HYDRAULIC REPORT

Interstate 55 (Stevenson Expressway) over Wards Creek

August 2016

ROUTE:	FAI 55 / Interstate 55 (Stevenson Expressway)
COUNTY:	DuPage
SECTION:	
STRUCTURE NUMBER:	022-0516
PROJECT LIMITS:	over Wards Creek
JOB NO.:	P-91-762-10

Prepared for:

Illinois Department of Transportation

Illinois Department of Transportation
Division of Highways – District 1
Bureau of Programming
Hydraulics Section

Prepared by:
Stantec Consulting Services, Inc.
135 S. LaSalle Street
Suite 3100
Chicago Illinois 60603
(312) 262-2300

Illinois Department of Transportation

HYDRAULIC REPORT OUTLINE (HRO)

In order to facilitate a more efficient and timely approval of Hydraulic Reports, a "Hydraulic Report Outline" shall be prepared and submitted with each hydraulic project. This Outline shall be submitted to the District Hydraulic Engineer along with the Hydraulic Report to aid in review of the report.

If any deviations from the procedural steps below are necessary, they must be documented in the outline. Hydraulic Reports prepared by a Qualified District Hydraulic Engineer or under his supervision, are exempt from the HRO requirement. To facilitate Pump Station Hydraulic Report reviews, the Checklist and Data Sheets from the IDOT Drainage Manual, 13-303 and 13-304, will be used. The Data Sheets must be signed by the consultant's QA/QC person or the District Hydraulic Engineer.

1. SN 22-0516 (Existing); SN - (Proposed)
   Route/Stream: Wards Creek
   County: DuPage

2. Prepared By: ☒ Consultant: Stantec Consulting Services
   ☐ District _____

3. Chapter 2 of the IDOT Drainage ☒ Yes ☐ No
   If no, explain _____
   Completed checklist (2-701.02) must be attached.

4. Design Considerations:
   a. Backwater limitations due to:
      IDNR Individual or Floodway Permit ☐ Yes ☐ No
      Sensitive Flood Receptor(s) ☐ Yes ☒ No
   b. Does proposed average design velocity through the structure exceed natural channel velocities? ☒ Yes ☐ No
   c. Is the clearance policy met? ☐ Yes ☐ No ☒ N/A
   d. Is the freeboard policy met? ☐ Yes ☒ No

5. Project scope (check all that apply):
   a. ☐ Complete replacement.
   b. ☐ Superstructure replacement.
   c. ☐ Superstructure replacement and/or widening; Length of pier extension in the water, upstream _____ ft., downstream _____ ft.
   d. ☐ Bridge ☐ Culvert
   e. ☐ New alignment
   f. Work planned below Q100 HWE: ☐ Yes ☐ No

6. Hydrology: ☐ USGS ☒ FIS ☐ Other _____
   Gage data utilized? ☐ Yes ☒ No

7. WIT: Attached copy of all completed WIT(s) ☒ Yes ☐ No Independent Analysis

8. Modeling:
   a. ☒ HEC RAS ☐ WSPRO ☐ Other _____
   b. N-values estimated according to Chapter 5 of Drainage Manual? ☒ Yes ☐ No
   c. Source of starting WSE FEMA FIS Regulatory Model elevations at downstream section.
   d. Non-IDOT encroachments in survey? ☒ Yes ☐ No
      If yes, are they accounted for? ☒ Yes ☐ No
   e. Tail water controls(s)? ☐ Yes ☒ No
      If yes, list: _____
      Properly addressed? ☐ Yes ☐ No
   f. Expansion/Contraction cones addressed per Chapter 7 of Drainage Manual? ☒ Yes ☐ No
      If N/A, explain: _____

9. IDNR-OWR Permit: Drainage Area 3.15 sq. ☐ Rural; ☒ Urbanizing;
   Public Water or within Public Water boundaries ☐ Yes ☒ No
   Indicate Permit Type Required:
   a. Individual ☐
   b. Statewide #2 ☐
   c. Statewide #12 ☐
   d. Floodway ☐
   e. Other: _____
   f. None: ☒

10. Sensitive flood receptors ☐ Yes ☒ No
    Give type, elevations and locations: Potential receptors are determined to be outside the limits of the floodplain
    History of flooding or overtopping problems: Yes ☒ No ☐
    Sources of observed highwater: City of Darien - overtopping of N. Frontage Road

11. Scour/migration problems: ☐ None/minimal ☒ Significant ☐ Severe
    Comments: Degredation behind the northwest wingwall of the culvert.
    Ice/Debris concerns: ☒ None/minimal ☐ Significant ☐ Severe ☐
    Comments: _____
    Countermeasures proposed: _____

12. Deviations from the general procedures presented above and in Chapters 6 and 7 of the Drainage Manual: Approach section is not fully effective due to upstream crossings.
    (Attach supporting documents if necessary)

Prepared by: Dustin Book Date: 2/25/2015

Signed: (AQ/QC) _____ Date: 3/9/16

HYDRAULIC REPORT
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JOB NO. P-91-762-10

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Exhibit B	Photographs of the Structure and Surrounding Area
Exhibit C	Flood Insurance Study (FIS) Information • Des Plaines River Flood Plain Information and WSP2 models, 1975. • Flood Insurance Study for DuPage County and Incorporated Areas, 2004. • FIS-Base Hydraulic Model and Results (HEC-RAS Plan 01)
Exhibit D	Streambed Profile Based on Christopher B. Burke Engineering Survey Data
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Narrative

Project Description

The Illinois Department of Transportation (IDOT) is currently preparing a Preliminary Engineering and Environmental Study (Phase 1) for the I-55 Managed Lanes Project. The project study area includes the Interstate 55 corridor (Stevenson Expressway) and extends from I-355 at the southern limit and to I-90/94 at the north.

The proposed improvement involves converting the existing paved median to provide one additional travel lane in each direction. The new lane will be implemented as a "Managed Lane" along the expressway. The term 'Managed Lane' includes the implementation of traffic calming concepts within the travel lanes such as High Occupancy Vehicle (HOV), High Occupancy Toll (HOT), or Congestion Pricing to improve the overall flow of traffic. This project has been identified in the Chicago Metropolitan Area for Planning (CMAP) Go To 2040 Plan as a priority project.

This report requested by the Illinois Department of Transportation is to evaluate the existing culvert structure carrying Intestate 55 (Stevenson Expressway) over Wards Creek located in the City of Darien, DuPage County, Illinois, and determine whether or not the structure meets IDOT requirements for design freeboard and clearance. The subject box culvert is situated between Lemont Road and Cass Avenue with the culvert found approximately 0.90-miles west of the Cass Avenue centerline. The total drainage area to the culvert is approximately 3.15 square miles. Refer to Exhibit A for the project location shown on the USGS Hydrologic Atlas.

Description of Existing Conditions

Site Description

Wards Creek in this area flows through a well-defined channel in a southeasterly direction towards its confluence with the Sawmill Creek Main Stem. The upstream limit of the study is located near the outlet of Swan Lake in the Carriage Green Subdivision, found northwest of the subject crossing. Wards Creek passes through bridge structures located at Kimberly Court, Kentwood Court and Carlisle Court before entering the Carriage Green Golf Course. The creek continues beneath two cart path bridges on the golf course property and is impounded by a berm located along the upstream right-of-way to Interstate 55. The berm is situated perpendicular to the creek and is believed to establish a semi-permanent water feature as part of the golf course. Three (3) small diameter pipe culverts and an overflow spillway provided in the berm maintain the elevation of the water feature and allow Wards Creek to continue south to the subject culvert passing under Interstate 55.

Two of the pipe three culverts include a 24" diameter RCP and 10" diameter RCP and outlet directly into the main channel and is provided at a short distance upstream of the subject crossing. At this location the stream flows towards the opening of the box culvert at a sharp angle. The third pipe culvert, consisting of a 30" diameter CMP, and

the adjacent berm overflow are located east of the main channel. The flows from these outlets are conveyed through a ditch located along the right-of-way, running perpendicular to the opening of the box culvert. The sharp change of direction into the culvert has resulted in the erosion of the embankment located behind the northwest wing wall.

