PHASES I and 2 FINAL DESIGN REPORT

115TH AVE & UNION HILLS DR DRAINAGE IMPROVEMENTS

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Prepared for:

Flood Control District of Maricopa County

CITY OF PEORIA

SURPRISE ARIZONA

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115th AVENUE AND UNION HILLS DRIVE
DRAINAGE IMPROVEMENTS PROJECT, PHASE 1 and 2
DESIGN REPORT
FINAL SUBMITTAL

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EXECUTIVE SUMMARY

RITOCH-POWELL & Associates (RPA) has been retained by the Flood Control District of Maricopa County (District) to complete a final design of the 115th Avenue and Union Hills Drive Improvement Project (Project). Assignment #1 authorized RPA to complete the 30% design of the entire project including Phase 1, 2, and 3. Assignment #2 authorized the final design of the Phase 1 improvements, and Assignment #3 authorized the final design on the Phase 2 improvements. The Phase 3 improvements will be done in a future project. The study area is located mainly between the Agua Fria River on the west, 99th Avenue on the east, Rose Garden Lane to the north, and the Greenway alignment on the southern end. There are three jurisdictions in the study area, the City of Peoria (Peoria), the City of Surprise (Surprise), and Unincorporated Maricopa County.

This design report documents drainage improvements to the 115th Avenue and Union Hills Drive study area. The purpose of the project is to capture the 100-year flood from the watershed within a channel, storm drain, and basin system and safely convey the floodwater to the Agua Fria River. The project will mitigate roadway flooding, especially at several intersections in the study area including the 107th Avenue and Union Hills Drive intersection, and the 115th Avenue and Bell Road intersection, as well as provide positive drainage for the Canyon Ridge drainage channel.

The District is partnered with Peoria and Surprise through an executed Intergovernmental Agreement (IGA) FCD2012A005 that specifies each agency's engineering and financial responsibilities. The District has conducted several hydrologic and alternative analysis studies for this area to assess flooding issues and developed preferred mitigation measures. The District completed a design concept report (Reference 1) that analyzed flooding issues and recommended flood mitigation solutions. The District completed a Value Analysis (VA) workshop (Reference 2) and the District's VA developed potential solutions that were further studied by the District and documented in their alternative analysis report (Reference 3). This report updated the DCR hydrology and hydraulics and identified the preferred solution.

The hydrology and hydraulics were updated in our analysis using one foot topography, updated landuse, and better utility information. This information was used to design, prepare construction documents, and complete utility coordination. This project is divided into three phases; the first phase includes drainage improvements from Union Hills Drive south to the

Agua Fria River. The second phase includes improvements along Union Hills Drive between 107th Avenue and 115th Avenue along with improvements along 107th Avenue between Palm Tree Drive and Union Hills Drive. The third phase will improve the Beardsley Road channel from 111th Avenue to 115th Avenue and includes a storm drain along 115th Avenue south to the first phase storm drain, which ends north of Union Hills Drive.

1. INTRODUCTION

1.1. Project Location

The overall study area for this project is approximately 5.2 square miles and includes portions of Peoria, Surprise, and unincorporated portions of Maricopa County. The majority of the drainage infrastructure is located along 115th Avenue from Union Hills Drive to the Agua Fria River just north of Grand Avenue. The study area is shown on Figure 1.

1.2. Need and Purpose

There are several areas within the study area that have recurring flooding issues, due to the lack of regional drainage infrastructure. The intersection of Union Hills Drive and 107th Avenue floods often and restricts vehicular access during even minor rainfall. The Paradise RV storage basins overtop and can take several days to percolate ponded water. The intersection of 111th Avenue and Union Hills Drive floods and overtops the roadway as runoff flows into the Peoria storage basin. The Bell Road culvert overtops and floods the roadway causing damage to the Sun City drain upstream of the roadway. The Beardsley Road channel overtops causing damage near the intersection of 115th Avenue and the Coyote Lakes golf course. The Canyon Ridge channel, which was constructed by a developer, has no outfall and there are several areas where storm water does not drain and remains ponded for hours. The existing channel south of Bell Road has inadequate capacity for the 100-year flows. The proposed design will mitigate these ponding and flooding issues and convey the 100-year flows to the Agua Fria River and provide a dedicated outfall with 100-year capacity.

1.3. Scope

The information and analysis presented in this design report is a part of the scope of work performed by RPA for the District under Contract No. 2013C003. The scope includes preparation of baseline hydrologic and hydraulic analysis, data collection, utility research, preparation of cost estimates, and final design plans. Assignment #1 scope of work included 30-percent design of all three phases of this project. Assignement #2 completed the final design of Phase 1. Assignment #3 scope of work includes completion of Phase 2 part of the project including final plans, special provisions and the engineer's construction cost estimate.

115th Avenue and Union Hills Drive

Figure 1 – Study Area

2. DATA COLLECTION AND PROJECT DATA

Data was provided by the District from the previous studies and concept reports completed for the study area. This information is included in the references.

2.1. Aerial Topographic Survey / Datum

2.1.1. Project Datum

The GIS information provided by the FCD is on NAVD 88 datum. The benchmark locations and geometric control sheet is located on Sheet 18 of the 100-percent plans.

2.1.2. Aerial Topographic Survey

An aerial topographic survey was performed in conjunction with the Phase 1 analysis for the project area. The aerial topographic survey included the entire area for improvements on all 3 phases and was flown at an altitude sufficient to provide 1-foot contours. The aerial topography includes all planimetric features that are necessary to create the digital terrain model (DTM) required for producing the 1-foot contours. These features include curbs, gutters, and break lines and this information was utilized with the final design.

2.1.3. Field Survey

Field survey was performed by RPA to supplement the aerial mapping. The field survey included setting the panel points used for the aerial mapping. Blind panel points were provided by the District to verify the mapping accuracy. The survey information is Appendix F.

3. HYDROLOGIC ANALYSIS

3.1. Existing Hydrologic Models

There have been many studies performed on this area over the last 25 years. The first Area Drainage Master Plan (ADMP) for this area was completed in 1987 (Reference 5). The results from that study were used to construct many of the storm drains within the southern developed portions of the study area. The study area went through major development after the initial ADMP was completed and were not designed with regional drainage as a consideration. There were many disconnected drainage systems and systems with no positive outfalls causing flooding within the study area and an update to the original study was necessary. The District, City of Peoria, and the City of Glendale funded the ADMP Update (Reference 6), which was completed in 2001. This study updated the hydrology and accounted for all recent development in the area. An alternative analysis with recommended solutions was also part of the study. Many of these regional drainage solutions proposed in that update have been constructed by the District, including the Rose Garden Lane channel and basin and the 83rd Avenue Storage Basin. These improvements have decreased the flows reaching the 115th Avenue and Union Hills project area. This 115th Avenue and Union Hills Drive Drainage Improvement project area was also included as a recommended alternative in that report.

The District authorized the Glendale/Peoria ADMPU Northwest Region Update (Reference 7) in 2006. This study would include any recent development as well as any planned development in the study area to study the effects on the proposed drainage infrastructure from the 2001 study. The Northwest Update included the Rose Garden Lane and 83rd Avenue Storage Basin project in the hydrologic analysis.

The recommended improvements from the ADMP update along 115th Avenue, Beardsley Road, and Union Hills Drive were not constructed. The area continued flooding and the District authorized another study, the Glendale/Peoria ADMPU 107th Avenue and Union Hills Drive Design Concept Report which was completed in 2010 (Reference 1). This DCR analyzed flooding issues and recommended solutions to mitigate flooding hazards.

A Value Analysis Workshop was held in June 2012 at the District with the purpose of improving performance and constructability as well as enhancing value of the proposed project. This workshop was attended by the City of Peoria, the City of Surprise and District staff. It was mediated by an independent third party and the results of the meeting were presented in the Design Concept Report Phase Value Analysis Workshop Final Report (Value Report). The project team brainstormed possible alternatives to the DCR design and ranked them accordingly. The Value Report proposed some additional alternatives that should be evaluated by District staff. These alternatives would use the new NOAA 14 rainfall as well as unsteady HEC-RAS modeling, which would most likely reduce the size of the drainage infrastructure.

The District analyzed the alternatives developed in the Value Report and presented the recommended alternative in the 115th Avenue and Union Hills Project Alternatives Analysis (District Report), which was completed in March 2013. The District determined that a basin at the northeast corner of 115th Avenue and Bell Road would not be effective. The report recommended the current planned concept for handling Beardsley Channel storm flows, which includes a splitter structure at 115th Avenue and Beardsley Road and a storm drain system along 115th Avenue between Beardsley and Union Hills Drive. The District report also recommended dividing the proposed improvements into three phases.

3.2. Hydrologic Revisions – Existing Conditions

The previous hydrology models generated for the design concept reports were reviewed to determine if they were adequate for use in the final design. Since the previous models did not use the District's GIS information, and many of the basin delineations were not correct, it was decided that a new model would be developed for this design project. The previous models were used for concept reports and were not required to be as accurate. A memorandum documenting the discrepancies of the previous model is included in Appendix C.

3.3. Summary of Hydrologic Modeling Results – Existing Conditions

A flow comparison of the hydrologic model developed in the previous accepted ADMPU to the developed condition hydrology model is shown on Table 1 below. There was not

a 24-hour model developed for the 2010 DCR (Reference 1). Figure 2 located in Appendix C shows where the concentration points are located.

Table 1 – HEC-1 Model Flow Comparison

Model	Concentration Point 100 year, 24 hour Discharge (cfs)			
	CA07C	CS30	CA07B(5)	Agua Fria
ADMPU Exist. Conditions (Entellus, Inc.)	502	792	1995	2087
RPA Developed Conditions HEC-1 model	303	752	1510	1931

3.4. Summary of Hydrologic Modeling Results – Developed Conditions

The revised existing model was modified to reflect the design changes. The stage-storage-discharge information for the two proposed storage basins and outlet pipes at 111th Avenue and Union Hills Drive is coded into the HEC-1 model. The updated split flow analysis results were incorporated into the developed HEC-1 model. This model is included in Appendix C and the flows are shown on Figure 2.

4. EXISTING DRAINAGE FACILITIES

The ownership of the existing roadways and drainage facilities was determined in the DCR (Reference 1). The drainage facilities and hydraulic models are shown on Figure 3 located in Appendix D. A discussion detailing the area drainage systems is included below.

4.1. Existing Drainage Systems

4.1.1. Beardsley Road Channel

The existing Beardsley Road channel is earthen between 115th Avenue and the 113th Avenue alignment. A portion of this channel bank is a designed underground embankment for the Coyote Lakes development and there is an existing FEMA floodplain to the north of that embankment. The existing conditions were modeled using information from the aerial topographic mapping supplemented by ground survey. The channel lacks capacity west of the 113th Avenue alignment. There are dual 36-inch corrugated metal pipes (CMP's) conveying flows from this channel into the Coyote Lakes golf course. These culverts are not large enough to carry all of the 100-year flows and this channel section often overtops during rainfall events (See Figure 4) causing damage to 115th Avenue, the southern channel bank, and the adjacent gravel pit.

There was damage to the northern end of the Coyote Lakes golf course from storm flows in 2010. The golf course management enlarged an existing basin to mitigate future storm damage.

Figure 4 – Beardsley Road Channel at 115th Avenue

4.1.2. Union Hills Drive Drainage

4.1.2.1. Union Hills Channel

There is an earthen channel within the roadway rights-of-way on the south side of Union Hills Drive between 107th and 111th Avenue. The channel decreases in size and lacks capacity as it nears 111th Avenue and flows overtop the channel and flow onto the roadway.

A portion of storm water runoff from Sun City is conveyed into a concrete channel that drains into two small culverts at the 107th Avenue and Union Hills Drive intersection. The channel section is upstream of these culverts and runoff overtops and floods the intersection during rainfall events, see Figure 5.

Figure 5 – Inlet at 107th Avenue and Union Hills Drive

4.1.2.2. Paradise RV Basins

A large area drains to two small basins at the southern end of the Paradise RV resort. There is no drainage outlet in these basins and the southwest basin does not have any drywells. When this basin's capacity is exceeded, runoff overtops the basin and flows onto Union Hills Drive and continues west. The ponded water in the southwest basin does not percolate efficiently and can take over a week to drain. The southwest basin is located above the Kinder-Morgan 20-inch high pressure gas line; therefore, a majority of the basin cannot be lowered.

4.1.2.3. City of Peoria Storage Basin

The City of Peoria constructed a retention basin northwest of 111th Avenue and Union Hills Drive. This basin was designed to collect roadway flows from 111th Avenue. The 111th Avenue and Union Hills Drive intersection often floods and overtops the curb flowing into this basin. There is evidence of storm damage from sheet flows into the basin. There is no drainage outlet or drywells in this basin and water ponds at the bottom of the basin. This basin does not drain within 36-hours in the existing configuration, which is an issue that will be mitigated in our design.

4.1.3. Canyon Ridge Channel

The Canyon Ridge Channel and detention basin system conveys flows through the Canyon Ridge development to the outfall located at the culvert at 115th Avenue and Bell Road. The channel begins west of 111th Avenue on the south side of Union Hills Drive continuing west to 115th Avenue. There is a large dual arched culvert conveying flows around an APS substation. The channel transitions south along 115th Avenue to the Bell Road culvert within an APS easement corridor where there are three large APS "spider" towers located in this section. There is an earthen berm located at each tower for access and the channel upstream acts as a storage basin. This section of channel is maintained by the Canyon Ridge Home Owners Association (HOA).

There is an earthen berm located just north of the Bell Road culvert that protects a sewer force main. There is a small culvert in this berm that flows into the Sun City drain. The Canyon Ridge channel ponds behind this berm until the water surface overtops and empties into the Sun City channel.

4.1.4. Sun City Drain

A portion of the Sun City Drain is located north of Bell Road from Del Webb Boulevard west to 115th Avenue then south under Bell Road. The District owns the drain from 112th Avenue east to Del Webb Boulevard, and the section of the drain to the west is located in a drainage easement. The drain turns south near 115th Avenue and Bell Road and could overtop during large

rainfall events. A section of the drain is damaged at the Bell Road culvert, because it is being uplifted by hydrostatic pressure, see Figure 6.

Figure 6 – Damage to Sun City Drain at the Bell Road Culvert

4.1.5. 115th Avenue Channel (South of Bell Road)

This channel flows south from the Bell Road culvert to the Agua Fria River, just upstream of Grand Avenue. This channel was originally constructed to convey flows from only Sun City and not from the Canyon Ridge development. This channel was constructed with shotcrete and is severely damaged along its alignment. There are areas where vegetation limits conveyance where the shotcrete has been washed away, see Figure 7. The channel's alignment follows the original 40 foot drainage easement that was created by Del Webb when Sun City was developed.

Figure 7 – 115th Avenue South of the Bell Road Culvert

5. HYDRAULIC ANALYSIS

5.1. Existing Condition Hydraulic Analysis

Two HEC-RAS models were created to analyze the existing drainage infrastructure in the study area. The first model examined the capacity of the Beardsley Road channel from 111th to 115th Avenue. The model results show the channel lacks capacity west of the 113th Avenue alignment. The existing dual 36-inch culvert pipes located along the La Farge sand and gravel road are undersized. The model results are shown in Appendix D.

The second HEC-RAS model was created to analyze the existing Sun City Drain. The cross sections are generated by supplemental survey performed by RPA. A split flow analysis was done at two locations in Sun City to determine flows reaching the Bell Road culvert at 115th Avenue. The results of that analysis revaled that 757 cfs would reach the Bell Road culvert, the memorandum is located in Appendic C. The initial hydrology information is located in Appendix C and the HEC-RAS model results are included in Appendix D. The HEC-RAS model results indicate that the Sun City Drain has adequate capacity. The QT box culverts overtops with floodwater less than six inches, which meets District requirements.

5.2. Proposed Storm Drain Analysis

5.2.1. Union Hills Drive

The proposed Union Hills system is composed of a storm drain system along Union Hills Drive and 107th Avenue. The locations and flows for concentration points were determined from the modified HEC-1 model and roadway spread calculations. The first collection point is at the intersection of 107th Avenue and Palm Tree Drive and is 11 cfs. This drainage is collected in grate inlets located on either side on the road. The second collection point is at Sack Drive and is 5 cfs (16 cfs total), which was distributed to the catch basins between Palm Tree Drive and Sack Drive. These grate inlets continue along 107th Avenue to Sack Drive and are spaced approximately 300 feet apart based on roadway spread calculations, which are included in Appendix D. There are curb inlets on the western side of the road south of Sack Drive to Union Hills Drive.

There are two concentration points at the intersection of 107th Avenue and Union Hills Drive. Two drainage basins from Sun City drain to this intersection, the first drains into a channel flowing southwest into a drop inlet at the intersection. The HEC-1 model calculated 25 cfs from that drainage basin (A07F2). There is a drop inlet at this location to collect this flow. The second Sun City basin drains south onto Union Hills Drive and then west in an inverted roadway section that has an inlet just east of the intersection. The HEC-1 flows at this collection point are 49 cfs (A07F1) and there is a 30-foot trench drain along the valley gutter that collects this flow. The total flow in the storm drain at the Union Hills Drive and 107th Avenue intersection is 90 cfs.

The final collection area is at the entrance to the Paradise RV Park, where 71 cfs is collected into the storm drain (C07E2*). The combined flow at this location is 162 cfs and this is conveyed to the outlet in the Canyon Ridge channel (CA07E2). The flows at major concentration points are located in Appendix C. There are on-grade catch basins located along the north side of Union Hills Drive and are spaced at an average of 400-feet based on the roadway spread calculations, which are included in Appendix D. The south side of the road will drain though scuppers into a swale on the south side of Union Hills Drive. The riprapped swale conitues west and flow is collected in grated manholes along the swale.

Storm Drain Sizing: The system starts at 107th Avenue and Palm Tree Drive with a single 24-inch concrete pipe constructed south to Sack Drive where the pipe is increased to 30-inches. The last section of storm drain on 107th Avenue was increased to 36-inches as flow is collected from the Sun City spillway. The storm drain turns west at the intersection of 107th Avenue and Union Hills Drive and is a 42-inch concrete pipe. This 42-inch pipe continues west for 800-feet then it increases to 48-inches. The 48-inch pipe contiues to the Paradise RV resort where the pipe is increased to a 54-inch concrete pipe. At the intersection of 111th Avenue and Union Hills Drive, the 54-inch pipe flows into a concrete drop manhole with a single 48-inch High-density polyethylene (HDPE) pipe outlet. This 7 foot drop structure manhole is required so the pipe is below the 20-inch Kinder-Morgan Engineering (KME)

High Pressure Gas (HPG) line. The hydraulic analysis revealed that the hydraulic grade line (HGL) is below ground and a single 48-inch pipe would suffice for the outlet pipe. The results of that analysis are included in Appendix D.

The slopes of the storm drain pipes are chosen based on the existing grade of Union Hills Drive and 107th Avenue with an adequate cover maintained through the entire system. StormCAD was used to calculate the hydraulic grade line of the system and assure that it was one foot below the existing ground elevation. The storm drain system calculations, roadway spread calculations, catch basins calculations are located in Appendix D.

5.2.2. 115th Avenue

The 115th Avenue system consists of dual 60-inch concrete pipes which begin where the Beardsley channel intersects 115th Avenue, then will be constructed along the east side of 115th Avenue south to the outlet into the channel at 115th Avenue and Union Hills Drive. The flow through the Beardsley channel prior to reaching the storm drain system is 336 cfs. The slope of the pipes was established by the proposed inverts at the upstream and downstream ends. The inlet elevation was established by setting the top of the pipe to the invert of the existing double 36-inch pipes that currently convey flow from the Beardsley channel to the Coyote Lakes Golf Course. A design goal for this storm drain was to greatly reduce flows into the golf course. The majority of runoff (283 cfs) will be collected and conveyed south through dual 60-inch pipes. The excess flows can flow west through the existing 36-inch pipes, but this flow amount is much less than current conditions. The improved basin on the Coyote Lakes property has adequate capacity to retain the excess flow for the 100-year storm. This basin size was recently increased to 9 acre-feet and the reduced runoff volume into this basin is 1.2 acre-feet.

A drop inlet structure is needed at the upstream section of the dual 60-inch storm drain system to achieve the necessary invert elevation because there was not enough cover. A single concrete splitter structure will be constructed at this location. There are multiple junction structures located along the 115th

Avenue storm drain alignment, typically 600 feet apart. The junction structures were used instead of manholes to allow the system to act as one continuous system and not separate the flows unevenly.

An additional design constraint on the pipe size was the shallow cover and minimal existing slope of 115th Avenue. The hydraulic grade line was calculated using StormCAD to assure that it remains one foot below the existing ground elevation (See Appendix D for all StormCAD output). The design of the 115th Avenue storm drain system and Beardsley Road channel will be further evaluated during Phase 3 final design.

5.3. Culvert Crossing Analysis

5.3.1. 111th Avenue

The southwest basin for the Paradise RV resort does not have drywells or a drainage outlet; therefore, water ponds in this basin for several days after rainfall. A culvert crossing under 111th Avenue is proposed to drain this runoff into the City of Peoria basin. The revised hydrologic model has 202 cfs flowing into the Paradise basin which can be conveyed with dual 48-inch reinforced concrete pipe (RCP) culverts. The culverts were initially sized using the Federal Highway Administrations (FHA) Chart 2 for concrete pipes with inlet control. The initial design was verified using Culvertmaster. The calculation are included in Appendix D.

The 111th Avenue roadway drainage will be collected in eight curb inlets along both sides of 111th Avenue. The runoff will drain into the Peoria basin through multiple RCP storm drains and headwalls.

5.3.2. Peoria Basin

The City of Peoria basin is approximately 3 feet deep and will be lowered to accommodate the proposed culverts across 111th Avenue. The entire basin will be lowered to a total depth of 6 feet and a proposed culvert will convey flow across Union Hills Drive. The hydraulic analysis reveals a three barrel 48-inch culvert (see Appendix D) will convey flows under Union Hills Drive. The additional culvert is necessary because this basin collects flows from

111th Avenue as well as flows from the Paradise RV basin. The FHWA Chart 2 was used to estimate flows though these pipes at different stages in the City of Peoria basin. That information was used in the HEC-1 analysis to ensure the basin would not be overtopped. This design was verified using Culvertmaster. That information is included in Appendix D.

5.4. HEC-RAS Design Analysis

There were three separate HEC-RAS models created for the design in the study area for all three phases of the project. The methodology, assumptions, and model results for each model is presented in the following sections.

5.4.1. Canyon Ridge Channel and Bell Road Culvert

The Canyon Ridge Channel runs north along the east side 115th Avenue on the east side from Bell Road to Union Hills Drive. The channel transitions east along the Canyon Ridge development to 111th Avenue along the south side of Union Hills Drive. An unsteady HEC-RAS model was developed for this reach of the project to accurately model the attenuation in the Canyon Ridge Channel and to obtain a more refined peak flow through the culvert at Bell Road. The geometry for the unsteady HEC-RAS was created from the updated topographic mapping, and the inflow hydrographs were taken from the developed conditions HEC-1 model (included in Appendix C.7).

A 10-inch EPCOR force main crosses the Canyon Ridge Channel in an existing berm that separates low flows from Canyon Ridge Channel from flow in Sun City Drain. To avoid relocating this force main, the berm was modeled as a lowered, concrete-covered, inline weir in the unsteady model. Since the culvert at Bell Road and the large inflow from Sun City Drain control the peak hydraulic grade line in the unsteady model, keeping a lowered berm does not adversely impact flow results. The berm will be lowered, protected with concrete, and combined into a multiuse access path. The results from this hydraulic modeling are included in Appendix D, while the models are included on the CD.

5.4.2. 115th Avenue South of Bell Road

The existing 115th Avenue channel segment is badly damaged in some areas, channel lining is missing in other areas, and vegetation is present in locations that limits the channels capacity. The flow in the channel in current conditions is transitional; the amount of flow and existing slopes (0.0056 feet/feet) causes hydraulic jumps in sections of the channel. The District's design standard requires that channels should be designed in the subcritical flow regime whenever possible. There is available land in this section of channel and a concrete channel was designed so flow would be subcritical throughout the reach. The channel slopes throughout this segment were reduced to 0.0015 feet/feet using drop structures so that subcritical flow could be achieved.

The flow in this channel section of 1181 cfs was taken from the unsteady HEC-RAS model. The HEC-1 model results had 1510 cfs at this location, which is concentration point CA07B5. The HEC-1 value is conservative compared to the unsteady HEC-RAS results, which more accurately models the flow and attenuation through the Canyon Ridge Channel and Bell Road culvert. The hydrographs south of Bell Road from the HEC-1 models revealed the peak inflows south of Bell Road would occur an hour before the peak flow, so they were disregarded.

The channel segment around the APS anchor pole was an important design constraint. The pole needs to be protected in place along with a private retention pond on the opposite channel bank that should be protected. This channel segment cannot exceed 32 feet in width in order to meet those criteria. The channel invert will also need to be raised at this location to reduce the slope in the channel section and reduce the flow velocities.

The initial HEC-RAS model used a 32 foot vertical channel from the Bell Road culvert to 50 feet past the APS anchor pole. There will be a drop structure at this location and the channel will transition into a trapezoidal channel. The results of that initial model showed that a larger bottom width was needed at the Bell Road culvert. The channel will be 36 feet wide at the Bell Road culvert with a 2 foot drop just outside of that culvert. The channel

needed to be wider just downstream of Bell Road to accommodate the freeboard requirements. The additional drop structures were initially placed every 600 feet to ensure the design was adequate, but locations were modified using the terrain so that the channel banks would not be above ground.

The downstream limit of the channel improvements were modified as the design progressed for the Phase 1 improvements. This modification was done because this section of the channel has capacity for the 100-year event and is not located adjacent to residential properties. The HEC-RAS model for this segment is located in Appendix D and the digital model is on the CD.

5.4.3. Beardsley Road Channel

The existing Beardsley Road channel east of the EPCOR access drive has capacity in the existing condition. The channel will be improved west of that access road to 115th Avenue. The peak flow used to design the channel along Beardsley Road and analyze in HEC-RAS is taken directly from the hydrologic model for this project which is 331 cfs.

The upstream section of the channel from the six 36-inch pipes west to the sand and gravel access drive will be a trapezoidal earthen channel with a 10 foot wide bottom, 4 to 1 side slopes, 4 feet deep, and a 42 foot top width. The existing cross-sections were created from the topography provided by a combination of ground and aerial surveys. HEC-RAS analysis shows a low Froude number (sub-critical flow) and low velocities.

Three 48-inch reinforced concrete pipes are proposed to convey flows at the sand and gravel access drive. Approximately 300 feet upstream of the proposed pipes, the channel section increases from 4 feet deep to 6 feet deep. This is the result of the existing channel banks increasing in height. This channel section will contain the headwater that builds up at the proposed pipe inlets. The pipes will have a proposed cover of two feet in order to prevent overtopping and breakout.

A second channel section is proposed between the sand and gravel access road and 115th Avenue. This section is a concrete-lined channel with a 10 foot wide bottom and 1 to 1 side slopes, approximately 4 feet deep and a top width of 18 feet. The concrete is necessary because of the high velocities. The HEC-RAS model shows that this proposed channel section will have velocities ranging from 7 to 9 feet/second. The Beardsley Road channel will be further evaluated during the Phase 3 final design.

Fill will be required between the proposed channel and the existing embankment on the southern bank. The embankment along this section will remain undisturbed as it provides bank protection from 100-year storm events to the north as shown in FEMA Firm Map 04013C1245L, Map Revised October 16, 2013.

6. UTILITIES

6.1. Utility Data Collection and Provider Contacts

As a part of the project scope, RPA was tasked with identifying existing utilities and providing coordination with their corresponding agencies. Initial information and as-built maps were provided from the District, Peoria, and Surprise. Utility maps and record drawings were requsted and collected from utility providers within the project area. Additional data was collected on existing utilities in the area from Bluestake, aerial and field surveys. Below is the list of utilities and utility contacts for this project.

Table 2 – Utility Contact Information

Utility Provider	Utility	Contact	Phone Number
APS	Electric - Distribution & Transmission	Bobby Garza Gary Biber	602-371-7989 602-371-5630
CenturyLink	Telephone Fiber Optics	Andre Hatcher	480-254-0127
Cox Communications	Fiber Optics. Coaxial	Randy Sims Ryan Quagliata	623-222-7040 623-328-4852
City of Peoria	Fiber Optics, Reclaimed Water, Sewer, Storm Drain, Traffic Signals, Water	Burton Charron	602-773-7237
City of Surprise	Fiber Optics, Reclaimed Water, Sewer, Streetlights, Traffic Signals, Water	Michael Boule	623-222-7040
Kinder Morgan (EPNG)	Transmission High Pressure Natural Gas	Ronnie Brown Russell Williams	602-980-0316 602-938-4229
EPCOR	Sewer, Water	Marc Allen	623-445-2451
Southwest Gas	High Pressure Natural Gas	Yvonne Aguirre	602-484-5338
SRP-Transmission	Electric - Transmission	Floyd Hardin Elija Lubandi	602-236-8327 602-236-3794
Tucson Electric & Power	Electric - Transmission	Majid Farahami Larry Robinson	520-745-3430 520-918-8354
WAPA	Electric - Transmission	Nan Wilcox	602-605-2580

6.1.1. Map Requests

Map requests were made to various resources to identify all existing utilities and ensure the correct providers were contacted and informed. Bluestake design requests were completed to identify the utilities located in the project area. The provider representatives were verified from these requests and were contacted by phone and email correspondence. Map requests were made using each company's formal process and forms and were received by email, post-marked mail, and CDs. RPA was able to produce a complete and concise utility base map from these collected documents.

6.1.2. Utility Base Mapping

The maps received from the various resources were compiled, logged, and analyzed. These maps primarily provided horizontal locations for the underground facilities within the project area. A field survey was also completed that identified utility structures, valves, poles, pedestals, towers, and other above ground facilities. The utilities were mapped based on data and field observations from these combined resources. Utility meetings were held throughout the course of the design, and utility providers supplied assistance for verification and to answer any questions regarding their facilities.

6.2. Utility Meetings and Coordination

Utility providers attended utility coordination meetings with the District and RPA to maintain open communication. Meetings were held at the District and the utility providers' offices which provided feedback and outlined standards required. The topics of discussion at these meetings included the Design Authorization Letter, data collection, anticipated utility conflicts, possible relocation efforts, prior rights, and other issues. The attached table lists the utility providers who attended utility meetings along with the major decisions that were made for the Phase 2 Design. The Phase 1 decisions and all meeting minutes can be found in Appendix B.

Table 3 – Utility Coordination Meetings – Phase 2

Utility Provider	Attendees	Date Attended
Arizona Public Service	Gary Biber / Bobby Garza	August 27, 2015
Major Decisions:	Identified approximately 18 conflicts along Union Hills Drive (UHD) and 107th Avenue. APS will vertically realign underground electric lines for areas in conlict with the storm drain on those two roads.	
CenturyLink	Andre Hatcher	August 27, 2015
Major Decisions:	It is unknown if CenturyLink has non-fiber optics within the area. Identified approximately 18 conflicts along UHD and 107th Avenue.	
Cox Communications	Randy Sims	August 27, 2015
Major Decisions:	Major fiber-optic facilities near 107th and UHD will be impacted and fiber-optic along 107th moving north towards Beardsley may be affected. Identified approximately 18 conflicts along UHD and 107th Avenue.	
EPCOR	Jesse Black, E. Coppinger, Marc Allen, William White, Y. Samarripa	August 27, 2015
Major Decisions:	Identified approximately 15 conflicts along UHD and 107th Avenue. EPCOR will design the relocations and has requested that they be included in the Phase 2 improvements construction work.	
Kinder Morgan / EPNG	Ronnie Brown / Russell Williams	February 06, 2014
Major Decisions:	KM was informed pipe will be installed under 20-inch gas line at 111th Avenue and UHD . KM requested a pothole at crossing of gas line and maintain a 2-foot vertical clearance. KM requested HDPE pipe. They will be onsite during construction near their pipe.	
Southwest Gas (SWG)	Yvonne Aguirre	February 06, 2014
Major Decisions:	SWG has no facilties in the project area.	
Salt River Project (SRP)	Floyd Hardin / Elijah Lubandi	August 27, 2015
Major Decisions:	Channel improvements under the transmission line west of 111th Ave must meet SRP standards.	
WAPA	Nan Wilcox	January 09, 2014
Major Decisions:	WAPA with SRP regarding any improvements or changes.	

6.3. Pothole Data

RPA subconsultants (Baseplans USA) completed 27 potholes, 16 of which were located in Phase 1 and the remainder located at Phase 2 & 3 critical locations. Based on this information, RPA developed a utility conflict table. Additional potholes were completed by RPA subconsultant, KC Locate for Phase 2 conflicts. Phase 2 storm drain alignments and connector pipe profiles have been adjusted to avoid costly utility relocations although some relocations will be necessary. More potholes will be necessary for Phase 3, during the Phase 3 Final Design

Phase 1 utility relocations include two water mains at the intersection of 115th Avenue and Union Hills Drive, which will be included I the Phase 1 construction work. The Phase 1 dry utltities have been relocated. Phase 2 utility relocations include several EPCOR water mains along Union Hills Drive, and multiple dry utilities throughout the Phase 2 project limits.

6.4. Utility Conflicts

The compiled utility map drawings are included in the final design plans. The proposed and existing drainage infrastructure was analyzed with the utility base map in order to identify all crossings and potential conflicts within the project area. The list of utility conflicts for the Phase 1 and Phase 2 improvements is provided in Appendix E. The Phase 3 utility relocations are not included in this report.

7. DESIGN SUMMARY

The following sections outline the design, constraints, and issues for the design of this project. The locations of existing easements and right-of-way are shown on the Phase 2 – 100% design plans. The horizontal utility information is correctly shown on the plans and the vertical information will be collected as the phases go to final design.

7.1. Design Parameters

This drainage design adheres to the following Agency requirements:

- District
- City of Surprise
- City of Peoria
- MCDOT

In general, the entire project follows:

- 100-year, 24-hour design storm
- District's Drainage Design Manual Volume 1 & 2 (Hydrology / Hydraulics)

Most of the design flows were taken from the Developed HEC-1 model results, the remaining flows were taken from the Unsteady HEC-RAS model. The following table shows the hydraulic models, design flows, and concentration points used for this project.

Table 4 – Design Flow Table

Design Flow Table			
Model Name	**Location**	**Design Flow**	**HEC-1 ID**
Beardsley Road HEC-RAS	111th Avenue	331 cfs	RA09D
115th Avenue StormCAD	Beardsley Rd	281 cfs	RA09C
Union Hills StormCAD	111th Avenue	90 cfs	RA07F1
Union Hills StormCAD	107th Avenue	162 cfs	CA07E2
Sun City Drain HEC-RAS	111th Ave	752 cfs	CS30
115th Avenue Unsteady	Weir north of Bell	601 cfs	Unsteady HEC-RAS Table
115th Avenue Unsteady	Bell Road	1181 cfs	Unsteady HEC-RAS Table

8. LANDSCAPE DESIGN

8.1. Landscape Inventory and Analysis

The landscape data collection and inventory was done as part of the Design Concept. The 107th Avenue and Union Hills Drive Landscape Inventory Analysis (LIA) were prepared by the District in June 2010. This analysis was taken directly from the District's LIA report and was verified through interviews with the project stakeholders as well as numerous site visits in the design concept report (Reference 1).

The Context Sensitive Flood Hazard Mitigation Planning and Design Approach (CSFHM) was used to develop the recommended design depicted in the Design Concept Report and confirm it's acceptability to the community, compatibility with the land and resources, and effectiveness in mitigating the flood risks. The LIA and CSFHM results from the Design Concept Report were utilized by the 115th Avenue and Union Hills Drive Drainage Improvements Project design team to confirm the modified design proposed by the VA and carried forward for final design remained compatible with the project setting and was acceptable to the community.

8.2. Corridor Landscape Approach

With the commencement of the 115th Avenue and Union Hills Drive Improvements Project final design, the team overlaid the updated recommended design onto the Landscape Design Themes and Flood Protection Structural Methods data provided from the original Design Concept Report LIA and CSFHM analysis in order to confirm that the recommended alternative remained compatible with the setting.

The LIA and CSFHM had identified three primary landscape design themes that are deemed appropriate for the project area to facilitate the choice of project designs elements that would be context-sensitive. These included:

<u>- The Natural Lower Sonoran Desert Theme</u>:

Includes visual elements characteristic of natural setting found within the valley floor of the Sonoran Desert. Basins and channels designed with this theme would be sized and formed to replicate natural secondary drainage features and include landscape berms and other features that replicate the landform of the desert floor. Vegetation would

consist of native plant materials with signature Sonoran Desert species such as Palo Verde and Mesquite trees, bursage, creosote, and configured in natural random patterns and densities.

- The Semi-Natural Sonoran Desert Theme:

Includes visual elements characteristic of the natural setting found within the valley floor of the Sonoran Desert, but configured in a manner that exaggerates the archetypical forms and patterns of the natural Sonoran Desert. Basins and channels designed with this theme would be accentuated versions of naturally occurring secondary drainage features and include visually significant landscape berms and other features that replicate the landform of the desert floor. Vegetation would consist of native plant materials with signature Sonoran Desert species such as Palo Verde and Mesquite trees, with understory plant materials selected to typify the signature species found within the underlying landscape character subtype. In the Valley Plain these would include flowering native shrubs, such as Brittlebush and Globe Mallow, as well as succulents and cacti species in combination with more subdued but characteristic plant material found in the Sonoran Desert. Plant materials would be configured in natural random patterns but at enhanced densities.

- The Enhanced Desert Theme:

This theme is a variation of the Semi-Natural Desert Theme that makes extensive use of natural-toned inert rock materials in combination with open, managed plantings. This theme reflects common xeriscape landscapes found in suburban and rural residential setting in the Sonoran Desert, with planting and inert materials laid out to create visually interesting pattern and form in the landscape setting. Drip irrigation may be used to enable the use of native-adapted species that add enhanced color to the natural landscape through prolonged and/or staggered flowering periods and greater variety in foliage forms and colors. Basins and channels designed with this theme would be accentuated versions of naturally occurring secondary drainage features and include visually significant landscape berms and other features that replicate the landform of the desert floor.

The recommended alternative consists of the following structural elements, divided into three design and construction phases:

Phase I: Agua Fria Outfall to Union Hills Drive/Bell Road and Sun City Drain

- A combination of earthen and concrete channels from Bell Road south to the outfall at the Agua Fria River to take the place or modify the existing earthen channel

- A narrow concrete channel segment immediate south of Bell Road, required to contain the conveyance through restricted right-of-way and utilities

- A confluence structure immediate upstream of Bell Road that will combine the flows from the Sun City Drain and the conveyance coming south along 115th Avenue through the existing Canyon Ridge basins

- The existing gunite Sun City Drain which follows the Bell Road from the east to 115th Avenue, which is proposed to remain unchanged

- The existing earthen basins along 115th Avenue at Canyon Ridge, that convey larger flows south to an existing under Bell Road

Phase II: Union Hills Drive and 107th Avenue Conveyances

- The existing earthen channels along Union Hills Drive at Canyon Ridge that convey flows from the east to 115th Avenue.

- The addition of storm drains along Union Hills Drive from 111th Avenue to 107th Avenue and on 107th Avenue

- A proposed earthen basin at the northwest corner of 111th Avenue and Union Hills Drive

Phase III: Beardsley Road and 115th Avenue to Union Hills Drive

- The addition of storm drains along 115th Avenue from Beardsley Road to Union Hills Drive

- A splitter structure at 115th Avenue and Beardsley Road

- Improvements to the existing earthen channel at Beardsley Road from west of 111th Avenue to 115th Avenue

- The existing conveyance channel on Beardsley Road, from the end of teh above improved channel to approximately 107th Avenue

The design team and District overlaid the recommended design elements, by phase, onto the proposed landscape design themes information from the CSFHM data to identify the following six distinctive areas within the project. These proposed reaches reflect combinations of the acceptable landscape design themes, compatible structure types, and recommended design requirement. The resulting reaches, with their proposed landscape treatments and structural elements, were presented at the first PAAC meeting, held on February 19, 2014 and to the public at the first public meeting held on March 27, 2014. Minutes from this first PAAC meeting are included in Appendix B. The PAAC and the public concurred with the design team's proposed treatments, with recommendations for proposed structural aesthetic theming which was further developed with the 60% design for Phase I only.

The following sections include descriptions of the six primary reaches, their proposed landscape design themes, structure types, and flood protection.

8.3. Segment 1 – 115th Avenue South of Irish Gold Drive

This channel segment begins at the Irish Gold Drive alignment and continues south to the Vulcan sand and gravel property, which is south of the Sun City RV Compound. This is an earthen channel section with 4 to 1 side slopes. The proposed landscape and structural aesthetic treatments proposed for this segment are as follows:

- Native shrubs and ground cover vegetation will be reestablished through hydro-seeding efforts, per the landscape design themes identified during the planning process.
- Dust and erosion control shall be provided for all construction disturbance areas;
- Proposed O&M access road will also be used as a multiple use path;
- Existing native trees and vegetation will be protected in place, where possible;
- Integral color riprap is proposed for placement on the east bank for erosion protection along the RV property.

8.4. Segment 2 – 115th Avenue Channel

This channel segment is along the Citrus Point subdivision, adjacent to 114th Avenue. This channel segment was designed as a trapezoidal concrete structure with one to one side slopes that will require safety railing. The proposed landscape and structural aesthetic treatments proposed for this segment are as follows:

- A Semi-natural Sonoran Desert Landscape Treatment to be implemented through the use of hydroseed, tall pot tree planting, and limited planting of container shrubs in the water-harvesting areas described below.
- Water-harvesting swales and micro-basins shall be located in the channel overback to capture storm water runoff from 114th Avenue for landscaping use and to provide water quality benefits.
- Proposed O&M roadway that can also be used as a multi-use path;
- Pipe railing on both sides of channel, to be treated with a simulated desert varnish stain;
- Dust control shall be provided for all landscape surfaces;
- Avoid impacts to existing vegetation where possible;

8.5. Segment 3 – Channel South of Bell Road

This channel segment begins at Bell Road and continues approximately 200-feet downstream of the APS anchor pole that is located in the right bank of the existing channel. The proposed design calls for a vertical walled concrete channel section with

safety rails along this segment. The proposed landscape and structural aesthetic treatments proposed for this segment are as follows:

- A Semi-natural Sonoran Desert Landscape Treatment to be implemented through the use of hydroseed and integral colored decomposed granite landscape mulch.
- Proposed O&M roadway that can also be used as a multi-use path;
- Concrete form liner with a simulated desert varnish stain on concrete surfaces;
- access control railings on both sides of channel, treated with a simulated desert varnish stain.

8.6. Segment 4 – 115th Ave Channel between Union Hills Dr and Bell Rd

The majority of this channel section will not be modified as part of this design project. There will be some minor modifications along the access berms near the large transmission towers, but landscape design will not be integrated in this channel section. The enhancements will be minimal in this segment, consisting mostly of hydroseeding for site stabilization and construction disturbance mitigation.

8.7. Segment 4 – Sun City Stilling Basin

The Sun City Drain and 115th Avenue channel will be modified just upstream of the Bell Road culvert. The Sun City drain will widen and intersect with the 115th Avenue channel as a stilling basin. The berm along the 115th Avenue channel will be lowered and protected with concrete before it connects with the Sun City drain. The proposed landscape and structural aesthetic treatments proposed for this segment are as follows:

- The existing stabilized granite trail will be modified from its current configuration. The trail is proposed to be shortened so that the damaged segment at Bell Road will be removed. Instead of directing pedestrians and other trail users to the non-signalized intersection at Bell Road and 115th Avenue, the trail will connect to a proposed O&M road that crosses the proposed confluence structure over the forced main berm and connects to the sidewalk on Bell Road at the western-most entry drive of the QuikTrip.

- Structural aesthetics include concrete formliner on vertical concrete elements and a broom finish on sloped concrete with a simulated desert varnish stain. . The riverine theme developed in conjunction with public and City of Surprise and Peoria staff at PAAC Meeting #2 was removed from the final design due in part to costs and a change in theming entry areas by the City of Surprise that were being developed at the time of design completion. The Phase I design was modified to allow the City a greater degree of flexibility in implementing their final gateway themes.
- Pipe safety rail with a simulated desert varnish is proposed on all concrete structures and along the O&M access area.
- Landscape with supplemental irrigation is proposed in the Bell Road streetscape that reflects the plant species identified in the City of Surprise Village 1 Plan for the Bell Road Corridor.
- Landscape areas at the Bell Road intersection will be dressed with a ½-inch screened brown decomposed granite, to match the City of Surprise's updated design guidelines.

8.8. Segment 5a – Western Portion of the Union Hills Drive Channel

This channel segment is west of 113th Avenue on the south side of Union Hills Drive. This channel section will not be modified as part of this design project. The only modification is the outlet of the 115th Avenue storm drain. The headwall will match the proposed structural aesthetics established for the entire corridor. The proposed landscape and structural aesthetic treatments proposed for this segment are as follows:

- Enhanced Sonoran Desert Landscape Treatment to match existing conditions;
- Hydro-seed shrubs and groundcover in disturbed channel area, to match existing species and landscape themes identified;
- Dust control shall be provided for all landscape surfaces;
- Salvage and re-establish of existing trees at the intersection of Union Hills Drive and 115th Avenue that will be disturbed by the storm drain modificiation;
- Replacement of removed irrigated shrubs and ground covers with new container grown material;

- Repair of the existing irrigation system at Union Hills Drive and 115th Avenue;
- Salvage, protection, and replacements of existing boulders in the streetscape;
- Use materials, shapes, and colors that blend in with the existing surroundings.

8.9. Segment 5b – Center Portion of the Union Hills Drive Channel

This channel segment is between 111th Avenue and 113th Avenue on the south side of Union Hills Drive. The existing channel will be modified to accommodate two storm drain outlets. The Canyon Ridge Development had homeowner representatives attend the PAAC meeting to discuss their issues and concerns. The HOA recently landscaped this channel section and were concerned about vegetation being removed. Review of the area by the Project team indicates the area to be disturbed by the Project has not been planted. The proposed landscape and structural aesthetic treatments proposed for this segment are as follows:

- Enhanced Sonoran Desert Landscape Treatment to match existing conditions;
- Replacement container grown shrubs and groundcover shall match existing species and landscape themes identified;
- Dust control shall be provided for all landscape surfaces;
- Salvage and re-establish of existing trees outside of the perimeter wall where possible;
- Existing trees removed within the Canyon Ridge Development perimeter wall will not be replaced at the request of the HOA;
- Disturbed landscaping, inert ground cover, and the existing irrigation system will be replaced or repaired as part of this project.
- Use materials, shapes, and colors that blend in with the existing surroundings.

8.10. Segment 5b – 107th Avenue and Union Hills Drive Storm Drains

The storm drains will be located along the 107th Avenue and Union Hills Drive alignment. Disturbed areas will be hydro-seeded, rock mulched as necessary, and areas of significant existing vegetation will be preserved in place or replaced.

8.11. Segment 6a – 115th Avenue Storm Drain

There are minimal landscape design considerations for the 115th Avenue storm drain segment. Disturbed areas will be hydro-seeded, rock mulched as necessary, and areas of significant existing vegetation will be preserved in place or replaced.

8.12. Segment 6b – Beardsley Road Channel

This channel segment is between 115th Avenue and the 113th Avenue alignment. There are proposed culverts across the La Farge sand and gravel access road and a splitter structure at the 115th Avenue and Beardsley Road intersection. These structures will follow that landscape theme and forming used throughout the project.

8.13. Segment 7a – 111th Avenue Basin

This segment includes capacity expansion of the existing City of Peoria-owned basin located on the northwest corner of 111th Avenue and Union Hills Drive. The existing basin will be modified to accommodate the new culverts under 111th Avenue. The City of Peoria staff who maintains the facility requested that minimal landscape be included with an emphasis on ease of maintenance. The north slope of the basin is to be graded at a 10:1 slope to facilitate access into the basin by maintenance vehicles and equipment when needed, and an ADOT 1-1/4" minus rock mulch used on the side slopes to reduce erosion. Hydro-seed is proposed on all disturbance areas for dust control and enhanced slope erosion protection. The existing themed CMU wall is to be extended from its current terminus on 111th Avenue to the intersection and west on Union Hills Drive to the project construction limit line where it will tie into the existing chain link fence. The landscape on 111th Avenue will be extended to the project limits on Union Hills Drive, including the expansion of the existing irrigation system. The proposed landscape and structural aesthetic treatments proposed for this segment are as follows:

- Enhanced Sonoran Desert Landscape Treatment to match existing conditions along 111th Avenue and Union Hills Drive;
- A minimalistic, easily maintained landscape treatment within the City of Peoria basin site;
- Salvage and re-establish of existing trees;

- Container grown shrubs and groundcover shall match existing species and landscape themes identified;
- Dust control shall be provided for all landscape surfaces;
- Use materials, shapes, and colors that blend in with the existing surroundings.

9. REFERENCES

1. *Glendale/Peoria ADMPU 107th and Union Hills Drive Design Concept Report – Analysis and Recommendations*; Goodwin and Marshall, Inc., 2010.
2. *Design Concept Report Phase Value Analysis Workshop FINAL REPORT*; Flood Control District of Maricopa County, 2012.
3. *115th Avenue and Union Hills Project Alternatives Analysis Report, PCN 450.07.31*; Flood Control District or Maricopa County, 2013.
4. *115th Avenue and Union Hills Drive Drainage Improvement Project – Survey Report Binder;* Ritoch-Powell and Associates, 2014.
5. *Glendale-Peoria Area Drainage Master Plan (ADMP);* Camp Dresser and McKee Inc., 1987.
6. *Glendale/Peoria Area Drainage Master Plan Update;* Entellus, 2001.
7. *Glendale/ Peoria ADMPU Northwest Region Update Hydrologic Study;* Wood, Patel & Associates, Inc., May 2007.
8. *Canyon Ridge West, Parcel 5 Improvement Plans*; Coe and Van Loo, November 2003.
9. *Canyon Ridge West, Infrastructure Improvement Plans;* Coe and Van Loo, November 2003.
10. *Canyon Ridge West, Mass Grading Plans;* Coe and Van Loo, November 2003.
11. *Canyon Ridge, Master Drainage Report*; Coe and Van Loo, January 1997.
12. *Drainage Design Manual for Maricopa County, Arizona Volume I, Hydrology;* Flood Control District of Maricopa County, 2009.
13. *Drainage Design Manual for Maricopa County, Arizona Volume II, Hydraulics*; Flood Control District of Maricopa County, 1996.
14. *The Village at Canyon Ridge West, Grading and Drainage;* M2 Group, February 2006.
15. *Grading and Drainage Plan for the Pavilions at Coyote Lakes*; Ritoch-Powell & Associates, Inc., September 2006.
16. *Drainage Memo for Union Hills Drive, 115th Avenue to +/- 1,080 ft. West of 107th Avenue*; Ritoch-Powell & Associates, September 2009.

17. *Landscape Aesthetics and Multi-Use Consultant Handbook;* Flood Control District of Maricopa County, 2003

18. *Glendale/Peoria ADMPU 107th and Union Hills Drive Design Concept Report - Appendix D "LIA Findings";* Flood Control District of Maricopa County, 2010

19. *Policy for the Aesthetic Treatment and Landscaping for Flood Control Projects;* Flood Control District, 1992

20. *Landscape Design Themes Handbook;* Flood Control District of Maricopa County, 2010

21. *Flood Protection Methods Handbook;* Flood Control District of Maricopa County, 2010

22. *Flood Protection Structure Types Handbook;* Flood Control District of Maricopa County, 2010

23. *2012 Engineering Development Standards, Chapter 8 - Landscaping and Irrigation Standards;* City of Surprise , 2012

24. *Chapter 3 - Street Design and Construction, Infrastructure Design Guidelines;* City of Peoria, 2014

25. *Chapter 4 - Storm Drainage Facilities - Design and Construction, Infrastructure Design Guidelines;* City of Peoria, 2013

26. *Surprise Center Villlage (Villlage 1 Plan); Planning and Zoning Division of the Surprise Community and Economic Development Department,* City of Surprise, 2009

27. *Public Involvement and Public Information Guidelines;* Flood Control District of Maricopa County, 2004

APPENDIX A – Site Photos

Photo 1: Existing channel at station 70+00, looking south.

Photo 2: Existing CMP pipe at station 74+00, looking west.

Photo 3: Existing channel at station 75+00, looking south.

Photo 4: Existing channel at station 79+00, looking north.

Photo 5: Existing channel at station 91+00, looking south.

Photo 6: Existing channel at station 95+00, looking south.

Photo 7: Existing channel at station 97+00, looking south with APS on right.

Photo 8: Existing channel at station 97+50, looking north to Bell Road.

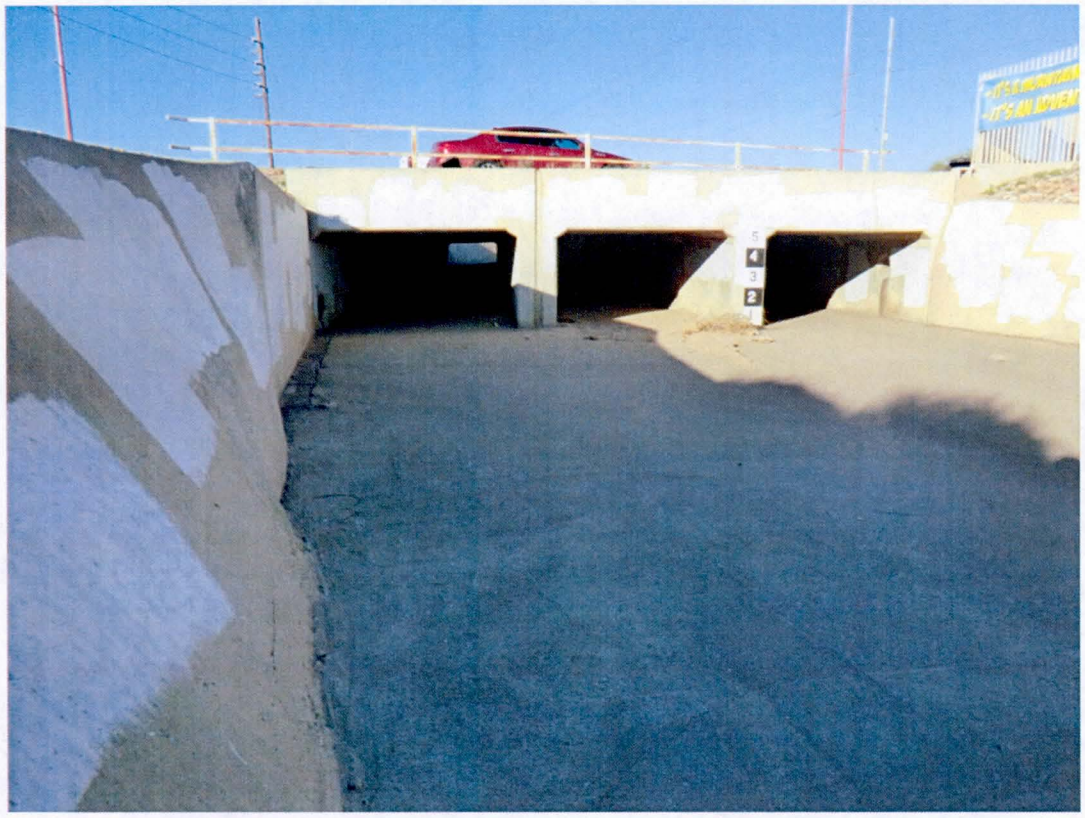


Photo 9: Existing channel at station 98+00, looking north to Bell Road culverts.

Photo 10: Existing channel at station 98+10, looking south.

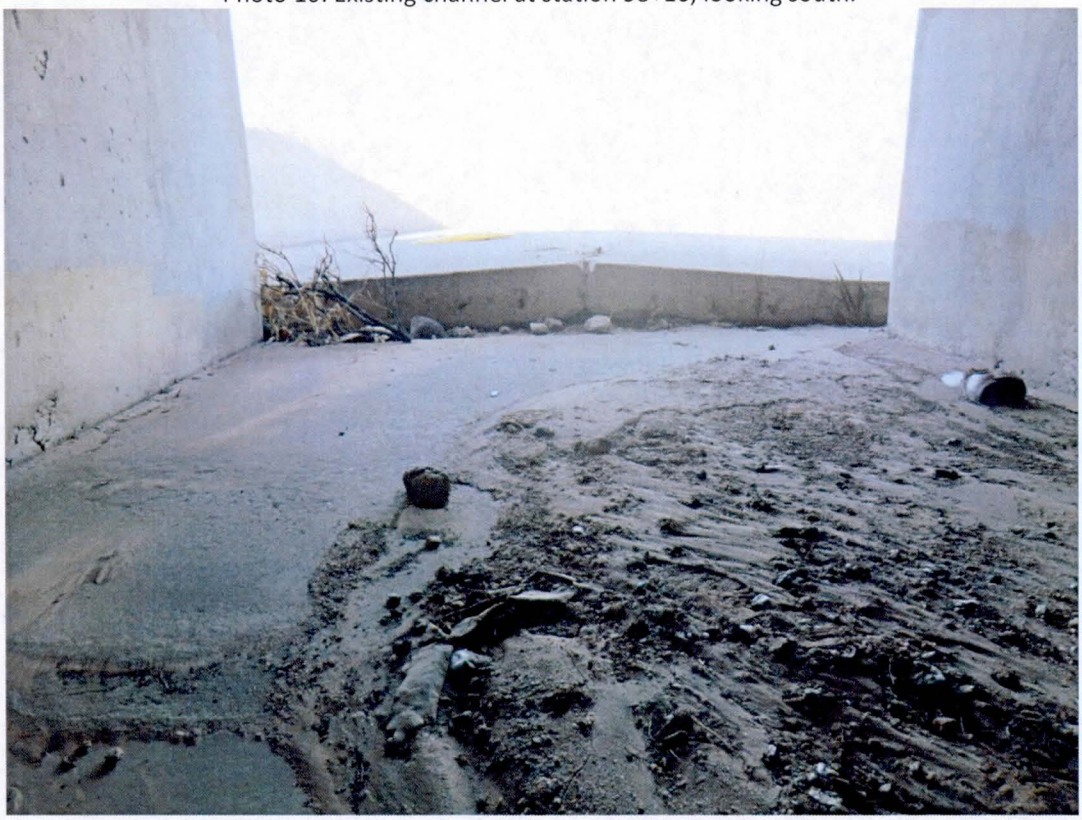


Photo 11: Existing channel at station 100+66, looking north from inside center Bell Road culvert.

Photo 12: Existing channel at Station 101+30, looking south to Bell Road culverts.

Photo 13: Existing channel at Station 101+50, 24-inch pipe outlet from north detention shown center-right.

Photo 14: Existing 24-inch pipe inlet to Sun City Drain at station 101+72, looking south to Bell Road.

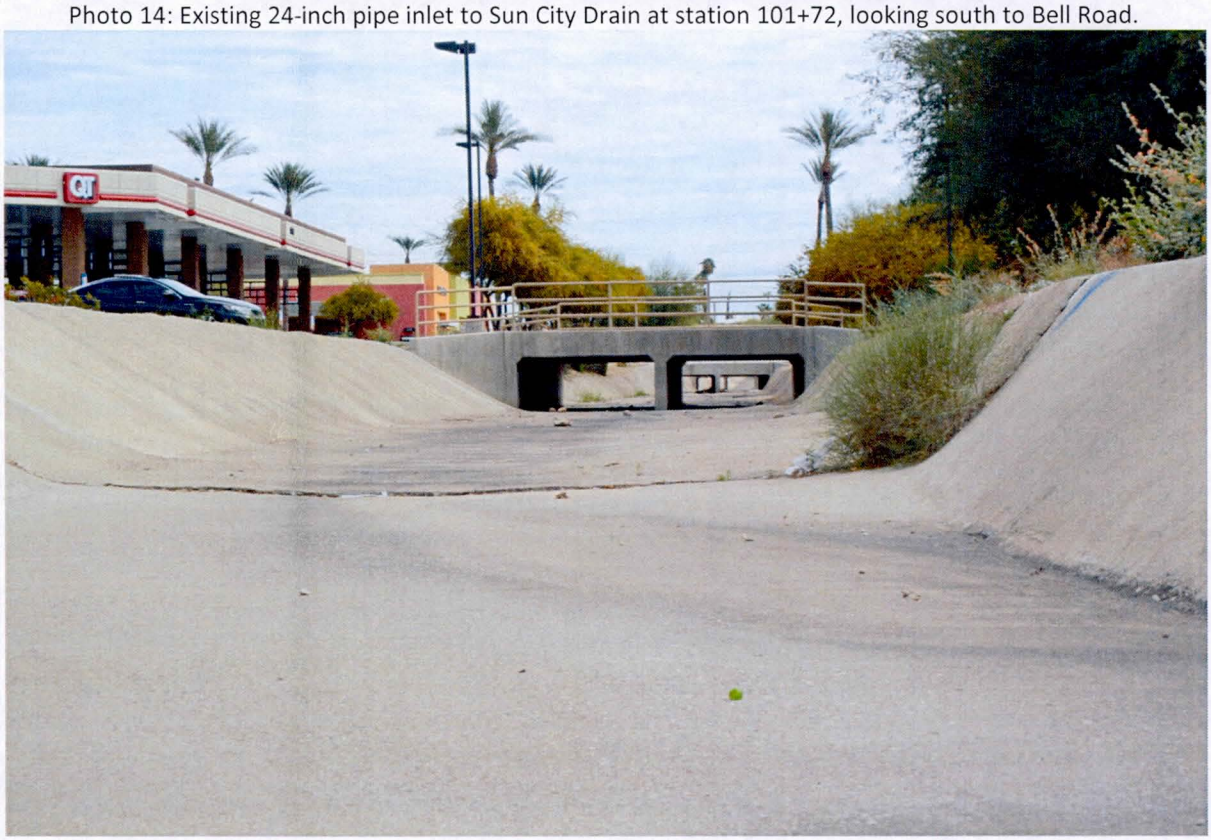


Photo 15: Existing Sun City Drain at station 101+40, looking east.

Photo 16: Existing Commercial Drive culvert outlet at station 114+00, looking north.

Photo 17: Existing Commercial Drive culvert inlet at station 114+60, looking south.

Photo 18: Existing channel at station 116+00, looking north.

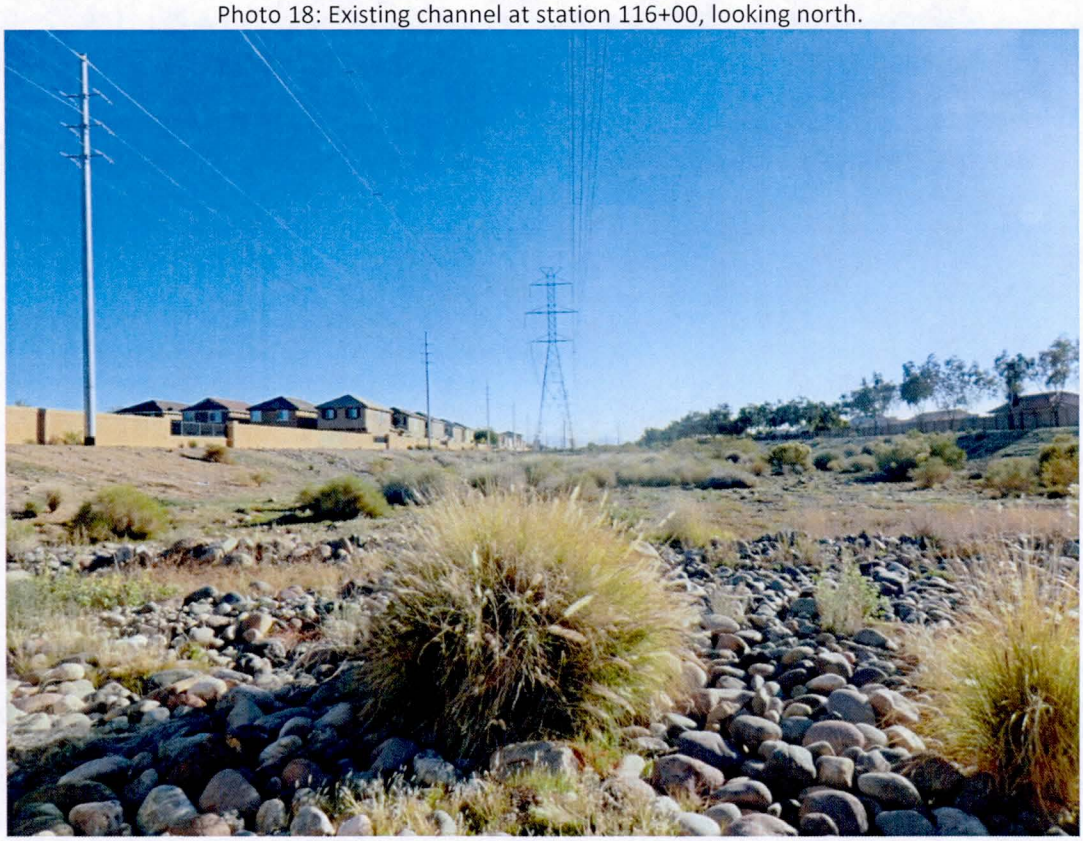


Photo 19: Existing channel at station 130+00, looking south.

Photo 20: Existing Avenue of the Arts culvert inlet at station 131+60, looking southwest.

Photo 21: Existing concrete pipe and berm at station 132+00, looking north.

Photo 22: Existing concrete pipe and berm at station 132+00, looking south to Avenue of the Arts.

Photo 23: Existing channel at station 147+85, looking northwest

Photo 24: Existing channel at station 305+00, looking west with Union Hills Drive on right.

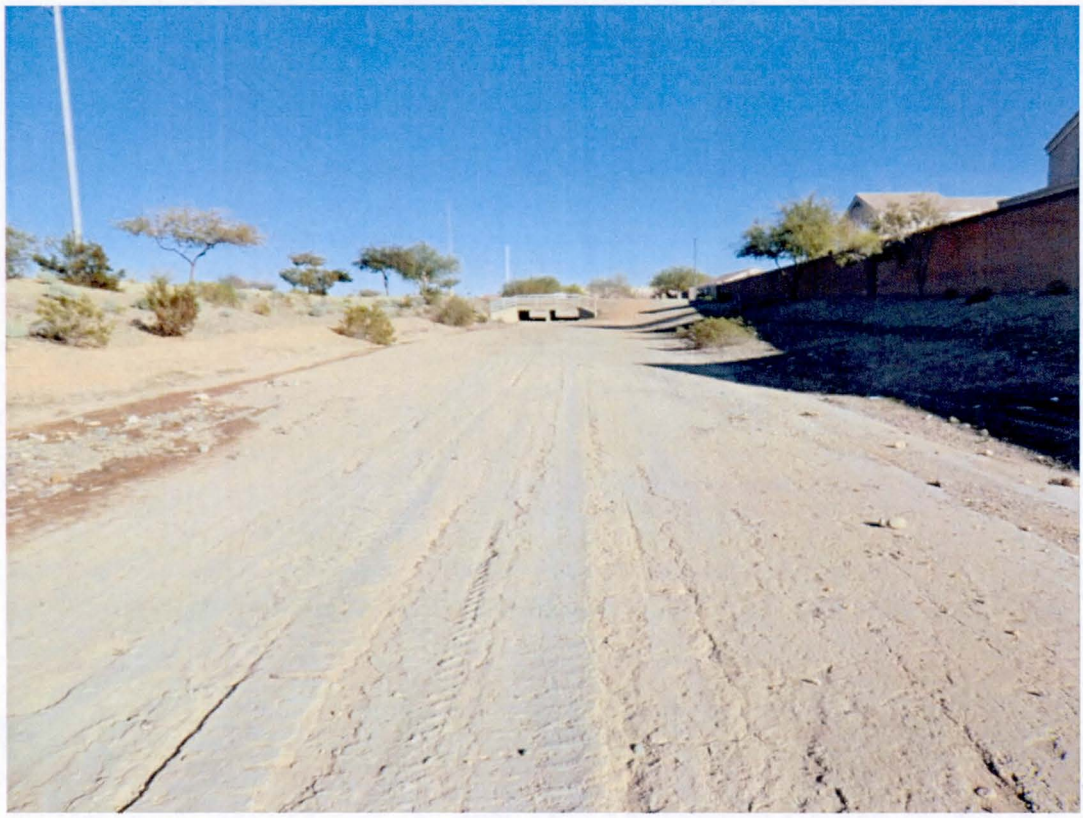


Photo 25: Existing channel at station 305+00, looking east with Union Hills Drive on left.

Photo 26: Existing concrete arch pipe outlet at station 311+50

Photo 27: Existing concrete arch pipe inlet at station 311+50

Photo 28: Existing Canyon Ridge HOA channel at station 320+00, looking east.

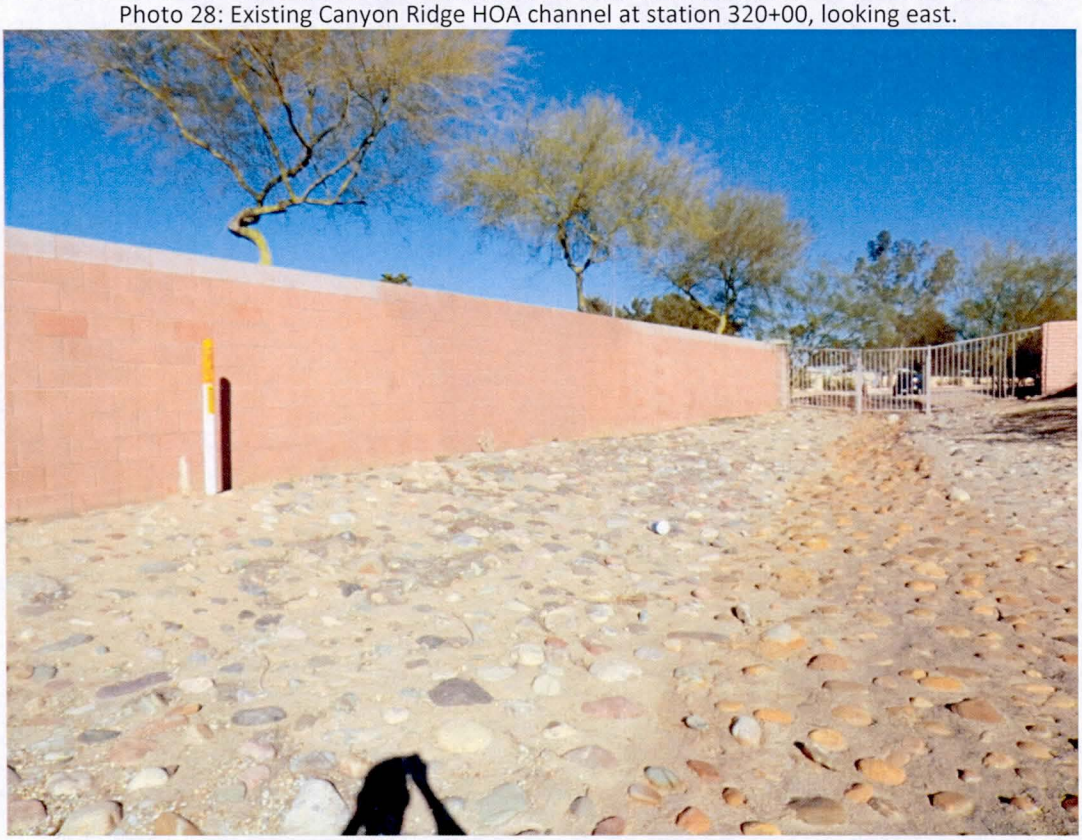


Photo 29: Existing Canyon Ridge channel, grouted riprap, and gas marker at station 328+00, looking east.

Photo 30: Existing channel at station 329+50, looking east with Union Hills Drive on the left.

Photo 31: Existing city of Peoria basin at the NWC of 111th Avenue and Union Hills Drive, looking southwest.

Photo 32: Existing RV Park retention pond at the NEC of 111th Avenue and Union Hills Drive, looking northeast

Photo 33: Existing channel at station 335+00, facing east with Union Hills Drive on the left.

Photo 34: Existing channel at station 348+00, facing east with Union Hills Drive on the left.

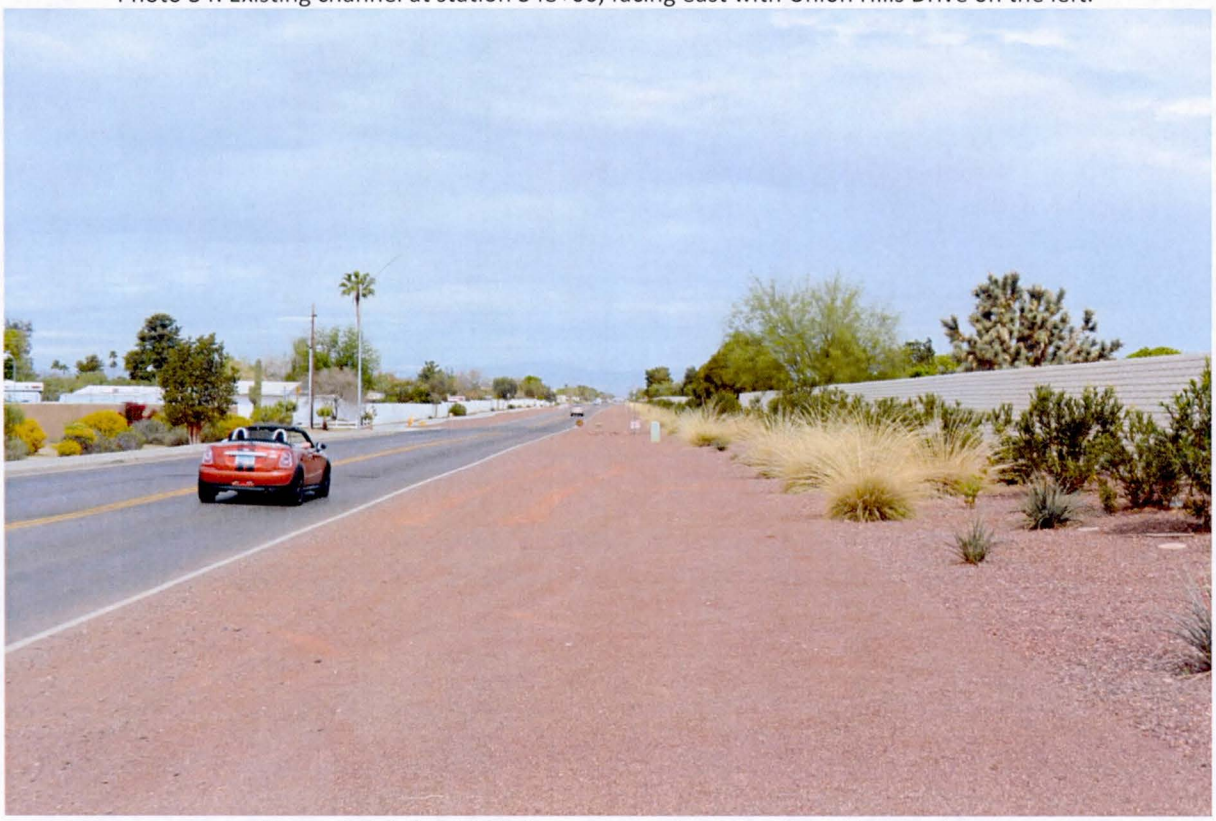


Photo 35: Existing 107th Avenue at station 364+00, looking north.

Photo 36: Existing 115th Avenue at station 157+00, looking north.

Photo 37: Existing 115th Avenue at station 186+00, looking north.

Photo 38: Existing sand and gravel mine at station 198+00, looking south.

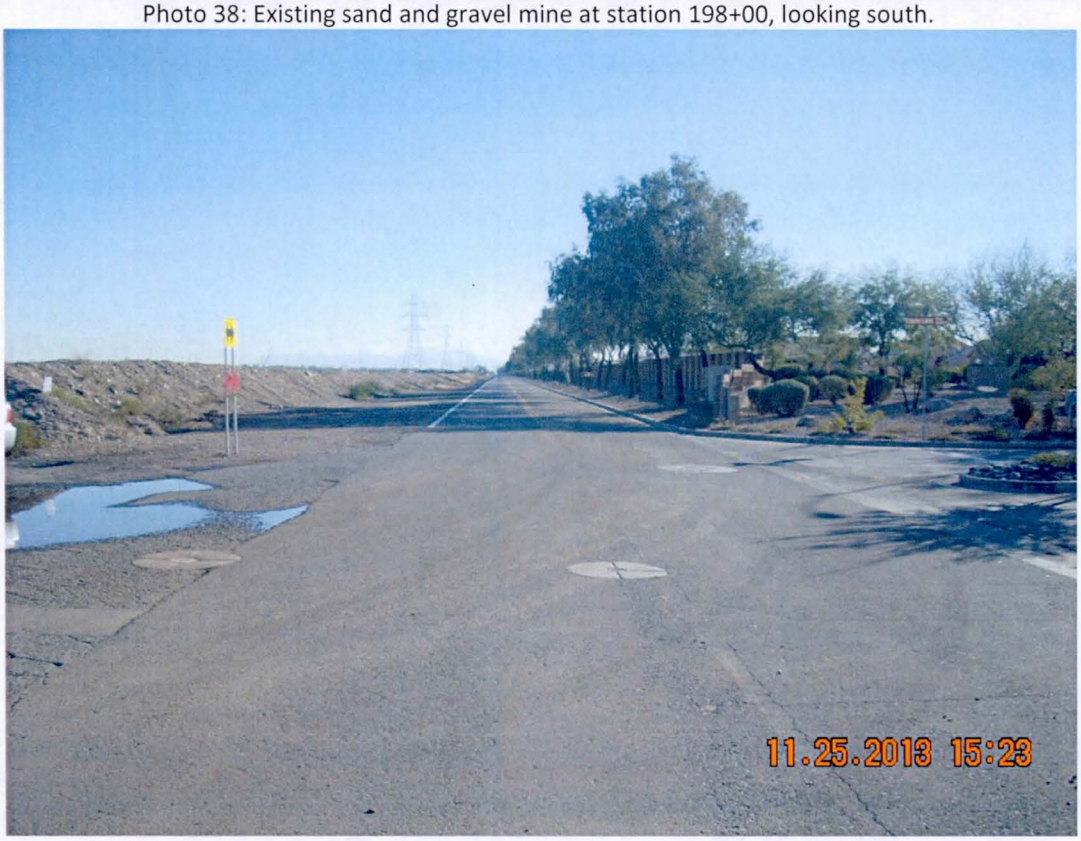


Photo 39: Existing 115th Avenue at station 200+00, looking south.

Photo 40: Existing channel at station 214+00, looking east with Union Hills Drive on the left.

Photo 41: Existing channel at station 216+00, looking west with Beardsley Road on right.

Photo 42: Existing channel at station 218+00, looking west with Beardsley Road on right.

Photo 43: Existing 36-inch culvert inlet at station 220+40, looking west.

Photo 44: Existing concrete lined channel parallel with Beardsley Road, looking west.

Photo 45: Existing culverts at the SWC of 111th Avenue and Beardsley Road, looking east.

APPENDIX B – Meeting Agenda and Notes & Utility Coordination Minutes (CD)

B.1 Meeting Agendas and Notes (CD)

B.2 Utility Coordination Minutes (CD)

APPENDIX C – Hydrologic Analysis

C.1 Basin Parameters

C.2 Land Use Information

C.3 Soil Information

C.4 Routing Data

C.5 Sun City Split Flow Analysis Memorandum

C.6 Existing HEC-1

C.7 Proposed HEC-1

C.8 Design Concept Report HEC-1 Model Review

C.9 Figure 2 – HEC-1 100 Yr Flows (With Improvements)

APPENDIX C.1 – Basin Parameters

Flood Control District of Maricopa County
Drainage Design Management System
SUB BASINS
Project Reference: 115TH_24_HR

Area ID	Sub Basin Parameters: Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	Rainfall Losses: IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		Return Period Parameters: 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
A061	0.080	0.70	22.8	22.8	URBAN	0.030	0.24	0.26	3.59	0.74	43	**Tc (Hrs)**	0.711*	0.658*	0.608*	0.559*	0.530*	0.504*
												Vel (f/s)	1.44	1.56	1.69	1.84	1.94	2.04
												R (Hrs)	0.804	0.737	0.676	0.616	0.580	0.549
A06A1	0.187	0.97	27.9	27.9	URBAN	0.027	0.21	0.25	4.65	0.44	24	**Tc (Hrs)**	0.775*	0.707*	0.653*	0.600*	0.561*	0.529*
												Vel (f/s)	1.84	2.01	2.18	2.37	2.54	2.69
												R (Hrs)	0.707	0.639	0.585	0.532	0.494	0.463
A06A2	0.106	0.50	96.4	96.4	URBAN	0.039	0.17	0.26	4.39	0.48	40	**Tc (Hrs)**	0.428*	0.396	0.369	0.341	0.322	0.304
												Vel (f/s)	1.71	1.85	1.99	2.15	2.28	2.41
												R (Hrs)	0.298	0.273	0.252	0.231	0.217	0.204
A06A3	0.053	0.41	46.9	46.9	URBAN	0.030	0.22	0.26	5.24	0.31	29	**Tc (Hrs)**	0.428*	0.395	0.368	0.336	0.316	0.300
												Vel (f/s)	1.40	1.52	1.63	1.79	1.90	2.00
												R (Hrs)	0.377	0.345	0.319	0.289	0.270	0.254
A07B1	0.081	0.59	54.4	54.4	URBAN	0.029	0.19	0.25	4.12	0.56	31	**Tc (Hrs)**	0.505*	0.461*	0.426*	0.392	0.370	0.349
												Vel (f/s)	1.71	1.88	2.03	2.21	2.34	2.48
												R (Hrs)	0.476	0.430	0.395	0.360	0.337	0.315
A07B2	0.101	0.60	67.2	67.2	URBAN	0.047	0.20	0.25	4.65	0.44	24	**Tc (Hrs)**	0.618*	0.564*	0.522*	0.479*	0.448*	0.422*
												Vel (f/s)	1.42	1.56	1.69	1.84	1.96	2.09
												R (Hrs)	0.532	0.481	0.441	0.401	0.372	0.349
A07B3	0.204	0.75	29.2	29.2	URBAN	0.027	0.20	0.25	4.96	0.37	26	**Tc (Hrs)**	0.651*	0.598*	0.556*	0.508*	0.477*	0.451*
												Vel (f/s)	1.69	1.84	1.98	2.17	2.31	2.44
												R (Hrs)	0.451	0.411	0.379	0.343	0.320	0.300
A07B4	0.053	0.50	28.2	28.2	URBAN	0.030	0.20	0.25	4.28	0.52	35	**Tc (Hrs)**	0.564*	0.518*	0.481*	0.444*	0.418*	0.395
												Vel (f/s)	1.30	1.42	1.52	1.65	1.75	1.86
												R (Hrs)	0.601	0.547	0.503	0.460	0.431	0.404
A07B5	0.057	0.49	12.3	12.3	URBAN	0.032	0.11	0.30	4.51	0.43	39	**Tc (Hrs)**	0.721*	0.668*	0.623*	0.576*	0.542*	0.514*
												Vel (f/s)	1.00	1.08	1.15	1.25	1.33	1.40
												R (Hrs)	0.745	0.684	0.633	0.580	0.543	0.511

* Non default value or value out of range

Flood Control District of Maricopa County
Drainage Design Management System
SUB BASINS
Project Reference: 115TH_24_HR

Area ID	Sub Basin Parameters: Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	Rainfall Losses: IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		Return Period Parameters: 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
A07B6	0.153	0.90	46.8	46.8	URBAN	0.061	0.15	0.25	4.65	0.47	26	**Tc (Hrs)**	0.962*	0.881*	0.815*	0.750*	0.703*	0.662*
												Vel (f/s)	1.37	1.50	1.62	1.76	1.88	1.99
												R (Hrs)	0.950	0.861	0.791	0.720	0.670	0.628
A07B7	0.021	0.30	52.8	52.8	URBAN	0.033	0.14	0.26	5.24	0.33	32	**Tc (Hrs)**	0.365	0.339	0.316	0.289	0.273	0.259
												Vel (f/s)	1.21	1.30	1.39	1.52	1.61	1.70
												R (Hrs)	0.418	0.384	0.356	0.323	0.302	0.285
A07C1	0.023	1.03	15.5	15.5	URBAN	0.033	0.12	0.23	6.76	0.14	55	**Tc (Hrs)**	0.885*	0.828*	0.778*	0.722*	0.687*	0.656*
												Vel (f/s)	1.71	1.82	1.94	2.09	2.20	2.30
												R (Hrs)	2.842	2.639	2.461	2.265	2.144	2.037
A07C2	0.165	0.71	45.1	45.1	URBAN	0.046	0.19	0.32	4.79	0.36	4	**Tc (Hrs)**	0.838*	0.747*	0.681*	0.616*	0.570*	0.533*
												Vel (f/s)	1.24	1.39	1.53	1.69	1.83	1.95
												R (Hrs)	0.645	0.568	0.513	0.459	0.421	0.391
A07D	0.252	1.11	25.3	25.3	URBAN	0.026	0.49	0.35	4.08	0.38		**Tc (Hrs)**	1.107*	0.943*	0.815*	0.720*	0.669*	0.618*
												Vel (f/s)	1.47	1.73	2.00	2.26	2.43	2.63
												R (Hrs)	0.988	0.826	0.703	0.613	0.564	0.518
A07E1	0.036	0.37	32.2	32.2	URBAN	0.031	0.25	0.15	7.94	0.10	40	**Tc (Hrs)**	0.414	0.385	0.360	0.333	0.317	0.303
												Vel (f/s)	1.31	1.41	1.51	1.63	1.71	1.79
												R (Hrs)	0.418	0.385	0.357	0.328	0.310	0.295
A07E2	0.033	0.37	34.9	34.9	URBAN	0.032	0.22	0.15	8.36	0.09	49	**Tc (Hrs)**	0.402	0.375	0.352	0.327	0.312	0.298
												Vel (f/s)	1.35	1.45	1.54	1.66	1.74	1.82
												R (Hrs)	0.424	0.393	0.366	0.338	0.320	0.305
A07E3	0.061	0.36	46.8	46.8	URBAN	0.030	0.24	0.19	6.54	0.17	34	**Tc (Hrs)**	0.375	0.348	0.324	0.298	0.281	0.268
												Vel (f/s)	1.41	1.52	1.63	1.77	1.88	1.97
												R (Hrs)	0.271	0.250	0.230	0.210	0.197	0.186
A07E4	0.056	0.36	30.7	30.7	URBAN	0.030	0.23	0.15	7.94	0.10	46	**Tc (Hrs)**	0.403	0.376	0.351	0.326	0.311	0.297
												Vel (f/s)	1.31	1.40	1.50	1.62	1.70	1.78
												R (Hrs)	0.308	0.285	0.265	0.244	0.231	0.219

* Non default value or value out of range

Flood Control District of Maricopa County
Drainage Design Management System
SUB BASINS
Project Reference: 115TH_24_HR

Area ID	Sub Basin Parameters: Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	Rainfall Losses: IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		Return Period Parameters: 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
A07E5	0.025	0.35	43.2	43.2	URBAN	0.032	0.23	0.25	5.46	0.29	27	**Tc (Hrs)**	0.420*	0.388	0.361	0.329	0.310	0.293
												Vel (f/s)	1.22	1.32	1.42	1.56	1.66	1.75
												R (Hrs)	0.500	0.457	0.423	0.381	0.356	0.335
A07E6	0.019	0.24	33.2	33.2	URBAN	0.033	0.10	0.15	7.94	0.11	80	**Tc (Hrs)**	0.319	0.301	0.285	0.267	0.255	0.245
												Vel (f/s)	1.10	1.17	1.24	1.32	1.38	1.44
												R (Hrs)	0.319	0.299	0.281	0.261	0.248	0.237
A07E7	0.006	0.13	52.6	52.6	URBAN	0.036	0.10	0.21	6.34	0.20	81	**Tc (Hrs)**	0.215	0.203	0.192	0.180	0.172	0.165
												Vel (f/s)	0.89	0.94	0.99	1.06	1.11	1.16
												R (Hrs)	0.243	0.228	0.214	0.199	0.189	0.180
A07E8	0.005	0.17	40.2	40.2	URBAN	0.037	0.10	0.25	4.79	0.40	81	**Tc (Hrs)**	0.274	0.259	0.245	0.229	0.219	0.210
												Vel (f/s)	0.91	0.96	1.02	1.09	1.14	1.19
												R (Hrs)	0.437	0.410	0.386	0.358	0.340	0.324
A07F1	0.107	1.30	17.7	17.7	URBAN	0.029	0.24	0.25	4.96	0.35	31	**Tc (Hrs)**	1.016*	0.936*	0.871*	0.799*	0.751*	0.711*
												Vel (f/s)	1.88	2.04	2.19	2.39	2.54	2.68
												R (Hrs)	1.660	1.516	1.401	1.272	1.187	1.117
A07F2	0.024	0.31	20.8	20.8	URBAN	0.033	0.25	0.25	4.96	0.35	31	**Tc (Hrs)**	0.505*	0.465*	0.433*	0.397	0.373	0.353
												Vel (f/s)	0.90	0.98	1.05	1.15	1.22	1.29
												R (Hrs)	0.569	0.520	0.480	0.436	0.407	0.383
A07G1	0.236	0.88	35.3	35.3	URBAN	0.028	0.23	0.15	7.94	0.10	27	**Tc (Hrs)**	0.601*	0.556*	0.517*	0.478*	0.454*	0.433*
												Vel (f/s)	2.15	2.32	2.50	2.70	2.84	2.98
												R (Hrs)	0.432	0.397	0.366	0.335	0.316	0.300
A07G2	0.028	0.58	24.0	24.0	URBAN	0.037	0.22	0.27	4.79	0.34	42	**Tc (Hrs)**	0.670*	0.622*	0.582*	0.536*	0.506*	0.481*
												Vel (f/s)	1.27	1.37	1.46	1.59	1.68	1.77
												R (Hrs)	1.178	1.085	1.008	0.920	0.863	0.815
A07H	0.092	0.53	72.0	72.0	URBAN	0.066	0.12	0.25	4.65	0.51	12	**Tc (Hrs)**	0.736*	0.662*	0.606*	0.553*	0.515*	0.482*
												Vel (f/s)	1.06	1.17	1.28	1.41	1.51	1.61
												R (Hrs)	0.617	0.548	0.497	0.449	0.415	0.386

* Non default value or value out of range

Area ID	Sub Basin Parameters: Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	Rainfall Losses: IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		Return Period Parameters: 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
A09C	0.113	1.04	36.7	36.7	URBAN	0.054	0.15	0.28	4.39	0.52	9	**Tc (Hrs)**	1.198*	1.063*	0.965*	0.875*	0.818*	0.762*
												Vel (f/s)	1.27	1.43	1.58	1.74	1.86	2.00
												R (Hrs)	1.617	1.415	1.272	1.141	1.059	0.979
A09D	0.244	0.99	20.3	20.3	URBAN	0.027	0.22	0.19	6.54	0.17	30	**Tc (Hrs)**	0.769*	0.713*	0.662*	0.608*	0.575*	0.546*
												Vel (f/s)	1.89	2.04	2.19	2.39	2.53	2.66
												R (Hrs)	0.613	0.563	0.519	0.472	0.443	0.419
A09E	0.140	1.02	17.7	17.7	URBAN	0.028	0.19	0.23	4.79	0.36	39	**Tc (Hrs)**	0.847*	0.788*	0.737*	0.677*	0.640*	0.608*
												Vel (f/s)	1.77	1.90	2.03	2.21	2.34	2.46
												R (Hrs)	0.959	0.885	0.822	0.748	0.702	0.663
A09F	0.370	1.20	21.7	21.7	URBAN	0.026	0.21	0.26	5.34	0.29	42	**Tc (Hrs)**	0.820*	0.763*	0.715*	0.657*	0.621*	0.591*
												Vel (f/s)	2.15	2.31	2.46	2.68	2.83	2.98
												R (Hrs)	0.605	0.559	0.520	0.473	0.445	0.420
A99P1	0.249	0.94	17.0	17.0	URBAN	0.028	0.21	0.19	6.54	0.19	26	**Tc (Hrs)**	0.821*	0.762*	0.704*	0.646*	0.610*	0.578*
												Vel (f/s)	1.68	1.81	1.96	2.13	2.26	2.39
												R (Hrs)	0.625	0.575	0.527	0.479	0.449	0.424
A99P2	0.226	1.05	63.1	63.1	URBAN	0.052	0.10	0.25	4.45	0.53	48	**Tc (Hrs)**	0.797*	0.741*	0.693*	0.643*	0.609*	0.578*
												Vel (f/s)	1.93	2.08	2.22	2.40	2.53	2.66
												R (Hrs)	0.698	0.644	0.598	0.550	0.518	0.488
A99Q	0.117	1.01	29.7	29.7	URBAN	0.100	0.11	0.27	3.25	1.20	2	**Tc (Hrs)**	1.500*	1.500*	1.500*	1.500*	1.389*	1.286*
												Vel (f/s)	0.99	0.99	0.99	0.99	1.07	1.15
												R (Hrs)	1.987	1.987	1.987	1.987	1.824	1.675
S30	0.342	1.01	31.7	31.7	URBAN	0.026	0.20	0.25	4.65	0.43	30	**Tc (Hrs)**	0.721*	0.662*	0.615*	0.566*	0.531*	0.501*
												Vel (f/s)	2.05	2.24	2.41	2.62	2.79	2.96
												R (Hrs)	0.478	0.435	0.400	0.365	0.340	0.319
S30B	0.567	1.37	7.3	7.3	URBAN	0.024	0.18	0.17	6.76	0.17	31	**Tc (Hrs)**	1.157*	1.072*	0.998*	0.918*	0.869*	0.827*
												Vel (f/s)	1.74	1.87	2.01	2.19	2.31	2.43
												R (Hrs)	0.774	0.710	0.656	0.598	0.563	0.533

* Non default value or value out of range

Flood Control District of Maricopa County
Drainage Design Management System
SUB BASINS
Project Reference: 115TH_24_HR

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
S30C	0.665	1.23	21.2	21.2	URBAN	0.024	0.26	0.19	6.54	0.16	13	**Tc (Hrs)**	0.834*	0.767*	0.705*	0.642*	0.604*	0.572*
												Vel (f/s)	2.16	2.35	2.56	2.81	2.99	3.15
												R (Hrs)	0.451	0.410	0.374	0.337	0.315	0.297

* Non default value or value out of range

APPENDIX C.2 – Land Use Information

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb
Major Basin ID: 01								
A061	160	0.074	92.0	0.25	40	50.0	NORMAL	0.029
	220	0.004	4.4	0.10	80	65.0	NORMAL	0.029
	615	0.002	2.9	0.10	85	25.0	NORMAL	0.029
	730	0.001	0.8	0.10	0	90.0	NORMAL	0.107
		0.080	**100.1**					
A06A1	150	0.139	74.1	0.25	30	50.0	NORMAL	0.027
	615	0.000	0.2	0.10	85	25.0	NORMAL	0.027
	720	0.047	25.3	0.10	5	90.0	NORMAL	0.027
	730	0.001	0.5	0.10	0	90.0	NORMAL	0.098
		0.187	**100.1**					
A06A2	150	0.042	39.8	0.25	30	50.0	NORMAL	0.029
	220	0.026	24.3	0.10	80	65.0	NORMAL	0.029
	615	0.011	10.0	0.10	85	25.0	NORMAL	0.029
	710	0.005	4.9	0.10	5	90.0	NORMAL	0.029
	730	0.013	12.1	0.10	0	90.0	NORMAL	0.104
	735	0.003	2.9	0.10	5	40.0	DRY	0.029
	900	0.006	5.9	0.35	0	25.0	DRY	0.055
		0.105	**99.9**					
A06A3	150	0.041	77.1	0.25	30	50.0	NORMAL	0.030
	220	0.000	0.8	0.10	80	65.0	NORMAL	0.030
	320	0.001	1.7	0.15	55	60.0	NORMAL	0.030
	615	0.002	4.0	0.10	85	25.0	NORMAL	0.030
	710	0.005	10.2	0.10	5	90.0	NORMAL	0.030
	735	0.003	6.2	0.10	5	40.0	DRY	0.030
		0.053	**100.0**					
A07B1	150	0.050	61.7	0.25	30	50.0	NORMAL	0.029
	310	0.000	0.2	0.10	80	75.0	NORMAL	0.029
	615	0.011	13.6	0.10	85	25.0	NORMAL	0.029
	710	0.020	24.4	0.10	5	90.0	NORMAL	0.029
		0.081	**99.9**					
A07B2	150	0.069	68.2	0.25	30	50.0	NORMAL	0.029
	615	0.003	3.4	0.10	85	25.0	NORMAL	0.029
	710	0.005	4.5	0.10	5	90.0	NORMAL	0.029
	730	0.024	24.0	0.10	0	90.0	NORMAL	0.105
		0.101	**100.1**					
A07B3	150	0.139	68.2	0.25	30	50.0	NORMAL	0.027
	205	0.005	2.5	0.10	80	75.0	NORMAL	0.027
	320	0.010	4.6	0.15	55	60.0	NORMAL	0.027
	615	0.001	0.3	0.10	85	25.0	NORMAL	0.027
	720	0.050	24.4	0.10	5	90.0	NORMAL	0.027
		0.205	**100.0**					
A07B4	160	0.034	64.6	0.25	40	50.0	NORMAL	0.030
	220	0.000	0.4	0.10	80	65.0	NORMAL	0.030
	615	0.005	8.9	0.10	85	25.0	NORMAL	0.030
	710	0.014	26.1	0.10	5	90.0	NORMAL	0.030
		0.053	**100.0**					
A07B5	220	0.021	37.1	0.10	80	65.0	NORMAL	0.030
	615	0.005	8.3	0.10	85	25.0	NORMAL	0.030
	710	0.001	1.1	0.10	5	90.0	NORMAL	0.030
	735	0.027	48.2	0.10	5	40.0	DRY	0.030
	900	0.003	5.3	0.35	0	25.0	DRY	0.059
		0.057	**100.0**					
A07B6	150	0.000	0.2	0.25	30	50.0	NORMAL	0.028

* Non default value

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb
Major Basin ID: 01								
A07B6	150	0.049	25.0	0.25	30	50.0	NORMAL	0.028
	170	0.016	8.1	0.25	45	50.0	NORMAL	0.028
	220	0.006	3.0	0.10	80	65.0	NORMAL	0.028
	230	0.015	7.6	0.10	80	75.0	NORMAL	0.028
	320	0.001	0.6	0.15	55	60.0	NORMAL	0.028
	615	0.013	6.8	0.10	85	25.0	NORMAL	0.028
	710	0.006	3.0	0.10	5	90.0	NORMAL	0.028
	730	0.089	45.8	0.10	0	90.0	NORMAL	0.100
		0.195	**100.1**					
A07B7	150	0.006	28.7	0.25	30	50.0	NORMAL	0.033
	310	0.002	7.7	0.10	80	75.0	NORMAL	0.033
	615	0.004	17.7	0.10	85	25.0	NORMAL	0.033
	710	0.008	39.7	0.10	5	90.0	NORMAL	0.033
	735	0.001	6.2	0.10	5	40.0	DRY	0.033
		0.021	**100.0**					
A07C1	160	0.002	9.5	0.25	40	50.0	NORMAL	0.033
	320	0.001	3.5	0.15	55	60.0	NORMAL	0.033
	615	0.013	55.8	0.10	85	25.0	NORMAL	0.033
	730	0.000	0.4	0.10	0	90.0	NORMAL	0.121
	735	0.007	30.7	0.10	5	40.0	DRY	0.033
		0.023	**99.9**					
A07C2	615	0.003	1.6	0.10	85	25.0	NORMAL	0.027
	715	0.039	23.7	0.50	0	0.0	DRY	0.027
	730	0.043	26.1	0.10	0	90.0	NORMAL	0.099
	735	0.080	48.6	0.10	5	40.0	DRY	0.027
		0.165	**100.0**					
A07D	710	0.003	1.3	0.10	5	90.0	NORMAL	0.026
	715	0.115	45.5	0.50	0	0.0	DRY	0.026
	715	0.134	53.2	0.50	0	0.0	DRY	0.026
		0.252	**100.0**					
A07E1	160	0.036	99.7	0.25	40	50.0	NORMAL	0.031
	710	0.000	0.3	0.10	5	90.0	NORMAL	0.031
		0.036	**100.0**					
A07E2	160	0.026	79.4	0.25	40	50.0	NORMAL	0.032
	220	0.000	0.9	0.10	80	65.0	NORMAL	0.032
	550	0.004	12.0	0.10	80	75.0	NORMAL	0.032
	615	0.003	7.7	0.10	85	25.0	NORMAL	0.032
		0.033	**100.0**					
A07E3	150	0.005	7.6	0.25	30	50.0	NORMAL	0.030
	150	0.052	85.8	0.25	30	50.0	NORMAL	0.030
	220	0.000	0.2	0.10	80	65.0	NORMAL	0.030
	615	0.004	6.4	0.10	85	25.0	NORMAL	0.030
		0.061	**100.0**					
A07E4	160	0.048	84.7	0.25	40	50.0	NORMAL	0.030
	550	0.006	11.4	0.10	80	75.0	NORMAL	0.030
	615	0.002	3.9	0.10	85	25.0	NORMAL	0.030
		0.056	**100.0**					
A07E5	150	0.022	88.0	0.25	30	50.0	NORMAL	0.032
	710	0.003	12.0	0.10	5	90.0	NORMAL	0.032
		0.025	**100.0**					
A07E6	220	0.017	93.0	0.10	80	65.0	NORMAL	0.033
	615	0.001	7.0	0.10	85	25.0	NORMAL	0.033

* Non default value

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb
Major Basin ID: 01								
		0.019	**100.0**					
A07E7	220	0.006	87.7	0.10	80	65.0	NORMAL	0.036
	615	0.001	12.3	0.10	85	25.0	NORMAL	0.036
		0.007	**100.0**					
A07E8	220	0.004	79.2	0.10	80	65.0	NORMAL	0.037
	615	0.001	20.8	0.10	85	25.0	NORMAL	0.037
		0.005	**100.0**					
A07F1	150	0.097	90.6	0.25	30	50.0	NORMAL	0.029
	220	0.000	0.2	0.10	80	65.0	NORMAL	0.029
	615	0.004	4.0	0.10	85	25.0	NORMAL	0.029
	720	0.006	5.2	0.10	5	90.0	NORMAL	0.029
		0.108	**100.0**					
A07F2	150	0.024	97.5	0.25	30	50.0	NORMAL	0.033
	615	0.001	2.5	0.10	85	25.0	NORMAL	0.033
		0.024	**100.0**					
A07G1	140	0.188	79.7	0.25	30	50.0	NORMAL	0.026
	205	0.005	2.3	0.10	80	75.0	NORMAL	0.026
	320	0.002	0.7	0.15	55	60.0	NORMAL	0.026
	615	0.001	0.5	0.10	85	25.0	NORMAL	0.026
	710	0.008	3.5	0.10	5	90.0	NORMAL	0.026
	740	0.016	6.7	0.00	0	0.0	WET	0.026
	900	0.016	6.7	0.35	0	25.0	DRY	0.050
		0.236	**100.1**					
A07G2	150	0.002	7.5	0.25	30	50.0	NORMAL	0.032
	150	0.013	44.8	0.25	30	50.0	NORMAL	0.032
	615	0.009	30.8	0.10	85	25.0	NORMAL	0.032
	900	0.005	16.8	0.35	0	25.0	DRY	0.063
		0.028	**99.9**					
A07H	320	0.017	18.3	0.15	55	60.0	NORMAL	0.029
	710	0.029	31.0	0.10	5	90.0	NORMAL	0.029
	715	0.002	2.0	0.50	0	0.0	DRY	0.029
	730	0.045	48.8	0.10	0	90.0	NORMAL	0.106
		0.092	**100.1**					
A09C	160	0.000	0.3	0.25	40	50.0	NORMAL	0.028
	220	0.004	3.2	0.10	80	65.0	NORMAL	0.028
	320	0.004	3.9	0.15	55	60.0	NORMAL	0.028
	615	0.003	2.5	0.10	85	25.0	NORMAL	0.028
	710	0.026	23.0	0.10	5	90.0	NORMAL	0.028
	715	0.012	10.8	0.50	0	0.0	DRY	0.028
	730	0.038	33.8	0.10	0	90.0	NORMAL	0.104
	735	0.026	22.6	0.10	5	40.0	DRY	0.028
		0.113	**100.1**					
A09D	150	0.192	78.6	0.25	30	50.0	NORMAL	0.026
	550	0.001	0.4	0.10	80	75.0	NORMAL	0.026
	615	0.017	6.9	0.10	85	25.0	NORMAL	0.026
	710	0.007	3.0	0.10	5	90.0	NORMAL	0.026
	740	0.016	6.4	0.00	0	0.0	WET	0.026
	900	0.011	4.6	0.35	0	25.0	DRY	0.050
		0.244	**99.9**					
A09E	150	0.093	66.8	0.25	30	50.0	NORMAL	0.028
	220	0.007	5.0	0.10	80	65.0	NORMAL	0.028
	550	0.006	4.6	0.10	80	75.0	NORMAL	0.028

* Non default value

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb
Major Basin ID: 01								
A09E	615	0.018	12.8	0.10	85	25.0	NORMAL	0.028
	710	0.004	2.5	0.10	5	90.0	NORMAL	0.028
	740	0.012	8.2	0.00	0	0.0	WET	0.028
		0.140	**99.9**					
A09F	150	0.000	0.1	0.25	30	50.0	NORMAL	0.025
	150	0.190	51.4	0.25	30	50.0	NORMAL	0.025
	170	0.032	8.7	0.25	45	50.0	NORMAL	0.025
	180	0.015	4.1	0.25	45	50.0	NORMAL	0.025
	220	0.008	2.2	0.10	80	65.0	NORMAL	0.025
	240	0.023	6.3	0.10	80	65.0	NORMAL	0.025
	320	0.000	0.1	0.15	55	60.0	NORMAL	0.025
	410	0.005	1.4	0.10	80	75.0	NORMAL	0.025
	550	0.012	3.2	0.10	80	75.0	NORMAL	0.025
	615	0.029	7.7	0.10	85	25.0	NORMAL	0.025
	710	0.021	5.7	0.10	5	90.0	NORMAL	0.025
	810	0.016	4.2	0.10	80	75.0	NORMAL	0.025
	900	0.018	4.9	0.35	0	25.0	DRY	0.047
		0.370	**100.0**					
A99P1	150	0.178	71.5	0.25	30	50.0	NORMAL	0.026
	220	0.008	3.3	0.10	80	65.0	NORMAL	0.026
	225	0.002	0.8	0.10	70	80.0	DRY	0.026
	540	0.015	5.9	0.10	5	90.0	NORMAL	0.050
	710	0.003	1.2	0.10	5	90.0	NORMAL	0.026
	720	0.043	17.3	0.10	5	90.0	NORMAL	0.026
	730	0.000	0.1	0.10	0	90.0	NORMAL	0.095
		0.249	**100.1**					
A99P2	150	0.006	2.6	0.25	30	50.0	NORMAL	0.026
	160	0.000	0.2	0.25	40	50.0	NORMAL	0.026
	220	0.009	4.0	0.10	80	65.0	NORMAL	0.026
	240	0.123	54.6	0.10	80	65.0	NORMAL	0.026
	615	0.001	0.5	0.10	85	25.0	NORMAL	0.026
	730	0.085	37.4	0.10	0	90.0	NORMAL	0.096
	735	0.001	0.6	0.10	5	40.0	DRY	0.026
		0.226	**99.9**					
A99Q	160	0.005	4.0	0.25	40	50.0	NORMAL	0.028
	730	0.112	96.0	0.10	0	90.0	NORMAL	0.103
		0.117	**100.0**					
S30	140	0.231	67.4	0.25	30	50.0	NORMAL	0.025
	240	0.018	5.2	0.10	80	65.0	NORMAL	0.025
	615	0.019	5.6	0.10	85	25.0	NORMAL	0.025
	710	0.000	0.1	0.10	5	90.0	NORMAL	0.025
	720	0.073	21.3	0.10	5	90.0	NORMAL	0.025
	730	0.001	0.4	0.10	0	90.0	NORMAL	0.091
		0.342	**100.0**					
S30B	140	0.256	45.1	0.25	30	50.0	NORMAL	0.024
	160	0.050	8.7	0.25	40	50.0	NORMAL	0.024
	205	0.008	1.4	0.10	80	75.0	NORMAL	0.024
	220	0.012	2.2	0.10	80	65.0	NORMAL	0.024
	320	0.004	0.7	0.15	55	60.0	NORMAL	0.024
	550	0.024	4.2	0.10	80	75.0	NORMAL	0.024
	615	0.040	7.1	0.10	85	25.0	NORMAL	0.024
	720	0.174	30.6	0.10	5	90.0	NORMAL	0.024
		0.567	**100.0**					
S30C	110	0.505	76.0	0.30	5	30.0	NORMAL	0.024
	170	0.013	2.0	0.25	45	50.0	NORMAL	0.024

* Non default value

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb
Major Basin ID: 01								
S30C	205	0.016	2.4	0.10	80	75.0	NORMAL	0.024
	220	0.004	0.6	0.10	80	65.0	NORMAL	0.024
	550	0.014	2.2	0.10	80	75.0	NORMAL	0.024
	615	0.027	4.1	0.10	85	25.0	NORMAL	0.024
	710	0.004	0.6	0.10	5	90.0	NORMAL	0.024
	720	0.081	12.2	0.10	5	90.0	NORMAL	0.024
		0.665	**100.1**					

APPENDIX C.3 – Soil Information

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)
Major Basin ID: 01								
A061	651	Cb	6512423	0.001	1.00	0.40	-	100
	651	Ma	6514421	0.016	19.50	0.40	-	100
	651	TD	6515826	0.002	2.90	1.20	-	100
	651	Vg	6516233	0.035	43.40	0.91	-	100
	651	GgA	651323320	0.027	33.20	0.25	-	100
A06A1	651	CA2	65124202	0.017	9.20	0.38	-	100
	651	GxA	651326720	0.001	0.50	0.23	-	100
	651	LcA	651422520	0.121	64.50	0.25	-	100
	651	PeA	651502920	0.026	13.90	0.37	-	100
	651	RbA	651542320	0.022	11.80	0.26	-	100
A06A2	651	Ma	6514421	0.019	17.60	0.40	-	100
	651	Mr	6514455	0.003	2.80	0.05	-	100
	651	Va	6516221	0.016	15.60	0.39	-	100
	651	Vg	6516233	0.002	2.00	0.91	-	100
	651	Vh	6516235	0.000	0.30	0.27	-	100
	651	CA2	65124202	0.005	4.60	0.38	-	100
	651	AbA	651202320	0.003	2.80	0.38	-	100
	651	GgA	651323320	0.024	22.30	0.25	-	100
	651	GxA	651326720	0.004	3.60	0.23	-	100
	651	RbA	651542320	0.005	5.00	0.26	-	100
	651	TfB	651583122	0.025	23.60	0.36	-	100
A06A3	651	Mr	6514455	0.009	17.00	0.05	-	100
	651	Te	6515829	0.001	2.60	0.25	-	100
	651	Va	6516221	0.008	15.10	0.39	-	100
	651	GgA	651323320	0.034	63.60	0.25	-	100
	651	TfB	651583122	0.001	1.70	0.36	-	100
A07B1	651	Ge	6513229	0.003	3.20	0.26	-	100
	651	Ma	6514421	0.000	0.50	0.40	-	100
	651	Mo	6514449	0.005	5.80	0.39	-	100
	651	Va	6516221	0.012	14.60	0.39	-	100
	651	Vh	6516235	0.007	8.50	0.27	-	100
	651	CA2	65124202	0.002	2.00	0.38	-	100
	651	AbA	651202320	0.051	62.40	0.38	-	100
	651	TfA	651583120	0.002	3.00	0.37	-	100
A07B2	651	Mp	6514451	0.004	3.50	0.25	-	100
	651	Te	6515829	0.006	5.60	0.25	-	100
	651	Va	6516221	0.008	8.30	0.39	-	100
	651	CA2	65124202	0.040	39.60	0.38	-	100
	651	AbA	651202320	0.005	4.60	0.38	-	100
	651	LcB	651422522	0.004	4.20	0.25	-	100
	651	TfB	651583122	0.011	11.10	0.36	-	100
	651	TrB	651585522	0.023	23.30	0.13	-	100
A07B3	651	Mr	6514455	0.009	4.50	0.05	-	100
	651	Te	6515829	0.004	2.00	0.25	-	100
	651	CA2	65124202	0.039	19.00	0.38	-	100
	651	GxA	651326720	0.085	41.70	0.23	-	100
	651	LcA	651422520	0.060	29.10	0.25	-	100
	651	LcB	651422522	0.002	1.10	0.25	-	100
	651	RbA	651542320	0.005	2.50	0.26	-	100
	651	RpE	651545128	0.000	0.00	0.29	-	100
A07B4	651	AbA	651202320	0.037	70.30	0.38	-	100
	651	GgA	651323320	0.014	25.60	0.25	-	100
	651	TfB	651583122	0.002	4.20	0.36	-	100
A07B5	651	Ma	6514421	0.004	6.50	0.40	-	100
	651	Te	6515829	0.011	19.80	0.25	-	100
	651	AbA	651202320	0.005	9.50	0.38	-	100
	651	GgA	651323320	0.018	32.20	0.25	-	100
	651	TfB	651583122	0.018	32.00	0.36	-	100
A07B6	651	Te	6515829	0.010	6.30	0.25	-	100
	651	Va	6516221	0.007	4.80	0.39	-	100
	651	CA2	65124202	0.075	49.30	0.38	-	100
	651	AbA	651202320	0.016	10.70	0.38	-	100

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)
Major Basin ID: 01								
A07B6	651	GxA	651326720	0.002	1.40	0.23	-	100
	651	RbA	651542320	0.006	3.70	0.26	-	100
	651	TrB	651585522	0.036	23.80	0.13	-	100
A07B7	651	Mp	6514451	0.004	20.00	0.25	-	100
	651	Te	6515829	0.003	15.20	0.25	-	100
	651	CA2	65124202	0.001	2.40	0.38	-	100
	651	LcB	651422522	0.003	12.40	0.25	-	100
	651	TfA	651583120	0.002	8.10	0.37	-	100
	651	TfB	651583122	0.002	7.10	0.36	-	100
	651	TrB	651585522	0.007	34.80	0.13	-	100
A07C1	651	Mr	6514455	0.005	21.50	0.05	-	100
	651	Te	6515829	0.008	33.90	0.25	-	100
	651	Tg	6515833	0.005	21.90	0.04	-	100
	651	Th	6515835	0.002	6.40	0.04	-	100
	651	LcB	651422522	0.002	9.40	0.25	-	100
	651	TfA	651583120	0.002	6.90	0.37	-	100
A07C2	651	Mp	6514451	0.020	12.00	0.25	-	100
	651	Mr	6514455	0.007	4.00	0.05	-	100
	651	Te	6515829	0.053	32.30	0.25	-	100
	651	Tg	6515833	0.006	3.40	0.04	-	100
	651	Va	6516221	0.017	10.10	0.39	-	100
	651	CA2	65124202	0.024	14.40	0.38	-	100
	651	LcB	651422522	0.011	6.40	0.25	-	100
	651	TfA	651583120	0.029	17.40	0.37	-	100
A07D	651	Cb	6512423	0.057	22.50	0.40	-	100
	651	Ge	6513229	0.010	3.90	0.26	-	100
	651	Mo	6514449	0.004	1.40	0.39	-	100
	651	Va	6516221	0.123	48.80	0.39	-	100
	651	GgA	651323320	0.005	1.90	0.25	-	100
	651	TfA	651583120	0.054	21.50	0.37	-	100
A07E1	651	Mr	6514455	0.031	86.50	0.05	-	100
	651	TfA	651583120	0.005	13.50	0.37	-	100
A07E2	651	Mr	6514455	0.030	92.60	0.05	-	100
	651	GxA	651326720	0.002	7.40	0.23	-	100
A07E3	651	Mr	6514455	0.032	52.30	0.05	-	100
	651	Te	6515829	0.002	3.30	0.25	-	100
	651	RbA	651542320	0.014	22.50	0.26	-	100
	651	RpE	651545128	0.008	13.30	0.29	-	100
	651	TfA	651583120	0.005	8.60	0.37	-	100
A07E4	651	Mr	6514455	0.043	76.40	0.05	-	100
	651	Te	6515829	0.005	9.20	0.25	-	100
	651	Th	6515835	0.003	5.30	0.04	-	100
	651	TfA	651583120	0.005	9.10	0.37	-	100
A07E5	651	Mr	6514455	0.008	33.60	0.05	-	100
	651	RpE	651545128	0.001	4.00	0.29	-	100
	651	TfA	651583120	0.016	62.40	0.37	-	100
A07E6	651	Mr	6514455	0.015	77.50	0.05	-	100
	651	RbA	651542320	0.004	22.50	0.26	-	100
A07E7	651	Mr	6514455	0.003	43.80	0.05	-	100
	651	RbA	651542320	0.001	7.80	0.26	-	100
	651	RpE	651545128	0.003	48.40	0.29	-	100
A07E8	651	Mr	6514455	0.000	1.90	0.05	-	100
	651	RbA	651542320	0.005	84.90	0.26	-	100
	651	RpE	651545128	0.001	13.20	0.29	-	100
A07F1	651	Mp	6514451	0.004	3.30	0.25	-	100
	651	Mr	6514455	0.002	1.70	0.05	-	100
	651	Te	6515829	0.054	49.90	0.25	-	100
	651	LcA	651422520	0.042	39.00	0.25	-	100
	651	RbA	651542320	0.007	6.10	0.26	-	100
A07F2	651	Mp	6514451	0.009	35.40	0.25	-	100

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)
Major Basin ID: 01								
A07F2	651	Mr	6514455	0.001	2.50	0.05	-	100
	651	Te	6515829	0.001	3.80	0.25	-	100
	651	LcA	651422520	0.007	28.30	0.25	-	100
	651	RbA	651542320	0.007	30.00	0.26	-	100
A07G1	651	Mr	6514455	0.163	69.20	0.05	-	100
	651	Te	6515829	0.000	0.10	0.25	-	100
	651	Tg	6515833	0.032	13.60	0.04	-	100
	651	RbA	651542320	0.006	2.70	0.26	-	100
	651	RpE	651545128	0.033	13.80	0.29	-	100
	651	TfA	651583120	0.001	0.50	0.37	-	100
	651	TPB	651585022	0.000	0.20	0.12	-	100
A07G2	651	Te	6515829	0.003	9.60	0.25	-	100
	651	RbA	651542320	0.025	89.30	0.26	-	100
	651	RpE	651545128	0.000	1.10	0.29	-	100
A07H	651	Te	6515829	0.027	29.50	0.25	-	100
	651	Tg	6515833	0.008	8.70	0.04	-	100
	651	Va	6516221	0.012	12.40	0.39	-	100
	651	CA2	65124202	0.020	22.10	0.38	-	100
	651	TfA	651583120	0.025	27.30	0.37	-	100
A09C	651	Cb	6512423	0.006	4.90	0.40	-	100
	651	Te	6515829	0.034	29.80	0.25	-	100
	651	Tg	6515833	0.001	1.20	0.04	-	100
	651	Va	6516221	0.017	14.70	0.39	-	100
	651	CA2	65124202	0.014	12.10	0.38	-	100
	651	AbA	651202320	0.016	14.10	0.38	-	100
	651	GgA	651323320	0.005	4.10	0.25	-	100
	651	TfA	651583120	0.021	18.20	0.37	-	100
	651	TPB	651585022	0.001	0.80	0.12	-	100
A09D	651	Mr	6514455	0.023	9.40	0.05	-	100
	651	Te	6515829	0.002	1.00	0.25	-	100
	651	Tg	6515833	0.006	2.60	0.04	-	100
	651	PRB	651505422	0.017	6.90	0.28	-	100
	651	RbA	651542320	0.004	1.60	0.26	-	100
	651	RpE	651545128	0.004	1.60	0.29	-	100
	651	TPB	651585022	0.188	76.90	0.12	-	100
A09E	651	Mp	6514451	0.003	2.10	0.25	-	100
	651	Te	6515829	0.010	7.00	0.25	-	100
	651	LcA	651422520	0.013	9.50	0.25	-	100
	651	PRB	651505422	0.107	76.30	0.28	-	100
	651	RbA	651542320	0.000	0.10	0.26	-	100
	651	TPB	651585022	0.007	5.00	0.12	-	100
A09F	651	BE	6512228	0.109	29.50	0.24	-	100
	651	Mp	6514451	0.036	9.70	0.25	-	100
	651	Mr	6514455	0.035	9.50	0.05	-	100
	651	PT	6515058	0.005	1.30	0.40	-	100
	651	LcA	651422520	0.011	2.80	0.25	-	100
	651	MTB	651445822	0.024	6.40	0.15	-	100
	651	PRB	651505422	0.053	14.30	0.28	-	100
	651	PWB	651506422	0.045	12.10	0.38	-	100
	651	TrA	651585520	0.017	4.70	0.11	-	100
	651	TrB	651585522	0.001	0.20	0.13	-	100
	651	TSC	651585624	0.036	9.60	0.14	-	100
A99P1	651	Le	6514229	0.100	40.30	0.04	-	100
	651	Tw	6515865	0.012	4.80	0.05	-	100
	651	CA2	65124202	0.008	3.30	0.38	-	100
	651	LcA	651422520	0.109	43.70	0.25	-	100
	651	PeA	651502920	0.020	7.90	0.37	-	100
A99P2	651	Cb	6512423	0.026	11.60	0.40	-	100
	651	Mr	6514455	0.011	4.90	0.05	-	100
	651	TD	6515826	0.003	1.10	1.20	-	100
	651	Te	6515829	0.005	2.00	0.25	-	100
	651	Va	6516221	0.000	0.10	0.39	-	100

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)
Major Basin ID: 01								
A99P2	651	Vh	6516235	0.007	2.90	0.27	-	100
	651	CA2	65124202	0.055	24.40	0.38	-	100
	651	AbA	651202320	0.059	26.20	0.38	-	100
	651	GgA	651323320	0.050	22.10	0.25	-	100
	651	PeA	651502920	0.008	3.40	0.37	-	100
	651	RbA	651542320	0.003	1.30	0.26	-	100
A99Q	651	Cb	6512423	0.055	47.40	0.40	-	100
	651	Ma	6514421	0.003	2.30	0.40	-	100
	651	TD	6515826	0.032	27.20	1.20	-	100
	651	Vg	6516233	0.025	21.70	0.91	-	100
	651	GgA	651323320	0.002	1.50	0.25	-	100
S30	651	CA2	65124202	0.066	19.30	0.38	-	100
	651	GxA	651326720	0.066	19.30	0.23	-	100
	651	LcA	651422520	0.161	47.20	0.25	-	100
	651	PeA	651502920	0.039	11.50	0.37	-	100
	651	RbA	651542320	0.009	2.60	0.26	-	100
	651	TrB	651585522	0.000	0.10	0.13	-	100
S30B	651	Le	6514229	0.086	15.20	0.04	-	100
	651	Mr	6514455	0.111	19.50	0.05	-	100
	651	Vf	6516231	0.043	7.60	0.01	-	100
	651	LcA	651422520	0.309	54.40	0.25	-	100
	651	PeA	651502920	0.003	0.50	0.37	-	100
	651	RbA	651542320	0.016	2.80	0.26	-	100
S30C	651	Lb	6514223	0.018	2.60	0.40	-	100
	651	Mp	6514451	0.047	7.00	0.25	-	100
	651	Mr	6514455	0.212	31.80	0.05	-	100
	651	Te	6515829	0.016	2.40	0.25	-	100
	651	Vf	6516231	0.049	7.30	0.01	-	100
	651	GxA	651326720	0.000	0.10	0.23	-	100
	651	LcA	651422520	0.291	43.80	0.25	-	100
	651	PeA	651502920	0.008	1.20	0.37	-	100
	651	RbA	651542320	0.001	0.10	0.26	-	100
	651	TrA	651585520	0.019	2.80	0.11	-	100
	651	TrB	651585522	0.005	0.80	0.13	-	100

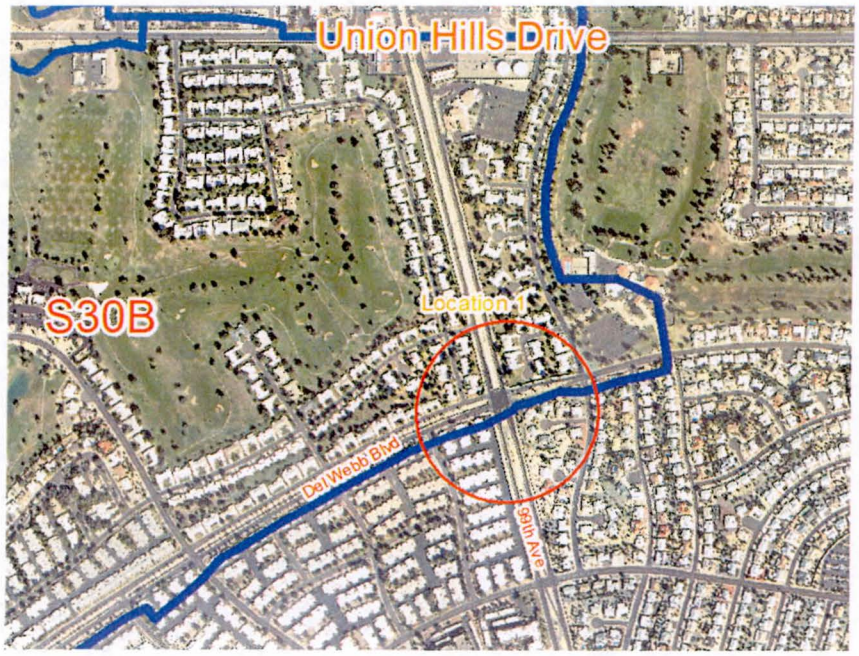
APPENDIX C.4 – Routing Data

Route ID	LOB N	Chan N	ROB N	Length (ft)	Slope (ft/ft)	Max Elev (ft)		1.	2.	3.	4.	5.	6.	7.	8.
NORMAL DEPTH															
Major Basin 01															
RA061	0.030	0.020	0.030	2,795.00	0.0057	-	X:	-	10.00	60.00	70.00	90.00	100.00	150.00	170.00
							Y:	10.00	9.00	8.00	4.00	4.00	8.00	9.00	10.00
RA06A1	0.035	0.025	0.035	3,945.00	0.0117	-	X:	-	50.00	100.00	110.00	130.00	140.00	190.00	240.00
							Y:	10.00	9.00	8.00	4.00	4.00	8.00	9.00	10.00
RA06A2	0.030	0.020	0.030	981.00	0.0031	-	X:	-	10.00	50.00	60.00	70.00	80.00	130.00	150.00
							Y:	10.00	9.00	8.00	4.00	4.00	8.00	9.00	10.00
RA06A3	0.030	0.020	0.030	3,203.00	0.0050	-	X:	-	10.00	50.00	60.00	70.00	80.00	100.00	120.00
							Y:	10.00	9.00	8.00	4.00	4.00	8.00	9.00	10.00
RA07B1	0.035	0.030	0.035	1,628.00	0.0031	-	X:	-	50.00	130.00	200.00	240.00	280.00	300.00	320.00
							Y:	10.00	9.00	-	-	5.00	9.00	10.00	12.00
RA07B2	0.035	0.030	0.035	2,388.00	0.0021	-	X:	-	50.00	100.00	150.00	200.00	250.00	300.00	350.00
							Y:	10.00	9.00	8.00	-	-	8.00	9.00	10.00
RA07B3	0.038	0.035	0.038	2,418.00	0.0124	-	X:	-	50.00	75.00	125.00	150.00	200.00	250.00	300.00
							Y:	10.00	9.00	8.00	-	-	8.00	9.00	10.00
RA07B4	0.035	0.030	0.035	1,476.00	0.0034	-	X:	-	50.00	100.00	125.00	150.00	175.00	225.00	275.00
							Y:	10.00	9.00	8.00	-	-	8.00	9.00	10.00
RA07B5	0.025	0.020	0.025	1,378.00	0.0051	-	X:	-	10.00	50.00	60.00	80.00	90.00	130.00	150.00
							Y:	10.00	5.00	4.00	-	-	4.00	5.00	6.00
RA07B6	0.030	0.020	0.030	672.00	0.0119	-	X:	-	50.00	70.00	90.00	110.00	130.00	150.00	170.00
							Y:	10.00	9.00	8.00	1.00	1.00	8.00	9.00	10.00
RA07B7	0.035	0.030	0.035	3,058.00	0.0075	-	X:	-	50.00	75.00	100.00	125.00	150.00	175.00	225.00
							Y:	10.00	9.00	-	-	-	-	9.00	10.00
RA07C1	0.035	0.030	0.035	1,305.00	0.0061	-	X:	-	50.00	100.00	125.00	150.00	175.00	200.00	250.00
							Y:	10.00	9.00	-	-	-	-	9.00	10.00
RA07C2	0.035	0.030	0.035	2,625.00	0.0057	-	X:	-	30.00	80.00	130.00	150.00	230.00	250.00	260.00
							Y:	10.00	9.00	-	-	-	9.00	10.00	12.00
RA07D	0.030	0.030	0.030	2,041.00	0.0049	1,180.00	X:	-	100.00	112.00	147.00	159.00	179.00	214.00	580.00
							Y:	8.00	6.00	-	-	6.00	7.00	7.00	9.00
RA07E1	0.030	0.020	0.030	1,471.00	0.0048	-	X:	-	10.00	20.00	30.00	40.00	50.00	60.00	70.00
							Y:	2.00	1.00	-	-	-	-	1.00	2.00
RA07E2	0.030	0.020	0.030	761.00	0.0092	-	X:	-	10.00	20.00	30.00	40.00	50.00	60.00	70.00
							Y:	2.00	1.00	-	-	-	-	1.00	2.00

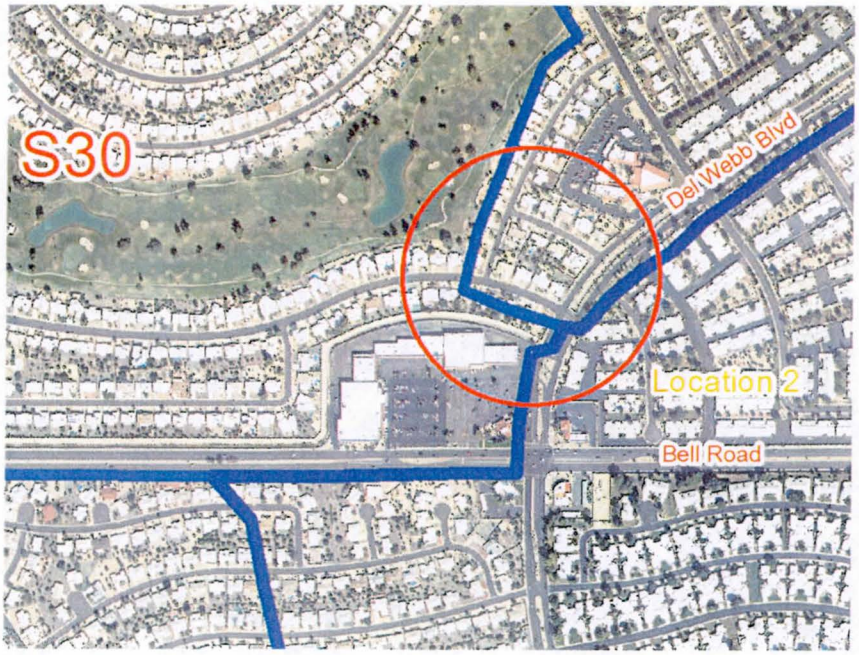
Route ID	LOB N	Chan N	ROB N	Length (ft)	Slope (ft/ft)	Max Elev (ft)		1.	2.	3.	4.	5.	6.	7.	8.
RA07E3	0.030	0.020	0.030	1,835.00	0.0076	-	X:	-	10.00	20.00	30.00	40.00	50.00	60.00	70.00
							Y:	2.00	1.00	-	-	-	-	1.00	2.00
RA07E5	0.030	0.020	0.030	1,796.00	0.0067	-	X:	-	10.00	20.00	30.00	40.00	50.00	60.00	70.00
							Y:	2.00	1.00	-	-	-	-	1.00	2.00
RA07E6	0.035	0.020	0.035	1,950.00	0.0062	-	X:	-	50.00	100.00	125.00	150.00	175.00	225.00	275.00
							Y:	4.00	3.00	2.00	1.00	1.00	2.00	3.00	4.00
RA07E7	0.030	0.020	0.030	1,042.00	0.0086	-	X:	-	1.00	13.00	23.00	53.00	83.00	108.00	109.00
							Y:	14.00	6.00	-	-	6.00	6.00	1.00	15.00
RA07F1	0.030	0.020	0.030	353.00	0.0028	-	X:	-	1.00	13.00	23.00	53.00	83.00	108.00	109.00
							Y:	14.00	6.00	-	-	6.00	6.00	7.00	15.00
RA07G1	0.040	0.020	0.040	2,548.00	0.0035	-	X:	-	1.00	26.00	41.00	71.00	86.00	126.00	576.00
							Y:	12.00	7.00	5.00	1.00	1.00	5.00	6.00	7.00
RA07G2	0.030	0.020	0.030	1,632.00	0.0073	-	X:	-	10.00	20.00	30.00	40.00	50.00	60.00	70.00
							Y:	2.00	1.00	-	-	-	-	1.00	2.00
RA07H	0.035	0.035	0.035	3,126.00	0.0048	-	X:	-	50.00	100.00	150.00	200.00	250.00	300.00	350.00
							Y:	10.00	9.00	8.00	7.00	7.00	8.00	9.00	10.00
RA09C	0.030	0.025	0.030	5,061.00	0.0020	-	X:	-	10.00	40.00	50.00	70.00	80.00	120.00	130.00
							Y:	7.00	5.00	4.00	3.00	3.00	4.00	5.00	10.00
RA09D	0.040	0.030	0.040	2,865.00	0.0098	-	X:	-	51.00	61.00	71.00	81.00	111.00	151.00	651.00
							Y:	9.00	8.00	-	-	8.00	9.00	9.00	10.00
RA09E	0.040	0.030	0.040	2,865.00	0.0069	-	X:	-	1.00	16.00	36.00	51.00	123.00	148.00	648.00
							Y:	16.00	8.00	-	-	8.00	8.00	9.00	11.00
RA09FW	0.030	0.025	0.030	1,619.00	0.0012	-	X:	-	1.00	16.00	36.00	51.00	123.00	148.00	648.00
							Y:	16.00	8.00	-	-	8.00	8.00	9.00	11.00
RA99P1	0.030	0.025	0.030	2,868.00	0.0160	-	X:	-	50.00	100.00	110.00	130.00	140.00	190.00	240.00
							Y:	10.00	9.00	8.00	4.00	4.00	8.00	9.00	10.00
RS30	0.030	0.020	0.030	1,258.00	0.0215	-	X:	-	50.00	60.00	80.00	90.00	100.00	125.00	140.00
							Y:	10.00	9.00	3.00	3.00	9.00	10.00	11.00	12.00
RS30B	0.030	0.020	0.030	4,113.00	0.0036	-	X:	-	10.00	60.00	62.00	82.00	84.00	134.00	144.00
							Y:	12.00	11.00	8.00	-	-	8.00	11.00	12.00
RS30C	0.030	0.020	0.030	6,874.00	0.0015	-	X:	-	10.00	50.00	60.00	70.00	80.00	120.00	130.00
							Y:	10.00	5.00	4.00	-	-	4.00	5.00	10.00

APPENDIX C.5 – Sun City Split Flow Analysis Memorandum

RPA was requested to evaluate flow splits at two locations. The first location is at 99th Avenue and Del Webb Boulevard and the second location is at Del Webb Boulevard and Palmeras Drive. The main split is at Location 2 where the Del Webb channel drains into culverts that convey flows into the Sun City drain. The northern split (Location 1) does not affect flows in the Sun City drain because drainage basin S30 is large, see below. The flow diverted at that location is not significant compared to the flow generated from that basin.

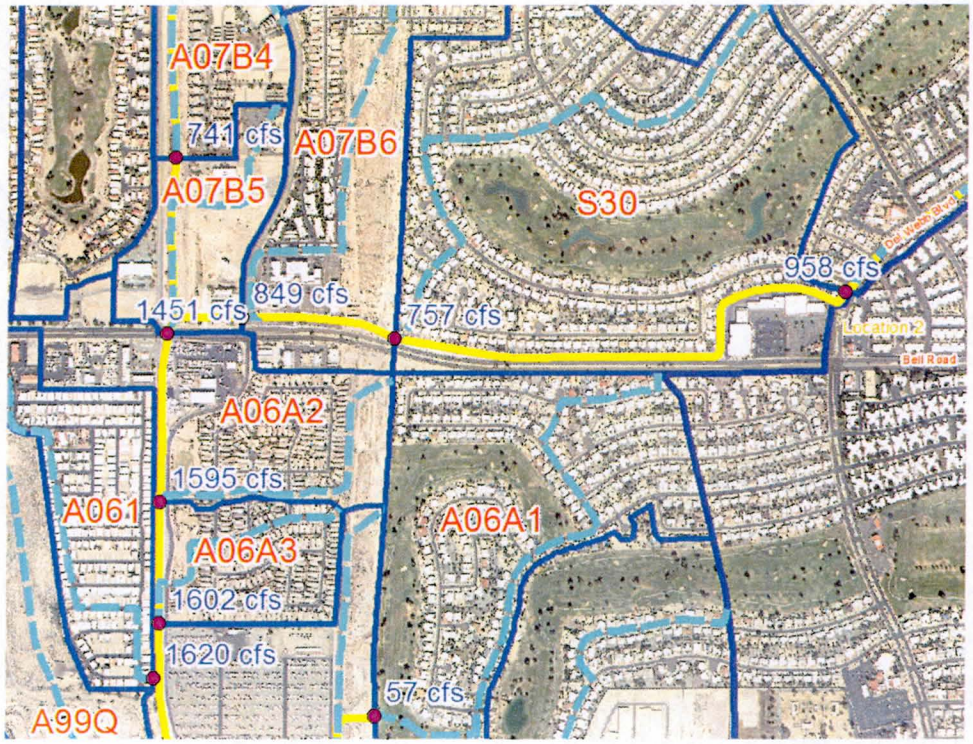


Location 1 – 99th Ave and Del Webb Blvd



Location 2 – Bell Road and Del Webb Blvd

The channel upstream of this culvert can handle over 900 cfs, see attached normal depth calculations. The channel dimensions were based on the recent District survey. There are 5-48" culverts that convey flow 90-degrees into the Sun City drain. The average culvert inverts are 1200.4 with a 6-foot headwall, see the attached survey results. The losses from the 90-degree bend were accounted by adjusting the manning's of the culverts to 0.018. The culverts can convey 421 cfs at Location 2, and this split was updated in the HEC-1 model using the HY-8 flow summary table. The unsteady HEC-RAS was updated with the hydrograph from CA07B6 and the resultant water surface at the Bell Road culvert is 1163.8.



Cross Section for Del Webb Channel

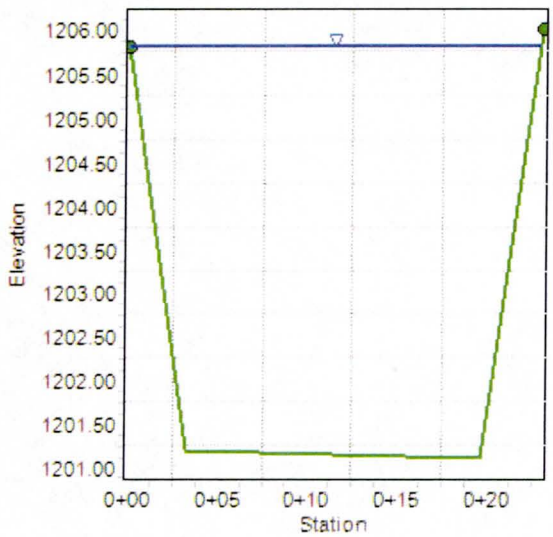
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00250	ft/ft
Normal Depth	4.69	ft
Discharge	936.43	ft^3/s

Cross Section Image



Survey Points - Location 1

115th ave. Watershed- 99th ave. & Bell- Del Web & Bell- Cross sections and Inverts

LOCATION 1

Pt #	N	E	HW EL.	Invert	Desc.	
11	962927	590320.6	1211.78	1205.18	CL HW 48" Concrete Pipe	
12	962932.7	590319.1	1211.86	1205.26	CL HW 48" Concrete Pipe	
13	962938.6	590317.6	1211.82	1205.22	CL HW 48" Concrete Pipe	Downstream
14	962943.9	590316.1	1211.9	1205.3	CL HW 48" Concrete Pipe	
15	962950	590314.5	1211.85	1205.25	CL HW 48" Concrete Pipe	

Pt #	N	E	HW EL.	Invert	Desc.	
16	963013.9	590356.5	1211.38	1205.38	CL HW 48" Concrete Pipe	
17	963015.5	590362.2	1211.39	1205.39	CL HW 48" Concrete Pipe	Upstream
18	963016.9	590367.9	1211.38	1205.38	CL HW 48" Concrete Pipe	
19	963018.5	590373.7	1211.37	1205.37	CL HW 48" Concrete Pipe	
20	963020	590379.3	1211.39	1205.39	CL HW 48" Concrete Pipe	

Pt #	N	E	Elev.	Desc.
600	963282.9	590369.8	1214.83	WALL
601	963279.2	590356	1212.72	NG
602	963278.5	590353	1212.55	EOP
603	963275	590338.8	1212.24	CL
604	963271.8	590325.3	1211.99	EOP
605	963271.6	590324.2	1211.6	EOP
606	963270.5	590319.9	1211.02	TB
607	963267	590305.9	1207.57	TOE
608	963265.2	590299.3	1207.43	TOE
609	963261.6	590282.3	1211.44	TB
610	963260.6	590278.4	1211.98	EOP
611	963260.3	590277.6	1212.22	EOP
612	963257.8	590263.8	1212.44	CL
613	963254.6	590250.6	1212.59	EOP
614	963252.7	590240.7	1213.6	NG
615	963250.1	590233.5	1214.33	WALL

Pt #	N	E	Elev.	Desc.
700	963026.4	590292.2	1213.5	WALL
701	963030	590304.6	1211.68	EOP
702	963037.2	590320.9	1211.52	CL
703	963040.8	590342.1	1211.1	FL
704	963040.7	590342.4	1211.62	TC
705	963040.8	590342.8	1211.62	BC
706	963040.8	590343	1211.17	TB
707	963044.6	590358.8	1206.45	TOE
708	963045.2	590360.4	1206.38	TOE
709	963049.5	590381.2	1211.16	TB
710	963050.2	590384.2	1211.32	EOP
711	963053.1	590396.7	1211.68	CL
712	963056.5	590410.5	1211.91	EOP
713	963059.4	590421	1212.85	NG
714	963061.6	590427.7	1214.16	WALL

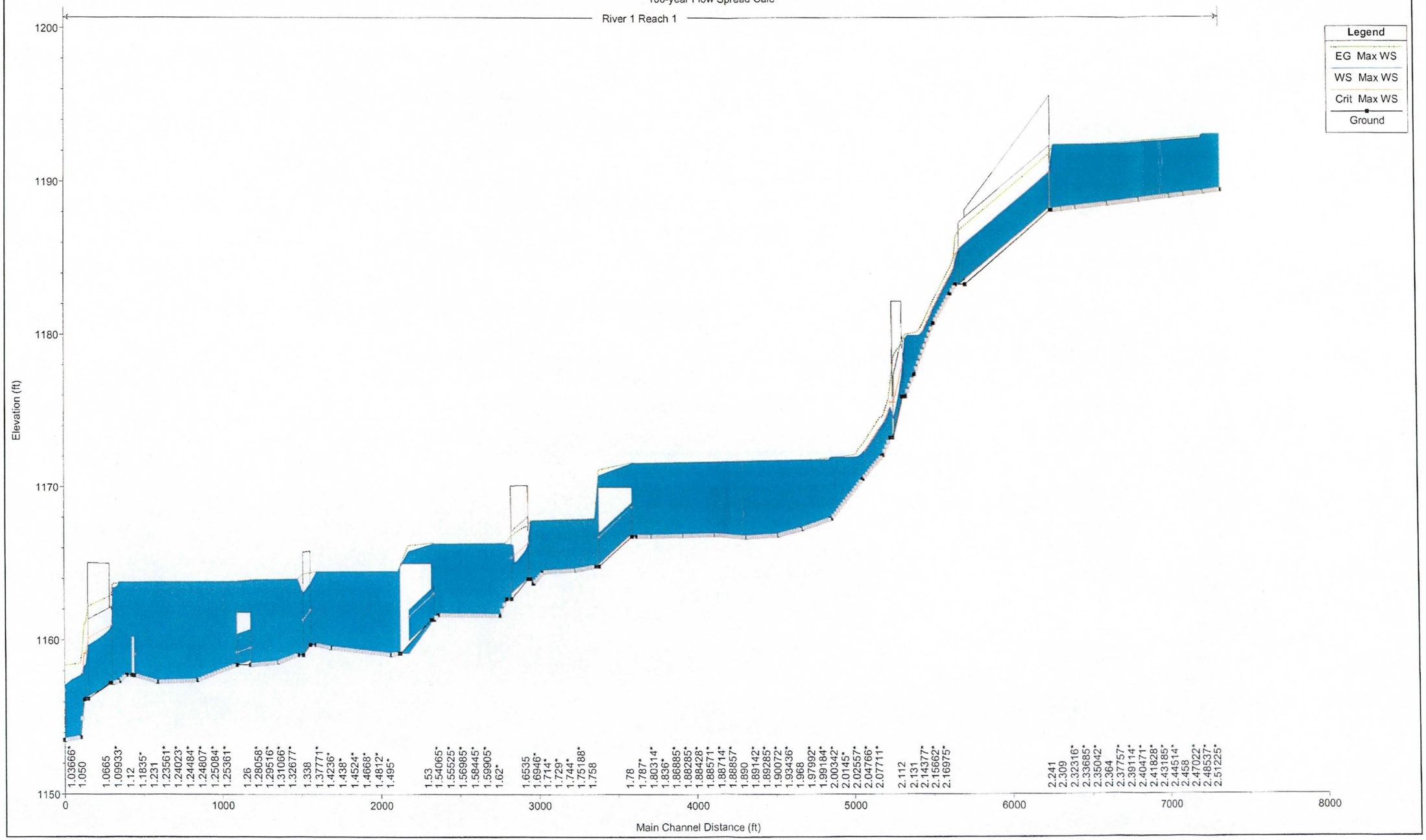
Pt #	N	E	Elev.	Desc.
800	962672.2	590384.6	1212.09	WALL
801	962676.2	590401.8	1209.76	EOP
802	962679.7	590417.1	1209.62	CL
803	962683.1	590430.6	1209.21	FL
804	962683.3	590430.8	1209.76	TC
805	962685	590441.4	1209.6	GB
806	962689.5	590455.7	1210.37	NG
807	962692.9	590473.8	1209.65	TC
808	962692.9	590474.1	1209.1	FL
809	962697.2	590488.7	1209.62	CL
810	962700.3	590503.5	1209.87	EOP
811	962703.1	590513.5	1211.22	NG
812	962704.5	590521.6	1212.34	WALL

Pt #	N	E	Elev.	Desc.
900	962948.4	590303.9	1205.59	TOE
901	962922.1	590310.9	1205.17	TOE
902	962872.6	590326.1	1211.57	BW
903	962878.2	590324.3	1211.62	TC
904	962878.4	590324.4	1211.14	FL
905	962895.9	590321	1211.27	CL
906	962918.2	590314.6	1210.92	FL
907	962918.4	590314.5	1211.36	TC
908	962920.9	590313.8	1211.34	TB
909	962951.2	590303.3	1211.75	TB
910	962953.4	590302.9	1211.71	TC
911	962953.6	590302.9	1211.25	FL
912	962968.4	590299.2	1211.5	CL
913	962984.9	590290.7	1211.74	FL
914	962985.1	590290.6	1212.14	TC
915	962989.8	590288.1	1212.37	BW

Pt #	N	E	Elev.	Desc.
1000	962866.6	590135.3	1205.82	TOE
1001	962882.7	590131.3	1205.4	TOE
1002	962819.5	590154.9	1210.91	BW
1003	962823.3	590153.9	1210.87	TC
1004	962825.2	590153.1	1210.63	FL
1005	962839.7	590146.5	1210.56	CL
1006	962857.4	590140.1	1210.07	FL
1007	962857.6	590139.9	1210.5	TC
1008	962864.2	590137.7	1210.22	TB
1009	962934.6	590120.3	1211.03	BW
1010	962930.9	590121.6	1210.91	TC
1011	962929.2	590122.6	1210.63	FL
1012	962912.3	590128.8	1210.45	CL
1013	962899.6	590133.2	1210.1	FL
1014	962899.3	590133.2	1210.55	TC
1015	962888.2	590136.7	1210.08	TB

115th_Bell_Final_Unsteady_4_15_2015 Plan: Updated 4/15/2015

100-year Flow Spread Calc



115th ave. Watershed- 99th ave. & Bell- Del Web & Bell- Cross sections and Inverts

LOCATION 2

Pt #	N	E	HW EL.	Invert	Desc.
1	960403.7	586450.1	1205.87	1199.87	CL HW 48" Concrete Pipe
2	960398.5	586447.3	1205.81	1199.81	CL HW 48" Concrete Pipe
3	960393.1	586444.5	1205.79	1199.79	CL HW 48" Concrete Pipe
4	960388.1	586441.9	1205.76	1199.76	CL HW 48" Concrete Pipe
5	960382.4	586439	1205.88	1199.88	CL HW 48" Concrete Pipe

Pt #	N	E	HW EL.	Invert	Desc.
6	960541.6	586588.1	1206.34	1200.34	CL HW 48" Concrete Pipe
7	960538.6	586593.3	1206.37	1200.37	CL HW 48" Concrete Pipe
8	960535.6	586598.6	1206.42	1200.42	CL HW 48" Concrete Pipe
9	960532.6	586603.9	1206.39	1200.39	CL HW 48" Concrete Pipe
10	960529.8	586609.1	1206.35	1200.35	CL HW 48" Concrete Pipe

Pt #	N	E	Elev.	Desc.
100	960414.7	586261.2	1208.09	ASPHALT
101	960433.3	586268.9	1207.87	ASPHALT
102	960448.3	586274.1	1207.6	ASPHALT @ WALL
103	960449.4	586274.4	1207.8	WALL
104	960451.6	586275	1207.79	TB
105	960456.1	586276.5	1199.98	TOE
106	960473.4	586283.2	1200.15	TOE
107	960478.9	586282.5	1207.74	TB
108	960486.8	586284.8	1208.05	WALL

Pt #	N	E	Elev.	Desc.
200	960414.9	586450.7	1206.67	WALL
201	960409.3	586448.8	1205.79	TB
202	960381	586434.5	1205.44	TB
203	960379.7	586433.7	1205.95	WALL
204	960368.8	586429.7	1206.44	ASPHALT
205	960354.6	586424.3	1206.78	ASPHALT
206	960405	586449.1	1200.05	TOE
207	960382.5	586436.3	1200.14	TOE

Pt #	N	E	Elev.	Desc.
300	960432	586473.6	1206.68	WALL
301	960428.7	586481.6	1206.17	TC
302	960428.1	586483.3	1205.92	FL
303	960421.2	586496.8	1205.86	GB
304	960414.3	586511.6	1205.32	FL
305	960414.3	586511.8	1205.79	TC
306	960411.7	586517.5	1206.1	GB
307	960408.4	586524.9	1208.24	GB
308	960406.6	586530.4	1208.01	GB
309	960402.9	586541.2	1205.84	GB
310	960400.8	586546.3	1205.74	TC
311	960400.7	586546.5	1205.21	FL
312	960390.8	586565.3	1205.69	CL
313	960383.6	586584.1	1205.76	FL
314	960383.5	586584.3	1206.28	TC
315	960382.3	586588.5	1206.27	BW
316	960377.6	586598.7	1207.39	GB
317	960374.6	586610.1	1208.08	WALL

Pt #	N	E	Elev.	Desc.
400	960579.6	586526.8	1206.5	NG
401	960570.3	586549.1	1206.58	BW
402	960568.3	586553.5	1206.45	TC
403	960568.3	586553.7	1206.08	FL
404	960560.1	586571.5	1206.09	CL
405	960553.2	586583.2	1205.86	FL
406	960553.1	586583.4	1206.24	TC
407	960549.2	586589.1	1205.76	TB
408	960547.1	586591.2	1200.35	TOE
409	960534.1	586612.6	1200.76	TOE
410	960533	586615.9	1205.92	TB
411	960529.8	586621.7	1206.14	TC
412	960529.8	586622	1205.7	FL
413	960521.5	586634.2	1206.02	CL
414	960511	586647.1	1206	FL
415	960509.9	586648.9	1206.25	TC
416	960507.9	586652.2	1206.28	BW
417	960495.9	586668.3	1207.49	NG

Pt #	N	E	Elev.	Desc.
500	960596	586710.8	1206.5	BW
501	960598	586707.4	1206.47	TC
502	960598.9	586706	1206.23	FL
503	960608	586691.3	1206.17	CL
504	960616.7	586680	1205.81	FL
505	960616.8	586679.7	1206.37	TC
506	**960625**	**586672.6**	**1205.99**	**TB**
507	**960627.6**	**586670.5**	**1201.11**	**TOE**
508	**960637.4**	**586657.4**	**1201.2**	**TOE**
509	**960638.7**	**586654.4**	**1205.81**	**TB**
510	960645.7	586645.3	1206.42	TC
511	960645.7	586645.2	1205.94	FL
512	960656.2	586633.5	1206.33	CL
513	960667.8	586622.6	1206.34	FL
514	960668.9	586620.9	1206.62	TC
515	960675.1	586613.2	1207.09	WALL

HY-8 Analysis Results

Crossing Summary Table

Culvert Crossing: Bell & Del Webb

Headwater Elevation (ft)	Total Discharge (cfs)	DelWeb Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1202.46	100.00	100.00	0.00	1
1203.81	240.00	240.00	0.00	1
1205.12	380.00	380.00	0.00	1
1205.38	400.00	400.00	0.00	1
1206.72	660.00	460.11	199.66	6
1207.03	800.00	444.11	355.69	5
1207.29	940.00	425.06	514.80	5
1207.52	1080.00	404.55	675.34	5
1207.73	1220.00	385.86	833.40	4
1207.94	1360.00	357.66	1002.16	4
1208.13	1500.00	331.99	1167.96	4
1205.70	421.42	421.42	0.00	Overtopping

HY-8 Analysis Results

Crossing Summary Table

Culvert Crossing: 99th & Del Webb

Headwater Elevation (ft)	Total Discharge (cfs)	99th Ave Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1207.45	100.00	100.00	0.00	1
1208.74	240.00	240.00	0.00	1
1209.87	380.00	380.00	0.00	1
1210.04	400.00	400.00	0.00	1
1211.88	660.00	552.97	106.75	5
1212.26	800.00	541.62	258.18	5
1212.57	940.00	521.97	417.89	5
1212.84	1080.00	499.12	580.77	5
1213.08	1220.00	473.63	745.71	4
1213.31	1360.00	446.22	913.32	4
1213.52	1500.00	419.60	1080.09	4
1211.10	507.50	507.50	0.00	Overtopping

```
*
*
* *** DIVERSION DS30AO ***************************************************
* *** DIVERTED  MAIN (WEST) DIVERTED (SOUTH)  **********************
* THERE IS A DIVERSION AT THIS LOCATION.  THE CULVERTS AND ROADWAY
* WERE SURVEYED AND THE AREA WAS MODELED IN HY-8.  THE CULVERT
* SUMMARY TABLE FROM HY-8 WAS USED FOR THIS SPLIT (TABLE IS IN
* DESIGN REPORT)
* THE DEL WEBB CULVERTS CAN CHANNEL CAN CARRY 508 CFS, THE REST
* OF THE FLOW OVERFLOWS TO THE SOUTH.
*
* DDM   ***** Preserved *****
KKDS30AO
DTDS30AI
DI     1     400     660     800     940    1080    1220    1360    1500

DQ    .1      .2     107     258     418     581     746     913    1080
*
*
KK  S30B   BASIN
BA 0.567
LG  0.18    0.17    6.76    0.17      31
UC 0.827   0.533
UA     0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA   100
*
KK CS30B COMBINE
HC     2
*
*
KK RS30B   ROUTE
RS     1    FLOW
RC 0.030   0.020   0.030    4113  0.0036    0.00
RX  0.00   10.00   60.00   62.00   82.00   84.00  134.00  144.00
RY 12.00   11.00    8.00    0.00    0.00    8.00   11.00   12.00
*
* *** DIVERTED  MAIN (WEST) DIVERTED (SOUTH)  **********************
* THERE IS A DIVERSION AT THIS LOCATION.  THE CULVERTS AND ROADWAY
* WERE SURVEYED AND THE AREA WAS MODELED IN HY-8.  THE CULVERT
* SUMMARY TABLE FROM HY-8 WAS USED FOR THIS SPLIT (TABLE IS IN
* DESIGN REPORT)
* THE DEL WEBB CULVERTS CAN CHANNEL CAN CARRY 421 CFS, THE REST
* OF THE FLOW OVERFLOWS TO THE SOUTH.
*
*
*
KKDS30BO
DTDS30BI
DI     1     400     660     800     940    1080    1220    1360    1500

DQ    .1      .2     200     355     515     675     833    1002    1168
*
KK   S30   BASIN
BA 0.342
LG  0.20    0.25    4.65    0.43      30
UC 0.501   0.319
UA     0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA   100
*
KK  CS30 COMBINE
HC     2
*
```

****

INTERPOLA HYDROGRA AT CA07B6

****

* DA *	* MON *	* HRMN	ORD	FLOW *
1	1118	340	43	*
1	1120	341	44	*
1	1122	342	45	*
1	1124	343	46	*
1	1126	344	47	*
1	1128	345	48	*
1	1130	346	49	*
1	1132	347	50	*
1	1134	348	52	*
1	1136	349	54	*
1	1138	350	56	*
1	1140	351	60	*
1	1142	352	66	*
1	1144	353	74	*
1	1146	354	89	*
1	1148	355	103	*
1	1150	356	121	*
1	1152	357	144	*
1	1154	358	175	*
1	1156	359	213	*
1	1158	360	266	*
1	1200	361	328	*
1	1202	362	392	*
1	1204	363	462	*
1	1206	364	539	*
1	1208	365	613	*
1	1210	366	692	*
1	1212	367	773	*
1	1214	368	826	*
1	1216	369	843	*
1	1218	370	849	*
1	1220	371	837	*
1	1222	372	811	*
1	1224	373	786	*
1	1226	374	761	*
1	1228	375	738	*
1	1230	376	715	*
1	1232	377	694	*
1	1234	378	673	*

1	1236	379	656 *
1	1238	380	640 *
1	1240	381	626 *
1	1242	382	614 *
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1	1306	394	510 *
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1	1408	425	125 *

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1	1528	465	37 *
1	1530	466	36 *
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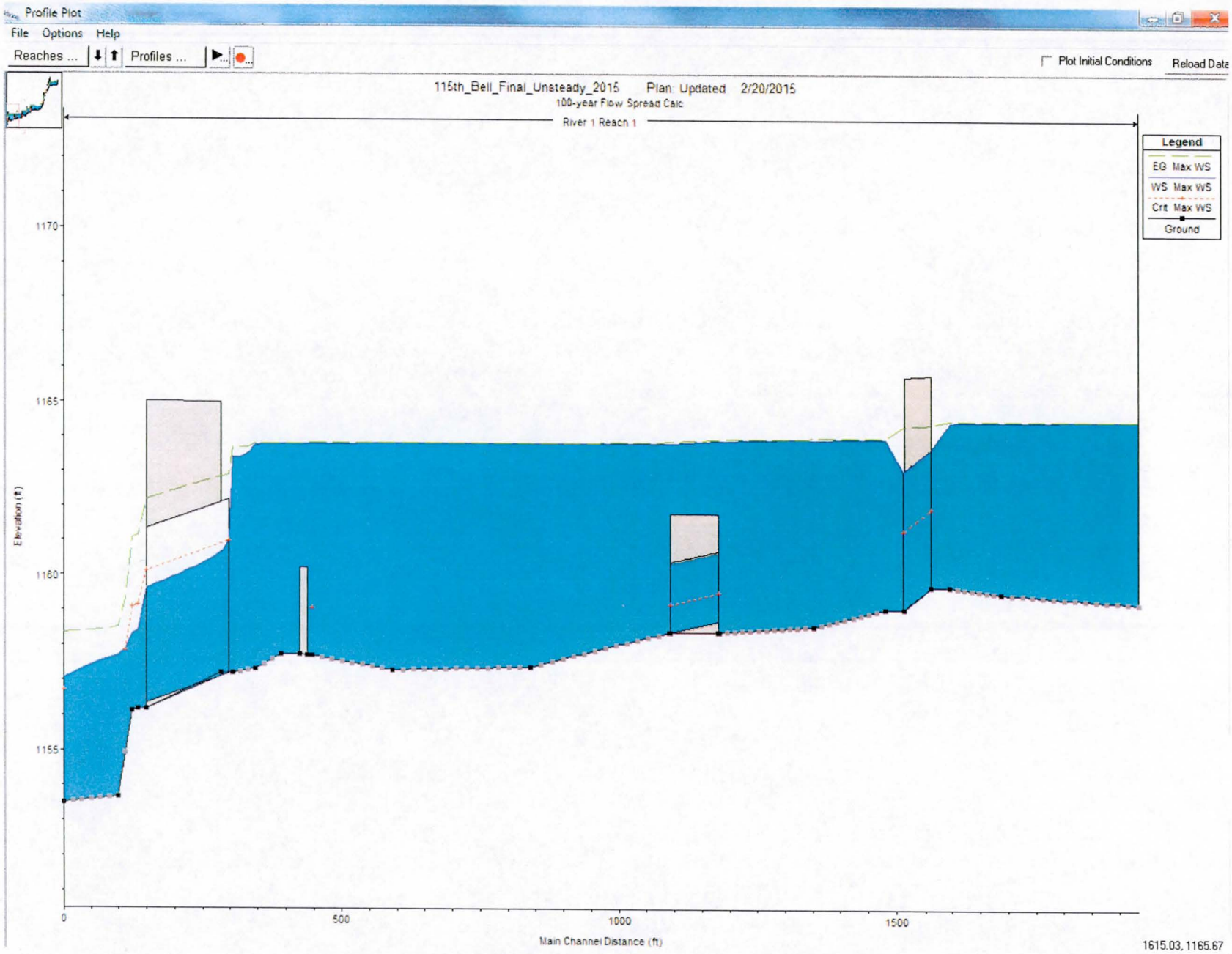
1	1534	468	34 *
1	1536	469	34 *
1	1538	470	33 *
1	1540	471	33 *


Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
115th_Bell_Final_Unsteady_2015 Plan: Updated 2/20/2015
100-year Flow Spread Calc
River 1 Reach 1
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
1170
1165
1160
1155
Elevation (ft)
0
500
1000
1500
Main Channel Distance (ft)
1615.03, 1165.67

HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	2.523	Max WS	20.00	1189.40	1193.02		1193.02	0.000002	0.13	155.29	55.89	0.01
Reach 1	2.51762*	Max WS	19.98	1189.38	1193.02		1193.02	0.000002	0.13	156.93	56.34	0.01
Reach 1	2.51225*	Max WS	19.97	1189.37	1193.02		1193.02	0.000002	0.13	158.09	56.74	0.01
Reach 1	2.50687*	Max WS	19.99	1189.35	1193.02		1193.02	0.000002	0.13	159.87	57.24	0.01
Reach 1	2.5015*	Max WS	20.00	1189.33	1193.02		1193.02	0.000002	0.12	161.67	57.75	0.01
Reach 1	2.49612*	Max WS	19.98	1189.32	1193.02		1193.02	0.000002	0.12	163.01	58.23	0.01
Reach 1	2.49075*	Max WS	19.97	1189.30	1193.02		1193.02	0.000002	0.12	164.95	58.80	0.01
Reach 1	2.48537*	Max WS	19.96	1189.29	1193.02		1193.02	0.000002	0.12	166.36	59.32	0.01
Reach 1	2.480	Max WS	19.94	1189.27	1193.02		1193.02	0.000002	0.12	168.45	59.96	0.01
Reach 1	2.47755*	Max WS	410.20	1189.25	1192.79		1192.90	0.000876	2.63	156.24	58.30	0.28
Reach 1	2.47511*	Max WS	410.72	1189.24	1192.78		1192.88	0.000880	2.63	156.16	58.30	0.28
Reach 1	2.47266*	Max WS	410.43	1189.22	1192.77		1192.87	0.000870	2.62	156.69	58.37	0.28
Reach 1	2.47022*	Max WS	409.13	1189.20	1192.76		1192.86	0.000856	2.60	157.24	58.44	0.28
Reach 1	2.46777*	Max WS	409.26	1189.19	1192.75		1192.85	0.000857	2.60	157.22	58.45	0.28
Reach 1	2.46533*	Max WS	407.90	1189.17	1192.73		1192.84	0.000843	2.59	157.72	58.51	0.28
Reach 1	2.46288*	Max WS	408.70	1189.15	1192.72		1192.83	0.000838	2.58	158.30	58.59	0.28
Reach 1	2.46044*	Max WS	406.97	1189.14	1192.71		1192.82	0.000831	2.57	158.29	58.60	0.28
Reach 1	2.458	Max WS	406.83	1189.12	1192.70		1192.81	0.000822	2.56	158.84	58.66	0.27
Reach 1	2.45542*	Max WS	405.92	1189.10	1192.69		1192.79	0.000811	2.55	159.37	58.71	0.27
Reach 1	2.45285*	Max WS	405.14	1189.09	1192.68		1192.78	0.000809	2.54	159.22	58.67	0.27
Reach 1	2.45028*	Max WS	404.60	1189.07	1192.67		1192.77	0.000799	2.53	159.73	58.70	0.27
Reach 1	2.44771*	Max WS	405.22	1189.06	1192.66		1192.76	0.000802	2.54	159.69	58.67	0.27
Reach 1	2.44514*	Max WS	404.46	1189.04	1192.65		1192.75	0.000791	2.52	160.19	58.70	0.27
Reach 1	2.44257*	Max WS	403.60	1189.03	1192.64		1192.74	0.000788	2.52	160.14	58.67	0.27
Reach 1	2.440	Max WS	404.20	1189.01	1192.63		1192.73	0.000783	2.52	160.64	58.71	0.27
Reach 1	2.43728*	Max WS	404.30	1188.99	1192.62		1192.72	0.000773	2.50	161.55	58.96	0.27
Reach 1	2.43457*	Max WS	403.71	1188.98	1192.61		1192.71	0.000768	2.49	161.98	59.19	0.27
Reach 1	2.43185*	Max WS	403.93	1188.96	1192.60		1192.70	0.000758	2.48	162.95	59.48	0.26
Reach 1	2.42914*	Max WS	403.45	1188.94	1192.59		1192.69	0.000746	2.46	163.96	59.81	0.26
Reach 1	2.42642*	Max WS	402.76	1188.92	1192.58		1192.68	0.000734	2.44	164.97	60.13	0.26
Reach 1	2.42371*	Max WS	402.65	1188.91	1192.57		1192.67	0.000730	2.43	165.56	60.47	0.26
Reach 1	2.421*	Max WS	401.78	1188.89	1192.56		1192.65	0.000717	2.41	166.70	60.87	0.26
Reach 1	2.41828*	Max WS	402.41	1188.87	1192.56		1192.64	0.000709	2.40	167.81	61.30	0.26
Reach 1	2.41557*	Max WS	401.86	1188.86	1192.55		1192.63	0.000702	2.38	168.57	61.68	0.25
Reach 1	2.41285*	Max WS	401.35	1188.84	1192.54		1192.62	0.000690	2.36	169.75	62.08	0.25
Reach 1	2.41014*	Max WS	400.63	1188.82	1192.53		1192.61	0.000676	2.34	171.04	62.48	0.25
Reach 1	2.40742*	Max WS	400.71	1188.80	1192.52		1192.60	0.000665	2.32	172.41	62.91	0.25
Reach 1	2.40471*	Max WS	401.31	1188.79	1192.51		1192.59	0.000658	2.32	173.20	62.98	0.25
Reach 1	2.402	Max WS	400.72	1188.77	1192.50		1192.59	0.000640	2.30	174.59	63.06	0.24
Reach 1	2.39928*	Max WS	400.32	1188.75	1192.50		1192.58	0.000631	2.27	176.08	63.91	0.24
Reach 1	2.39657*	Max WS	400.59	1188.74	1192.49		1192.57	0.000629	2.26	177.28	64.81	0.24
Reach 1	2.39385*	Max WS	400.03	1188.72	1192.48		1192.56	0.000620	2.24	178.87	65.70	0.24
Reach 1	2.39114*	Max WS	400.10	1188.70	1192.47		1192.55	0.000614	2.22	180.47	66.65	0.24
Reach 1	2.38842*	Max WS	399.66	1188.68	1192.47		1192.54	0.000605	2.19	182.20	67.64	0.24
Reach 1	2.38571*	Max WS	399.92	1188.67	1192.46		1192.53	0.000604	2.18	183.55	68.77	0.24
Reach 1	2.383*	Max WS	399.82	1188.65	1192.45		1192.52	0.000596	2.16	185.41	69.94	0.23
Reach 1	2.38028*	Max WS	399.71	1188.63	1192.44		1192.51	0.000589	2.13	187.36	71.18	0.23
Reach 1	2.37757*	Max WS	399.49	1188.62	1192.44		1192.51	0.000586	2.11	188.92	72.49	0.23
Reach 1	2.37485*	Max WS	399.56	1188.60	1192.43		1192.50	0.000580	2.09	191.02	73.88	0.23
Reach 1	2.37214*	Max WS	398.95	1188.58	1192.42		1192.49	0.000566	2.07	193.19	75.36	0.23
Reach 1	2.36942*	Max WS	398.86	1188.56	1192.42		1192.48	0.000552	2.04	195.64	76.79	0.22
Reach 1	2.36671*	Max WS	399.24	1188.55	1192.41		1192.47	0.000543	2.02	197.70	78.25	0.22
Reach 1	2.364	Max WS	398.68	1188.53	1192.40		1192.46	0.000529	2.00	200.25	79.68	0.22
Reach 1	2.36128*	Max WS	398.81	1188.51	1192.40		1192.46	0.000480	1.93	206.83	80.84	0.21
Reach 1	2.35857*	Max WS	399.06	1188.50	1192.39		1192.45	0.000439	1.88	213.13	81.90	0.20
Reach 1	2.35585*	Max WS	399.13	1188.48	1192.39		1192.44	0.000400	1.82	219.90	82.98	0.19
Reach 1	2.35314*	Max WS	398.67	1188.46	1192.39		1192.43	0.000363	1.77	226.91	84.04	0.18
Reach 1	2.35042*	Max WS	399.05	1188.44	1192.38		1192.43	0.000331	1.72	234.01	85.08	0.18
Reach 1	2.34771*	Max WS	399.01	1188.43	1192.38		1192.42	0.000304	1.67	241.01	86.18	0.17
Reach 1	2.345*	Max WS	398.82	1188.41	1192.38		1192.42	0.000278	1.62	248.39	87.22	0.16
Reach 1	2.34228*	Max WS	399.03	1188.39	1192.38		1192.41	0.000255	1.57	255.89	88.24	0.16
Reach 1	2.33957*	Max WS	398.87	1188.38	1192.37		1192.41	0.000234	1.53	263.24	89.27	0.15
Reach 1	2.33685*	Max WS	399.00	1188.36	1192.37		1192.41	0.000216	1.49	270.98	90.25	0.15
Reach 1	2.33414*	Max WS	398.94	1188.34	1192.37		1192.40	0.000198	1.45	278.96	91.24	0.14
Reach 1	2.33142*	Max WS	398.55	1188.32	1192.37		1192.40	0.000182	1.41	286.99	92.20	0.13
Reach 1	2.32871*	Max WS	398.83	1188.31	1192.37		1192.40	0.000169	1.37	294.71	93.21	0.13
Reach 1	2.326	Max WS	398.93	1188.29	1192.37		1192.40	0.000156	1.34	303.06	94.17	0.13
Reach 1	2.32316*	Max WS	398.91	1188.27	1192.37		1192.39	0.000150	1.33	306.66	95.08	0.12
Reach 1	2.32033*	Max WS	398.95	1188.25	1192.36		1192.39	0.000145	1.32	310.67	96.00	0.12
Reach 1	2.3175*	Max WS	398.84	1188.24	1192.36		1192.39	0.000140	1.31	314.82	96.95	0.12
Reach 1	2.31466*	Max WS	398.79	1188.22	1192.36		1192.39	0.000135	1.30	319.58	97.85	0.12
Reach 1	2.31183*	Max WS	398.82	1188.20	1192.36		1192.38	0.000129	1.29	324.97	98.74	0.12
Reach 1	2.309	Max WS	398.77	1188.18	1192.36		1192.38	0.000124	1.28	330.63	99.61	0.11
Reach 1	2.30675*	Max WS	398.76	1188.17	1192.35		1192.38	0.000141	1.32	315.00	98.32	0.12
Reach 1	2.3045*	Max WS	398.76	1188.16	1192.35		1192.38	0.000165	1.38	297.60	96.26	0.13
Reach 1	2.30225*	Max WS	398.78	1188.14	1192.34		1192.37	0.000200	1.44	279.26	93.55	0.14

HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	2.300	Max WS	398.75	1188.13	1192.34		1192.37	0.000255	1.53	260.63	87.71	0.16
Reach 1	2.241		Culvert									
Reach 1	2.182	Max WS	398.74	1183.29	1184.86	1185.26	1186.39	0.025593	9.93	40.17	54.55	1.41
Reach 1	2.17966*	Max WS	398.74	1183.09	1184.33	1184.42	1185.01	0.019168	6.62	60.23	57.39	1.14
Reach 1	2.17733*	Max WS	398.71	1182.89	1184.08	1184.16	1184.71	0.019046	6.38	62.53	62.83	1.13
Reach 1	2.175	Max WS	398.71	1182.69	1183.83	1183.88	1184.39	0.017743	6.02	66.19	68.72	1.08
Reach 1	2.17237*	Max WS	398.70	1182.45	1183.58	1183.64	1184.14	0.018030	5.98	66.73	71.00	1.09
Reach 1	2.16975*	Max WS	398.72	1182.21	1183.33	1183.39	1183.88	0.018383	5.93	67.21	73.36	1.09
Reach 1	2.16712*	Max WS	398.76	1181.97	1183.08	1183.13	1183.62	0.018749	5.89	67.72	75.88	1.10
Reach 1	2.1645*	Max WS	398.70	1181.72	1182.81	1182.87	1183.34	0.019063	5.84	68.26	78.40	1.10
Reach 1	2.16187*	Max WS	398.74	1181.48	1182.55	1182.61	1183.07	0.019456	5.81	68.66	80.79	1.11
Reach 1	2.15925*	Max WS	398.66	1181.24	1182.28	1182.34	1182.80	0.019876	5.79	68.91	82.86	1.12
Reach 1	2.15662*	Max WS	398.72	1181.00	1182.00	1182.07	1182.52	0.020505	5.78	69.02	85.13	1.13
Reach 1	2.154	Max WS	398.64	1180.76	1181.69	1181.80	1182.25	0.024255	6.00	66.39	87.61	1.22
Reach 1	2.15144*	Max WS	398.72	1180.39	1181.36	1181.47	1181.94	0.023934	6.09	65.47	83.75	1.21
Reach 1	2.14888*	Max WS	398.72	1180.01	1181.04	1181.15	1181.63	0.023367	6.16	64.72	79.89	1.21
Reach 1	2.14633*	Max WS	398.72	1179.64	1180.74	1180.83	1181.32	0.021599	6.13	65.03	76.22	1.17
Reach 1	2.14377*	Max WS	398.64	1179.27	1180.45	1180.51	1181.01	0.018827	5.99	66.55	72.85	1.10
Reach 1	2.14122*	Max WS	398.74	1178.89	1180.21	1180.20	1180.71	0.014916	5.68	70.23	69.90	1.00
Reach 1	2.13866*	Max WS	398.42	1178.52	1180.01		1180.43	0.010707	5.21	76.45	67.44	0.86
Reach 1	2.13611*	Max WS	398.28	1178.15	1179.95		1180.25	0.005928	4.39	90.68	66.29	0.66
Reach 1	2.13355*	Max WS	398.32	1177.77	1179.95		1180.17	0.003265	3.76	106.48	66.06	0.51
Reach 1	2.131	Max WS	398.30	1177.40	1179.95		1180.12	0.000612	3.33	121.69	66.63	0.41
Reach 1	2.12875*	Max WS	398.31	1177.04	1179.94		1180.10	0.001962	3.17	126.23	69.70	0.40
Reach 1	2.1265*	Max WS	398.29	1176.67	1179.94		1180.07	0.001556	2.84	140.07	71.88	0.36
Reach 1	2.12425*	Max WS	398.27	1176.30	1179.95		1180.04	0.000959	2.43	163.83	73.83	0.29
Reach 1	2.122	Max WS	398.26	1175.94	1179.69		1180.02	0.001764	4.59	86.73	68.79	0.43
Reach 1	2.112		Culvert									
Reach 1	2.102	Max WS	398.15	1173.24	1175.23	1175.56	1176.62	0.022000	9.47	42.03	39.10	1.31
Reach 1	2.09725*	Max WS	397.96	1172.95	1174.82	1174.99	1175.72	0.020669	7.63	52.19	42.39	1.21
Reach 1	2.0925*	Max WS	397.64	1172.66	1174.54	1174.64	1175.31	0.018023	7.04	56.46	46.68	1.13
Reach 1	2.08775*	Max WS	396.93	1172.37	1174.30	1174.30	1174.93	0.014601	6.38	62.26	51.04	1.02
Reach 1	2.083	Max WS	395.67	1172.08	1174.10		1174.59	0.010800	5.62	70.42	55.66	0.88
Reach 1	2.07711*	Max WS	478.48	1171.91	1173.89	1173.93	1174.59	0.015286	6.72	71.25	55.95	1.05
Reach 1	2.07122*	Max WS	478.53	1171.74	1173.67	1173.71	1174.37	0.015178	6.69	71.49	56.12	1.05
Reach 1	2.06533*	Max WS	478.52	1171.57	1173.46	1173.48	1174.15	0.015038	6.67	71.78	56.33	1.04
Reach 1	2.05944*	Max WS	478.51	1171.40	1173.24	1173.26	1173.92	0.014812	6.62	72.23	56.57	1.03
Reach 1	2.05355*	Max WS	478.57	1171.22	1173.03	1173.04	1173.70	0.014468	6.57	72.87	56.83	1.02
Reach 1	2.04766*	Max WS	478.50	1171.05	1172.82	1172.82	1173.47	0.014014	6.49	73.72	57.13	1.01
Reach 1	2.04177*	Max WS	478.55	1170.88	1172.62	1172.60	1173.25	0.013378	6.39	74.94	57.48	0.99
Reach 1	2.03588*	Max WS	478.55	1170.71	1172.43	1172.38	1173.03	0.012429	6.23	76.87	57.98	0.95
Reach 1	2.030	Max WS	478.53	1170.54	1172.26		1172.81	0.010828	5.94	80.51	58.68	0.89
Reach 1	2.02778*	Max WS	478.52	1170.35	1172.13		1172.65	0.009988	5.79	82.65	58.98	0.86
Reach 1	2.02557*	Max WS	478.52	1170.17	1172.01		1172.49	0.008624	5.52	86.68	59.52	0.81
Reach 1	2.02335*	Max WS	330.02	1169.98	1171.99		1172.17	0.003019	3.44	95.85	60.79	0.48
Reach 1	2.02114*	Max WS	329.54	1169.79	1171.98		1172.13	0.002221	3.11	106.02	62.25	0.42
Reach 1	2.01892*	Max WS	329.43	1169.60	1171.97		1172.09	0.001665	2.82	116.83	63.93	0.37
Reach 1	2.01671*	Max WS	329.99	1169.42	1171.96		1172.07	0.001270	2.57	128.18	65.59	0.32
Reach 1	2.0145*	Max WS	329.96	1169.23	1171.96		1172.04	0.000980	2.36	139.91	67.19	0.29
Reach 1	2.01228*	Max WS	330.15	1169.04	1171.96		1172.03	0.000766	2.17	152.05	68.70	0.26
Reach 1	2.01007*	Max WS	329.75	1168.86	1171.95		1172.02	0.000604	2.00	164.59	70.18	0.23
Reach 1	2.00785*	Max WS	328.70	1168.67	1171.95		1172.01	0.000481	1.85	177.57	71.79	0.21
Reach 1	2.00564*	Max WS	328.58	1168.48	1171.95		1172.00	0.000341	1.72	190.79	73.13	0.19
Reach 1	2.00342*	Max WS	329.33	1168.29	1171.95		1171.99	0.000316	1.61	204.38	74.11	0.17
Reach 1	2.00121*	Max WS	329.22	1168.11	1171.95		1171.99	0.000259	1.51	217.93	75.02	0.16
Reach 1	1.999	Max WS	328.78	1167.92	1171.95		1171.98	0.000214	1.42	231.79	75.91	0.14
Reach 1	1.99661*	Max WS	576.67	1167.87	1171.80		1171.90	0.000716	2.53	228.08	77.79	0.26
Reach 1	1.99423*	Max WS	576.56	1167.82	1171.80		1171.89	0.000667	2.44	236.21	80.58	0.25
Reach 1	1.99184*	Max WS	576.51	1167.77	1171.79		1171.88	0.000616	2.35	245.18	83.38	0.24
Reach 1	1.98946*	Max WS	576.08	1167.72	1171.79		1171.87	0.000561	2.25	255.50	86.26	0.23
Reach 1	1.98707*	Max WS	576.45	1167.67	1171.79		1171.86	0.000508	2.16	266.75	89.14	0.22
Reach 1	1.98469*	Max WS	576.43	1167.62	1171.78		1171.85	0.000456	2.07	279.11	92.11	0.21
Reach 1	1.98230*	Max WS	576.41	1167.56	1171.78		1171.84	0.000405	1.97	292.78	95.04	0.20
Reach 1	1.97992*	Max WS	576.27	1167.51	1171.78		1171.84	0.000430	1.88	307.22	98.00	0.19
Reach 1	1.97753*	Max WS	576.16	1167.46	1171.78		1171.83	0.000298	1.78	322.89	101.00	0.18
Reach 1	1.97515*	Max WS	575.44	1167.41	1171.78		1171.82	0.000278	1.69	339.77	104.06	0.17
Reach 1	1.97276*	Max WS	575.81	1167.36	1171.78		1171.82	0.000244	1.61	357.60	107.13	0.16
Reach 1	1.97038*	Max WS	576.17	1167.31	1171.78		1171.81	0.000255	1.53	376.67	110.23	0.15
Reach 1	1.968	Max WS	576.03	1167.26	1171.78		1171.81	0.000181	1.45	396.63	113.43	0.14
Reach 1	1.96127*	Max WS	575.78	1167.22	1171.77		1171.81	0.000190	1.47	391.24	111.57	0.14
Reach 1	1.95454*	Max WS	575.92	1167.18	1171.77		1171.80	0.000191	1.49	386.32	109.55	0.14
Reach 1	1.94781*	Max WS	575.93	1167.14	1171.77		1171.80	0.000195	1.51	382.21	107.73	0.14
Reach 1	1.94109*	Max WS	575.89	1167.10	1171.76		1171.80	0.000211	1.52	378.66	105.93	0.14
Reach 1	1.93436*	Max WS	575.69	1167.06	1171.76		1171.80	0.000212	1.53	375.77	104.19	0.14
Reach 1	1.92763*	Max WS	575.84	1167.03	1171.75		1171.79	0.000199	1.54	373.36	102.47	0.14
Reach 1	1.92090*	Max WS	575.40	1166.99	1171.75		1171.79	0.000197	1.55	371.78	100.72	0.14

HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1.91418*	Max WS	575.45	1166.95	1171.75		1171.79	0.000171	1.55	370.77	98.97	0.14
Reach 1	1.90745*	Max WS	575.74	1166.91	1171.75		1171.78	0.000168	1.55	370.42	97.28	0.14
Reach 1	1.90072*	Max WS	575.52	1166.87	1171.74		1171.78	0.000164	1.55	370.75	95.65	0.14
Reach 1	1.894	Max WS	575.66	1166.83	1171.74		1171.78	0.000160	1.55	371.54	94.10	0.14
Reach 1	1.89371*	Max WS	575.64	1166.82	1171.74		1171.78	0.000166	1.57	367.24	94.24	0.14
Reach 1	1.89342*	Max WS	575.59	1166.81	1171.74		1171.77	0.000173	1.59	363.09	94.34	0.14
Reach 1	1.89314*	Max WS	575.56	1166.80	1171.73		1171.77	0.000180	1.60	358.76	94.45	0.15
Reach 1	1.89285*	Max WS	575.30	1166.80	1171.73		1171.77	0.000187	1.62	354.77	94.60	0.15
Reach 1	1.89257*	Max WS	575.49	1166.79	1171.72		1171.77	0.000195	1.64	350.67	94.69	0.15
Reach 1	1.89228*	Max WS	575.13	1166.78	1171.72		1171.76	0.000202	1.66	346.77	94.81	0.15
Reach 1	1.892*	Max WS	575.37	1166.77	1171.72		1171.76	0.000210	1.68	342.91	94.94	0.16
Reach 1	1.89171*	Max WS	575.38	1166.76	1171.71		1171.76	0.000219	1.70	339.02	95.07	0.16
Reach 1	1.89142*	Max WS	575.00	1166.75	1171.71		1171.75	0.000227	1.71	335.42	95.20	0.16
Reach 1	1.89114*	Max WS	575.04	1166.74	1171.70		1171.75	0.000236	1.73	331.68	95.30	0.16
Reach 1	1.89085*	Max WS	575.21	1166.74	1171.70		1171.75	0.000244	1.75	328.20	95.37	0.17
Reach 1	1.89057*	Max WS	575.29	1166.73	1171.69		1171.74	0.000254	1.77	324.63	95.52	0.17
Reach 1	1.89028*	Max WS	575.21	1166.72	1171.69		1171.74	0.000263	1.79	321.22	95.60	0.17
Reach 1	1.890	Max WS	575.24	1166.71	1171.68		1171.74	0.000273	1.81	317.87	95.67	0.17
Reach 1	1.88971*	Max WS	575.19	1166.72	1171.68		1171.73	0.000265	1.79	321.25	95.96	0.17
Reach 1	1.88942*	Max WS	575.16	1166.73	1171.68		1171.73	0.000256	1.77	324.70	96.25	0.17
Reach 1	1.88914*	Max WS	575.05	1166.74	1171.68		1171.72	0.000248	1.75	328.21	96.53	0.17
Reach 1	1.88885*	Max WS	575.08	1166.75	1171.67		1171.72	0.000240	1.73	331.70	96.80	0.17
Reach 1	1.88857*	Max WS	575.07	1166.76	1171.67		1171.72	0.000233	1.72	335.28	97.09	0.16
Reach 1	1.88828*	Max WS	575.05	1166.77	1171.67		1171.71	0.000226	1.70	338.75	97.41	0.16
Reach 1	1.888*	Max WS	574.99	1166.78	1171.67		1171.71	0.000219	1.68	342.52	97.71	0.16
Reach 1	1.88771*	Max WS	575.01	1166.80	1171.66		1171.71	0.000212	1.66	346.28	97.99	0.16
Reach 1	1.88742*	Max WS	574.99	1166.81	1171.66		1171.70	0.000205	1.64	349.82	98.32	0.15
Reach 1	1.88714*	Max WS	574.88	1166.82	1171.66		1171.70	0.000199	1.63	353.70	98.63	0.15
Reach 1	1.88685*	Max WS	574.95	1166.83	1171.66		1171.70	0.000193	1.61	357.54	98.92	0.15
Reach 1	1.88657*	Max WS	574.92	1166.84	1171.65		1171.69	0.000186	1.59	361.53	99.17	0.15
Reach 1	1.88628*	Max WS	574.90	1166.85	1171.65		1171.69	0.000181	1.57	365.41	99.46	0.14
Reach 1	1.886	Max WS	574.87	1166.86	1171.65		1171.69	0.000175	1.56	369.40	99.74	0.14
Reach 1	1.88571*	Max WS	574.89	1166.86	1171.65		1171.69	0.000176	1.56	368.50	99.81	0.14
Reach 1	1.88542*	Max WS	574.87	1166.85	1171.65		1171.68	0.000177	1.56	368.11	99.85	0.14
Reach 1	1.88514*	Max WS	574.81	1166.85	1171.64		1171.68	0.000178	1.56	367.73	99.94	0.14
Reach 1	1.88485*	Max WS	574.80	1166.85	1171.64		1171.68	0.000178	1.56	367.54	100.04	0.14
Reach 1	1.88457*	Max WS	574.83	1166.84	1171.64		1171.68	0.000178	1.56	367.69	100.11	0.14
Reach 1	1.88428*	Max WS	574.77	1166.84	1171.63		1171.67	0.000178	1.56	368.02	100.17	0.14
Reach 1	1.884*	Max WS	574.76	1166.83	1171.63		1171.67	0.000177	1.56	368.76	100.25	0.14
Reach 1	1.88371*	Max WS	574.71	1166.83	1171.63		1171.67	0.000175	1.55	369.60	100.29	0.14
Reach 1	1.88342*	Max WS	574.75	1166.83	1171.63		1171.66	0.000174	1.55	370.47	100.33	0.14
Reach 1	1.88314*	Max WS	574.71	1166.82	1171.63		1171.66	0.000172	1.55	371.81	100.40	0.14
Reach 1	1.88285*	Max WS	574.66	1166.82	1171.62		1171.66	0.000170	1.54	373.34	100.43	0.14
Reach 1	1.88257*	Max WS	574.68	1166.82	1171.62		1171.66	0.000167	1.53	375.20	100.47	0.14
Reach 1	1.88228*	Max WS	574.69	1166.81	1171.62		1171.66	0.000164	1.52	377.09	100.50	0.14
Reach 1	1.882	Max WS	574.64	1166.81	1171.62		1171.65	0.000161	1.52	379.20	100.54	0.14
Reach 1	1.87542*	Max WS	574.63	1166.81	1171.61		1171.65	0.000160	1.51	379.49	100.83	0.14
Reach 1	1.86885*	Max WS	574.66	1166.80	1171.61		1171.65	0.000159	1.51	379.95	101.10	0.14
Reach 1	1.86228*	Max WS	574.59	1166.80	1171.61		1171.65	0.000158	1.51	380.36	101.31	0.14
Reach 1	1.85571*	Max WS	574.59	1166.80	1171.61		1171.64	0.000156	1.51	380.94	101.53	0.14
Reach 1	1.84914*	Max WS	574.62	1166.80	1171.61		1171.64	0.000154	1.51	381.48	101.72	0.13
Reach 1	1.84257*	Max WS	574.57	1166.79	1171.60		1171.64	0.000152	1.51	382.23	101.94	0.13
Reach 1	1.836*	Max WS	574.58	1166.79	1171.60		1171.64	0.000150	1.51	382.99	102.36	0.13
Reach 1	1.82942*	Max WS	574.57	1166.79	1171.60		1171.63	0.000148	1.51	383.94	102.83	0.13
Reach 1	1.82285*	Max WS	574.52	1166.78	1171.60		1171.63	0.000146	1.50	385.03	103.24	0.13
Reach 1	1.81628*	Max WS	574.55	1166.78	1171.60		1171.63	0.000144	1.50	386.13	103.67	0.13
Reach 1	1.80971*	Max WS	574.56	1166.78	1171.59		1171.63	0.000142	1.50	387.40	104.12	0.13
Reach 1	1.80314*	Max WS	574.54	1166.78	1171.59		1171.63	0.000140	1.50	388.80	104.54	0.13
Reach 1	1.79657*	Max WS	574.50	1166.77	1171.59		1171.62	0.000139	1.50	390.24	104.74	0.13
Reach 1	1.790	Max WS	574.56	1166.77	1171.59		1171.62	0.000137	1.50	391.85	104.84	0.13
Reach 1	1.789*	Max WS	574.48	1166.77	1171.59		1171.62	0.000136	1.49	392.93	105.15	0.13
Reach 1	1.788*	Max WS	574.51	1166.77	1171.58		1171.62	0.000135	1.48	394.02	105.16	0.13
Reach 1	1.787*	Max WS	574.52	1166.78	1171.58		1171.62	0.000135	1.47	395.37	105.06	0.13
Reach 1	1.786*	Max WS	574.42	1166.78	1171.58		1171.61	0.000134	1.46	396.77	104.83	0.13
Reach 1	1.785*	Max WS	574.42	1166.78	1171.58		1171.61	0.000133	1.45	398.57	104.60	0.13
Reach 1	1.784	Max WS	574.48	1166.78	1171.58		1171.61	0.000132	1.45	400.40	104.64	0.13
Reach 1	1.78		Culvert									
Reach 1	1.758	Max WS	572.87	1164.82	1167.92		1167.97	0.000441	1.90	302.00	122.21	0.21
Reach 1	1.75677*	Max WS	572.99	1164.79	1167.91		1167.97	0.000416	1.86	308.12	122.78	0.21
Reach 1	1.75555*	Max WS	572.90	1164.76	1167.91		1167.96	0.000392	1.82	314.21	123.40	0.20
Reach 1	1.75433*	Max WS	572.99	1164.74	1167.90		1167.95	0.000369	1.79	320.47	123.93	0.20
Reach 1	1.75311*	Max WS	572.87	1164.71	1167.90		1167.95	0.000348	1.75	326.88	124.47	0.19
Reach 1	1.75188*	Max WS	572.70	1164.68	1167.90		1167.94	0.000327	1.72	333.45	125.03	0.19
Reach 1	1.75066*	Max WS	572.81	1164.65	1167.89		1167.94	0.000309	1.68	340.06	125.60	0.18
Reach 1	1.74944*	Max WS	572.85	1164.63	1167.89		1167.93	0.000291	1.65	346.95	126.18	0.18
Reach 1	1.74822*	Max WS	572.80	1164.60	1167.89		1167.93	0.000274	1.62	353.87	126.79	0.17

HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1.747	Max WS	572.80	1164.57	1167.89		1167.92	0.000258	1.59	360.91	127.39	0.17
Reach 1	1.744*	Max WS	572.80	1164.56	1167.88		1167.92	0.000261	1.59	359.20	126.79	0.17
Reach 1	1.741*	Max WS	572.71	1164.55	1167.88		1167.92	0.000263	1.60	357.58	126.20	0.17
Reach 1	1.738*	Max WS	572.73	1164.54	1167.87		1167.91	0.000265	1.61	356.08	125.61	0.17
Reach 1	1.735*	Max WS	572.63	1164.53	1167.87		1167.91	0.000267	1.62	354.38	125.01	0.17
Reach 1	1.732*	Max WS	572.62	1164.52	1167.86		1167.91	0.000269	1.62	353.04	124.40	0.17
Reach 1	1.729*	Max WS	572.65	1164.51	1167.86		1167.90	0.000271	1.63	351.64	123.83	0.17
Reach 1	1.726*	Max WS	572.70	1164.50	1167.86		1167.90	0.000273	1.64	350.24	123.23	0.17
Reach 1	1.723*	Max WS	572.74	1164.50	1167.85		1167.89	0.000275	1.64	348.84	122.61	0.17
Reach 1	1.72*	Max WS	572.67	1164.49	1167.85		1167.89	0.000276	1.65	347.59	122.03	0.17
Reach 1	1.717*	Max WS	572.68	1164.48	1167.84		1167.89	0.000278	1.65	346.42	121.44	0.17
Reach 1	1.714*	Max WS	572.64	1164.47	1167.84		1167.88	0.000278	1.66	345.50	120.87	0.17
Reach 1	1.711*	Max WS	572.61	1164.46	1167.83		1167.88	0.000279	1.66	344.14	120.30	0.17
Reach 1	1.708*	Max WS	572.66	1164.45	1167.83		1167.87	0.000278	1.67	343.31	119.80	0.17
Reach 1	1.705	Max WS	572.61	1164.44	1167.83		1167.87	0.000277	1.67	342.32	119.30	0.17
Reach 1	1.6998*	Max WS	581.84	1164.29	1167.82		1167.86	0.000267	1.65	353.69	122.00	0.17
Reach 1	1.6946*	Max WS	581.89	1164.15	1167.82		1167.86	0.000249	1.59	365.04	124.85	0.16
Reach 1	1.6894*	Max WS	581.83	1164.00	1167.82		1167.86	0.000233	1.55	376.21	127.66	0.16
Reach 1	1.6842*	Max WS	581.85	1163.86	1167.82		1167.85	0.000218	1.50	387.05	130.33	0.15
Reach 1	1.679	Max WS	581.88	1163.71	1167.82		1167.85	0.000203	1.46	397.83	132.18	0.15
Reach 1	1.667	Max WS	581.82	1164.02	1167.74		1167.84	0.000531	2.54	229.46	115.78	0.25
Reach 1	1.6535		Culvert									
Reach 1	1.640	Max WS	581.31	1162.70	1166.28		1166.41	0.000847	2.94	197.99	150.64	0.30
Reach 1	1.63*	Max WS	581.45	1162.34	1166.33		1166.36	0.000180	1.37	426.21	145.72	0.14
Reach 1	1.62*	Max WS	581.62	1161.98	1166.33		1166.35	0.000135	1.30	450.79	138.44	0.12
Reach 1	1.610	Max WS	581.42	1161.62	1166.33		1166.35	0.000097	1.22	483.86	131.22	0.11
Reach 1	1.60635*	Max WS	583.48	1161.62	1166.33		1166.35	0.000096	1.22	486.17	131.49	0.11
Reach 1	1.6027*	Max WS	583.33	1161.62	1166.32		1166.35	0.000095	1.22	488.57	131.76	0.11
Reach 1	1.59905*	Max WS	583.45	1161.62	1166.32		1166.35	0.000093	1.21	491.07	132.05	0.11
Reach 1	1.5954*	Max WS	583.50	1161.63	1166.32		1166.34	0.000092	1.21	493.44	132.30	0.11
Reach 1	1.59175*	Max WS	583.48	1161.63	1166.32		1166.34	0.000091	1.20	495.96	132.60	0.10
Reach 1	1.5881*	Max WS	583.37	1161.63	1166.32		1166.34	0.000090	1.20	498.50	132.90	0.10
Reach 1	1.58445*	Max WS	583.25	1161.63	1166.32		1166.34	0.000088	1.19	501.13	133.22	0.10
Reach 1	1.5808*	Max WS	583.37	1161.63	1166.31		1166.34	0.000087	1.18	503.70	133.53	0.10
Reach 1	1.57715*	Max WS	583.33	1161.63	1166.31		1166.33	0.000086	1.18	506.37	133.85	0.10
Reach 1	1.5735*	Max WS	583.38	1161.64	1166.31		1166.33	0.000085	1.18	508.79	134.27	0.10
Reach 1	1.56985*	Max WS	583.36	1161.64	1166.31		1166.33	0.000083	1.17	511.48	134.74	0.10
Reach 1	1.5662*	Max WS	583.36	1161.64	1166.31		1166.33	0.000082	1.17	514.06	135.26	0.10
Reach 1	1.56255*	Max WS	583.27	1161.64	1166.31		1166.33	0.000081	1.16	516.82	135.87	0.10
Reach 1	1.5589*	Max WS	583.23	1161.64	1166.31		1166.33	0.000080	1.16	519.63	136.53	0.10
Reach 1	1.55525*	Max WS	583.25	1161.64	1166.30		1166.32	0.000079	1.15	522.24	137.28	0.10
Reach 1	1.5516*	Max WS	583.30	1161.64	1166.30		1166.32	0.000078	1.15	525.32	138.04	0.10
Reach 1	1.54795*	Max WS	583.31	1161.65	1166.30		1166.32	0.000077	1.14	528.12	138.57	0.10
Reach 1	1.5443*	Max WS	583.24	1161.65	1166.30		1166.32	0.000075	1.14	531.11	139.12	0.10
Reach 1	1.54065*	Max WS	583.19	1161.65	1166.30		1166.32	0.000074	1.13	534.13	139.70	0.10
Reach 1	1.537	Max WS	583.21	1161.65	1166.30		1166.32	0.000073	1.13	537.13	140.26	0.10
Reach 1	1.534*	Max WS	583.18	1161.50	1166.30		1166.32	0.000074	1.13	536.91	140.21	0.10
Reach 1	1.531	Max WS	583.18	1161.35	1166.30		1166.31	0.000073	1.14	540.59	141.26	0.10
Reach 1	1.53		Culvert									
Reach 1	1.501	Max WS	567.71	1159.16	1164.50		1164.52	0.000059	1.07	551.28	132.17	0.09
Reach 1	1.498*	Max WS	567.70	1159.13	1164.50		1164.52	0.000056	1.05	561.53	132.47	0.08
Reach 1	1.495*	Max WS	567.64	1159.10	1164.50		1164.51	0.000052	1.03	573.79	133.01	0.08
Reach 1	1.492	Max WS	567.65	1159.07	1164.50		1164.51	0.000048	1.00	588.27	134.20	0.08
Reach 1	1.4884*	Max WS	567.72	1159.09	1164.50		1164.51	0.000049	1.00	588.19	135.34	0.08
Reach 1	1.4848*	Max WS	567.68	1159.11	1164.50		1164.51	0.000049	1.00	588.16	136.48	0.08
Reach 1	1.4812*	Max WS	567.64	1159.14	1164.50		1164.51	0.000050	1.00	588.23	137.61	0.08
Reach 1	1.4776*	Max WS	567.63	1159.16	1164.49		1164.51	0.000050	0.99	588.30	138.69	0.08
Reach 1	1.474*	Max WS	567.63	1159.18	1164.49		1164.51	0.000051	0.99	588.25	139.74	0.08
Reach 1	1.4704*	Max WS	567.62	1159.20	1164.49		1164.51	0.000051	0.99	588.26	140.72	0.08
Reach 1	1.4668*	Max WS	567.55	1159.22	1164.49		1164.51	0.000052	0.99	588.43	141.74	0.08
Reach 1	1.4632*	Max WS	567.47	1159.25	1164.49		1164.51	0.000052	0.98	588.60	142.70	0.08
Reach 1	1.4596*	Max WS	567.55	1159.27	1164.49		1164.50	0.000053	0.98	588.75	143.57	0.08
Reach 1	1.456*	Max WS	567.54	1159.29	1164.49		1164.50	0.000053	0.98	589.11	144.38	0.08
Reach 1	1.4524*	Max WS	567.50	1159.31	1164.49		1164.50	0.000053	0.98	589.33	145.08	0.08
Reach 1	1.4488*	Max WS	567.53	1159.33	1164.49		1164.50	0.000054	0.97	589.79	145.78	0.08
Reach 1	1.4452*	Max WS	567.56	1159.36	1164.49		1164.50	0.000054	0.97	590.20	146.26	0.08
Reach 1	1.4416*	Max WS	567.52	1159.38	1164.48		1164.50	0.000055	0.97	590.88	146.60	0.08
Reach 1	1.438*	Max WS	567.53	1159.40	1164.48		1164.50	0.000055	0.96	591.53	146.73	0.08
Reach 1	1.4344*	Max WS	567.44	1159.42	1164.48		1164.50	0.000056	0.96	592.36	146.75	0.08
Reach 1	1.4308*	Max WS	567.45	1159.44	1164.48		1164.50	0.000056	0.96	593.59	146.78	0.08
Reach 1	1.4272*	Max WS	567.48	1159.47	1164.48		1164.49	0.000056	0.96	594.86	147.09	0.08
Reach 1	1.4236*	Max WS	567.47	1159.49	1164.48		1164.49	0.000057	0.95	596.23	147.69	0.08
Reach 1	1.420	Max WS	567.38	1159.51	1164.48		1164.49	0.000057	0.95	597.79	148.43	0.08
Reach 1	1.40942*	Max WS	581.65	1159.54	1164.48		1164.49	0.000062	0.98	591.70	147.85	0.09
Reach 1	1.39885*	Max WS	581.55	1159.57	1164.47		1164.49	0.000063	0.99	586.52	147.28	0.09
Reach 1	1.38828*	Max WS	581.60	1159.60	1164.47		1164.49	0.000064	1.00	582.09	146.80	0.09

HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1.37771*	Max WS	581.60	1159.62	1164.47		1164.49	0.000065	1.01	578.51	146.81	0.09
Reach 1	1.36714*	Max WS	581.62	1159.65	1164.47		1164.49	0.000065	1.01	575.66	147.49	0.09
Reach 1	1.35657*	Max WS	581.55	1159.68	1164.47		1164.49	0.000066	1.01	574.05	148.16	0.09
Reach 1	1.346	Max WS	581.57	1159.71	1164.44		1164.48	0.000166	1.78	326.44	147.98	0.15
Reach 1	1.338		Culvert									
Reach 1	1.330	Max WS	581.40	1159.05	1163.96		1164.01	0.000138	1.66	350.99	144.54	0.13
Reach 1	1.32677*	Max WS	581.39	1159.00	1163.96		1164.00	0.000133	1.64	354.79	145.18	0.13
Reach 1	1.32355*	Max WS	581.40	1158.94	1163.96		1164.00	0.000128	1.62	358.60	145.74	0.13
Reach 1	1.32033*	Max WS	581.33	1158.89	1163.96		1164.00	0.000124	1.60	362.45	146.29	0.13
Reach 1	1.31711*	Max WS	581.34	1158.83	1163.96		1164.00	0.000120	1.59	366.16	146.91	0.12
Reach 1	1.31388*	Max WS	581.50	1158.78	1163.96		1164.00	0.000116	1.57	369.74	147.53	0.12
Reach 1	1.31066*	Max WS	581.34	1158.72	1163.96		1163.99	0.000112	1.56	373.07	148.16	0.12
Reach 1	1.30744*	Max WS	581.46	1158.67	1163.95		1163.99	0.000109	1.55	376.28	148.80	0.12
Reach 1	1.30422*	Max WS	581.49	1158.61	1163.95		1163.99	0.000106	1.53	379.53	149.48	0.12
Reach 1	1.301	Max WS	581.48	1158.56	1163.95		1163.99	0.000103	1.52	382.73	150.11	0.12
Reach 1	1.29808*	Max WS	581.45	1158.55	1163.97		1163.98	0.000048	0.93	629.54	147.64	0.08
Reach 1	1.29516*	Max WS	581.51	1158.53	1163.96		1163.98	0.000055	0.98	598.66	144.57	0.08
Reach 1	1.29225*	Max WS	581.50	1158.52	1163.96		1163.98	0.000063	1.03	568.63	140.93	0.09
Reach 1	1.28933*	Max WS	581.43	1158.51	1163.96		1163.98	0.000074	1.08	538.94	136.70	0.09
Reach 1	1.28641*	Max WS	581.37	1158.49	1163.95		1163.97	0.000086	1.14	510.28	132.29	0.10
Reach 1	1.2835*	Max WS	581.38	1158.48	1163.95		1163.97	0.000101	1.21	482.11	128.66	0.11
Reach 1	1.28058*	Max WS	581.37	1158.47	1163.95		1163.97	0.000119	1.28	454.87	125.04	0.12
Reach 1	1.27766*	Max WS	581.36	1158.45	1163.94		1163.97	0.000141	1.36	428.23	121.30	0.13
Reach 1	1.27475*	Max WS	581.42	1158.44	1163.93		1163.97	0.000168	1.45	402.29	117.53	0.14
Reach 1	1.27183*	Max WS	581.33	1158.43	1163.93		1163.96	0.000201	1.54	376.89	114.25	0.15
Reach 1	1.26891*	Max WS	581.27	1158.41	1163.92		1163.96	0.000243	1.65	352.16	110.96	0.16
Reach 1	1.266	Max WS	581.21	1158.40	1163.91		1163.95	0.000305	1.77	327.95	107.64	0.18
Reach 1	1.26		Culvert									
Reach 1	1.255	Max WS	581.34	1158.40	1163.83		1163.87	0.000323	1.69	344.23	124.68	0.18
Reach 1	1.25430*	Max WS	581.33	1158.32	1163.83		1163.86	0.000243	1.53	379.01	127.30	0.16
Reach 1	1.25361*	Max WS	581.25	1158.25	1163.83		1163.86	0.000184	1.40	413.86	129.81	0.14
Reach 1	1.25292*	Max WS	581.32	1158.17	1163.83		1163.85	0.000143	1.29	449.53	132.32	0.12
Reach 1	1.25223*	Max WS	581.13	1158.09	1163.83		1163.85	0.000112	1.20	485.97	134.79	0.11
Reach 1	1.25153*	Max WS	581.55	1158.02	1163.83		1163.85	0.000083	1.11	521.97	137.20	0.10
Reach 1	1.25084*	Max WS	581.50	1157.94	1163.83		1163.84	0.000067	1.04	559.13	139.54	0.09
Reach 1	1.25015*	Max WS	581.21	1157.86	1163.83		1163.84	0.000055	0.97	597.06	141.92	0.08
Reach 1	1.24946*	Max WS	581.01	1157.78	1163.83		1163.84	0.000045	0.91	635.21	146.95	0.08
Reach 1	1.24876*	Max WS	581.11	1157.71	1163.83		1163.84	0.000038	0.86	673.69	155.75	0.07
Reach 1	1.24807*	Max WS	581.04	1157.63	1163.83		1163.84	0.000032	0.82	714.56	165.32	0.07
Reach 1	1.24738*	Max WS	580.92	1157.55	1163.83		1163.84	0.000027	0.77	756.03	171.00	0.06
Reach 1	1.24669*	Max WS	580.89	1157.48	1163.83		1163.84	0.000025	0.74	796.64	173.65	0.06
Reach 1	1.246	Max WS	581.11	1157.40	1163.83		1163.84	0.000022	0.70	837.86	173.86	0.05
Reach 1	1.24484*	Max WS	581.15	1157.39	1163.83		1163.84	0.000022	0.70	840.47	174.39	0.05
Reach 1	1.24369*	Max WS	580.83	1157.38	1163.83		1163.83	0.000021	0.70	843.11	174.70	0.05
Reach 1	1.24253*	Max WS	580.93	1157.38	1163.83		1163.83	0.000022	0.69	844.61	175.25	0.05
Reach 1	1.24138*	Max WS	581.16	1157.37	1163.83		1163.83	0.000021	0.69	847.41	175.79	0.05
Reach 1	1.24023*	Max WS	580.60	1157.36	1163.83		1163.83	0.000021	0.69	849.95	176.04	0.05
Reach 1	1.23907*	Max WS	580.69	1157.35	1163.83		1163.83	0.000021	0.69	852.80	176.61	0.05
Reach 1	1.23792*	Max WS	580.93	1157.35	1163.83		1163.83	0.000021	0.69	854.38	176.91	0.05
Reach 1	1.23676*	Max WS	580.93	1157.34	1163.82		1163.83	0.000021	0.68	857.25	177.45	0.05
Reach 1	1.23561*	Max WS	580.98	1157.33	1163.82		1163.83	0.000020	0.68	860.15	178.03	0.05
Reach 1	1.23446*	Max WS	581.03	1157.32	1163.82		1163.83	0.000020	0.68	862.92	178.33	0.05
Reach 1	1.23330*	Max WS	580.53	1157.32	1163.82		1163.83	0.000020	0.68	864.54	178.90	0.05
Reach 1	1.23215*	Max WS	580.68	1157.31	1163.82		1163.83	0.000020	0.68	867.54	179.47	0.05
Reach 1	1.231	Max WS	580.67	1157.30	1163.82		1163.83	0.000019	0.67	870.27	179.90	0.05
Reach 1	1.21912*	Max WS	601.15	1157.35	1163.82		1163.83	0.000025	0.74	817.99	174.77	0.06
Reach 1	1.20725*	Max WS	600.92	1157.41	1163.82		1163.83	0.000029	0.79	770.31	169.61	0.06
Reach 1	1.19537*	Max WS	600.87	1157.46	1163.82		1163.83	0.000033	0.83	728.63	164.59	0.06
Reach 1	1.1835*	Max WS	601.38	1157.51	1163.81		1163.83	0.000038	0.88	692.12	159.57	0.07
Reach 1	1.17162*	Max WS	600.93	1157.56	1163.81		1163.83	0.000043	0.92	660.87	153.63	0.07
Reach 1	1.15975*	Max WS	601.47	1157.61	1163.81		1163.82	0.000046	0.95	634.87	148.04	0.08
Reach 1	1.14787*	Max WS	601.45	1157.67	1163.81		1163.82	0.000050	0.99	613.82	143.53	0.08
Reach 1	1.136	Max WS	600.94	1157.72	1163.81	1159.10	1163.82	0.000050	1.01	598.45	137.22	0.08
Reach 1	1.12		Inl Struct									
Reach 1	1.104	Max WS	601.69	1157.75	1163.80		1163.81	0.000004	0.55	1096.68	228.58	0.04
Reach 1	1.10166*	Max WS	601.74	1157.61	1163.80		1163.81	0.000004	0.70	860.97	193.41	0.05
Reach 1	1.09933*	Max WS	600.68	1157.48	1163.79		1163.81	0.000007	0.94	649.55	158.67	0.07
Reach 1	1.097	Max WS	600.20	1157.34	1163.78		1163.80	0.000013	1.31	463.79	109.00	0.09
Reach 1	1.09233*	Max WS	1181.27	1157.30	1163.51		1163.69	0.000110	3.45	345.36	73.98	0.27
Reach 1	1.08766*	Max WS	1181.25	1157.26	1163.42		1163.69	0.000161	4.11	290.36	63.48	0.32
Reach 1	1.083	Max WS	1181.22	1157.22	1163.41		1163.68	0.000153	4.18	285.11	53.50	0.30
Reach 1	1.0665		Culvert									
Reach 1	1.050	Max WS	1181.22	1156.19	1158.41	1159.18	1161.14	0.007114	13.27	88.99	40.25	1.57
Reach 1	1.048	Max WS	1174.62	1156.14	1158.34	1159.12	1161.09	0.005438	13.32	88.19	40.24	1.59
Reach 1	1.0455*	Max WS	1166.91	1154.92	1157.90	1157.87	1159.35	0.002306	9.66	120.75	40.82	0.99
Reach 1	1.043	Max WS	1189.96	1153.69	1157.71		1158.52	0.001041	7.21	164.94	41.58	0.64

HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1.03983*	Max WS	1183.33	1153.66	1157.63		1158.48	0.001122	7.42	159.58	40.74	0.66
Reach 1	1.03666*	Max WS	1181.71	1153.63	1157.54		1158.45	0.001064	7.66	154.28	39.89	0.69
Reach 1	1.0335*	Max WS	1181.36	1153.60	1157.45		1158.43	0.001170	7.94	148.78	39.06	0.72
Reach 1	1.03033*	Max WS	1181.26	1153.58	1157.33		1158.40	0.001333	8.33	141.87	38.22	0.76
Reach 1	1.02716*	Max WS	1181.20	1153.55	1157.20		1158.38	0.001307	8.73	135.32	37.38	0.81
Reach 1	1.024	Max WS	1181.24	1153.52	1157.07	1156.73	1158.38	0.001500	9.18	128.70	36.54	0.86

APPENDIX C.6 – Existing HEC-1

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1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998              *                                    *   HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1               *                                    *         609 SECOND STREET            *
 *                                      *                                    *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   24FEB14  TIME  10:02:36  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************


                                        X     X  XXXXXXX   XXXXX          X
                                        X     X  X       X     X         XX
                                        X     X  X       X               X
                                        XXXXXXX  XXXX    X       XXXXX   X
                                        X     X  X       X               X
                                        X     X  X       X     X         X
                                        X     X  XXXXXXX   XXXXX         XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                   HEC-1 INPUT
PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID        Flood Control District of Maricopa County
            2           ID        115TH_24HR - Updated Hydrology
            3           ID        100 YEAR
            4           ID        24 Hour Storm
            5           ID        Unit Hydrograph: Clark
            6           ID        01/07/2014
            7           ID
            8           IT       5       0       0    1000
            9           IN      15
           10           IO       5
                        *
                        *DIAGRAM
                        *
           11           JD   3.568  0.0001
           12           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
           13           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
           14           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
           15           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
           16           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
           17           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
           18           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
           19           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
           20           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
           21           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
           22           JD   3.390    10.0
                        *

           23           KK    A09F   BASIN
           24           BA   0.370
           25           LG    0.20    0.25    5.34    0.30      46
           26           UC   0.575   0.409
           27           UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
           28           UA     100
                        *
                        * *** THIS DIVERSION IS TO MODEL ON-SITE RETENTION (LA09F) ****************
                        * *** PARKRIDGE ESTATES RESIDENTIAL DEVELOPMENT (ACCOUNTED) ***************
                        *

           29           KK   LA09F
           30           DT  LA09FD    13.6
           31           DI       0     100    1000   10000
```

Existing HEC-1 Model

```
 32          DQ       0     100    1000   10000
             *
             *
             * *** DIVERTED  MAIN (WEST), DIVERTED (SOUTH)  ****************************
             * BEARDSLEY ROAD CHANNEL TO THE WEST. EXCESS FLOW TO THE SOUTH.
             *

 33          KK   DA09F
 34          DT   A09FI
 35          DI       0      10      30      50     100     500     700    1000
 36          DQ       0      .2      .3      .4      .5      80     250     500
             *
             * ******************************************************************************
             * ********************   BEARDSLEY RD DRAINAGE    ******************************
             * ******************************************************************************
             *
1                                          HEC-1 INPUT
PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 37          KK  RA09FW   ROUTE
 38          RS       4    FLOW
 39          RC   0.030   0.025   0.030    1619  0.0012    0.00
 40          RX    0.00    1.00   16.00   36.00   51.00  123.00  148.00  648.00
 41          RY   16.00    8.00    0.00    0.00    8.00    8.00    9.00   11.00
             *

 42          KK    A09E   BASIN
 43          BA   0.140
 44          LG    0.19    0.23    4.79    0.36      39
 45          UC   0.608   0.663
 46          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 47          UA     100
             *
             * *** THIS DIVERSION IS TO MODEL ON-SITE RETENTION (LA09E) ****************
             * *** VENTANA LAKES RESIDENTIAL DEVELOPMENT (ACCOUNTED) *******************
             *

 48          KK   LA09E
 49          DT  LA09ED     8.2
 50          DI       0     100    1000   10000
 51          DQ       0     100    1000   10000
             *
             * *** COMBINE LA09E AND A09F ****************************************
             *

 52          KK   CA09E COMBINE
 53          HC       2
             *

 54          KK   RA09E   ROUTE
 55          RS       5    FLOW
 56          RC   0.040   0.030   0.040    2865  0.0069    0.00
 57          RX    0.00    1.00   16.00   36.00   51.00  123.00  148.00  648.00
 58          RY   16.00    8.00    0.00    0.00    8.00    8.00    9.00   11.00
             *

 59          KK    A09D   BASIN
 60          BA   0.244
 61          LG    0.21    0.18    6.54    0.17      34
 62          UC   0.533   0.408
 63          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 64          UA     100
             *
             *
             * *** THIS DIVERSION IS TO MODEL ON-SITE RETENTION (LA09D) ****************
             * *** VENTANA LAKES RESIDENTIAL DEVELOPMENT (ACCOUNTED) *******************
             *
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Existing HEC-1 Model

HEC-1 INPUT

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  65          KK   LA09D
  66          DT  LA09DD    15.3
  67          DI       0     100    1000   10000
  68          DQ       0     100    1000   10000
              *
              * *** COMBINE LA09D AND RA09E *************************
              *

  69          KK   CA09E COMBINE
  70          HC       2
              *

  71          KK   RA09D   ROUTE
  72          RS       3    FLOW
  73          RC   0.040   0.030   0.040    2865  0.0098    0.00
  74          RX    0.00   51.00   61.00   71.00   81.00  111.00  151.00  651.00
  75          RY    9.00    8.00    0.00    0.00    8.00    9.00    9.00   10.00
              *

  76          KK    A09C   BASIN
  77          BA   0.113
  78          LG    0.20    0.28    4.39    0.44       9
  79          UC   0.747   0.957
  80          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  81          UA     100
              *

  82          KK   CA09C COMBINE
  83          HC       2
              *
              *
              * THIS FLOW IS DIVERTED. THERE IS TWO 36" CMP THAT CARRIES
              * FLOW TO THE WEST, AND THE REST FLOWS SOUTH.
              *

  84          KK  DA09AO
  85          DT   A09AI
  86          DI       0      70     140     400     600     800    1000    3000    5000
  87          DQ       0      70     140     140     140     140     140     140     140
              *

  88          KK   RA09C   ROUTE
  89          RS      15    FLOW
  90          RC   0.030   0.025   0.030    5061  0.0020    0.00
  91          RX    0.00   10.00   40.00   50.00   70.00   80.00  120.00  130.00
  92          RY    7.00    5.00    4.00    3.00    3.00    4.00    5.00   10.00
              *
              *
```


HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  93          KK    A07D   BASIN
  94          BA   0.252
  95          LG    0.99    0.35    4.08    0.38       0
  96          UC   0.678   0.573
  97          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  98          UA     100
              *
              *

  99          KK   CA07D COMBINE
 100          HC       2
```

Existing HEC-1 Model

```
                    *

 101                KK   RA07D   ROUTE
 102                RS       1    FLOW
 103                RC   0.030   0.030   0.030    2041  0.0049 1180.00
 104                RX    0.00  100.00  112.00  147.00  159.00  179.00  214.00  580.00
 105                RY    8.00    6.00    0.00    0.00    6.00    7.00    7.00    9.00
                    *

 106                KK   A07G1   BASIN
 107                BA   0.236
 108                LG    0.21    0.14    7.94    0.10      32
 109                UC   0.415   0.287
 110                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 111                UA     100
                    *
                    *
                    * *** THIS DIVERSION IS TO MODEL ON-SITE RETENTION (LA07G) ****************
                    * *** VENTANA LAKES RESIDENTIAL DEVELOPMENT (ACCOUNTED) *******************
                    *

 112                KK   LA07G
 113                DT  LA07GD    12.9
 114                DI       0     100    1000   10000
 115                DQ       0     100    1000   10000
                    *

 116                KK  RA07G1   ROUTE
 117                RS       5    FLOW
 118                RC   0.040   0.020   0.040    2548  0.0035    0.00
 119                RX    0.00    1.00   26.00   41.00   71.00   86.00  126.00  576.00
 120                RY   12.00    7.00    5.00    1.00    1.00    5.00    6.00    7.00
                    *
                    *

 121                KK   A07E1   BASIN
 122                BA   0.036
 123                LG    0.25    0.15    7.94    0.10      40
 124                UC   0.303   0.295
 125                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 126                UA     100
                    *
                    *
1                                          HEC-1 INPUT
PAGE  5

          LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 127                KK  DI7E.1
 128                DT  DI7E.1     1.4
 129                DI       0     100    1000   10000
 130                DQ       0     100    1000   10000
                    *

 131                KK  RA07E1   ROUTE
 132                RS       4    FLOW
 133                RC   0.030   0.020   0.030    1471  0.0048    0.00
 134                RX    0.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00
 135                RY    2.00    1.00    0.00    0.00    0.00    0.00    1.00    2.00
                    *

 136                KK   A07G2   BASIN
 137                BA   0.028
 138                LG    0.18    0.25    4.79    0.35      55
 139                UC   0.436   0.732
 140                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 141                UA     100
                    *

 142                KK  RA07G2   ROUTE
```

Existing HEC-1 Model

```
143          RS       4    FLOW
144          RC   0.030   0.020   0.030    1632  0.0086    0.00
145          RX    0.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00
146          RY    2.00    1.00    0.00    0.00    0.00    0.00    1.00    2.00
             *

147          KK   A07E3   BASIN
148          BA   0.061
149          LG    0.24    0.19    6.54    0.17      34
150          UC   0.268   0.186
151          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
152          UA     100
             *

153          KK  CA07E3 COMBINE
154          HC       2
             *
             *

155          KK  DI7E.3
156          DT  DI7E.3     0.1
157          DI       0     100    1000   10000
158          DQ       0     100    1000   10000
             *

159          KK  RA07E3   ROUTE
160          RS       2    FLOW
161          RC   0.030   0.020   0.030    1835  0.0076    0.00
162          RX    0.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00
163          RY    2.00    1.00    0.00    0.00    0.00    0.00    1.00    2.00
             *
```



```
                                          HEC-1 INPUT

        LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

164          KK   A07E5   BASIN
165          BA   0.025
166          LG    0.23    0.25    5.46    0.29      27
167          UC   0.293   0.335
168          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
169          UA     100
             *

170          KK  RA07E5   ROUTE
171          RS       4    FLOW
172          RC   0.030   0.020   0.030    1796  0.0067    0.00
173          RX    0.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00
174          RY    2.00    1.00    0.00    0.00    0.00    0.00    1.00    2.00
             *

175          KK   A07E4   BASIN
176          BA   0.056
177          LG    0.23    0.15    7.94    0.10      46
178          UC   0.297   0.219
179          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
180          UA     100
             *
             *
             *

181          KK  CA07E4 COMBINE
182          HC       3
             *
             *
             * This is the PV Resort Storage Basin
             *

183          KK  DI7E.4
184          DT  DI7E.4     0.7
```

Existing HEC-1 Model

```
185          DI       0     100    1000   10000
186          DQ       0     100    1000   10000
             *
             *

187          KK   A07C1   BASIN
188          BA   0.023
189          LG    0.12    0.23    6.76    0.13      55
190          UC   0.654   2.032
191          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
192          UA     100
             *

193          KK   A07F1   BASIN
194          BA   0.107
195          LG    0.24    0.25    4.96    0.35      31
196          UC   0.711   1.117
197          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
198          UA     100
             *
1                                                HEC-1 INPUT
PAGE  7

        LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


199          KK   A07F2   BASIN
200          BA   0.024
201          LG    0.25    0.25    4.96    0.34      31
202          UC   0.353   0.382
203          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
204          UA     100
             *
             *

205          KK   A07E8   BASIN
206          BA   0.005
207          LG    0.10    0.25    4.79    0.38      81
208          UC   0.209   0.324
209          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
210          UA     100
             *

211          KK   CA07F COMBINE
212          HC       3
             *

213          KK  RA07F1   ROUTE
214          RS       1    FLOW
215          RC   0.030   0.020   0.030     353  0.0028    0.00
216          RX    0.00    1.00   13.00   23.00   53.00   83.00  108.00  109.00
217          RY   14.00    6.00    0.00    0.00    6.00    6.00    7.00   15.00
             *

218          KK   A07E7   BASIN
219          BA   0.006
220          LG    0.10    0.21    6.34    0.20      81
221          UC   0.165   0.180
222          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
223          UA     100
             *

224          KK  CA07E7 COMBINE
225          HC       2
             *

226          KK  RA07E7   ROUTE
227          RS       1    FLOW
228          RC   0.030   0.020   0.030    1042  0.0086    0.00
229          RX    0.00    1.00   13.00   23.00   53.00   83.00  108.00  109.00
230          RY   14.00    6.00    0.00    0.00    6.00    6.00    1.00   15.00
```

Existing HEC-1 Model

```
                    *
 231                KK   A07E6   BASIN
 232                BA   0.019
 233                LG    0.10    0.15    7.94    0.11      80
 234                UC   0.245   0.237
 235                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 236                UA     100
                    *
                    *
1                                                HEC-1 INPUT
PAGE  8

          LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 237                KK  DI7E.6
 238                DT  DI7E.6    0.12
 239                DI       0     100    1000   10000
 240                DQ       0     100    1000   10000
                    *
                    *

 241                KK  RA07E6   ROUTE
 242                RS       5    FLOW
 243                RC   0.035   0.020   0.035    1950  0.0062    0.00
 244                RX    0.00   50.00  100.00  125.00  150.00  175.00  225.00  275.00
 245                RY    4.00    3.00    2.00    1.00    1.00    2.00    3.00    4.00
                    *

 246                KK   A07E2   BASIN
 247                BA   0.033
 248                LG    0.22    0.15    8.36    0.09      49
 249                UC   0.298   0.305
 250                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 251                UA     100
                    *
                    *

 252                KK  DI7E.2
 253                DT  DI7E.2    0.04
 254                DI       0     100    1000   10000
 255                DQ       0     100    1000   10000
                    *

 256                KK  CA07E2 COMBINE
 257                HC       3
                    *

 258                KK  RA07E2   ROUTE
 259                RS       1    FLOW
 260                RC   0.030   0.020   0.030     761  0.0092    0.00
 261                RX    0.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00
 262                RY    2.00    1.00    0.00    0.00    0.00    0.00    1.00    2.00
                    *

 263                KK   CA07C COMBINE
 264                HC       5
                    *
                    *
                    * This is the Peoria Storage Basin
                    *
                    *
                    *
1                                                HEC-1 INPUT
PAGE  9

          LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 265                KK  DIA07E
```

Existing HEC-1 Model

```
266          DT  DIA07E     2.8
267          DI       0     100    1000   10000
268          DQ       0     100    1000   10000
             *

269          KK  RA07C1   ROUTE
270          RS       2    FLOW
271          RC   0.035   0.030   0.035    1305  0.0061    0.00
272          RX    0.00   50.00  100.00  125.00  150.00  175.00  200.00  250.00
273          RY   10.00    9.00    0.00    0.00    0.00    0.00    9.00   10.00
             *

274          KK   A07B7   BASIN
275          BA   0.021
276          LG    0.14    0.26    5.24    0.33      32
277          UC   0.259   0.285
278          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
279          UA     100
             *

280          KK  CA07B7 COMBINE
281          HC       2
             *

282          KK  RA07B7   ROUTE
283          RS       3    FLOW
284          RC   0.035   0.030   0.035    3058  0.0075    0.00
285          RX    0.00   50.00   75.00  100.00  125.00  150.00  175.00  225.00
286          RY   10.00    9.00    0.00    0.00    0.00    0.00    9.00   10.00
             *

287          KK    A07H   BASIN
288          BA   0.092
289          LG    0.13    0.25    4.65    0.41      12
290          UC   0.469   0.375
291          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
292          UA     100
             *

293          KK   RA07H   ROUTE
294          RS      13    FLOW
295          RC   0.035   0.035   0.035    3126  0.0048    0.00
296          RX    0.00   50.00  100.00  150.00  200.00  250.00  300.00  350.00
297          RY   10.00    9.00    8.00    7.00    7.00    8.00    9.00   10.00
             *

298          KK   A07C2   BASIN
299          BA   0.165
300          LG    0.31    0.32    4.79    0.31       4
301          UC   0.528   0.387
302          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
303          UA     100
             *
```



```
                                        HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

304          KK  CA07C2 COMBINE
305          HC       2
             *

306          KK  RA07C2   ROUTE
307          RS      15    FLOW
308          RC   0.035   0.030   0.035    2625  0.0057    0.00
309          RX    0.00   30.00   80.00  130.00  150.00  230.00  250.00  260.00
310          RY   10.00    9.00    0.00    0.00    0.00    9.00   10.00   12.00
             *

311          KK   A07B1   BASIN
```

Existing HEC-1 Model

```
312          BA   0.081
313          LG    0.19    0.25    4.12    0.55      31
314          UC   0.348   0.315
315          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
316          UA     100
             *
             *

317          KK  A07B1N STORAGE
318          KM      Online Detention Basin, Downstream of the APS pole.
319          RS       1    STOR       0
320          SV       0    1.15    2.66    4.43    4.43
321          SE       0       1       2       3       4
322          SQ       0       4      13      20     830
             *
             *

323          KK  A07B1S STORAGE
324          KM      Online Detention Basin, Upstream of the APS pole.
325          RS       1    STOR       0
326          SV       0    0.84   1.795     1.8
327          SE       0       1       2       3
328          SQ       0       4      13     813
             *

329          KK  CA07B1 COMBINE
330          HC       4
             *

331          KK  RA07B1   ROUTE
332          RS       9    FLOW
333          RC   0.035   0.030   0.035    1628  0.0031    0.00
334          RX    0.00   50.00  130.00  200.00  240.00  280.00  300.00  320.00
335          RY   10.00    9.00    0.00    0.00    5.00    9.00   10.00   12.00
             *

336          KK   A07B3   BASIN
337          BA   0.204
338          LG    0.20    0.25    4.96    0.37      26
339          UC   0.451   0.300
340          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
341          UA     100
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

342          KK  RA07B3   ROUTE
343          RS       3    FLOW
344          RC   0.038   0.035   0.038    2418  0.0124    0.00
345          RX    0.00   50.00   75.00  125.00  150.00  200.00  250.00  300.00
346          RY   10.00    9.00    8.00    0.00    0.00    8.00    9.00   10.00
             *

347          KK   A07B2   BASIN
348          BA   0.101
349          LG    0.20    0.25    4.65    0.39      24
350          UC   0.417   0.344
351          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
352          UA     100
             *

353          KK  CA07B2 COMBINE
354          HC       2
             *

355          KK  RA07B2   ROUTE
356          RS       5    FLOW
357          RC   0.035   0.030   0.035    2388  0.0021    0.00
```

Existing HEC-1 Model

```
358          RX    0.00   50.00  100.00  150.00  200.00  250.00  300.00  350.00
359          RY   10.00    9.00    8.00    0.00    0.00    8.00    9.00   10.00
             *

360          KK   A07B4   BASIN
361          BA   0.053
362          LG    0.20    0.25    4.28    0.52      35
363          UC   0.395   0.404
364          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
365          UA     100
             *
             *

366          KK  A07B4N STORAGE
367          KM      Online Detention Basin, Upstream of the APS pole.
368          RS       1    STOR       0
369          SV       0    1.12    2.41    3.79     3.8
370          SE       0       1       2       3       4
371          SQ       0       4      13      20     830
             *
             *

372          KK  A07B4S STORAGE
373          KM      Online Detention Basin, Downstream of the APS pole.
374          RS       1    STOR       0
375          SV       0    1.89    3.97    6.21    6.21
376          SE       0       1       2       3       4
377          SQ       0       4      13      20     830
             *
1                                          HEC-1 INPUT
PAGE 12

        LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

378          KK  CA07B4 COMBINE
379          HC       3
             *

380          KK  RA07B4   ROUTE
381          RS       2    FLOW
382          RC   0.035   0.030   0.035    1476  0.0034    0.00
383          RX    0.00   50.00  100.00  125.00  150.00  175.00  225.00  275.00
384          RY   10.00    9.00    8.00    0.00    0.00    8.00    9.00   10.00
             *

385          KK    S30C   BASIN
386          BA   0.665
387          LG    0.26    0.19    6.54    0.16      13
388          UC   0.572   0.297
389          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
390          UA     100
             *
             *
             * RECOVER DIVERTED FLOW FROM A09FI
             *

391          KK  DA09FI
392          DR   A09FI
             *

393          KK  RA09FI
394          RS      21    FLOW       0
395          RC     .02     .02     .02    7000  0.0023
396          RX       0       1      85      95     109     134     239     240
397          RY      12       6       5       0       0       5       6      12
             *

398          KK   CS30C
399          HC       2
             *
```

Existing HEC-1 Model

```
400          KK   RS30C   ROUTE
401          RS      12    FLOW
402          RC   0.030   0.020   0.030    6874  0.0015    0.00
403          RX    0.00   10.00   50.00   60.00   70.00   80.00  120.00  130.00
404          RY   10.00    5.00    4.00    0.00    0.00    4.00    5.00   10.00
             *
             * *** DIVERTED  MAIN (WEST) DIVERTED (SOUTH)  **********************
             * THERE IS A DIVERSION AT THIS LOCATION. THE DEL WEBB CHANNEL CAN CARRY
             * 550 CFS, THE REST OF THE FLOW OVERFLOWS TO THE SOUTH.
             *

405          KK  DS30BO
406          DT  DS30BI
407          DI       1     250     550     750    1000    1500    1750    2000
408          DQ      .1      .2      .3     200     450     950    1200    1450
             *
1                                          HEC-1 INPUT
PAGE 13

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


409          KK    S30B   BASIN
410          BA   0.567
411          LG    0.18    0.17    6.76    0.17      31
412          UC   0.827   0.533
413          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
414          UA     100
             *

415          KK   CS30B COMBINE
416          HC       2
             *
             *
             * *** DIVERSION DS30AO ************************************************
             * *** DIVERTED  MAIN (WEST) DIVERTED (SOUTH)  *************************
             *
             * THERE IS A DIVERSION AT THIS LOCATION. THE DEL WEBB CHANNEL CAN CARRY
             * 550 CFS, THE REST OF THE FLOW OVERFLOWS TO THE SOUTH.
             *
             * DDM   ***** Preserved *****

417          KK  DS30AO
418          DT  DS30AI
419          DI       1     250     550     750    1000    1500    1750    2000
420          DQ      .1      .2      .3     200     450     950    1200    1450
             *

421          KK   RS30B   ROUTE
422          RS       1    FLOW
423          RC   0.030   0.020   0.030    4113  0.0036    0.00
424          RX    0.00   10.00   60.00   62.00   82.00   84.00  134.00  144.00
425          RY   12.00   11.00    8.00    0.00    0.00    8.00   11.00   12.00
             *

426          KK     S30   BASIN
427          BA   0.342
428          LG    0.20    0.25    4.65    0.43      30
429          UC   0.501   0.319
430          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
431          UA     100
             *

432          KK    CS30 COMBINE
433          HC       2
             *
             *
             *

434          KK    RS30   ROUTE
```

Existing HEC-1 Model

```
 435          RS       1    FLOW
 436          RC   0.030   0.020   0.030    1258  0.0215    0.00
 437          RX    0.00   50.00   60.00   80.00   90.00  100.00  125.00  140.00
 438          RY   10.00    9.00    3.00    3.00    9.00   10.00   11.00   12.00
              *
1                                          HEC-1 INPUT
PAGE 14

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 439          KK   A07B6   BASIN
 440          BA   0.153
 441          LG    0.15    0.25    4.65    0.38      26
 442          UC   0.650   0.614
 443          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 444          UA     100
              *

 445          KK  CA07B6 COMBINE
 446          HC       2
              *

 447          KK  RA07B6   ROUTE
 448          RS       1    FLOW
 449          RC   0.030   0.020   0.030     672  0.0119    0.00
 450          RX    0.00   50.00   70.00   90.00  110.00  130.00  150.00  170.00
 451          RY   10.00    9.00    8.00    1.00    1.00    8.00    9.00   10.00
              *

 452          KK   A07B5   BASIN
 453          BA   0.057
 454          LG    0.14    0.27    4.51    0.44      50
 455          UC   0.486   0.481
 456          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 457          UA     100
              *
              *

 458          KK  A07B5S STORAGE
 459          KM      Online Detention Basin, Upstream of the APS pole.
 460          RS       1    STOR       0
 461          SV       0    1.74    3.62   5.695     5.7
 462          SE       0       1       2       3       4
 463          SQ       0       4      13      20     830
              *
              *

 464          KK  A07B5N STORAGE
 465          KM      Online Detention Basin, Downstream of the APS pole.
 466          RS       1    STOR       0
 467          SV       0    0.37    0.80    1.29    1.84    1.84
 468          SE       0       1       2       3       4       5
 469          SQ       0       4      13      20      26     830
              *

 470          KK  CA07B5 COMBINE
 471          HC       3
              *
1                                          HEC-1 INPUT
PAGE 15

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 472          KK  RA07B5   ROUTE
 473          RS       1    FLOW
 474          RC   0.025   0.020   0.025    1378  0.0051    0.00
 475          RX    0.00   10.00   50.00   60.00   80.00   90.00  130.00  150.00
 476          RY   10.00    5.00    4.00    0.00    0.00    4.00    5.00    6.00
              *
```

Existing HEC-1 Model

```
477          KK   A06A2   BASIN
478          BA   0.106
479          LG    0.16    0.25    4.39    0.46      45
480          UC   0.296   0.198
481          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
482          UA     100
             *

483          KK  CA06A2 COMBINE
484          HC       2
             *

485          KK  RA06A2   ROUTE
486          RS       1    FLOW
487          RC   0.030   0.020   0.030     981  0.0031    0.00
488          RX    0.00   10.00   50.00   60.00   70.00   80.00  130.00  150.00
489          RY   10.00    9.00    8.00    4.00    4.00    8.00    9.00   10.00
             *

490          KK   A06A3   BASIN
491          BA   0.053
492          LG    0.22    0.26    5.24    0.31      29
493          UC   0.300   0.254
494          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
495          UA     100
             *

496          KK  CA06A3 COMBINE
497          HC       2
             *

498          KK  RA06A3   ROUTE
499          RS       3    FLOW
500          RC   0.030   0.020   0.030    3203  0.0050    0.00
501          RX    0.00   10.00   50.00   60.00   70.00   80.00  100.00  120.00
502          RY   10.00    9.00    8.00    4.00    4.00    8.00    9.00   10.00
             *

503          KK    A061   BASIN
504          BA   0.080
505          LG    0.24    0.26    3.59    0.73      43
506          UC   0.503   0.548
507          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
508          UA     100
             *
```



```
                                          HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

509          KK   CA061 COMBINE
510          HC       2
             *

511          KK   RA061   ROUTE
512          RS       2    FLOW
513          RC   0.030   0.020   0.030    2795  0.0057    0.00
514          RX    0.00   10.00   60.00   70.00   90.00  100.00  150.00  170.00
515          RY   10.00    9.00    8.00    4.00    4.00    8.00    9.00   10.00
             *

516          KK   A06A1   BASIN
517          BA   0.187
518          LG    0.21    0.25    4.65    0.44      24
519          UC   0.529   0.463
520          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
521          UA     100
             *
```

Existing HEC-1 Model

```
522          KK  RA06A1   ROUTE
523          RS       4    FLOW
524          RC   0.035   0.025   0.035    3945  0.0117    0.00
525          RX    0.00   50.00  100.00  110.00  130.00  140.00  190.00  240.00
526          RY   10.00    9.00    8.00    4.00    4.00    8.00    9.00   10.00
             *

527          KK   A99P1   BASIN
528          BA   0.249
529          LG    0.21    0.19    6.54    0.19      26
530          UC   0.578   0.424
531          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
532          UA     100
             *

533          KK  RA99P1   ROUTE
534          RS       2    FLOW
535          RC   0.030   0.025   0.030    2868  0.0160    0.00
536          RX    0.00   50.00  100.00  110.00  130.00  140.00  190.00  240.00
537          RY   10.00    9.00    8.00    4.00    4.00    8.00    9.00   10.00
             *

538          KK   A99P2   BASIN
539          BA   0.226
540          LG    0.10    0.25    4.45    0.45      48
541          UC   0.572   0.483
542          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
543          UA     100
             *
1                                                HEC-1 INPUT
PAGE 17

        LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


544          KK    A99Q   BASIN
545          BA   0.117
546          LG    0.11    0.27    3.25    0.79       2
547          UC   1.187   1.533
548          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
549          UA     100
             *

550          KK  CA99P2 COMBINE
551          HC       5
             *
552          ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    23        A09F
                 .
                 .
    30           .-------> LA09FD
    29       LA09F
                 .
                 .
    34           .------->  A09FI
    33       DA09F
                 V
                 V
    37      RA09FW
                 .
                 .
    42           .        A09E
                 .           .
                 .           .
```

Existing HEC-1 Model

```
 49          .           .-------> LA09ED
 48          .       LA09E
             .           .
             .           .
 52      CA09E............
             V
             V
 54      RA09E
             .
             .
 59          .        A09D
             .           .
             .           .
 66          .           .-------> LA09DD
 65          .       LA09D
             .           .
             .           .
 69      CA09E............
             V
             V
 71      RA09D
             .
             .
 76          .        A09C
             .           .
             .           .
 82      CA09C............
             .
             .
 85          .------->   A09AI
 84     DA09AO
             V
             V
 88      RA09C
             .
             .
 93          .        A07D
             .           .
             .           .
 99      CA07D............
             V
             V
101      RA07D
             .
             .
106          .       A07G1
             .           .
             .           .
113          .           .-------> LA07GD
112          .       LA07G
             .           V
             .           V
116          .      RA07G1
             .           .
             .           .
121          .           .       A07E1
             .           .           .
             .           .           .
128          .           .           .-------> DI7E.1
127          .           .      DI7E.1
             .           .           V
             .           .           V
131          .           .      RA07E1
             .           .           .
             .           .           .
136          .           .           .      A07G2
             .           .           .          V
             .           .           .          V
142          .           .           .      RA07G2
             .           .           .           .
             .           .           .           .
```

Existing HEC-1 Model

```
147          .          .          .          .       A07E3
             .          .          .          .          .
             .          .          .          .          .
153          .          .          .     CA07E3............
             .          .          .          .
             .          .          .          .
156          .          .          .          .-------> DI7E.3
155          .          .          .     DI7E.3
             .          .          .         V
             .          .          .         V
159          .          .          .     RA07E3
             .          .          .          .
             .          .          .          .
164          .          .          .          .       A07E5
             .          .          .          .          V
             .          .          .          .          V
170          .          .          .          .     RA07E5
             .          .          .          .          .
             .          .          .          .          .
175          .          .          .          .          .       A07E4
             .          .          .          .          .          .
             .          .          .          .          .          .
181          .          .          .     CA07E4......................
             .          .          .          .
             .          .          .          .
184          .          .          .          .-------> DI7E.4
183          .          .          .     DI7E.4
             .          .          .          .
             .          .          .          .
187          .          .          .          .       A07C1
             .          .          .          .          .
             .          .          .          .          .
193          .          .          .          .          .       A07F1
             .          .          .          .          .          .
             .          .          .          .          .          .
199          .          .          .          .          .          .       A07F2
             .          .          .          .          .          .          .
             .          .          .          .          .          .          .
205          .          .          .          .          .          .          .       A07E8
             .          .          .          .          .          .          .          .
             .          .          .          .          .          .          .          .
211          .          .          .          .          .       CA07F......................
             .          .          .          .          .          V
             .          .          .          .          .          V
213          .          .          .          .          .     RA07F1
             .          .          .          .          .          .
             .          .          .          .          .          .
218          .          .          .          .          .          .       A07E7
             .          .          .          .          .          .          .
             .          .          .          .          .          .          .
224          .          .          .          .          .     CA07E7............
             .          .          .          .          .          V
             .          .          .          .          .          V
226          .          .          .          .          .     RA07E7
             .          .          .          .          .          .
             .          .          .          .          .          .
231          .          .          .          .          .          .       A07E6
             .          .          .          .          .          .          .
             .          .          .          .          .          .          .
238          .          .          .          .          .          .          .-------> DI7E.6
237          .          .          .          .          .          .     DI7E.6
             .          .          .          .          .          .         V
             .          .          .          .          .          .         V
241          .          .          .          .          .          .     RA07E6
             .          .          .          .          .          .          .
             .          .          .          .          .          .          .
246          .          .          .          .          .          .          .       A07E2
             .          .          .          .          .          .          .          .
             .          .          .          .          .          .          .          .
253          .          .          .          .          .          .          .          .-------> DI7E.2
```

Existing HEC-1 Model

```
252          .          .          .          .          .          .          .      DI7E.2
             .          .          .          .          .          .          .          .
             .          .          .          .          .          .          .          .
256          .          .          .          .          .     CA07E2.......................
             .          .          .          .          .          V
             .          .          .          .          .          V
258          .          .          .          .          .     RA07E2
             .          .          .          .          .          .
             .          .          .          .          .          .
263          .      CA07C.............................................
             .          .
             .          .
266          .          .-------> DIA07E
265          .     DIA07E
             .          V
             .          V
269          .     RA07C1
             .          .
             .          .
274          .          .      A07B7
             .          .          .
             .          .          .
280          .     CA07B7............
             .          V
             .          V
282          .     RA07B7
             .          .
             .          .
287          .          .       A07H
             .          .          V
             .          .          V
293          .          .      RA07H
             .          .          .
             .          .          .
298          .          .          .      A07C2
             .          .          .          .
             .          .          .          .
304          .          .     CA07C2............
             .          .          V
             .          .          V
306          .          .     RA07C2
             .          .          .
             .          .          .
311          .          .          .      A07B1
             .          .          .          V
             .          .          .          V
317          .          .          .     A07B1N
             .          .          .          V
             .          .          .          V
323          .          .          .     A07B1S
             .          .          .          .
             .          .          .          .
329     CA07B1.....................................
             V
             V
331     RA07B1
             .
             .
336          .      A07B3
             .          V
             .          V
342          .     RA07B3
             .          .
             .          .
347          .          .      A07B2
             .          .          .
             .          .          .
353          .     CA07B2............
             .          V
             .          V
355          .     RA07B2
```

Existing HEC-1 Model

```
            .           .
            .           .
360         .           .       A07B4
            .           .           V
            .           .           V
366         .           .      A07B4N
            .           .           V
            .           .           V
372         .           .      A07B4S
            .           .           .
            .           .           .
378     CA07B4......................
            V
            V
380     RA07B4
            .
            .
385         .        S30C
            .           .
            .           .
392         .           .           .<-------   A09FI
391         .           .      DA09FI
            .           .           V
            .           .           V
393         .           .      RA09FI
            .           .           .
            .           .           .
398         .       CS30C............
            .           V
            .           V
400         .       RS30C
            .           .
            .           .
406         .           .-------> DS30BI
405         .      DS30BO
            .           .
            .           .
409         .           .        S30B
            .           .           .
            .           .           .
415         .       CS30B............
            .           .
            .           .
418         .           .-------> DS30AI
417         .      DS30AO
            .           V
            .           V
421         .       RS30B
            .           .
            .           .
426         .           .         S30
            .           .           .
            .           .           .
432         .        CS30............
            .           V
            .           V
434         .        RS30
            .           .
            .           .
439         .           .       A07B6
            .           .           .
            .           .           .
445         .      CA07B6............
            .           V
            .           V
447         .      RA07B6
            .           .
            .           .
452         .           .       A07B5
            .           .           V
            .           .           V
```

Existing HEC-1 Model

```
458          .           .      A07B5S
             .           .           V
             .           .           V
464          .           .      A07B5N
             .           .           .
             .           .           .
470      CA07B5.......................
             V
             V
472      RA07B5
             .
             .
477          .       A06A2
             .           .
             .           .
483      CA06A2............
             V
             V
485      RA06A2
             .
             .
490          .       A06A3
             .           .
             .           .
496      CA06A3............
             V
             V
498      RA06A3
             .
             .
503          .        A061
             .           .
             .           .
509       CA061............
             V
             V
511       RA061
             .
             .
516          .       A06A1
             .           V
             .           V
522          .      RA06A1
             .           .
             .           .
527          .           .       A99P1
             .           .           V
             .           .           V
533          .           .      RA99P1
             .           .           .
             .           .           .
538          .           .           .       A99P2
             .           .           .           .
             .           .           .           .
544          .           .           .           .        A99Q
             .           .           .           .           .
             .           .           .           .           .
550      CA99P2..............................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   24FEB14  TIME  10:02:36  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

Existing HEC-1 Model

```
                    Flood Control District of Maricopa County
                    115TH_24HR - Updated Hydrology
                    100 YEAR
                    24 Hour Storm
                    Unit Hydrograph: Clark
                    01/07/2014

10 IO        OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          0  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                 NMIN          5  MINUTES IN COMPUTATION INTERVAL
                IDATE      1   0  STARTING DATE
                ITIME       0000  STARTING TIME
                   NQ       1000  NUMBER OF HYDROGRAPH ORDINATES
               NDDATE      4   0  ENDING DATE
               NDTIME       1115  ENDING TIME
                ICENT         19  CENTURY MARK

             COMPUTATION INTERVAL     .08 HOURS
                  TOTAL TIME BASE   83.25 HOURS

       ENGLISH UNITS
            DRAINAGE AREA         SQUARE MILES
            PRECIPITATION DEPTH   INCHES
            LENGTH, ELEVATION     FEET
            FLOW                  CUBIC FEET PER SECOND
            STORAGE VOLUME        ACRE-FEET
            SURFACE AREA          ACRES
            TEMPERATURE           DEGREES FAHRENHEIT

11 JD        INDEX STORM NO. 1
                STRM        3.57  PRECIPITATION DEPTH
                TRDA         .00  TRANSPOSITION DRAINAGE AREA
```

Existing HEC-1 Model

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	A09F	355.	12.25	65.	21.	7.	.37
+	DIVERSION TO	LA09FD	283.	12.08	23.	7.	2.	.37
+	HYDROGRAPH AT	LA09F	355.	12.25	50.	14.	5.	.37
+	DIVERSION TO	A09FI	51.	12.25	4.	1.	0.	.37
+	HYDROGRAPH AT	DA09F	304.	12.25	46.	13.	4.	.37
+	ROUTED TO	RA09FW	307.	12.42	46.	13.	4.	.37
+	HYDROGRAPH AT	A09E	97.	12.25	23.	7.	2.	.14
+	DIVERSION TO	LA09ED	97.	12.25	15.	4.	1.	.14
+	HYDROGRAPH AT	LA09E	53.	12.92	11.	3.	1.	.14
+	2 COMBINED AT	CA09E	306.	12.42	56.	16.	5.	.51
+	ROUTED TO	RA09E	312.	12.50	56.	16.	5.	.51
+	HYDROGRAPH AT	A09D	248.	12.25	42.	13.	4.	.24
+	DIVERSION TO	LA09DD	248.	12.25	28.	8.	3.	.24
+	HYDROGRAPH AT	LA09D	130.	12.67	18.	5.	2.	.24
+	2 COMBINED AT	CA09E	398.	12.58	72.	21.	7.	.75
+	ROUTED TO	RA09D	390.	12.67	72.	21.	7.	.75
+	HYDROGRAPH AT	A09C	45.	12.42	12.	3.	1.	.11
+	2 COMBINED AT	CA09C	429.	12.67	82.	24.	8.	.87
+	DIVERSION TO	A09AI	140.	12.50	57.	18.	6.	.87
+	HYDROGRAPH AT	DA09AO	289.	12.67	25.	6.	2.	.87
+	ROUTED TO	RA09C	236.	13.17	25.	6.	2.	.87

Existing HEC-1 Model

	HYDROGRAPH AT						
		A07D	100.	12.33	16.	4.	1.	.25
	2 COMBINED AT						
+		CA07D	264.	13.17	41.	10.	3.	1.12
	ROUTED TO						
+		RA07D	264.	13.17	41.	10.	3.	1.12
	HYDROGRAPH AT						
+		A07G1	311.	12.17	44.	13.	4.	.24
	DIVERSION TO						
+		LA07GD	311.	12.17	24.	7.	2.	.24
	HYDROGRAPH AT						
+		LA07G	240.	12.33	24.	6.	2.	.24
	ROUTED TO						
+		RA07G1	230.	12.50	23.	6.	2.	.24
	HYDROGRAPH AT						
+		A07E1	49.	12.08	7.	2.	1.	.04
	DIVERSION TO						
+		DI7E.1	35.	12.00	2.	1.	0.	.04
	HYDROGRAPH AT						
+		DI7E.1	49.	12.08	5.	1.	0.	.04
	ROUTED TO						
+		RA07E1	48.	12.25	5.	1.	0.	.04
	HYDROGRAPH AT						
		A07G2	21.	12.25	5.	2.	1.	.03
	ROUTED TO						
+		RA07G2	21.	12.33	5.	2.	1.	.03
	HYDROGRAPH AT						
+		A07E3	99.	12.08	11.	3.	1.	.06
	2 COMBINED AT						
+		CA07E3	109.	12.08	16.	5.	2.	.09
	DIVERSION TO						
+		DI7E.3	1.	1.83	0.	0.	0.	.09
	HYDROGRAPH AT						
+		DI7E.3	109.	12.08	16.	5.	2.	.09
	ROUTED TO						
+		RA07E3	103.	12.17	16.	5.	2.	.09
	HYDROGRAPH AT						
+		A07E5	28.	12.08	4.	1.	0.	.03
	ROUTED TO						
+		RA07E5	27.	12.25	4.	1.	0.	.03
	HYDROGRAPH AT						
+		A07E4	89.	12.08	11.	4.	1.	.06
	3 COMBINED AT						
+		CA07E4	209.	12.17	30.	9.	3.	.17
	DIVERSION TO						
+		DI7E.4	2.	5.50	1.	0.	0.	.17
	HYDROGRAPH AT						

+	DI7E.4	209.	12.17	30.	9.	3.	.17
HYDROGRAPH AT +	A07C1	9.	12.50	4.	2.	1.	.02
HYDROGRAPH AT +	A07F1	49.	12.42	16.	5.	2.	.11
HYDROGRAPH AT +	A07F2	24.	12.17	4.	1.	0.	.02
HYDROGRAPH AT +	A07E8	7.	12.08	1.	0.	0.	.00
3 COMBINED AT +	CA07F	72.	12.25	20.	6.	2.	.14
ROUTED TO +	RA07F1	72.	12.25	20.	6.	2.	.14
HYDROGRAPH AT +	A07E7	11.	12.00	1.	0.	0.	.01
2 COMBINED AT +	CA07E7	78.	12.25	22.	7.	2.	.14
ROUTED TO +	RA07E7	77.	12.25	22.	7.	2.	.14
HYDROGRAPH AT +	A07E6	31.	12.08	5.	2.	1.	.02
DIVERSION TO +	DI7E.6	0.	3.83	0.	0.	0.	.02
HYDROGRAPH AT	DI7E.6	31.	12.08	5.	2.	1.	.02
ROUTED TO +	RA07E6	29.	12.25	5.	2.	1.	.02
HYDROGRAPH AT +	A07E2	45.	12.08	7.	2.	1.	.03
DIVERSION TO +	DI7E.2	0.	1.50	0.	0.	0.	.03
HYDROGRAPH AT +	DI7E.2	45.	12.08	7.	2.	1.	.03
3 COMBINED AT +	CA07E2	143.	12.25	33.	10.	3.	.19
ROUTED TO +	RA07E2	144.	12.25	33.	10.	3.	.19
5 COMBINED AT +	CA07C	480.	12.50	94.	29.	10.	.66
DIVERSION TO +	DIA07E	9.	8.92	5.	1.	0.	.66
HYDROGRAPH AT +	DIA07E	480.	12.50	94.	27.	9.	.66
ROUTED TO +	RA07C1	458.	12.50	94.	27.	9.	.66
HYDROGRAPH AT	A07B7	26.	12.08	3.	1.	0.	.02

	2 COMBINED AT						
+	CA07B7	467.	12.50	97.	28.	9.	.68
	ROUTED TO						
+	RA07B7	445.	12.58	97.	28.	9.	.68
	HYDROGRAPH AT						
+	A07H	79.	12.17	11.	3.	1.	.09
	ROUTED TO						
+	RA07H	72.	12.58	11.	3.	1.	.09
	HYDROGRAPH AT						
+	A07C2	131.	12.25	17.	4.	1.	.17
	2 COMBINED AT						
+	CA07C2	142.	12.50	27.	7.	2.	.26
	ROUTED TO						
+	RA07C2	140.	12.75	27.	7.	2.	.26
	HYDROGRAPH AT						
+	A07B1	83.	12.17	11.	3.	1.	.08
	ROUTED TO						
+	A07B1N	17.	12.83	10.	3.	1.	.08
	ROUTED TO						
+	A07B1S	12.	14.42	9.	3.	1.	.08
	4 COMBINED AT						
+	CA07B1	648.	12.58	171.	48.	16.	2.14
	ROUTED TO						
+	RA07B1	652.	12.67	171.	48.	16.	2.14
	HYDROGRAPH AT						
+	A07B3	214.	12.17	28.	8.	3.	.20
	ROUTED TO						
+	RA07B3	207.	12.25	28.	8.	3.	.20
	HYDROGRAPH AT						
+	A07B2	100.	12.17	14.	4.	1.	.10
	2 COMBINED AT						
+	CA07B2	297.	12.25	42.	13.	4.	.31
	ROUTED TO						
+	RA07B2	283.	12.42	42.	13.	4.	.31
	HYDROGRAPH AT						
+	A07B4	48.	12.17	8.	2.	1.	.05
	ROUTED TO						
+	A07B4N	13.	12.92	7.	2.	1.	.05
	ROUTED TO						
+	A07B4S	5.	15.58	4.	2.	1.	.05
	3 COMBINED AT						
+	CA07B4	870.	12.58	214.	62.	21.	2.50
	ROUTED TO						
+	RA07B4	872.	12.58	214.	62.	21.	2.50
	HYDROGRAPH AT						
+	S30C	733.	12.25	95.	26.	9.	.67
	HYDROGRAPH AT						
+	DA09FI	51.	12.25	4.	1.	0.	.37

	ROUTED TO						
		RA09FI	38.	12.92	4.	1.	0.	.37
	2 COMBINED AT						
+		CS30C	733.	12.25	99.	27.	9.	.67
	ROUTED TO						
+		RS30C	664.	12.58	99.	27.	9.	.67
	DIVERSION TO						
+		DS30BI	114.	12.58	5.	1.	0.	.67
	HYDROGRAPH AT						
+		DS30BO	550.	12.58	94.	26.	9.	.67
	HYDROGRAPH AT						
+		S30B	456.	12.33	95.	28.	10.	.57
	2 COMBINED AT						
+		CS30B	994.	12.42	188.	54.	18.	1.23
	DIVERSION TO						
+		DS30AI	444.	12.42	39.	10.	3.	1.23
	HYDROGRAPH AT						
+		DS30AO	550.	12.25	149.	44.	15.	1.23
	ROUTED TO						
+		RS30B	550.	12.83	149.	44.	15.	1.23
	HYDROGRAPH AT						
+		S30	335.	12.17	48.	15.	5.	.34
	2 COMBINED AT						
		CS30	791.	12.33	196.	59.	20.	1.57
	ROUTED TO						
+		RS30	792.	12.33	196.	59.	20.	1.57
	HYDROGRAPH AT						
+		A07B6	101.	12.25	21.	6.	2.	.15
	2 COMBINED AT						
+		CA07B6	891.	12.33	217.	65.	22.	1.73
	ROUTED TO						
+		RA07B6	891.	12.33	217.	65.	22.	1.73
	HYDROGRAPH AT						
+		A07B5	50.	12.25	10.	3.	1.	.06
	ROUTED TO						
+		A07B5S	12.	13.25	8.	3.	1.	.06
	ROUTED TO						
+		A07B5N	11.	14.08	7.	3.	1.	.06
	3 COMBINED AT						
+		CA07B5	1676.	12.50	434.	129.	44.	4.28
	ROUTED TO						
+		RA07B5	1674.	12.58	434.	129.	44.	4.28
	HYDROGRAPH AT						
+		A06A2	152.	12.08	18.	6.	2.	.11
	2 COMBINED AT						
		CA06A2	1704.	12.58	451.	135.	46.	4.39
	ROUTED TO						

```
+                    RA06A2     1693.   12.58       451.       135.       46.      4.39

     HYDROGRAPH AT
+                     A06A3       67.   12.08         8.         2.        1.       .05

     2 COMBINED AT
+                    CA06A3     1710.   12.58       458.       137.       46.      4.44

     ROUTED TO
+                    RA06A3     1692.   12.75       458.       137.       46.      4.44

     HYDROGRAPH AT
+                      A061       57.   12.25        12.         4.        1.       .08

     2 COMBINED AT
+                     CA061     1723.   12.75       470.       141.       48.      4.52

     ROUTED TO
+                     RA061     1718.   12.75       470.       141.       48.      4.52

     HYDROGRAPH AT
+                     A06A1      144.   12.25        24.         7.        2.       .19

     ROUTED TO
+                    RA06A1      141.   12.33        24.         7.        2.       .19

     HYDROGRAPH AT
+                     A99P1      237.   12.25        39.        12.        4.       .25

     ROUTED TO
+                    RA99P1      233.   12.33        39.        12.        4.       .25

     HYDROGRAPH AT
+                     A99P2      194.   12.25        39.        13.        4.       .23

     HYDROGRAPH AT
                       A99Q       22.   12.67         8.         2.        1.       .12

     5 COMBINED AT
+                    CA99P2     2053.   12.75       577.       174.       59.      5.30

*** NORMAL END OF HEC-1 ***
```

Existing HEC-1 Model

APPENDIX C.7 – Proposed HEC-1

```
1*************************************                    *************************************
*                                   *                    *                                   *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *  U.S. ARMY CORPS OF ENGINEERS     *
*            JUN  1998              *                    *  HYDROLOGIC ENGINEERING CENTER    *
*          VERSION 4.1              *                    *         609 SECOND STREET         *
*                                   *                    *      DAVIS, CALIFORNIA 95616      *
* RUN DATE  19JAN16  TIME  10:18:33 *                    *          (916) 756-1104           *
*                                   *                    *                                   *
*************************************                    *************************************

X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                    HEC-1 INPUT
PAGE  1

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1           ID        Flood Control District of Maricopa County
   2           ID
   3           ID        115TH Avenue and Union Hills Drive Drainage Improvements
   4           ID
   5           ID         Ritoch-Powell and Associates  October 23, 2015
   6           ID
   7           ID         Proposed Hydrology Model (115_24P.DAT)
   8           ID
   9           ID        100 YEAR
  10           ID        24 Hour Storm
  11           ID
  12           ID         NOAA 14 Rainfall
  13           ID        Unit Hydrograph: Clark
  14           ID
  15           ID     Note:  This model was updated so that the Union Hills Drive storm drain
  16           ID            flows into the channel southwest of the 111th Avenue and Union
  17           ID            Hills Drive intersection.  It is not collected in the Peoria
  18           ID            Storage Basin.
  19           ID
  20           ID
  21           IT       2       0       0    1000
  22           IN      15
  23           IO       3
               *DIAGRAM
               *
  24           JD   3.568  0.0001
  25           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
  26           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
  27           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
  28           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
  29           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
  30           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
  31           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
  32           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
  33           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
```

Proposed HEC-1 Model

```
 34          PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 35          JD   3.390    10.0
             *

 36          KK    A09F   BASIN
 37          BA   0.370
 38          LG    0.21    0.26    5.34    0.29      42
 39          UC   0.591   0.420
 40          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 41          UA     100
             *
             * *** THIS DIVERSION IS TO MODEL ON-SITE RETENTION (LA09F) ****************
             * *** PARKRIDGE ESTATES RESIDENTIAL DEVELOPMENT (ACCOUNTED) ***************
             *
1                                          HEC-1 INPUT
PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 42          KK   LA09F
 43          DT  LA09FD    13.6
 44          DI       0     100    1000   10000
 45          DQ       0     100    1000   10000
             *
             *
             * *** DIVERTED  MAIN (WEST), DIVERTED (SOUTH)  ****************************
             * BEARDSLEY ROAD CHANNEL TO THE WEST. EXCESS FLOW TO THE SOUTH.
             *

 46          KK   DA09F
 47          DT   A09FI
 48          DI       0      10      30      50     100     500     700    1000
 49          DQ       0      .2      .3      .4      .5      80     250     500
             *
             * ******************************************************************************
             * ********************   BEARDSLEY RD DRAINAGE    ******************************
             * ******************************************************************************
             *

 50          KK  RA09FW   ROUTE
 51          RS       4    FLOW
 52          RC   0.030   0.025   0.030    1619  0.0012    0.00
 53          RX    0.00    1.00   16.00   36.00   51.00  123.00  148.00  648.00
 54          RY   16.00    8.00    0.00    0.00    8.00    8.00    9.00   11.00
             *

 55          KK    A09E   BASIN
 56          BA   0.140
 57          LG    0.19    0.23    4.79    0.36      39
 58          UC   0.608   0.663
 59          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 60          UA     100
             *
             *
             * *** THIS DIVERSION IS TO MODEL ON-SITE RETENTION (LA09E) ****************
             * *** VENTANA LAKES RESIDENTIAL DEVELOPMENT (ACCOUNTED) *******************
             *

 61          KK   LA09E
 62          DT  LA09ED     8.2
 63          DI       0     100    1000   10000
 64          DQ       0     100    1000   10000
             *
             * *** COMBINE LA09E AND A09F ****************************************
             *

 65          KK   CA09E COMBINE
 66          HC       2
             *
```

Proposed HEC-1 Model

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  67          KK   RA09E   ROUTE
  68          RS       5    FLOW
  69          RC   0.040   0.030   0.040    2865  0.0069    0.00
  70          RX    0.00    1.00   16.00   36.00   51.00  123.00  148.00  648.00
  71          RY   16.00    8.00    0.00    0.00    8.00    8.00    9.00   11.00
              *

  72          KK    A09D   BASIN
  73          BA   0.244
  74          LG    0.22    0.19    6.54    0.17      30
  75          UC   0.546   0.419
  76          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  77          UA     100
              *
              *
              * *** THIS DIVERSION IS TO MODEL ON-SITE RETENTION (LA09D) ****************
              * *** VENTANA LAKES RESIDENTIAL DEVELOPMENT (ACCOUNTED) *******************
              *

  78          KK   LA09D
  79          DT  LA09DD    15.3
  80          DI       0     100    1000   10000
  81          DQ       0     100    1000   10000
              *
              * *** COMBINE LA09D AND RA09E *************************
              *

  82          KK   CA09E COMBINE
  83          HC       2
              *

  84          KK   RA09D   ROUTE
  85          RS       3    FLOW
  86          RC   0.040   0.030   0.040    2865  0.0098    0.00
  87          RX    0.00   51.00   61.00   71.00   81.00  111.00  151.00  651.00
  88          RY    9.00    8.00    0.00    0.00    8.00    9.00    9.00   10.00
              *

  89          KK    A09C   BASIN
  90          BA   0.113
  91          LG    0.15    0.28    4.39    0.52       9
  92          UC   0.762   0.979
  93          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  94          UA     100
              *

  95          KK   CA09C COMBINE
  96          HC       2
              *
              * THE LOW FLOWS ARE DIRECTED SOUTH INTO THE PROPOSED STORM DRAIN,
              * WHHEN LARGER FLOWS OCCUR, SOME OF THE FLOWS CONTINUE WEST INTO
              * THE TWO 36" CMP INTO THE COYOTE LAKES GOLF COURSE.
              * THE 60-INCH STORM DRAIN CONVEYS 280 CFS.
              *
              *
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  97          KK  DA09AO
  98          DT   A09AI
  99          DI       0      70     200     280     350     800    1000    3000    5000
 100          DQ       0       0       0       0      70      70      70      70      70
```

Proposed HEC-1 Model

```
                 *
101              KK   RA09C   ROUTE
102              RS      15    FLOW
103              RC   0.030   0.025   0.030    5061  0.0020    0.00
104              RX    0.00   10.00   40.00   50.00   70.00   80.00  120.00  130.00
105              RY    7.00    5.00    4.00    3.00    3.00    4.00    5.00   10.00
                 *
                 *
                 *  THis storm drain was designed using StormAD as a dual 60-inch pipe.
                 *  The equivalent diameter was used for this routing of a 90-inch singular pipe.
                 *

106              KK   RA09C
107              KM   CHANNEL ROUTING
108              RD    5061   0.002   0.013            CIRC     7.5
                 *

109              KK    A07D   BASIN
110              BA   0.252
111              LG    0.99    0.35    4.08    0.38       0
112              UC   0.665   0.561
113              UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
114              UA     100
                 *
                 *

115              KK   CA07D COMBINE
116              HC       2
                 *
                 *

117              KK   RA07D   ROUTE
118              RS       1    FLOW
119              RC   0.030   0.030   0.030    2041  0.0049 1180.00
120              RX    0.00  100.00  112.00  147.00  159.00  179.00  214.00  580.00
121              RY    8.00    6.00    0.00    0.00    6.00    7.00    7.00    9.00
                 *

122              KK   A07G1   BASIN
123              BA   0.236
124              LG    0.23    0.15    7.94    0.10      27
125              UC   0.433   0.300
126              UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
127              UA     100
                 *
                 *
                 * *** STORAGE ROUTING LA07G ***********************************************
                 * *** VENTANA LAKES RESIDENTIAL DEVELOPMENT (ACCOUNTED) ******************
                 *
1                                                HEC-1 INPUT
PAGE  5

          LINE   ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


128              KK   LA07G
129              DT  LA07GD    12.9
130              DI       0     100    1000   10000
131              DQ       0     100    1000   10000
                 *

132              KK  RA07G1   ROUTE
133              RS       5    FLOW
134              RC   0.040   0.020   0.040    2548  0.0035    0.00
135              RX    0.00    1.00   26.00   41.00   71.00   86.00  126.00  576.00
136              RY   12.00    7.00    5.00    1.00    1.00    5.00    6.00    7.00
                 *
                 *

137              KK   A07E1   BASIN
```

Proposed HEC-1 Model

```
138          BA   0.036
139          LG    0.25    0.15    7.94    0.10      40
140          UC   0.303   0.295
141          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
142          UA     100
             *
             *

143          KK  DI7E.1
144          DT  DI7E.1     1.4
145          DI       0     100    1000   10000
146          DQ       0     100    1000   10000
             *

147          KK  RA07E1   ROUTE
148          RS       4    FLOW
149          RC   0.030   0.020   0.030    1471  0.0048    0.00
150          RX    0.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00
151          RY    2.00    1.00    0.00    0.00    0.00    0.00    1.00    2.00
             *
             *

152          KK   A07E3   BASIN
153          BA   0.061
154          LG    0.24    0.19    6.54    0.17      34
155          UC   0.268   0.186
156          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
157          UA     100
             *
             *   Differs at this location.
             *

158          KK  DI7E.3
159          DT  DI7E.3     0.1
160          DI       0     100    1000   10000
161          DQ       0     100    1000   10000
             *
1                                        HEC-1 INPUT
PAGE  6

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

162          KK  RA07E3   ROUTE
163          RS       2    FLOW
164          RC   0.030   0.020   0.030    1835  0.0076    0.00
165          RX    0.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00
166          RY    2.00    1.00    0.00    0.00    0.00    0.00    1.00    2.00
             *

167          KK   A07E5   BASIN
168          BA   0.025
169          LG    0.23    0.25    5.46    0.29      27
170          UC   0.293   0.335
171          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
172          UA     100
             *

173          KK  RA07E5   ROUTE
174          RS       4    FLOW
175          RC   0.030   0.020   0.030    1796  0.0067    0.00
176          RX    0.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00
177          RY    2.00    1.00    0.00    0.00    0.00    0.00    1.00    2.00
             *

178          KK   A07E4   BASIN
179          BA   0.056
180          LG    0.23    0.15    7.94    0.10      46
181          UC   0.297   0.219
182          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
183          UA     100
```

```
                 *
                 *
                 *

184              KK  CA07E4 COMBINE
185              HC       3
                 *
                 *
                 * This is the PV Resort Storage Basin
                 *

186              KK  DI7E.4
187              DT  DI7E.4     0.7
188              DI       0     100    1000   10000
189              DQ       0     100    1000   10000
                 *
                 *
                 *

190              KK   A07C1   BASIN
191              BA   0.023
192              LG    0.12    0.23    6.76    0.14      55
193              UC   0.656   2.037
194              UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
195              UA     100
                 *
1                                                HEC-1 INPUT
PAGE  7

LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

196              KK   CA07C COMBINE
197              HC       4
                 *
                 *  The Peoria Storage Basin (proposed) lowered to a depth of 6ft.
                 *  The top footprint matches the existing.
                 *

198              KK   LA07C STORAGE
199              KM      This is the stage storage discharge for the Peoria Basin.
200              RS       1    STOR       0
201              SV       0    0.60    1.28    2.04    2.89    3.83    4.86     4.9     4.9
202              SE       0       1       2       3       4       5       6       7       8
203              SQ       0      98     143     173     197     219     240     257     290
                 *
                 *

204              KK  RA07C1   ROUTE
205              RS       2    FLOW
206              RC   0.035   0.030   0.035    1305  0.0061    0.00
207              RX    0.00   50.00  100.00  125.00  150.00  175.00  200.00  250.00
208              RY   10.00    9.00    0.00    0.00    0.00    0.00    9.00   10.00
                 *
                 *

209              KK   A07G2   BASIN
210              BA   0.028
211              LG    0.22    0.27    4.79    0.34      42
212              UC   0.481   0.815
213              UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
214              UA     100
                 *
                 *  This drainage basin is now collected in a storm drain directed south on 107th
                 *  THis storm drain was designed using StormAD as a 24-inch pipe.
                 *

215              KK  RA07G2
216              KM   CHANNEL ROUTING
217              RD    1632  0.0073   0.013            CIRC       2
                 *
```

Proposed HEC-1 Model

```
                    *

 218                KK   A07F1   BASIN
 219                BA   0.107
 220                LG    0.24    0.25    4.96    0.35      31
 221                UC   0.711   1.117
 222                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 223                UA     100
                    *
1                                                HEC-1 INPUT
PAGE  8

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 224                KK   A07F2   BASIN
 225                BA   0.024
 226                LG    0.25    0.25    4.96    0.35      31
 227                UC   0.353   0.383
 228                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 229                UA     100
                    *

 230                KK   A07E8   BASIN
 231                BA   0.005
 232                LG    0.10    0.25    4.79    0.40      81
 233                UC   0.210   0.324
 234                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 235                UA     100
                    *

 236                KK   CA07F COMBINE
 237                HC       4
                    *
                    *
                    *  THis storm drain was designed using StormAD as a dual 36-inch pipe.
                    *  The equivalent diameter for a 54-inch was used in this routing.
                    *

 238                KK  RA07F1
 239                KM   CHANNEL ROUTING
 240                RD     353  0.0028   0.013            CIRC     4.5
                    *
                    *

 241                KK   A07E7   BASIN
 242                BA   0.006
 243                LG    0.10    0.21    6.34    0.20      81
 244                UC   0.165   0.180
 245                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 246                UA     100
                    *

 247                KK  CA07E7 COMBINE
 248                HC       2
                    *
                    *
                    *  THis storm drain was designed using StormAD as a dual 36-inch pipe.
                    *  The equivalent diameter for a 54-inch was used in this routing.
                    *

 249                KK  RA07E7
 250                KM   CHANNEL ROUTING
 251                RD    1042  0.0086   0.013            CIRC     4.5
                    *
                    *
1                                                HEC-1 INPUT
PAGE  9

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

Proposed HEC-1 Model

```
252          KK   A07E6   BASIN
253          BA   0.019
254          LG    0.10    0.15    7.94    0.11      80
255          UC   0.245   0.237
256          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
257          UA     100
             *
             *

258          KK  DI7E.6
259          DT  DI7E.6    0.12
260          DI       0     100    1000   10000
261          DQ       0     100    1000   10000
             *
             *

262          KK  RA07E6   ROUTE
263          RS       5    FLOW
264          RC   0.035   0.020   0.035    1950  0.0062    0.00
265          RX    0.00   50.00  100.00  125.00  150.00  175.00  225.00  275.00
266          RY    4.00    3.00    2.00    1.00    1.00    2.00    3.00    4.00
             *

267          KK   A07E2   BASIN
268          BA   0.033
269          LG    0.22    0.15    8.36    0.09      49
270          UC   0.298   0.305
271          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
272          UA     100
             *
             *

273          KK  DI7E.2
274          DT  DI7E.2    0.04
275          DI       0     100    1000   10000
276          DQ       0     100    1000   10000
             *
             * THIS IS THE FLOW COMING OUT OF PARADISE RV PARK

277          KK  C07E2* COMBINE
278          HC       2
             *

279          KK  CA07E2 COMBINE
280          HC       2
             *
             *
             *  THis storm drain was designed using StormAD as a dual 42-inch pipe.
             *  The equivalent diameter for a 60-inch was used in this routing.
             *
1                                          HEC-1 INPUT
PAGE 10

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


281          KK  RA07E7
282          KM   CHANNEL ROUTING
283          RD     761  0.0092   0.013            CIRC       5
             *

284          KK  RA07E2   ROUTE
285          RS       1    FLOW
286          RC   0.030   0.020   0.030     761  0.0092    0.00
287          RX    0.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00
288          RY    2.00    1.00    0.00    0.00    0.00    0.00    1.00    2.00
             *

289          KK   A07B7   BASIN
290          BA   0.021
```

Proposed HEC-1 Model

```
291          LG    0.14    0.26    5.24    0.33      32
292          UC   0.259   0.285
293          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
294          UA     100
             *

295          KK  CA07B7 COMBINE
296          HC       3
             *

297          KK  RA07B7   ROUTE
298          RS       3    FLOW
299          RC   0.035   0.030   0.035    3058  0.0075    0.00
300          RX    0.00   50.00   75.00  100.00  125.00  150.00  175.00  225.00
301          RY   10.00    9.00    0.00    0.00    0.00    0.00    9.00   10.00
             *

302          KK    A07H   BASIN
303          BA   0.092
304          LG    0.12    0.25    4.65    0.51      12
305          UC   0.482   0.386
306          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
307          UA     100
             *

308          KK   RA07H   ROUTE
309          RS      13    FLOW
310          RC   0.035   0.035   0.035    3126  0.0048    0.00
311          RX    0.00   50.00  100.00  150.00  200.00  250.00  300.00  350.00
312          RY   10.00    9.00    8.00    7.00    7.00    8.00    9.00   10.00
             *

313          KK   A07C2   BASIN
314          BA   0.165
315          LG    0.19    0.32    4.79    0.36       4
316          UC   0.533   0.391
317          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
318          UA     100
             *
```



```
                                    HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

319          KK  CA07C2 COMBINE
320          HC       2
             *

321          KK  RA07C2   ROUTE
322          RS      15    FLOW
323          RC   0.035   0.030   0.035    2625  0.0057    0.00
324          RX    0.00   30.00   80.00  130.00  150.00  230.00  250.00  260.00
325          RY   10.00    9.00    0.00    0.00    0.00    9.00   10.00   12.00
             *

326          KK   A07B1   BASIN
327          BA   0.081
328          LG    0.19    0.25    4.12    0.56      31
329          UC   0.349   0.315
330          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
331          UA     100
             *
             *
             *

332          KK  A07B1N STORAGE
333          KM      Online Detention Basin, Downstream of the APS pole.
334          RS       1    STOR       0
335          SV       0    1.15    2.66    4.43    4.43
336          SE       0       1       2       3       4
```

```
 337          SQ       0       4      13      20     830
              *
              *

 338          KK  A07B1S STORAGE
 339          KM      Online Detention Basin, Upstream of the APS pole.
 340          RS       1    STOR       0
 341          SV       0    0.84   1.795     1.8
 342          SE       0       1       2       3
 343          SQ       0       4      13     813
              *
              *

 344          KK  CA07B1 COMBINE
 345          HC       4
              *

 346          KK  RA07B1   ROUTE
 347          RS       9    FLOW
 348          RC   0.035   0.030   0.035    1628  0.0031    0.00
 349          RX    0.00   50.00  130.00  200.00  240.00  280.00  300.00  320.00
 350          RY   10.00    9.00    0.00    0.00    5.00    9.00   10.00   12.00
              *
1                                          HEC-1 INPUT
PAGE 12

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 351          KK   A07B3   BASIN
 352          BA   0.204
 353          LG    0.20    0.25    4.96    0.37      26
 354          UC   0.451   0.300
 355          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 356          UA     100
              *

 357          KK  RA07B3   ROUTE
 358          RS       3    FLOW
 359          RC   0.038   0.035   0.038    2418  0.0124    0.00
 360          RX    0.00   50.00   75.00  125.00  150.00  200.00  250.00  300.00
 361          RY   10.00    9.00    8.00    0.00    0.00    8.00    9.00   10.00
              *

 362          KK   A07B2   BASIN
 363          BA   0.101
 364          LG    0.20    0.25    4.65    0.44      24
 365          UC   0.422   0.349
 366          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 367          UA     100
              *

 368          KK  CA07B2 COMBINE
 369          HC       2
              *

 370          KK  RA07B2   ROUTE
 371          RS       5    FLOW
 372          RC   0.035   0.030   0.035    2388  0.0021    0.00
 373          RX    0.00   50.00  100.00  150.00  200.00  250.00  300.00  350.00
 374          RY   10.00    9.00    8.00    0.00    0.00    8.00    9.00   10.00
              *

 375          KK   A07B4   BASIN
 376          BA   0.053
 377          LG    0.20    0.25    4.28    0.52      35
 378          UC   0.395   0.404
 379          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 380          UA     100
              *
              *
```

Proposed HEC-1 Model

```
 381          KK  A07B4N STORAGE
 382          KM      Online Detention Basin, Upstream of the APS pole.
 383          RS       1    STOR       0
 384          SV       0    1.12    2.41    3.79     3.8
 385          SE       0       1       2       3       4
 386          SQ       0       4      13      20     830
              *
              *
1                                          HEC-1 INPUT
PAGE 13

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 387          KK  A07B4S STORAGE
 388          KM      Online Detention Basin, Downstream of the APS pole.
 389          RS       1    STOR       0
 390          SV       0    1.89    3.97    6.21    6.21
 391          SE       0       1       2       3       4
 392          SQ       0       4      13      20     830
              *
              *

 393          KK  CA07B4 COMBINE
 394          HC       3
              *

 395          KK  RA07B4   ROUTE
 396          RS       2    FLOW
 397          RC   0.035   0.030   0.035    1476  0.0034    0.00
 398          RX    0.00   50.00  100.00  125.00  150.00  175.00  225.00  275.00
 399          RY   10.00    9.00    8.00    0.00    0.00    8.00    9.00   10.00
              *

 400          KK    S30C   BASIN
 401          BA   0.665
 402          LG    0.26    0.19    6.54    0.16      13
 403          UC   0.572   0.297
 404          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 405          UA     100
              *
              *
              * RECOVER DIVERTED FLOW FROM A09FI
              *

 406          KK  DA09FI
 407          DR   A09FI
              *

 408          KK  RA09FI
 409          RS      21    FLOW       0
 410          RC     .02     .02     .02    7000  0.0023
 411          RX       0       1      85      95     109     134     239     240
 412          RY      12       6       5       0       0       5       6      12
              *

 413          KK   CS30C
 414          HC       2
              *

 415          KK   RS30C   ROUTE
 416          RS      12    FLOW
 417          RC   0.030   0.020   0.030    6874  0.0015    0.00
 418          RX    0.00   10.00   50.00   60.00   70.00   80.00  120.00  130.00
 419          RY   10.00    5.00    4.00    0.00    0.00    4.00    5.00   10.00
              *
              *
              * *** DIVERSION DS30AO ***************************************************
              * *** DIVERTED  MAIN (WEST) DIVERTED (SOUTH)  ***********************
              * THERE IS A DIVERSION AT THIS LOCATION.  THE CULVERTS AND ROADWAY
```

Proposed HEC-1 Model

```
                    * WERE SURVEYED AND THE AREA WAS MODELED IN HY-8.  THE CULVERT
                    * SUMMARY TABLE FROM HY-8 WAS USED FOR THIS SPLIT (TABLE IS IN
                    * DESIGN REPORT)
                    * THE DEL WEBB CULVERTS CAN CHANNEL CAN CARRY 508 CFS, THE REST
                    * OF THE FLOW OVERFLOWS TO THE SOUTH.
                    *
                    * DDM   ***** Preserved *****
1                                          HEC-1 INPUT
PAGE 14

          LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           420      KK  DS30AO
           421      DT  DS30AI
           422      DI       1     400     660     800     940    1080    1220    1360    1500
           423      DQ      .1      .2     107     258     418     581     746     913    1080
                    *
                    *

           424      KK    S30B   BASIN
           425      BA   0.567
           426      LG    0.18    0.17    6.76    0.17      31
           427      UC   0.827   0.533
           428      UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
           429      UA     100
                    *

           430      KK   CS30B COMBINE
           431      HC       2
                    *
                    *

           432      KK   RS30B   ROUTE
           433      RS       1    FLOW
           434      RC   0.030   0.020   0.030    4113  0.0036    0.00
           435      RX    0.00   10.00   60.00   62.00   82.00   84.00  134.00  144.00
           436      RY   12.00   11.00    8.00    0.00    0.00    8.00   11.00   12.00
                    *
                    * *** DIVERTED  MAIN (WEST) DIVERTED (SOUTH)  ***********************
                    * THERE IS A DIVERSION AT THIS LOCATION.  THE CULVERTS AND ROADWAY
                    * WERE SURVEYED AND THE AREA WAS MODELED IN HY-8.  THE CULVERT
                    * SUMMARY TABLE FROM HY-8 WAS USED FOR THIS SPLIT (TABLE IS IN
                    * DESIGN REPORT)
                    * THE DEL WEBB CULVERTS CAN CHANNEL CAN CARRY 421 CFS, THE REST
                    * OF THE FLOW OVERFLOWS TO THE SOUTH.
                    *
                    *
                    *

           437      KK  DS30BO
           438      DT  DS30BI
           439      DI       1     400     660     800     940    1080    1220    1360    1500
           440      DQ      .1      .2     200     355     515     675     833    1002    1168
                    *

           441      KK     S30   BASIN
           442      BA   0.342
           443      LG    0.20    0.25    4.65    0.43      30
           444      UC   0.501   0.319
           445      UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
           446      UA     100
                    *
1                                          HEC-1 INPUT
PAGE 15

          LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           447      KK    CS30 COMBINE
           448      HC       2
```

Proposed HEC-1 Model

```
                *
                *
449             KK    RS30   ROUTE
450             RS       1    FLOW
451             RC   0.030   0.020   0.030    1258  0.0215    0.00
452             RX    0.00   50.00   60.00   80.00   90.00  100.00  125.00  140.00
453             RY   10.00    9.00    3.00    3.00    9.00   10.00   11.00   12.00
                *
454             KK   A07B6   BASIN
455             BA   0.153
456             LG    0.15    0.25    4.65    0.47      26
457             UC   0.662   0.628
458             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
459             UA     100
                *
460             KK  CA07B6 COMBINE
461             HC       2
                *
462             KK  RA07B6   ROUTE
463             RS       1    FLOW
464             RC   0.030   0.020   0.030     672  0.0119    0.00
465             RX    0.00   50.00   70.00   90.00  110.00  130.00  150.00  170.00
466             RY   10.00    9.00    8.00    1.00    1.00    8.00    9.00   10.00
                *
467             KK   A07B5   BASIN
468             BA   0.057
469             LG    0.11    0.30    4.51    0.43      39
470             UC   0.514   0.511
471             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
472             UA     100
                *
                * This basin was removed in these improvements.
                * KKA07B5S STORAGE
                * KM    Online Detention Basin, Upstream of the APS pole.
                * RS     1    STOR       0
                * SV     0    1.74    3.62   5.695     5.7
                * SE     0       1       2       3       4
                * SQ     0       4      13      20     830
                *
                *
473             KK  A07B5N STORAGE
474             KM      Online Detention Basin, Downstream of the APS pole.
475             RS       1    STOR       0
476             SV       0    0.37    0.80    1.29    1.84    1.84
477             SE       0       1       2       3       4       5
478             SQ       0       4      13      20      26     830
                *
1                                                HEC-1 INPUT
PAGE 16

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

479             KK  CA07B5 COMBINE
480             HC       3
                *
481             KK  RA07B5   ROUTE
482             RS       1    FLOW
483             RC   0.025   0.020   0.025    1378  0.0051    0.00
484             RX    0.00   10.00   50.00   60.00   80.00   90.00  130.00  150.00
485             RY   10.00    5.00    4.00    0.00    0.00    4.00    5.00    6.00
                *
486             KK   A06A2   BASIN
```

```
487          BA   0.106
488          LG    0.17    0.26    4.39    0.48      40
489          UC   0.304   0.204
490          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
491          UA     100
             *

492          KK  CA06A2 COMBINE
493          HC       2
             *

494          KK  RA06A2   ROUTE
495          RS       1    FLOW
496          RC   0.030   0.020   0.030     981  0.0031    0.00
497          RX    0.00   10.00   50.00   60.00   70.00   80.00  130.00  150.00
498          RY   10.00    9.00    8.00    4.00    4.00    8.00    9.00   10.00
             *

499          KK   A06A3   BASIN
500          BA   0.053
501          LG    0.22    0.26    5.24    0.31      29
502          UC   0.300   0.254
503          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
504          UA     100
             *

505          KK  CA06A3 COMBINE
506          HC       2
             *

507          KK  RA06A3   ROUTE
508          RS       3    FLOW
509          RC   0.030   0.020   0.030    3203  0.0050    0.00
510          RX    0.00   10.00   50.00   60.00   70.00   80.00  100.00  120.00
511          RY   10.00    9.00    8.00    4.00    4.00    8.00    9.00   10.00
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

512          KK    A061   BASIN
513          BA   0.080
514          LG    0.24    0.26    3.59    0.74      43
515          UC   0.504   0.549
516          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
517          UA     100
             *

518          KK   CA061 COMBINE
519          HC       2
             *
             *
             *  This route was updated based on the proposed improvements.
             *

520          KK   RA061   ROUTE
521          RS       2    FLOW
522          RC   0.030   0.018   0.030    2795  0.0015    0.00
523          RX    0.00   10.00   60.00   66.00   91.00   97.00  120.00  170.00
524          RY   10.00    9.00    8.00    2.00    2.00    8.00    9.00   10.00
             *

525          KK   A06A1   BASIN
526          BA   0.187
527          LG    0.21    0.25    4.65    0.44      24
528          UC   0.529   0.463
529          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
530          UA     100
             *
```

```
                    *  This route was updated based on the proposed improvements.
                    *

 531                KK  RA06A1   ROUTE
 532                RS       4    FLOW
 533                RC   0.030   0.018   0.030    3945  0.0015    0.00
 534                RX    0.00   50.00  100.00  106.00  131.00  137.00  150.00  240.00
 535                RY   10.00    9.00    8.00    2.00    2.00    8.00    9.00   10.00
                    *

 536                KK   A99P1   BASIN
 537                BA   0.249
 538                LG    0.21    0.19    6.54    0.19      26
 539                UC   0.578   0.424
 540                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 541                UA     100
                    *
                    *  This route was updated based on the proposed improvements.
                    *
1                                                HEC-1 INPUT
PAGE 18

LINE                ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 542                KK  RA99P1   ROUTE
 543                RS       2    FLOW
 544                RC   0.030   0.018   0.030    2868  0.0015    0.00
 545                RX    0.00   50.00  100.00  106.00  131.00  137.00  150.00  240.00
 546                RY   10.00    9.00    8.00    2.00    2.00    8.00    9.00   10.00
                    *

 547                KK   A99P2   BASIN
 548                BA   0.226
 549                LG    0.10    0.25    4.45    0.53      48
 550                UC   0.578   0.488
 551                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 552                UA     100
                    *

 553                KK    A99Q   BASIN
 554                BA   0.117
 555                LG    0.11    0.27    3.25    1.20       2
 556                UC   1.286   1.675
 557                UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 558                UA     100
                    *

 559                KK  CA99P2 COMBINE
 560                HC       5
                    *
 561                ZZ
1
            SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   36         A09F
                .
                .
   43           .-------> LA09FD
   42        LA09F
                .
                .
   47           .------->  A09FI
   46        DA09F
                V
                V
   50        RA09FW
```

Proposed HEC-1 Model

```
            .
            .
 55         .        A09E
            .           .
            .           .
 62         .           .-------> LA09ED
 61         .       LA09E
            .           .
            .           .
 65      CA09E............
            V
            V
 67      RA09E
            .
            .
 72         .        A09D
            .           .
            .           .
 79         .           .-------> LA09DD
 78         .       LA09D
            .           .
            .           .
 82      CA09E............
            V
            V
 84      RA09D
            .
            .
 89         .        A09C
            .           .
            .           .
 95      CA09C............
            .
            .
 98         .------->   A09AI
 97     DA09AO
            V
            V
101      RA09C
            V
            V
106      RA09C
            .
            .
109         .        A07D
            .           .
            .           .
115      CA07D............
            V
            V
117      RA07D
            .
            .
122         .       A07G1
            .           .
            .           .
129         .           .-------> LA07GD
128         .       LA07G
            .           V
            .           V
132         .      RA07G1
            .           .
            .           .
137         .           .       A07E1
            .           .           .
            .           .           .
144         .           .           .-------> DI7E.1
143         .           .      DI7E.1
            .           .           V
            .           .           V
147         .           .      RA07E1
```

Proposed HEC-1 Model

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                .          .          .
                .          .          .
152             .          .          .       A07E3
                .          .          .          .
                .          .          .          .
159             .          .          .          .-------> DI7E.3
158             .          .          .      DI7E.3
                .          .          .          V
                .          .          .          V
162             .          .          .      RA07E3
                .          .          .          .
                .          .          .          .
167             .          .          .          .       A07E5
                .          .          .          .          V
                .          .          .          .          V
173             .          .          .          .      RA07E5
                .          .          .          .          .
                .          .          .          .          .
178             .          .          .          .          .       A07E4
                .          .          .          .          .          .
                .          .          .          .          .          .
184             .          .          .      CA07E4.......................
                .          .          .          .
                .          .          .          .
187             .          .          .          .-------> DI7E.4
186             .          .          .      DI7E.4
                .          .          .          .
                .          .          .          .
190             .          .          .          .       A07C1
                .          .          .          .          .
                .          .          .          .          .
196             .      CA07C.................................
                .          V
                .          V
198             .      LA07C
                .          V
                .          V
204             .     RA07C1
                .          .
                .          .
209             .          .     A07G2
                .          .         V
                .          .         V
215             .          .    RA07G2
                .          .         .
                .          .         .
218             .          .          .      A07F1
                .          .          .          .
                .          .          .          .
224             .          .          .          .       A07F2
                .          .          .          .          .
                .          .          .          .          .
230             .          .          .          .          .       A07E8
                .          .          .          .          .          .
                .          .          .          .          .          .
236             .          .     CA07F.................................
                .          .         V
                .          .         V
238             .          .    RA07F1
                .          .         .
                .          .         .
241             .          .          .      A07E7
                .          .          .          .
                .          .          .          .
247             .          .    CA07E7............
                .          .         V
                .          .         V
249             .          .    RA07E7
                .          .         .
                .          .         .
252             .          .          .      A07E6
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Proposed HEC-1 Model

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                .          .          .          .
                .          .          .          .
259             .          .          .          .-------> DI7E.6
258             .          .          .     DI7E.6
                .          .          .          V
                .          .          .          V
262             .          .          .     RA07E6
                .          .          .          .
                .          .          .          .
267             .          .          .          .      A07E2
                .          .          .          .          .
                .          .          .          .          .
274             .          .          .          .          .-------> DI7E.2
273             .          .          .          .     DI7E.2
                .          .          .          .          .
                .          .          .          .          .
277             .          .          .     C07E2*............
                .          .          .          .
                .          .          .          .
279             .          .     CA07E2............
                .          .          V
                .          .          V
281             .          .     RA07E7
                .          .          V
                .          .          V
284             .          .     RA07E2
                .          .          .
                .          .          .
289             .          .          .      A07B7
                .          .          .          .
                .          .          .          .
295             .     CA07B7........................
                .          V
                .          V
297             .     RA07B7
                .          .
                .          .
302             .          .       A07H
                .          .          V
                .          .          V
308             .          .      RA07H
                .          .          .
                .          .          .
313             .          .          .      A07C2
                .          .          .          .
                .          .          .          .
319             .          .     CA07C2............
                .          .          V
                .          .          V
321             .          .     RA07C2
                .          .          .
                .          .          .
326             .          .          .      A07B1
                .          .          .          V
                .          .          .          V
332             .          .          .     A07B1N
                .          .          .          V
                .          .          .          V
338             .          .          .     A07B1S
                .          .          .          .
                .          .          .          .
344        CA07B1....................................
                V
                V
346        RA07B1
                .
                .
351             .      A07B3
                .          V
                .          V
357             .     RA07B3
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Proposed HEC-1 Model

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            .           .
            .           .
362         .           .       A07B2
            .           .           .
            .           .           .
368         .      CA07B2............
            .           V
            .           V
370         .      RA07B2
            .           .
            .           .
375         .           .       A07B4
            .           .           V
            .           .           V
381         .           .      A07B4N
            .           .           V
            .           .           V
387         .           .      A07B4S
            .           .           .
            .           .           .
393     CA07B4........................
            V
            V
395     RA07B4
            .
            .
400         .        S30C
            .           .
            .           .
407         .           .           .<-------   A09FI
406         .           .      DA09FI
            .           .           V
            .           .           V
408         .           .      RA09FI
            .           .           .
            .           .           .
413         .      CS30C............
            .           V
            .           V
415         .      RS30C
            .           .
            .           .
421         .           .------->  DS30AI
420         .      DS30AO
            .           .
            .           .
424         .           .        S30B
            .           .           .
            .           .           .
430         .      CS30B............
            .           V
            .           V
432         .      RS30B
            .           .
            .           .
438         .           .------->  DS30BI
437         .      DS30BO
            .           .
            .           .
441         .           .         S30
            .           .           .
            .           .           .
447         .        CS30............
            .           V
            .           V
449         .        RS30
            .           .
            .           .
454         .           .       A07B6
            .           .           .
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Proposed HEC-1 Model

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460          .      CA07B6............
             .          V
             .          V
462          .      RA07B6
             .          .
             .          .
467          .          .       A07B5
             .          .           V
             .          .           V
473          .          .      A07B5N
             .          .           .
             .          .           .
479      CA07B5........................
             V
             V
481      RA07B5
             .
             .
486          .       A06A2
             .          .
             .          .
492      CA06A2............
             V
             V
494      RA06A2
             .
             .
499          .       A06A3
             .          .
             .          .
505      CA06A3............
             V
             V
507      RA06A3
             .
             .
512          .        A061
             .          .
             .          .
518       CA061............
             V
             V
520       RA061
             .
             .
525          .       A06A1
             .          V
             .          V
531          .      RA06A1
             .          .
             .          .
536          .          .       A99P1
             .          .           V
             .          .           V
542          .          .      RA99P1
             .          .           .
             .          .           .
547          .          .           .       A99P2
             .          .           .           .
             .          .           .           .
553          .          .           .           .        A99Q
             .          .           .           .           .
             .          .           .           .           .
559      CA99P2.............................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*************************************                    *************************************
*                                   *                    *                                   *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)*                    *  U.S. ARMY CORPS OF ENGINEERS     *
*            JUN  1998              *                    *  HYDROLOGIC ENGINEERING CENTER    *
*          VERSION 4.1              *                    *         609 SECOND STREET         *
*                                   *                    *      DAVIS, CALIFORNIA 95616      *
* RUN DATE  19JAN16  TIME  10:18:33 *                    *          (916) 756-1104           *
*                                   *                    *                                   *
*************************************                    *************************************
```

Flood Control District of Maricopa County

115TH Avenue and Union Hills Drive Drainage Improvements

Ritoch-Powell and Associates October 23, 2015

Proposed Hydrology Model (115_24P.DAT)

100 YEAR
24 Hour Storm

NOAA 14 Rainfall
Unit Hydrograph: Clark

Note: This model was updated so that the Union Hills Drive storm drain flows into the channel southwest of the 111th Avenue and Union Hills Drive intersection. It is not collected in the Peoria Storage Basin.

```
23 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

22 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN         15  TIME INTERVAL IN MINUTES
                    JXDATE      1    0  STARTING DATE
                    JXTIME           0  STARTING TIME

   IT          HYDROGRAPH TIME DATA
                      NMIN          2  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ       1000  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2    0  ENDING DATE
                    NDTIME       0918  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .03 HOURS
                      TOTAL TIME BASE   33.30 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

24 JD          INDEX STORM NO. 1
                      STRM       3.57  PRECIPITATION DEPTH
                      TRDA        .00  TRANSPOSITION DRAINAGE AREA

25 PI          PRECIPITATION PATTERN
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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Proposed HEC-1 Model

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          .01       .01       .03       .04       .04       .04       .04       .04       .04       .04
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          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00

35 JD          INDEX STORM NO. 2
                  STRM         3.39  PRECIPITATION DEPTH
                  TRDA        10.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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   .01      .01      .03      .04      .04      .04      .04      .04      .04      .04
   .01      .01      .01      .01      .01      .01      .01      .00      .00      .00
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            *            *
178 KK      *   A07E4    *        BASIN
            *            *
            **************

              SUBBASIN RUNOFF DATA

179 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .06   SUBBASIN AREA

180 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .23   STARTING LOSS
                        DTH         .15   MOISTURE DEFICIT
                       PSIF        7.94   WETTING FRONT SUCTION
                      XKSAT         .10   HYDRAULIC CONDUCTIVITY
                      RTIMP       46.00   PERCENT IMPERVIOUS AREA

181 UC          CLARK UNITGRAPH
                         TC         .30   TIME OF CONCENTRATION
                          R         .22   STORAGE COEFFICIENT

182 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
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                    .0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0
97.0
                  100.0

                                                  ***

                                          UNIT HYDROGRAPH PARAMETERS
                                   CLARK   TC=   .30 HR,       R=   .22 HR
                                  SNYDER   TP=   .17 HR,      CP=   .44

                                          UNIT HYDROGRAPH
                                   39 END-OF-PERIOD ORDINATES
                 5.       19.       44.       78.       96.       96.       92.       85.       78.       69.
                60.       51.       44.       38.       32.       28.       24.       21.       18.       15.
                13.       11.       10.        8.        7.        6.        5.        4.        4.        3.
                 3.        2.        2.        2.        2.        1.        1.        1.        1.

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION    A07E4
                   TRANSPOSITION AREA       .0 SQ MI

    TOTAL RAINFALL =    3.57, TOTAL LOSS =    1.15, TOTAL EXCESS =    2.42

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                         (CFS)
+      93.     12.10                 12.          4.          3.          3.
                       (INCHES)    1.935       2.409       2.411       2.411
                        (AC-FT)       6.          7.          7.          7.

                     CUMULATIVE AREA =     .06 SQ MI

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION    A07E4
                   TRANSPOSITION AREA     10.0 SQ MI

    TOTAL RAINFALL =    3.39, TOTAL LOSS =    1.11, TOTAL EXCESS =    2.28

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                         (CFS)
+      88.     12.10                 11.          3.          2.          2.
                       (INCHES)    1.819       2.269       2.271       2.271
                        (AC-FT)       5.          7.          7.          7.

                     CUMULATIVE AREA =     .06 SQ MI

     ***            ***            ***            ***            ***


                     INTERPOLATED HYDROGRAPH AT    A07E4

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                         (CFS)
+      90.     12.10                 11.          4.          3.          3.
                       (INCHES)    1.872       2.332       2.334       2.334
                        (AC-FT)       6.          7.          7.          7.

                     CUMULATIVE AREA =     .06 SQ MI
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              *            *
  184 KK      *    CA07E4  *      COMBINE
              *            *
              **************

  185 HC          HYDROGRAPH COMBINATION
                        ICOMP           3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION   CA07E4
                      TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+     209.     12.13                  26.          8.          6.           6.
                        (INCHES)    1.723       2.095       2.098        2.098
                         (AC-FT)     13.         16.         16.          16.

                        CUMULATIVE AREA =     .14 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION   CA07E4
                      TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+     197.     12.13                  25.          8.          5.           5.
                        (INCHES)    1.617       1.970       1.973        1.973
                         (AC-FT)     12.         15.         15.          15.

                        CUMULATIVE AREA =     .14 SQ MI

      ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT   CA07E4

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+     202.     12.13                  25.          8.          6.           6.
                        (INCHES)    1.656       2.016       2.019        2.019
                         (AC-FT)     13.         15.         15.          15.

                        CUMULATIVE AREA =     .14 SQ MI


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Proposed HEC-1 Model

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186 KK      *    DI7E.4  *
            *            *
            **************

     DT          DIVERSION
                      ISTAD      DI7E.4  DIVERSION HYDROGRAPH IDENTIFICATION
                     DSTRMX         .70  MAXIMUM VOLUME TO BE DIVERTED

     DI             INFLOW         .00    100.00   1000.00  10000.00

     DQ       DIVERTED FLOW        .00    100.00   1000.00  10000.00

                                                                  ***

      ***            ***            ***            ***            ***

                        DIVERSION HYDROGRAPH   DI7E.4
                      TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+      2.       6.40                  1.          0.          0.          0.
                       (INCHES)     .091        .092        .092        .092
                        (AC-FT)       1.          1.          1.          1.

                       CUMULATIVE AREA =     .14 SQ MI


      ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION   DI7E.4
                      TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+    209.      12.13                 26.          8.          6.          6.
                       (INCHES)    1.723       2.006       2.006       2.006
                        (AC-FT)      13.         15.         15.         15.

                       CUMULATIVE AREA =     .14 SQ MI


      ***            ***            ***            ***            ***

                        DIVERSION HYDROGRAPH   DI7E.4
                      TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+      2.       6.63                  1.          0.          0.          0.
                       (INCHES)     .090        .092        .092        .092
                        (AC-FT)       1.          1.          1.          1.

                       CUMULATIVE AREA =     .14 SQ MI


      ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION   DI7E.4
                      TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
   (CFS)        (HR)
                          (CFS)
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+     197.     12.13                    25.          7.          5.          5.
                          (INCHES)    1.617       1.880       1.880       1.880
                           (AC-FT)     12.         14.         14.         14.

                          CUMULATIVE AREA =     .14 SQ MI

      ***             ***             ***             ***             ***


                    INTERPOLATED DIVERSION HYDROGRAPH AT   DI7E.4

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                            (CFS)
+       2.      6.40                     1.          0.          0.          0.
                          (INCHES)     .090        .092        .092        .092
                           (AC-FT)      1.          1.          1.          1.

                          CUMULATIVE AREA =     .14 SQ MI

      ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT   DI7E.4

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                            (CFS)
+     202.     12.13                    25.          7.          5.          5.
                          (INCHES)    1.656       1.927       1.927       1.927
                           (AC-FT)     13.         15.         15.         15.

                          CUMULATIVE AREA =     .14 SQ MI


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            *            *
 190 KK     *    A07C1   *        BASIN
            *            *
            **************

              SUBBASIN RUNOFF DATA

 191 BA          SUBBASIN CHARACTERISTICS
                       TAREA         .02  SUBBASIN AREA

 192 LG          GREEN AND AMPT LOSS RATE
                       STRTL         .12  STARTING LOSS
                         DTH         .23  MOISTURE DEFICIT
                        PSIF        6.76  WETTING FRONT SUCTION
                       XKSAT         .14  HYDRAULIC CONDUCTIVITY
                       RTIMP       55.00  PERCENT IMPERVIOUS AREA

 193 UC          CLARK UNITGRAPH
                          TC         .66  TIME OF CONCENTRATION
                           R        2.04  STORAGE COEFFICIENT

 194 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                        .0       5.0      16.0      30.0      65.0      77.0      84.0      90.0      94.0
0
                     100.0
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Proposed HEC-1 Model

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                                        UNIT HYDROGRAPH PARAMETERS
                                   CLARK   TC=    .66 HR,        R=  2.04 HR
                                  SNYDER   TP=    .65 HR,       CP=    .25

                                              UNIT HYDROGRAPH
                                        300 END-OF-PERIOD ORDINATES
                                              VOLUME =  .99
          0.       0.       1.       1.       1.       2.       3.       4.       5.       5.
          5.       6.       6.       6.       6.       6.       6.       6.       6.       6.
          6.       6.       6.       6.       6.       5.       5.       5.       5.       5.
          5.       5.       5.       5.       5.       5.       5.       4.       4.       4.
          4.       4.       4.       4.       4.       4.       4.       4.       4.       4.
          4.       4.       4.       3.       3.       3.       3.       3.       3.       3.
          3.       3.       3.       3.       3.       3.       3.       3.       3.       3.
          3.       3.       3.       2.       2.       2.       2.       2.       2.       2.
          2.       2.       2.       2.       2.       2.       2.       2.       2.       2.
          2.       2.       2.       2.       2.       2.       2.       2.       2.       2.
          2.       2.       2.       2.       1.       1.       1.       1.       1.       1.
          1.       1.       1.       1.       1.       1.       1.       1.       1.       1.
          1.       1.       1.       1.       1.       1.       1.       1.       1.       1.
          1.       1.       1.       1.       1.       1.       1.       1.       1.       1.
          1.       1.       1.       1.       1.       1.       1.       1.       1.       1.
          1.       1.       1.       1.       1.       1.       1.       1.       1.       1.
          1.       1.       1.       1.       1.       1.       1.       1.       1.       1.
          1.       1.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.

   ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION    A07C1
                  TRANSPOSITION AREA       .0 SQ MI

   TOTAL RAINFALL =    3.57, TOTAL LOSS =    1.03, TOTAL EXCESS =    2.53

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+      9.      12.50                  4.          2.          1.          1.
                        (INCHES)    1.807       2.483       2.513       2.513
                         (AC-FT)      2.          3.          3.          3.

                       CUMULATIVE AREA =     .02 SQ MI


   ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION    A07C1
                  TRANSPOSITION AREA     10.0 SQ MI

   TOTAL RAINFALL =    3.39, TOTAL LOSS =    1.00, TOTAL EXCESS =    2.39

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
      9.      12.50                  4.          1.          1.          1.
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Proposed HEC-1 Model

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                    (INCHES)      1.705       2.346       2.374       2.374
                     (AC-FT)        2.          3.          3.          3.

                    CUMULATIVE AREA =     .02 SQ MI

     ***            ***            ***            ***            ***


                    INTERPOLATED HYDROGRAPH AT    A07C1

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)                                 `
                          (CFS)
+       9.     12.50                  4.          1.          1.          1.
                    (INCHES)      1.759       2.418       2.448       2.448
                     (AC-FT)        2.          3.          3.          3.

                    CUMULATIVE AREA =     .02 SQ MI


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            *            *
  196 KK    *     CA07C  *      COMBINE
            *            *
            **************

  197 HC          HYDROGRAPH COMBINATION
                    ICOMP           4  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION    CA07C
                    TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+     355.     12.47                 58.         17.         12.         12.
                    (INCHES)      1.233       1.442       1.444       1.444
                     (AC-FT)       29.         34.         34.         34.

                    CUMULATIVE AREA =     .44 SQ MI

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION    CA07C
                    TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+     291.     12.50                 53.         15.         11.         11.
                    (INCHES)      1.118       1.315       1.316       1.316
                     (AC-FT)       26.         31.         31.         31.

                    CUMULATIVE AREA =     .44 SQ MI

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                    INTERPOLATED HYDROGRAPH AT    CA07C

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                           (CFS)
+     303.     12.50                 54.         16.         11.         11.
                         (INCHES)  1.149       1.349       1.351       1.351
                          (AC-FT)    27.         31.         31.         31.

                    CUMULATIVE AREA =     .44 SQ MI


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            *            *
  198 KK    *     LA07C  *      STORAGE
            *            *
            **************
                              This is the stage storage discharge for the Peoria Basin.

              HYDROGRAPH ROUTING DATA

  200 RS          STORAGE ROUTING
                       NSTPS          1  NUMBER OF SUBREACHES
                        ITYP       STOR  TYPE OF INITIAL CONDITION
                       RSVRIC       .00  INITIAL CONDITION
                            X       .00 WORKING R AND D COEFFICIENT

  201 SV            STORAGE        .0        .6       1.3       2.0       2.9       3.8       4.9       4.9
4.9

  202 SE          ELEVATION      .00      1.00      2.00      3.00      4.00      5.00      6.00      7.00
8.00

  203 SQ          DISCHARGE       0.       98.      143.      173.      197.      219.      240.      257.
290.

                                                                  ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    LA07C
                      TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                           (CFS)
+     230.     12.67                 58.         17.         12.         12.
                         (INCHES)  1.233       1.442       1.444       1.444
                          (AC-FT)    29.         34.         34.         34.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     33.30-HR
+  (AC-FT)      (HR)
       4.      12.67                  1.          0.          0.          0.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                     6-HR       24-HR       72-HR     33.30-HR
+   (FEET)      (HR)
     5.54     12.67                 .99         .27         .20         .20
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                    CUMULATIVE AREA =     .44 SQ MI

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION    LA07C
                   TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+     209.     12.70                     53.         15.         11.         11.
                        (INCHES)      1.118       1.315       1.316       1.316
                         (AC-FT)        26.         31.         31.         31.

 PEAK STORAGE   TIME                         MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR     33.30-HR
+  (AC-FT)      (HR)
       3.      12.70                      1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR     33.30-HR
+   (FEET)      (HR)
     4.53      12.70                    .82         .23         .16         .16

                    CUMULATIVE AREA =     .44 SQ MI

     ***            ***            ***            ***            ***


                   INTERPOLATED HYDROGRAPH AT    LA07C

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     33.30-HR
   (CFS)        (HR)
                          (CFS)
+     214.     12.70                     54.         16.         11.         11.
                        (INCHES)      1.149       1.349       1.351       1.351
                         (AC-FT)        27.         31.         31.         31.

                    CUMULATIVE AREA =     .44 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  204 KK    *    RA07C1  *        ROUTE
            *            *
            **************

               HYDROGRAPH ROUTING DATA

  205 RS          STORAGE ROUTING
                        NSTPS           2  NUMBER OF SUBREACHES
                         ITYP        FLOW  TYPE OF INITIAL CONDITION
                        RSVRIC         .00  INITIAL CONDITION
                             X         .00 WORKING R AND D COEFFICIENT

  206 RC          NORMAL DEPTH CHANNEL
                          ANL        .035  LEFT OVERBANK N-VALUE
                         ANCH        .030  MAIN CHANNEL N-VALUE
                          ANR        .035  RIGHT OVERBANK N-VALUE
                        RLNTH       1305.  REACH LENGTH
                          SEL       .0061  ENERGY SLOPE
```

Proposed HEC-1 Model

```
                    ELMAX          .0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                          CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  208 RY       ELEVATION    10.00      9.00       .00       .00       .00       .00      9.00     10.00
  207 RX       DISTANCE       .00     50.00    100.00    125.00    150.00    175.00    200.00    250.00

                                                                  ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

            STORAGE        .00      1.22      2.50      3.86      5.28      6.78      8.34      9.97     11.67
13.44
            OUTFLOW        .00    101.36    326.70    651.78   1068.33   1572.19   2161.04   2833.65   3589.37
4428.02
          ELEVATION        .00       .53      1.05      1.58      2.11      2.63      3.16      3.68      4.21
4.74

            STORAGE      15.28     17.19     19.17     21.22     23.33     25.52     27.77     30.10     32.80
36.32
            OUTFLOW    5349.69   6354.71   7443.55   8616.80   9875.17  11219.41  12650.37  14168.91  15071.08
16459.71
          ELEVATION       5.26      5.79      6.32      6.84      7.37      7.89      8.42      8.95      9.47
10.00


 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     1572. TO    16460.
                 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK
INFLOWS.
                 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER
REACH.)

      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION   RA07C1
                     TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                           (CFS)
+     229.     12.73                 58.         17.         12.         12.
                         (INCHES)   1.233      1.442       1.444       1.444
                          (AC-FT)     29.         34.         34.         34.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     33.30-HR
+  (AC-FT)      (HR)
       1.      12.73                  0.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR       24-HR       72-HR     33.30-HR
+   (FEET)      (HR)
       .82     12.73                 .25         .07         .05         .05

                       CUMULATIVE AREA =      .44 SQ MI

      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION   RA07C1
                     TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                           (CFS)
+     208.     12.77                 53.         15.         11.         11.
                         (INCHES)   1.118      1.315       1.316       1.316
                          (AC-FT)     26.         31.         31.         31.
```

Proposed HEC-1 Model

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	33.30-HR
1.	12.73	0.	0.	0.	0.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	33.30-HR
.77	12.77	.23	.07	.05	.05

CUMULATIVE AREA = .44 SQ MI

*** *** *** *** ***

INTERPOLATED HYDROGRAPH AT RA07C1

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.30-HR
		(CFS)				
213.	12.77		54.	16.	11.	11.
		(INCHES)	1.149	1.349	1.351	1.351
		(AC-FT)	27.	31.	31.	31.

CUMULATIVE AREA = .44 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

+	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	A09F	346.	12.23	62.	20.	14.	.37		
+	DIVERSION TO	LA09FD	311.	12.13	23.	7.	5.	.37		
+	HYDROGRAPH AT	LA09F	346.	12.23	47.	13.	9.	.37		
+	DIVERSION TO	A09FI	49.	12.23	4.	1.	1.	.37		
+	HYDROGRAPH AT	DA09F	296.	12.23	43.	12.	9.	.37		
+	ROUTED TO	RA09FW	279.	12.40	43.	12.	9.	.37		
+	HYDROGRAPH AT	A09E	98.	12.27	23.	7.	5.	.14		
+	DIVERSION TO	LA09ED	98.	12.27	15.	4.	3.	.14		
+	HYDROGRAPH AT	LA09E	58.	12.83	10.	3.	2.	.14		
+	2 COMBINED AT	CA09E	278.	12.40	53.	15.	11.	.51		
+	ROUTED TO	RA09E	267.	12.53	53.	15.	11.	.51		
	HYDROGRAPH AT	A09D	243.	12.20	40.	12.	9.	.24		

	DIVERSION TO	LA09DD	243.	12.20	29.	8.	6.	.24
+	HYDROGRAPH AT	LA09D	128.	12.67	15.	4.	3.	.24
+	2 COMBINED AT	CA09E	356.	12.67	67.	19.	14.	.75
+	ROUTED TO	RA09D	331.	12.77	67.	19.	14.	.75
+	HYDROGRAPH AT	A09C	42.	12.40	11.	3.	2.	.11
+	2 COMBINED AT	CA09C	365.	12.73	77.	22.	16.	.87
+	DIVERSION TO	A09AI	70.	12.73	3.	1.	1.	.87
+	HYDROGRAPH AT	DA09AO	296.	12.67	73.	21.	15.	.87
+	ROUTED TO	RA09C	284.	13.20	73.	21.	15.	.87
+	ROUTED TO	RA09C	281.	13.37	72.	21.	15.	.87
+	HYDROGRAPH AT	A07D	102.	12.30	16.	4.	3.	.25
+	2 COMBINED AT	CA07D	300.	13.37	86.	25.	18.	1.12
+	ROUTED TO	RA07D	300.	13.37	86.	25.	18.	1.12
	HYDROGRAPH AT	A07G1	305.	12.17	42.	12.	9.	.24
+	DIVERSION TO	LA07GD	305.	12.17	24.	7.	5.	.24
+	HYDROGRAPH AT	LA07G	240.	12.33	21.	6.	4.	.24
+	ROUTED TO	RA07G1	187.	12.50	21.	6.	4.	.24
+	HYDROGRAPH AT	A07E1	51.	12.10	7.	2.	2.	.04
+	DIVERSION TO	DI7E.1	40.	12.00	2.	1.	1.	.04
+	HYDROGRAPH AT	DI7E.1	51.	12.10	5.	1.	1.	.04
+	ROUTED TO	RA07E1	46.	12.27	5.	1.	1.	.04
+	HYDROGRAPH AT	A07E3	101.	12.07	11.	3.	2.	.06
+	DIVERSION TO	DI7E.3	1.	1.27	0.	0.	0.	.06
+	HYDROGRAPH AT	DI7E.3	101.	12.07	11.	3.	2.	.06
+	ROUTED TO	RA07E3	94.	12.17	11.	3.	2.	.06
+	HYDROGRAPH AT	A07E5	29.	12.10	4.	1.	1.	.03
+	ROUTED TO	RA07E5	27.	12.23	4.	1.	1.	.03

	HYDROGRAPH AT	A07E4	90.	12.10	11.	4.	3.	.06
+	3 COMBINED AT	CA07E4	202.	12.13	25.	8.	6.	.14
+	DIVERSION TO	DI7E.4	2.	6.40	1.	0.	0.	.14
+	HYDROGRAPH AT	DI7E.4	202.	12.13	25.	7.	5.	.14
+	HYDROGRAPH AT	A07C1	9.	12.50	4.	1.	1.	.02
+	4 COMBINED AT	CA07C	303.	12.50	54.	16.	11.	.44
+	ROUTED TO	LA07C	214.	12.70	54.	16.	11.	.44
+	ROUTED TO	RA07C1	213.	12.77	54.	16.	11.	.44
+	HYDROGRAPH AT	A07G2	18.	12.23	5.	1.	1.	.03
+	ROUTED TO	RA07G2	18.	12.30	5.	1.	1.	.03
+	HYDROGRAPH AT	A07F1	49.	12.40	16.	5.	4.	.11
+	HYDROGRAPH AT	A07F2	25.	12.13	4.	1.	1.	.02
+	HYDROGRAPH AT	A07E8	7.	12.07	1.	0.	0.	.00
+	4 COMBINED AT	CA07F	91.	12.27	25.	8.	6.	.16
+	ROUTED TO	RA07F1	90.	12.27	25.	8.	6.	.16
+	HYDROGRAPH AT	A07E7	11.	12.03	1.	0.	0.	.01
+	2 COMBINED AT	CA07E7	96.	12.27	26.	8.	6.	.17
+	ROUTED TO	RA07E7	95.	12.27	26.	8.	6.	.17
+	HYDROGRAPH AT	A07E6	32.	12.07	5.	2.	1.	.02
+	DIVERSION TO	DI7E.6	0.	3.83	0.	0.	0.	.02
+	HYDROGRAPH AT	DI7E.6	32.	12.07	5.	1.	1.	.02
+	ROUTED TO	RA07E6	29.	12.23	5.	1.	1.	.02
+	HYDROGRAPH AT	A07E2	47.	12.10	7.	2.	2.	.03
+	DIVERSION TO	DI7E.2	0.	1.53	0.	0.	0.	.03
+	HYDROGRAPH AT	DI7E.2	47.	12.10	7.	2.	2.	.03
+	2 COMBINED AT	C07E2*	71.	12.17	11.	4.	3.	.05
+	2 COMBINED AT	CA07E2	162.	12.20	37.	12.	9.	.22

	ROUTED TO						
	RA07E7	162.	12.23	37.	12.	9.	.22
+	ROUTED TO						
	RA07E2	161.	12.27	37.	12.	9.	.22
+	HYDROGRAPH AT						
	A07B7	27.	12.10	3.	1.	1.	.02
+	3 COMBINED AT						
	CA07B7	340.	12.33	94.	29.	21.	.68
+	ROUTED TO						
	RA07B7	331.	12.50	94.	29.	21.	.68
+	HYDROGRAPH AT						
	A07H	73.	12.20	10.	3.	2.	.09
+	ROUTED TO						
	RA07H	64.	12.63	10.	3.	2.	.09
+	HYDROGRAPH AT						
	A07C2	129.	12.20	16.	4.	3.	.17
+	2 COMBINED AT						
	CA07C2	131.	12.53	26.	7.	5.	.26
+	ROUTED TO						
	RA07C2	124.	12.77	26.	7.	5.	.26
+	HYDROGRAPH AT						
	A07B1	84.	12.13	11.	3.	3.	.08
+	ROUTED TO						
	A07B1N	17.	12.83	10.	3.	2.	.08
+	ROUTED TO						
	A07B1S	12.	14.43	9.	3.	2.	.08
	4 COMBINED AT						
	CA07B1	593.	13.23	211.	63.	46.	2.14
+	ROUTED TO						
	RA07B1	591.	13.30	211.	63.	46.	2.14
+	HYDROGRAPH AT						
	A07B3	218.	12.17	28.	8.	6.	.20
+	ROUTED TO						
	RA07B3	209.	12.27	28.	8.	6.	.20
+	HYDROGRAPH AT						
	A07B2	97.	12.17	13.	4.	3.	.10
+	2 COMBINED AT						
	CA07B2	297.	12.23	41.	12.	9.	.31
+	ROUTED TO						
	RA07B2	280.	12.40	41.	12.	9.	.31
+	HYDROGRAPH AT						
	A07B4	49.	12.17	8.	2.	2.	.05
+	ROUTED TO						
	A07B4N	13.	12.90	7.	2.	2.	.05
+	ROUTED TO						
	A07B4S	5.	15.57	4.	2.	2.	.05
+	3 COMBINED AT						
	CA07B4	792.	12.50	254.	77.	56.	2.50
+	ROUTED TO						
	RA07B4	788.	12.57	254.	77.	56.	2.50
+	HYDROGRAPH AT						
	S30C	752.	12.20	95.	26.	19.	.67
+	HYDROGRAPH AT						
	DA09FI	49.	12.23	4.	1.	1.	.37

	ROUTED TO	RA09FI	31.	12.93	4.	1.	1.	.37
+	2 COMBINED AT	CS30C	752.	12.20	98.	27.	19.	.67
+	ROUTED TO	RS30C	674.	12.60	98.	27.	19.	.67
+	DIVERSION TO	DS30AI	122.	12.60	8.	2.	1.	.67
+	HYDROGRAPH AT	DS30AO	552.	12.57	91.	25.	18.	.67
+	HYDROGRAPH AT	S30B	455.	12.33	95.	28.	21.	.57
+	2 COMBINED AT	CS30B	958.	12.50	185.	53.	38.	1.23
+	ROUTED TO	RS30B	942.	12.60	185.	53.	38.	1.23
+	DIVERSION TO	DS30BI	517.	12.60	51.	13.	9.	1.23
+	HYDROGRAPH AT	DS30BO	458.	12.93	135.	40.	29.	1.23
+	HYDROGRAPH AT	S30	342.	12.17	48.	15.	11.	.34
+	2 COMBINED AT	CS30	757.	12.30	182.	55.	40.	1.57
+	ROUTED TO	RS30	756.	12.30	182.	55.	40.	1.57
	HYDROGRAPH AT	A07B6	95.	12.27	20.	6.	4.	.15
+	2 COMBINED AT	CA07B6	849.	12.30	202.	61.	44.	1.73
+	ROUTED TO	RA07B6	847.	12.30	202.	61.	44.	1.73
+	HYDROGRAPH AT	A07B5	46.	12.20	9.	3.	2.	.06
+	ROUTED TO	A07B5N	24.	12.77	9.	3.	2.	.06
+	3 COMBINED AT	CA07B5	1510.	12.50	459.	140.	102.	4.28
+	ROUTED TO	RA07B5	1504.	12.53	459.	140.	102.	4.28
+	HYDROGRAPH AT	A06A2	148.	12.10	17.	5.	4.	.11
+	2 COMBINED AT	CA06A2	1538.	12.53	474.	145.	106.	4.39
+	ROUTED TO	RA06A2	1530.	12.57	474.	145.	106.	4.39
+	HYDROGRAPH AT	A06A3	69.	12.10	8.	2.	2.	.05
+	2 COMBINED AT	CA06A3	1547.	12.57	482.	148.	107.	4.44
+	ROUTED TO	RA06A3	1530.	12.67	482.	148.	107.	4.44
+	HYDROGRAPH AT	A061	57.	12.23	12.	4.	3.	.08

```
        2 COMBINED AT
                        CA061     1565.  12.67        493.       151.       110.       4.52
        ROUTED TO
+                       RA061     1554.  12.73        493.       151.       110.       4.52
        HYDROGRAPH AT
+                       A06A1      146.  12.20         24.         7.         5.        .19
        ROUTED TO
+                      RA06A1      134.  12.43         24.         7.         5.        .19
        HYDROGRAPH AT
+                       A99P1      238.  12.23         39.        12.         8.        .25
        ROUTED TO
+                      RA99P1      225.  12.37         39.        12.         8.        .25
        HYDROGRAPH AT
+                       A99P2      187.  12.23         38.        12.         9.        .23
        HYDROGRAPH AT
+                        A99Q       15.  12.77          6.         2.         1.        .12
        5 COMBINED AT
+                      CA99P2     1931.  12.67        596.       183.       133.       5.30
 1
                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                          INTERPOLATED TO
                                                                      COMPUTATION INTERVAL
          ISTAQ    ELEMENT      DT        PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                     PEAK

                               (MIN)     (CFS)     (MIN)      (IN)     (MIN)     (CFS)     (MIN)       (IN)

        FOR STORM = 1  STORM AREA (SQ MI) =        .00
           RA09C  MANE          2.00    303.97    796.00       .97      2.00    303.97    796.00        .97

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .4514E+02 EXCESS= .0000E+00 OUTFLOW= .4493E+02 BASIN STORAGE= .9888E-03
PERCENT ERROR=    .5

        FOR STORM = 2  STORM AREA (SQ MI) =      10.00
           RA09C  MANE          2.00    277.37    804.00       .90      2.00    277.37    804.00        .90

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .4157E+02 EXCESS= .0000E+00 OUTFLOW= .4139E+02 BASIN STORAGE= .1044E-02
PERCENT ERROR=    .4

        FOR STORM = 1  STORM AREA (SQ MI) =        .00
          RA07G2  MANE          2.00     18.61    738.00      2.05      2.00     18.61    738.00       2.05

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .3056E+01 EXCESS= .0000E+00 OUTFLOW= .3056E+01 BASIN STORAGE= .2316E-03
PERCENT ERROR=    .0

        FOR STORM = 2  STORM AREA (SQ MI) =      10.00
          RA07G2  MANE          2.00     17.43    738.00      1.93      2.00     17.43    738.00       1.93

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .2877E+01 EXCESS= .0000E+00 OUTFLOW= .2877E+01 BASIN STORAGE= .2309E-03
PERCENT ERROR=    .0

        FOR STORM = 1  STORM AREA (SQ MI) =        .00
          RA07F1  MANE           .69     94.33    736.13      1.85      2.00     94.29    736.00       1.85
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```
 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1614E+02 EXCESS= .0000E+00 OUTFLOW= .1614E+02 BASIN STORAGE= .6519E-04
PERCENT ERROR=    .0

          FOR STORM = 2  STORM AREA (SQ MI) =      10.00
            RA07F1  MANE          .70     88.10    736.44      1.73      2.00     88.04    736.00        1.73

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1516E+02 EXCESS= .0000E+00 OUTFLOW= .1516E+02 BASIN STORAGE= .6488E-04
PERCENT ERROR=    .0

          FOR STORM = 1  STORM AREA (SQ MI) =        .00
            RA07E7  MANE         1.29     99.67    736.95      1.89      2.00     99.58    736.00        1.89

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1713E+02 EXCESS= .0000E+00 OUTFLOW= .1713E+02 BASIN STORAGE= .1238E-03
PERCENT ERROR=    .0

          FOR STORM = 2  STORM AREA (SQ MI) =      10.00
            RA07E7  MANE         1.30     93.13    736.59      1.78      2.00     93.03    736.00        1.78

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1610E+02 EXCESS= .0000E+00 OUTFLOW= .1610E+02 BASIN STORAGE= .1239E-03
PERCENT ERROR=    .0

          FOR STORM = 1  STORM AREA (SQ MI) =        .00
            RA07E7  MANE          .81    169.12    733.24      2.07      2.00    168.97    734.00        2.07

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .2453E+02 EXCESS= .0000E+00 OUTFLOW= .2453E+02 BASIN STORAGE= .8527E-04
PERCENT ERROR=    .0

          FOR STORM = 2  STORM AREA (SQ MI) =      10.00
            RA07E7  MANE          .82    158.71    733.63      1.95      2.00    158.56    734.00        1.95

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .2308E+02 EXCESS= .0000E+00 OUTFLOW= .2308E+02 BASIN STORAGE= .8526E-04
PERCENT ERROR=    .0


 *** NORMAL END OF HEC-1 ***
```

APPENDIX C.8 – Design Concept Report HEC-1 Model Review

Hydrologic Changes to HEC-1 Model

Project Name: 115th Avenue and Union Hills Drive Drainage Improvements

Subject: This memorandum documents that were made to the HEC-1 model from the Goodwin-Marshall analysis.

LOCATIONS

Changes to the HEC-1 model

This area has been studied many times over the last 20 years, but it has not been done to the District's GIS standards. I wanted to get one model in that format for ease of District review and resolution to any District comments. As the hydrologic parameters were being coded into ArcMAP, I noticed issues with delineations and routing reaches. The previous model was sufficient for conceptual alternatives, but not for final design. The following documents changes made to the Goodwin-Marshall (G-M) model.

Drainage Basin Changes

A07F2 – This basin was modified and the golf course was removed, there is a large basin that retains the water. The concentration point for this basin was moved west on Union Hills Drive to where the grate inlet collects flow. The new basin accounts for more drainage from Sun City based on Field Recon.

A07C1 – This is a new basin accounting for 111th Avenue roadway drainage and the COP storage basin.

A09C – This basin was modified based on field observations, aerial mapping and topography.

A07F1 & A07E6 - These basins were modified because the lots along the western side of Sun City drain into a channel that flows south into the concrete channel.

A07E5 (A07E5 &A07B3) – G-M basin ID was changed to A07E2. The basins were modified for the Sun City Wall. The areas south of the wall now drain into basin A07B3.

A07B3 – The southern end of this basin was modified based on field observations.

A07B2- This Basin was modified on the northern end because the Union Hills Drive channel does not flow south. A new basin was created A07B7 that accounts for the channel on the southern end of Union Hills Drive that flows into the arch culvert.

A07C2 – This southern end of this basin was modified to the north side of Union Hills Drive. The road drains into basin A07B2.

A07B4 – The basin was modified on the northern end along the roadway. The channel on the southern end drains to the 115th Avenue channel.

A07B5 – This basin was modified for the commercial property northwest of Bell Road and 115th Ave based on field recon.

Hydrologic Changes to HEC-1 Model

A07B6 – This basin was greatly changed, Sun City drains into the Sun City drain and not into this basin as configured in the G-M delineation.

S30 – This was also greatly modified because field observations reveal Sun City drains into the Sun City drain. A concentration point was put at the Sun City drain right at the Sun City limits, just upstream of the drop in the drain.

A06A - This basin was divided into three basins and reflects results of our field investigations. Sun City drains to the golf course (we verified location in the field). This drainage flows south into the RV compound and then into the channel. This is much different than the G-M (and all previous) delineations. This delineation was never updated in any previous model because the area was not a concern for any drainage improvement.

A06 – This basin as divided into two basins, the first basin is the Rose Garden Mobile Home Resort and the second basin accounts for the area between the proposed levee and the park, which drains around the park and then into the channel.

A99P – This basin was divided into two basins accounting for Sun City drainage into the RV park.

Routing Changes

This table shows the routes that did not match from the updated GIS information and the G-M HEC-1 model.

Route ID	Updated GIS Data USGE	DSGE	LENGTH	SLOPE	G-M HEC-1 Model LENGTH	SLOPE
RA07E7	1219.00	1210.00	1042.2	0.0086	1820.00	0.0042
RA07G2	1230.00	1229.00	1632.0	0.0006	1400.00	0.0107
RA07D	1180.00	1170.00	2041.2	0.0049	1800.00	0.0017
RA07B3	1200.00	1170.00	2417.8	0.0124	3600.00	0.0075
RA07B1	1170.00	1165.00	1628.3	0.0031	1800.00	0.0017
RA07B2	1170.00	1165.00	2387.9	0.0021	800.00	0.0075
RA07B4	1165.00	1160.00	1476.1	0.0034	1285.00	0.0025
RS30	1195.00	1168.00	1257.7	0.0215	691.00	0.0058
RS30B	1210.00	1195.00	4112.5	0.0036	5060.00	0.0008
RA07E1	1208.00	1201.00	1470.7	0.0048	1200.00	0.0025
RA07E4	1203.00	1193.00	1605.4	0.0062	1771.00	0.0040
RA07E3	1218.00	1204.00	1834.9	0.0076	1650.00	0.0048
RA07E6	1222.00	1210.00	1949.7	0.0062	1400.00	0.0057
RA07F1	1221.00	1220.00	352.9	0.0028	2619.00	0.0042
RA07F2	1221.00	1220.00	388.9	0.0026	800.00	0.0042
RA07G1	1210.00	1201.00	2547.8	0.0035	2439.00	0.0012
RA07H	1200.00	1185.00	3126.4	0.0048	2386.00	0.0461
RA09E	1238.00	1220.00	2597.0	0.0069	2700.00	0.0041
RA09F	1240.00	1238.00	1618.7	0.0012	3031.00	0.0020

Hydrologic Changes to HEC-1 Model

Split Flow Changes

Split at Beardsley and 115th Avenue (Diversion DA09A0) – This split was reversed so the diverted flow (140 cfs) is diverted out of the updated model. The 140 cfs was determined previously as the capacity of the 2-36" CMPs.

Split at 99th Avenue and Beardsley Road (Diversion DA09F) – This diversion was not changed from the previous model. The Beardsley Channel collects all the flow and no flow overtops the roadway and south into Sun City.

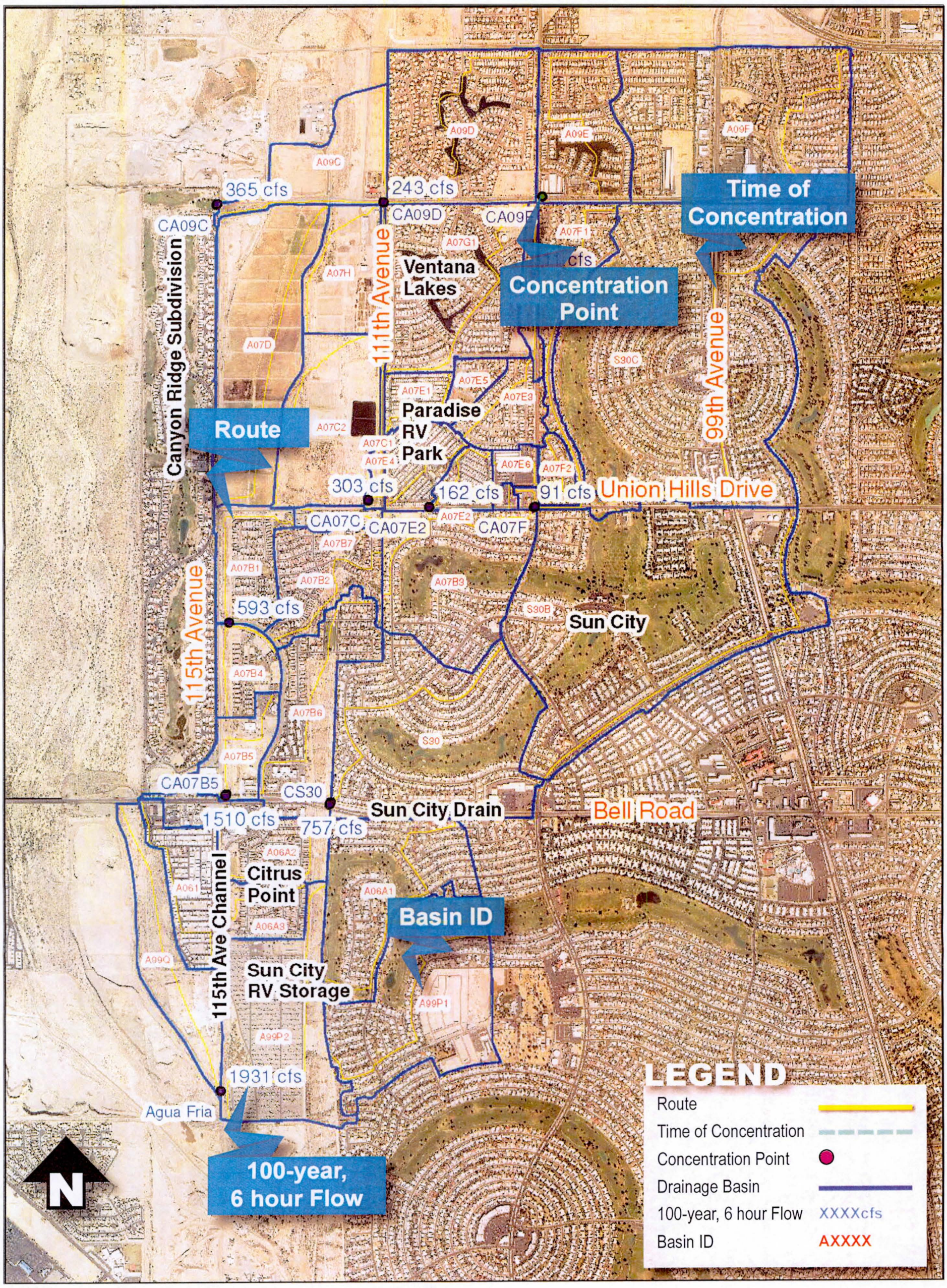
Split at 99th Avenue and Del Webb Blvd (Diversion DS30BO) – This diversion remains from the G-M model and was originally developed in the ADMP model. The 4-48" inch RCP's can convey 550 cfs, the remaining flow overtops the roadway and continues down 99th and not into the 115th Avenue channel.

Split at Bell Road and Del Webb Blvd (Diversion DS30AO) - This diversion remains from the G-M model and was originally developed in the ADMP model. The 4-48" inch RCP's can convey 550 cfs, the remaining flow overtops the roadway and continues across Bell Road and into Sun City golf courses, not into the 115th Avenue channel.

APPENDIX C.9

Figure 2 – HEC-1 100 Yr Flows (With Improvements)

Figure 2
115th Avenue and Union Hills Drive
HEC-1 100-year Flow
(With Improvements)



APPENDIX D – Hydraulic Analysis

D.1 Beardsley Channel Existing HEC-RAS

D.2 Sun City Drain HEC-RAS

D.3 Union Hills Drive StormCAD

D.4 115th Avenue StormCAD

D.5 111th Avenue Culvertmaster

D.6 Union Hills Drive Culvertmaster

D.7 115th Avenue Channel South of Bell Road HEC-RAS

D.8 115th Avenue and Canyon Ridge Unsteady HEC-RAS

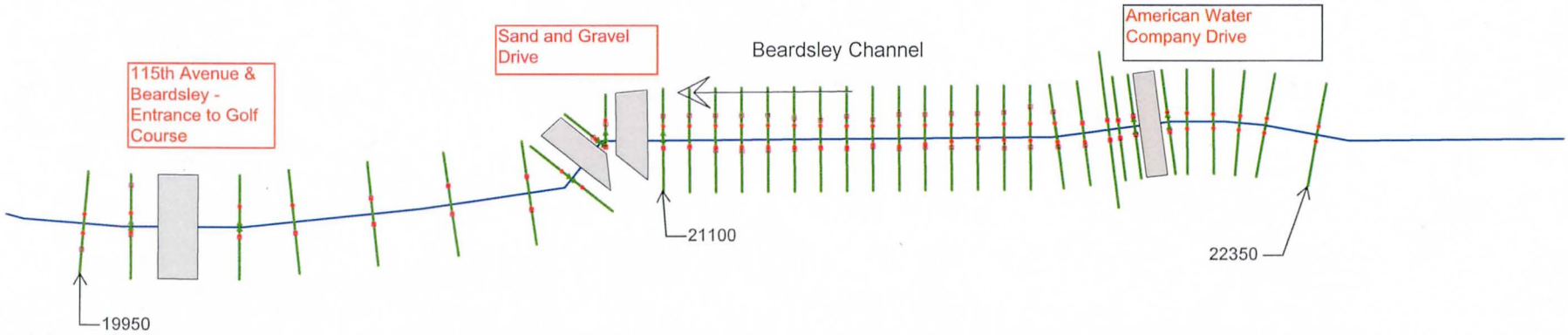
D.9 Proposed Beardsley Road HEC-RAS

D.10 Riprap Calculations

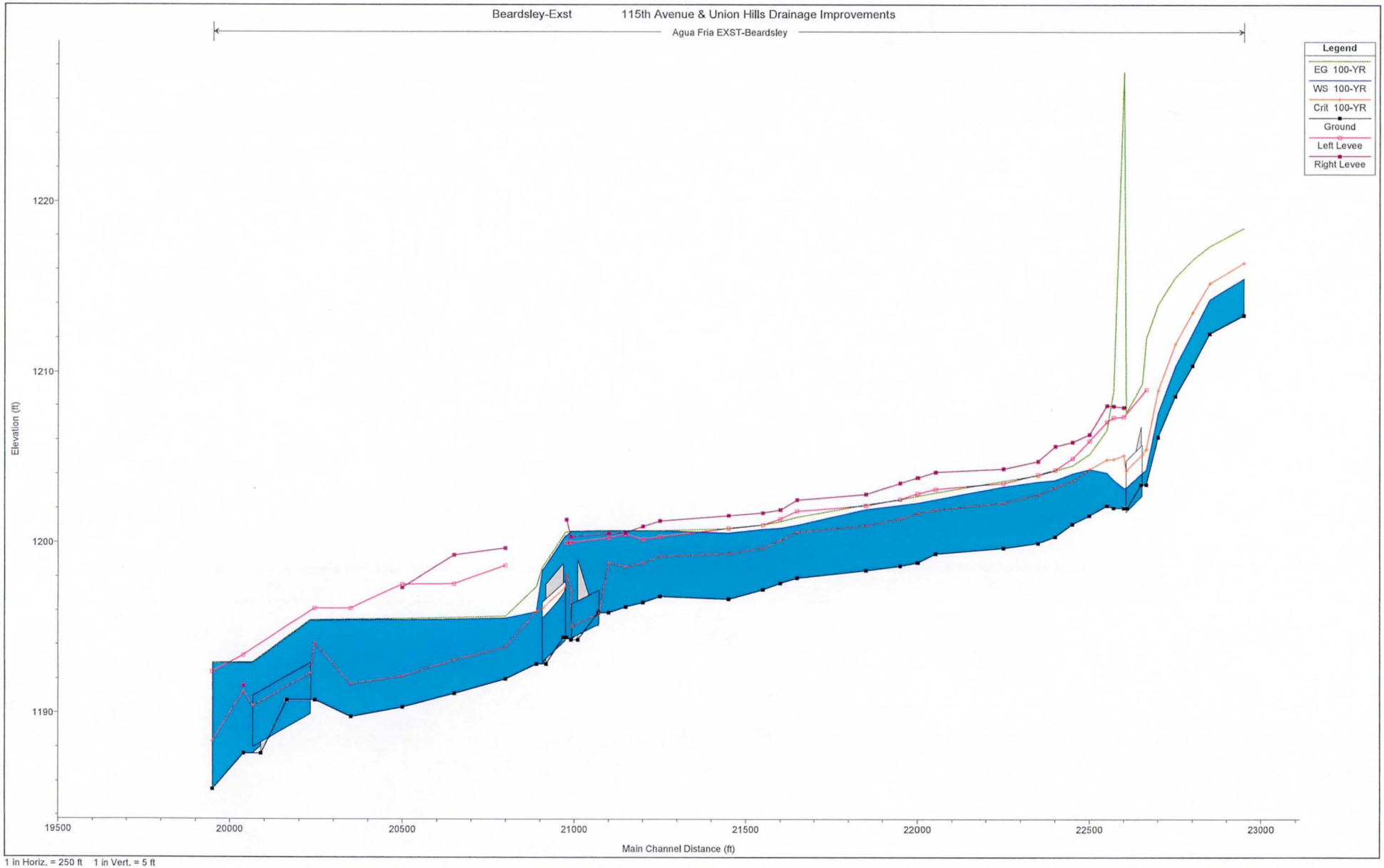
D.11 Figure 3 – Hydraulic Models

APPENDIX D.1 – Beardsley Channel Existing HEC-RAS

Beardsley-Exst



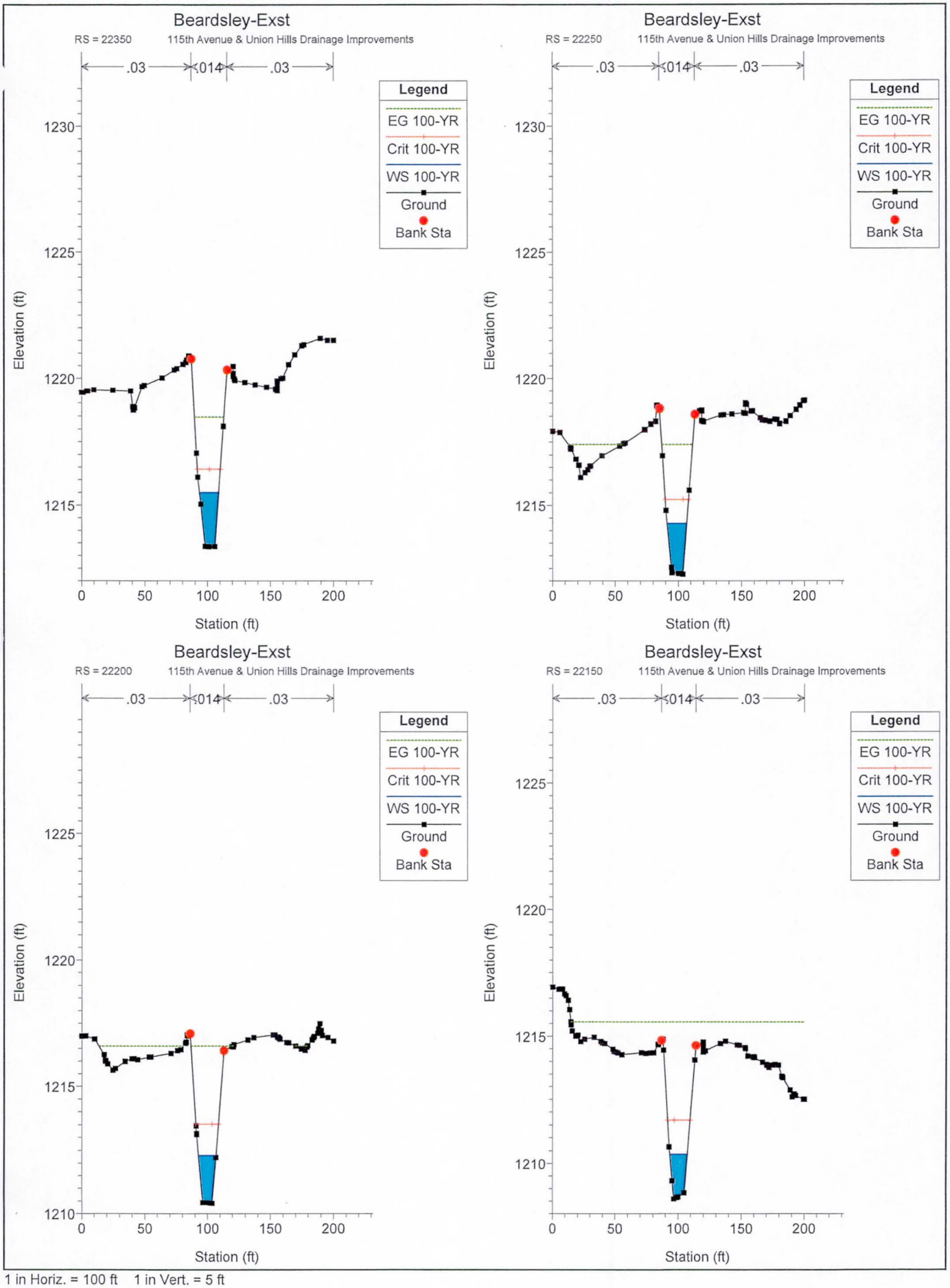
1 in Horiz. = 200 ft 1 in Vert. = 200 ft



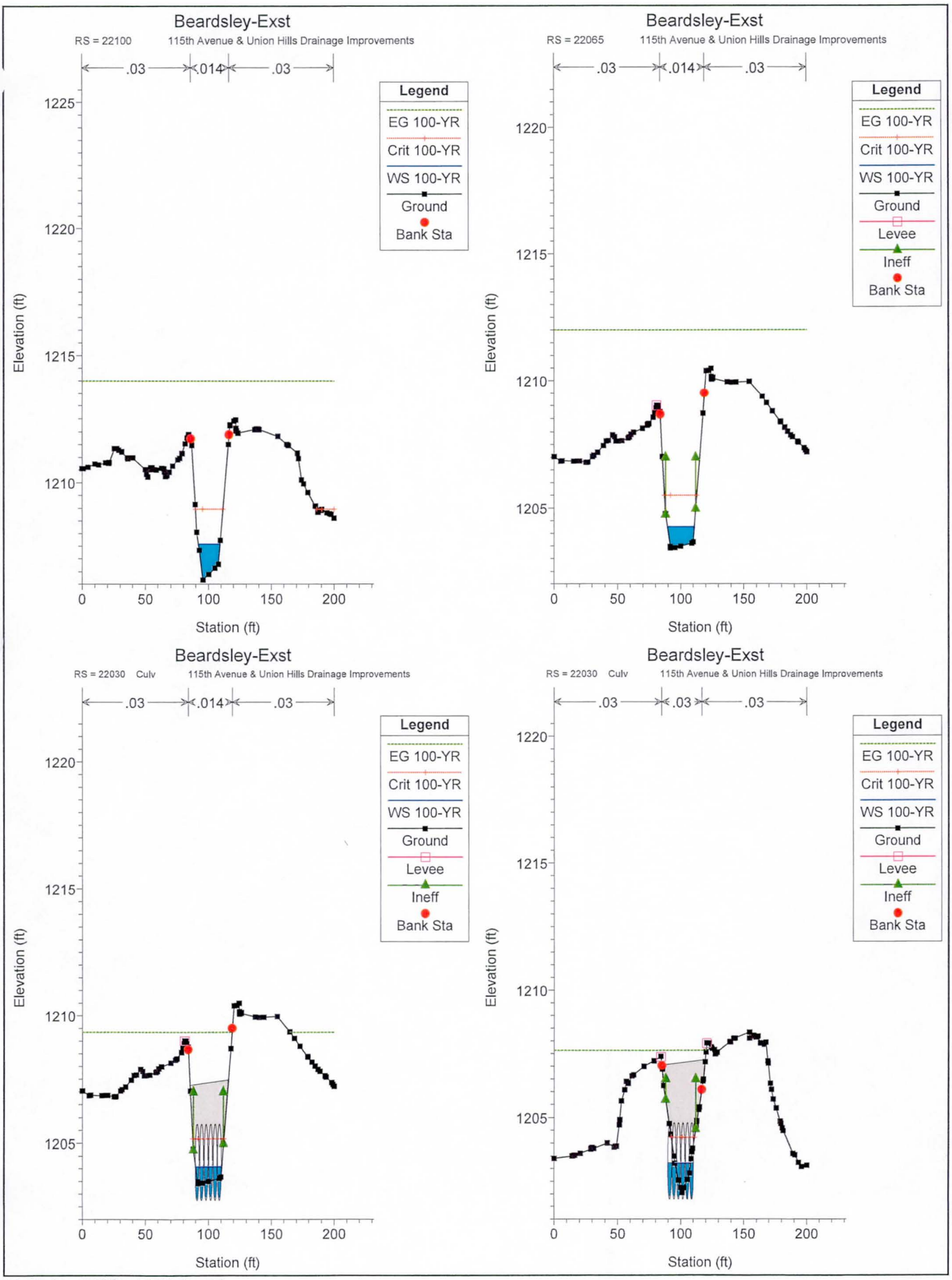
1 in Horiz. = 250 ft 1 in Vert. = 5 ft

HEC-RAS Plan: EXST-W-LEVEES River: Agua Fria Reach: EXST-Beardsley Profile: 100-YR

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
EXST-Beardsley	22350	100-YR	336.00	1213.35	1215.50	1216.42	1218.46	0.010016	13.82	24.31	15.25	1.93
EXST-Beardsley	22250	100-YR	336.00	1212.27	1214.28	1215.23	1217.40	0.011008	14.17	23.71	15.46	2.02
EXST-Beardsley	22200	100-YR	336.00	1210.41	1212.32	1213.54	1216.61	0.016551	16.63	20.21	14.04	2.44
EXST-Beardsley	22150	100-YR	336.00	1208.59	1210.37	1211.70	1215.57	0.022203	18.29	18.37	13.86	2.80
EXST-Beardsley	22100	100-YR	336.00	1206.17	1207.58	1208.96	1213.99	0.039902	20.31	16.54	17.14	3.64
EXST-Beardsley	22065	100-YR	336.00	1203.42	1204.27	1205.50	1212.01	0.072796	22.34	15.04	21.52	4.71
EXST-Beardsley	22030		Culvert									
EXST-Beardsley	22000	100-YR	336.00	1202.05	1203.23	1205.13	1227.62	1.111174	39.63	8.48	12.56	8.50
EXST-Beardsley	21970	100-YR	336.00	1202.06	1203.70	1204.90	1208.89	0.139623	18.29	18.37	18.35	3.22
EXST-Beardsley	21950	100-YR	336.00	1202.19	1204.11	1204.88	1206.57	0.046489	12.59	26.68	20.26	1.93
EXST-Beardsley	21900	100-YR	336.00	1201.59	1204.32	1204.32	1205.19	0.011333	7.51	44.74	25.58	1.00
EXST-Beardsley	21850	100-YR	336.00	1201.09	1204.06	1203.61	1204.52	0.005464	5.43	61.93	33.68	0.71
EXST-Beardsley	21800	100-YR	336.00	1200.36	1203.66	1203.26	1204.22	0.005947	5.99	56.33	29.12	0.74
EXST-Beardsley	21750	100-YR	336.00	1199.97	1203.58	1202.81	1203.95	0.003327	4.94	70.98	36.85	0.57
EXST-Beardsley	21700	100-YR	336.00	1199.69	1203.28	1202.35	1203.62	0.002983	4.67	72.67	40.23	0.54
EXST-Beardsley	21650	100-YR	336.00	1199.36	1202.53	1201.93	1202.93	0.003960	5.13	67.21	34.79	0.62
EXST-Beardsley	21600	100-YR	336.00	1198.84	1202.33	1201.73	1202.73	0.004220	5.04	66.82	34.49	0.63
EXST-Beardsley	21550	100-YR	336.00	1198.64	1202.20	1201.39	1202.52	0.003252	4.52	74.32	35.93	0.55
EXST-Beardsley	21500	100-YR	336.00	1198.37	1201.95	1201.01	1202.22	0.002460	4.19	81.01	38.41	0.49
EXST-Beardsley	21450	100-YR	336.00	1197.94	1201.01	1200.62	1201.48	0.005802	5.48	61.26	34.29	0.72
EXST-Beardsley	21400	100-YR	336.00	1197.64	1200.85	1200.13	1201.21	0.003930	4.82	69.71	35.29	0.60
EXST-Beardsley	21350	100-YR	336.00	1197.25	1200.79	1199.70	1201.03	0.002287	3.98	84.50	38.02	0.47
EXST-Beardsley	21300	100-YR	336.00	1196.69	1200.57	1199.37	1200.80	0.002213	3.91	86.02	38.63	0.46
EXST-Beardsley	21250	100-YR	336.00	1196.85	1200.69	1199.22	1200.70	0.000067	0.73	397.83	125.92	0.08
EXST-Beardsley	21200	100-YR	336.00	1196.49	1200.68	1198.83	1200.69	0.000061	0.74	411.74	135.71	0.08
EXST-Beardsley	21150	100-YR	336.00	1196.23	1200.68	1198.58	1200.69	0.000050	0.73	480.80	179.25	0.07
EXST-Beardsley	21100	100-YR	336.00	1195.89	1200.68	1198.83	1200.69	0.000064	0.87	449.30	187.36	0.08
EXST-Beardsley	21031		Culvert									
EXST-Beardsley	20990	100-YR	336.00	1194.29	1200.63	1197.21	1200.66	0.000152	1.48	261.11	100.00	0.13
EXST-Beardsley	20978	100-YR	336.00	1194.44	1200.39	1198.11	1200.60	0.001265	3.70	91.76	26.84	0.34
EXST-Beardsley	20942		Culvert									
EXST-Beardsley	20890	100-YR	336.00	1192.88	1195.95	1195.95	1197.41	0.009314	9.69	34.67	27.92	1.00
EXST-Beardsley	20800	100-YR	336.00	1192.00	1195.57	1193.88	1195.69	0.000828	2.76	121.87	43.69	0.29
EXST-Beardsley	20650	100-YR	336.00	1191.15	1195.50	1193.12	1195.59	0.000484	2.34	143.48	43.57	0.23
EXST-Beardsley	20500	100-YR	336.00	1190.34	1195.47	1192.17	1195.53	0.000265	1.97	170.58	42.00	0.17
EXST-Beardsley	20350	100-YR	336.00	1189.78	1195.45	1191.70	1195.49	0.000173	1.62	231.57	104.23	0.14
EXST-Beardsley	20245	100-YR	336.00	1190.76	1195.42	1194.11	1195.47	0.000287	1.87	205.86	99.10	0.18
EXST-Beardsley	20150		Culvert									
EXST-Beardsley	20040	100-YR	336.00	1187.63	1192.94	1191.29	1192.97	0.000267	1.57	246.20	113.97	0.16
EXST-Beardsley	19950	100-YR	336.00	1185.53	1192.95	1188.38	1192.96	0.000022	0.62	572.17	197.67	0.05



1 in Horiz. = 100 ft 1 in Vert. = 5 ft



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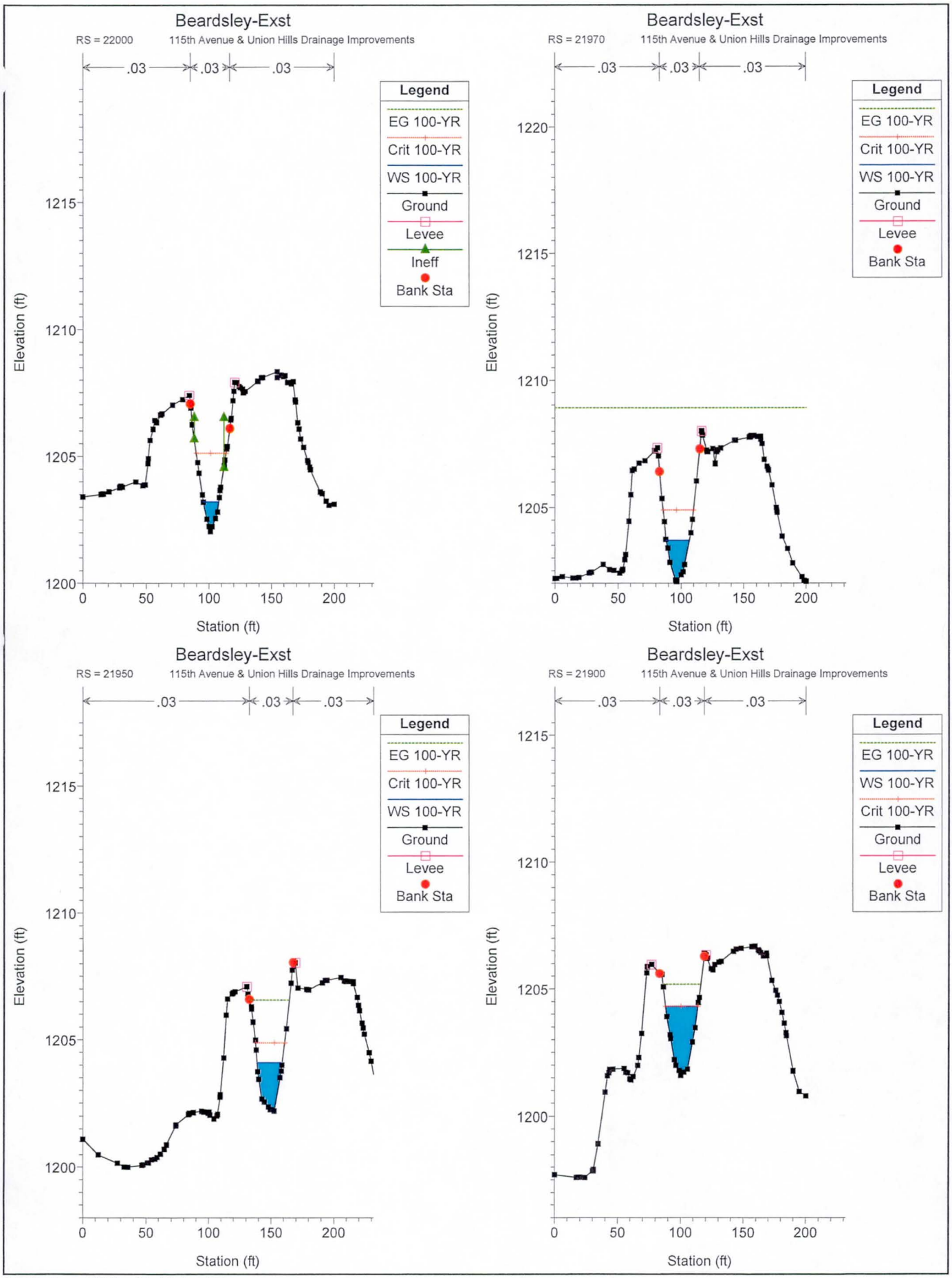

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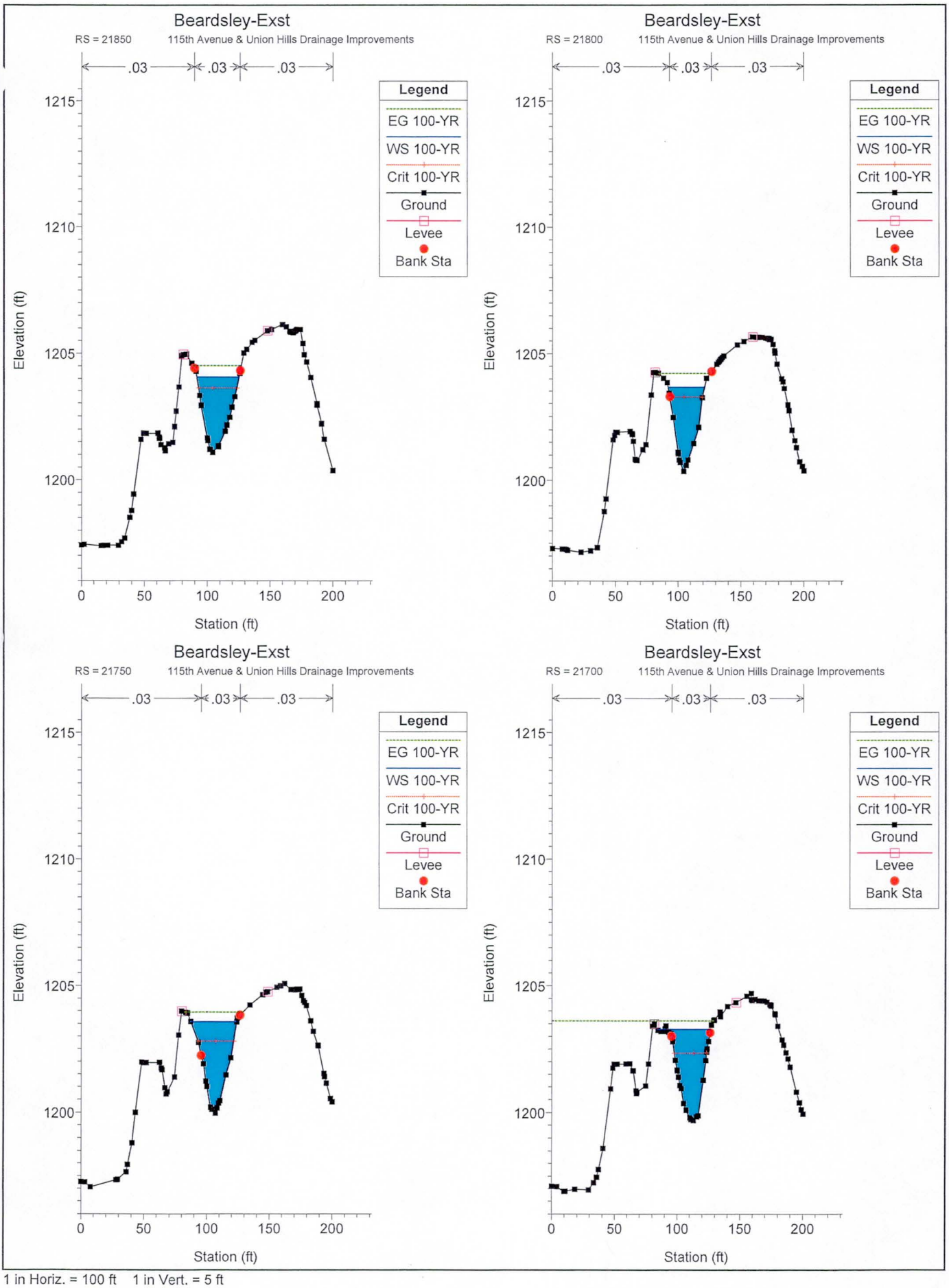

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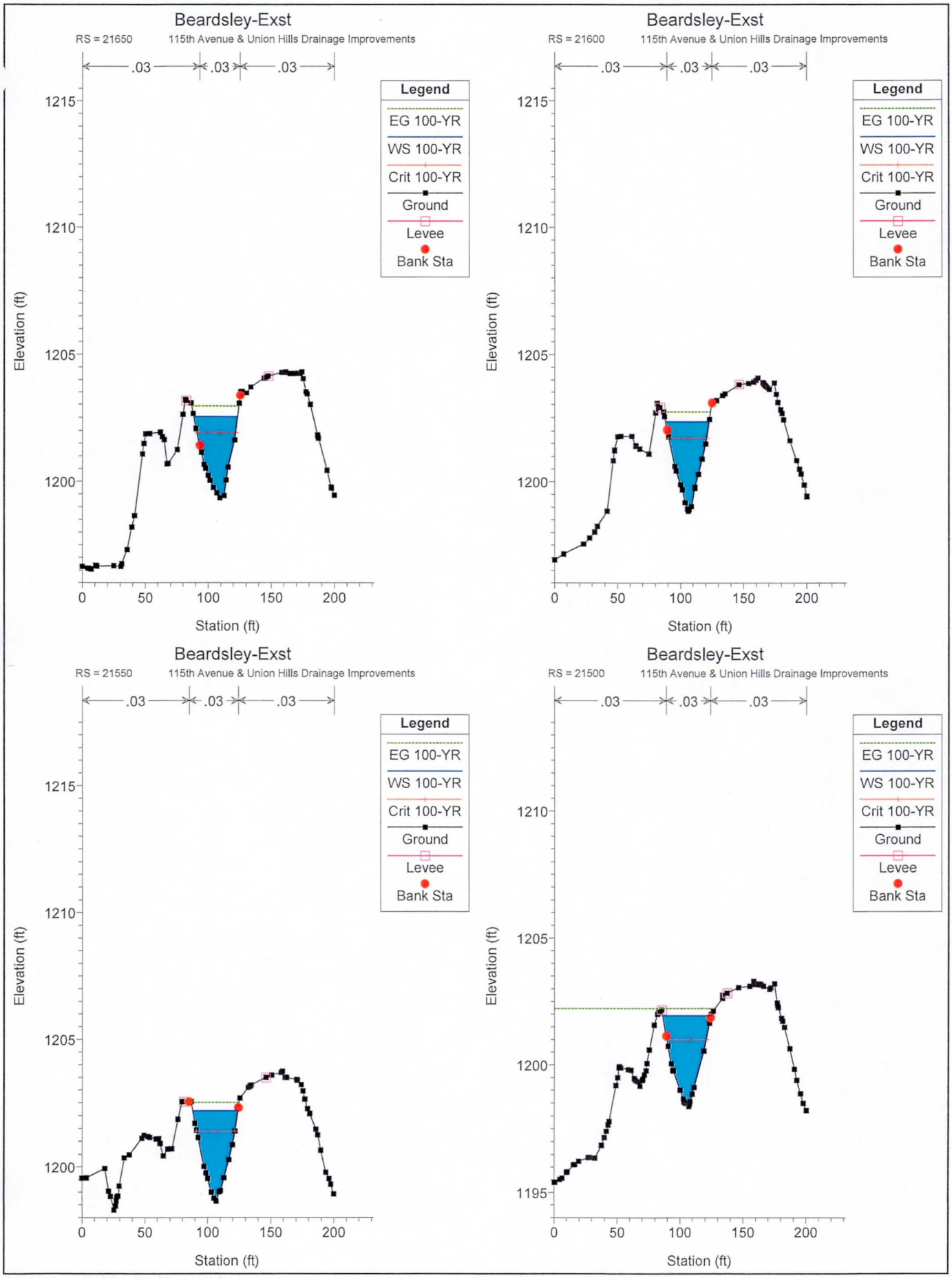

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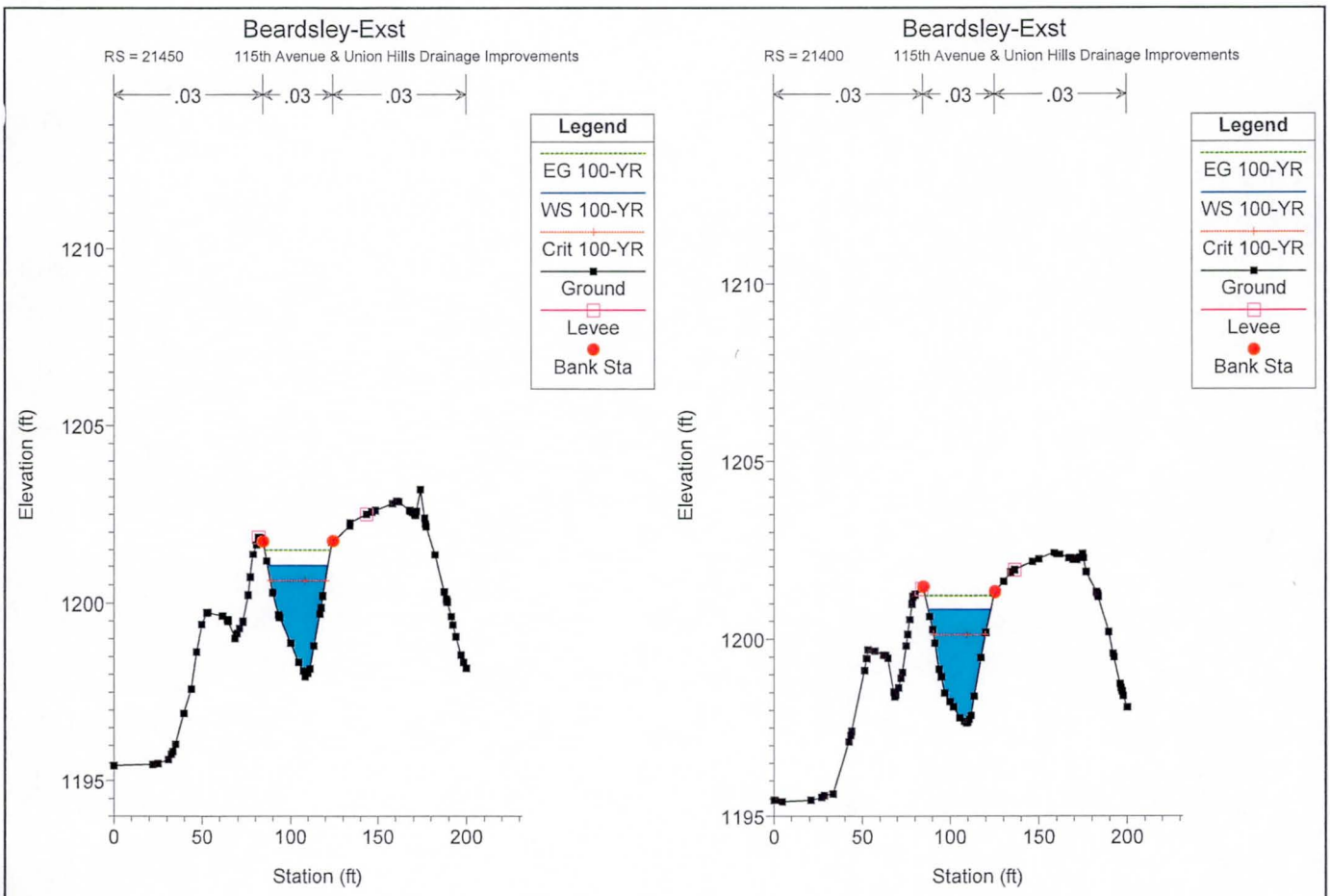

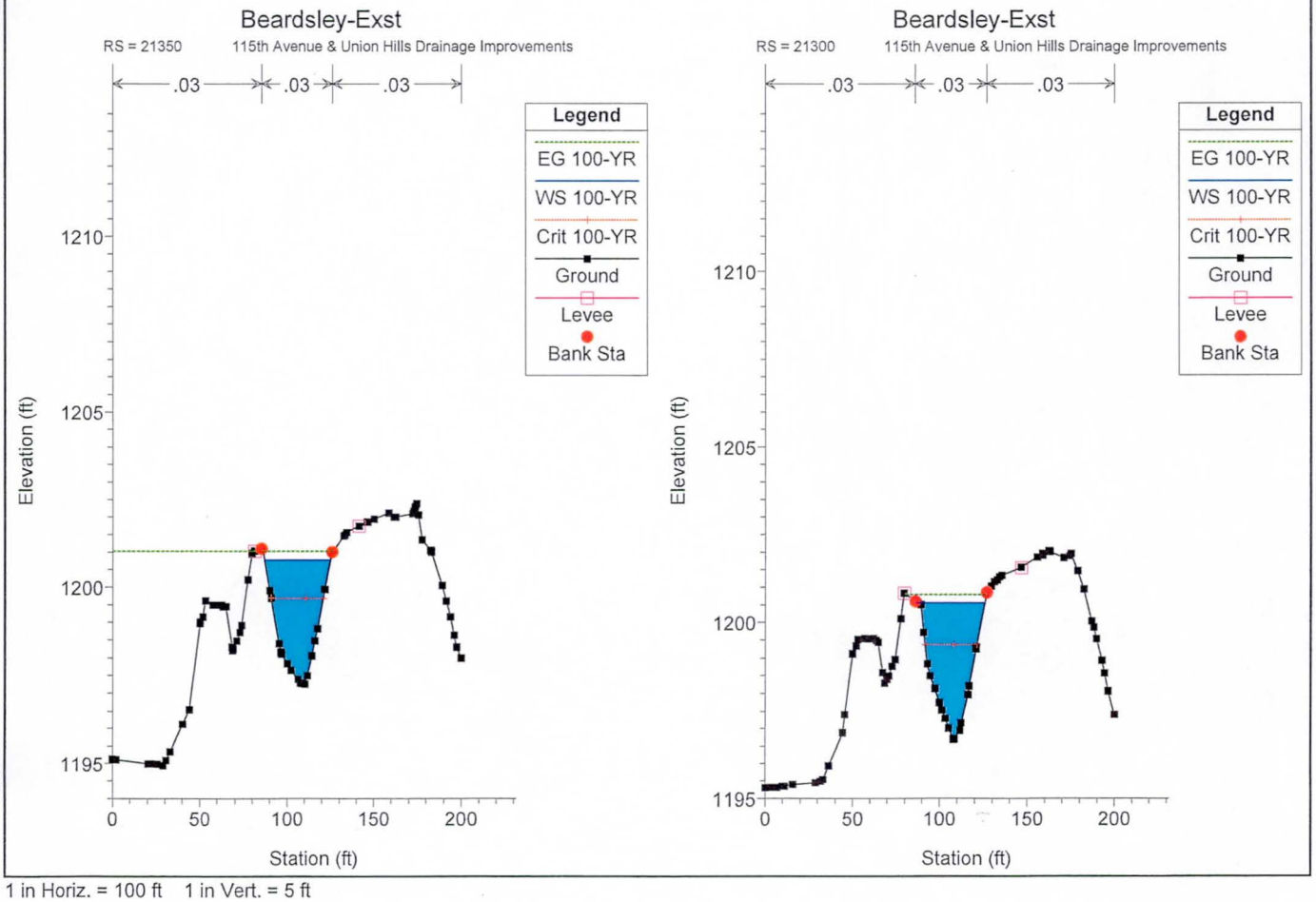

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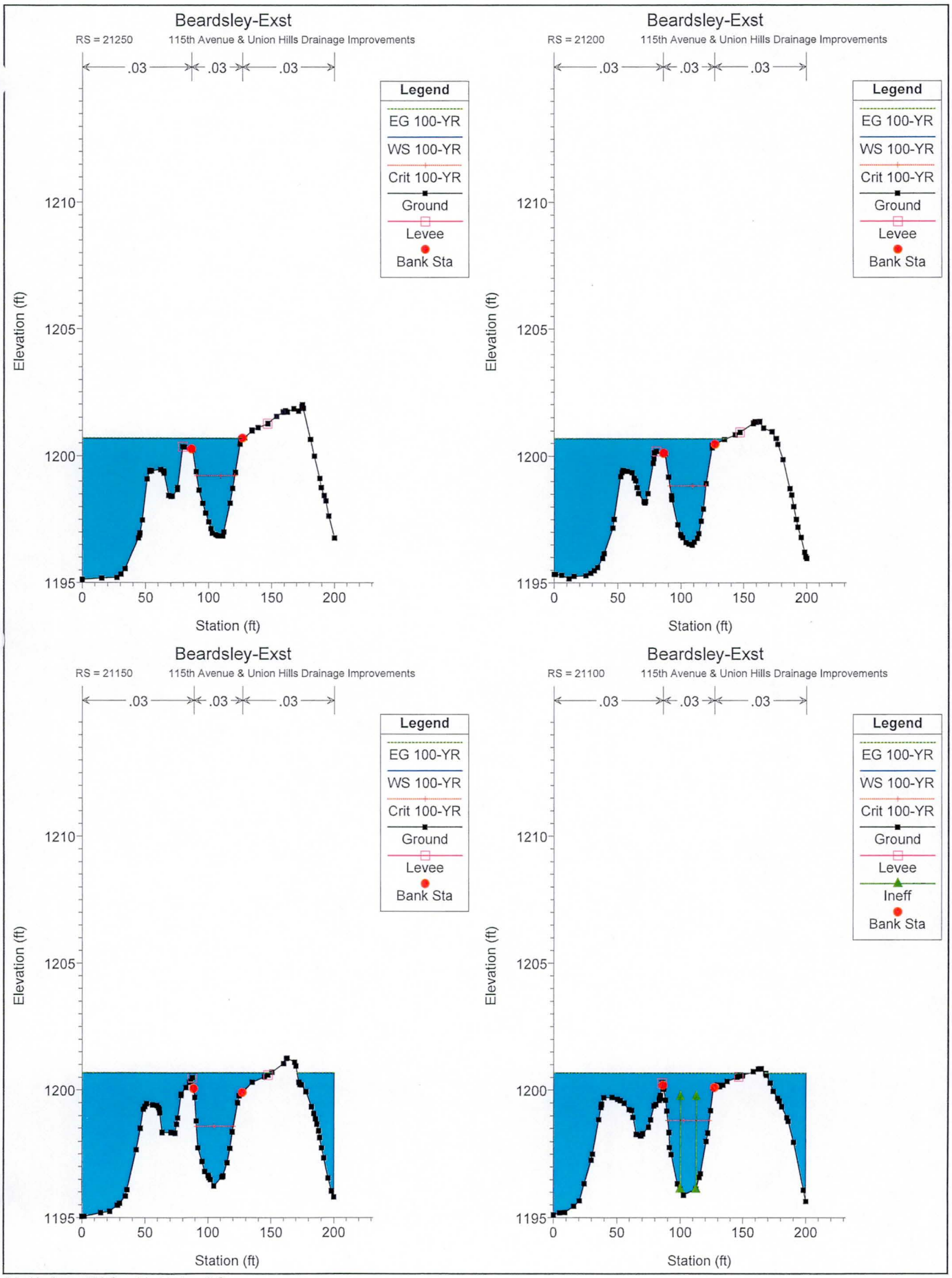

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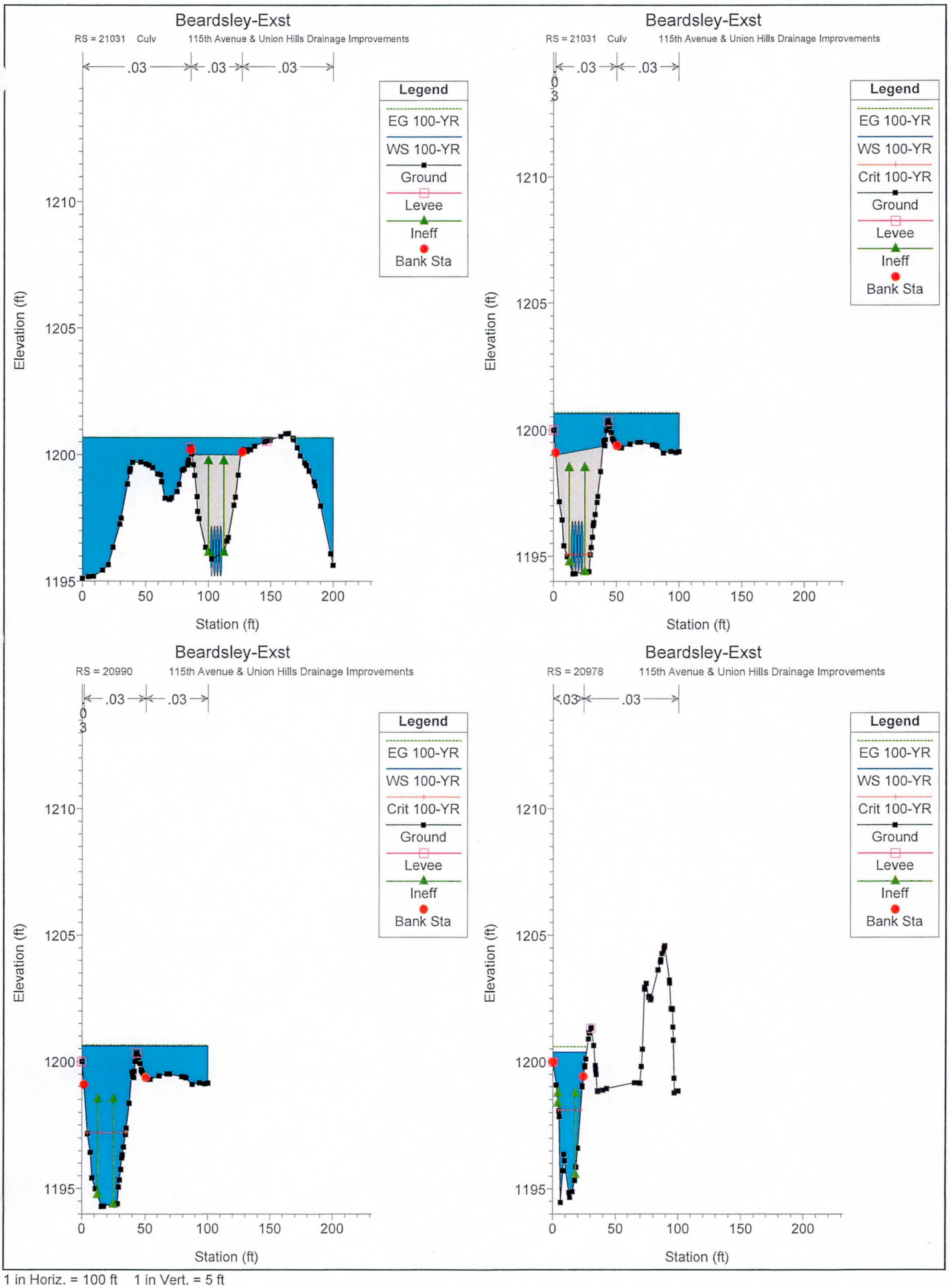
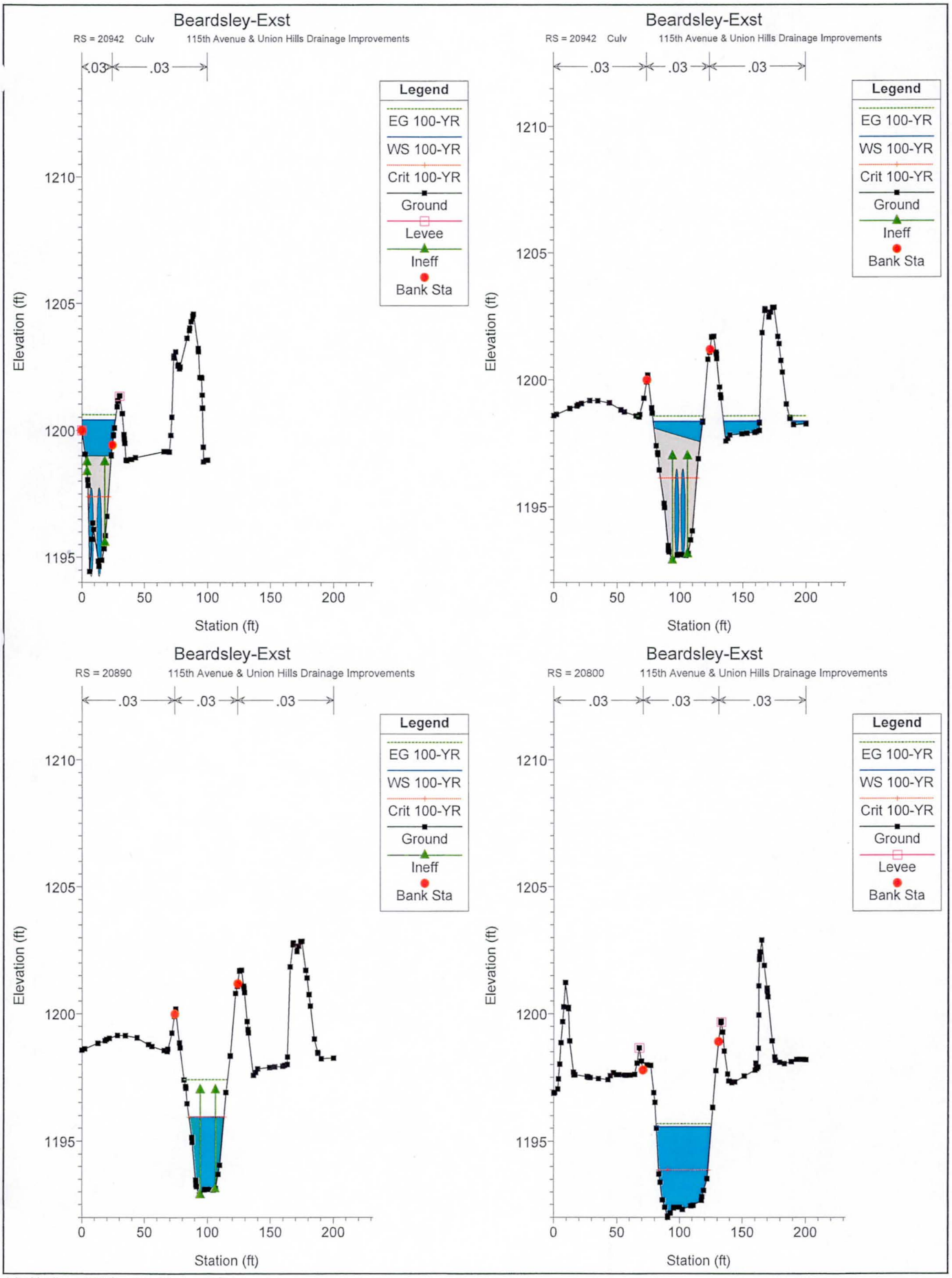


1 in Horiz. = 100 ft 1 in Vert. = 5 ft



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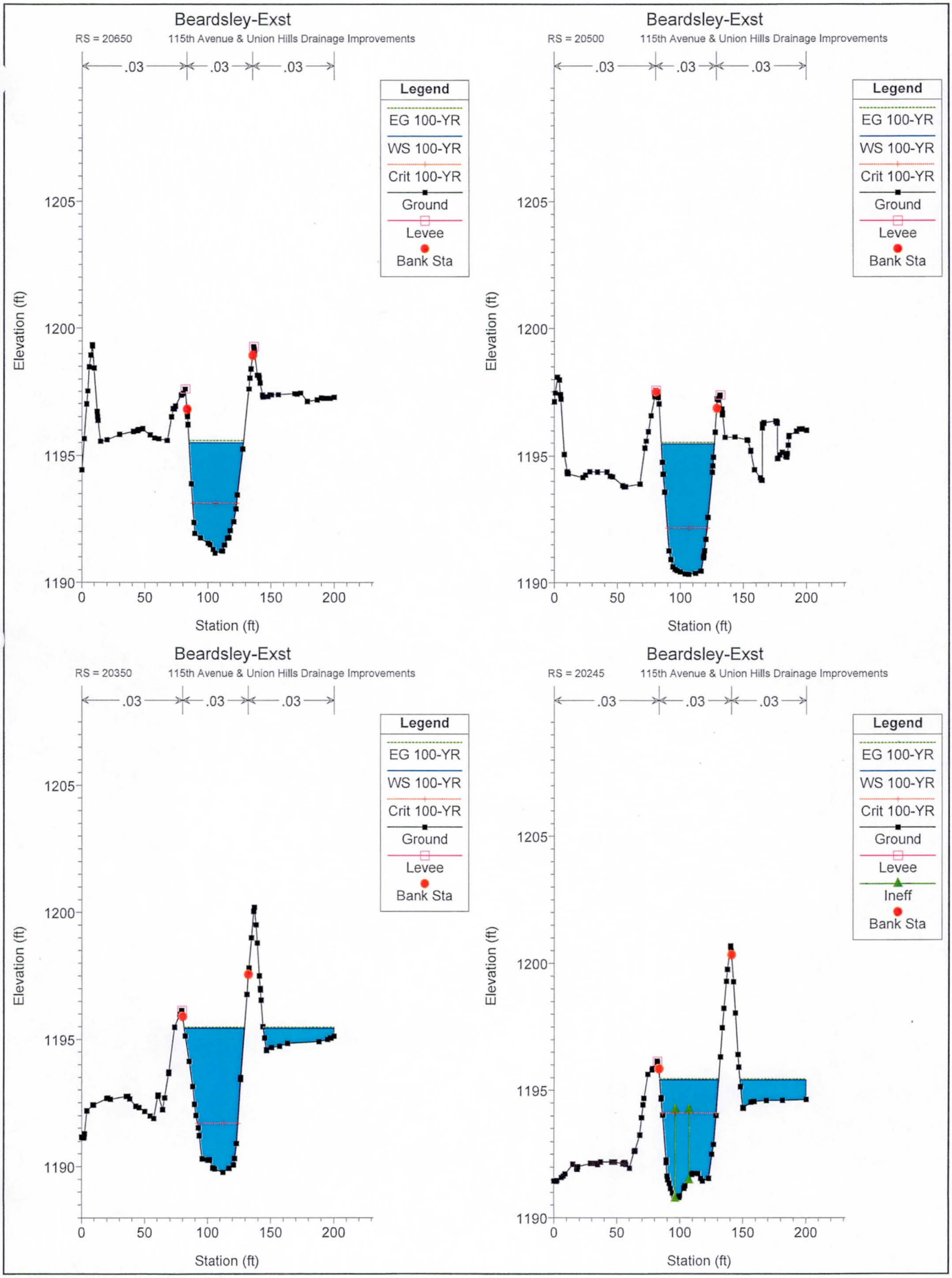

