2	1.2	0.2	0.1	2.5	2.4	1.0	3.6	0.8	0.7
425.07	6,389.6	6,388.7	6,389.6	6,389.8	8.5	3.5	4.0	30.3	3.3	10.5	16.5	0.9	0.2	0.1	2.9	2.0	1.9	3.2	0.7	0.5
398.95	6,387.8	6,386.9	6,387.8	6,388.3	7.7	0.3	8.0	35.0	3.3	1.8	29.9	1.1	0.2	0.2	2.1	0.7	1.2	2.2	0.5	0.5
375.95	6,386.9	6,385.9	6,386.8	6,387.2	10.0	0.1	6.0	24.0	3.3	0.3	20.4	1.0	0.2	0.2	3.1	1.5	1.9	2.3	0.3	0.5
351.90	6,385.3	6,384.1	6,385.3	6,385.6	7.6	0.6	7.8	26.2	2.4	1.3	22.5	1.2	0.2	0.2	2.6	2.6	2.1	4.3	0.9	0.9
328.75	6,383.2	6,382.0	6,383.2	6,383.5	6.8	0.1	9.1	24.8	2.4	0.6	21.8	1.2	0.2	0.2	2.3	1.3	2.7	4.6	0.9	1.0
303.79	6,381.0	6,379.8	6,381.0	6,381.4	6.3	0.3	9.4	25.3	2.4	0.7	22.2	1.2	0.2	0.2	2.1	2.3	2.5	3.7	0.7	0.8
278.78	6,378.8	6,377.6	6,378.8	6,379.1	6.9	0.2	8.9	23.3	2.4	0.6	20.3	1.2	0.2	0.2	2.4	2.5	2.9	4.6	0.9	0.9
253.89	6,376.6	6,375.4	6,376.6	6,377.1	7.4	0.2	8.4	22.6	2.4	1.0	19.3	1.4	0.2	0.3	2.2	1.0	1.3	3.9	1.0	1.5
240.28	6,375.4	6,374.2	6,375.4	6,376.0	8.2	1.1	6.7	9.5	2.4	1.2	5.9	1.5	0.3	0.3	2.3	3.2	3.8	4.0	1.2	1.3
218.65	6,373.4	6,372.3	6,373.5	6,374.4	12.0	1.4	2.6	6.1	2.3	1.4	2.4	1.9	0.6	0.5	2.8	1.6	2.3	5.4	2.2	2.0
199.88	6,372.3	6,371.6	6,372.3	6,373.0	10.2	3.1	2.7	6.2	2.0	2.3	1.9	1.3	0.3	0.3	4.0	4.2	4.2	3.3	1.2	1.2
192.50	6,372.2	6,371.5	6,372.2	6,372.6	15.1	0.3	0.6	5.8	3.3	0.9	1.6	1.0	0.2	0.2	4.8	1.8	1.9	1.1	0.3	0.3
Ave					8.4	3.0	4.7	32.8	2.9	12.9	17.4	1.1	0.2	0.2	2.8	1.8	1.9	3.8	0.7	0.8
Median					8.0	3.4	4.2	32.1	3.3	11.8	16.4	1.0	0.2	0.2	2.7	1.6	1.9	3.1	0.7	0.6
Max					16.0	7.6	9.7	98.7	9.8	80.7	55.7	1.9	0.6	0.5	5.7	4.2	4.2	20.4	2.2	2.3
Min					4.2	0.1	0.4	5.8	2.0	0.3	1.1	0.8	0.0	0.0	1.6	0.5	0.7	0.9	0.2	0.1

HEC-RAS results for the estimated 2-year event with total discharge of 4 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft/s)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (lb/sq ft)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank
2,107.56	6,487.6	6,486.3	6,487.8	6,487.0	4.0			7.2	7.2			0.4			1.5			1.0		
2,069.70	6,485.3	6,484.4	6,485.3	6,485.2	4.0			3.3	3.3			0.6			1.9			1.4		
2,028.96	6,483.1	6,482.2	6,483.1	6,483.0	4.0			3.0	3.0			0.6			2.3			2.1		
2,013.81	6,482.4	6,481.5	6,482.4	6,482.4	3.8	0.1	0.1	9.4	3.3	2.6	3.5	0.7	0.0	0.0	1.6	0.7	0.6	0.9	0.1	0.1
1,971.94	6,480.2	6,479.3	6,480.2	6,479.8	4.0			2.6	2.6			0.4			3.7			5.8		