Refer to Exhibit H for a detailed plot showing the plan layout of the berm and detailed elevations of the berm, culverts, and weir overflow.

Downstream of the Interstate, Wards Creek continues to flow to the south and to the east through the Waterfall Glen Forest Preserve toward its confluence with Sawmill Creek located near Cass Avenue.

In general, upstream of Interstate 55, the Wards Creek Watershed is comprised mainly of residential properties and large open areas maintained as a golf course. The watershed downstream of the crossing features largely undeveloped land uses resulting from Forest Preserve property.

Photographs of the structure and surrounding area are included in Exhibit B.

Structure Description

The structure carrying Interstate 55 over Wards Creek was originally constructed as part of the roadway historically known as US Route 66. The original culvert carried the two lane section and shoulders of US Route 66; however no as-built drawings are available to identify the dimensions of the original structure. In 1957, the original structure was extended to the north and south as part of project F.A.I. Route 3, Section 22-2, Project I-103-6 (7) for the construction of the multi-lane expressway currently referred to as Interstate 55.

The existing structure is a cast-in-place reinforced concrete box culvert with cast-in-place reinforced concrete wingwalls. The original culvert carrying US Route 66 was shown to total 72'-4 3/8" from face of headwall to headwall. The overall length of the existing structure, complete with extensions on the north and south totals 288'-7 ½" measured from face of headwall to face of headwall. The as-built opening dimensions are 6'-0" wide x 6'-0" high. The sidewalls are 8" thick for a total box width of 7'-4". The wingwalls are 8" thick, angled between 30 and 50-degrees to the structure.

The culvert carries three (3) 12'-0" travel lanes, a 19-0" inside shoulder, and an 11'-0" outside shoulder in each direction of Interstate 55. In addition, the culvert carries the north and south frontage roads located outside of the expressway. The frontage roads are comprised of a 2-lane section with aggregate shoulders.

A Typical Cross Section of the expressway and frontage roads is included as part of Exhibit E.

Floodplain Description

At the Interstate 55 crossing, Wards Creek drains approximately 3.15 square miles of urbanized area. Wards Creek is approximately 20 to 30-feet in width and consists of a consistent cross section throughout the study limits. There is a mapped FEMA floodplain for Wards Creek extending upstream and downstream of the subject crossing.

Upstream of the Interstate 55 crossing, the floodplain is mapped as Zone A and consists of largely open areas maintained by a golf course and estate-type residential homes. The floodplain is generally comprised of open spaces and is free of obstructions. Trees and heavy vegetation are located adjacent to the stream banks along the upstream portions of the reach. The mapped width varies from 275-feet at the widest point to 35-feet at the narrowest. The floodplain is at its widest immediately upstream of Interstate 55 behind the golf course berm.

The Wards Creek floodplain located immediately downstream of the Interstate is mapped as Zone AE by FEMA with defined base flood elevations extending to the confluence with the main stem of Sawmill Creek. The 2004 FIS indicates the South Frontage Road as the upstream limit of the detailed study and have not determined the base flood elevations upstream of this point. The downstream floodplain is characterized by forested area and estate-type residential homes. The floodplain is generally covered by heavy trees and overgrowth and contains many obstructions.

The Flood Insurance Rate Map Nos. 17043C1001H and 17043C1002H for DuPage County, Illinois and Incorporated Areas, effective December 16, 2004 are included as part of Exhibit C.

Historical Observations / Records

Pavement flooding on Interstate 55 due to flooding at the culvert crossing was reported on one occasion during the 1980's by the Bureau of Maintenance.

The City of Darien officials indicate recurring incidents of flooding upstream of North Frontage Road. No specific dates were provided, however, through conversation it was shared that under heavy rain events, the golf course located upstream of the crossing will flood and overtop the berm located along the upstream right-of-way. On certain occasions, the water level will reach North Frontage Road. No reports from City of Darien officials have indicated flood waters overtopping North Frontage Road.

The Hydrologic Investigations Atlas, HA-149 (Sag Bridge), prepared by the United States Geological Survey in cooperation with the Northeastern Illinois Metropolitan Area Planning Commission does not show historic flooding over Interstate 55 or U.S. 66 Frontage Road on the plan view mapping. The flood profile indicates a record storm level of approximately 698.49 for the September 1961 event at the U.S. Highway 66 North Frontage Road (River mile 4.175). The elevation is below the low beam elevation of the subject culvert (Low Beam=700.12). The hydrologic atlas only covers the extreme storm events from October 1954, July 1957 and September 1961 with only the

September 1961 flood mapped on the flood profile. A portion of the Hydrologic Atlas (HA-149) is included in Exhibit A.

There are no current or functioning stream gages located in the project area. A historic stream gage USGS 05533300 WARDS CREEK NEAR WOODRIDGE, IL is identified with record discharges and gage heights for the water years of 1962 through 1976. The drainage area at the gage is 3.21 square miles. The gage is positioned on the downstream face of the culvert on U.S. Highway 66, 3 miles southwest of Woodridge, 3.5 miles north of Lemont and at River Mile 4.12. The gage datum is 695.30 feet above NGVD29 datum (695.02 feet NAVD88) and the peak gage height of 2.93-feet was recorded on May 12, 1966. The projected peak water surface elevation is therefore 698.23 (695.30 + 2.93) and corresponds with a discharge of 151 cfs. The discharge is found to be approximately less than 10-year frequency discharges as indicated by the FIS discharges. A copy of the gage documents may be found in Exhibit C.

In addition, the following documents were utilized in developing this report:

- *USGS Hydrologic Atlas HA-149, Sag Bridge* Quadrangle, Illinois, 1967.
- Flood Plain Information Maps and Profiles, Des Plaines River, December 1975.
- Flood Insurance Study for DuPage County, Illinois and Unincorporated Areas, Community 170197, December 4, 1985.
- FEMA Letter of Map Revision #97-05-053P, effective October 3, 1997.
- Flood Insurance Study for DuPage County, Illinois and Incorporated Areas, 17043CV000H, effective December 16, 2004.
- Flood Insurance Study for DuPage County, Illinois and Incorporated Areas, 17043CV000A, effective March 2007.
- Location Drainage Study for I-55, prepared by Wight & Company, March 1994.

Sensitive Flood Receptors

No flood receptors were identified within the project limits. A review of the current FEMA FIRM Map panel (17043C1001H and 17043C1002H) show all potential structures to be located out of the floodplain.

Design and Analysis Procedures

Design Requirements

The analysis of the Interstate 55 culvert crossing over Wards Creek was performed in accordance with the IDOT Drainage Manual.

Stream Survey / Datum Correlation

Christopher B. Burke Engineering, Ltd (CBBEL) conducted a stream survey for Interstate 55 over Wards Creek from November 9, 2012 to January 11, 2013. CBBEL completed the stream survey for this project and is based on the North American Vertical Datum of 1988 (NAVD88). Field survey notes and COGO generated output files provided in NAVD88 datum are included in Exhibit O.

The current FEMA FIS model and supporting documentation is presented in National Geodetic Vertical Datum of 1929 (NGVD 29). The surveyed elevations included as part of the hydraulic report, analysis, and supporting exhibits are correlated to the North Geodetic Vertical Datum of 1929 (NGVD 29), unless otherwise noted.

To convert elevations from NGVD 29 to NAVD 88 one must subtract 0.282 feet (NGVD 29 – 0.282 = NAVD 88).

Hydrologic Methodology

The source hydrology and hydraulic model is taken from the current FEMA Flood Insurance Study (FIS) for DuPage County, No. 17403CV000H. A review of the documents identifies the "Des Plaines River Flood Plain Information Maps and Profiles" report, prepared by the Des Plaines River Steering Committees, dated December 1975 as the underlying study used in the preparation of the FIS. The Des Plaines River Study includes the analysis of Wards Creek as a tributary to Sawmill Creek.