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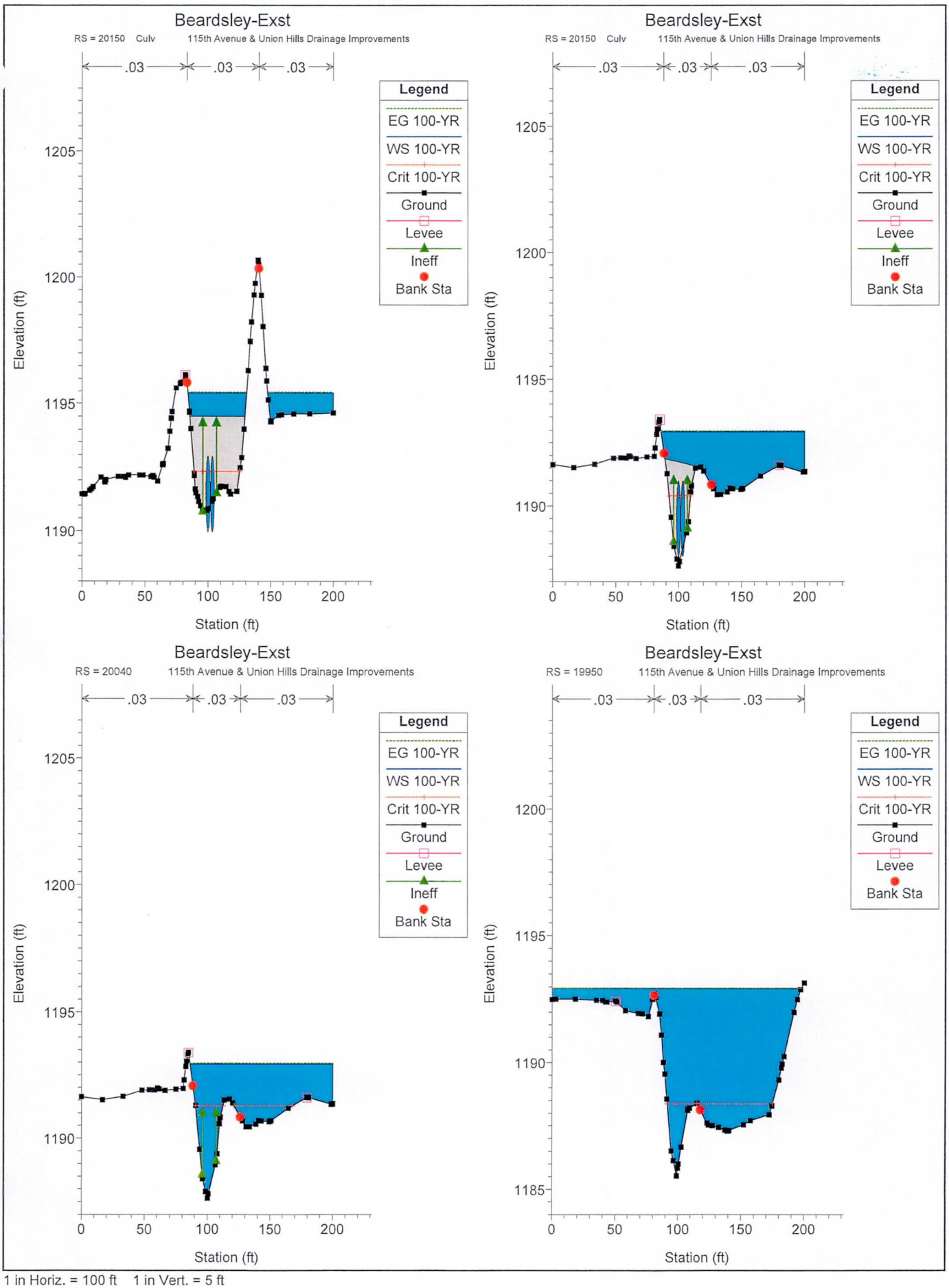
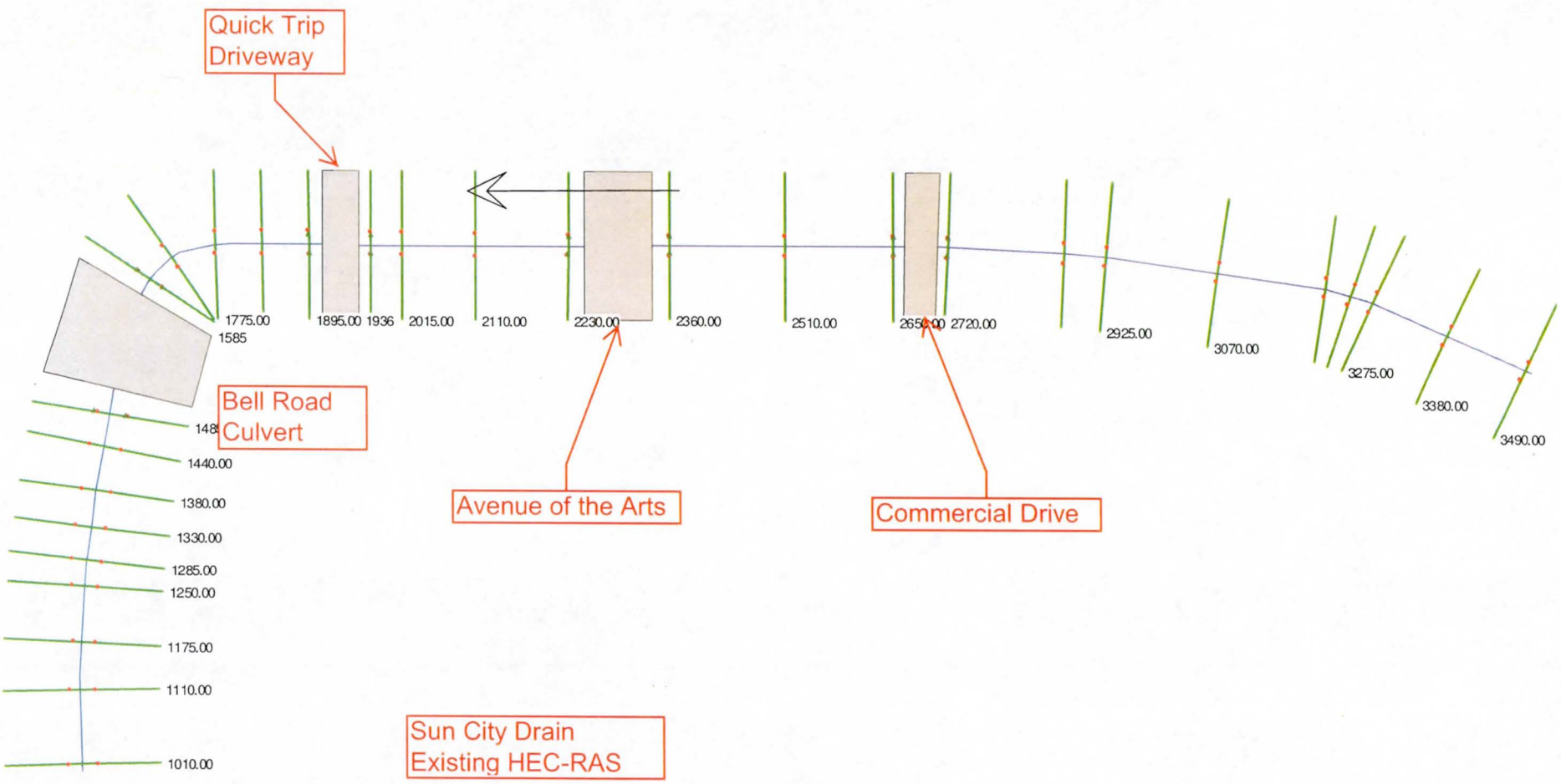


1 in Horiz. = 100 ft 1 in Vert. = 5 ft

APPENDIX D.2 – Sun City Drain HEC-RAS

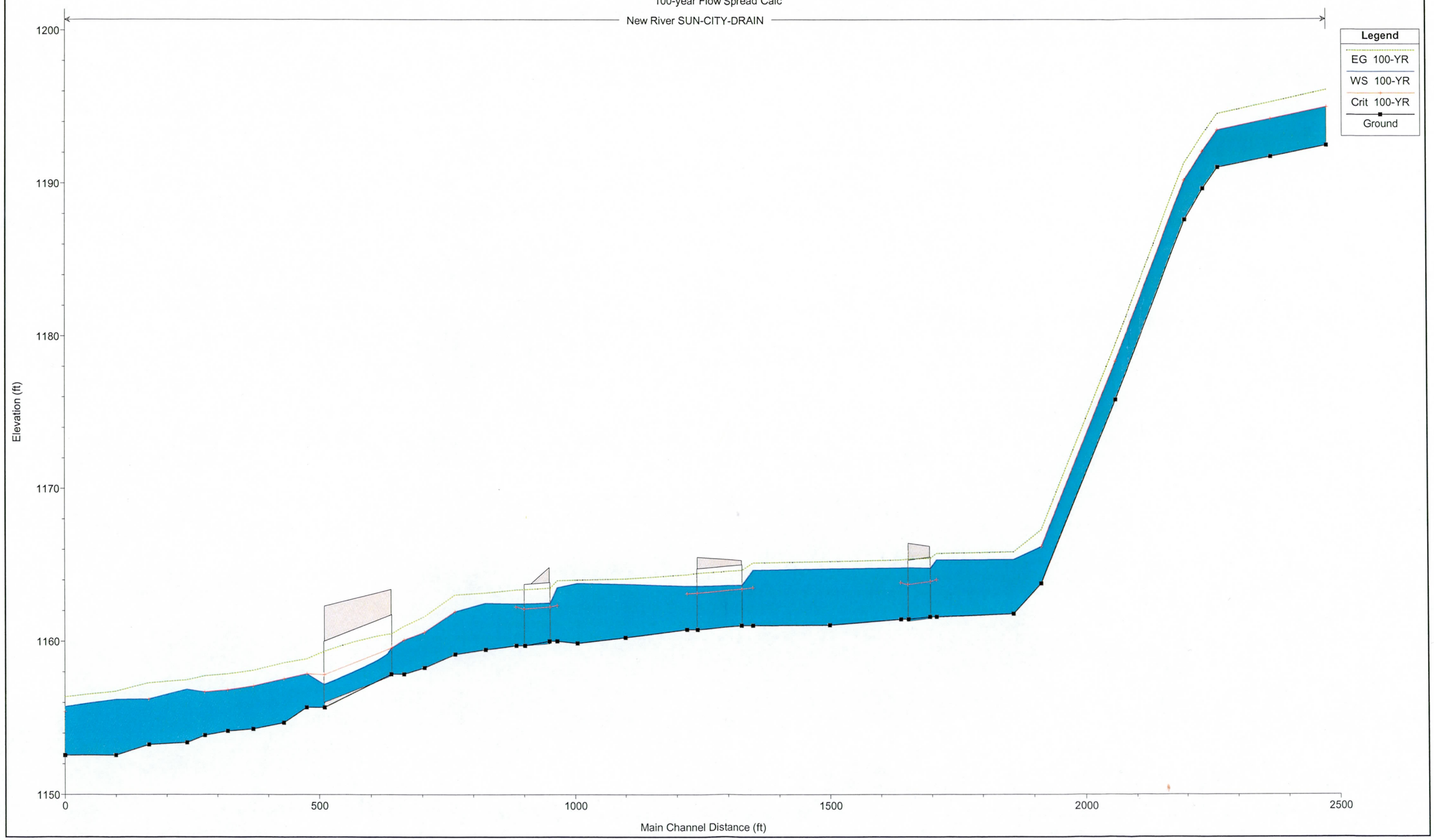

Quick Trip
Driveway
1775.00
1585
1895.00
1936
2015.00
2110.00
2230.00
2360.00
2510.00
2650.00
2720.00
2925.00
3070.00
3275.00
3380.00
3490.00
Bell Road
Culvert
1440.00
1380.00
1330.00
1285.00
1250.00
1175.00
1110.00
1010.00
Avenue of the Arts
Commercial Drive
Sun City Drain
Existing HEC-RAS

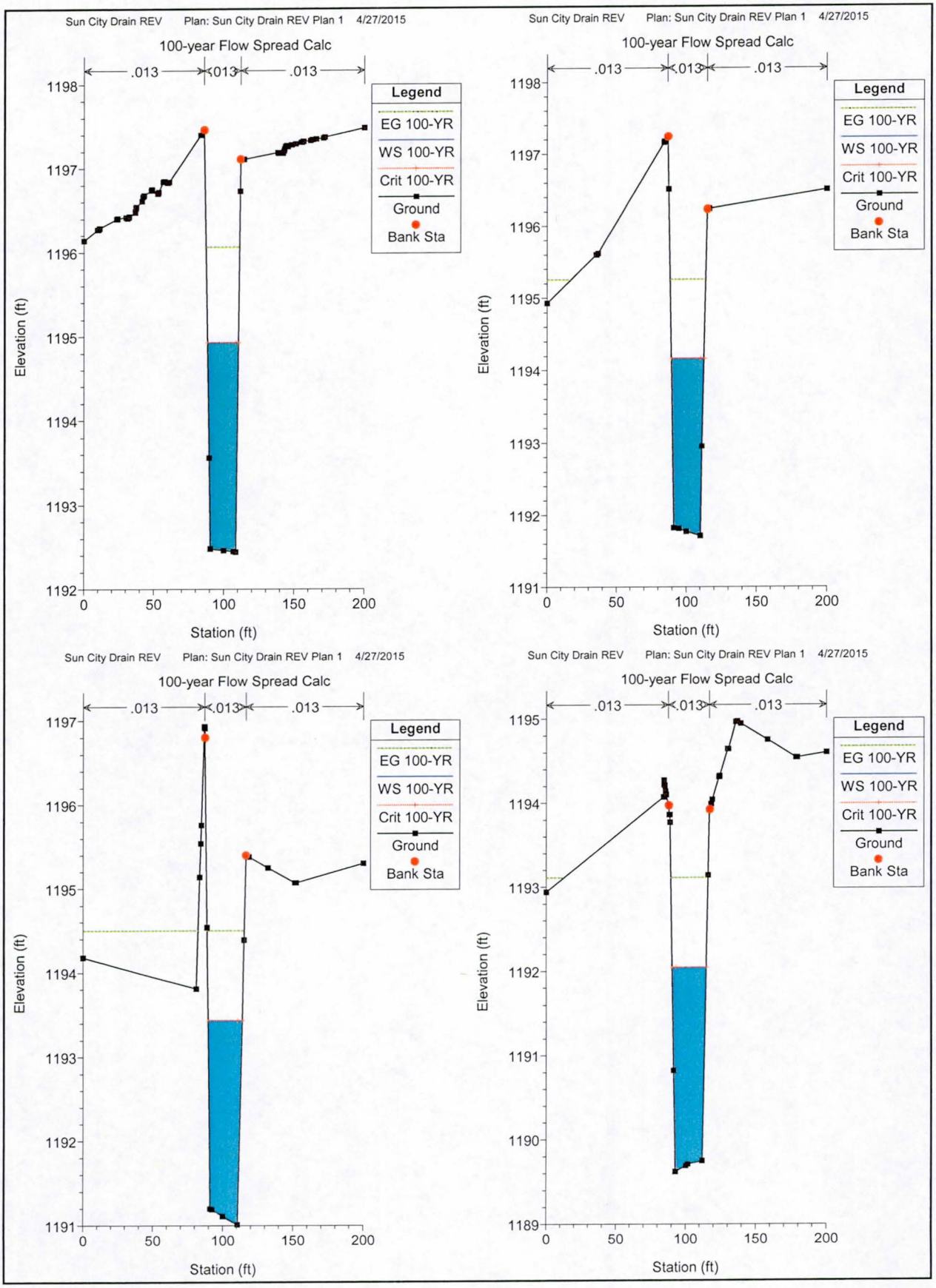
HEC-RAS Plan: SCDrev1 River: New River Reach: SUN-CITY-DRAIN Profile: 100-YR

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SUN-CITY-DRAIN	3490.00	100-YR	421.00	1192.44	1194.93	1194.93	1196.06	0.002179	8.54	49.32	22.00	1.00
SUN-CITY-DRAIN	3380.00	100-YR	421.00	1191.71	1194.17	1194.17	1195.25	0.002153	8.37	50.30	23.24	1.00
SUN-CITY-DRAIN	3275.00	100-YR	421.00	1191.01	1193.44	1193.44	1194.50	0.002160	8.27	50.91	24.27	1.01
SUN-CITY-DRAIN	3245.00	100-YR	421.00	1189.62	1192.05	1192.05	1193.11	0.002146	8.27	50.91	24.28	1.01
SUN-CITY-DRAIN	3210.00	100-YR	421.00	1187.60	1190.18	1190.18	1191.27	0.002138	8.37	50.28	23.34	1.01
SUN-CITY-DRAIN	3070.00	100-YR	421.00	1175.82	1178.35	1178.35	1179.44	0.002163	8.37	50.28	23.40	1.01
SUN-CITY-DRAIN	2925.00	100-YR	421.00	1163.77	1166.19	1166.19	1167.28	0.002175	8.36	50.35	23.49	1.01
SUN-CITY-DRAIN	2870.00	100-YR	421.00	1161.79	1165.35		1165.84	0.000634	5.61	75.03	24.19	0.56
SUN-CITY-DRAIN	2720.00	100-YR	421.00	1161.59	1165.32	1164.01	1165.74	0.000485	5.19	81.04	24.62	0.50
SUN-CITY-DRAIN	2686		Culvert									
SUN-CITY-DRAIN	2650.00	100-YR	421.00	1161.43	1164.81	1163.82	1165.32	0.000649	5.75	73.25	24.29	0.57
SUN-CITY-DRAIN	2510.00	100-YR	421.00	1161.06	1164.74		1165.21	0.000613	5.50	76.56	25.20	0.56
SUN-CITY-DRAIN	2360.00	100-YR	421.00	1161.02	1164.65	1163.48	1165.12	0.000586	5.50	76.52	24.21	0.54
SUN-CITY-DRAIN	2295		Culvert									
SUN-CITY-DRAIN	2230.00	100-YR	421.00	1160.76	1163.61	1163.11	1164.36	0.001072	6.93	60.73	24.56	0.74
SUN-CITY-DRAIN	2110.00	100-YR	421.00	1160.24	1163.74		1164.08	0.000438	4.69	90.40	38.82	0.48
SUN-CITY-DRAIN	2015.00	100-YR	421.00	1159.87	1163.80		1164.01	0.000235	3.75	126.44	59.65	0.36
SUN-CITY-DRAIN	1975.00	100-YR	421.00	1160.01	1163.52	1162.34	1163.97	0.000489	5.37	78.45	32.79	0.52
SUN-CITY-DRAIN	1936		Culvert									
SUN-CITY-DRAIN	1895.00	100-YR	421.00	1159.72	1162.46	1162.25	1163.36	0.001513	7.61	55.32	26.00	0.87
SUN-CITY-DRAIN	1835.00	100-YR	421.00	1159.45	1162.50		1163.16	0.001107	6.51	64.67	27.18	0.74
SUN-CITY-DRAIN	1775.00	100-YR	421.00	1159.15	1161.95	1161.95	1163.03	0.002112	8.36	50.38	23.56	1.01
SUN-CITY-DRAIN	1715.00	100-YR	421.00	1158.27	1160.59	1160.59	1161.61	0.002153	8.10	51.98	25.85	1.01
SUN-CITY-DRAIN	1675.00	100-YR	421.00	1157.85	1160.09	1160.09	1160.98	0.002219	7.57	55.58	31.24	1.00
SUN-CITY-DRAIN	1585		Culvert									
SUN-CITY-DRAIN	1485.00	100-YR	421.00	1155.68	1157.88	1157.88	1158.85	0.002187	7.92	53.14	27.55	1.01
SUN-CITY-DRAIN	1440.00	100-YR	421.00	1154.68	1157.56	1157.56	1158.61	0.002084	8.21	51.25	24.80	1.01
SUN-CITY-DRAIN	1380.00	100-YR	421.00	1154.27	1157.09	1157.09	1158.11	0.002089	8.10	52.01	25.96	1.01
SUN-CITY-DRAIN	1330.00	100-YR	421.00	1154.14	1156.84	1156.84	1157.87	0.002098	8.17	51.54	25.21	1.01
SUN-CITY-DRAIN	1285.00	100-YR	421.00	1153.86	1156.70	1156.70	1157.74	0.002093	8.21	51.26	24.87	1.01
SUN-CITY-DRAIN	1250.00	100-YR	421.00	1153.39	1156.88		1157.48	0.001062	6.23	67.57	30.19	0.73
SUN-CITY-DRAIN	1175.00	100-YR	421.00	1153.26	1156.24	1156.24	1157.28	0.006551	8.27	52.31	26.12	0.98
SUN-CITY-DRAIN	1110.00	100-YR	421.00	1152.57	1156.21		1156.73	0.002851	5.81	72.52	29.77	0.66
SUN-CITY-DRAIN	1010.00	100-YR	421.00	1152.57	1155.75	1155.41	1156.37	0.004401	6.32	66.61	34.05	0.80

Sun City Drain REV Plan: Sun City Drain REV Plan 1 4/27/2015

100-year Flow Spread Calc

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100-year Flow Spread Calc
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100-year Flow Spread Calc
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100-year Flow Spread Calc
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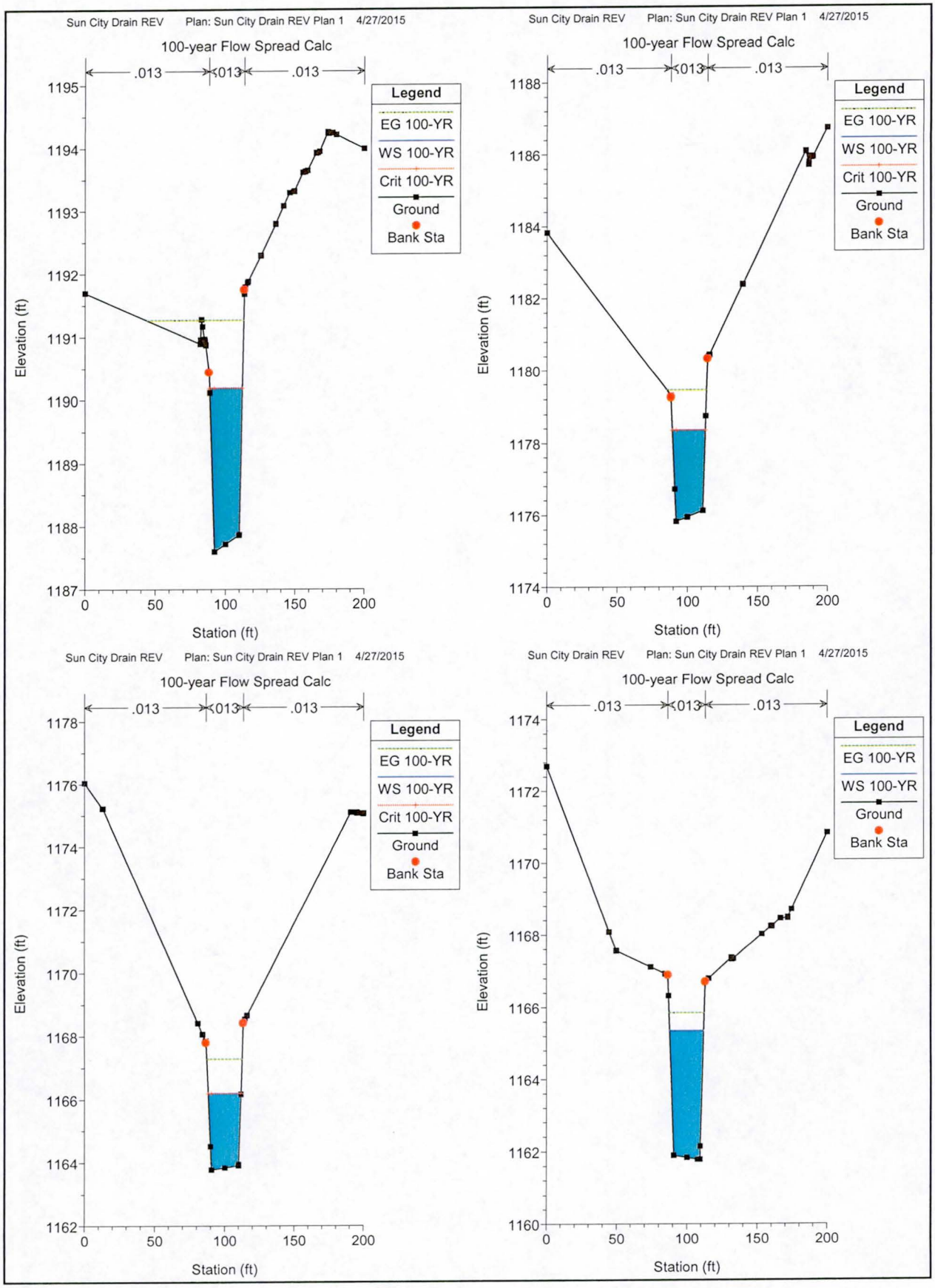
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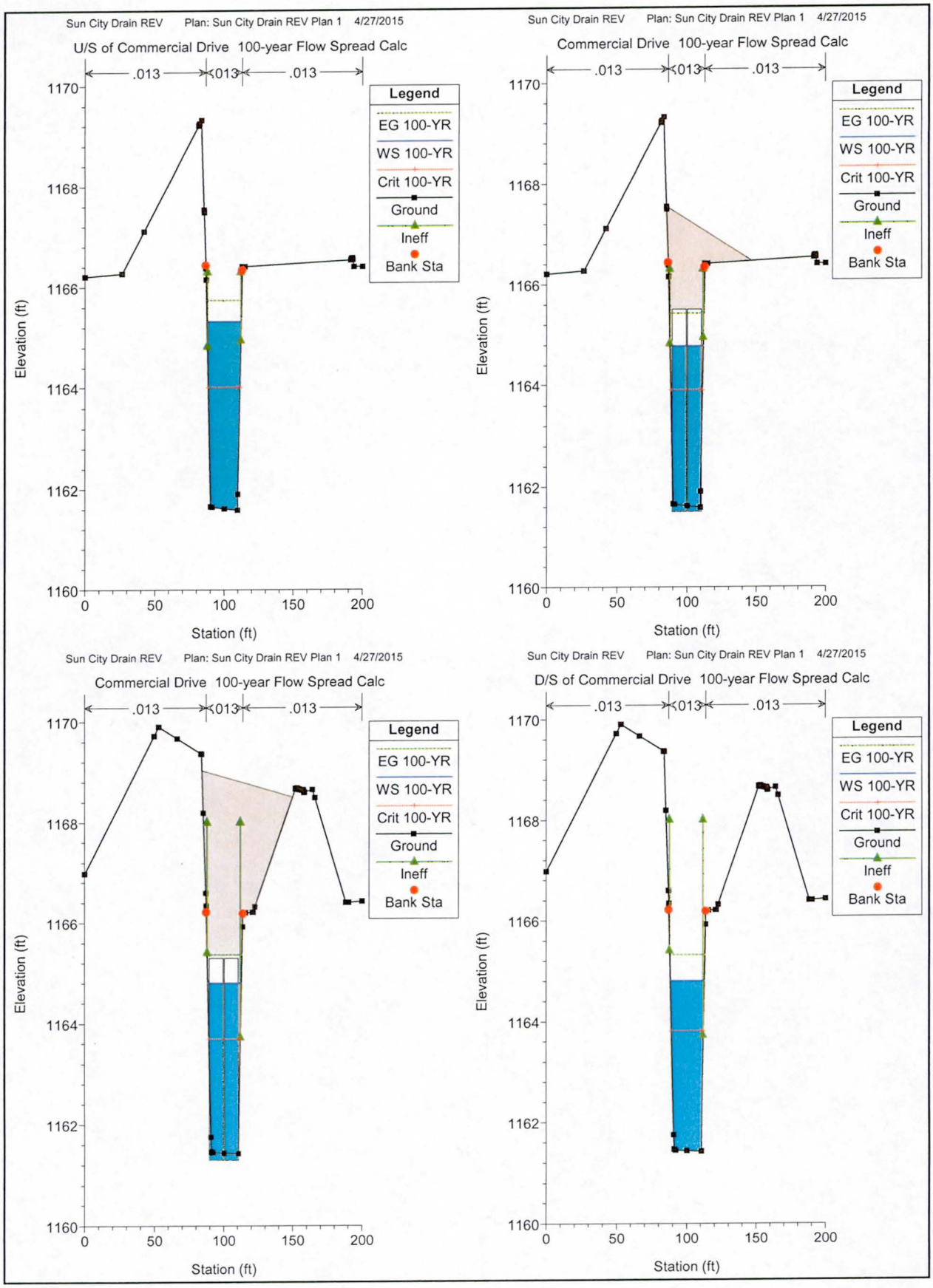
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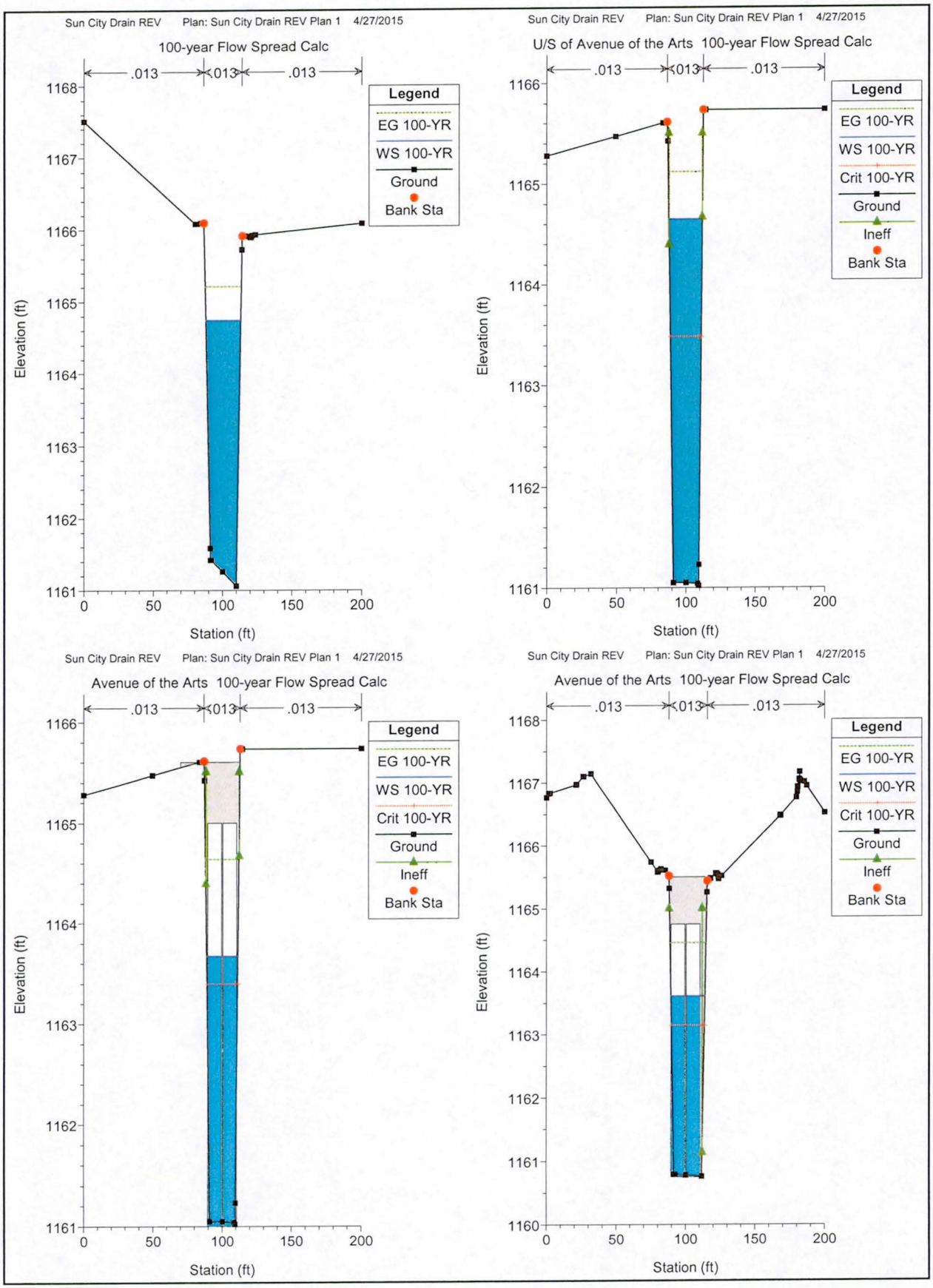
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Sun City Drain REV Plan: Sun City Drain REV Plan 1 4/27/2015
U/S of Avenue of the Arts 100-year Flow Spread Calc
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Avenue of the Arts 100-year Flow Spread Calc
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Avenue of the Arts 100-year Flow Spread Calc
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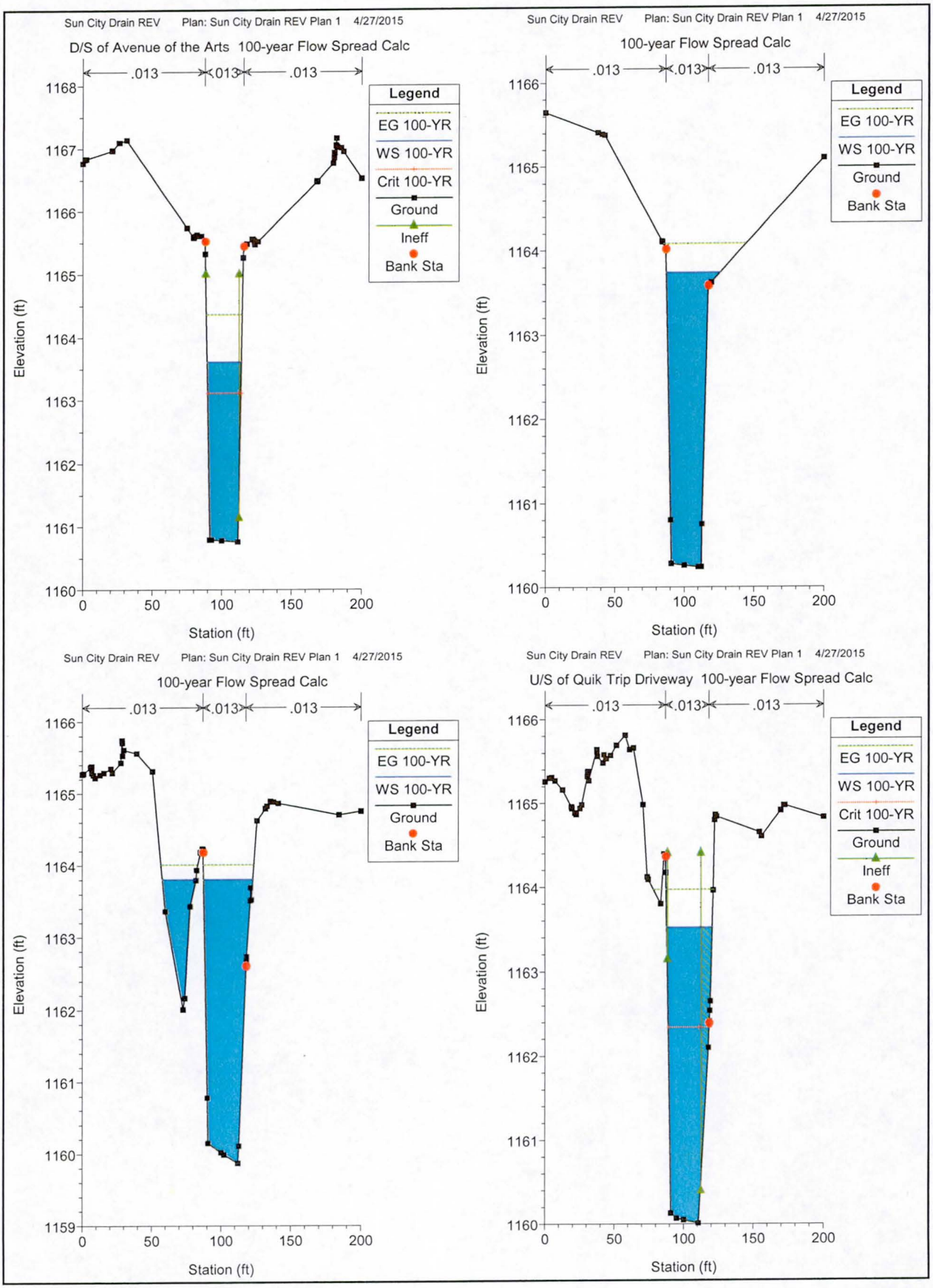
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Sun City Drain REV Plan: Sun City Drain REV Plan 1 4/27/2015
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Sun City Drain REV Plan: Sun City Drain REV Plan 1 4/27/2015
U/S of Quik Trip Driveway 100-year Flow Spread Calc
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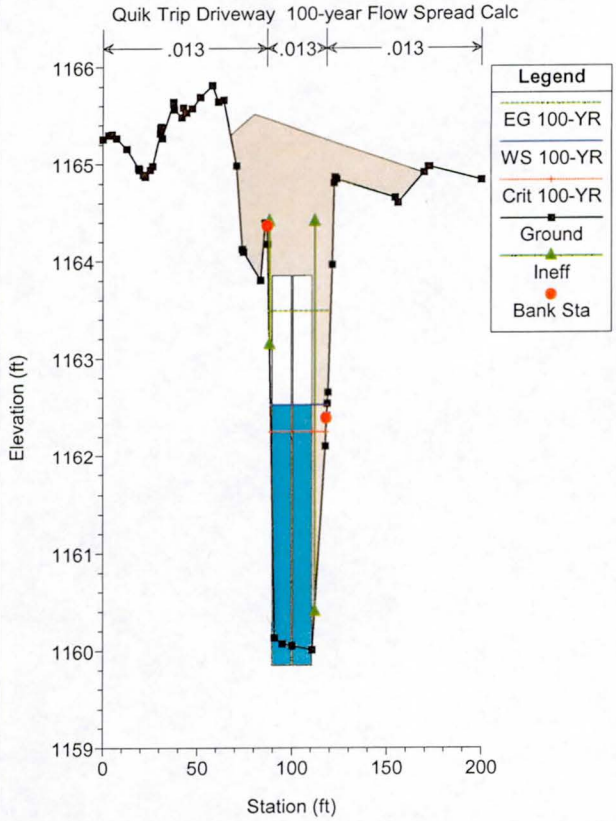
Sun City Drain REV Plan: Sun City Drain REV Plan 1 4/27/2015

Quik Trip Driveway 100-year Flow Spread Calc



Sun City Drain REV Plan: Sun City Drain REV Plan 1 4/27/2015

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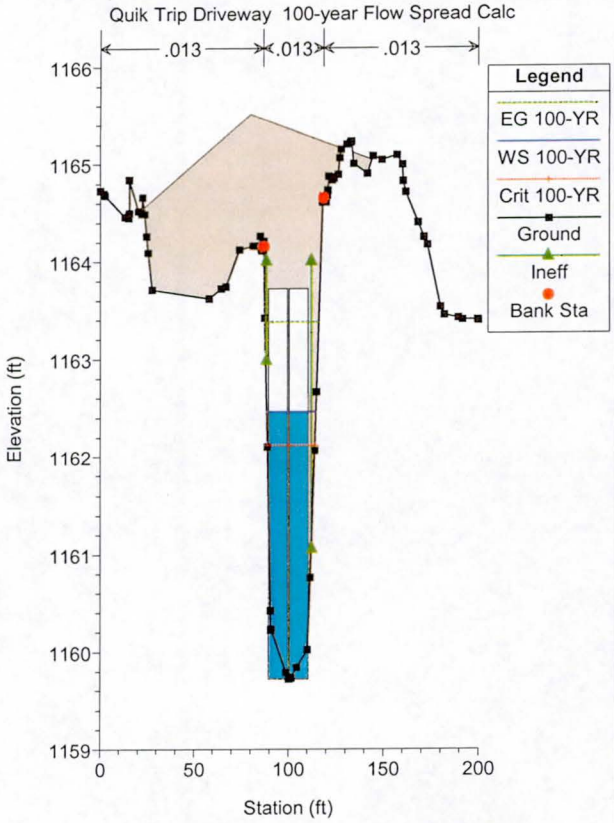

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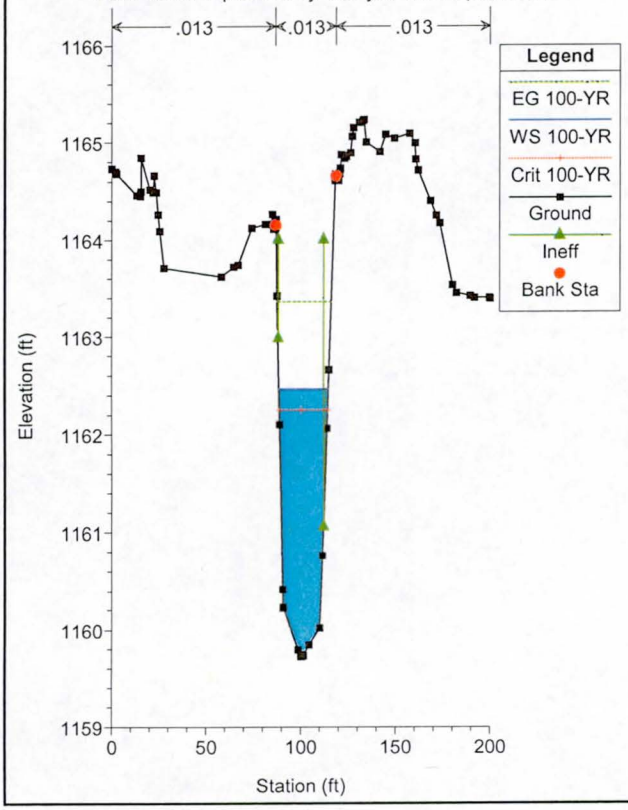
D/S of Quick Trip Driveway 100-year Flow Spread Calc



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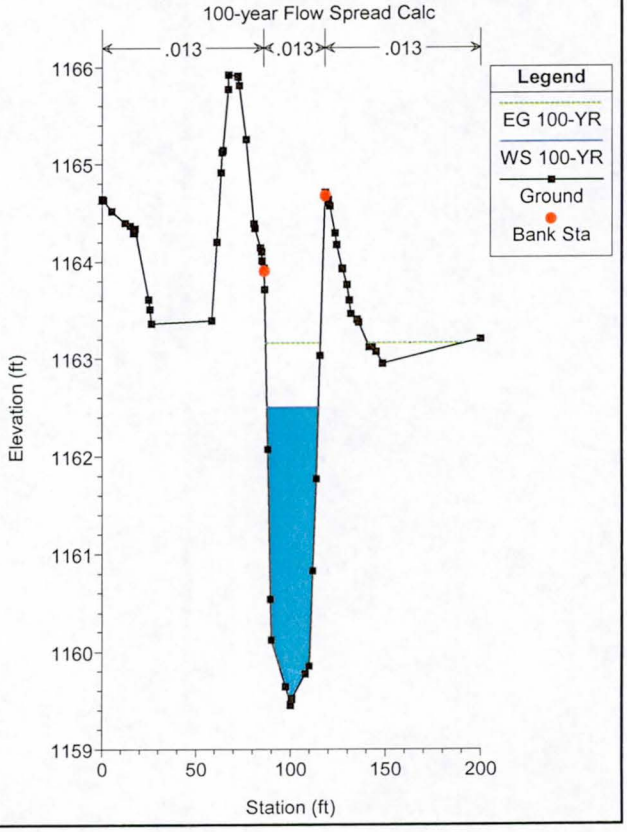
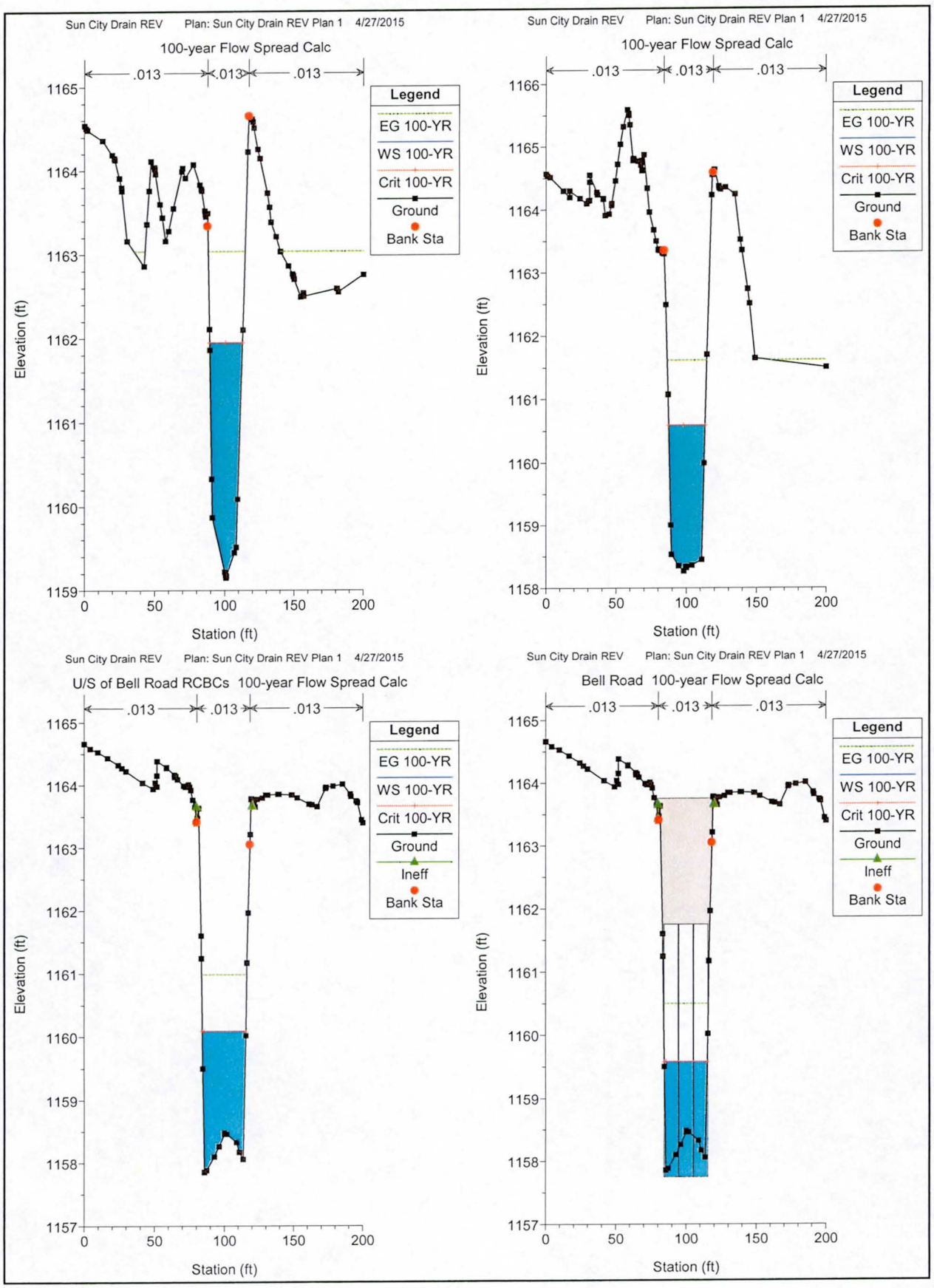
100-year Flow Spread Calc

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100-year Flow Spread Calc
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U/S of Bell Road RCBCs 100-year Flow Spread Calc
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Sun City Drain REV Plan: Sun City Drain REV Plan 1 4/27/2015
Bell Road 100-year Flow Spread Calc
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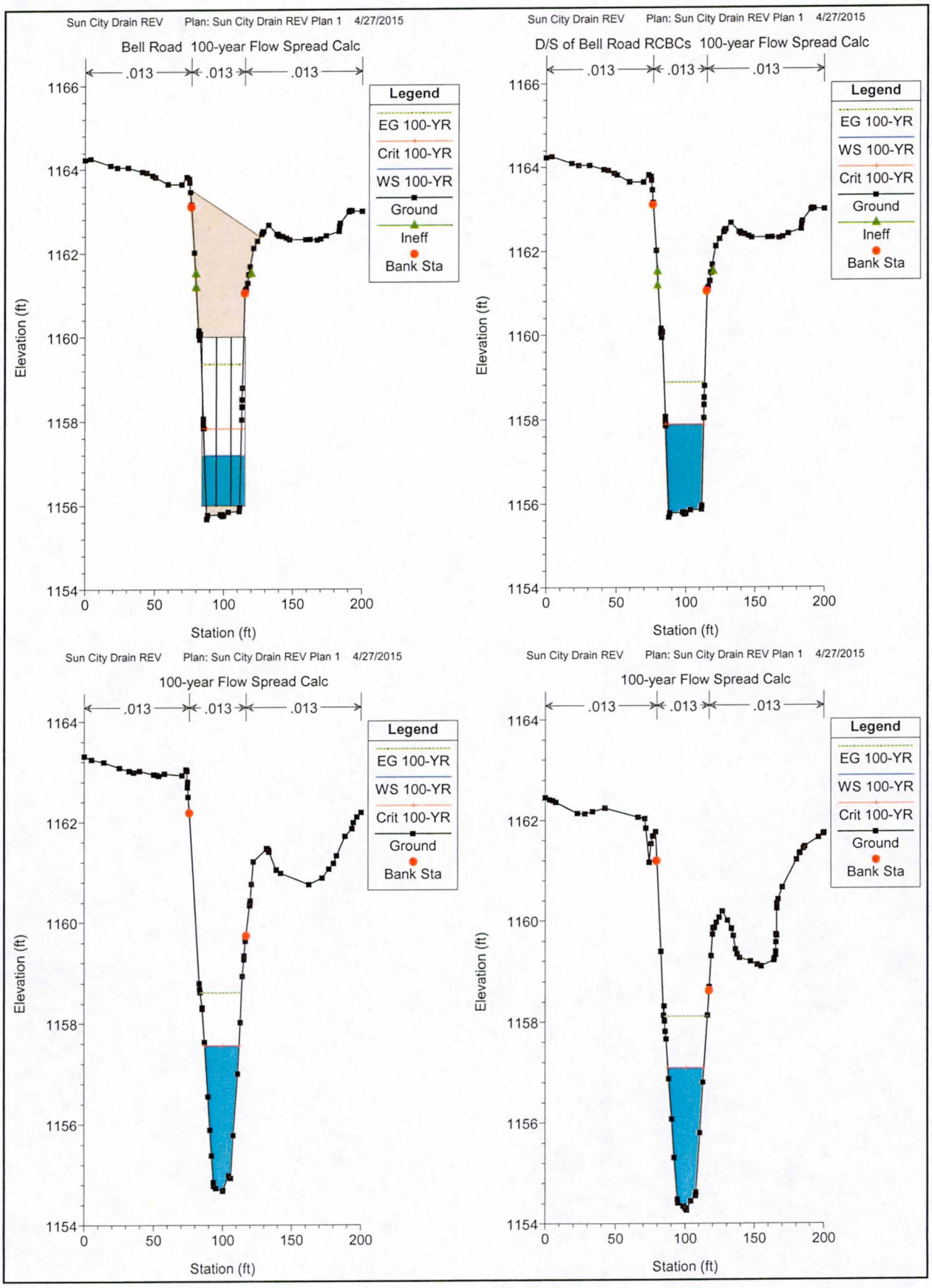
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D/S of Bell Road RCBCs 100-year Flow Spread Calc
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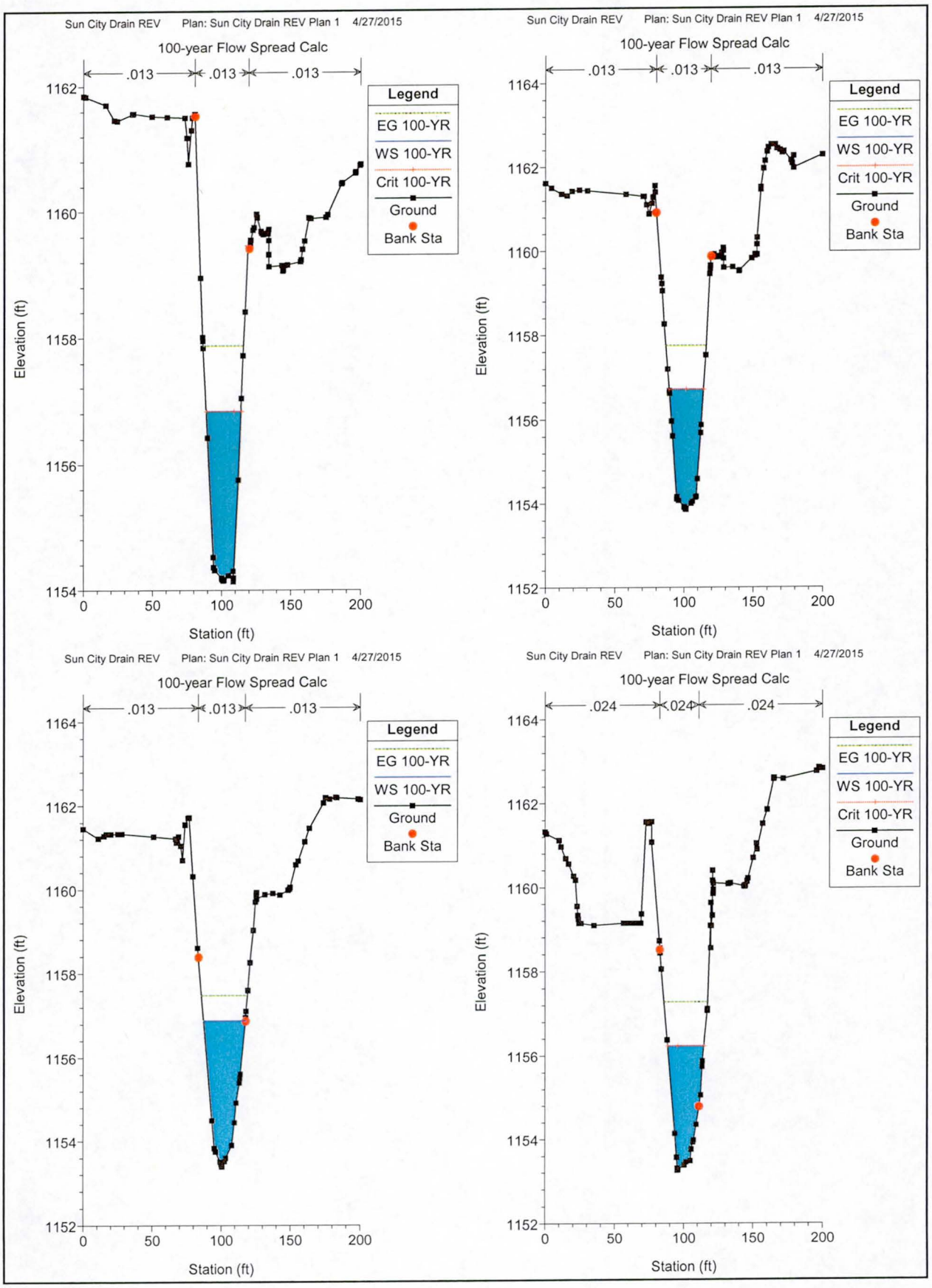
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100-year Flow Spread Calc
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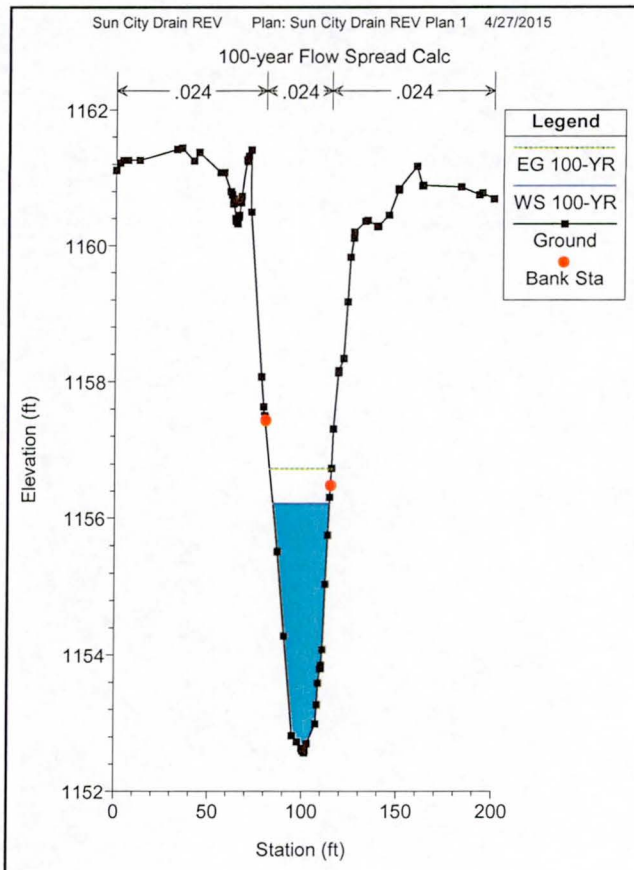
Sun City Drain REV Plan: Sun City Drain REV Plan 1 4/27/2015
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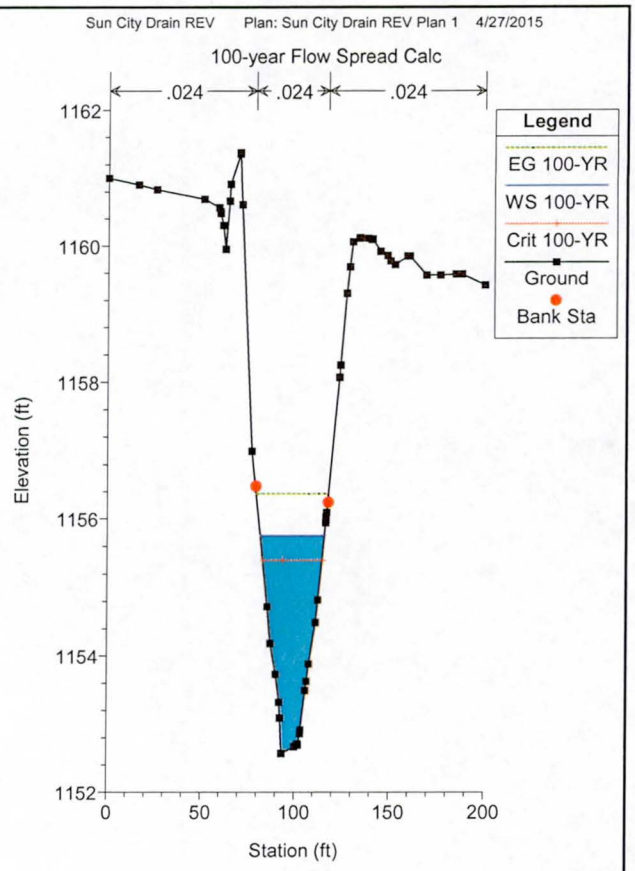
Sun City Drain REV Plan: Sun City Drain REV Plan 1 4/27/2015
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APPENDIX D.3 – Union Hills Drive StormCAD

115th Ave & Union Hills Drainage Improvements

Union Hills Storm Drain System

Label	Start Node	Stop Node	Length (ft)	No. of Barrels	Diameter (in)	Slope (ft/ft)	Total Flow (ft^3/s)	Capacity (Full Flow) (ft^3/s)	Velocity (ft/s)	Invert (Upstream)	Invert (Downstream)	Cover (Start) (ft)	Cover (Stop) (ft)	HGL (In) (ft)	HGL (Out) (ft)
UH-P01	UH-JS1	UH-OF 01	325	1	48	0.001	145	38.2	11.54	1,190.00	1,189.77	10.00	5.23	1,197.08	1,193.77
UH-P02	UH-JS2	UH-JS1	259	1	54	0.006	145	147.1	10.55	1,198.45	1,197.00	0.98	2.50	1,202.08	1,200.54
UH-P03	UH-JS3	UH-JS2	400	1	54	0.006	145	145.8	10.45	1,200.65	1,198.45	1.49	0.98	1,204.32	1,202.17
UH-P04	UH-JS4	UH-JS3	283	1	54	0.005	145	145.8	10.45	1,202.21	1,200.65	3.19	1.49	1,205.87	1,204.40
UH-P05	UH-JS5	UH-JS4	117	1	48	0.005	90	106.5	7.16	1,202.85	1,202.21	3.63	3.69	1,207.35	1,206.89
UH-P06	UH-JS6	UH-JS5	400	1	48	0.006	90	106.5	9.51	1,205.05	1,202.85	4.26	3.63	1,208.93	1,207.39
UH-P07	UH-JS7	UH-JS6	400	1	48	0.006	90	106.5	9.51	1,207.25	1,205.05	4.17	4.26	1,210.13	1,208.97
UH-P08	UH-JS8	UH-JS7	400	1	48	0.006	90	106.5	9.51	1,209.45	1,207.25	4.39	4.17	1,212.33	1,210.19
UH-P09	UH-JS9	UH-JS8	400	1	48	0.006	90	106.5	9.51	1,211.65	1,209.45	4.61	4.39	1,214.53	1,212.39
UH-P10	UH-MH01	UH-JS9	89	1	30	0.006	41	30.6	8.35	1,212.15	1,211.65	5.94	6.11	1,216.75	1,215.86
UH-P11	UH-MH02	UH-MH01	162	1	30	0.005	16	29.8	3.26	1,213.00	1,212.15	8.12	5.94	1,217.64	1,217.40
UH-P12	UH-MH03	UH-MH02	300	1	30	0.005	16	30.1	3.26	1,214.62	1,213.00	7.16	8.12	1,218.11	1,217.65
UH-P13	UH-MH04	UH-MH03	300	1	30	0.005	16	30.1	6.23	1,216.24	1,214.62	5.94	7.16	1,218.56	1,218.12
UH-P14	UH-MH05	UH-MH04	300	1	24	0.005	16	16.6	5.09	1,217.86	1,216.24	3.66	6.44	1,220.07	1,218.57
UH-P15	UH-MH06	UH-MH05	300	1	24	0.005	11	16.6	5.65	1,219.48	1,217.86	4.05	3.66	1,220.88	1,220.31
UH-P16	UH-MH07	UH-MH06	300	1	24	0.005	11	16.6	5.65	1,221.10	1,219.48	3.99	4.05	1,222.29	1,220.89
UH-P17	UH-MH08	UH-MH07	300	1	24	0.005	11	16.6	5.65	1,222.72	1,221.10	3.03	3.99	1,223.91	1,222.31
UH-P18	UH-MH09	UH-MH08	300	1	24	0.005	11	16.6	5.65	1,224.34	1,222.72	2.05	3.03	1,225.53	1,223.93
UH-P19	UH-MH10	UH-MH09	244	1	24	0.005	11	16.6	5.65	1,225.66	1,224.34	2.17	2.05	1,226.85	1,225.55
UH-P21	UH-CB02	UH-JS9	35	1	36	0.010	49	66.7	6.93	1,212.00	1,211.65	4.70	5.61	1,216.05	1,215.86
UH-P22	UH-CB03	UH-MH01	15	1	24	0.110	25	75.1	7.96	1,213.80	1,212.15	5.50	6.44	1,217.58	1,217.40
UH-P23	UH-CB04	UH-MH05	63	1	24	0.002	5	10.7	1.59	1,218.00	1,217.86	2.42	3.66	1,220.34	1,220.31
UH-P24	UH-CB05	UH-MH10	53	1	24	0.006	11	17.1	5.78	1,225.96	1,225.66	2.09	2.17	1,227.16	1,227.14

Profile Report
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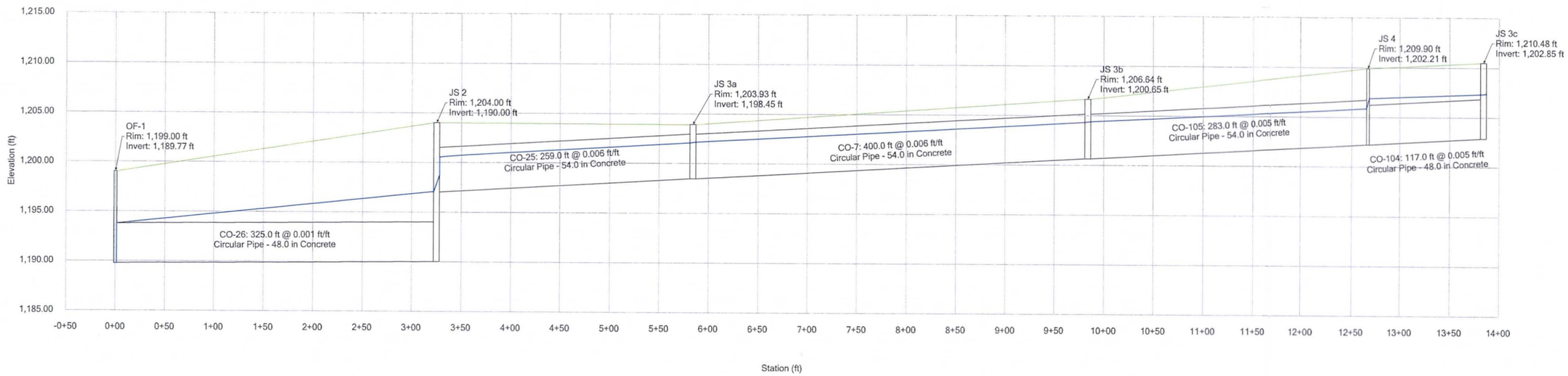
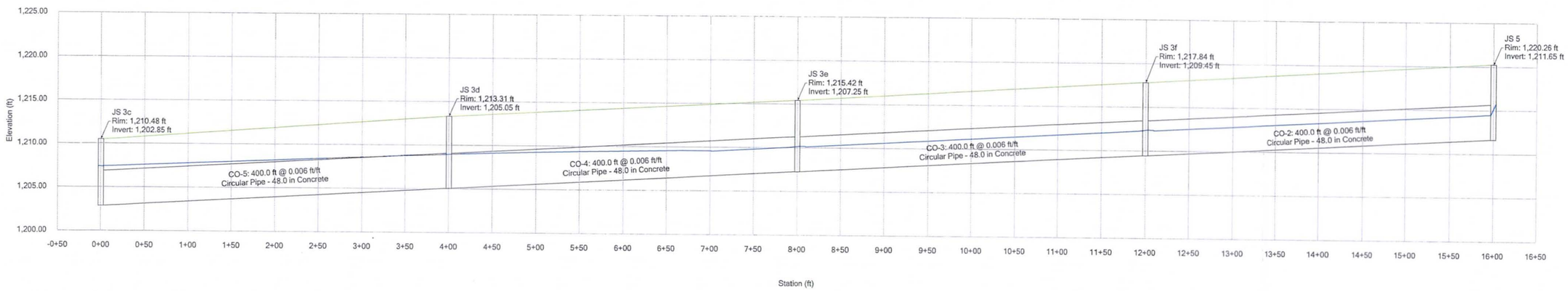


Profile Report
Engineering Profile - Union Hills E (214115-StCAD.stc)



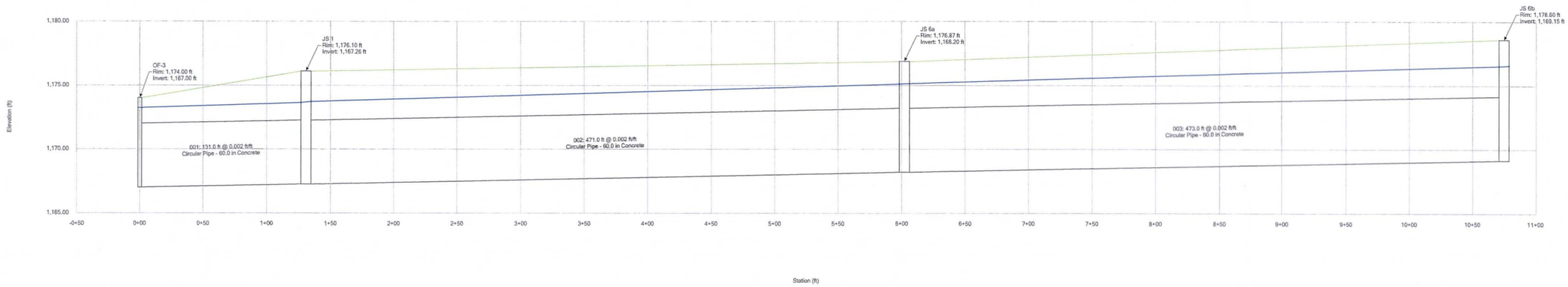
APPENDIX D.4 – 115th Avenue StormCAD

115th Ave & Union Hills Drainage Improvements

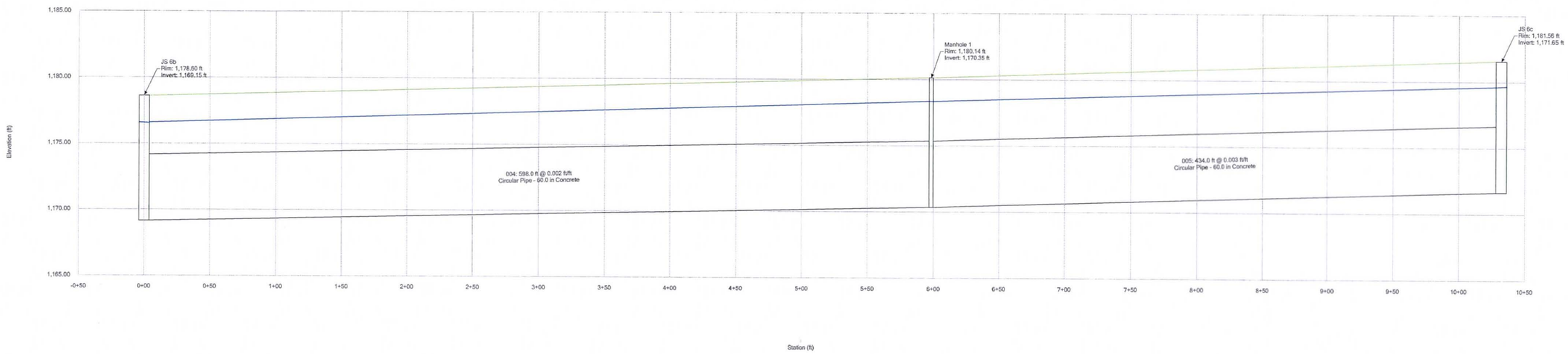
115th Ave Storm Drain System

Label	Start Node	Stop Node	Length (ft)	No. of Barrels	Diameter (in)	Slope (ft/ft)	Total Flow (ft^3/s)	Capacity (Full Flow) (ft^3/s)	Velocity (ft/s)	Invert (Upstream)	Invert (Downstream)	Cover (Start) (ft)	Cover (Stop) (ft)	HGL (In) (ft)	HGL (Out) (ft)
001	JS 1	OF-3	131	2	60	0.002	283	232.0	7.21	1,167.26	1,167.00	3.84	2.00	1,173.64	1,173.25
0010	JS 7	JS 6g	602	2	60	0.003	283	284.8	7.21	1,181.01	1,179.21	6.47	4.58	1,189.05	1,187.27
0011	JS 8a	JS 7	127	2	60	0.031	283	917.4	20.58	1,184.95	1,181.01	6.05	6.47	1,189.94	1,189.57
002	JS 6a	JS 1	471	2	60	0.002	283	232.7	7.21	1,168.20	1,167.26	3.67	3.84	1,175.11	1,173.72
003	JS 6b	JS 6a	473	2	60	0.002	283	233.4	7.21	1,169.15	1,168.20	4.45	3.67	1,176.54	1,175.15
004	Manhole 1	JS 6b	598	2	60	0.002	283	233.3	7.21	1,170.35	1,169.15	4.79	4.45	1,178.35	1,176.58
005	JS 6c	Manhole 1	434	2	60	0.003	283	285.1	7.21	1,171.65	1,170.35	4.91	4.79	1,179.63	1,178.35
006	JS 6d	JS 6c	630	2	60	0.003	283	285.3	7.21	1,173.54	1,171.65	4.04	4.91	1,181.53	1,179.67
007	JS 6e	JS 6d	630	2	60	0.003	283	285.3	7.21	1,175.43	1,173.54	4.30	4.04	1,183.43	1,181.57
008	JS 6f	JS 6e	630	2	60	0.003	283	285.3	7.21	1,177.32	1,175.43	4.98	4.30	1,185.33	1,183.47
009	JS 6g	JS 6f	630	2	60	0.003	283	285.3	7.21	1,179.21	1,177.32	4.58	4.98	1,187.23	1,185.37
CO-62	JS 8b	OF-6	166	2	36	0.012	53	78.7	5.97	1,189.95	1,187.98	2.05	2.02	1,191.79	1,190.98

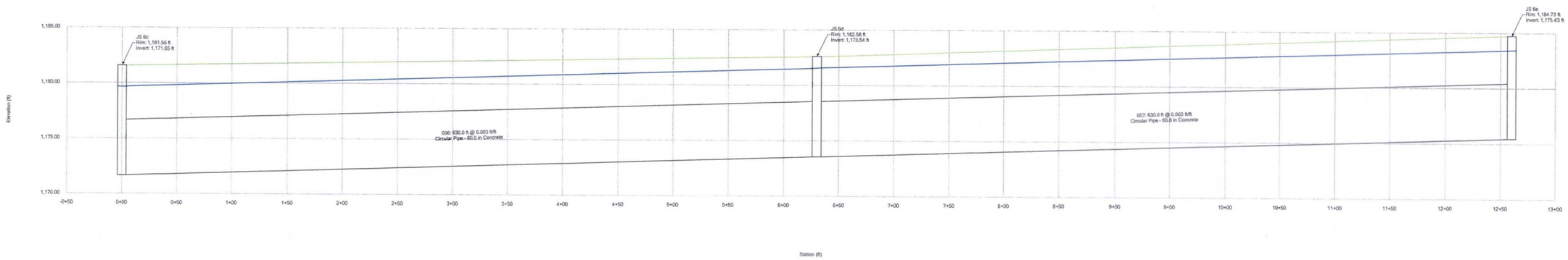
Profile Report
Engineering Profile - 115th 1 (214115-StCAD.stc)



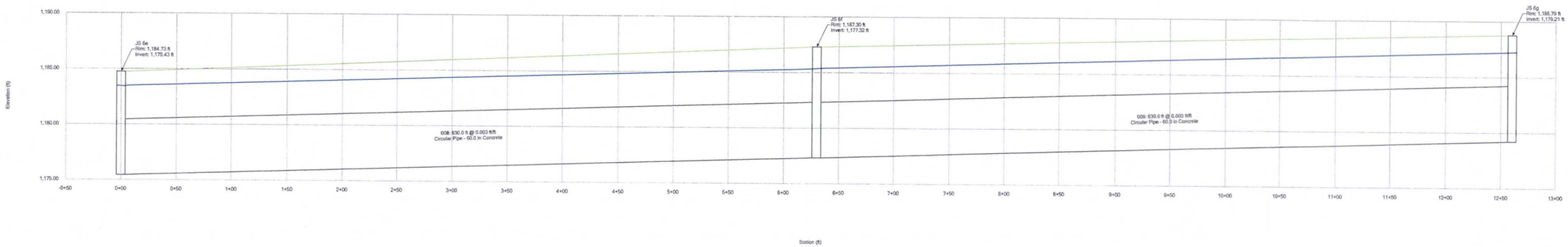
Profile Report
Engineering Profile - 115th 2 (214115-StCAD.stc)



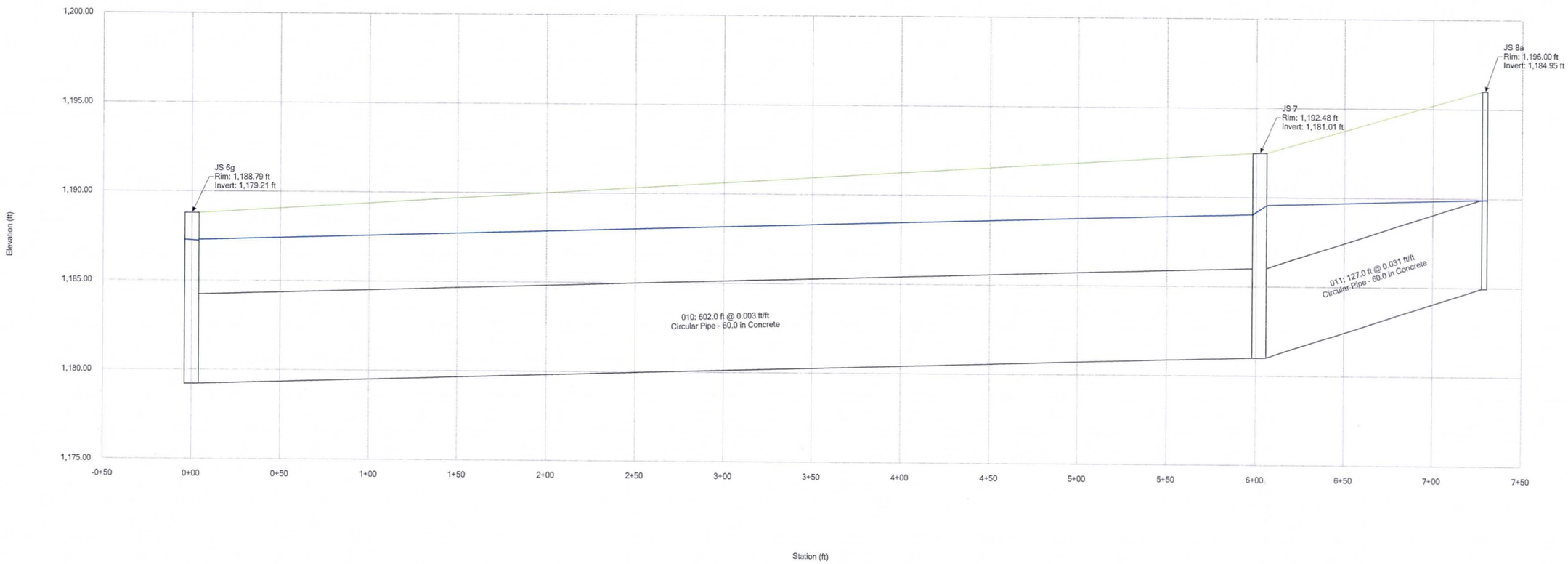
Profile Report
Engineering Profile - 115th 3 (214115-StCAD.stc)



Profile Report
Engineering Profile - 115th 4 (214115-StCAD.stc)



Profile Report
Engineering Profile - 115th 5 (214115-StCAD.stc)



APPENDIX D.5 – 111th Avenue Culvertmaster

Rating Table Report
RV-Peoria

Range Data:

	Minimum	Maximum	Increment
Allowable HW E	1,201.00	1,210.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
1,201.00	0.00
1,202.00	131.37
1,203.00	190.41
1,204.00	231.24
1,205.00	263.33
1,206.00	291.91
1,207.00	317.94
1,208.00	341.99
1,209.00	364.45
1,210.00	385.61

APPENDIX D.6 – Union Hills Drive Culvertmaster

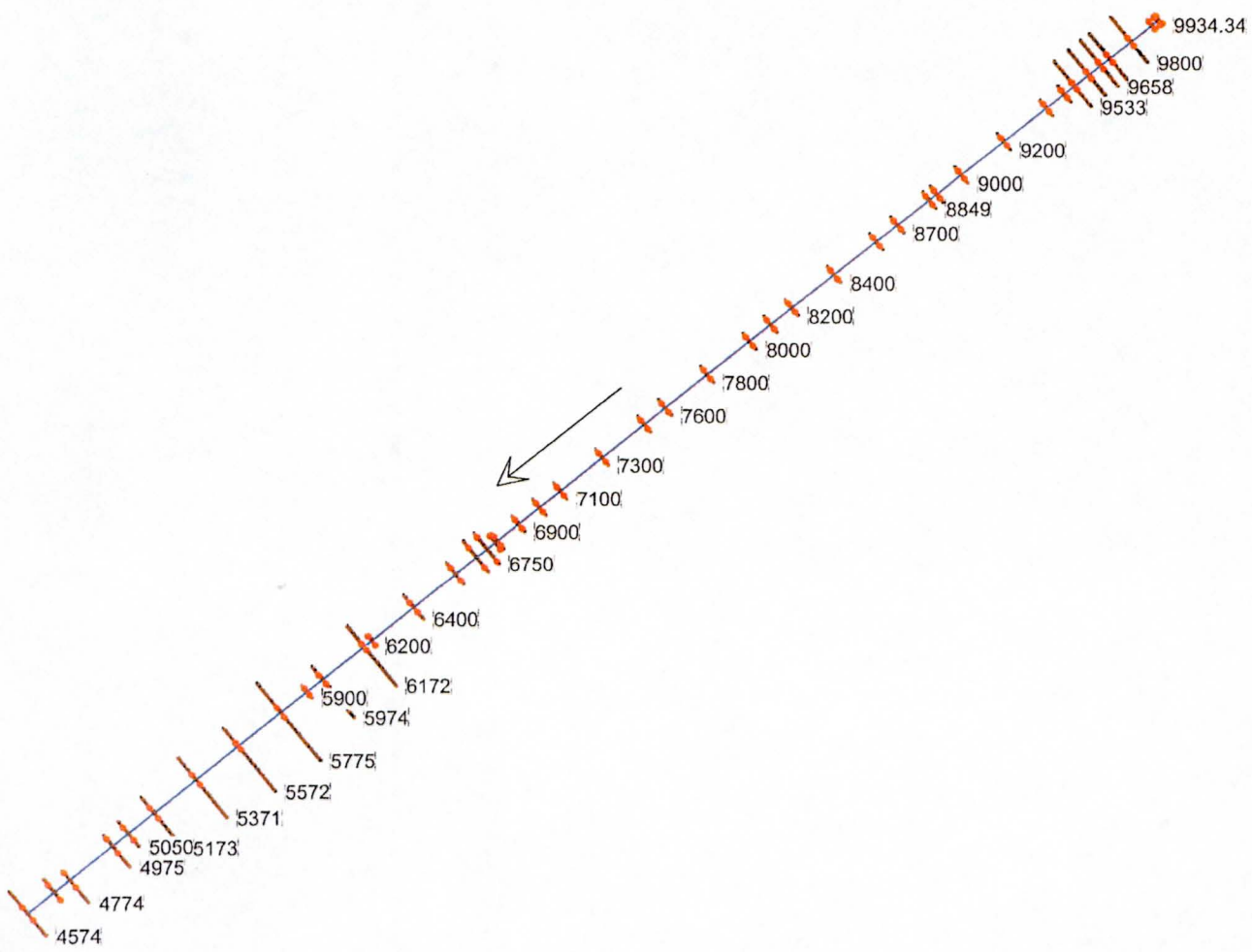
Rating Table Report
Peoria-Channel

Range Data:

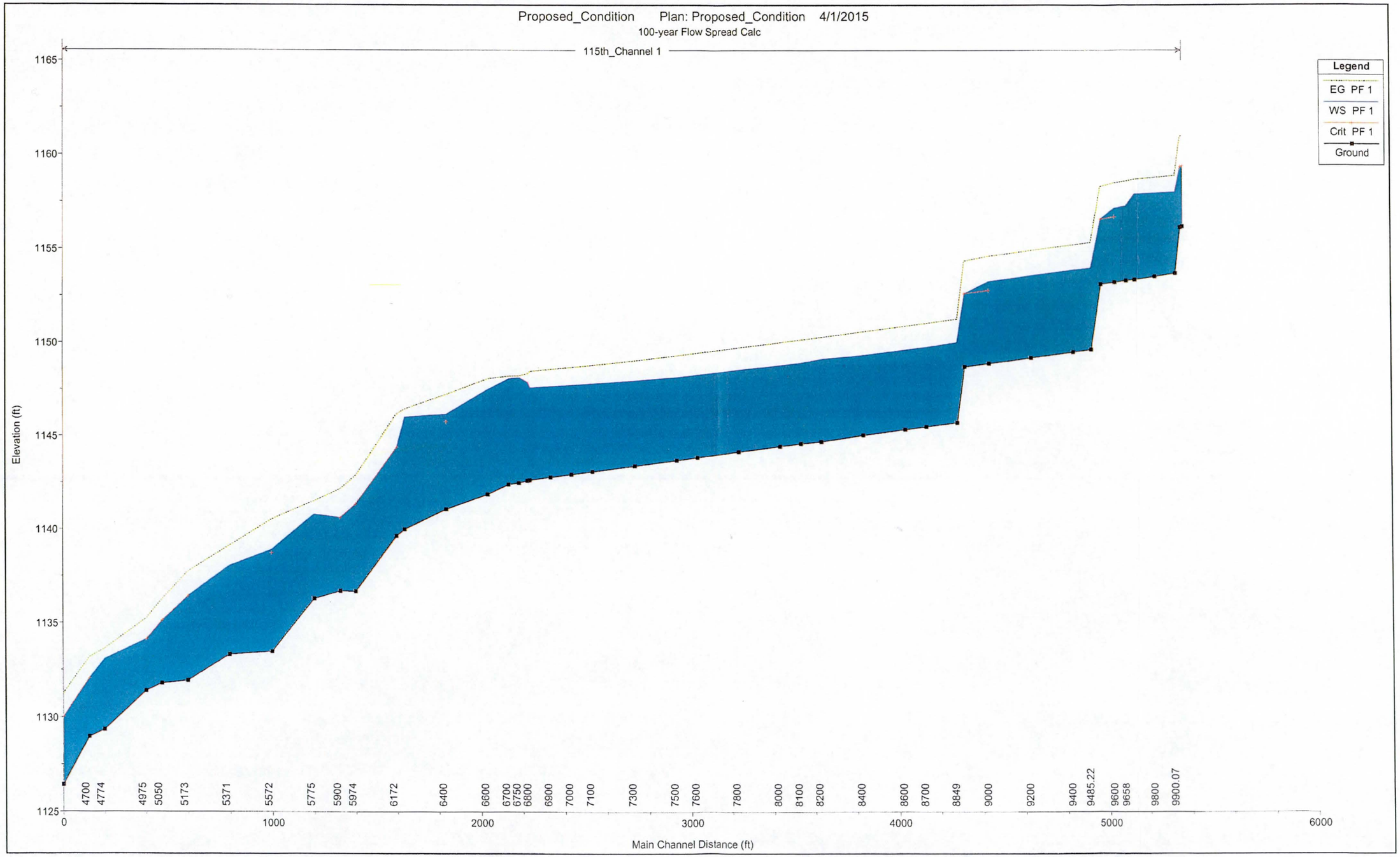
	Minimum	Maximum	Increment	
Allowable HW E	1,194.00	1,202.00	1.00	ft

HW Elev. (ft)	Discharge (cfs)
1,194.00	14.41
1,195.00	65.64
1,196.00	145.75
1,197.00	245.06
1,198.00	353.01
1,199.00	448.88
1,200.00	514.76
1,201.00	573.12
1,202.00	626.06

APPENDIX D.7 – 115th Avenue Channel South of Bell Road HEC-RAS



Some schematic data outside default extents (see View/Set Schematic Plot Extents...)
None of the XS's are Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)

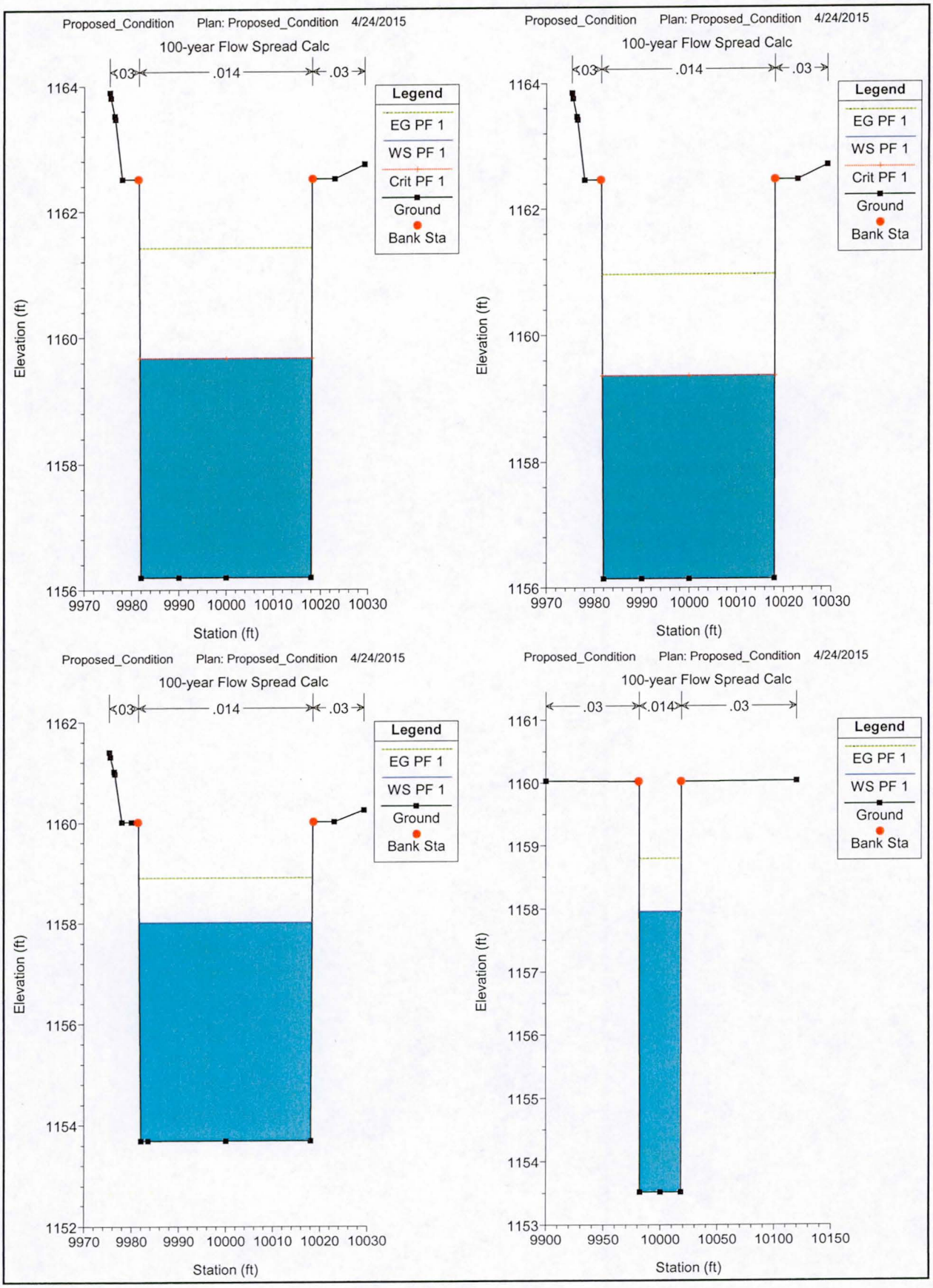

Proposed_Condition Plan: Proposed_Condition 4/1/2015
100-year Flow Spread Calc
115th_Channel 1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
1165
1160
1155
1150
1145
1140
1135
1130
1125
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)
4700
4774
4975
5050
5173
5371
5572
5775
5900
5974
6172
6400
6600
6700
6750
6800
6900
7000
7100
7300
7500
7600
7800
8000
8100
8200
8400
8600
8700
8849
9000
9200
9400
9485.22
9600
9658
9800
9900.07

HEC-RAS Plan: Proposed River: 115th_Channel Reach: 1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	9934.34	PF 1	1182.00	1156.19	1159.40	1159.40	1161.01	0.002408	10.19	116.03	36.36	1.00
1	9924.34	PF 1	1182.00	1156.14	1159.35	1159.35	1160.96	0.002415	10.20	115.94	36.36	1.01
1	9900.07	PF 1	1182.00	1153.69	1158.01		1158.89	0.000939	7.52	157.12	36.68	0.64
1	9800	PF 1	1182.00	1153.52	1157.95		1158.79	0.000870	7.34	161.09	36.68	0.62
1	9700	PF 1	1182.00	1153.36	1157.90		1158.69	0.000811	7.17	164.84	36.70	0.60
1	9658	PF 1	1182.00	1153.31	1157.27		1158.60	0.001608	9.24	127.87	32.61	0.82
1	9600	PF 1	1182.00	1153.22	1157.16	1156.69	1158.50	0.001636	9.30	127.14	32.61	0.83
1	9533	PF 1	1182.00	1153.12	1156.59	1156.59	1158.32	0.002433	10.57	111.79	32.53	1.01
1	9485.22	PF 1	1182.00	1149.62	1153.98		1155.34	0.001292	9.35	126.44	32.99	0.84
1	9400	PF 1	1182.00	1149.49	1153.87		1155.21	0.001479	9.31	127.00	33.03	0.84
1	9200	PF 1	1182.00	1149.19	1153.57		1154.91	0.001473	9.29	127.18	33.04	0.83
1	9000	PF 1	1182.00	1148.89	1153.26	1152.79	1154.61	0.001483	9.32	126.88	33.02	0.84
1	8885	PF 1	1182.00	1148.72	1152.62	1152.62	1154.37	0.002183	10.61	111.39	32.15	1.00
1	8849	PF 1	1182.00	1145.72	1150.01		1151.27	0.001649	9.01	131.16	36.21	0.83
1	8700	PF 1	1182.00	1145.50	1149.76		1151.04	0.001466	9.08	130.24	36.14	0.84
1	8600	PF 1	1182.00	1145.35	1149.61		1150.89	0.001462	9.07	130.38	36.15	0.84
1	8400	PF 1	1182.00	1145.05	1149.33		1150.59	0.001446	9.03	130.87	36.19	0.84
1	8200	PF 1	1182.00	1144.70	1149.12		1150.29	0.001290	8.69	136.07	36.56	0.79
1	8100	PF 1	1182.00	1144.60	1148.92		1150.16	0.001398	8.93	132.38	36.30	0.82
1	8000	PF 1	1182.00	1144.45	1148.78		1150.01	0.001381	8.89	132.93	36.34	0.82
1	7800	PF 1	1182.00	1144.15	1148.54		1149.73	0.001322	8.76	134.93	36.48	0.80
1	7600	PF 1	1182.00	1143.85	1148.28		1149.45	0.001473	8.67	136.32	36.58	0.79
1	7500	PF 1	1182.00	1143.70	1148.15		1149.30	0.001265	8.63	137.00	36.63	0.79
1	7300	PF 1	1182.00	1143.40	1147.97		1149.04	0.001136	8.29	142.58	37.43	0.75
1	7100	PF 1	1182.00	1143.10	1147.80		1148.80	0.001028	8.01	147.61	37.79	0.71
1	7000	PF 1	1182.00	1142.95	1147.73		1148.69	0.000971	7.85	150.51	38.00	0.70
1	6900	PF 1	1182.00	1142.80	1147.66		1148.58	0.000914	7.69	153.66	38.22	0.68
1	6800	PF 1	1182.00	1142.65	1147.60		1148.48	0.000858	7.52	157.08	38.46	0.66
1	6790	PF 1	1182.00	1142.62	1147.89		1148.35	0.000460	5.41	218.40	57.88	0.49
1	6750	PF 1	1182.00	1142.49	1148.13		1148.23	0.000092	2.54	465.73	105.13	0.21
1	6700	PF 1	1182.00	1142.41	1148.08		1148.22	0.000509	3.02	390.87	85.99	0.25
1	6600	PF 1	1182.00	1141.88	1147.51		1148.07	0.003004	6.03	195.97	57.63	0.58
1	6400	PF 1	1182.00	1141.08	1146.18	1145.76	1147.23	0.005532	8.23	144.16	51.32	0.82
1	6200	PF 1	1182.00	1140.00	1146.01		1146.44	0.001874	5.36	227.97	54.53	0.43
1	6172	PF 1	1182.00	1139.65	1144.39	1144.39	1146.18	0.007723	10.77	111.18	33.19	0.99
1	5974	PF 1	1182.00	1136.68	1141.34	1141.34	1142.87	0.008324	9.94	118.96	38.85	1.00
1	5900	PF 1	1182.00	1136.70	1140.62	1140.62	1142.16	0.002867	10.05	122.33	42.14	0.95
1	5775	PF 1	1182.00	1136.30	1140.80		1141.52	0.002948	6.84	177.51	53.23	0.62
1	5572	PF 1	1182.00	1133.48	1138.91	1138.72	1140.54	0.007104	10.26	115.35	31.30	0.93
1	5371	PF 1	1182.00	1133.33	1138.05		1139.13	0.005491	8.33	141.97	44.50	0.82
1	5173	PF 1	1182.00	1131.95	1136.43	1136.43	1137.74	0.008897	9.16	129.03	50.45	1.01
1	5050	PF 1	1182.00	1131.81	1135.14	1135.14	1136.29	0.009325	8.59	137.54	60.02	1.00
1	4975	PF 1	1182.00	1131.40	1134.14	1134.14	1135.24	0.009117	8.44	140.08	64.06	1.01
1	4774	PF 1	1182.00	1129.35	1133.09		1133.64	0.002944	5.95	198.60	65.26	0.60
1	4700	PF 1	1182.00	1128.98	1132.08	1132.08	1133.19	0.012707	8.46	139.75	62.92	1.00
1	4574	PF 1	1182.00	1126.43	1130.01	1130.01	1131.25	0.008915	8.93	132.29	54.40	1.01

HEC-RAS Output Table

W.S. Elev (ft)	Freeboard (ft)	Freeboard & WSEL (ft)	Chanel Depth	River Station	Freeboard Difference	Hydraulic Depth	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Hydr Depth (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)
3.21	1.21	4.42	6.5	9934.34	2.08	1185.19	1182	1156.19	1159.4	3.19	1161.01	0.002408	10.19	116.03
3.21	1.21	4.42	6.5	9924	2.08	1185.19	1182	1156.14	1159.35	3.19	1160.96	0.002415	10.2	115.94
4.32	1.30	5.62	6.5	9900	0.88	1186.28	1182	1153.69	1158.01	4.28	1158.89	0.000939	7.52	157.12
4.43	1.32	5.75	6.5	9800	0.75	1186.39	1182	1153.52	1157.95	4.39	1158.79	0.00087	7.34	161.09
4.54	1.33	5.87	6.5	9700	0.63	1186.49	1182	1153.36	1157.9	4.49	1158.69	0.000811	7.17	164.84
3.96	1.32	5.28	6.5	9658	1.22	1185.92	1182	1153.31	1157.27	3.92	1158.6	0.001608	9.24	127.87
3.94	1.32	5.26	6.5	9600	1.24	1185.9	1182	1153.22	1157.16	3.9	1158.5	0.001636	9.3	127.14
3.47	1.30	4.77	6.5	9533	1.73	1185.44	1182	1153.12	1156.59	3.44	1158.32	0.002433	10.57	111.79
4.36	1.43	5.79	6.5	9485	0.71	1185.83	1182	1149.62	1153.98	3.83	1155.34	0.001292	9.35	126.44
4.38	1.43	5.81	6.5	9400	0.69	1185.85	1182	1149.49	1153.87	3.85	1155.21	0.001479	9.31	127.00
4.38	1.43	5.81	6.5	9200	0.69	1185.85	1182	1149.19	1153.57	3.85	1154.91	0.001473	9.29	127.18
4.37	1.43	5.80	6.5	9000	0.70	1185.84	1182	1148.89	1153.26	3.84	1154.61	0.001483	9.32	126.88
3.9	1.41	5.31	6.5	8885	1.19	1185.47	1182	1148.72	1152.62	3.47	1154.37	0.002183	10.61	111.39
4.29	1.39	5.68	6.5	8849	0.82	1185.62	1182	1145.72	1150.01	3.62	1151.27	0.001649	9.01	131.16
4.26	1.39	5.65	6.5	8700	0.85	1185.6	1182	1145.5	1149.76	3.6	1151.04	0.001466	9.08	130.24
4.26	1.38	5.64	6.5	8600	0.86	1185.61	1182	1145.35	1149.61	3.61	1150.89	0.001462	9.07	130.38
4.28	1.39	5.67	6.5	8400	0.83	1185.62	1182	1145.05	1149.33	3.62	1150.59	0.001446	9.03	130.87
4.42	1.40	5.82	6.5	8200	0.68	1185.72	1182	1144.7	1149.12	3.72	1150.29	0.00129	8.69	136.07
4.32	1.39	5.71	6.5	8100	0.79	1185.65	1182	1144.6	1148.92	3.65	1150.16	0.001398	8.93	132.38
4.33	1.39	5.72	6.5	8000	0.78	1185.66	1182	1144.45	1148.78	3.66	1150.01	0.001381	8.89	132.93
4.39	1.40	5.79	6.5	7800	0.71	1185.7	1182	1144.15	1148.54	3.7	1149.73	0.001322	8.76	134.93
4.43	1.40	5.83	6.5	7600	0.67	1185.73	1182	1143.85	1148.28	3.73	1149.45	0.001473	8.67	136.32
4.45	1.40	5.85	6.5	7500	0.65	1185.74	1182	1143.7	1148.15	3.74	1149.3	0.001265	8.63	137.00
4.57	1.41	5.98	6.5	7300	0.52	1185.81	1182	1143.4	1147.97	3.81	1149.04	0.001136	8.29	142.58
4.7	1.42	6.12	6.5	7100	0.38	1185.91	1182	1143.1	1147.8	3.91	1148.8	0.001028	8.01	147.61
4.78	1.43	6.21	6.5	7000	0.29	1185.96	1182	1142.95	1147.73	3.96	1148.69	0.000971	7.85	150.51
4.86	1.44	6.30	6.5	6900	0.20	1186.02	1182	1142.8	1147.66	4.02	1148.58	0.000914	7.69	153.66
4.95	1.46	6.41	6.5	6800	0.09	1186.08	1182	1142.65	1147.6	4.08	1148.48	0.000858	7.52	157.08
5.27	1.43	6.70	6.25	6790	-0.45	1185.77	1182	1142.62	1147.89	3.77	1148.35	0.00046	5.41	218.40
5.64	1.44	7.08	6.25	6750	-0.83	1186.43	1182	1142.49	1148.13	4.43	1148.23	0.000092	2.54	465.73
5.67	1.45	7.12	6.25	6700	-0.87	1186.55	1182	1142.41	1148.08	4.55	1148.22	0.000509	3.02	390.87
5.63	1.55	7.18	6	6600	-1.18	1185.4	1182	1141.88	1147.51	3.4	1148.07	0.003004	6.03	195.97
5.1	1.54	6.64	6.25	6400	-0.39	1184.81	1182	1141.08	1146.18	2.81	1147.23	0.005532	8.23	144.16
6.01	1.61	7.62	6.25	6200	-1.37	1186.18	1182	1140	1146.01	4.18	1146.44	0.001874	5.36	227.97
4.74	1.64	6.38	6.25	6172	-0.13	1185.35	1182	1139.65	1144.39	3.35	1146.18	0.007723	10.77	111.18
4.66	1.55	6.21	6.25	5974	0.04	1185.06	1182	1136.68	1141.34	3.06	1142.87	0.008324	9.94	118.96
3.92	1.37	5.29	6.25	5900	0.96	1184.9	1182	1136.7	1140.62	2.9	1142.16	0.002867	10.05	122.33
4.5	1.31	5.81	6.25	5775	0.44	1185.33	1182	1136.3	1140.8	3.33	1141.52	0.002948	6.84	177.51
5.43	1.77	7.20	6.25	5572	-0.95	1185.68	1182	1133.48	1138.91	3.68	1140.54	0.007104	10.26	115.35
4.72	1.45	6.17	6.25	5371	0.08	1185.19	1182	1133.33	1138.05	3.19	1139.13	0.005491	8.33	141.97
4.48	1.45	5.93	6.5	5173	0.57	1184.56	1182	1131.95	1136.43	2.56	1137.74	0.008897	9.16	129.03
3.33	1.12	4.45	6.5	5050	2.05	1184.29	1182	1131.81	1135.14	2.29	1136.29	0.009325	8.59	137.54
2.74	0.96	3.70	6.5	4975	2.80	1184.19	1182	1131.4	1134.14	2.19	1135.24	0.009117	8.44	140.08
3.74	1.07	4.81	6.5	4774	1.69	1185.04	1182	1129.35	1133.09	3.04	1133.64	0.002944	5.95	198.60
3.1	1.05	4.15	6.5	4700	2.35	1184.22	1182	1128.98	1132.08	2.22	1133.19	0.012707	8.46	139.75
3.58	1.20	4.78	6.5	4574	1.72	1184.43	1182	1126.43	1130.01	2.43	1131.25	0.008915	8.93	132.29


Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
.03
.014
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
.03
.014
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
.03
.014
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Bank Sta
Elevation (ft)
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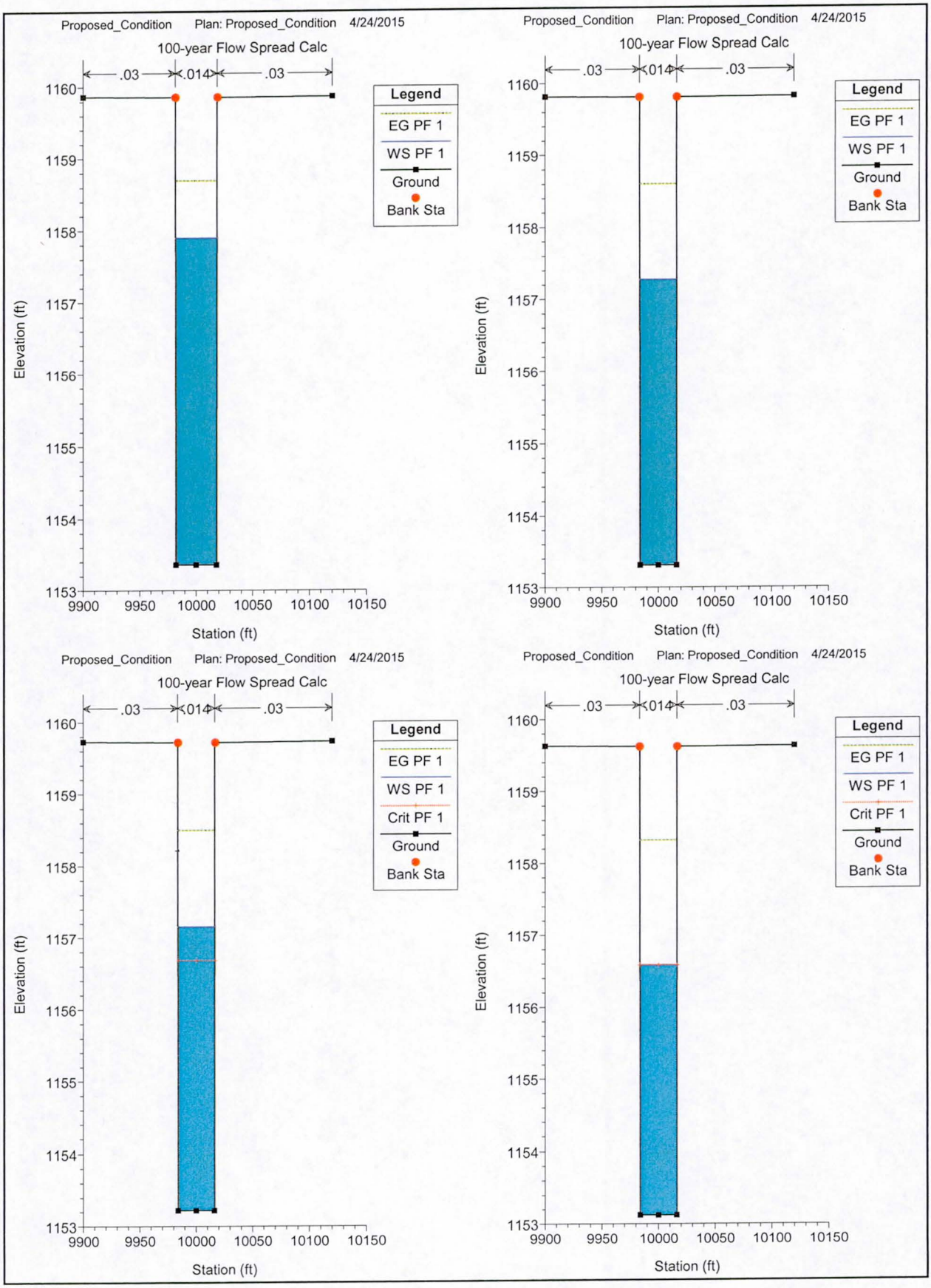
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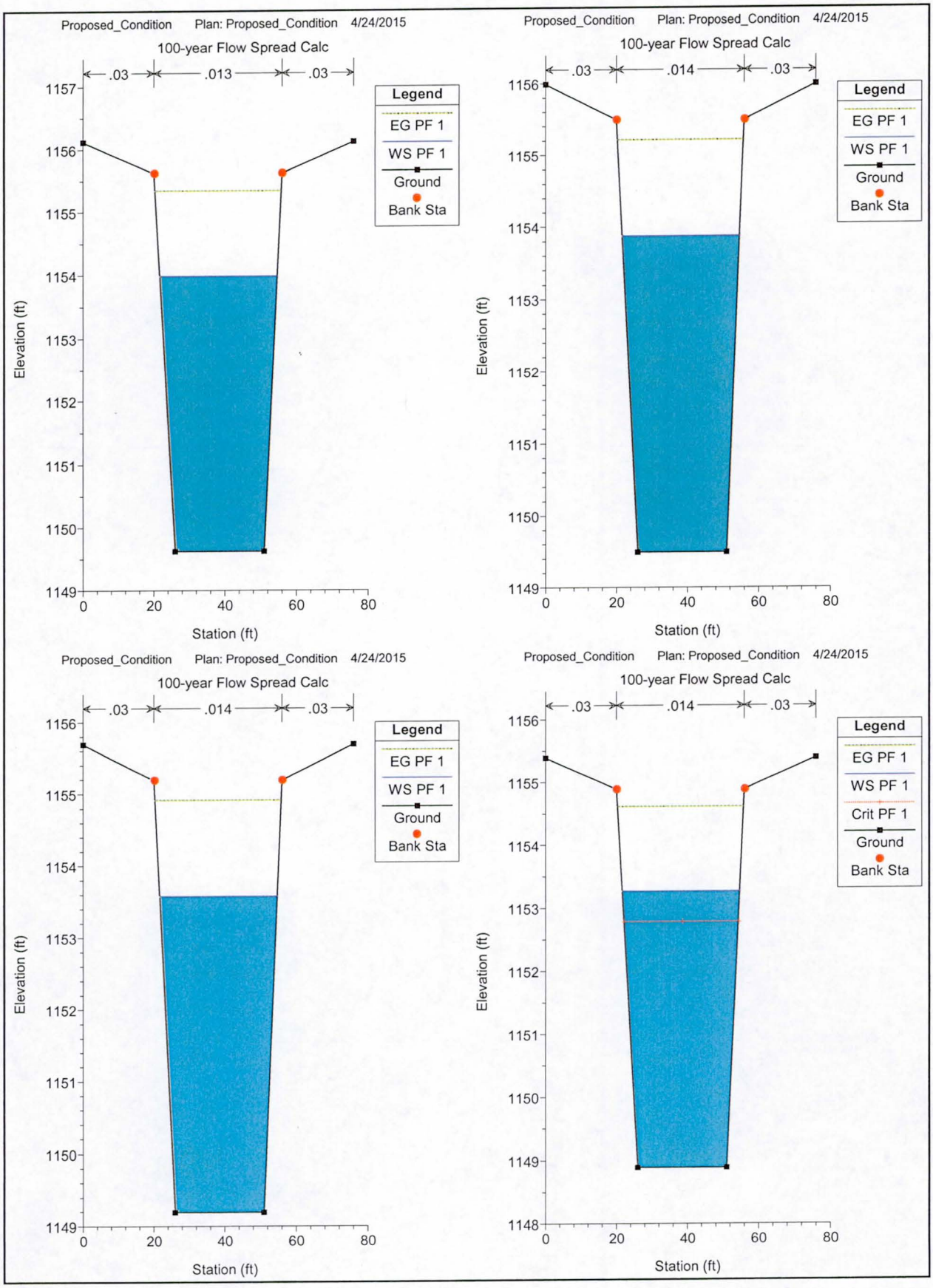
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Elevation (ft)
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
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Elevation (ft)
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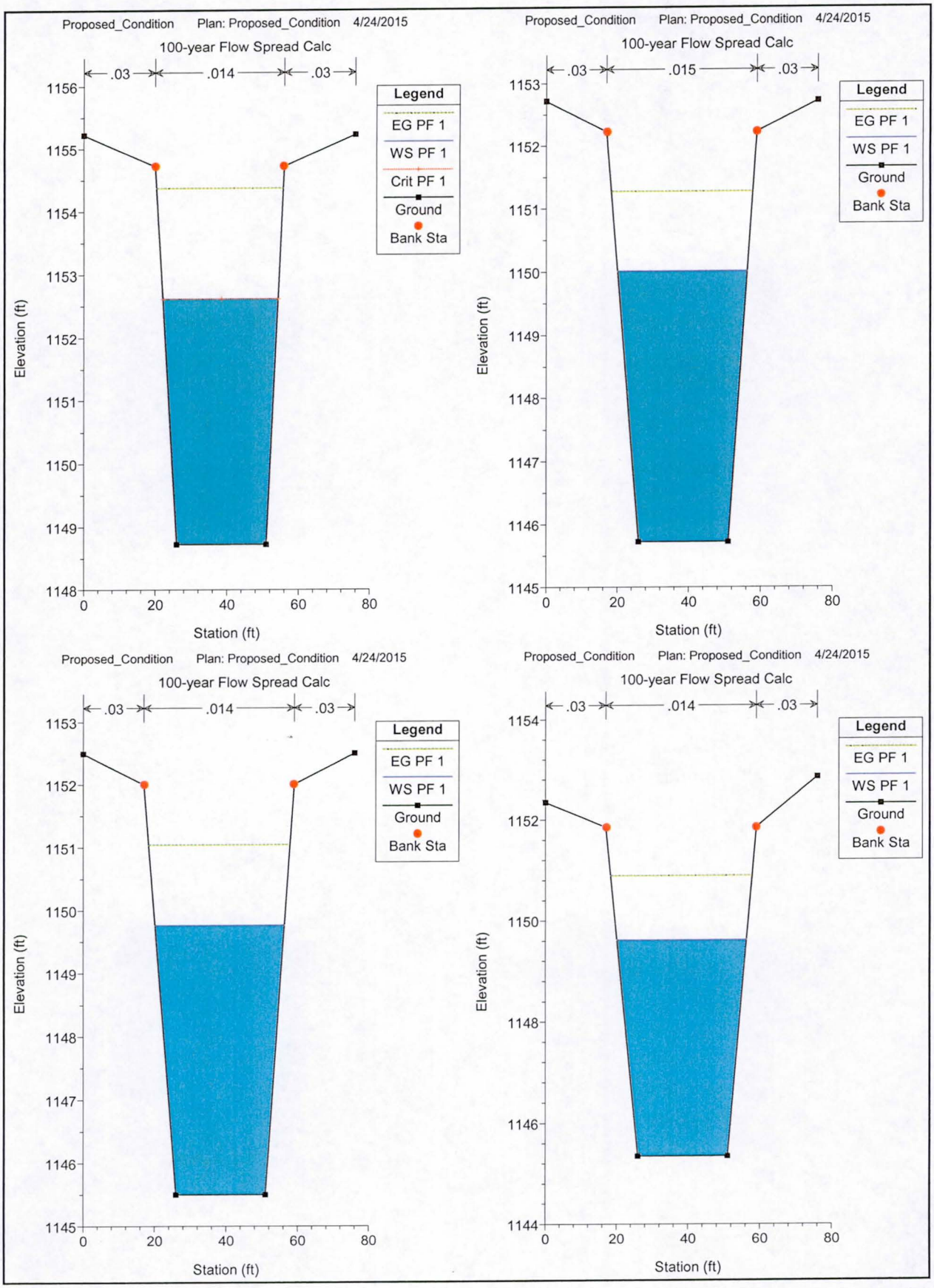
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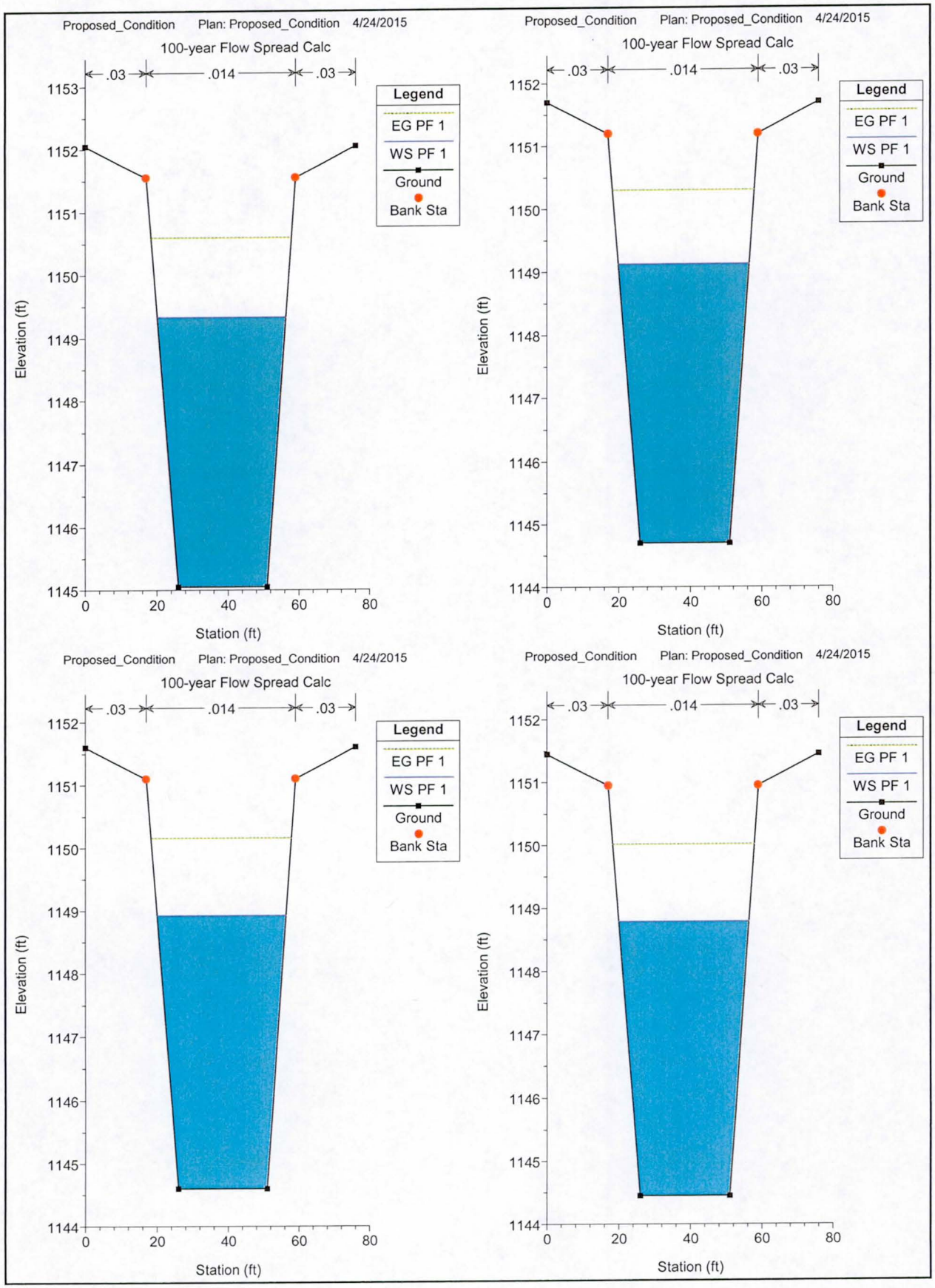
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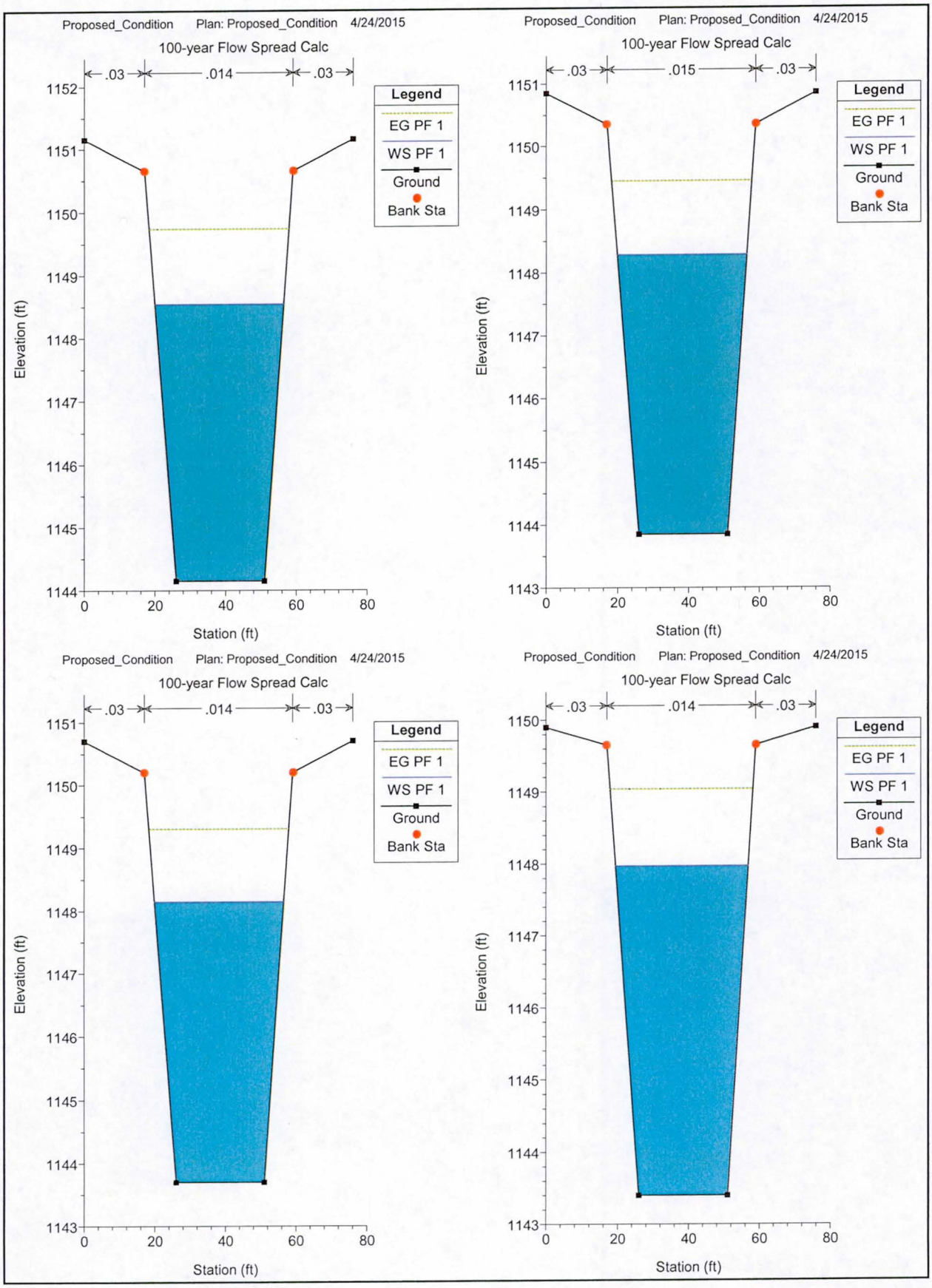
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Elevation (ft)
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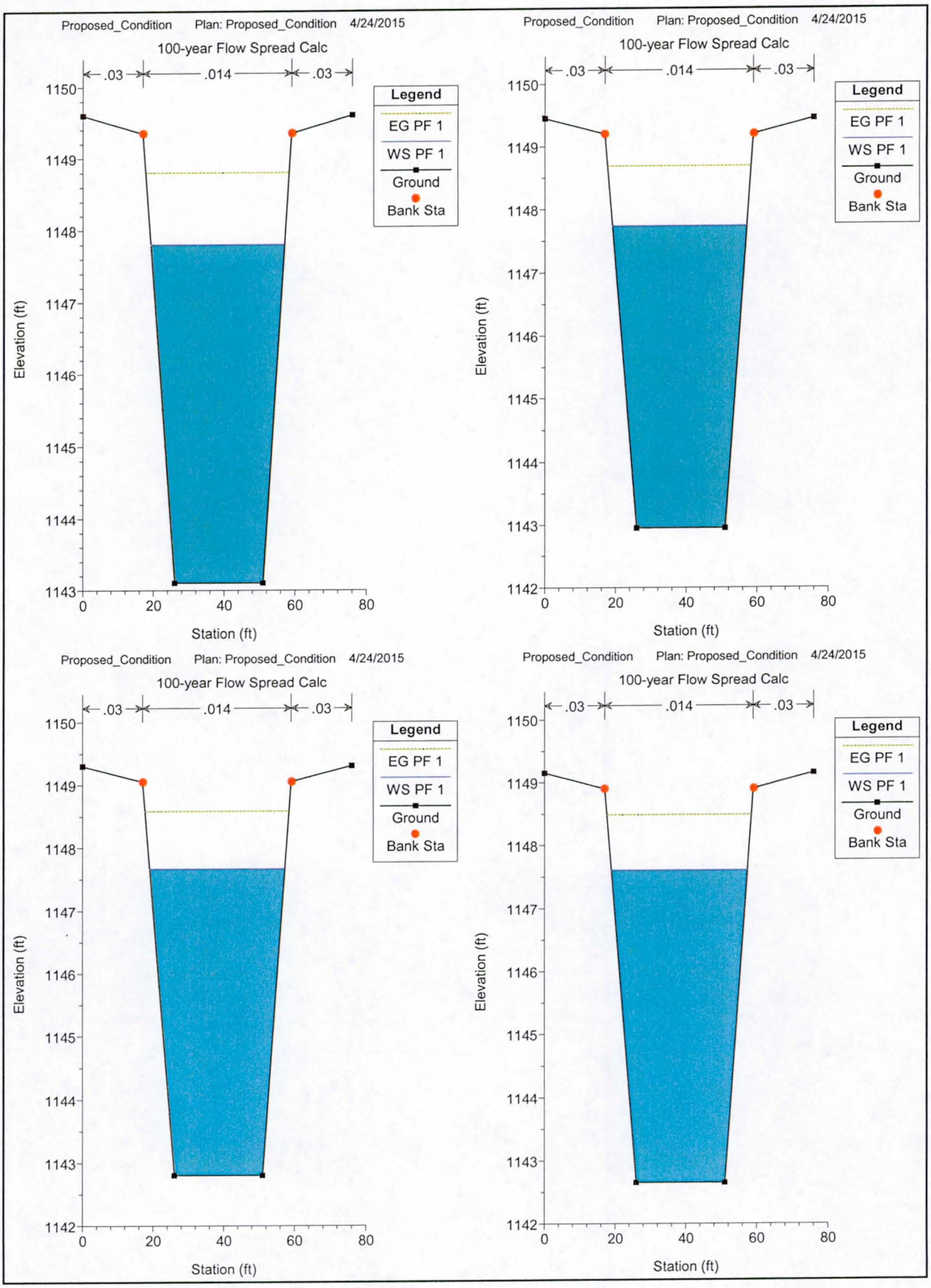
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Ground
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Elevation (ft)
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Elevation (ft)
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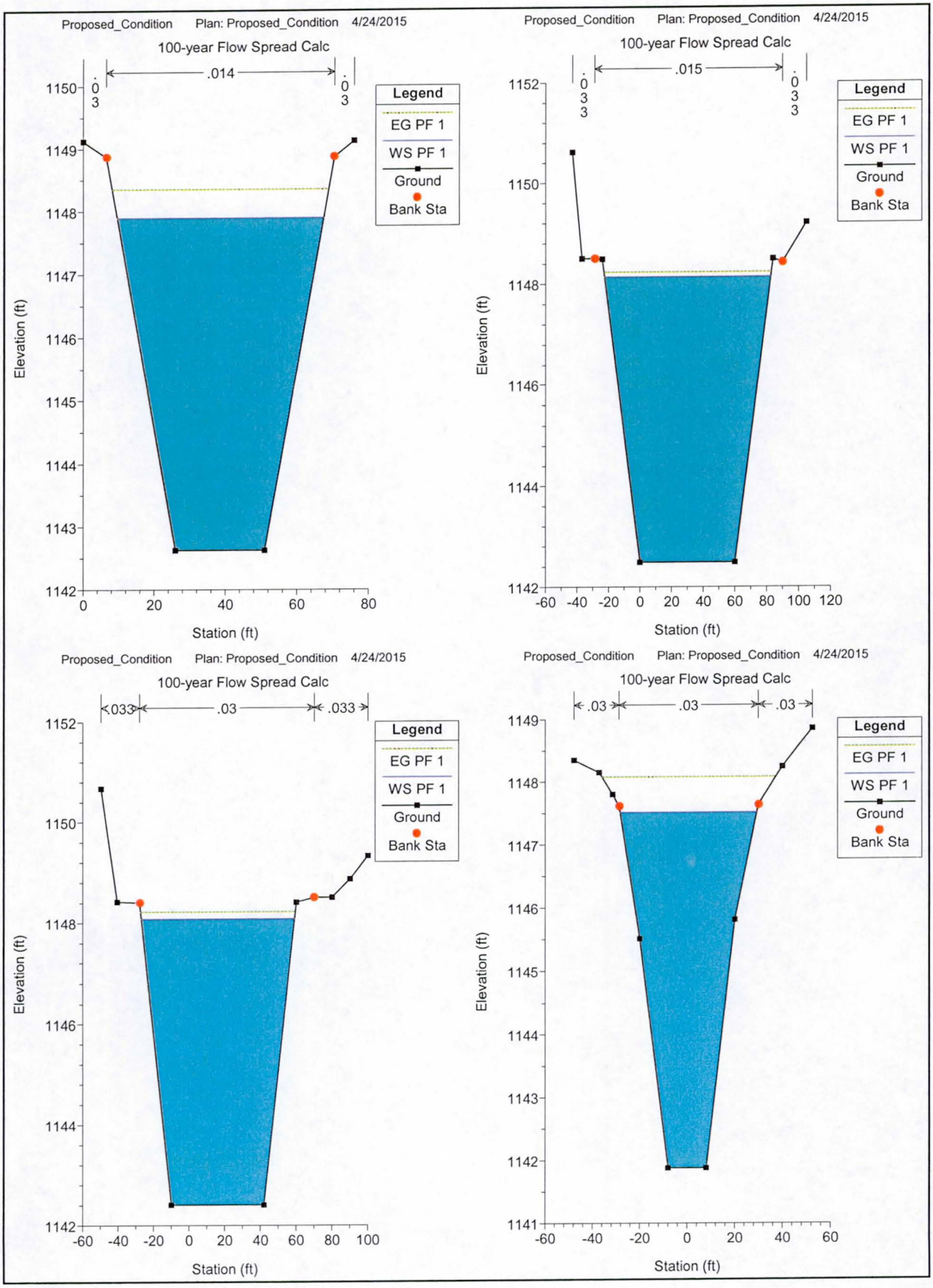
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100-year Flow Spread Calc
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WS PF 1
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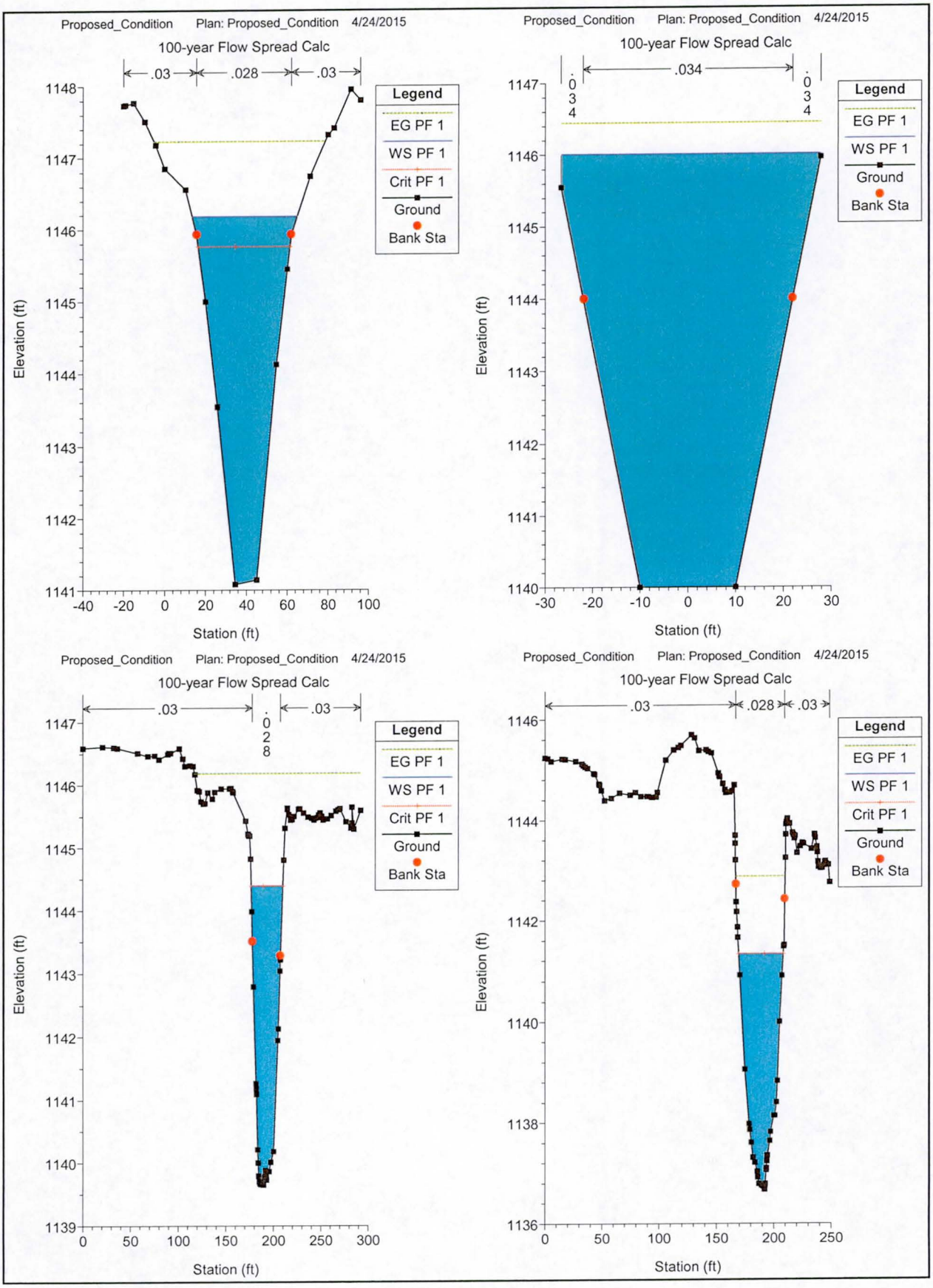
Bank Sta
Elevation (ft)
Station (ft)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Crit PF 1
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Bank Sta
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Station (ft)
Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Ground
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Elevation (ft)
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Elevation (ft)
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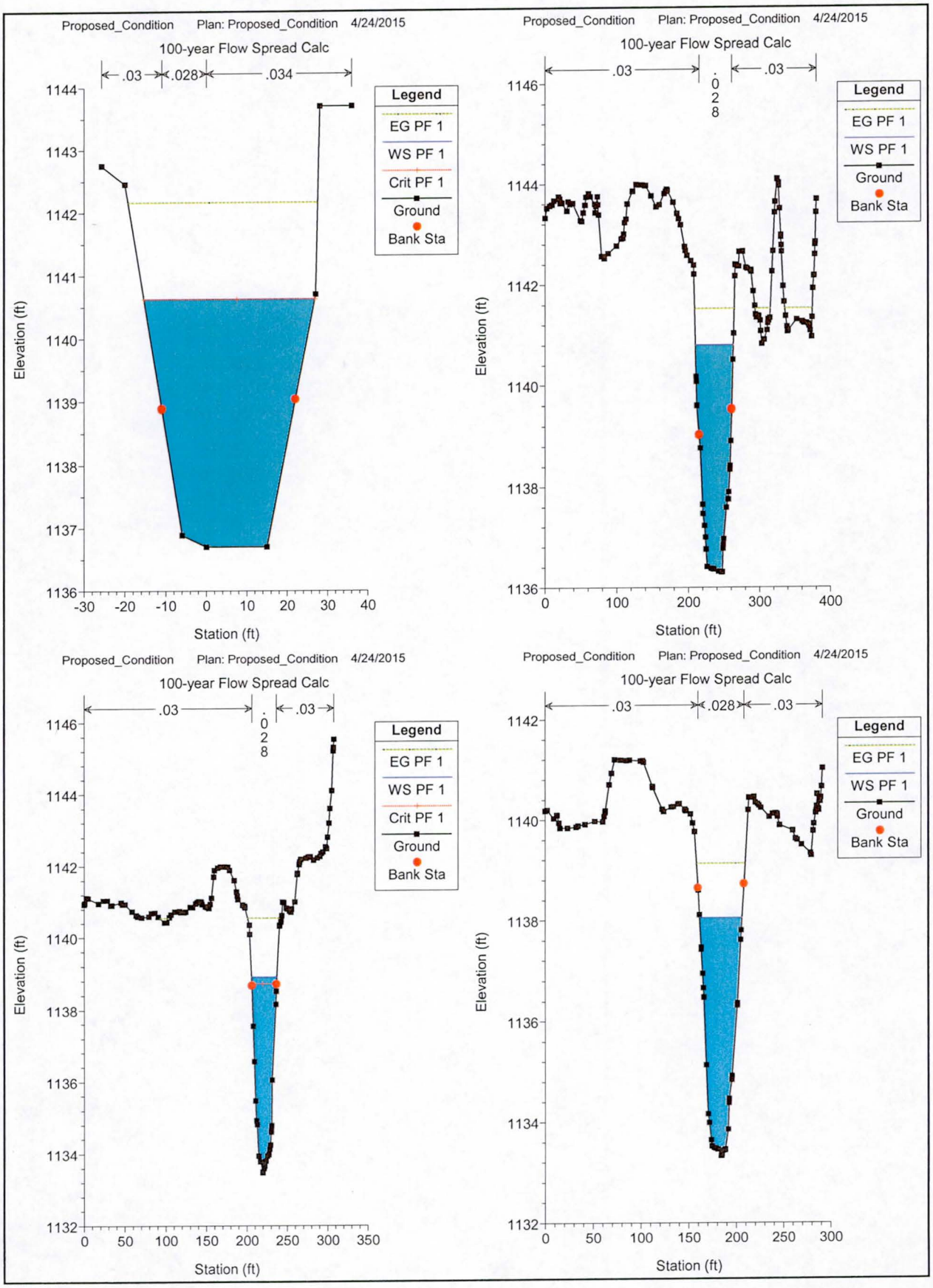
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
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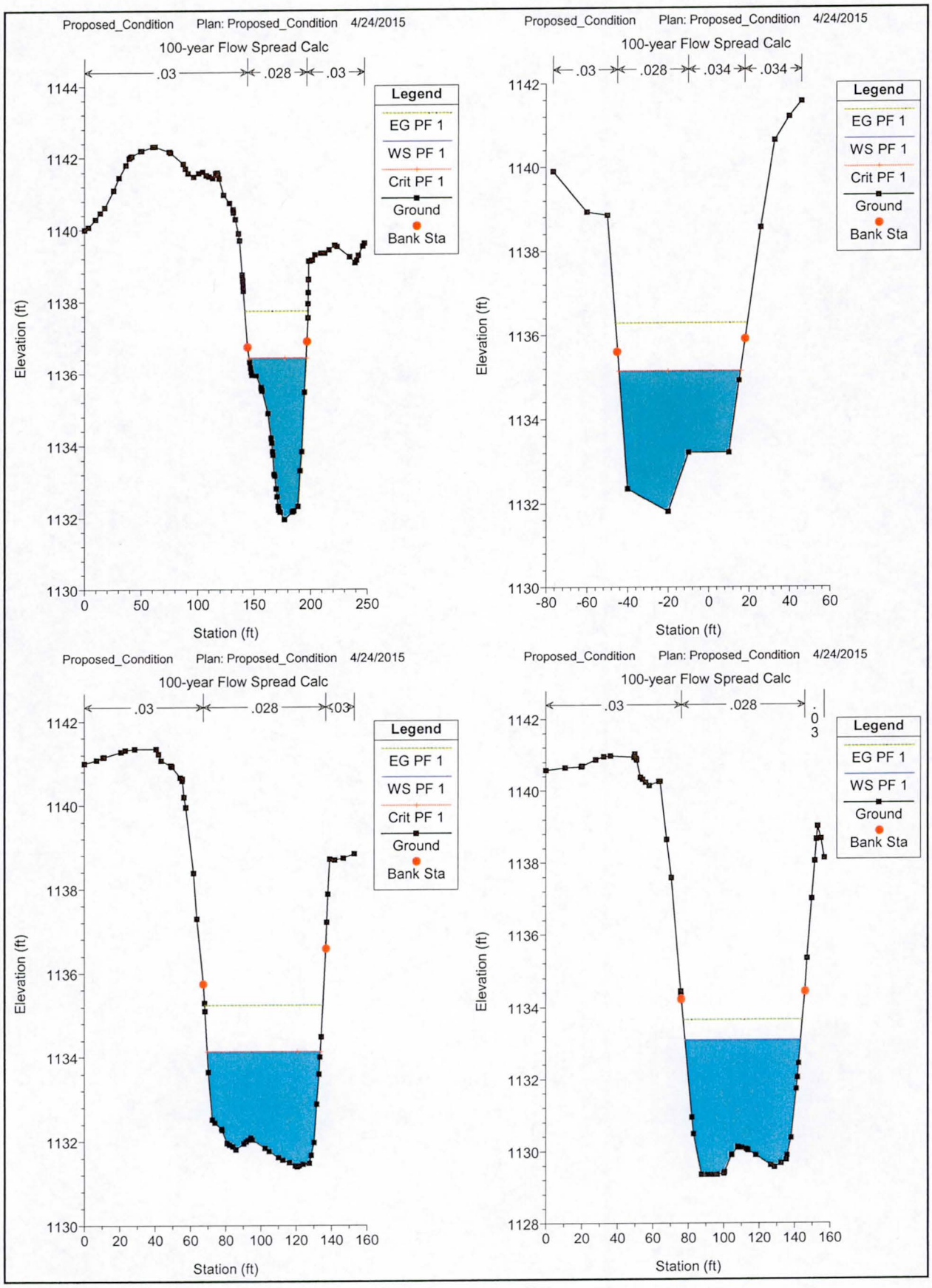
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Elevation (ft)
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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EG PF 1
WS PF 1
Crit PF 1
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Bank Sta
Elevation (ft)
Station (ft)
Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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Legend
EG PF 1
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Crit PF 1
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Elevation (ft)
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Proposed_Condition Plan: Proposed_Condition 4/24/2015
100-year Flow Spread Calc
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EG PF 1
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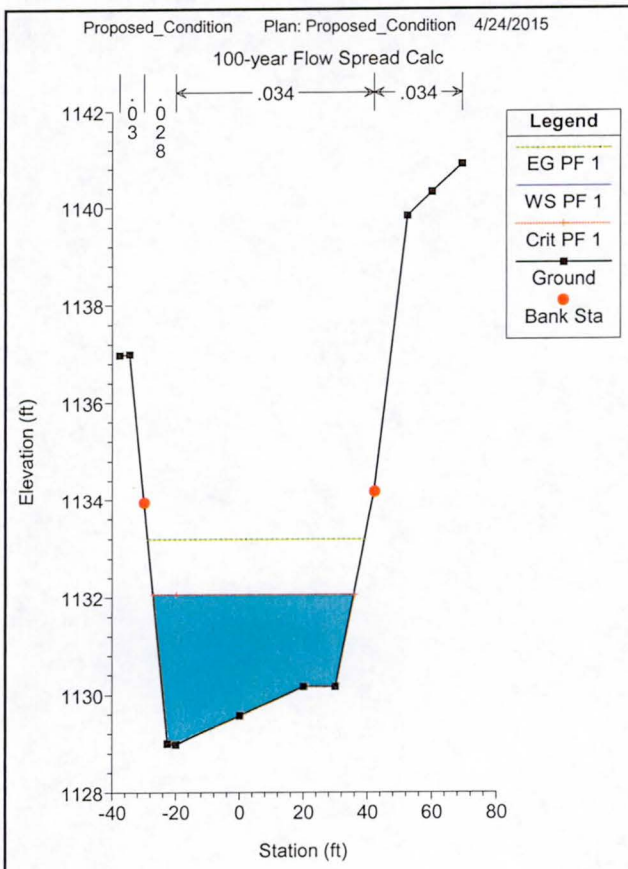
Bank Sta
Elevation (ft)
Station (ft)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100-year Flow Spread Calc
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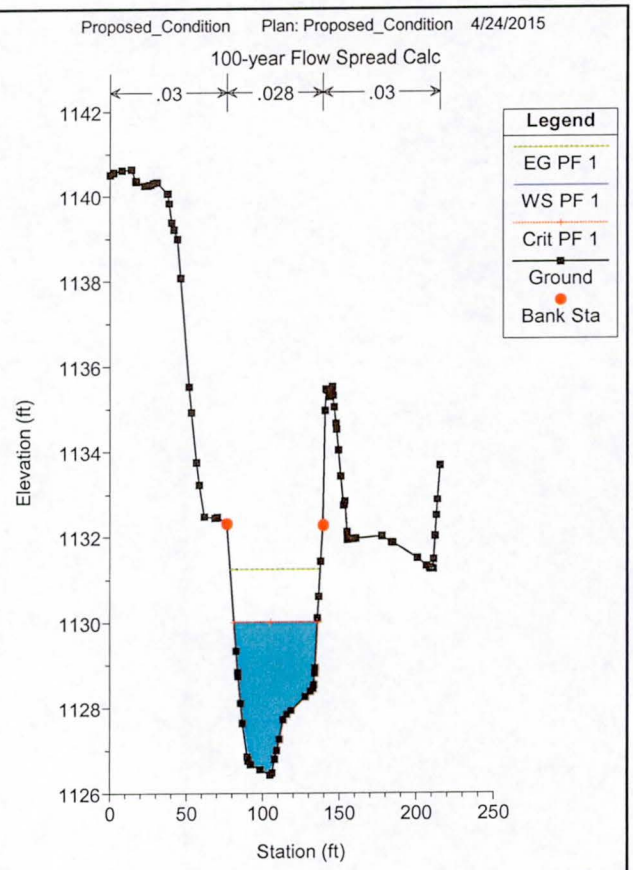
Bank Sta
Elevation (ft)
Station (ft)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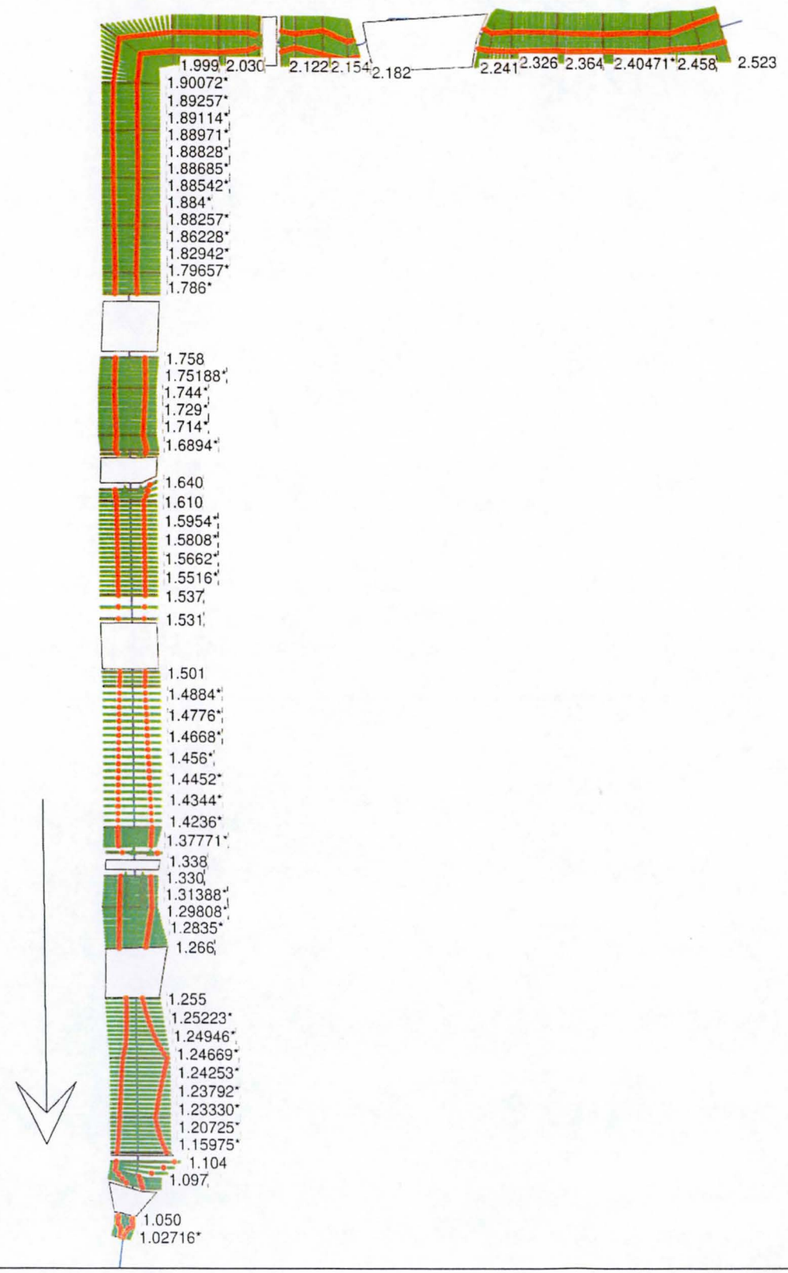
Bank Sta
Elevation (ft)
Station (ft)

APPENDIX D.8 – 115th Avenue and Canyon Ridge Unsteady HEC-RAS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HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	2.523	Max WS	20.00	1189.40	1193.02		1193.02	0.000002	0.13	155.29	55.89	0.01
Reach 1	2.51762*	Max WS	19.98	1189.38	1193.02		1193.02	0.000002	0.13	156.93	56.34	0.01
Reach 1	2.51225*	Max WS	19.97	1189.37	1193.02		1193.02	0.000002	0.13	158.09	56.74	0.01
Reach 1	2.50687*	Max WS	19.99	1189.35	1193.02		1193.02	0.000002	0.13	159.87	57.24	0.01
Reach 1	2.5015*	Max WS	20.00	1189.33	1193.02		1193.02	0.000002	0.12	161.67	57.75	0.01
Reach 1	2.49612*	Max WS	19.98	1189.32	1193.02		1193.02	0.000002	0.12	163.01	58.23	0.01
Reach 1	2.49075*	Max WS	19.97	1189.30	1193.02		1193.02	0.000002	0.12	164.95	58.80	0.01
Reach 1	2.48537*	Max WS	19.96	1189.29	1193.02		1193.02	0.000002	0.12	166.36	59.32	0.01
Reach 1	2.480	Max WS	19.94	1189.27	1193.02		1193.02	0.000002	0.12	168.45	59.96	0.01
Reach 1	2.47755*	Max WS	410.20	1189.25	1192.79		1192.90	0.000876	2.63	156.24	58.30	0.28
Reach 1	2.47511*	Max WS	410.72	1189.24	1192.78		1192.88	0.000880	2.63	156.16	58.30	0.28
Reach 1	2.47266*	Max WS	410.43	1189.22	1192.77		1192.87	0.000870	2.62	156.69	58.37	0.28
Reach 1	2.47022*	Max WS	409.13	1189.20	1192.76		1192.86	0.000856	2.60	157.24	58.44	0.28
Reach 1	2.46777*	Max WS	409.26	1189.19	1192.75		1192.85	0.000857	2.60	157.22	58.45	0.28
Reach 1	2.46533*	Max WS	407.90	1189.17	1192.73		1192.84	0.000843	2.59	157.72	58.51	0.28
Reach 1	2.46288*	Max WS	408.70	1189.15	1192.72		1192.83	0.000838	2.58	158.30	58.59	0.28
Reach 1	2.46044*	Max WS	406.97	1189.14	1192.71		1192.82	0.000831	2.57	158.29	58.60	0.28
Reach 1	2.458	Max WS	406.83	1189.12	1192.70		1192.81	0.000822	2.56	158.84	58.66	0.27
Reach 1	2.45542*	Max WS	405.92	1189.10	1192.69		1192.79	0.000811	2.55	159.37	58.71	0.27
Reach 1	2.45285*	Max WS	405.14	1189.09	1192.68		1192.78	0.000809	2.54	159.22	58.67	0.27
Reach 1	2.45028*	Max WS	404.60	1189.07	1192.67		1192.77	0.000799	2.53	159.73	58.70	0.27
Reach 1	2.44771*	Max WS	405.22	1189.06	1192.66		1192.76	0.000802	2.54	159.69	58.67	0.27
Reach 1	2.44514*	Max WS	404.46	1189.04	1192.65		1192.75	0.000791	2.52	160.19	58.70	0.27
Reach 1	2.44257*	Max WS	403.60	1189.03	1192.64		1192.74	0.000788	2.52	160.14	58.67	0.27
Reach 1	2.440	Max WS	404.20	1189.01	1192.63		1192.73	0.000783	2.52	160.64	58.71	0.27
Reach 1	2.43728*	Max WS	404.30	1188.99	1192.62		1192.72	0.000773	2.50	161.55	58.96	0.27
Reach 1	2.43457*	Max WS	403.71	1188.98	1192.61		1192.71	0.000768	2.49	161.98	59.19	0.27
Reach 1	2.43185*	Max WS	403.93	1188.96	1192.60		1192.70	0.000758	2.48	162.95	59.48	0.26
Reach 1	2.42914*	Max WS	403.45	1188.94	1192.59		1192.69	0.000746	2.46	163.96	59.81	0.26
Reach 1	2.42642*	Max WS	402.76	1188.92	1192.58		1192.68	0.000734	2.44	164.97	60.13	0.26
Reach 1	2.42371*	Max WS	402.65	1188.91	1192.57		1192.67	0.000730	2.43	165.56	60.47	0.26
Reach 1	2.421*	Max WS	401.78	1188.89	1192.56		1192.65	0.000717	2.41	166.70	60.87	0.26
Reach 1	2.41828*	Max WS	402.41	1188.87	1192.56		1192.64	0.000709	2.40	167.81	61.30	0.26
Reach 1	2.41557*	Max WS	401.86	1188.86	1192.55		1192.63	0.000702	2.38	168.57	61.68	0.25
Reach 1	2.41285*	Max WS	401.35	1188.84	1192.54		1192.62	0.000690	2.36	169.75	62.08	0.25
Reach 1	2.41014*	Max WS	400.63	1188.82	1192.53		1192.61	0.000676	2.34	171.04	62.48	0.25
Reach 1	2.40742*	Max WS	400.71	1188.80	1192.52		1192.60	0.000665	2.32	172.41	62.91	0.25
Reach 1	2.40471*	Max WS	401.31	1188.79	1192.51		1192.59	0.000658	2.32	173.20	62.98	0.25
Reach 1	2.402	Max WS	400.72	1188.77	1192.50		1192.59	0.000640	2.30	174.59	63.06	0.24
Reach 1	2.39928*	Max WS	400.32	1188.75	1192.50		1192.58	0.000631	2.27	176.08	63.91	0.24
Reach 1	2.39657*	Max WS	400.59	1188.74	1192.49		1192.57	0.000629	2.26	177.28	64.81	0.24
Reach 1	2.39385*	Max WS	400.03	1188.72	1192.48		1192.56	0.000620	2.24	178.87	65.70	0.24
Reach 1	2.39114*	Max WS	400.10	1188.70	1192.47		1192.55	0.000614	2.22	180.47	66.65	0.24
Reach 1	2.38842*	Max WS	399.66	1188.68	1192.47		1192.54	0.000605	2.19	182.20	67.64	0.24
Reach 1	2.38571*	Max WS	399.92	1188.67	1192.46		1192.53	0.000604	2.18	183.55	68.77	0.24
Reach 1	2.383*	Max WS	399.82	1188.65	1192.45		1192.52	0.000596	2.16	185.41	69.94	0.23
Reach 1	2.38028*	Max WS	399.71	1188.63	1192.44		1192.51	0.000589	2.13	187.36	71.18	0.23
Reach 1	2.37757*	Max WS	399.49	1188.62	1192.44		1192.51	0.000586	2.11	188.92	72.49	0.23
Reach 1	2.37485*	Max WS	399.56	1188.60	1192.43		1192.50	0.000580	2.09	191.02	73.88	0.23
Reach 1	2.37214*	Max WS	398.95	1188.58	1192.42		1192.49	0.000566	2.07	193.19	75.36	0.23
Reach 1	2.36942*	Max WS	398.86	1188.56	1192.42		1192.48	0.000552	2.04	195.64	76.79	0.22
Reach 1	2.36671*	Max WS	399.24	1188.55	1192.41		1192.47	0.000543	2.02	197.70	78.25	0.22
Reach 1	2.364	Max WS	398.68	1188.53	1192.40		1192.46	0.000529	2.00	200.25	79.68	0.22
Reach 1	2.36128*	Max WS	398.81	1188.51	1192.40		1192.46	0.000480	1.93	206.83	80.84	0.21
Reach 1	2.35857*	Max WS	399.06	1188.50	1192.39		1192.45	0.000439	1.88	213.13	81.90	0.20
Reach 1	2.35585*	Max WS	399.13	1188.48	1192.39		1192.44	0.000400	1.82	219.90	82.98	0.19
Reach 1	2.35314*	Max WS	398.67	1188.46	1192.39		1192.43	0.000363	1.77	226.91	84.04	0.18
Reach 1	2.35042*	Max WS	399.05	1188.44	1192.38		1192.43	0.000331	1.72	234.01	85.08	0.18
Reach 1	2.34771*	Max WS	399.01	1188.43	1192.38		1192.42	0.000304	1.67	241.01	86.18	0.17
Reach 1	2.345*	Max WS	398.82	1188.41	1192.38		1192.42	0.000278	1.62	248.39	87.22	0.16
Reach 1	2.34228*	Max WS	399.03	1188.39	1192.38		1192.41	0.000255	1.57	255.89	88.24	0.16
Reach 1	2.33957*	Max WS	398.87	1188.38	1192.37		1192.41	0.000234	1.53	263.24	89.27	0.15
Reach 1	2.33685*	Max WS	399.00	1188.36	1192.37		1192.41	0.000216	1.49	270.98	90.25	0.15
Reach 1	2.33414*	Max WS	398.94	1188.34	1192.37		1192.40	0.000198	1.45	278.96	91.24	0.14
Reach 1	2.33142*	Max WS	398.55	1188.32	1192.37		1192.40	0.000182	1.41	286.99	92.20	0.13
Reach 1	2.32871*	Max WS	398.83	1188.31	1192.37		1192.40	0.000169	1.37	294.71	93.21	0.13
Reach 1	2.326	Max WS	398.93	1188.29	1192.37		1192.40	0.000156	1.34	303.06	94.17	0.13
Reach 1	2.32316*	Max WS	398.91	1188.27	1192.37		1192.39	0.000150	1.33	306.66	95.08	0.12
Reach 1	2.32033*	Max WS	398.95	1188.25	1192.36		1192.39	0.000145	1.32	310.67	96.00	0.12
Reach 1	2.3175*	Max WS	398.84	1188.24	1192.36		1192.39	0.000140	1.31	314.82	96.95	0.12
Reach 1	2.31466*	Max WS	398.79	1188.22	1192.36		1192.39	0.000135	1.30	319.58	97.85	0.12
Reach 1	2.31183*	Max WS	398.82	1188.20	1192.36		1192.38	0.000129	1.29	324.97	98.74	0.12
Reach 1	2.309	Max WS	398.77	1188.18	1192.36		1192.38	0.000124	1.28	330.63	99.61	0.11
Reach 1	2.30675*	Max WS	398.76	1188.17	1192.35		1192.38	0.000141	1.32	315.00	98.32	0.12
Reach 1	2.3045*	Max WS	398.76	1188.16	1192.35		1192.38	0.000165	1.38	297.60	96.26	0.13
Reach 1	2.30225*	Max WS	398.78	1188.14	1192.34		1192.37	0.000200	1.44	279.26	93.55	0.14

HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	2.300	Max WS	398.75	1188.13	1192.34		1192.37	0.000255	1.53	260.63	87.71	0.16
Reach 1	2.241		Culvert									
Reach 1	2.182	Max WS	398.74	1183.29	1184.86	1185.26	1186.39	0.025593	9.93	40.17	54.55	1.41
Reach 1	2.17966*	Max WS	398.74	1183.09	1184.33	1184.42	1185.01	0.019168	6.62	60.23	57.39	1.14
Reach 1	2.17733*	Max WS	398.71	1182.89	1184.08	1184.16	1184.71	0.019046	6.38	62.53	62.83	1.13
Reach 1	2.175	Max WS	398.71	1182.69	1183.83	1183.88	1184.39	0.017743	6.02	66.19	68.72	1.08
Reach 1	2.17237*	Max WS	398.70	1182.45	1183.58	1183.64	1184.14	0.018030	5.98	66.73	71.00	1.09
Reach 1	2.16975*	Max WS	398.72	1182.21	1183.33	1183.39	1183.88	0.018383	5.93	67.21	73.36	1.09
Reach 1	2.16712*	Max WS	398.76	1181.97	1183.08	1183.13	1183.62	0.018749	5.89	67.72	75.88	1.10
Reach 1	2.1645*	Max WS	398.70	1181.72	1182.81	1182.87	1183.34	0.019063	5.84	68.26	78.40	1.10
Reach 1	2.16187*	Max WS	398.74	1181.48	1182.55	1182.61	1183.07	0.019456	5.81	68.66	80.79	1.11
Reach 1	2.15925*	Max WS	398.66	1181.24	1182.28	1182.34	1182.80	0.019876	5.79	68.91	82.86	1.12
Reach 1	2.15662*	Max WS	398.72	1181.00	1182.00	1182.07	1182.52	0.020505	5.78	69.02	85.13	1.13
Reach 1	2.154	Max WS	398.64	1180.76	1181.69	1181.80	1182.25	0.024255	6.00	66.39	87.61	1.22
Reach 1	2.15144*	Max WS	398.72	1180.39	1181.36	1181.47	1181.94	0.023934	6.09	65.47	83.75	1.21
Reach 1	2.14888*	Max WS	398.72	1180.01	1181.04	1181.15	1181.63	0.023367	6.16	64.72	79.89	1.21
Reach 1	2.14633*	Max WS	398.72	1179.64	1180.74	1180.83	1181.32	0.021599	6.13	65.03	76.22	1.17
Reach 1	2.14377*	Max WS	398.64	1179.27	1180.45	1180.51	1181.01	0.018827	5.99	66.55	72.85	1.10
Reach 1	2.14122*	Max WS	398.74	1178.89	1180.21	1180.20	1180.71	0.014916	5.68	70.23	69.90	1.00
Reach 1	2.13866*	Max WS	398.42	1178.52	1180.01		1180.43	0.010707	5.21	76.45	67.44	0.86
Reach 1	2.13611*	Max WS	398.28	1178.15	1179.95		1180.25	0.005928	4.39	90.68	66.29	0.66
Reach 1	2.13355*	Max WS	398.32	1177.77	1179.95		1180.17	0.003265	3.76	106.48	66.06	0.51
Reach 1	2.131	Max WS	398.30	1177.40	1179.95		1180.12	0.000612	3.33	121.69	66.63	0.41
Reach 1	2.12875*	Max WS	398.31	1177.04	1179.94		1180.10	0.001962	3.17	126.23	69.70	0.40
Reach 1	2.1265*	Max WS	398.29	1176.67	1179.94		1180.07	0.001556	2.84	140.07	71.88	0.36
Reach 1	2.12425*	Max WS	398.27	1176.30	1179.95		1180.04	0.000959	2.43	163.83	73.83	0.29
Reach 1	2.122	Max WS	398.26	1175.94	1179.69		1180.02	0.001764	4.59	86.73	68.79	0.43
Reach 1	2.112		Culvert									
Reach 1	2.102	Max WS	398.15	1173.24	1175.23	1175.56	1176.62	0.022000	9.47	42.03	39.10	1.31
Reach 1	2.09725*	Max WS	397.96	1172.95	1174.82	1174.99	1175.72	0.020669	7.63	52.19	42.39	1.21
Reach 1	2.0925*	Max WS	397.64	1172.66	1174.54	1174.64	1175.31	0.018023	7.04	56.46	46.68	1.13
Reach 1	2.08775*	Max WS	396.93	1172.37	1174.30	1174.30	1174.93	0.014601	6.38	62.26	51.04	1.02
Reach 1	2.083	Max WS	395.67	1172.08	1174.10		1174.59	0.010800	5.62	70.42	55.66	0.88
Reach 1	2.07711*	Max WS	478.48	1171.91	1173.89	1173.93	1174.59	0.015286	6.72	71.25	55.95	1.05
Reach 1	2.07122*	Max WS	478.53	1171.74	1173.67	1173.71	1174.37	0.015178	6.69	71.49	56.12	1.05
Reach 1	2.06533*	Max WS	478.52	1171.57	1173.46	1173.48	1174.15	0.015038	6.67	71.78	56.33	1.04
Reach 1	2.05944*	Max WS	478.51	1171.40	1173.24	1173.26	1173.92	0.014812	6.62	72.23	56.57	1.03
Reach 1	2.05355*	Max WS	478.57	1171.22	1173.03	1173.04	1173.70	0.014468	6.57	72.87	56.83	1.02
Reach 1	2.04766*	Max WS	478.50	1171.05	1172.82	1172.82	1173.47	0.014014	6.49	73.72	57.13	1.01
Reach 1	2.04177*	Max WS	478.55	1170.88	1172.62	1172.60	1173.25	0.013378	6.39	74.94	57.48	0.99
Reach 1	2.03588*	Max WS	478.55	1170.71	1172.43	1172.38	1173.03	0.012429	6.23	76.87	57.98	0.95
Reach 1	2.030	Max WS	478.53	1170.54	1172.26		1172.81	0.010828	5.94	80.51	58.68	0.89
Reach 1	2.02778*	Max WS	478.52	1170.35	1172.13		1172.65	0.009988	5.79	82.65	58.98	0.86
Reach 1	2.02557*	Max WS	478.52	1170.17	1172.01		1172.49	0.008624	5.52	86.68	59.52	0.81
Reach 1	2.02335*	Max WS	330.02	1169.98	1171.99		1172.17	0.003019	3.44	95.85	60.79	0.48
Reach 1	2.02114*	Max WS	329.54	1169.79	1171.98		1172.13	0.002221	3.11	106.02	62.25	0.42
Reach 1	2.01892*	Max WS	329.43	1169.60	1171.97		1172.09	0.001665	2.82	116.83	63.93	0.37
Reach 1	2.01671*	Max WS	329.99	1169.42	1171.96		1172.07	0.001270	2.57	128.18	65.59	0.32
Reach 1	2.0145*	Max WS	329.96	1169.23	1171.96		1172.04	0.000980	2.36	139.91	67.19	0.29
Reach 1	2.01228*	Max WS	330.15	1169.04	1171.96		1172.03	0.000766	2.17	152.05	68.70	0.26
Reach 1	2.01007*	Max WS	329.75	1168.86	1171.95		1172.02	0.000604	2.00	164.59	70.18	0.23
Reach 1	2.00785*	Max WS	328.70	1168.67	1171.95		1172.01	0.000481	1.85	177.57	71.79	0.21
Reach 1	2.00564*	Max WS	328.58	1168.48	1171.95		1172.00	0.000341	1.72	190.79	73.13	0.19
Reach 1	2.00342*	Max WS	329.33	1168.29	1171.95		1171.99	0.000316	1.61	204.38	74.11	0.17
Reach 1	2.00121*	Max WS	329.22	1168.11	1171.95		1171.99	0.000259	1.51	217.93	75.02	0.16
Reach 1	1.999	Max WS	328.78	1167.92	1171.95		1171.98	0.000214	1.42	231.79	75.91	0.14
Reach 1	1.99661*	Max WS	576.67	1167.87	1171.80		1171.90	0.000716	2.53	228.08	77.79	0.26
Reach 1	1.99423*	Max WS	576.56	1167.82	1171.80		1171.89	0.000667	2.44	236.21	80.58	0.25
Reach 1	1.99184*	Max WS	576.51	1167.77	1171.79		1171.88	0.000616	2.35	245.18	83.38	0.24
Reach 1	1.98946*	Max WS	576.08	1167.72	1171.79		1171.87	0.000561	2.25	255.50	86.26	0.23
Reach 1	1.98707*	Max WS	576.45	1167.67	1171.79		1171.86	0.000508	2.16	266.75	89.14	0.22
Reach 1	1.98469*	Max WS	576.43	1167.62	1171.78		1171.85	0.000456	2.07	279.11	92.11	0.21
Reach 1	1.98230*	Max WS	576.41	1167.56	1171.78		1171.84	0.000405	1.97	292.78	95.04	0.20
Reach 1	1.97992*	Max WS	576.27	1167.51	1171.78		1171.84	0.000430	1.88	307.22	98.00	0.19
Reach 1	1.97753*	Max WS	576.16	1167.46	1171.78		1171.83	0.000298	1.78	322.89	101.00	0.18
Reach 1	1.97515*	Max WS	575.44	1167.41	1171.78		1171.82	0.000278	1.69	339.77	104.06	0.17
Reach 1	1.97276*	Max WS	575.81	1167.36	1171.78		1171.82	0.000244	1.61	357.60	107.13	0.16
Reach 1	1.97038*	Max WS	576.17	1167.31	1171.78		1171.81	0.000255	1.53	376.67	110.23	0.15
Reach 1	1.968	Max WS	576.03	1167.26	1171.78		1171.81	0.000181	1.45	396.63	113.43	0.14
Reach 1	1.96127*	Max WS	575.78	1167.22	1171.77		1171.81	0.000190	1.47	391.24	111.57	0.14
Reach 1	1.95454*	Max WS	575.92	1167.18	1171.77		1171.80	0.000191	1.49	386.32	109.55	0.14
Reach 1	1.94781*	Max WS	575.93	1167.14	1171.77		1171.80	0.000195	1.51	382.21	107.73	0.14
Reach 1	1.94109*	Max WS	575.89	1167.10	1171.76		1171.80	0.000211	1.52	378.66	105.93	0.14
Reach 1	1.93436*	Max WS	575.69	1167.06	1171.76		1171.80	0.000212	1.53	375.77	104.19	0.14
Reach 1	1.92763*	Max WS	575.84	1167.03	1171.75		1171.79	0.000199	1.54	373.36	102.47	0.14
Reach 1	1.92090*	Max WS	575.40	1166.99	1171.75		1171.79	0.000197	1.55	371.78	100.72	0.14

HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1.91418*	Max WS	575.45	1166.95	1171.75		1171.79	0.000171	1.55	370.77	98.97	0.14
Reach 1	1.90745*	Max WS	575.74	1166.91	1171.75		1171.78	0.000168	1.55	370.42	97.28	0.14
Reach 1	1.90072*	Max WS	575.52	1166.87	1171.74		1171.78	0.000164	1.55	370.75	95.65	0.14
Reach 1	1.894	Max WS	575.66	1166.83	1171.74		1171.78	0.000160	1.55	371.54	94.10	0.14
Reach 1	1.89371*	Max WS	575.64	1166.82	1171.74		1171.78	0.000166	1.57	367.24	94.24	0.14
Reach 1	1.89342*	Max WS	575.59	1166.81	1171.74		1171.77	0.000173	1.59	363.09	94.34	0.14
Reach 1	1.89314*	Max WS	575.56	1166.80	1171.73		1171.77	0.000180	1.60	358.76	94.45	0.15
Reach 1	1.89285*	Max WS	575.30	1166.80	1171.73		1171.77	0.000187	1.62	354.77	94.60	0.15
Reach 1	1.89257*	Max WS	575.49	1166.79	1171.72		1171.77	0.000195	1.64	350.67	94.69	0.15
Reach 1	1.89228*	Max WS	575.13	1166.78	1171.72		1171.76	0.000202	1.66	346.77	94.81	0.15
Reach 1	1.892*	Max WS	575.37	1166.77	1171.72		1171.76	0.000210	1.68	342.91	94.94	0.16
Reach 1	1.89171*	Max WS	575.38	1166.76	1171.71		1171.76	0.000219	1.70	339.02	95.07	0.16
Reach 1	1.89142*	Max WS	575.00	1166.75	1171.71		1171.75	0.000227	1.71	335.42	95.20	0.16
Reach 1	1.89114*	Max WS	575.04	1166.74	1171.70		1171.75	0.000236	1.73	331.68	95.30	0.16
Reach 1	1.89085*	Max WS	575.21	1166.74	1171.70		1171.75	0.000244	1.75	328.20	95.37	0.17
Reach 1	1.89057*	Max WS	575.29	1166.73	1171.69		1171.74	0.000254	1.77	324.63	95.52	0.17
Reach 1	1.89028*	Max WS	575.21	1166.72	1171.69		1171.74	0.000263	1.79	321.22	95.60	0.17
Reach 1	1.890	Max WS	575.24	1166.71	1171.68		1171.74	0.000273	1.81	317.87	95.67	0.17
Reach 1	1.88971*	Max WS	575.19	1166.72	1171.68		1171.73	0.000265	1.79	321.25	95.96	0.17
Reach 1	1.88942*	Max WS	575.16	1166.73	1171.68		1171.73	0.000256	1.77	324.70	96.25	0.17
Reach 1	1.88914*	Max WS	575.05	1166.74	1171.68		1171.72	0.000248	1.75	328.21	96.53	0.17
Reach 1	1.88885*	Max WS	575.08	1166.75	1171.67		1171.72	0.000240	1.73	331.70	96.80	0.17
Reach 1	1.88857*	Max WS	575.07	1166.76	1171.67		1171.72	0.000233	1.72	335.28	97.09	0.16
Reach 1	1.88828*	Max WS	575.05	1166.77	1171.67		1171.71	0.000226	1.70	338.75	97.41	0.16
Reach 1	1.888*	Max WS	574.99	1166.78	1171.67		1171.71	0.000219	1.68	342.52	97.71	0.16
Reach 1	1.88771*	Max WS	575.01	1166.80	1171.66		1171.71	0.000212	1.66	346.28	97.99	0.16
Reach 1	1.88742*	Max WS	574.99	1166.81	1171.66		1171.70	0.000205	1.64	349.82	98.32	0.15
Reach 1	1.88714*	Max WS	574.88	1166.82	1171.66		1171.70	0.000199	1.63	353.70	98.63	0.15
Reach 1	1.88685*	Max WS	574.95	1166.83	1171.66		1171.70	0.000193	1.61	357.54	98.92	0.15
Reach 1	1.88657*	Max WS	574.92	1166.84	1171.65		1171.69	0.000186	1.59	361.53	99.17	0.15
Reach 1	1.88628*	Max WS	574.90	1166.85	1171.65		1171.69	0.000181	1.57	365.41	99.46	0.14
Reach 1	1.886	Max WS	574.87	1166.86	1171.65		1171.69	0.000175	1.56	369.40	99.74	0.14
Reach 1	1.88571*	Max WS	574.89	1166.86	1171.65		1171.69	0.000176	1.56	368.50	99.81	0.14
Reach 1	1.88542*	Max WS	574.87	1166.85	1171.65		1171.68	0.000177	1.56	368.11	99.85	0.14
Reach 1	1.88514*	Max WS	574.81	1166.85	1171.64		1171.68	0.000178	1.56	367.73	99.94	0.14
Reach 1	1.88485*	Max WS	574.80	1166.85	1171.64		1171.68	0.000178	1.56	367.54	100.04	0.14
Reach 1	1.88457*	Max WS	574.83	1166.84	1171.64		1171.68	0.000178	1.56	367.69	100.11	0.14
Reach 1	1.88428*	Max WS	574.77	1166.84	1171.63		1171.67	0.000178	1.56	368.02	100.17	0.14
Reach 1	1.884*	Max WS	574.76	1166.83	1171.63		1171.67	0.000177	1.56	368.76	100.25	0.14
Reach 1	1.88371*	Max WS	574.71	1166.83	1171.63		1171.67	0.000175	1.55	369.60	100.29	0.14
Reach 1	1.88342*	Max WS	574.75	1166.83	1171.63		1171.66	0.000174	1.55	370.47	100.33	0.14
Reach 1	1.88314*	Max WS	574.71	1166.82	1171.63		1171.66	0.000172	1.55	371.81	100.40	0.14
Reach 1	1.88285*	Max WS	574.66	1166.82	1171.62		1171.66	0.000170	1.54	373.34	100.43	0.14
Reach 1	1.88257*	Max WS	574.68	1166.82	1171.62		1171.66	0.000167	1.53	375.20	100.47	0.14
Reach 1	1.88228*	Max WS	574.69	1166.81	1171.62		1171.66	0.000164	1.52	377.09	100.50	0.14
Reach 1	1.882	Max WS	574.64	1166.81	1171.62		1171.65	0.000161	1.52	379.20	100.54	0.14
Reach 1	1.87542*	Max WS	574.63	1166.81	1171.61		1171.65	0.000160	1.51	379.49	100.83	0.14
Reach 1	1.86885*	Max WS	574.66	1166.80	1171.61		1171.65	0.000159	1.51	379.95	101.10	0.14
Reach 1	1.86228*	Max WS	574.59	1166.80	1171.61		1171.65	0.000158	1.51	380.36	101.31	0.14
Reach 1	1.85571*	Max WS	574.59	1166.80	1171.61		1171.64	0.000156	1.51	380.94	101.53	0.14
Reach 1	1.84914*	Max WS	574.62	1166.80	1171.61		1171.64	0.000154	1.51	381.48	101.72	0.13
Reach 1	1.84257*	Max WS	574.57	1166.79	1171.60		1171.64	0.000152	1.51	382.23	101.94	0.13
Reach 1	1.836*	Max WS	574.58	1166.79	1171.60		1171.64	0.000150	1.51	382.99	102.36	0.13
Reach 1	1.82942*	Max WS	574.57	1166.79	1171.60		1171.63	0.000148	1.51	383.94	102.83	0.13
Reach 1	1.82285*	Max WS	574.52	1166.78	1171.60		1171.63	0.000146	1.50	385.03	103.24	0.13
Reach 1	1.81628*	Max WS	574.55	1166.78	1171.60		1171.63	0.000144	1.50	386.13	103.67	0.13
Reach 1	1.80971*	Max WS	574.56	1166.78	1171.59		1171.63	0.000142	1.50	387.40	104.12	0.13
Reach 1	1.80314*	Max WS	574.54	1166.78	1171.59		1171.63	0.000140	1.50	388.80	104.54	0.13
Reach 1	1.79657*	Max WS	574.50	1166.77	1171.59		1171.62	0.000139	1.50	390.24	104.74	0.13
Reach 1	1.790	Max WS	574.56	1166.77	1171.59		1171.62	0.000137	1.50	391.85	104.84	0.13
Reach 1	1.789*	Max WS	574.48	1166.77	1171.59		1171.62	0.000136	1.49	392.93	105.15	0.13
Reach 1	1.788*	Max WS	574.51	1166.77	1171.58		1171.62	0.000135	1.48	394.02	105.16	0.13
Reach 1	1.787*	Max WS	574.52	1166.78	1171.58		1171.62	0.000135	1.47	395.37	105.06	0.13
Reach 1	1.786*	Max WS	574.42	1166.78	1171.58		1171.61	0.000134	1.46	396.77	104.83	0.13
Reach 1	1.785*	Max WS	574.42	1166.78	1171.58		1171.61	0.000133	1.45	398.57	104.60	0.13
Reach 1	1.784	Max WS	574.48	1166.78	1171.58		1171.61	0.000132	1.45	400.40	104.64	0.13
Reach 1	1.78		Culvert									
Reach 1	1.758	Max WS	572.87	1164.82	1167.92		1167.97	0.000441	1.90	302.00	122.21	0.21
Reach 1	1.75677*	Max WS	572.99	1164.79	1167.91		1167.97	0.000416	1.86	308.12	122.78	0.21
Reach 1	1.75555*	Max WS	572.90	1164.76	1167.91		1167.96	0.000392	1.82	314.21	123.40	0.20
Reach 1	1.75433*	Max WS	572.99	1164.74	1167.90		1167.95	0.000369	1.79	320.47	123.93	0.20
Reach 1	1.75311*	Max WS	572.87	1164.71	1167.90		1167.95	0.000348	1.75	326.88	124.47	0.19
Reach 1	1.75188*	Max WS	572.70	1164.68	1167.90		1167.94	0.000327	1.72	333.45	125.03	0.19
Reach 1	1.75066*	Max WS	572.81	1164.65	1167.89		1167.94	0.000309	1.68	340.06	125.60	0.18
Reach 1	1.74944*	Max WS	572.85	1164.63	1167.89		1167.93	0.000291	1.65	346.95	126.18	0.18
Reach 1	1.74822*	Max WS	572.80	1164.60	1167.89		1167.93	0.000274	1.62	353.87	126.79	0.17

HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1.747	Max WS	572.80	1164.57	1167.89		1167.92	0.000258	1.59	360.91	127.39	0.17
Reach 1	1.744*	Max WS	572.80	1164.56	1167.88		1167.92	0.000261	1.59	359.20	126.79	0.17
Reach 1	1.741*	Max WS	572.71	1164.55	1167.88		1167.92	0.000263	1.60	357.58	126.20	0.17
Reach 1	1.738*	Max WS	572.73	1164.54	1167.87		1167.91	0.000265	1.61	356.08	125.61	0.17
Reach 1	1.735*	Max WS	572.63	1164.53	1167.87		1167.91	0.000267	1.62	354.38	125.01	0.17
Reach 1	1.732*	Max WS	572.62	1164.52	1167.86		1167.91	0.000269	1.62	353.04	124.40	0.17
Reach 1	1.729*	Max WS	572.65	1164.51	1167.86		1167.90	0.000271	1.63	351.64	123.83	0.17
Reach 1	1.726*	Max WS	572.70	1164.50	1167.86		1167.90	0.000273	1.64	350.24	123.23	0.17
Reach 1	1.723*	Max WS	572.74	1164.50	1167.85		1167.89	0.000275	1.64	348.84	122.61	0.17
Reach 1	1.72*	Max WS	572.67	1164.49	1167.85		1167.89	0.000276	1.65	347.59	122.03	0.17
Reach 1	1.717*	Max WS	572.68	1164.48	1167.84		1167.89	0.000278	1.65	346.42	121.44	0.17
Reach 1	1.714*	Max WS	572.64	1164.47	1167.84		1167.88	0.000278	1.66	345.50	120.87	0.17
Reach 1	1.711*	Max WS	572.61	1164.46	1167.83		1167.88	0.000279	1.66	344.14	120.30	0.17
Reach 1	1.708*	Max WS	572.66	1164.45	1167.83		1167.87	0.000278	1.67	343.31	119.80	0.17
Reach 1	1.705	Max WS	572.61	1164.44	1167.83		1167.87	0.000277	1.67	342.32	119.30	0.17
Reach 1	1.6998*	Max WS	581.84	1164.29	1167.82		1167.86	0.000267	1.65	353.69	122.00	0.17
Reach 1	1.6946*	Max WS	581.89	1164.15	1167.82		1167.86	0.000249	1.59	365.04	124.85	0.16
Reach 1	1.6894*	Max WS	581.83	1164.00	1167.82		1167.86	0.000233	1.55	376.21	127.66	0.16
Reach 1	1.6842*	Max WS	581.85	1163.86	1167.82		1167.85	0.000218	1.50	387.05	130.33	0.15
Reach 1	1.679	Max WS	581.88	1163.71	1167.82		1167.85	0.000203	1.46	397.83	132.18	0.15
Reach 1	1.667	Max WS	581.82	1164.02	1167.74		1167.84	0.000531	2.54	229.46	115.78	0.25
Reach 1	1.6535		Culvert									
Reach 1	1.640	Max WS	581.31	1162.70	1166.28		1166.41	0.000847	2.94	197.99	150.64	0.30
Reach 1	1.63*	Max WS	581.45	1162.34	1166.33		1166.36	0.000180	1.37	426.21	145.72	0.14
Reach 1	1.62*	Max WS	581.62	1161.98	1166.33		1166.35	0.000135	1.30	450.79	138.44	0.12
Reach 1	1.610	Max WS	581.42	1161.62	1166.33		1166.35	0.000097	1.22	483.86	131.22	0.11
Reach 1	1.60635*	Max WS	583.48	1161.62	1166.33		1166.35	0.000096	1.22	486.17	131.49	0.11
Reach 1	1.6027*	Max WS	583.33	1161.62	1166.32		1166.35	0.000095	1.22	488.57	131.76	0.11
Reach 1	1.59905*	Max WS	583.45	1161.62	1166.32		1166.35	0.000093	1.21	491.07	132.05	0.11
Reach 1	1.5954*	Max WS	583.50	1161.63	1166.32		1166.34	0.000092	1.21	493.44	132.30	0.11
Reach 1	1.59175*	Max WS	583.48	1161.63	1166.32		1166.34	0.000091	1.20	495.96	132.60	0.10
Reach 1	1.5881*	Max WS	583.37	1161.63	1166.32		1166.34	0.000090	1.20	498.50	132.90	0.10
Reach 1	1.58445*	Max WS	583.25	1161.63	1166.32		1166.34	0.000088	1.19	501.13	133.22	0.10
Reach 1	1.5808*	Max WS	583.37	1161.63	1166.31		1166.34	0.000087	1.18	503.70	133.53	0.10
Reach 1	1.57715*	Max WS	583.33	1161.63	1166.31		1166.33	0.000086	1.18	506.37	133.85	0.10
Reach 1	1.5735*	Max WS	583.38	1161.64	1166.31		1166.33	0.000085	1.18	508.79	134.27	0.10
Reach 1	1.56985*	Max WS	583.36	1161.64	1166.31		1166.33	0.000083	1.17	511.48	134.74	0.10
Reach 1	1.5662*	Max WS	583.36	1161.64	1166.31		1166.33	0.000082	1.17	514.06	135.26	0.10
Reach 1	1.56255*	Max WS	583.27	1161.64	1166.31		1166.33	0.000081	1.16	516.82	135.87	0.10
Reach 1	1.5589*	Max WS	583.23	1161.64	1166.31		1166.33	0.000080	1.16	519.63	136.53	0.10
Reach 1	1.55525*	Max WS	583.25	1161.64	1166.30		1166.32	0.000079	1.15	522.24	137.28	0.10
Reach 1	1.5516*	Max WS	583.30	1161.64	1166.30		1166.32	0.000078	1.15	525.32	138.04	0.10
Reach 1	1.54795*	Max WS	583.31	1161.65	1166.30		1166.32	0.000077	1.14	528.12	138.57	0.10
Reach 1	1.5443*	Max WS	583.24	1161.65	1166.30		1166.32	0.000075	1.14	531.11	139.12	0.10
Reach 1	1.54065*	Max WS	583.19	1161.65	1166.30		1166.32	0.000074	1.13	534.13	139.70	0.10
Reach 1	1.537	Max WS	583.21	1161.65	1166.30		1166.32	0.000073	1.13	537.13	140.26	0.10
Reach 1	1.534*	Max WS	583.18	1161.50	1166.30		1166.32	0.000074	1.13	536.91	140.21	0.10
Reach 1	1.531	Max WS	583.18	1161.35	1166.30		1166.31	0.000073	1.14	540.59	141.26	0.10
Reach 1	1.53		Culvert									
Reach 1	1.501	Max WS	568.00	1159.16	1164.54		1164.55	0.000058	1.06	556.17	132.37	0.09
Reach 1	1.498*	Max WS	568.20	1159.13	1164.54		1164.55	0.000055	1.04	566.44	132.68	0.08
Reach 1	1.495*	Max WS	568.21	1159.10	1164.53		1164.55	0.000051	1.02	578.58	133.25	0.08
Reach 1	1.492	Max WS	568.17	1159.07	1164.53		1164.55	0.000047	1.00	593.26	134.50	0.08
Reach 1	1.4884*	Max WS	568.16	1159.09	1164.53		1164.55	0.000048	1.00	593.20	135.64	0.08
Reach 1	1.4848*	Max WS	568.18	1159.11	1164.53		1164.55	0.000048	0.99	593.21	136.80	0.08
Reach 1	1.4812*	Max WS	568.15	1159.14	1164.53		1164.55	0.000049	0.99	593.19	137.92	0.08
Reach 1	1.4776*	Max WS	568.04	1159.16	1164.53		1164.55	0.000049	0.99	593.44	139.02	0.08
Reach 1	1.474*	Max WS	568.13	1159.18	1164.53		1164.55	0.000049	0.99	593.42	140.09	0.08
Reach 1	1.4704*	Max WS	568.04	1159.20	1164.53		1164.54	0.000050	0.98	593.49	141.07	0.08
Reach 1	1.4668*	Max WS	568.07	1159.22	1164.53		1164.54	0.000050	0.98	593.68	142.09	0.08
Reach 1	1.4632*	Max WS	568.03	1159.25	1164.53		1164.54	0.000051	0.98	593.88	143.07	0.08
Reach 1	1.4596*	Max WS	568.00	1159.27	1164.53		1164.54	0.000051	0.97	594.07	143.96	0.08
Reach 1	1.456*	Max WS	568.01	1159.29	1164.53		1164.54	0.000052	0.97	594.45	144.79	0.08
Reach 1	1.4524*	Max WS	567.90	1159.31	1164.52		1164.54	0.000052	0.97	594.70	145.51	0.08
Reach 1	1.4488*	Max WS	568.01	1159.33	1164.52		1164.54	0.000052	0.97	595.19	146.22	0.08
Reach 1	1.4452*	Max WS	568.02	1159.36	1164.52		1164.54	0.000053	0.96	595.62	146.74	0.08
Reach 1	1.4416*	Max WS	567.93	1159.38	1164.52		1164.54	0.000053	0.96	596.32	147.12	0.08
Reach 1	1.438*	Max WS	567.94	1159.40	1164.52		1164.53	0.000054	0.96	596.97	147.29	0.08
Reach 1	1.4344*	Max WS	567.85	1159.42	1164.52		1164.53	0.000054	0.95	597.80	147.21	0.08
Reach 1	1.4308*	Max WS	567.86	1159.44	1164.52		1164.53	0.000054	0.95	599.03	147.27	0.08
Reach 1	1.4272*	Max WS	567.85	1159.47	1164.52		1164.53	0.000055	0.95	600.31	147.42	0.08
Reach 1	1.4236*	Max WS	567.86	1159.49	1164.52		1164.53	0.000055	0.94	601.70	147.96	0.08
Reach 1	1.420	Max WS	567.92	1159.51	1164.52		1164.53	0.000056	0.94	603.29	148.70	0.08
Reach 1	1.40942*	Max WS	582.46	1159.54	1164.51		1164.53	0.000060	0.98	597.18	148.13	0.09
Reach 1	1.39885*	Max WS	582.37	1159.57	1164.51		1164.53	0.000061	0.98	592.12	147.58	0.09
Reach 1	1.38828*	Max WS	582.43	1159.60	1164.51		1164.53	0.000062	0.99	587.67	147.11	0.09

HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS (Continued)

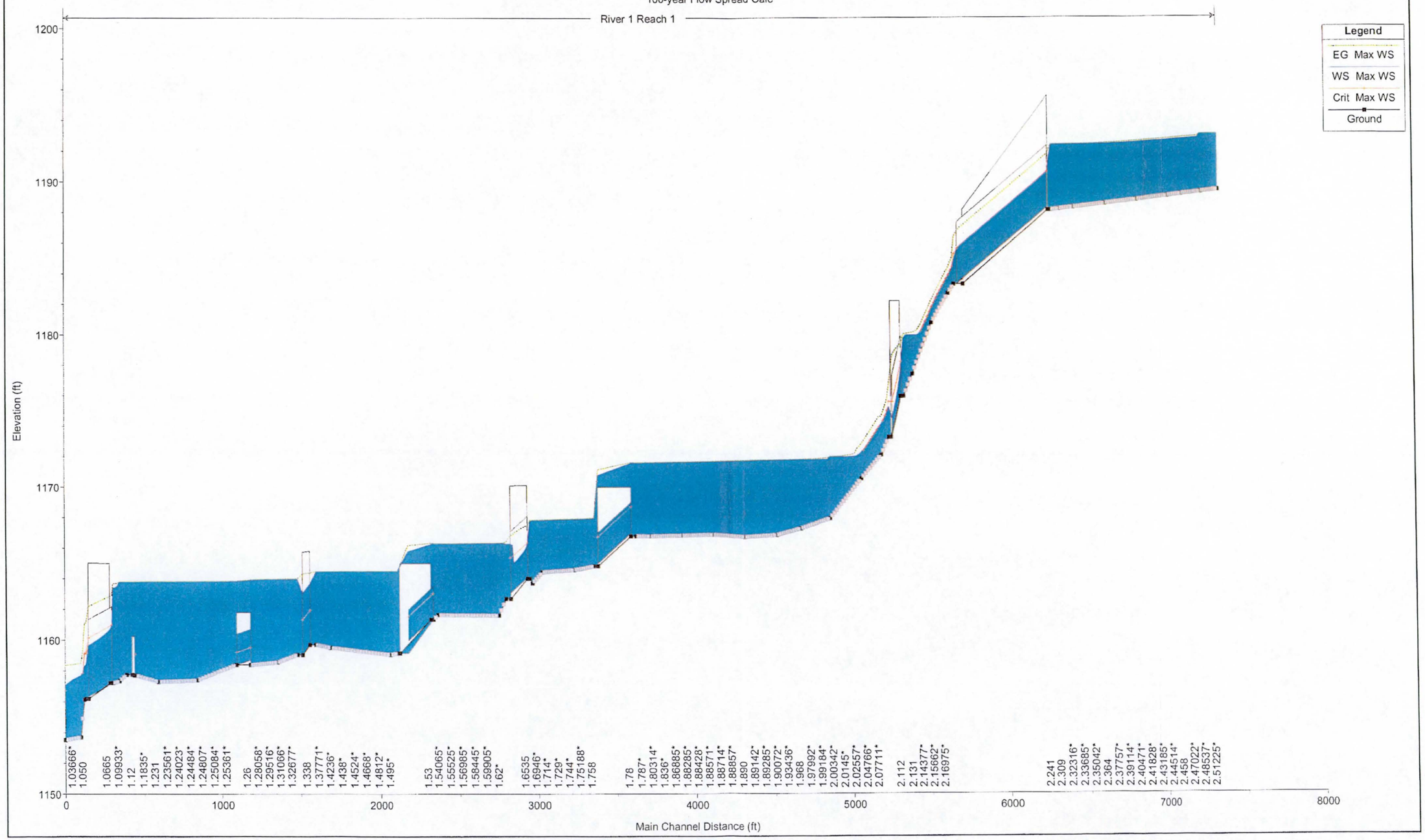
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1.37771*	Max WS	582.41	1159.62	1164.51		1164.53	0.000063	1.00	584.09	147.47	0.09
Reach 1	1.36714*	Max WS	582.35	1159.65	1164.51		1164.53	0.000064	1.00	581.29	148.16	0.09
Reach 1	1.35657*	Max WS	582.38	1159.68	1164.51		1164.52	0.000064	1.01	579.70	148.93	0.09
Reach 1	1.346	Max WS	582.32	1159.71	1164.47		1164.52	0.000162	1.77	329.10	148.58	0.14
Reach 1	1.338		Culvert									
Reach 1	1.330	Max WS	582.09	1159.05	1164.00		1164.04	0.000135	1.65	353.62	144.92	0.13
Reach 1	1.32677*	Max WS	582.01	1159.00	1164.00		1164.04	0.000130	1.63	357.33	145.56	0.13
Reach 1	1.32355*	Max WS	582.24	1158.94	1164.00		1164.04	0.000126	1.61	361.23	146.13	0.13
Reach 1	1.32033*	Max WS	582.15	1158.89	1163.99		1164.03	0.000121	1.59	365.08	146.70	0.13
Reach 1	1.31711*	Max WS	581.99	1158.83	1163.99		1164.03	0.000117	1.58	368.78	147.29	0.12
Reach 1	1.31388*	Max WS	582.11	1158.78	1163.99		1164.03	0.000113	1.56	372.36	147.89	0.12
Reach 1	1.31066*	Max WS	581.98	1158.72	1163.99		1164.03	0.000110	1.55	375.63	148.50	0.12
Reach 1	1.30744*	Max WS	582.05	1158.67	1163.99		1164.03	0.000107	1.54	378.91	149.13	0.12
Reach 1	1.30422*	Max WS	582.06	1158.61	1163.99		1164.02	0.000104	1.52	382.15	149.81	0.12
Reach 1	1.301	Max WS	582.20	1158.56	1163.99		1164.02	0.000101	1.51	385.36	150.46	0.12
Reach 1	1.29808*	Max WS	582.11	1158.55	1164.00		1164.01	0.000046	0.92	634.72	148.04	0.08
Reach 1	1.29516*	Max WS	582.05	1158.53	1164.00		1164.01	0.000053	0.97	603.87	145.05	0.08
Reach 1	1.29225*	Max WS	582.18	1158.52	1164.00		1164.01	0.000062	1.02	573.72	141.50	0.09
Reach 1	1.28933*	Max WS	582.17	1158.51	1163.99		1164.01	0.000072	1.07	543.87	137.36	0.09
Reach 1	1.28641*	Max WS	582.05	1158.49	1163.99		1164.01	0.000084	1.13	515.05	132.63	0.10
Reach 1	1.2835*	Max WS	582.00	1158.48	1163.99		1164.01	0.000098	1.20	486.75	129.00	0.11
Reach 1	1.28058*	Max WS	581.86	1158.47	1163.98		1164.01	0.000115	1.27	459.38	125.39	0.12
Reach 1	1.27766*	Max WS	582.00	1158.45	1163.98		1164.00	0.000136	1.35	432.72	121.68	0.13
Reach 1	1.27475*	Max WS	581.90	1158.44	1163.97		1164.00	0.000163	1.43	406.53	117.84	0.14
Reach 1	1.27183*	Max WS	582.09	1158.43	1163.96		1164.00	0.000195	1.53	381.12	114.48	0.15
Reach 1	1.26891*	Max WS	581.87	1158.41	1163.95		1163.99	0.000235	1.63	356.26	111.18	0.16
Reach 1	1.266	Max WS	581.78	1158.40	1163.94		1163.99	0.000295	1.75	332.04	107.87	0.18
Reach 1	1.26		Culvert									
Reach 1	1.255	Max WS	581.72	1158.40	1163.87		1163.91	0.000309	1.67	349.09	125.03	0.18
Reach 1	1.25430*	Max WS	581.75	1158.32	1163.87		1163.90	0.000234	1.52	383.97	127.63	0.15
Reach 1	1.25361*	Max WS	581.71	1158.25	1163.87		1163.90	0.000178	1.39	418.92	130.14	0.14
Reach 1	1.25292*	Max WS	581.69	1158.17	1163.87		1163.89	0.000138	1.28	454.69	132.65	0.12
Reach 1	1.25223*	Max WS	582.03	1158.09	1163.87		1163.89	0.000109	1.18	491.23	135.11	0.11
Reach 1	1.25153*	Max WS	581.85	1158.02	1163.87		1163.88	0.000081	1.10	527.32	137.52	0.10
Reach 1	1.25084*	Max WS	581.88	1157.94	1163.87		1163.88	0.000066	1.03	564.71	139.87	0.09
Reach 1	1.25015*	Max WS	581.89	1157.86	1163.87		1163.88	0.000054	0.97	602.60	142.23	0.08
Reach 1	1.24946*	Max WS	581.42	1157.78	1163.87		1163.88	0.000044	0.91	640.97	149.15	0.08
Reach 1	1.24876*	Max WS	581.95	1157.71	1163.87		1163.88	0.000037	0.86	679.81	158.85	0.07
Reach 1	1.24807*	Max WS	581.55	1157.63	1163.87		1163.88	0.000031	0.81	721.05	167.79	0.06
Reach 1	1.24738*	Max WS	581.47	1157.55	1163.87		1163.88	0.000026	0.77	762.89	172.97	0.06
Reach 1	1.24669*	Max WS	581.41	1157.48	1163.87		1163.88	0.000025	0.73	803.60	175.24	0.06
Reach 1	1.246	Max WS	581.87	1157.40	1163.87		1163.87	0.000021	0.70	844.66	175.07	0.05
Reach 1	1.24484*	Max WS	581.36	1157.39	1163.87		1163.87	0.000021	0.69	847.29	175.62	0.05
Reach 1	1.24369*	Max WS	581.28	1157.38	1163.87		1163.87	0.000021	0.69	849.93	175.92	0.05
Reach 1	1.24253*	Max WS	581.71	1157.38	1163.87		1163.87	0.000021	0.69	851.63	176.51	0.05
Reach 1	1.24138*	Max WS	581.20	1157.37	1163.87		1163.87	0.000021	0.69	854.28	177.03	0.05
Reach 1	1.24023*	Max WS	581.19	1157.36	1163.87		1163.87	0.000021	0.69	857.03	177.32	0.05
Reach 1	1.23907*	Max WS	581.19	1157.35	1163.86		1163.87	0.000020	0.68	859.72	177.86	0.05
Reach 1	1.23792*	Max WS	581.32	1157.35	1163.86		1163.87	0.000020	0.68	861.31	178.17	0.05
Reach 1	1.23676*	Max WS	581.50	1157.34	1163.86		1163.87	0.000020	0.68	864.38	178.75	0.05
Reach 1	1.23561*	Max WS	580.83	1157.33	1163.86		1163.87	0.000020	0.68	867.13	179.24	0.05
Reach 1	1.23446*	Max WS	580.68	1157.32	1163.86		1163.87	0.000020	0.68	869.91	179.53	0.05
Reach 1	1.23330*	Max WS	580.95	1157.32	1163.86		1163.87	0.000020	0.67	871.55	180.07	0.05
Reach 1	1.23215*	Max WS	580.83	1157.31	1163.86		1163.87	0.000019	0.67	874.57	180.72	0.05
Reach 1	1.231	Max WS	580.84	1157.30	1163.86		1163.87	0.000019	0.67	877.50	181.26	0.05
Reach 1	1.21912*	Max WS	601.88	1157.35	1163.86		1163.87	0.000024	0.74	824.85	176.13	0.06
Reach 1	1.20725*	Max WS	601.74	1157.41	1163.86		1163.87	0.000028	0.78	776.96	170.94	0.06
Reach 1	1.19537*	Max WS	602.06	1157.46	1163.86		1163.87	0.000033	0.83	735.23	166.00	0.06
Reach 1	1.1835*	Max WS	601.72	1157.51	1163.85		1163.87	0.000037	0.87	698.52	160.15	0.07
Reach 1	1.17162*	Max WS	601.88	1157.56	1163.85		1163.87	0.000042	0.91	667.03	154.27	0.07
Reach 1	1.15975*	Max WS	601.85	1157.61	1163.85		1163.86	0.000045	0.95	640.80	148.76	0.08
Reach 1	1.14787*	Max WS	601.57	1157.67	1163.85		1163.86	0.000048	0.98	619.60	144.77	0.08
Reach 1	1.136	Max WS	602.03	1157.72	1163.85	1159.10	1163.86	0.000049	1.00	603.80	137.41	0.08
Reach 1	1.12		Inl Struct									
Reach 1	1.104	Max WS	601.16	1157.75	1163.82		1163.83	0.000004	0.55	1101.71	229.12	0.04
Reach 1	1.10166*	Max WS	600.91	1157.61	1163.82		1163.83	0.000004	0.70	865.42	193.80	0.05
Reach 1	1.09933*	Max WS	600.79	1157.48	1163.81		1163.83	0.000007	0.93	653.20	159.02	0.07
Reach 1	1.097	Max WS	601.08	1157.34	1163.80		1163.83	0.000013	1.31	466.35	112.60	0.09
Reach 1	1.09233*	Max WS	1184.37	1157.30	1163.53		1163.72	0.000109	3.45	347.14	74.12	0.27
Reach 1	1.08766*	Max WS	1184.35	1157.26	1163.45		1163.71	0.000160	4.10	291.95	63.62	0.32
Reach 1	1.083	Max WS	1184.34	1157.22	1163.44		1163.71	0.000152	4.17	286.45	53.62	0.30
Reach 1	1.0665		Culvert									
Reach 1	1.050	Max WS	1184.31	1156.19	1158.41	1159.19	1161.15	0.007098	13.28	89.19	40.25	1.57
Reach 1	1.048	Max WS	1176.96	1156.14	1158.34	1159.12	1161.10	0.005418	13.32	88.39	40.24	1.58
Reach 1	1.0455*	Max WS	1168.38	1154.92	1157.90	1157.87	1159.35	0.002299	9.66	120.95	40.82	0.99
Reach 1	1.043	Max WS	1194.02	1153.69	1157.72		1158.53	0.001041	7.22	165.32	41.58	0.64