1,890.78	6,477.9	6,476.7	6,477.9	6,477.6	4.0			2.2	2.2			0.8			2.4			3.4		
1,875.70	6,476.3	6,475.4	6,476.3	6,476.4	4.0	0.0	0.0	7.6	3.3	2.2	2.1	0.7	0.0	0.0	1.8	0.2	0.2	2.5	0.1	0.1
1,853.14	6,474.9	6,474.0	6,474.9	6,474.8	4.0			3.2	3.2			0.6			2.0			2.1		
1,830.88	6,473.4	6,472.5	6,473.4	6,473.4	4.0			3.2	3.2			0.6			2.0			2.1		
1,805.92	6,472.0	6,471.3	6,472.0	6,472.0	3.9	0.0	0.0	9.0	3.3	2.9	2.8	0.6	0.0	0.0	2.0	0.5	0.5	1.5	0.1	0.1
1,771.81	6,471.0	6,469.8	6,471.0	6,470.6	4.0			2.0	2.0			0.7			3.1			0.8		
1,755.99	6,470.0	6,468.8	6,470.0	6,469.9	4.0			2.4	2.4			0.9			2.0			2.6		
1,731.03	6,468.1	6,466.9	6,468.1	6,468.1	4.0			2.4	2.4			0.9			1.9			2.6		
1,706.04	6,466.1	6,464.9	6,466.1	6,466.1	4.0			2.4	2.4			0.9			2.0			2.8		
1,681.08	6,464.1	6,462.9	6,464.1	6,464.1	4.0	-	-	3.7	2.4	0.7	0.6	0.9	-	-	1.8	0.2	0.2	2.6		
1,656.21	6,462.2	6,461.3	6,462.2	6,462.1	4.0			3.1	3.1			0.6			2.2			2.8		
1,631.54	6,460.5	6,459.6	6,460.5	6,460.6	3.9	0.0	0.1	9.2	3.3	2.5	3.3	0.7	0.0	0.0	1.7	0.5	0.5	1.6	0.1	0.1
1,606.91	6,459.2	6,458.3	6,459.2	6,459.0	4.0			3.0	3.0			0.6			2.5			2.6		
1,582.17	6,457.9	6,457.0	6,457.9	6,457.9	3.9	0.1	0.1	12.2	3.3	4.5	4.4	0.7	0.0	0.0	1.6	0.5	0.5	1.0	0.1	0.1
1,557.87	6,457.3	6,456.4	6,457.3	6,457.0	4.0			2.8	2.8			0.5			2.8			1.0		
1,532.88	6,456.0	6,455.1	6,456.0	6,455.9	4.0			3.1	3.1			0.6			2.2			1.8		
1,508.01	6,454.6	6,453.7	6,454.6	6,454.5	4.0			3.2	3.2			0.6			1.9			1.7		
1,483.04	6,453.5	6,452.6	6,453.5	6,453.5	4.0			3.2	3.2			0.6			2.0			1.1		
1,458.23	6,452.4	6,451.2	6,452.4	6,452.2	4.0			2.2	2.2			0.8			2.3			2.5		
1,433.29	6,450.1	6,448.9	6,450.1	6,450.2	4.0	-	-	3.6	2.4	0.6	0.6	0.9	-	-	1.8	0.2	0.3	3.1		
1,408.46	6,448.0	6,447.1	6,448.0	6,447.9	4.0			3.2	3.2			0.6			2.0			2.9		
1,383.72	6,446.7	6,445.8	6,446.7	6,446.7	3.9	0.0	0.0	9.3	3.3	3.0	3.0	0.7	0.0	0.0	1.7	0.4	0.4	1.1	0.0	0.0
1,358.88	6,446.1	6,445.2	6,446.1	6,445.9	4.0			2.9	2.9			0.5			2.6			0.8		
1,334.28	6,445.2	6,444.3	6,445.2	6,445.1	4.0			3.0	3.0			0.6			2.4			1.4		
1,309.40	6,444.4	6,443.5	6,444.4	6,444.4	4.0	-	-	5.7	3.3	1.1	1.4	0.7	0.0	0.0	1.8	0.2	0.2	0.7		0.0
1,284.43	6,443.9	6,442.7	6,443.9	6,443.5	4.0			2.1	2.1			0.7			2.9			1.6		
1,259.52	6,442.1	6,440.9	6,442.1	6,442.1	4.0			2.4	2.4			0.9			1.9			2.2		
1,234.79	6,439.3	6,438.1	6,439.3	6,439.0	4.0			2.1	2.1			0.7			2.6			10.0		