The model titled, "SAWMILL CREEK FLOODWAYS WITHOUT PROJECT HC1" as prepared by Harza Engineering Company (WSP2 format), dated 1975, and is cited to be the underlying analysis referenced in the published FIS. The Illinois State Water Survey (ISWS) provided a copy of the original input files from Harza, working WSP2 model (titled SewM1975w.txt) dated 09/01/1982, and map exhibits for use in the study.

The design discharges identified in the 1975 Des Plaines River Study are considered to be the regulatory discharges and are used as part of the analysis. The 1975 WSP2 model provide discharges only for the 10- and 100-year frequencies. The design discharges were plotted on a log-log scale and the discharge values were estimated using straight line interpolation (50-year) and extrapolation (500-year). A copy of the plot is provided as part of the calculations.

The summary of the cited discharges and stages from the 1975 WSP2 regulatory model is contained in Table 1 as follows:

Table 1. Summary of Discharges – 1975 WSP2 Regulatory Model & Interpolated Values

Section		Frequency					
		5-Year	10-Year	25-Year	50-Year*	100-Year	500-Year*
Section SMD03 River Mile 3.173 (5150 ft. downstream of I-55) Drain Area = 5.12 sq. mi.	Discharge (cfs)	352.88	478.84	625.30	775	923.06	1290
	Water Surface Elevation	669.40	669.80	669.90	670.2	670.30	670.7
Section SMD10 River Mile 3.883 (1400 ft. downstream of I-55) Drain Area = 3.52 sq. mi.	Discharge (cfs)	253.71	344.05	449.52	550	661.33	905
Section SMD13 River Mile 4.196 (250 ft. upstream of I-55) Drain Area = 3.15 sq. mi.	Discharge (cfs)	230.07	311.94	407.62	480	599.10	850
Section SMD18 River Mile 4.707 (2950 ft. upstream of I-55) Drain Area = 2.44 sq. mi.	Discharge (cfs)	183.73	249.01	325.50	400	477.30	690

** Designates the values provided for the water surface elevations and discharge value are interpolated / extrapolated from the FIS data.*

It should be noted that the discharges and drainage area identified in the 2004 FIS for Wards Creek at Interstate 55 (Table 3 – Summary of Discharges) do not correspond with the discharges listed in the Des Plaines River Study and are believed to be incorrectly published. The 2004 FIS identifies the drainage area at Interstate 55 to be 0.75 sq. mile while the Des Plaines River Study indicates the drainage area to be 3.15 sq. miles. The drainage area cited in the Des Plaines River is confirmed by the USGS StreamStats tool and believed to serve as a true representation of the drainage area tributary to the study location.

A Letter of Map Revision , LOMR #97-05-053P, was issued by FEMA on October 3, 1997 to reflect changes to the floodplain demonstrated in an analysis prepared by Lindley &Sons, Inc., dated February 6, 1997. The subject area of the LOMR is identified to be in

the vicinity of the Farmingdale Ridge Subdivision and is well upstream of the project limits. The hydrologic and hydraulic models provided as supporting documents for the LOMR begin at the upstream limit of the 1985 FIS, located south of the Interstate 55 crossing, and extend upstream. The analysis includes an executed TR20 and WSP2 model for Wards Creek demonstrating several stormwater and flood control improvements provided along the reach. The model results in reduced frequency discharges for the corresponding events provided in the 1975 Des Plaines River Study. In addition to the discharges, the LOMR includes stream crossing information at the Carriage Green Golf Course Berm, Carlisle Court, Kentwood Court, and Kimberly Court, as identified in the survey.

The 1997 LOMR was used to revise the mapped limits of a Zone A floodplain upstream of the project area and provided corresponding base flood elevations to support the mapping. However, it does not appear that the published 2004 FIS includes the impacts of the 1997 LOMR. The 10- and 100-year flood profiles presented in the 2004 FIS are identical to those provided in the 1985 FIS for DuPage County.

As a result, it is recommended that the base hydrology and hydraulic model of this study reflect the findings of the 1975 SCS study of the Des Plaines River, not the 1985 or 2004 Flood Insurance Studies. The 1975 study is cited to be the source model for the current 2004 DuPage County FIS. Further, the results of the LOMR were not included in the current FIS to establish base flood elevations or result in changes to the flood profiles.

A previous Location Drainage Study conducted for Interstate 55, prepared by Wight & Company in March of 1994, includes an analysis for the Wards Creek crossing. The design discharges used on the LDS were found to correlate with the discharges provided in the 1975 WSP2 model and extrapolated as part of this report.

Hydraulic Methodology

Select portions of the FIS regulatory model, "SAWMILL CREEK FLOODWAYS WITHOUT PROJECT HC1" as prepared by Harza Engineering Company (WSP2 format), dated 1975 were obtained from the ISWS and served as a basis of the hydraulic analysis. As noted earlier, the drainage area and corresponding 10- and 100-year discharges do not match those published in the 2004 FIS. However, the water surface elevations calculated in the WSP2 file do correspond with the flood profiles found in the published FIS.

The geometric and flow input data provided in FIS regulatory model (WSP2 format) was entered into HEC-RAS v4.1.0 to validate the provided WSP2 model and to establish a working model of the given data set. The working HEC-RAS model serves as the basis of analysis and is titled, FIS-Base Model (Plan 01). Only the cross sections located within the limits of the Wards Creek study were included in the model and extend from Section SMD03 at the downstream limit to SMD18 upstream. The resulting study area reaches approximately 5100 feet downstream and 2800 feet upstream of the subject crossing at Interstate 55. The water surface profiles begin at the downstream cross section of River

Mile=3.173 (FIS Section SMD03). The starting water surface elevations are defined by the stages provided in the FIS study and as outlined previously.

The initial results of the FIS–Base Model (Plan 01) generally displayed small variances in the calculated water surface elevations when compared to the source data. Therefore, the Manning's n values for the channel and overbank locations were modified from the given conditions at several sections in an attempt to calibrate the working model and provide calculated water surface elevations within acceptable tolerances to the given data set. Specifically, the floodplain and channel "n" values at Mile 3.883 and the channel "n" value at Mile 4.707 were increased in the HEC-RAS model to better approximate the given results. The following table provides a comparison of the given Manning's value and the corresponding calibrated value for each of the modified cross sections.

Table 2. Comparison of Manning's n Value (WSP2 vs. HEC-RAS Model)

Section	River Mile	FIS WSP2 Model n-Value (Given Conditions)		HEC-RAS Model n-Value (Calibrated Value)	
		Channel	Overbank (L/R)	Channel	Overbank (L/R)
SMD 03	3.173	0.055	0.080 / 0.080	No Change	
SMD 10	3.883	0.065	0.080 / 0.080	0.070	0.080 / 0.080
SMD 13	4.196	0.065	0.080 / 0.080	No Change	
SMD 18	4.707	0.050	0.070 / 0.075	0.055	0.070 / 0.075

It should be noted that the initial run of the HEC-RAS model generated the following warnings after executing the model:

> Warning: The energy loss was greater than 1.0 ft (0.3 m) between the current and previous cross section. This may indicate the need for additional cross sections
>
> Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

The warnings are noted to be the result excessive reach lengths between two cross sections. As noted in the warning, the recommended corrective action is to include additional cross sections and provide for a shorter distance between each calculated step in the hydraulic analysis. The model is revised to include interpolated sections provided at 500-foot intervals and located between River Miles 3.883 and 3.173 and also between River Miles 4.707 and 4.196. The revised model brought the results of the

model to favorable tolerances of the given data. However, not all the the warning messages were not eliminated from the model.

The model was again revised to provide for additional interpolated sections until cross sections were provided at 100-foot intervals for the entire length of the model. The results of the 100-foot intervals eliminated all warning messages within the model but did not result in discernable changes to the calculated water surface elevations within the model. As such, the numerous cross sections generated at 100-foot intervals were not considered to be relevant to the report and were not included in the final analysis. The calculated stages in HEC-RAS Plan 01 are compared to those in the original WSP2 model and the results are presented in the following table.