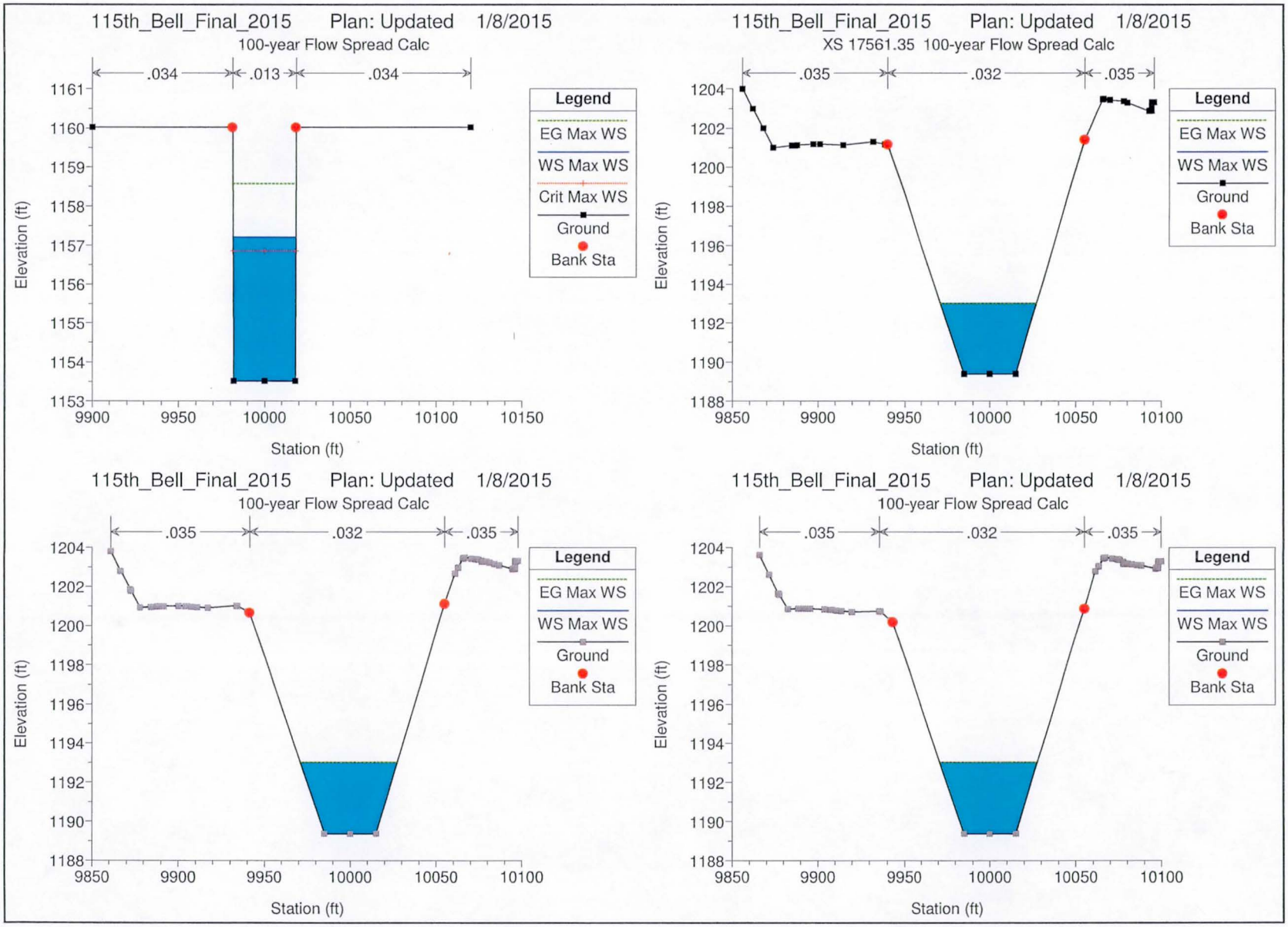
HEC-RAS Plan: Updated River: River 1 Reach: Reach 1 Profile: Max WS (Continued)

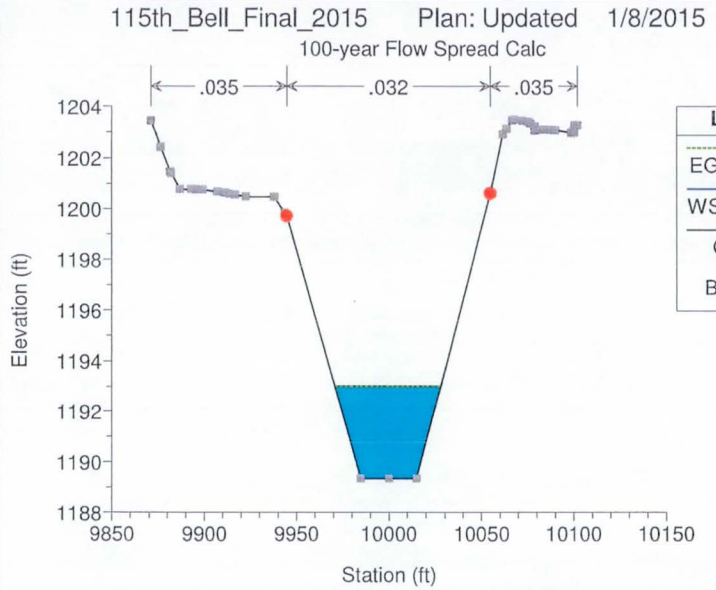
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1.03983*	Max WS	1186.64	1153.66	1157.63		1158.49	0.001122	7.42	159.86	40.74	0.66
Reach 1	1.03666*	Max WS	1184.90	1153.63	1157.55		1158.46	0.001064	7.67	154.56	39.90	0.69
Reach 1	1.0335*	Max WS	1184.48	1153.60	1157.46		1158.44	0.001169	7.95	149.06	39.06	0.72
Reach 1	1.03033*	Max WS	1184.35	1153.58	1157.33		1158.41	0.001333	8.33	142.10	38.22	0.76
Reach 1	1.02716*	Max WS	1184.35	1153.55	1157.21		1158.39	0.001308	8.74	135.54	37.38	0.81
Reach 1	1.024	Max WS	1184.35	1153.52	1157.07	1156.73	1158.39	0.001500	9.19	128.91	36.55	0.86

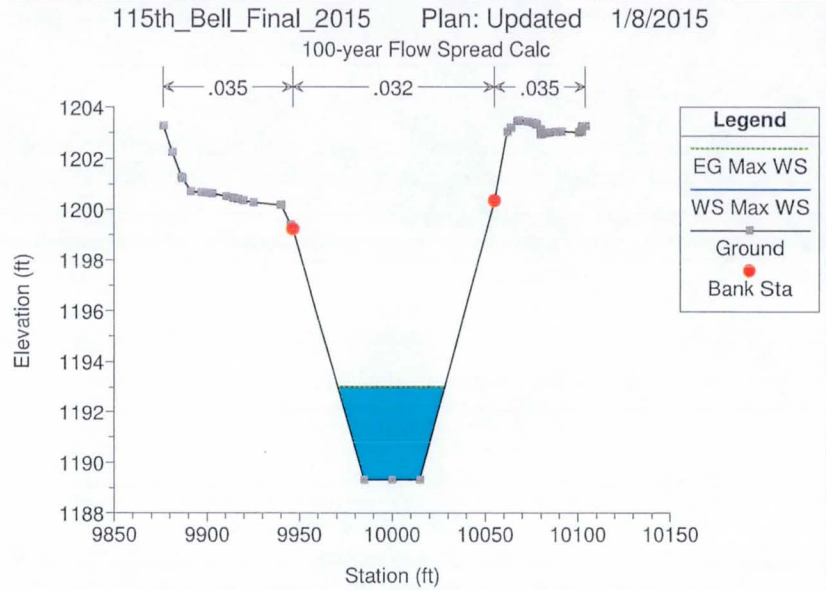
115th_Bell_Final_Unsteady_4_15_2015 Plan: Updated 4/15/2015

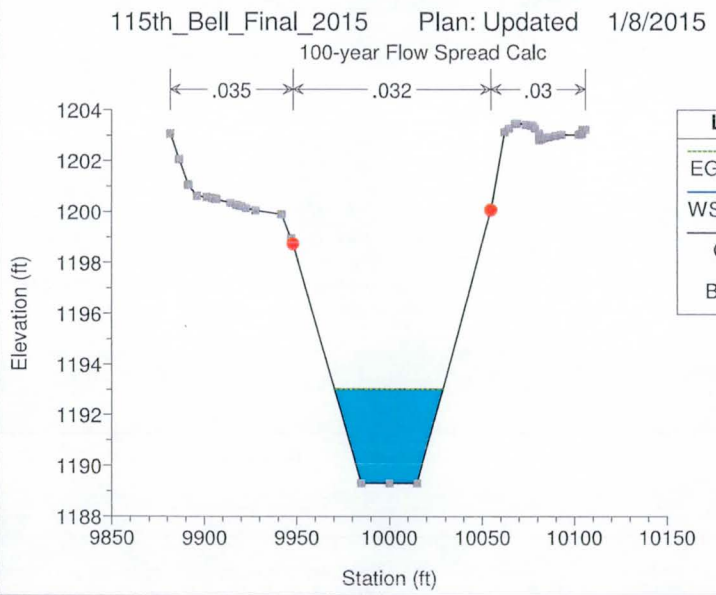
100-year Flow Spread Calc

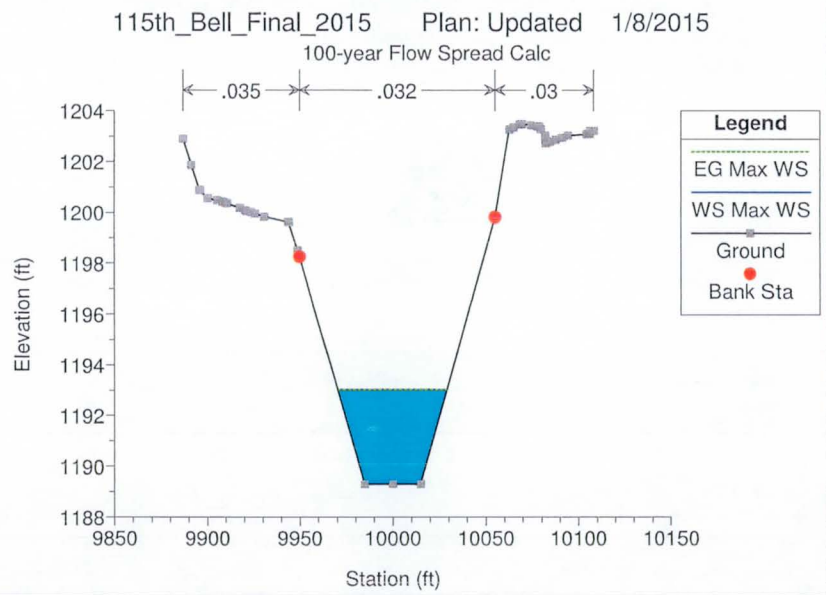


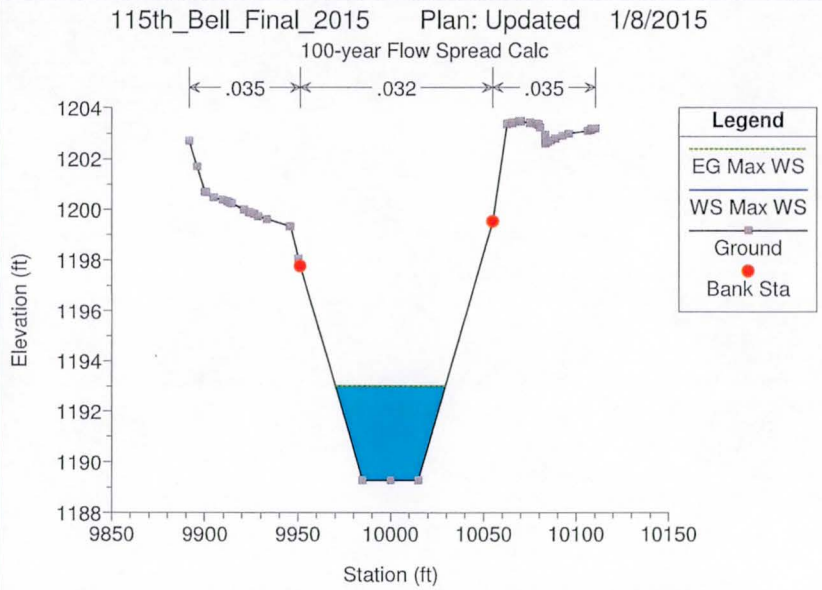

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.013
.034
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
XS 17561.35 100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)

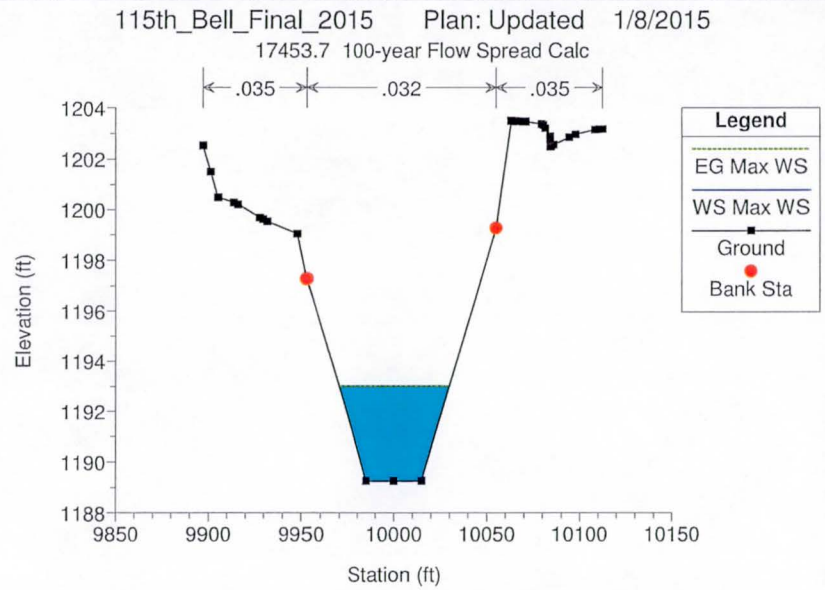

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

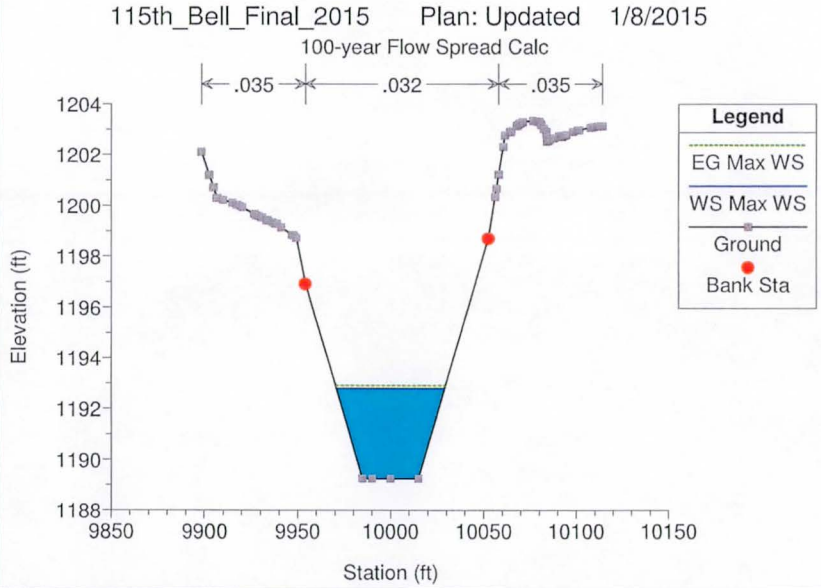

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

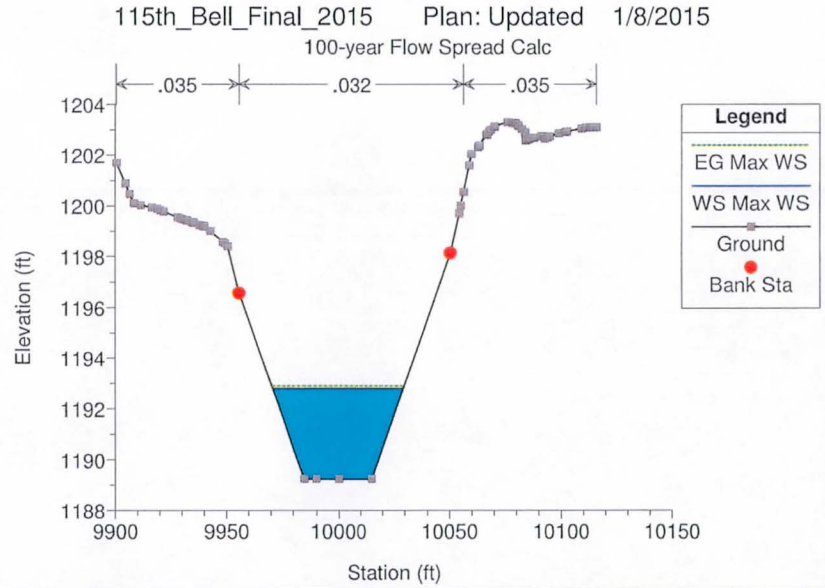

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.03
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

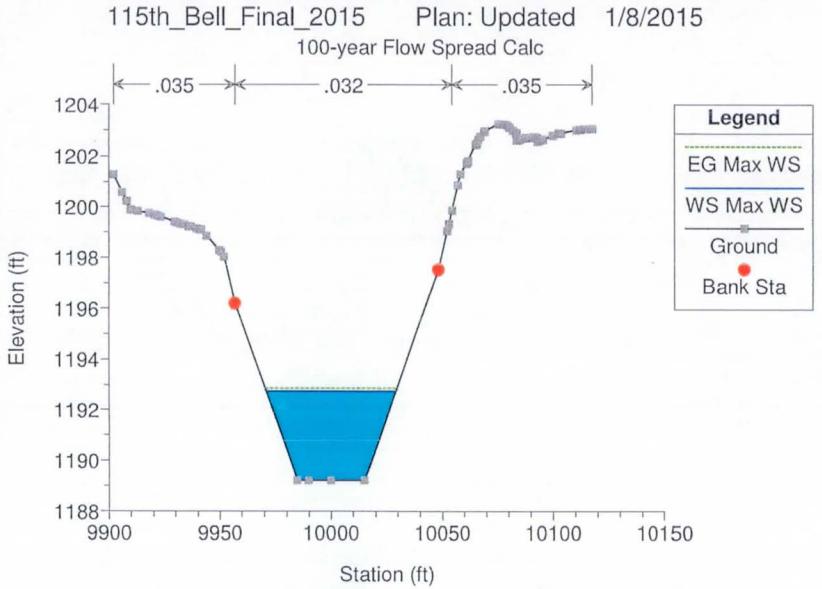

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.03
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

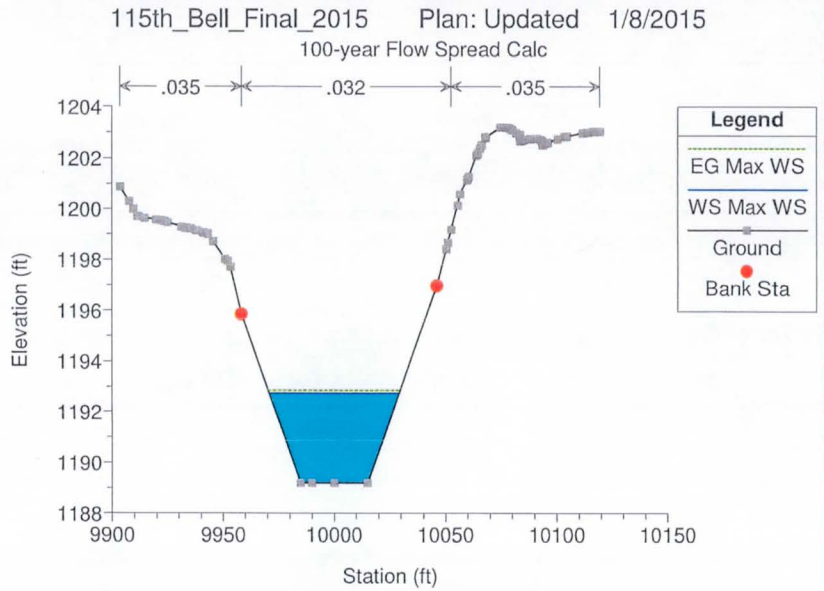

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

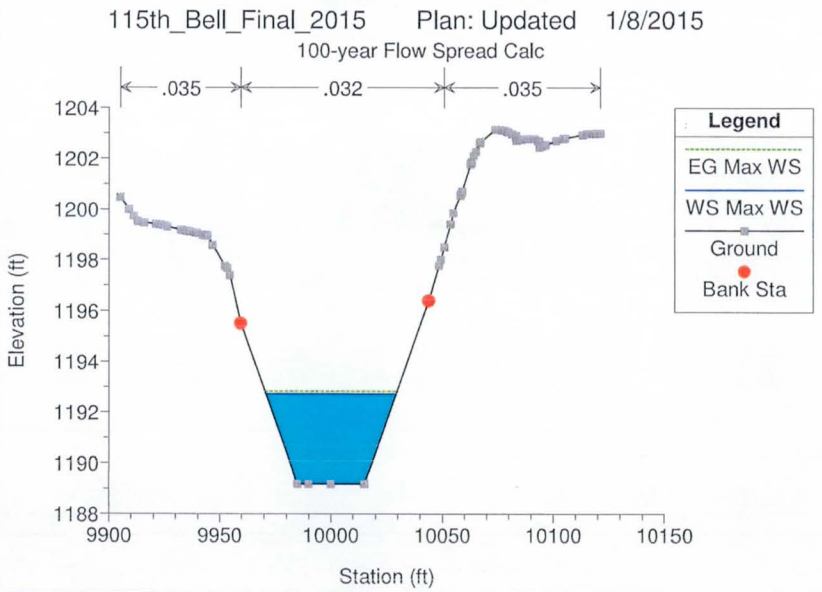

115th_Bell_Final_2015 Plan: Updated 1/8/2015
17453.7 100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1204
1202
1200
1198
1196
1194
1192
1190
1188
9900
9950
10000
10050
10100
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1204
1202
1200
1198
1196
1194
1192
1190
1188
9900
9950
10000
10050
10100
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1204
1202
1200
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1196
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1190
1188
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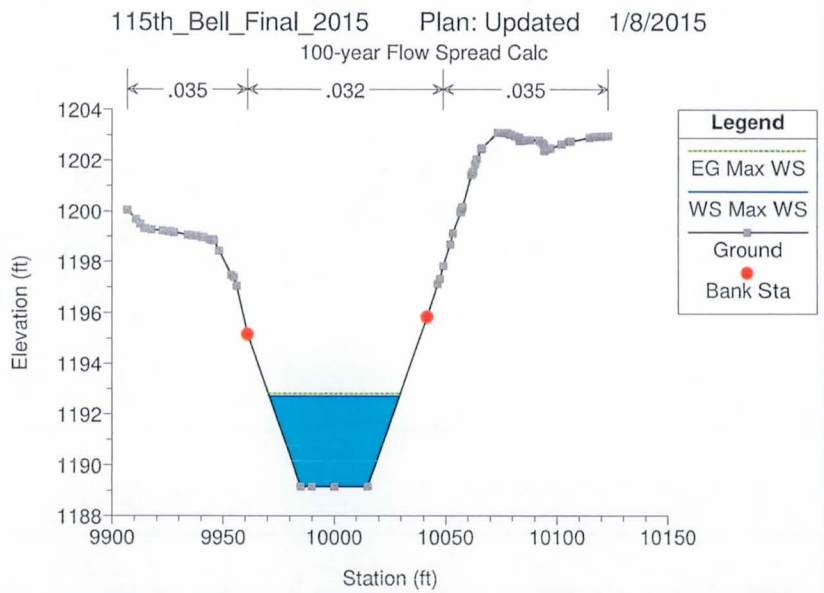
10000
10050
10100
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1204
1202
1200
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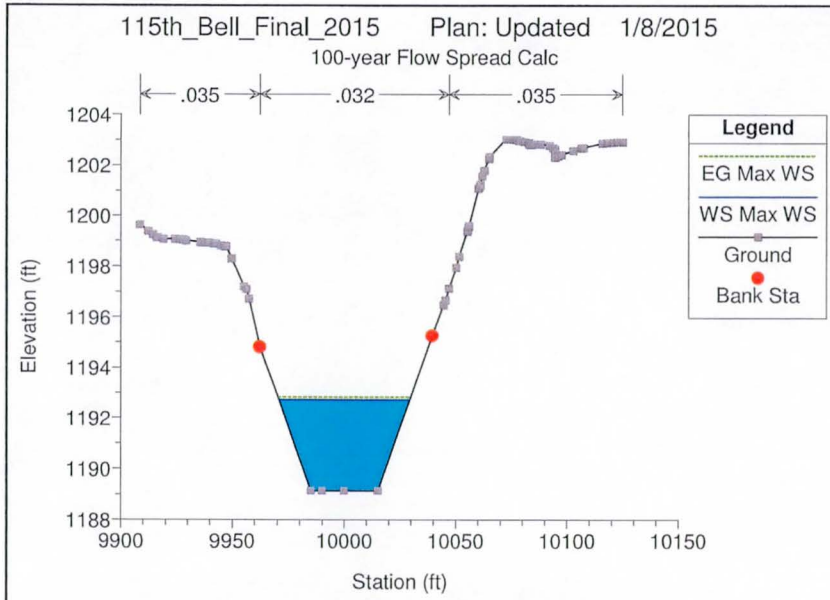
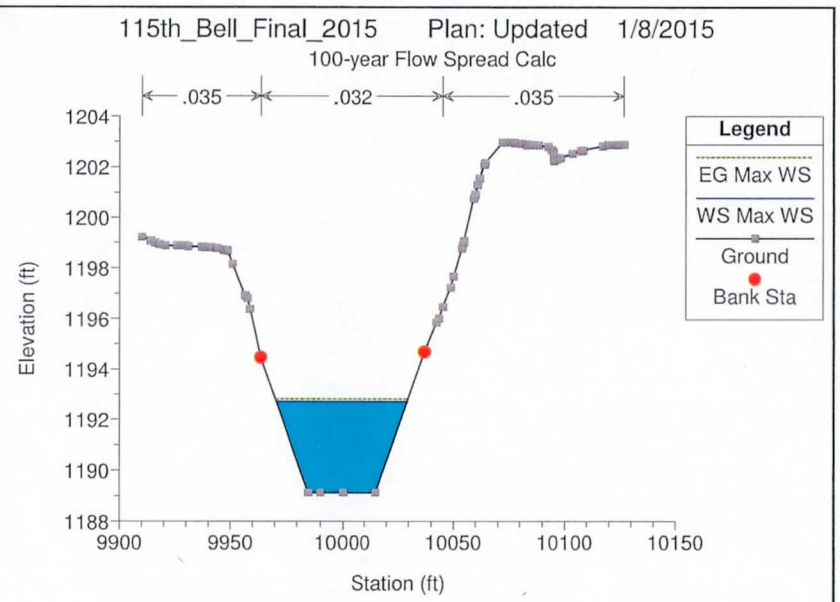
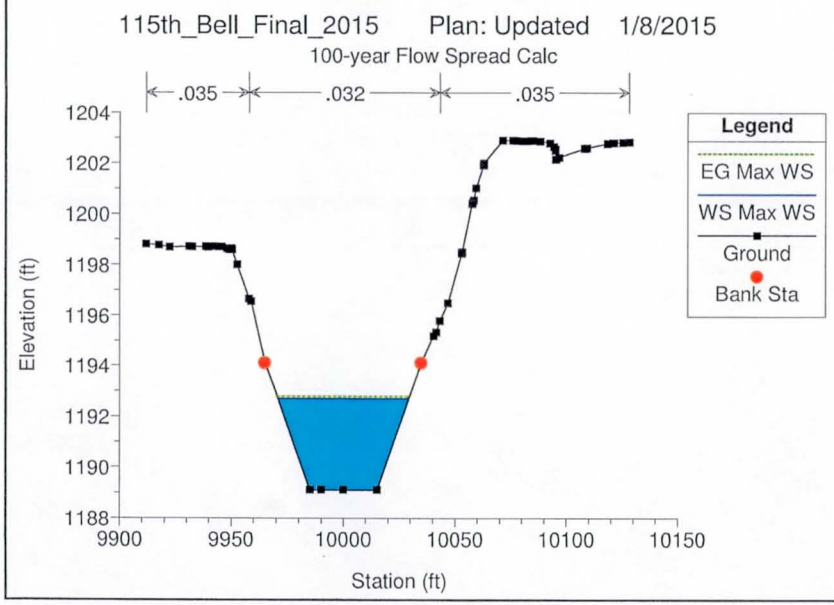
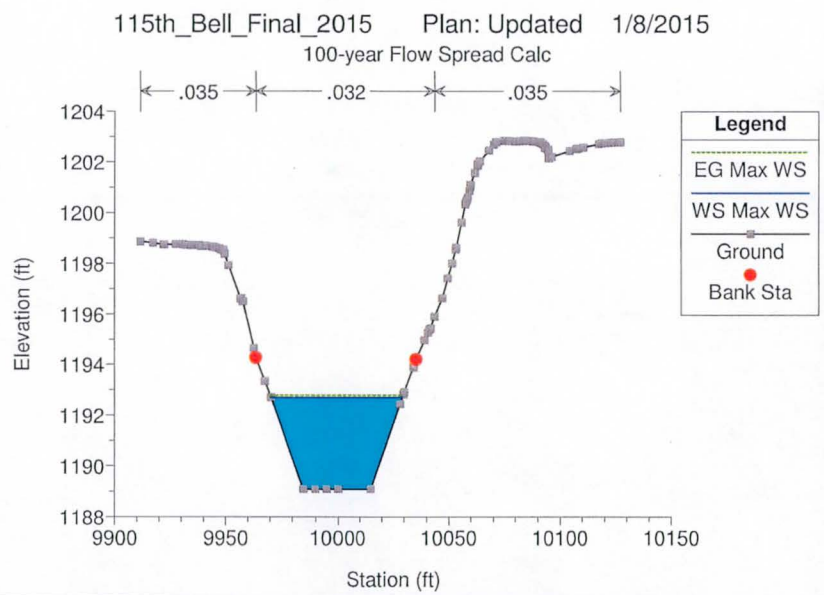
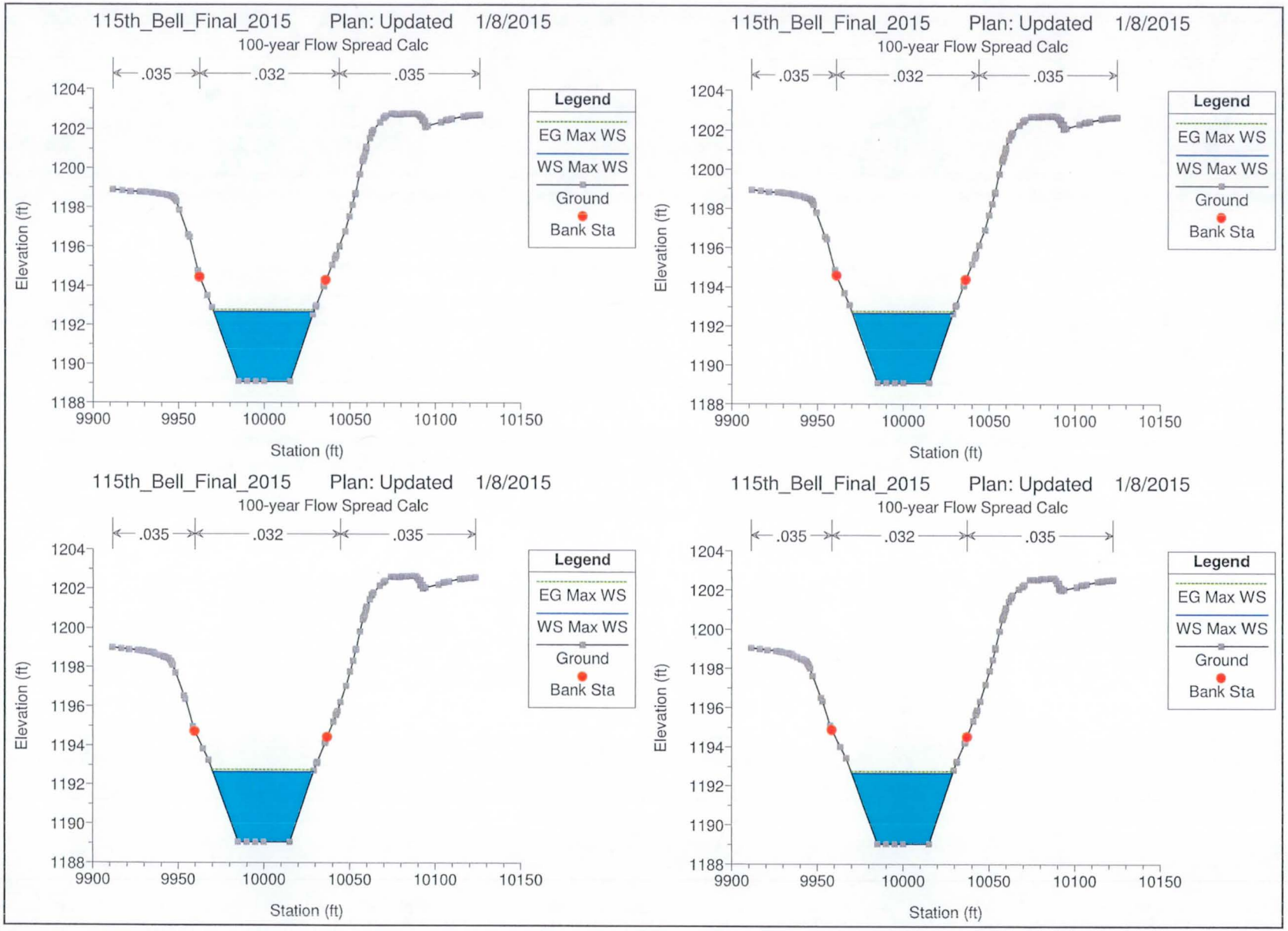
1196
1194
1192
1190
1188
9900
9950
10000
10050
10100
10150
Station (ft)

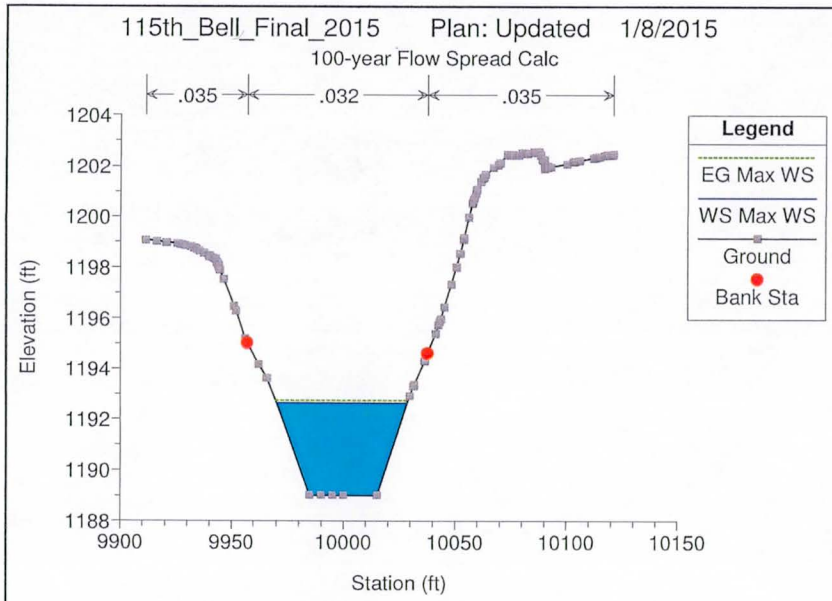

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

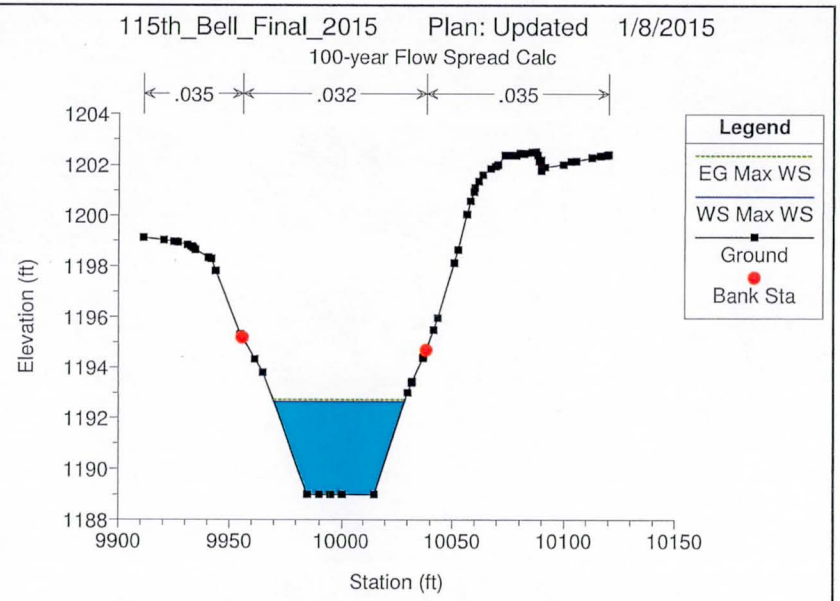

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

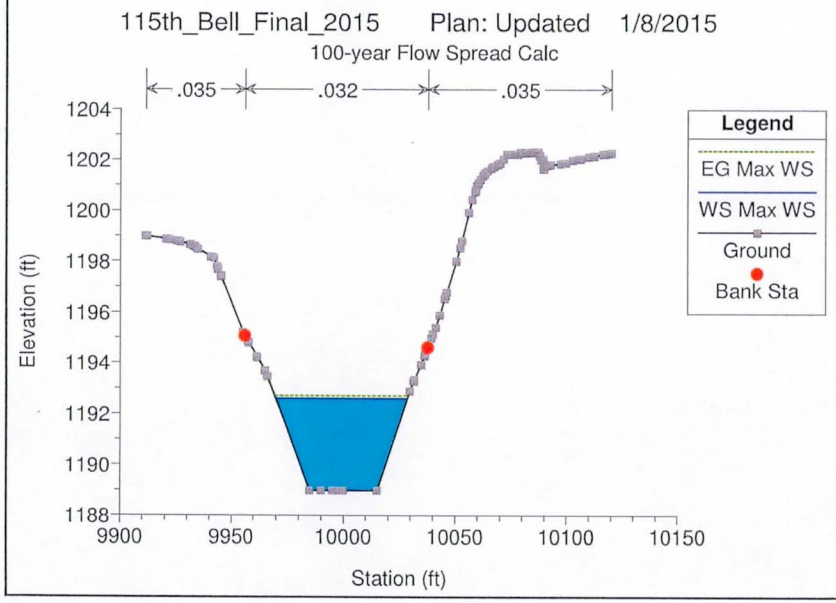

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

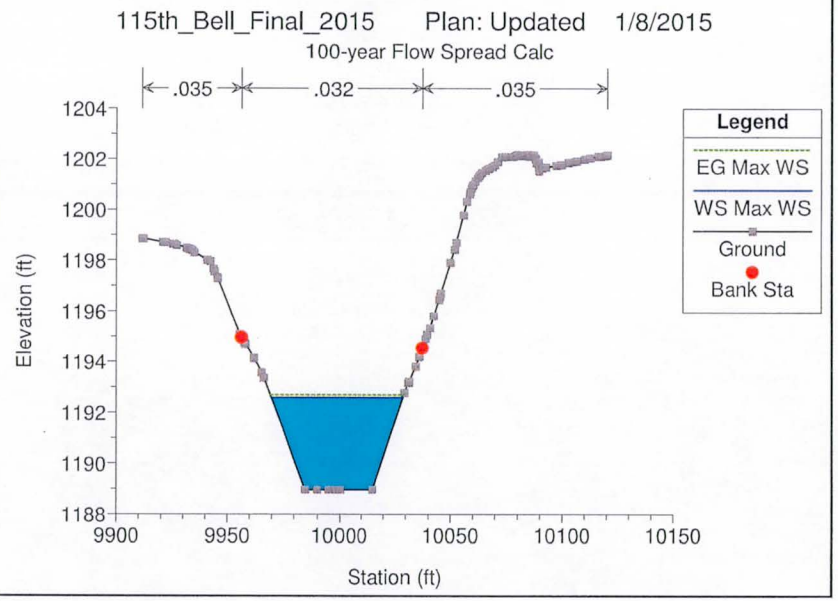

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

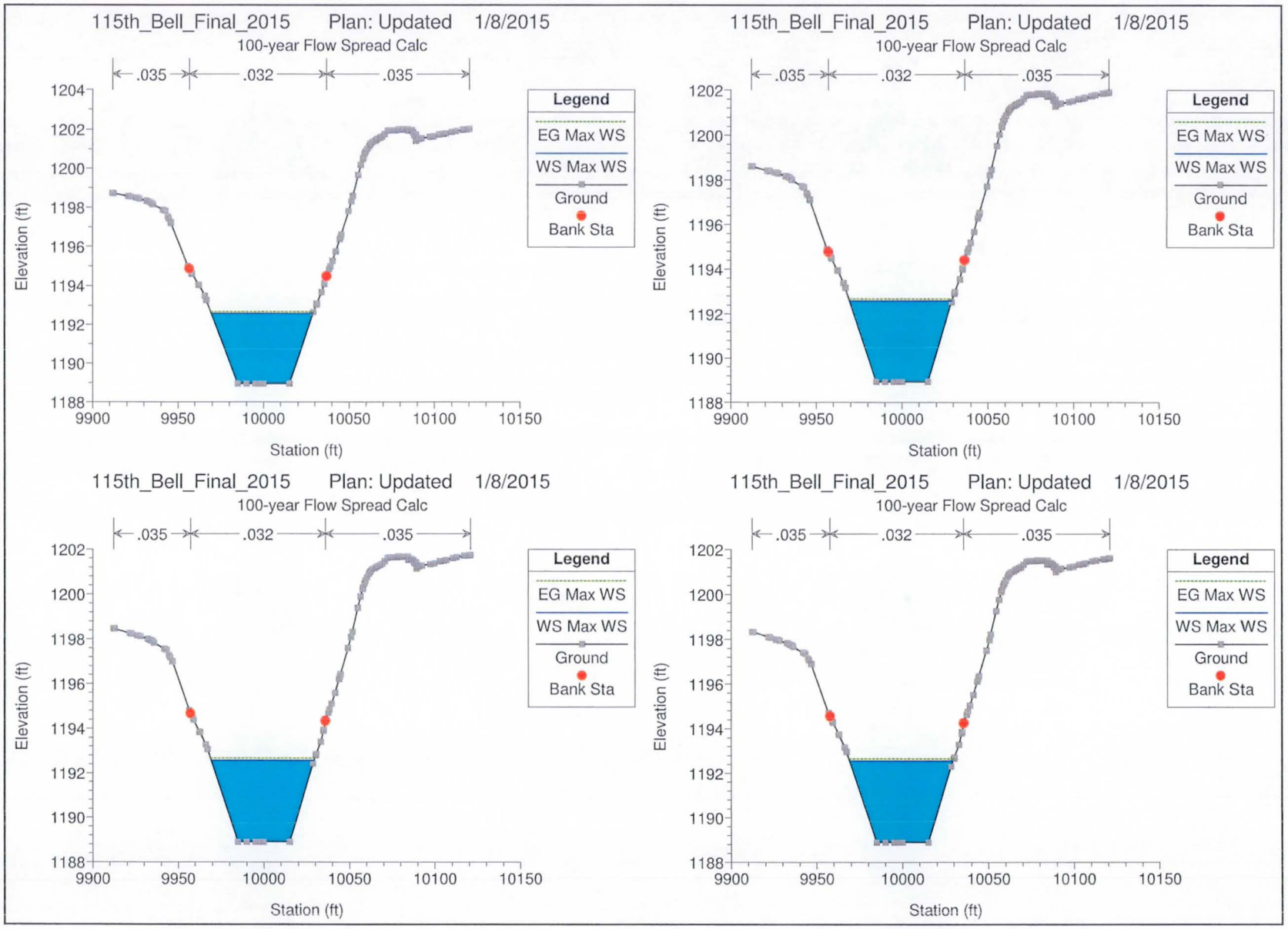

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
1188
1190
1192
1194
1196
1198
1200
1202
1204
9900
9950
10000
10050
10100
10150