1,209.85	6,436.8	6,435.9	6,436.8	6,436.9	3.3	0.3	0.3	18.2	3.3	7.5	7.4	0.8	0.1	0.1	1.3	0.8	0.8	1.5	0.1	0.1
1,184.54	6,435.9	6,435.0	6,435.9	6,435.7	4.0			2.9	2.9			0.5			2.5			1.3		
1,159.57	6,434.5	6,433.3	6,434.5	6,434.5	4.0	-	-	3.1	2.4	0.6	0.0	0.9	-	-	1.8	0.2	0.2	2.0		
1,128.03	6,432.9	6,432.0	6,432.9	6,432.7	4.0			3.0	3.0			0.6			2.4			1.5		
1,106.83	6,431.8	6,430.9	6,431.8	6,431.8	4.0			3.5	3.3	0.1	0.1	0.7			1.9			1.1		
1,081.77	6,430.9	6,430.0	6,430.9	6,430.8	4.0			2.9	2.9			0.5			2.5			1.4		
1,056.88	6,429.7	6,428.8	6,429.7	6,429.7	4.0			3.3	3.3			0.7			1.9			1.2		
1,031.81	6,428.5	6,427.6	6,428.5	6,428.3	4.0			2.9	2.9			0.5			2.5			2.3		
1,006.81	6,426.5	6,425.8	6,426.5	6,426.7	2.6	0.0	1.4	13.7	2.0	0.3	11.4	0.8	0.1	0.1	1.7	1.2	1.5	1.8	0.3	0.3
981.85	6,424.6	6,423.4	6,424.6	6,424.6	4.0			2.3	2.3			0.9			2.0			4.0		
956.72	6,422.8	6,422.1	6,422.8	6,422.9	3.9	0.1	0.1	11.4	3.3	4.0	4.2	0.6	0.0	0.0	1.9	0.6	0.6	1.4	0.1	0.1
933.31	6,422.2	6,421.5	6,422.2	6,422.3	4.0	0.0	0.0	10.7	3.3	4.6	2.9	0.6	0.0	0.0	2.0	0.3	0.3	0.5	0.0	0.0
908.33	6,421.8	6,420.9	6,421.8	6,421.6	4.0			2.8	2.8			0.5			3.0			1.2		
871.52	6,419.6	6,418.4	6,419.6	6,419.5	4.0			2.4	2.4			0.9			2.0			2.3		
849.98	6,418.1	6,416.9	6,418.1	6,418.1	4.0			2.4	2.4			0.9			2.0			2.1		
831.35	6,416.9	6,415.7	6,416.9	6,416.8	4.0			2.3	2.3			0.8			2.1			2.4		
807.12	6,414.9	6,413.7	6,414.9	6,414.9	4.0			2.4	2.4			0.9			1.9			3.1		
773.29	6,412.9	6,412.0	6,412.9	6,412.9	4.0			3.3	3.3			0.6			1.9			1.3		
746.18	6,412.0	6,411.1	6,412.0	6,411.9	4.0			3.1	3.1			0.6			2.2			1.1		
719.27	6,410.7	6,409.5	6,410.7	6,410.5	4.0			2.2	2.2			0.8			2.3			2.5		
691.39	6,408.9	6,408.0	6,408.9	6,408.9	4.0			3.2	3.2			0.6			2.0			1.5		
671.41	6,407.9	6,407.0	6,407.9	6,407.8	4.0			3.1	3.1			0.6			2.3			1.8		

HEC-RAS results for the estimated 2-year event with total discharge of 4 cfs

	Ground Surface Elevation				Discharge			Top Width of Wetted Area				Hydraulic Depth			Velocity			Shear Stress		
Proposed Channel Station	Left Bank (ft)	Channel Bed (ft)	Right Bank (ft)	Water Surface Elevation (ft)	In Channel (cfs)	Left Overbank (cfs)	Right Overbank (cfs)	Total Active Flow (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft)	Active Channel (ft)	Left Overbank (ft)	Right Overbank (ft/s)	Active Channel (ft/s)	Left Overbank (ft/s)	Right Overbank (lb/sq ft)	Active Channel (lb/sq ft)	Left Overbank (lb/sq ft)	Right Overbank