Table 3. Comparison of Calculated Water Surface Elevations (WSP2 vs. HEC-RAS Model)

Section	River Mile	Design Event	FIS WSP2 Model (Given Conditions)	HEC-RAS Model Plan 01: FIS – Base Model	Calculated Difference from Given Data
SMD 03	3.173	10-Year	669.8	669.80	0.00
		100-Year	670.3	670.30	0.00
SMD 10	3.883	10-Year	688.0	687.98	-0.02
		100-Year	688.8	688.80	+0.00
SMD 13	4.196	10-Year	703.2	703.45	+0.25
		100-Year	704.2	704.72	+0.52
SMD 18	4.707	10-Year	713.7	713.79	+0.09
		100-Year	715.3	715.32	+0.02

Both studies use the same frequency flows and starting water surface elevations. The discrepancies between the results of the two studies are found to be less than 0.5-feet for three of the four upstream section locations. The remaining section is located immediately upstream of the culvert crossing and the resulting stage for the 100-year frequency is outside of the tolerable limits. The difference in the calculated result is attributed to the culvert analysis procedures used for each of the two programs, WSP2 and HEC-RAS.

Note that the ineffective flow areas and contraction/expansion coefficients were omitted from the HEC-RAS model to reflect the given WSP2 model and applied methodology.

The calibrated model, Plan 01, serves as the basis of the hydraulic analysis. The surveyed cross sections and structure geometry were incorporated into the Plan 01 model to evaluate the existing conditions.

Summary of Hydraulic Analysis

Existing Conditions

The existing conditions were evaluated independently by means of a HEC-RAS plan titled, IND-Existing Conditions (Plan 02). Plan 02 incorporates field measured geometry of the subject culvert; the CBBEL surveyed cross sections, and additional upstream crossings of the subdivision and golf course into the FIS-Base Model (Plan 01) HEC-RAS geometry.

An independent evaluation of Manning's N roughness coefficient values for the channel and floodplain was prepared for use in the HEC-RAS analysis and is contained in Exhibit G. The Manning's N values for the channel and adjacent floodplain were based on field site visits and procedures defined in Chapter 5 of the IDOT Drainage Manual. The independent evaluation produced roughness coefficient values that generally compared to those values used in the FIS model with the exception of the outer edges of the floodplain characterized by residential developments. The FIS-Regulatory model did not provide a change in the Manning's N value for surfaces characterized as residential areas consisting of manicured lawns and defined the floodplain uniformly as part of the study. As a result, the roughness coefficients presented in the IND-Existing Conditions (Plan 02) model reflect the calculations identified in the Independent analysis. Refer to Exhibit G for the Manning's Roughness Calculations.

The inclusion of the Manning's n value, CBBEL surveyed cross sections and culvert geometry results in a water surface profile for the existing conditions model that does not match the FIS profile to allowable tolerances of 0.10-feet. A comparison of the water surface elevations from the calculated existing condition and regulatory FIS models at key stations are provided below in Table 4.

Table 4. Comparison of Calculated Water Surface Elevations (FIS vs. Independent Model)

Section	River Mile	Design Event	HEC-RAS Model Plan 01: FIS-Base Model	HEC-RAS Model Plan 02: IND -Existing Conditions	Calculated Difference from Given Data
SMD 03	3.173	10-Year	669.80	669.80	0.00
		100-Year	670.30	670.30	0.00
SMD 10	3.883	10-Year	687.89	687.46	-0.43
		100-Year	688.91	688.50	-0.41
SMD 13	4.196	10-Year	703.45	Section removed from analysis due to conflict.	
		100-Year	704.72		
SMD 18	4.707	10-Year	713.73	713.61	-0.12
		100-Year	715.34	715.05	-0.29

The variation in water surface elevations can be attributed to the differences identified between the two models, Plan 01 & Plan 02.

- A review of the channel geometry provided in the 1975 WSP2 model and the survey performed as part of this project show differences along the streambed profile.
- The WSP 2 model shows the culvert with a zero percent slope and references a Manning's "n" value of 0.020 for the structure. However, the surveyed field conditions show the culvert with a slope of approximately 0.90% and the Independent analysis used 0.013 to represent the structure
- The WSP2 model does not provide for contraction/expansion losses in the model. Also, the WPS2 model does not identify the ineffective flow areas upstream and downstream of the culvert crossing. These conditions are modeled in the Independent Model.
- The field survey includes five (5) additional stream crossings located upstream of Interstate 55 and also includes the berm and outlet located at the Golf Course right-of-way. These are not included in the 1975 WSP2 model.
- The surveyed overtopping elevation along the North Frontage Road is approximately 5-feet higher than presented in the FIS conditions. As a result, the calculated water surface elevation of Plan 02 does not overtop the roadway, and results in elevated water surface elevations upstream of the culvert when compared to Plan 01. The weir overtopping elevation provided in the WSP2 model is identified at an elevation of 702.90. The surveyed conditions reflected in the Independent Model showed the overtopping elevation to by 708.00.

It should be noted that the FIS model cannot be matched to within the allowable tolerance of 0.1-feet for each section. However, since no regulatory floodway is identified at the subject crossing, the IDNR Part 3700 rules will apply and do not require the FIS model for permitting activities. As such, Plan 02, IND-Existing Conditions, the independent analysis including surveyed cross sections, culvert geometry, and additional upstream bridges/culvert serves as the basis of the design, evaluation of the IDOT design criteria and Permitting Purposes.

During the HEC-RAS run for IND-Existing Conditions, several warning and notes were generated. The nature of each warning was reviewed and many warnings were found to be the result of calculations being outside of the expected tolerances. The warnings for energy loss, conveyance ratio, and velocity head indicated results outside the standard tolerances and noted a possible need for additional cross sections to be able to compute a more accurate water profile. Additional cross sections were interpolated between the reach lengths exhibiting the warning in an attempt to eliminate the warning. A review of the program output indicated no discernable changes in the calculated results and as a result, the interpolated cross sections were removed and the warnings were noted as part of the final calculations.

The following notes and warnings were observed within the model. A summary of the identified warning and a brief explanation is provided below:

Note: ***Multiple critical depths were found at this location. The critical depth with the lowest, valid water surface was used.***

This note appears when the program was required to determine the critical depth and accompanies the use of the secant method in the determination of the critical depth. This note prompts the user to examine closer the critical depth that was determined to ensure that the program supplied a valid answer.

Warning: ***During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.***

This warning is issued when a subcritical flow analysis is being performed but the program could not determine a subcritical flow depth at the specified cross section. As the program is attempting to determine the upstream depth, it is using an iterative technique to solve the energy equation. During the iterations, the program tried critical depth as a possible solution, which resulted in a flow depth less than critical. Since this is not possible in a subcritical analysis, the program defaulted to using critical depth at this cross section and continued on with the analysis. This error is often associated with too long of a reach length between cross sections or misrepresentation of the effective flow area of the cross section.

The locations for the critical flow notes are limited to the structures found upstream of the subject crossing. The existing condition includes the placement of 2 inline weirs along the channel resulting in flow passing through critical depth.

Note: The flow in the culvert is entirely supercritical.

This note indicates the presence of critical flow through the culvert. The culvert is shown to be under inlet control conditions. For headwaters submerging the entrance the entrance operates as an orifice. The inlet end is submerged and the outlet end flows freely. In this scenario, the flow is supercritical and the barrel flows partly full over its length. Critical depth is located just downstream of the culvert entrance, and the flow is approaching normal depth at the downstream end of the culvert. This culvert is believed to be under critical flow.

Natural Conditions Analysis

A third HEC-RAS plan titled, IND-Natural Conditions (Plan 03) was created to reflect the natural profile of the stream without the subject culvert. The geometry information for the culvert carrying Interstate 55 and the defining upstream and downstream cross sections were removed in order to calculate the natural high water elevations for the Waterway Information Table. These cross sections were replaced by a HEC-RAS interpolated cross section placed at the upstream face of the Interstate 55 culvert, River Station = 4.176 intended to simulate the natural geometry. The interpolated cross section was generated from Section 4.178 located at the downstream of the berm and Section 4.063 located 500-feet downstream of the culvert location. HEC-RAS generates the cross section geometry through linear interpolation of the various points and elevations provided at the nearest upstream and downstream sections. The corresponding water surface elevations at this cross section location are used in the calculations.