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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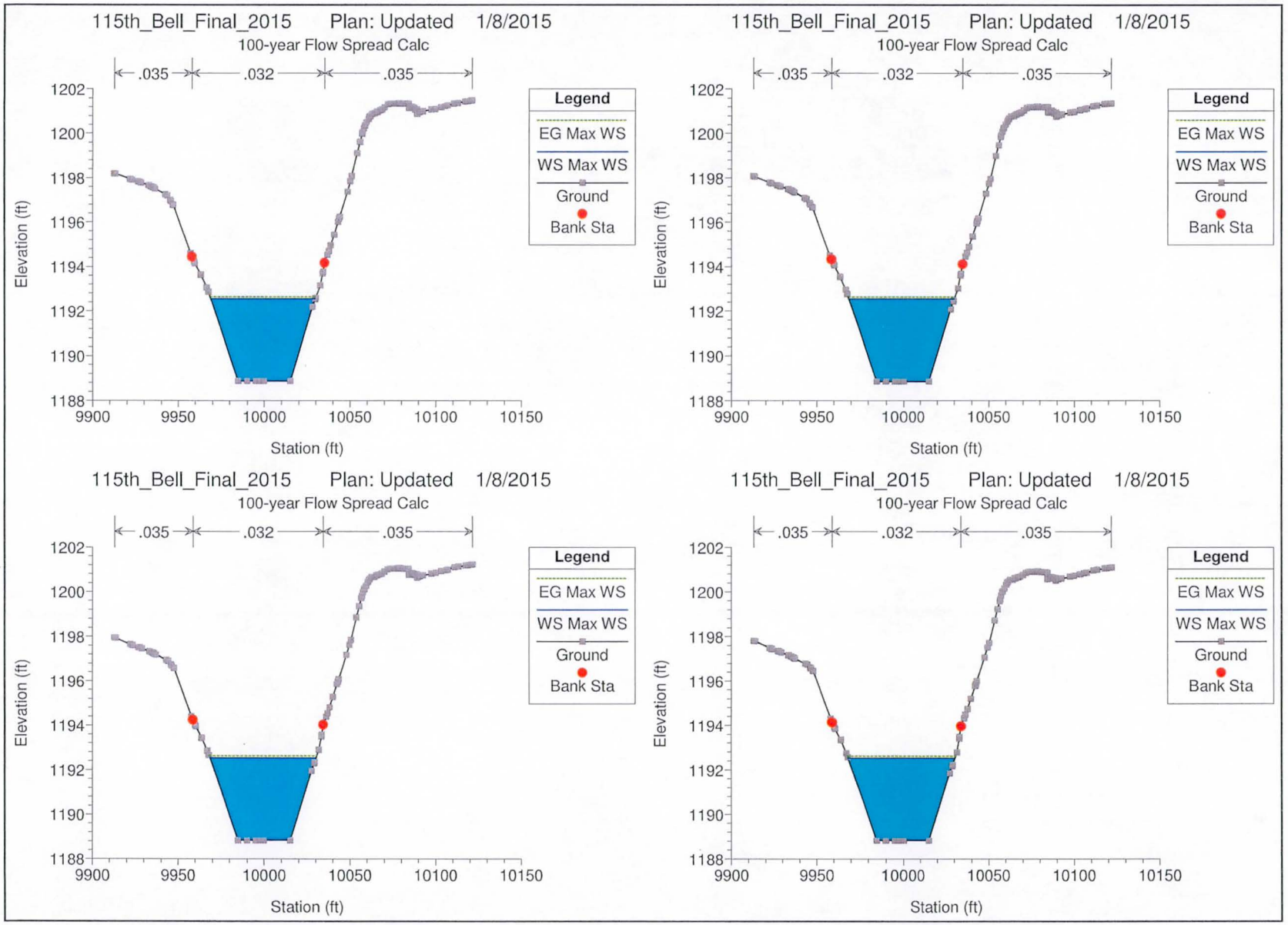
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)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100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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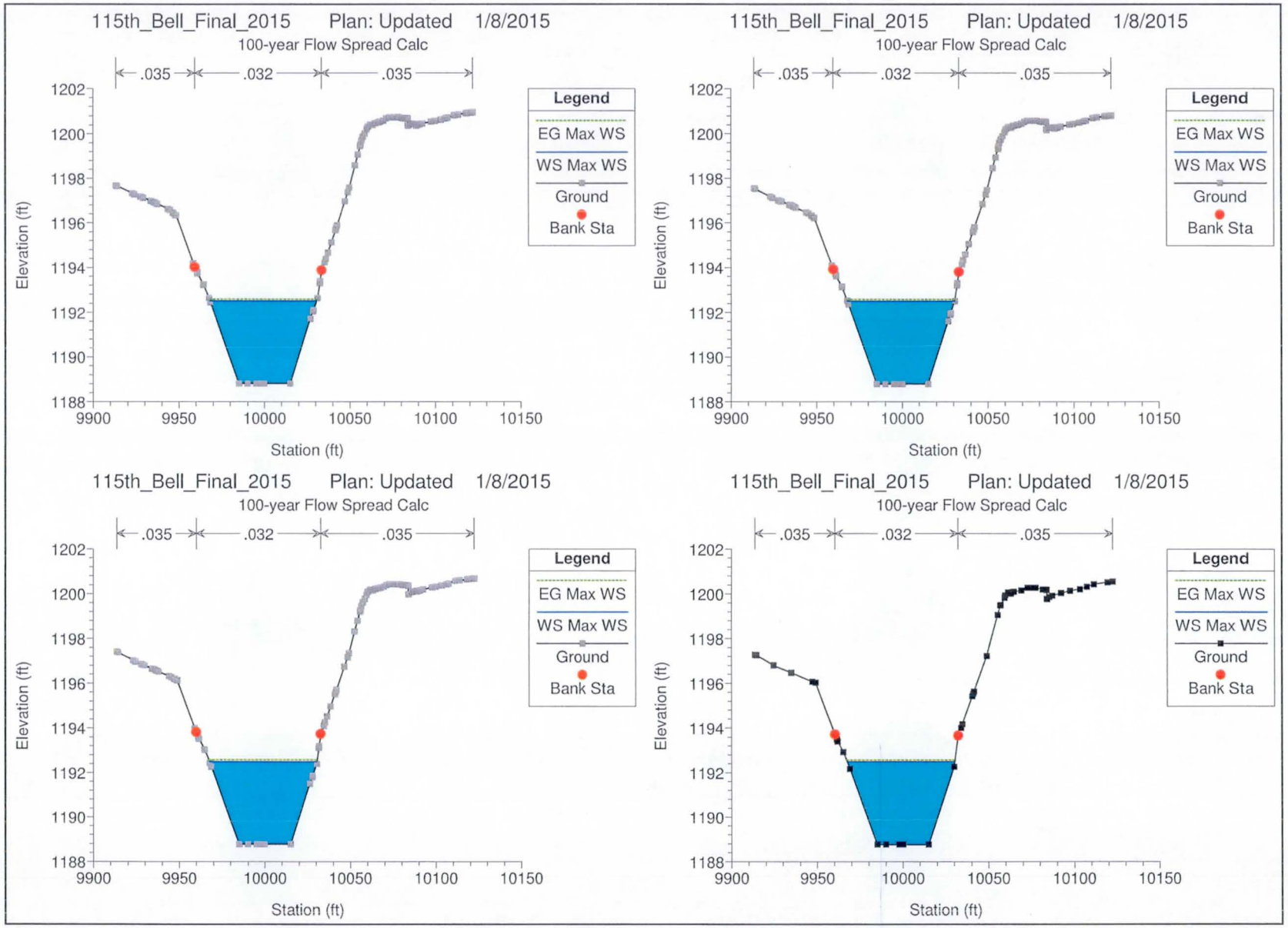
Station (ft)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100-year Flow Spread Calc
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Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
Station (ft)
Legend
EG Max WS
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Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
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Elevation (ft)
Station (ft)
Legend
EG Max WS
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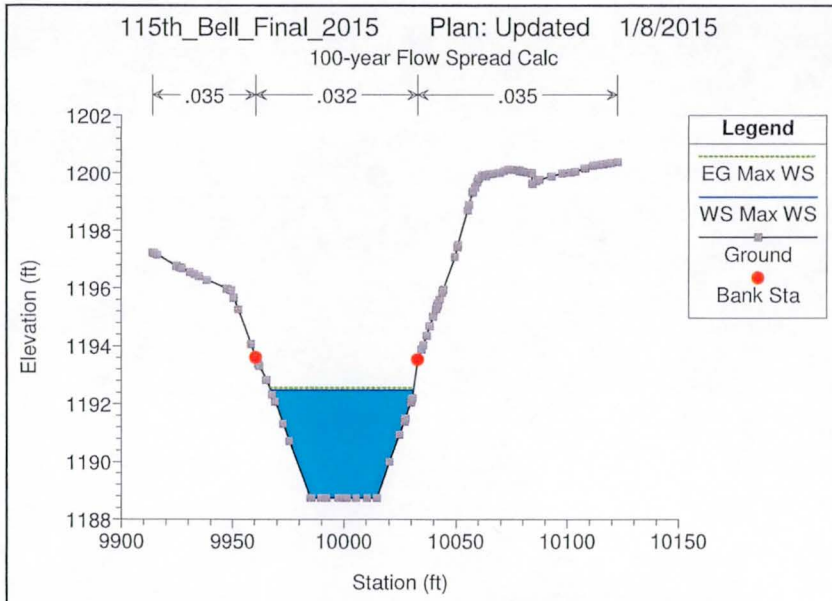
Ground
Bank Sta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100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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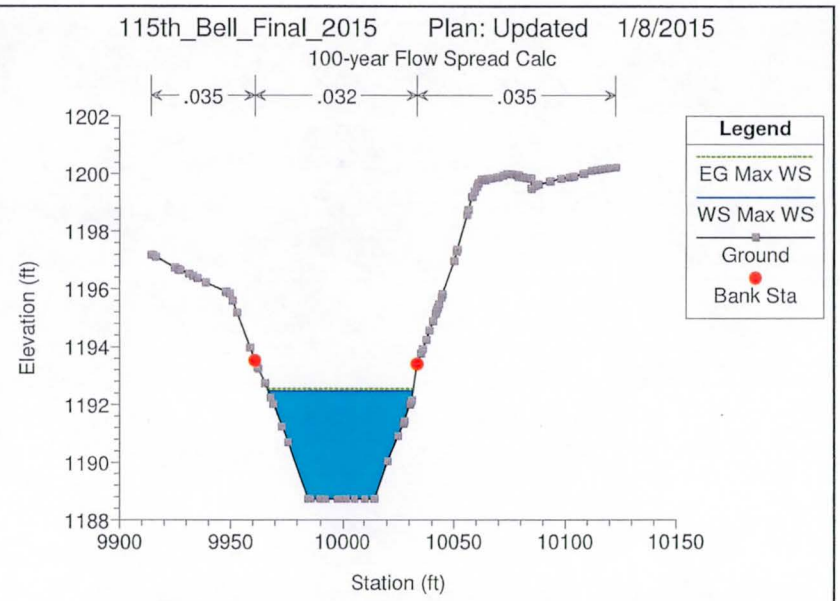
Station (ft)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100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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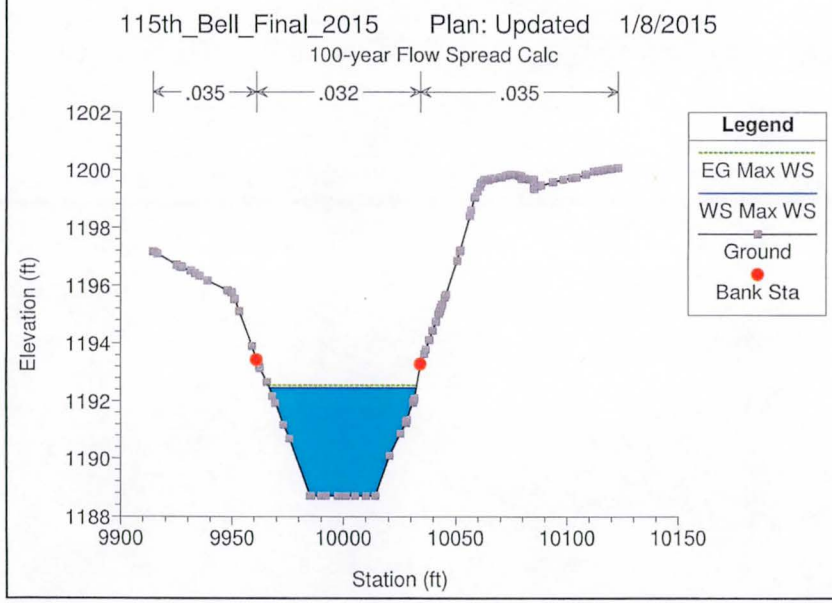
Station (ft)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100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
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Elevation (ft)
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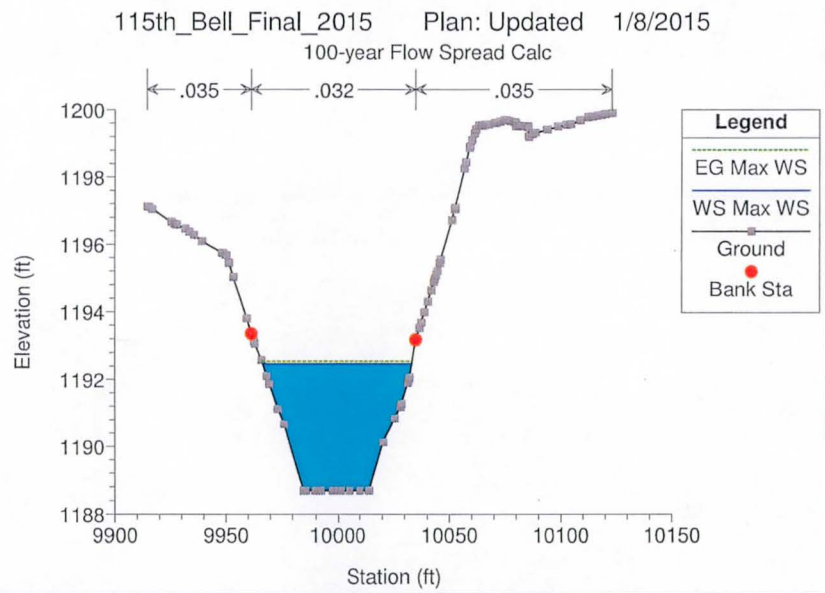
Station (ft)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100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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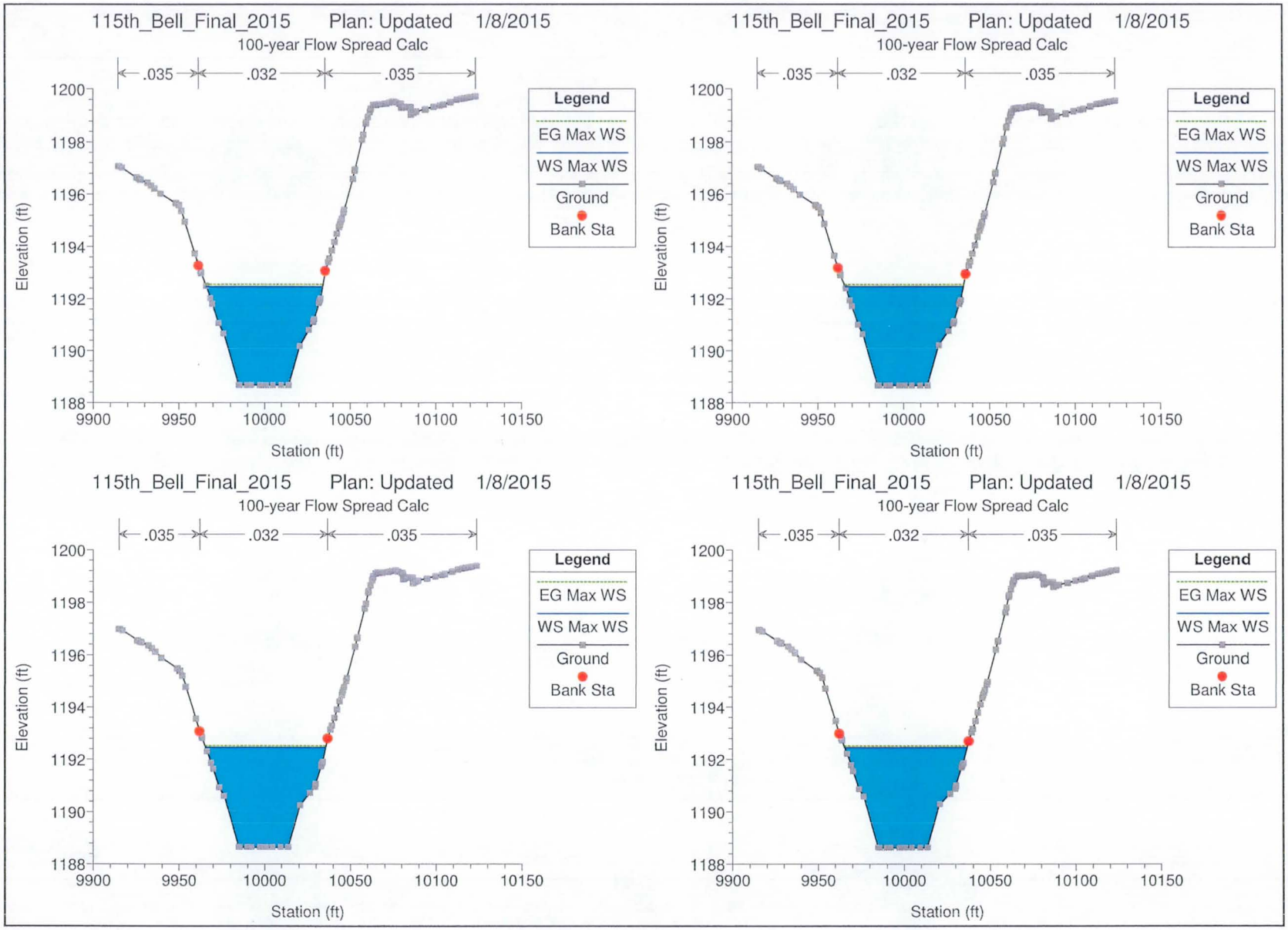
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
Bank Sta
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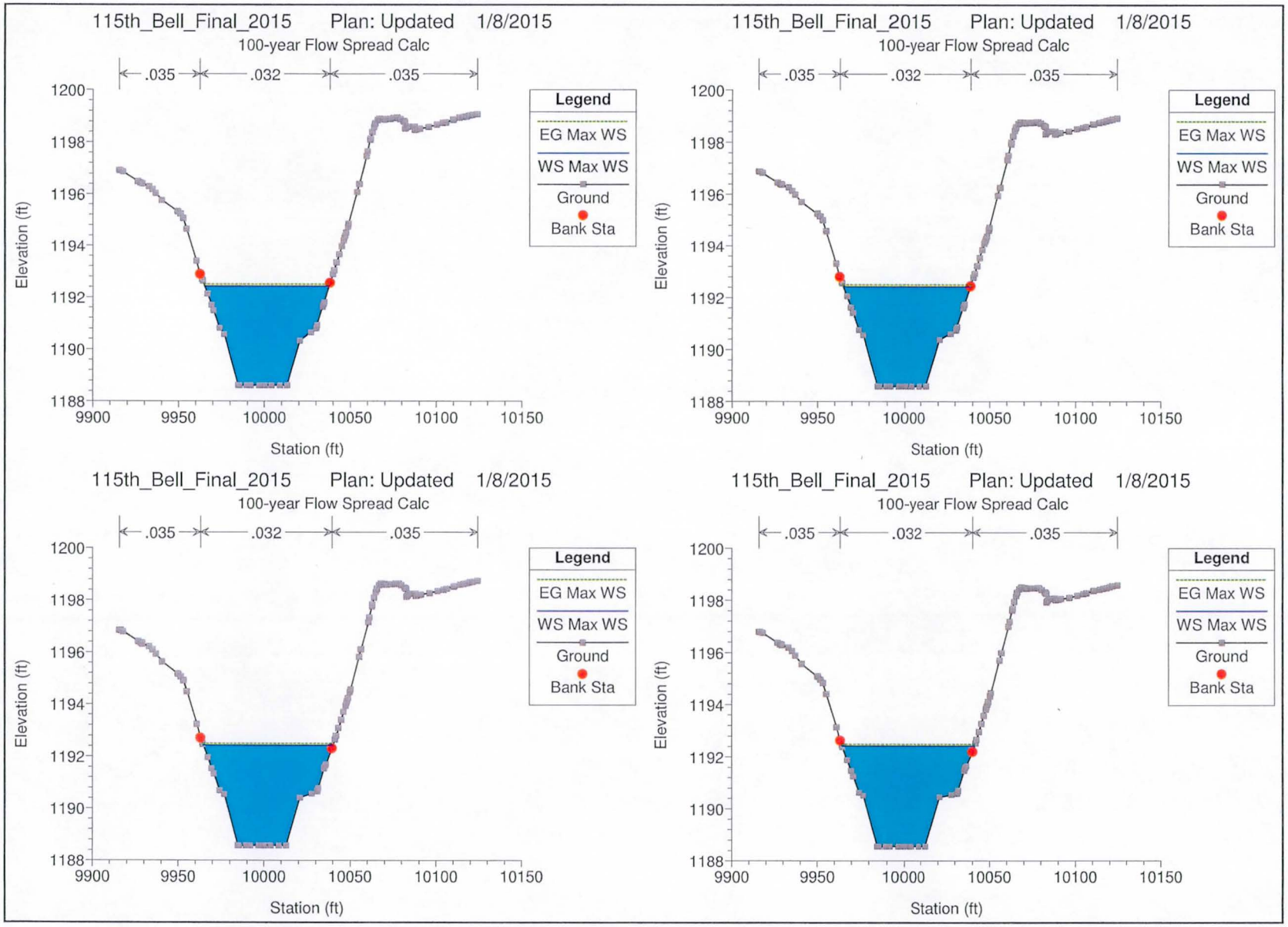
Station (ft)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100-year Flow Spread Calc
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Legend
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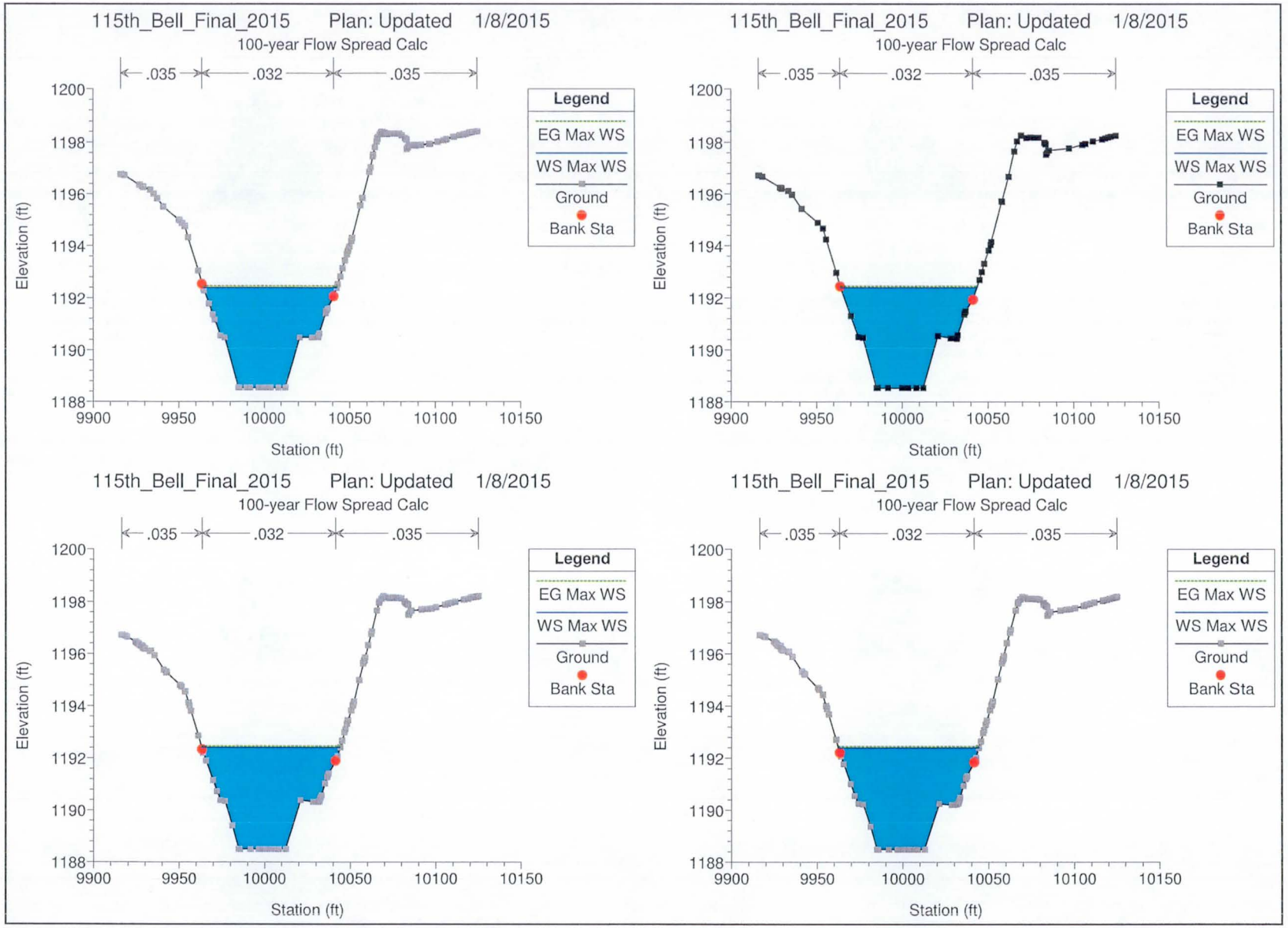
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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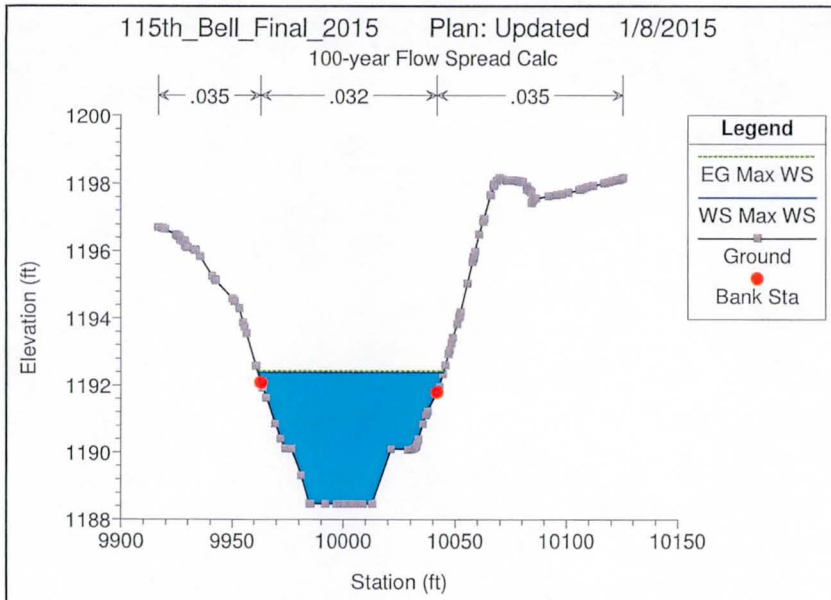
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100-year Flow Spread Calc
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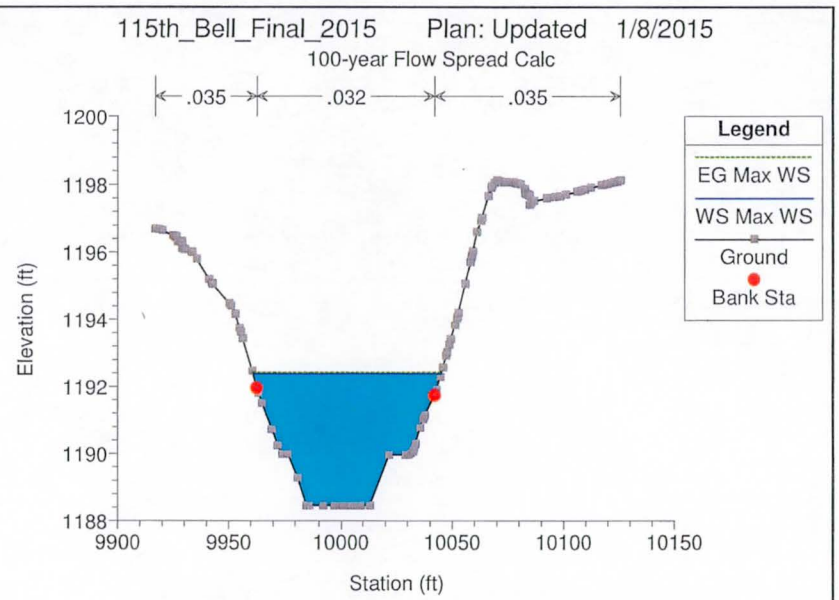
Station (ft)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100-year Flow Spread Calc
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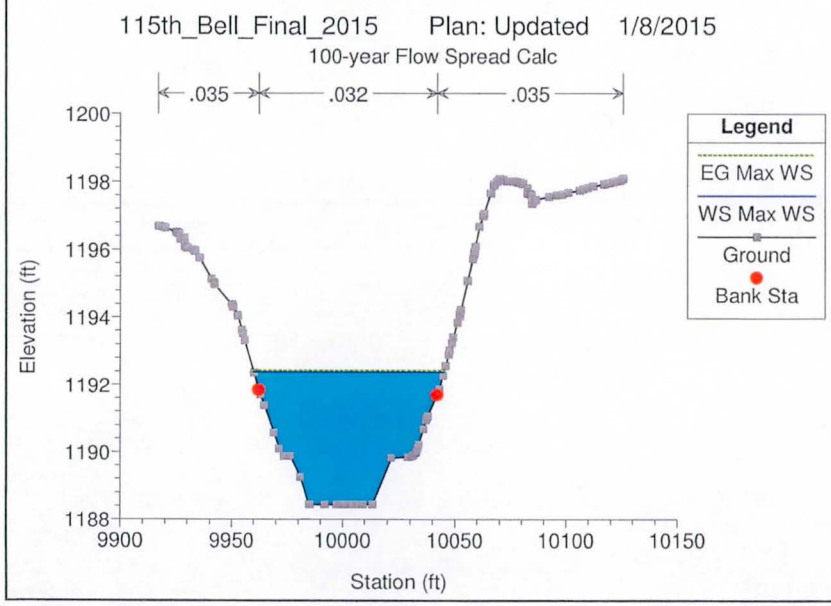
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100-year Flow Spread Calc
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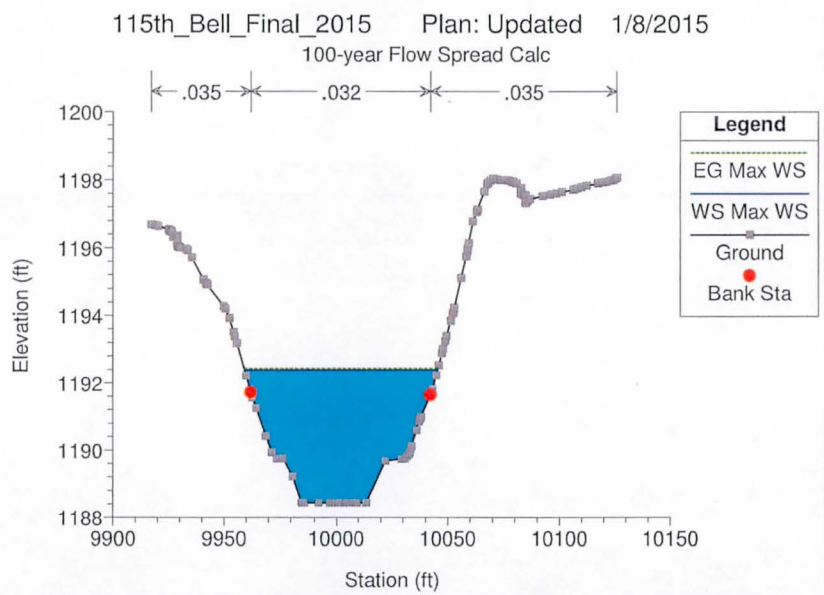
Station (ft)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100-year Flow Spread Calc
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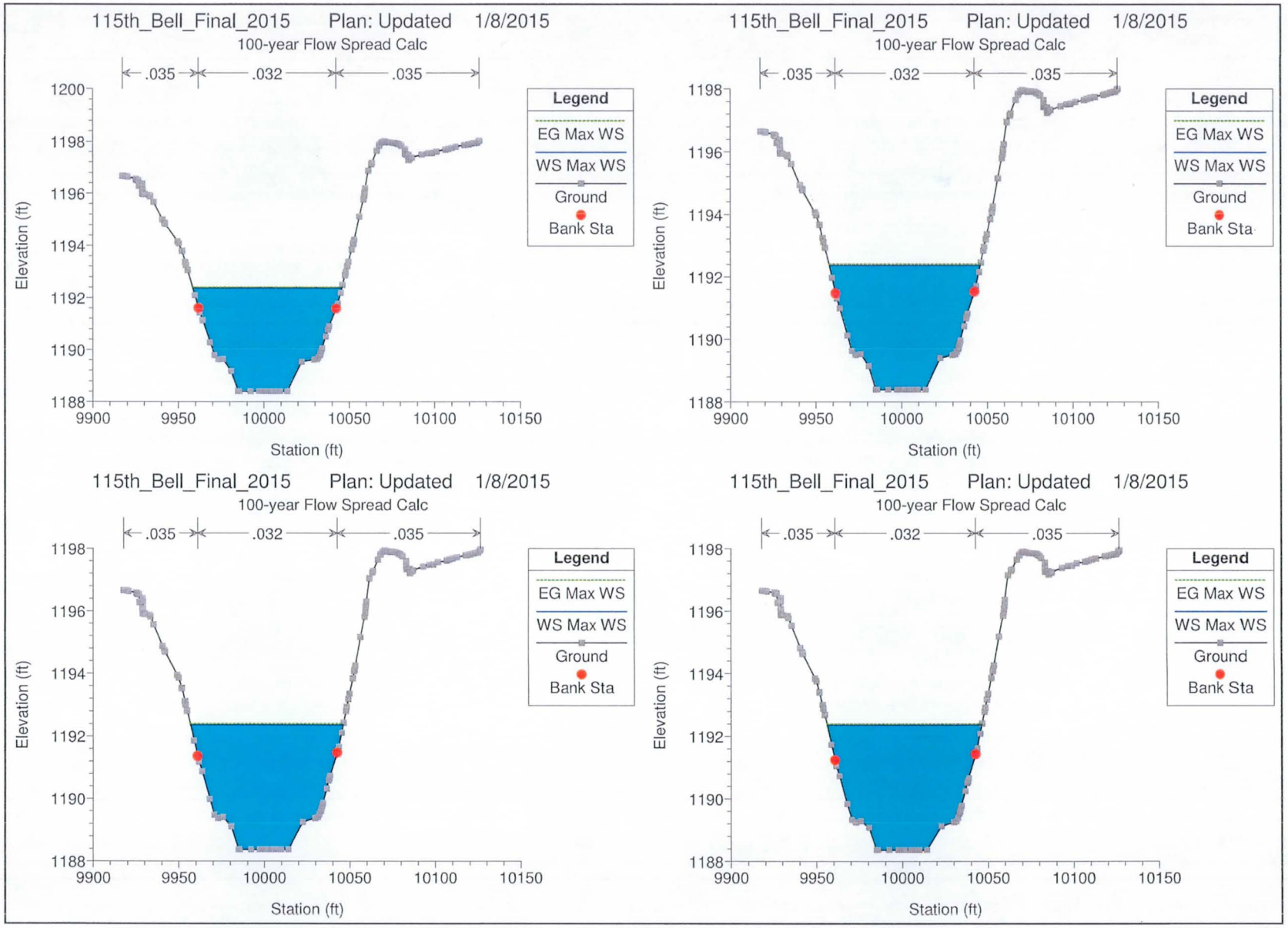
Station (ft)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100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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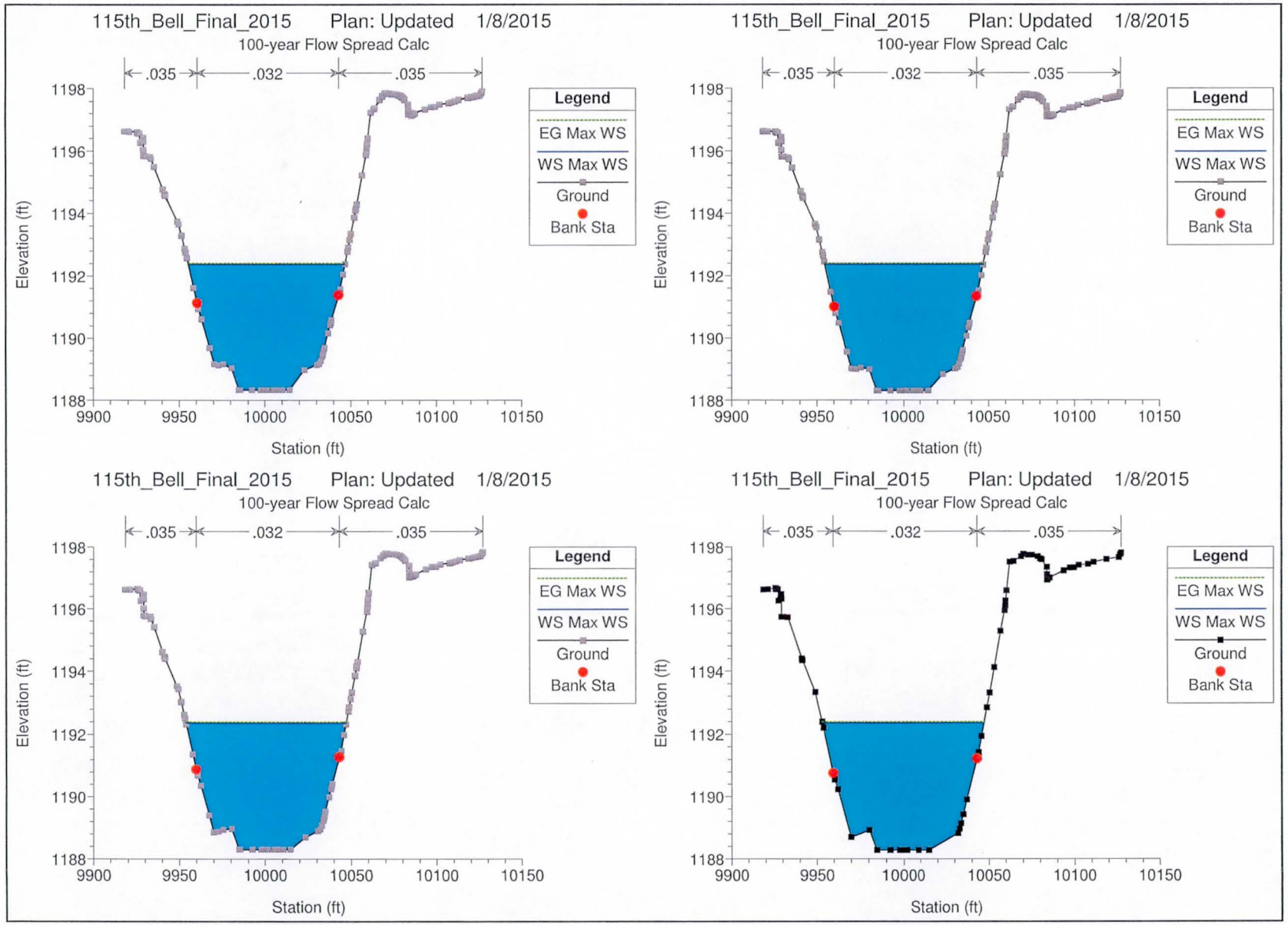
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100-year Flow Spread Calc
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Station (ft)
Legend
EG Max WS
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Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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Station (ft)
Legend
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Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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Station (ft)
Legend
EG Max WS
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Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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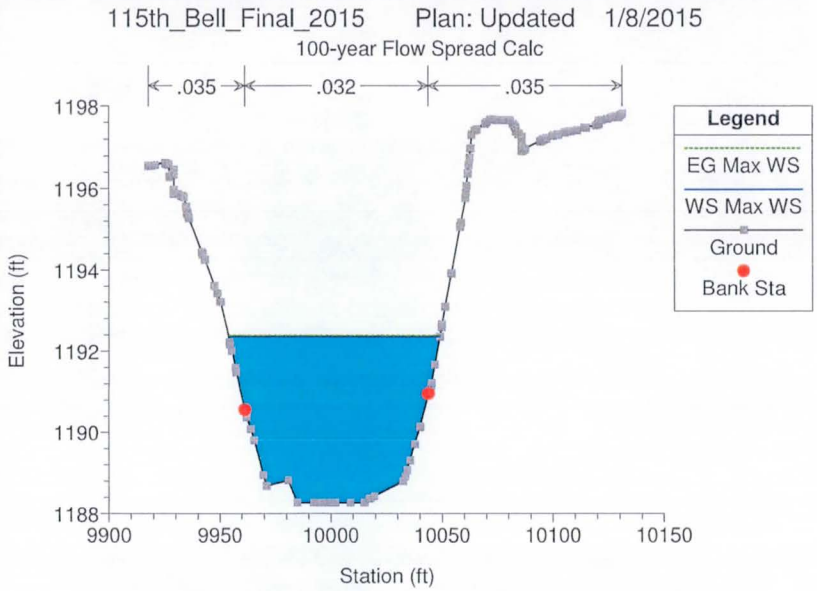
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta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100-year Flow Spread Calc
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Bank Sta
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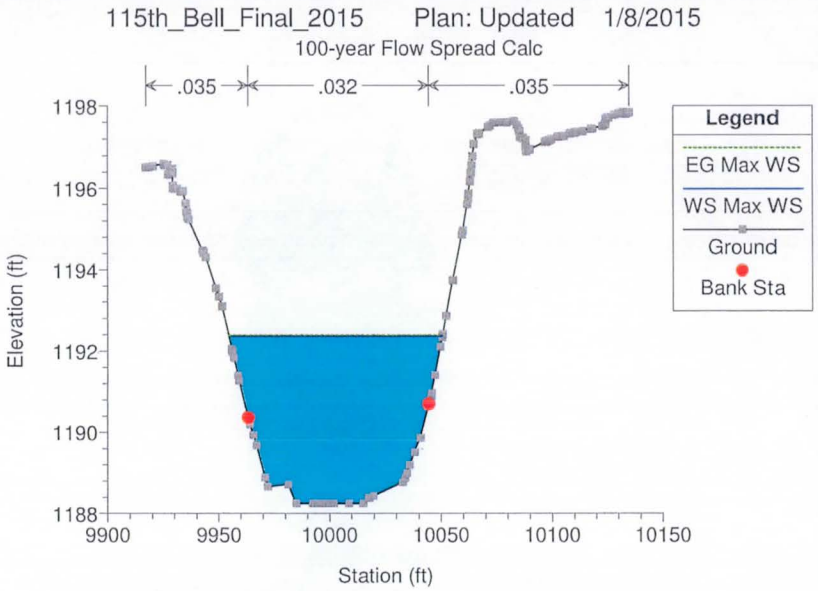
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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EG Max WS
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Ground
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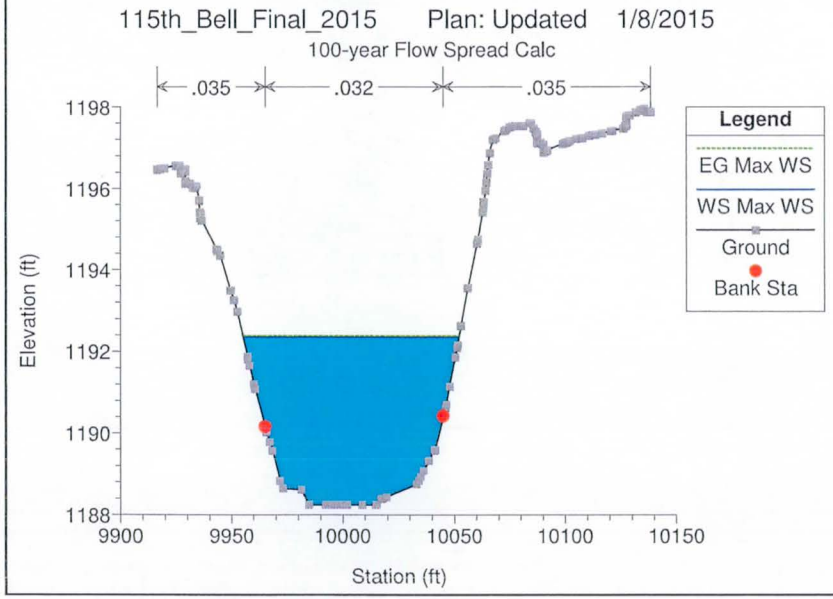
Station (ft)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100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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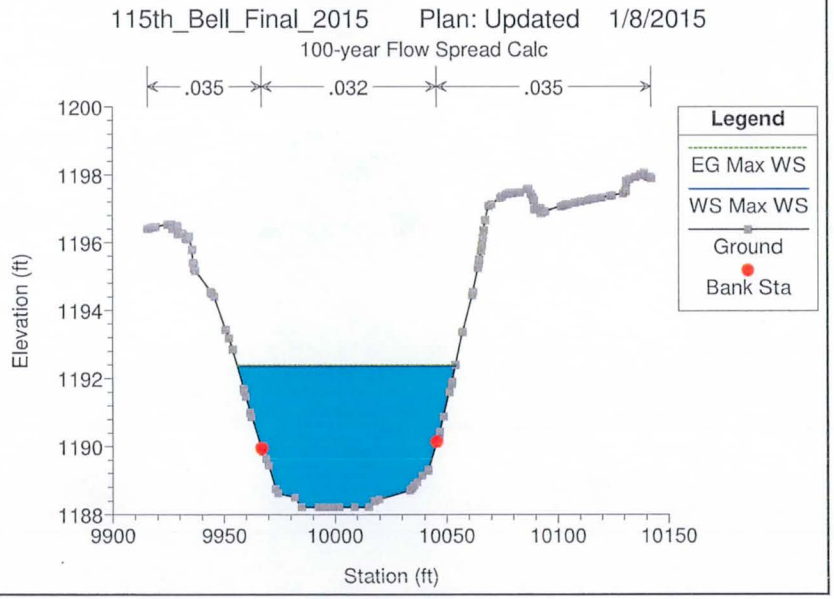
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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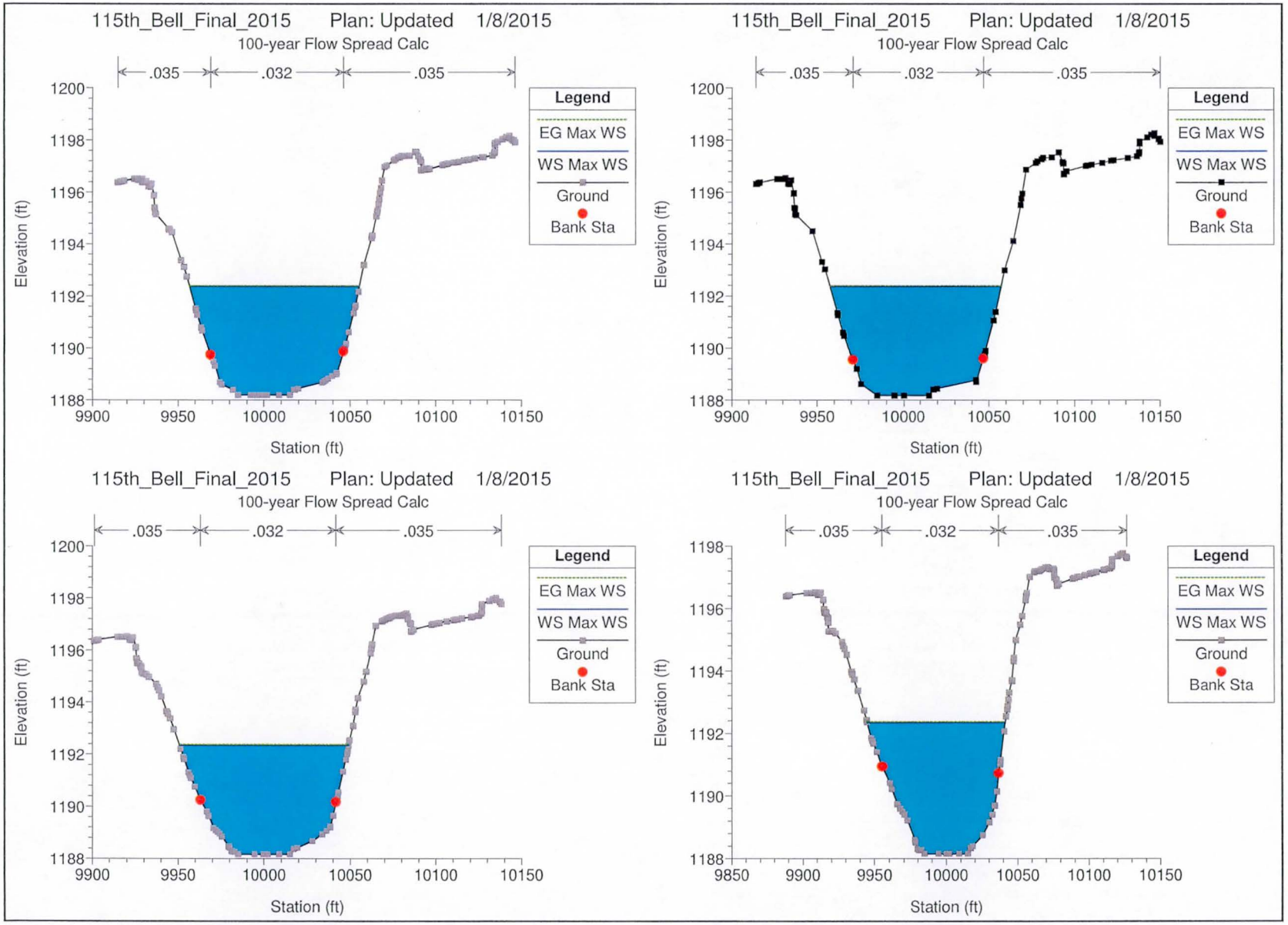
Station (ft)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100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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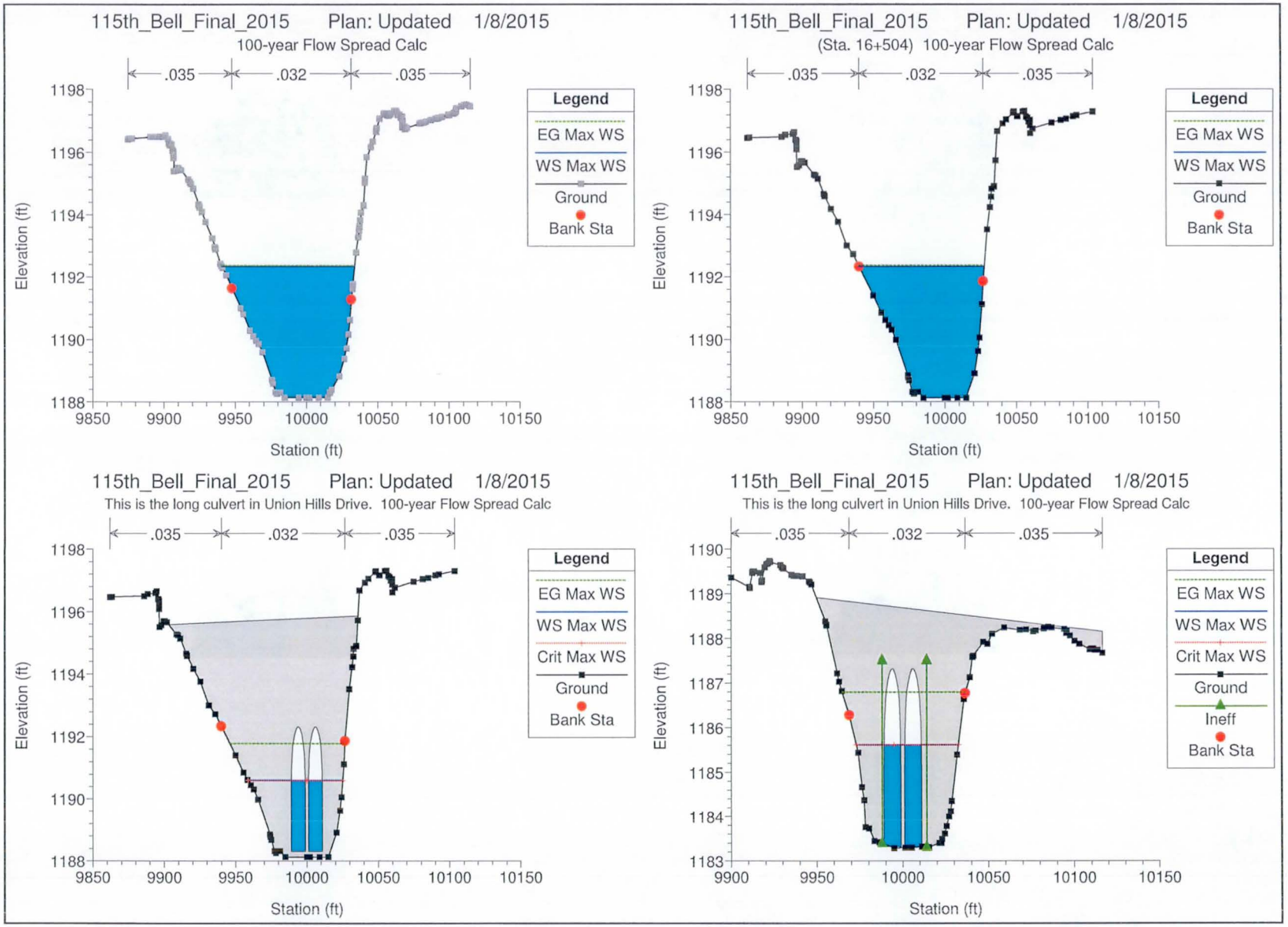
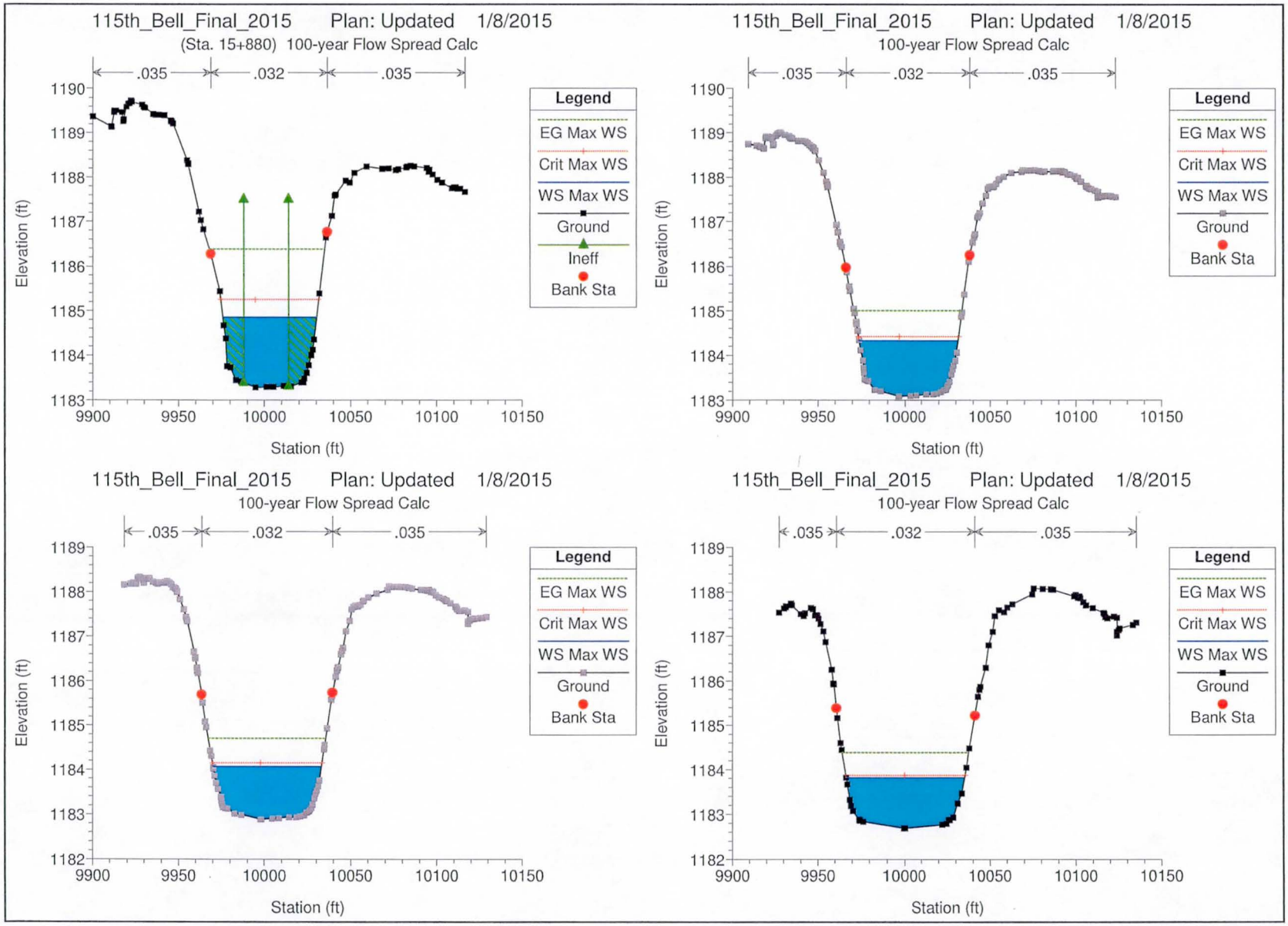
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035 .032 .035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
(Sta. 16+504) 100-year Flow Spread Calc
.035 .032 .035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the long culvert in Union Hills Drive. 100-year Flow Spread Calc
.035 .032 .035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the long culvert in Union Hills Drive. 100-year Flow Spread Calc
.035 .032 .035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Ineff
Bank Sta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(Sta. 15+880) 100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Ineff
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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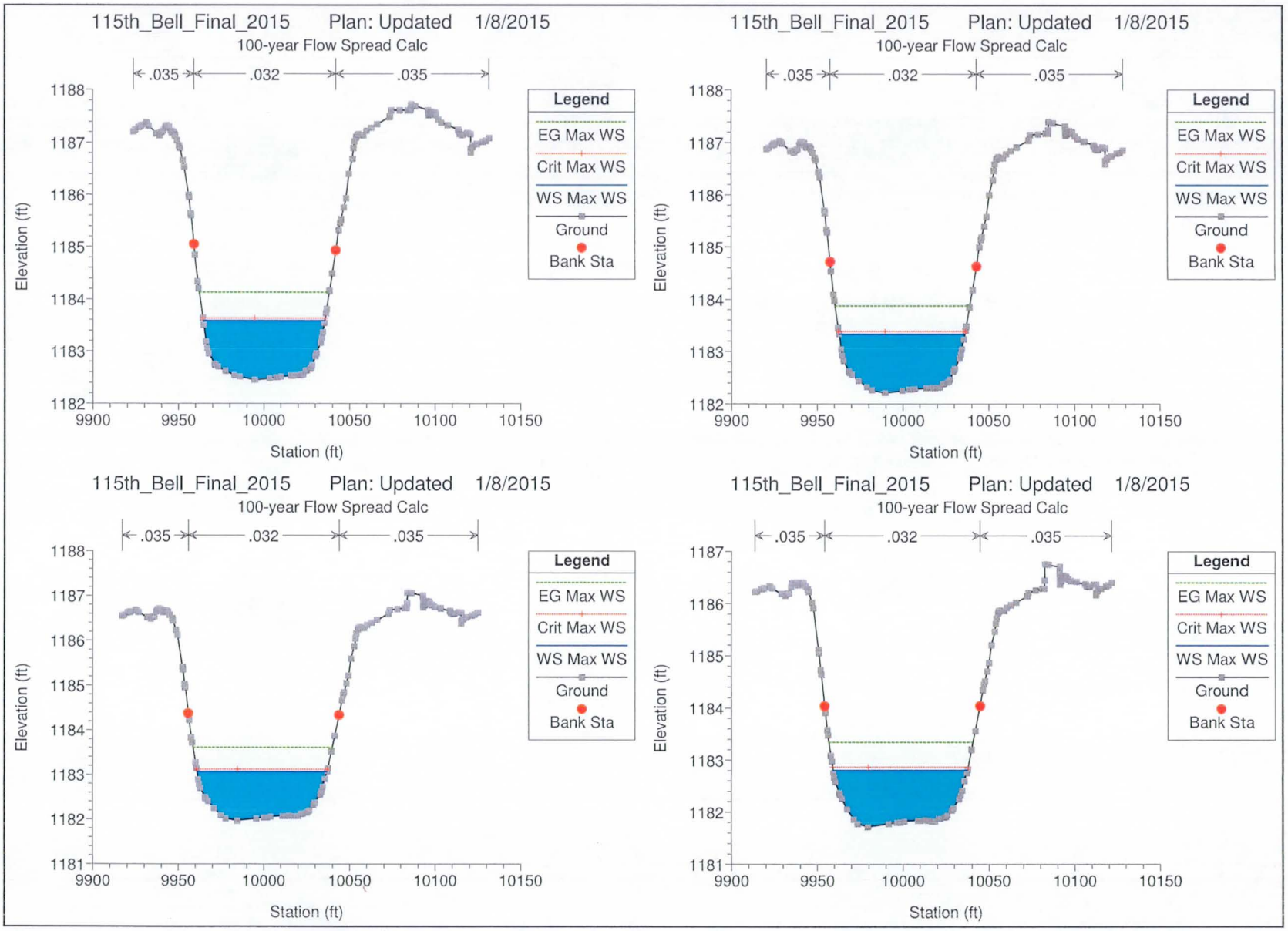
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
Crit Max WS
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Ground
Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
Crit Max WS
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Ground
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Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Crit Max WS
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Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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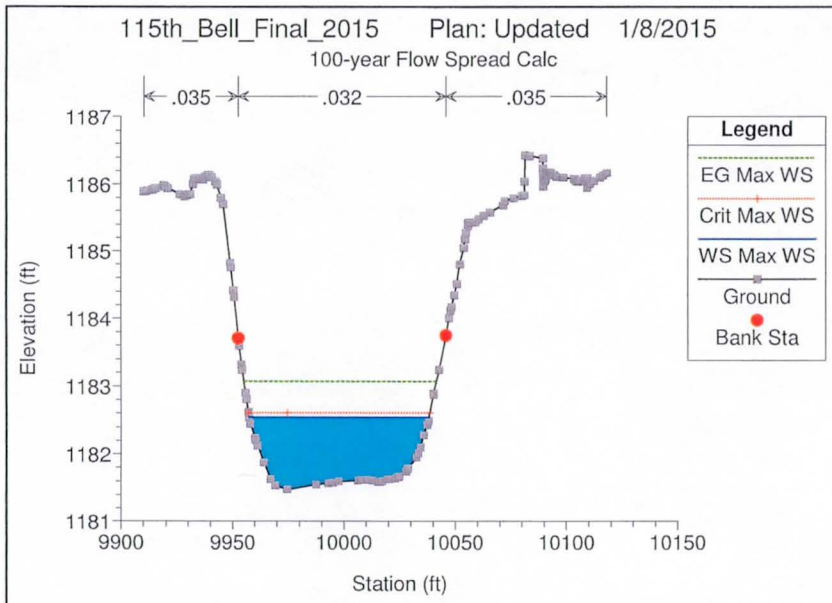
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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Legend
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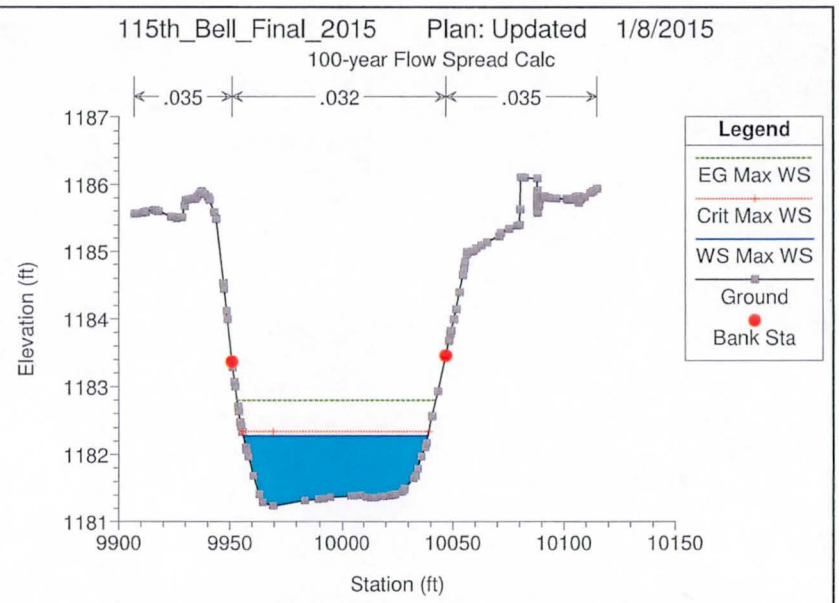
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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Ground
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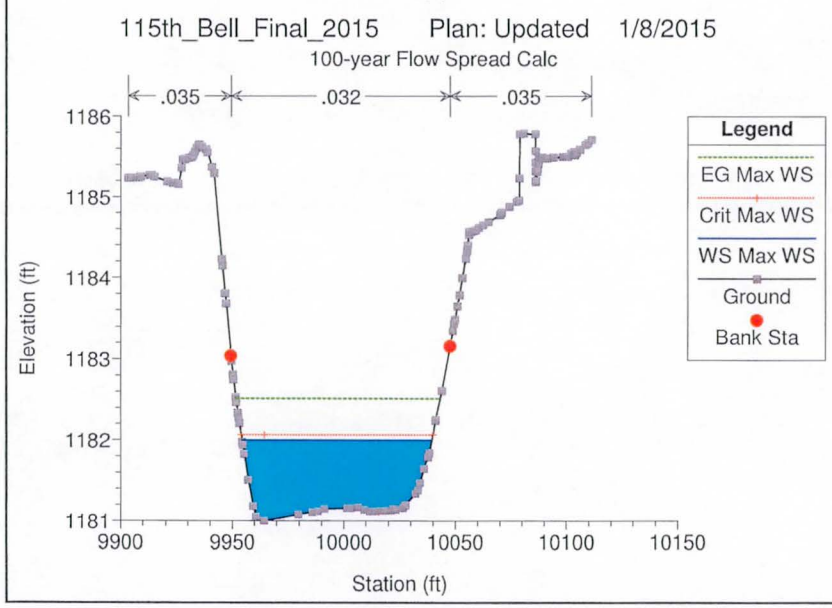
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100-year Flow Spread Calc
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Elevation (ft)
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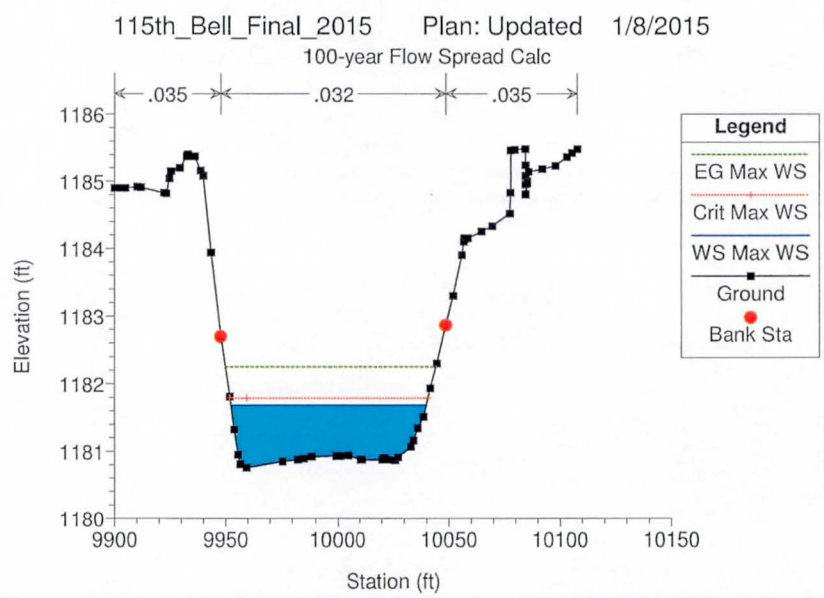
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100-year Flow Spread Calc
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Elevation (ft)
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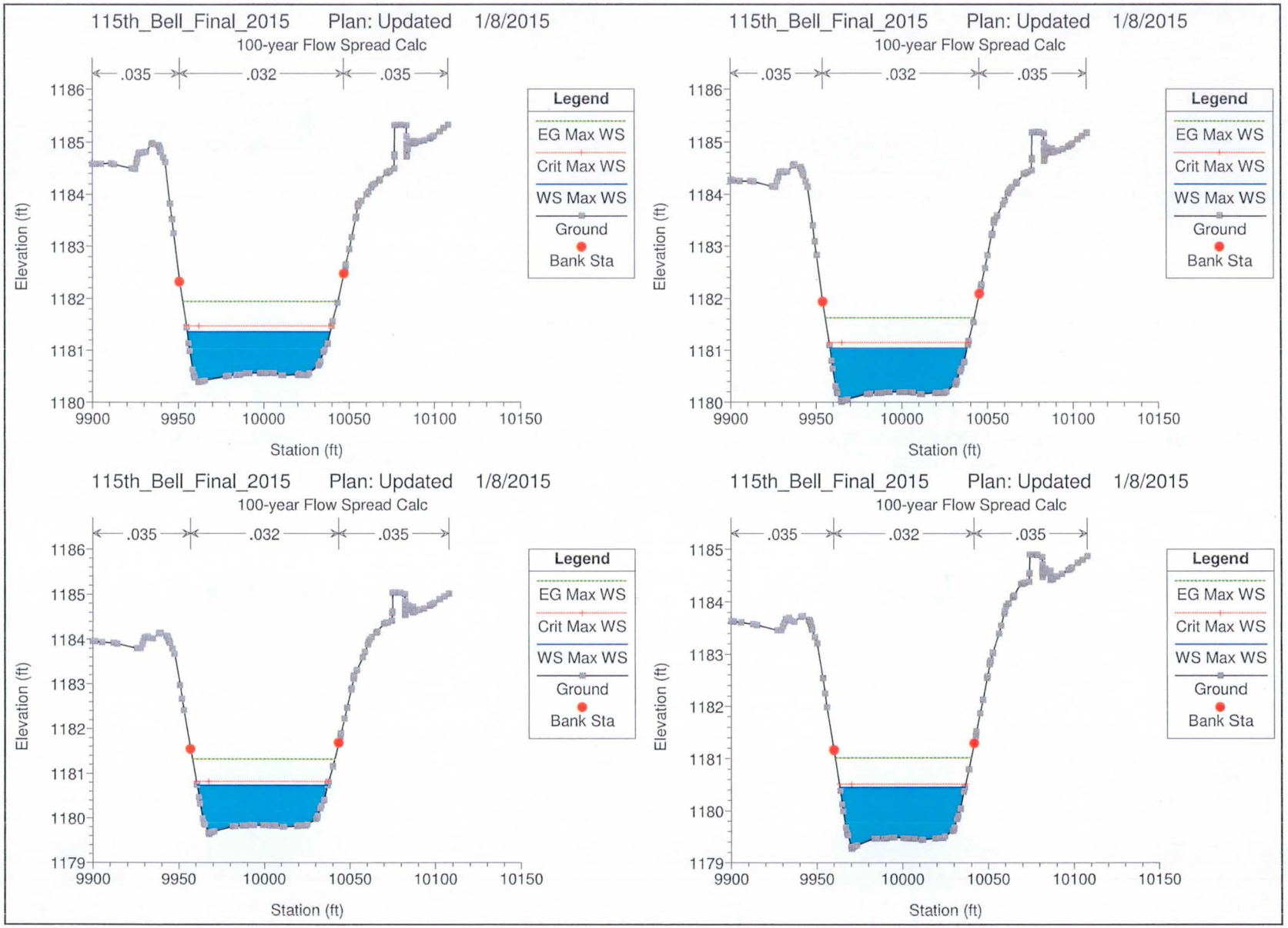
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100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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Elevation (ft)
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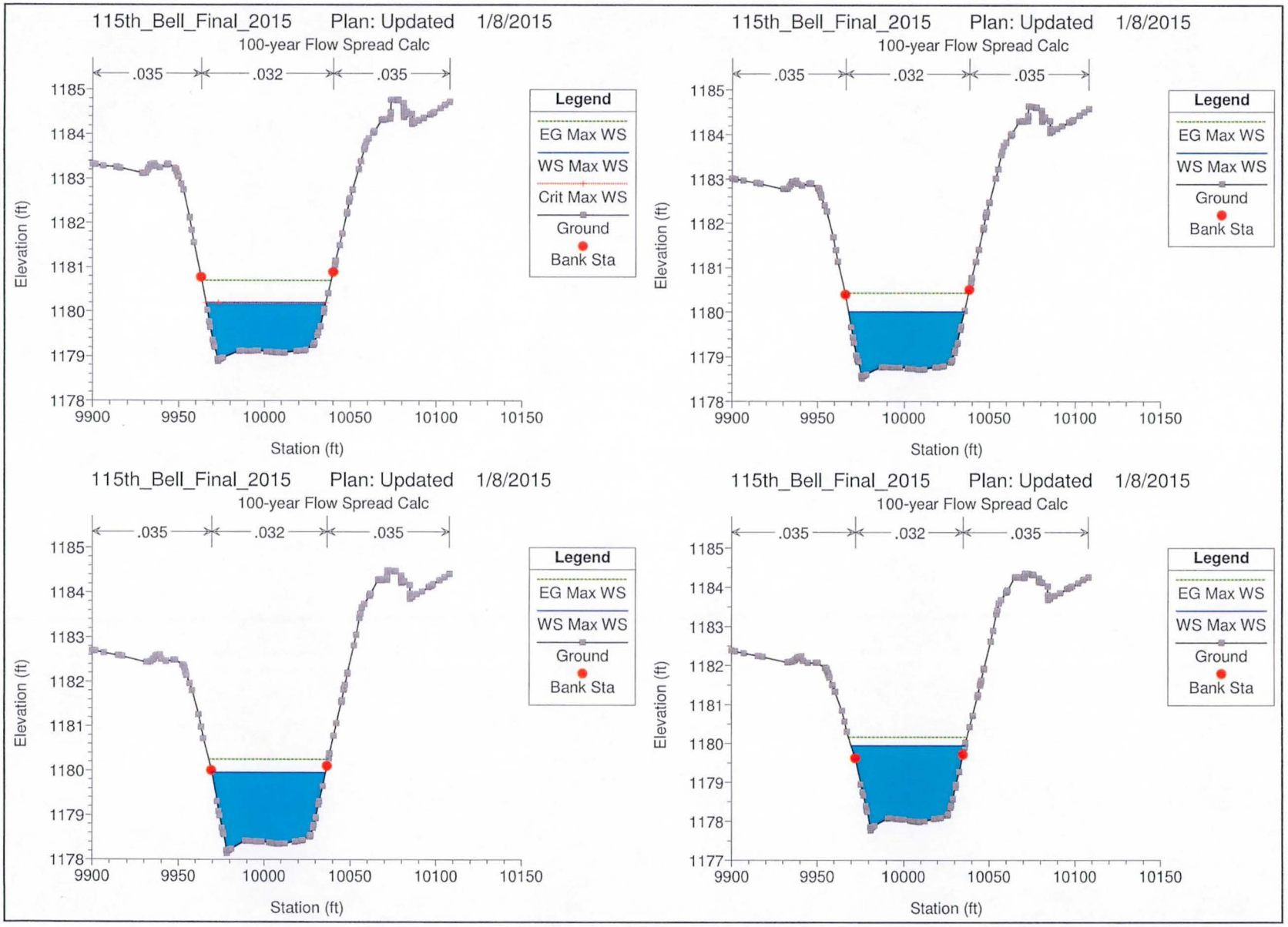
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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Elevation (ft)
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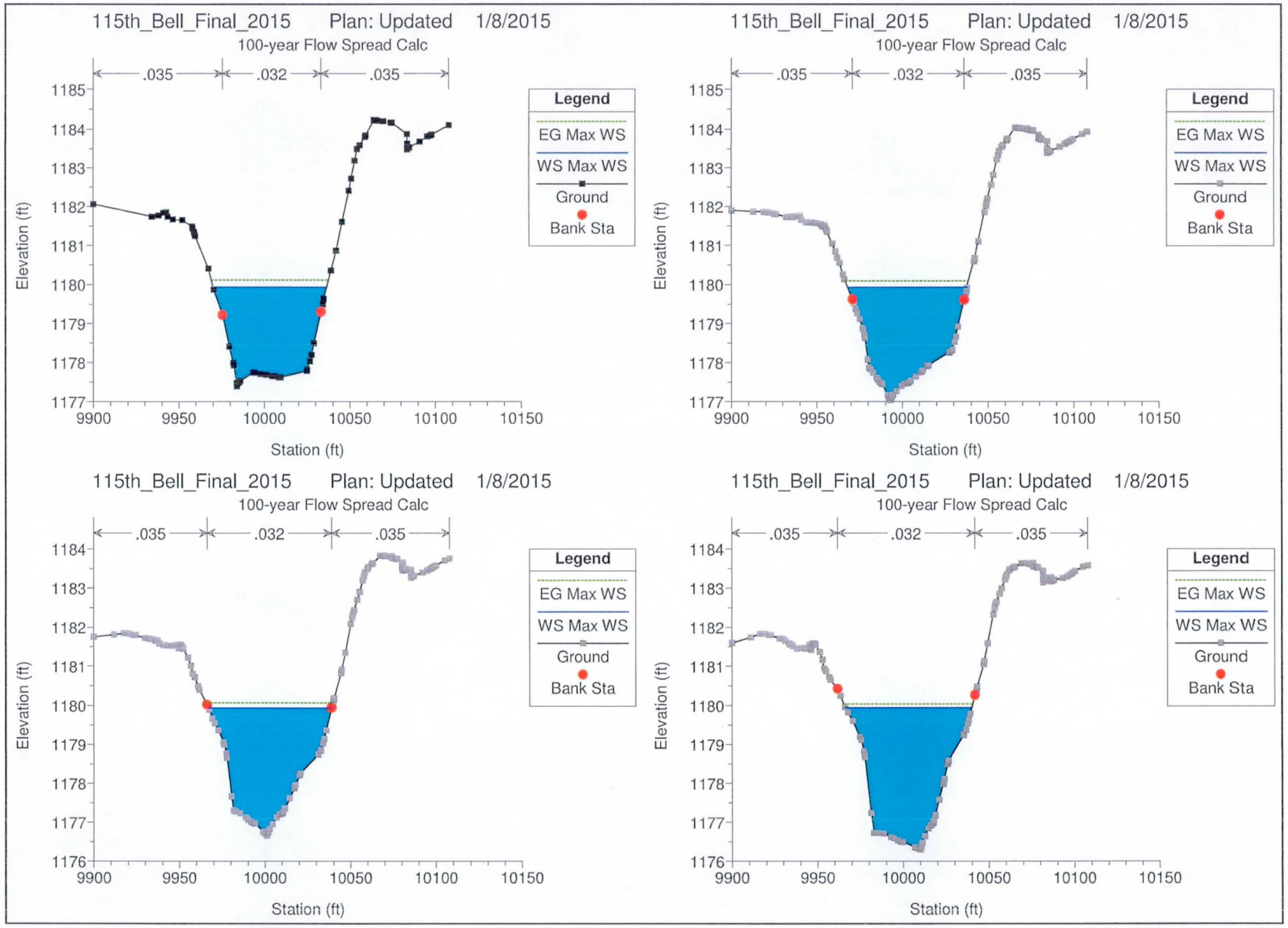
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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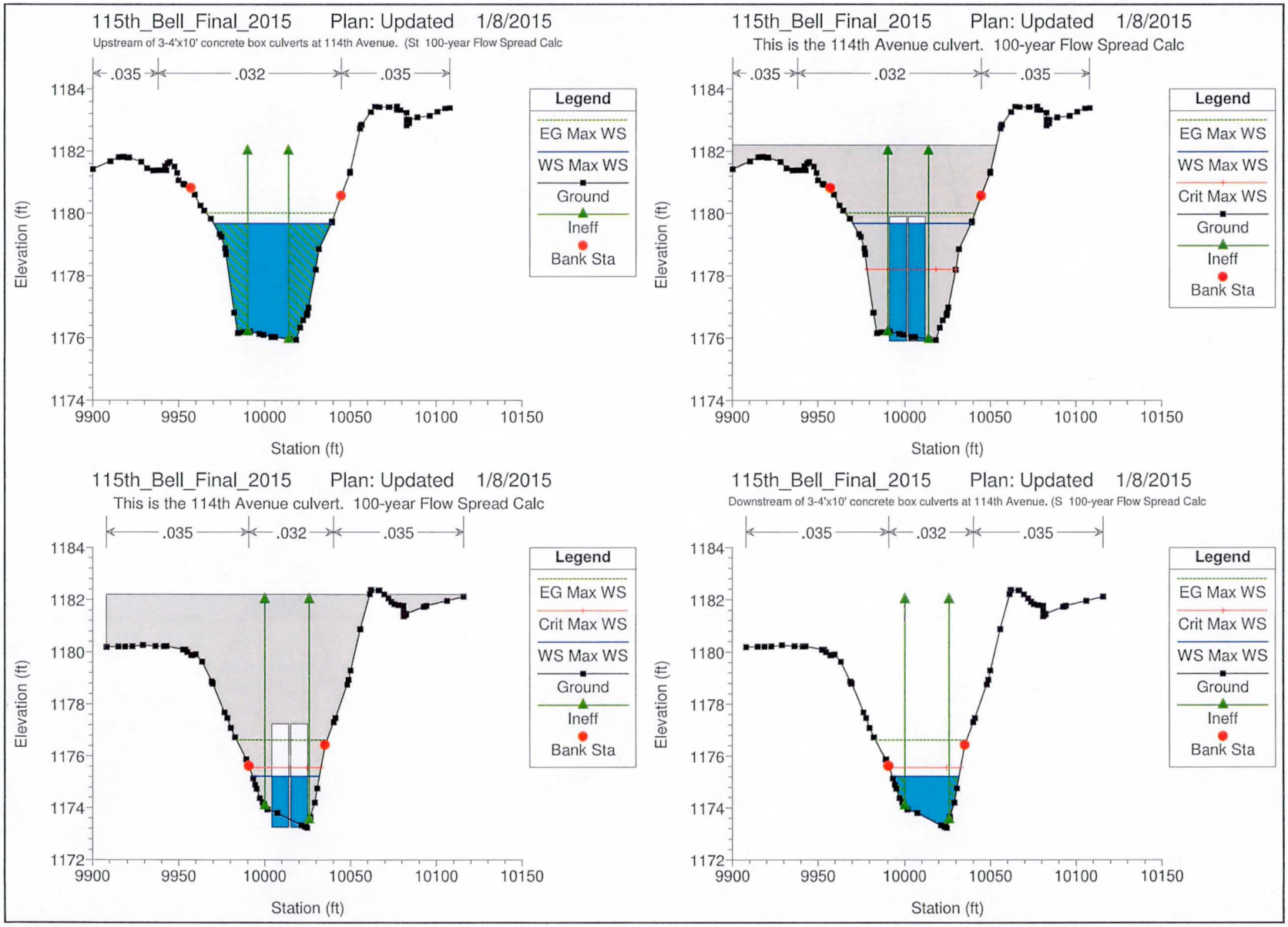
115th_Bell_Final_2015 Plan: Updated 1/8/2015
Upstream of 3-4'x10' concrete box culverts at 114th Avenue. (St 100-year Flow Spread Calc
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Legend
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Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the 114th Avenue culvert. 100-year Flow Spread Calc
Legend
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Crit Max WS
Ground
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Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the 114th Avenue culvert. 100-year Flow Spread Calc
Legend
EG Max WS
Crit Max WS
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Ground
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Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
Downstream of 3-4'x10' concrete box culverts at 114th Avenue. (S 100-year Flow Spread Calc
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Elevation (ft)
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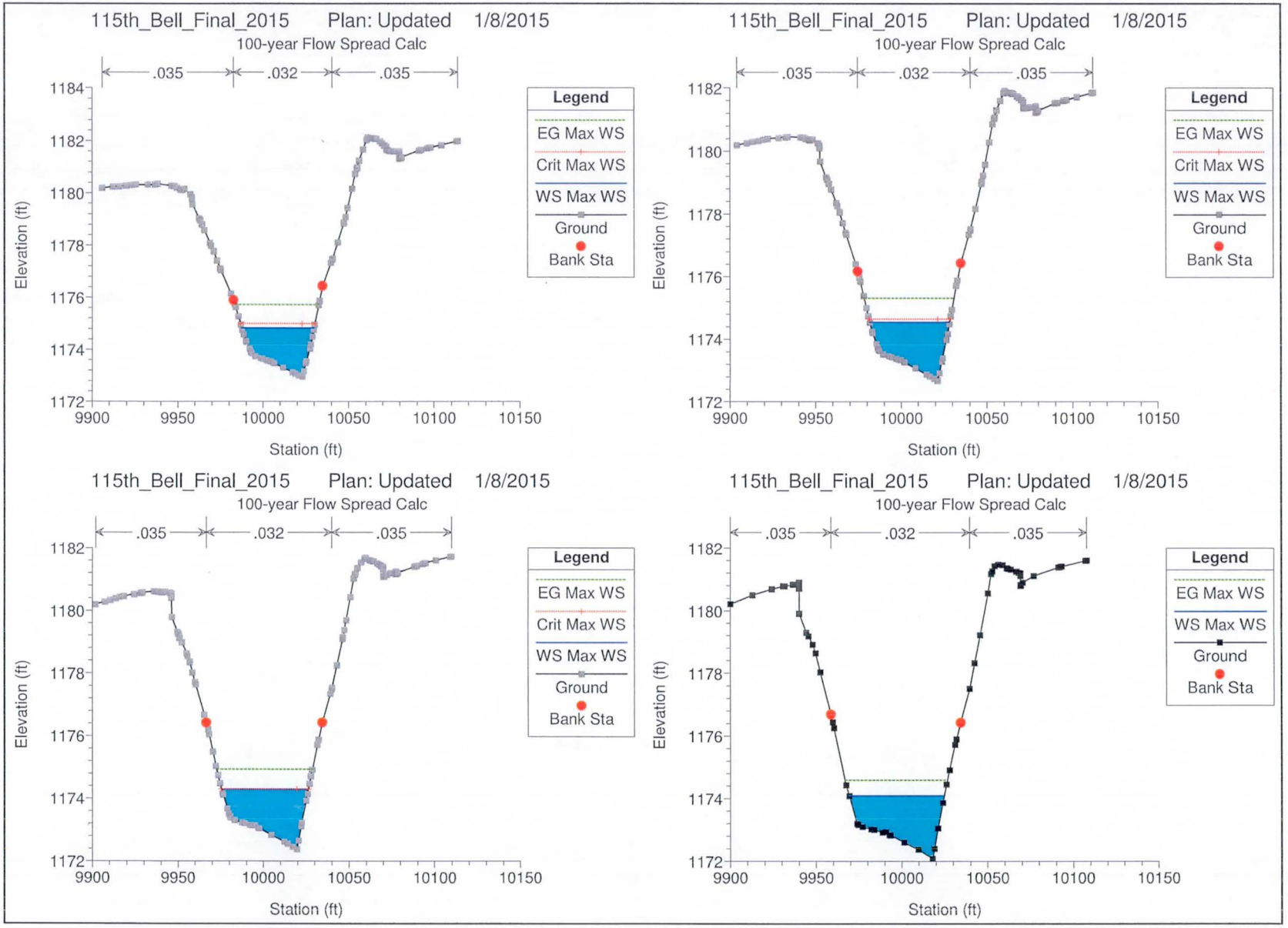
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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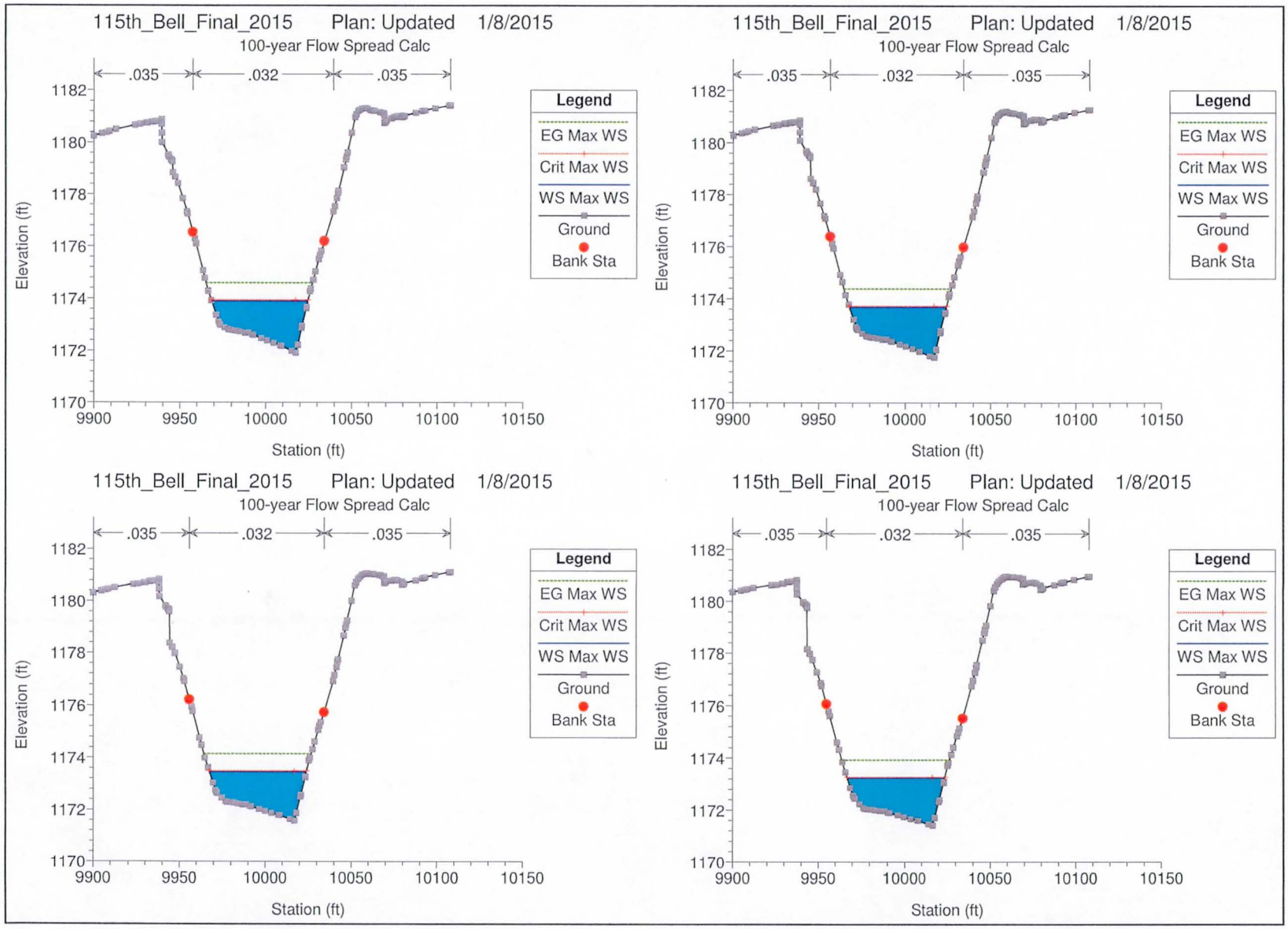
115th_Bell_Final_2015 Plan: Updated 1/8/2015
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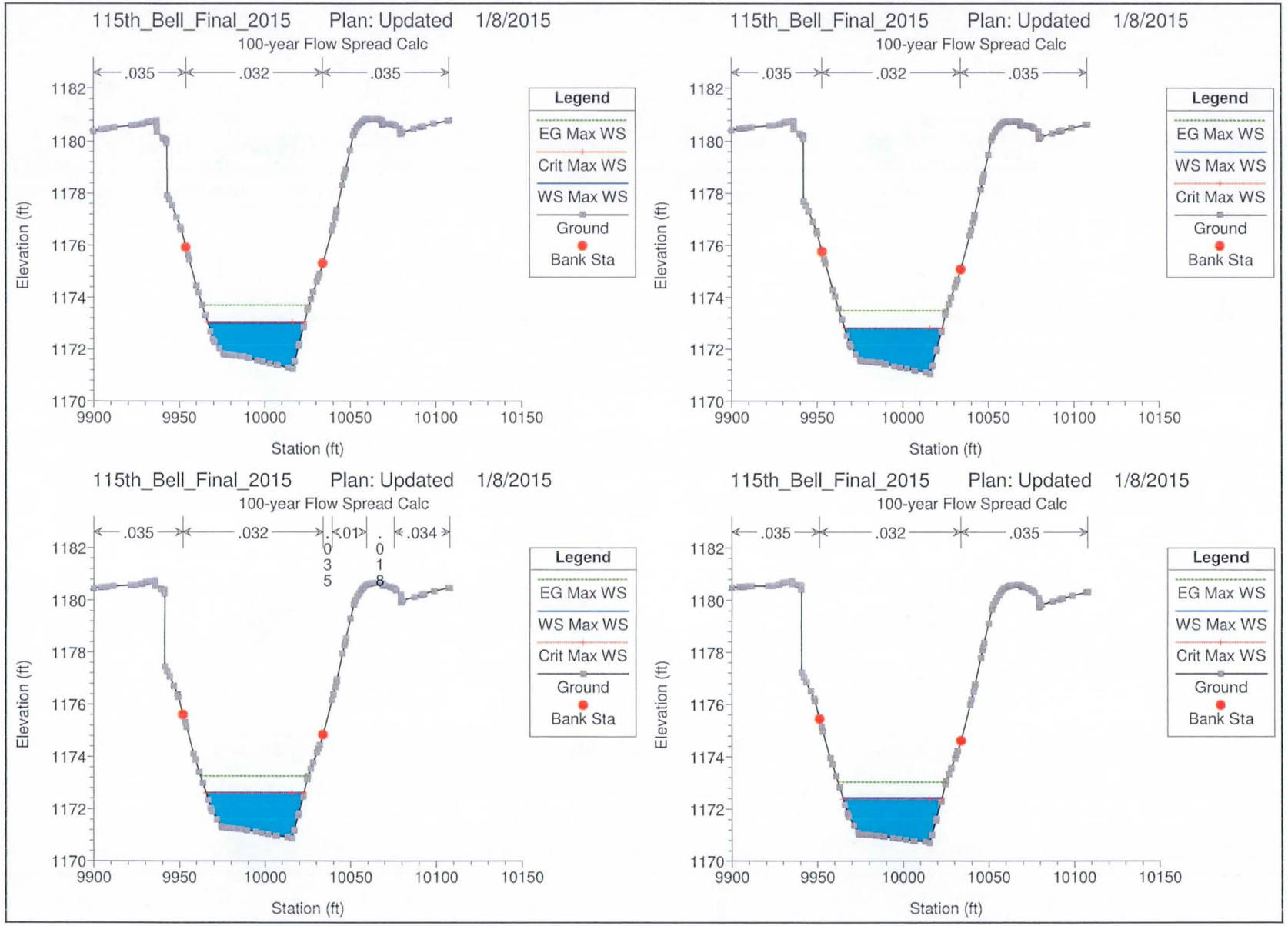
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100-year Flow Spread Calc
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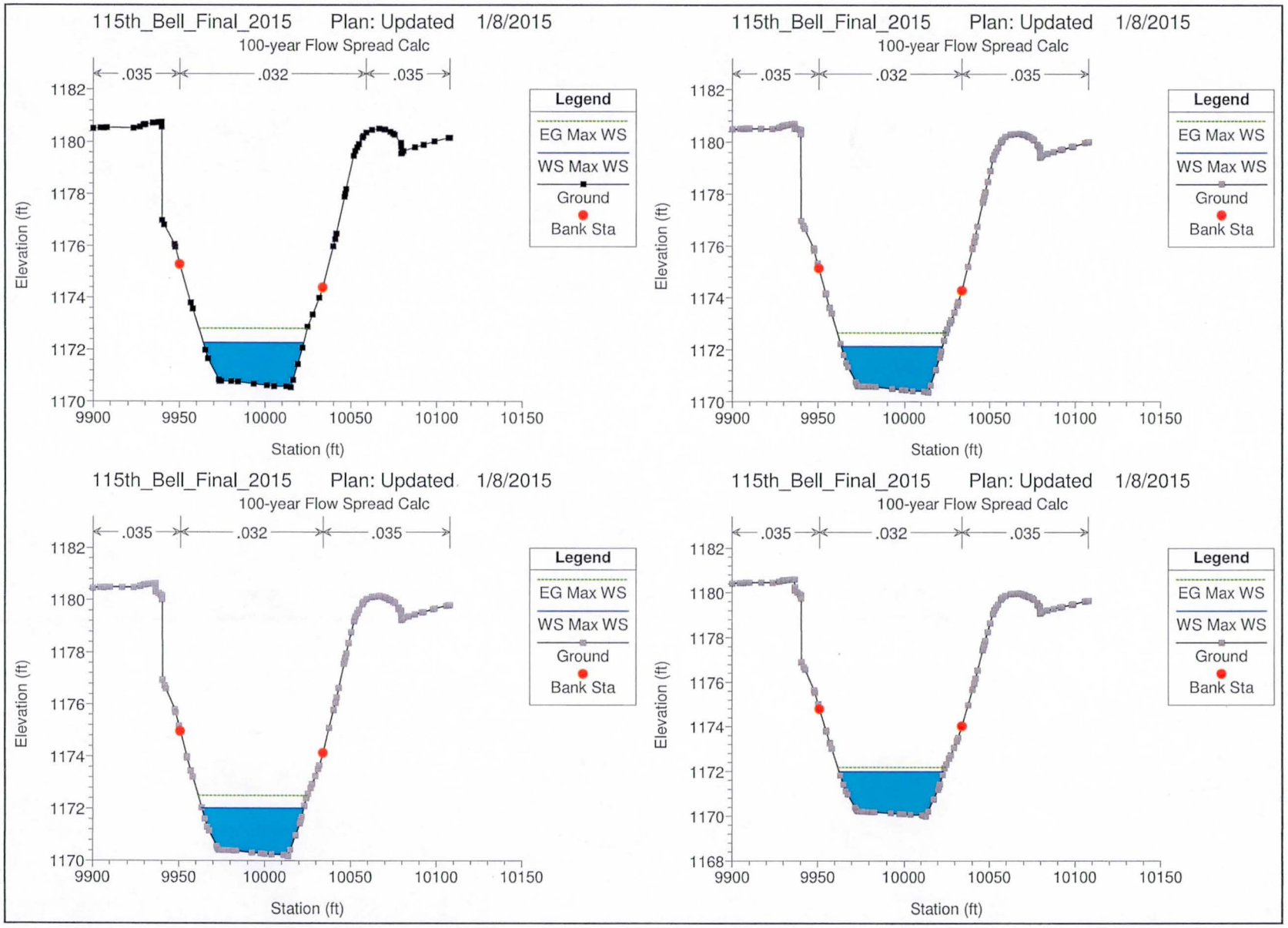
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100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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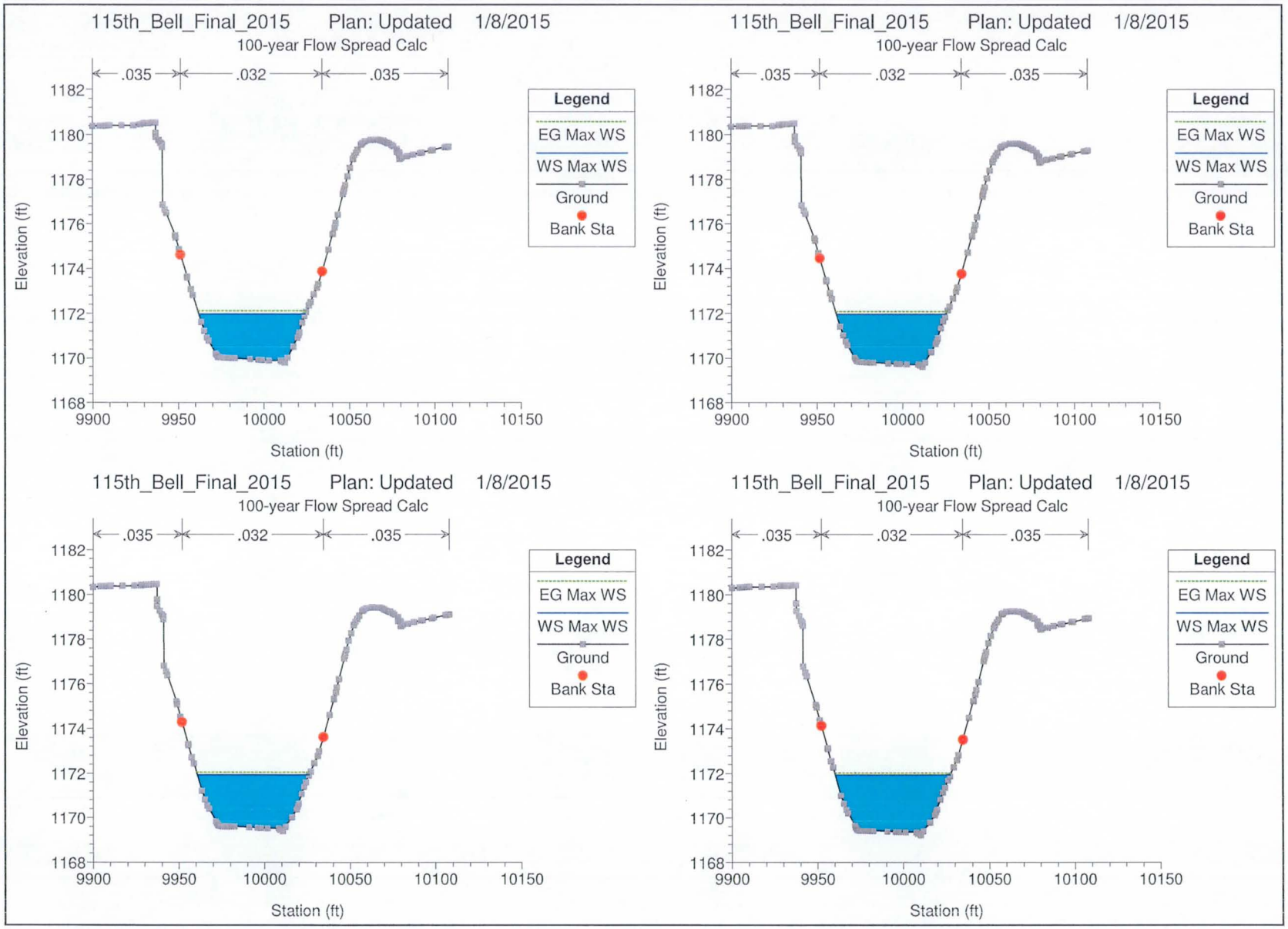
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc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100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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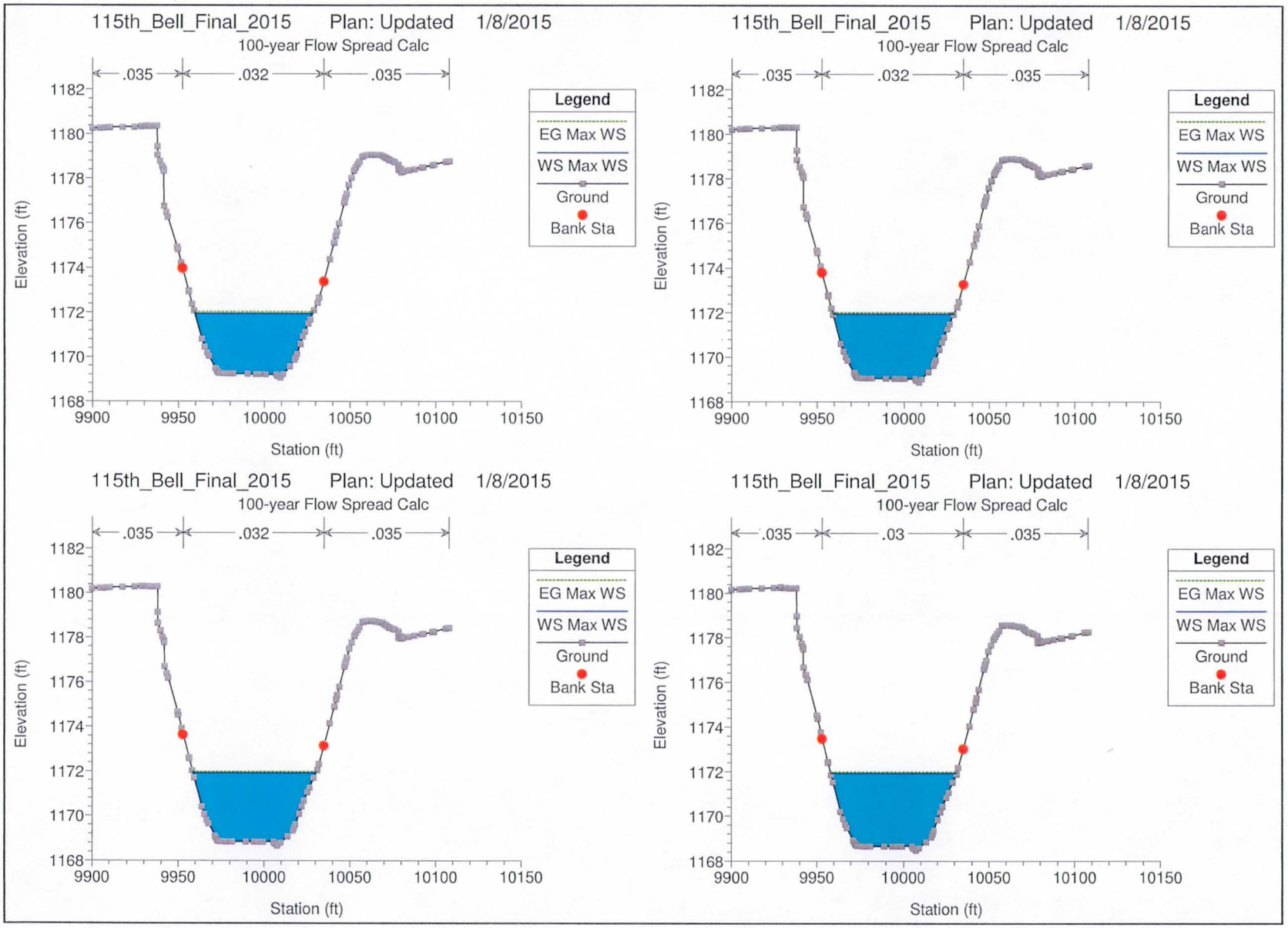
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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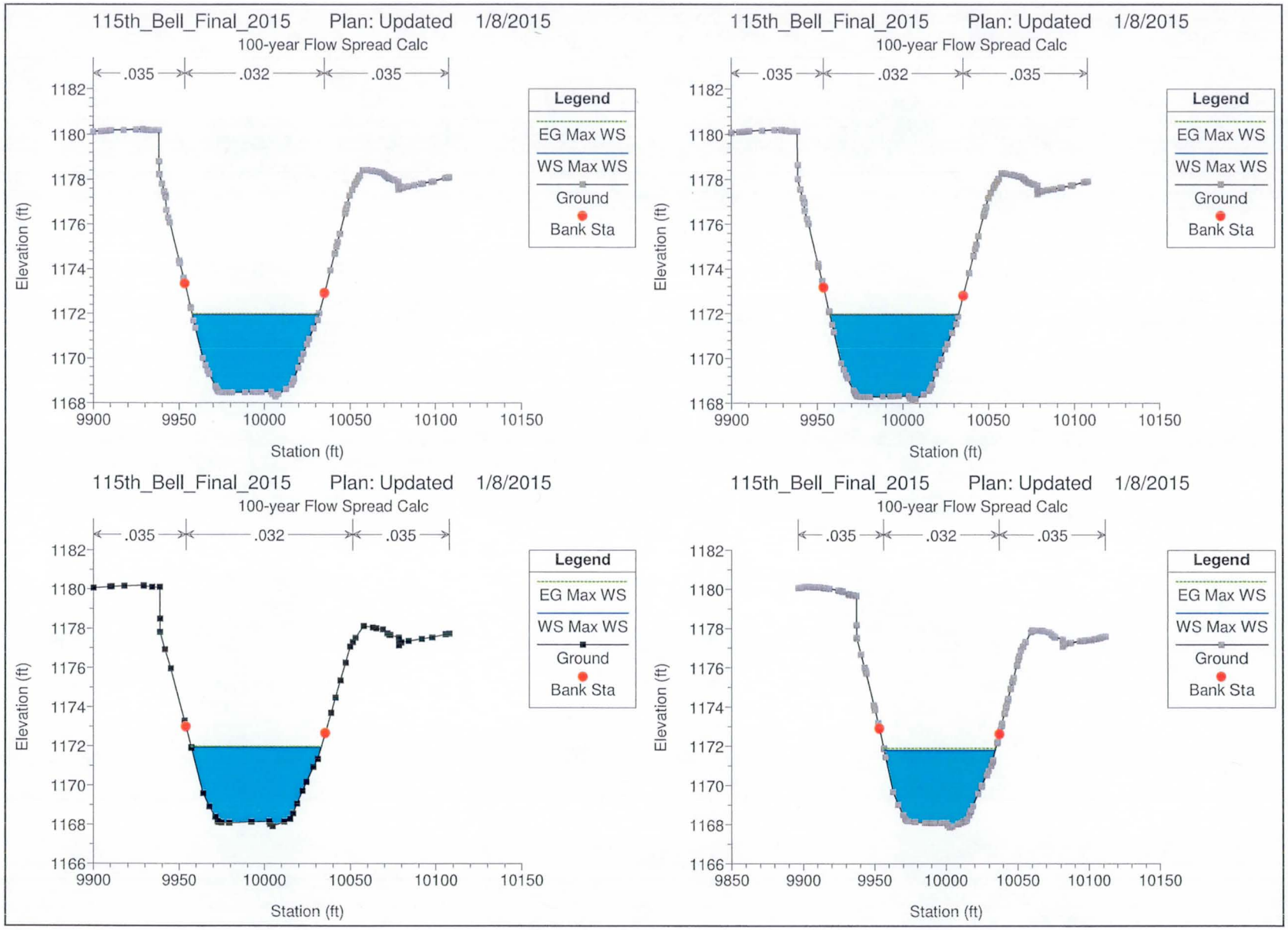
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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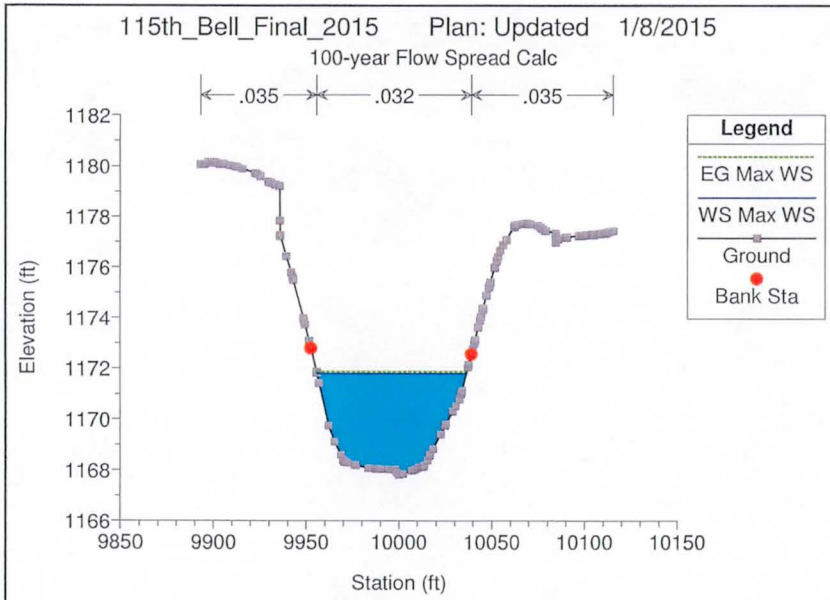
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100-year Flow Spread Calc
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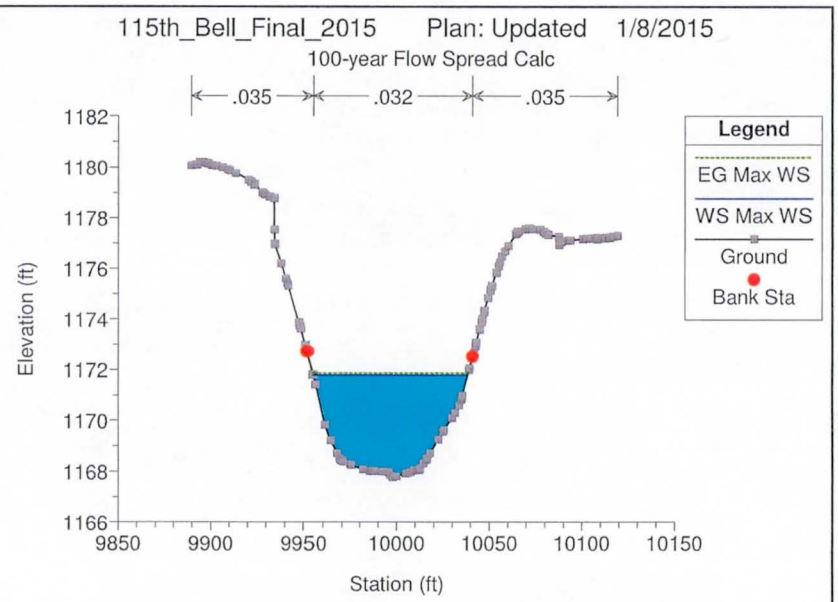
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100-year Flow Spread Calc
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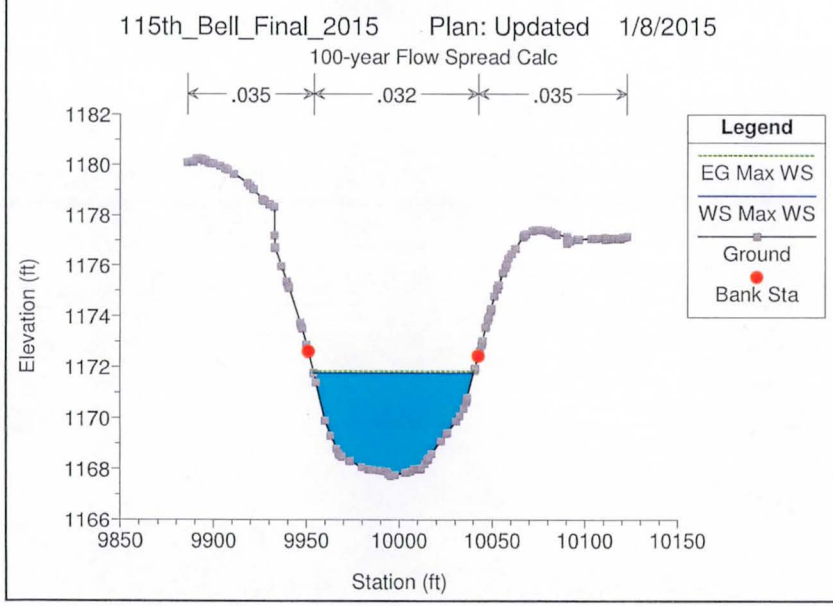
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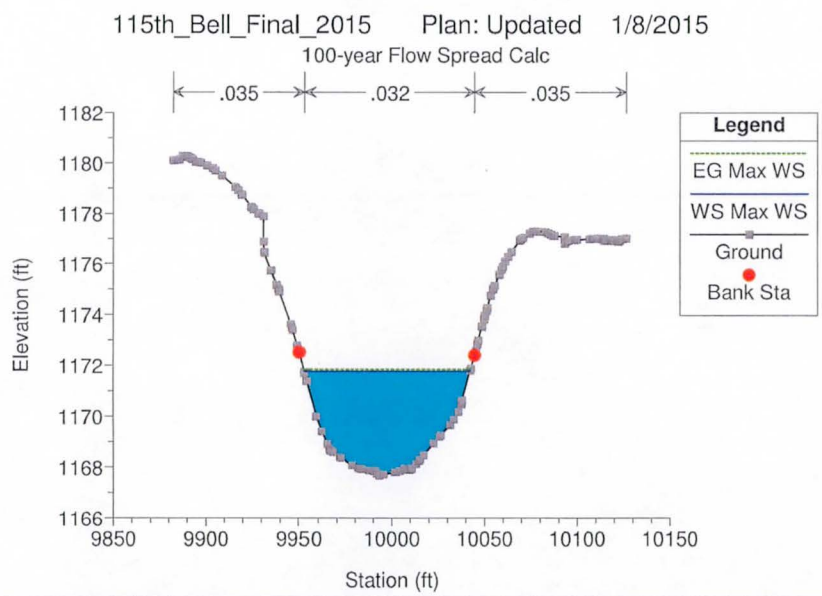
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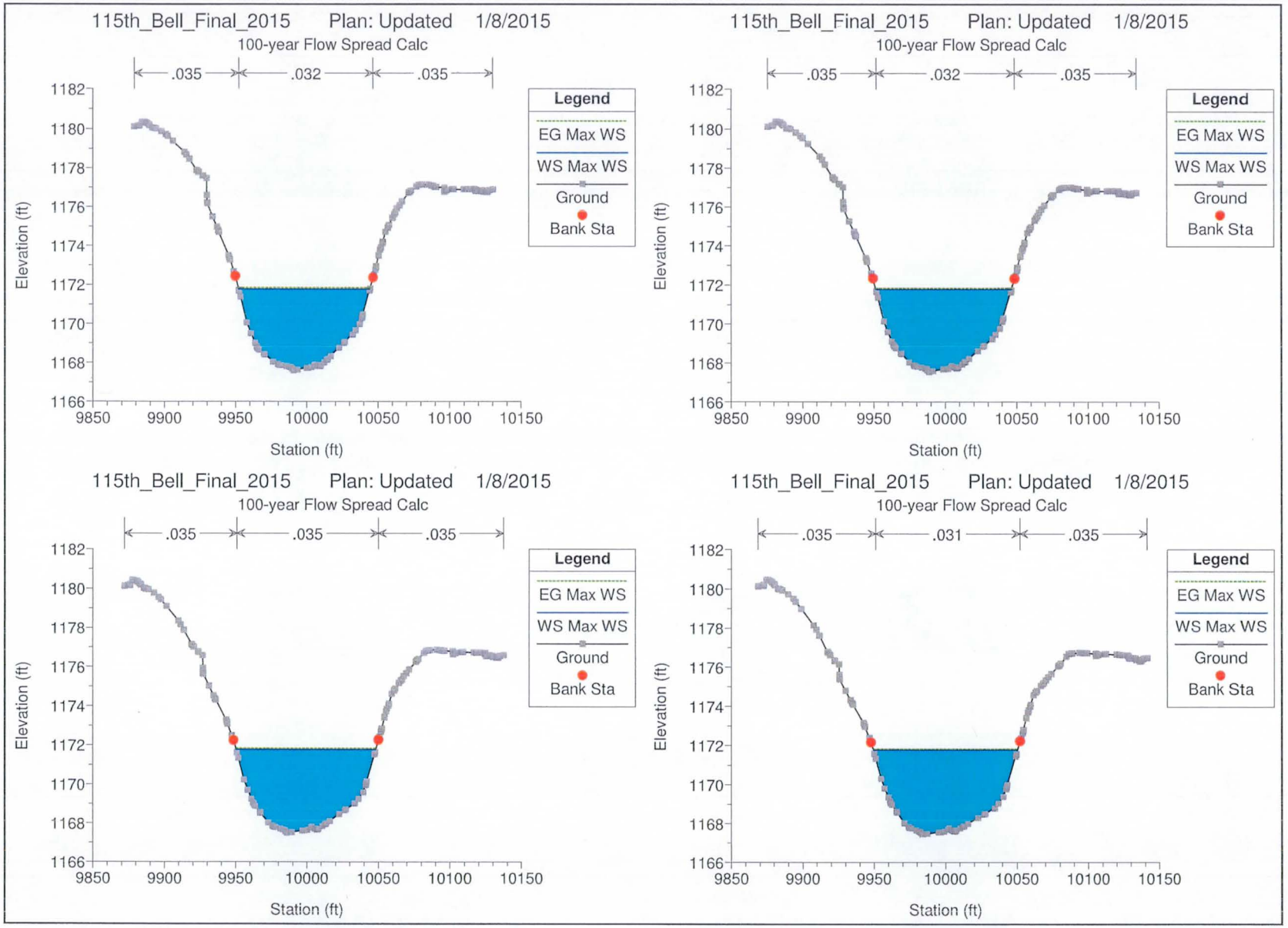
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100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Elevation (ft)
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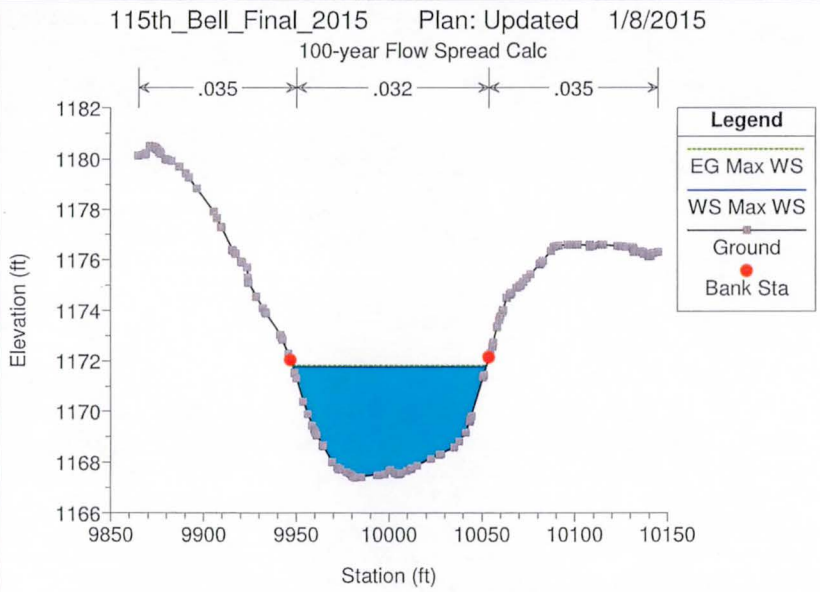
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100-year Flow Spread Calc
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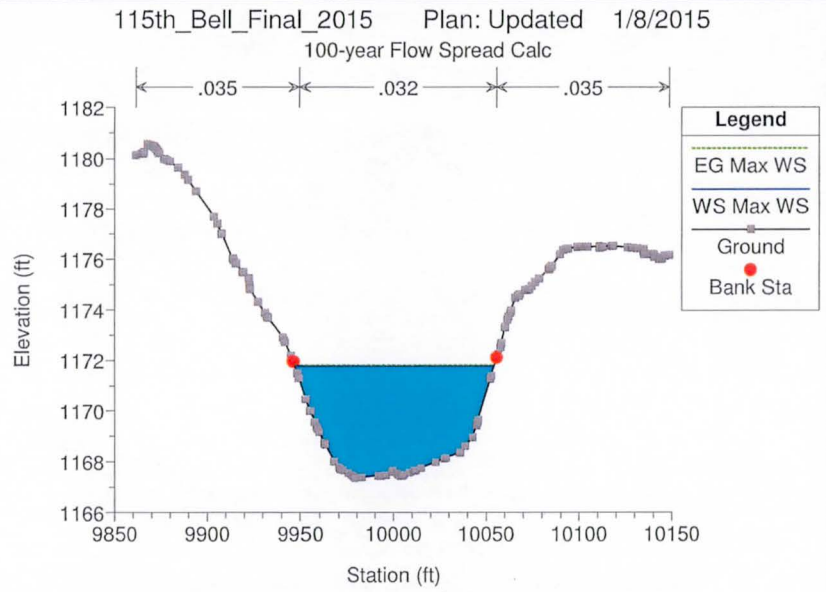
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100-year Flow Spread Calc
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Legend
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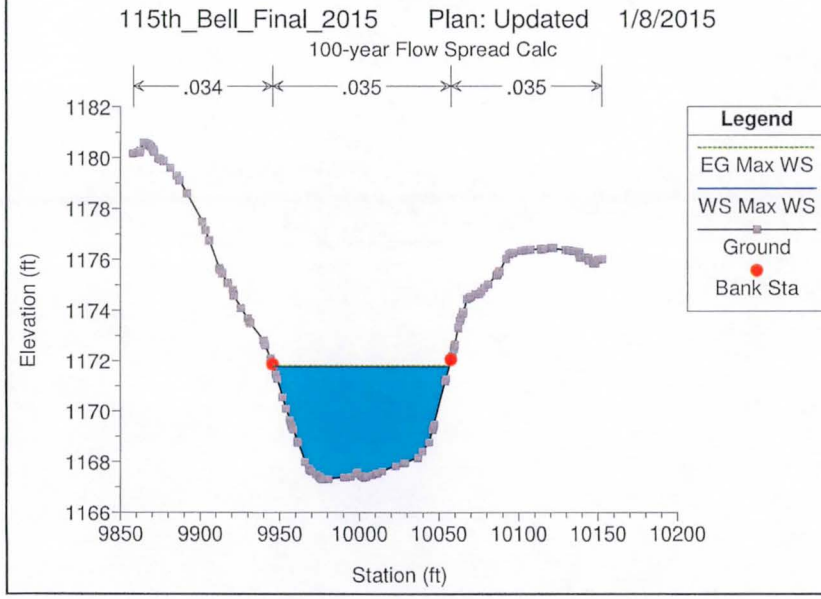
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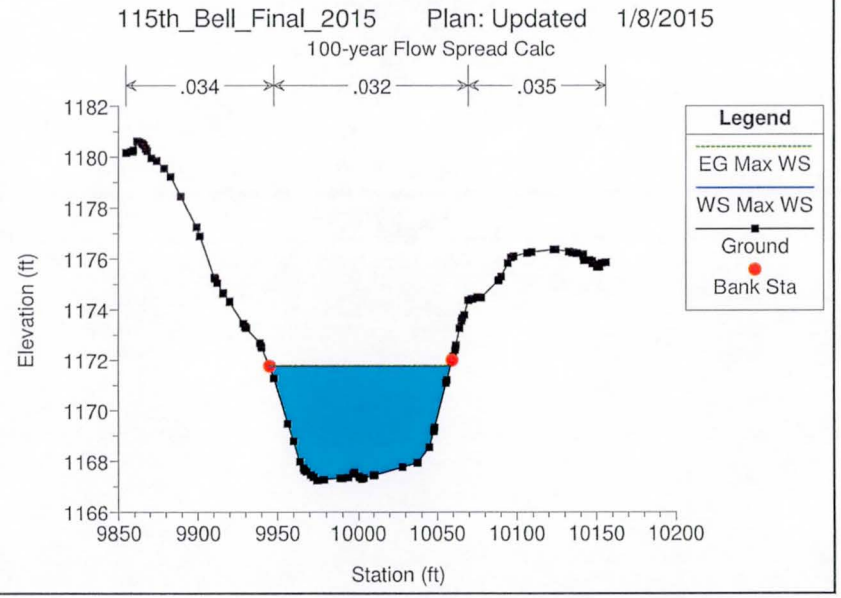
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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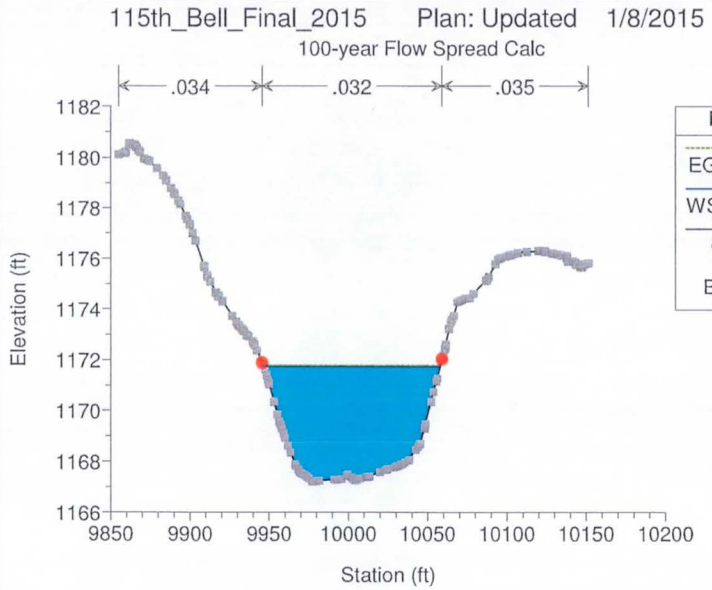
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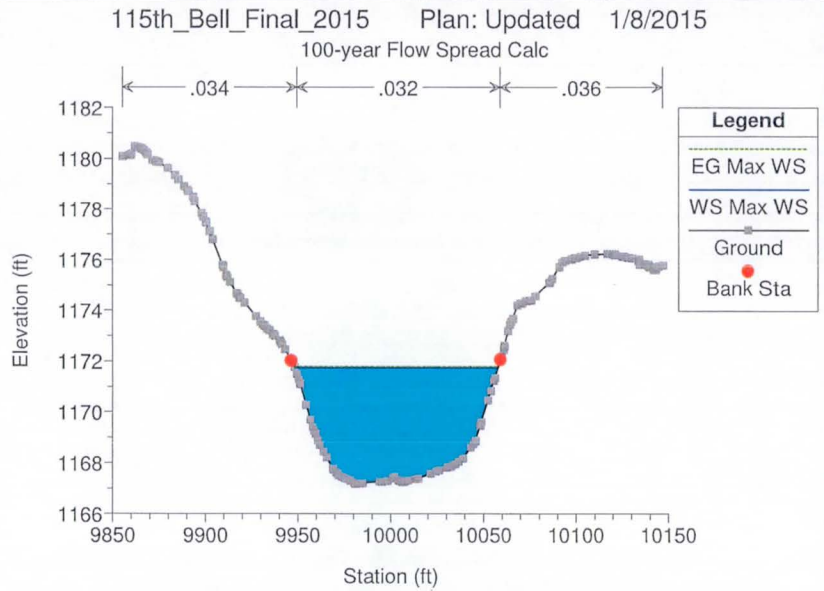
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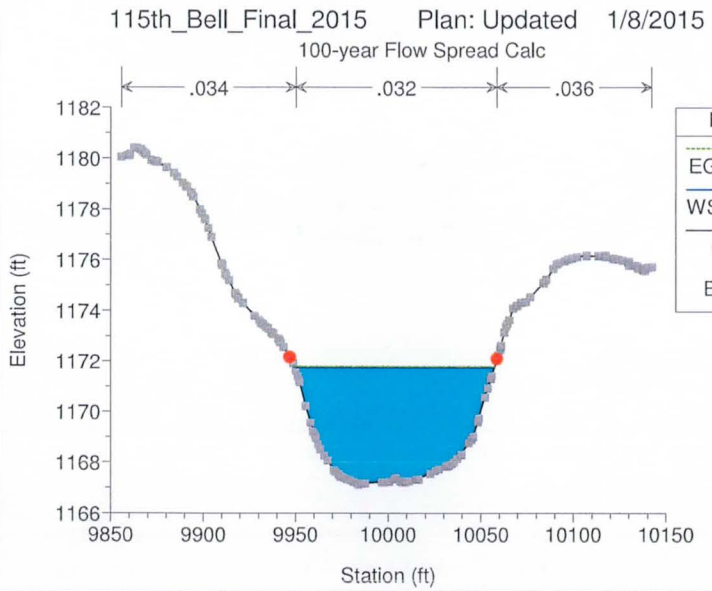
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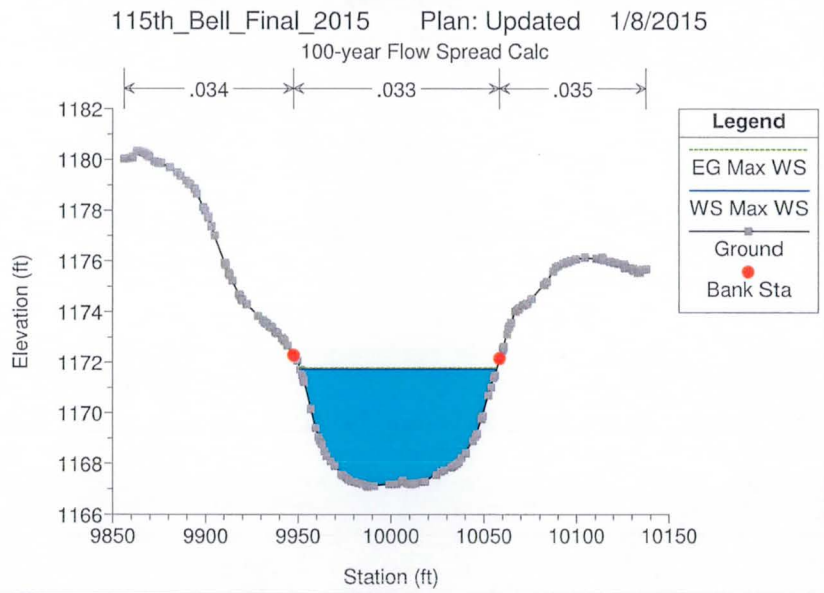
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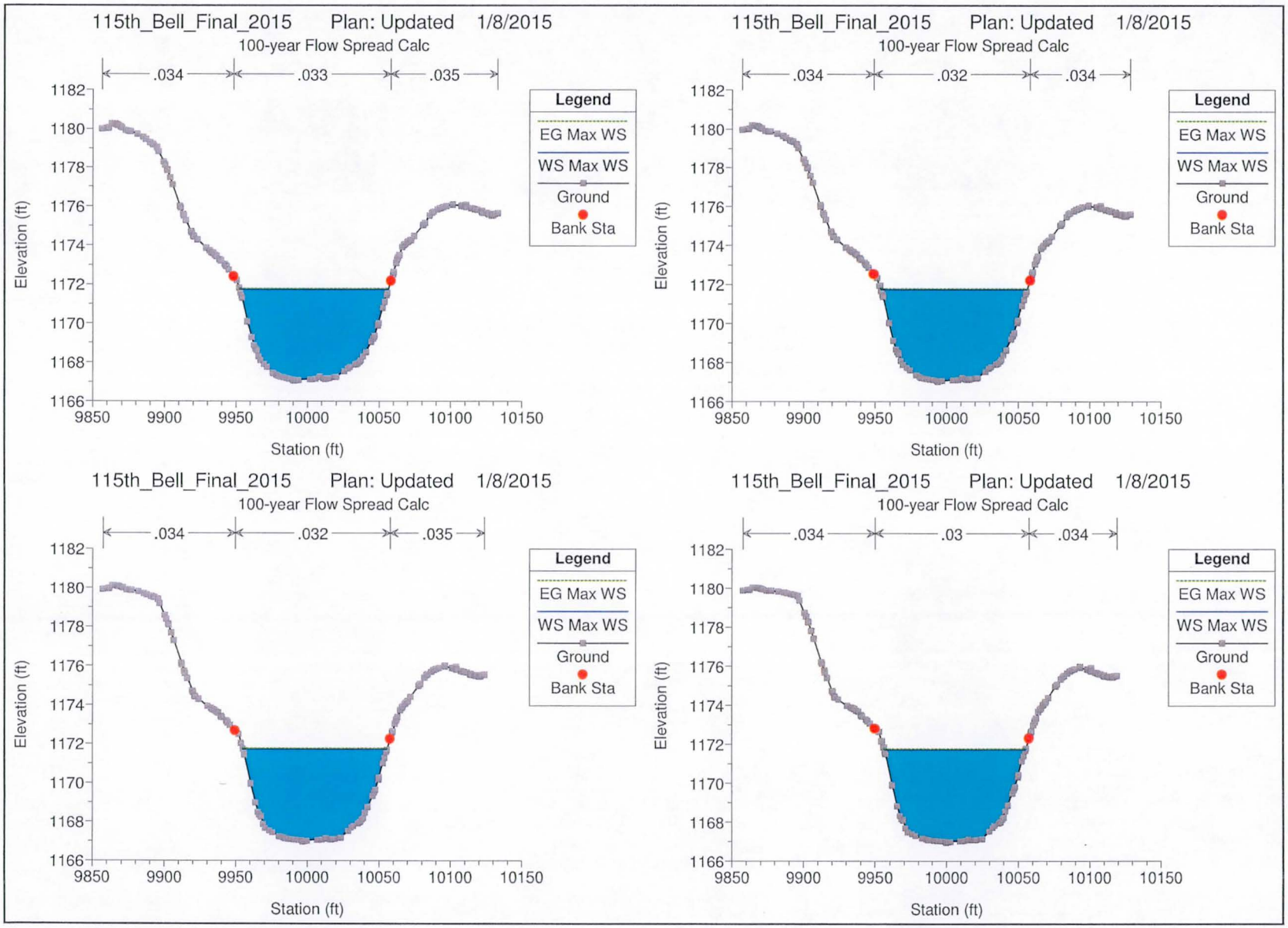
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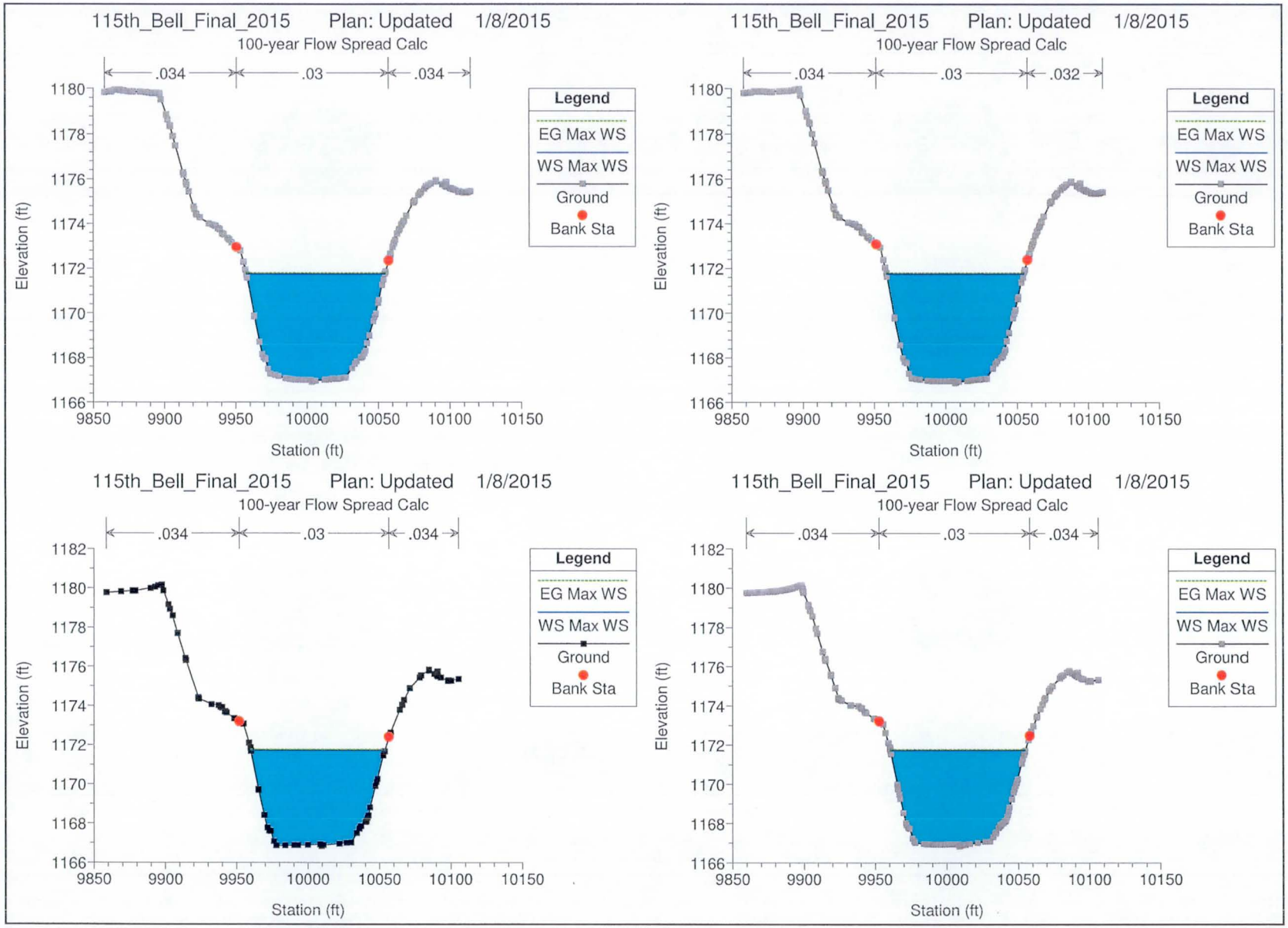
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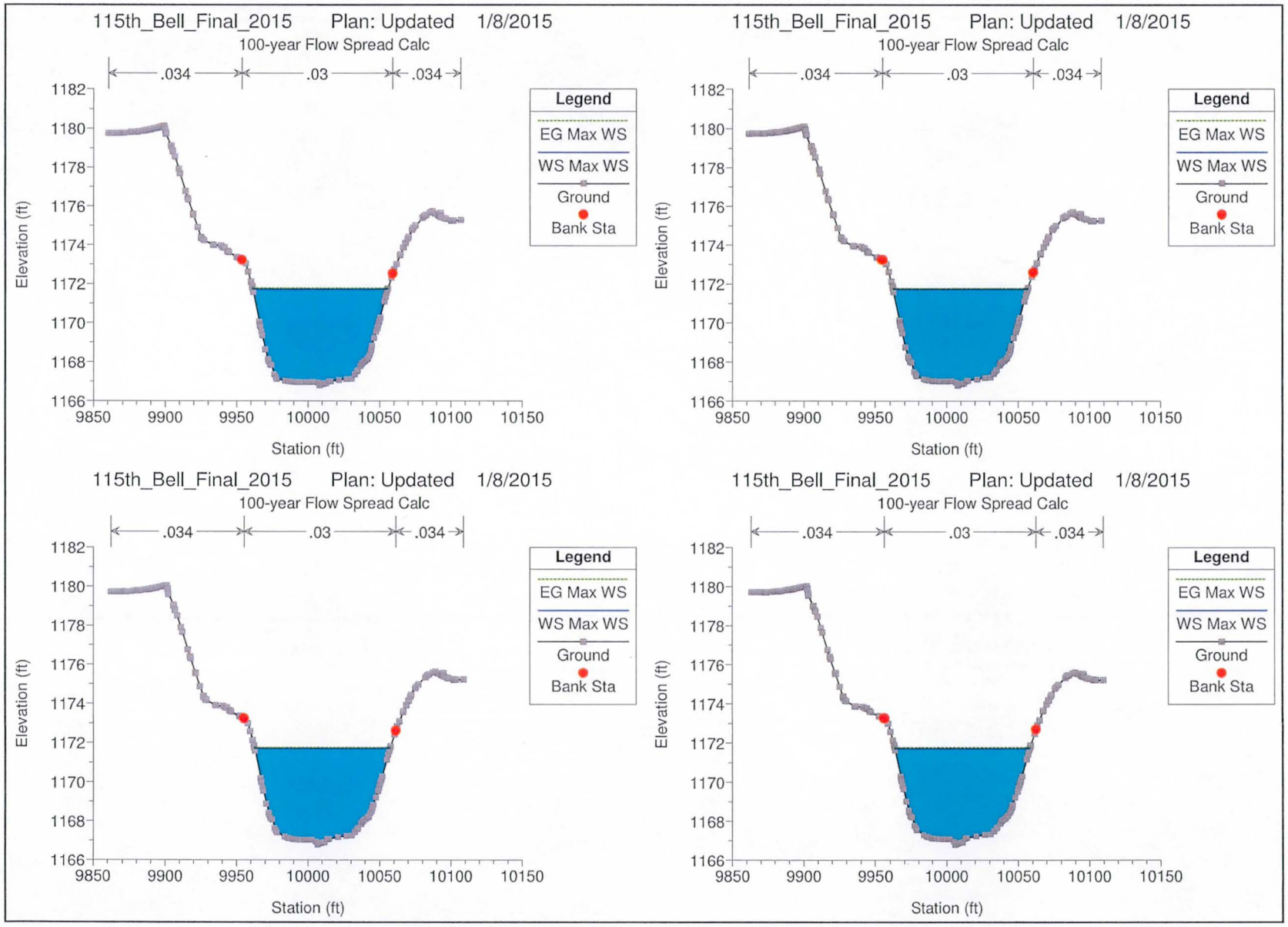
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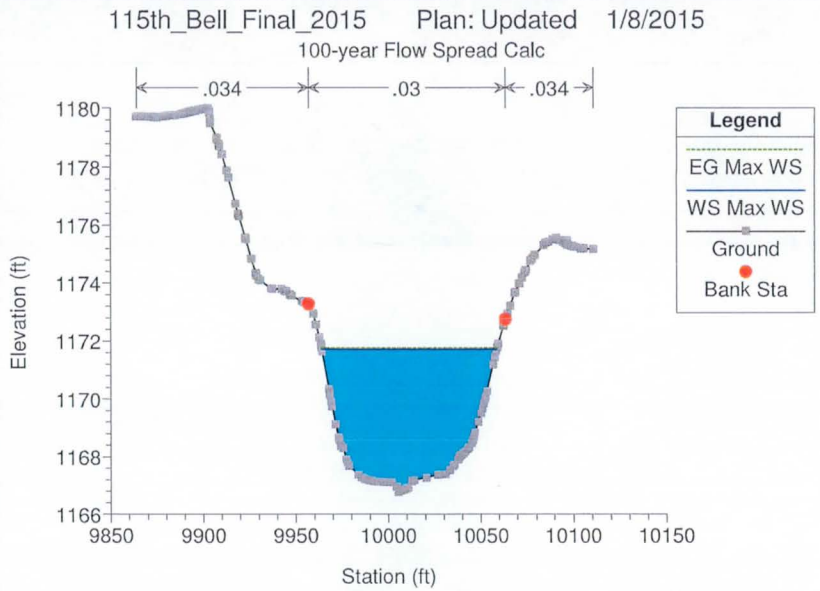
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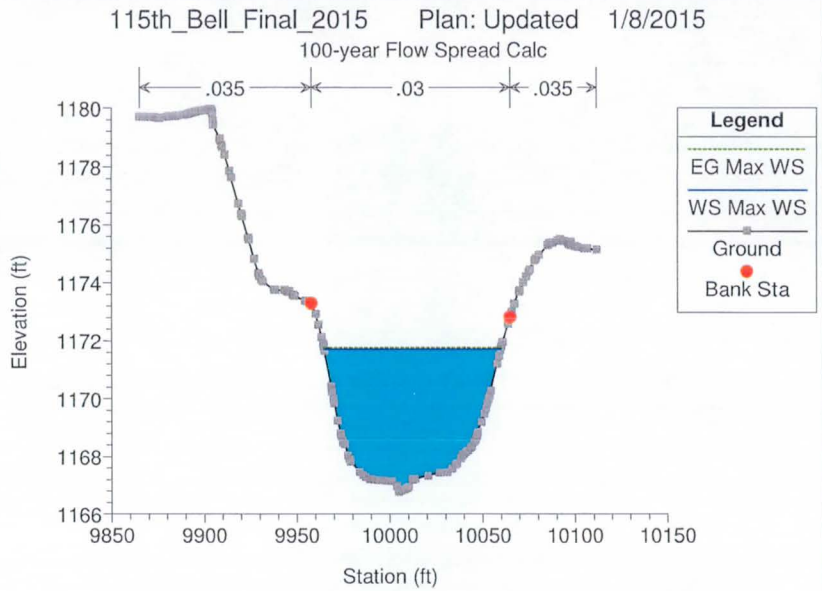
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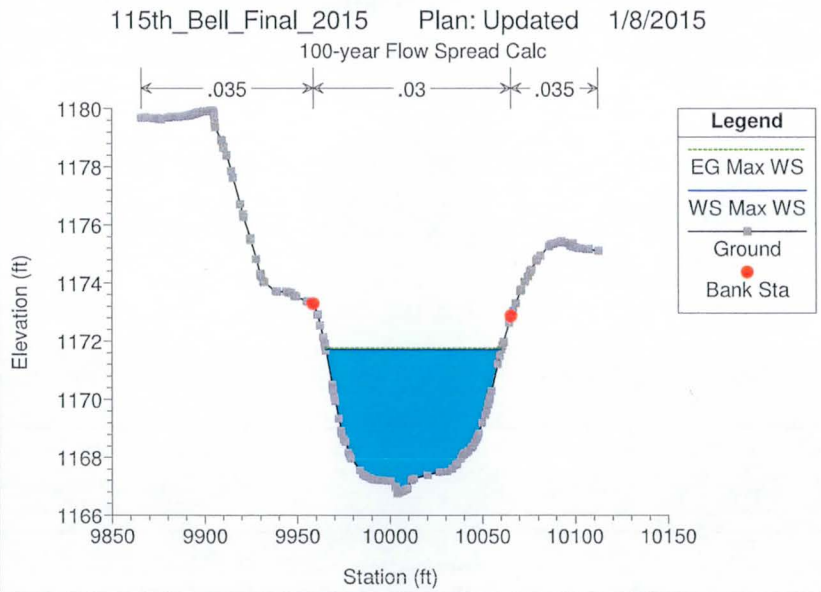
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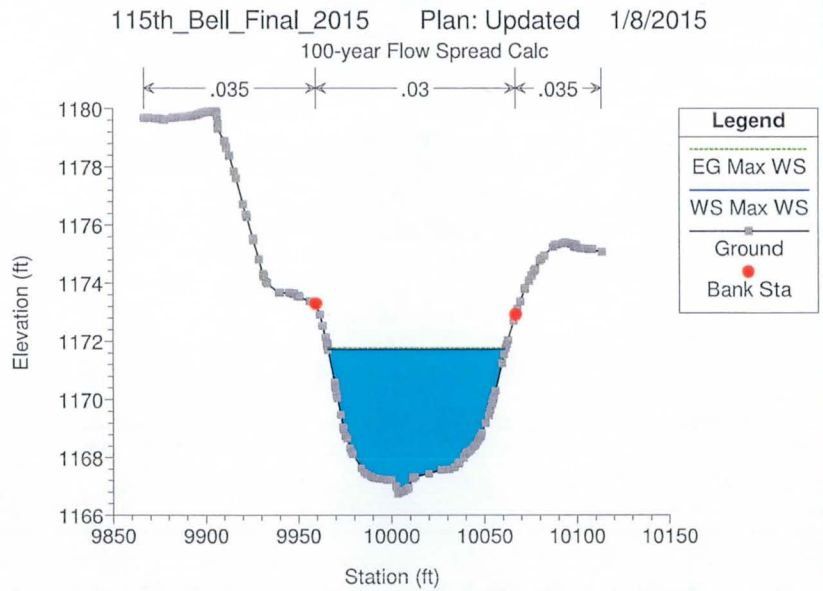
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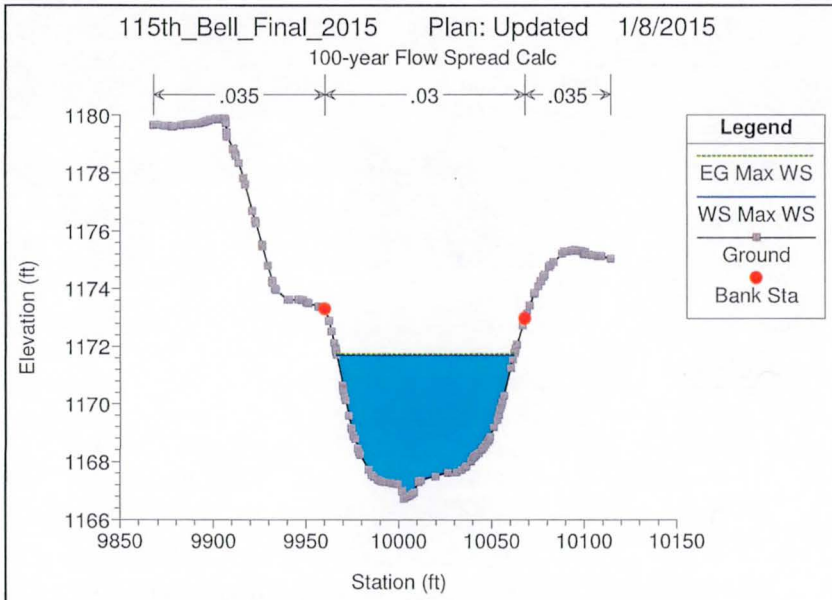
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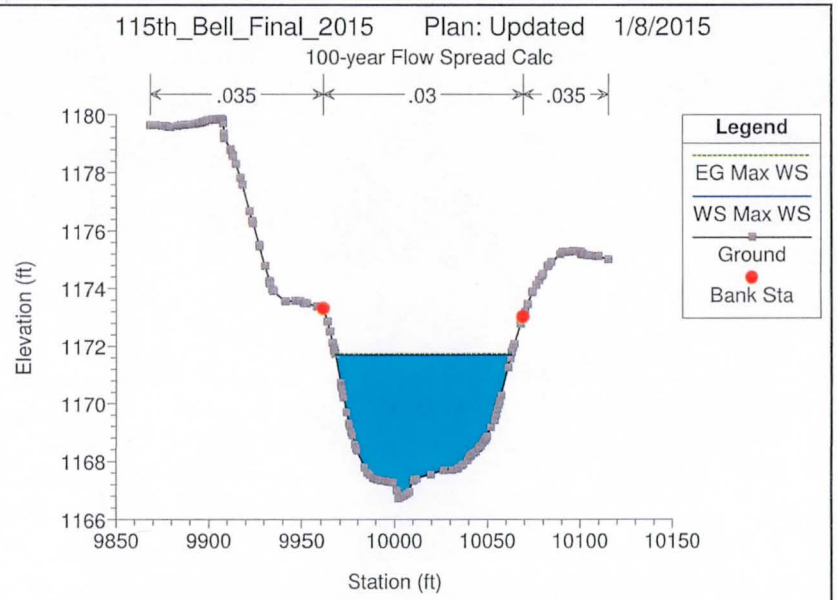
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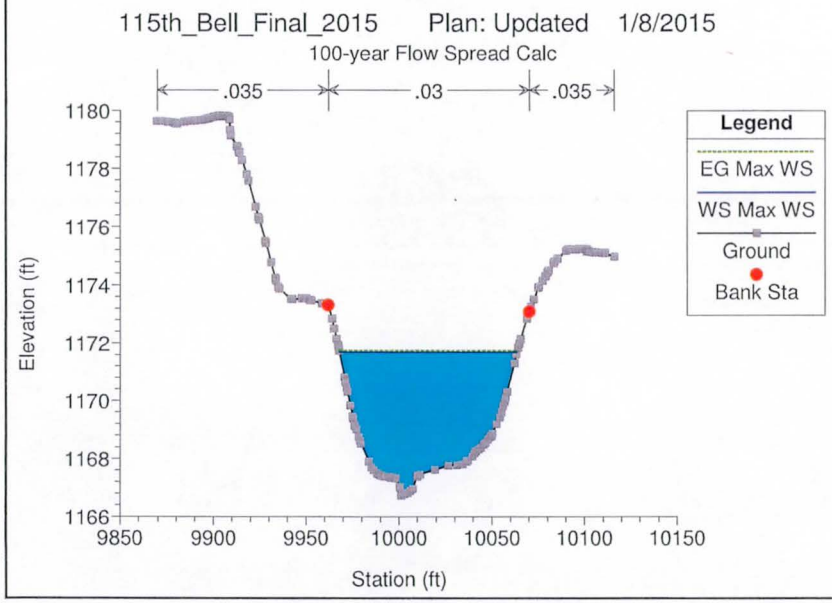
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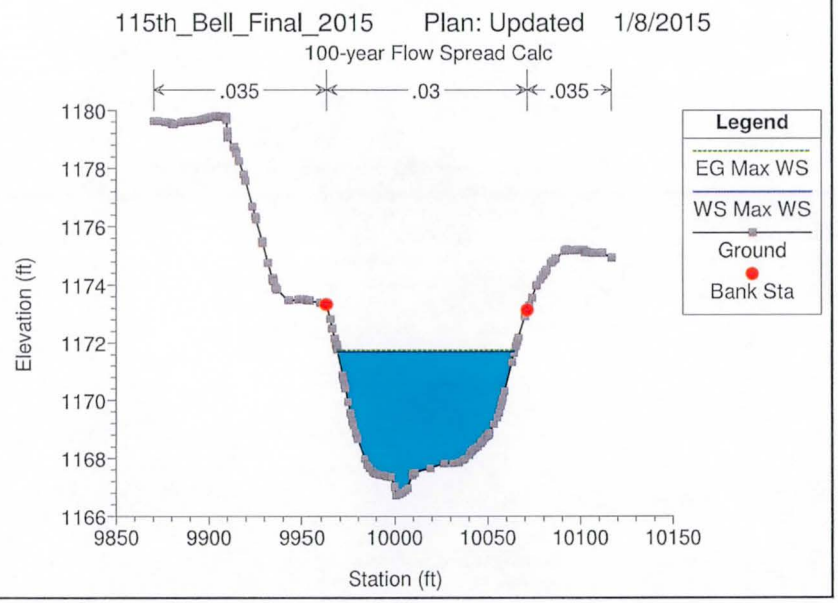
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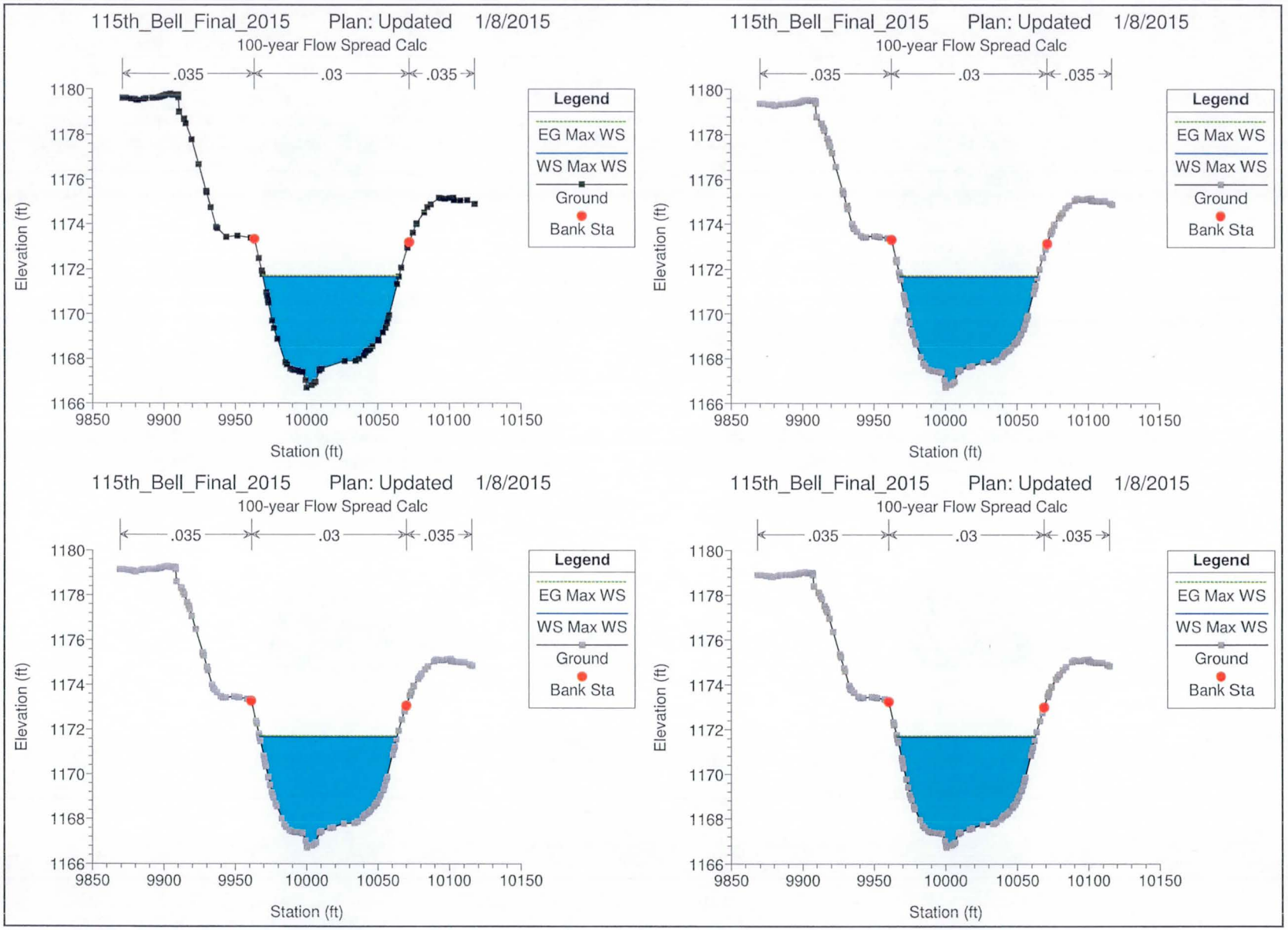
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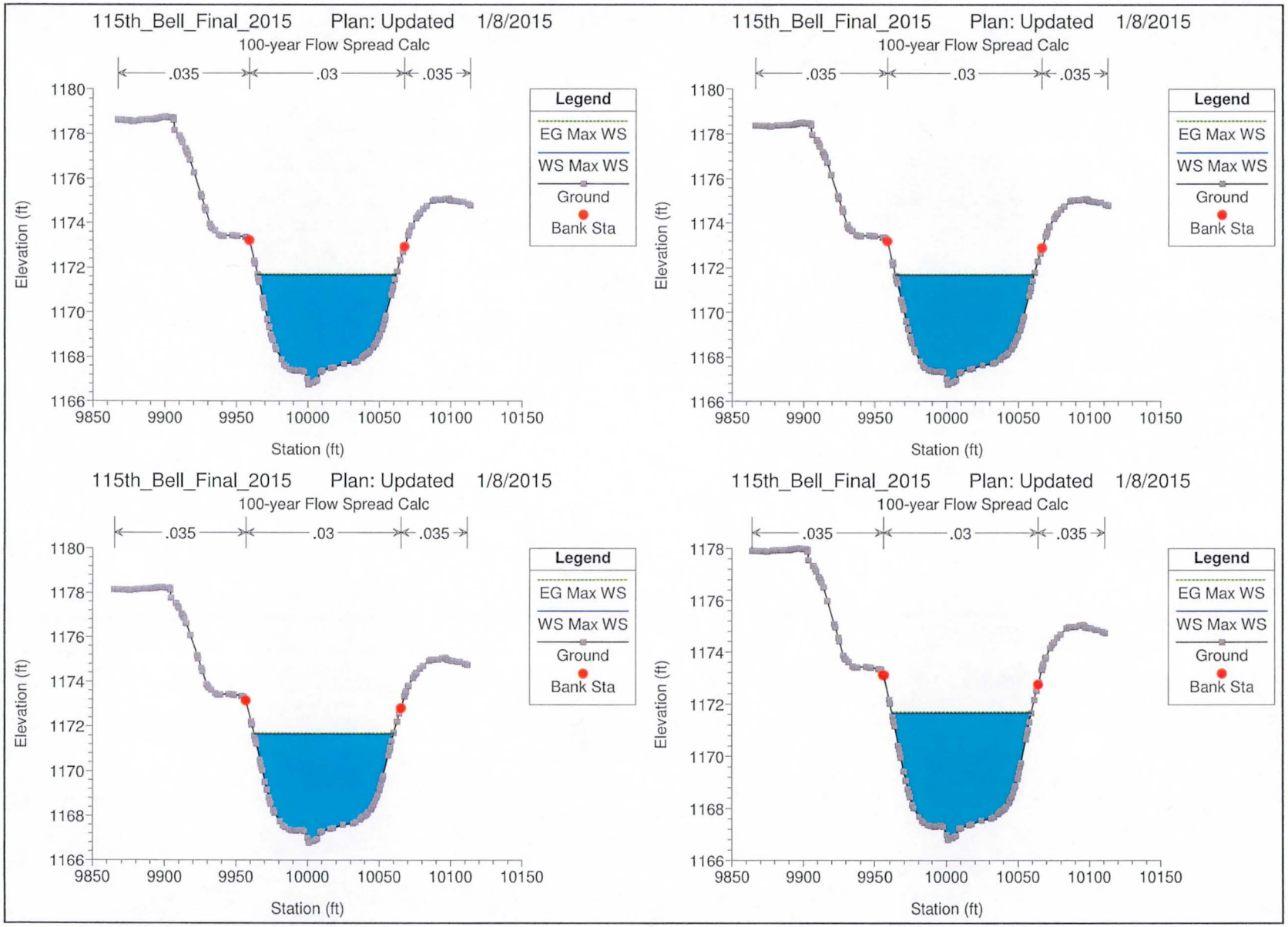
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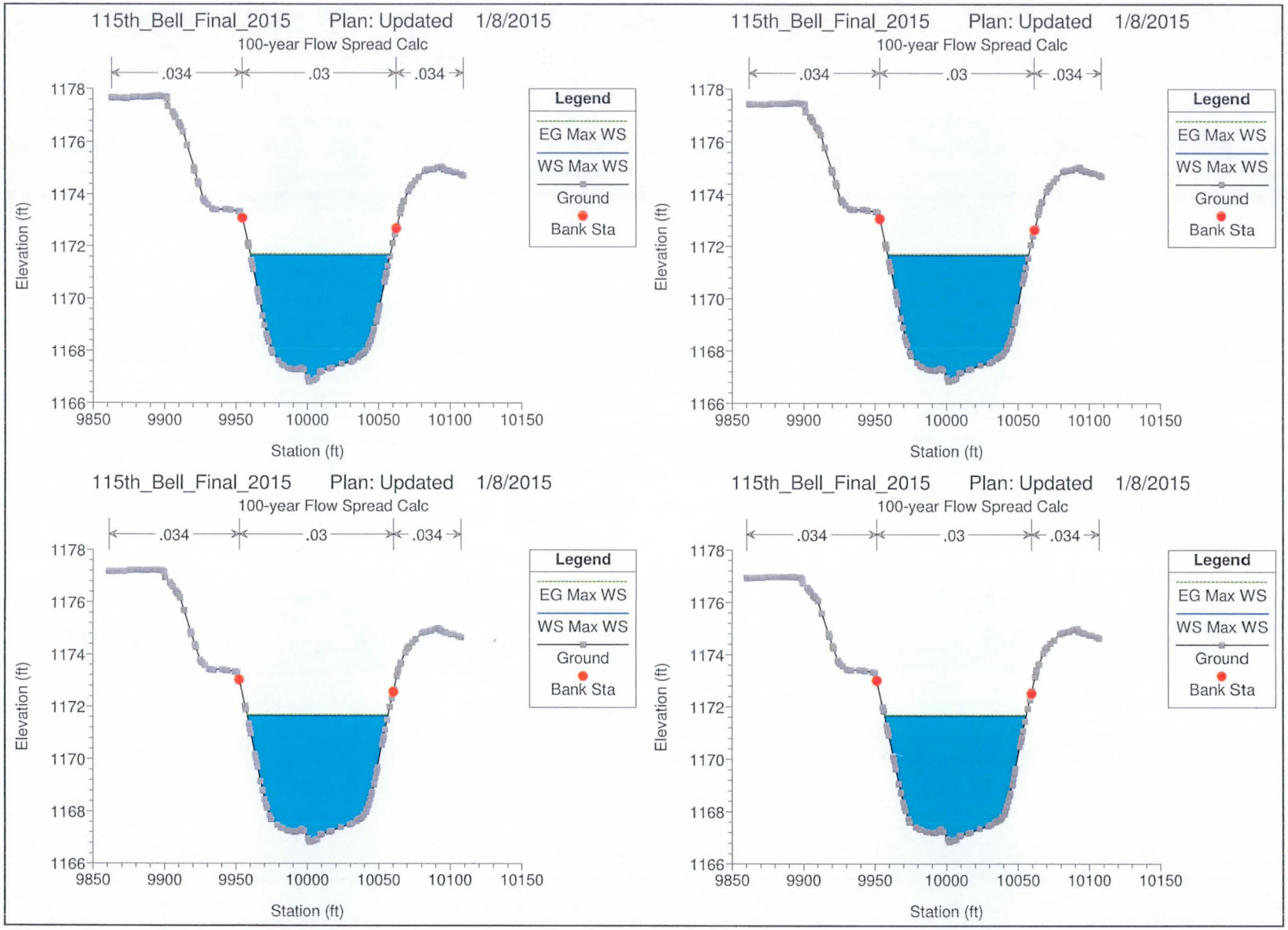
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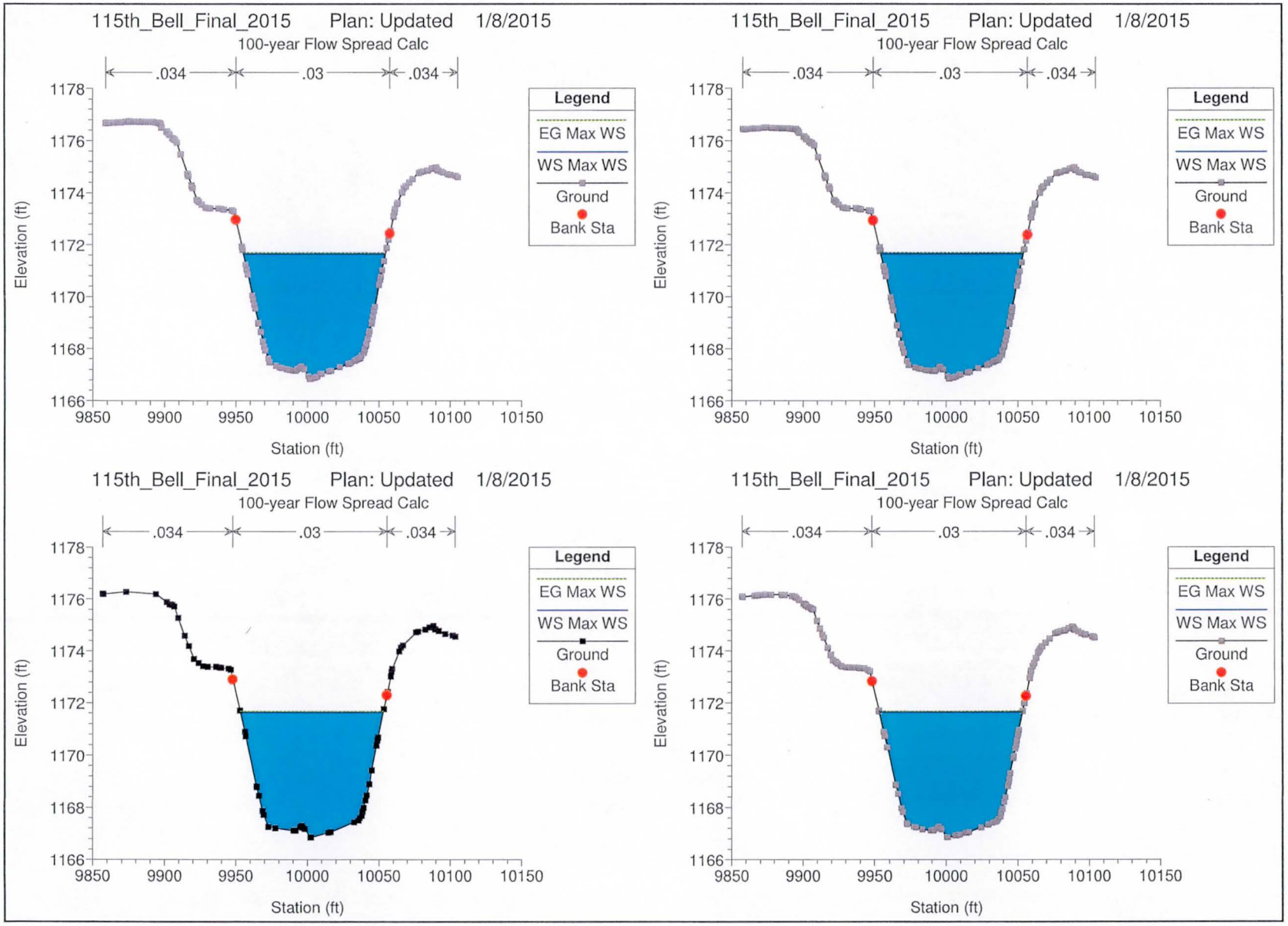
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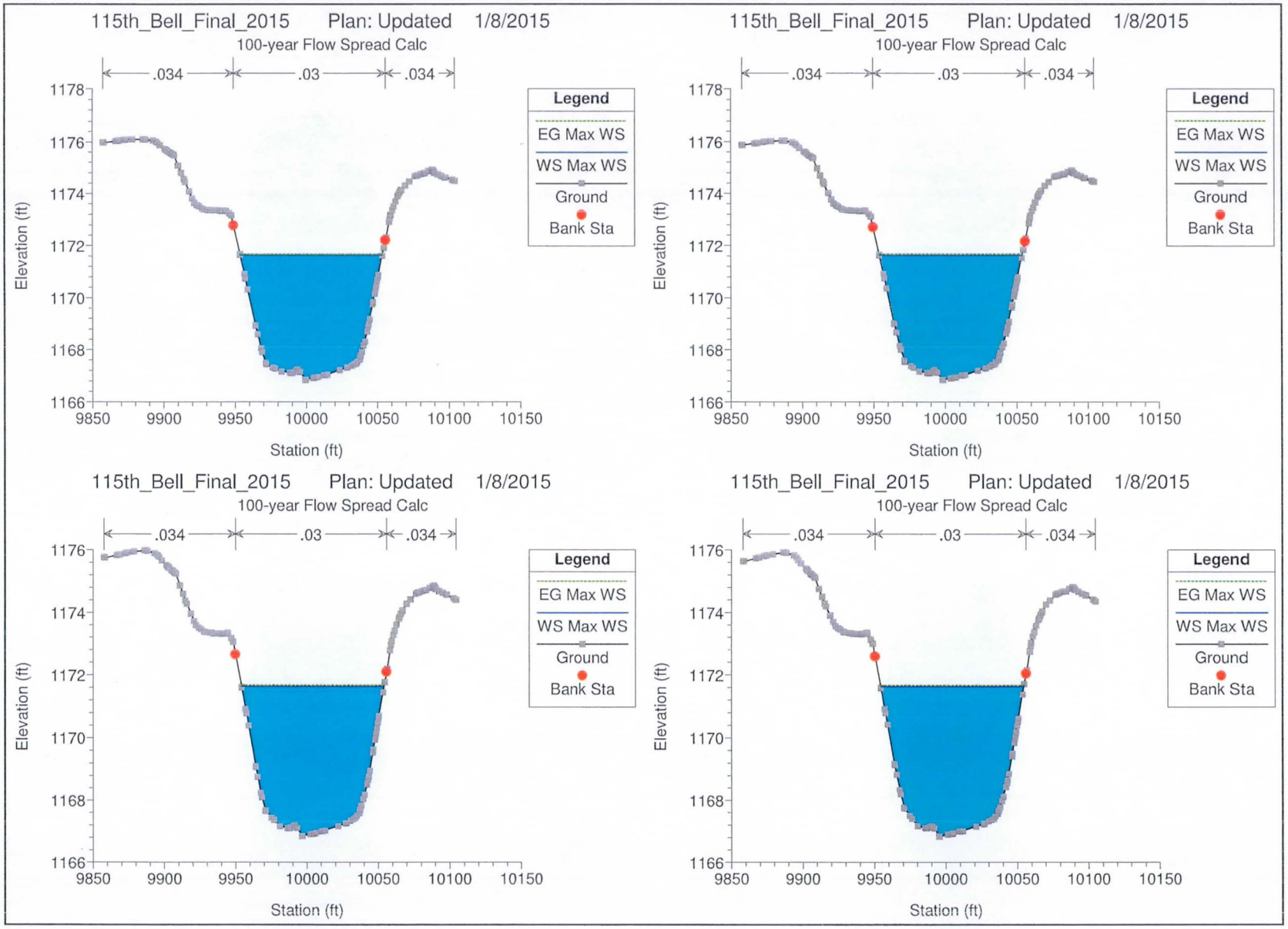
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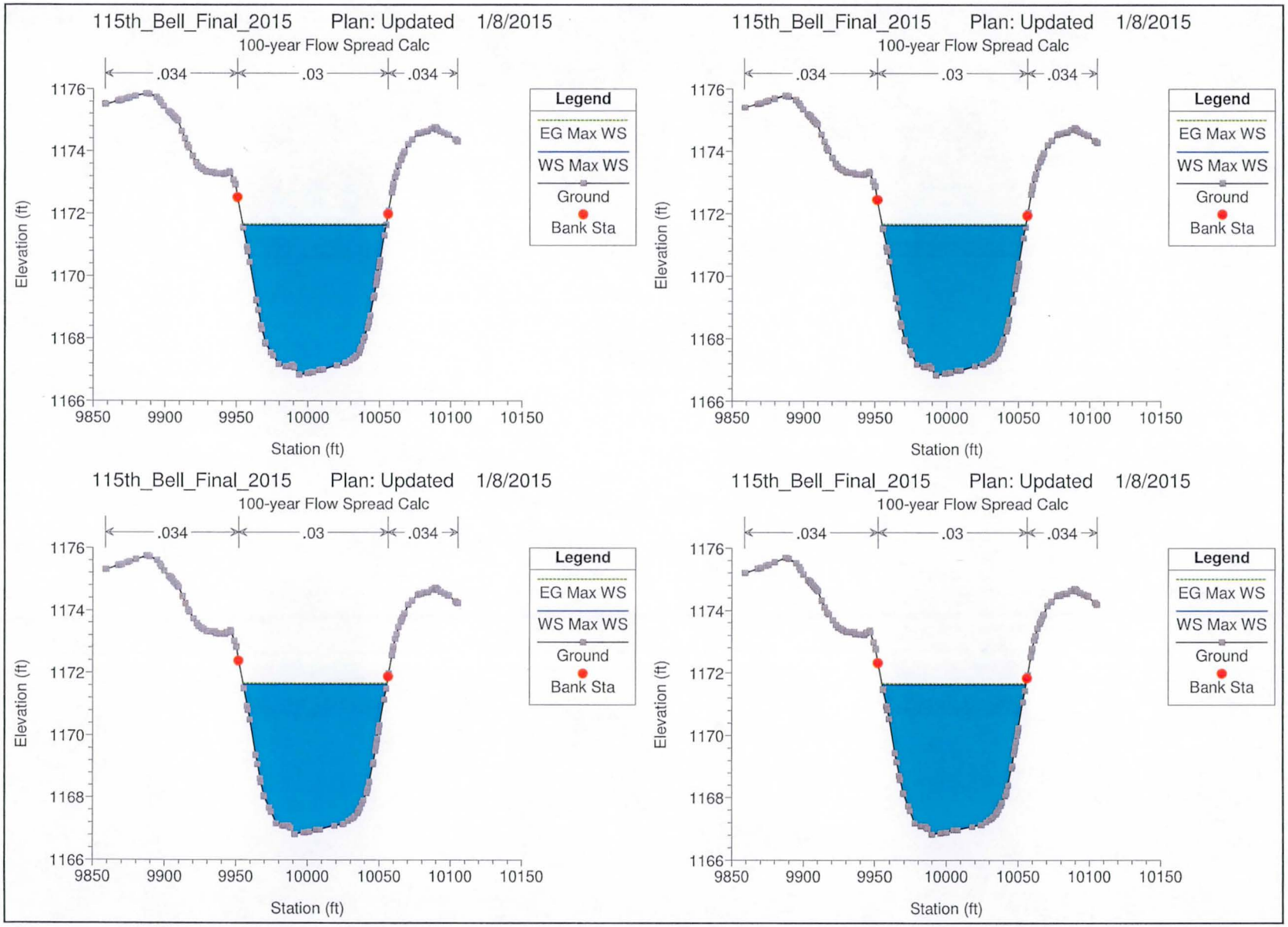
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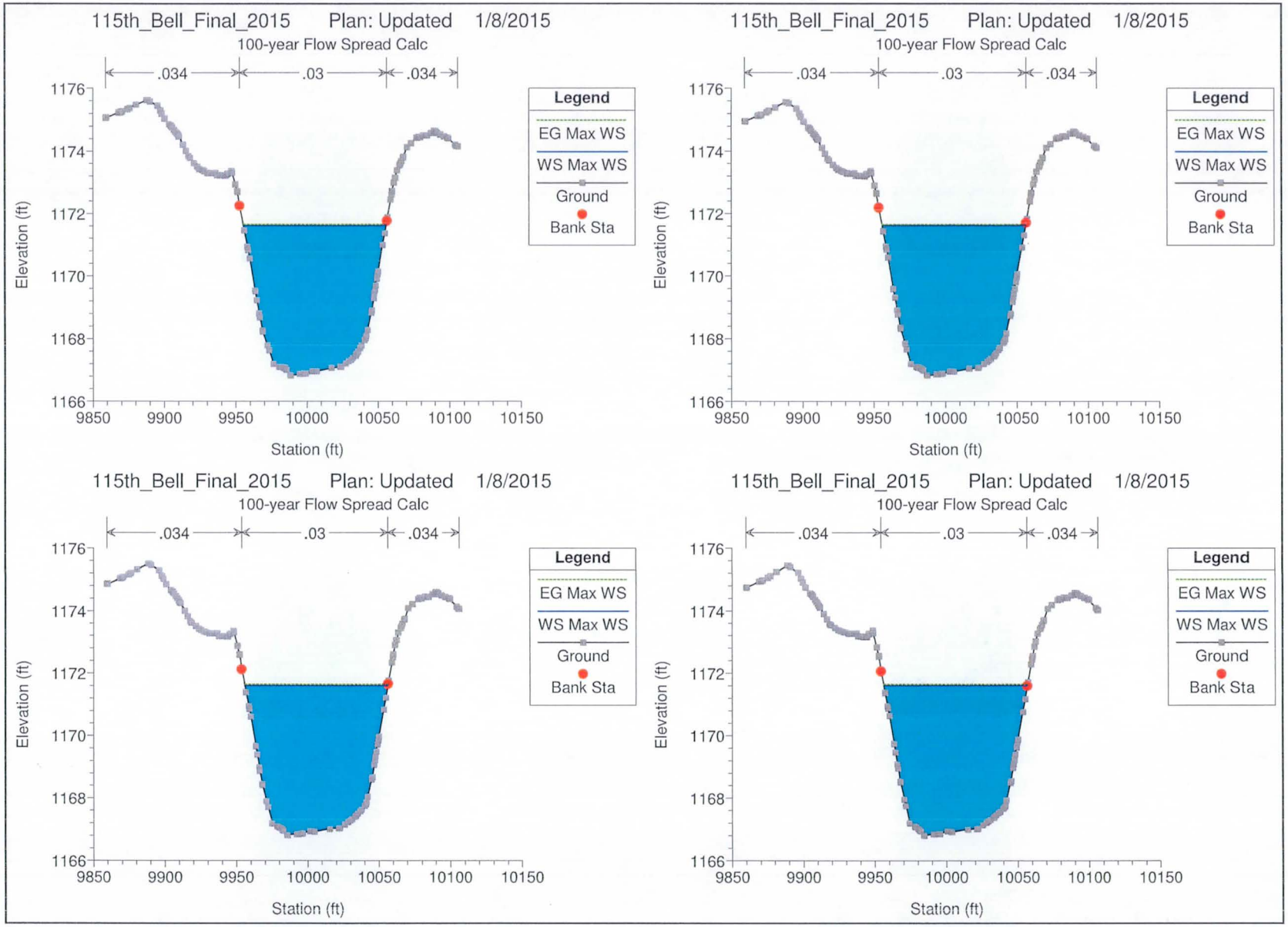
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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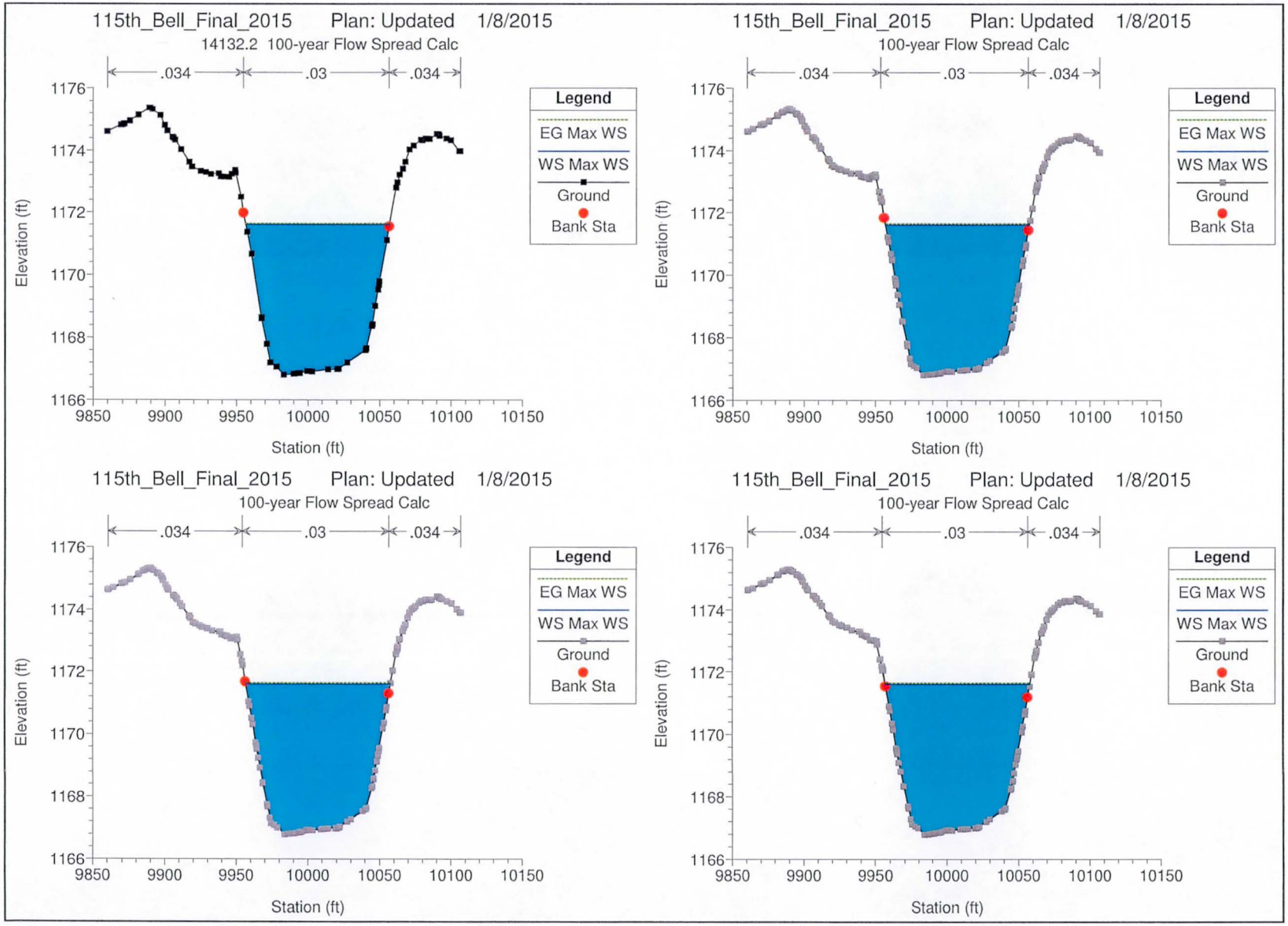
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
14132.2 100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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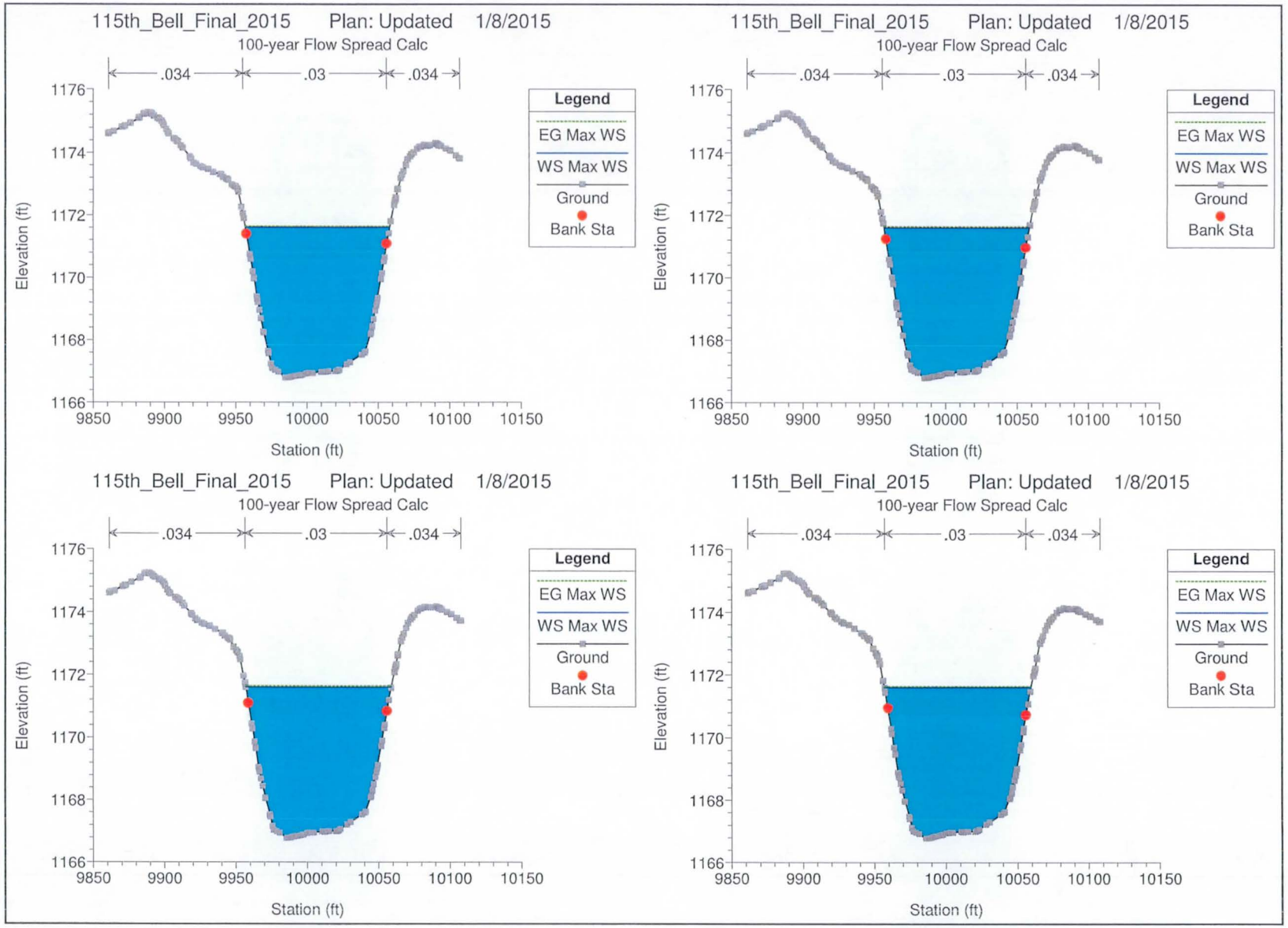
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
Bank Sta
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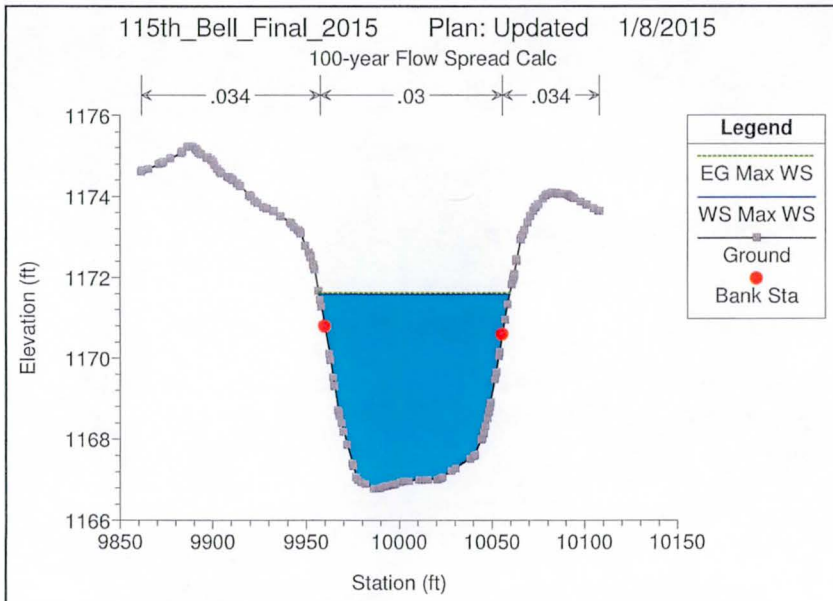
Station (ft)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100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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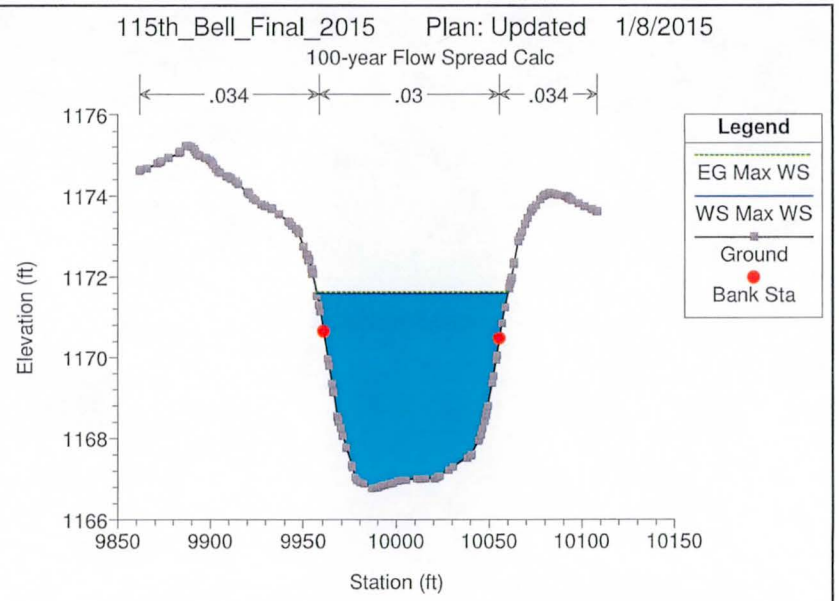
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
Bank Sta
Elevation (ft)
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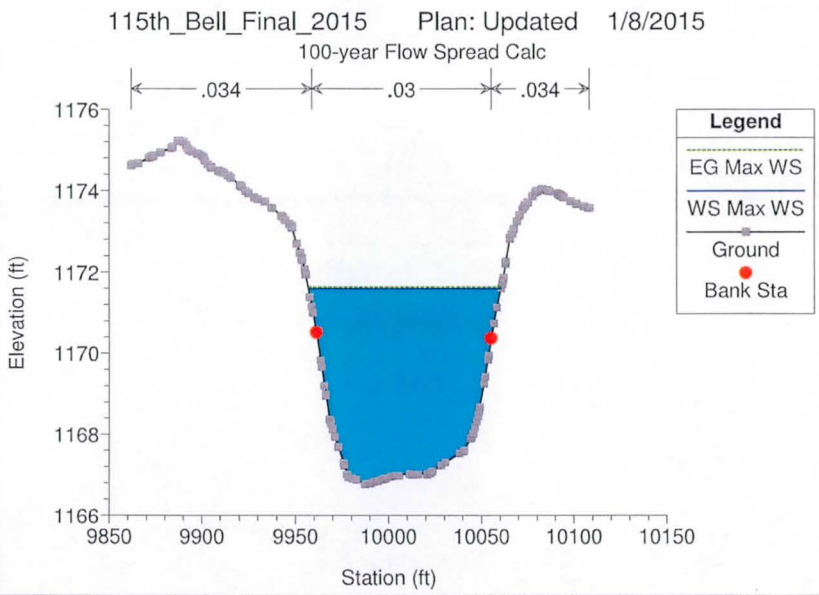
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Elevation (ft)
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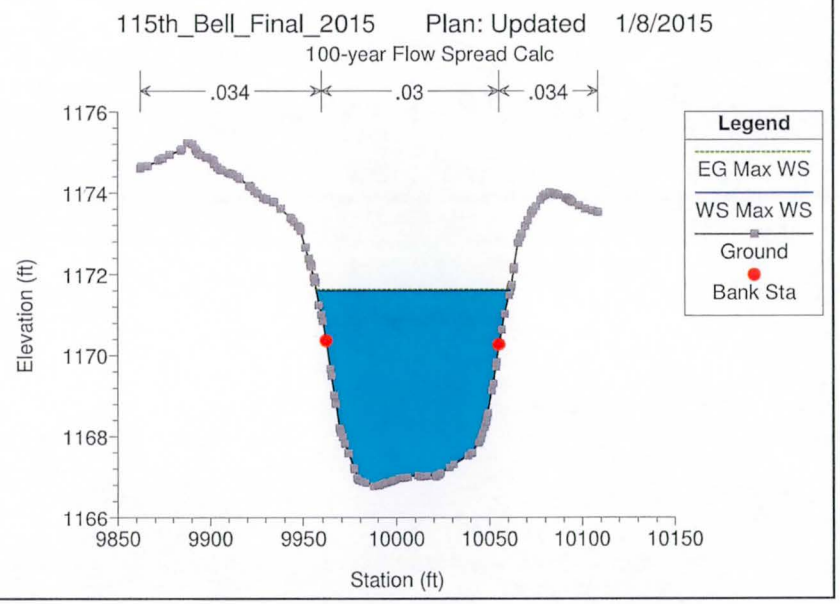
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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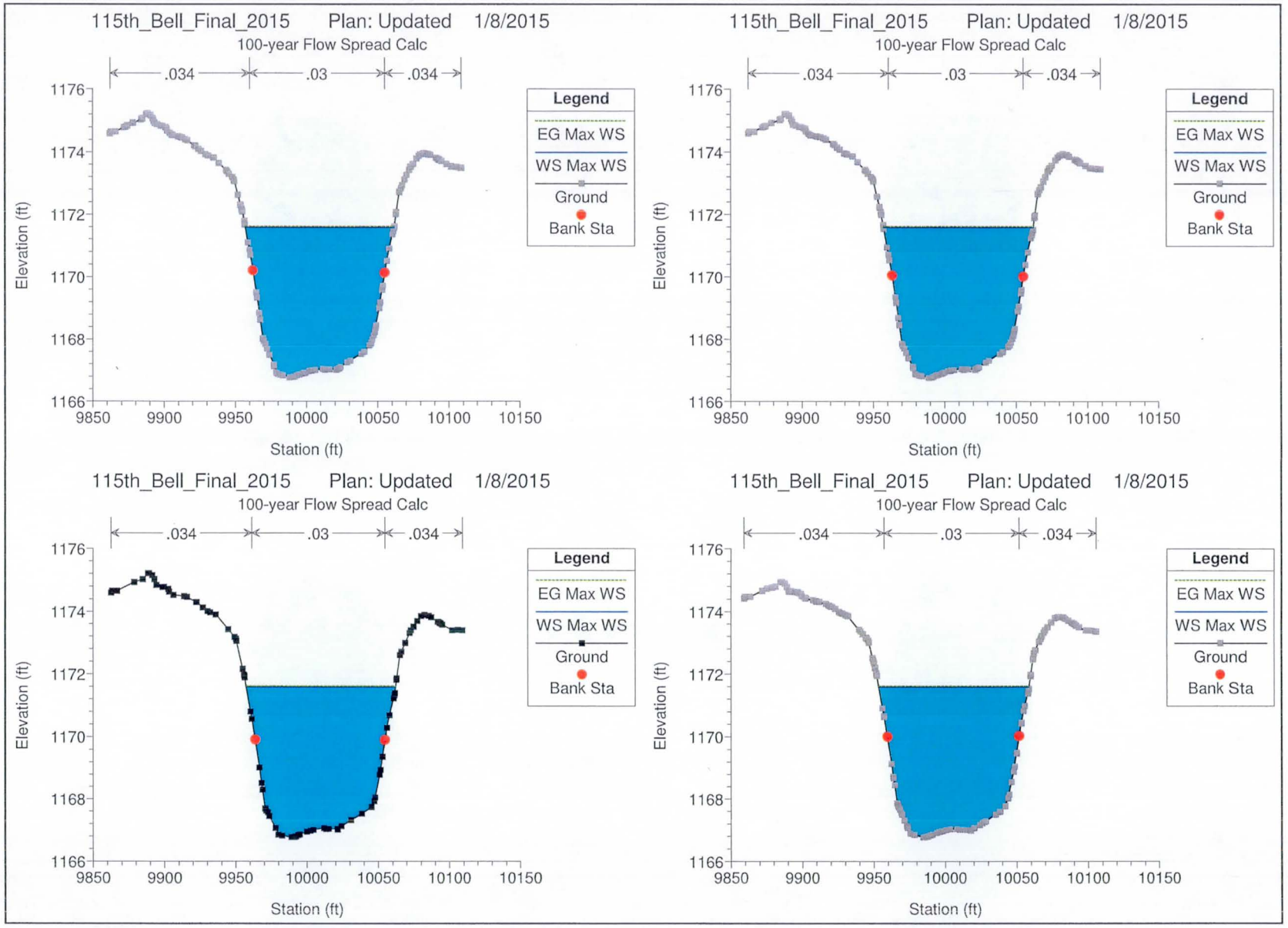
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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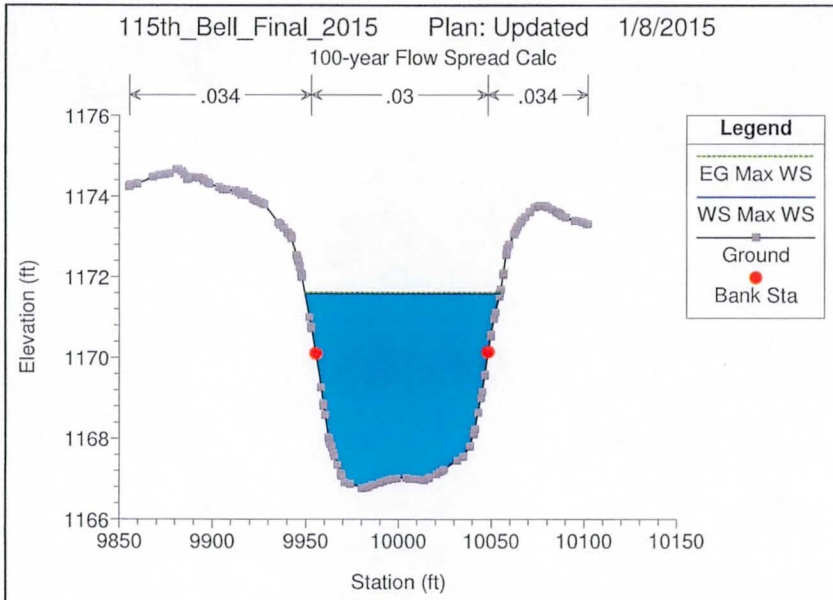
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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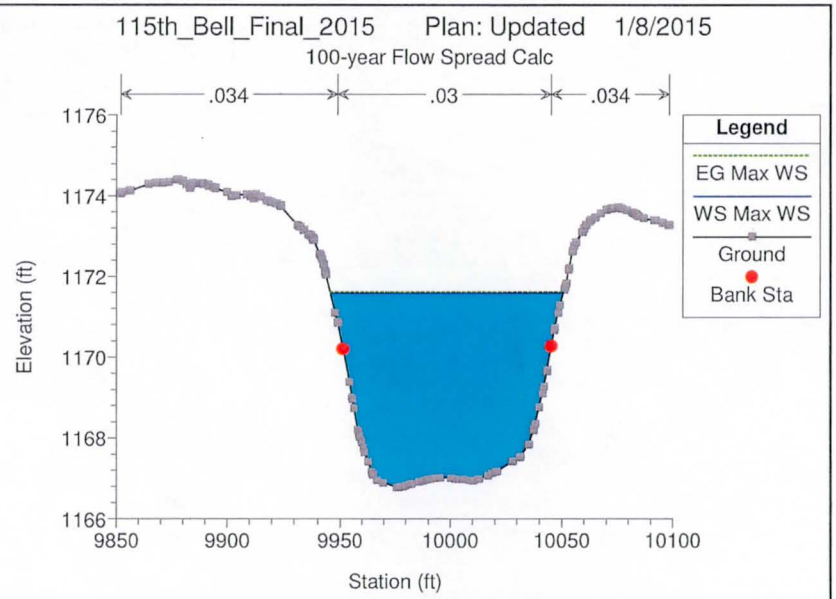
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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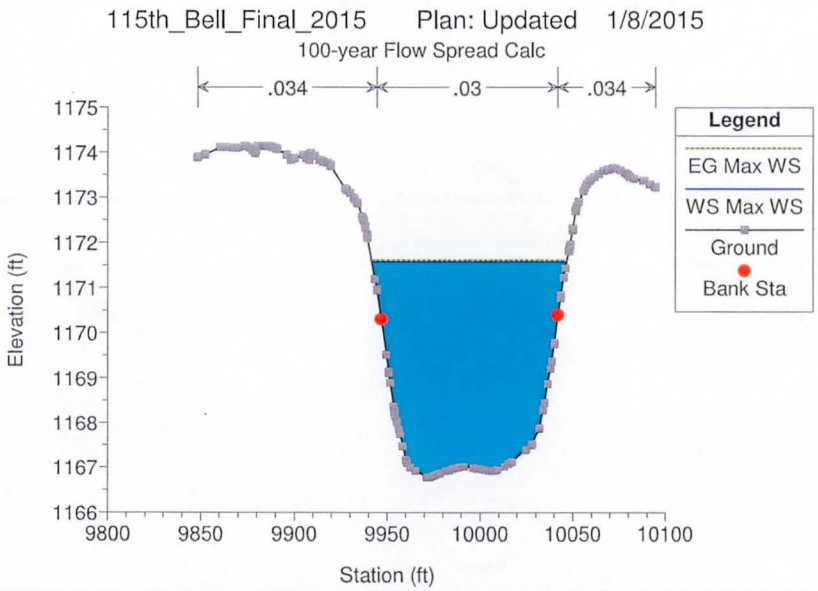
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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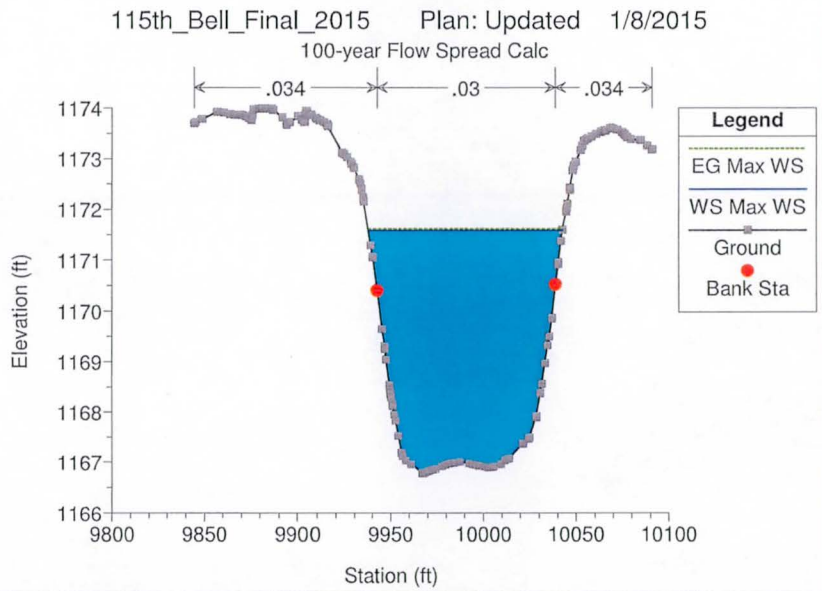
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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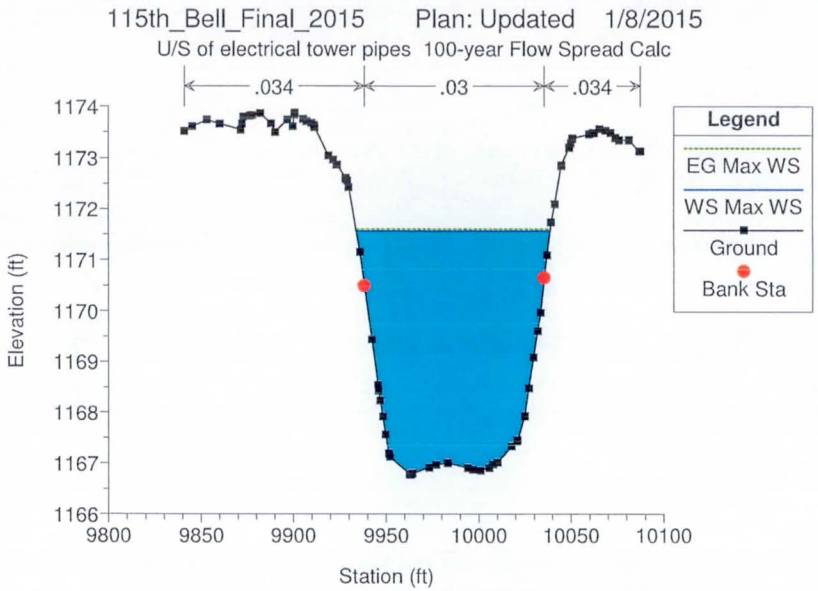
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
U/S of electrical tower pipes 100-year Flow Spread Calc
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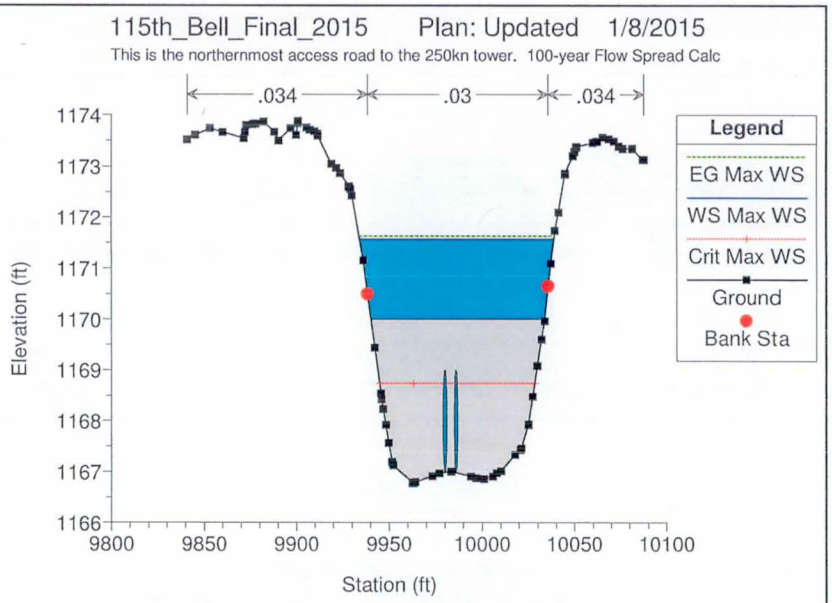
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the northernmost access road to the 250kn tower. 100-year Flow Spread Calc
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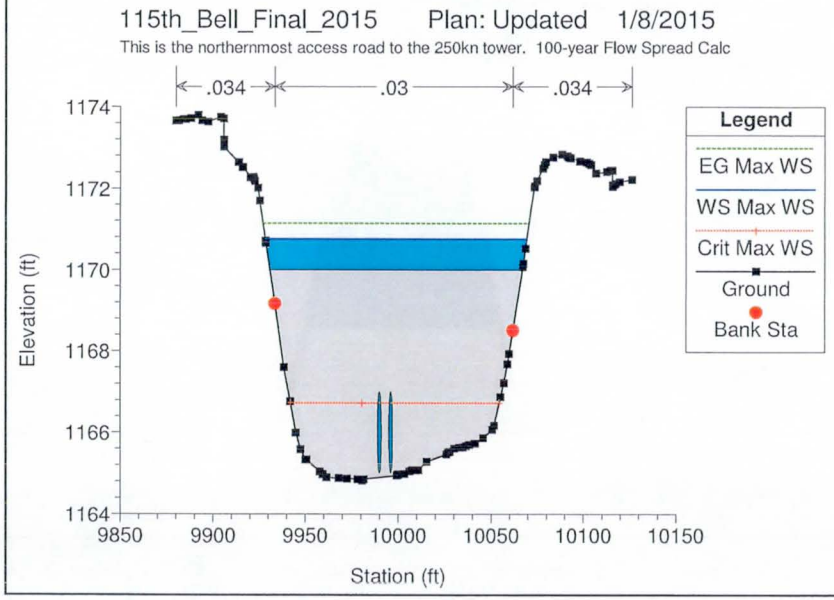
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the northernmost access road to the 250kn tower. 100-year Flow Spread Calc
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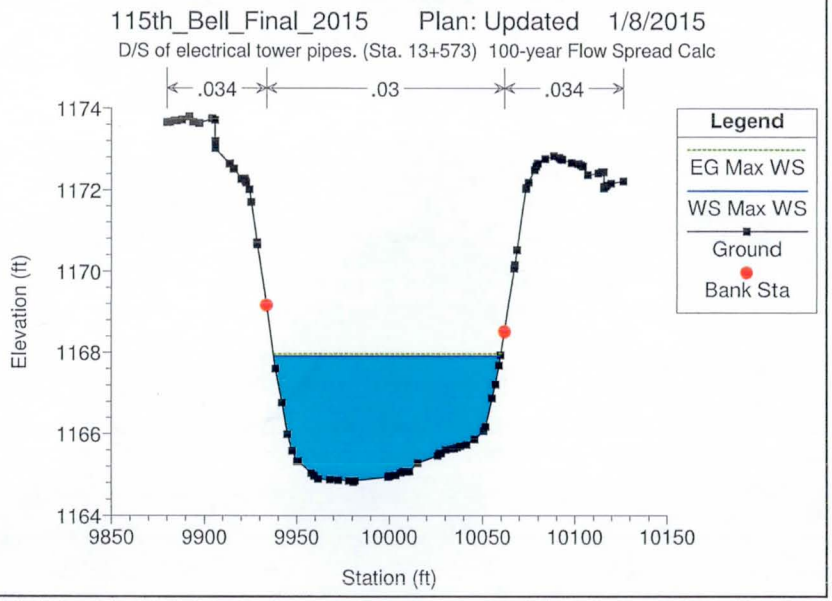
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
D/S of electrical tower pipes. (Sta. 13+573) 100-year Flow Spread Calc
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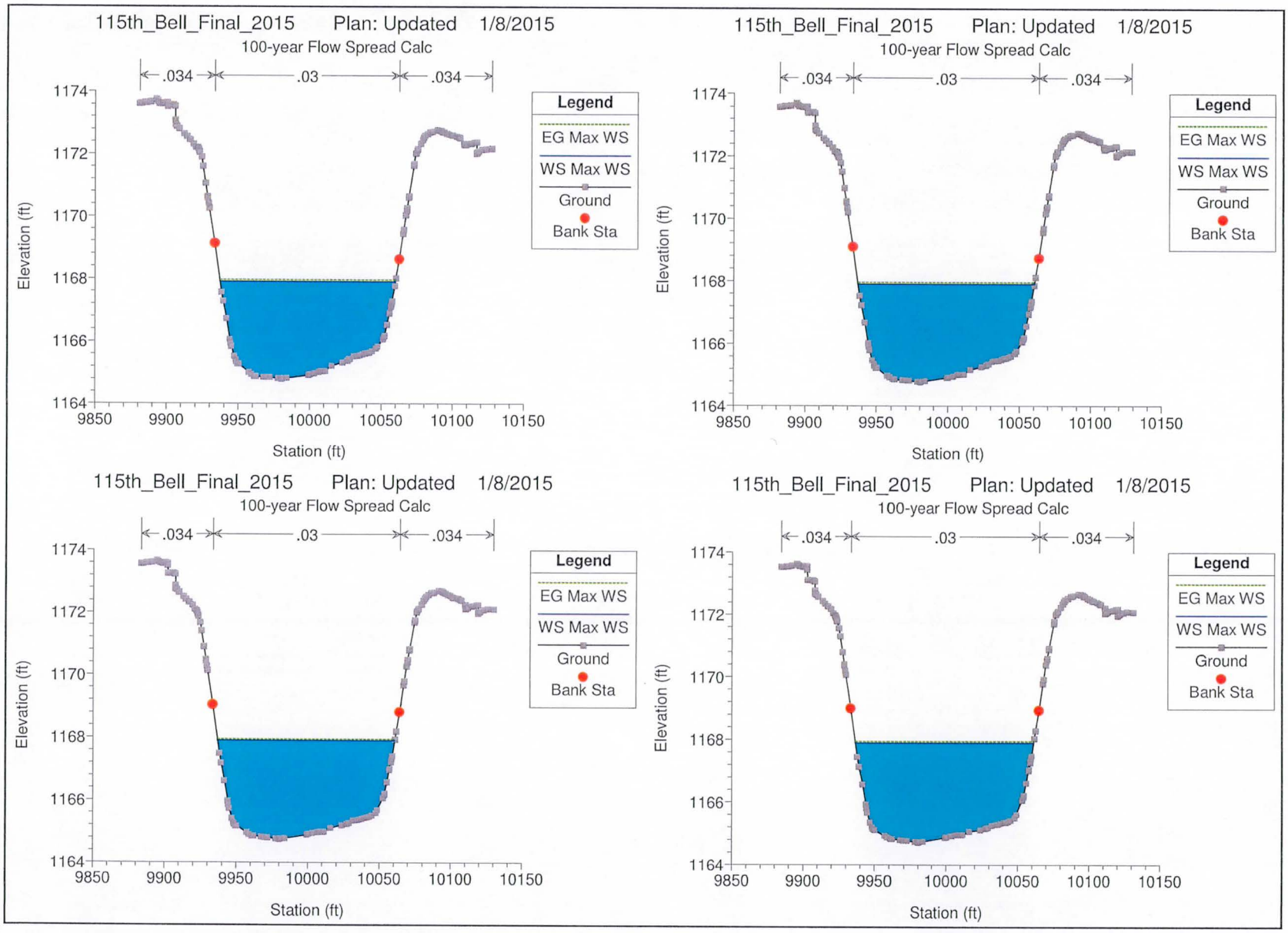
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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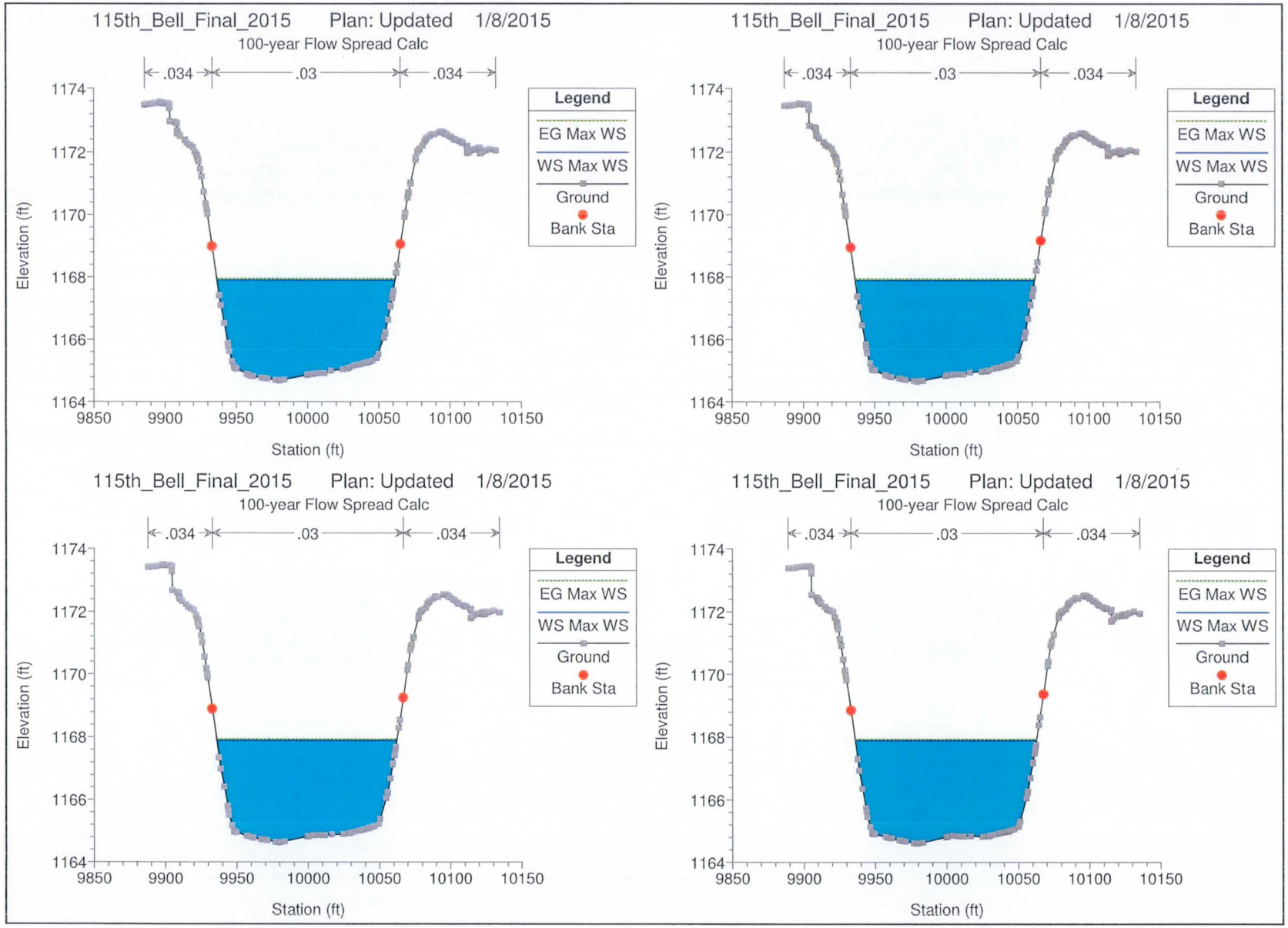
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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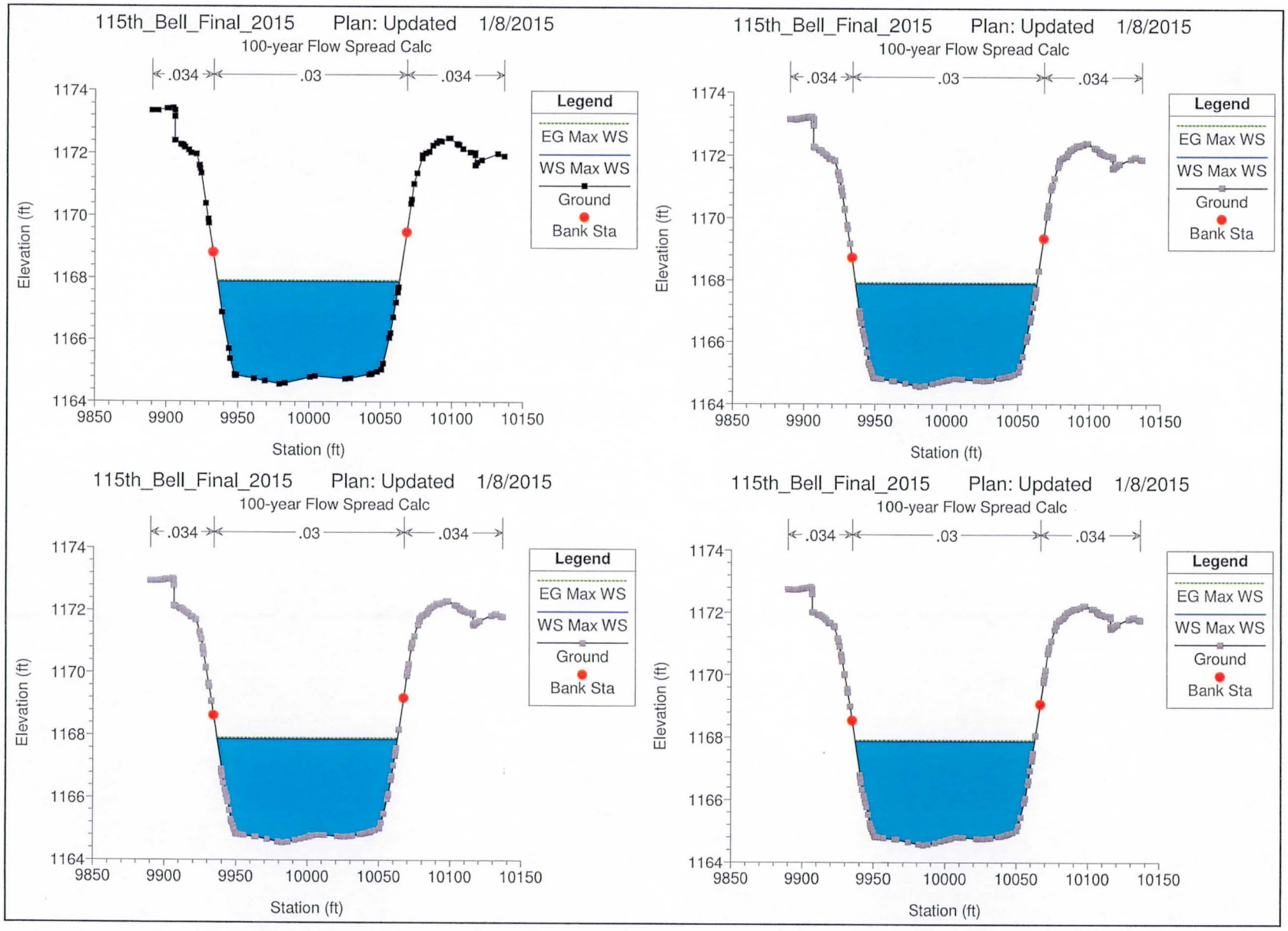
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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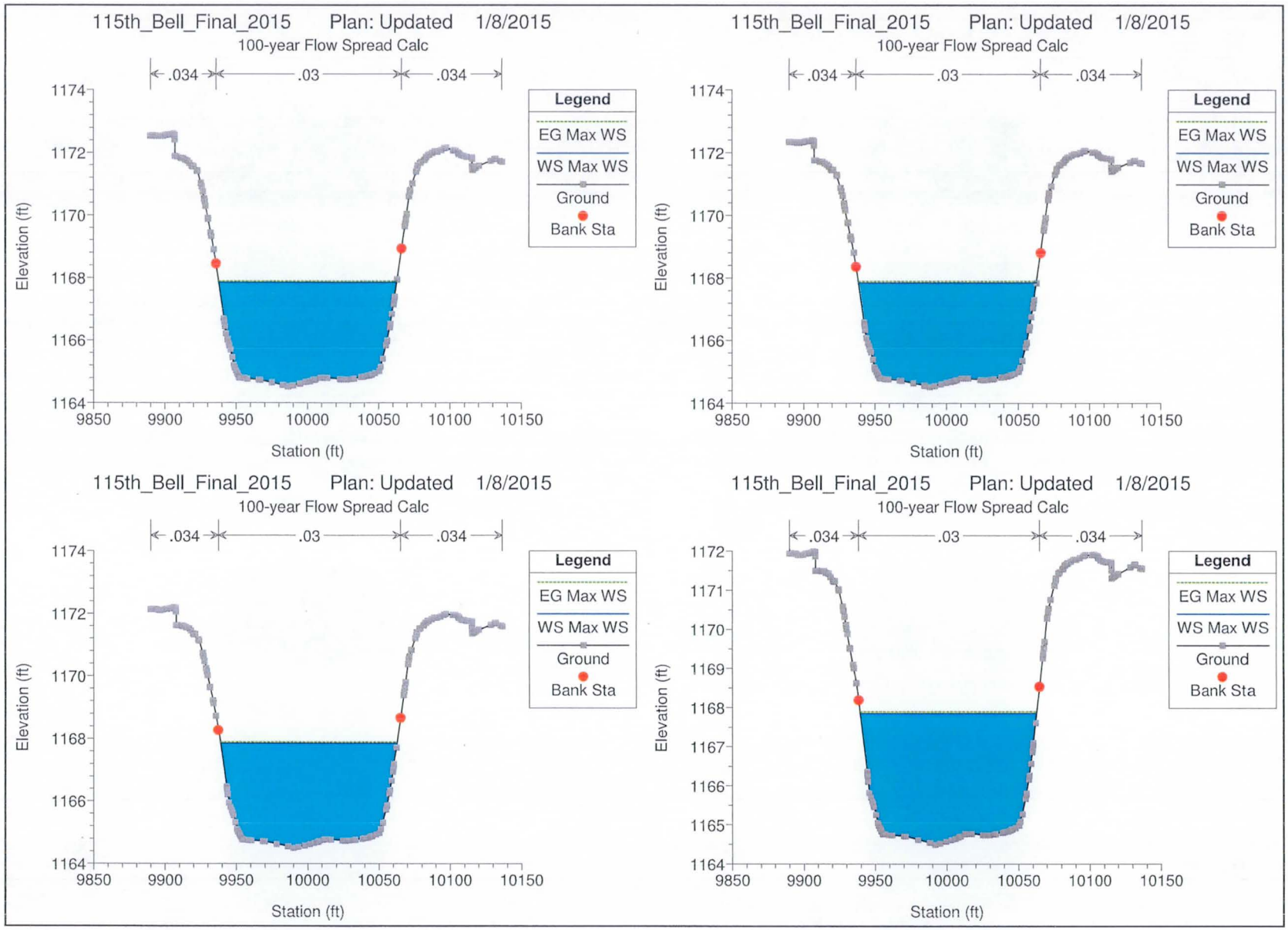
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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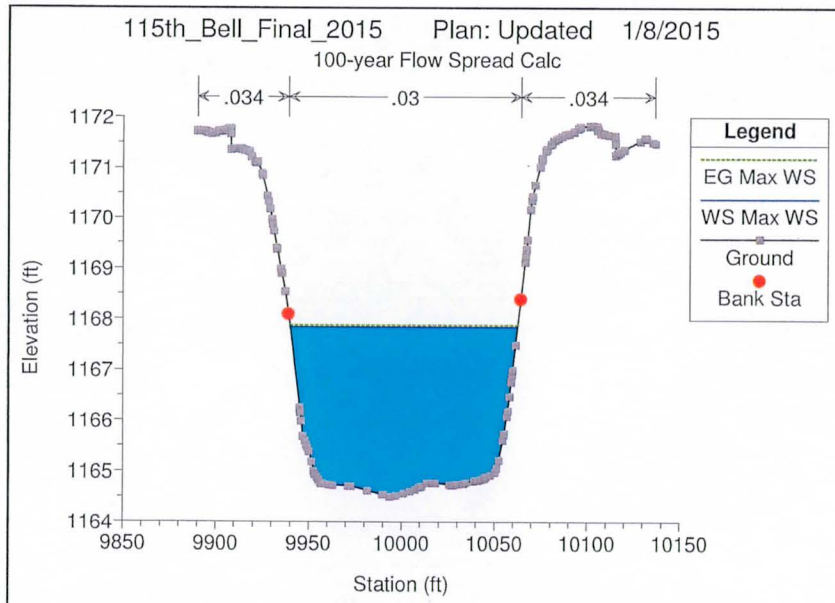
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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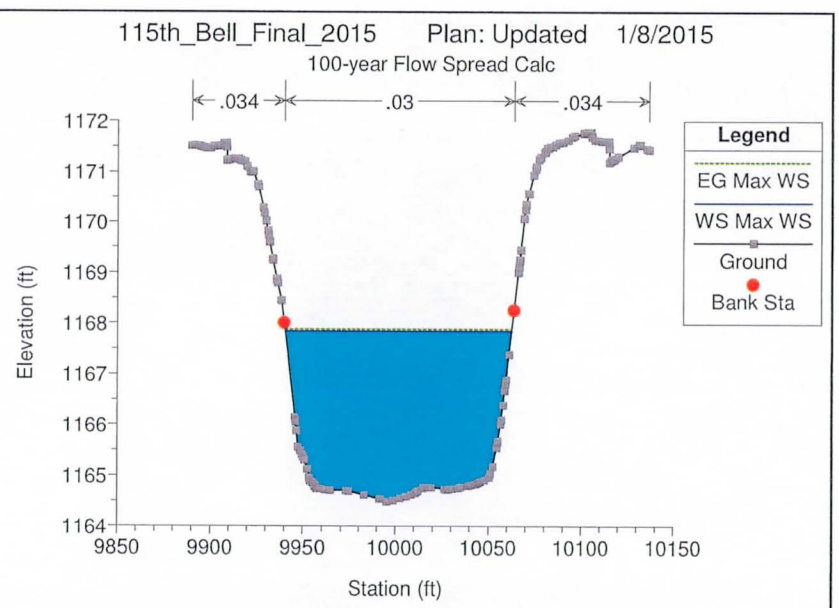
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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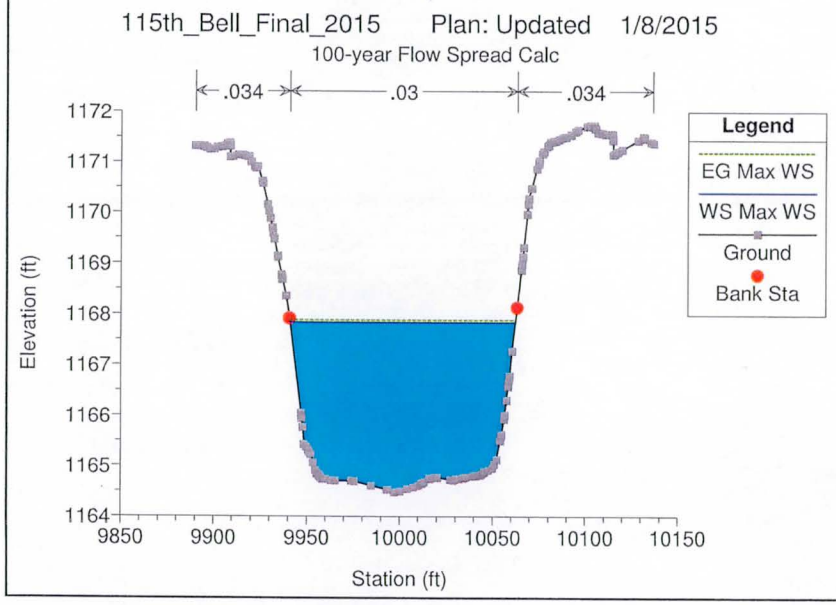
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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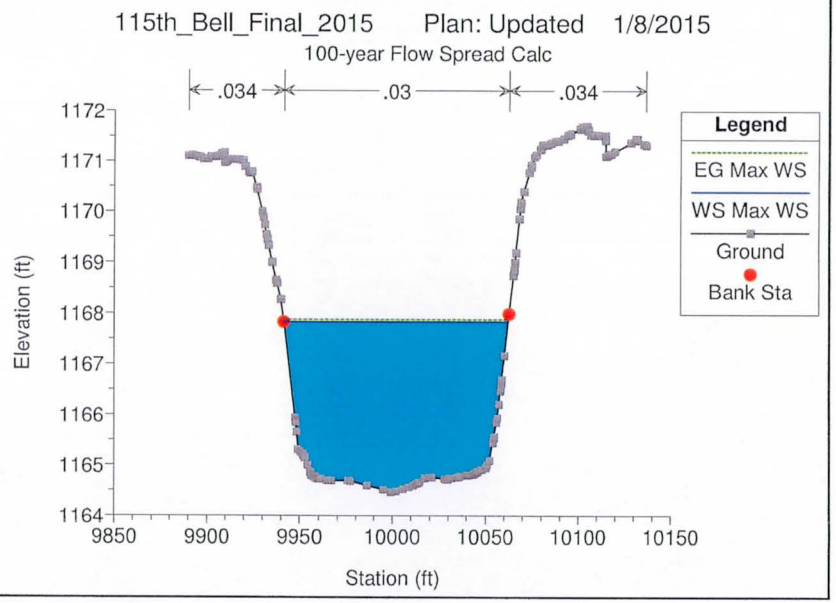
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Elevation (ft)
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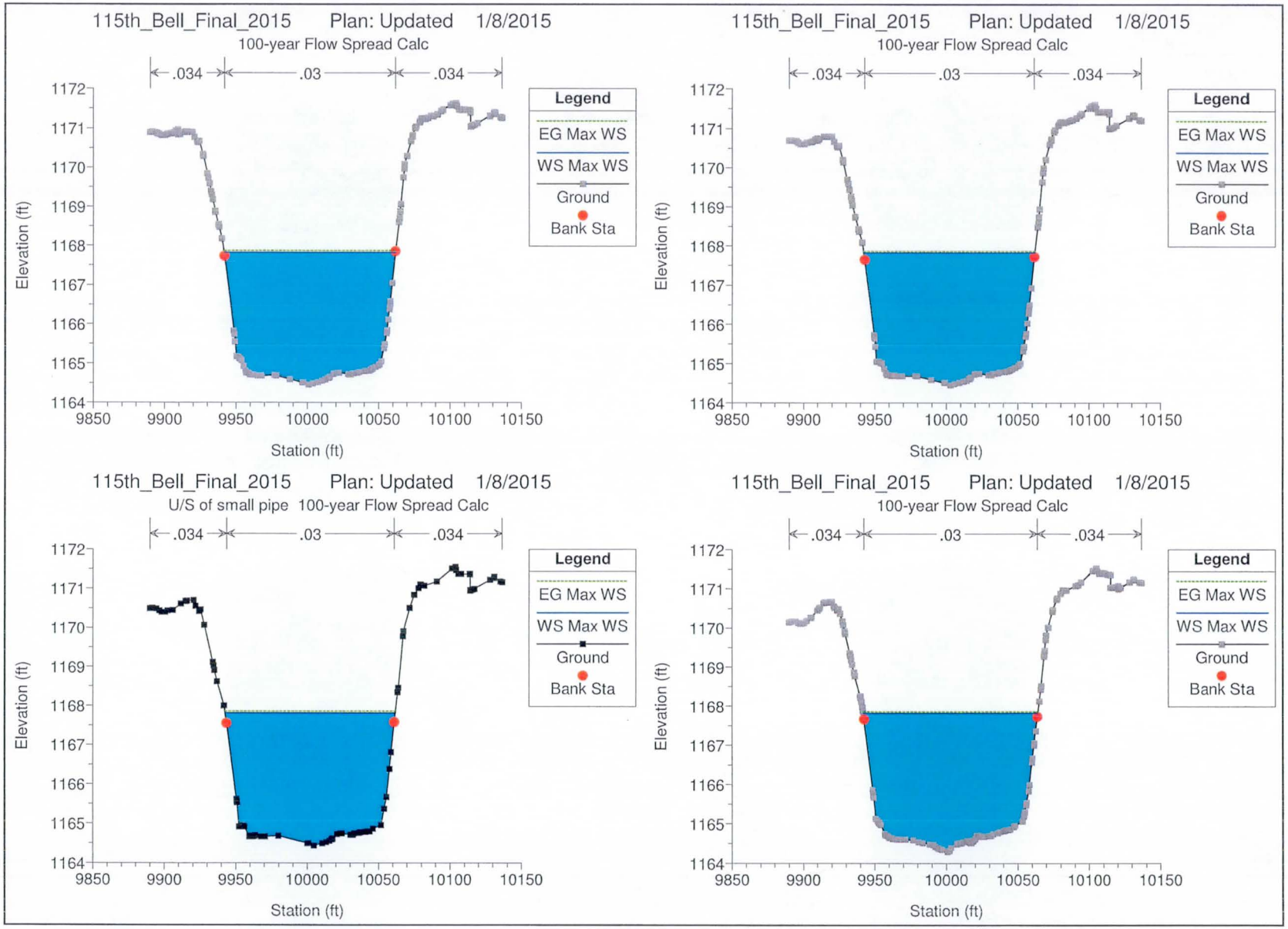
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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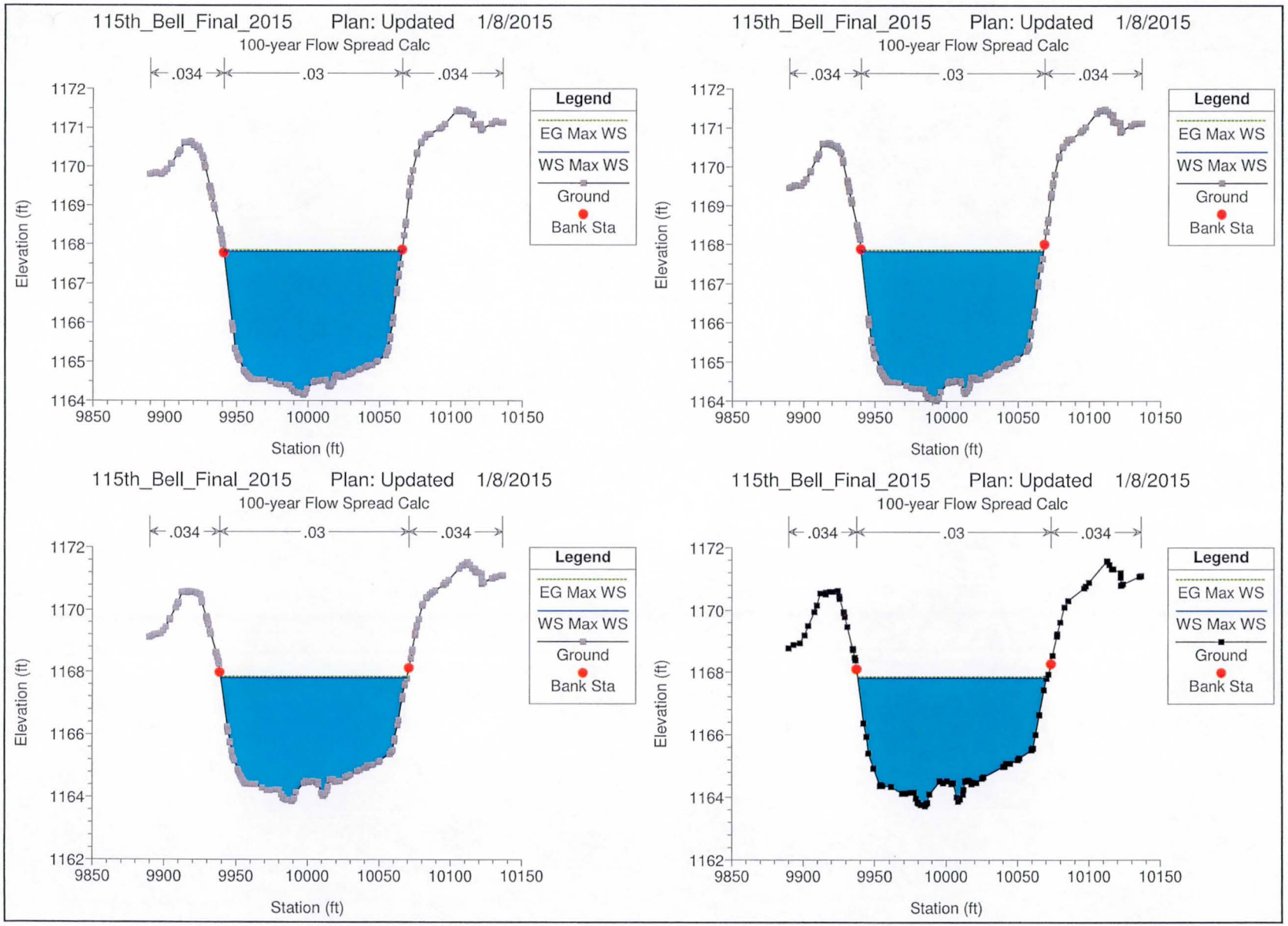
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
U/S of small pipe 100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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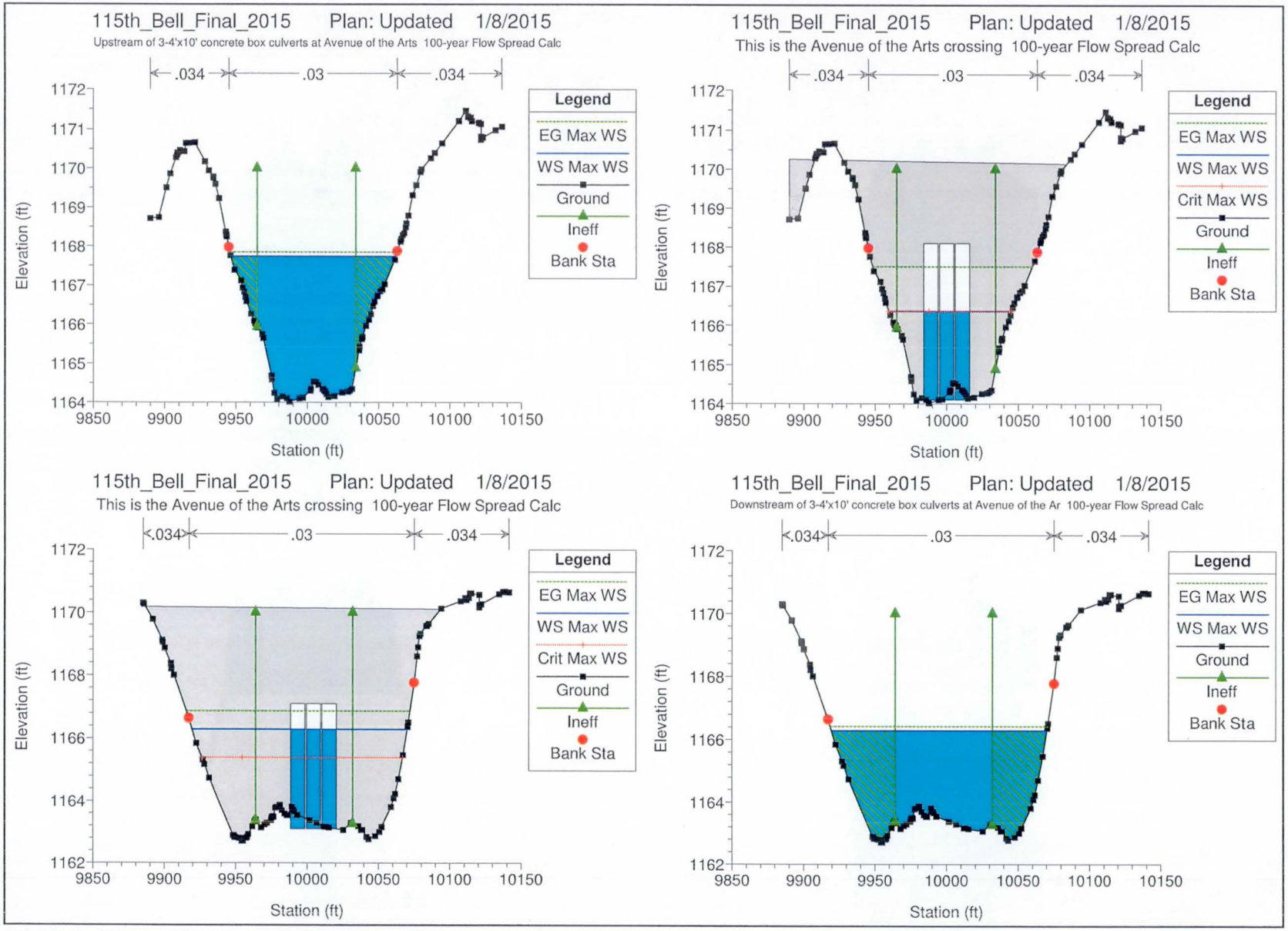
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
Upstream of 3-4'x10' concrete box culverts at Avenue of the Arts 100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the Avenue of the Arts crossing 100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
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Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the Avenue of the Arts crossing 100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
Downstream of 3-4'x10' concrete box culverts at Avenue of the Ar 100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
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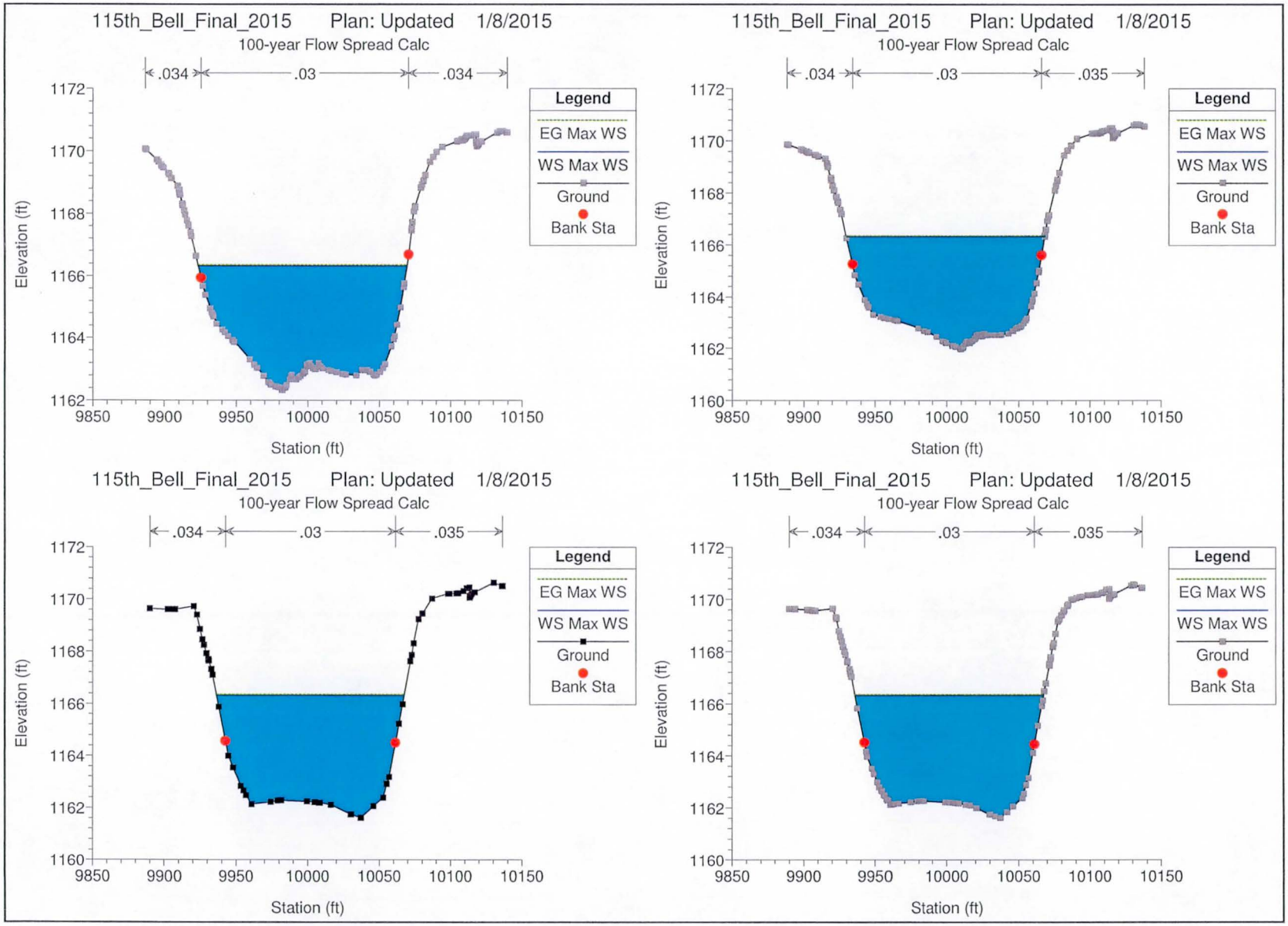
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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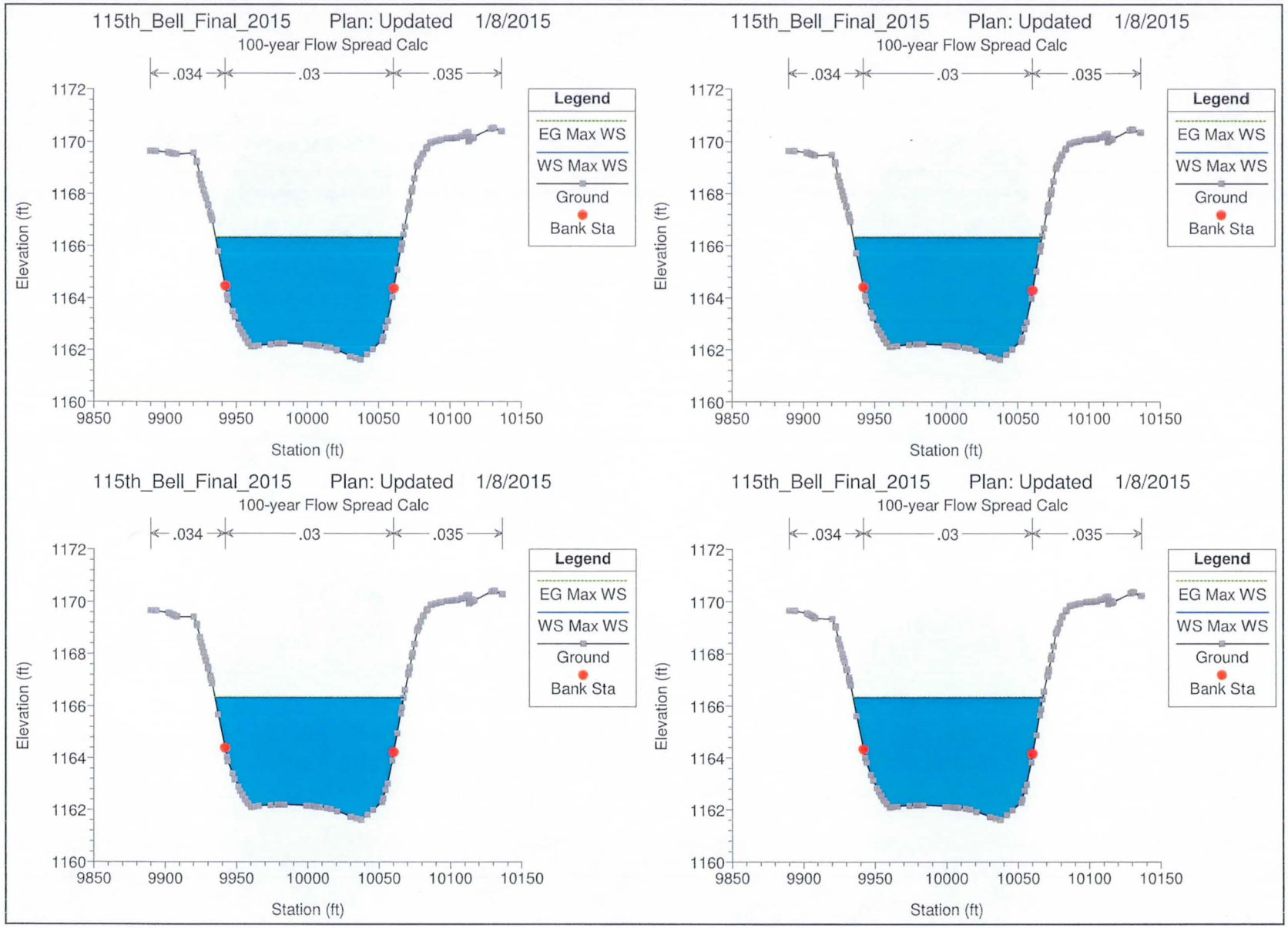
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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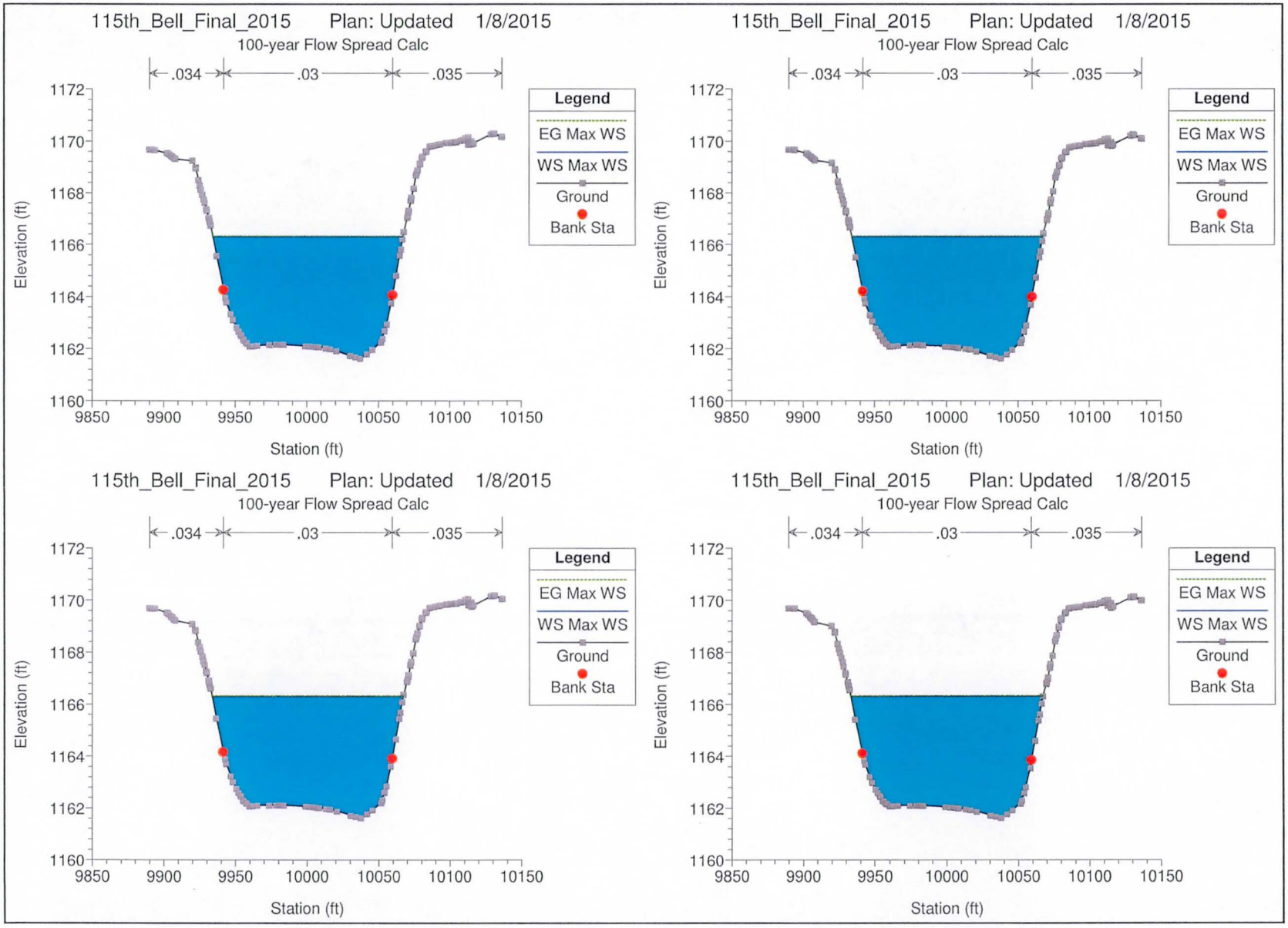
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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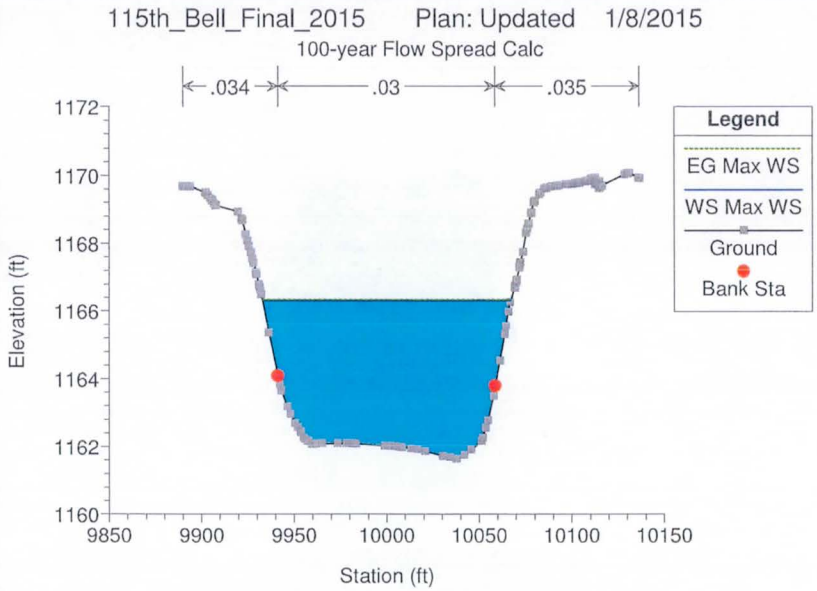
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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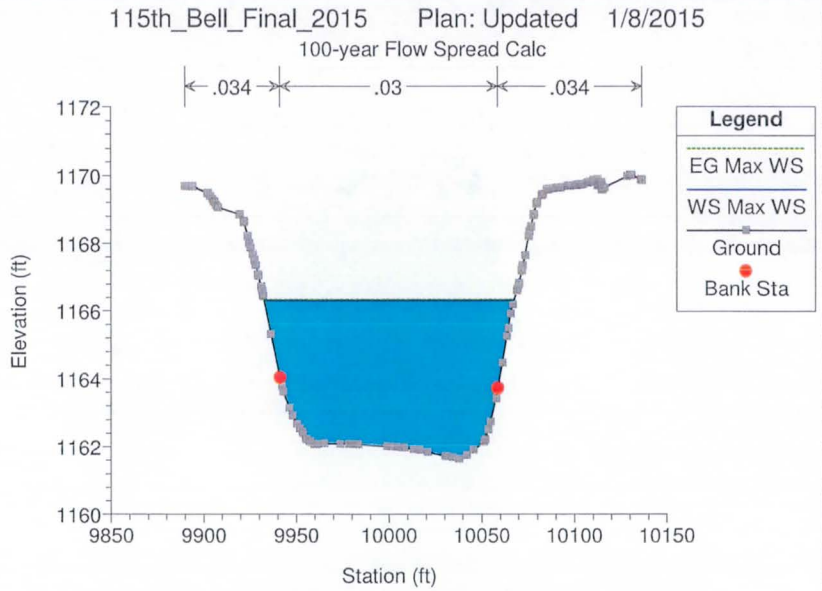
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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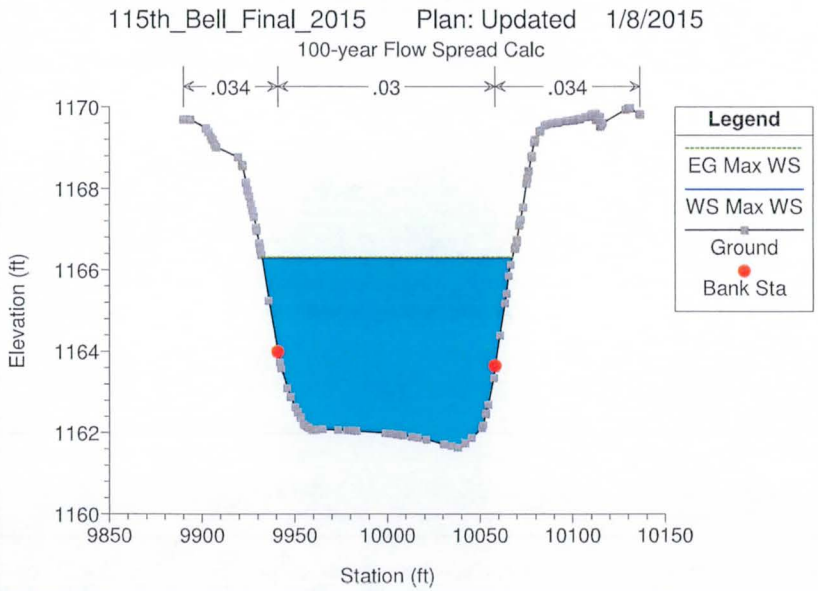
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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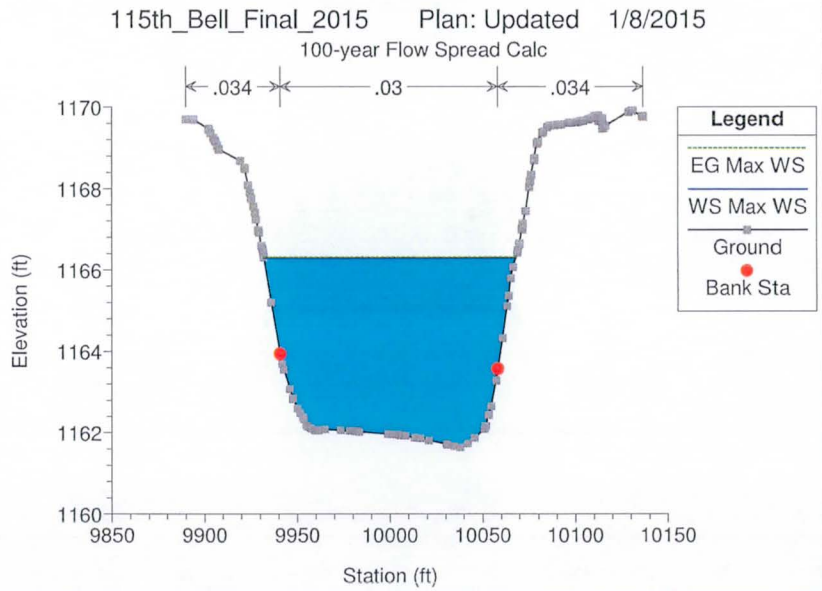
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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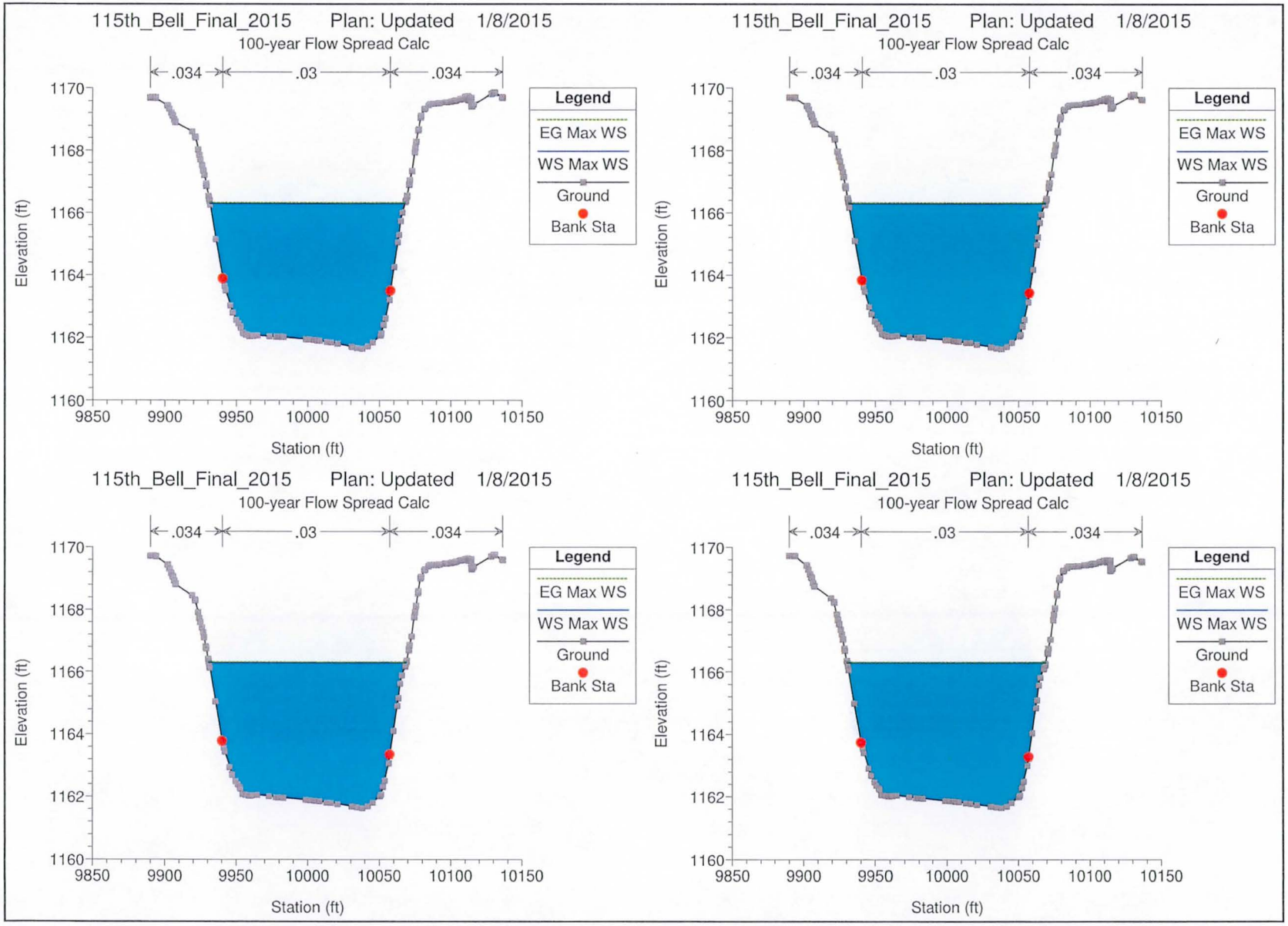
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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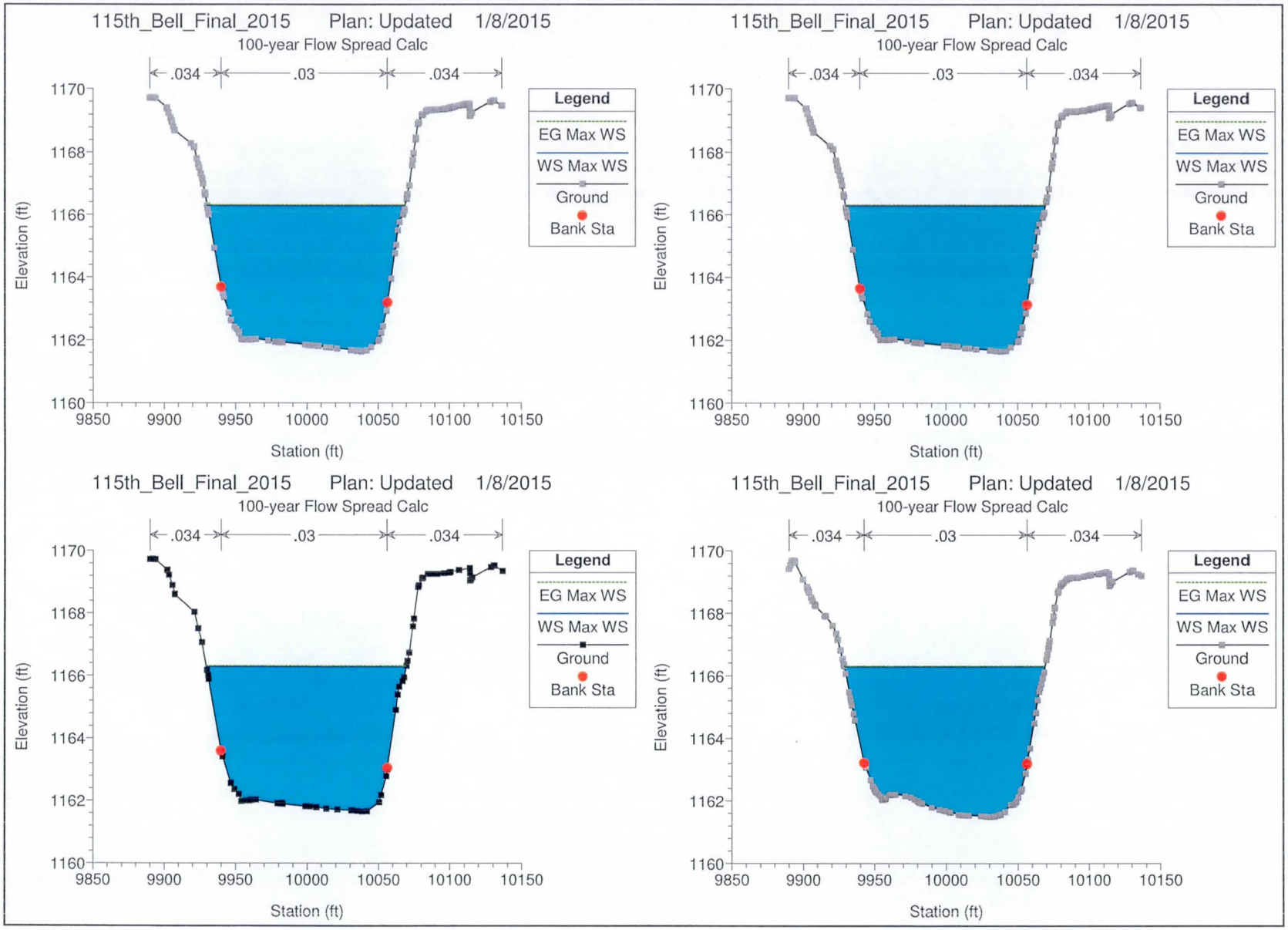
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
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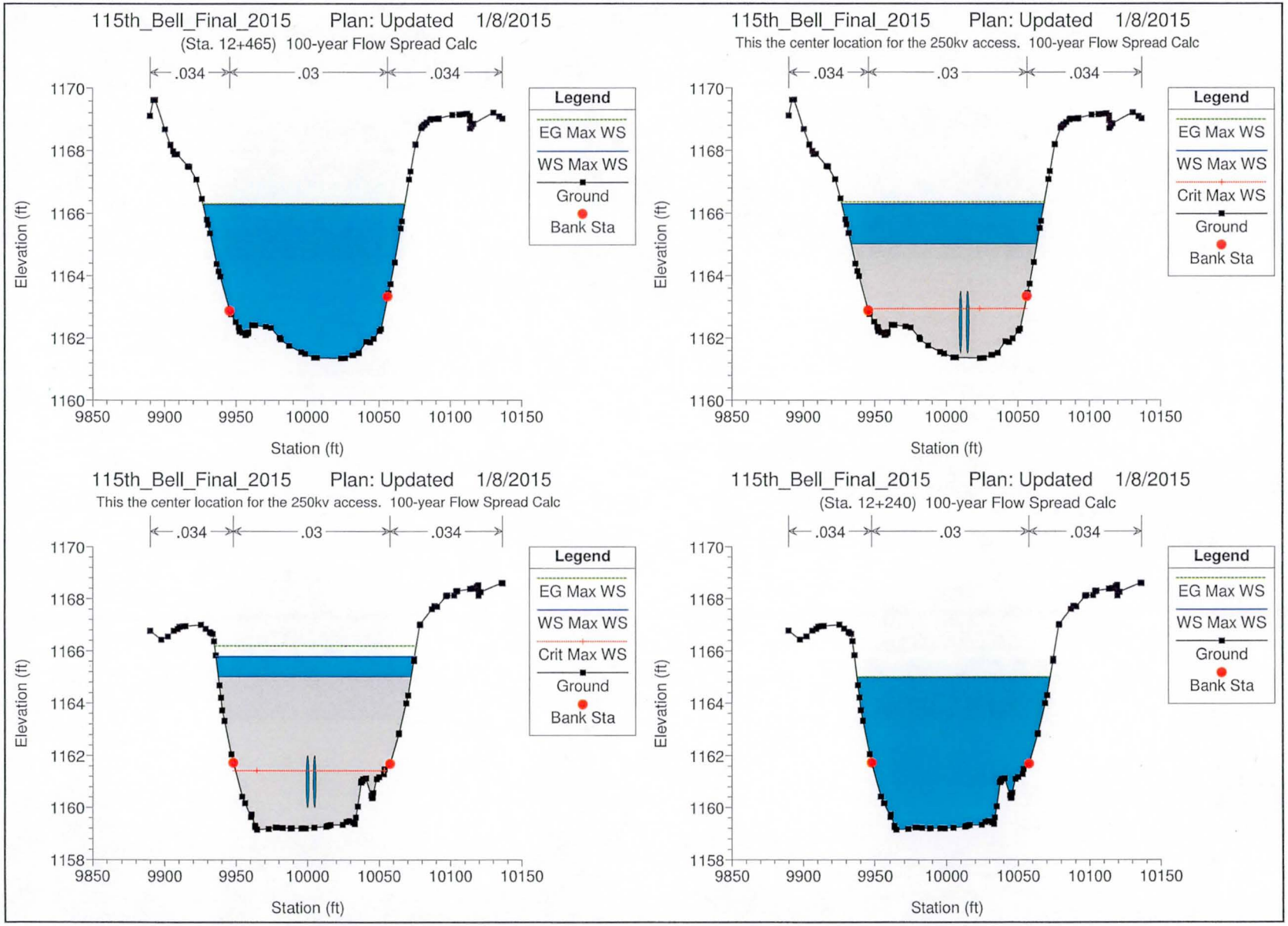
115th_Bell_Final_2015 Plan: Updated 1/8/2015
(Sta. 12+465) 100-year Flow Spread Calc
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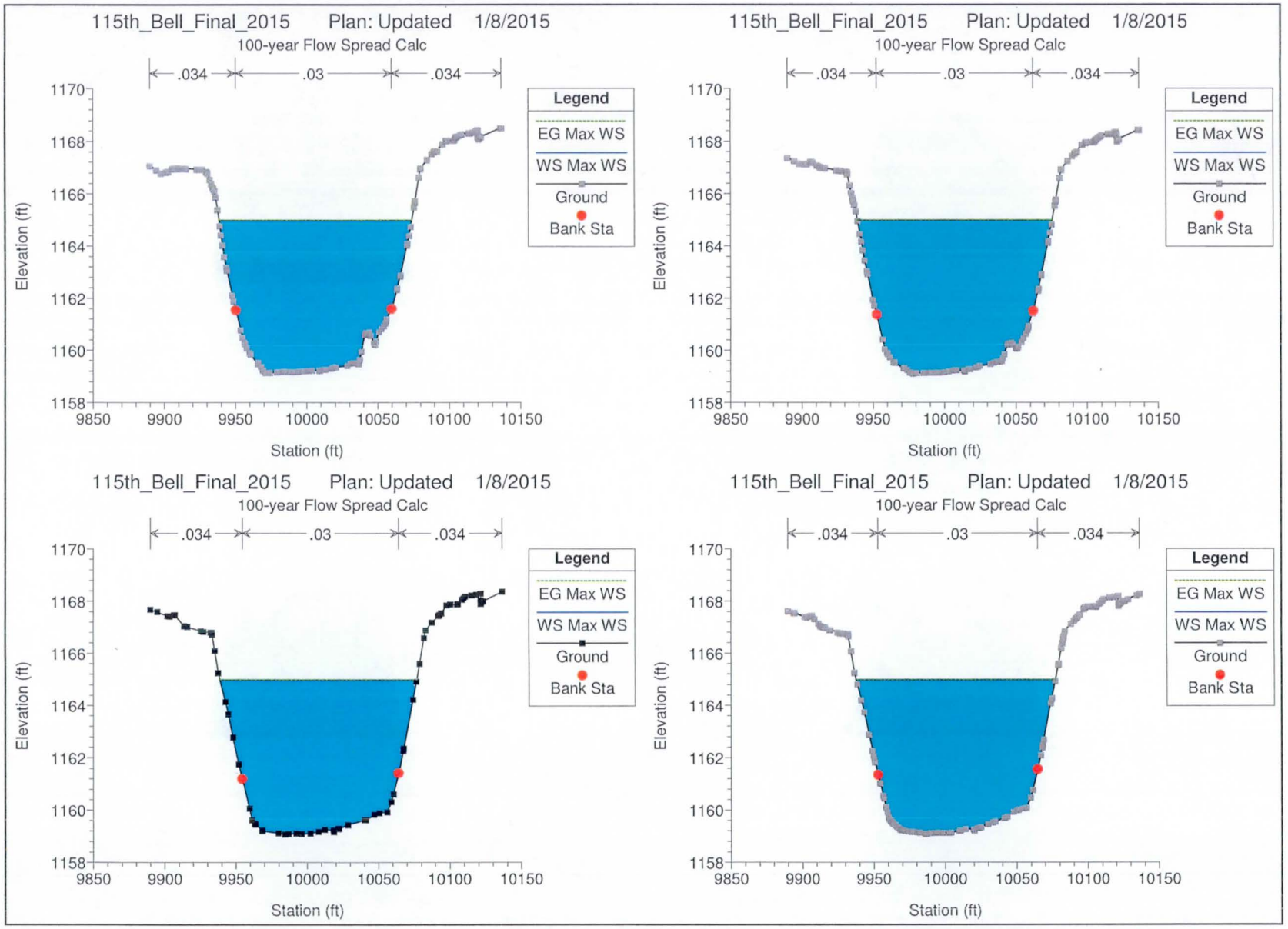
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This the center location for the 250kv access. 100-year Flow Spread Calc
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This the center location for the 250kv access. 100-year Flow Spread Calc
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
(Sta. 12+240) 100-year Flow Spread Calc
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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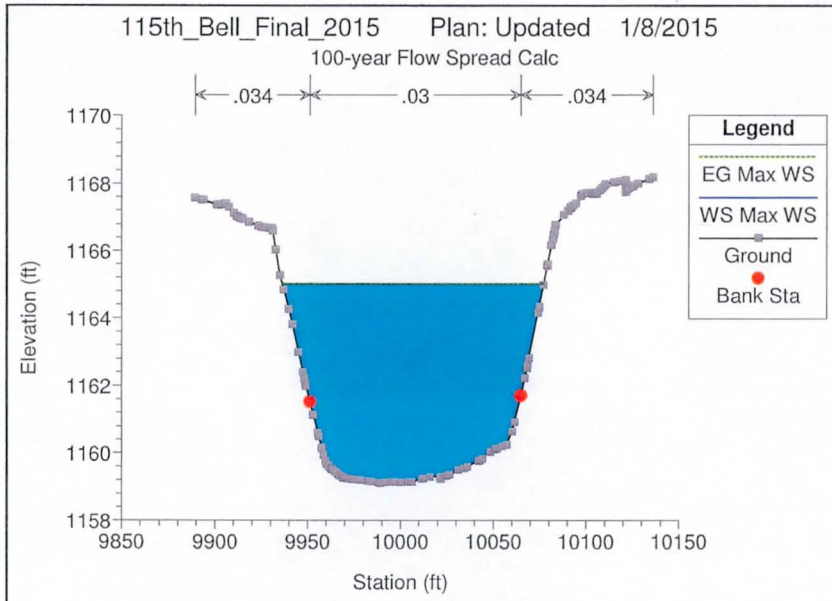
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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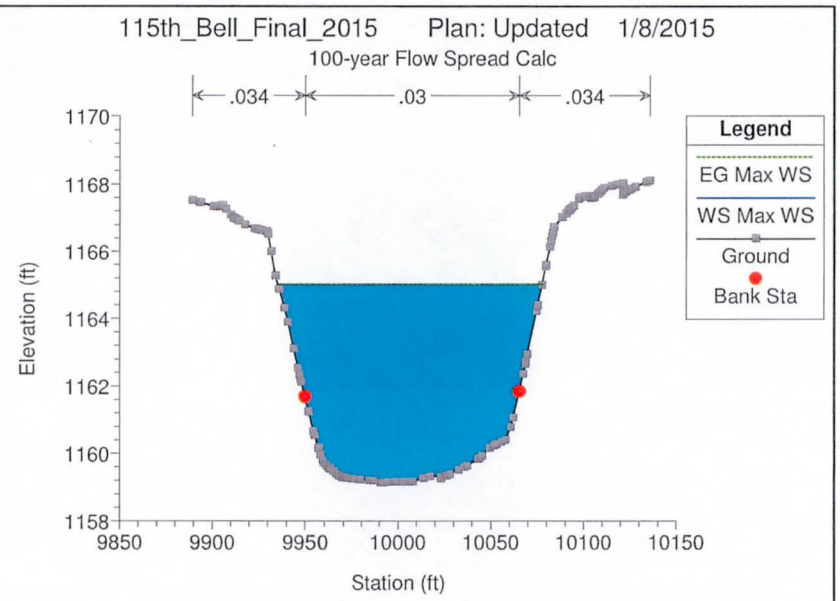
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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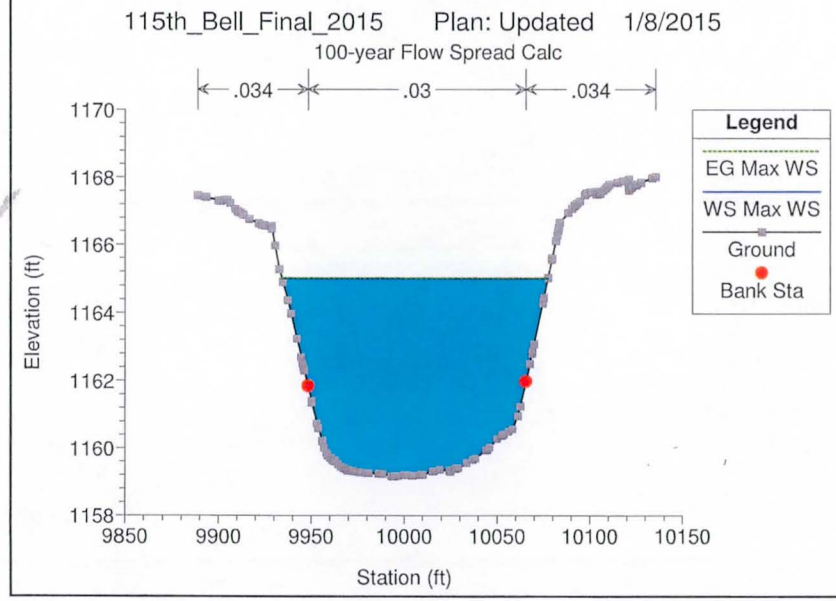
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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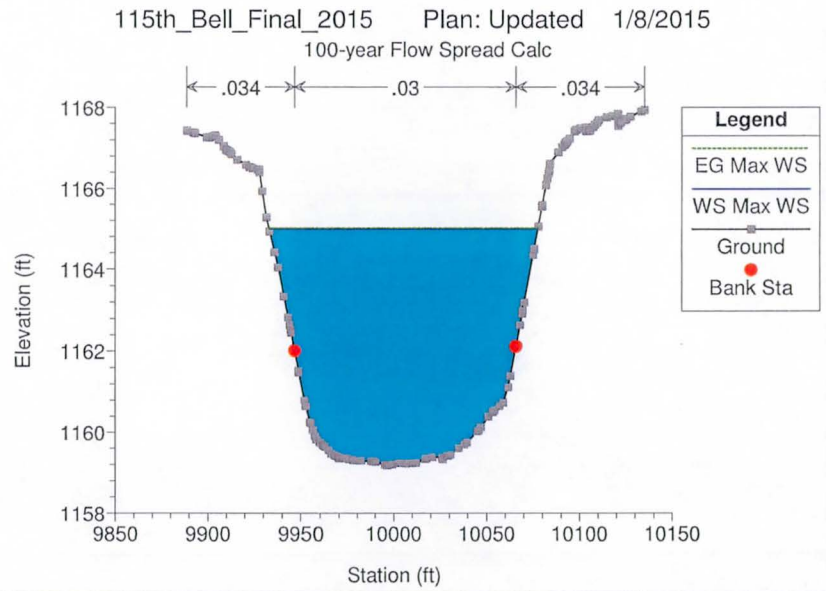
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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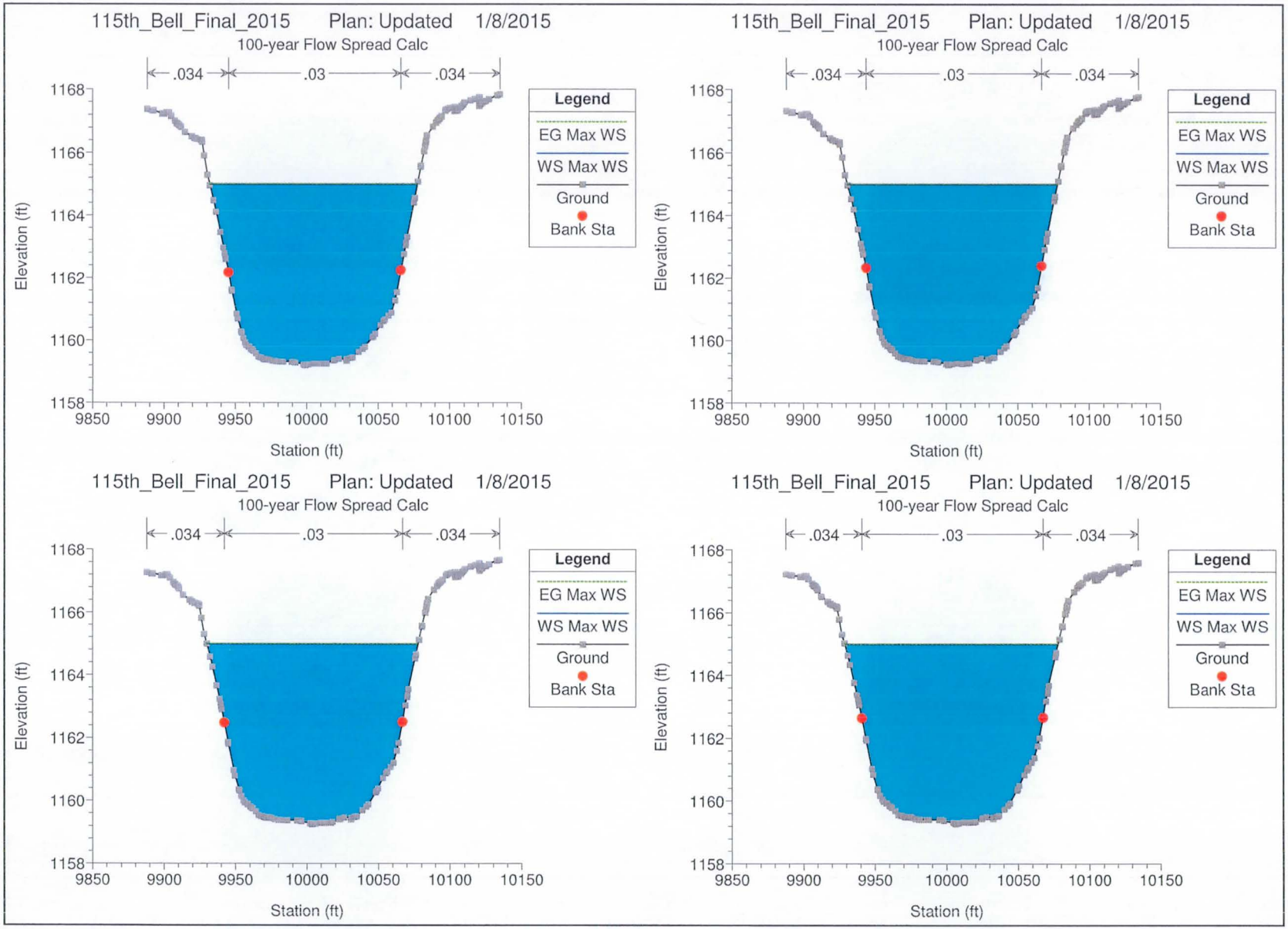
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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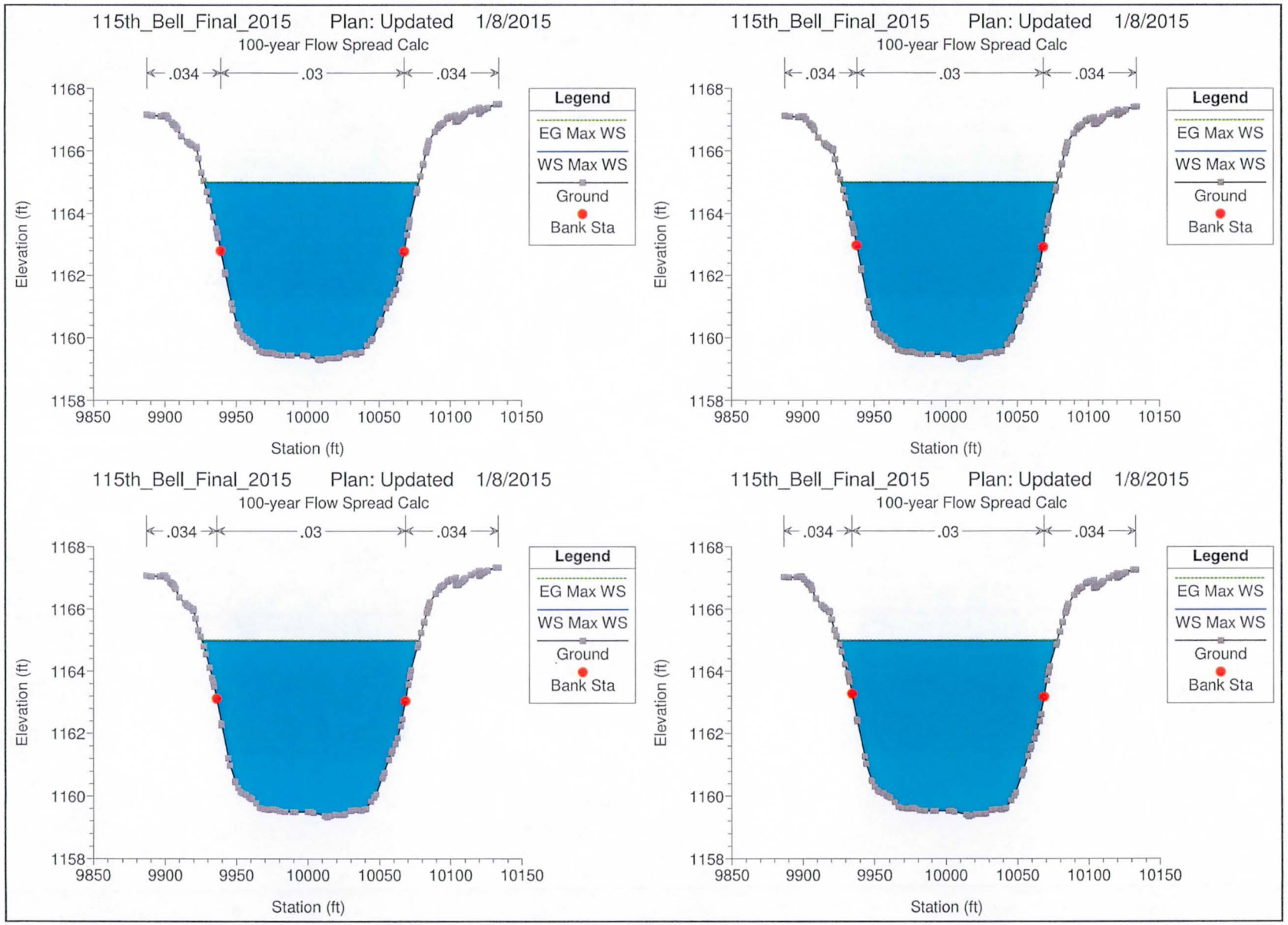
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100-year Flow Spread Calc
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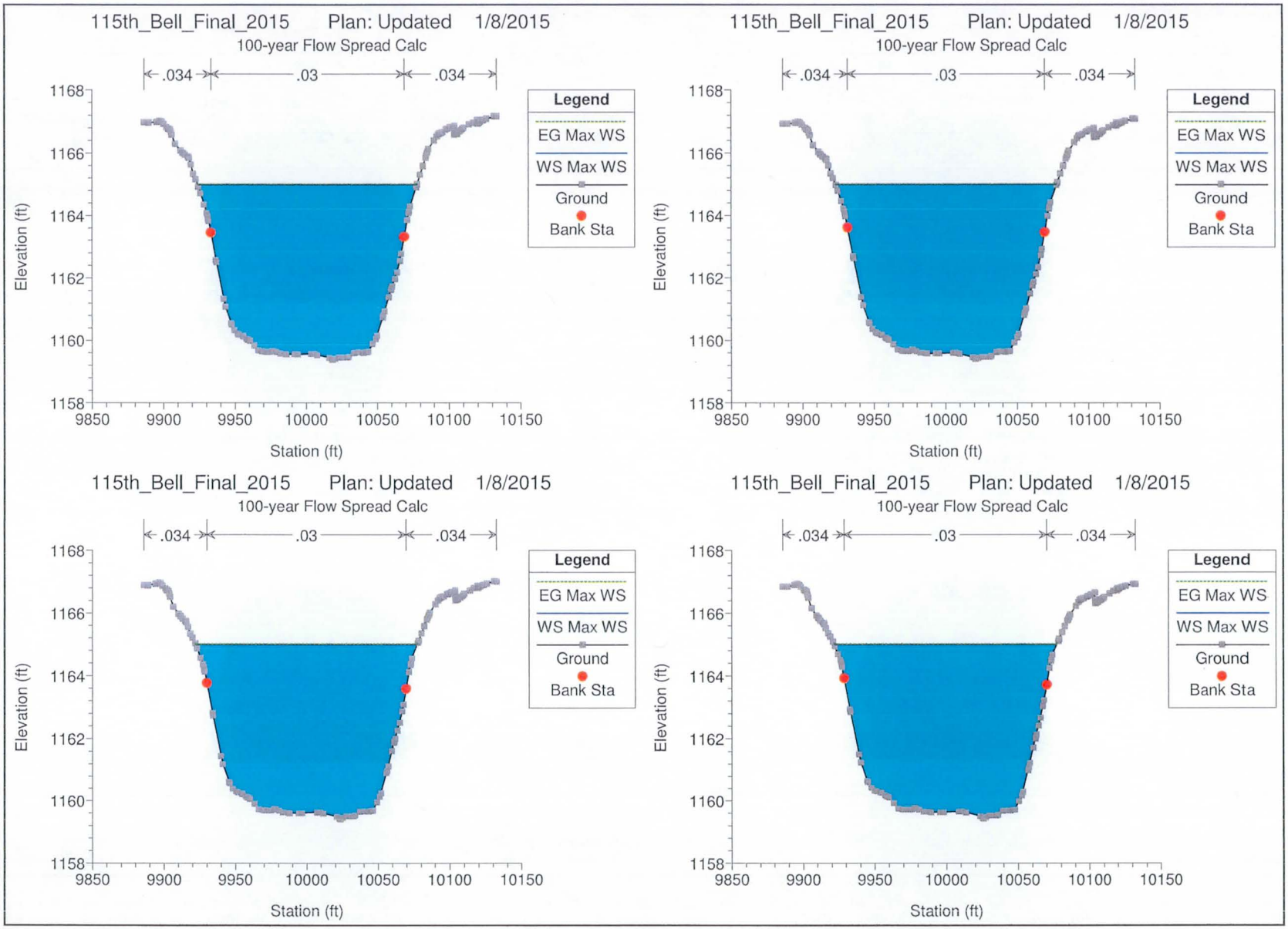
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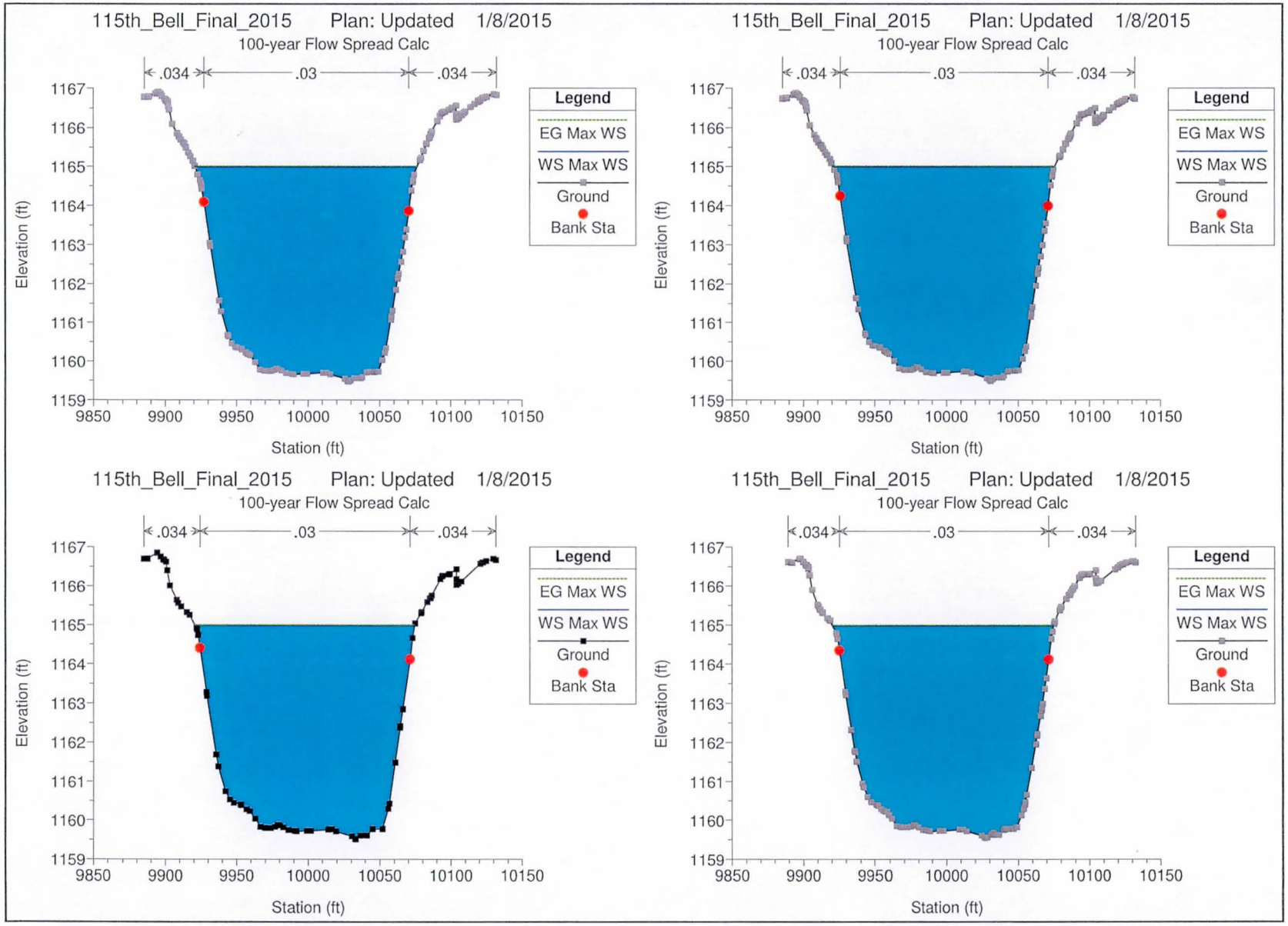
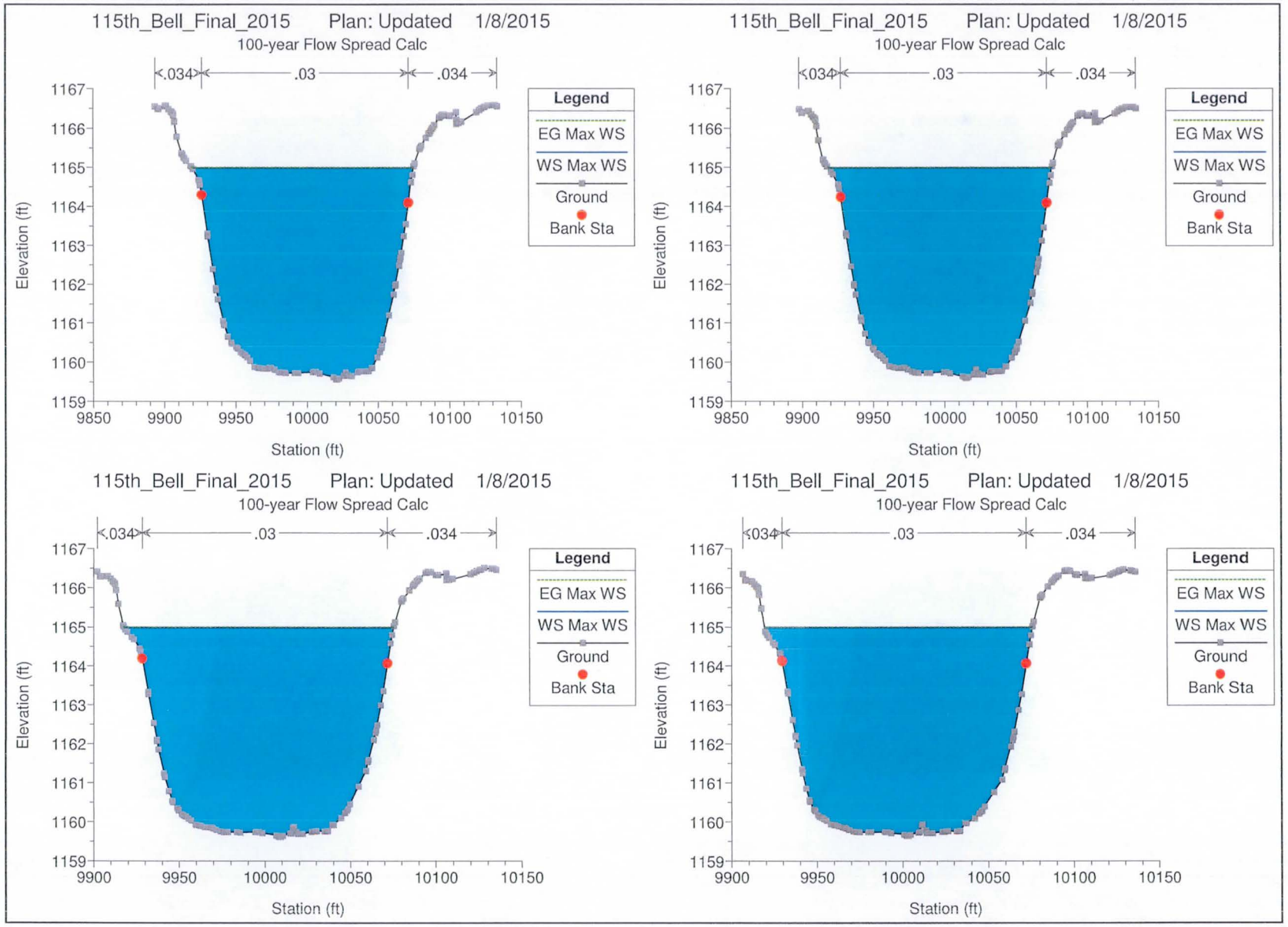
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
1167
1166
1165
1164
1163
1162
1161
1160
1159
9850
9900
9950
10000
10050
10100
10150
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
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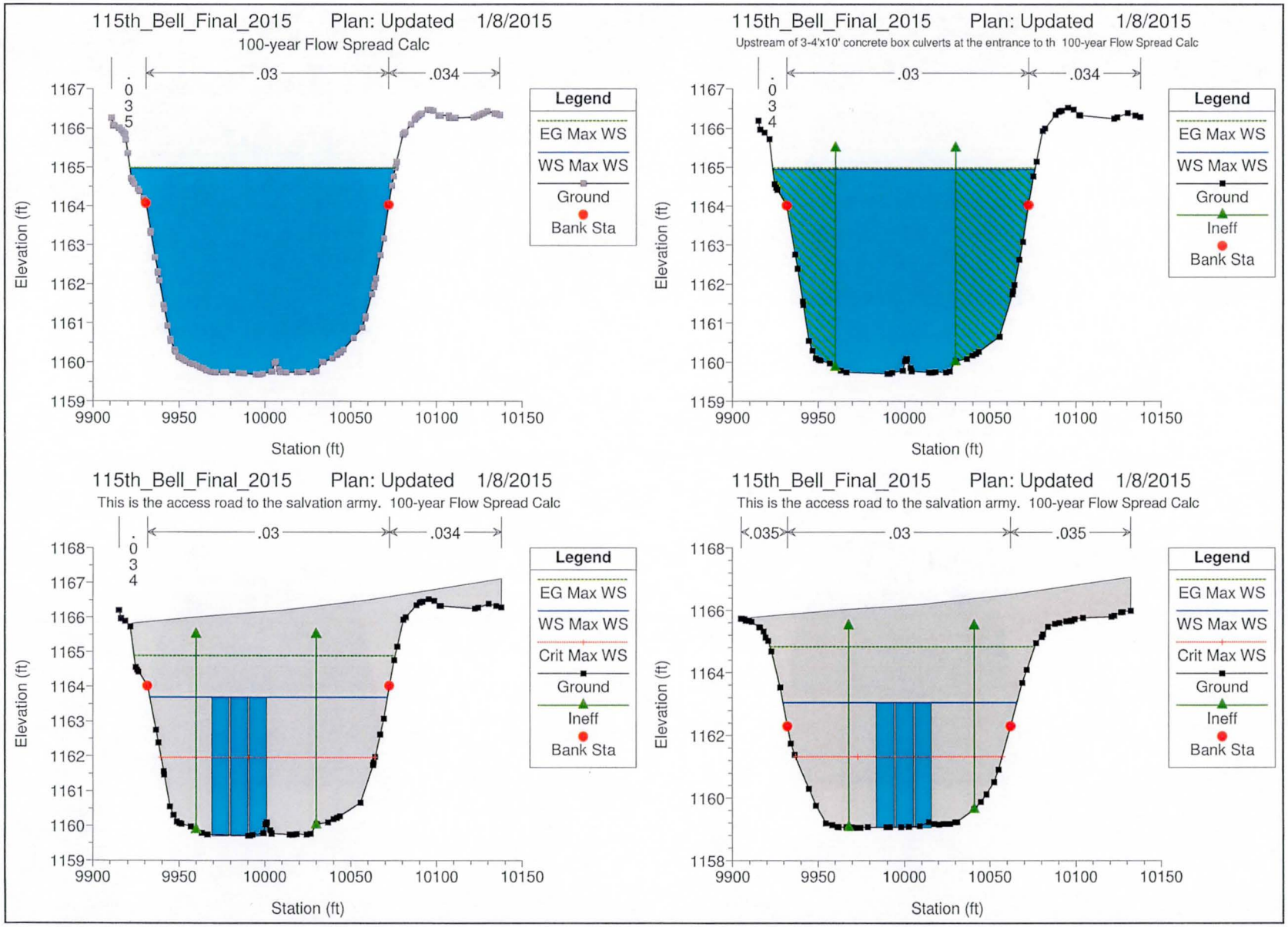
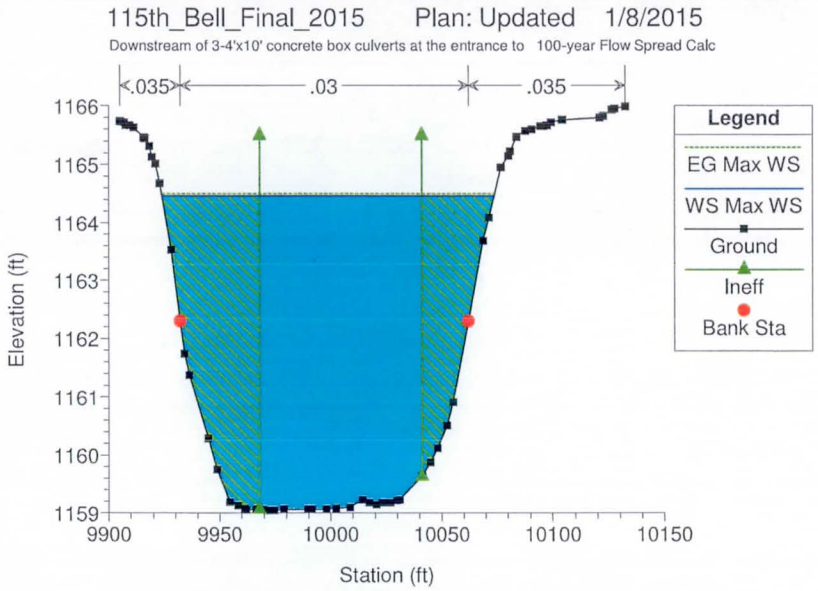
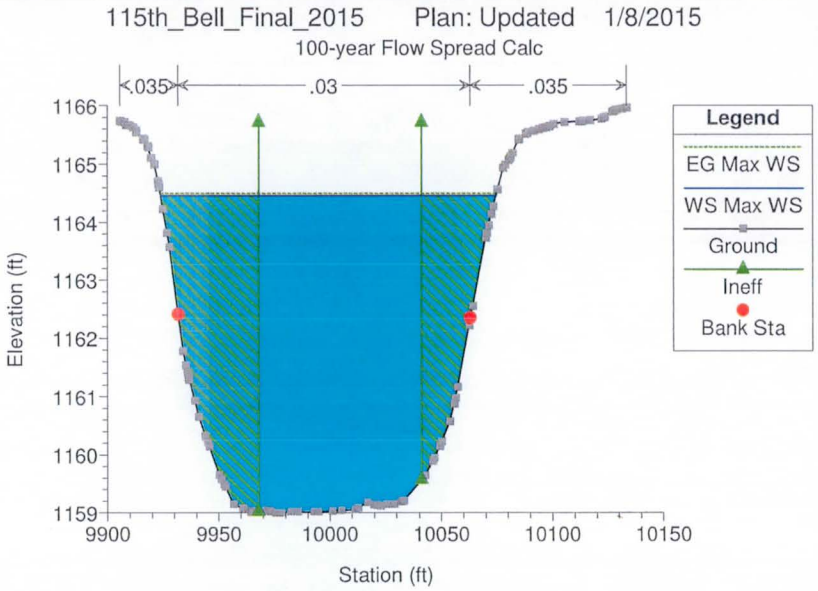
.034
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.034
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
Upstream of 3-4'x10' concrete box culverts at the entrance to th 100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the access road to the salvation army. 100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the access road to the salvation army. 100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
Downstream of 3-4'x10' concrete box culverts at the entrance to 100-year Flow Spread Calc
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
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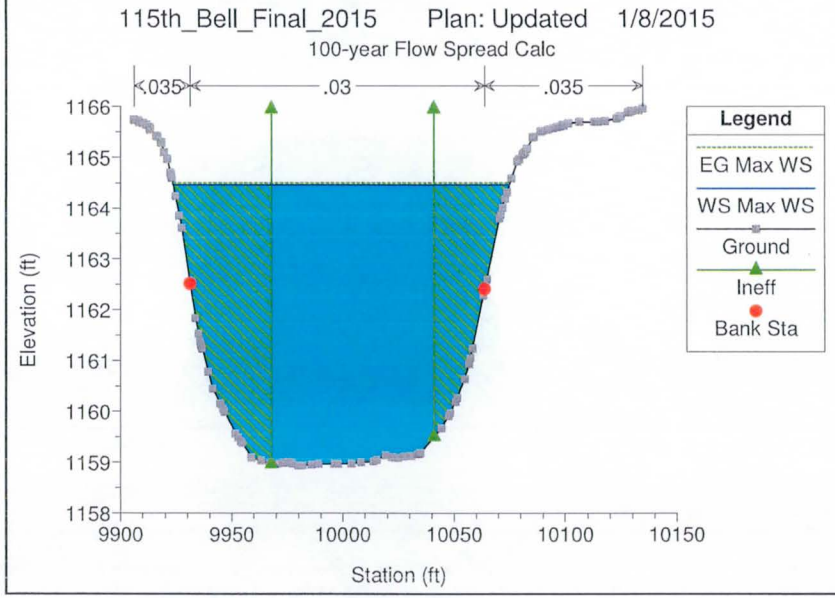
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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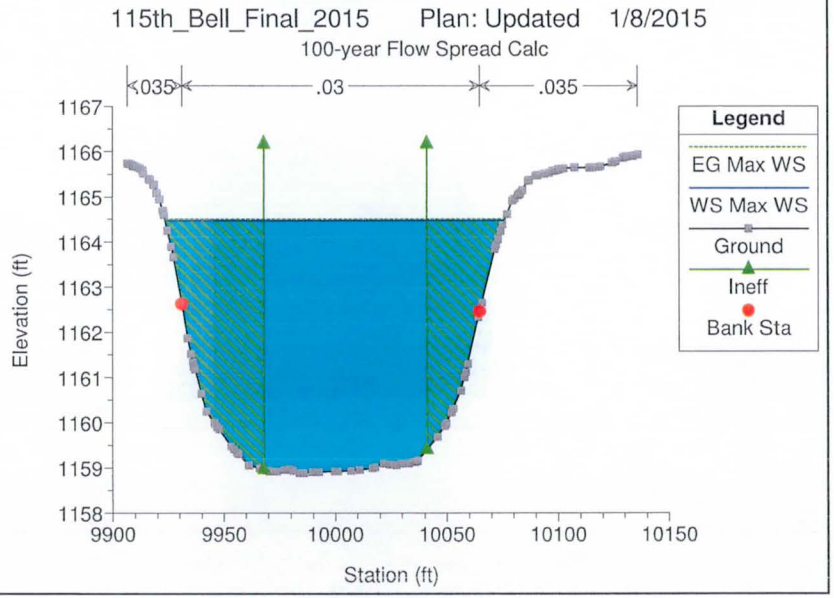
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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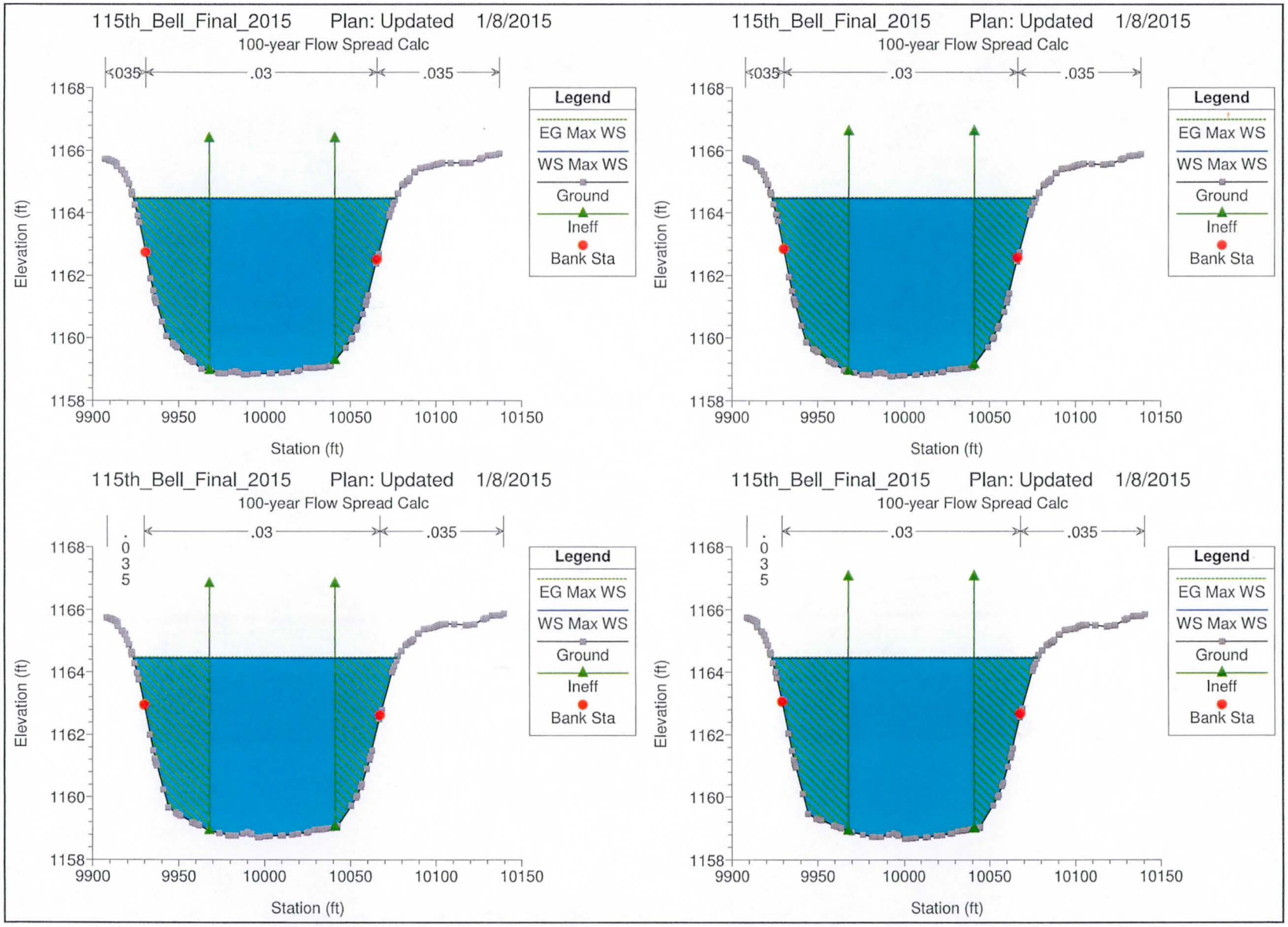
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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Station (ft)
Legend
EG Max WS
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Ground
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Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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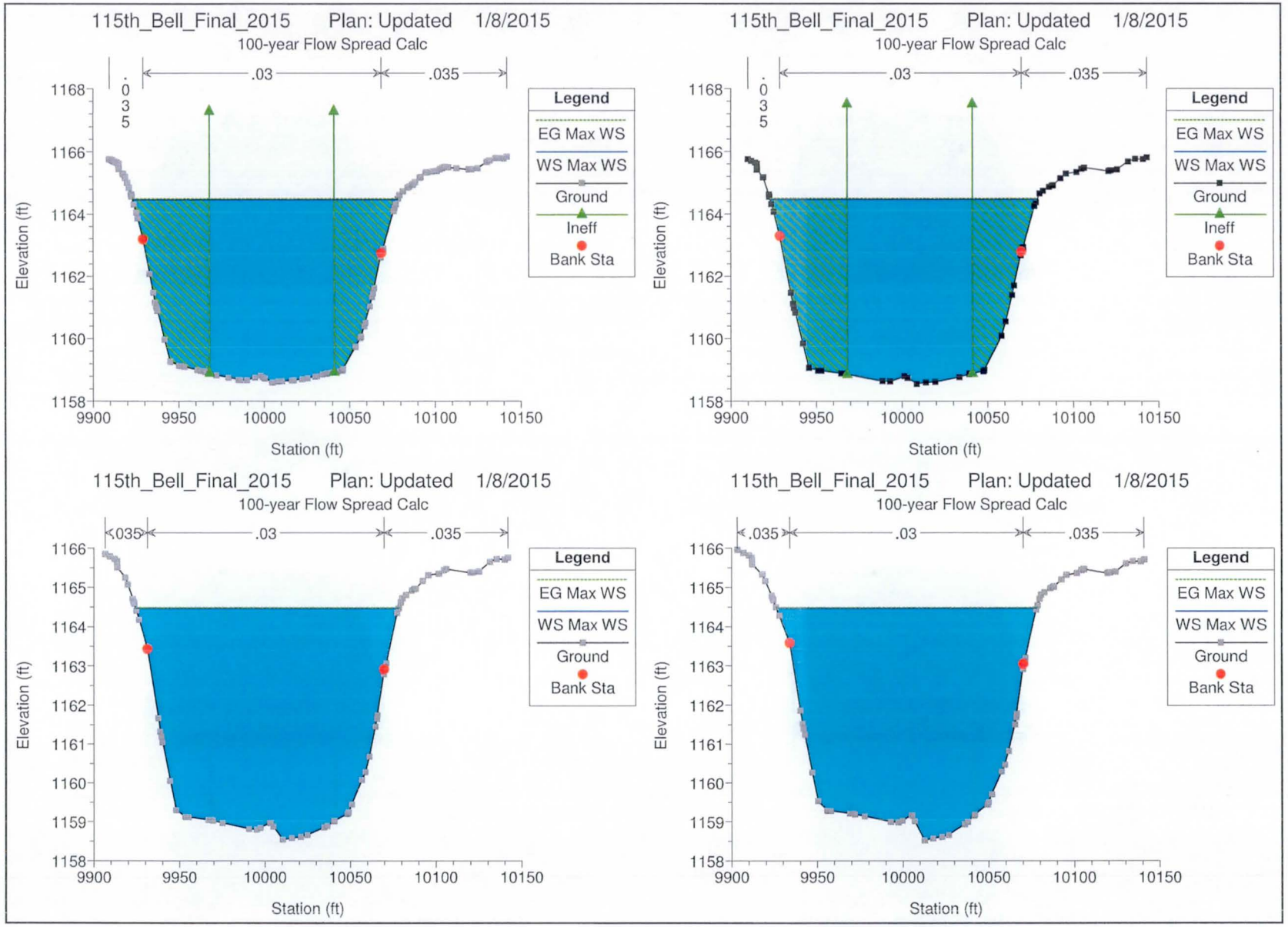
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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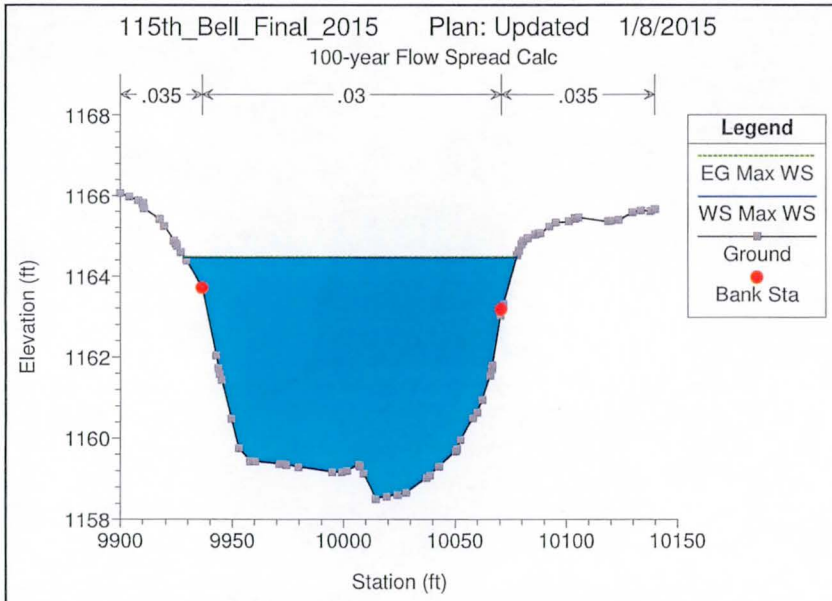
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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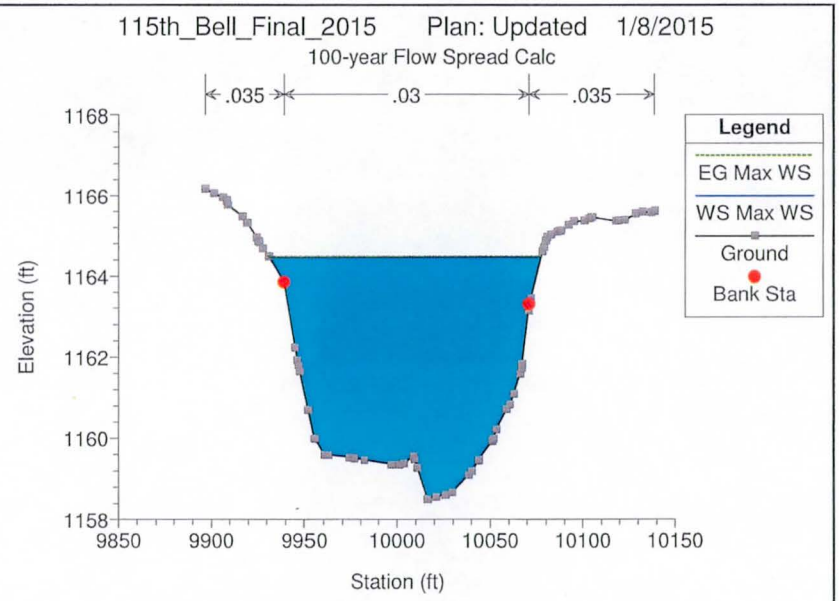
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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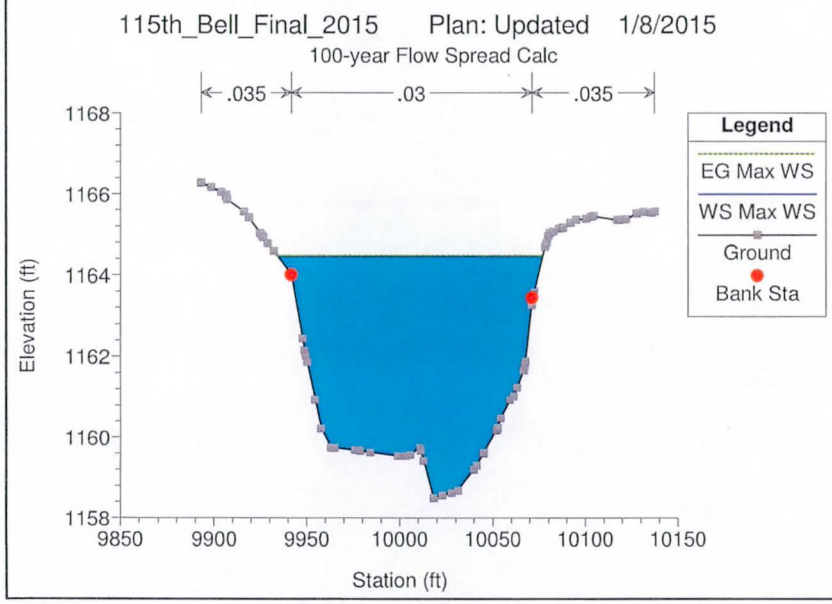
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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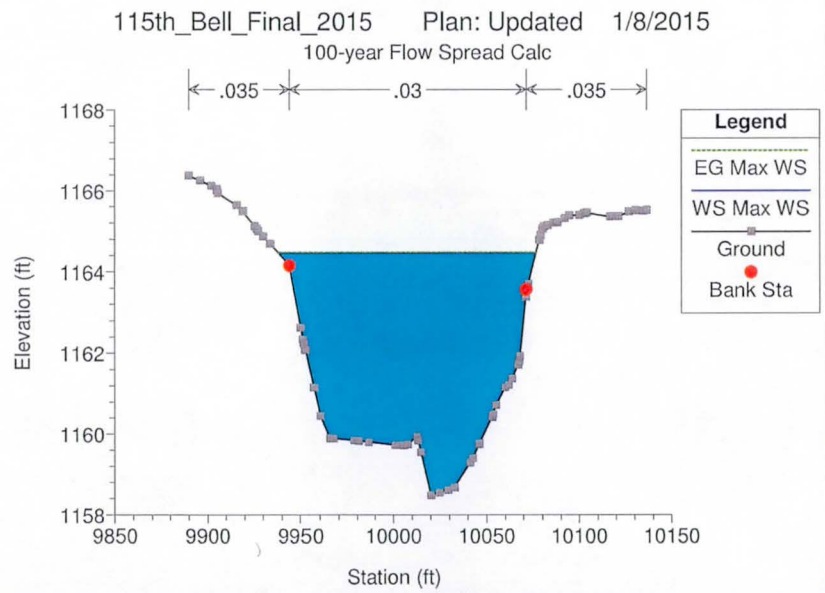
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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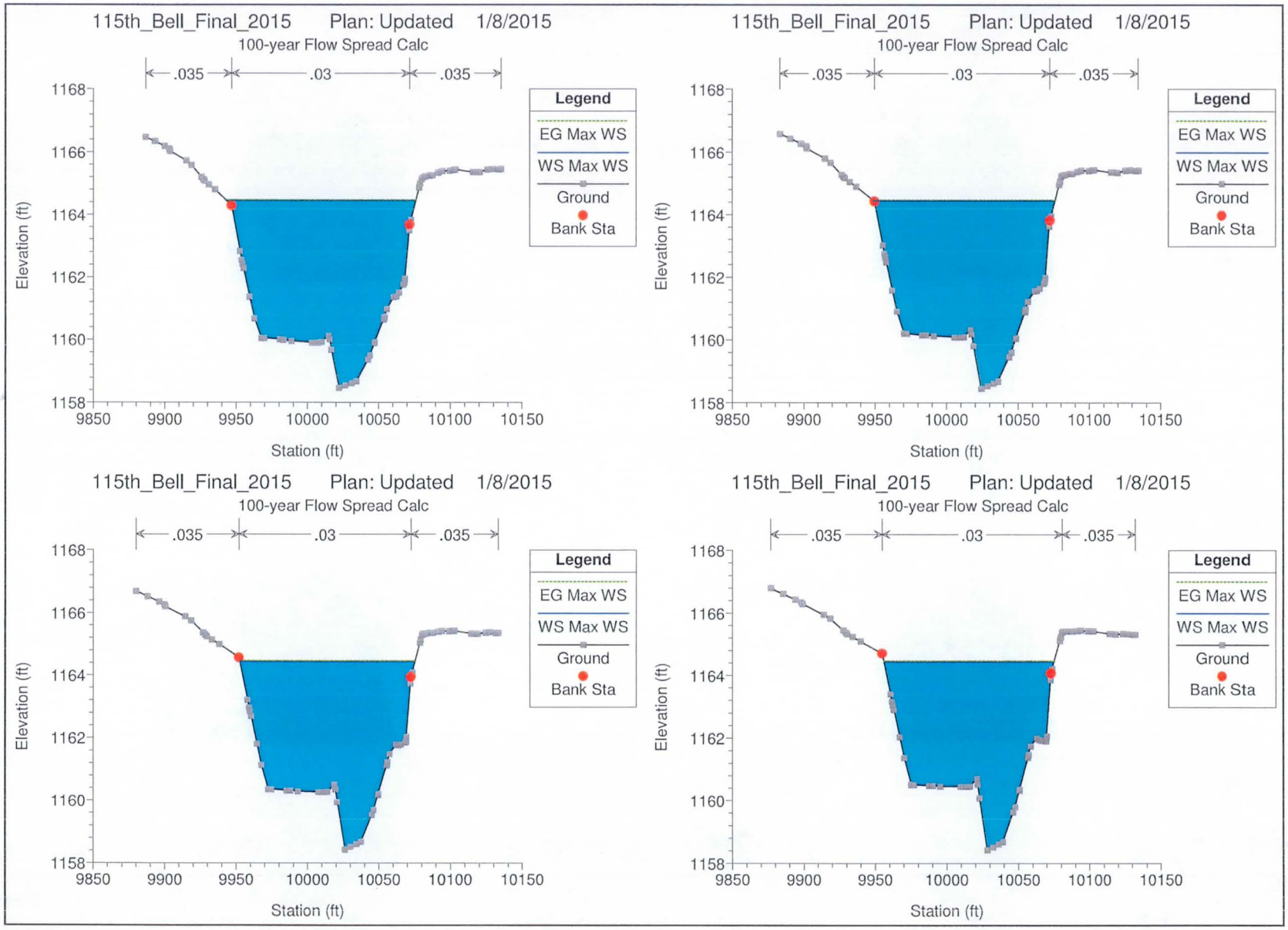
10000
10050
10100
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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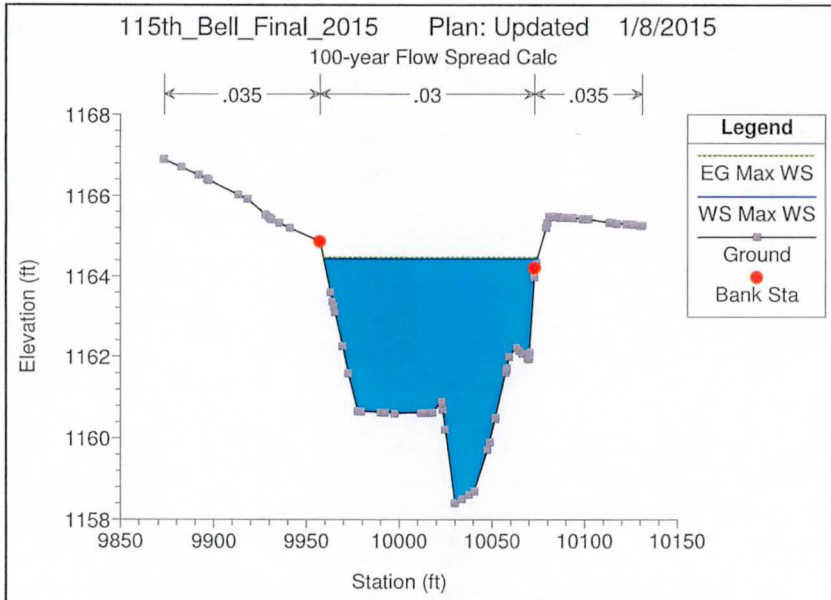
10050
10100
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1168
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1164
1162
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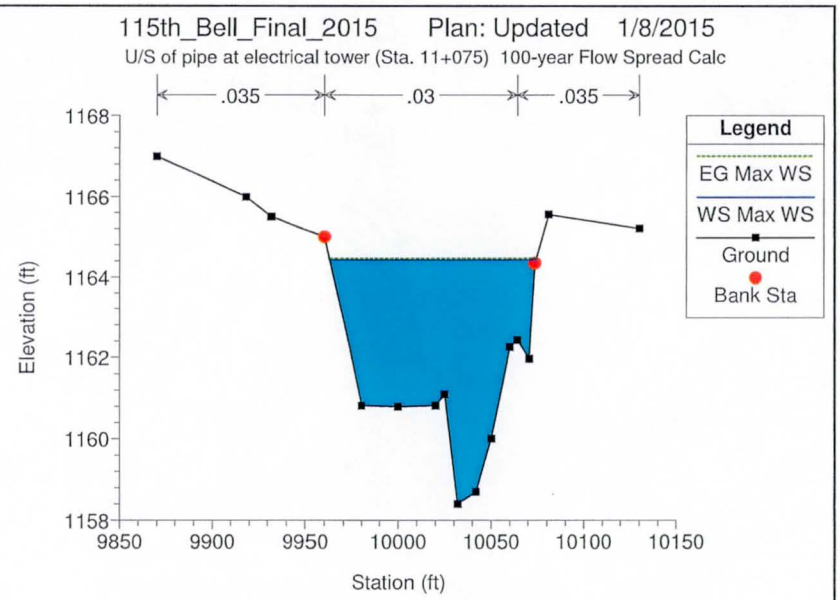
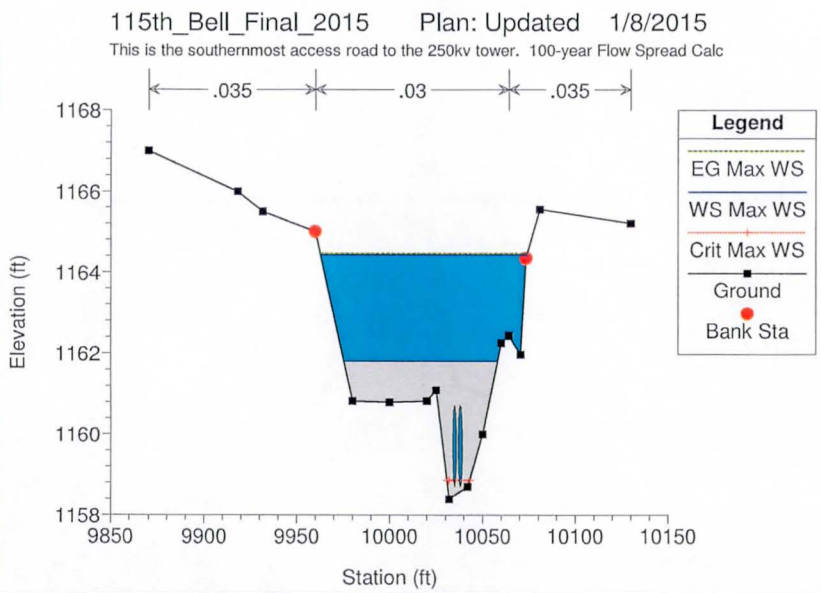
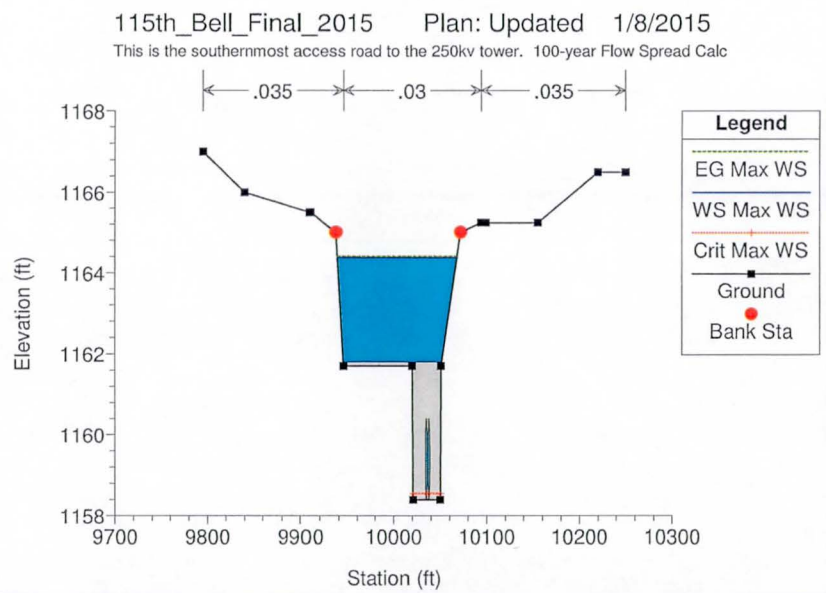
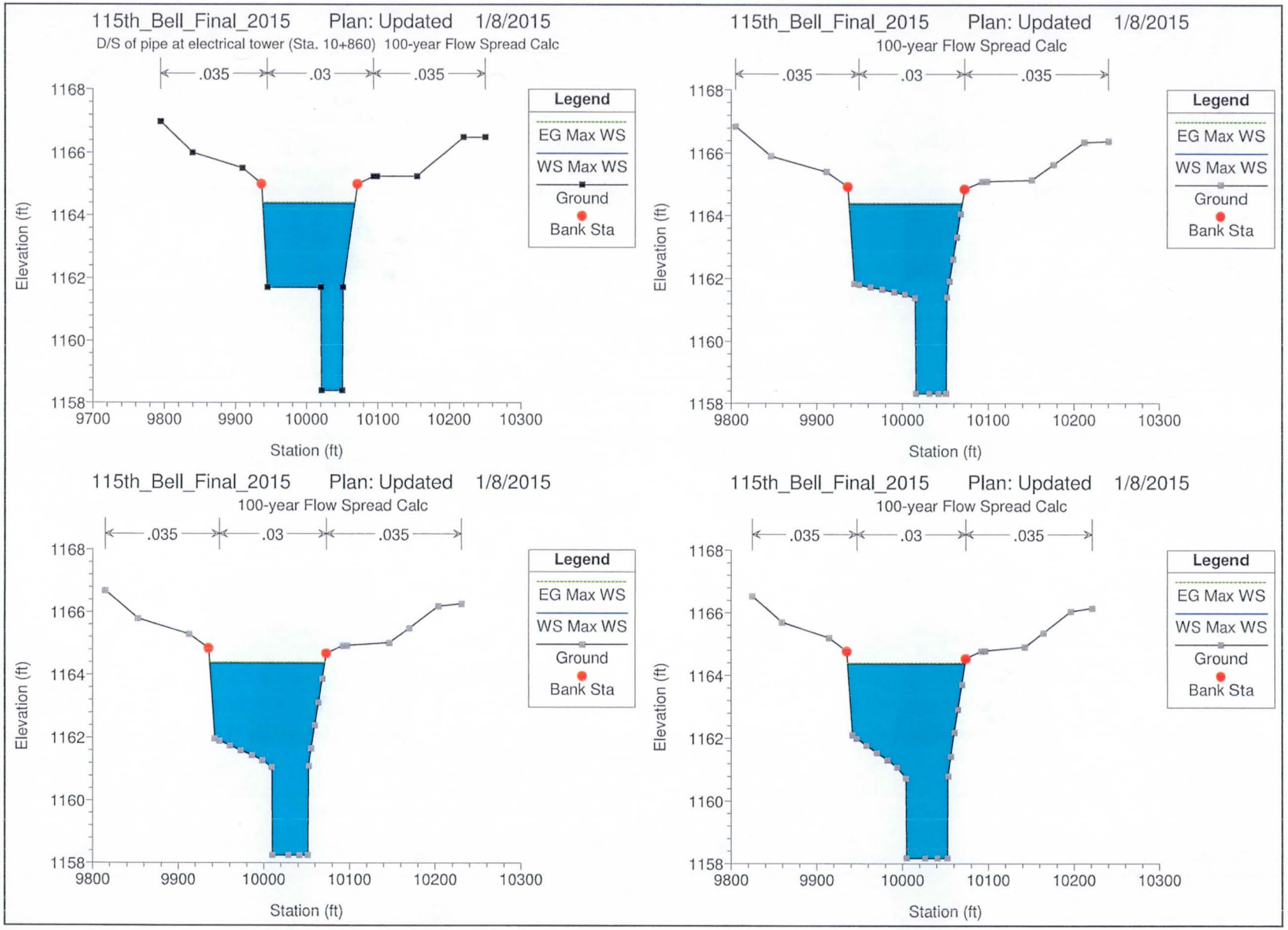
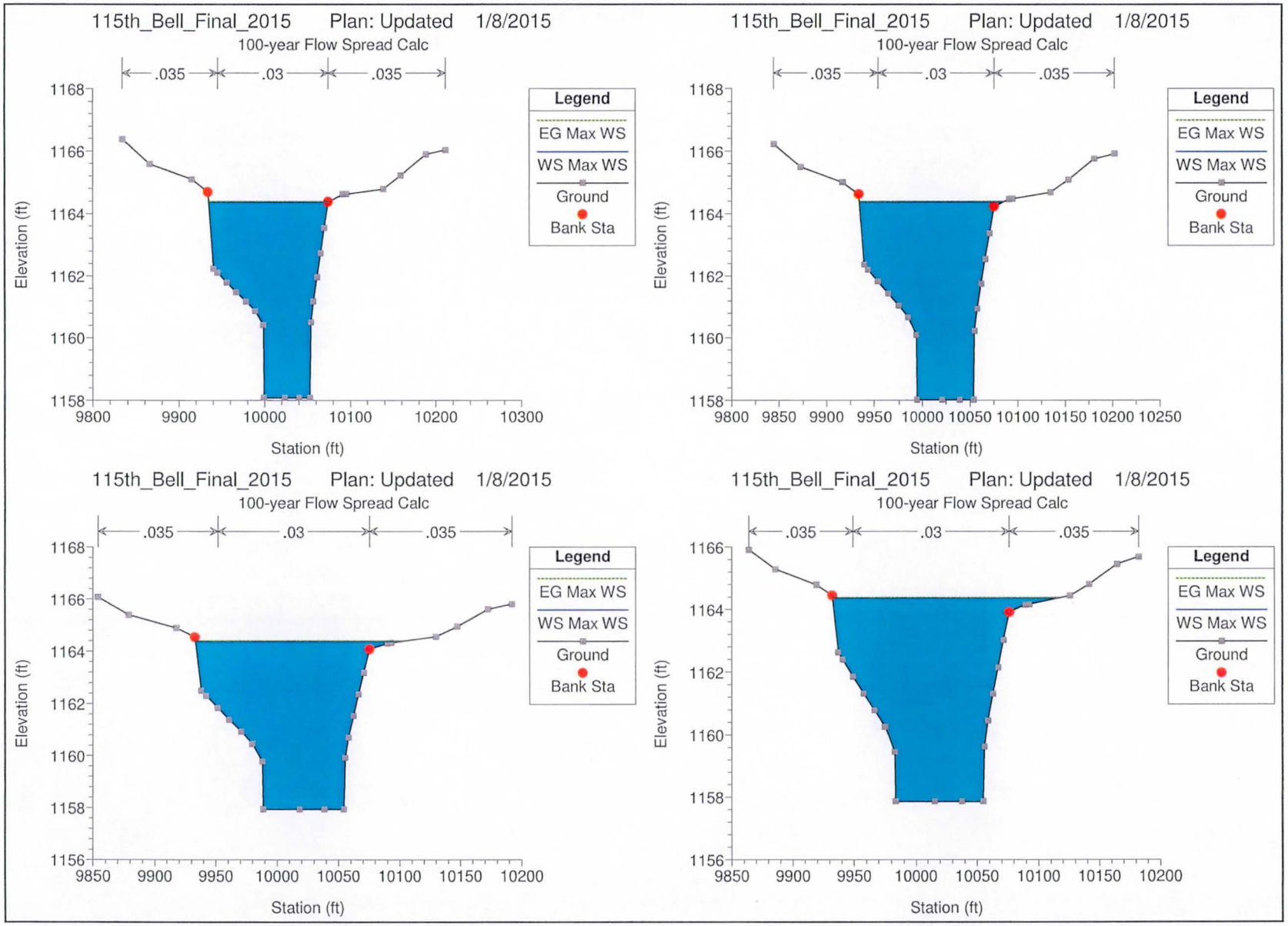
9850
9900
9950
10000
10050
10100
10150
Station (ft)