645.51	6,406.2	6,405.0	6,406.2	6,406.2	3.6		0.4	12.3	2.3		9.9	0.9		0.1	1.8		0.6	2.2		0.3
621.14	6,404.4	6,403.2	6,404.4	6,404.3	4.0			2.3	2.3			0.9			2.0			3.0		
593.44	6,402.2	6,401.0	6,402.2	6,402.2	4.0	0.0	0.0	6.2	2.4	0.7	3.1	0.9	0.0	0.0	1.8	0.6	0.6	2.2	0.1	0.1
573.89	6,400.9	6,399.7	6,400.9	6,400.8	4.0			2.2	2.2			0.8			2.3			2.9		
555.42	6,399.2	6,398.0	6,399.2	6,399.3	3.9	0.0	0.2	7.7	2.4	0.7	4.5	1.0	0.0	0.0	1.7	0.3	0.9	2.7	0.2	0.2
531.28	6,397.6	6,396.4	6,397.6	6,397.5	4.0			2.3	2.3			0.8			2.1			2.4		
505.26	6,395.5	6,394.3	6,395.5	6,395.5	4.0			2.4	2.4			0.9			1.9			2.8		
479.88	6,393.4	6,392.2	6,393.4	6,393.4	4.0			2.4	2.4			0.9			1.9			2.9		
455.34	6,391.6	6,390.4	6,391.6	6,391.6	4.0	-	-	3.3	2.4	0.4	0.5	0.9	-	-	1.8	0.2	0.1	2.1		
425.07	6,389.6	6,388.7	6,389.6	6,389.5	4.0			3.0	3.0			0.6			2.3			2.5		
398.95	6,387.8	6,386.9	6,387.8	6,387.9	4.0	-	0.0	6.7	3.3	0.2	3.2	0.7	0.0	0.0	1.7	0.2	0.2	1.7		0.1
375.95	6,386.9	6,385.9	6,386.8	6,386.7	4.0			3.0	3.0			0.6			2.3			1.4		
351.90	6,385.3	6,384.1	6,385.3	6,385.2	4.0			2.3	2.3			0.9			2.0			2.9		
328.75	6,383.2	6,382.0	6,383.2	6,383.2	4.0		-	2.7	2.4		0.2	0.9		-	1.8		0.1	3.1		
303.79	6,381.0	6,379.8	6,381.0	6,381.0	4.0	-	-	3.2	2.4	0.0	0.8	0.9	0.0	0.0	1.8	0.3	0.3	3.0		
278.78	6,378.8	6,377.6	6,378.8	6,378.8	4.0			2.4	2.4			0.9			1.9			3.3		
253.89	6,376.6	6,375.4	6,376.6	6,376.6	4.0	-	0.0	4.8	2.4	0.1	2.3	0.9	0.0	0.0	1.8	0.2	0.2	2.8		0.1
240.28	6,375.4	6,374.2	6,375.4	6,375.3	4.0			2.3	2.3			0.8			2.1			4.0		
218.65	6,373.4	6,372.3	6,373.5	6,373.6	4.0	0.0	0.0	3.0	2.3	0.4	0.3	1.0	0.1	0.1	1.6	0.5	0.5	2.3	0.3	0.2
199.88	6,372.3	6,371.6	6,372.3	6,372.4	4.0	0.0	0.0	2.7	2.0	0.4	0.3	0.7	0.1	0.1	2.8	1.2	1.2	1.9	0.2	0.2
192.50	6,372.2	6,371.5	6,372.2	6,372.0	4.0			2.9	2.9			0.4			3.5			0.8		
Ave					4.0	0.0	0.1	4.3	2.8	1.7	2.9	0.7	0.0	0.0	2.1	0.5	0.5	2.2	0.1	0.1
Median					4.0	0.0	0.0	3.0	2.8	0.7	2.8	0.7	0.0	0.0	2.0	0.4	0.5	2.1	0.1	0.1
Max					4.0	0.3	1.4	18.2	7.2	7.5	11.4	1.0	0.1	0.1	3.7	1.2	1.5	10.0	0.3	0.3
Min					2.6	-	-	2.0	2.0	0.0	0.0	0.4	-	-	1.3	0.2	0.1	0.5	0.0	0.0

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