The location of the fully effective cross section could not be determined due to the proximity of the upstream structures in relation to the subject culvert. The proximity of the upstream structures do not allow for a fully effective to develop within channel. However, as defined by current standards, the location and amount of created head is determined by comparing the amount of head generated between the natural and existing conditions at each of the upstream cross section locations. The cross section resulting in the greatest value of created head is used in the hydraulic analysis and identified in the WIT. For the analysis, the cross section resulting in the greatest value of created head was found to be at River Station =4.178 and is located 14-feet upstream of the culvert crossing. Refer to the WIT back-up calculations for the Determination of Created Head calculations.

The input data and results of the HEC-RAS models for the Natural and Existing Conditions are summarized in Exhibits I and J respectively and digital version of these models is also contained in Exhibit P.

Description of Proposed Structure

As a result of the limited nature of the expressway improvements proposed as part of the I-55 Managed Lanes project, the replacement of the existing culvert is not proposed at this time. The scope of the project does not result in the reconstruction of the expressway and a culvert replacement would require staging and lane closures unrelated to the roadway improvements.

Culvert Inspection Reports provided by the IDOT Bridge Office note the existing structure to be in fair condition. The reports prepared on the existing culvert note the need for the following repairs that should be made to the existing culvert:

- Repair the erosion located behind the wingwalls, notably at the northwest wingwall.
- Formed concrete repair at locations within the structure to repair spalls and cracks.
- Assess the break in flow located within the culvert as a result of a misalignment or settlement along the structure floor.

The existing structure shall remain in place and the suggested repairs to the culvert are implemented. The Structure Inspection reports are provided in Exhibit N for reference.

The existing condition of the stream crossing provide edge protection to the low edge of pavement for the 10- and 50-year design events, but is overtopped by the 100- and 500-year events. The proposed improvements should include a profile raise along N. Frontage Road to bring the low elevation of pavement to meet the required 3-feet freeboard for the 50-Year Design Frequency.

Scour Analysis

A visual inspection of the culvert conducted in the spring of 2012 observed an existing scour problem located at the upstream wing wall at the northwest corner of the structure. The observation noted that the backfill provided behind the wing wall had been eroded away and exposed the wing wall.

Based on the field observation, it is believed that the scouring behind the wing wall is the result of the sharp change of direction made by the stream as it enters the subject culvert. The discharge from the Golf Course culverts is situated at a sharp skew to the culvert. The resulting stream flow is directed at the embankment prior to changing direction and flowing through the culvert.

It is recommended that the embankment provided behind the wing wall be repaired and the affected areas be armored with rip-rap or other such material. The condition of the wing wall and surrounding area should be monitored against continued scour.

Compensatory Storage

The scope of the project for this structure is limited to performing necessary repairs and maintenance to the existing culvert. Compensatory storage is not required for

maintenance activities related to existing structures and is not required as part of this project.

IDNR Permit Requirements

Since there is no floodway at the crossing of I-55 and Wards Creek, the IDNR 3700 rules will apply to this project. This approach was coordinated with the IDNR as part of project coordination meetings. A copy of the email correspondence is included in Exhibit N – Correspondence.

The Illinois Department of Natural Resources – Division of Water Resource Management (DWRM) issues permits for work in and along the rivers, lakes and streams of the state. The Division regulates construction projects that may impact the flood carrying capacity of the rivers, lakes and streams.

The Part 3700 rules of the Illinois Department of Natural Resources states that "all construction activities in the floodway of stream in urban areas where the one square mile or more…must be permitted by the Division prior to construction."

The drainage area tributary to the proposed crossing is approximately 2.73-square miles. Therefore, this project does fall under jurisdiction of the IDNR-OWR and a permit may be required pending the scope of the planned improvements, unless noted to be an exempted activity. A number of common minor construction activities regulated under the Part 3700 rules and are automatically authorized by statewide permits. A permit application submittal to the Division is not needed for a construction activity that meets the terms and conditions of a statewide permit.

Routine maintenance and repair of existing culvert structures and the maintenance and repair stream channels are considered activities that are exempt from the Part 3700 rules and do not require a permit.

Freeboard / Clearance

The IDOT Drainage Manual requires a minimum of three feet freeboard between the calculated design (50-year) headwater elevation and the edge of pavement. In addition, the base (100-year) headwater should not overtop the roadway. The independent hydraulic analysis, IND Existing Conditions (Plan 02), indicates the existing culvert does not meet the criteria for freeboard. The low edge of pavement in the vicinity of the culvert is 705.67 found along the North Frontage Road at Station 333+04.31. The existing 50-year headwater elevation at the culvert is 705.34, providing only 0.33-feet of freeboard. Therefore, the roadway profile of North Frontage Road would need to be raised approximately 2.67-feet at the lowest point in order to provide the design criteria for freeboard.

The roadway also does not meet the criteria for overtopping. The existing 100-year headwater at the culvert is 708.34, showing the roadway is overtopped to a depth of 2.67-feet during the base flood event. Therefore, the roadway profile of North Frontage

Road would need to be raised approximately 2.67-feet at the lowest point in order to provide the design criteria for overtopping.

The Manual further states the 2-feet clearance between the design natural high-water and the low beam elevation does not apply to culverts. Therefore this analysis was not performed.

Conclusions

The existing condition analysis concludes that the existing culvert carrying Interstate 55 and Frontage Roads over Wards Creek does not meet the IDOT requirements for design freeboard or overtopping. The North Frontage Road profile needs to be raised approximately 2.67-feet to prevent overtopping during the base, 100-year, flood event. This would also provide the minimum 3-feet of freeboard for the design 50-year flood event.

The analysis of Wards Creek indicates that the presence of the Golf Course Berm located upstream of the culvert does not result in adverse impacts to the calculated headwater elevations for the 50-, 100-, and 500-year design events. For these events, the headwater elevation at the upstream face of the subject culvert is well above the elevation of the berm structure and is not influenced by the berm. The HEC-RAS model indicates a change in the calculated water surface elevation analyzed without the berm to be less than 0.1-feet for each of the design events (50- to 500-year). The 10-year design event indicates the berm to result in an increase of water surface elevation of approximately 2-feet and is believed to be the result of the lowest culvert through the berm being located above the channel flow line elevation. The placement of the culvert pipe requires the water surface to elevate in order to flow through the culvert. HEC-RAS calculates the water surface elevation at each section through a back-step procedure using the energy equation and the adjacent downstream section. As such, the resulting water surface elevations at the upstream face of the culvert are not influenced by the upstream sections or structures.

Note that the berm is approximately 10-feet in height in relation to the channel flow line and the model shows the berm to be overtopped at high flows. As such, the water behind the berm has the potential to reach a depth of 10-feet and results in detained storage volume and, if large enough, can potentially attenuate the flows of the stream at the subject culvert. However, the hydraulic model reflects the use of consistent discharges at both upstream and downstream side of the berm. This indicates that the discharge is not reduced by the Golf Course Berm structure which reflects a conservative and safer approach in the modeling.

The recommended improvement to the Wards Creek culvert as part of the I-55 Managed Lanes project is limited to structural repairs of the existing culvert. The structural repairs should be performed as indicated in the Culvert Inspection Report. The proposed scope of the I-55 Managed Lanes project does not call for the reconstruction of the expressway and does not allow for the existing structure to be replaced as part of this project.

Recommended future improvements at the Wards Creek stream crossing is to raise the profile of N. Frontage Road approximately 2.67-feet at the low grade to meet the freeboard planning objectives. The raised roadway profile results in the required 3-foot freeboard for the 50-year design and provides edge protection to the 100-year design.

Alternately, potential improvements at this crossing in order to meet the IDOT requirement for freeboard include a culvert replacement with a larger opening or to provide an additional opening next to the existing culvert. This proposed remedy would help to lower the headwater elevation to meet the 3-foot freeboard design criterion. The increase waterway opening would also serve to reduce the outlet velocity.