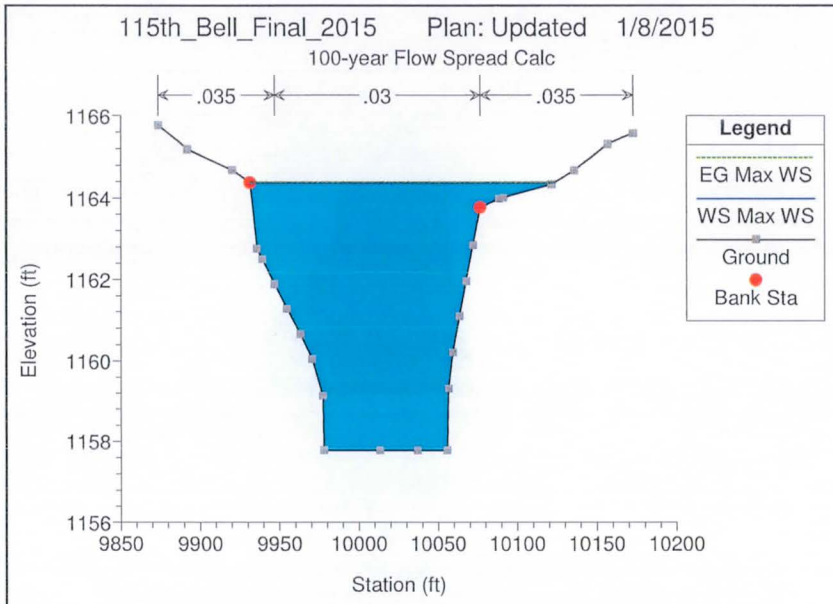

115th_Bell_Final_2015 Plan: Updated 1/8/2015
U/S of pipe at electrical tower (Sta. 11+075) 100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1168
1166
1164
1162
1160
1158
9850
9900
9950
10000
10050
10100
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the southernmost access road to the 250kv tower. 100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
1168
1166
1164
1162
1160
1158
9850
9900
9950
10000
10050
10100
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the southernmost access road to the 250kv tower. 100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
1168
1166
1164
1162
1160
1158
9700
9800
9900
10000
10100
10200
10300
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
D/S of pipe at electrical tower (Sta. 10+860) 100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035 .03 .035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035 .03 .035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035 .03 .035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035 .03 .035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
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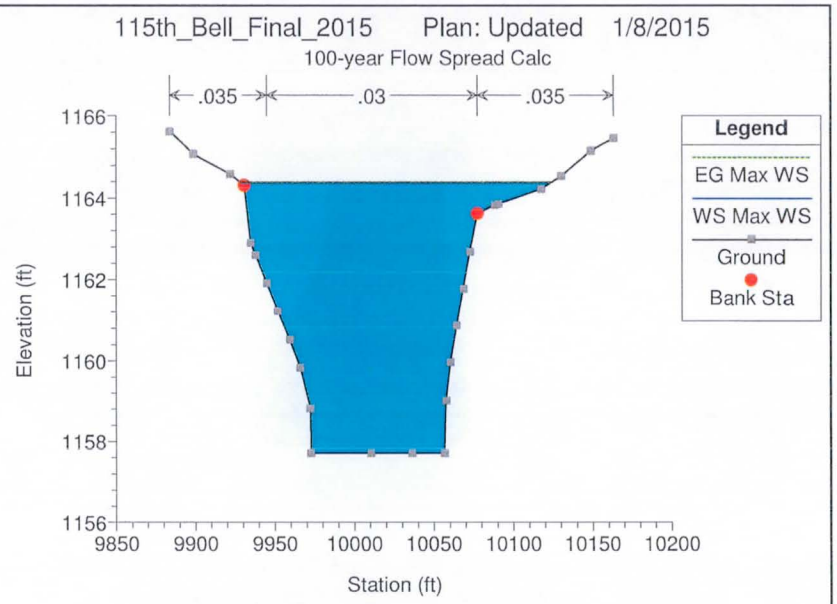
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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10050
10100
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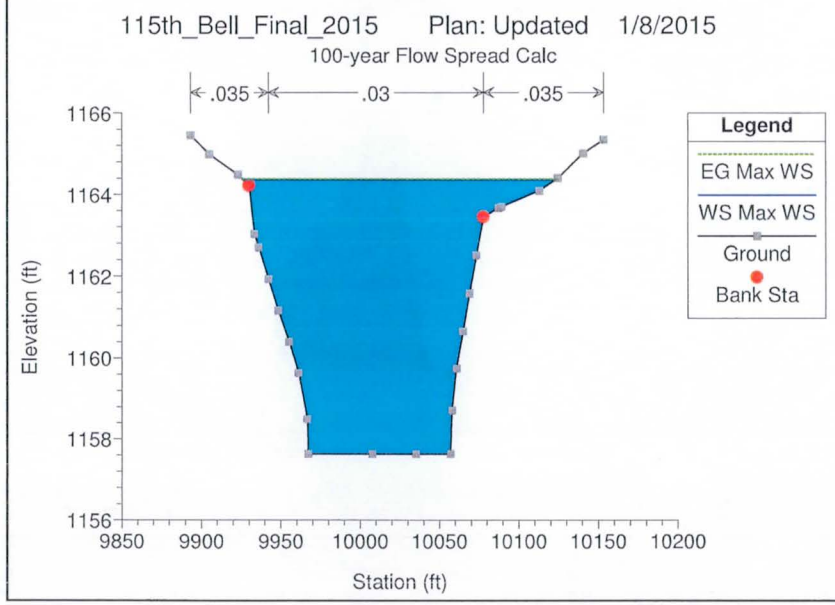
10200
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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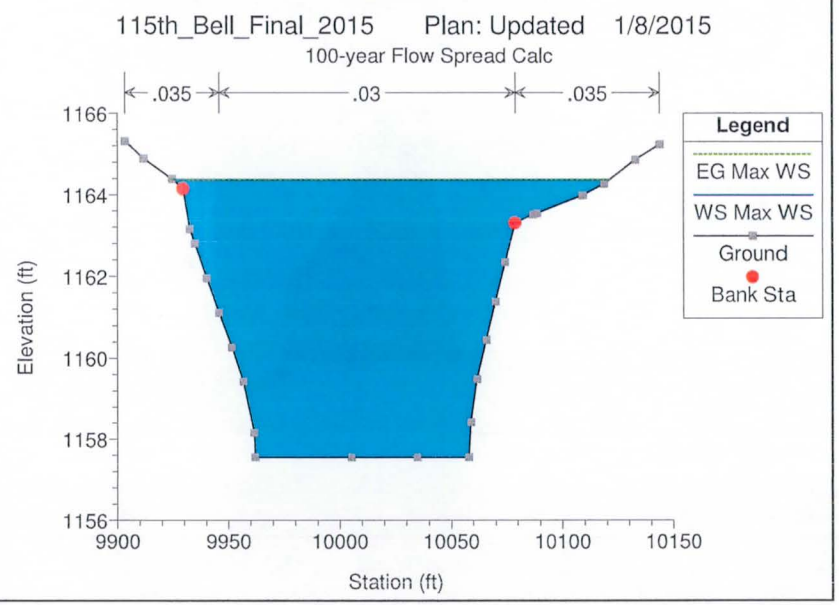
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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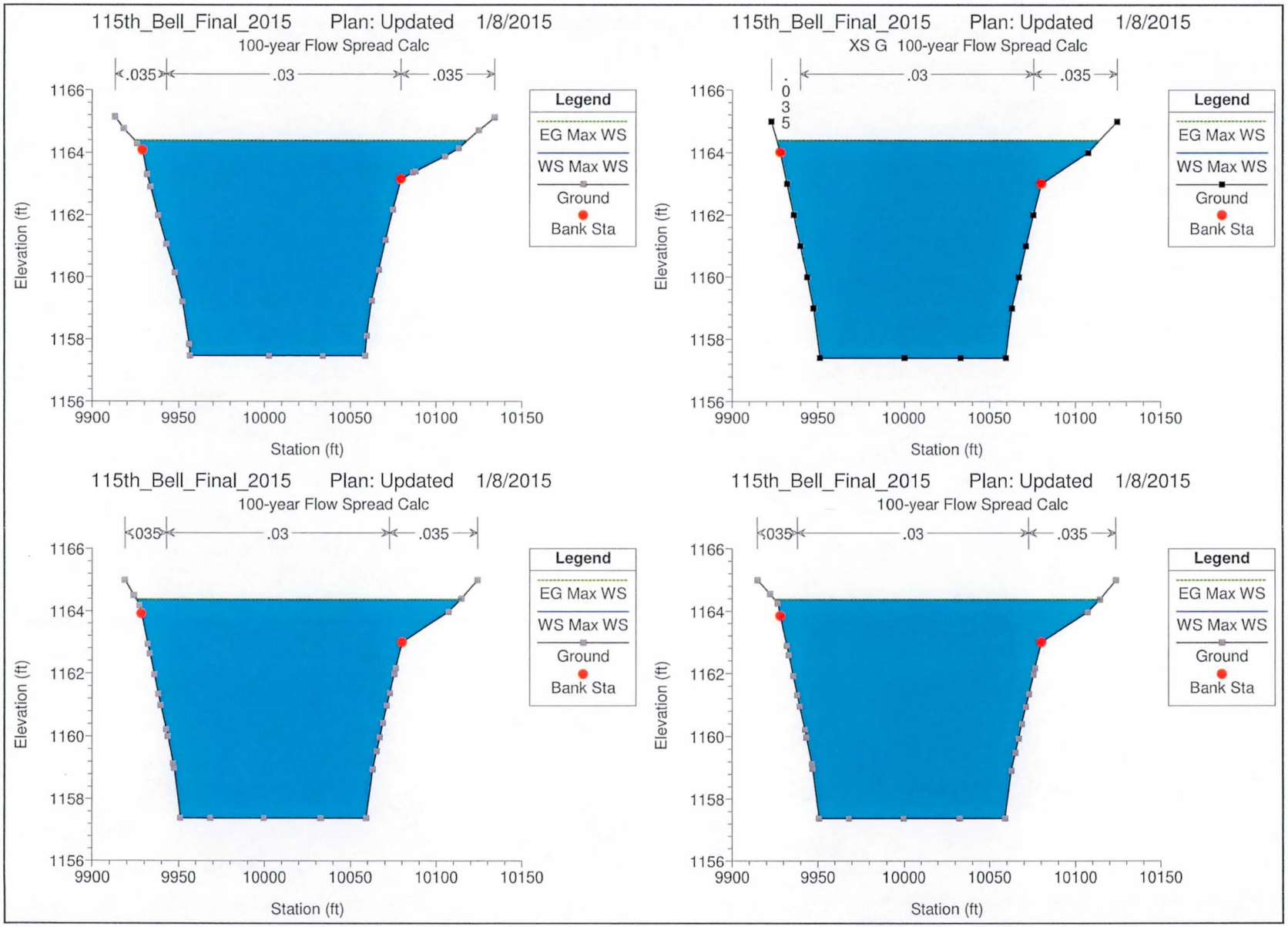
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
XS G 100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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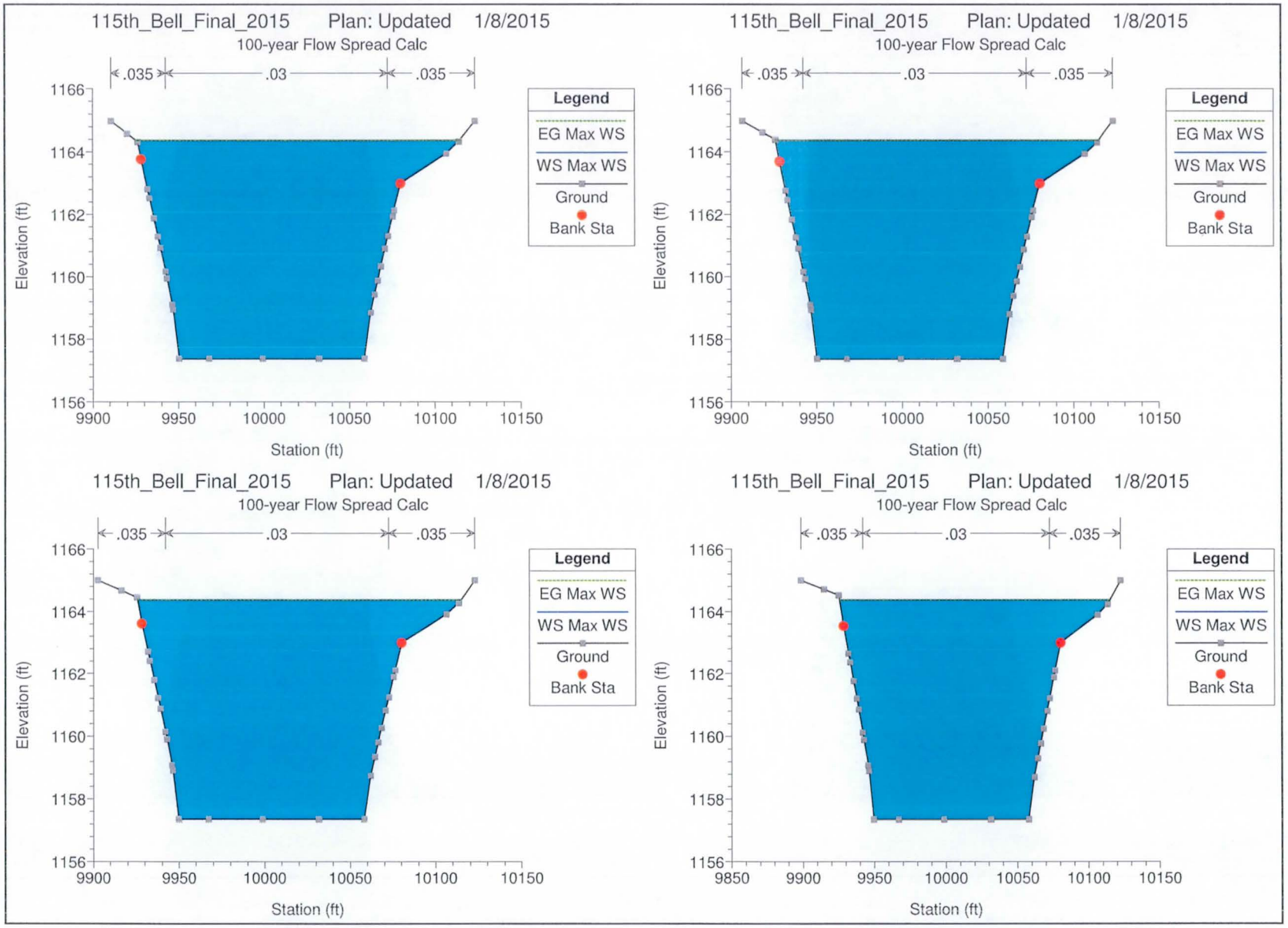
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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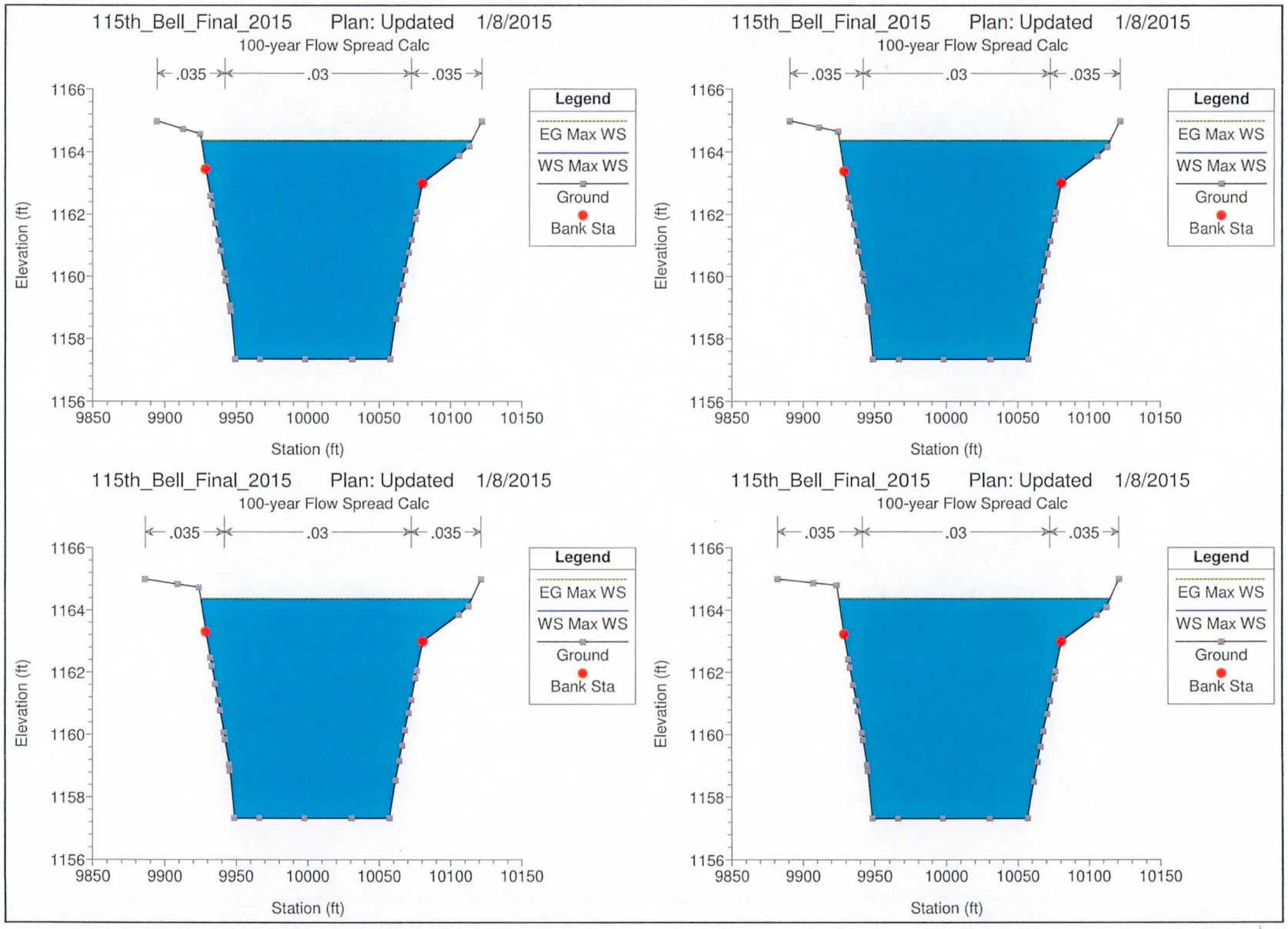
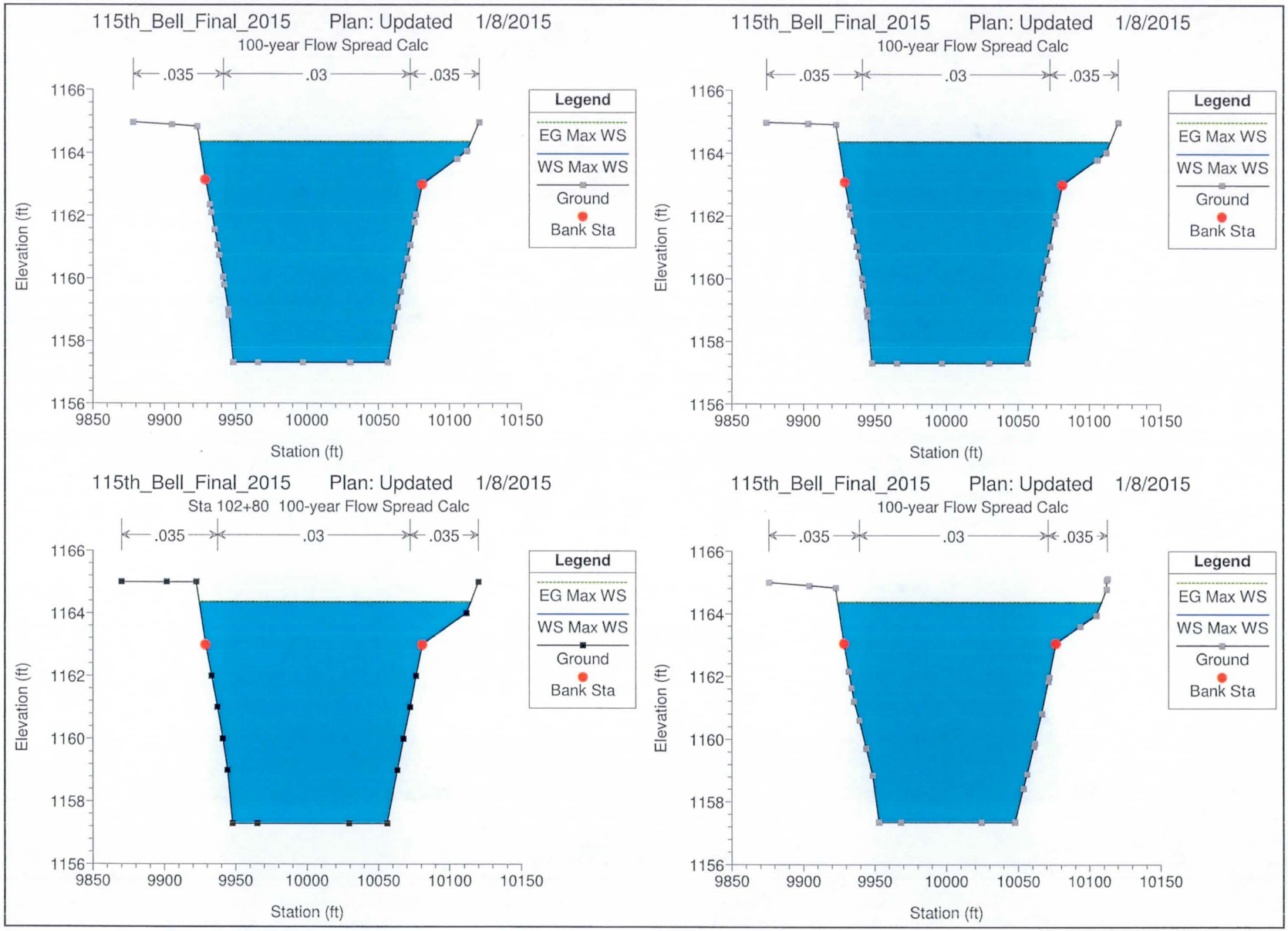
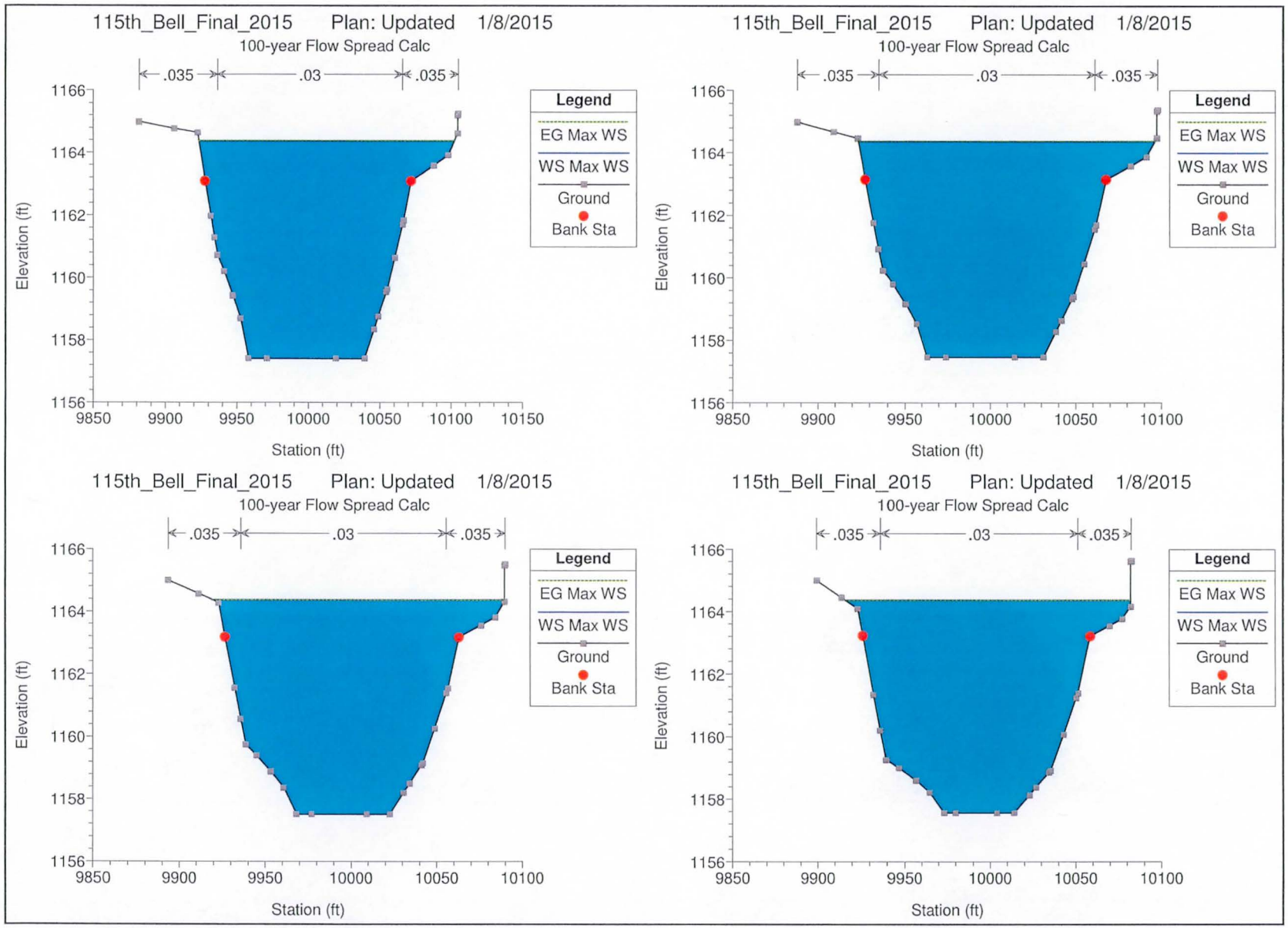
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
10150
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
10150
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
10150
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
10150
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
10150
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
Sta 102+80 100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
10150
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
10150
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
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1162
1160
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1156
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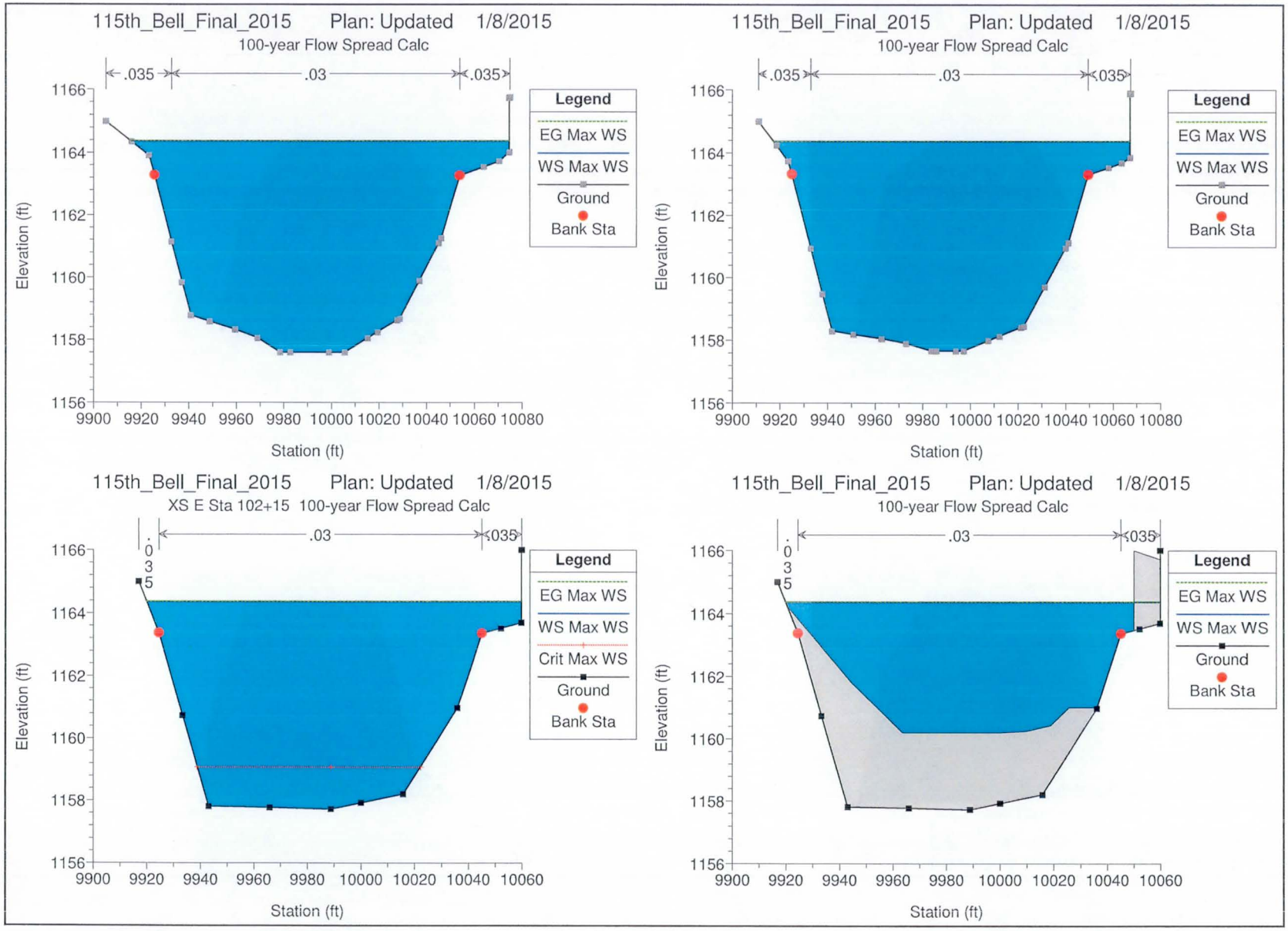
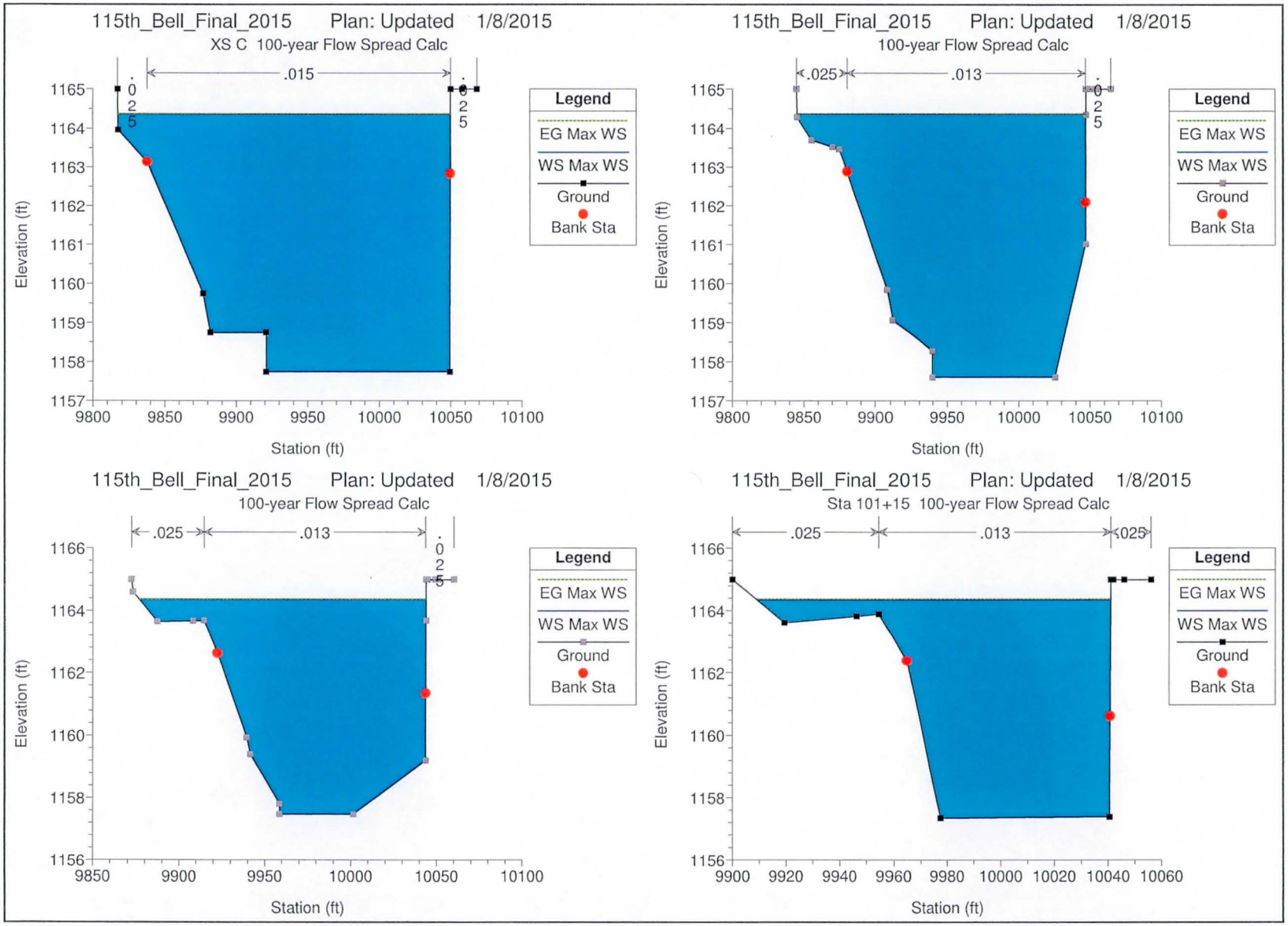
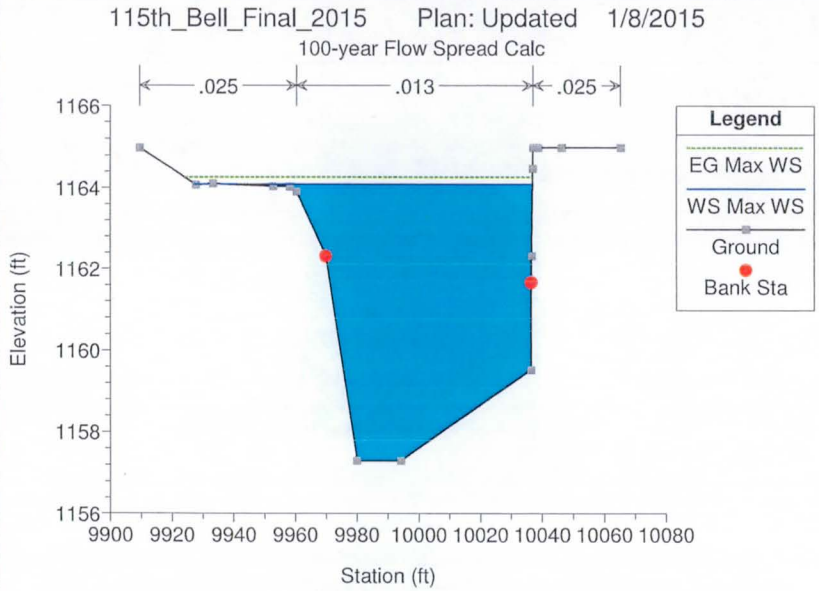
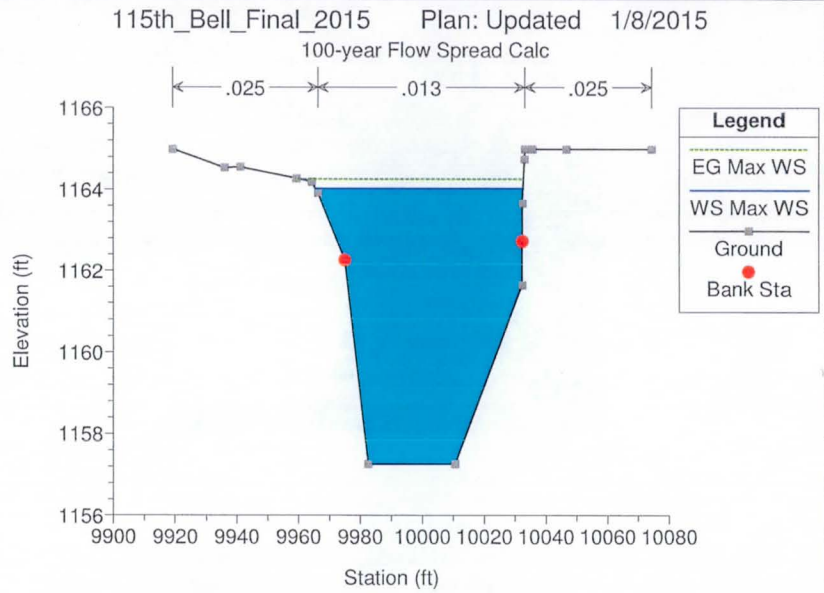
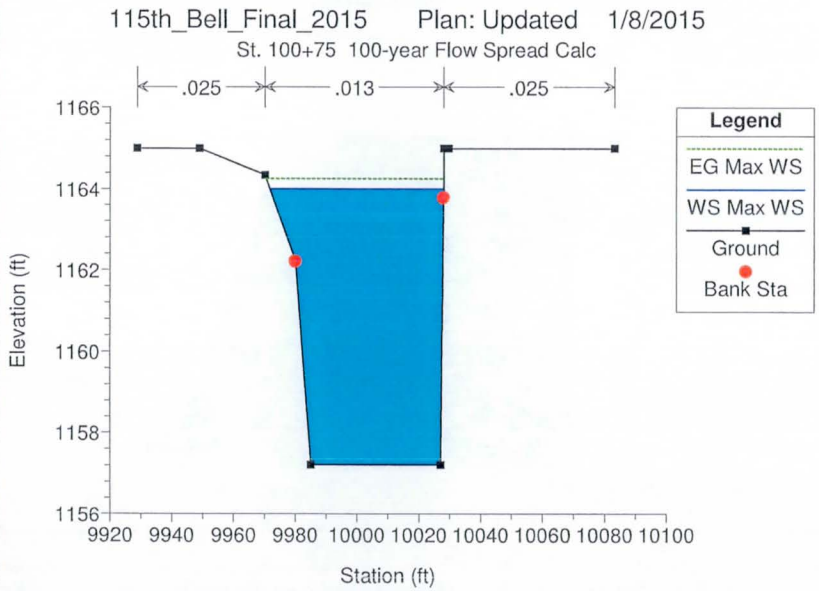
9900
9950
10000
10050
10100
Station (ft)

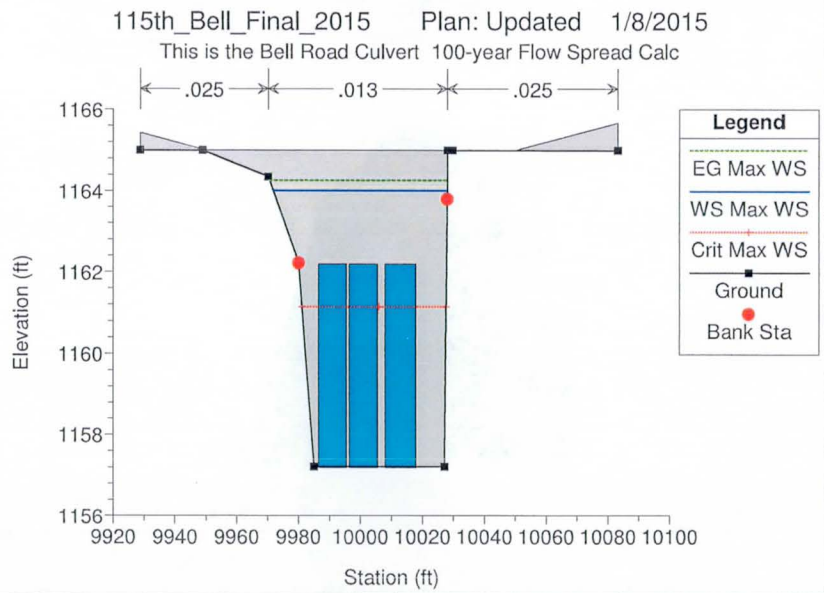

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
XS E Sta 102+15 100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)

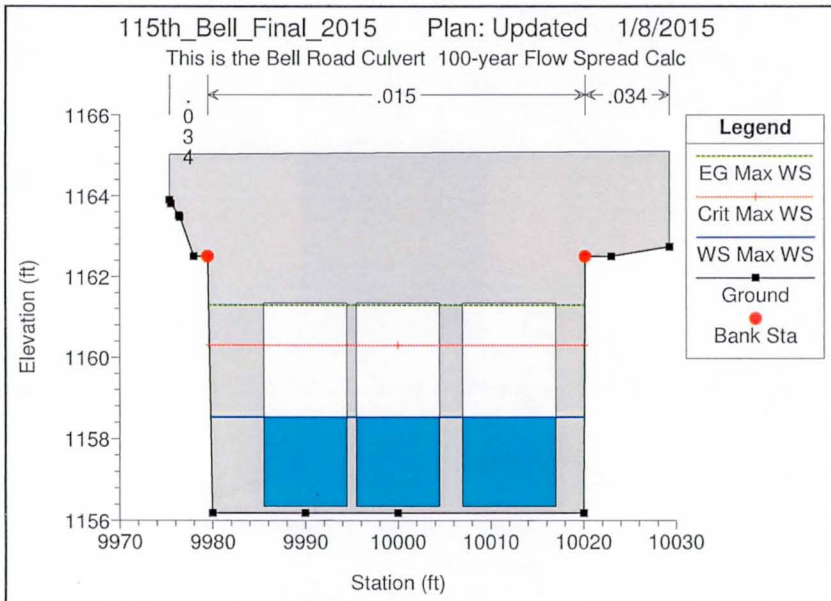

115th_Bell_Final_2015 Plan: Updated 1/8/2015
XS C 100-year Flow Spread Calc
.015
.025
.025
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.025
.013
.025
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.025
.013
.025
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
Sta 101+15 100-year Flow Spread Calc
.025
.013
.025
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)

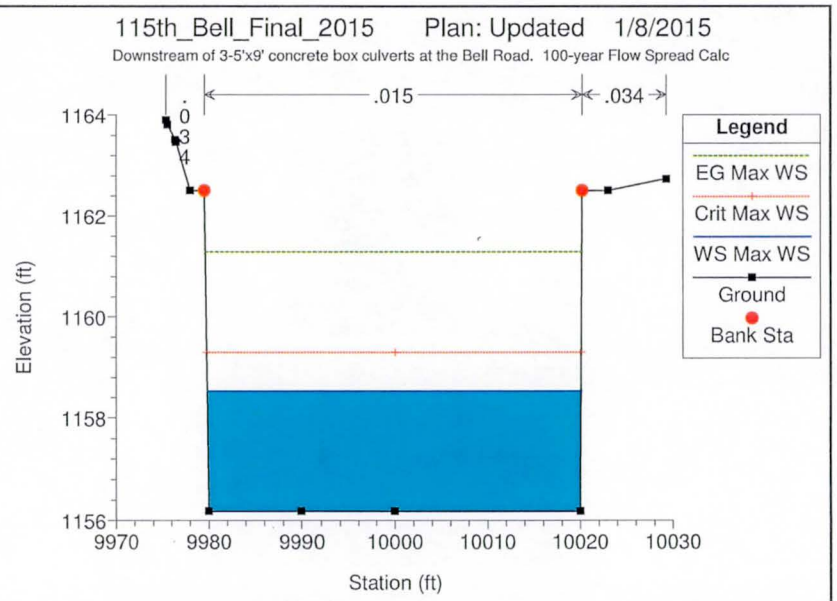

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.025
.013
.025
Elevation (ft)
1166
1164
1162
1160
1158
1156
9900 9920 9940 9960 9980 10000 10020 10040 10060 10080
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

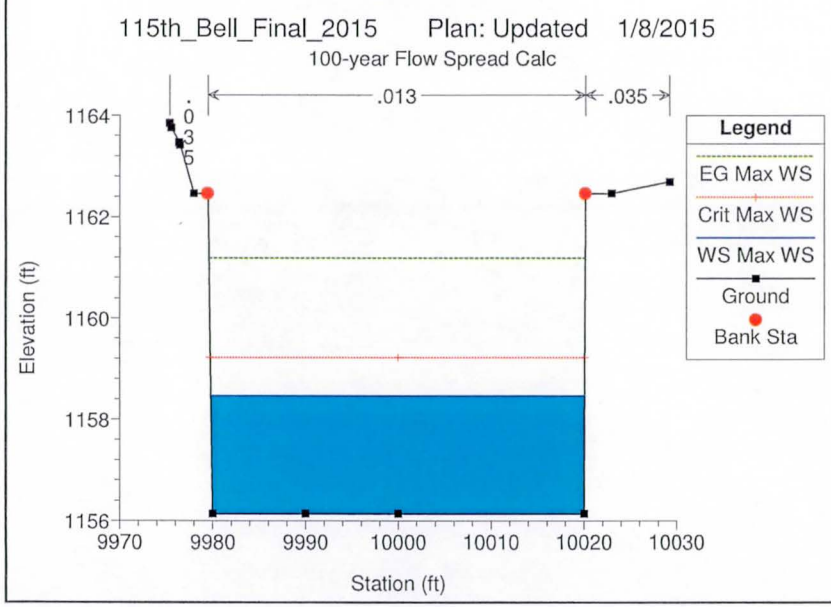

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.025
.013
.025
Elevation (ft)
1166
1164
1162
1160
1158
1156
9900 9920 9940 9960 9980 10000 10020 10040 10060 10080
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

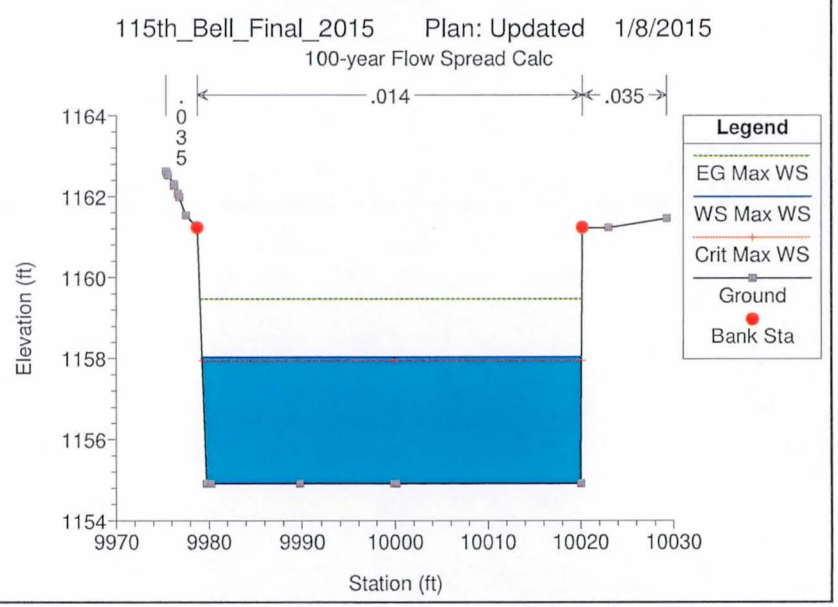

115th_Bell_Final_2015 Plan: Updated 1/8/2015
St. 100+75 100-year Flow Spread Calc
.025
.013
.025
Elevation (ft)
1166
1164
1162
1160
1158
1156
9920 9940 9960 9980 10000 10020 10040 10060 10080 10100
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

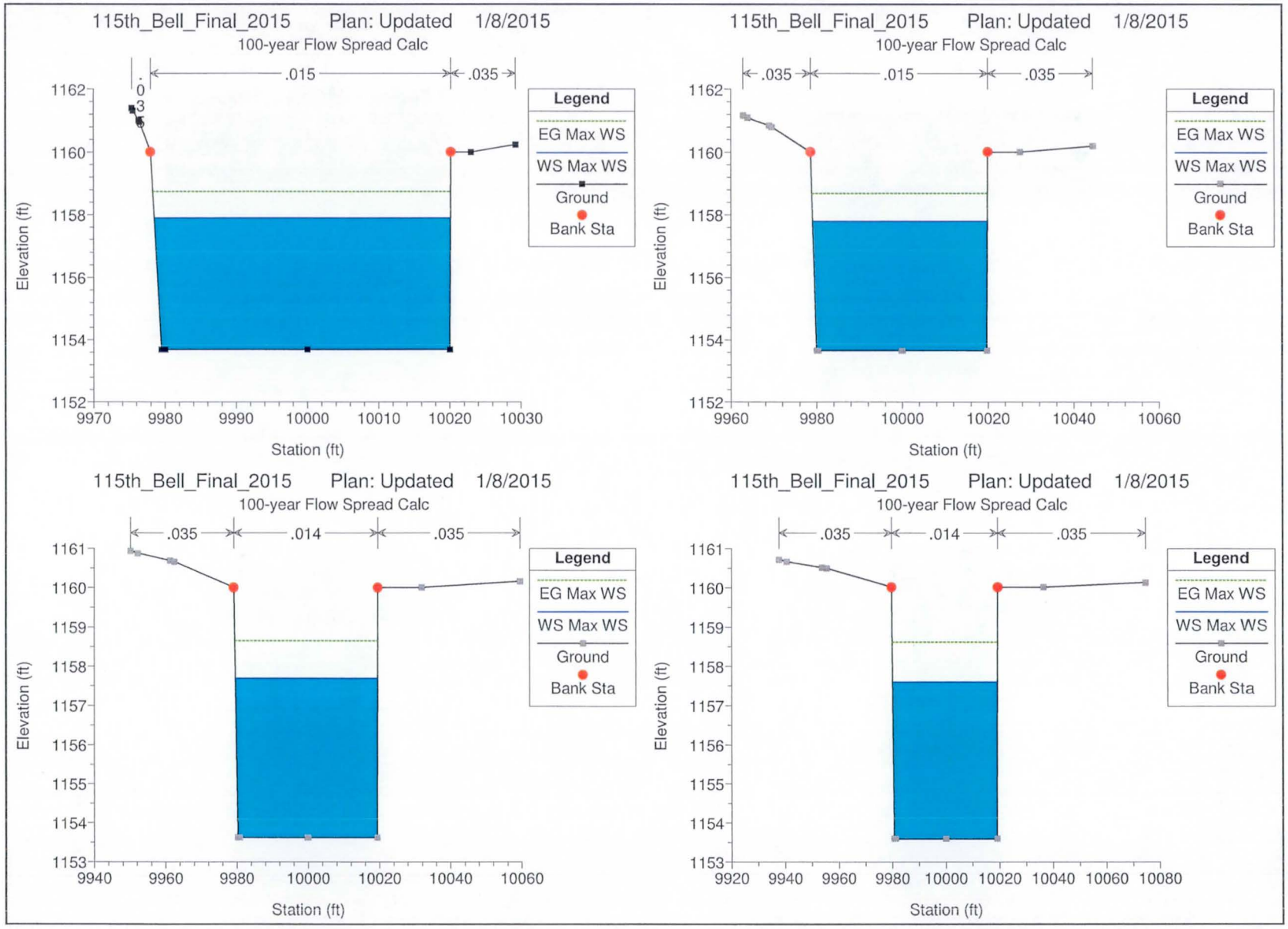

115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the Bell Road Culvert 100-year Flow Spread Calc
.025
.013
.025
Elevation (ft)
1166
1164
1162
1160
1158
1156
9920 9940 9960 9980 10000 10020 10040 10060 10080 10100
Station (ft)
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta

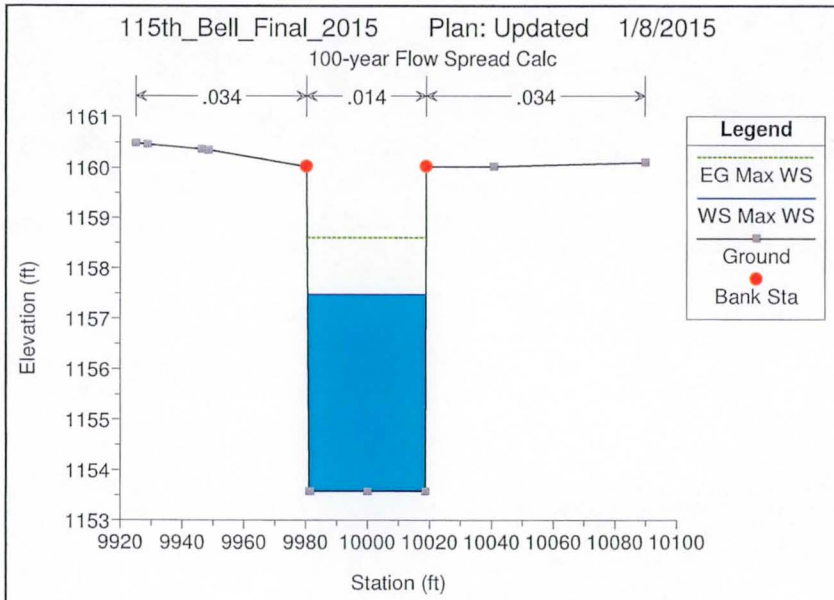

115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the Bell Road Culvert 100-year Flow Spread Calc
.015
.034
.034
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)

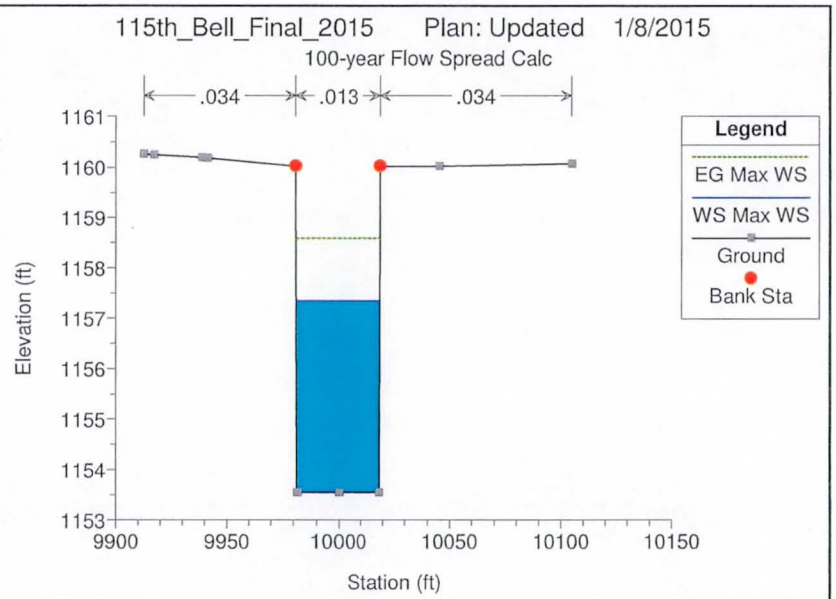

115th_Bell_Final_2015 Plan: Updated 1/8/2015
Downstream of 3-5'x9' concrete box culverts at the Bell Road. 100-year Flow Spread Calc
.015
.034
.034
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)

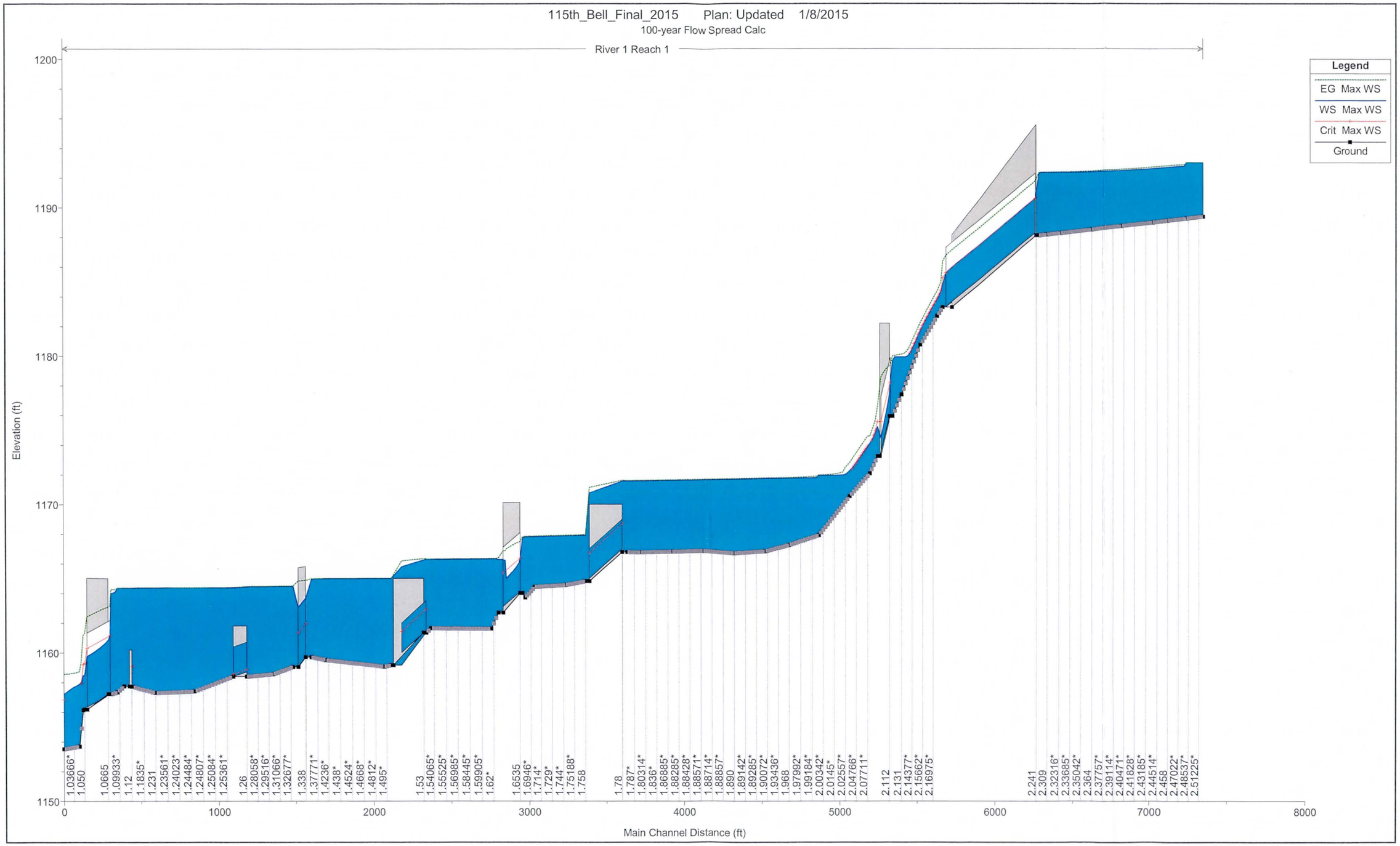

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.013
.035
.035
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)

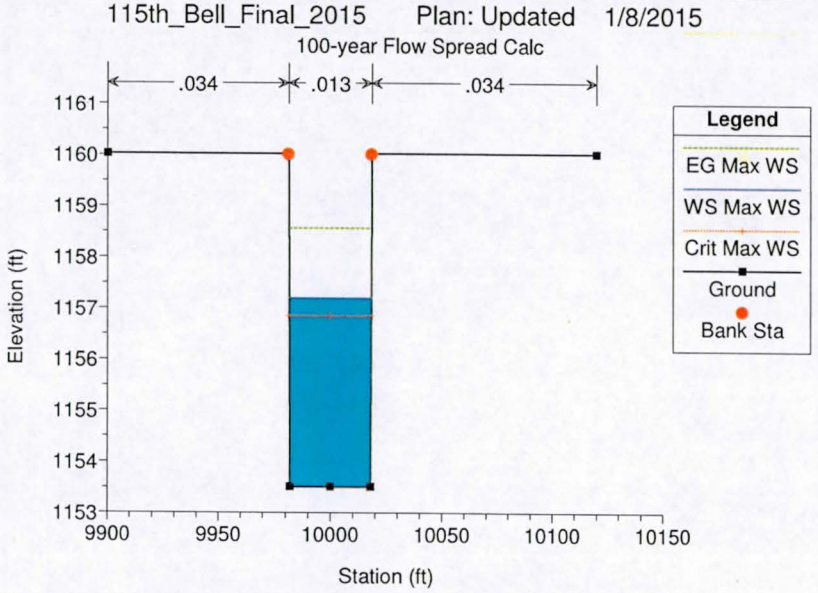

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.014
.035
.035
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)

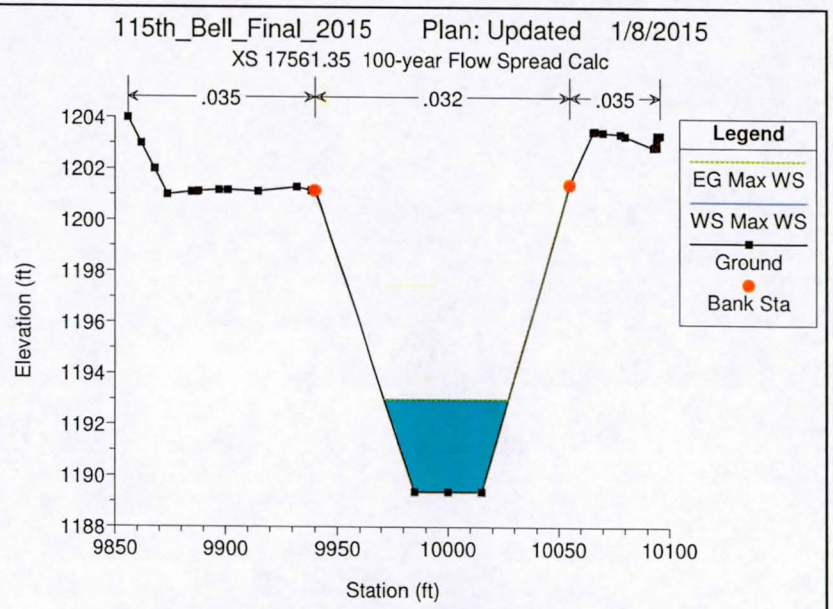

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.015
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.015
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.014
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.014
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)

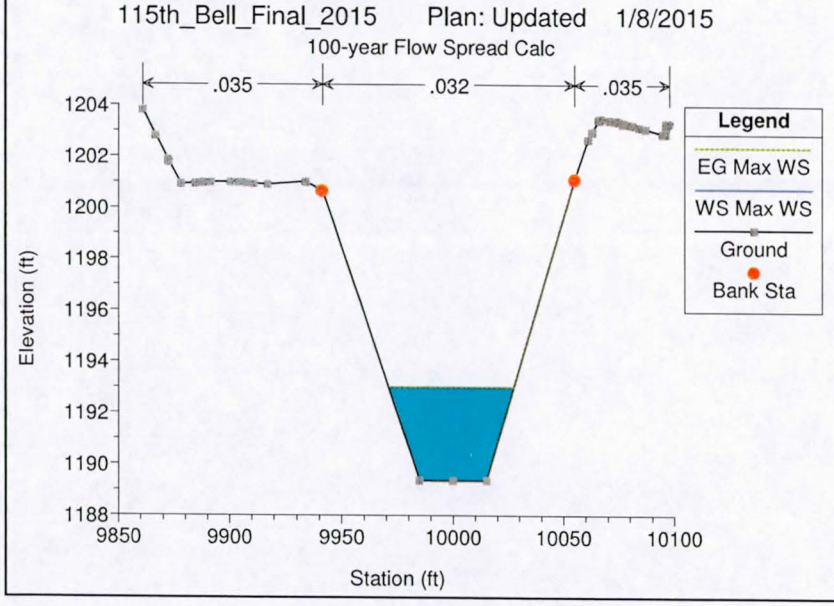

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.014
.034
Elevation (ft)
1161
1160
1159
1158
1157
1156
1155
1154
1153
9920 9940 9960 9980 10000 10020 10040 10060 10080 10100
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

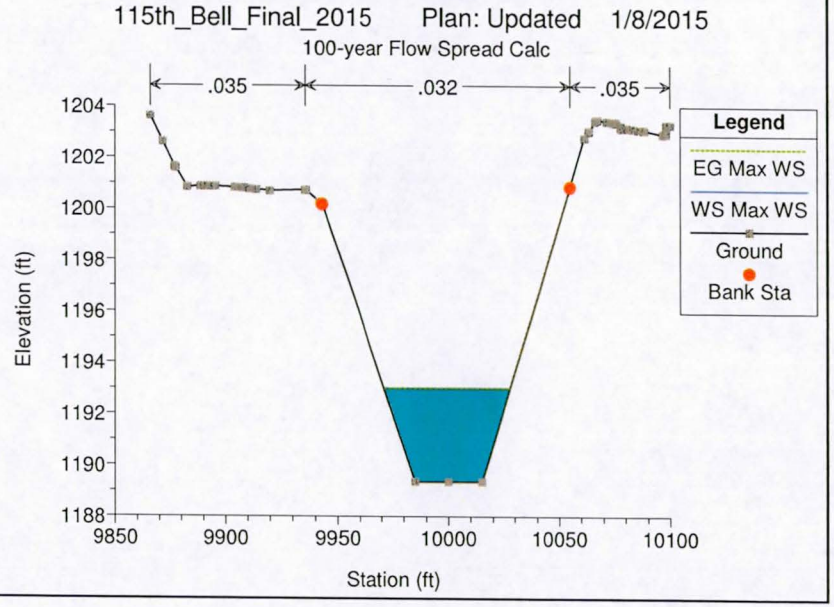

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.013
.034
Elevation (ft)
1161
1160
1159
1158
1157
1156
1155
1154
1153
9900 9950 10000 10050 10100 10150
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

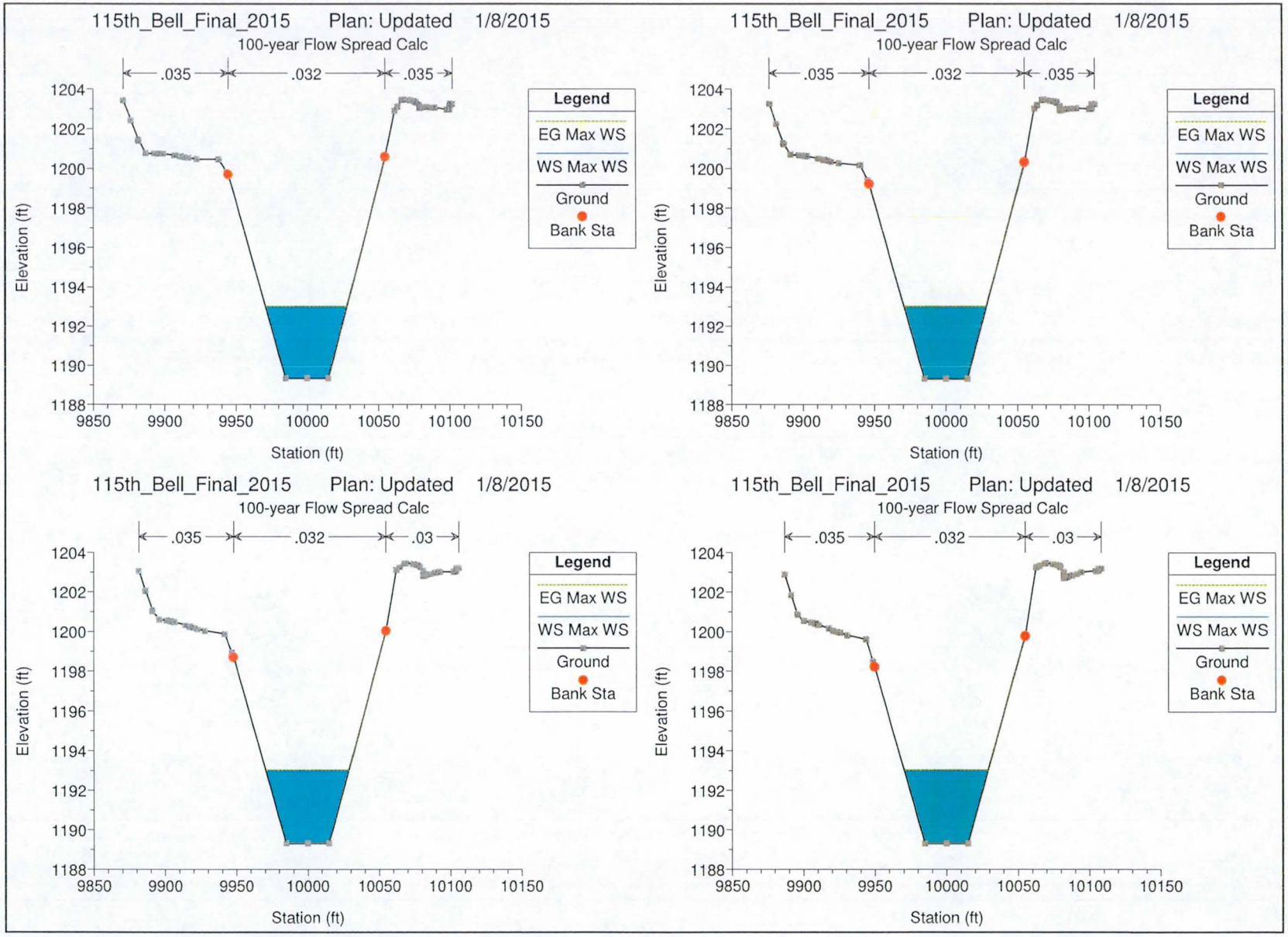

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
River 1 Reach 1
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Elevation (ft)
1200
1190
1180
1170
1160
1150
0
1000
2000
3000
4000
5000
6000
7000
8000
Main Channel Distance (ft)
1.03666*
1.050
1.0665
1.09933*
1.12
1.1835*
1.231
1.23561*
1.24023*
1.24484*
1.24807*
1.25084*
1.25361*
1.26
1.28058*
1.29516*
1.31066*
1.32677*
1.338
1.37771*
1.4236*
1.438*
1.4524*
1.4668*
1.4812*
1.495*
1.53
1.54065*
1.55525*
1.56985*
1.58445*
1.59905*
1.62*
1.6535
1.6946*
1.714*
1.729*
1.744*
1.75188*
1.758
1.78
1.787*
1.80314*
1.836*
1.86885*
1.88285*
1.88428*
1.88571*
1.88714*
1.88857*
1.890
1.89142*
1.89285*
1.90072*
1.93436*
1.968
1.97992*
1.99184*
2.00342*
2.0145*
2.02557*
2.04766*
2.07711*
2.112
2.131
2.14377*
2.15662*
2.16975*
2.241
2.309
2.32316*
2.33685*
2.35042*
2.364
2.37757*
2.39114*
2.40471*
2.41828*
2.43185*
2.44514*
2.458
2.47022*
2.48537*
2.51225*

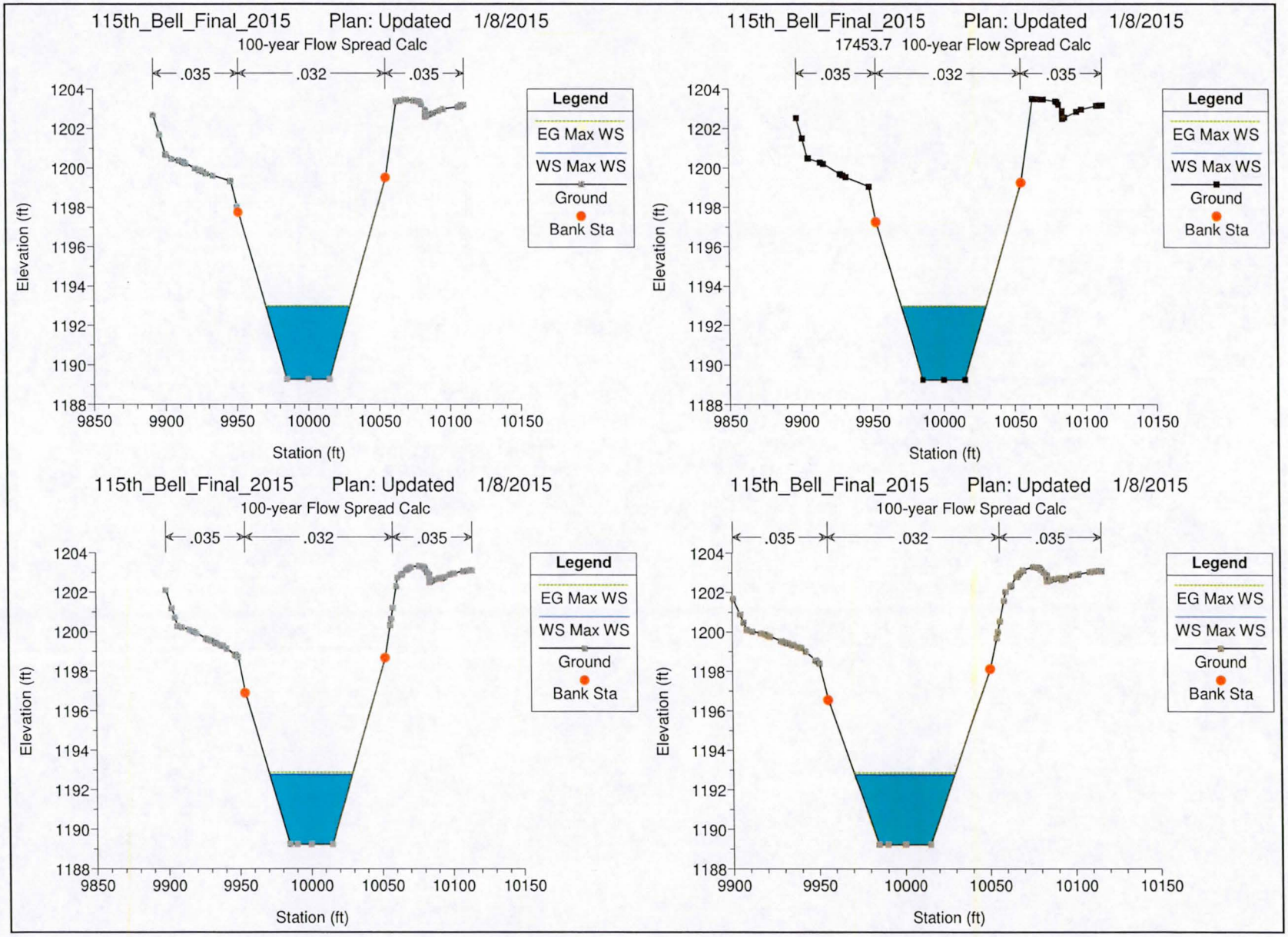

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.013
.034
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta

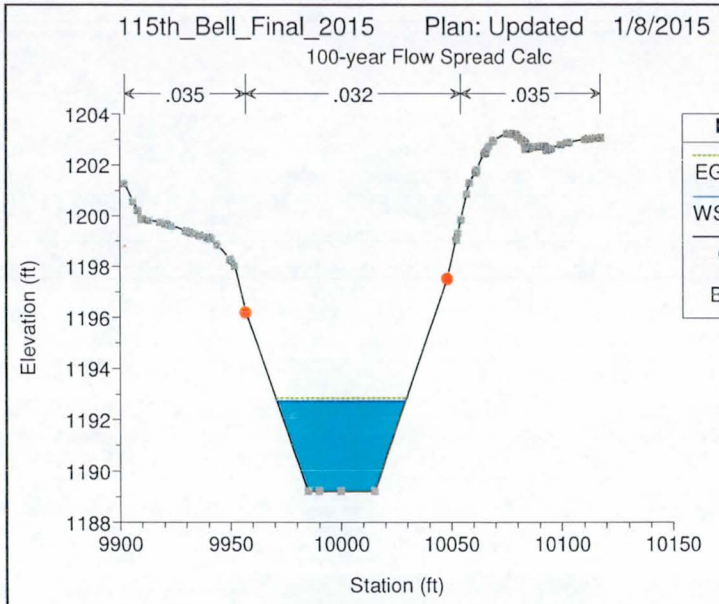

115th_Bell_Final_2015 Plan: Updated 1/8/2015
XS 17561.35 100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
17453.7 100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1204
1202
1200
1198
1196
1194
1192
1190
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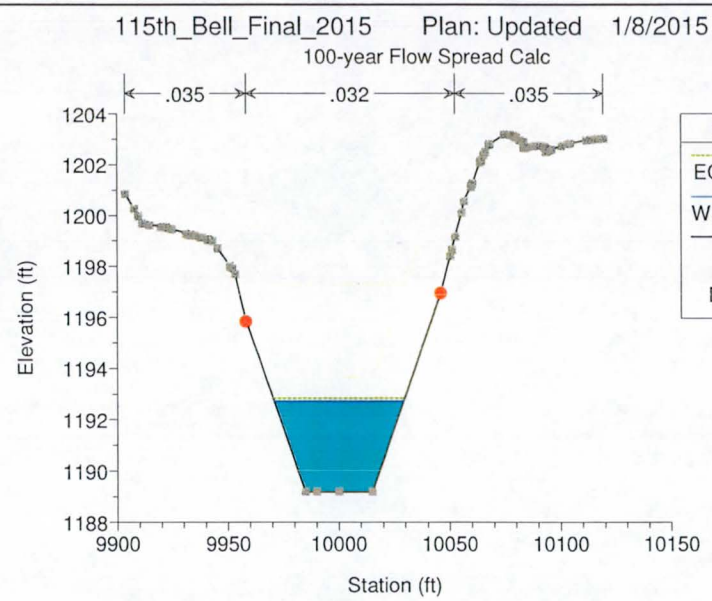
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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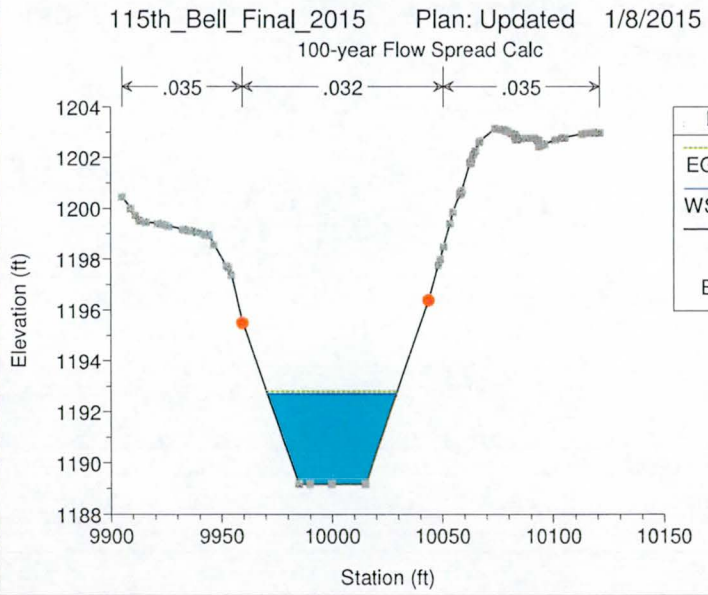
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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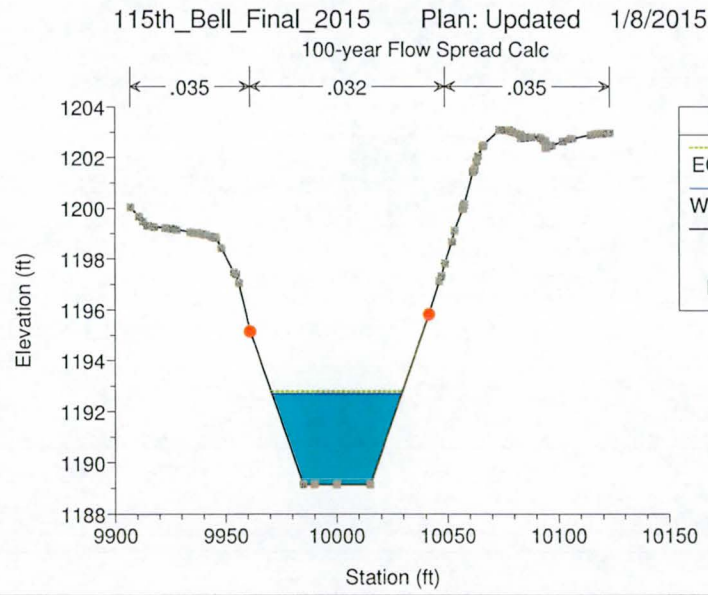
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100-year Flow Spread Calc
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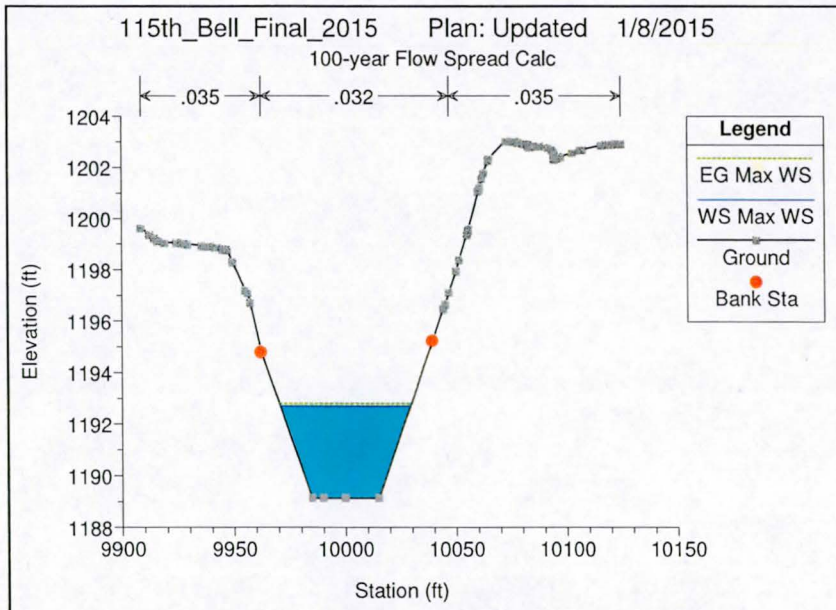
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100-year Flow Spread Calc
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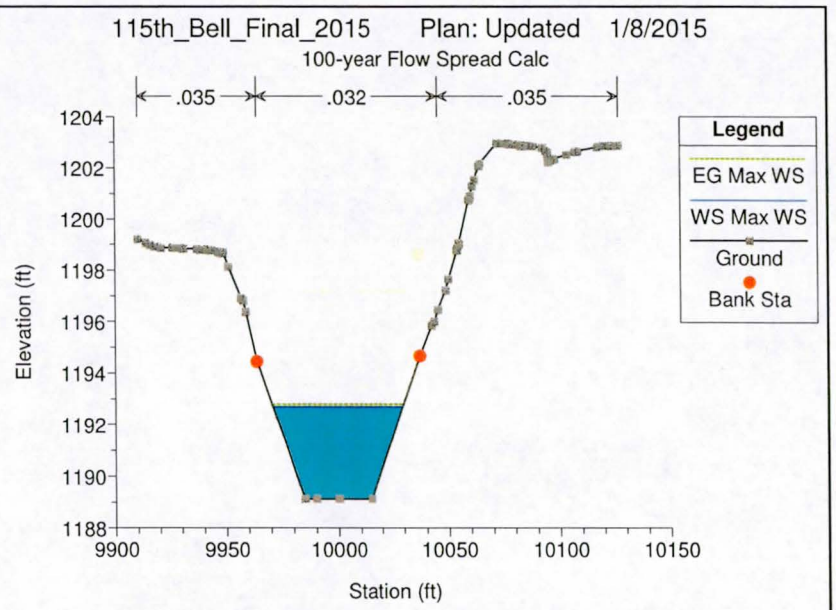
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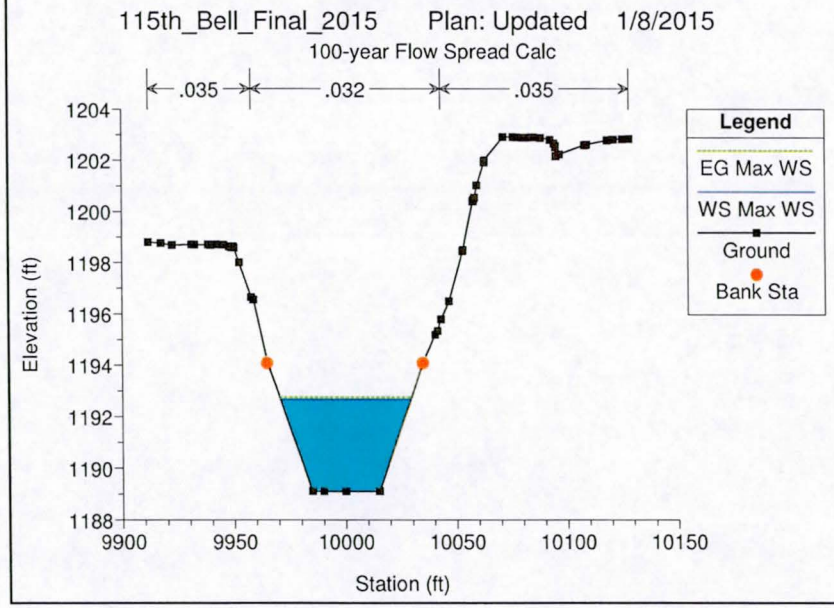
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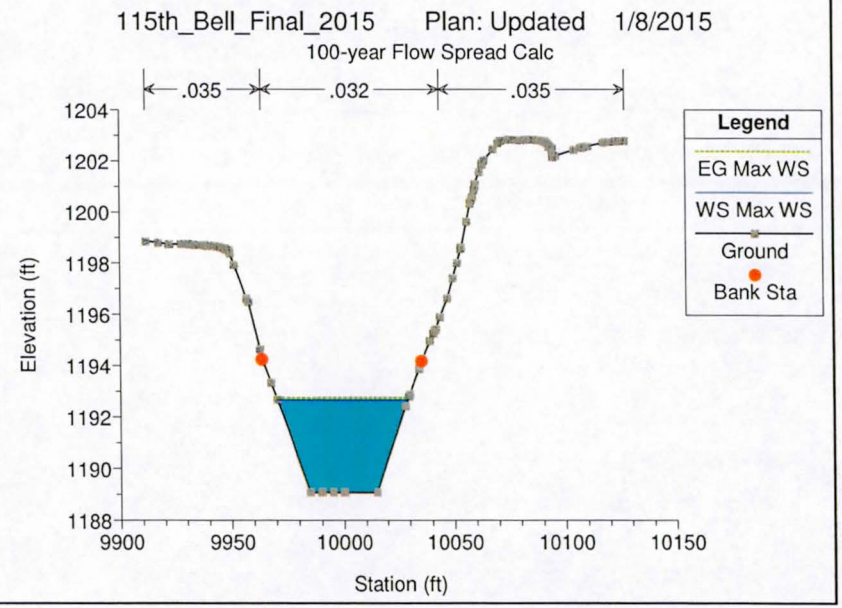
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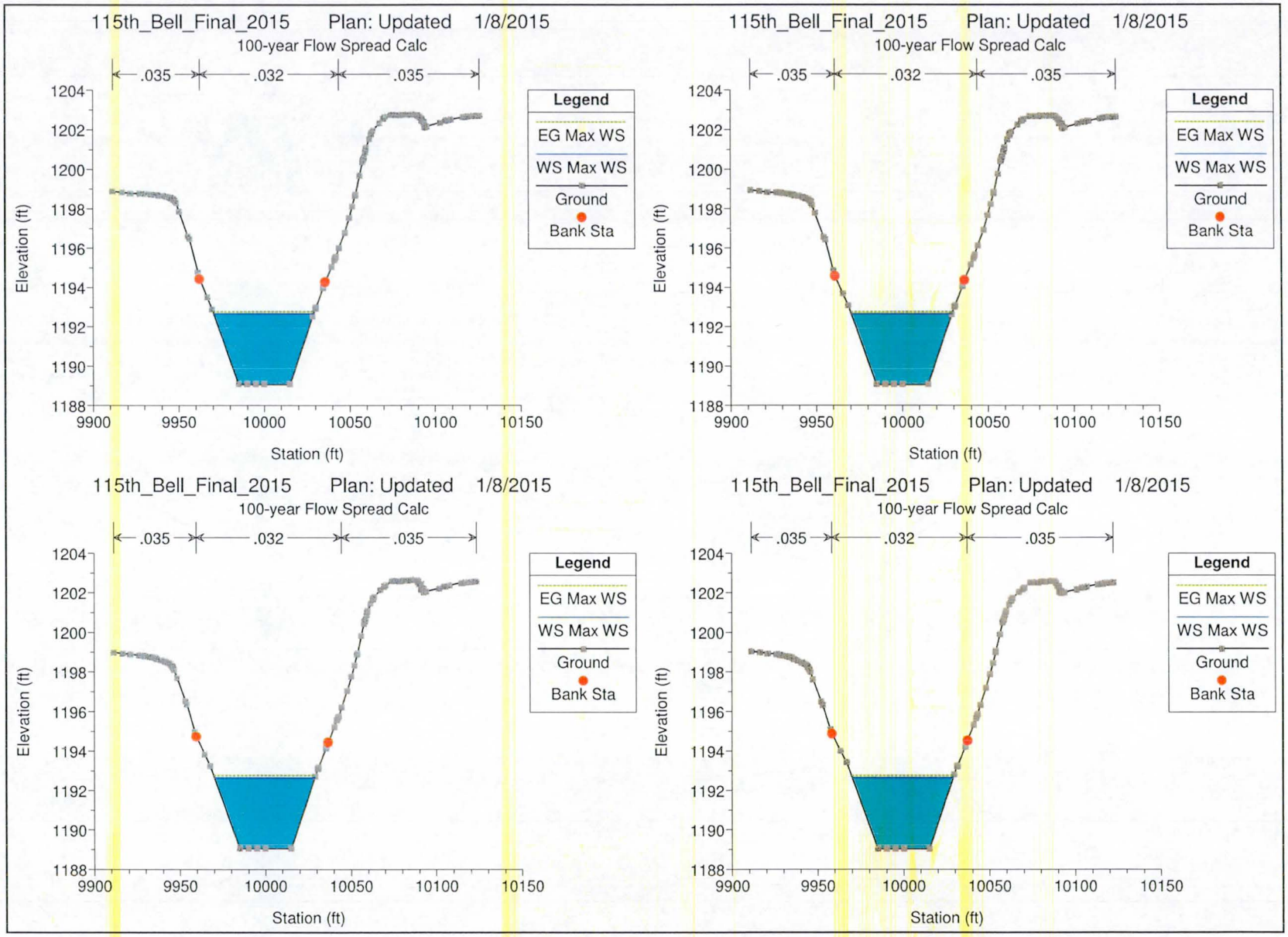
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100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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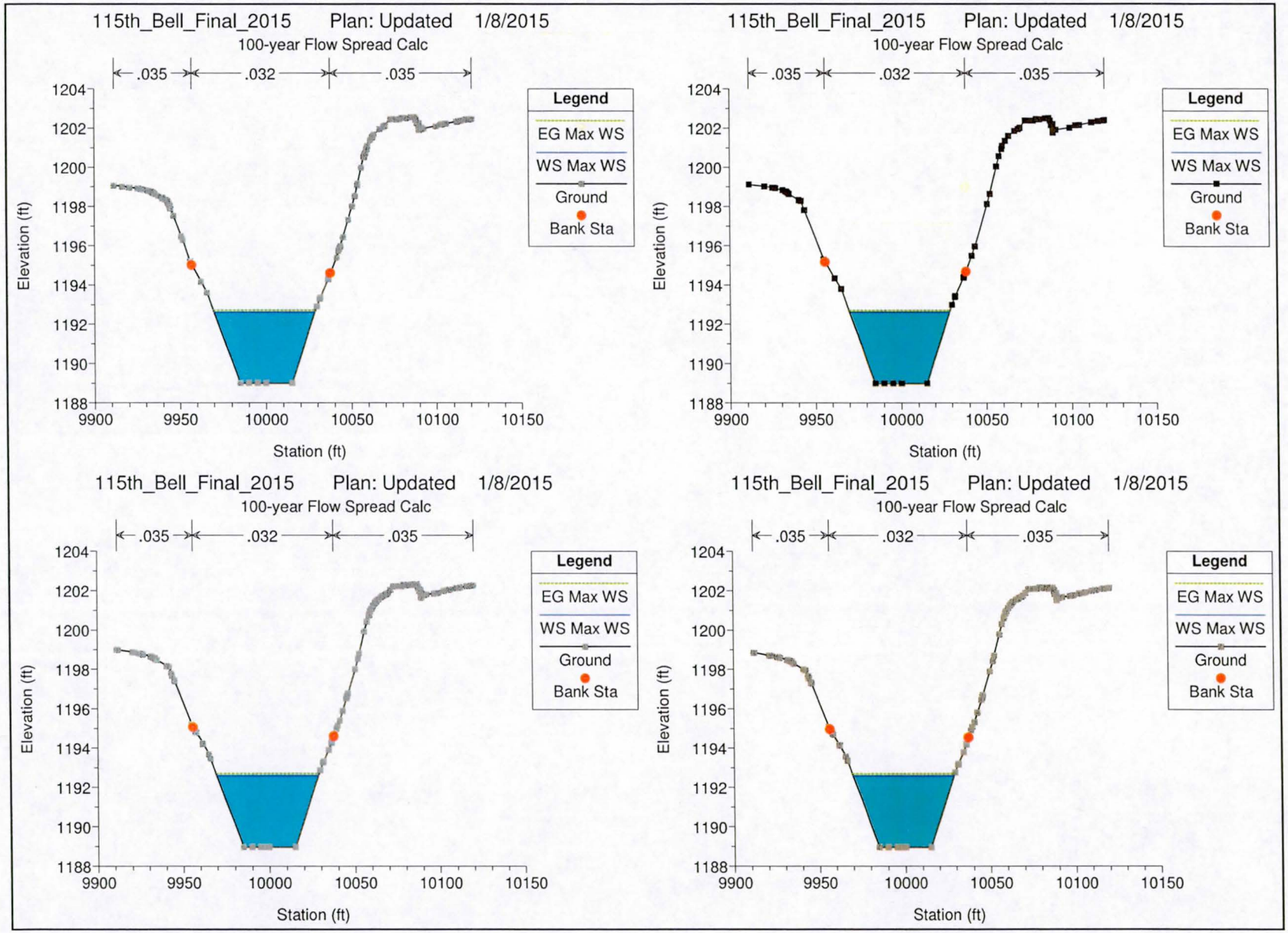
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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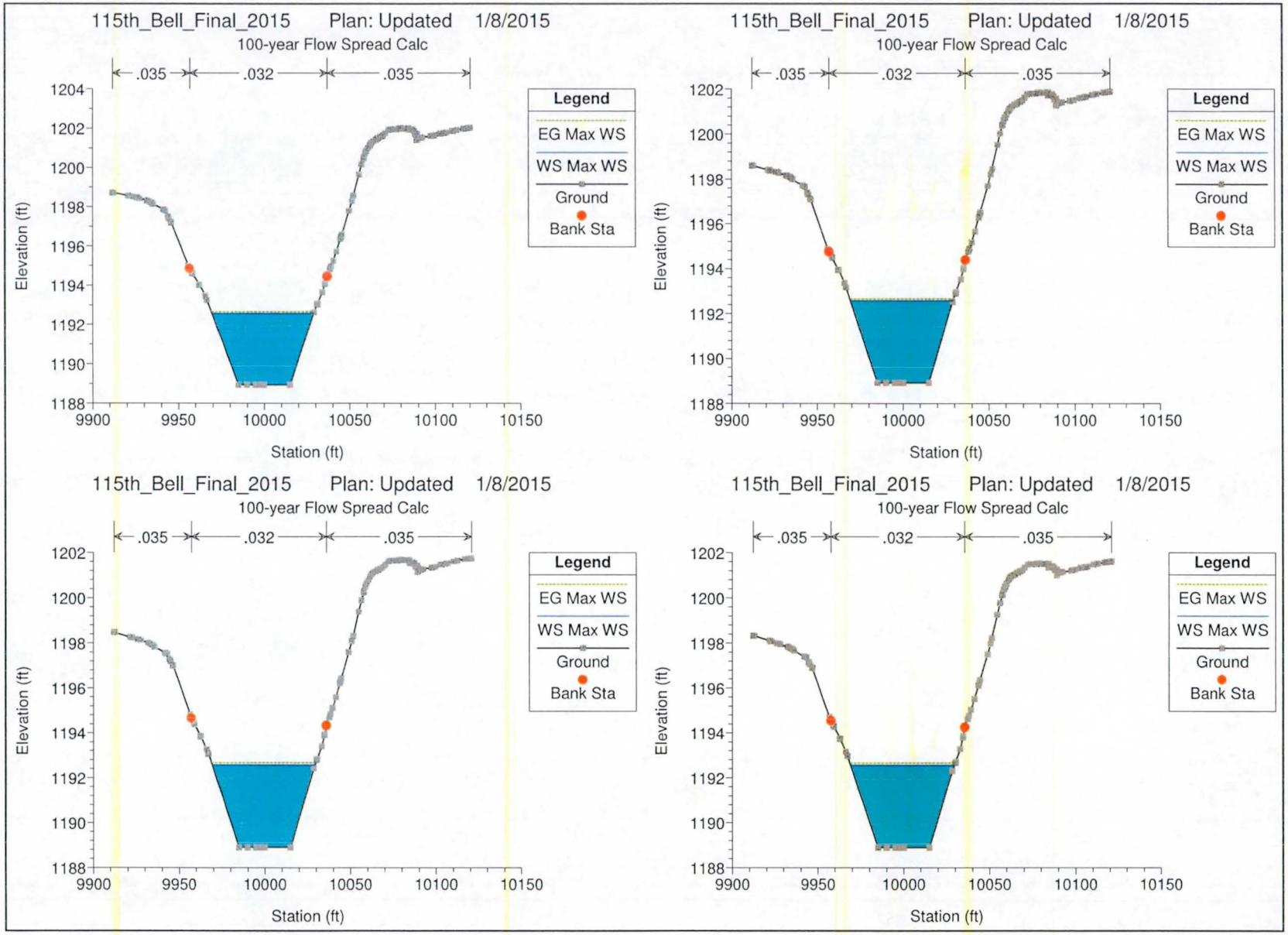
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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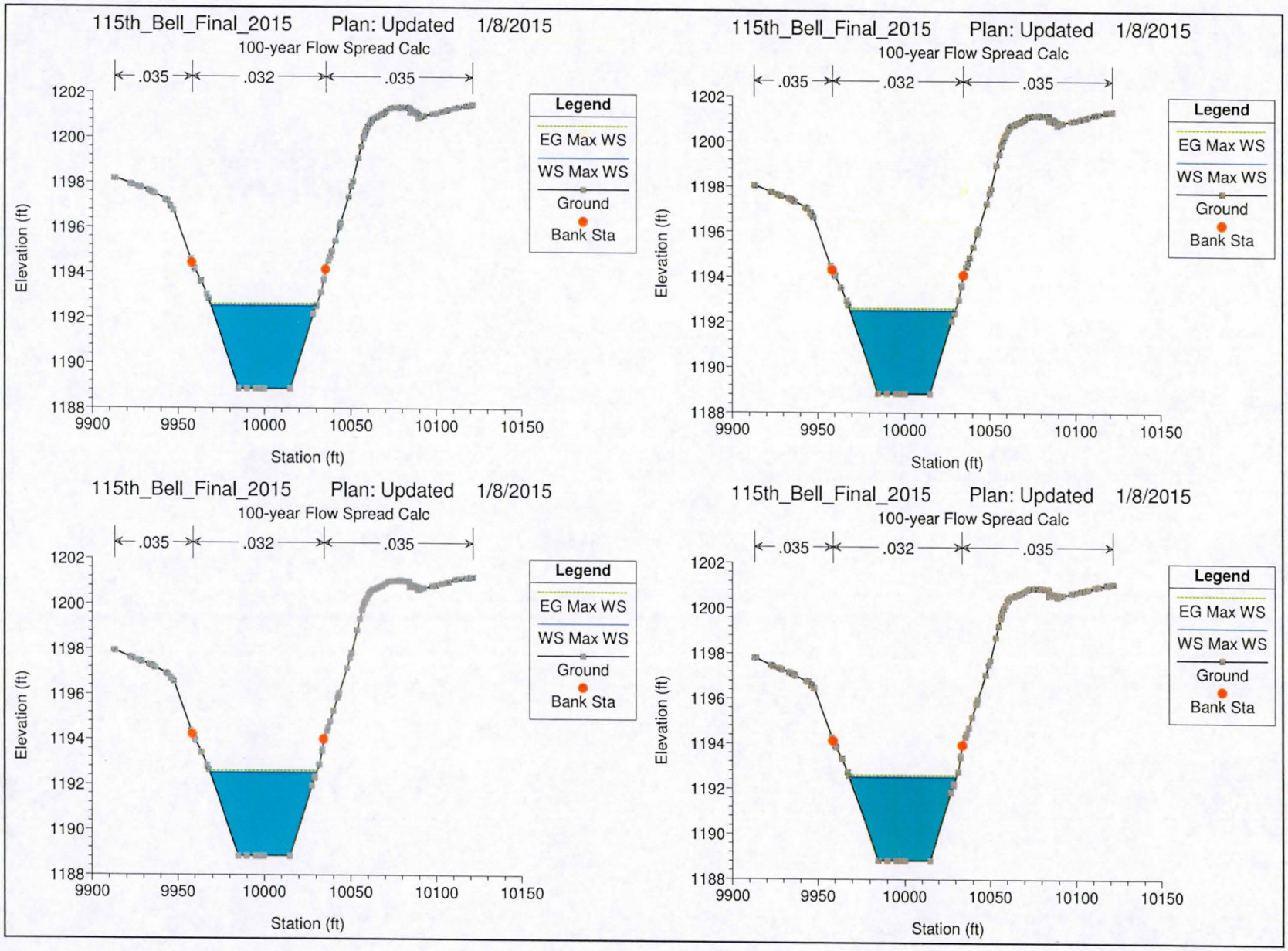
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100-year Flow Spread Calc
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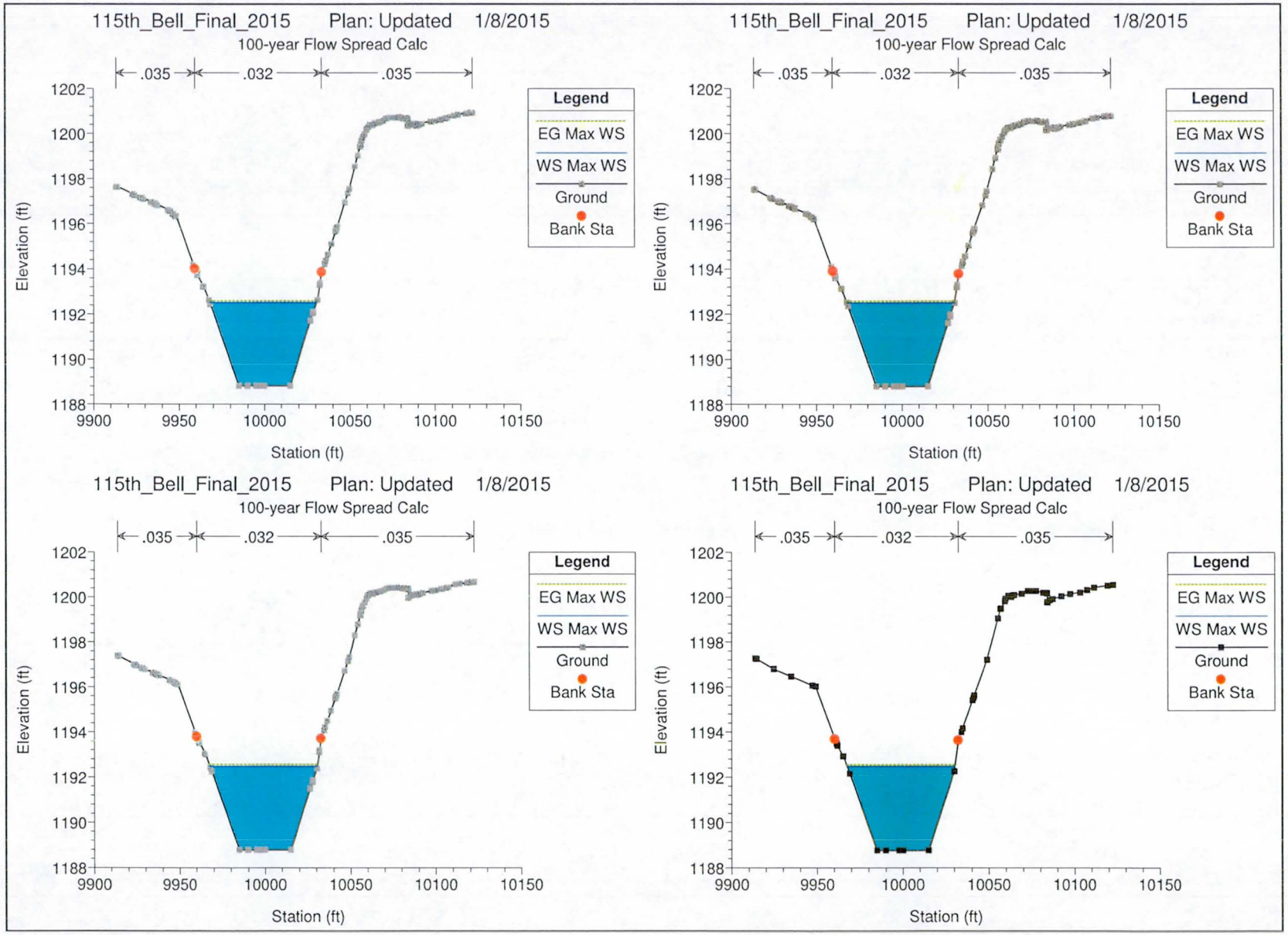
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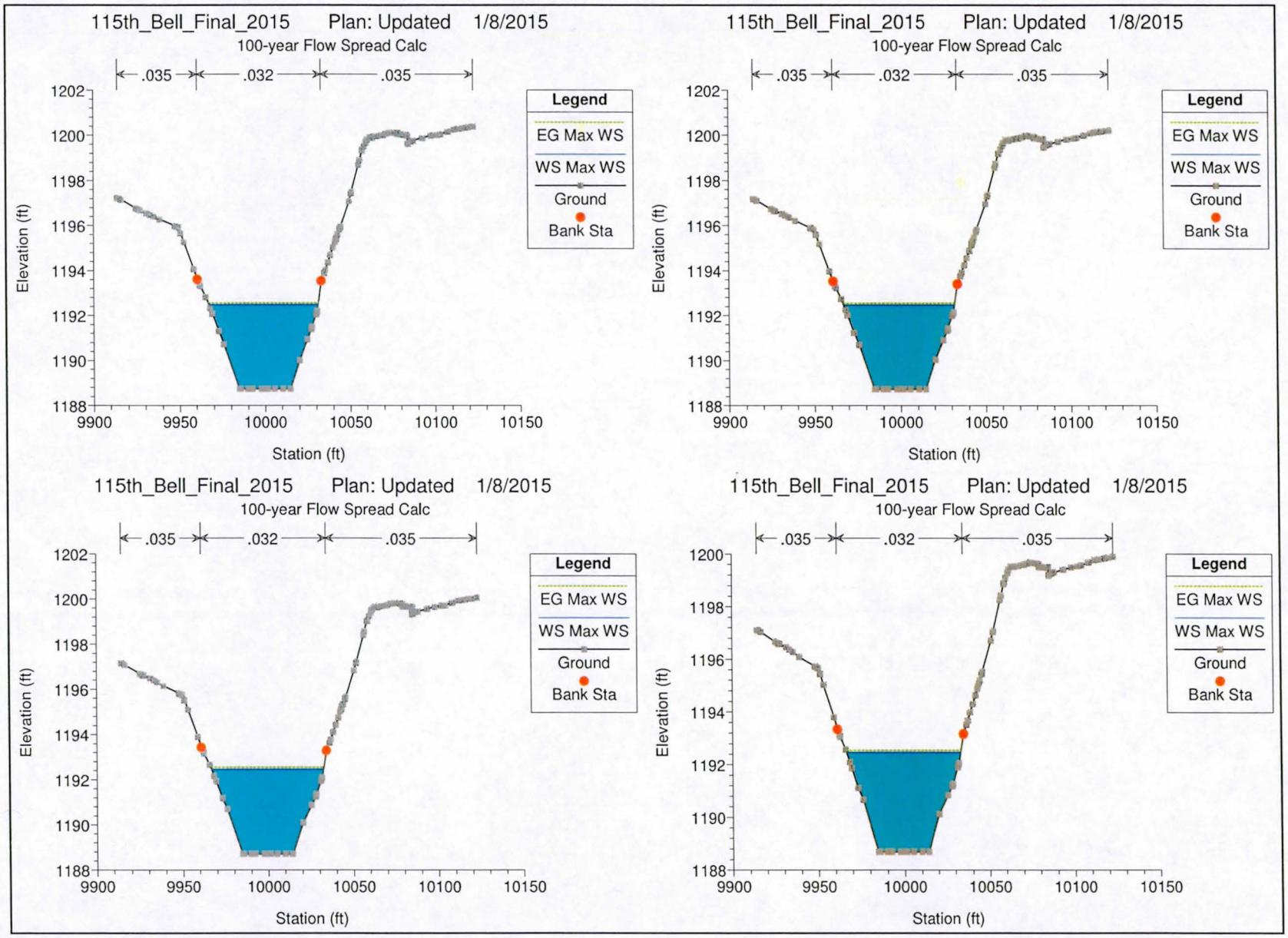
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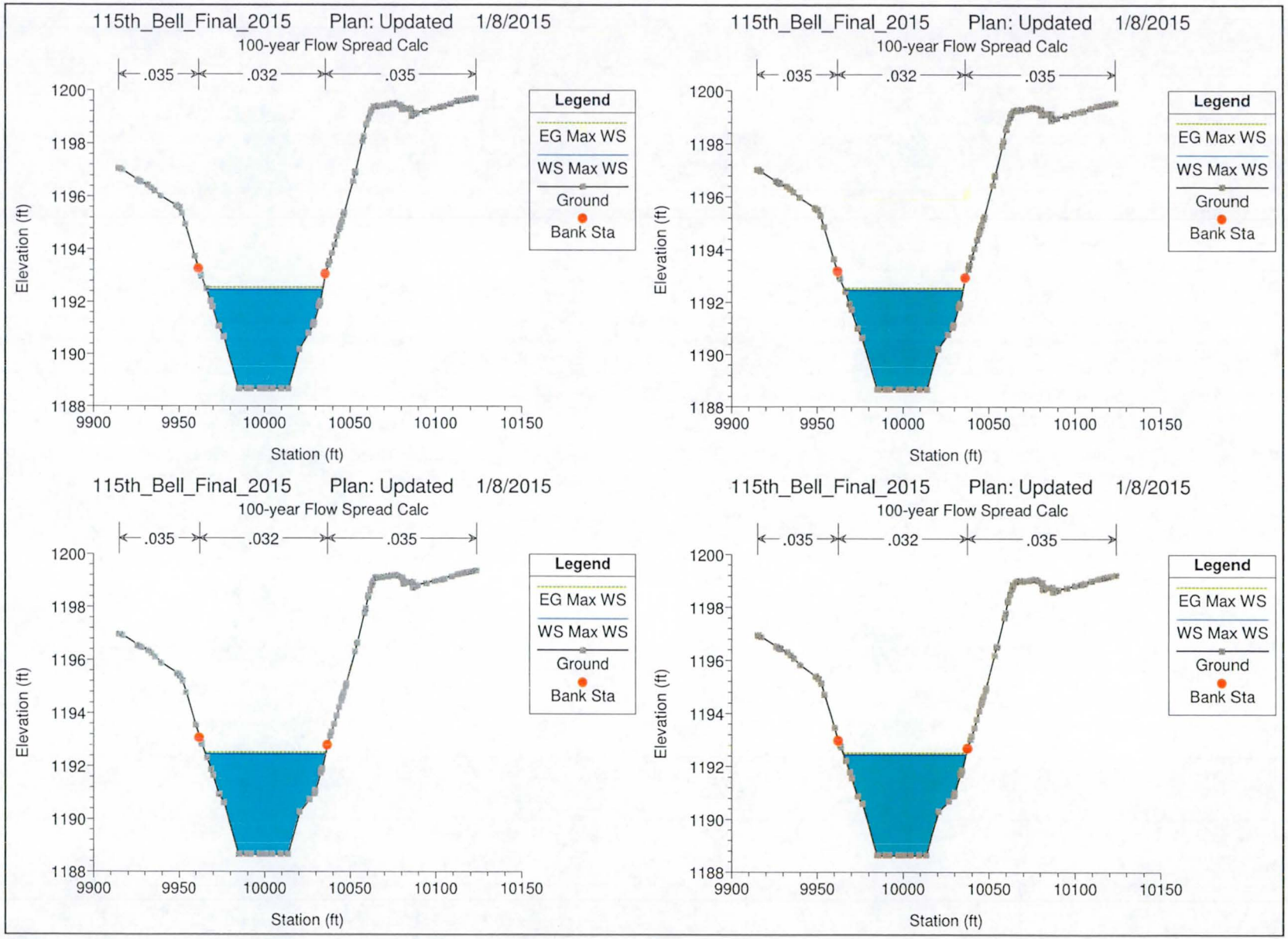
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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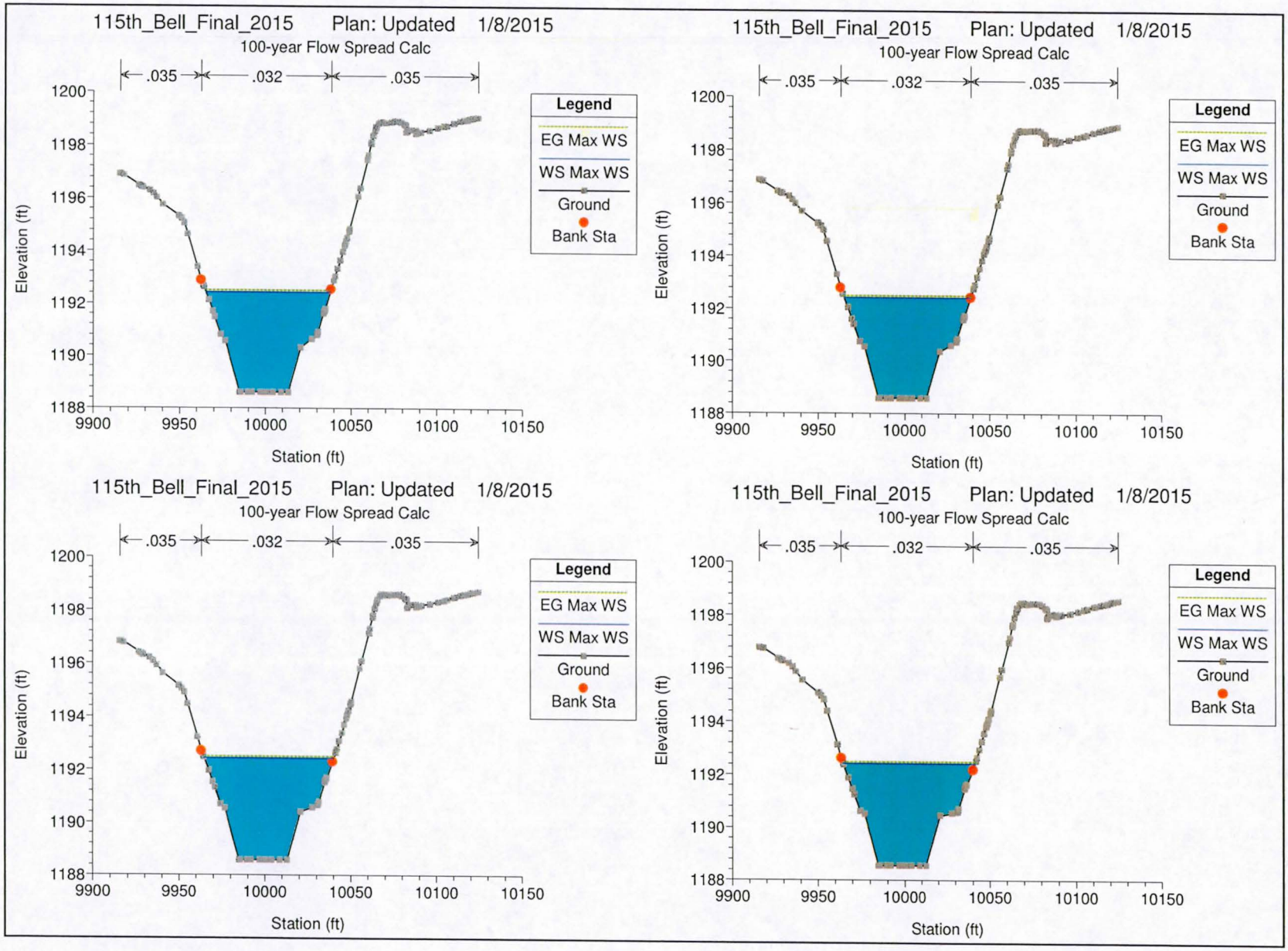
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100-year Flow Spread Calc
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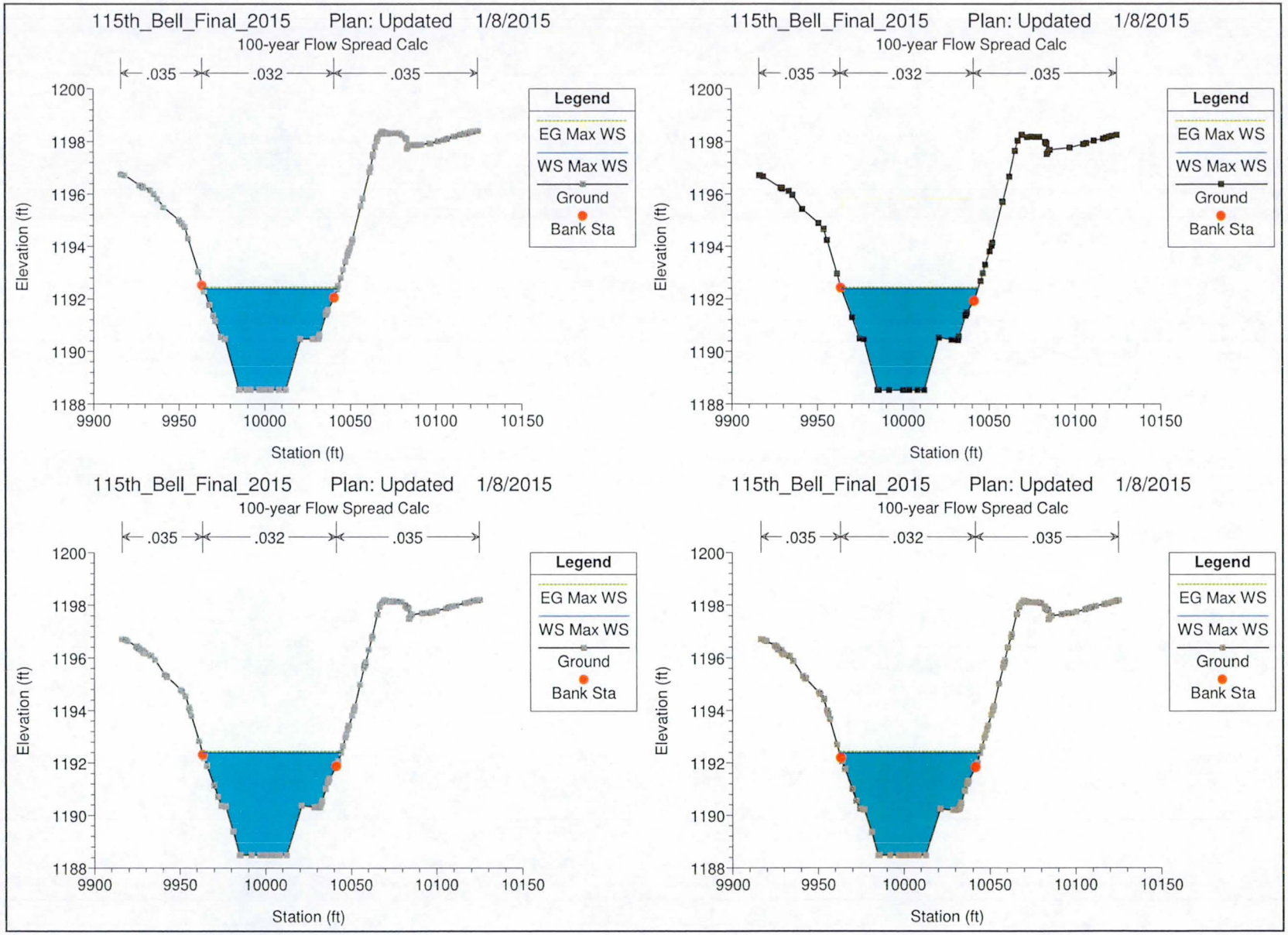
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100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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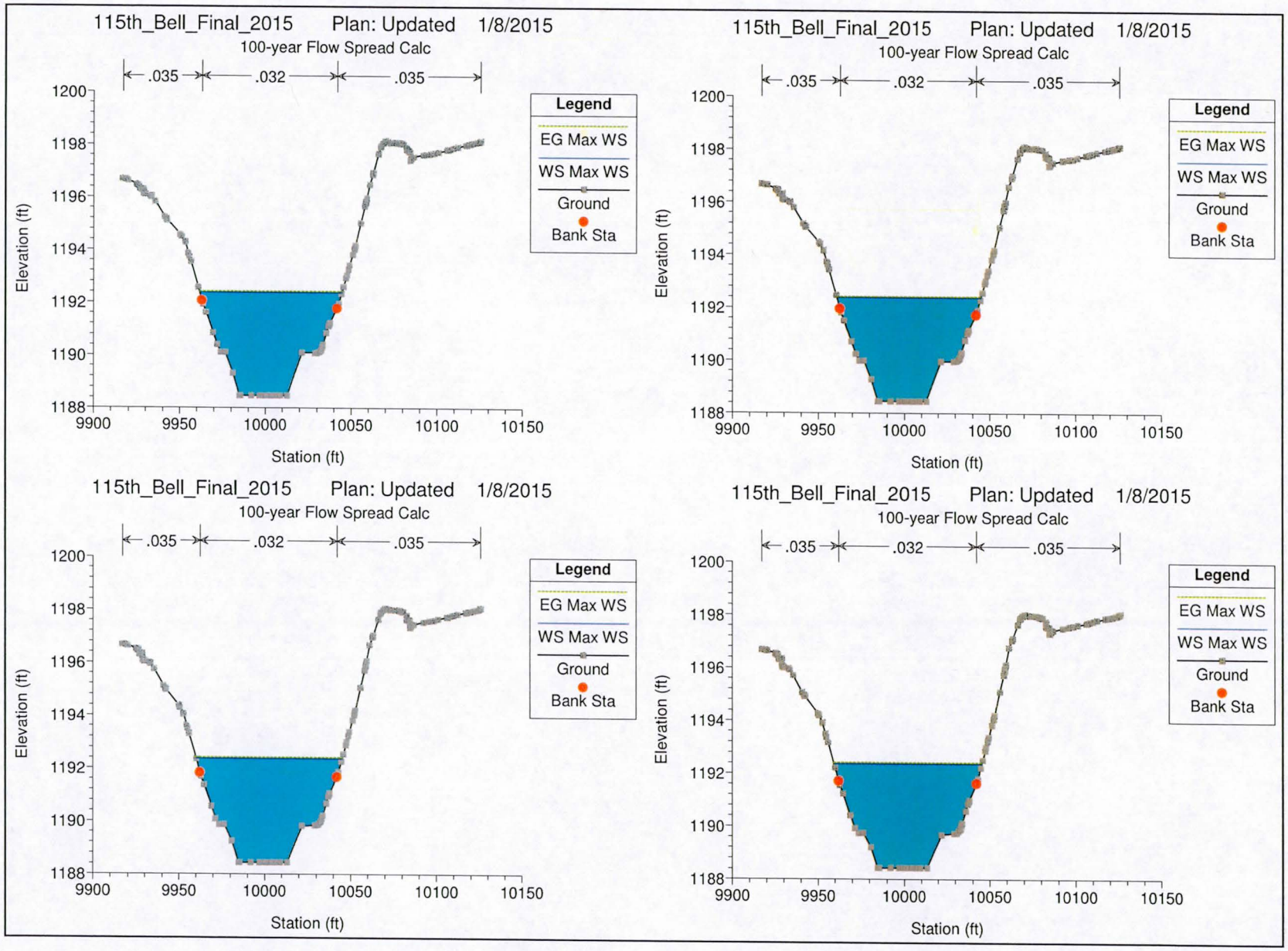
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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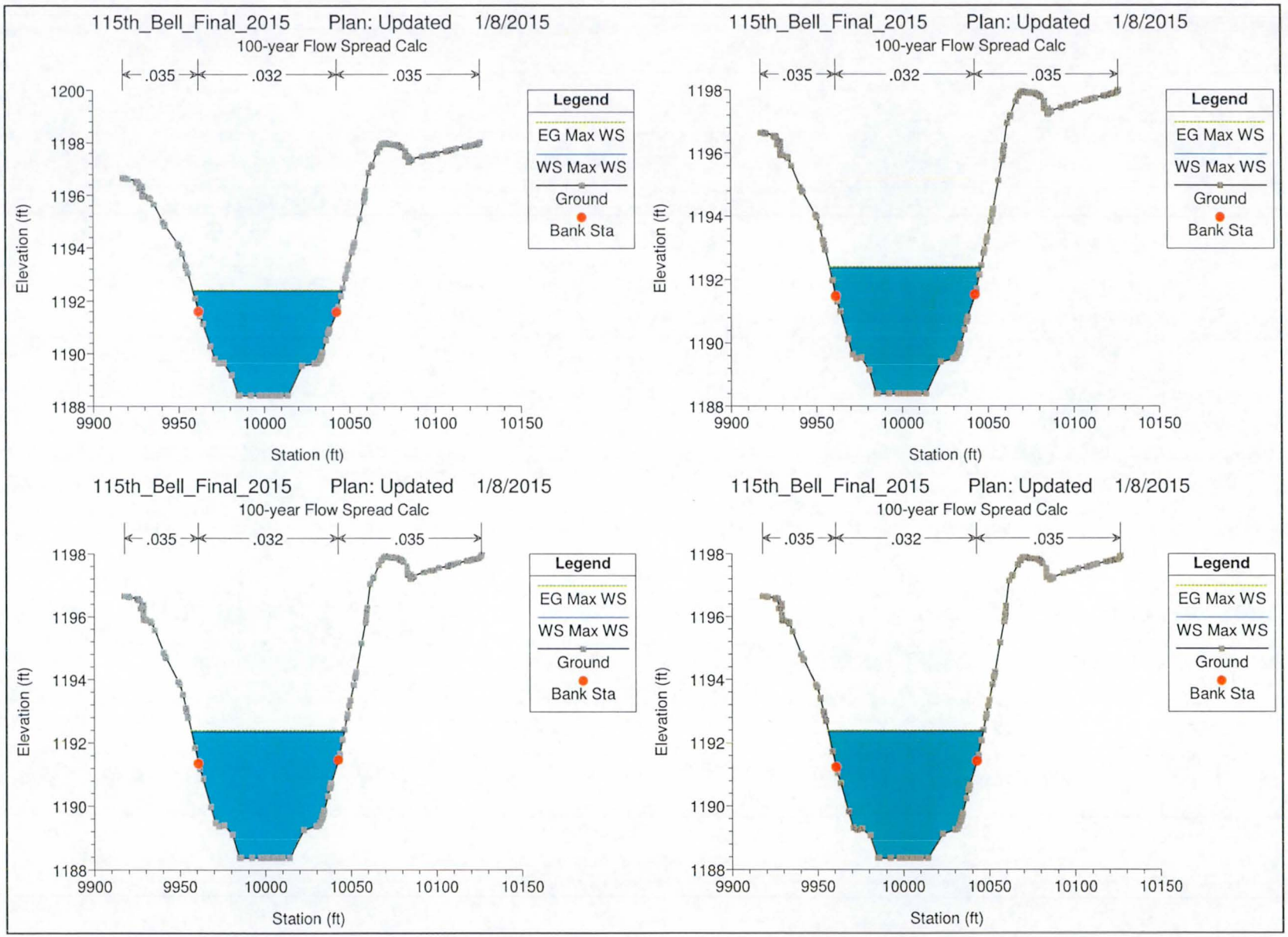
Station (ft)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100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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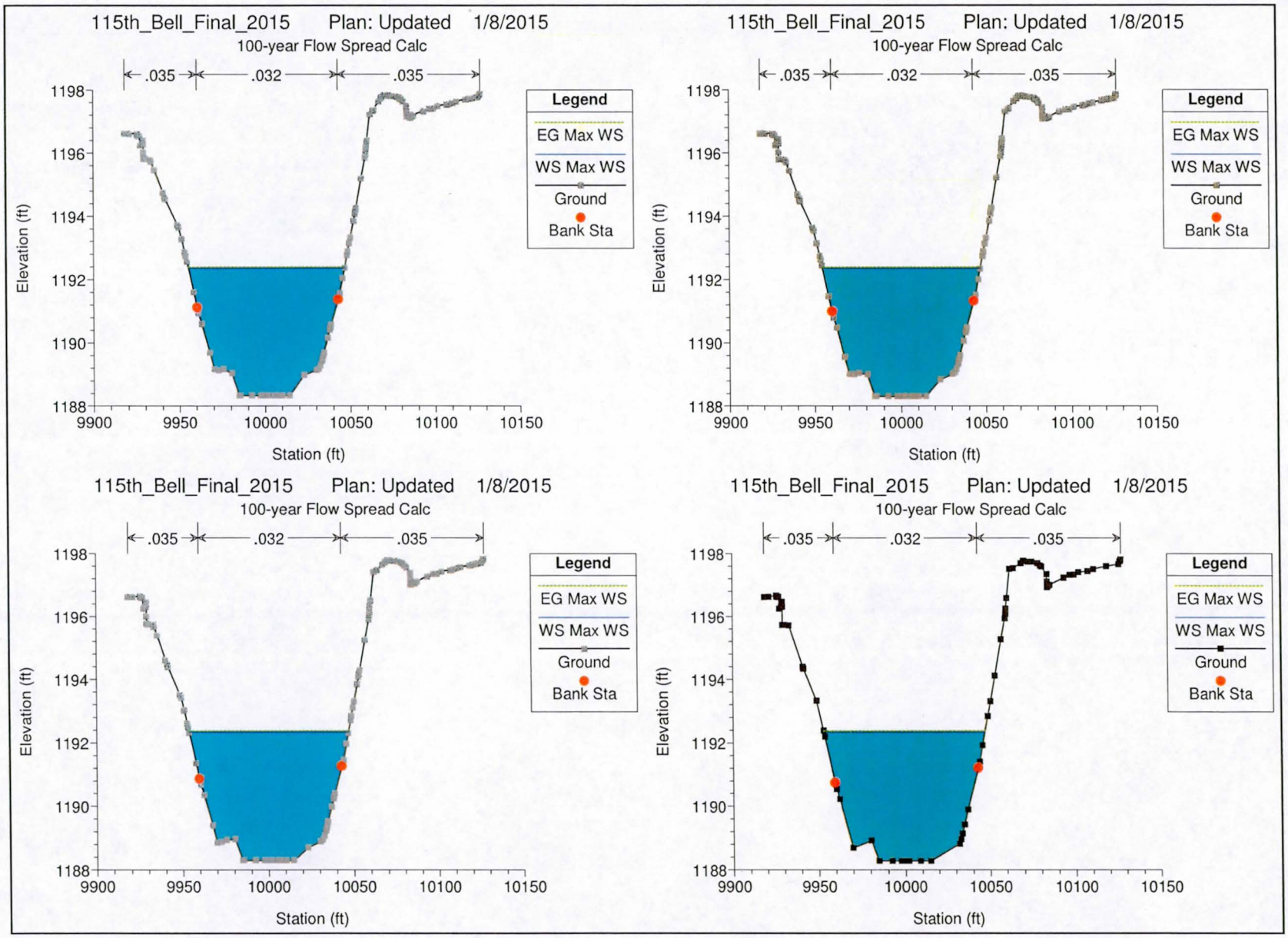
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100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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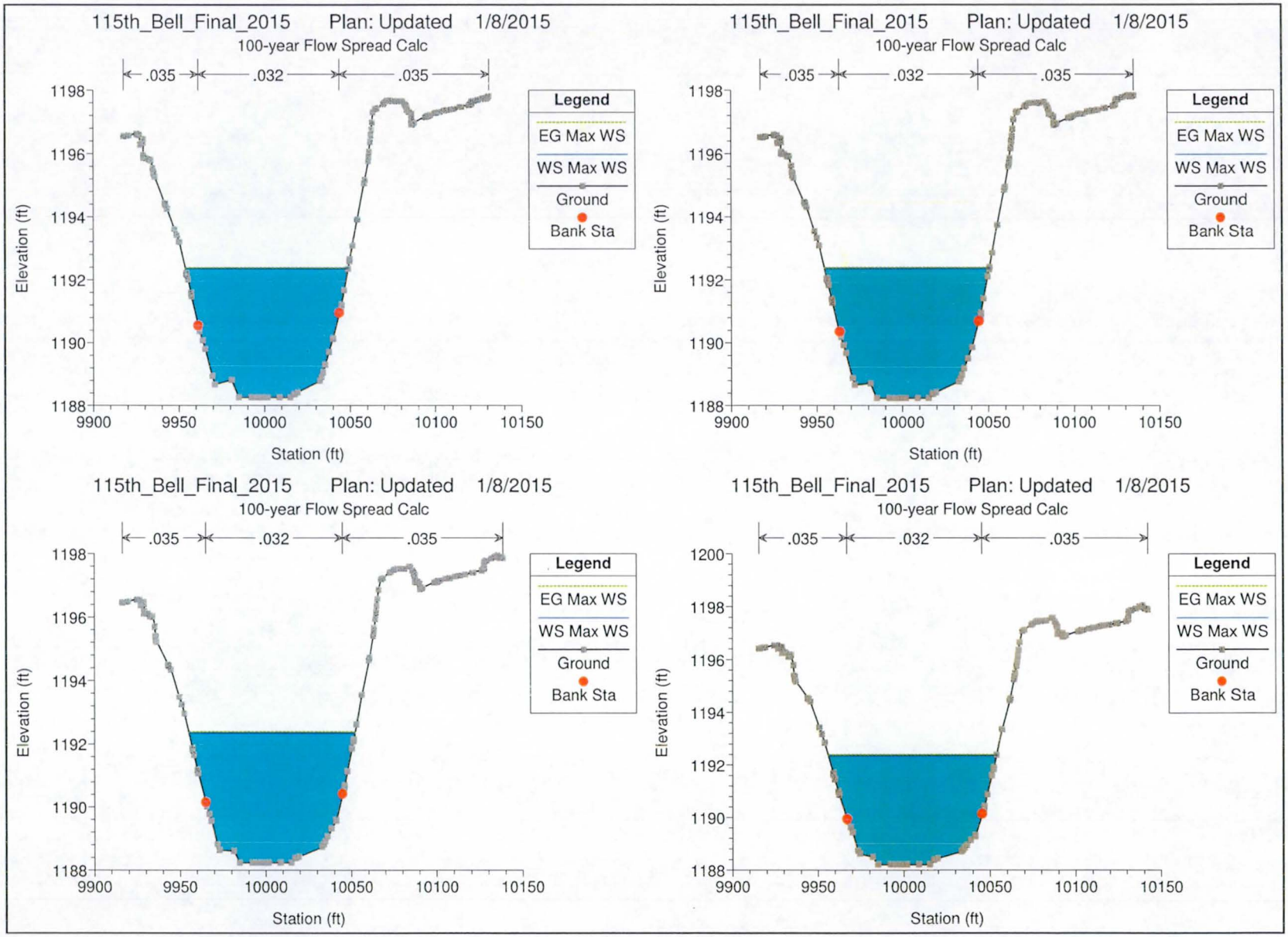
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Legend
EG Max WS
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Ground
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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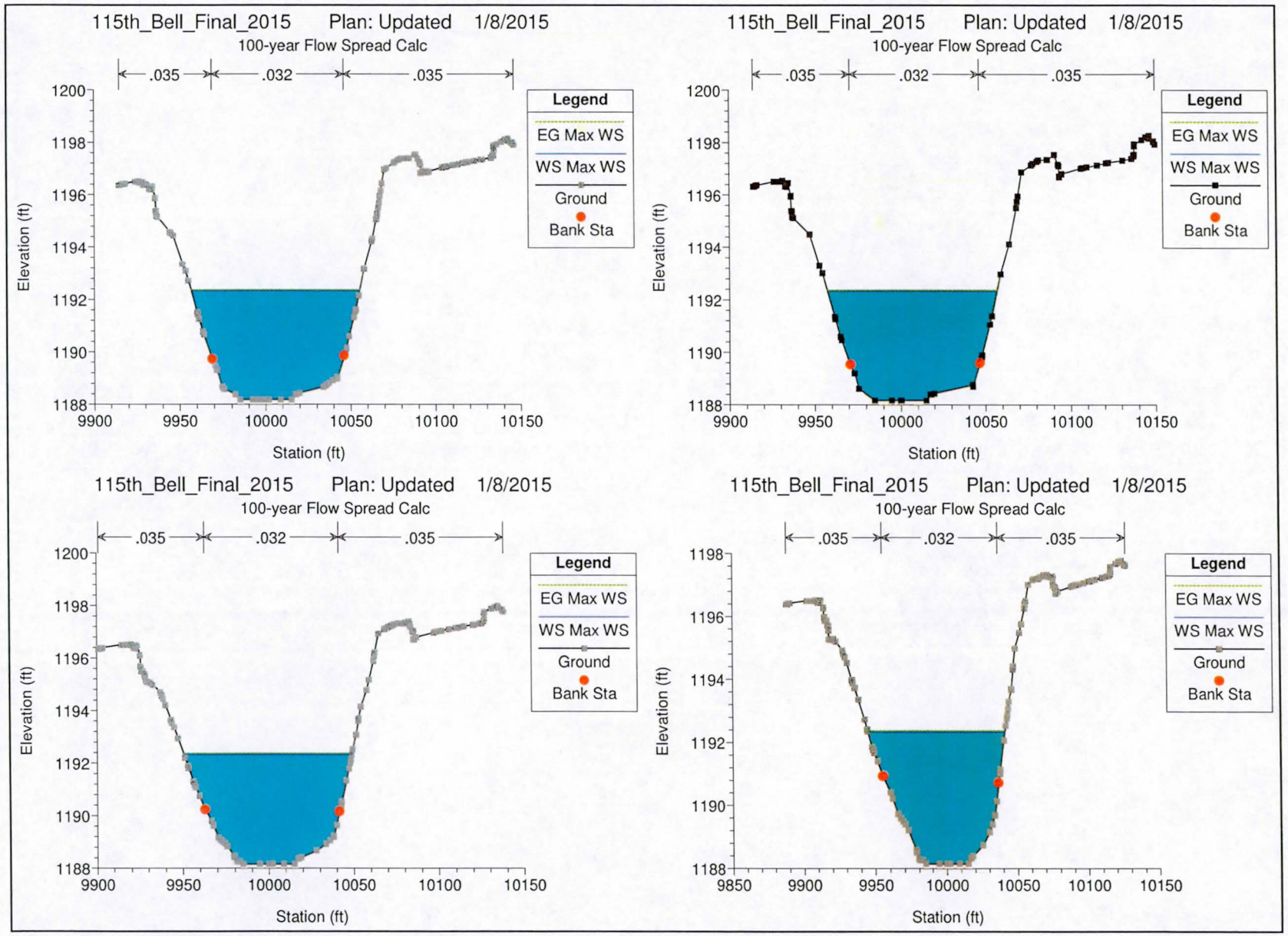
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100-year Flow Spread Calc
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Legend
EG Max WS
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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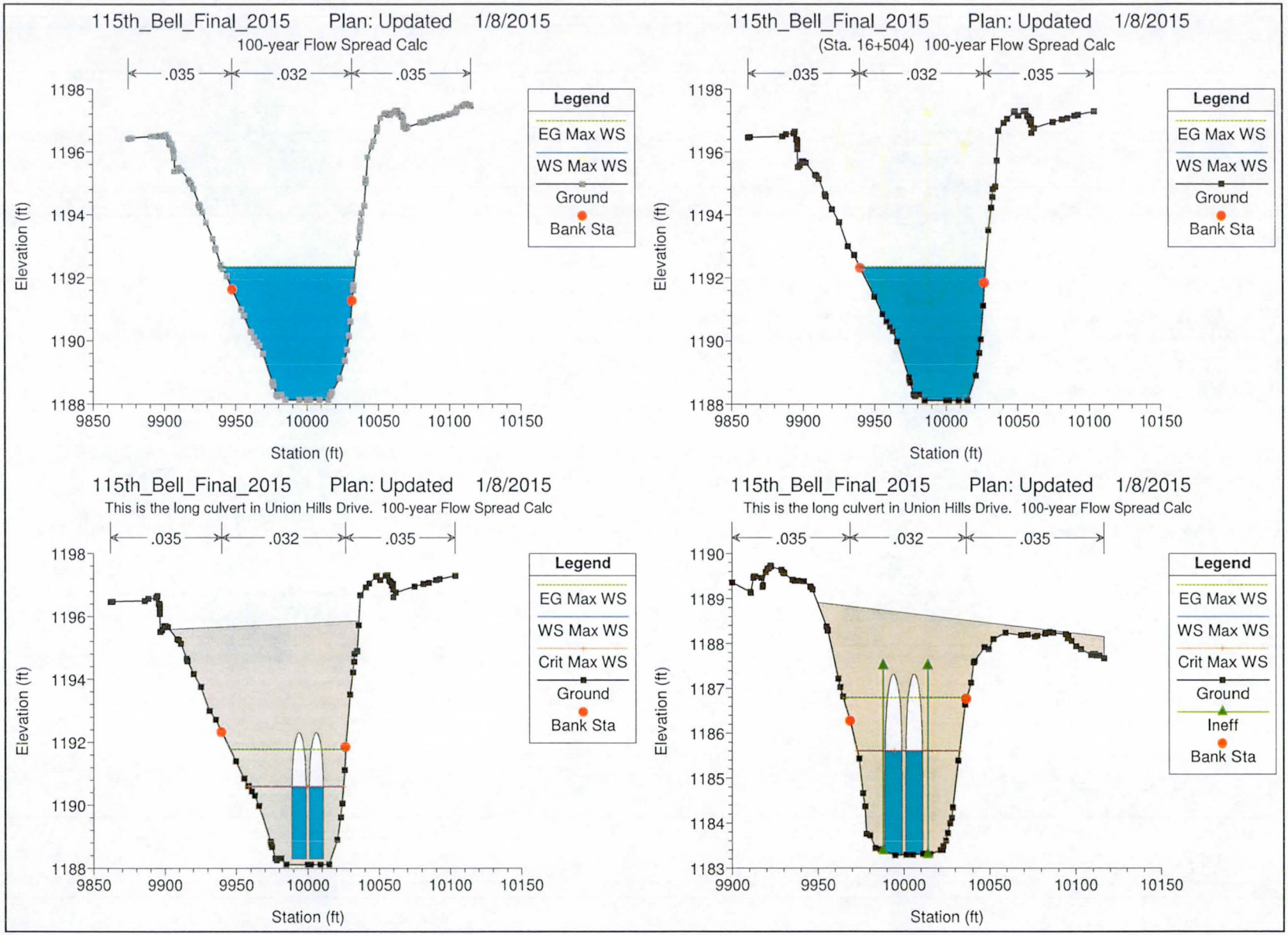
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
(Sta. 16+504) 100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the long culvert in Union Hills Drive. 100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the long culvert in Union Hills Drive. 100-year Flow Spread Calc
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Legend
EG Max WS
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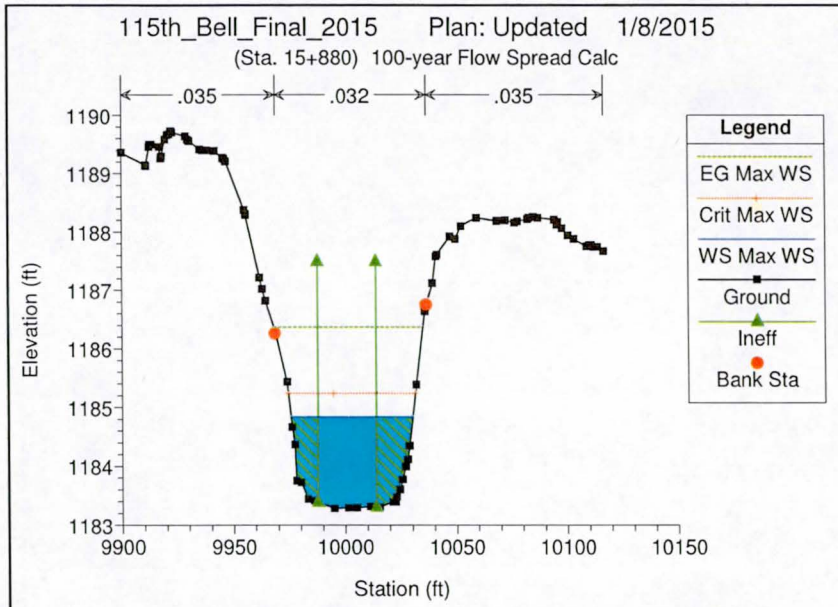
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
(Sta. 15+880) 100-year Flow Spread Calc
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Elevation (ft)
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
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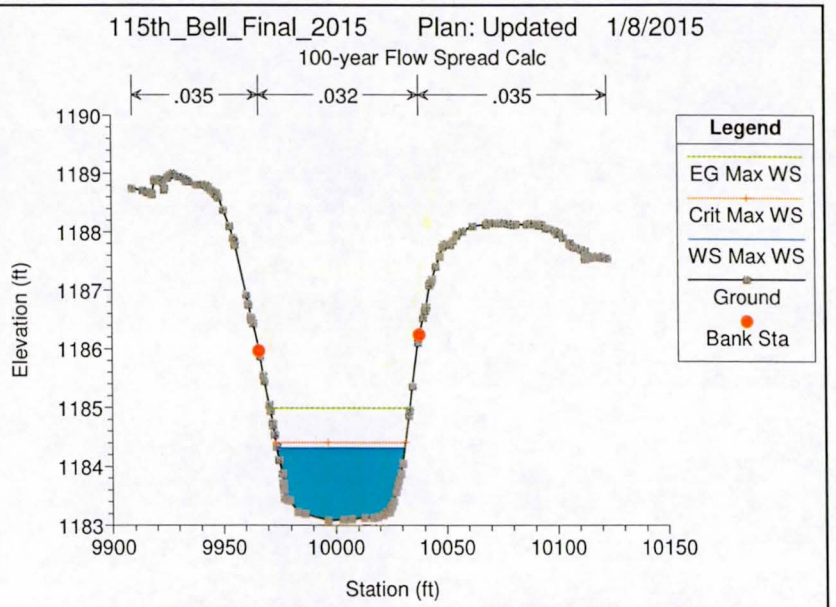
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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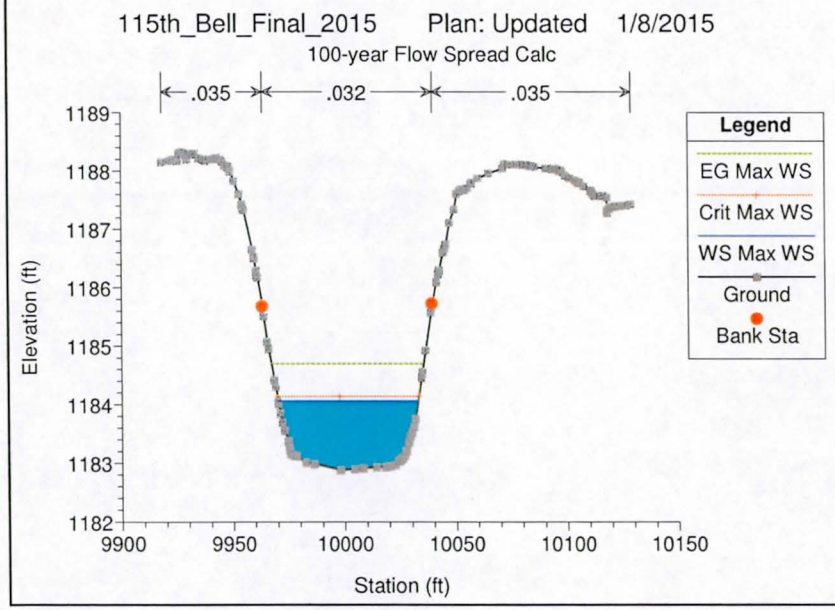
Elevation (ft)
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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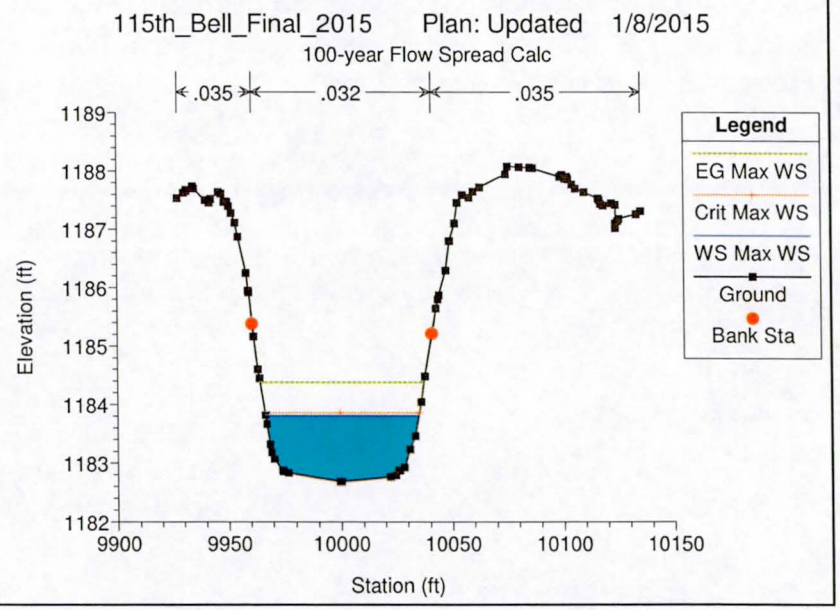
Elevation (ft)
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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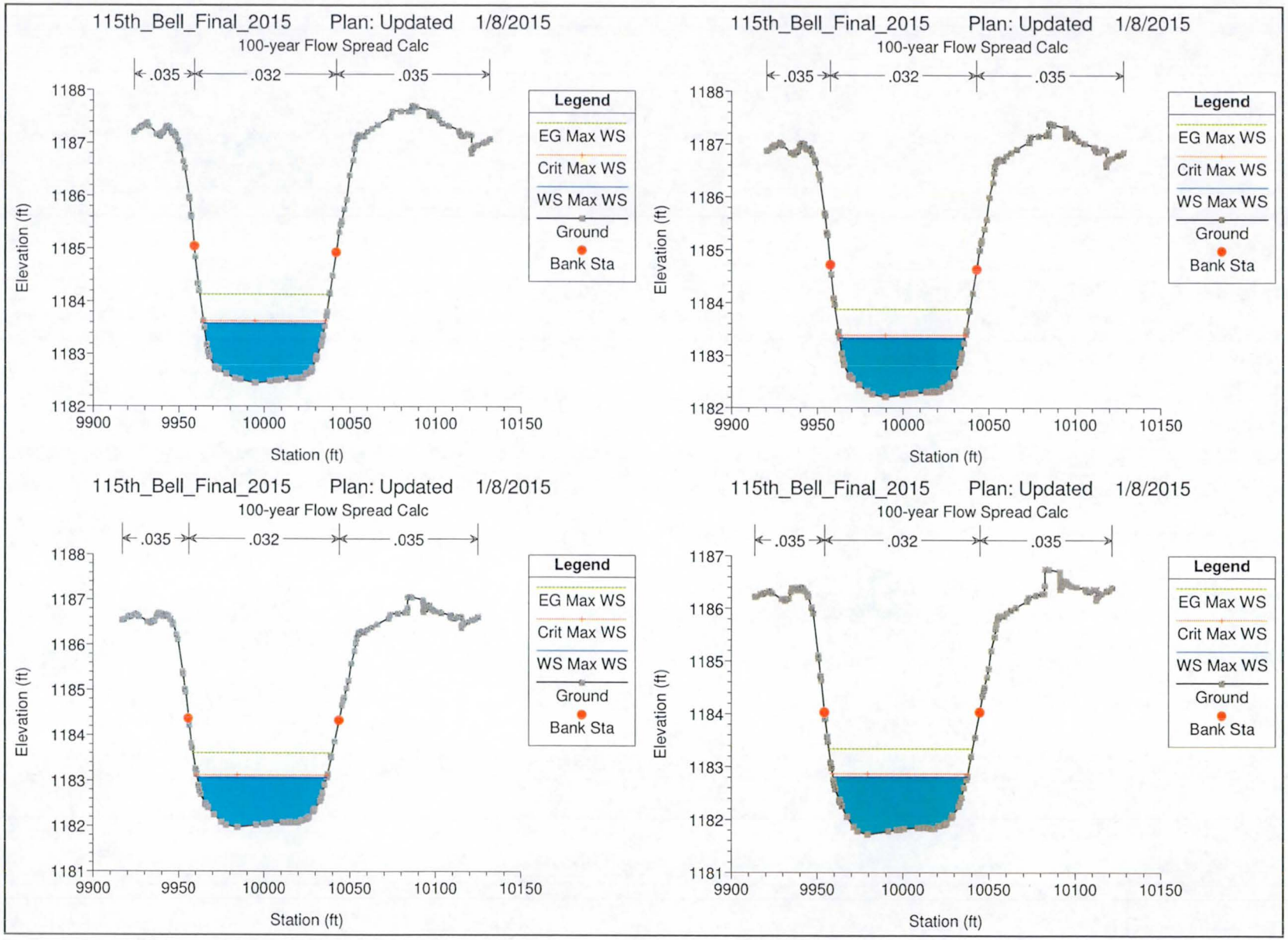
Elevation (ft)
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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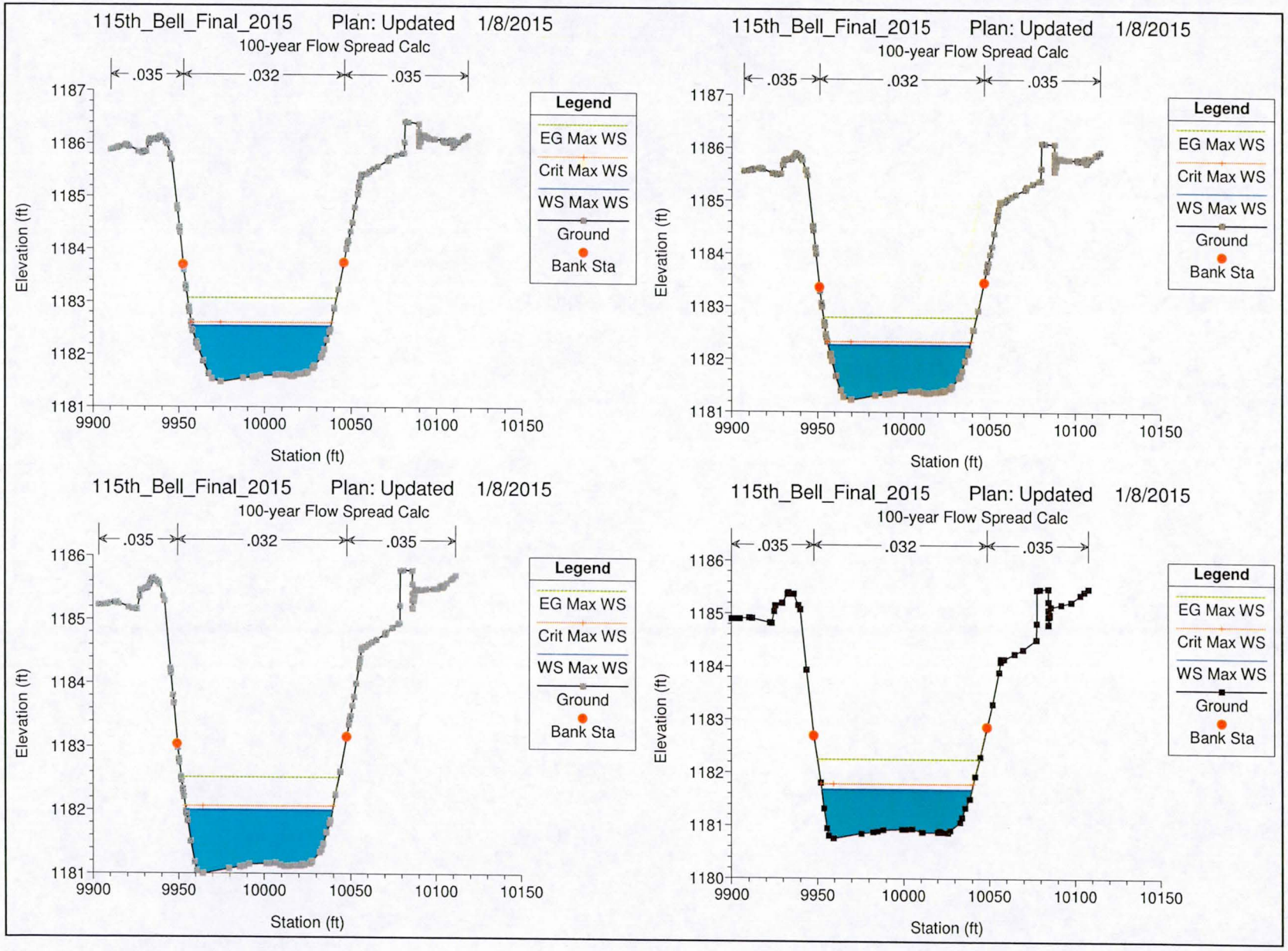
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
Station (ft)
Legend
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Crit Max WS
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Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
Station (ft)
Legend
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Crit Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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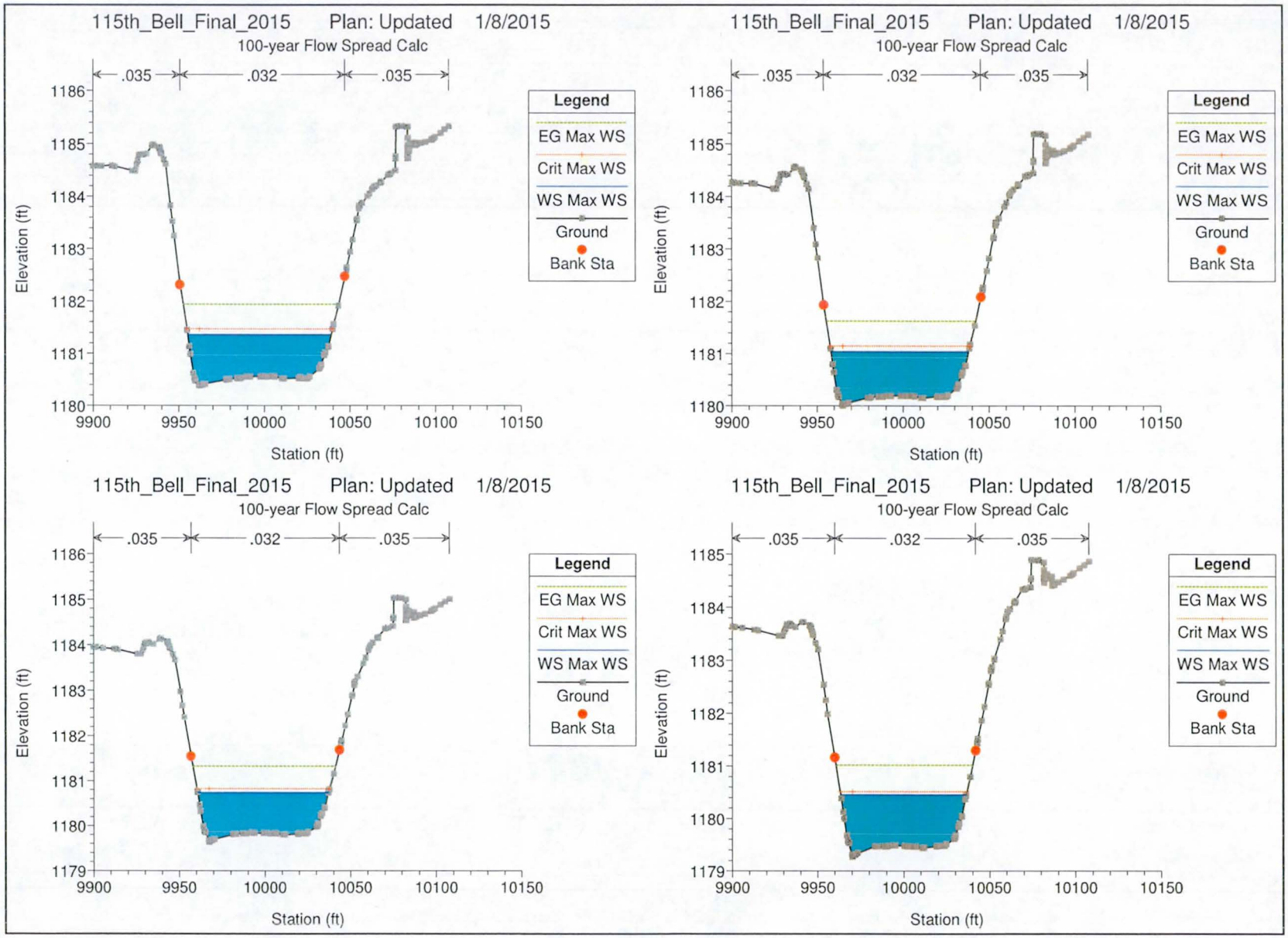
Elevation (ft)
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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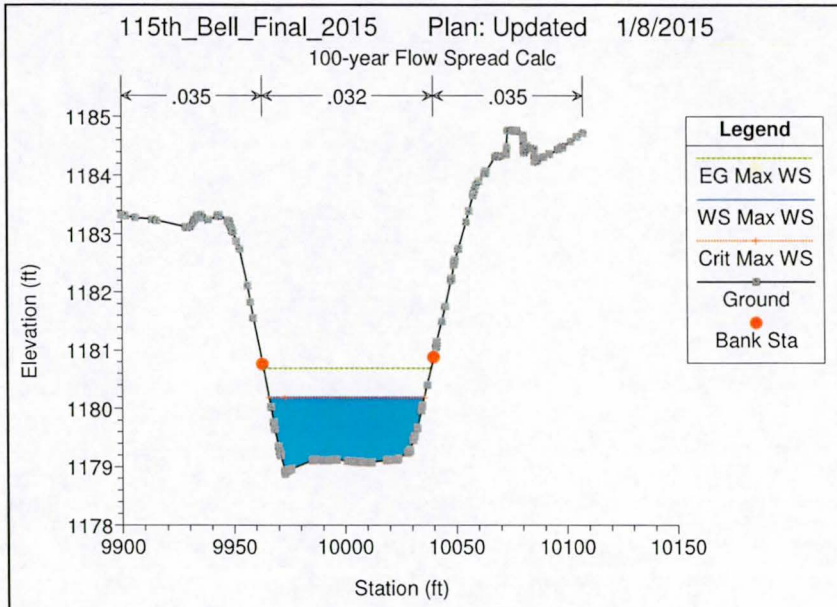
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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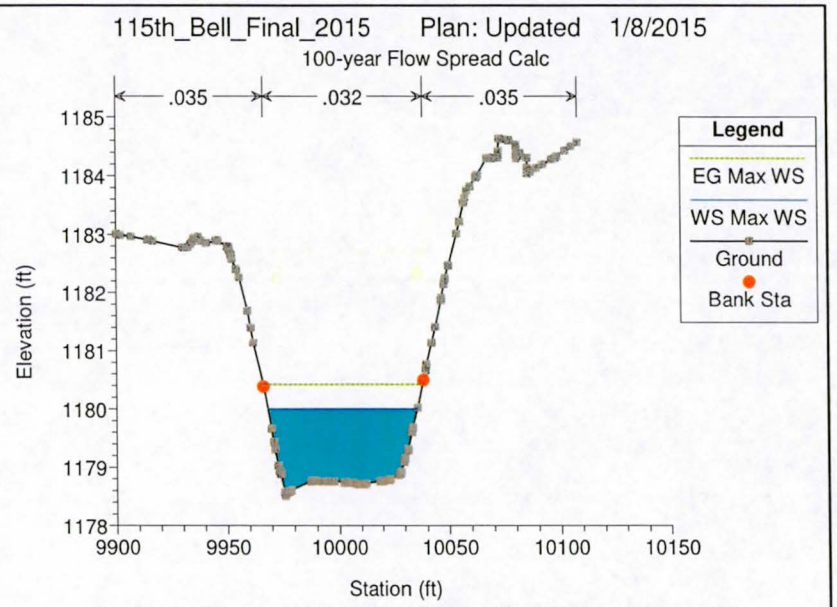
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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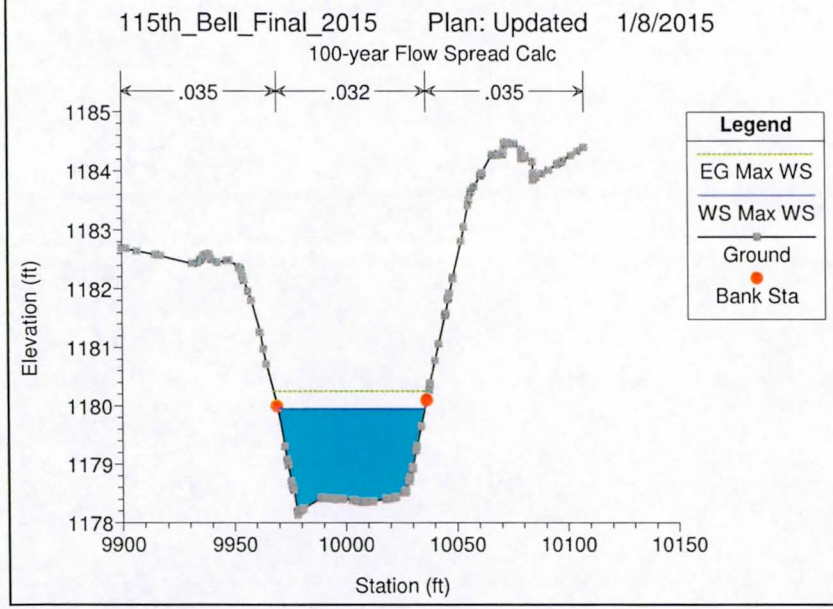
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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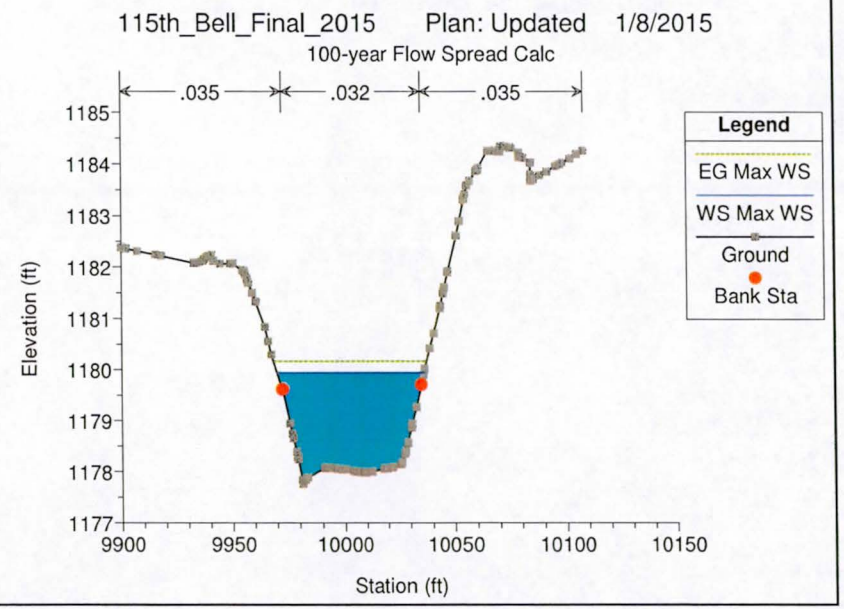
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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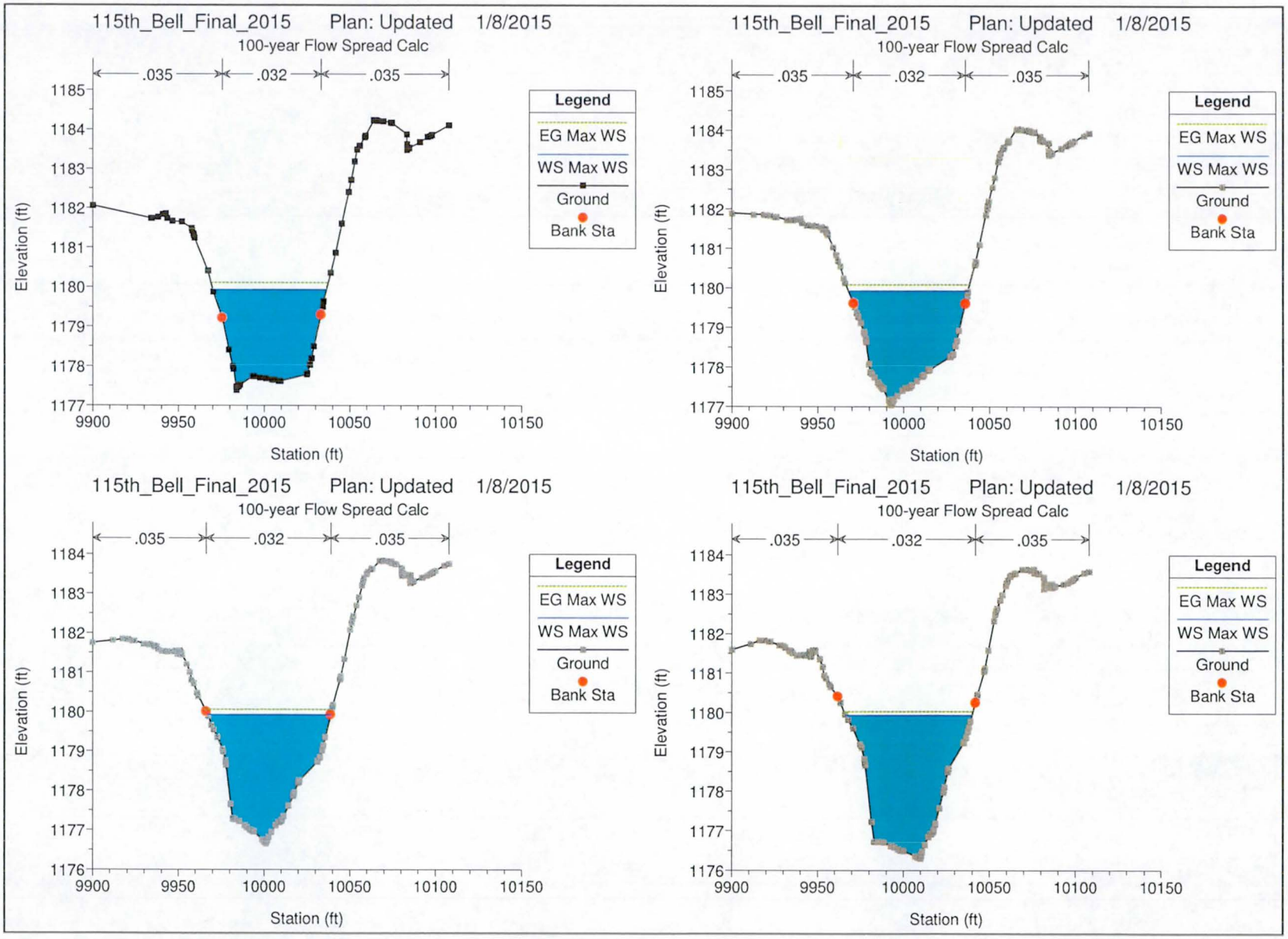
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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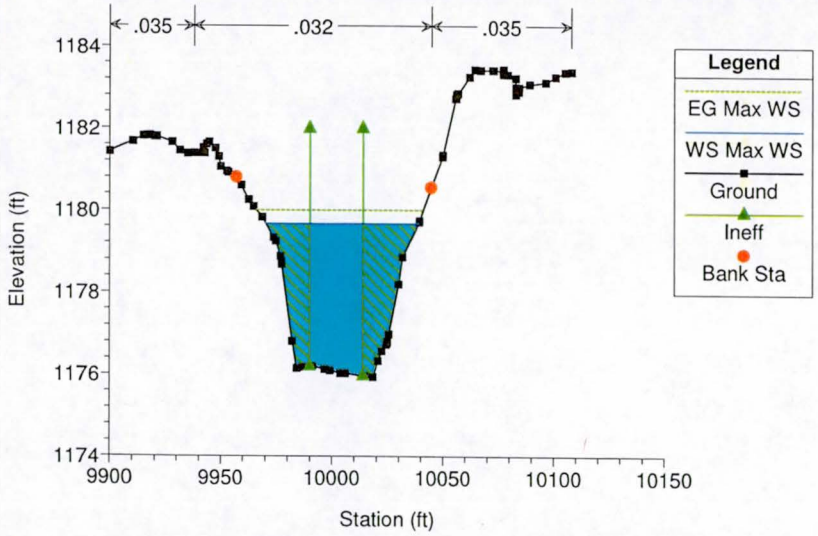
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)

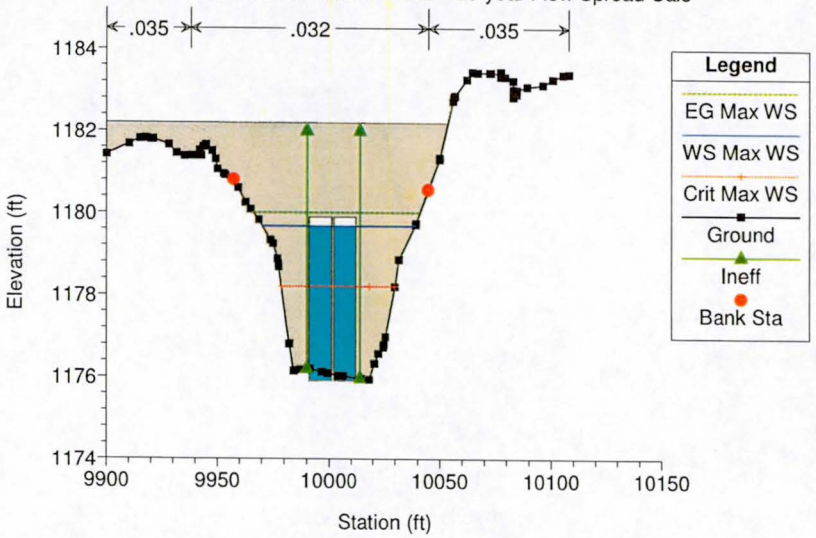
115th_Bell_Final_2015 Plan: Updated 1/8/2015

Upstream of 3-4'x10' concrete box culverts at 114th Avenue. (St 100-year Flow Spread Calc



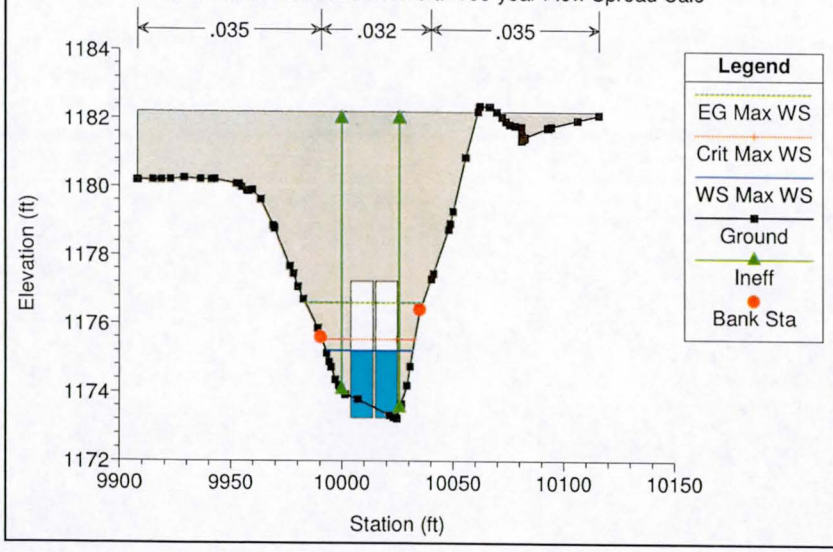
115th_Bell_Final_2015 Plan: Updated 1/8/2015

This is the 114th Avenue culvert. 100-year Flow Spread Calc



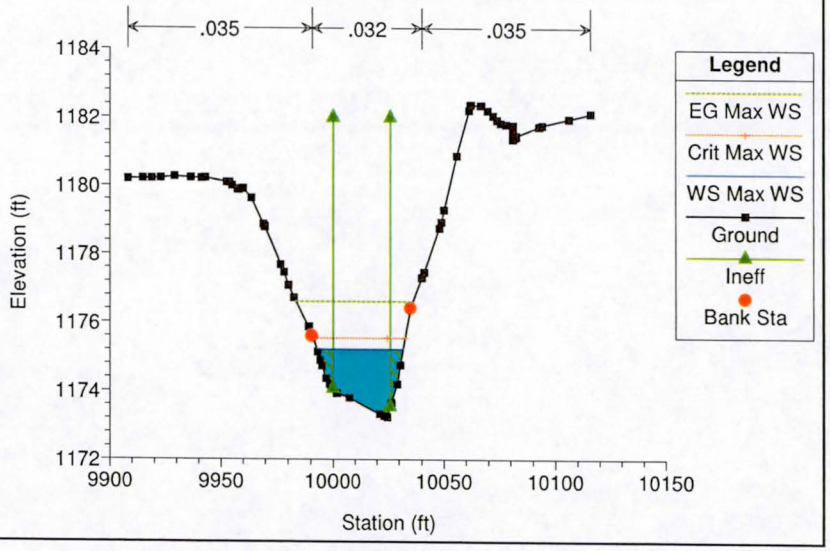
115th_Bell_Final_2015 Plan: Updated 1/8/2015

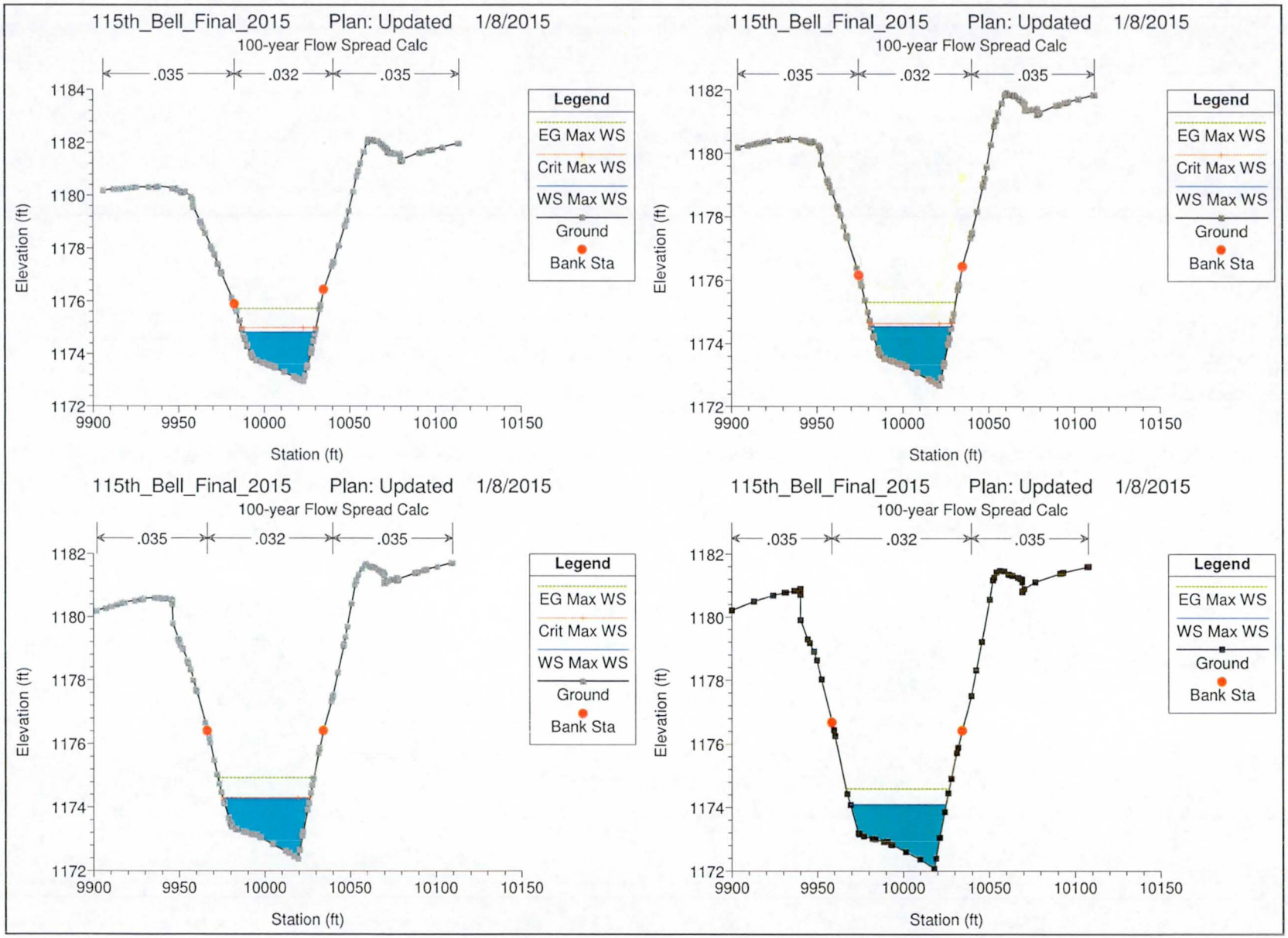
This is the 114th Avenue culvert. 100-year Flow Spread Calc



115th_Bell_Final_2015 Plan: Updated 1/8/2015

Downstream of 3-4'x10' concrete box culverts at 114th Avenue. (S 100-year Flow Spread Calc