Illinois Department of Transportation

Culvert Waterway Information Table
Independent Analysis

Route: Interstate 55 (FAI 55)
Waterway: Wards Creek
Section:
County: DuPage

Existing SN: 022-516
Proposed SN:
Prepared by: Dustin Book DJB Date: 2/25/2016
Checked by: [signature] Date: 3/9/16

Drainage Area = 3.15 square miles

Existing Overtopping Elev. = 708.19 at Sta. 4785+88.62 (I-55)
Proposed Overtopping Elev. = at Sta.

Flood Event	Freq. Yr.	Discharge ft^3/s	Waterway Opening - ft^2		Natural H.W.E. - ft	Head - ft		Headwater Elevation – ft	
			Existing	Proposed		Existing	Proposed	Existing	Proposed
	10	312	25		698.3	3.2		701.5	
Design	50	480	29		698.9	6.5		701.4	
Base	100	599	30		699.2	9.2		708.4	
Scour Design Check									
Overtop Existing	>50	>480							
Overtop Proposed									
Max. Calc.	500	850	33		699.6	9.1		708.7	

Datum:

All-Time H.W.E. & Date: May 12, 1966 / 698.23 (approx.) ft
Surveyed Normal Water Level: 694.34 ft

10-Year Velocity through Existing Structure = 12 ft/s
10-Year Velocity through Proposed Structure = ft/s
2-Yr. Flow Rate = 145 ft^3/s

EXISTING STRUCTURE

Type: Reinforced Concere Box Culvert
Length/Width: 6' W x 6' H x 290' L
Spans/Cells: 1
Low Chord: 700.12 (u/s) 697.53 (d/s)
Skew: 3-degrees (relative to road)
Clearance: N/A
Bridge Flow Line: N/A (u/s) N/A (d/s)
Low E.O.P: 705.67 (Sta. 333+04.31 N. Frontage Rd.)
Freeboard: 0.33-feet
Culvert Inverts: 694.12 (u/s) 691.53 (d/s)

PROPOSED STRUCTURE

Culvert Type:
Length Of Span:
Cells:
Top Of Crown Elev.: Beam:
Skew: (relative to road)
Culvert Invert Elev.: (u/s) (d/s)
Low E.O.P:
Freeboard:

EXISTING EMBEDMENT

Depth: 0.0-feet
U/S Streambed Elev.: N/A
D/S Streambed Elev.: N/A

PROPOSED EMBEDMENT

Depth:
U/S Streambed Elev.:
D/S Streambed Elev.:

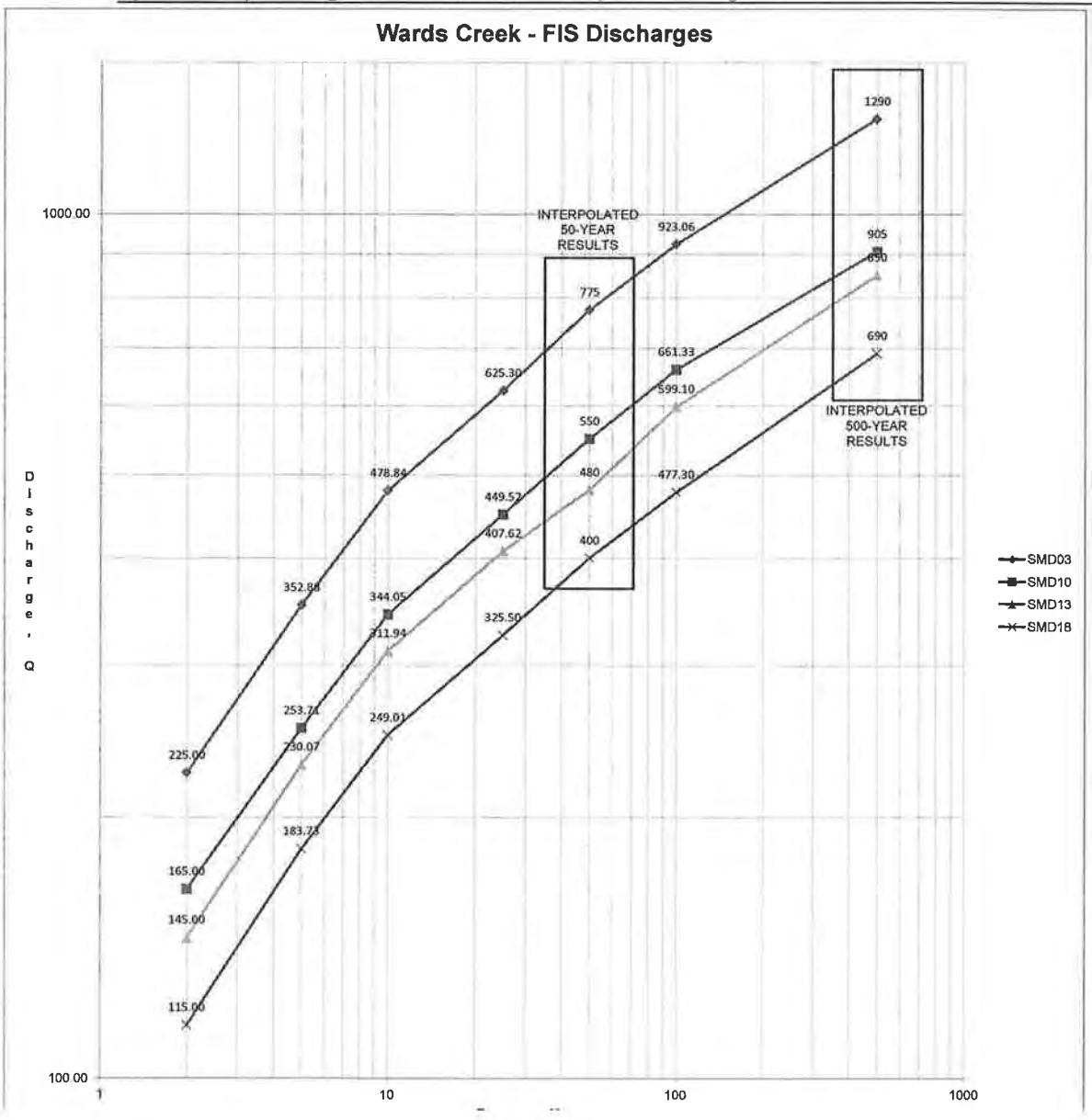
NOTE(S):
1. Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage.
2. The opening calculations consider the skew angle and the resulting opening is measured perpendicular to the stream.
3. Elevations are provided in NGVD29 datum. Subtract 0.279-feet to achieve NAVD88 (NGVD29 - 0.279 = NAVD88).

FIS Discharges - Wards Creek

Route: Interstate 55 (FAI 55) S.N. Exist: 022-0516 Calc By: DJB
Section: S.N. Prop:
County: DuPage Waterway: Wards Creek Chk'd By: CAM

Frequency (Year)	Starting Water Surface Elevation	Discharge, Q (CFS)			
		SMD03	SMD10	SMD13	SMD18
		RM=3.173	RM=3.883	RM=4.196	RM=4.707
2		225.00	165.00	145.00	115.00
5	669.4	352.88	253.71	230.07	183.73
10	669.8	478.84	344.05	311.94	249.01
25	669.9	625.30	449.52	407.62	325.50
50	670.1	775	550	480	400
100	670.3	923.06	661.33	599.10	477.30
500	670.8	1290	905	850	690

NOTE(S): 1.) 50- and 500-year discharges are extraploted graphically from the given data using a log-log graph.
2.) 50- and 500-year starting water surface elevations are interpolatef from the given data.



Printed 2/25/2016

WIT BACK-UP CALCULATIONS - INDEPENDENT ANALYSIS

Route: Interstate 55 (FAI 55)
Waterway: Wards
Section
County DuPage

Exisitng SN: 022-516
Proposed SN:
Calc by: Dustin Book / DJB
Chck by: Cam Ste / CAM

Calculate Created Head

Design Frequency	Natural HWE [1] (ft) U/S Face of Structure	Max. Created Head [2] (ft) Existing	Max. Created Head [2] (ft) Proposed	Exist. Headwater Elevation [3] (ft) U/S Face of Structure	Prop. Headwater Elevation [3] (ft) U/S Face of Structure
10-Year	698.26	3.22		701.48	
50-Year	698.87	6.47		705.34	
100-Year	699.15	9.19		708.34	
500-Year	699.60	9.12		708.72	

NOTE(S):
The Hydraulic models and supporting calculations are provided in NGVD29 datum.

(1) The natural highwater elevation is the water surface elevation at the upstream side of the crossing, as modeled in the stream natural conditions, without the structure (RS = 4.175).

(2) The created head is taken at the upstream approach cross section resulting in the greatest difference in water surface elevation between the nautral conditions and existing conditions. The difference in elevation is then added to the natural H.W.E. at the U/S face of structure. This method of calculating created head is only required for bridges and some major culvert crossings. Also, the preferred created head should never be negative. The created head at the upstream face of the culvert is not considered for this calculation.

(3) Headwater elevation = Natural H.W.E. + Created Head. Refer to Water Surface Elevation Table for calculations.

Calculate Freeboard and Clearance

Low Road Elevation (ft) [4]			
Existing	Station	Proposed	Station
705.67	333+04.31		
Low Beam Elevation (ft) [5]			
Existing	Station	Proposed	Station
700.12	337+24.18		
Existing / Proposed Freeboard (ft) [6]			
10-Year	50-Year	100-Year	500-Year
4.19	0.33	-2.67	-3.05
0.00	0.00	0.00	0.00
Existing / Proposed Clearance (ft) [7]			
10-Year	50-Year	100-Year	500-Year
Not Applicable to Culvert			

(4) Low Road Elevation is calculated at the edge of pavement, at the low side of the roadway (N. Frontage Rd)
(5) The Low Beam Elevation is taken at the upstream end of the culvert.
(6) Freeboard is calculated from the headwater elevation to the proposed low road elevation in the floodplain (3-ft minimum requirement for the design event)
(7) Vertical clearance is not applicable to culverts

CREATED HEAD CALCULATIONS - INDEPENDENT ANALYSIS

Route: Interstate 55 (FAI 55)
Waterway: Wards Creek
Section
County: DuPage

Exisitng SN: 022-516
Proposed SN:

Date: 2/25/2016

X-Section	River Mile	Frequency	Water Surface Elevation			Created Head	
			IND-Natural Conditions Plan 03	IND-Existing Conditions Plan 02	IND-Proposed Conditions TBD	Existing Conditions	Proposed Conditions
SMD18	4.707	10-Year	713.61	713.61		0.00	
		50-Year	714.59	714.59		0.00	
		100-Year	715.05	715.06		0.01	
		500-Year	715.91	715.91		0.00	
10+00	4.532	10-Year	709.70	709.70		0.00	
		50-Year	712.26	712.42		0.16	
		100-Year	713.38	713.52		0.14	
		500-Year	714.36	714.36		0.00	
10+92.66	4.516	10-Year	709.61	709.61		0.00	
		50-Year	712.20	712.37		0.17	
		100-Year	713.33	713.47		0.14	
		500-Year	714.30	714.31		0.01	
	4.515	Inline Structure - U/S of Kimberly Court Bridge					
11+00	4.514	10-Year	709.50	709.50		0.00	
		50-Year	712.17	712.34		0.17	
		100-Year	713.31	713.47		0.16	
		500-Year	714.28	714.28		0.00	
	4.508	Kimberly Court Bridge					
11+59.88	4.502	10-Year	708.86	708.86		0.00	
		50-Year	710.85	710.98		0.13	
		100-Year	711.89	712.08		0.19	
		500-Year	713.80	713.81		0.01	
15+82.92	4.421	10-Year	708.49	708.49		0.00	
		50-Year	710.58	710.73		0.15	
		100-Year	711.66	711.89		0.23	
		500-Year	713.64	713.65		0.01	
	4.415	Kentwood Court Bridge					
16+58.57	4.410	10-Year	707.60	707.60		0.00	
		50-Year	709.17	709.40		0.23	
		100-Year	709.70	710.05		0.35	
		500-Year	710.86	710.89		0.03	
	4.409	Inline Structure - D/S of Kentwood Court					
16+53.57	4.408	10-Year	706.30	706.32		0.02	
		50-Year	708.91	709.20		0.29	
		100-Year	709.41	709.84		0.43	
		500-Year	710.33	710.53		0.20	

CREATED HEAD CALCULATIONS - INDEPENDENT ANALYSIS

Route: Interstate 55 (FAI 55)
Waterway: Wards Creek
Section
County: DuPage

Exisitng SN: 022-516
Proposed SN:

Date: 2/25/2016

X-Section	River Mile	Frequency	Water Surface Elevation			Created Head	
			IND-Natural Conditions Plan 03	IND-Existing Conditions Plan 02	IND-Proposed Conditions TBD	Existing Conditions	Proposed Conditions
18+82.22	4.365	10-Year	706.01	706.03		0.02	
		50-Year	708.79	709.11		0.32	
		100-Year	709.29	709.75		0.46	
		500-Year	710.19	710.40		0.21	
20+55.09	4.332	10-Year	705.73	705.76		0.03	
		50-Year	708.69	709.03		0.34	
		100-Year	709.18	709.68		0.50	
		500-Year	710.07	710.29		0.22	
	4.327	Carlisle Court Bridge					
21+10.39	4.322	10-Year	703.99	704.06		0.07	
		50-Year	704.80	705.50		0.70	
		100-Year	705.07	708.45		3.38	
		500-Year	705.45	708.85		3.40	
23+63.91	4.274	10-Year	703.93	704.00		0.07	
		50-Year	704.82	705.56		0.74	
		100-Year	705.13	708.45		3.32	
		500-Year	705.68	708.87		3.19	
	4.2715	Golf Cart Path Bridge #2					
23+90.48	4.269	10-Year	703.82	703.90		0.08	
		50-Year	704.72	705.51		0.79	
		100-Year	705.02	708.45		3.43	
		500-Year	705.54	708.85		3.31	
26+01.01	4.229	10-Year	703.82	703.91		0.09	
		50-Year	704.72	705.51		0.79	
		100-Year	705.02	708.44		3.42	
		500-Year	705.54	708.85		3.31	
26+85.99	4.213	10-Year	703.82	703.90		0.08	
		50-Year	704.71	705.51		0.80	
		100-Year	705.01	708.44		3.43	
		500-Year	705.52	708.85		3.33	
	4.2115	Golf Cart Path Bridge #1					
27+01.48	4.210	10-Year	703.81	703.90		0.09	
		50-Year	704.70	705.51		0.81	
		100-Year	705.01	708.44		3.43	
		500-Year	705.52	708.85		3.33	

CREATED HEAD CALCULATIONS - INDEPENDENT ANALYSIS

Route: Interstate 55 (FAI 55)
Waterway: Wards Creek
Section
County: DuPage

Exisitng SN: 022-516
Proposed SN:

Date: 2/25/2016

X-Section	River Mile	Frequency	Water Surface Elevation			Created Head	
			IND-Natural Conditions Plan 03	IND-Existing Conditions Plan 02	IND-Proposed Conditions TBD	Existing Conditions	Proposed Conditions
27+98.62	4.185	10-Year	703.81	703.90		0.09	
		50-Year	704.70	705.51		0.81	
		100-Year	705.01	708.44		3.43	
		500-Year	705.52	708.85		3.33	
	4.183	Golf Course Berm					
28+52.56	**4.178**	10-Year	698.36	701.58		**3.22**	
		50-Year	698.97	705.44		**6.47**	
		100-Year	699.25	708.44		**9.19**	
		500-Year	699.72	708.84		**9.12**	
28+72.78	4.175 (U/S Face of Culvert)	10-Year	698.26	701.50		3.24	
		50-Year	698.87	705.36		6.49	
		100-Year	699.15	708.44		9.29	
		500-Year	699.60	708.84		9.24	
	4.148	Wards Creek Culvert at Interstate 55					

Note: The maximum created head is taken to at Cross Section 28+52.56 (River Mile 4.178) since it cannot be taken at the upstream face of the subject culvert.