115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
.035
Elevation (ft)
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.032
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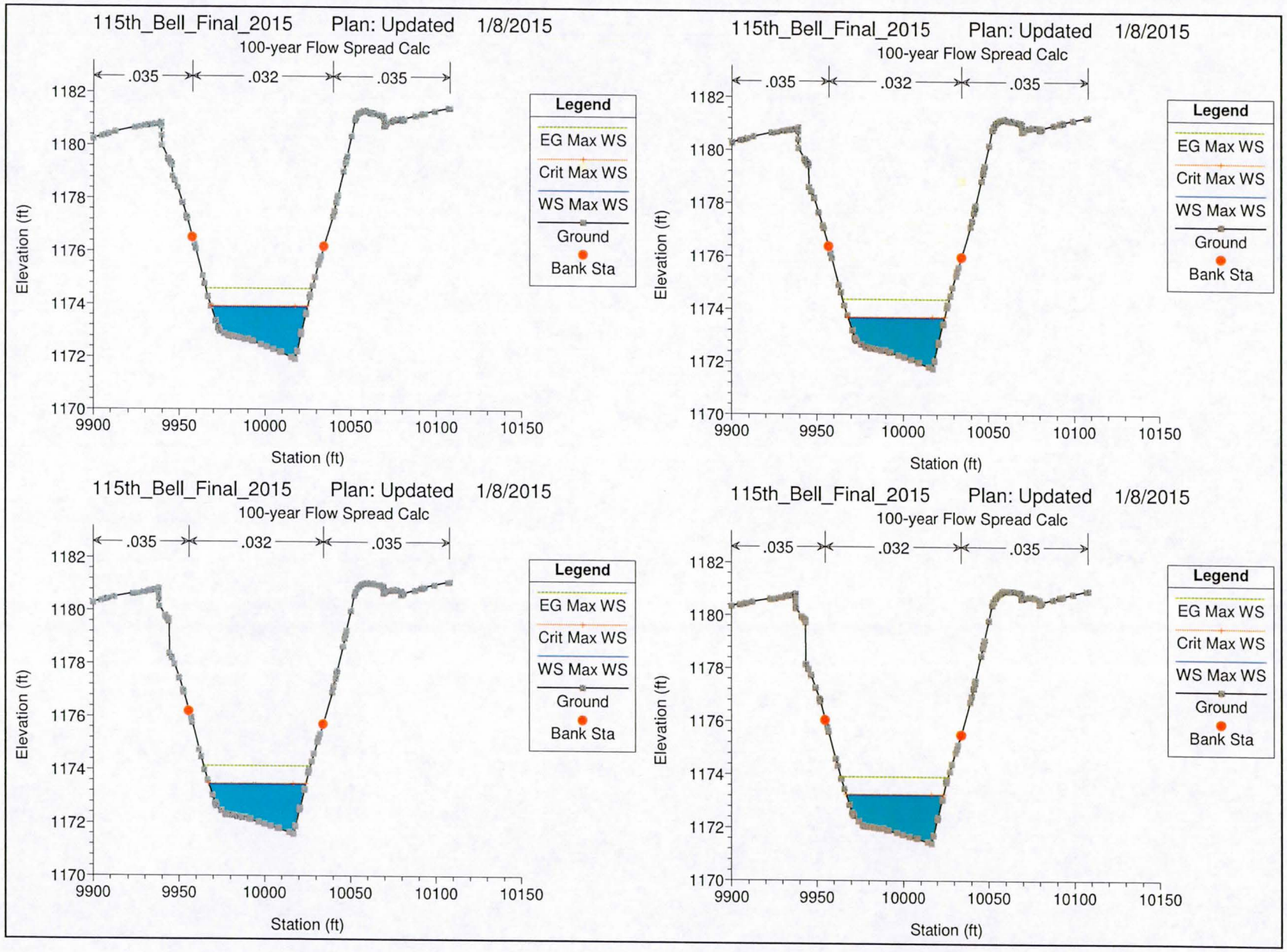
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
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.035
Elevation (ft)
1182
1180
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1176
1174
1172
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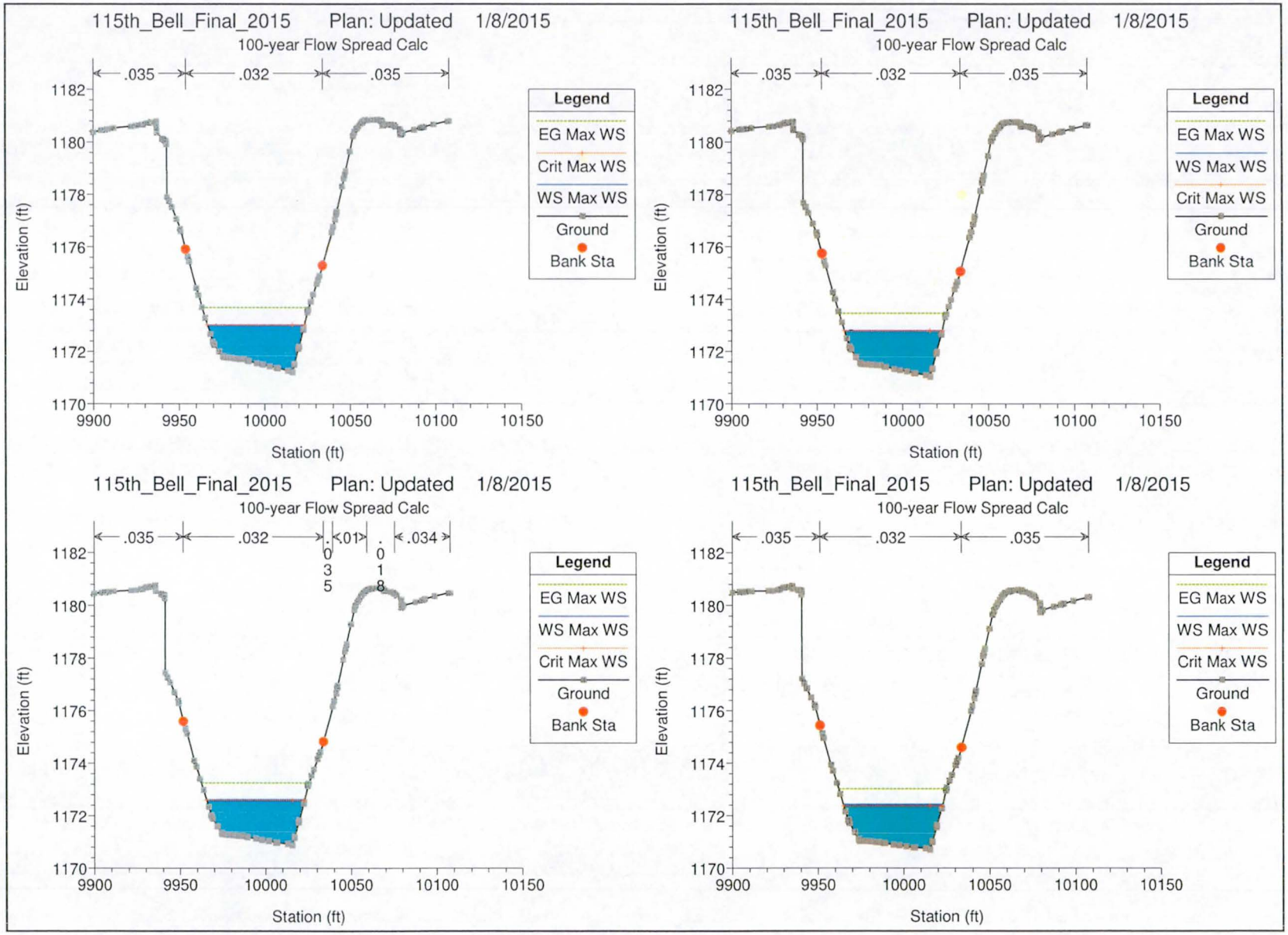
10150
Station (ft)
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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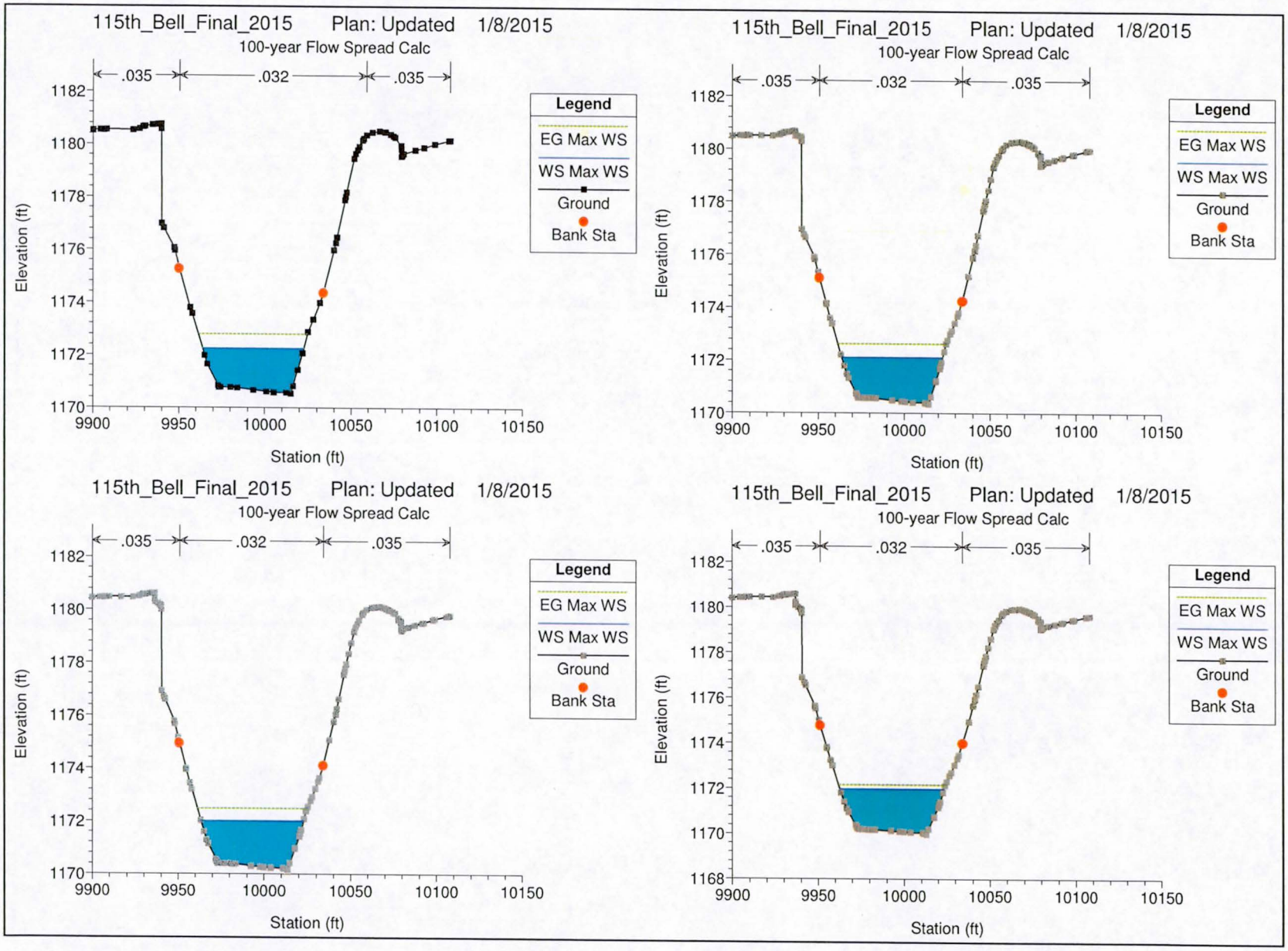
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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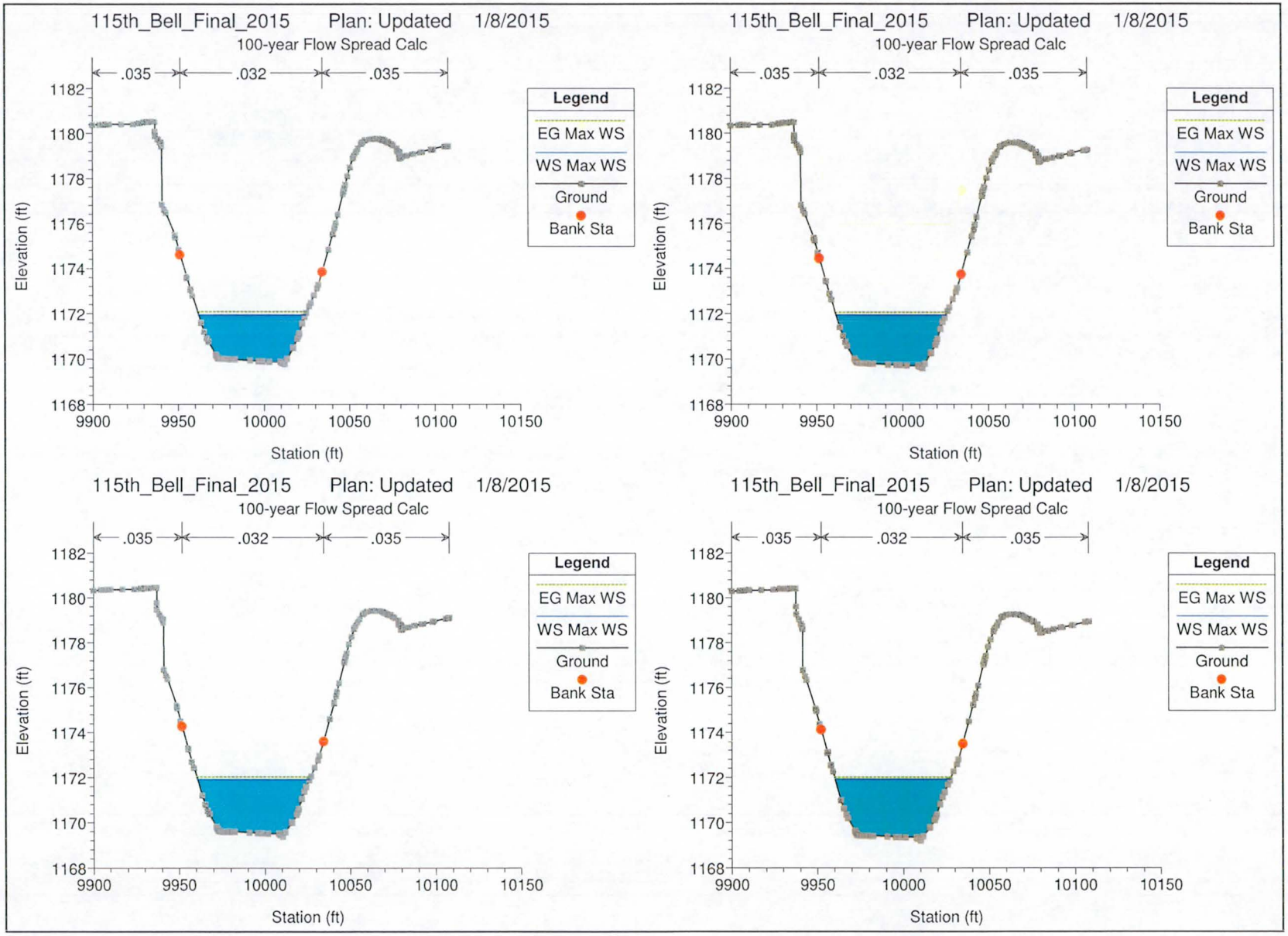
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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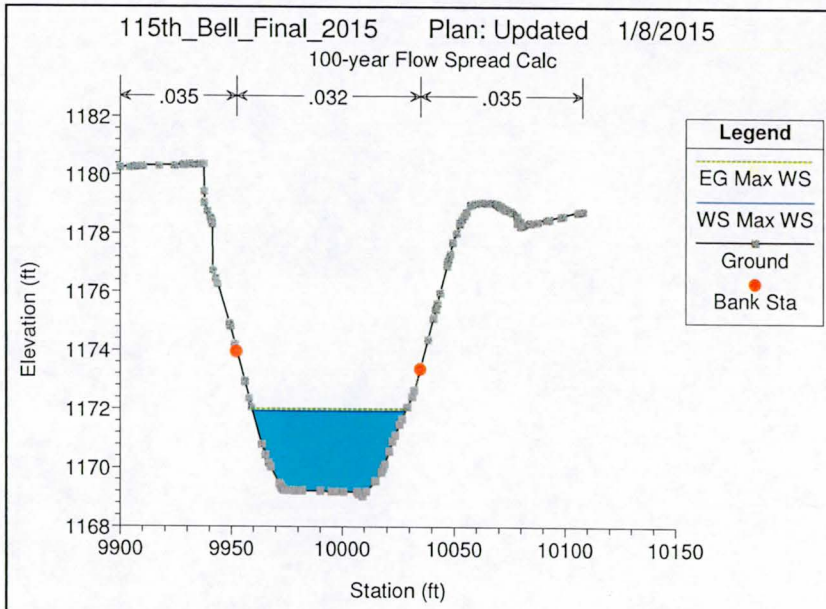
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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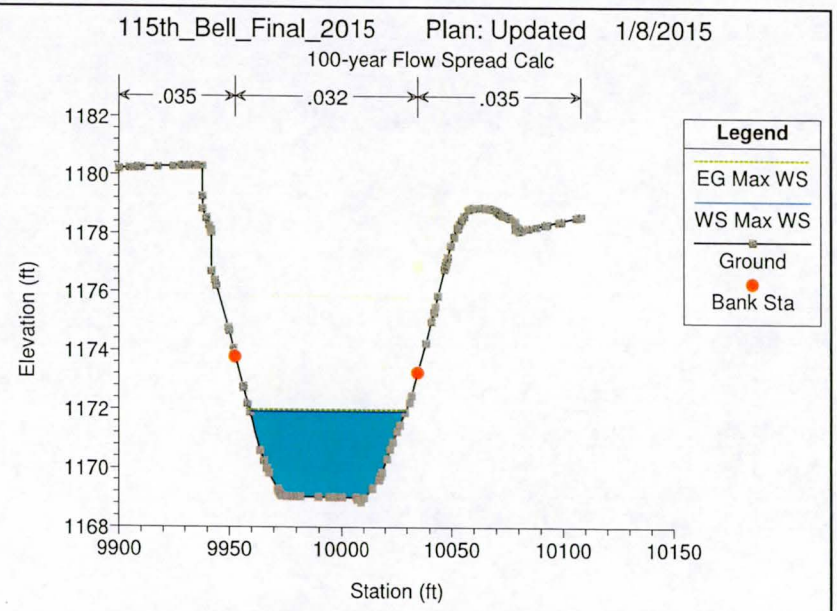
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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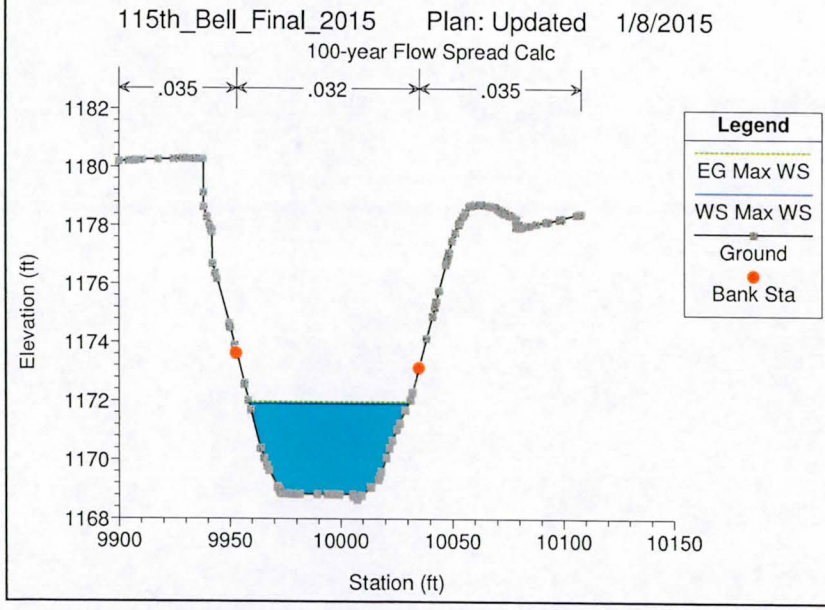
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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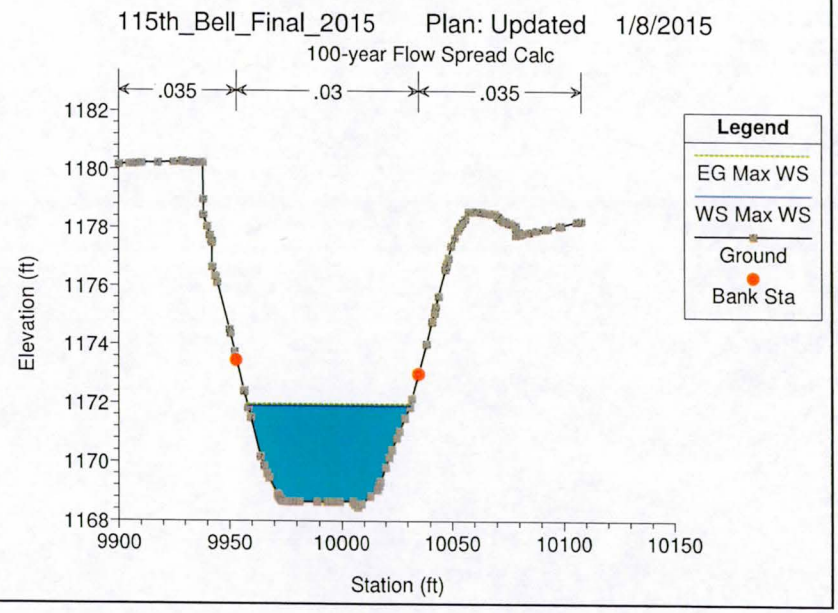
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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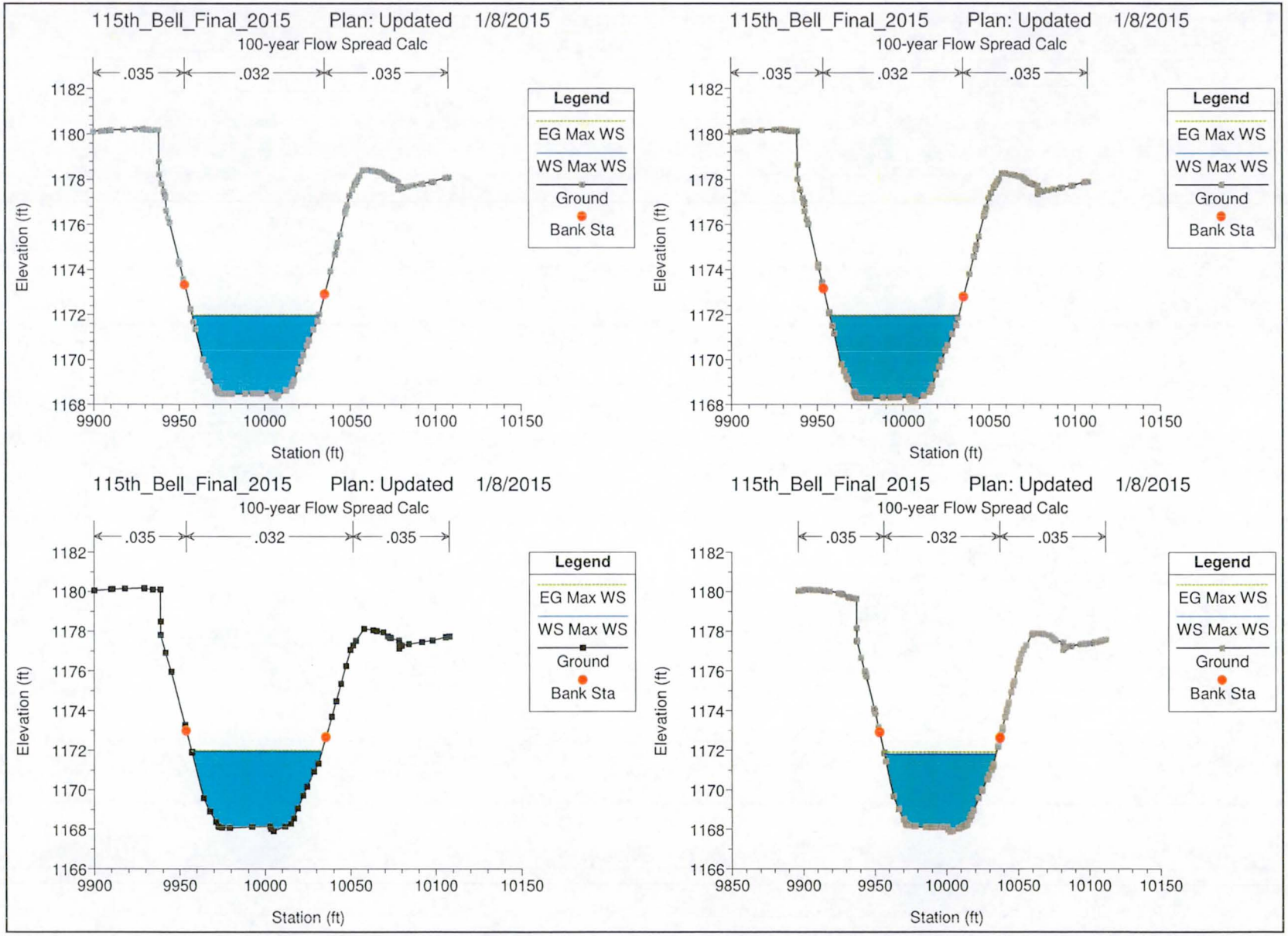
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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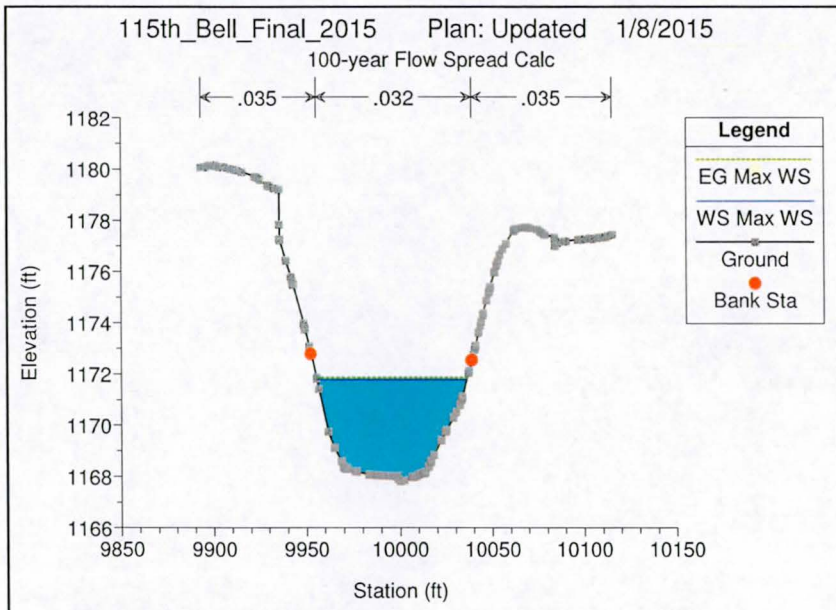
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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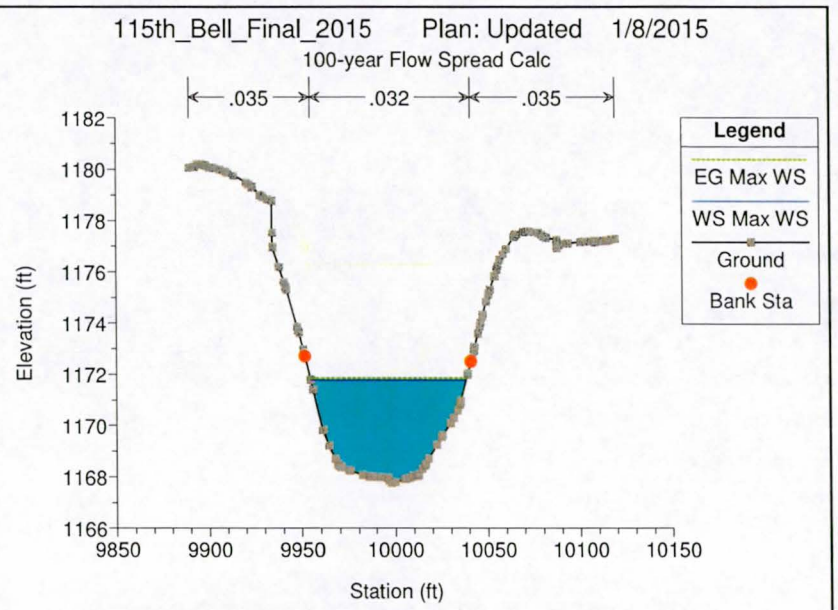
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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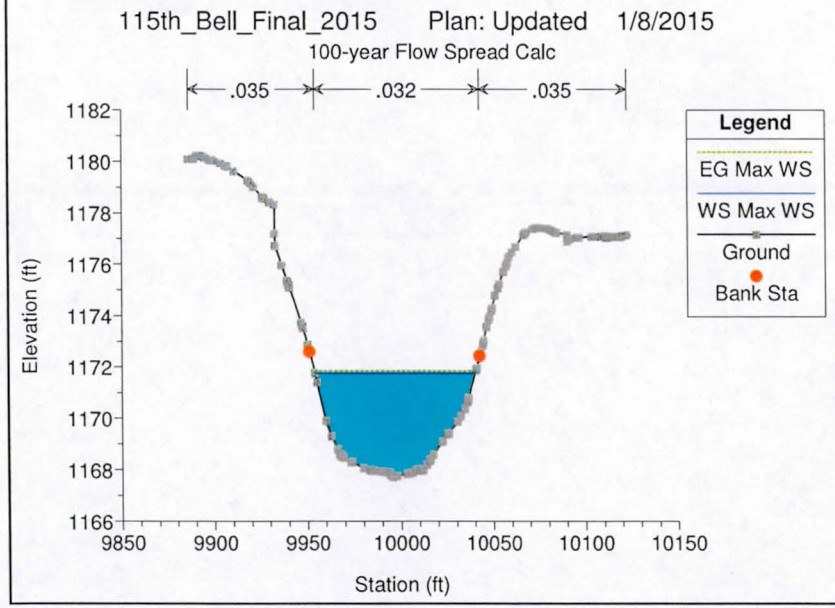
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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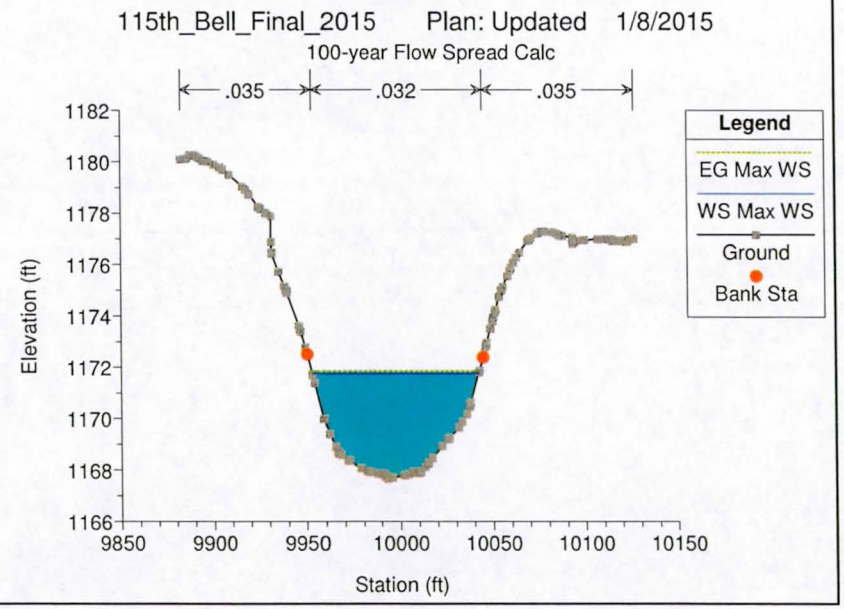
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100-year Flow Spread Calc
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Legend
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Elevation (ft)
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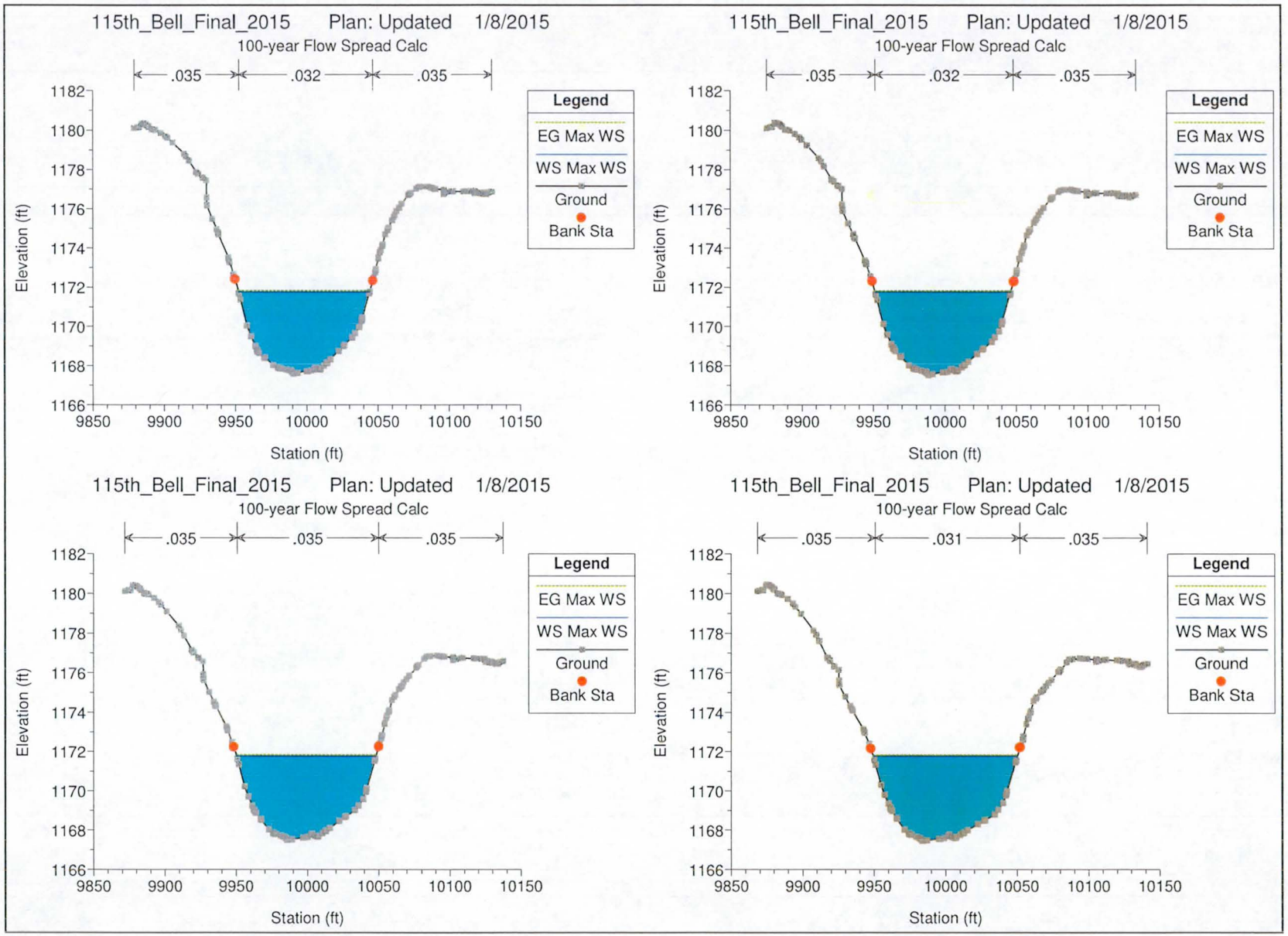
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100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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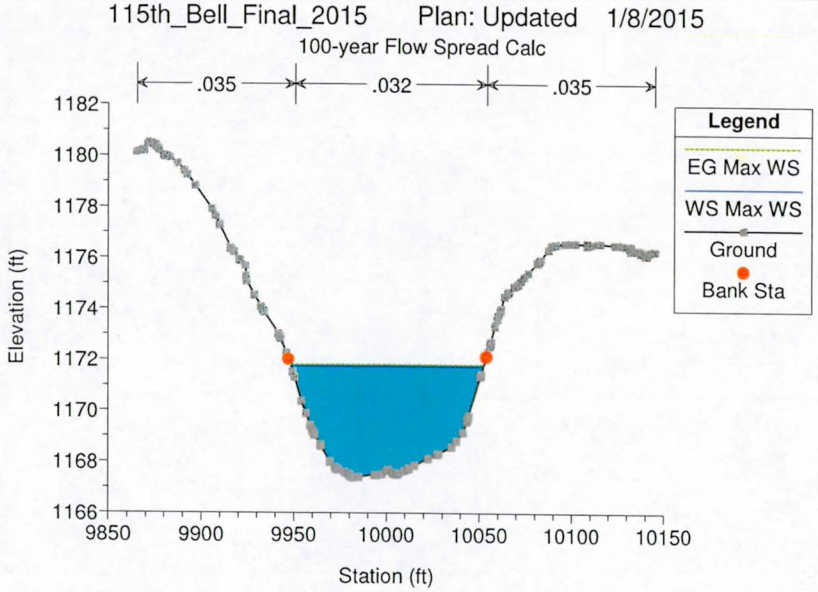
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100-year Flow Spread Calc
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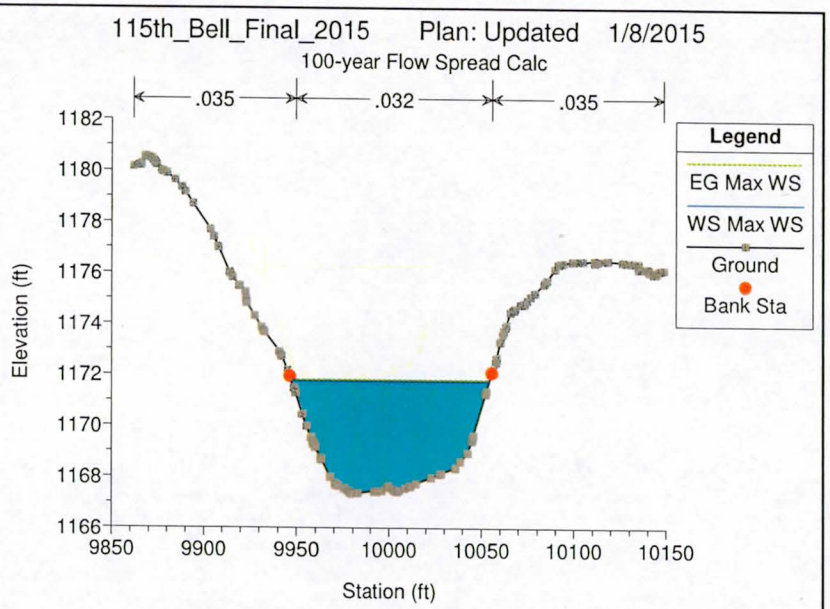
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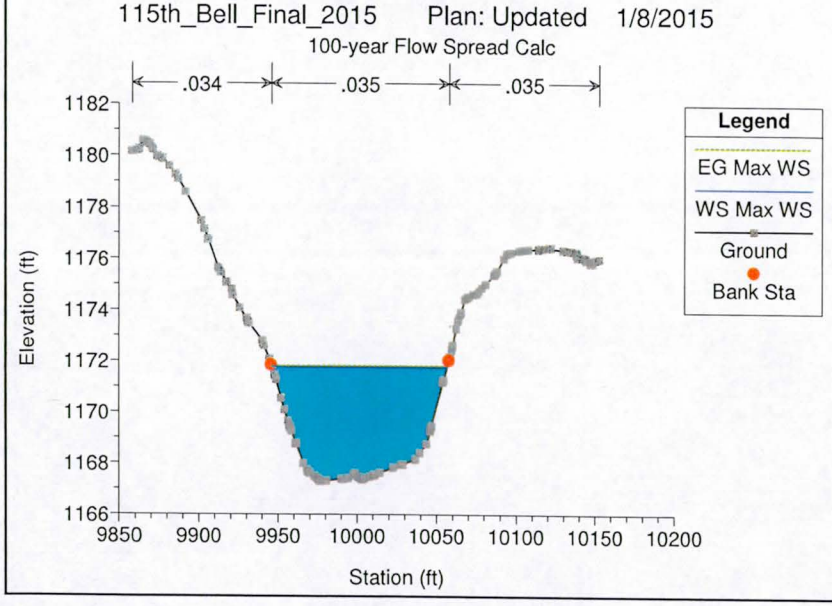
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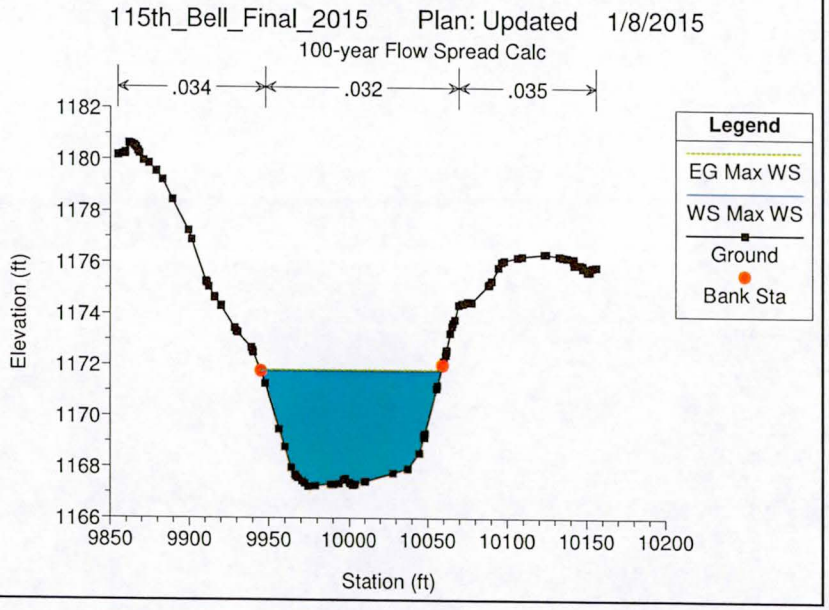
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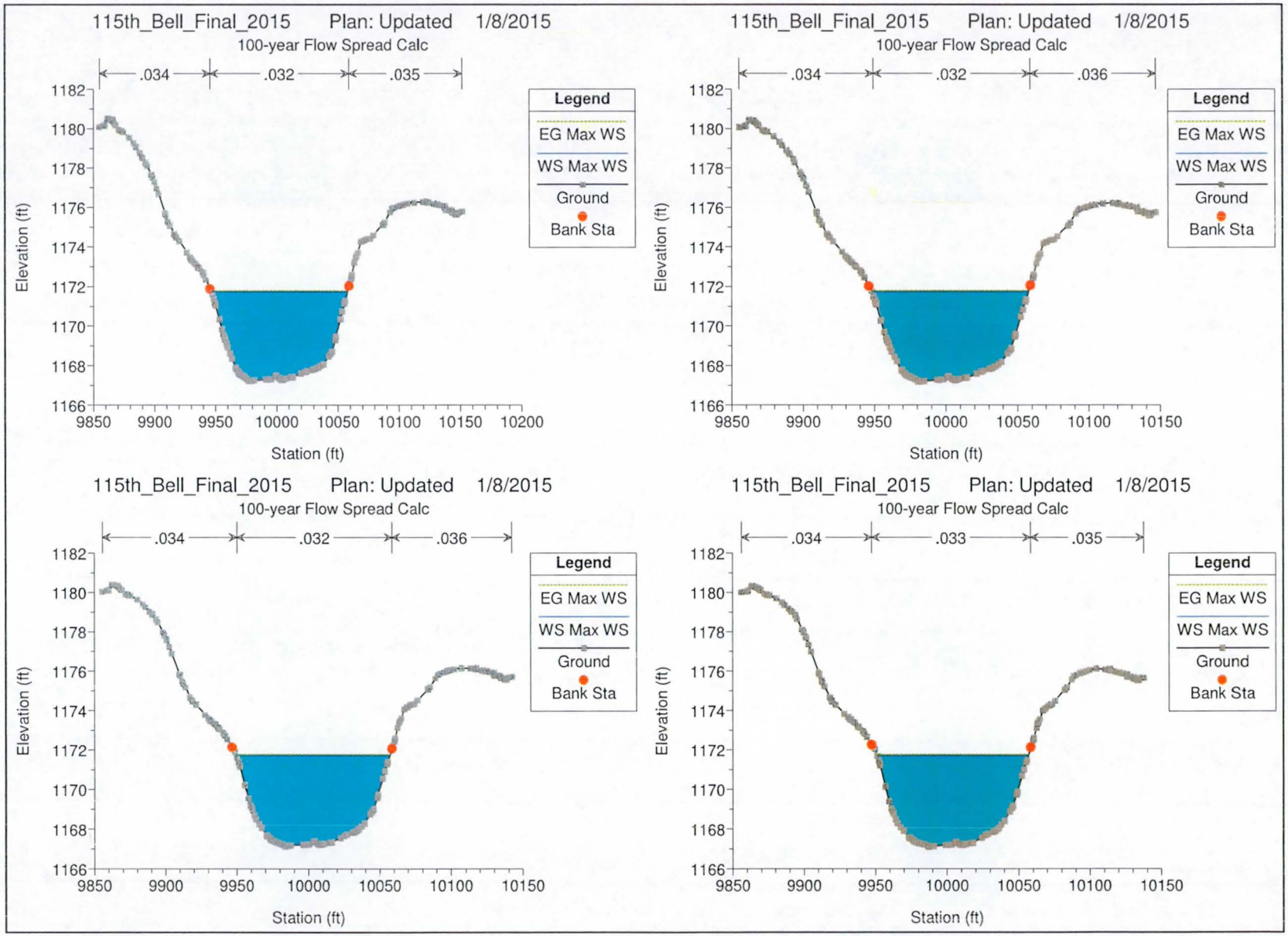
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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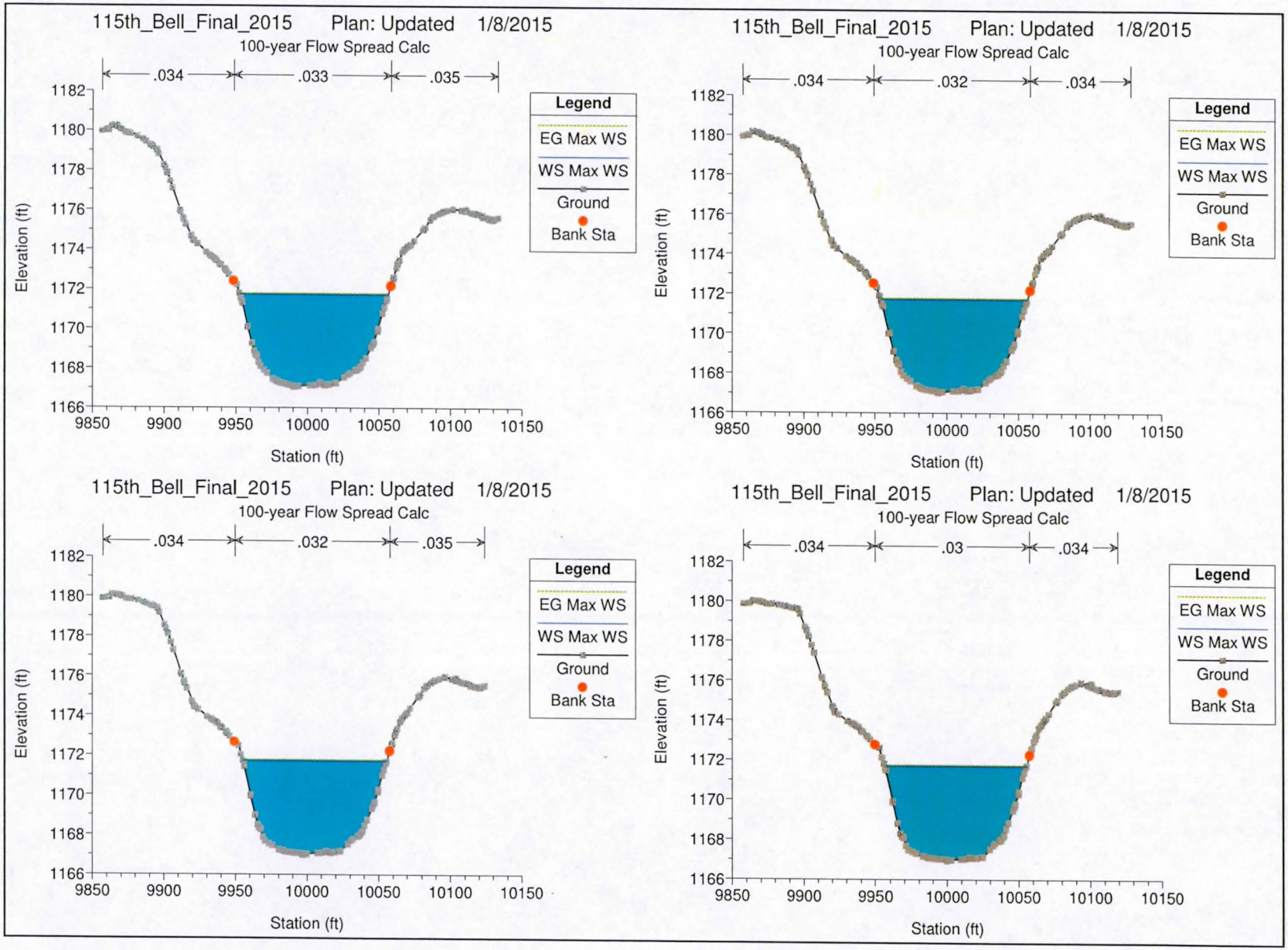
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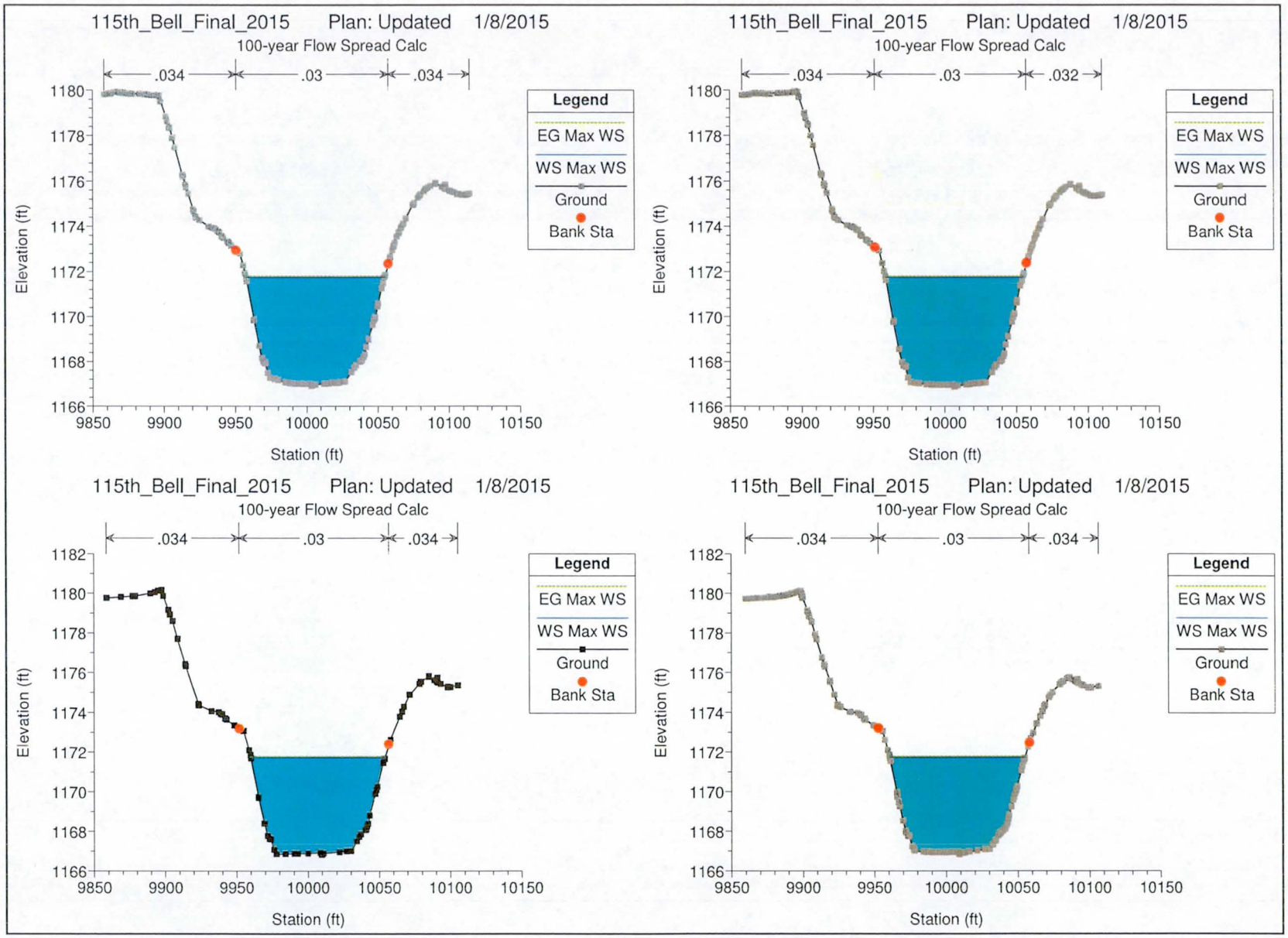
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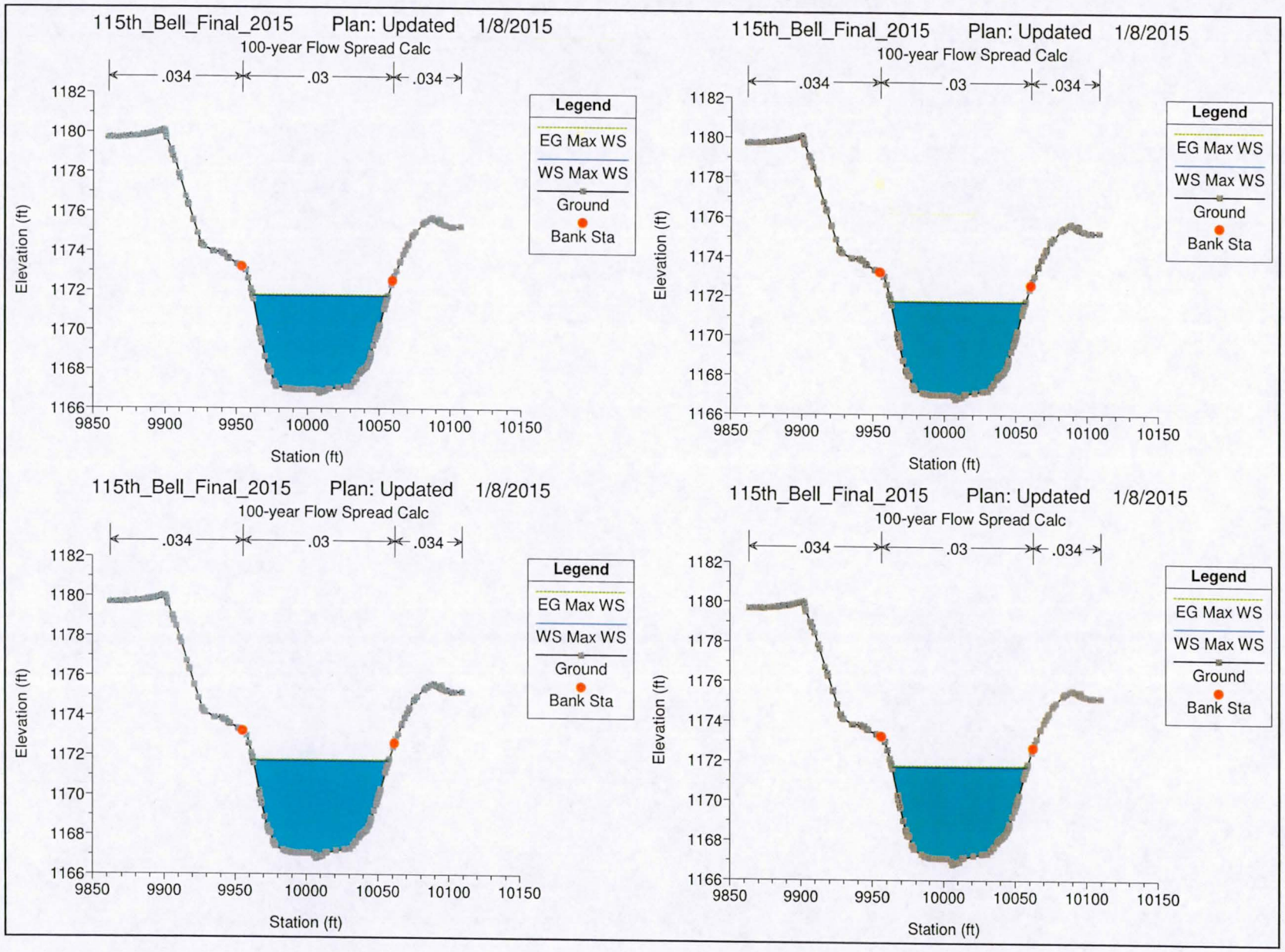
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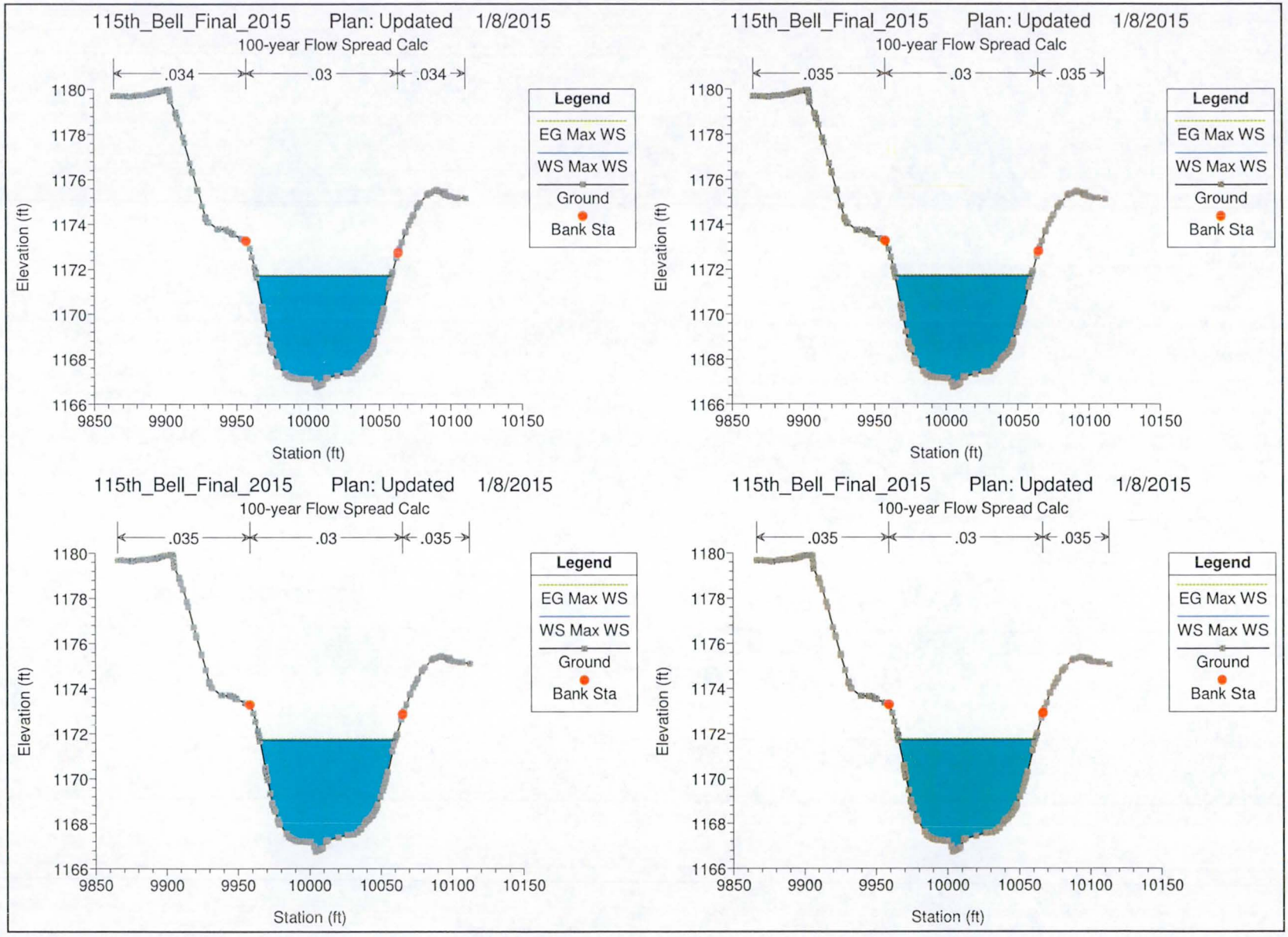
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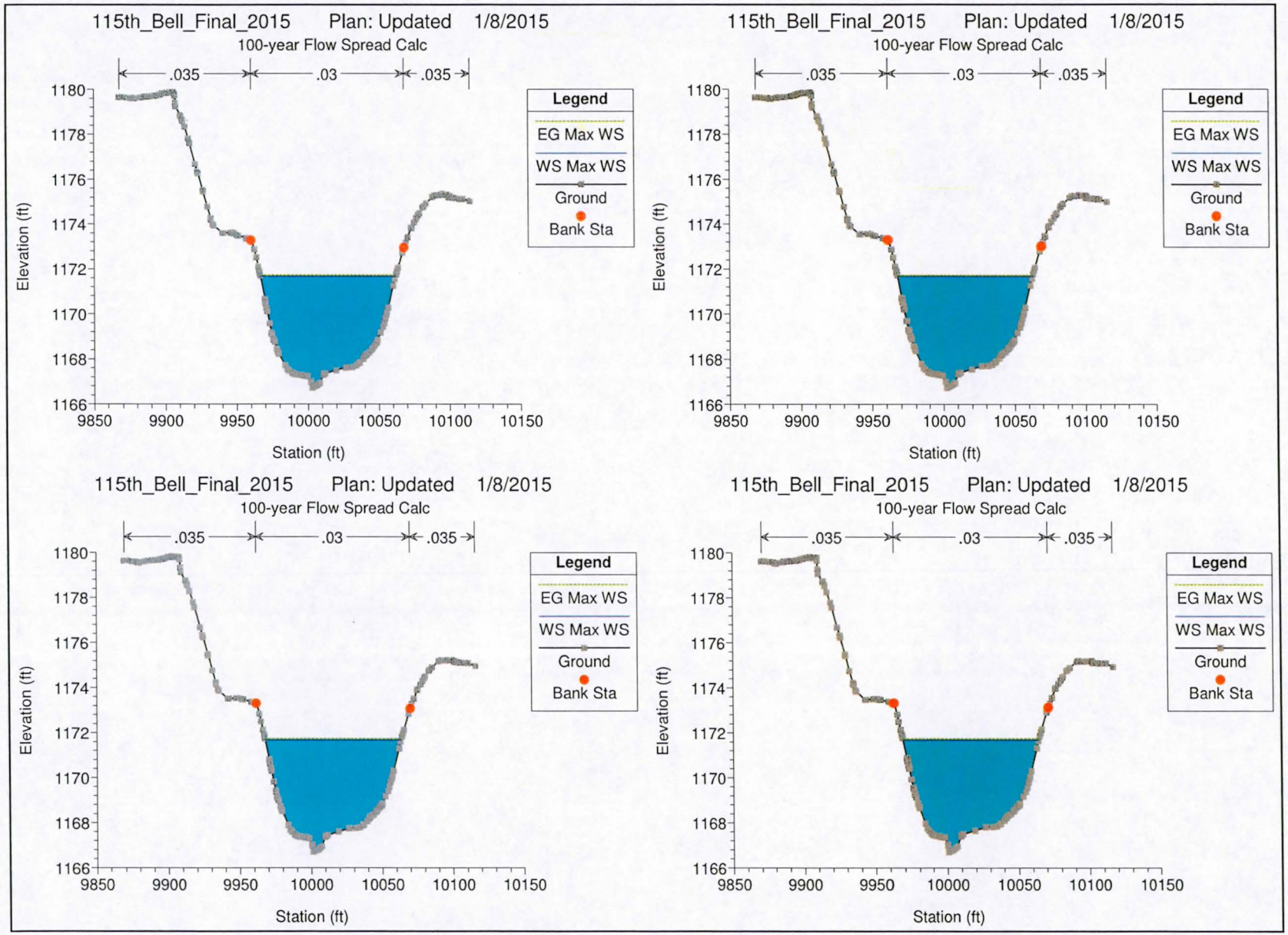
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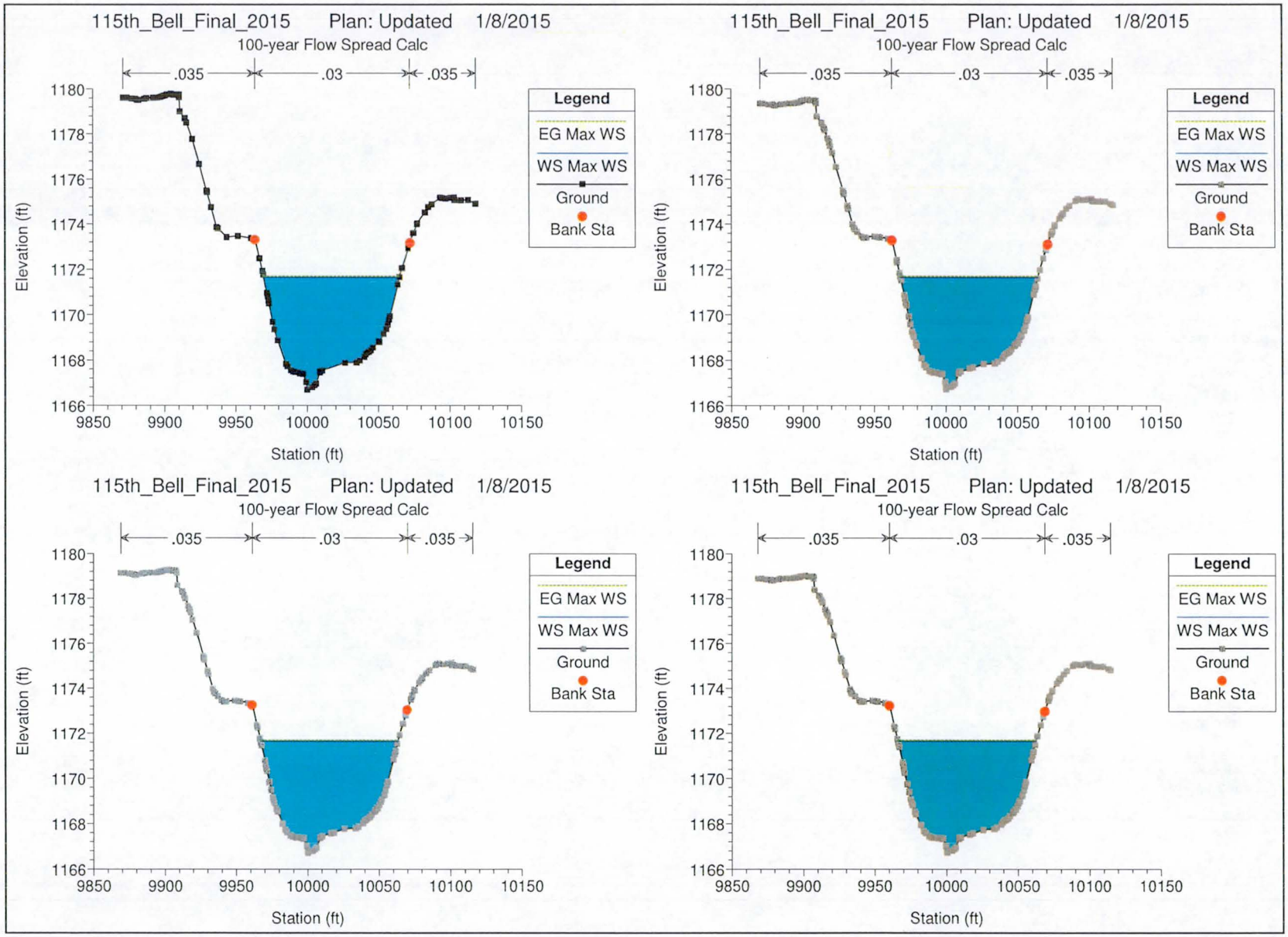
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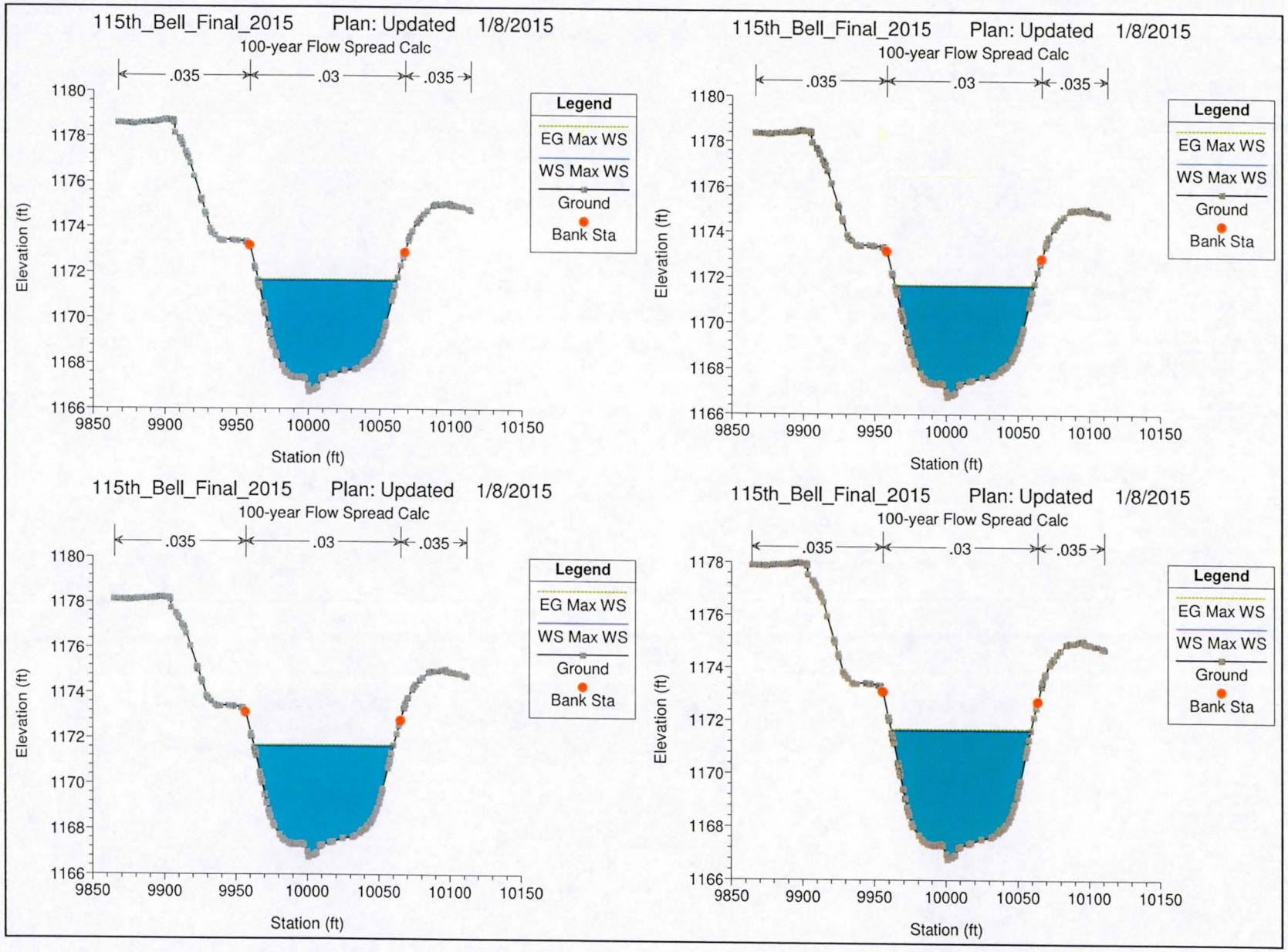
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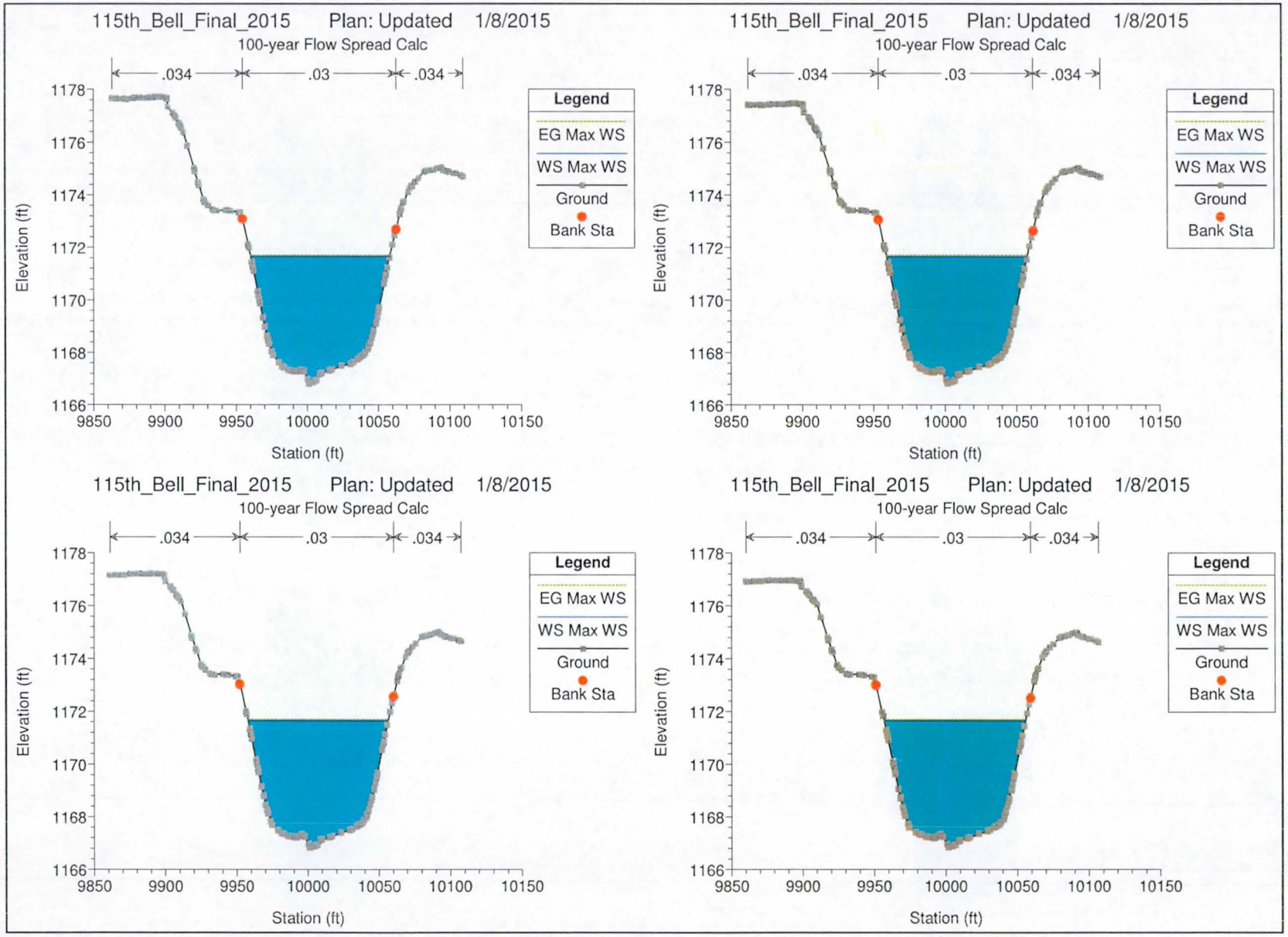
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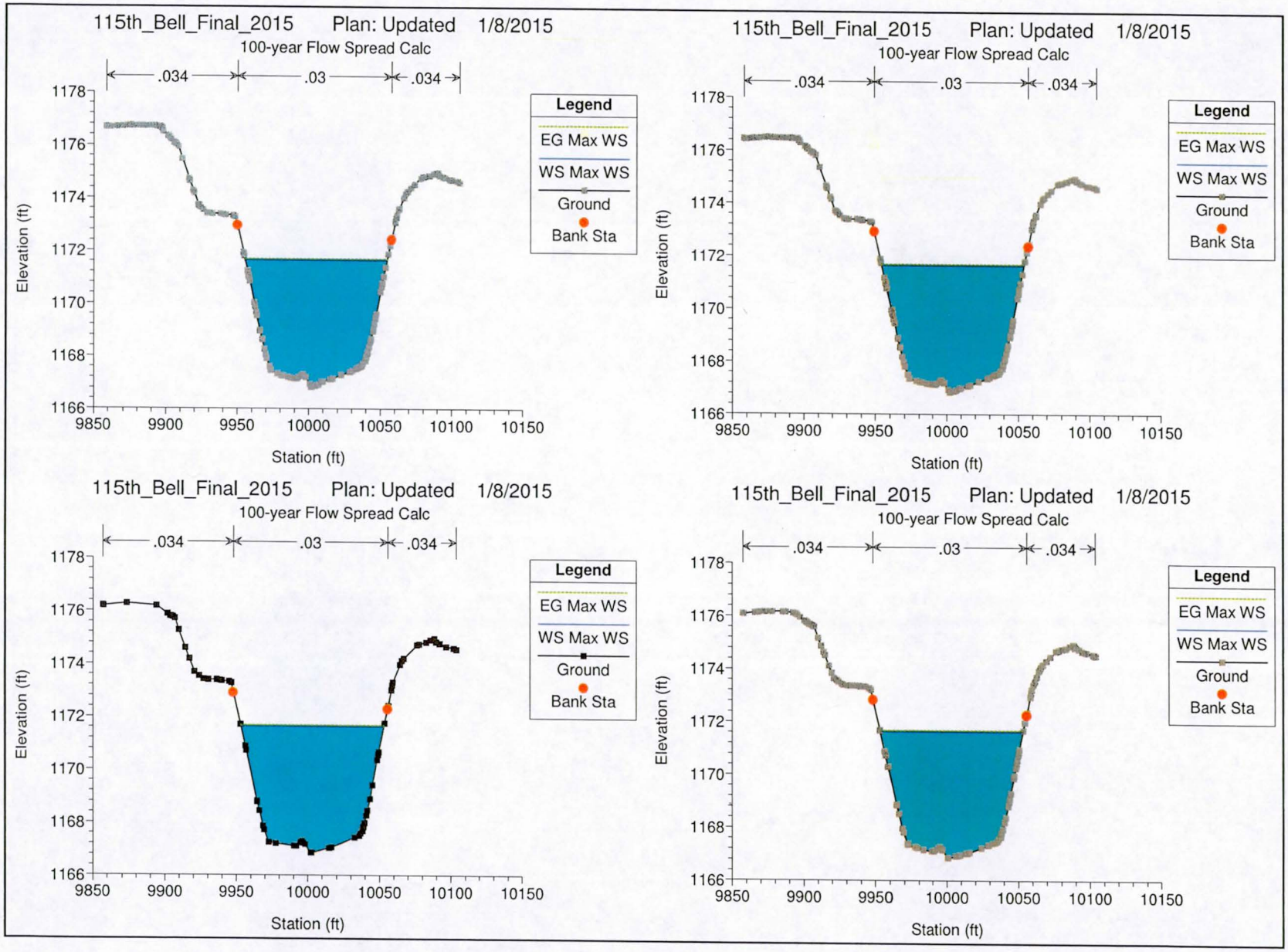
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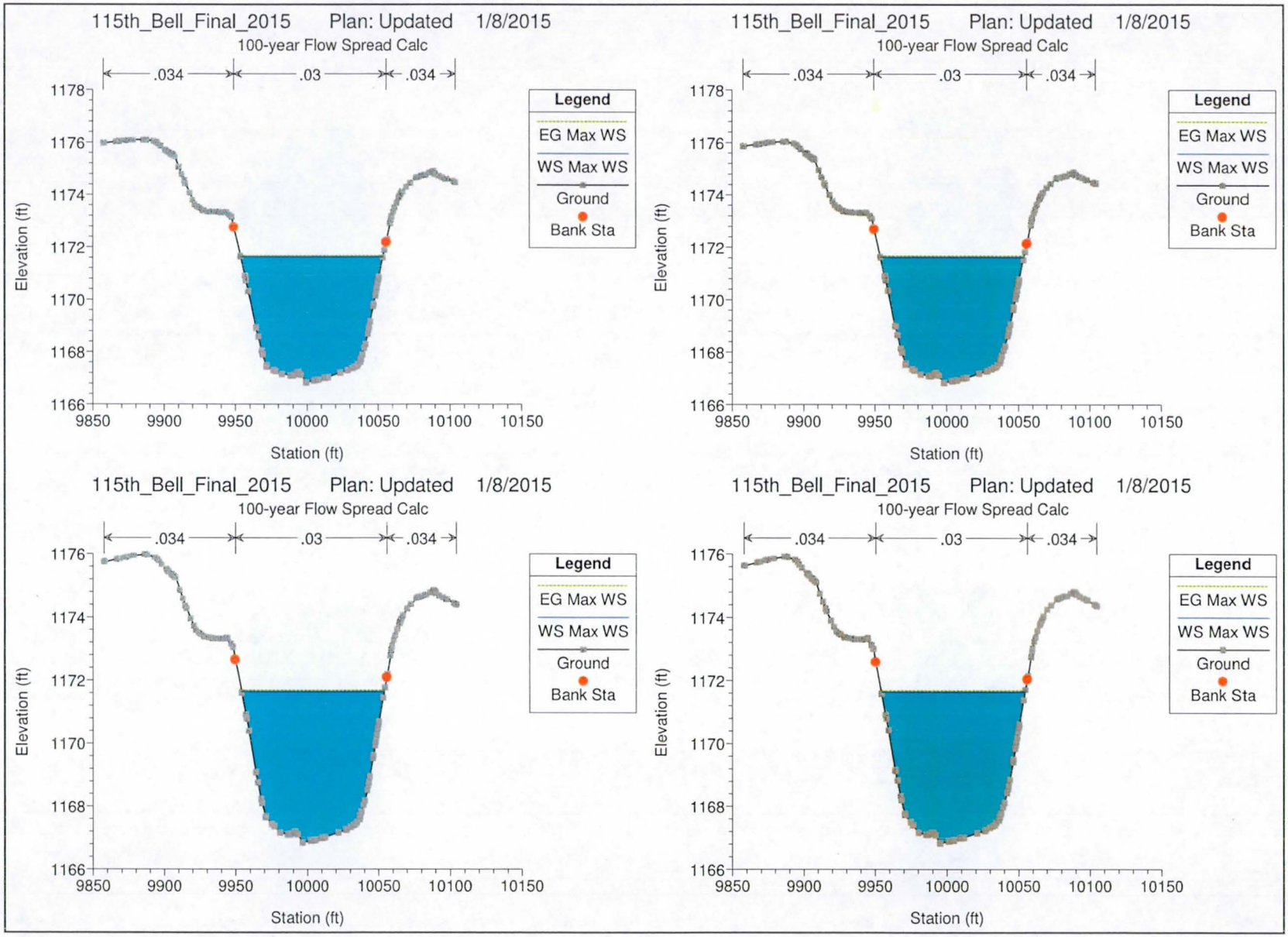
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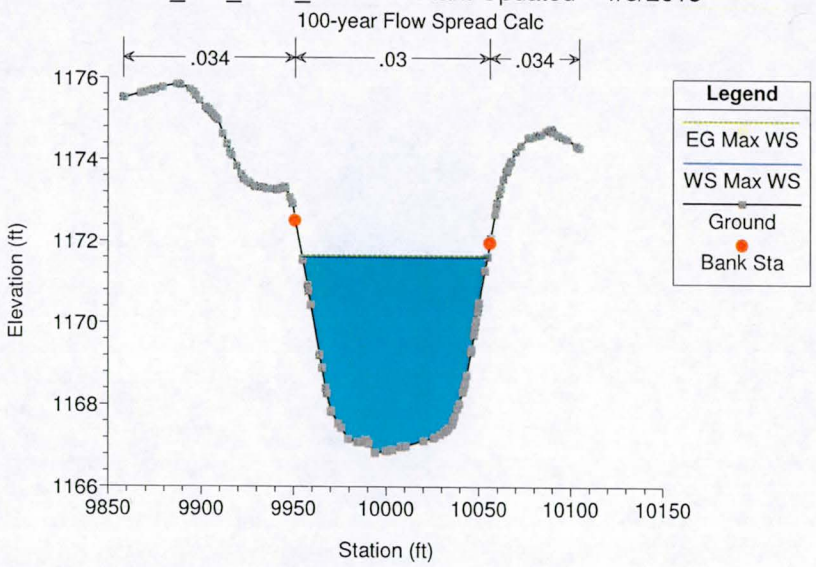
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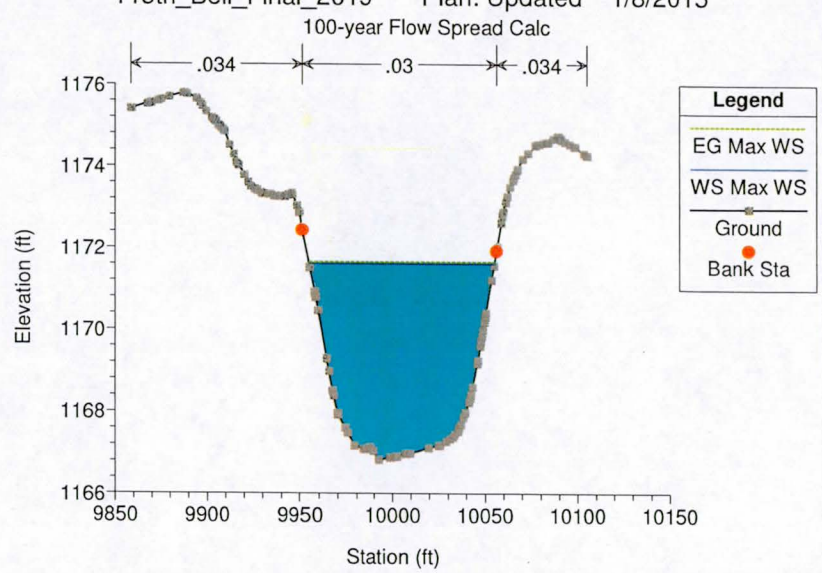
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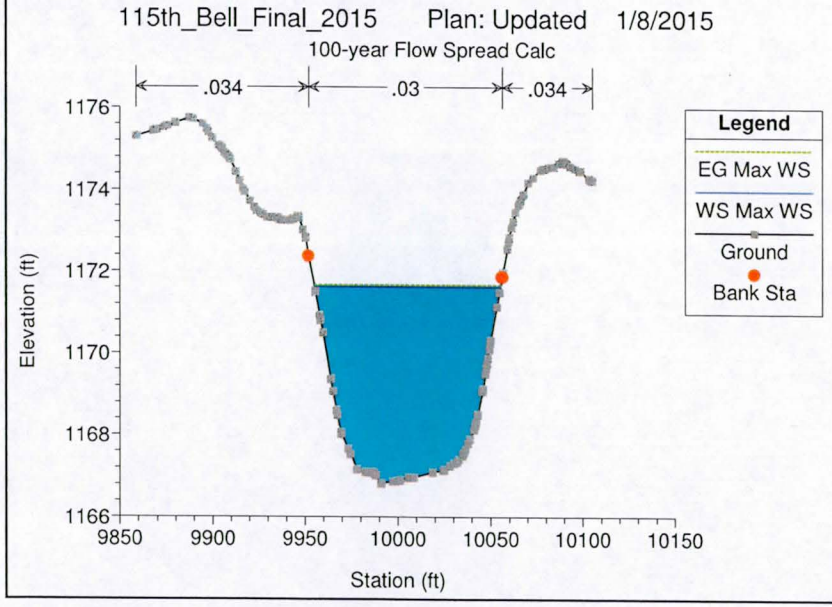
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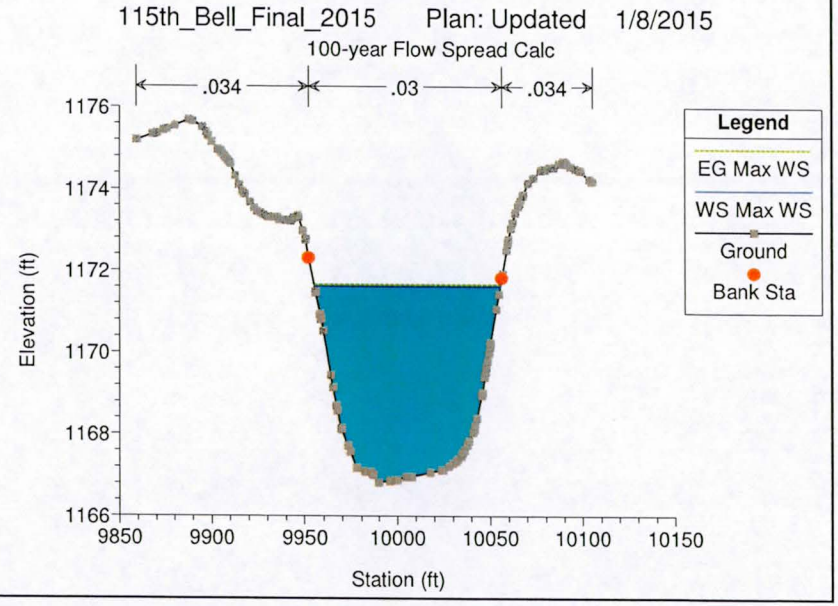
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100-year Flow Spread Calc
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Elevation (ft)
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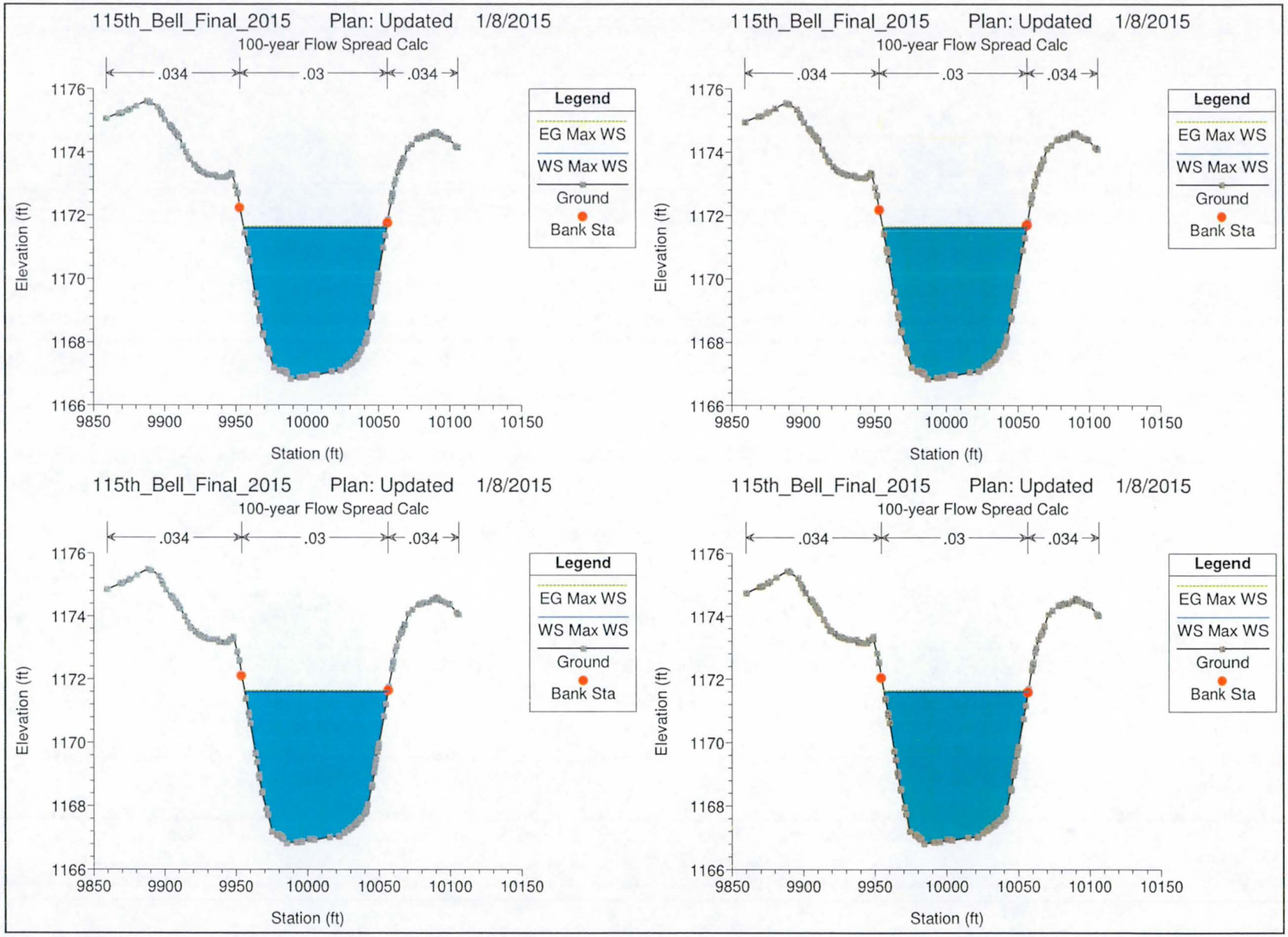
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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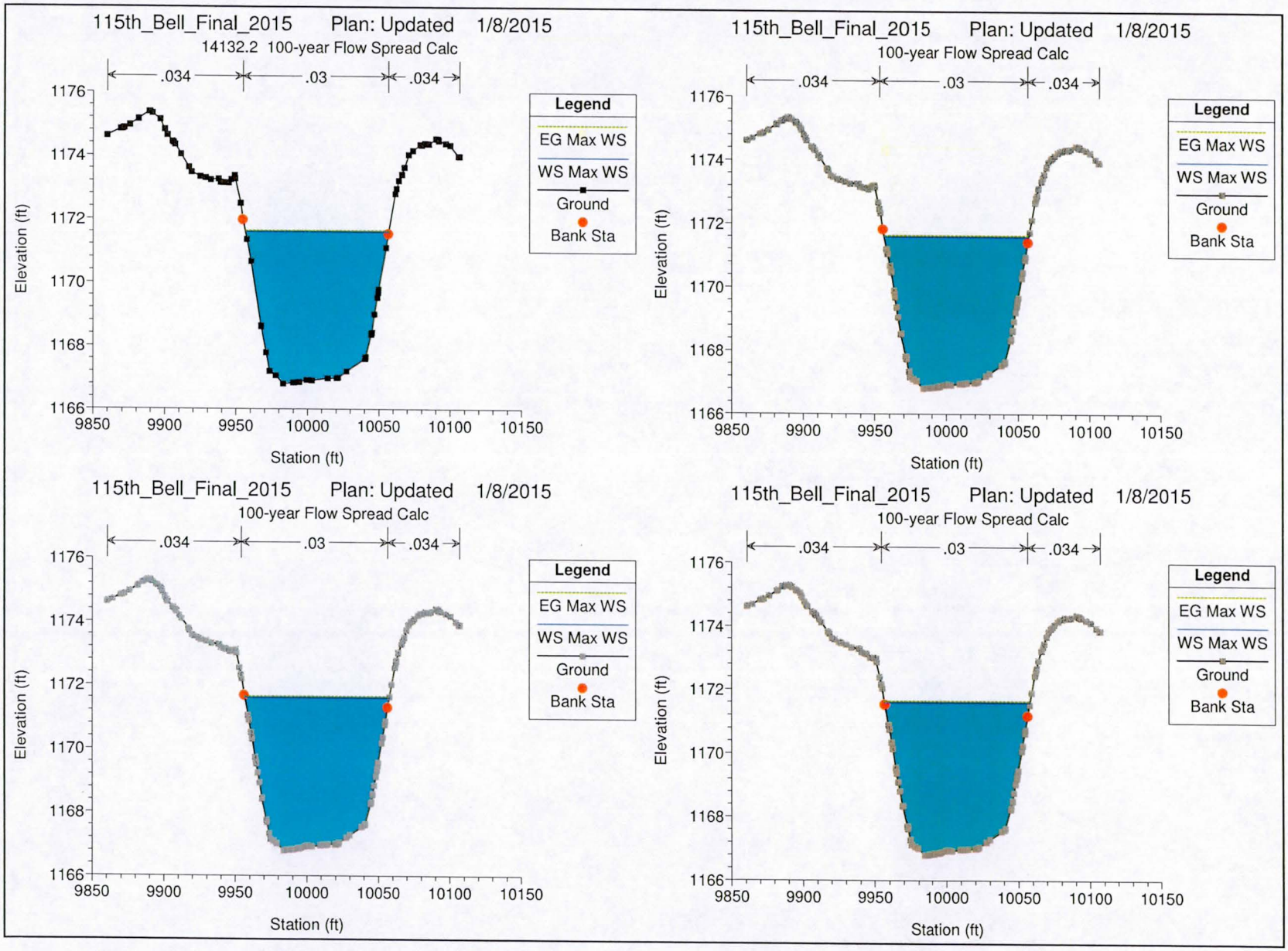
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
14132.2 100-year Flow Spread Calc
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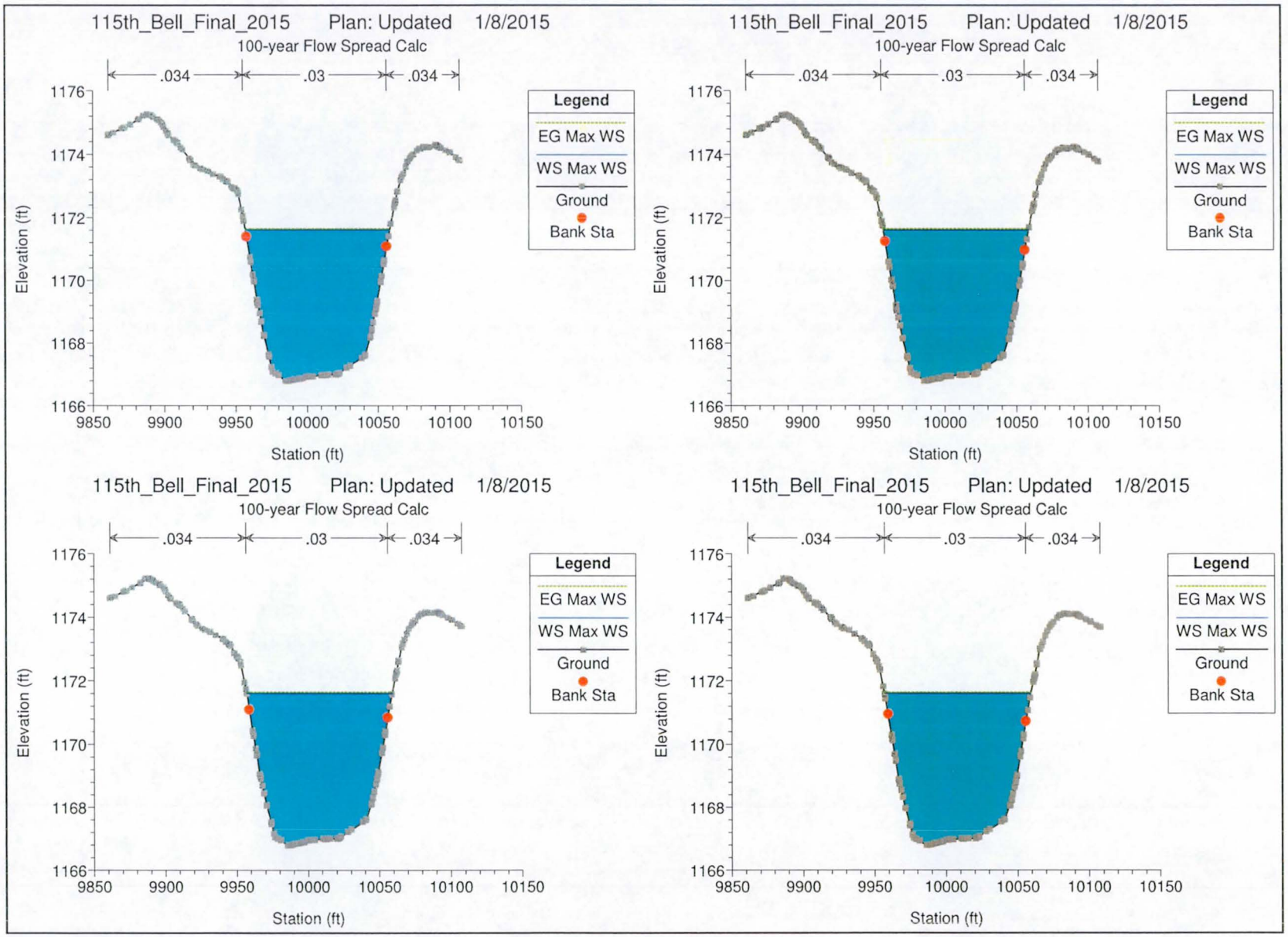
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
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Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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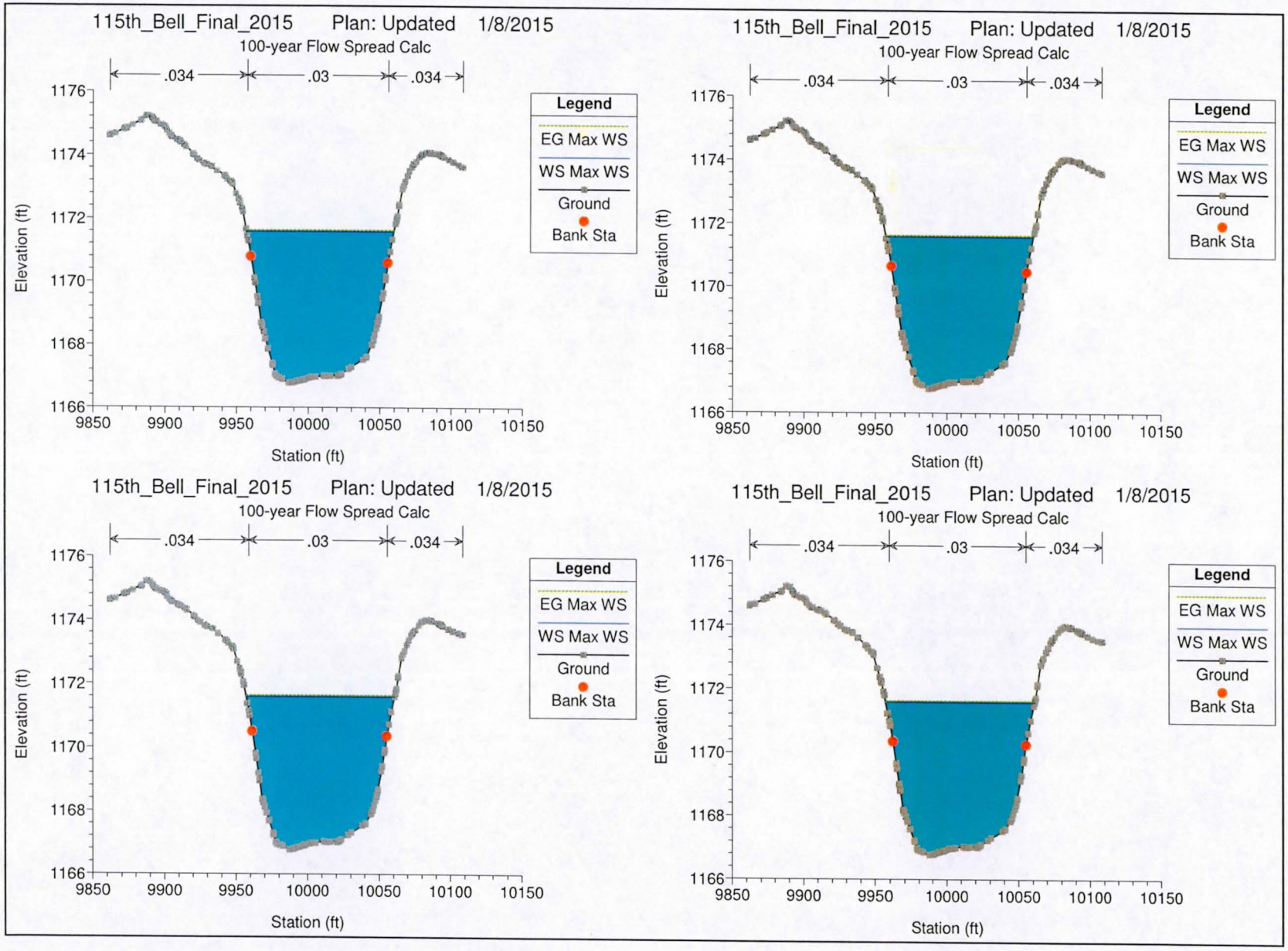
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
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Bank Sta
Elevation (ft)
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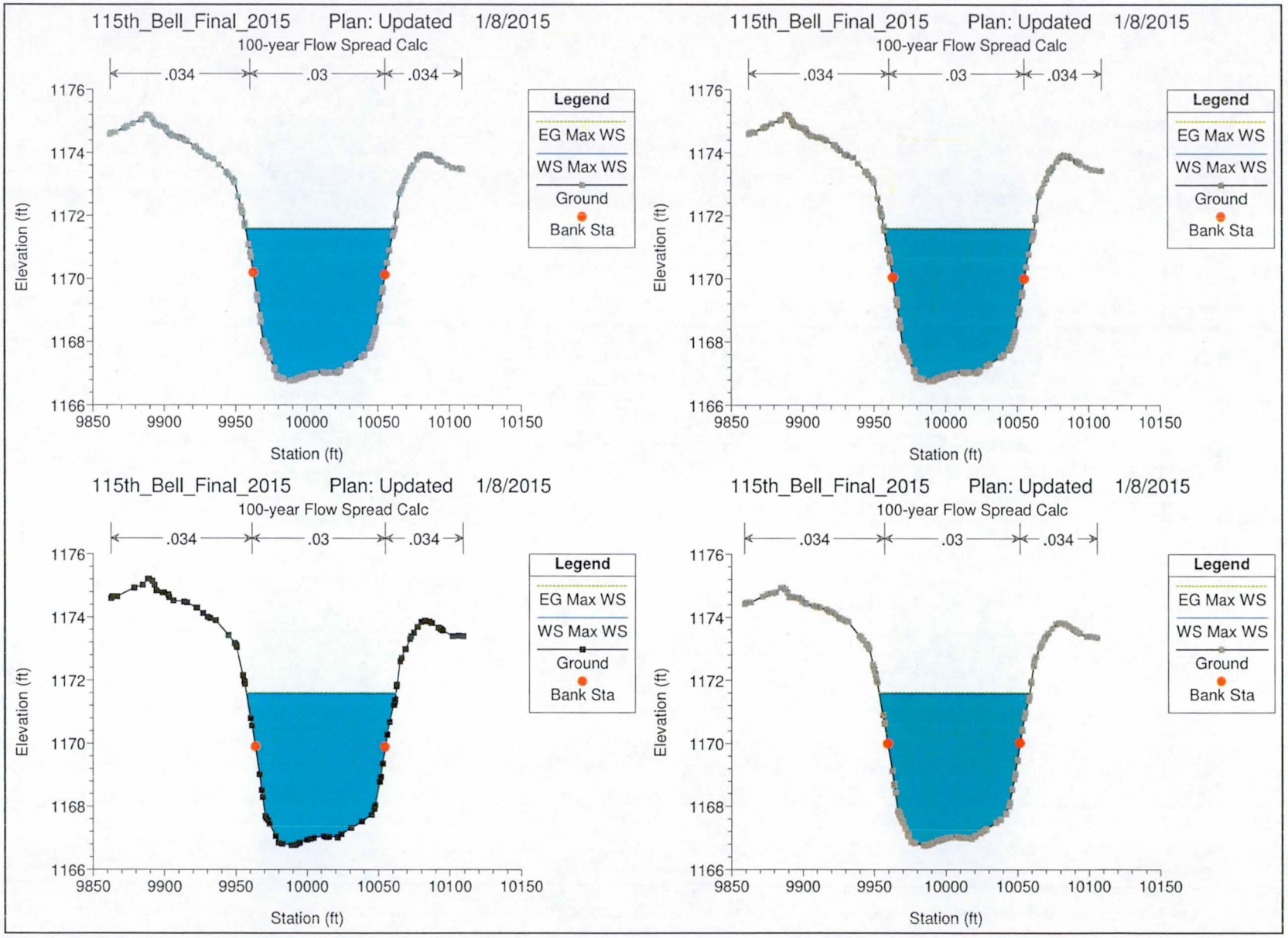
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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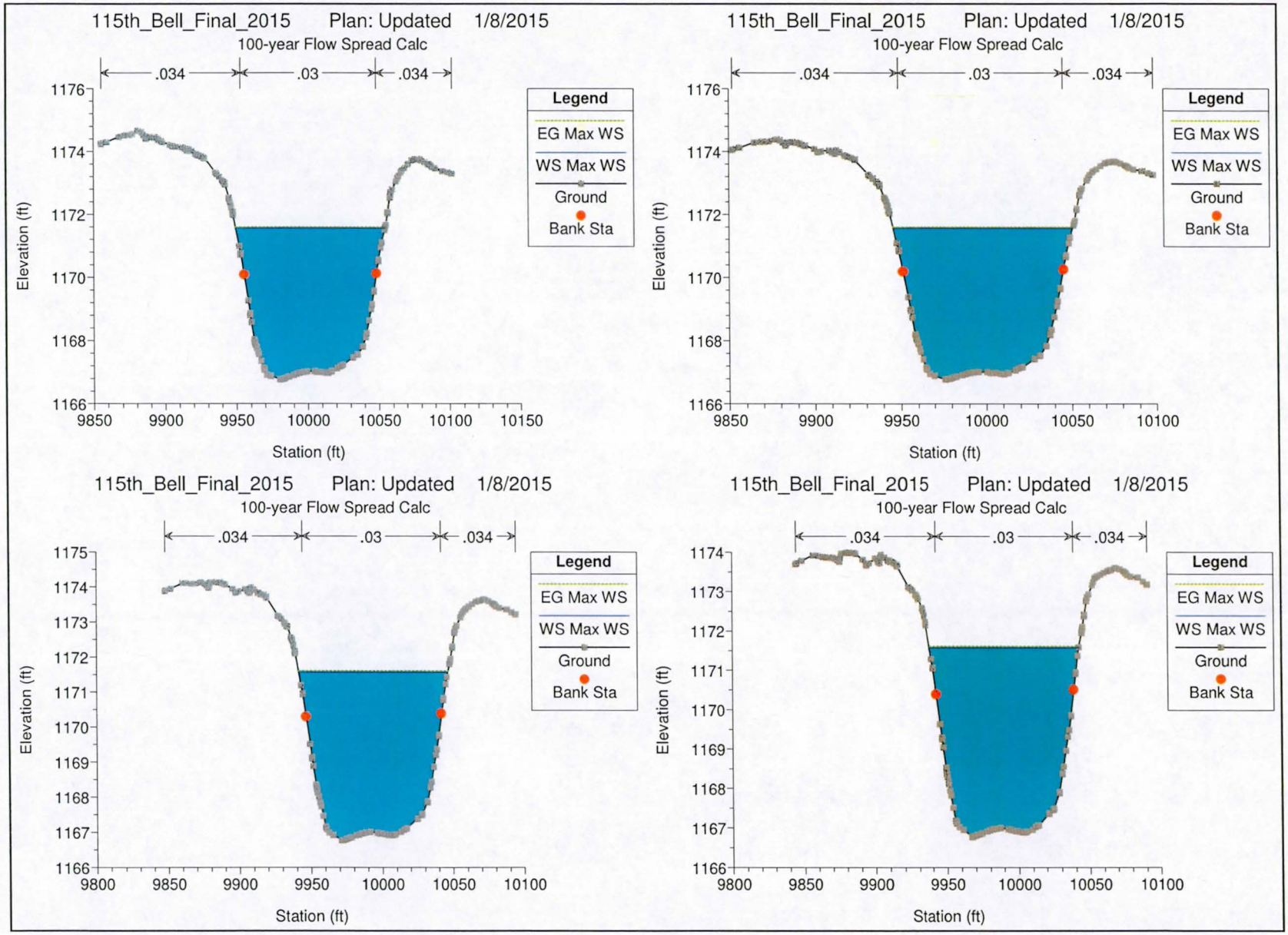
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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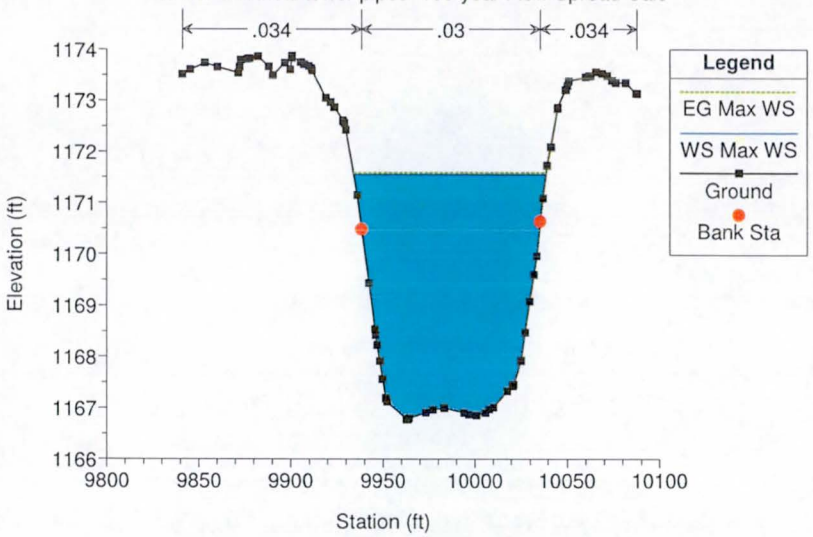
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
U/S of electrical tower pipes 100-year Flow Spread Calc
.034
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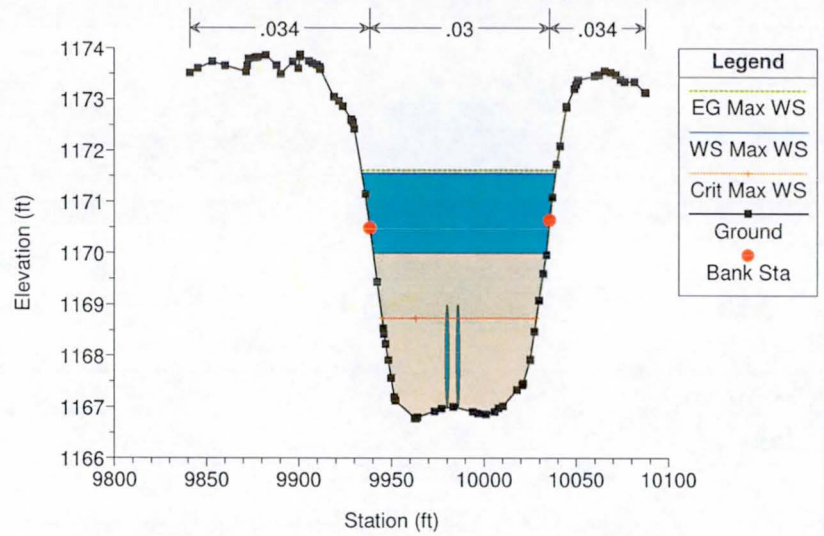
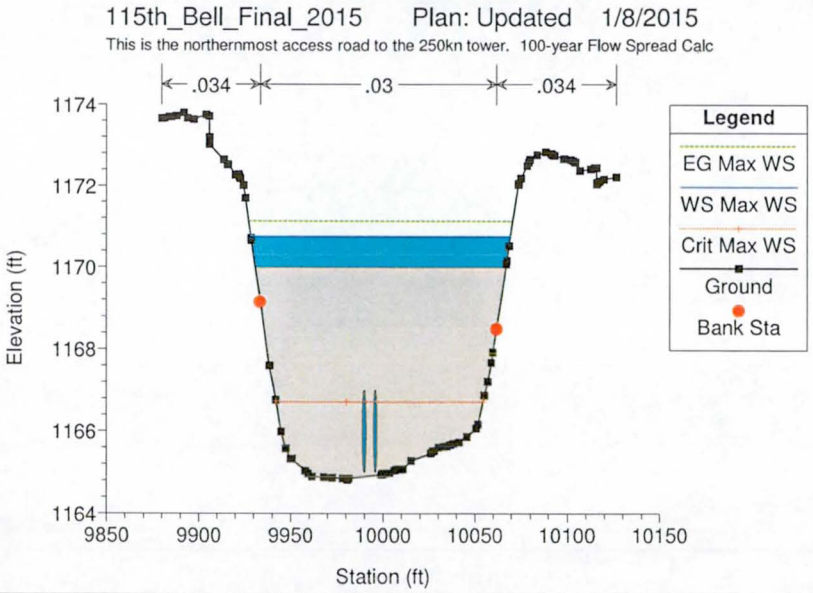
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the northernmost access road to the 250kn tower. 100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the northernmost access road to the 250kn tower. 100-year Flow Spread Calc
.034
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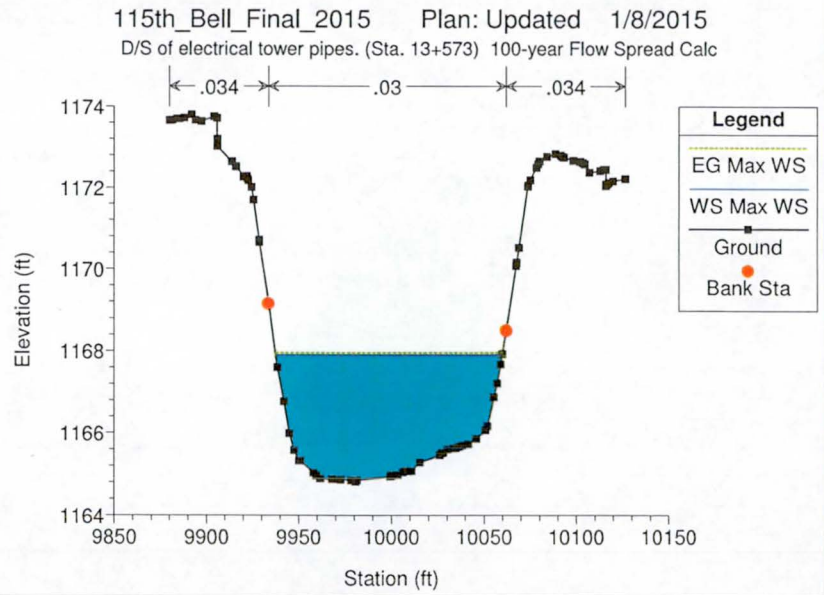
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
D/S of electrical tower pipes. (Sta. 13+573) 100-year Flow Spread Calc
.034
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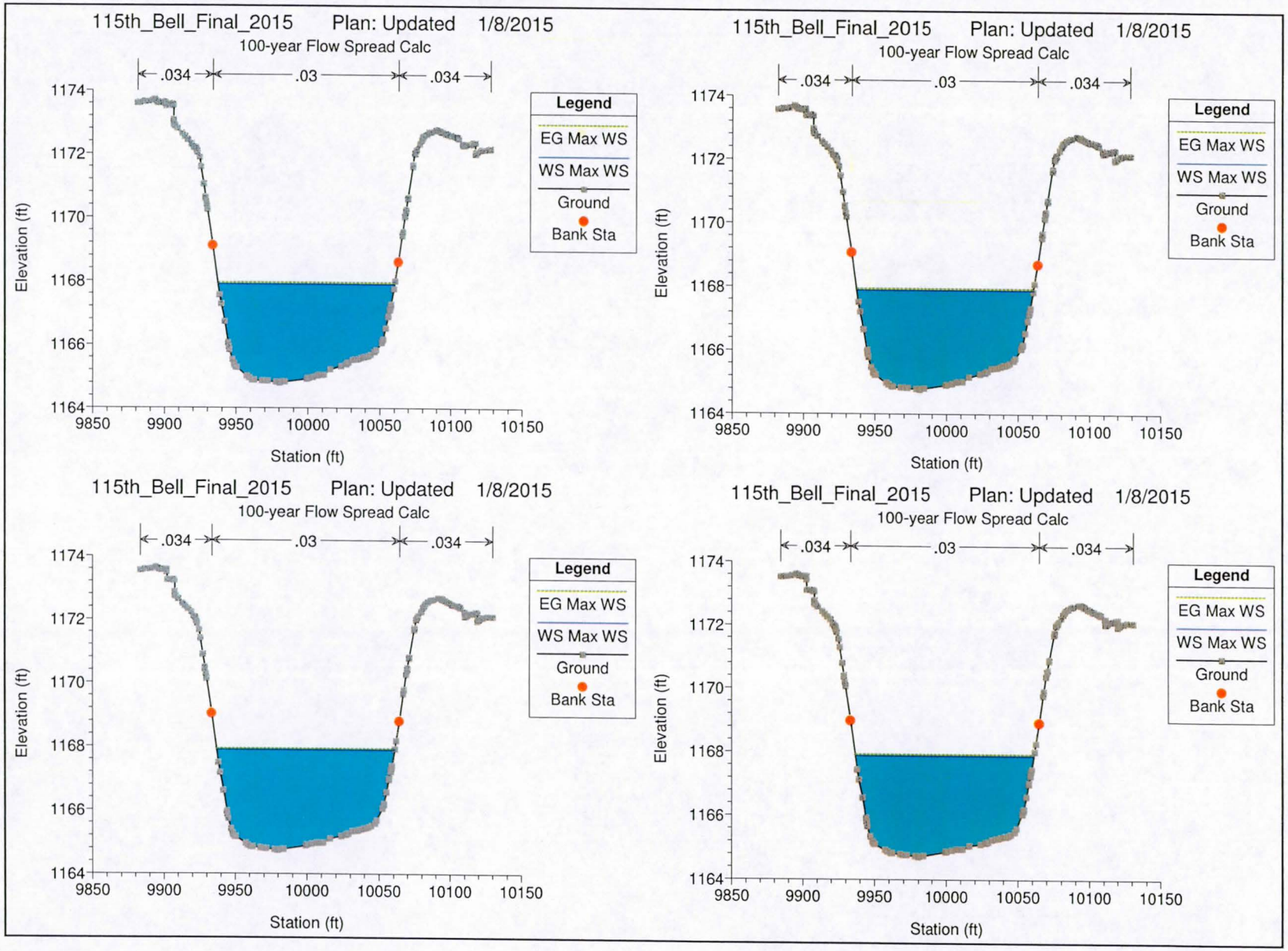
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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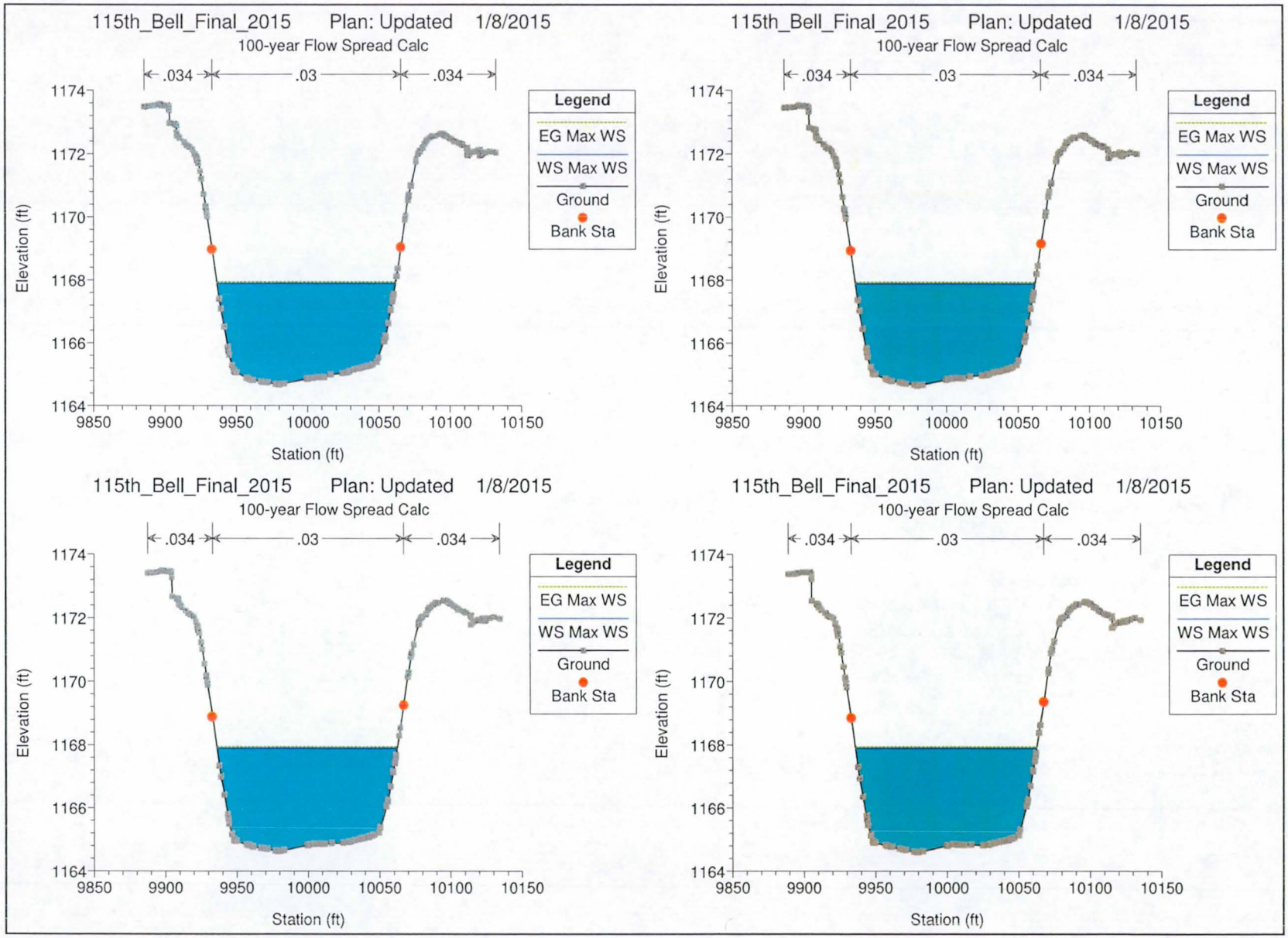
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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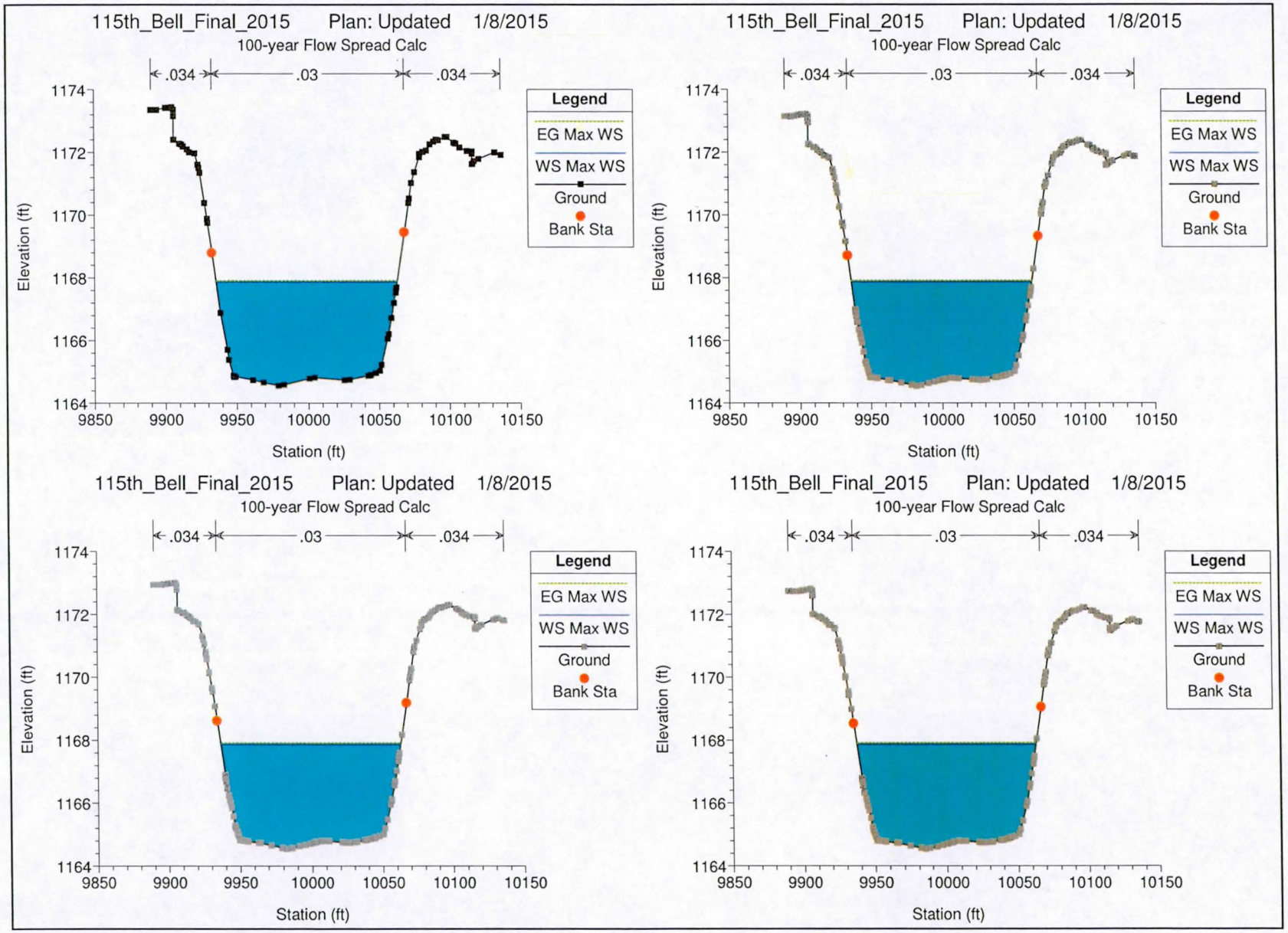
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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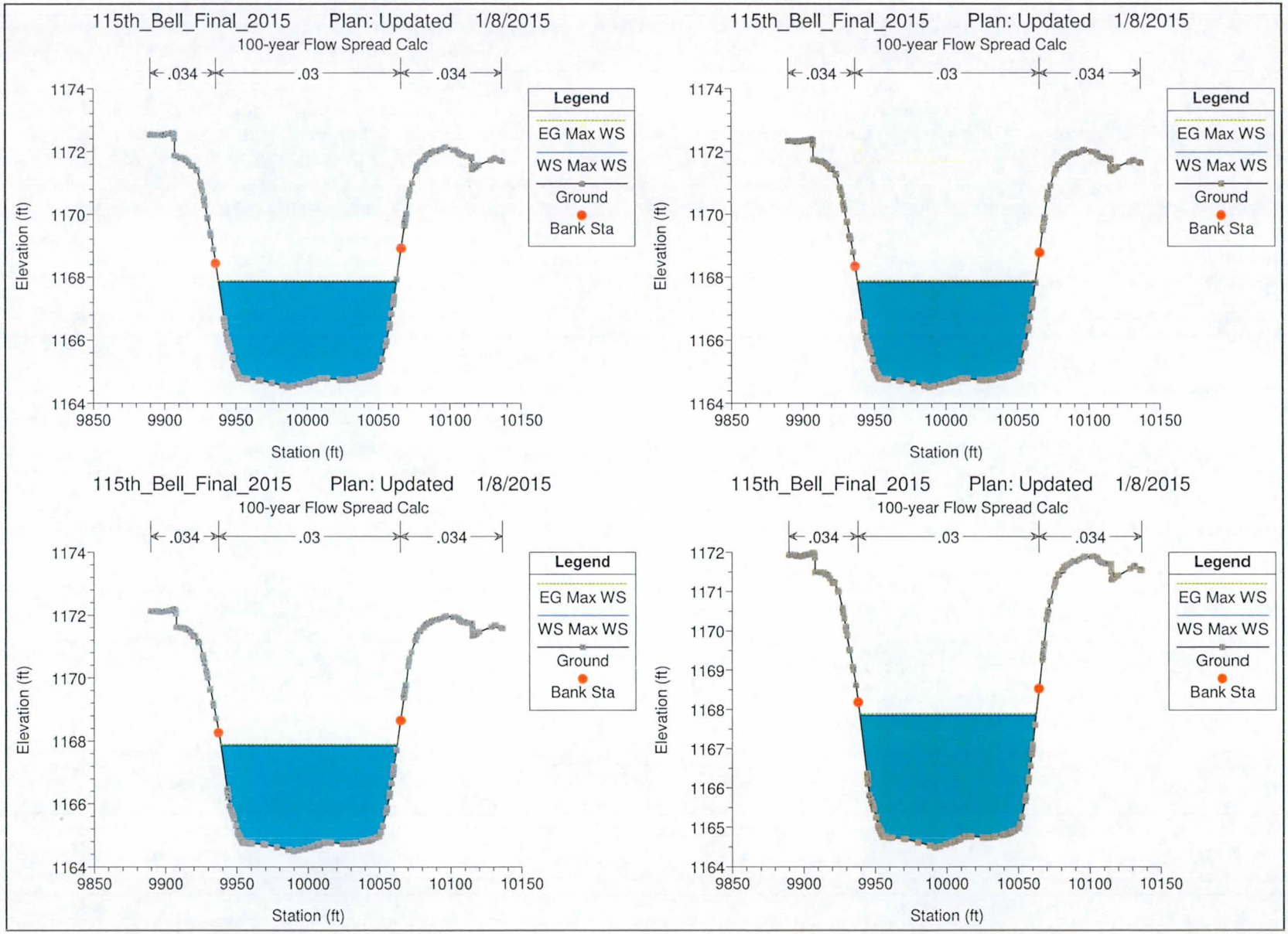
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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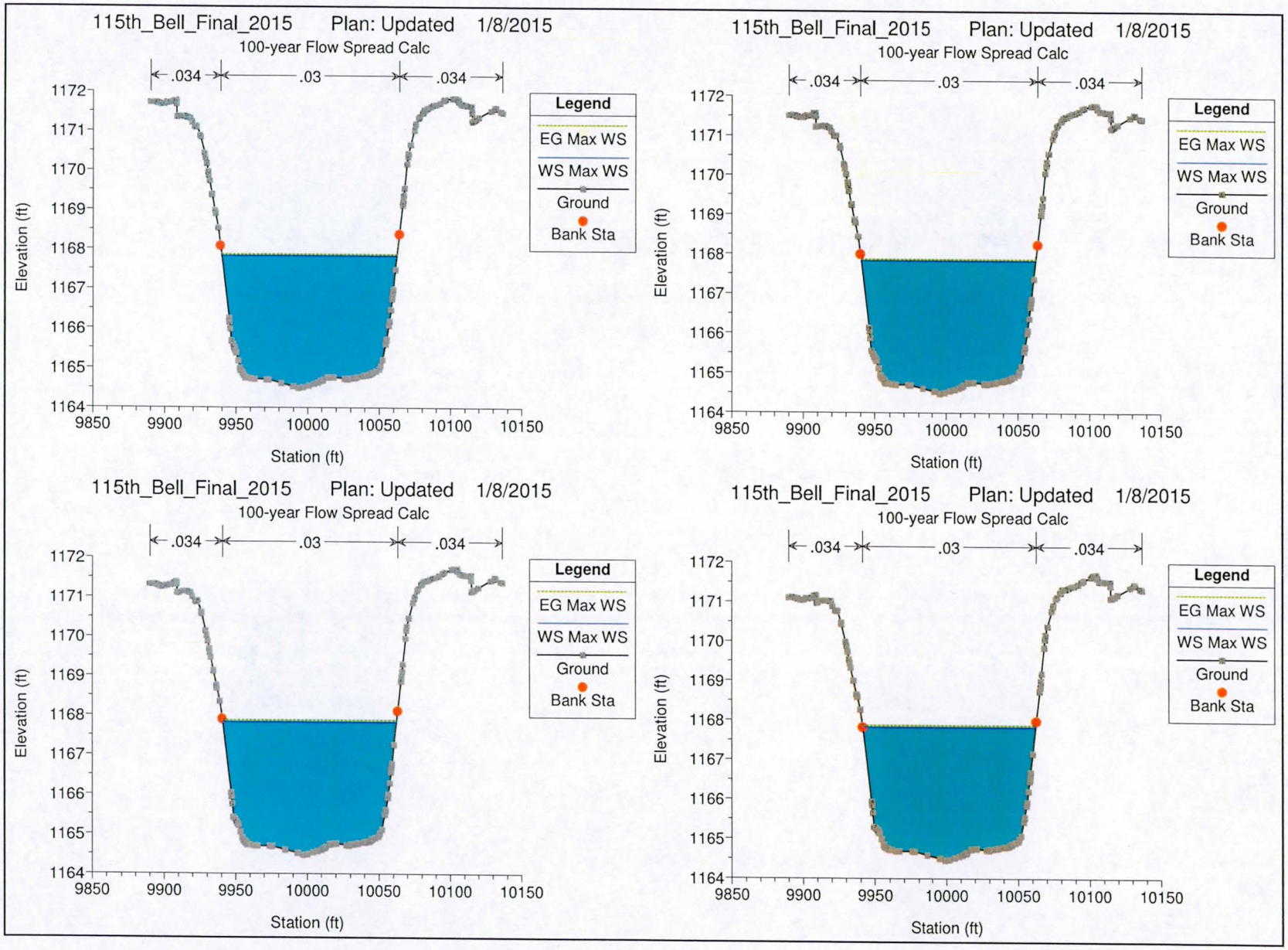
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
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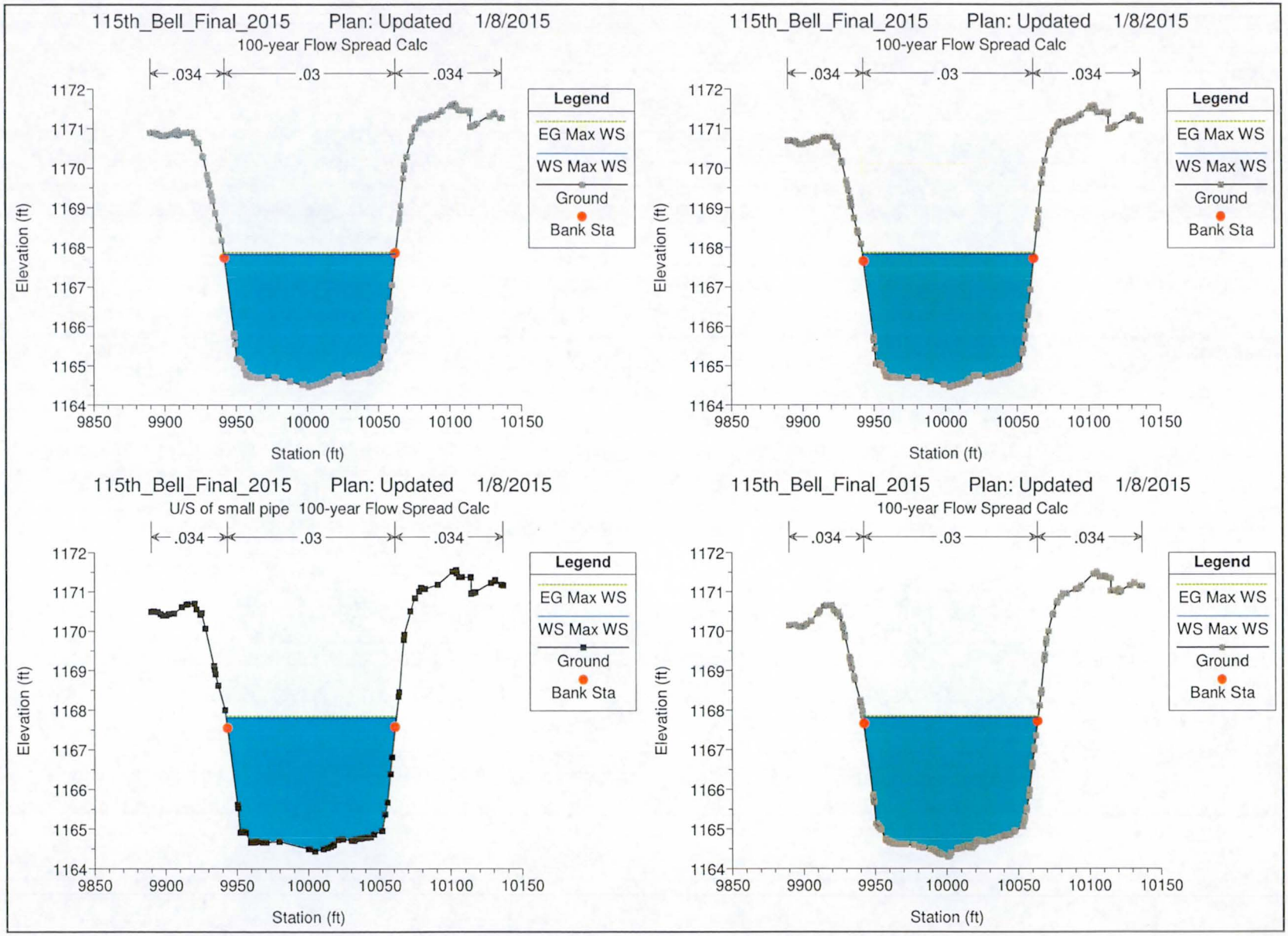
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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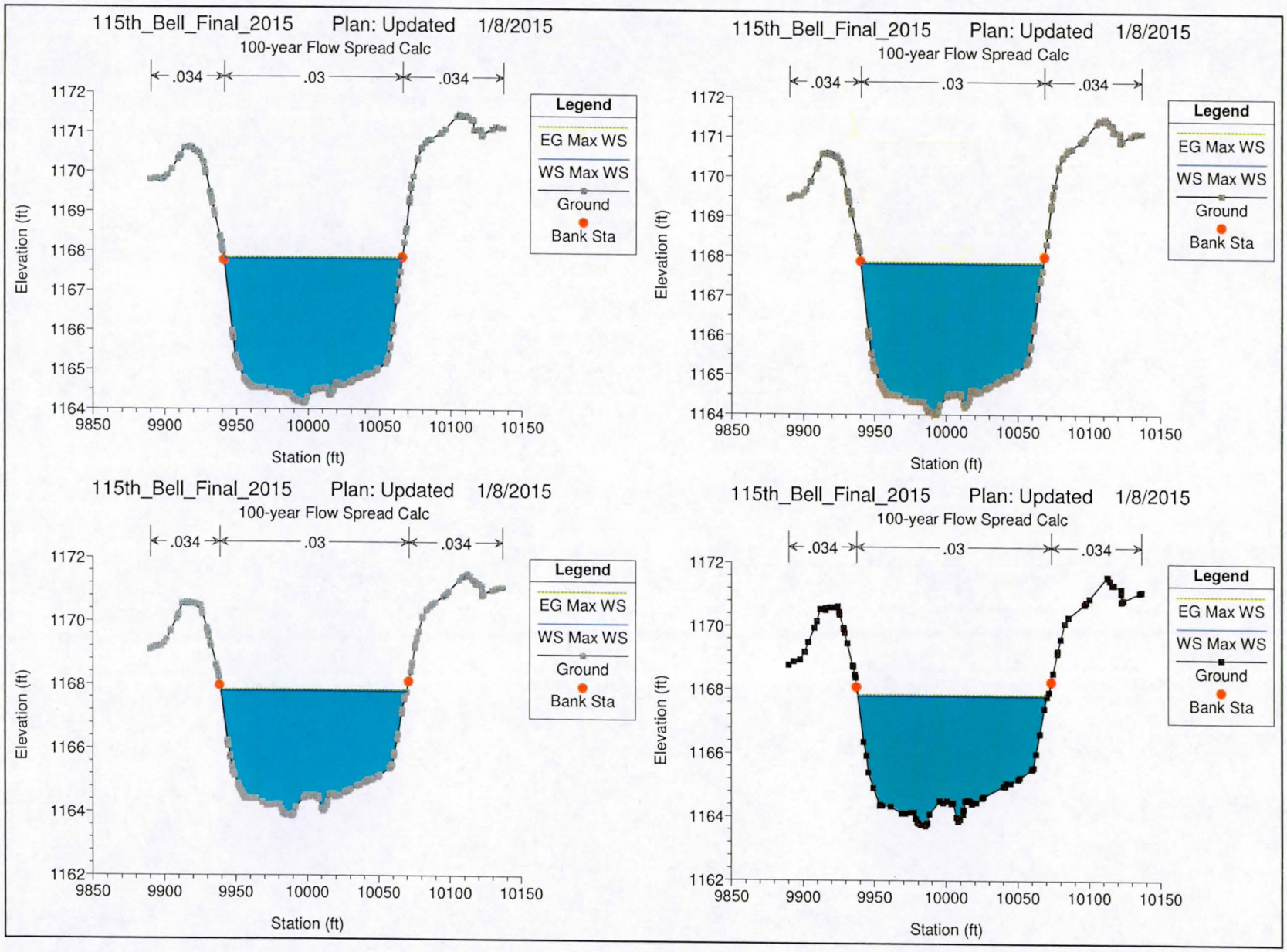
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
U/S of small pipe 100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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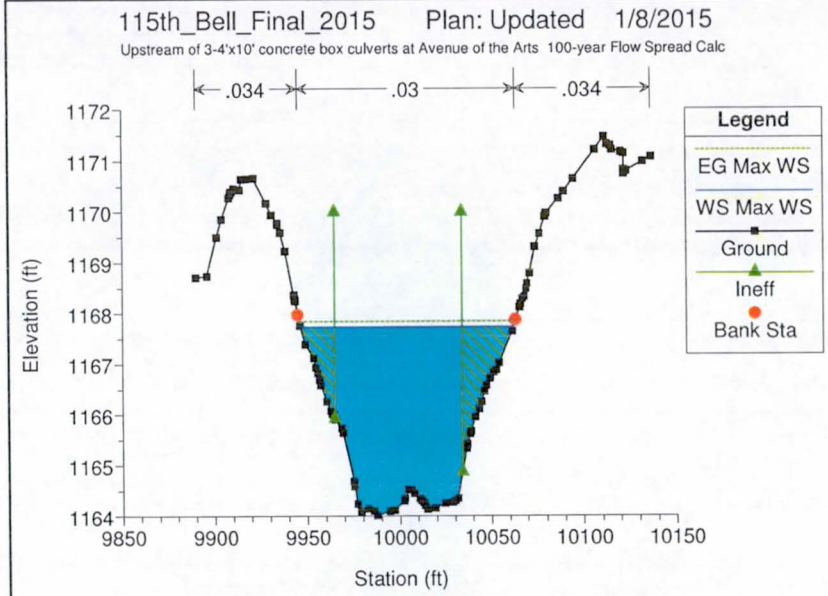
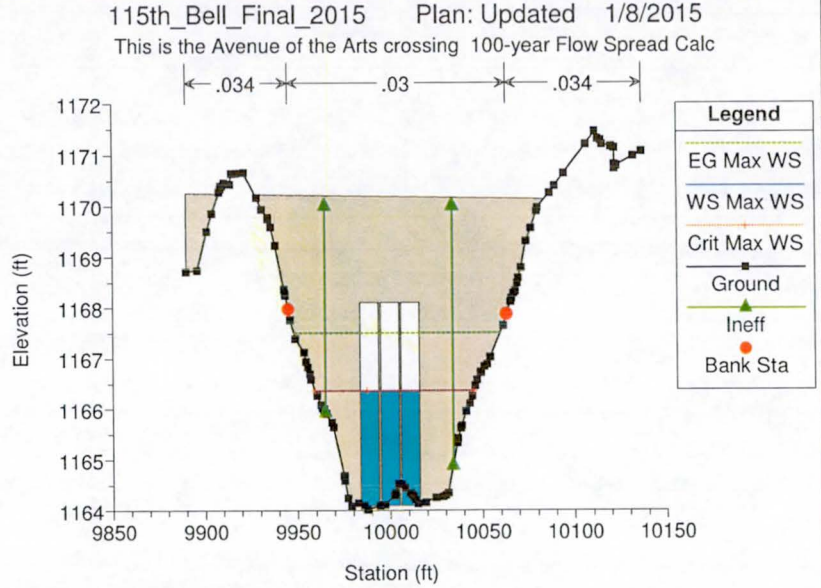
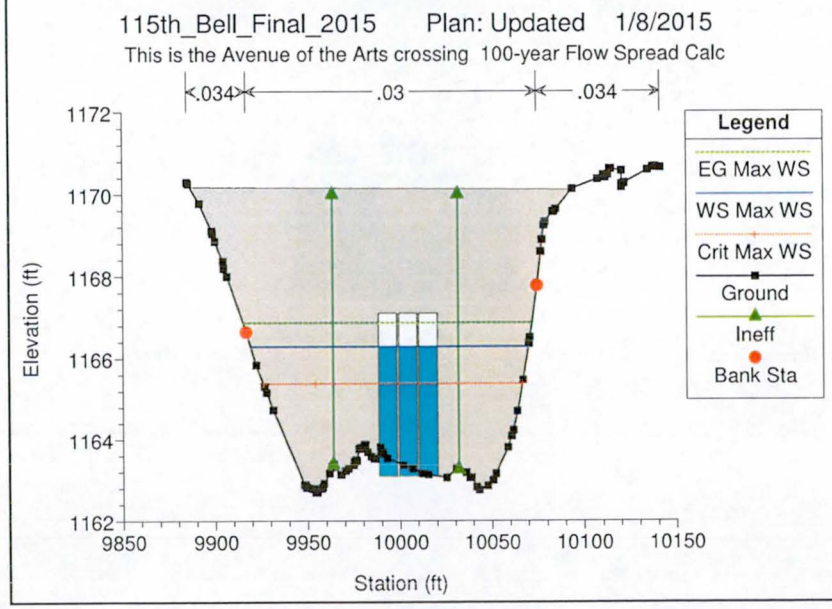
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
Upstream of 3-4'x10' concrete box culverts at Avenue of the Arts 100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the Avenue of the Arts crossing 100-year Flow Spread Calc
.034
.03
.034
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the Avenue of the Arts crossing 100-year Flow Spread Calc
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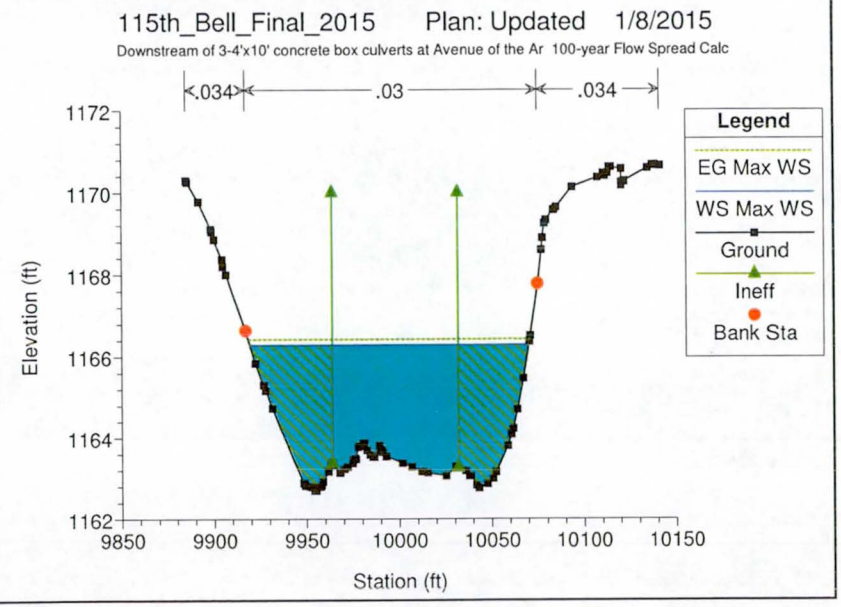
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
Downstream of 3-4'x10' concrete box culverts at Avenue of the Ar 100-year Flow Spread Calc
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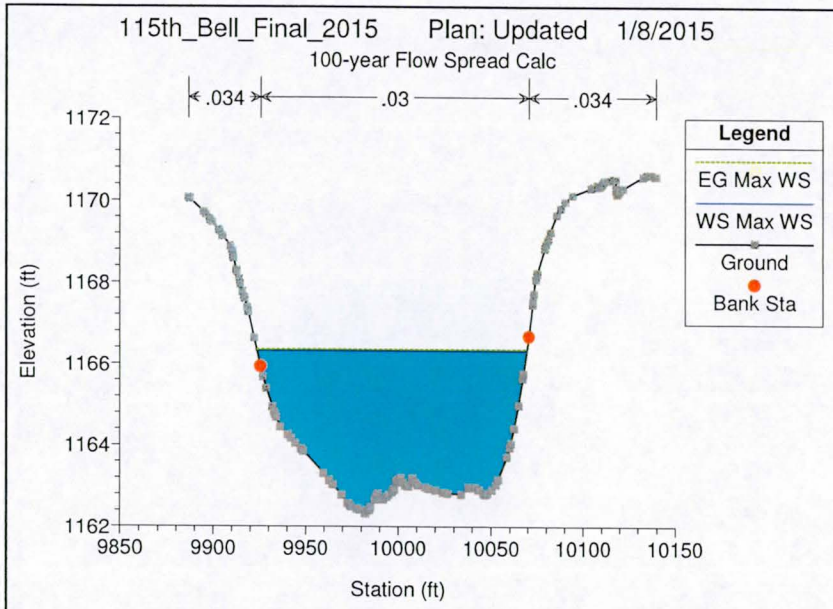
Legend
EG Max WS
WS Max WS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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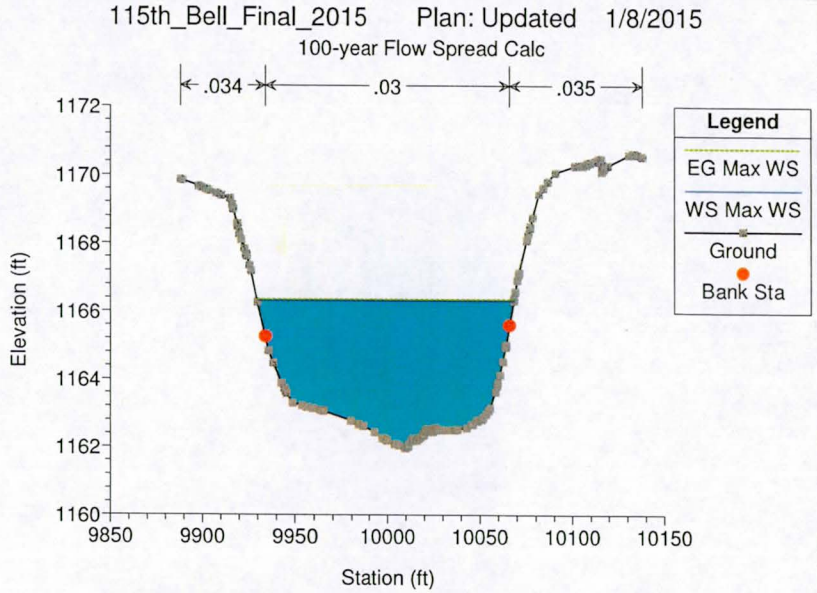
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Bank Sta
Elevation (ft)
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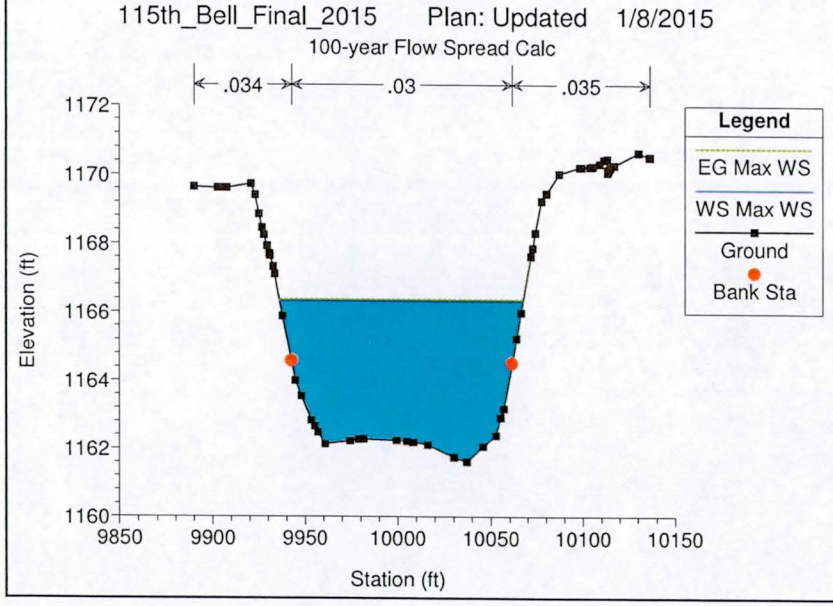
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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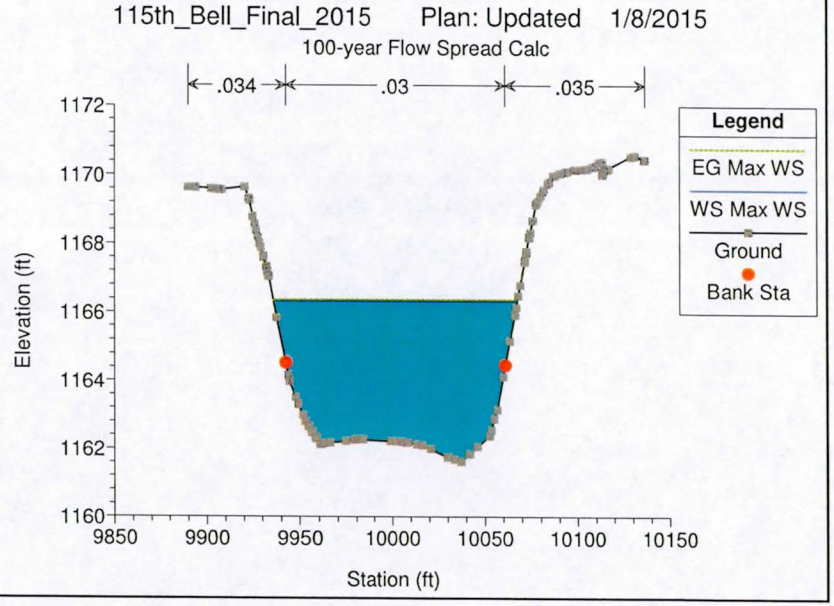
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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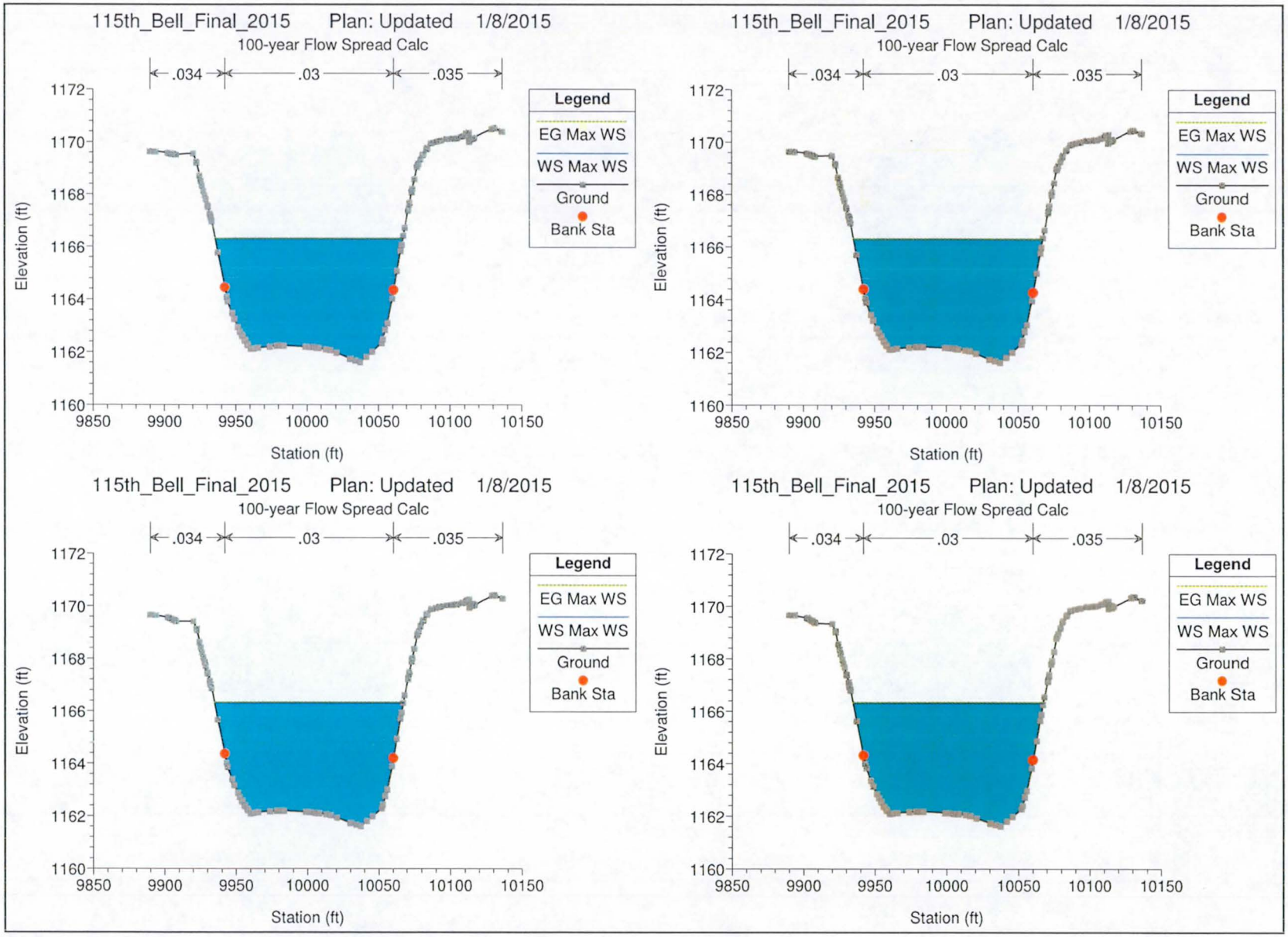
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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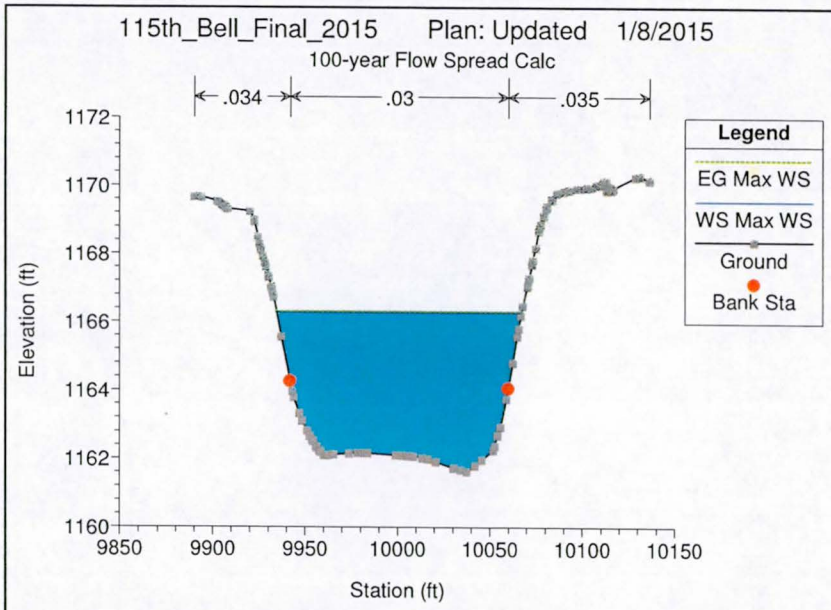
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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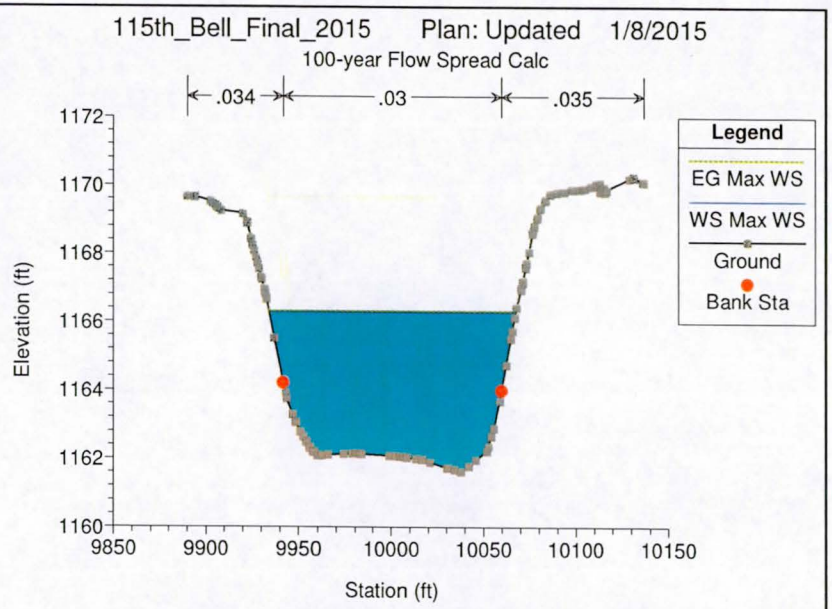
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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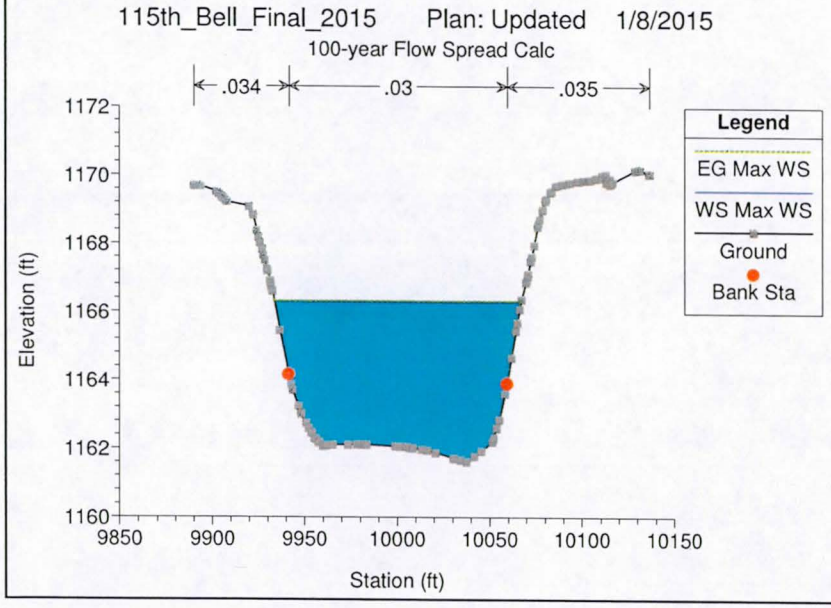
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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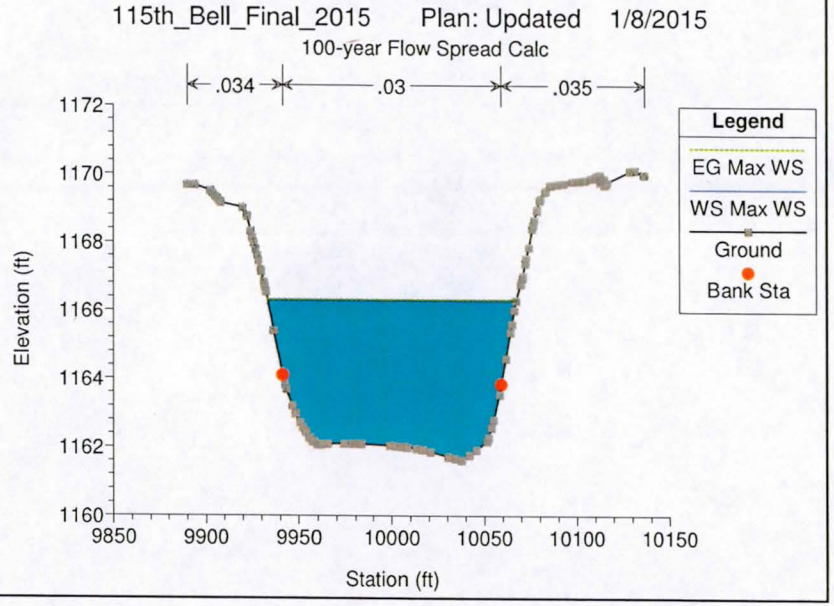
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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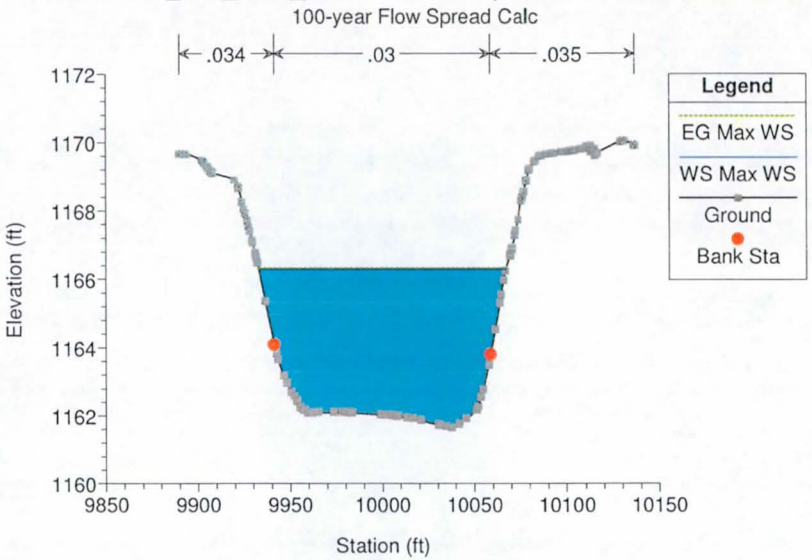
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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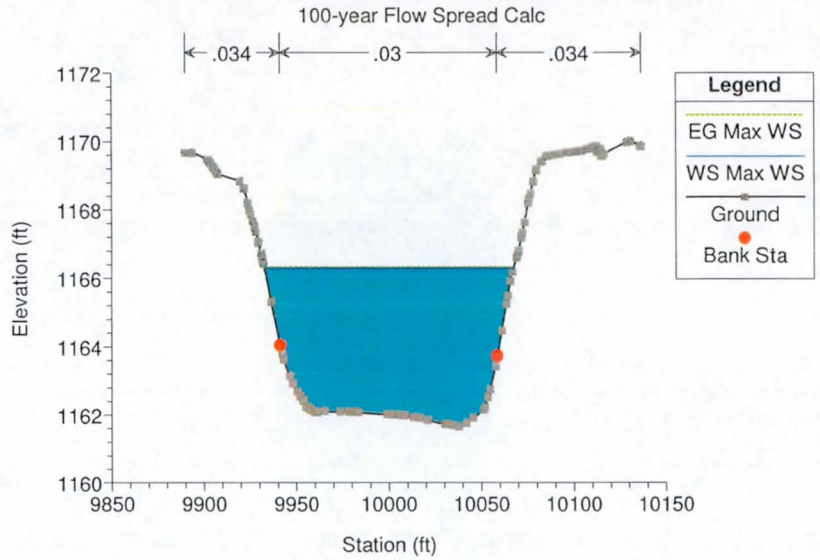
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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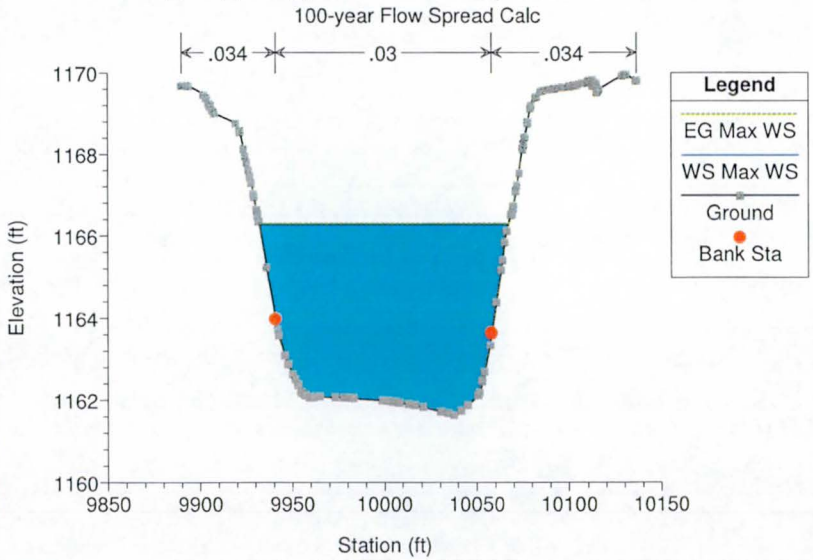
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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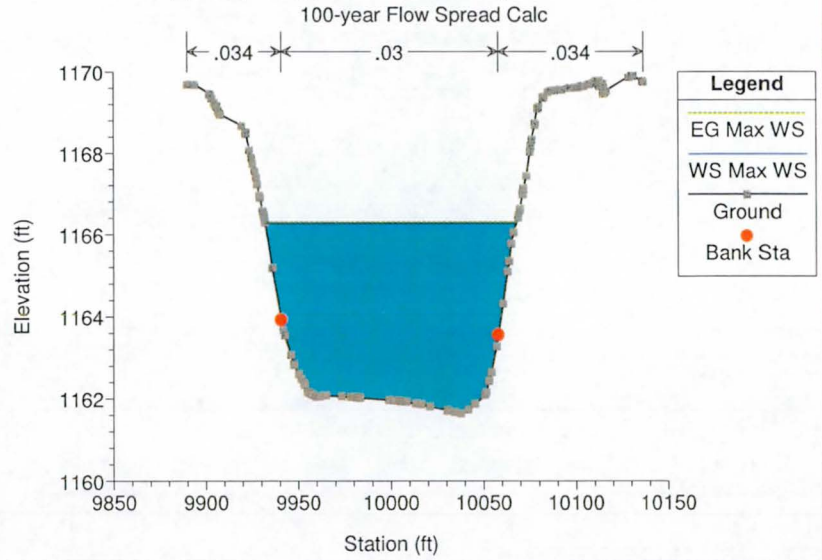
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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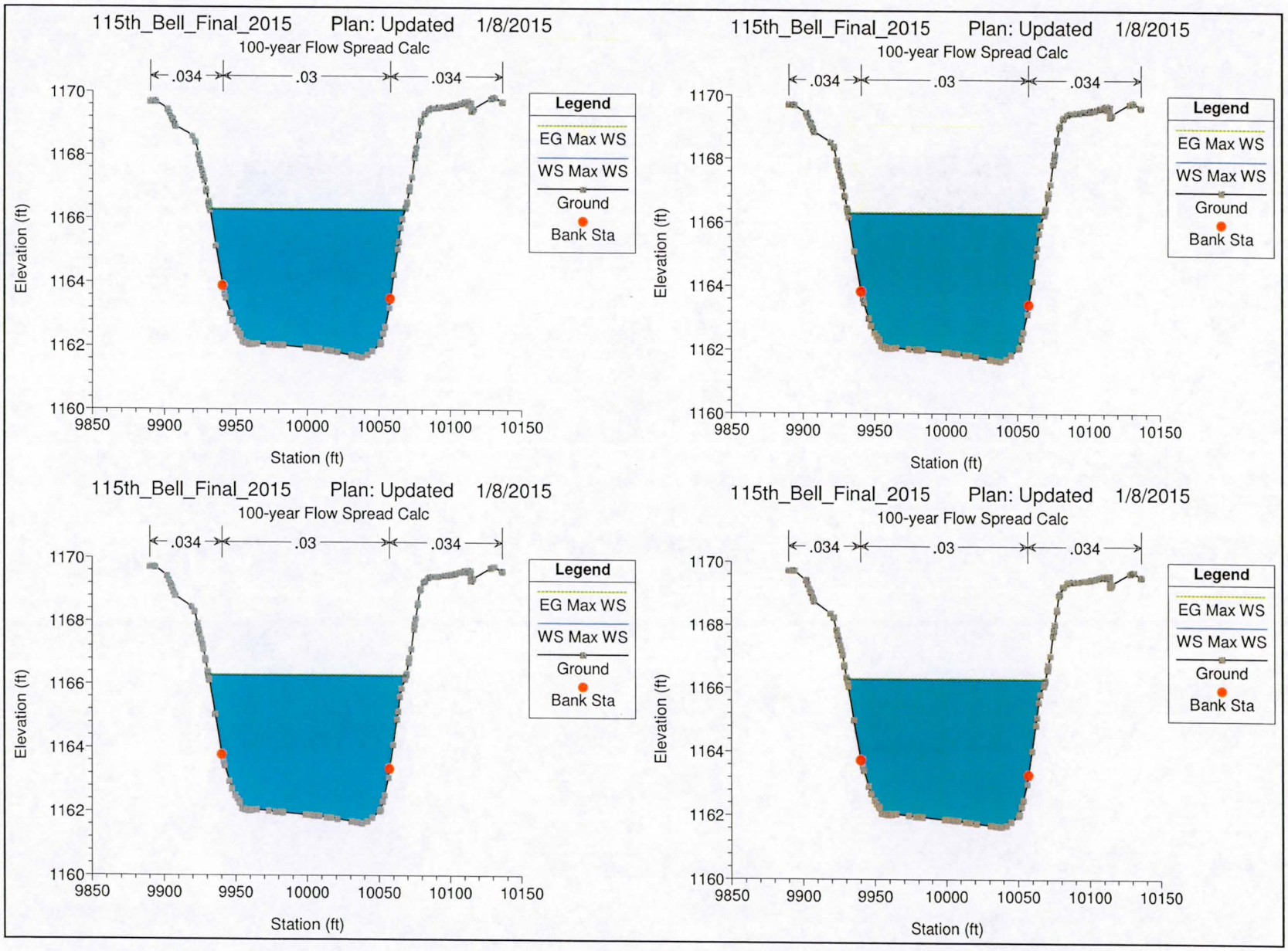
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Bank Sta
Elevation (ft)
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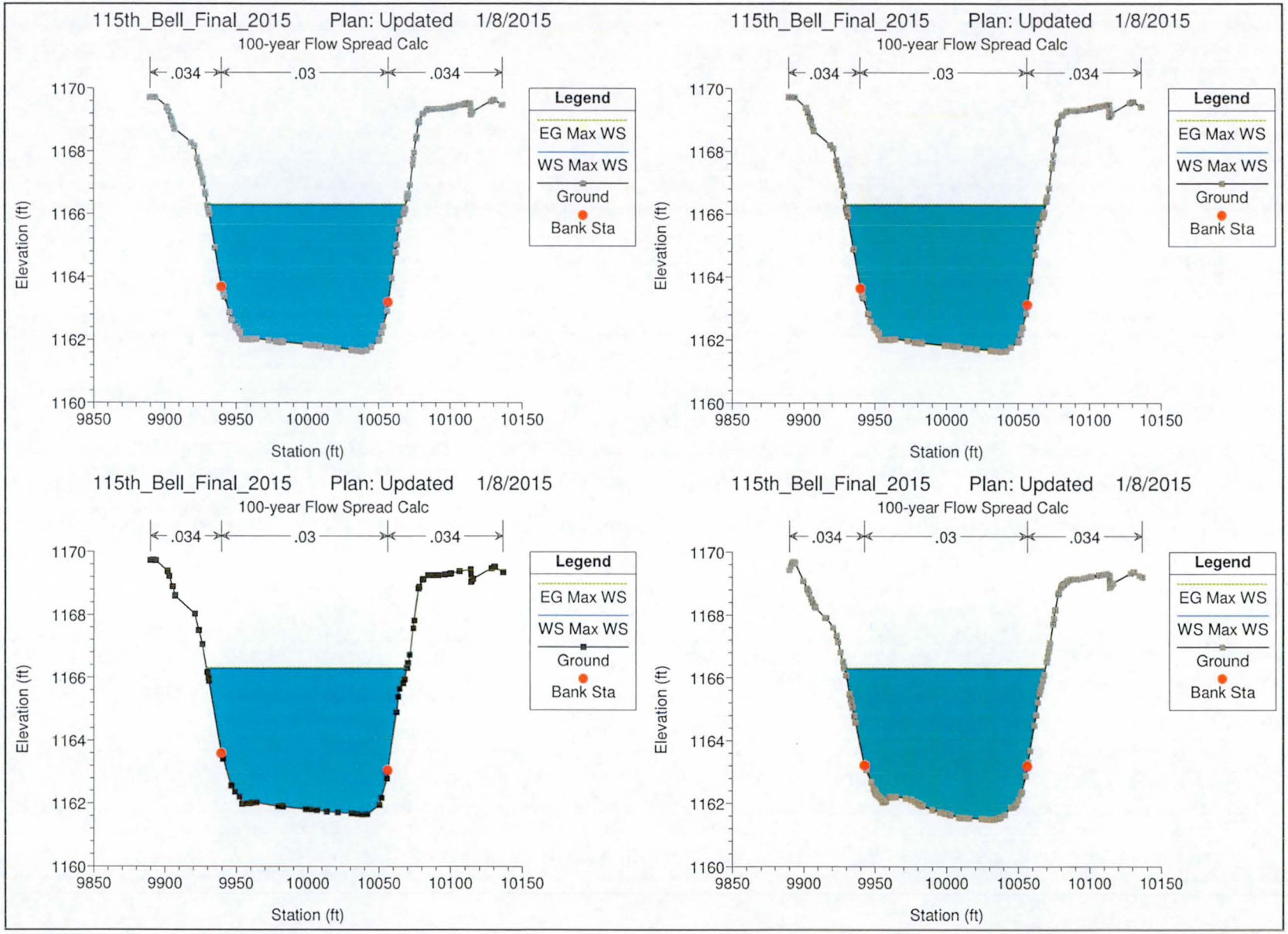
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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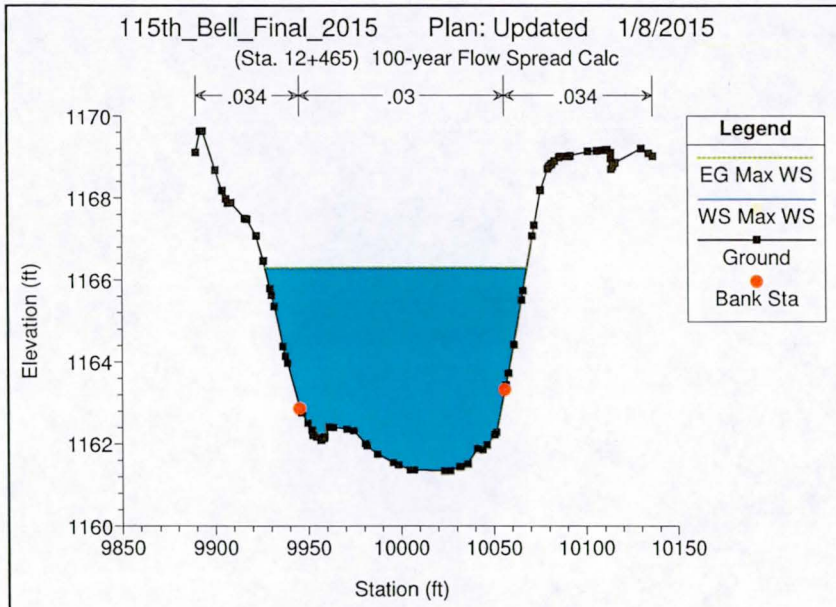
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
(Sta. 12+465) 100-year Flow Spread Calc
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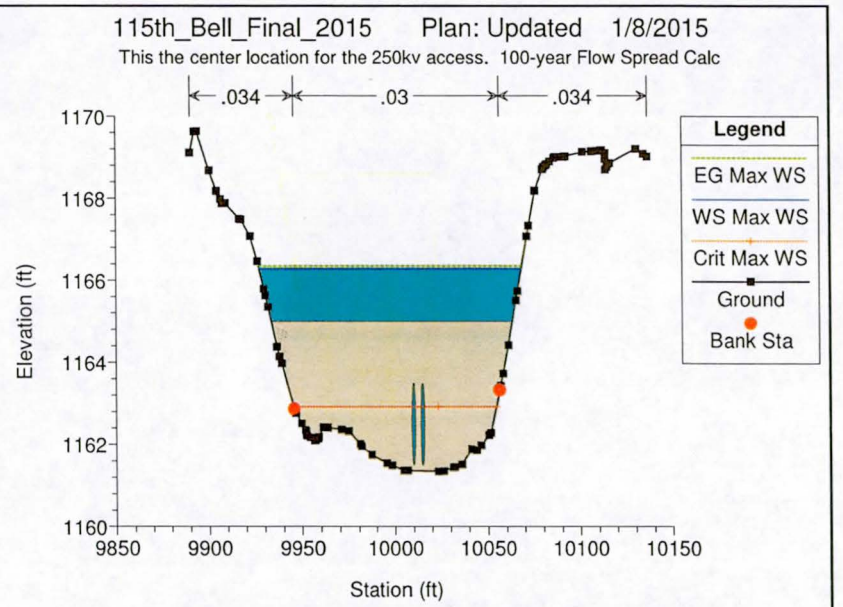
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This the center location for the 250kv access. 100-year Flow Spread Calc
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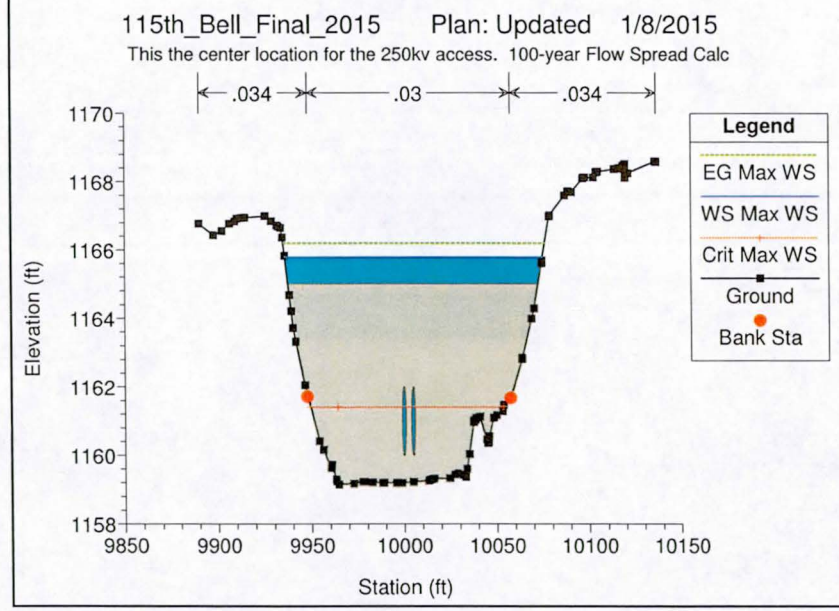
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This the center location for the 250kv access. 100-year Flow Spread Calc
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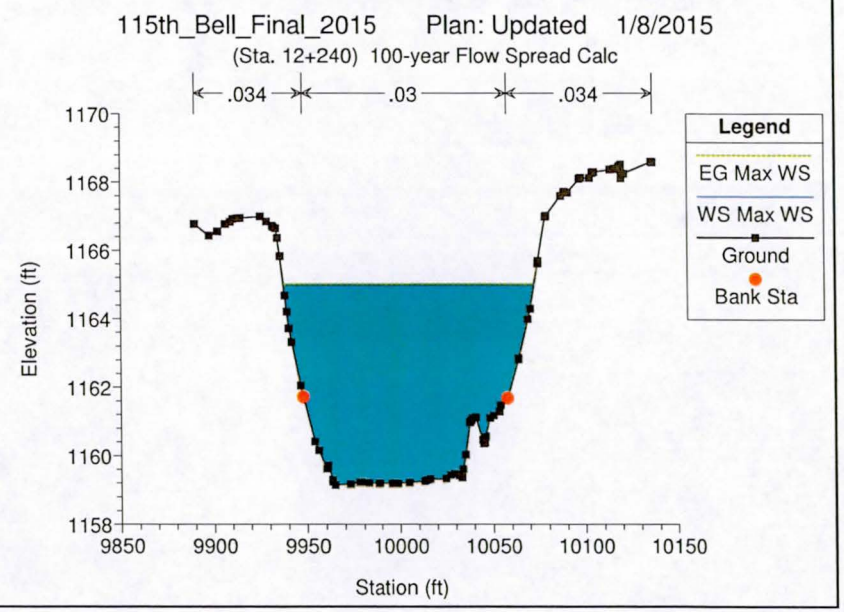
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
(Sta. 12+240) 100-year Flow Spread Calc
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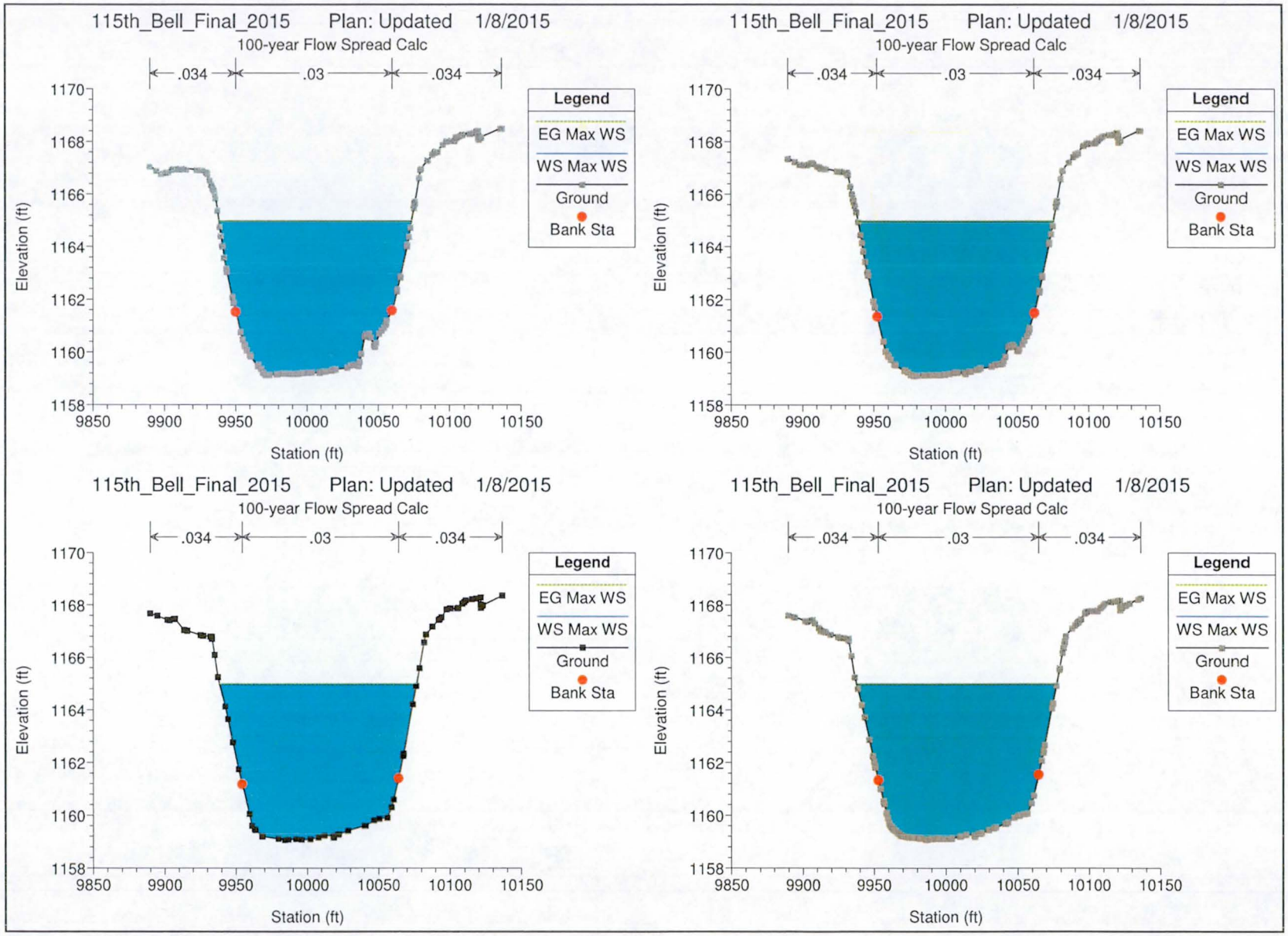
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Bank Sta
Elevation (ft)
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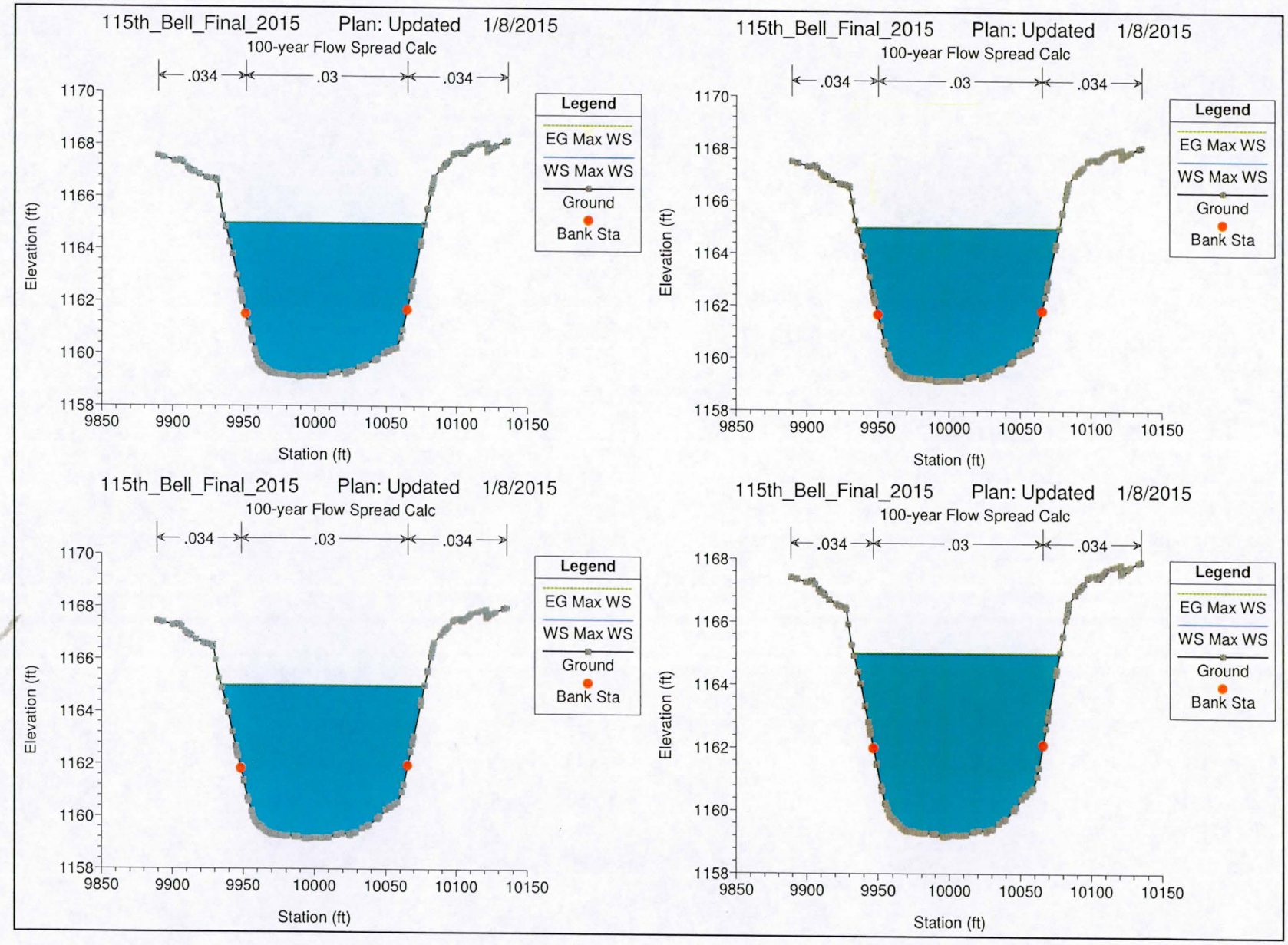
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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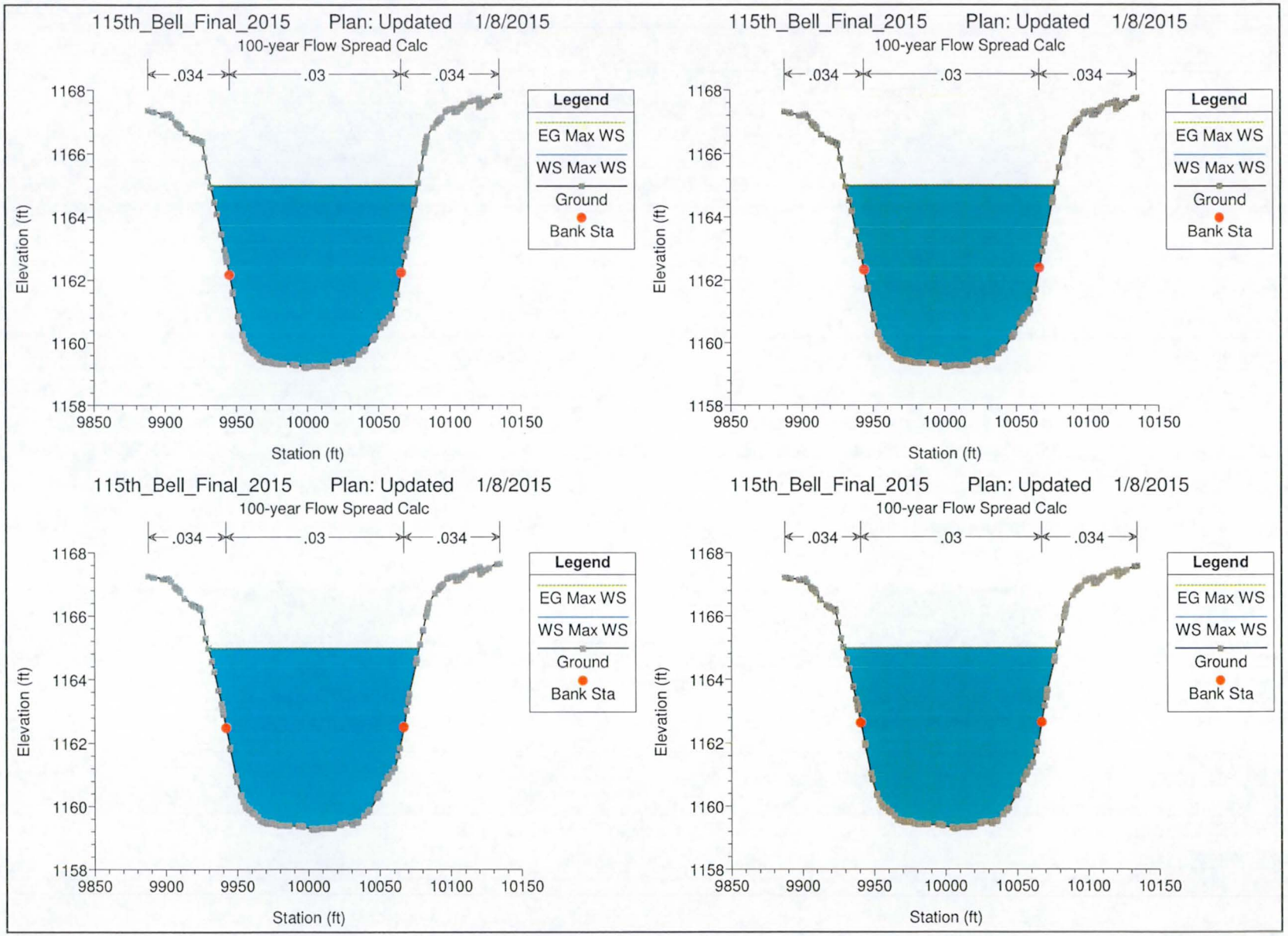
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Elevation (ft)
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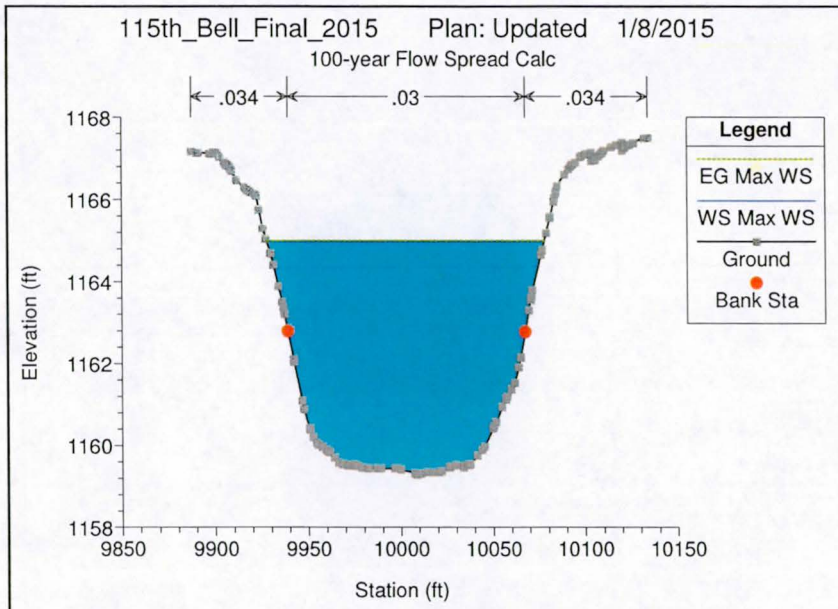
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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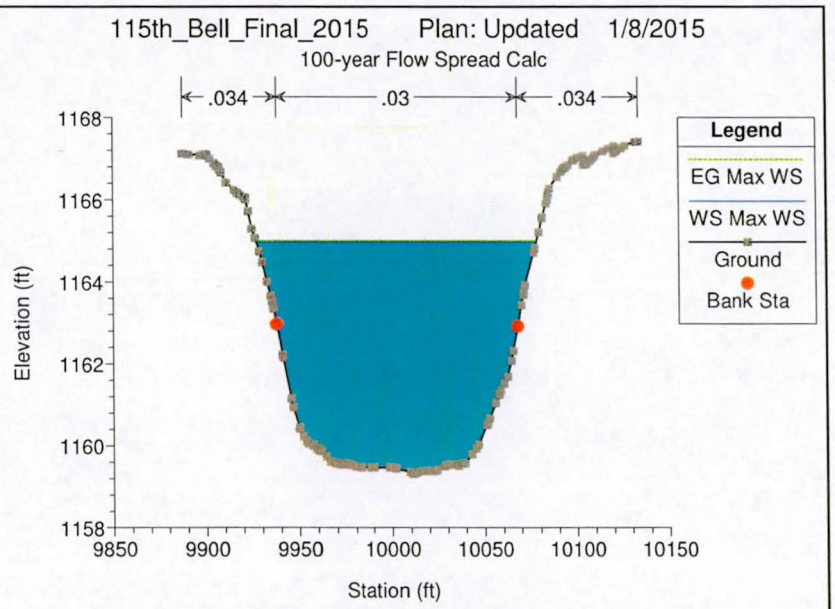
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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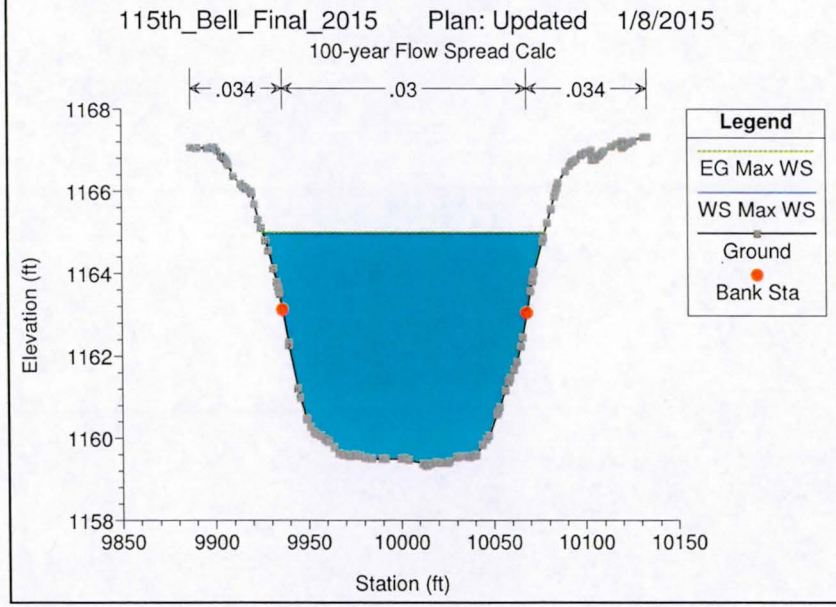
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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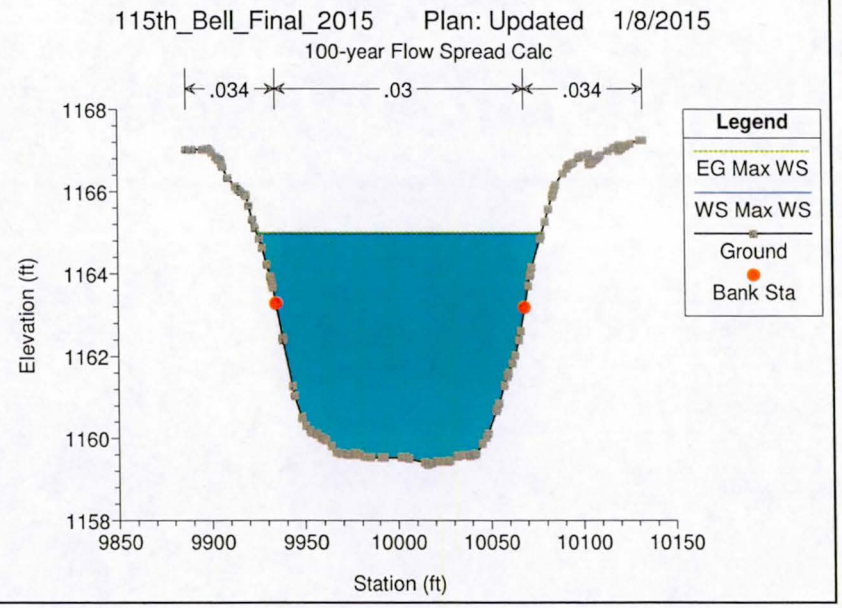
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100-year Flow Spread Calc
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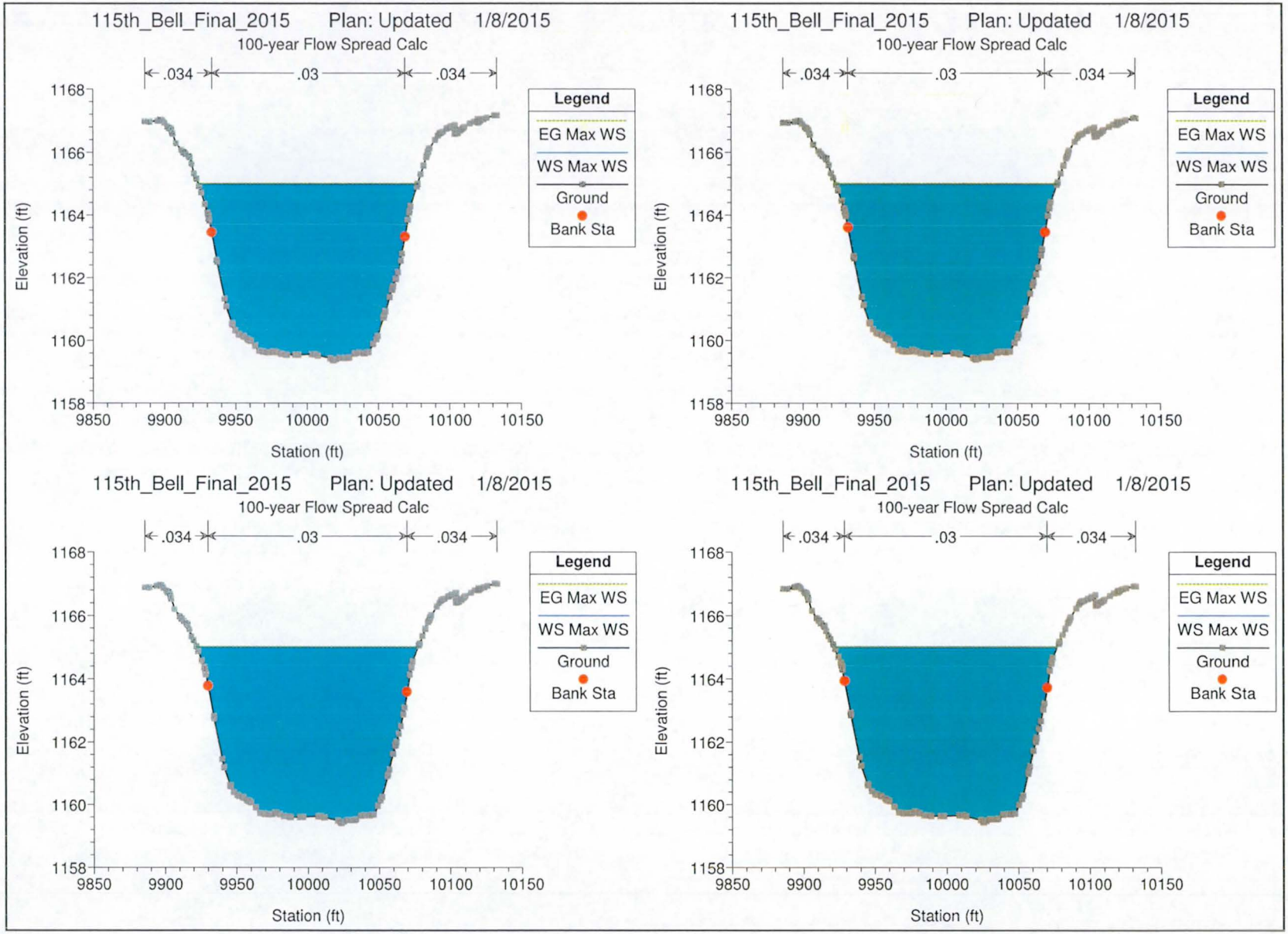
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100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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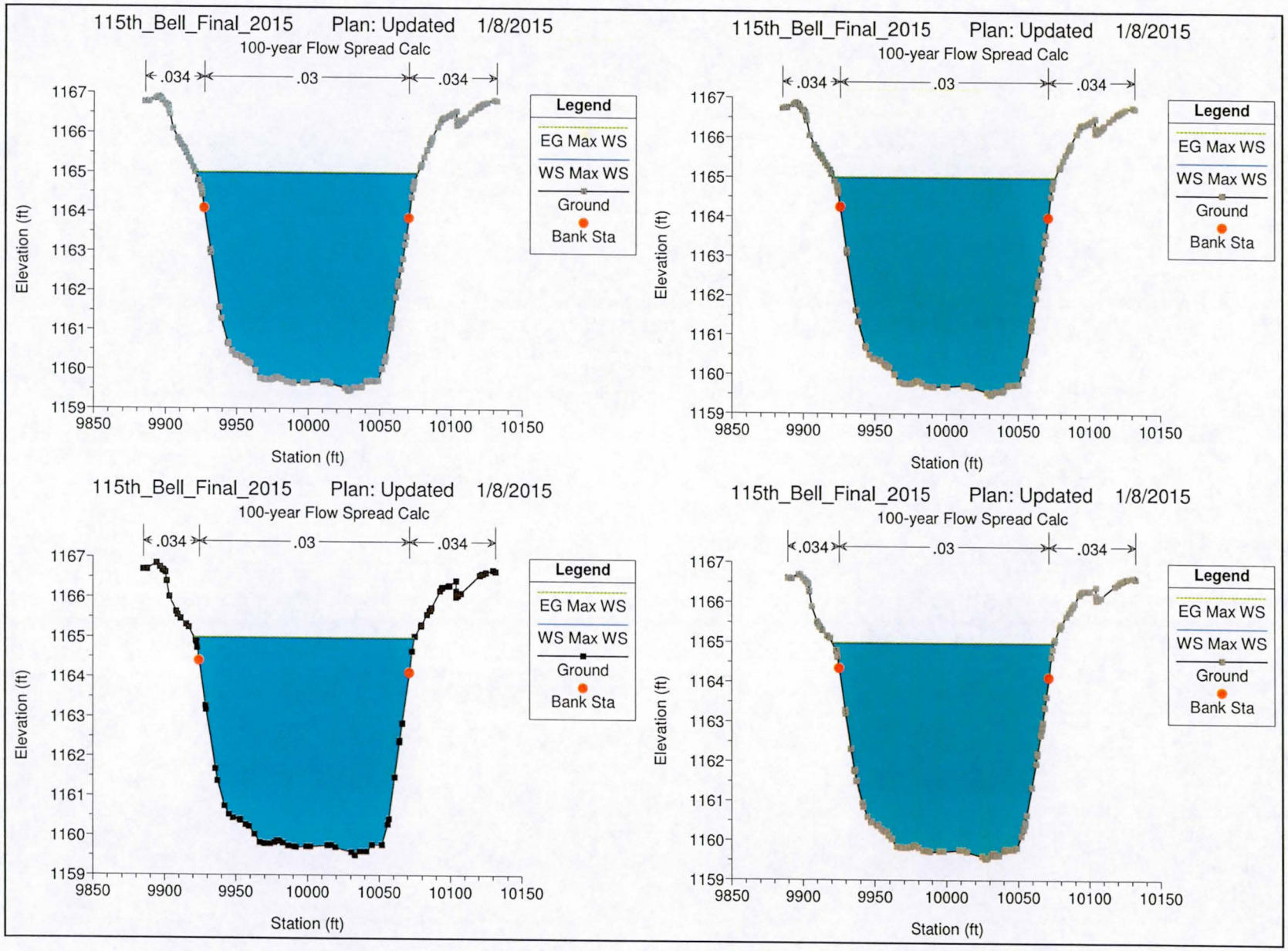
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
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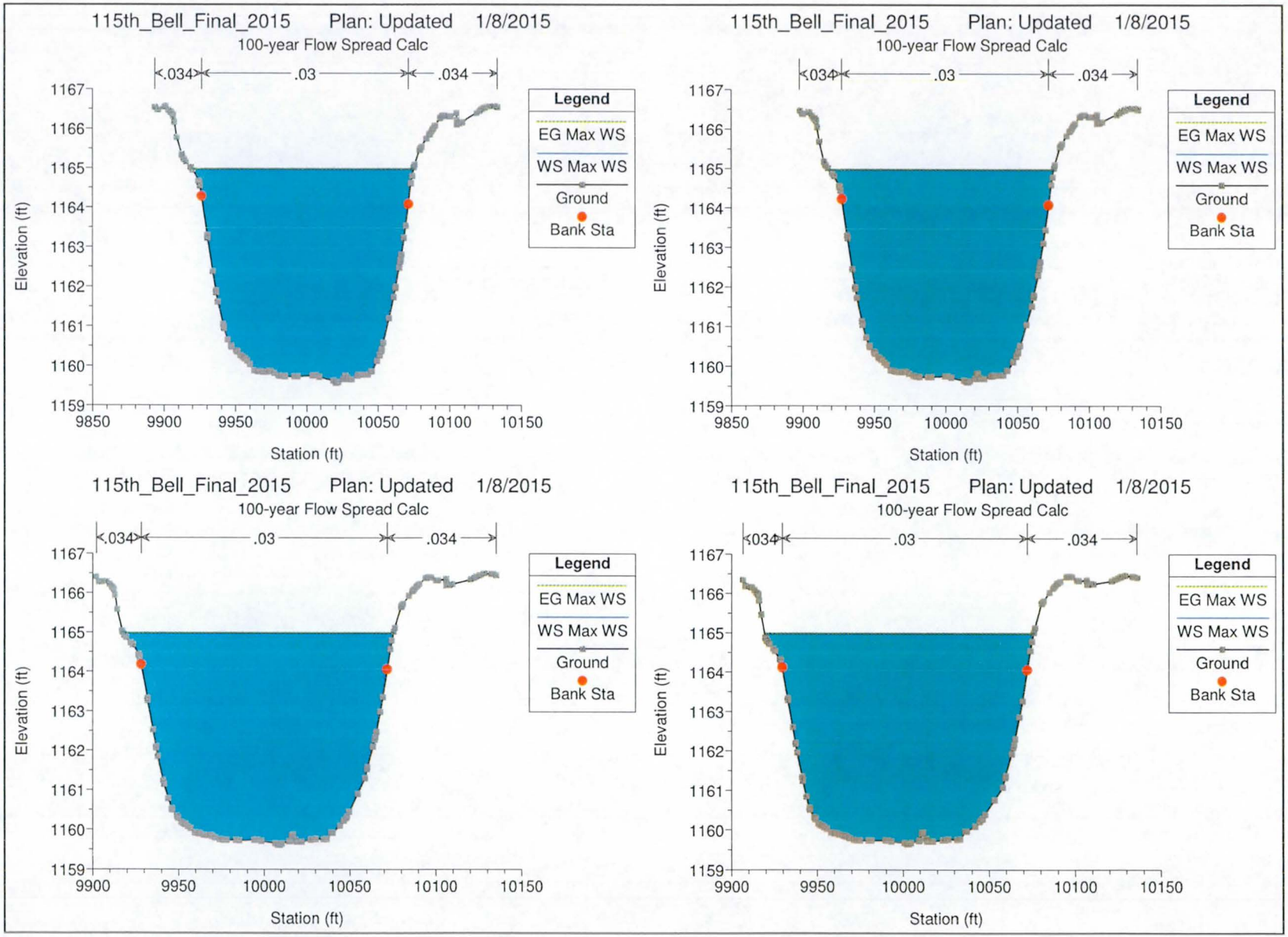
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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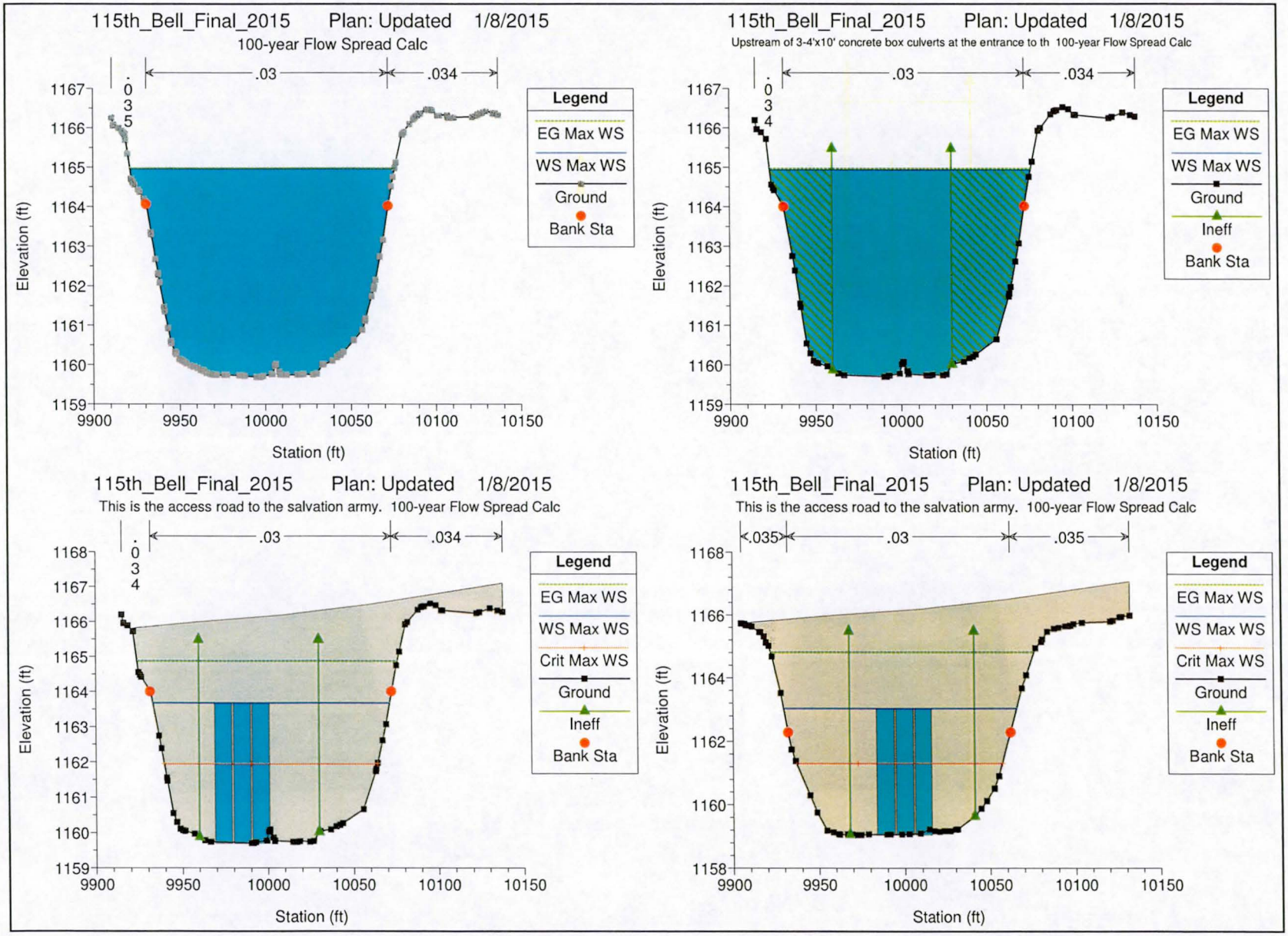
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
Upstream of 3-4'x10' concrete box culverts at the entrance to th 100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the access road to the salvation army. 100-year Flow Spread Calc
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Legend
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Ground
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Bank Sta
Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the access road to the salvation army. 100-year Flow Spread Calc
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Legend
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Crit Max WS
Ground
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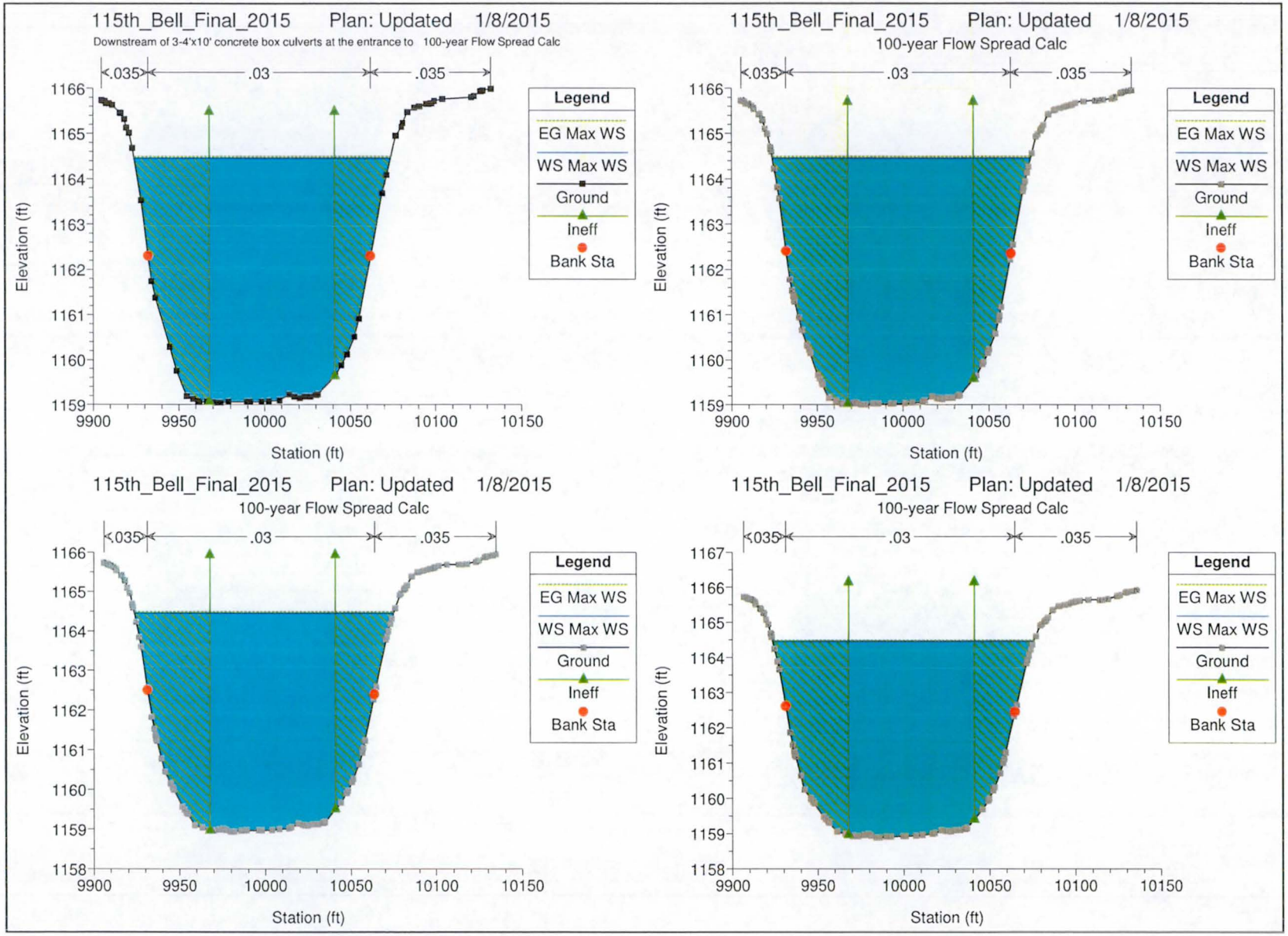
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
Downstream of 3-4'x10' concrete box culverts at the entrance to 100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
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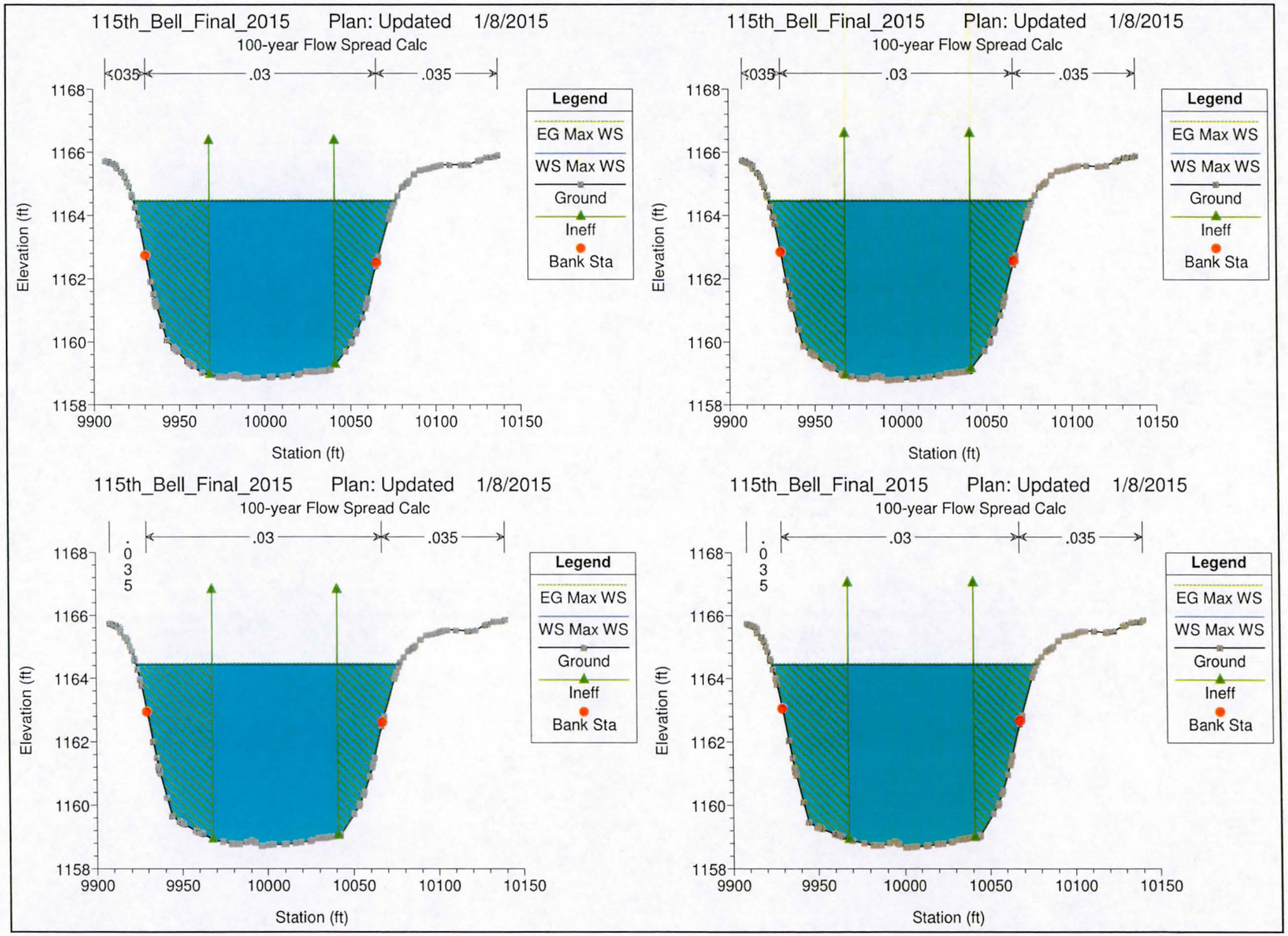
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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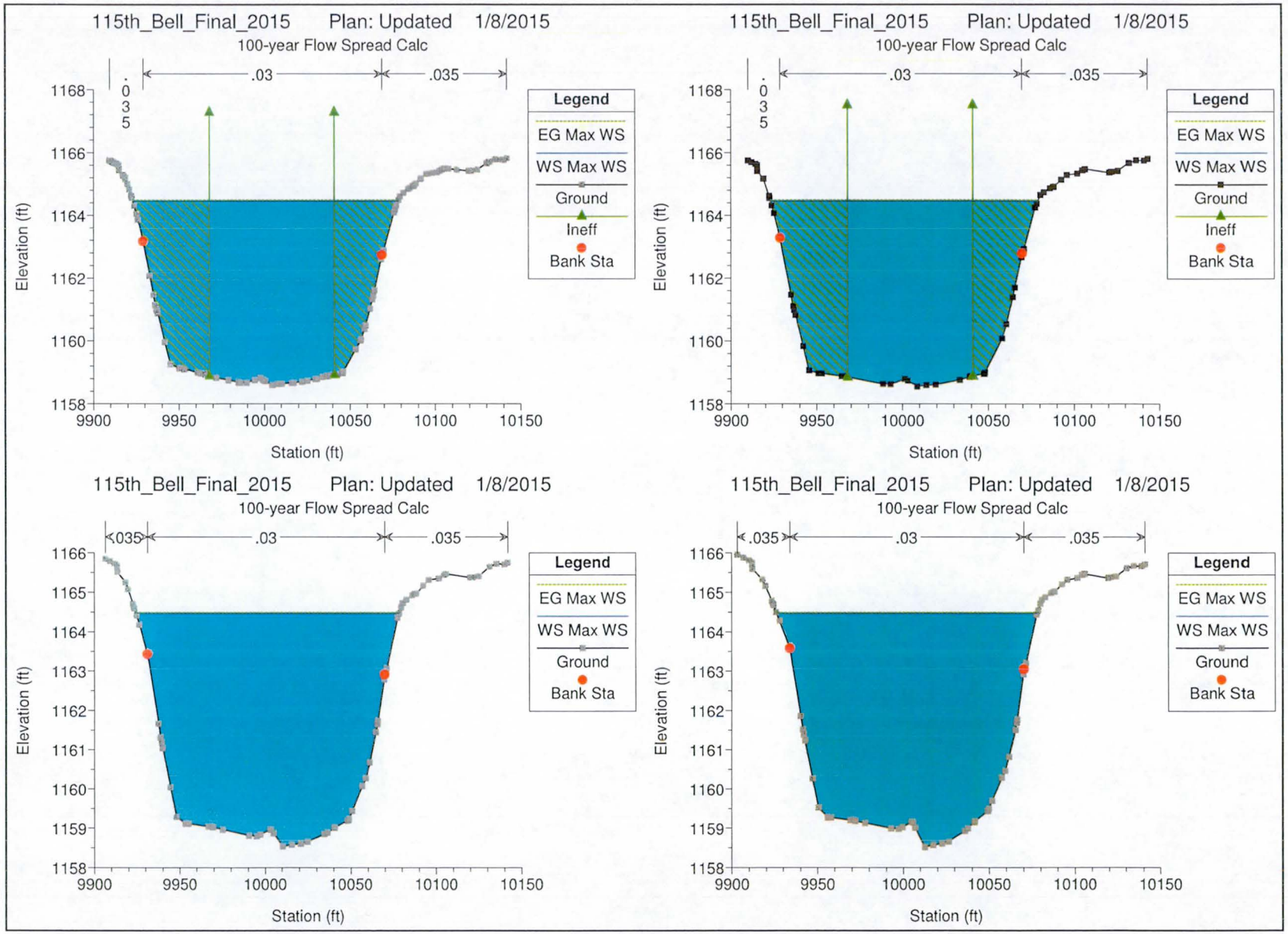
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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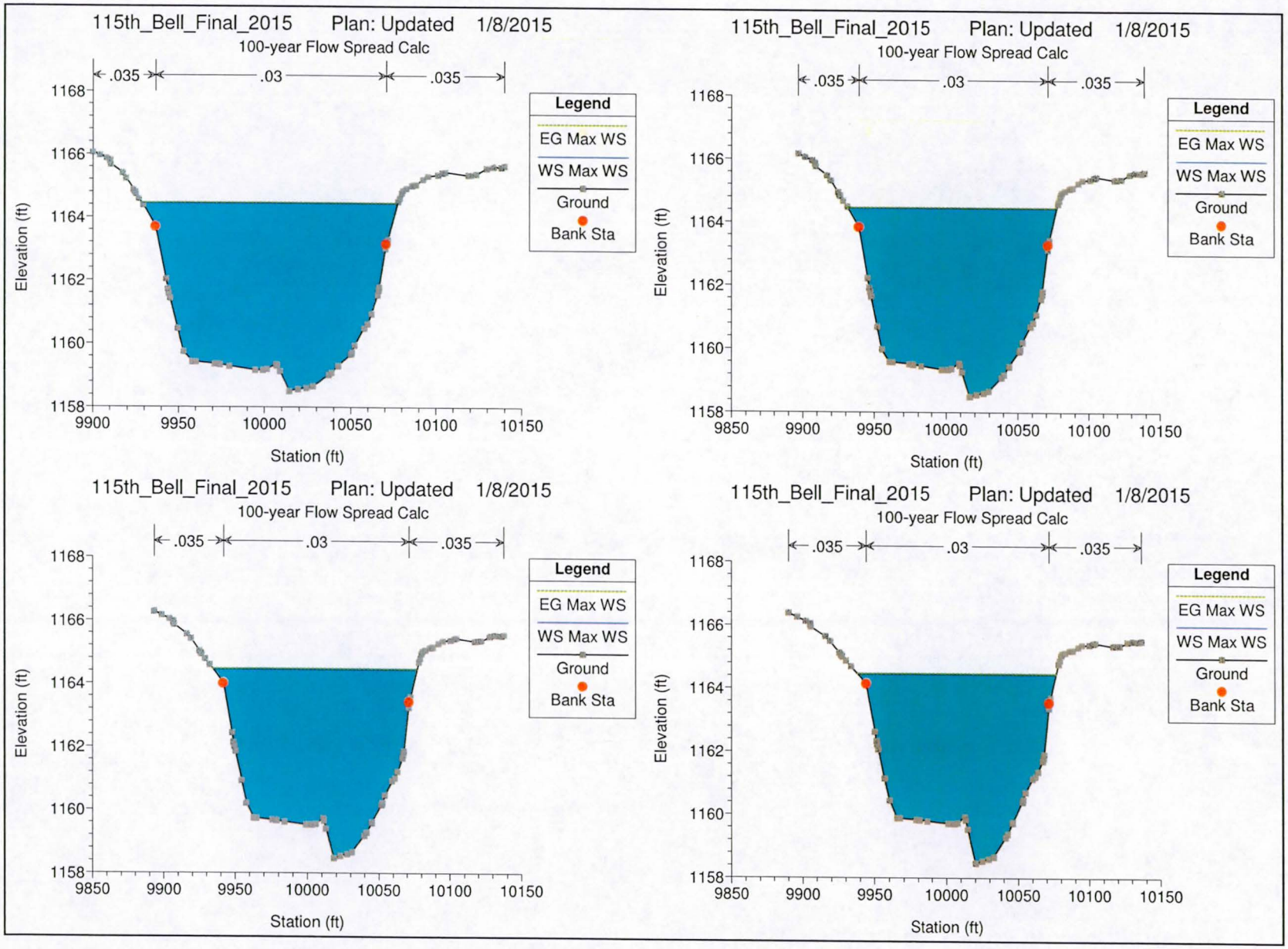
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Bank Sta
Elevation (ft)
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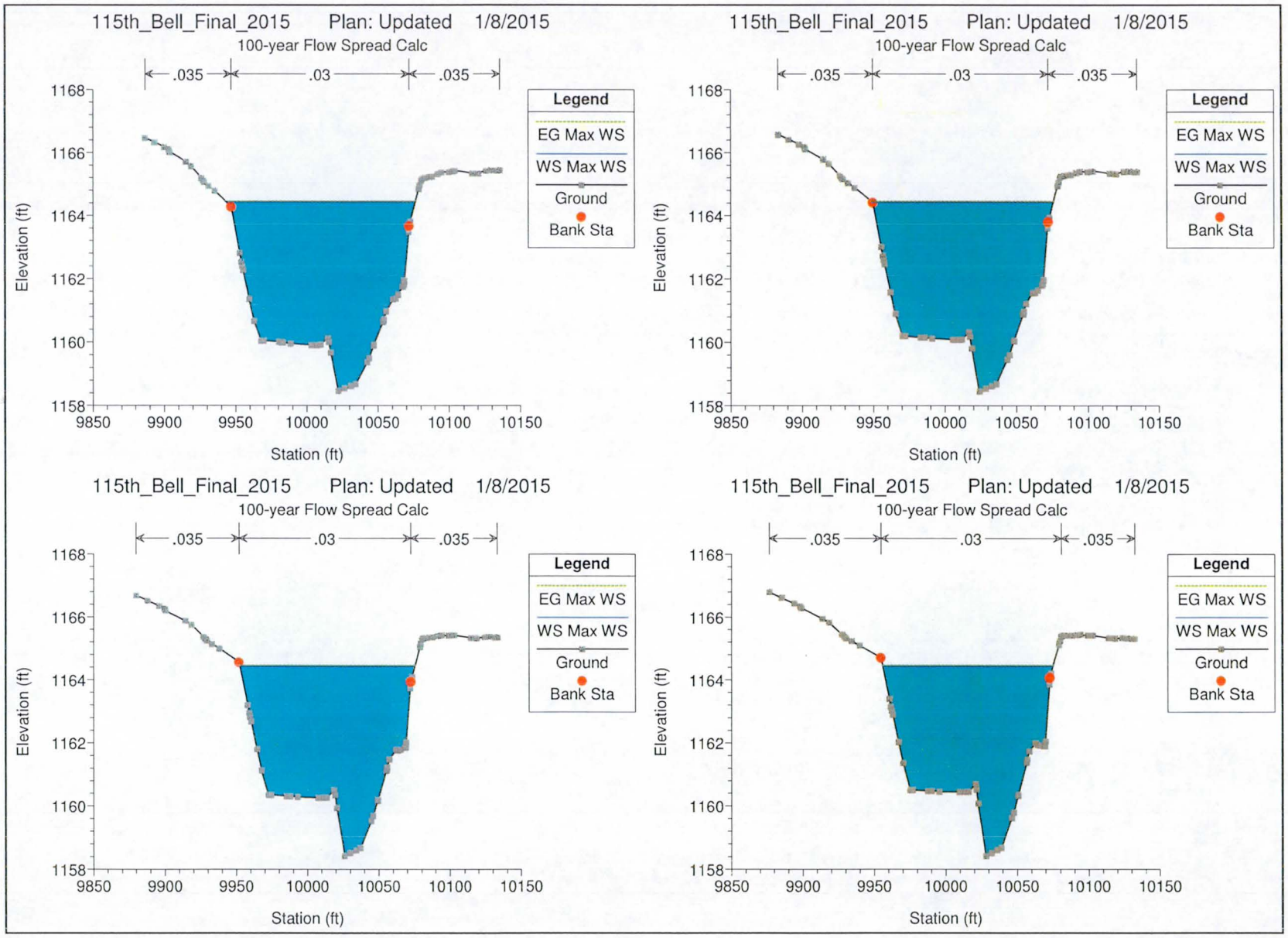
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Ground
Bank Sta
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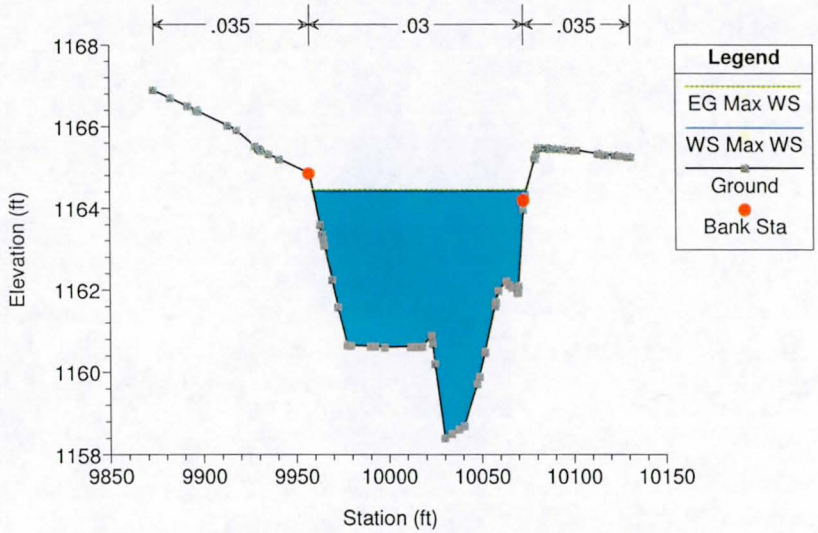
Station (ft)

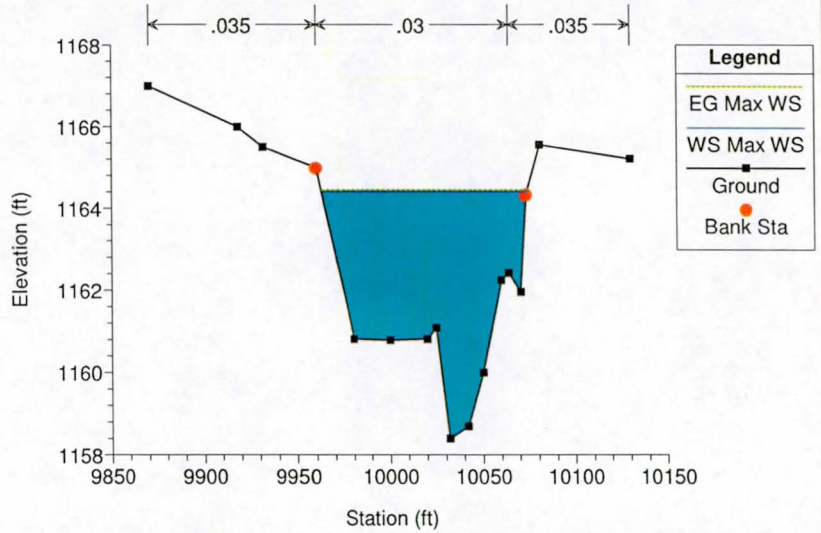
115th_Bell_Final_2015 Plan: Updated 1/8/2015

100-year Flow Spread Calc



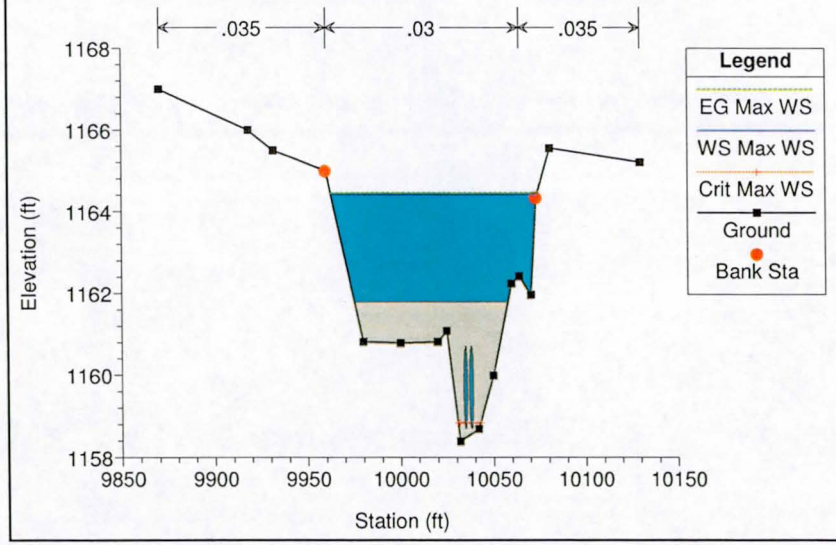
115th_Bell_Final_2015 Plan: Updated 1/8/2015

U/S of pipe at electrical tower (Sta. 11+075) 100-year Flow Spread Calc



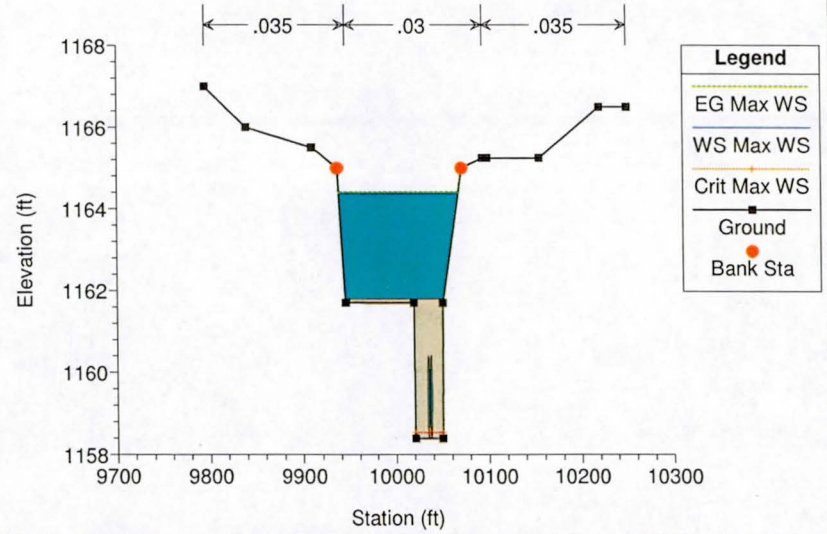
115th_Bell_Final_2015 Plan: Updated 1/8/2015

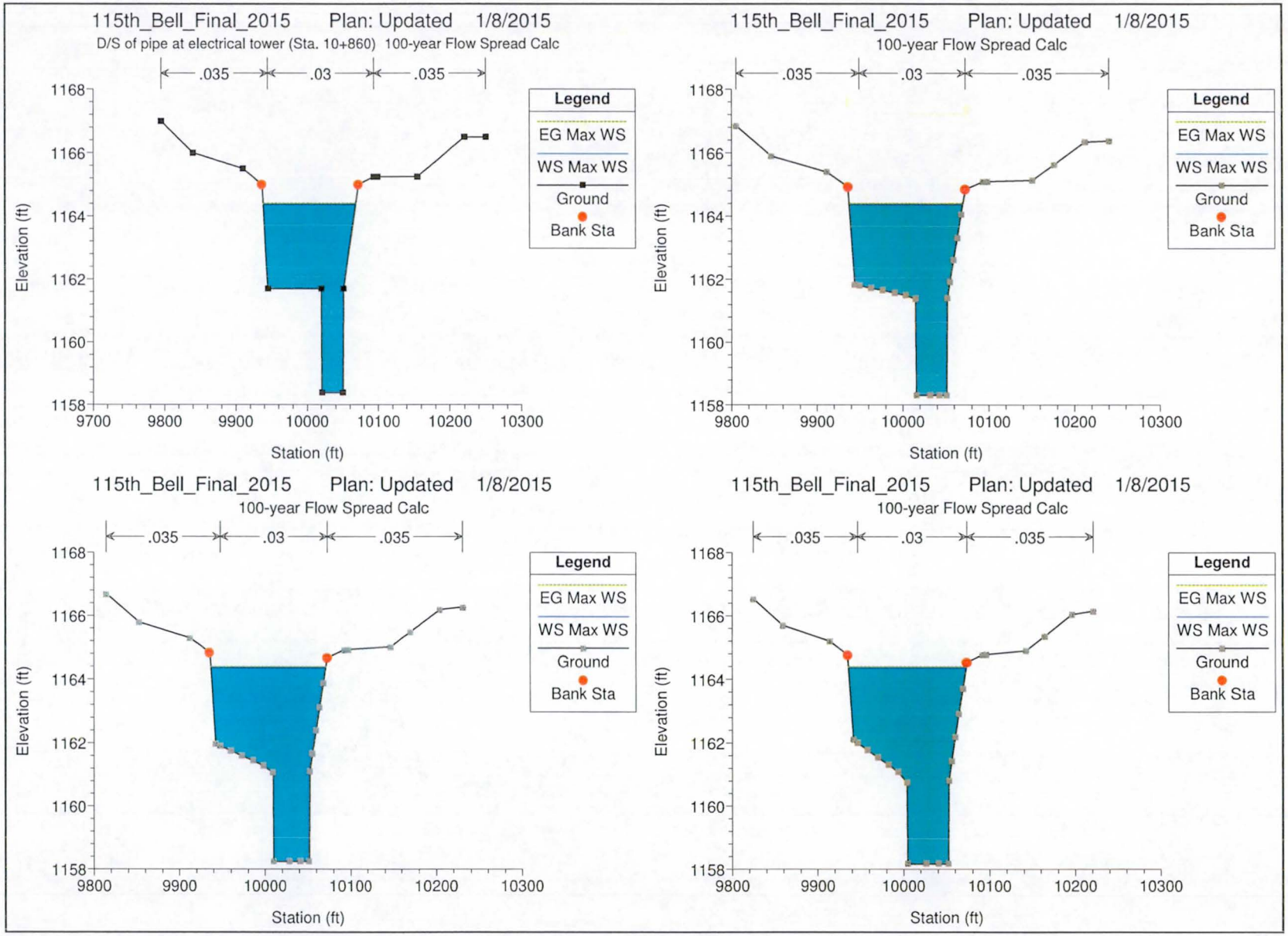
This is the southernmost access road to the 250kv tower. 100-year Flow Spread Calc



115th_Bell_Final_2015 Plan: Updated 1/8/2015

This is the southernmost access road to the 250kv tower. 100-year Flow Spread Calc




115th_Bell_Final_2015 Plan: Updated 1/8/2015
D/S of pipe at electrical tower (Sta. 10+860) 100-year Flow Spread Calc
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Legend
EG Max WS
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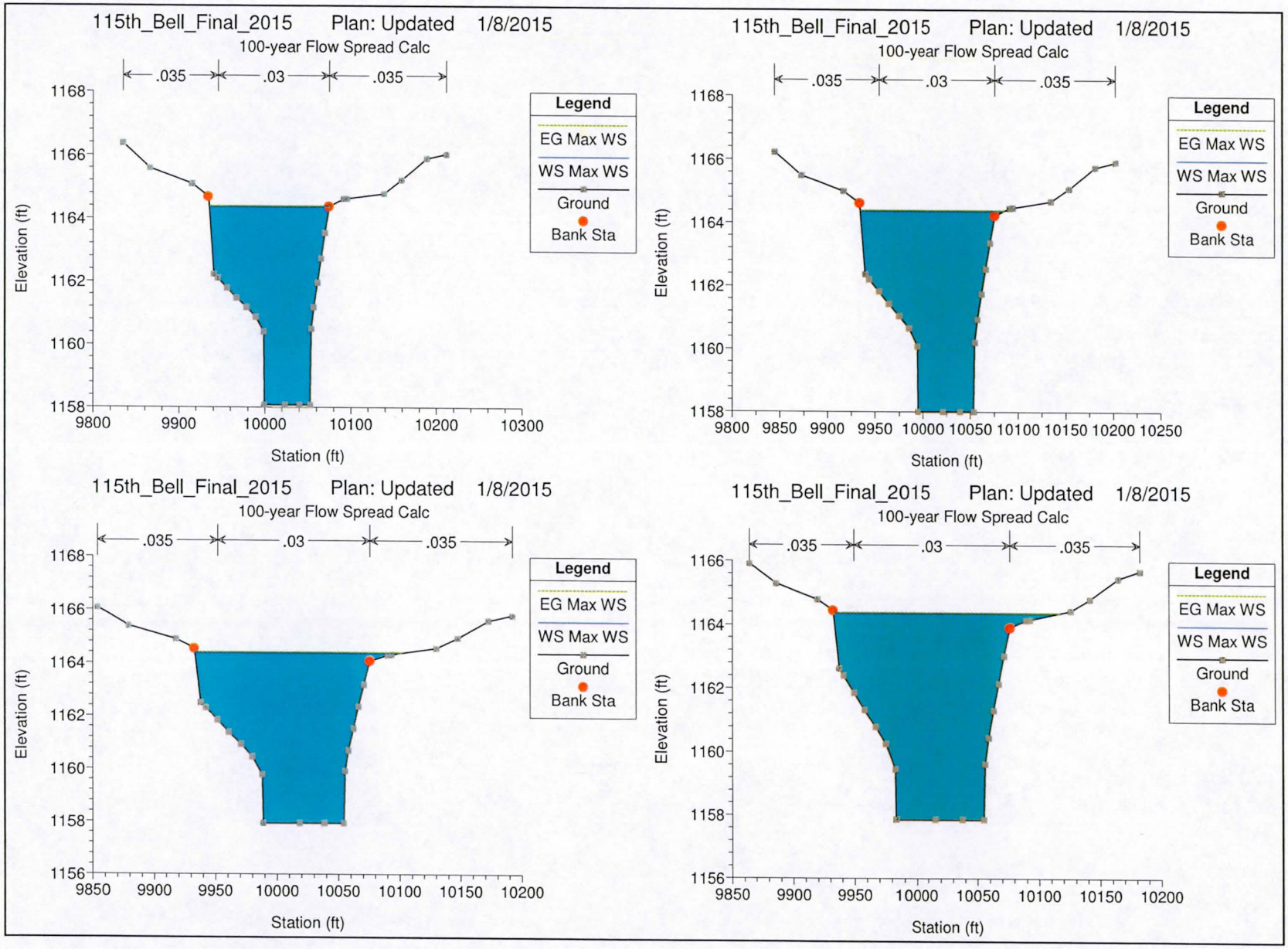
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Elevation (ft)
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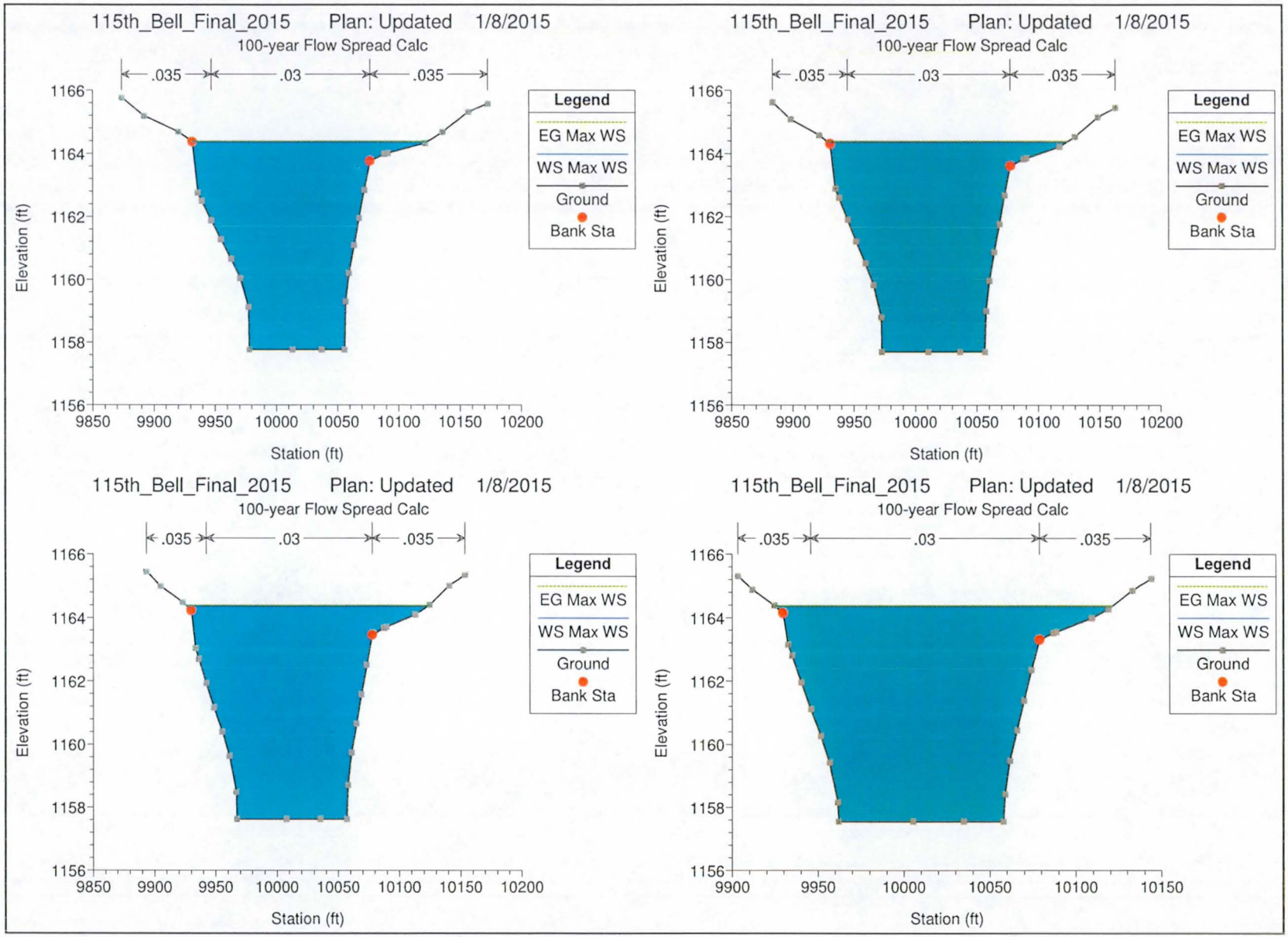
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100-year Flow Spread Calc
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115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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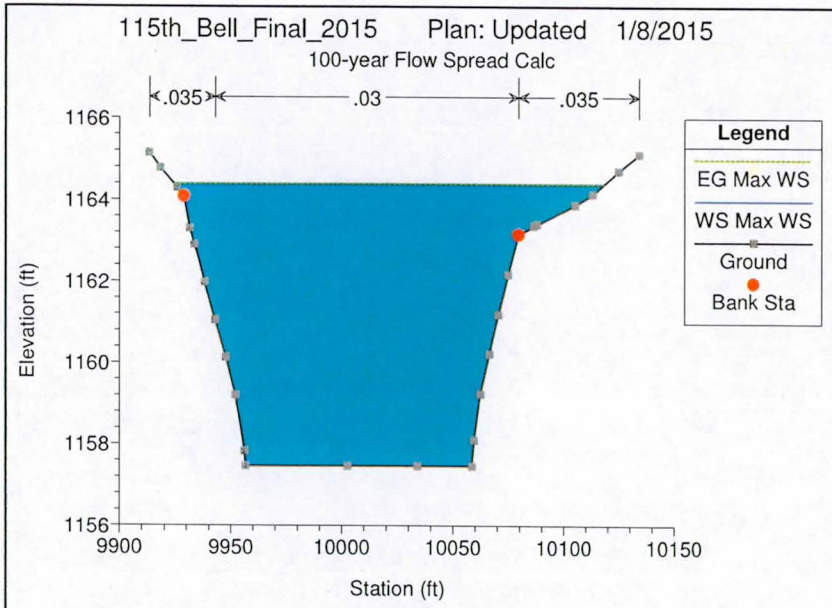
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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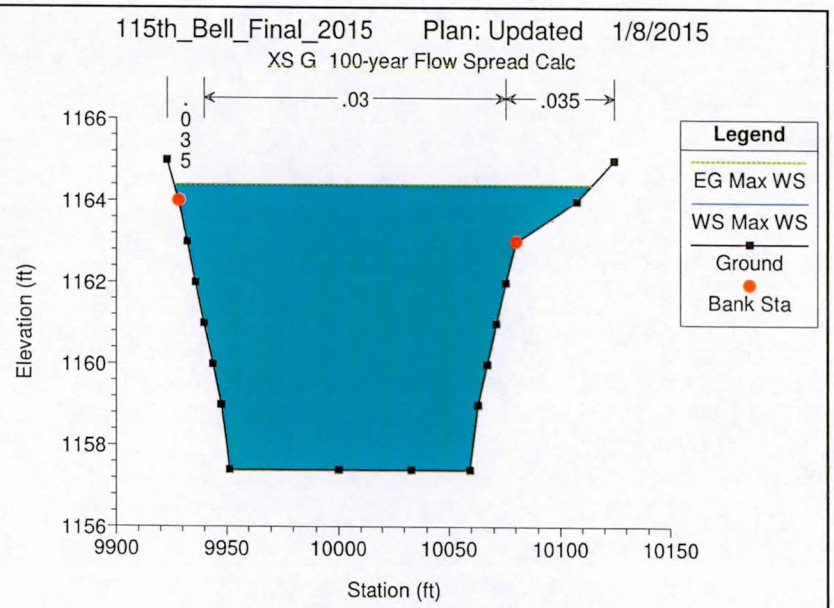
115th_Bell_Final_2015 Plan: Updated 1/8/2015
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Legend
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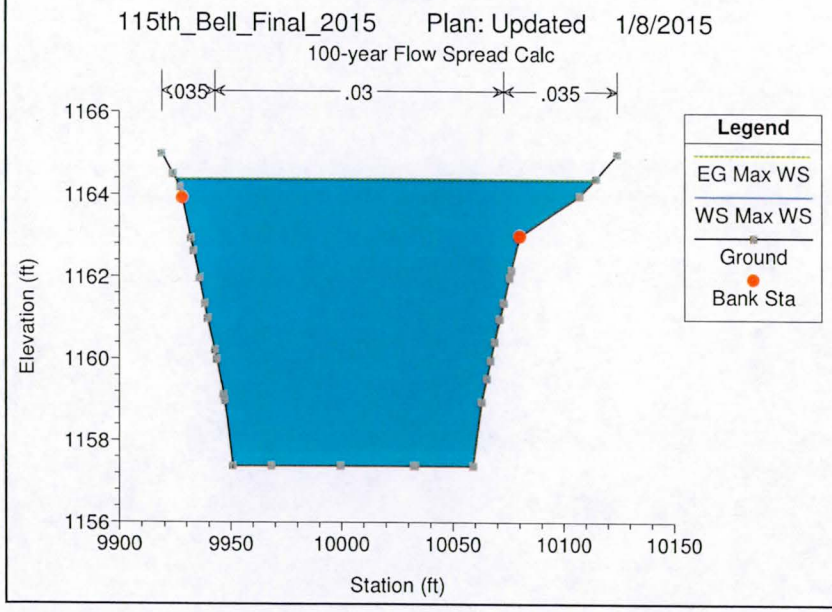
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
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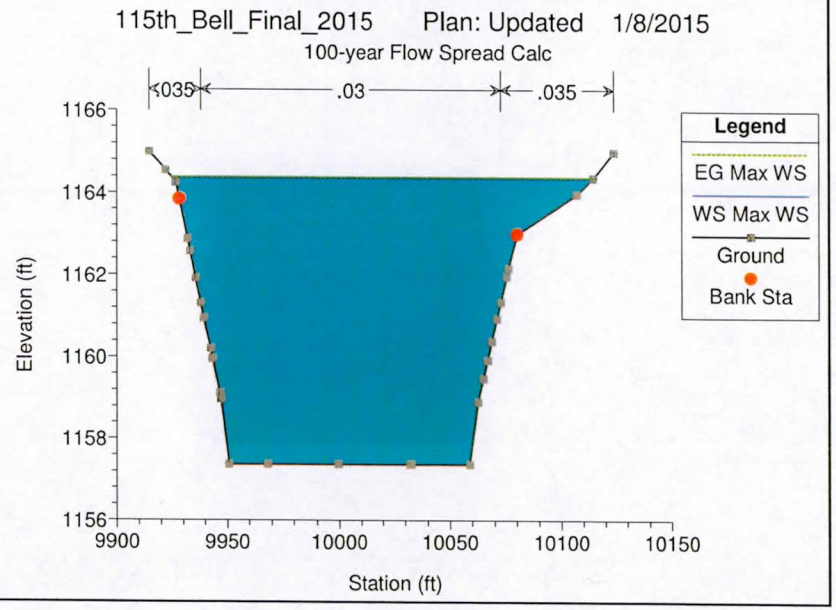
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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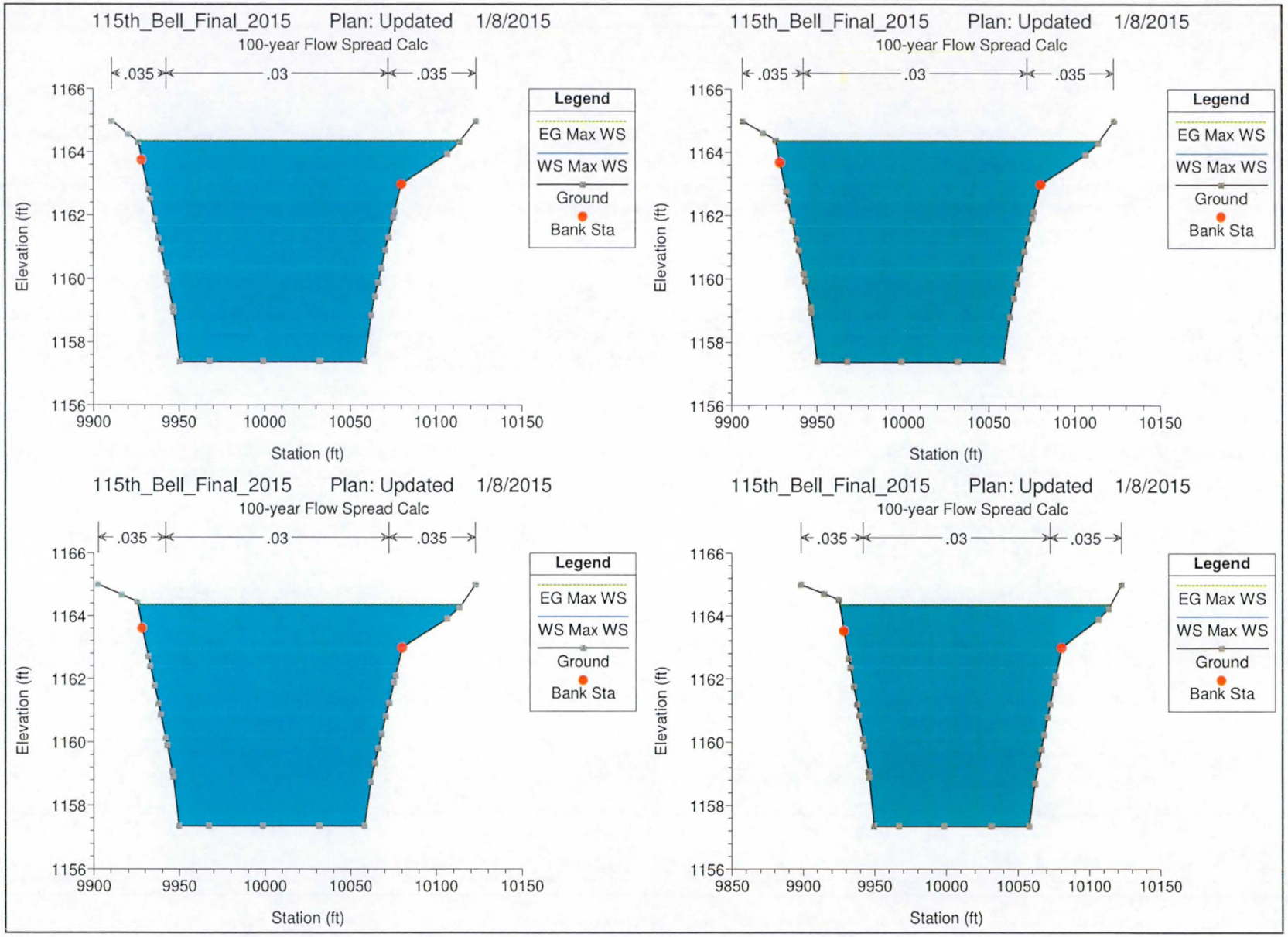
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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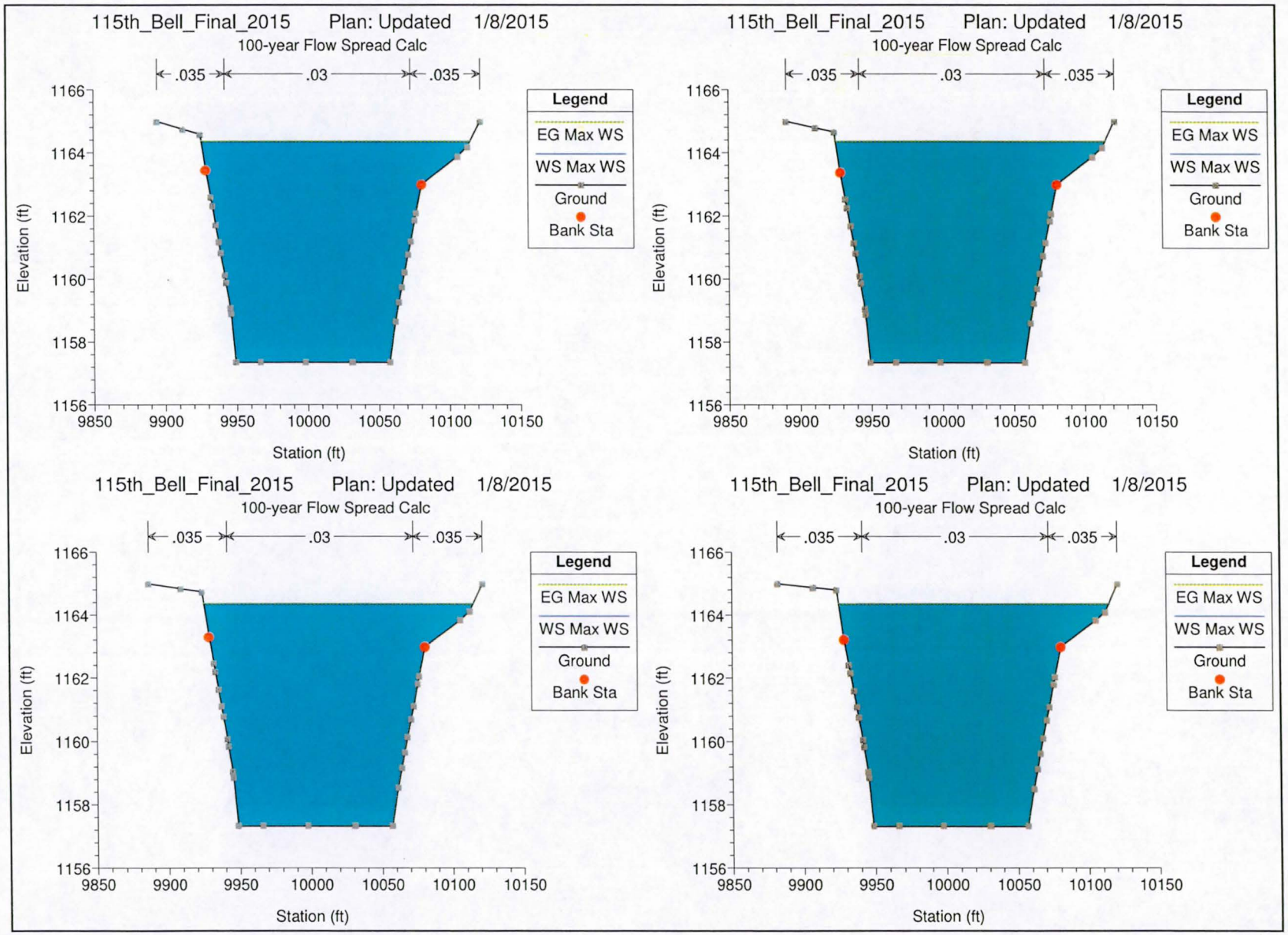
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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Legend
EG Max WS
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Ground
Bank Sta
Elevation (ft)
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Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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10100
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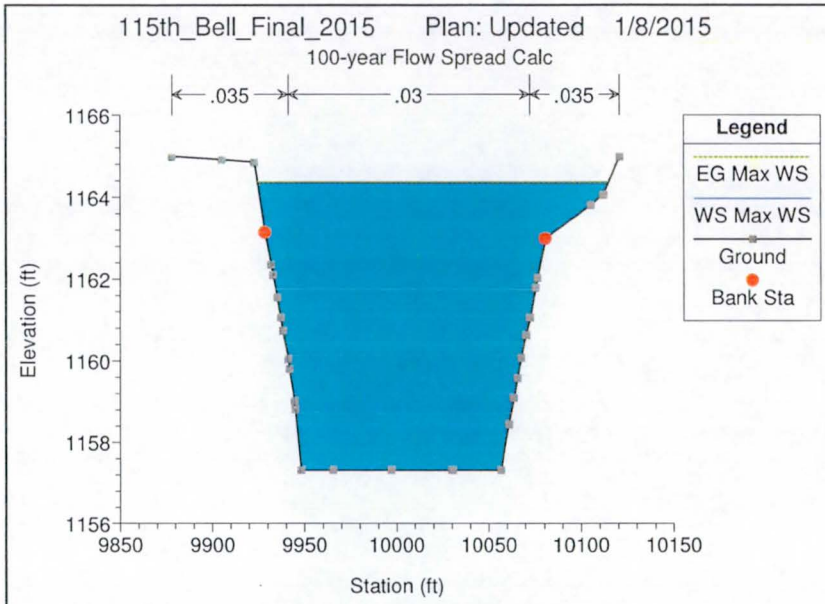
Station (ft)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100-year Flow Spread Calc
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Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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10000
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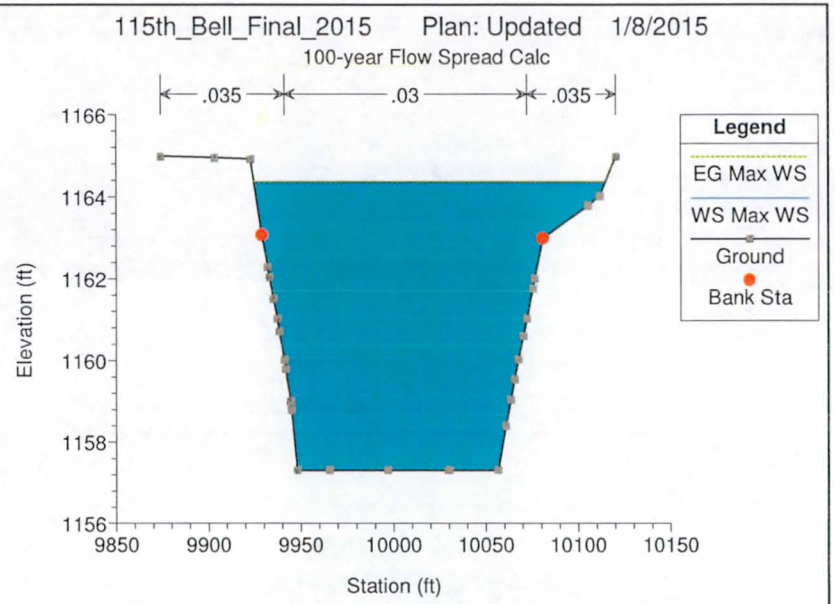
10100
10150
Station (ft)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100-year Flow Spread Calc
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.03
.035
Legend
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WS Max WS
Ground
Bank Sta
Elevation (ft)
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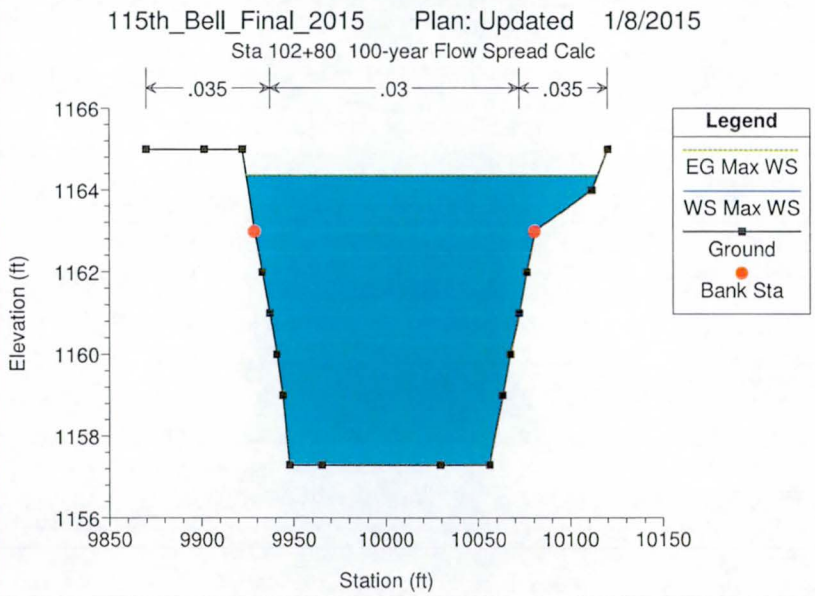
9850
9900
9950
10000
10050
10100
10150
Station (ft)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Sta 102+80 100-year Flow Spread Calc
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.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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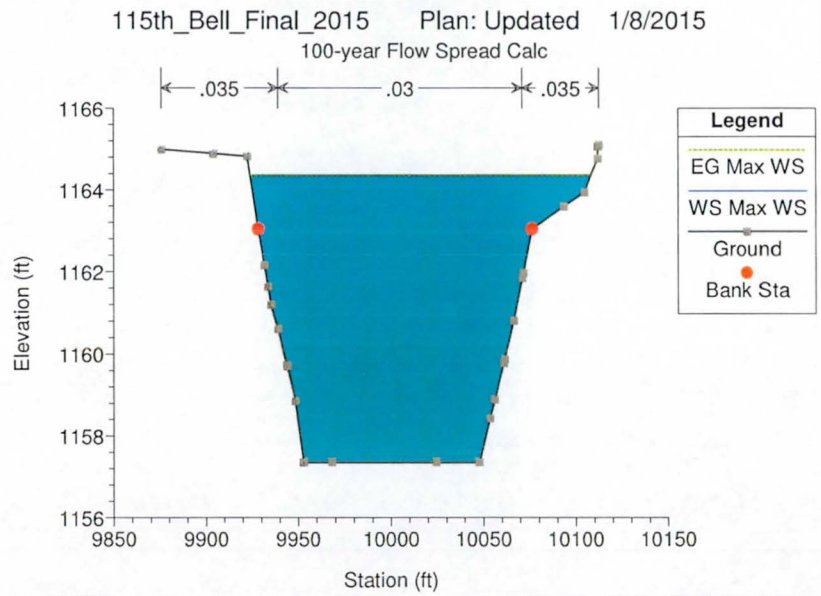
1162
1160
1158
1156
9850
9900
9950
10000
10050
10100
10150
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
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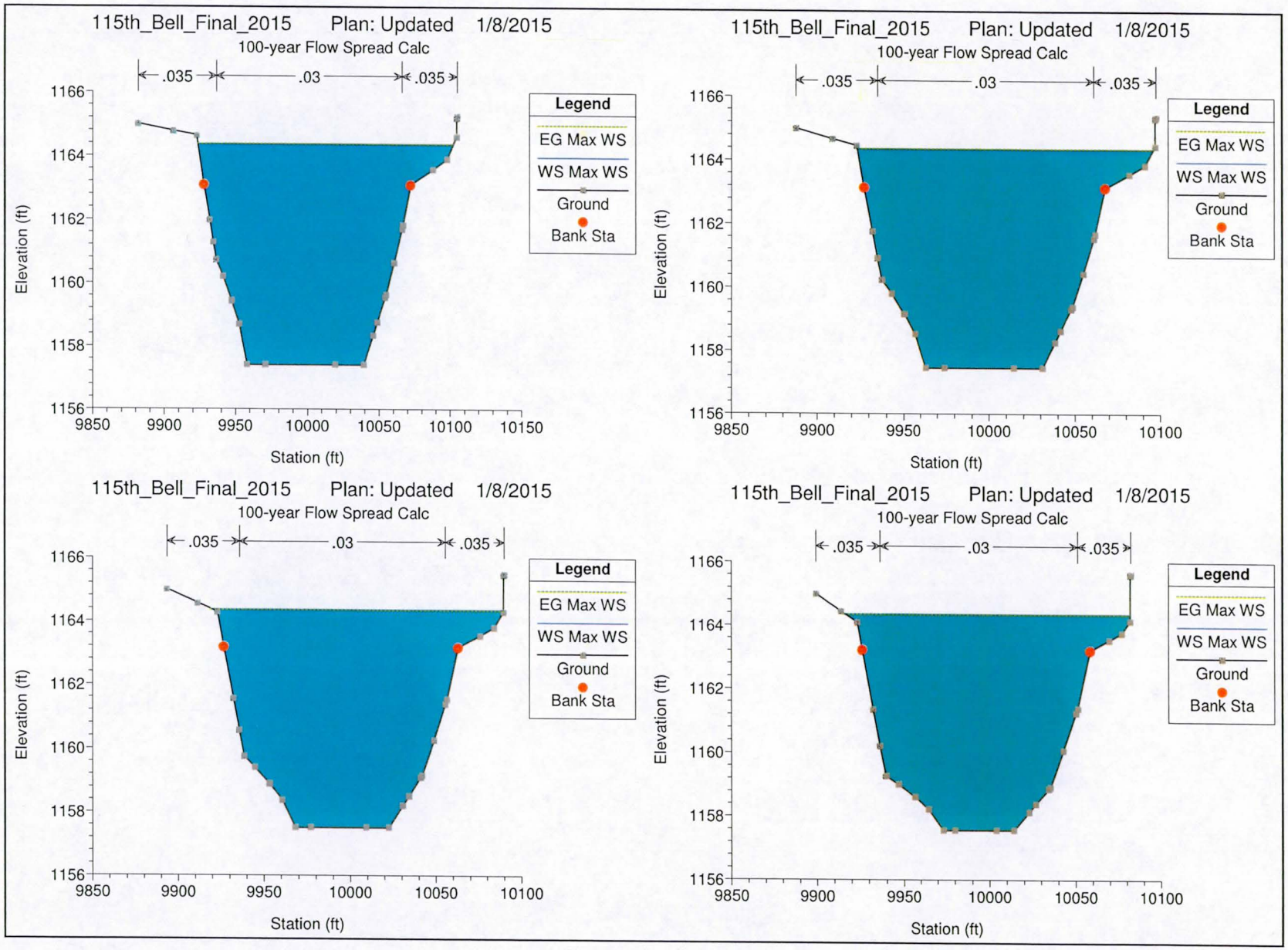
10050
10100
10150
Station (ft)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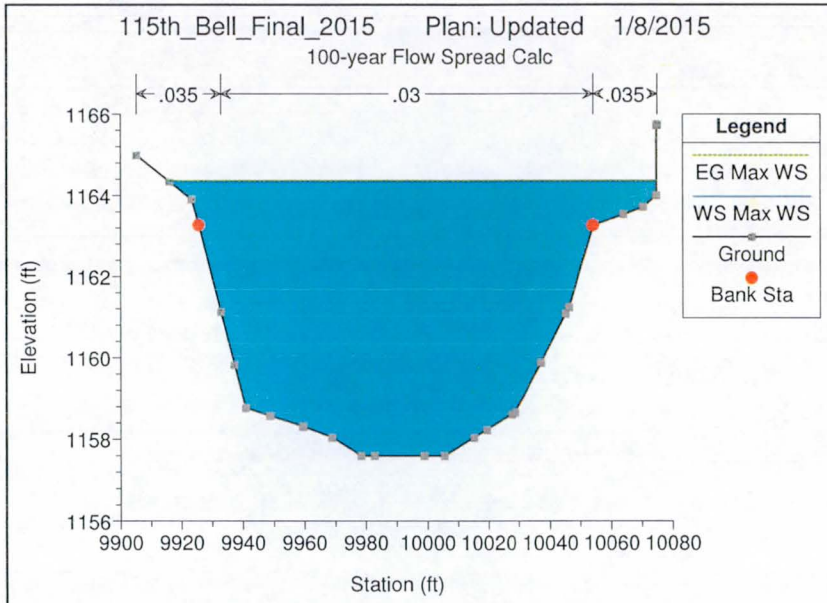
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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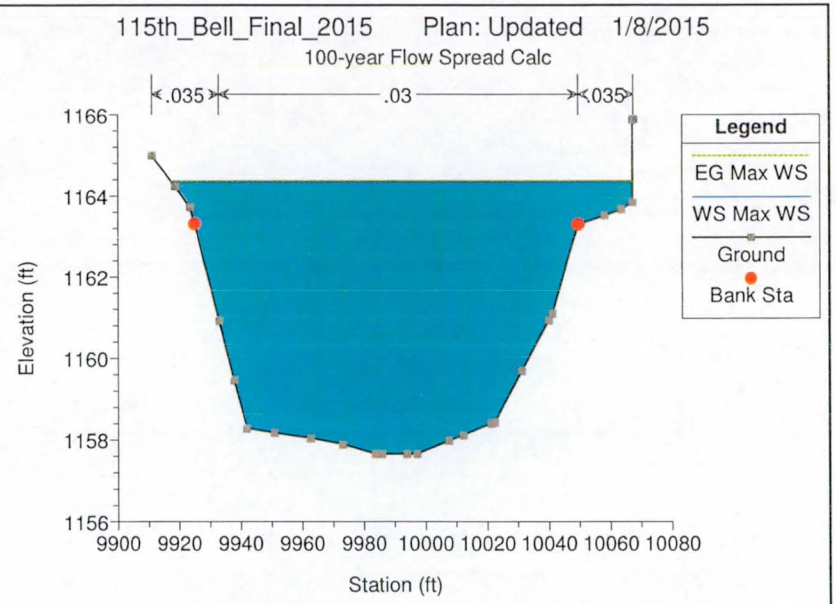
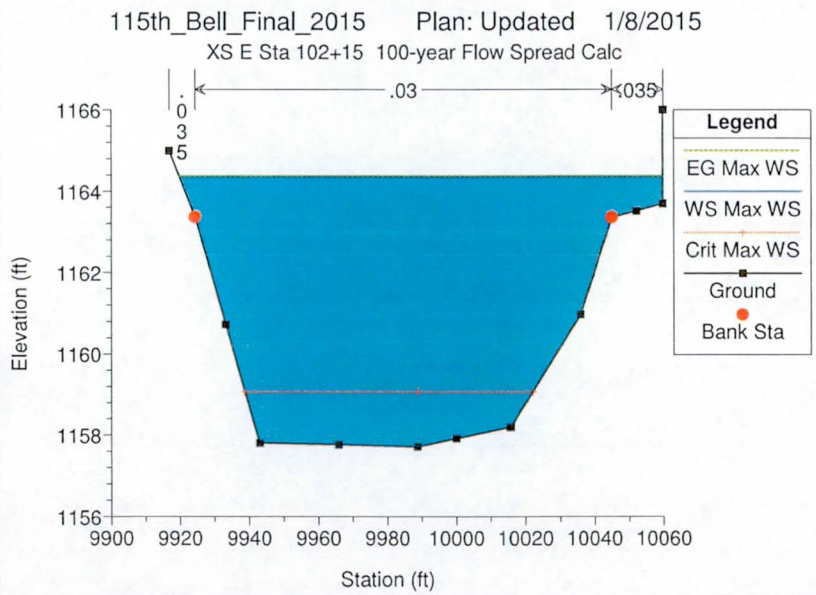
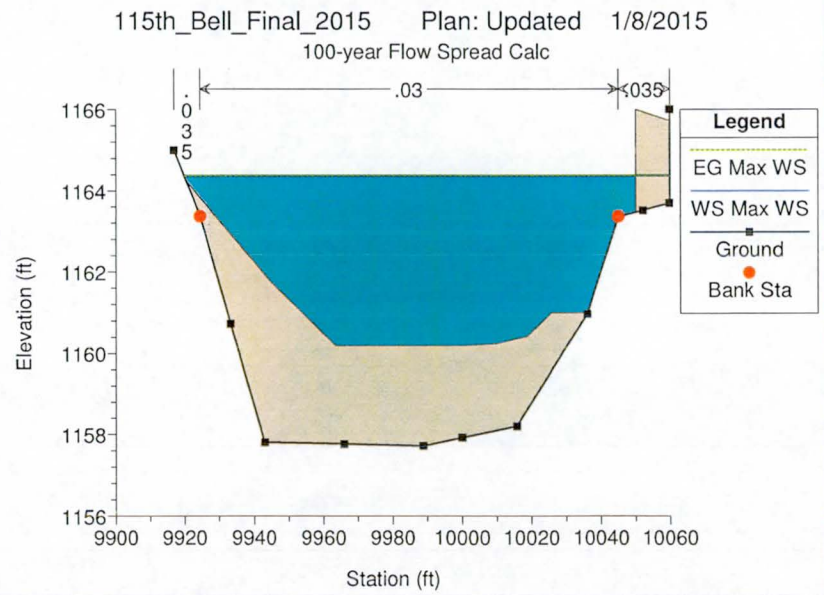
1160
1158
1156
9900 9920 9940 9960 9980 10000 10020 10040 10060 10080
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9900 9920 9940 9960 9980 10000 10020 10040 10060 10080
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
XS E Sta 102+15 100-year Flow Spread Calc
.035
.03
.035
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
1166
1164
1162
1160
1158
1156
9900 9920 9940 9960 9980 10000 10020 10040 10060
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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.03
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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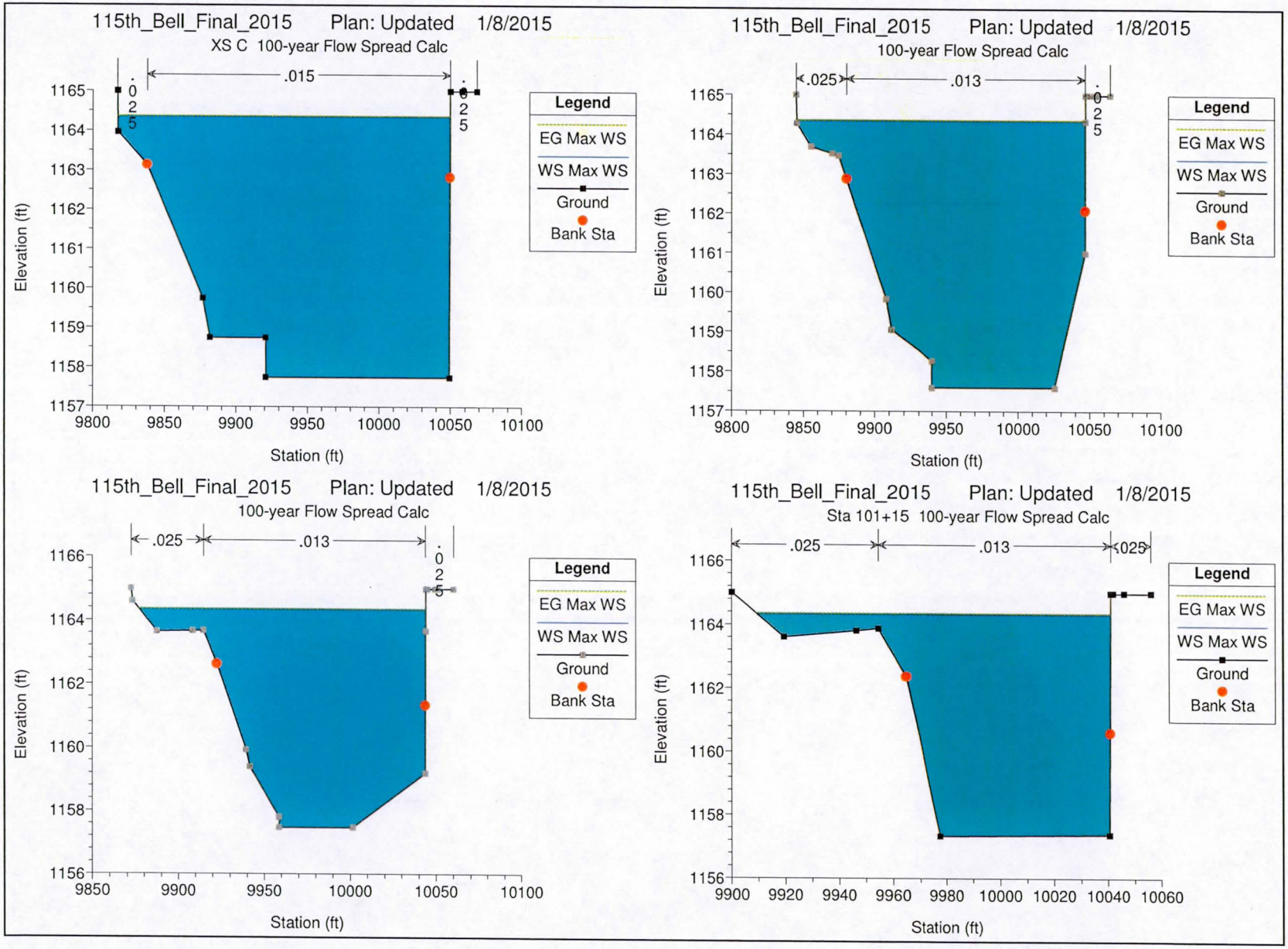
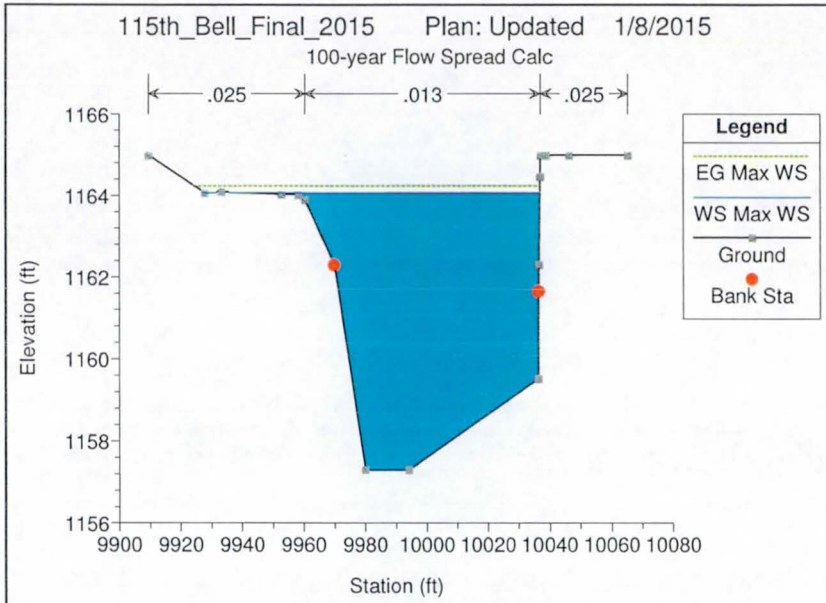
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
XS C 100-year Flow Spread Calc
.015
.025
.025
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.025
.013
.025
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.025
.013
.025
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
115th_Bell_Final_2015 Plan: Updated 1/8/2015
Sta 101+15 100-year Flow Spread Calc
.025
.013
.025
Elevation (ft)
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta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100-year Flow Spread Calc
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.013
.025
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
1166
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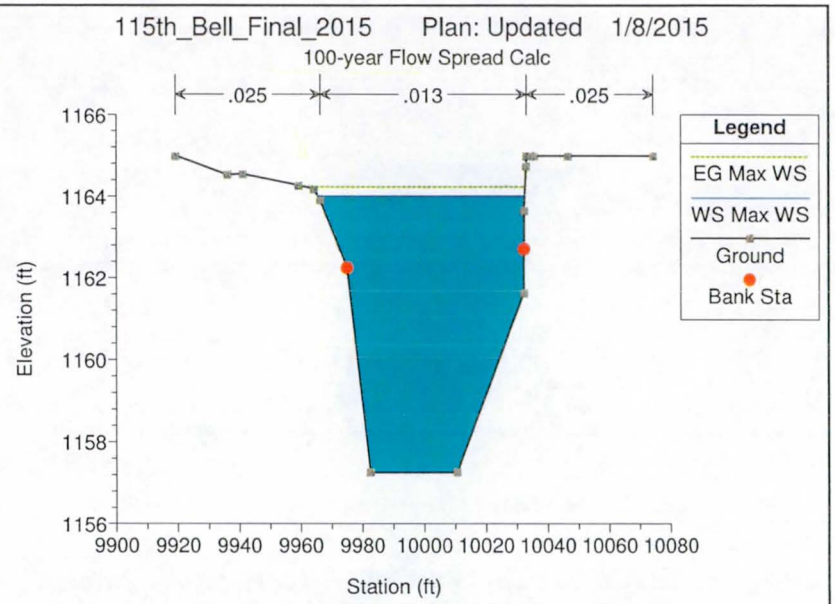
Station (ft)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100-year Flow Spread Calc
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.013
.025
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
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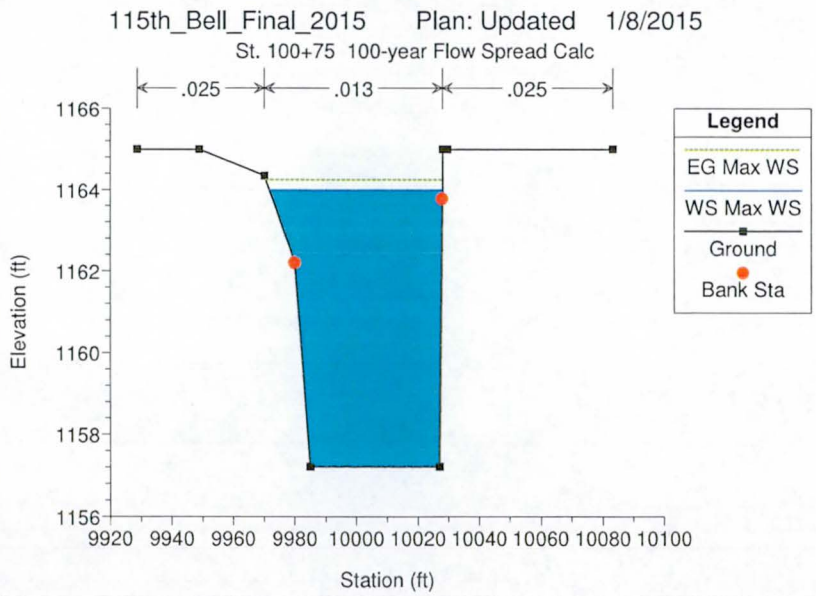
Station (ft)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St. 100+75 100-year Flow Spread Calc
.025
.013
.025
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
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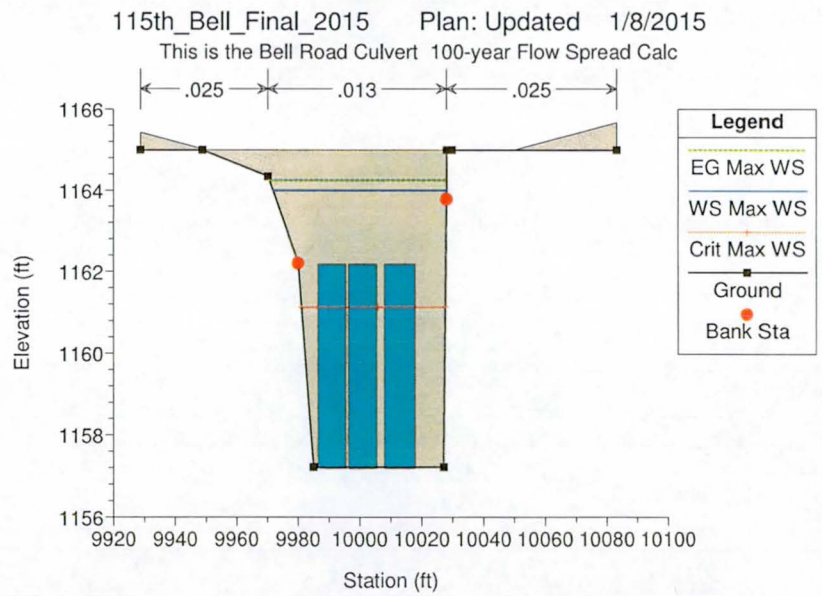
1164
1162
1160
1158
1156
9920 9940 9960 9980 10000 10020 10040 10060 10080 10100
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the Bell Road Culvert 100-year Flow Spread Calc
.025
.013
.025
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
1166
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1162
1160
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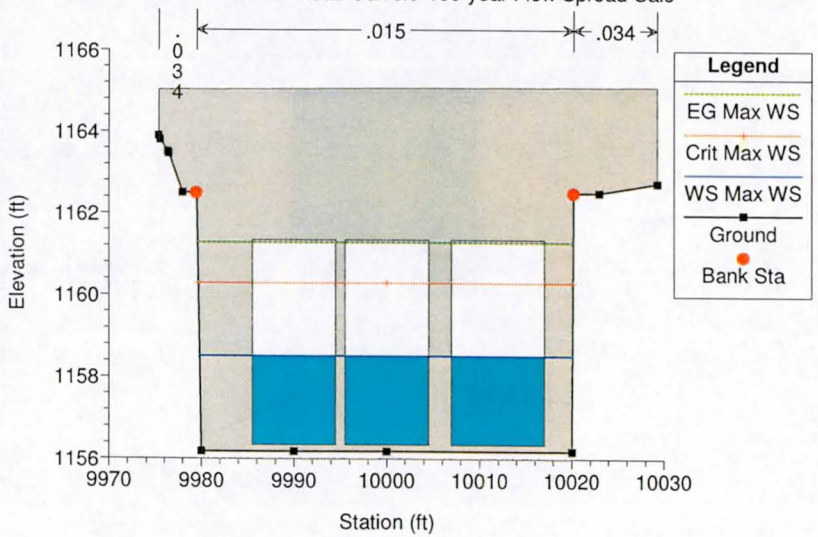
1156
9920 9940 9960 9980 10000 10020 10040 10060 10080 10100
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
This is the Bell Road Culvert 100-year Flow Spread Calc
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.015
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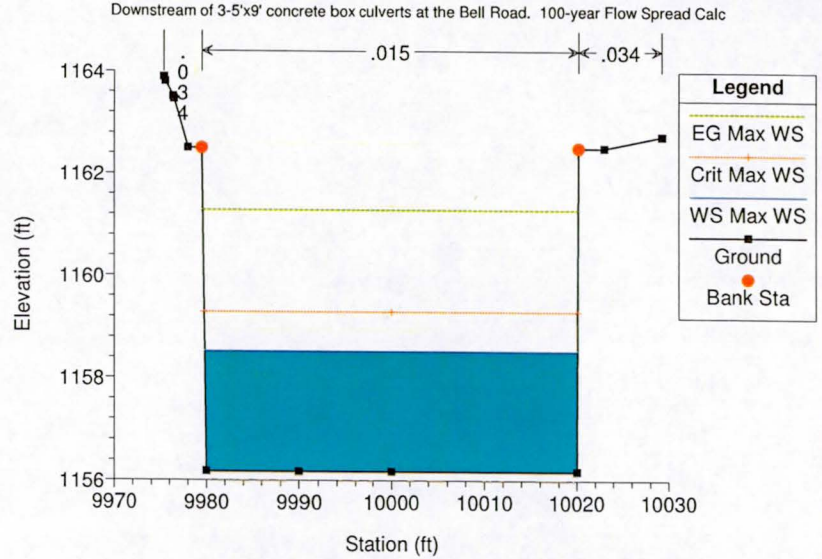
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
Downstream of 3-5'x9' concrete box culverts at the Bell Road. 100-year Flow Spread Calc
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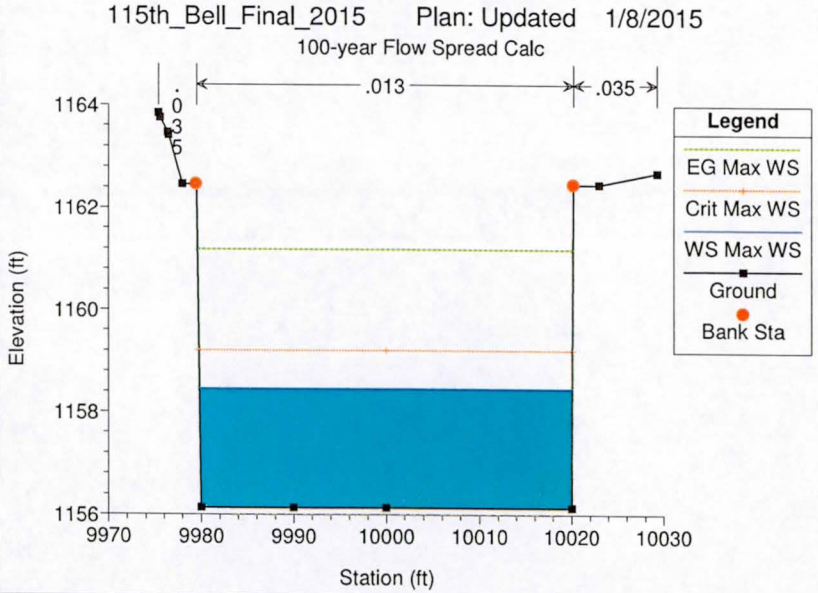
.015
.034
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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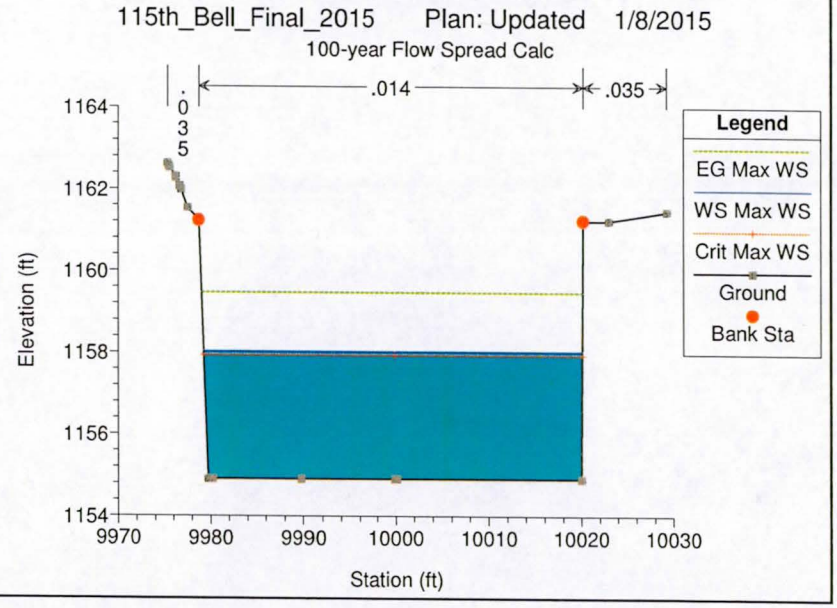
.013
.035
Legend
EG Max WS
Crit Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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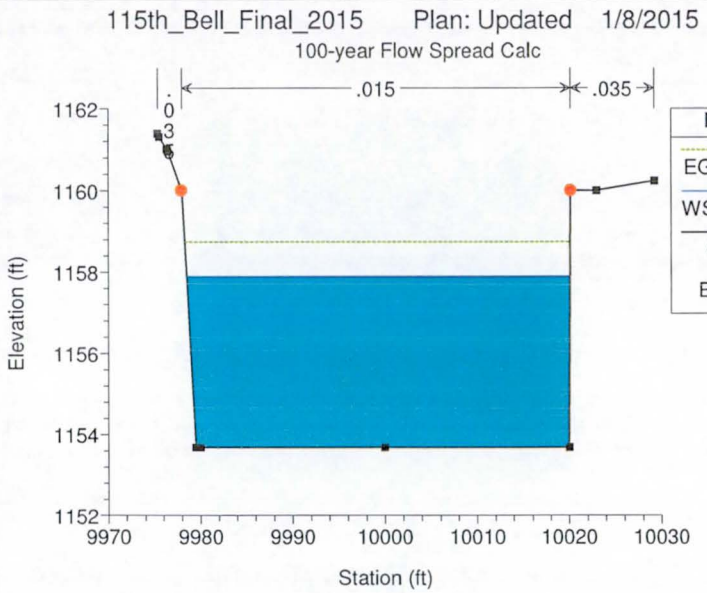
.014
.035
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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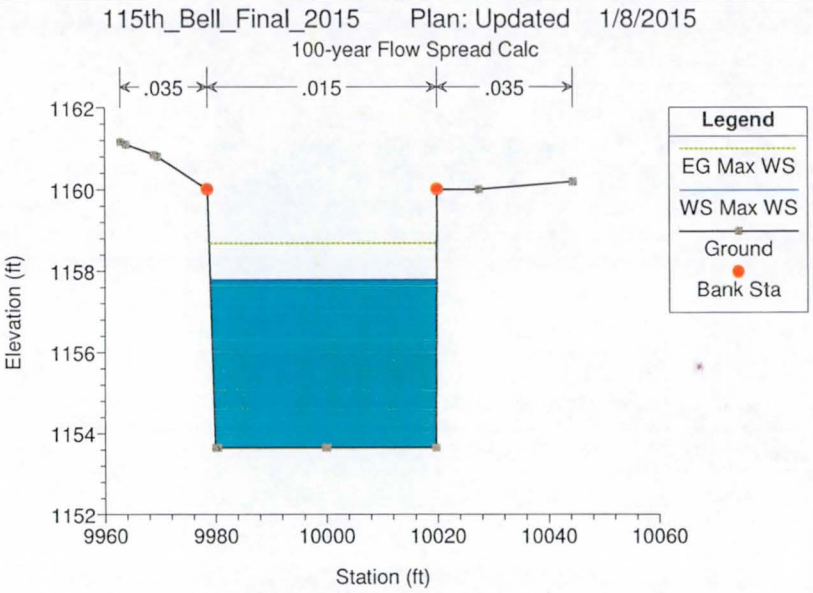
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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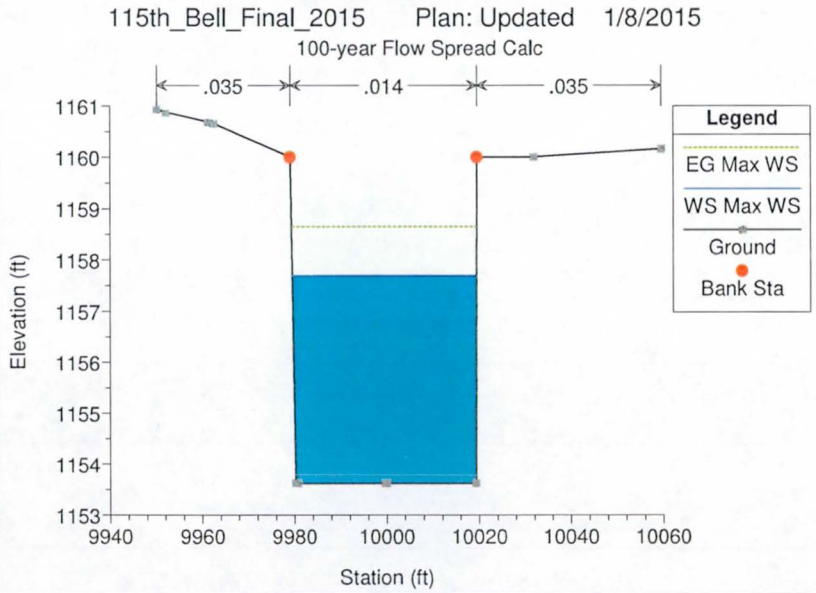
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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.014
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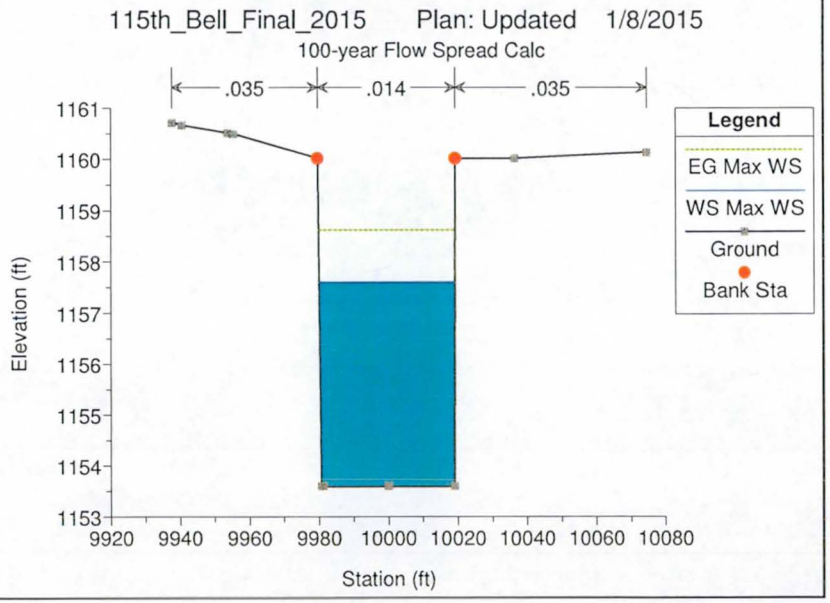
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
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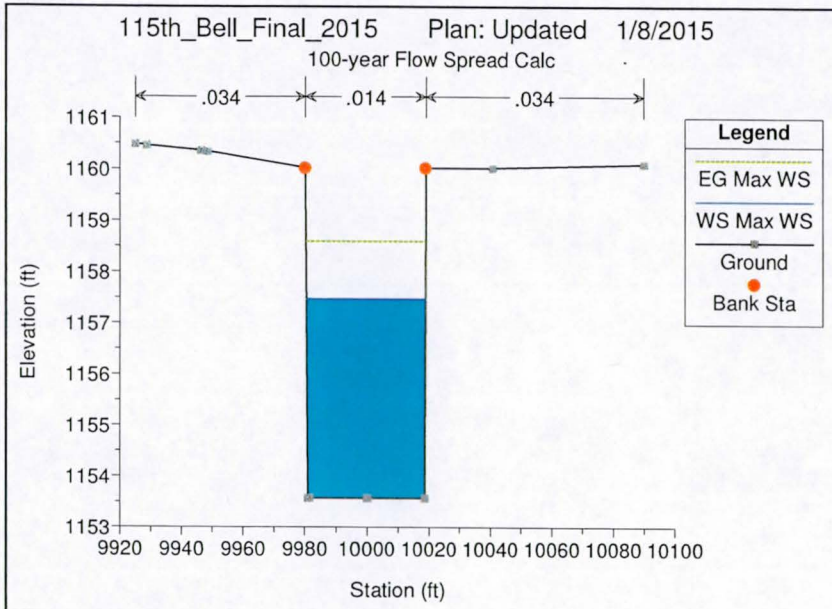
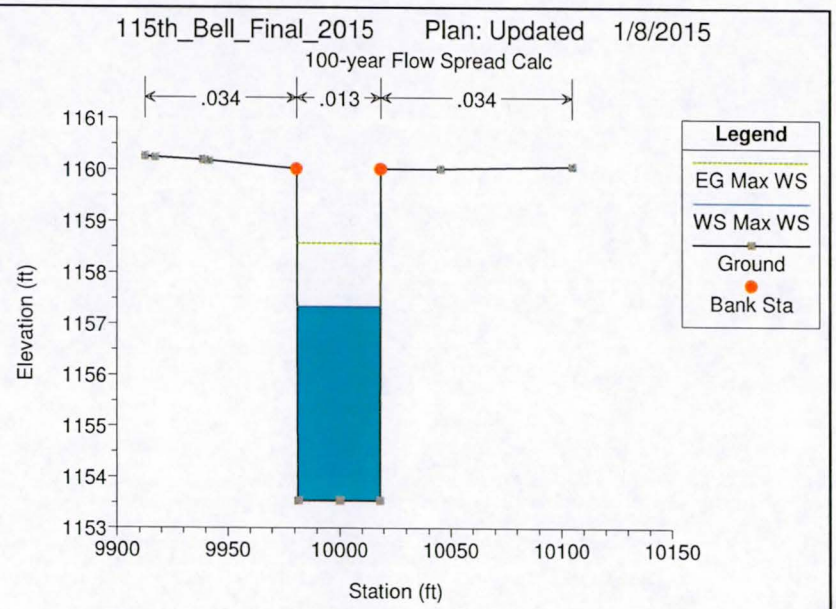
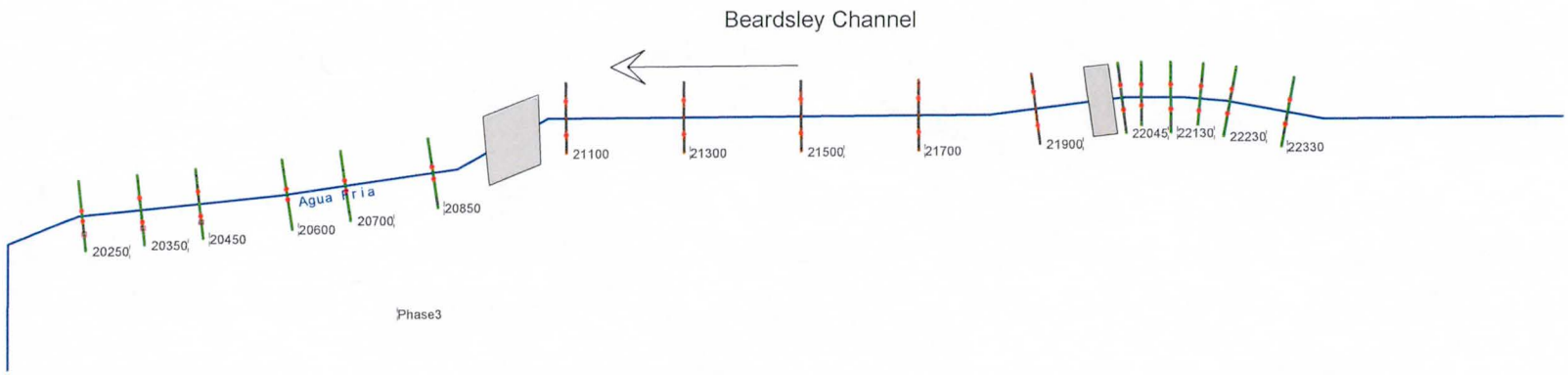
.014
.035
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (ft)
Station (ft)


115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.014
.034
Elevation (ft)
1161
1160
1159
1158
1157
1156
1155
1154
1153
9920 9940 9960 9980 10000 10020 10040 10060 10080 10100
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

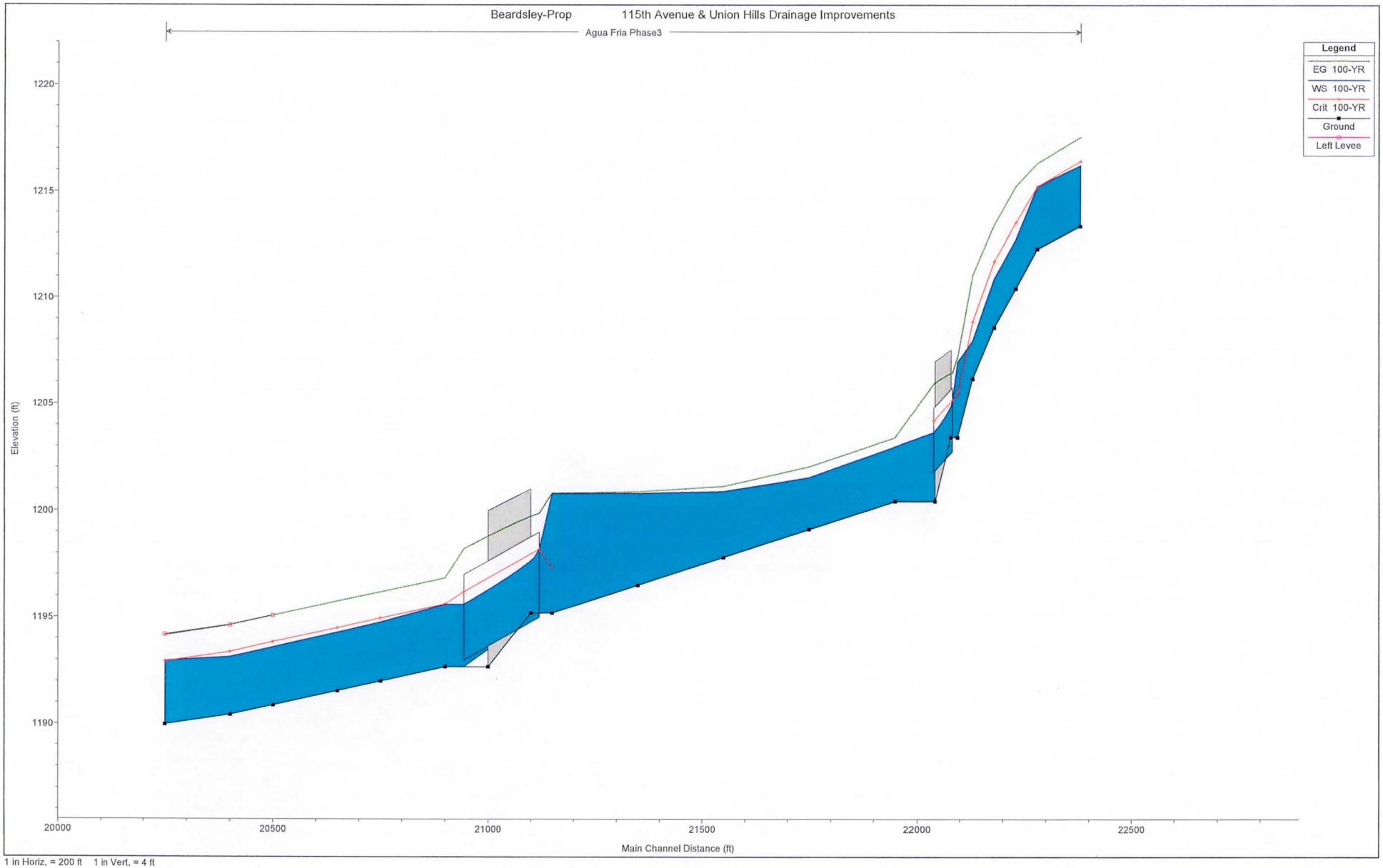

115th_Bell_Final_2015 Plan: Updated 1/8/2015
100-year Flow Spread Calc
.034
.013
.034
Elevation (ft)
1161
1160
1159
1158
1157
1156
1155
1154
1153
9900 9950 10000 10050 10100 10150
Station (ft)
Legend
EG Max WS
WS Max WS
Ground
Bank Sta

APPENDIX D.9 – Proposed Beardsley Road HEC-RAS

Beardsley-Prop



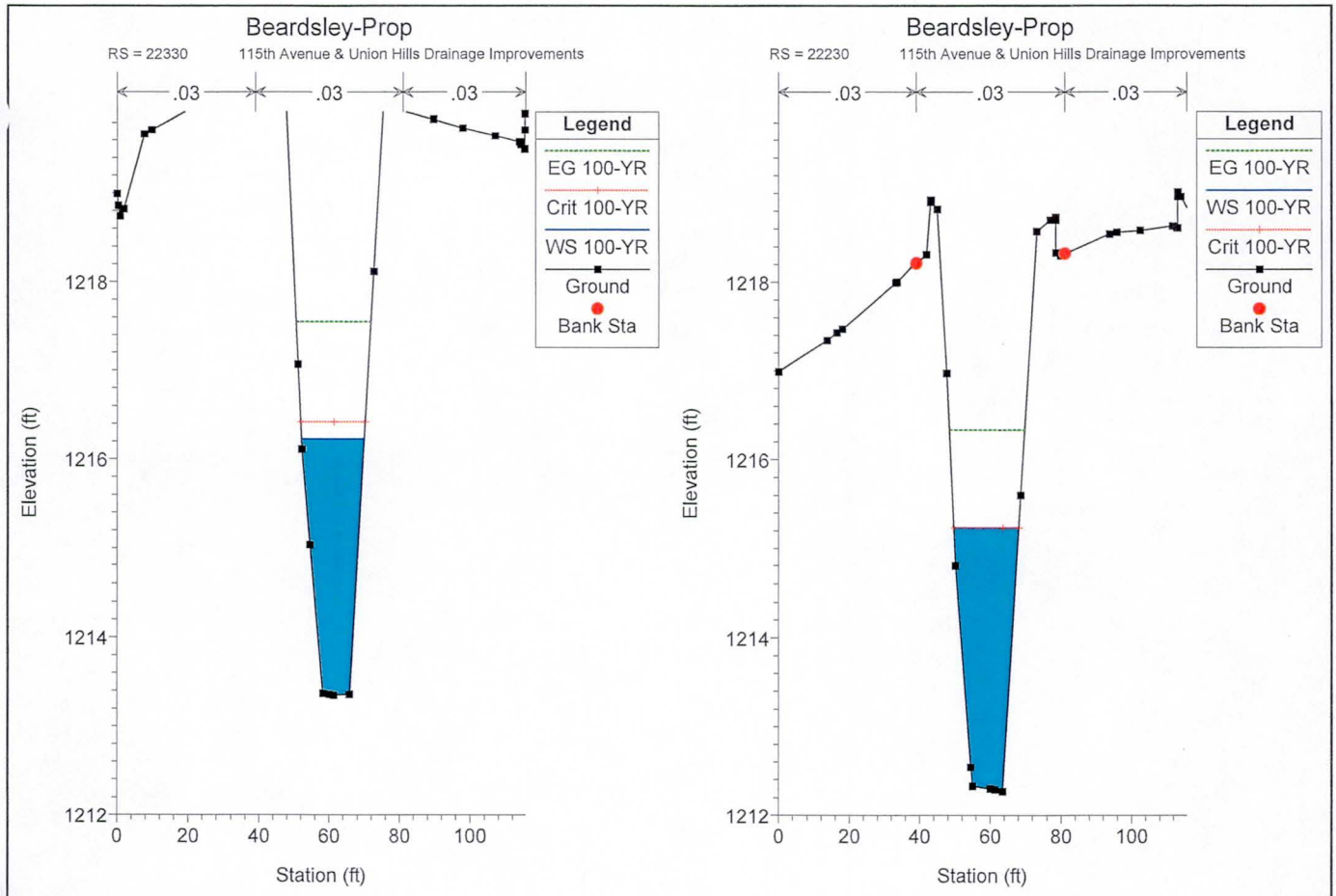
1 in Horiz. = 200 ft 1 in Vert. = 200 ft

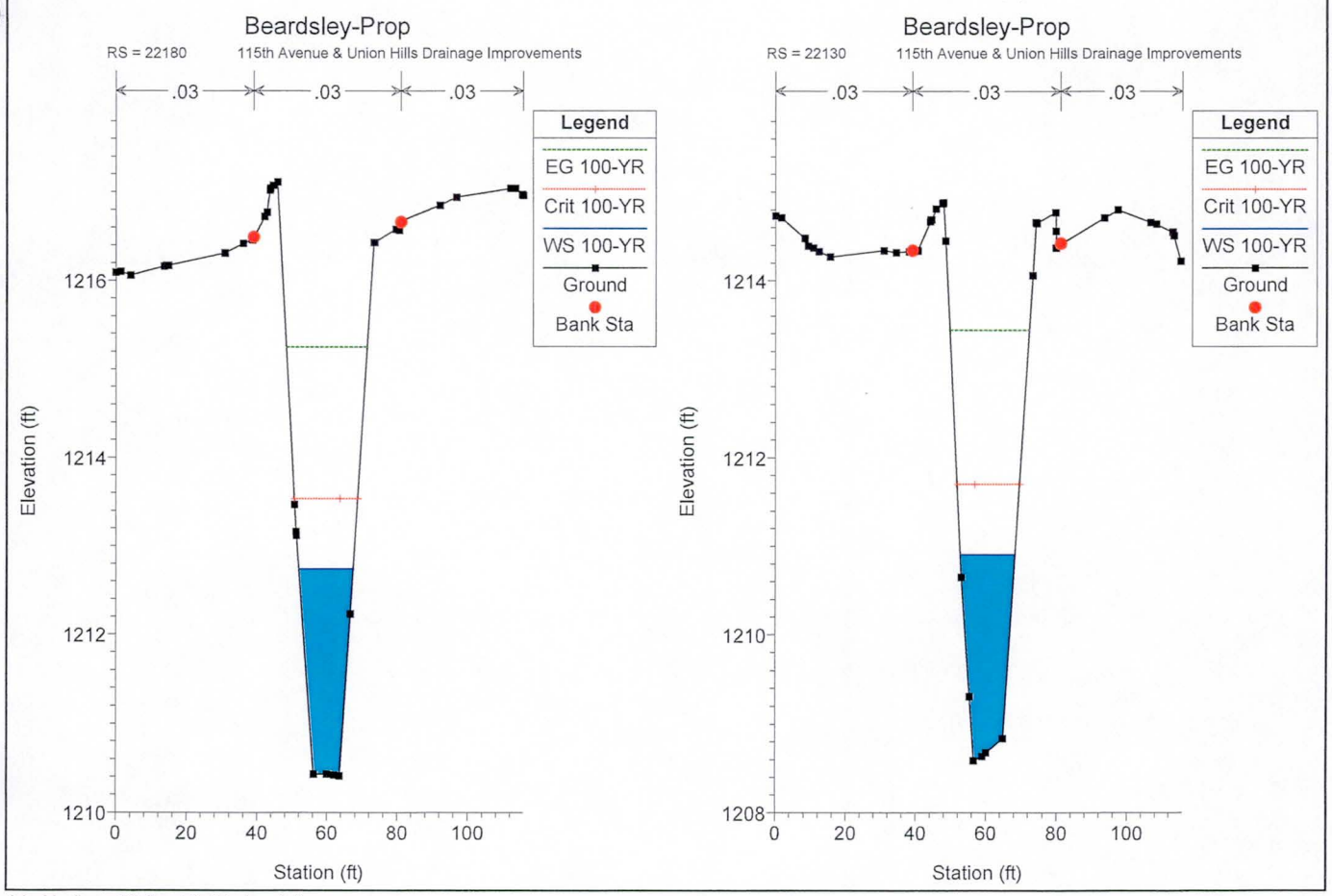


1 in Horiz. = 200 ft 1 in Vert. = 4 ft

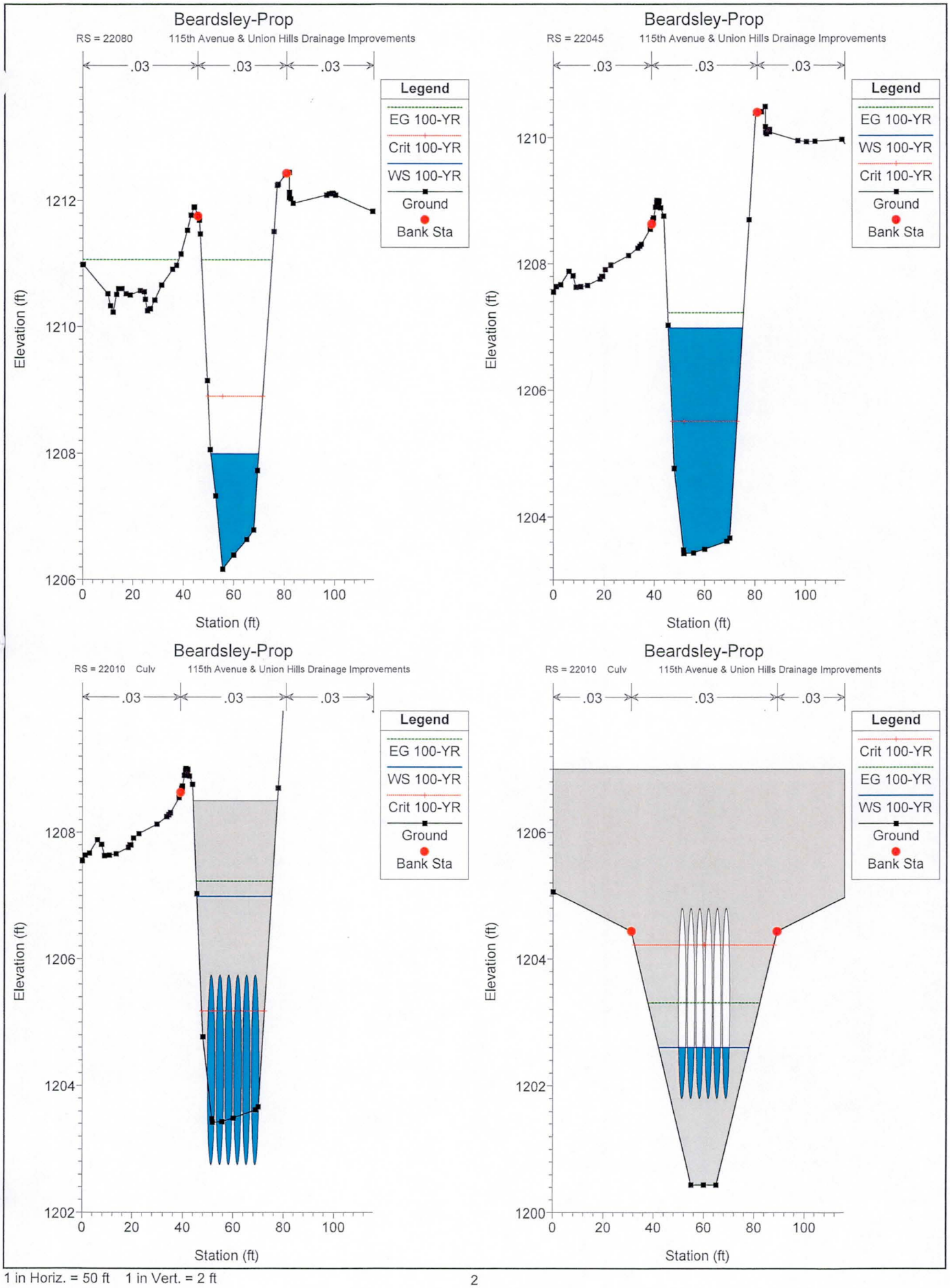
HEC-RAS Plan: PROP River: Agua Fria Reach: Phase3 Profile: 100-YR

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Phase3	22330	100-YR	336.00	1213.35	1216.22	1216.42	1217.55	0.015016	9.25	36.33	17.79	1.14
Phase3	22230	100-YR	336.00	1212.27	1215.23	1215.23	1216.33	0.011529	8.41	39.94	18.44	1.01
Phase3	22180	100-YR	336.00	1210.41	1212.74	1213.54	1215.25	0.035841	12.72	26.42	15.51	1.72
Phase3	22130	100-YR	336.00	1208.59	1210.91	1211.70	1213.44	0.036415	12.77	26.32	15.54	1.73
Phase3	22080	100-YR	336.00	1206.17	1207.99	1208.89	1211.06	0.062101	14.05	23.92	19.02	2.21
Phase3	22045	100-YR	336.00	1203.42	1206.99	1205.51	1207.23	0.001671	3.93	85.53	29.57	0.41
Phase3	22010		Culvert									
Phase3	21900	100-YR	336.00	1200.44	1203.00		1203.42	0.005958	5.18	64.86	40.70	0.72
Phase3	21700	100-YR	336.00	1199.13	1201.55		1202.05	0.007632	5.68	59.19	39.00	0.81
Phase3	21500	100-YR	336.00	1197.82	1200.90		1201.13	0.002627	3.82	87.85	46.99	0.49
Phase3	21300	100-YR	336.00	1196.51	1200.81		1200.88	0.000542	2.19	157.47	87.50	0.24
Phase3	21100	100-YR	336.00	1195.20	1200.79	1197.37	1200.82	0.000127	1.38	270.43	111.02	0.12
Phase3	20980		Culvert									
Phase3	20850	100-YR	336.00	1192.68	1195.60	1195.62	1196.83	0.003494	8.91	37.73	15.84	1.02
Phase3	20700	100-YR	336.00	1192.01	1194.76	1194.96	1196.19	0.004330	9.60	34.99	15.49	1.13
Phase3	20600	100-YR	336.00	1191.56	1194.28	1194.50	1195.74	0.004460	9.70	34.63	15.44	1.14
Phase3	20450	100-YR	336.00	1190.88	1193.59	1193.83	1195.07	0.004541	9.76	34.41	15.42	1.15
Phase3	20350	100-YR	336.00	1190.43	1193.14	1193.37	1194.62	0.004541	9.76	34.41	15.42	1.15
Phase3	20250	100-YR	336.00	1189.98	1192.95	1192.92	1194.13	0.003294	8.72	38.52	15.94	0.99

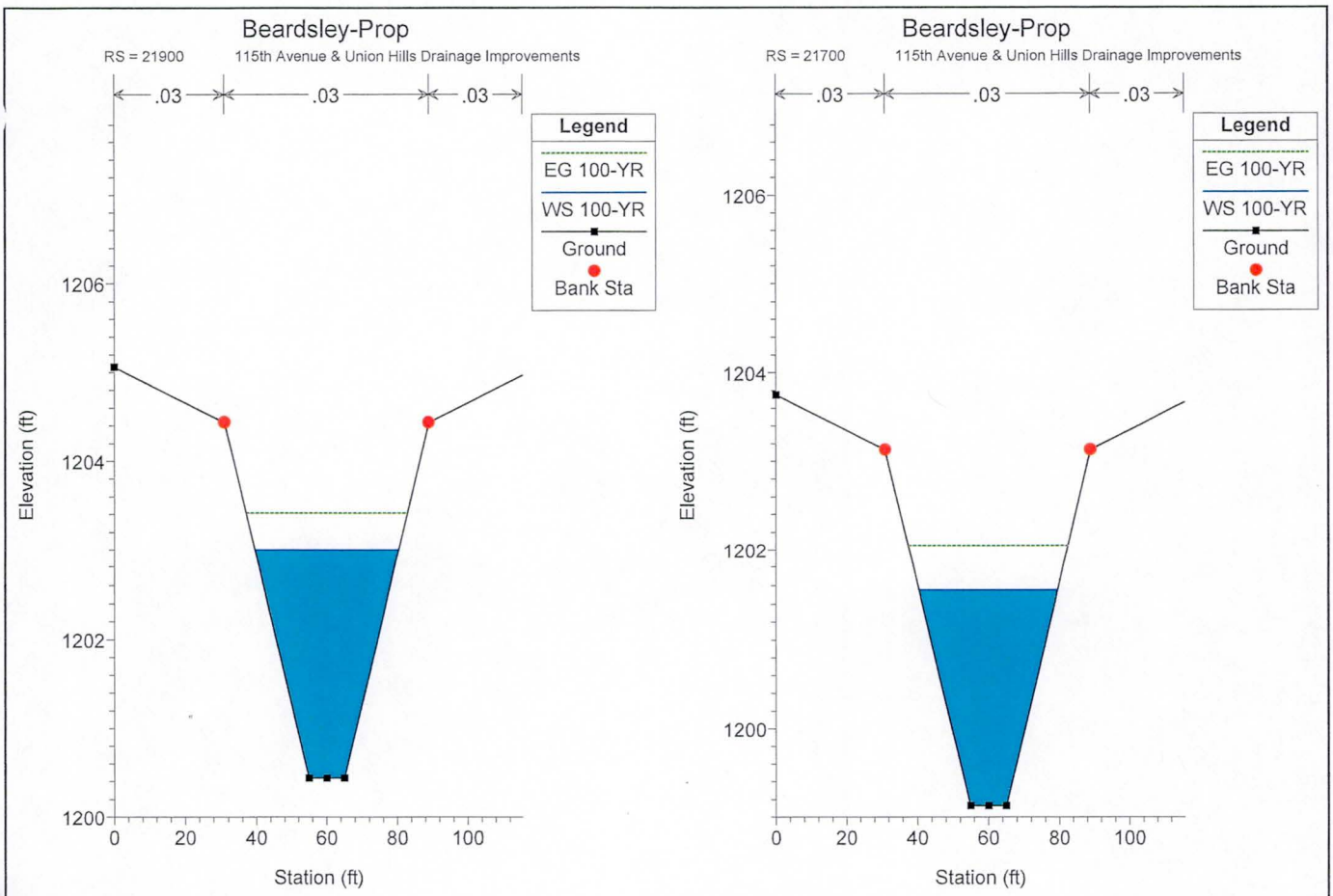




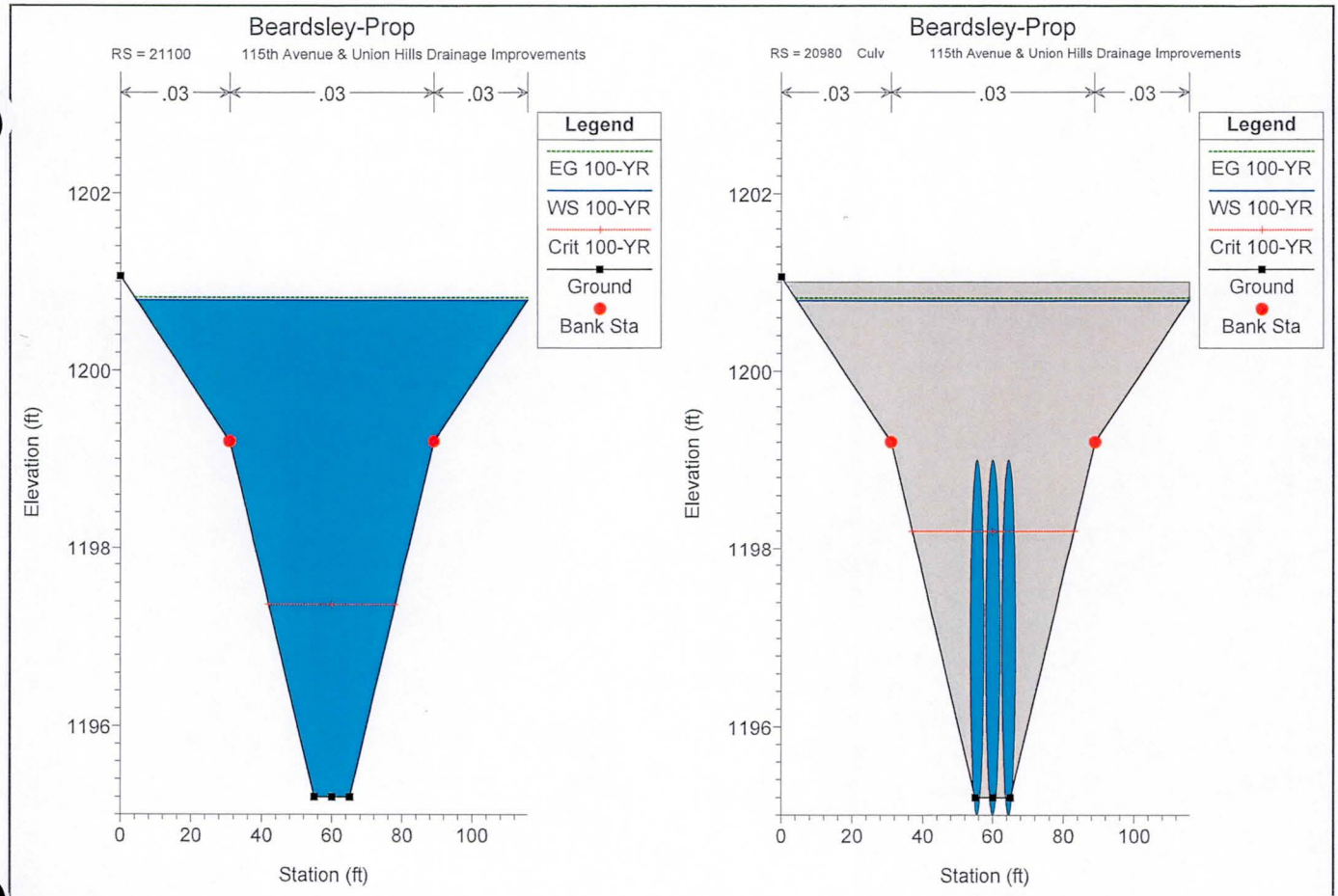
1 in Horiz. = 50 ft 1 in Vert. = 2 ft

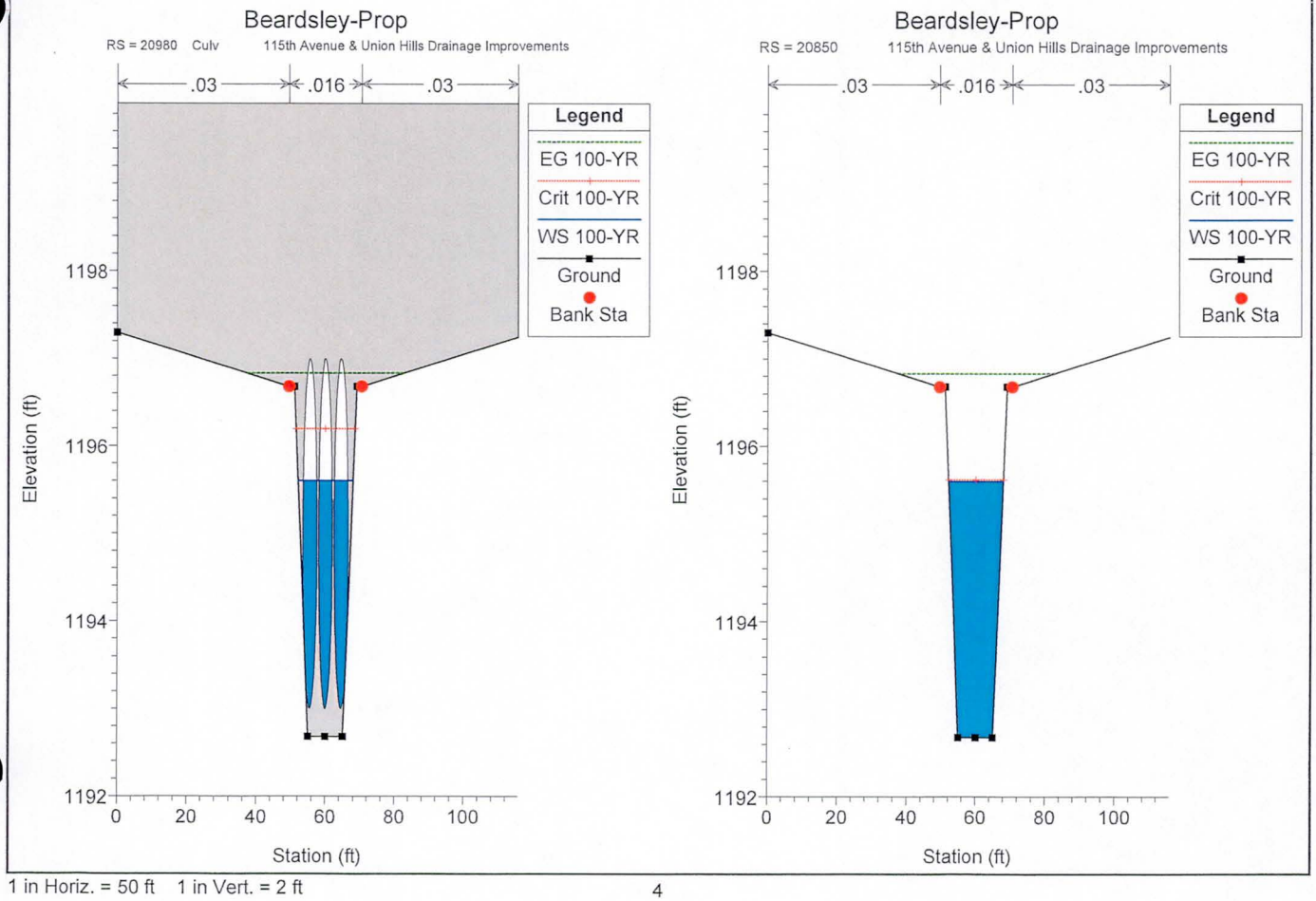


1 in Horiz. = 50 ft 1 in Vert. = 2 ft

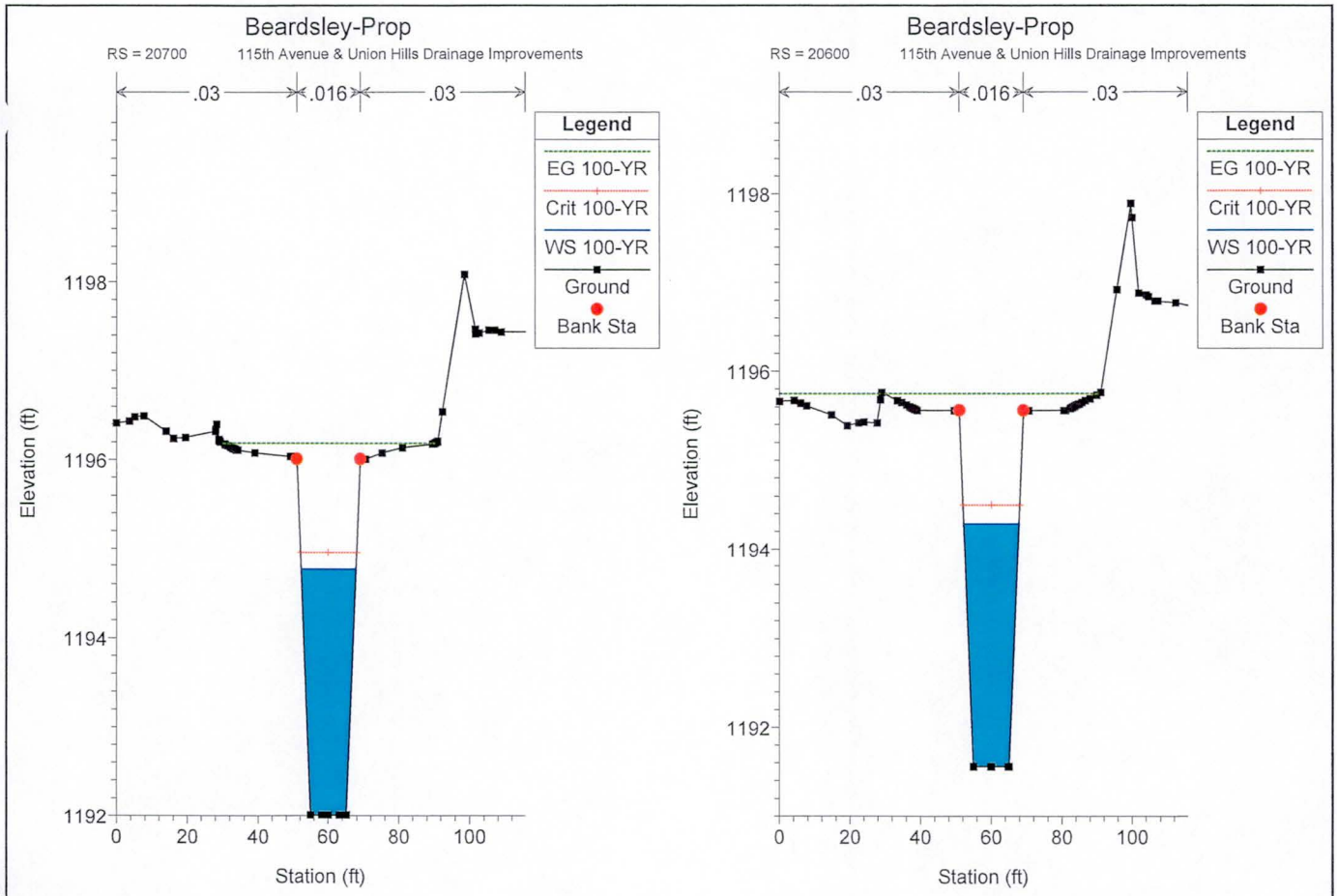


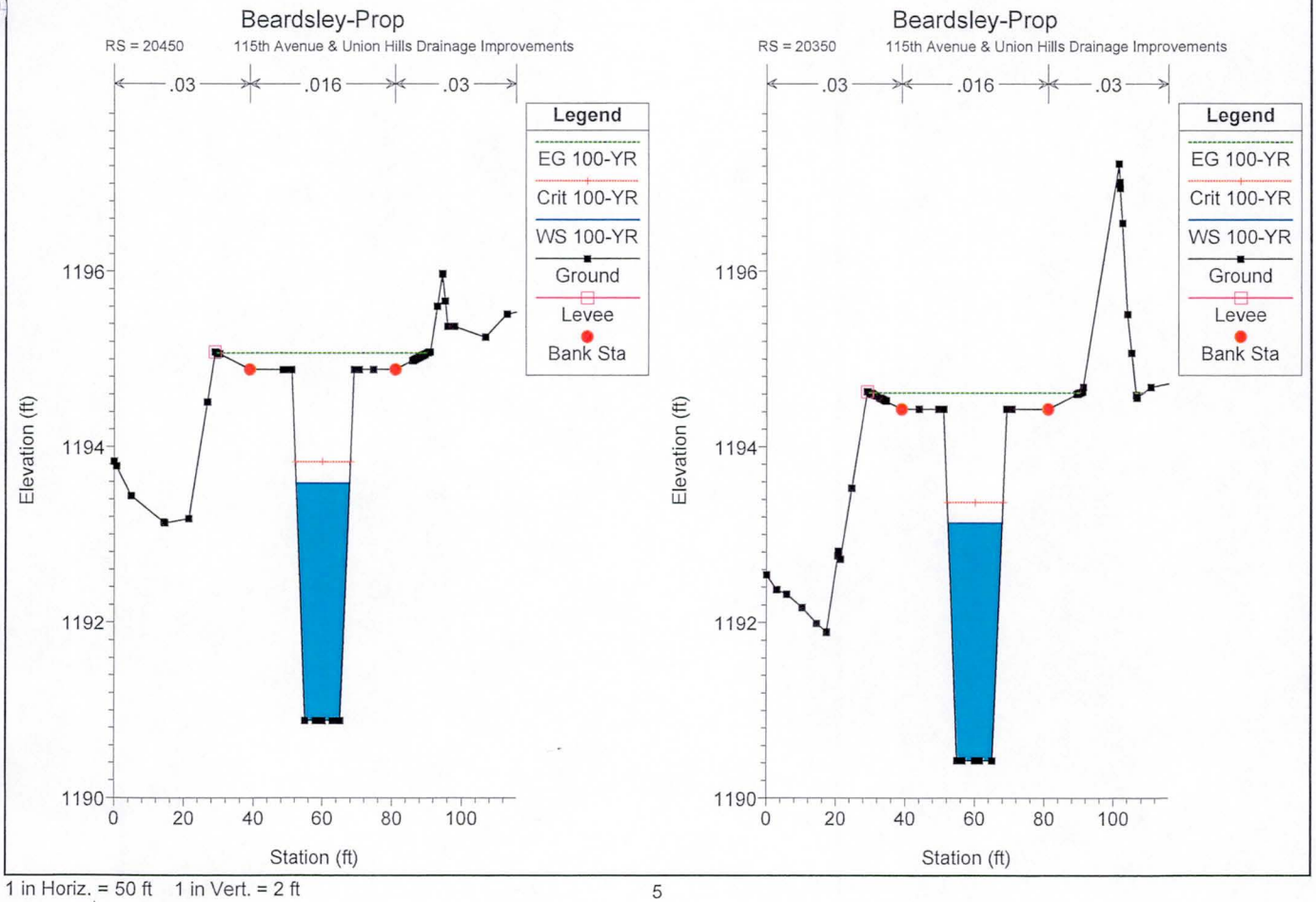
1 in Horiz. = 50 ft 1 in Vert. = 2 ft



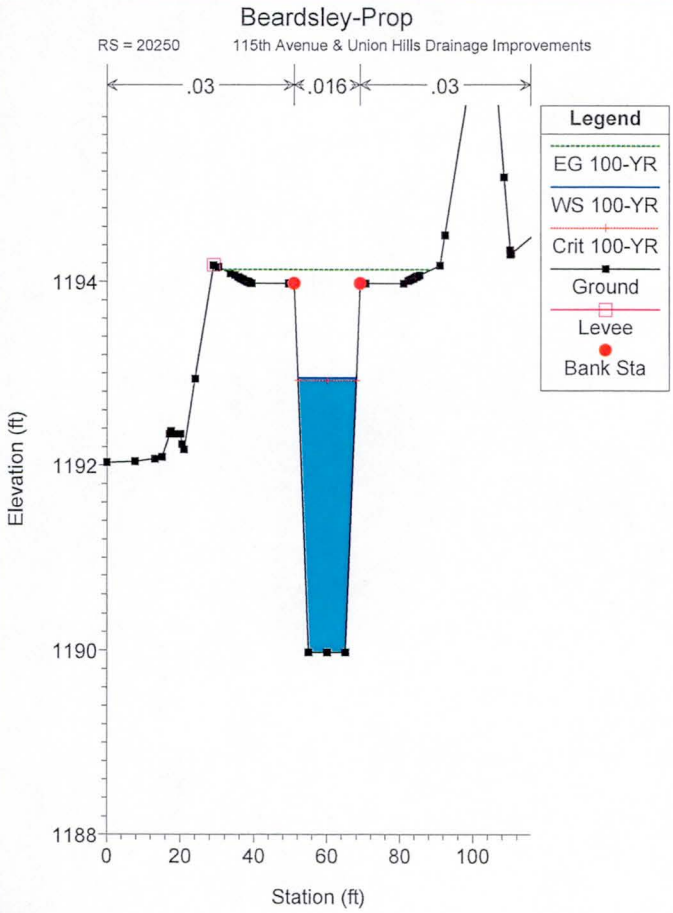


1 in Horiz. = 50 ft 1 in Vert. = 2 ft





1 in Horiz. = 50 ft 1 in Vert. = 2 ft



1 in Horiz. = 50 ft 1 in Vert. = 2 ft

APPENDIX D.10 – Riprap Calculations

Downstream of Grade Control/Drop Structure The loose riprap D_{50} for channel bed protection downstream of a grade control or a drop structure is:

$$D_{50} = 0.0372 V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where:

D_{50} = is the median diameter (ft) V_a = average velocity (ft/s)

γ_s = specific weight of stone (lb/ft^3) = 156 lb/ft^3

γ_w = specific weight of water (lb/ft^3) = 62.4 lb/ft^3

Rip-Rap sizing at concrete end - Station 68+00 (Channel Bottom).

V_a = average velocity (ft/s) = Sta 68+00 = 7.52 ft/s

$$D_{50} = 0.0372\ (7.52)^2 \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 1.4\ ft}$$ **-> Use 1.5 ft**

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = (Need\ Equivalent\ Diameter)}$$

D_{eq} = $(4A/\pi)^{1/2}$ -> A= Flow area of channel (from HEC-RAS)

$$\mathbf{Deq\ =\ (4\ x\ 157.08/\pi)^{1/2}}$$

$$\mathbf{Deq\ = 14.14\ ft}$$

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 14.14 = 99\ ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 3 ft

18-inch Riprap Gradation Table

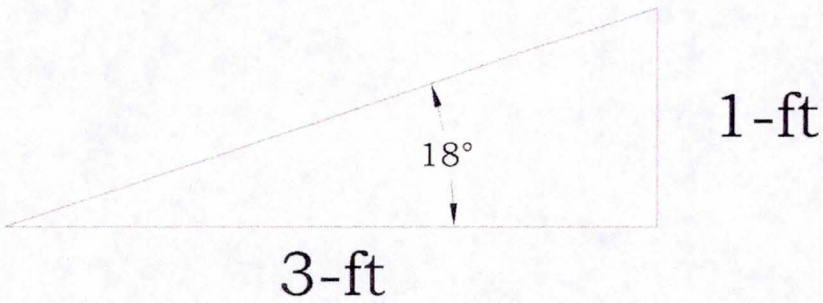
Stone Size Range (ft.)	*% Gradation Smaller Than*
27-in to 31-in	*100*
22-in to 25-in	*85*
18-in to 21-in	*50*
7-in to 11-in	*15*

Rip-Rap sizing at concrete end - Station 68+00 (Channel Banks).

$$D_{50} = 0.0191 \frac{V_a^2}{\cos\varphi} \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where: D_{50} = is the median diameter (ft)

V_a = average velocity (ft/s) φ= bank angle = 18° (see Figure)



$$D_{50} = 0.0191 \frac{7.52}{\cos(18)}^{2} \left(\frac{62.4}{156 - 62.4}\right)$$

$D_{50} = 0.76\ ft$ -> **Use 0.75 ft (9-in)**

Thickness - The riprap-layer thickness shall be the greater of 1.0 times the d_{100} value, or 1.5 times the d_{50} value.

1 x 16in = 16in (d_{100} value) or 1.5 x 9in =14in (d_{50} value)

16 inch thickness – USE 18-inch thickness

9-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
14-in to 16-in	*100*
11-in to 13-in	*85*
9-in to 11-in	*50*
4-in to 6-in	*15*

Rip-Rap sizing at culvert outlet at APS Berms

Channel Bed on Straight Reach The loose riprap *D50* for a straight reach or mildly curved channel:

$$D_{50} = 0.0191 V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where:

D_{50} = is the median diameter (ft)

V_a = average velocity (ft/s) = 9.68 ft/s (APS Berm Sta 123+50)

γ_s = specific weight of stone (lb/ft^3) = 156 lb/ft^3

γ_w = specific weight of water (lb/ft^3) = 62.4 lb/ft^3

$$D_{50} = 0.0191\ (9.68)^2 \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 1.2\ ft}$$ **-> Use 1.5 ft**

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 2 = 14ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 3ft

18-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
27-in to 31-in	*100*
22-in to 25-in	*85*
18-in to 21-in	*50*
7-in to 11-in	*15*

Rip-Rap sizing at culvert outlet at Dual 60-inch culverts

$$D_{50} = 0.0191\,(10.06)^2\left(\frac{62.4}{156-62.4}\right)$$

Q= 291 CFS (HEC-1 model)

V= 10.06 ft/s (HY-8 output)

$D_{50} = 1.29\,ft$ -> **Use 1.5 ft (18-inches)**

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 5 = 35ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 3ft

18-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
27-in to 31-in	*100*
22-in to 25-in	*85*
18-in to 21-in	*50*
7-in to 11-in	*15*

Rip-Rap sizing at Sta 47+00 (Channel Banks).

V_a = average velocity (ft/s) -> (8.46 ft/s) HEC-RAS output (attached)

$$D_{50} = 0.0191 \frac{8.5^2}{\cos(18)} \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 0.97\ ft}$$ **-> Use 1.0 ft (12-inches)**

12-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
18-in to 20-in	*100*
14-in to 17-in	*85*
12-in to 14-in	*50*
5-in to 7-in	*15*

Total Scour and Launchable RipRap Calculations Attached

Rip-Rap sizing at Sta 50+50 (Channel Banks).

V_a = average velocity (ft/s) -> (8.59 ft/s) HEC-RAS output (attached)

$$D_{50} = 0.0191 \frac{8.6^2}{\cos(18)} \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 0.98\ ft}$$ **-> Use 1.0 ft**

12-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
18-in to 20-in	*100*
14-in to 17-in	*85*
12-in to 14-in	*50*
5-in to 7-in	*15*

Total Scour and Launchable RipRap Calculations Attached

Rip-Rap sizing at Sta 59+00 (Channel Banks).

V_a = average velocity (ft/s) -> (10.05 ft/s) HEC-RAS output (attached)

$$D_{50} = 0.0191 \frac{10.05^2}{\cos(18)} \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 1.35ft}$$ **-> Use 1.5 ft (18-inches)**

18-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
27-in to 31-in	*100*
22-in to 25-in	*85*
18-in to 21-in	*50*
7-in to 11-in	*15*

Total Scour and Launchable RipRap Calculations Attached

D_{50} 6-inches

6-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
9-in to 10-in	*100*
7-in to 8-in	*85*
6-in to 7-in	*50*
2-in to 4-in	*15*

Sta 46+95 to 47+45 **Launchable Riprap Calculations**

Q= 1182 cfs

Long term scour (Arizona state Standard, page 11-94 of 2013 Hydraulics Manual)

Zlongterm=0.02*Q_{100}^0.6

Zlongterm= 1.395 ft

General scour (Blench's equation # 11.57, page 11-103 of 2013 Hydraulics Manual)

Z=	0.6				
D50=	0.1115 mm	0.000366 ft			WS Elev
qf=	26.22 cfs/ft	(Q/flow average width)			1132.08
Fb0=	0.541727	Flow Area (HEC-RAS) =	139.75		Min Ch El
Zblench=	**6.496 ft**	Flow Depth =	3.1		1128.98
		qf=	26.22		

Bed form (eqn # 11.61, page 11-106 of 2013 Hydraulics Manual)

(Since the Froude Number is 0.99, the greater value of the dune or antidune height is used.)

Using Dune Va= 8.5 cfs (average)

dh= 1.951 ft

Using Anti-Dune yh= 3.5 ft

0.525 <yh< 1.05

Zbedform= 0.975 ft

Low flow incisement (page 11.107 of 2013 Hydraulics Manual)

Zlowflow **1 ft**

Local Scour Not Needed

Headcut

Zheadcut= 5 ft ---> Recommended by FCDMC (HEC-6T Analysis)

Total Scour Depth

Ztotal= 18.826 ft 1.3 safety factor is used for all components except local scour and headcut

Riprap sizing for Channel Banks

d_{50}= 12 in **<-- From Channel Bank Calculations**

1

Launchable Riprap design (2013 hydraulic manual Page 6-56 to 6-60)

T=	1.5	(T=1.5 * D50)		
H=	6	(H= 4 * T)	**use**	**6 ft**
Area=	94.72 sq.ft	(total scour depth with 2:1 slope, considered dry placement for volume increase; volume increase coefficient is 1.5 1.5 per Table 6.7 on page 6-59 of 2013 Hydraulics Manual)		
Length=	**15.79 ft**		**use**	**16 ft**

Sta 46+95 to 47+45 **Launchable Riprap Calculations**

Q= 1182 cfs

Long term scour (Arizona state Standard, page 11-94 of 2013 Hydraulics Manual)

Zlongterm=0.02*Q_{100}^0.6

Zlongterm= 1.395 ft

General scour (Blench's equation # 11.57, page 11-103 of 2013 Hydraulics Manual)

Z=	0.6				
D50=	0.1115 mm	0.000366 ft			WS Elev
qf=	26.22 cfs/ft	(Q/flow average width)			1132.08
Fb0=	0.541727	Flow Area (HEC-RAS) =	139.75		Min Ch El
Zblench=	**6.496 ft**	Flow Depth =	3.1		1128.98
		qf=	26.22		

Bed form (eqn # 11.61, page 11-106 of 2013 Hydraulics Manual)

(Since the Froude Number is 0.99, the greater value of the dune or antidune height is used.)

Using Dune Va= 8.5 cfs (average)

dh= 1.951 ft

Using Anti-Dune yh= 3.5 ft

0.525 <yh< 1.05

Zbedform= 0.975 ft

Low flow incisement (page 11.107 of 2013 Hydraulics Manual)

Zlowflow **1 ft**

Local Scour Not Needed

Headcut

Zheadcut= 5 ft ---> Recommended by FCDMC (HEC-6T Analysis)

Total Scour Depth

Ztotal= 18.826 ft 1.3 safety factor is used for all components except local scour and headcut

Riprap sizing for Channel Banks

d_{50}= 12 in **<-- From Channel Bank Calculations**

1

Launchable Riprap design (2013 hydraulic manual Page 6-56 to 6-60)

T= 1.5 (T=1.5 * D50)

H= 6 (H= 4 * T) **use 6 ft**

Area= 94.72 sq.ft (total scour depth with 2:1 slope, considered dry placement for volume increase; volume increase coefficient is 1.5 1.5 per Table 6.7 on page 6-59 of 2013 Hydraulics Manual)

Length= 15.79 ft use 16 ft

Sta 58+50 to 59+58 **Launchable Riprap Calculations**

Q= 1182 cfs

Long term scour (Arizona state Standard, page 11-94 of 2013 Hydraulics Manual)

Zlongterm=0.02*Q_{100}^0.6

Zlongterm= 1.395 ft

General scour (Blench's equation # 11.57, page 11-103 of 2013 Hydraulics Manual)

Z=	0.6				
D50=	0.1115 mm		0.000366 ft		
qf=	40.38 cfs/ft		(Q/flow average width)		WS Elev
Fb0=	0.541727		Flow Area (HEC-RAS) =	114.75	1140.62
Zblench=	**8.663 ft**		Flow Depth =	3.92	Min Ch El
			qf=	40.38	1136.7

Bed form (eqn # 11.61, page 11-106 of 2013 Hydraulics Manual)

(Since the Froude Number is 0.99, the greater value of the dune or antidune height is used.)

Using Dune Va= 10.05 cfs (average)

dh= 2.727 ft

Using Anti-Dune yh= 3.5 ft

0.525 <yh< 1.05

Zbedform= 1.364 ft

Low flow incisement (page 11.107 of 2013 Hydraulics Manual)

Zlowflow **1 ft**

Local Scour Not Needed

Headcut

Zheadcut= 3 ft ---> Recommended by FCDMC (HEC-6T Analysis)

Total Scour Depth

Ztotal= 20.148 ft 1.3 safety factor is used for all components except local scour and headcut

Riprap sizing for Channel Banks

d_{50}= 18 in <-- **From Channel Bank Calculations**

1.5

Launchable Riprap design (2013 hydraulic manual Page 6-56 to 6-60)

T=	2.25	(T=1.5*D50)		
H=	6.3	(H=2.8*T)	**use**	**6.5 ft**
Area=	152.05 sq.ft	(total scour depth with 2:1 slope, considered dry placement for volume increase; volume increase coefficient is 1.5 1.5 per Table 6.7 on page 6-59 of 2013 Hydraulics Manual)		
Length=	**24.13 ft**		**use**	**24.00 ft**

Tucson Electric Crossing
Launchable Riprap Calculations (Station 61+60 tp 62+20)

Q= 1182 cfs

Long term scour (Arizona state Standard, page 11-94 of 2013 Hydraulics Manual)

Zlongterm=0.02*Q_{100}^0.6

Zlongterm= 1.395 ft

General scour (Blench's equation # 11.57, page 11-103 of 2013 Hydraulics Manual)

Z=	0.6					
D50=	0.1115	mm	0.000366 ft			WS Elev
qf=	51.27	cfs/ft	(Q/flow average width)			1144.39
Fb0=	0.541727		Flow Area (HEC-RAS) =	109.27	(Sta. 61+72)	Min Ch El
Zblench=	**10.158**	**ft**	Flow Depth =	4.74	(Sta. 61+72)	1139.65
			qf=	51.27		

Bed form (eqn # 11.61, page 11-106 of 2013 Hydraulics Manual)

(Since the Froude Number is 0.99, the greater value of the dune or antidune height is used.)

Using Dune Va= 8 cfs (average)

dh= 1.728 ft

Using Anti-Dune yh= 3.5 ft

0.525 <yh< 1.05

Zbedform= 0.864 ft

Low flow incisement (page 11.107 of 2013 Hydraulics Manual)

Zlowflow **1 ft**

Local Scour (Zimmerman and Maniak eqn # 11.76, page 11-121 of 2013 Hydraulics Manual)

q= 50 (should be computed by Q/AverageWidth, instead of Q/WP)

ym= 3.71

D85= 0.335 mm

Zimmerman 14.850 ft

Headcut

Zheadcut= 2 ft ---> Recommended by FCDMC

Total Scour Depth

Ztotal= 34.293 ft 1.3 safety factor is used for all components except local scour and headcut

Riprap sizing for sloped rock chute Sta: 61+72 (equation # 6.41 on page 6-55 of 2013 hydraulic manual)

q= 51.27 cfs/ft (should be computed by Q/AverageWidth, instead of Q/WP)

S0= 0.044 ft

d50= 1.425 **use 1.5 ft**

1.5 ft

Launchable Riprap design (2013 hydraulic manual Page 6-56 to 6-60)

T= 2.25 (T=1.5*D50)

H= 4.5 (H=2*T) **use 5 ft**

Area= 258.80 sq.ft (total scour depth with 2:1 slope, considered dry placement for volume increase; volume increase coefficient is 1.5 1.5 per Table 6.7 on page 6-59 of 2013 Hydraulics Manual)

Length= **57.511 ft** **use 60 ft**

HEC-RAS Plan: 115-Exst-01 River: New River Reach: 115-EXST Profile: 100-YR

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
115-EXST	9904.63	100-YR	1182.00	1155.73	1161.16	1159.81	1162.09	0.003050	7.76	152.33	34.73	0.62
115-EXST	9871.53	100-YR	1182.00	1155.20	1160.13	1160.13	1161.73	0.008537	10.15	116.42	36.92	1.01
115-EXST	9773.86	100-YR	1182.00	1154.16	1160.36		1160.95	0.002362	6.45	212.68	82.74	0.55
115-EXST	9726.77	100-YR	1182.00	1153.98	1159.78	1158.84	1160.77	0.003938	8.03	155.37	68.41	0.71
115-EXST	9672.84	100-YR	1182.00	1153.42	1159.81		1160.52	0.002561	6.78	175.54	50.41	0.58
115-EXST	9576.33	100-YR	1182.00	1153.24	1158.22	1158.22	1160.01	0.007997	10.77	111.26	31.84	1.00
115-EXST	9475.81	100-YR	1182.00	1152.70	1157.23	1157.23	1158.76	0.007592	9.95	120.96	42.00	0.97
115-EXST	9279.46	100-YR	1182.00	1150.47	1157.45		1157.58	0.000332	2.94	402.40	72.84	0.22
115-EXST	9004.66	100-YR	1182.00	1150.51	1156.68		1157.33	0.002935	6.55	193.66	74.21	0.61
115-EXST	8763.6	100-YR	1182.00	1150.23	1155.83		1156.55	0.003427	6.96	184.29	90.00	0.66
115-EXST	8576.73	100-YR	1182.00	1149.52	1154.75	1154.26	1155.71	0.005812	7.92	158.72	96.90	0.83
115-EXST	8374.93	100-YR	1182.00	1148.20	1154.08		1154.77	0.003260	6.81	193.17	95.16	0.64
115-EXST	8175.43	100-YR	1182.00	1148.18	1153.33	1152.79	1154.10	0.003418	7.22	187.63	101.12	0.67
115-EXST	7971.55	100-YR	1182.00	1147.40	1152.51	1152.22	1153.30	0.004490	7.42	179.03	89.72	0.74
115-EXST	7773.9	100-YR	1182.00	1146.88	1151.79		1152.52	0.003352	7.05	190.32	93.77	0.66
115-EXST	7572.12	100-YR	1182.00	1145.91	1151.29		1151.86	0.002779	6.28	217.60	103.17	0.60
115-EXST	7377.44	100-YR	1182.00	1145.41	1150.46		1151.23	0.003494	7.55	189.53	87.11	0.68
115-EXST	7172.71	100-YR	1182.00	1144.56	1150.07		1150.58	0.002249	6.13	223.19	82.24	0.55
115-EXST	6972.39	100-YR	1182.00	1143.66	1148.80	1148.52	1149.83	0.006221	8.16	145.07	54.21	0.86
115-EXST	6772.5	100-YR	1182.00	1142.55	1147.98	1147.29	1148.79	0.003916	7.24	166.33	62.16	0.70
115-EXST	6571.28	100-YR	1182.00	1141.85	1147.26	1146.44	1148.02	0.003609	7.01	169.51	55.00	0.68
115-EXST	6372.24	100-YR	1182.00	1140.85	1146.47	1145.64	1147.30	0.003606	7.33	165.30	58.50	0.68
115-EXST	6172	100-YR	1182.00	1139.65	1144.39	1144.39	1146.18	0.007723	10.77	111.18	33.19	0.99
115-EXST	5974	100-YR	1182.00	1136.68	1142.42		1143.23	0.003326	7.24	163.25	42.47	0.65
115-EXST	5900	100-YR	1182.00	1136.70	1140.78	1140.67	1142.27	0.006386	9.91	124.78	40.77	0.91
115-EXST	5775	100-YR	1182.00	1136.30	1140.80		1141.52	0.002948	6.84	177.50	53.23	0.62
115-EXST	5572	100-YR	1182.00	1133.48	1138.91	1138.72	1140.54	0.007099	10.25	115.37	31.31	0.93
115-EXST	5371	100-YR	1182.00	1133.33	1138.03	1137.59	1139.12	0.005574	8.37	141.19	44.40	0.83
115-EXST	5173	100-YR	1182.00	1131.95	1136.45	1136.45	1137.74	0.008697	9.09	130.04	50.58	1.00
115-EXST	5050	100-YR	1182.00	1131.81	1135.04	1135.04	1136.19	0.009053	8.62	137.08	60.38	1.01
115-EXST	4975	100-YR	1182.00	1131.40	1134.13	1134.13	1135.24	0.009182	8.46	139.77	64.05	1.01
115-EXST	4774	100-YR	1182.00	1128.67	1132.02	1132.02	1133.16	0.009134	8.58	137.78	61.41	1.01
115-EXST	4700	100-YR	1182.00	1127.40	1131.33	1131.11	1132.26	0.006789	7.73	152.96	62.87	0.87
115-EXST	4573.5	100-YR	1182.00	1126.43	1130.01	1130.01	1131.25	0.008915	8.93	132.29	54.40	1.01

HEC-RAS Plan: Proposed River: 115th_Channel Reach: 1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Hydr Depth	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Area Channel
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(sq ft)
1	9934.34	PF 1	1182.00	1156.19	1159.40	3.19	1161.01	0.002408	10.19	116.03	36.36	1.00	116.03
1	9924.34	PF 1	1182.00	1156.14	1159.35	3.19	1160.96	0.002415	10.20	115.94	36.36	1.01	115.94
1	9900.07	PF 1	1182.00	1153.69	1158.01	4.28	1158.89	0.000939	7.52	157.12	36.68	0.64	157.12
1	9800	PF 1	1182.00	1153.52	1157.95	4.39	1158.79	0.000870	7.34	161.09	36.68	0.62	161.09
1	9700	PF 1	1182.00	1153.36	1157.90	4.49	1158.69	0.000811	7.17	164.84	36.70	0.60	164.84
1	9658	PF 1	1182.00	1153.31	1157.27	3.92	1158.60	0.001608	9.24	127.87	32.61	0.82	127.87
1	9600	PF 1	1182.00	1153.22	1157.16	3.90	1158.50	0.001636	9.30	127.14	32.61	0.83	127.14
1	9533	PF 1	1182.00	1153.12	1156.59	3.44	1158.32	0.002433	10.57	111.79	32.53	1.01	111.79
1	9485.22	PF 1	1182.00	1149.62	1153.98	3.83	1155.34	0.001292	9.35	126.44	32.99	0.84	126.44
1	9400	PF 1	1182.00	1149.49	1153.87	3.85	1155.21	0.001479	9.31	127.00	33.03	0.84	127.00
1	9200	PF 1	1182.00	1149.19	1153.57	3.85	1154.91	0.001473	9.29	127.18	33.04	0.83	127.18
1	9000	PF 1	1182.00	1148.89	1153.26	3.84	1154.61	0.001483	9.32	126.88	33.02	0.84	126.88
1	8885	PF 1	1182.00	1148.72	1152.62	3.47	1154.37	0.002183	10.61	111.39	32.15	1.00	111.39
1	8849	PF 1	1182.00	1145.72	1150.01	3.62	1151.27	0.001649	9.01	131.16	36.21	0.83	131.16
1	8700	PF 1	1182.00	1145.50	1149.76	3.60	1151.04	0.001466	9.08	130.24	36.14	0.84	130.24
1	8600	PF 1	1182.00	1145.35	1149.61	3.61	1150.89	0.001462	9.07	130.38	36.15	0.84	130.38
1	8400	PF 1	1182.00	1145.05	1149.33	3.62	1150.59	0.001446	9.03	130.87	36.19	0.84	130.87
1	8200	PF 1	1182.00	1144.70	1149.12	3.72	1150.29	0.001290	8.69	136.07	36.56	0.79	136.07
1	8100	PF 1	1182.00	1144.60	1148.92	3.65	1150.16	0.001398	8.93	132.38	36.30	0.82	132.38
1	8000	PF 1	1182.00	1144.45	1148.78	3.66	1150.01	0.001381	8.89	132.93	36.34	0.82	132.93
1	7800	PF 1	1182.00	1144.15	1148.54	3.70	1149.73	0.001322	8.76	134.93	36.48	0.80	134.93
1	7600	PF 1	1182.00	1143.85	1148.28	3.73	1149.45	0.001473	8.67	136.32	36.58	0.79	136.32
1	7500	PF 1	1182.00	1143.70	1148.15	3.74	1149.30	0.001265	8.63	137.00	36.63	0.79	137.00
1	7300	PF 1	1182.00	1143.40	1147.97	3.81	1149.04	0.001136	8.29	142.58	37.43	0.75	142.58
1	7100	PF 1	1182.00	1143.10	1147.80	3.91	1148.80	0.001028	8.01	147.61	37.79	0.71	147.61
1	7000	PF 1	1182.00	1142.95	1147.73	3.96	1148.69	0.000971	7.85	150.51	38.00	0.70	150.51
1	6900	PF 1	1182.00	1142.80	1147.66	4.02	1148.58	0.000914	7.69	153.66	38.22	0.68	153.66
1	6800	PF 1	1182.00	1142.65	1147.60	4.08	1148.48	0.000858	7.52	157.08	38.46	0.66	157.08
1	6790	PF 1	1182.00	1142.62	1147.89	3.77	1148.35	0.000460	5.41	218.40	57.88	0.49	218.40
1	6750	PF 1	1182.00	1142.49	1148.13	4.43	1148.23	0.000092	2.54	465.73	105.13	0.21	465.73
1	6700	PF 1	1182.00	1142.41	1148.08	4.55	1148.22	0.000509	3.02	390.87	85.99	0.25	390.87
1	6600	PF 1	1182.00	1141.88	1147.51	3.40	1148.07	0.003004	6.03	195.97	57.63	0.58	195.97
1	6400	PF 1	1182.00	1141.08	1146.18	2.81	1147.23	0.005532	8.23	144.16	51.32	0.82	143.56
1	6200	PF 1	1182.00	1140.00	1146.01	4.18	1146.44	0.001874	5.36	227.97	54.53	0.43	216.22
1	6172	PF 1	1182.00	1139.65	1144.39	3.35	1146.18	0.007723	10.77	111.18	33.19	0.99	109.27
1	5974	PF 1	1182.00	1136.68	1141.34	3.06	1142.87	0.008324	9.94	118.96	38.85	1.00	118.96
1	5900	PF 1	1182.00	1136.70	1140.62	2.90	1142.16	0.002867	10.05	122.33	42.14	0.95	114.75
1	5775	PF 1	1182.00	1136.30	1140.80	3.33	1141.52	0.002948	6.84	177.51	53.23	0.62	170.05
1	5572	PF 1	1182.00	1133.48	1138.91	3.68	1140.54	0.007104	10.26	115.35	31.30	0.93	115.25
1	5371	PF 1	1182.00	1133.33	1138.05	3.19	1139.13	0.005491	8.33	141.97	44.50	0.82	141.97
1	5173	PF 1	1182.00	1131.95	1136.43	2.56	1137.74	0.008897	9.16	129.03	50.45	1.01	129.03
1	5050	PF 1	1182.00	1131.81	1135.14	2.29	1136.29	0.009325	8.59	137.54	60.02	1.00	137.54
1	4975	PF 1	1182.00	1131.40	1134.14	2.19	1135.24	0.009117	8.44	140.08	64.06	1.01	140.08
1	4774	PF 1	1182.00	1129.35	1133.09	3.04	1133.64	0.002944	5.95	198.60	65.26	0.60	198.60
1	4700	PF 1	1182.00	1128.98	1132.08	2.22	1133.19	0.012707	8.46	139.75	62.92	1.00	139.75
1	4574	PF 1	1182.00	1126.43	1130.01	2.43	1131.25	0.008915	8.93	132.29	54.40	1.01	132.29

HY-8 Analysis Results

Culvert Summary Table - Sta 110+00

Culvert Crossing: APS-Sta 110+00

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
40.00	40.00	1161.84	2.66	2.84	7-M2c	2.00	1.60	1.60	0.56	7.40	1.79
60.00	57.37	1164.01	4.02	5.01	7-M2c	2.00	1.84	1.84	0.72	9.48	2.10
80.00	57.72	1164.06	4.05	5.06	7-M2c	2.00	1.84	1.84	0.85	9.53	2.35
100.00	57.94	1164.09	4.07	5.09	7-M2c	2.00	1.85	1.85	0.98	9.56	2.56
120.00	58.17	1164.12	4.09	5.12	7-M2c	2.00	1.85	1.85	1.09	9.59	2.75
140.00	58.34	1164.14	4.11	5.14	7-M2c	2.00	1.85	1.85	1.20	9.62	2.92
160.00	58.50	1164.17	4.12	5.17	7-M2c	2.00	1.85	1.85	1.30	9.64	3.07
180.00	58.64	1164.19	4.14	5.19	7-M2c	2.00	1.85	1.85	1.40	9.66	3.21
200.00	58.79	1164.21	4.15	5.21	7-M2c	2.00	1.85	1.85	1.49	9.68	3.35
220.00	58.92	1164.23	4.17	5.23	7-M2c	2.00	1.85	1.85	1.59	9.70	3.47
240.00	59.04	1164.24	4.18	5.24	7-M2c	2.00	1.85	1.85	1.67	9.72	3.59

HY-8 Analysis Results

Culvert Summary Table - Sta 123+50

Culvert Crossing: APS-Sta 123+50

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
40.00	40.00	1163.18	2.66~	2.64	7-M2c	1.81	1.60	1.60	0.56	7.40	1.79
60.00	58.79	1166.01	4.15	5.49	7-M2c	2.00	1.85	1.85	0.72	9.68	2.10
80.00	59.11	1166.06	4.18	5.54	7-M2c	2.00	1.85	1.85	0.85	9.73	2.35
100.00	59.29	1166.09	4.20	5.57	7-M2c	2.00	1.85	1.85	0.98	9.75	2.56
120.00	59.47	1166.12	4.22	5.60	7-M2c	2.00	1.86	1.86	1.09	9.78	2.75
140.00	59.61	1166.14	4.23	5.62	7-M2c	2.00	1.86	1.86	1.20	9.80	2.92
160.00	59.73	1166.17	4.24	5.65	7-M2c	2.00	1.86	1.86	1.30	9.82	3.07
180.00	59.87	1166.19	4.26	5.67	7-M2c	2.00	1.86	1.86	1.40	9.83	3.21
200.00	59.98	1166.21	4.27	5.69	7-M2c	2.00	1.86	1.86	1.49	9.84	3.35
220.00	60.08	1166.23	4.28	5.71	7-M2c	2.00	1.86	1.86	1.59	9.85	3.47
240.00	60.19	1166.24	4.29	5.72	7-M2c	2.00	1.86	1.86	1.67	9.87	3.59

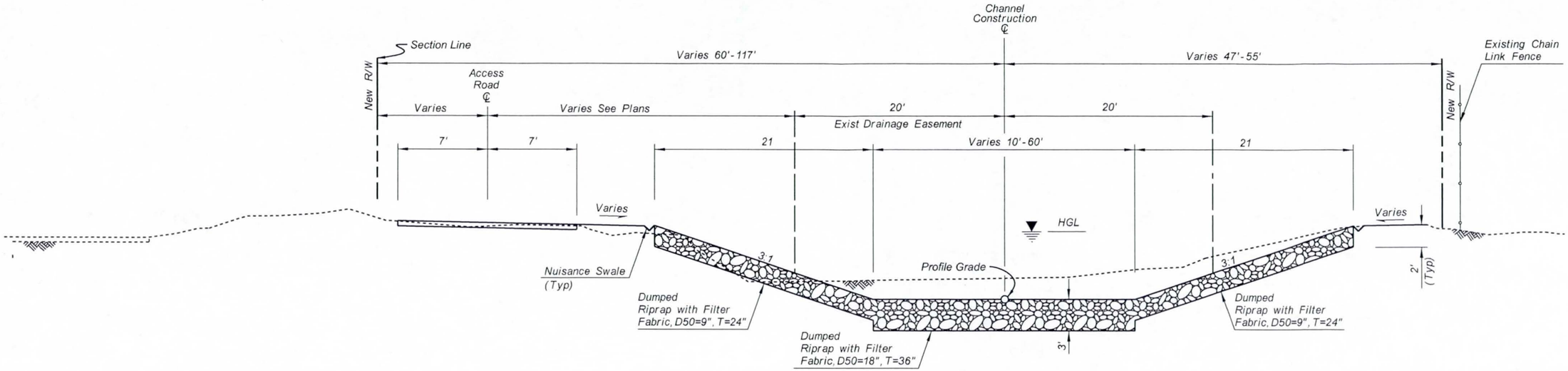
Max. Value used in Calcs

HY-8 Analysis Results

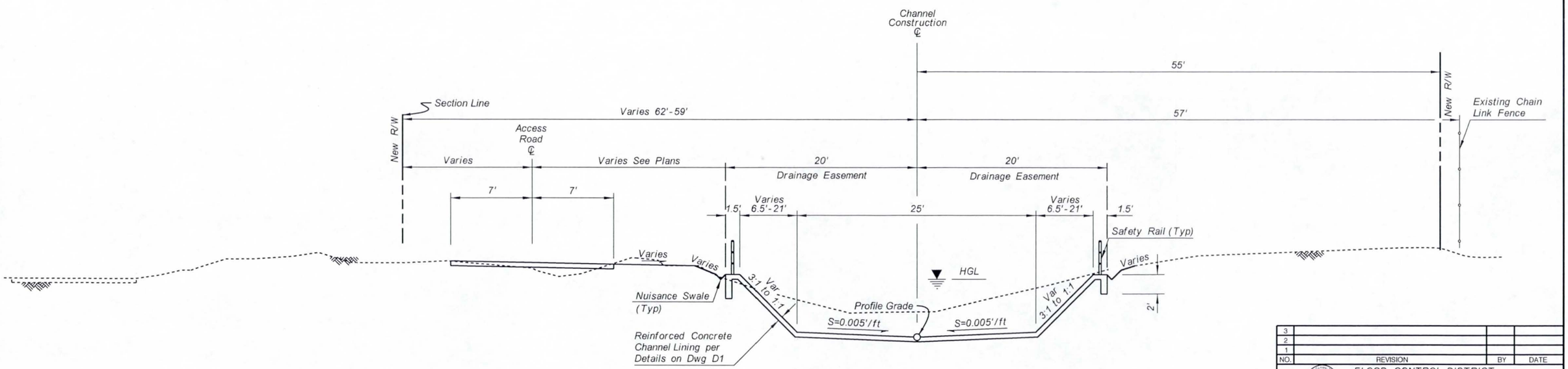
Culvert Summary Table - Sta 137+00

Culvert Crossing: APS-Sta 137+00

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
40.00	40.00	1169.19	2.66~	2.64	7-M2c	1.80	1.60	1.60	0.56	7.40	1.79
60.00	52.89	1171.03	3.61	4.50	7-M2c	2.00	1.80	1.80	0.72	8.89	2.10
80.00	53.16	1171.07	3.64	4.54	7-M2c	2.00	1.80	1.80	0.85	8.93	2.35
100.00	53.35	1171.10	3.65	4.57	7-M2c	2.00	1.80	1.80	0.98	8.95	2.56
120.00	53.53	1171.13	3.67	4.60	7-M2c	2.00	1.80	1.80	1.09	8.98	2.75
140.00	53.68	1171.15	3.68	4.62	7-M2c	2.00	1.80	1.80	1.20	8.99	2.92
160.00	53.82	1171.17	3.69	4.64	7-M2c	2.00	1.81	1.81	1.30	9.01	3.07
180.00	53.93	1171.19	3.70	4.66	7-M2c	2.00	1.81	1.81	1.40	9.03	3.21
200.00	54.06	1171.21	3.72	4.68	7-M2c	2.00	1.81	1.81	1.49	9.04	3.35
220.00	54.18	1171.23	3.73	4.70	7-M2c	2.00	1.81	1.81	1.59	9.06	3.47
240.00	54.29	1171.25	3.74	4.72	7-M2c	2.00	1.81	1.81	1.67	9.07	3.59



TYPICAL SECTION
Sta 66+00.00 to Sta 67+90.00
(ALONG 115TH AVE)
NTS



TYPICAL SECTION
Sta 67+90.00 to Sta 68+00.00
(ALONG 115TH AVE)
NTS

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2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

115th AVE & UNION HILLS DR DRAINAGE IMPROVEMENTS
PCN 450.07.31
FCD CONTRACT NO. 2015C004

Registered Professional Engineer (Civil) CERTIFICATE NO. 27556 RAJU C. SHAH Date Signed ARIZONA U.S.A. EXPIRES 12/31/2017

	BY	DATE
DESIGNED	P. Wolf	04/15/15
DRAWN	J. Metrailer	04/15/15
CHECKED	R. Shah	04/15/15

RPA RITOCH-POWELL & Associates 602.263.1177 www.ritochpowell.com

DRAWING NO. G11

TYPICAL SECTION

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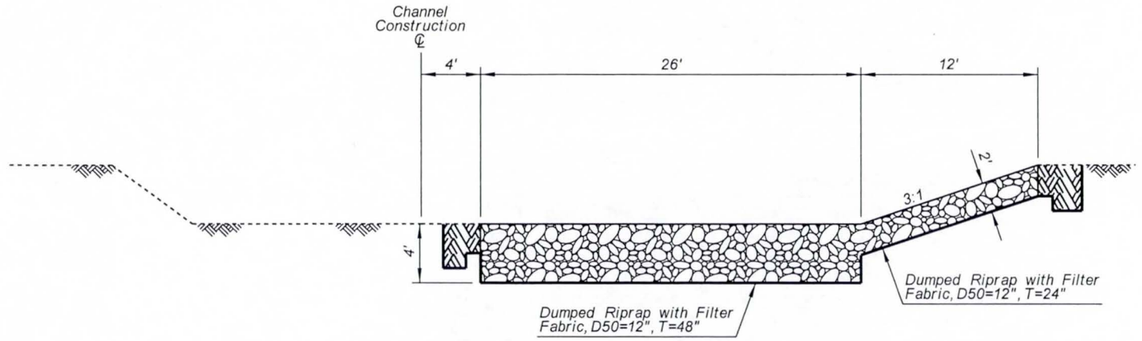
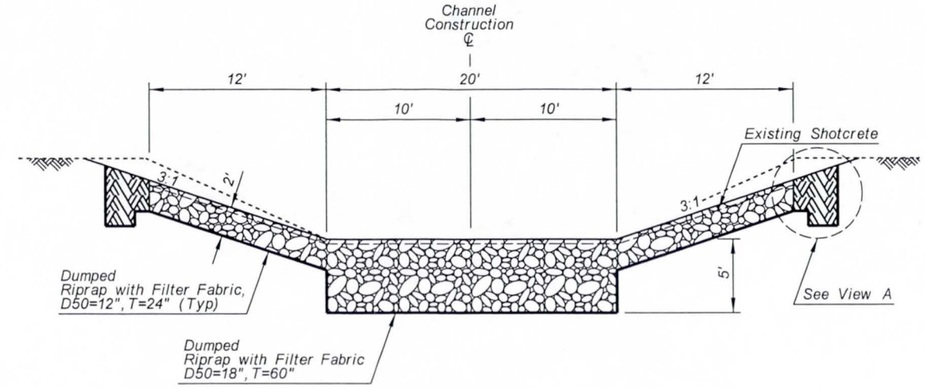


Riprap Section
Sta 46+75 to Sta 47+25



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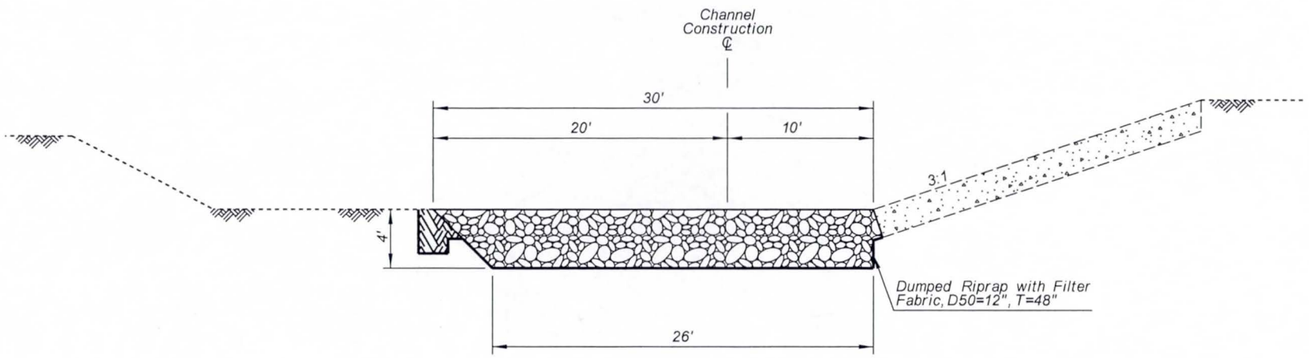
Sta 61+40 to Sta 61+90



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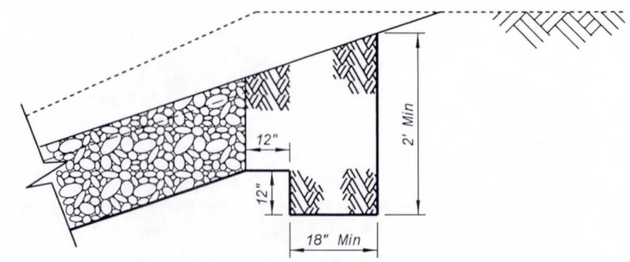
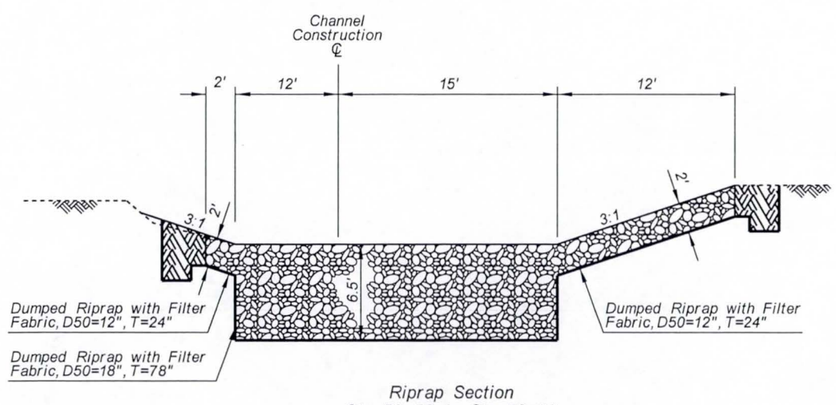


View A



Riprap Section
Sta 58+50 to Sta 59+58

RIPRAP GRADATION TABLE	
D50 6-inches	
Stone Size Range (ft.)	% Gradation Smaller Than
9-in to 10-in	100
7-in to 8-in	85
6-in to 7-in	50
2-in to 4-in	15

RIPRAP GRADATION TABLE	
D50 9-inches	
Stone Size Range (ft.)	% Gradation Smaller Than
14-in to 16-in	100
11-in to 13-in	85
9-in to 11-in	50
4-in to 6-in	15

RIPRAP GRADATION TABLE	
D50 12-inches	
Stone Size Range (ft.)	% Gradation Smaller Than
18-in to 20-in	100
14-in to 17-in	85
12-in to 14-in	50
5-in to 7-in	15

RIPRAP GRADATION TABLE	
D50 18-inches	
Stone Size Range (ft.)	% Gradation Smaller Than
27-in to 31-in	100
22-in to 25-in	85
18-in to 21-in	50
7-in to 11-in	15

DETAIL 14

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

115th AVE & UNION HILLS DR DRAINAGE IMPROVEMENTS
PCN 450.07.31
FCD CONTRACT NO. 2015C004

	BY	DATE
DESIGNED	P. Wolf	03/17/15
DRAWN	J. Metrailer	03/17/15
CHECKED	R. Shah	03/17/15

Registered Professional Engineer (Civil) CERTIFICATE NO. 27556 RAJU C. SHAH Date Signed ARIZONA, U.S.A.
EXPIRES 12/31/2017

RPA RITOCH-POWELL & Associates 602.263.1177 www.ritochpowell.com

DRAWING NO. D15

RIPRAP DETAILS

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Rip-Rap sizing for triple 48-inch culvert outlet for Peoria Storage Basin

Channel Bed on Straight Reach The loose riprap *D50* for a straight reach or mildly curved channel:

$$D_{50} = 0.0191 V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where:

D_{50} = is the median diameter (ft)
V_a = average velocity (ft/s) = 8.04 ft/s

γ_s = specific weight of stone (lb/ft^3) = 156 lb/ft^3

γ_w = specific weight of water (lb/ft^3) = 62.4 lb/ft^3

$$D_{50} = 0.0191\ (8.04)^2 \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 0.82\ ft}$$ **-> Use 1.0 ft**

(18-inches was used)

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 4 = 28ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 3 ft

18-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
27-in to 31-in	*100*
22-in to 25-in	*85*
18-in to 21-in	*50*
7-in to 11-in	*15*

Rip-Rap sizing for triple 42-inch culvert outlet for Paradise RV Storage Basin

Channel Bed on Straight Reach The loose riprap $D50$ for a straight reach or mildly curved channel:

$$D_{50} = 0.0191 V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where:

D_{50} = is the median diameter (ft)
V_a = average velocity (ft/s) = 7.0 ft/s

γ_s = specific weight of stone (lb/ft^3) = 156 lb/ft^3

γ_w = specific weight of water (lb/ft^3) = 62.4 lb/ft^3

$$D_{50} = 0.0191\ (7.0)^2 \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 0.62\ ft}$$ **-> Use 1.0 ft**

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 3.5 = 24.5\ ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 2 ft

12-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
18-in to 20-in	*100*
14-in to 17-in	*85*
12-in to 14-in	*50*
5-in to 7-in	*15*

Rip-Rap sizing for double 48-inch culvert outlet for Paradise RV Storage Basin

Channel Bed on Straight Reach The loose riprap *D50* for a straight reach or mildly curved channel:

$$D_{50} = 0.0191 V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where:

D_{50} = is the median diameter (ft)
V_a = average velocity (ft/s) = 8.66 ft/s

γ_s = specific weight of stone (lb/ft^3) = 156 lb/ft^3

γ_w = specific weight of water (lb/ft^3) = 62.4 lb/ft^3

$$D_{50} = 0.0191\ (8.66)^2 \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 0.95\ ft}$$ **-> Use 1.0 ft**

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 4 = 28ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 2 ft

12-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
18-in to 20-in	*100*
14-in to 17-in	*85*
12-in to 14-in	*50*
5-in to 7-in	*15*

Rip-Rap sizing for 48-inch storm drain outlet at 111th Avenue and Union Hills Drive

$$D_{50} = 0.0191 V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where:

D_{50} = is the median diameter (ft)

V_a = average velocity (ft/s) = 12.89 ft/s (StormCAD output)

γ_s = specific weight of stone (lb/ft^3) = 156 lb/ft^3

γ_w = specific weight of water (lb/ft^3) = 62.4 lb/ft^3

$$D_{50} = 0.0191\ (12.89)^2 \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 2.11\ ft}$$ **-> Use 2.0 ft**

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 4 = 28ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 4 ft

24-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
36-in to 41-in	*100*
29-in to 34-in	*85*
24-in to 28-in	*50*
10-in to 14-in	*15*

Rip-Rap sizing for north 36-inch storm drain outlet at 111th Avenue (Sta. 52+11)

$$D_{50} = 0.0191 V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where:

D_{50} = is the median diameter (ft)

V_a = average velocity (ft/s) = 9.53 ft/s (StormCAD results)

γ_s = specific weight of stone (lb/ft^3) = 156 lb/ft^3

γ_w = specific weight of water (lb/ft^3) = 62.4 lb/ft^3

$$D_{50} = 0.0191\ (9.53)^2 \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 1.16\ ft}$$ **-> Use 1.0 ft**

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 3 = 21\ ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 3 ft

12-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
18-in to 20-in	*100*
14-in to 17-in	*85*
12-in to 14-in	*50*
5-in to 7-in	*15*

Rip-Rap sizing for 30-inch storm drain outlet at 111th Ave and Union Hills Drive

$$D_{50} = 0.0191 V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where:

D_{50} = is the median diameter (ft)

V_a = average velocity (ft/s) = 7.63 ft/s (StormCAD results)

γ_s = specific weight of stone (lb/ft^3) = 156 lb/ft^3

γ_w = specific weight of water (lb/ft^3) = 62.4 lb/ft^3

$$D_{50} = 0.0191\ (7.63)^2 \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 0.74\ ft}$$ **-> Use 1.0 ft**

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 2.5 = 17.5\ ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 3 ft

12-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
18-in to 20-in	*100*
14-in to 17-in	*85*
12-in to 14-in	*50*
5-in to 7-in	*15*

Rip-Rap sizing for 36-inch storm drain outlet at 111th Avenue (Sta. 50+86)

$$D_{50} = 0.0191 V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where:

D_{50} = is the median diameter (ft)

V_a = average velocity (ft/s) = 9.53 ft/s (StormCAD results)

γ_s = specific weight of stone (lb/ft^3) = 156 lb/ft^3

γ_w = specific weight of water (lb/ft^3) = 62.4 lb/ft^3

$$D_{50} = 0.0191\,(9.53)^2 \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 1.16\,ft}$$ **-> Use 1.0 ft**

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 3 = 21\ ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 3 ft

12-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
18-in to 20-in	*100*
14-in to 17-in	*85*
12-in to 14-in	*50*
5-in to 7-in	*15*

Rip-Rap sizing for 24-inch storm drain outlet at 111th Ave and Union Hills Dr

$$D_{50} = 0.0191 V_a^2 \left(\frac{\gamma_w}{\gamma_s - \gamma_w}\right)$$

where:

D_{50} = is the median diameter (ft)

V_a = average velocity (ft/s) = 9.84 ft/s (StormCAD results)

γ_s = specific weight of stone (lb/ft^3) = 156 lb/ft^3

γ_w = specific weight of water (lb/ft^3) = 62.4 lb/ft^3

$$D_{50} = 0.0191\ (9.84)^2 \left(\frac{62.4}{156 - 62.4}\right)$$

$$\boldsymbol{D_{50} = 1.16\ ft}$$ **-> Use 1.5 ft**

$$\boldsymbol{Apron\ Length\ (Lp) \rightarrow\ 7D = 7\ x\ 2 = 14\ ft}$$

Apron Thickness (ft) -> 2.0 x d_{50} = 3 ft

18-inch Riprap Gradation Table

Stone Size Range (ft.)	*% Gradation Smaller Than*
27-in to 31-in	*100*
22-in to 25-in	*85*
18-in to 21-in	*50*
7-in to 11-in	*15*

ID	Type	Section ID	Design Q (cfs)	Slope (ft/ft)	Width (ft)	Average Velocity (ft/s)	Specific Weight Stone (lb/cu ft)	Specific Weight Water (lb/cu ft)	Bank Angle (degrees)	Safety Factor	D50 (ft)
320+00	Sloped Drop Structure/Rock Chute		2	0.25	14.00	-	150.00	62.43	-	1.50	0.16

D50 = 6-inches was used, thickness of 2 x D50 = 1 foot .
The Q was assumed as 2 cfs because upstream catch basins.

Apron = The Lp from the calculation was negative due to the width of the spillway. Lp of 5 x H = 2.5ft (H=0.5 ft)
Spillway was rounded up to 3-ft

Worksheet for Spillway 320+00

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.25000	ft/ft
Bottom Width	14.00	ft
Discharge	2.00	ft^3/s

Results

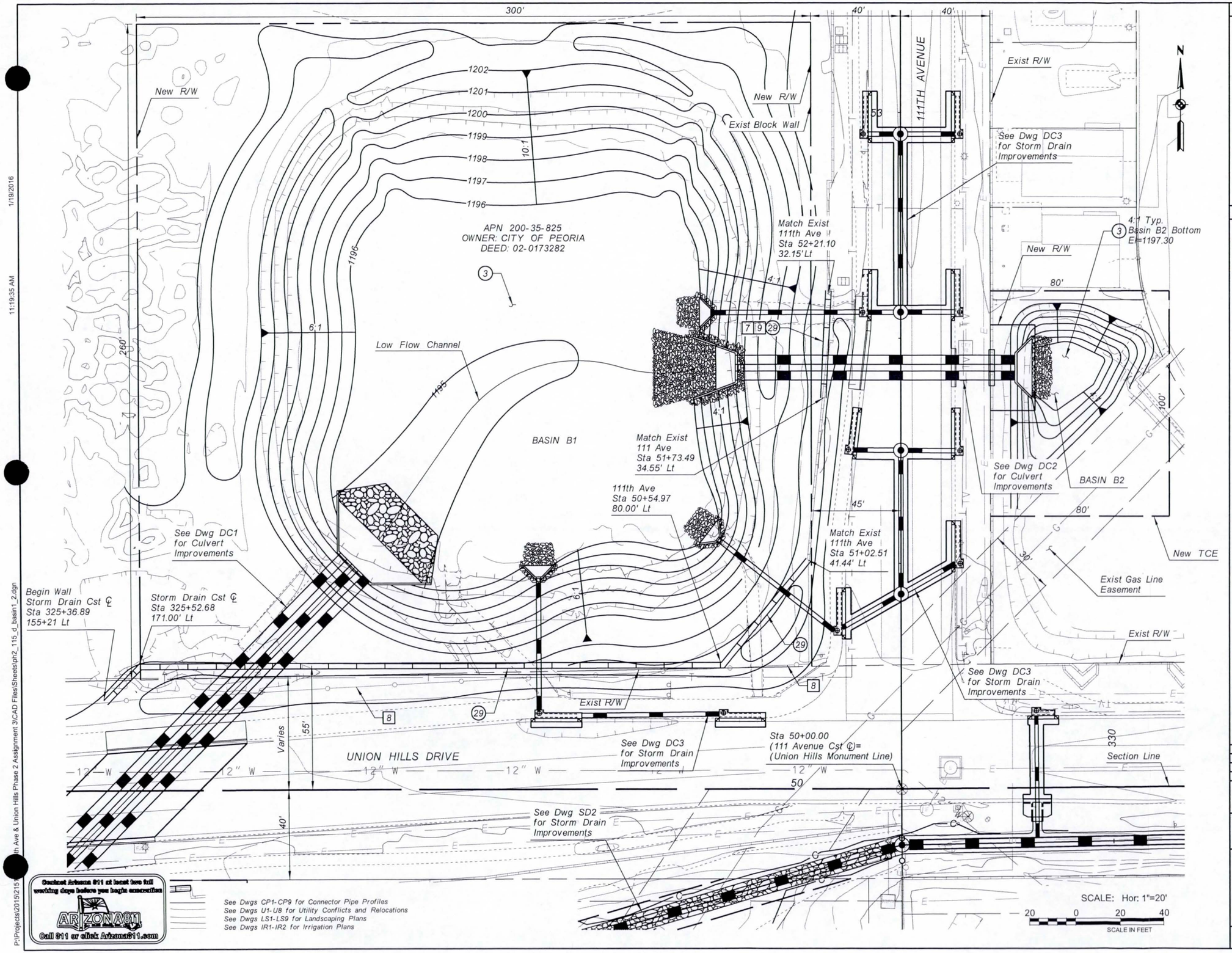
Normal Depth	0.03	ft
Flow Area	0.38	ft^2
Wetted Perimeter	14.05	ft
Hydraulic Radius	0.03	ft
Top Width	14.00	ft
Critical Depth	0.09	ft
Critical Slope	0.00567	ft/ft
Velocity	5.20	ft/s
Velocity Head	0.42	ft
Specific Energy	0.45	ft
Froude Number	5.53	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.03	ft
Critical Depth	0.09	ft
Channel Slope	0.25000	ft/ft
Critical Slope	0.00567	ft/ft



REMOVE		
7	Remove Existing Block Wall	48 LF
8	Remove Existing Chainlink Fence	361 LF
9	Remove Existing Gate	1 EA

CONSTRUCT		
3	Basin Grading Per Dwg LS5 & LS6	4,800 CY
29	CMU Block Wall per Details on Dwgs D5 and LS9	391 LF

Existing Utilities are shown at approximate depth based on available as built & record drawing data from each utility provider. Final location TBD from utility potholing.

CAUTION:
Overhead High Voltage Electrical Lines Present (Multiple Utility Corridor). Maintain Min. OSHA Clearances During Construction.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

115th AVE & UNION HILLS DR DRAINAGE IMPROVEMENTS
PCN 450.07.31
FCD CONTRACT NO. 2016C001

100%
PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	P. Wolf	1/19/16
DRAWN	S. Johannsen	1/19/16
CHECKED	R. Shah	1/19/16

RPA RITOCH-POWELL & Associates 602.263.1177 www.ritochpowell.com

DRAWING NO. B1

DETENTION BASIN SHEET
BASIN B1 & BASIN B2

SHEET 29 OF 68

1/19/2016 11:19:35 AM
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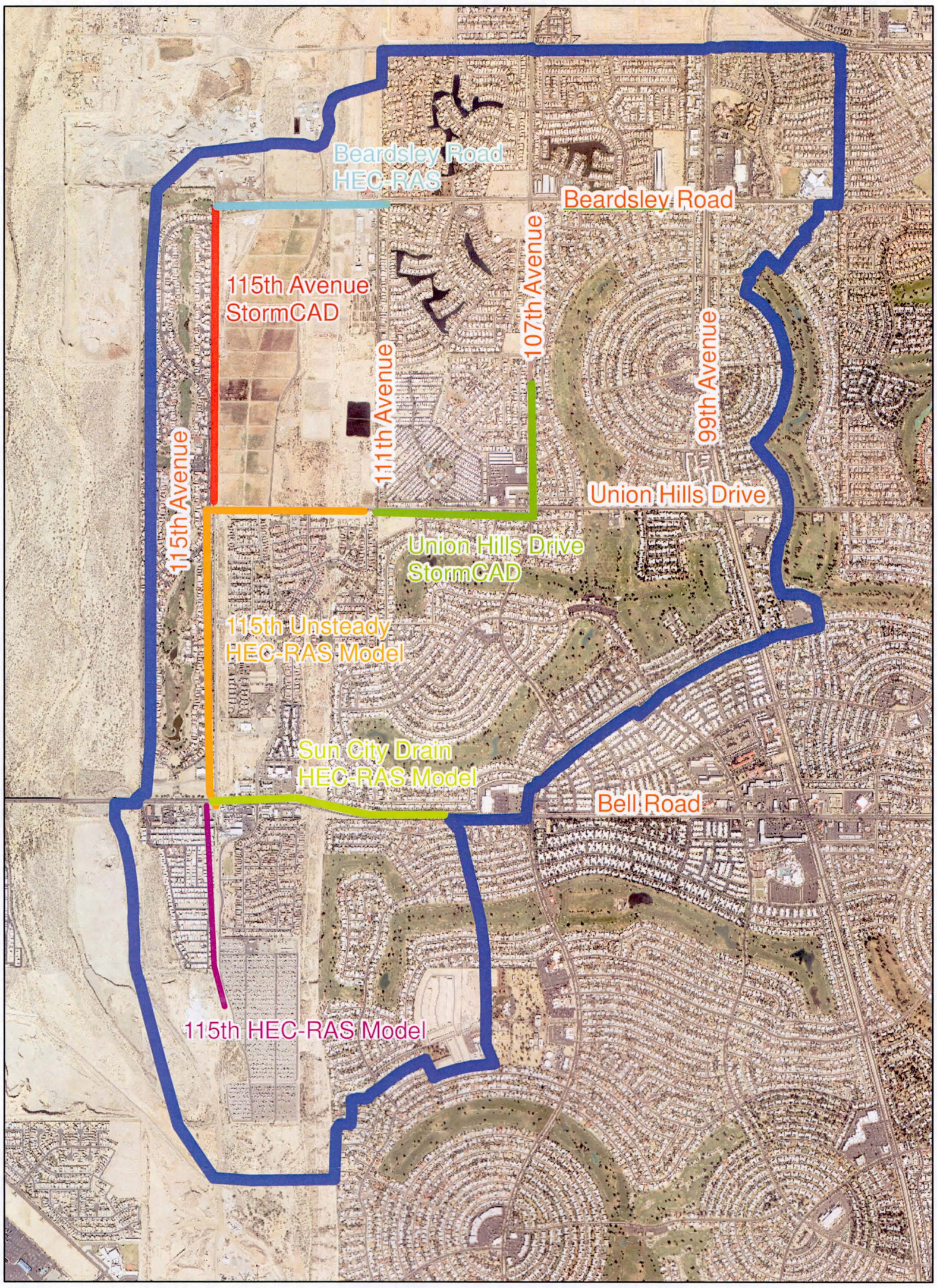
Label	Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Flow (Link) (ft^3/s)	Capacity (Full Flow) (ft^3/s)	Velocity (ft/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Slope (ft/ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
P 50+86R	CB 50+86R	MH 50+86	28	24	15	48.93	13.69	1,199.41	1,198.10	0.047	1,204.41	1,204.60	1,200.92	1,200.98
P 51+50L	CB 51+50L	MH 51+50	21	24	15	46.31	13.16	1,200.67	1,199.79	0.042	1,204.67	1,204.74	1,202.07	1,202.11
P 51+50R	CB 51+50R	MH 51+50	24	24	15	38.63	11.52	1,200.49	1,199.79	0.029	1,204.49	1,204.74	1,202.08	1,202.11
P 111th S	MH 51+50	MH 50+86	64	24	30	36.76	9.55	1,199.79	1,198.10	0.026	1,204.74	1,204.60	1,202.11	1,200.98
P 50+86L	MH 50+86	CB 50+86L	30	24	45	47.27	14.32	1,198.10	1,196.79	0.044	1,204.60	1,204.29	1,200.98	1,199.80
P 50+86S outlet	CB 50+86L	OF 50+86	69	36	60	43.24	9.53	1,196.79	1,196.50	0.004	1,204.29	1,200.50	1,199.80	1,199.00
P 52+11R	CB 52+11R	MH 52+11	24	24	15	60.21	15.91	1,199.58	1,197.88	0.071	1,204.58	1,204.87	1,200.98	1,200.36
P 52+90L	CB 52+90L	MH 52+90	14	24	15	58.62	15.61	1,200.97	1,200.03	0.067	1,204.97	1,205.03	1,202.37	1,201.89
P 52+90R	CB 52+90R	MH 52+90	24	24	15	39.18	11.64	1,200.75	1,200.03	0.03	1,204.75	1,205.03	1,202.15	1,201.89
P 111th N	MH 52+90	MH 52+11	79	24	30	37.32	13.21	1,200.03	1,197.88	0.027	1,205.03	1,204.87	1,201.89	1,200.36
P 52+11L	MH 52+11	CB 52+11L	15	24	45	58.7	14.32	1,197.88	1,196.87	0.067	1,204.87	1,204.87	1,200.36	1,199.77
P 52+11N outlet	CB 52+11L	OF 52+11	70	36	60	48.49	9.53	1,196.87	1,196.50	0.005	1,204.87	1,200.50	1,199.77	1,199.00
P Union Hills/111th	CB 328+44	CB 327+66	80	24	15	33.84	10.45	1,198.60	1,196.81	0.022	1,203.60	1,203.31	1,200.00	1,199.52
P Union Hills/111th outlet	CB 327+66	OF Union Hills	61	24	30	16.13	9.84	1,196.81	1,196.50	0.005	1,203.31	1,200.50	1,199.52	1,198.36

APPENDIX D.11

Figure 3 – Hydraulic Models

Figure 3
Hydraulic Models



115th Avenue and Union Hills Drive
Hydraulic Model Exhibit

N

APPENDIX E – Utility Conflicts and Pothole Information (CD)

APPENDIX F – Final Design Plans - Digital (CD)

APPENDIX G – CD Containing Digital Data

APPENDIX H – Survey Report –Digital (CD)

APPENDIX I – Structural Design Report - Digital (CD)