WATERWAY OPENING CALCULATIONS - INDEPENDENT ANALYSIS

Route: Interstate 55 (FAI 55)
Waterway: Wards
Section
County: DuPage

Exisitng SN: 022-516
Proposed SN:

Date: 2/25/2016

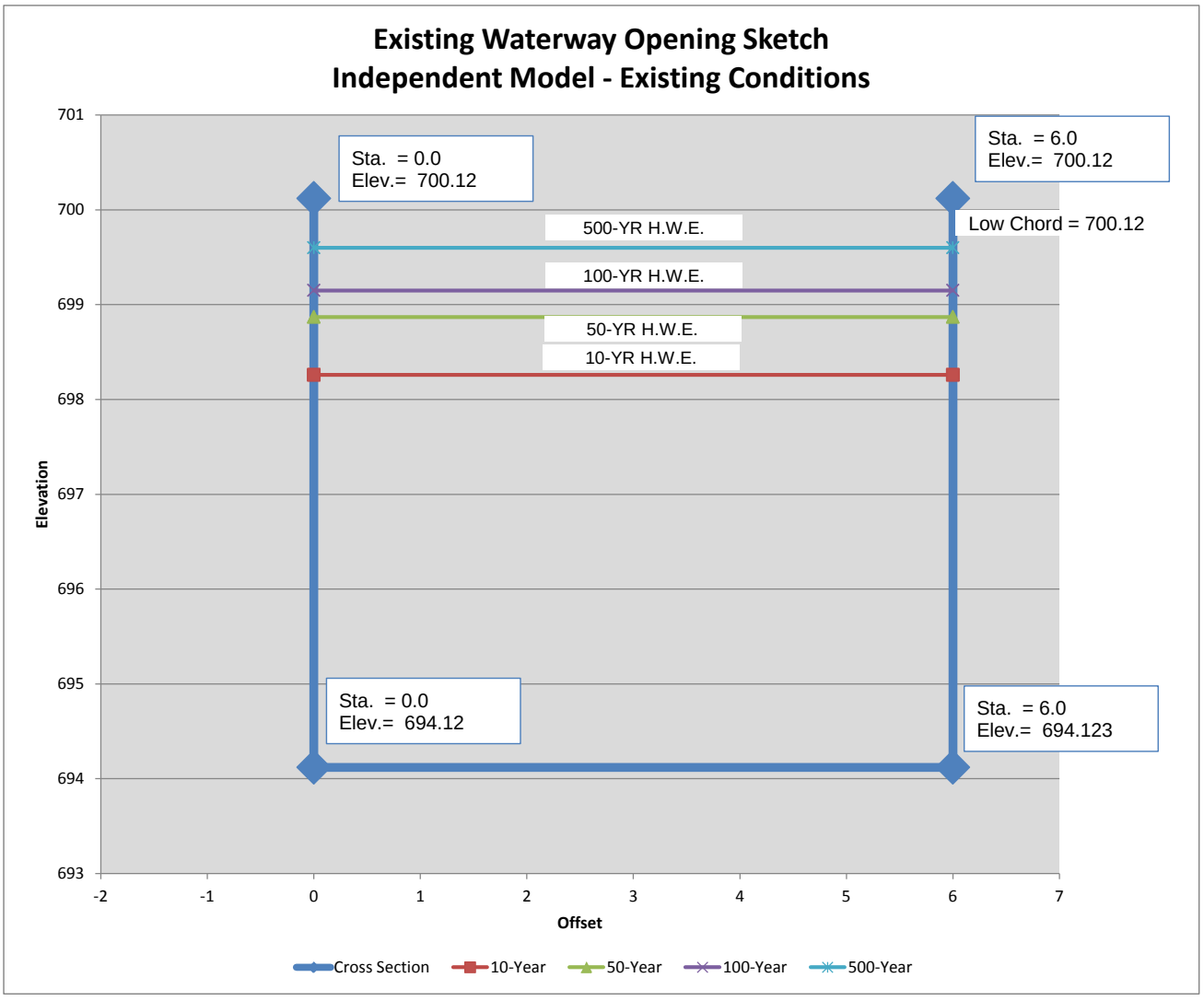
Calculated Opening:

Frequency	H.W.E.	L.B.	Waterway Opening Area Ft^2
10 Year	698.26	700.12	25.00
50 Year	698.87		29.00
100 Year	699.15		30.00
500 Year	699.60		33.00

Calculations:

Frequency	Width*	L.B.	H.W.E.	Inv. EL.	Dep. Below Low Beam	Dep. Below H.W.E.	Area Under Low Beam	Area Under H.W.E.	Waterway Opening
10 Year	6	700.12	698.26	694.12	6.0	4.14	36.00	24.84	24.84
50 Year			698.87			4.75		28.50	28.50
100 Year			699.15			5.03		30.18	30.18
500 Year			699.60			5.48		32.88	32.88

NOTE(S): 1.) Width is measured perpendicular to flow.



III. HYDRAULIC REPORT DATA SHEETS

Illinois Department of Transportation

Hydraulic Report Data Sheets

Route	Interstate 55 (FAI 55)	P or D #	P91-762-10
Section		PTB #	158/002
County	DuPage		
Exist SN	022-0516		
Prop SN			

General Information

1. Stream name: Wards Creek

2. Structure location: NW ¼ of the NW ¼ of Section 4, Township 37N, Range 11E of the 3rd P.M.

3. Hydraulic Report Prepared By: ☒ Consultant Stantec Consulting Services ☒ Prime ☐ Sub
   ☐ District

4. Hydraulic Report Approval Authority: ☒ District – Post PDF of HR to BBS Hydraulics SharePoint Server
   ☐ BBS Hydraulics - Submit 2 hard copies of HR to BBS Hydraulics

Site Design Data

5. Drainage Area (sq. mi.): 3.15

6. Highway Classification: ☐ Rural ☒ Urban ☐ Other
   ☐ Principal Arterial ☐ Minor Arterial ☐ Collector ☐ Local

7. Design Frequency: ☐ 30 yr ☒ 50 Yr. ☐ Other

8. Number of Waterway Information Tables (WIT): 1
   If more than one, explain:

Hydrologic & Hydraulic Analysis

9. Hydrology Modeling (check all that apply): ☐ USGS/Stream Stats ☒ FIS ☐ Gage Data
   ☐ Other

10. Hydraulic Modeling (check all that apply):
    a. Method: ☒ HEC-RAS ☐ WSPRO ☐ Other
    b. Manning's "n" values determined per IDOT Drainage Manual Chap. 5? ☒ Yes ☐ No
       If no, explain:
    c. Source of Starting WSE: FIS Regulatory Model
    d. Non- IDOT encroachments in Survey? ☒ Yes ☐ No
       If yes, are they accounted for? ☒ Yes ☐ No
    e. Does a Tailwater Control exist? ☐ Yes ☒ No
       If yes, list:
    f. Were the Expansion/Contraction cones properly addressed? ☒ Yes ☐ No ☐ N/A
       If No or N/A, explain:

g. What Expansion and Contraction Rates were used? Expansion: 1:1 (X:1)
Contraction 4:1 (X:1)

IDNR – OWR Floodway Permit

11. Is area experiencing urbanization or expected to urbanize within 10 years? ☒ Yes ☐ No (Rural)

12. Are there any sensitive flood receptors located upstream within possible backwater influence? ☐ Yes ☒ No
If yes, list and describe critical upstream flood damageable properties and their elevations.

13. Is there any History of Flooding or Overtopping problems? ☒ Yes ☐ No
Sources & dates of Observed Highwater:
City of Darien indicates that Wards Creek upstream of the berm experiences high water levels. In addition, the City noted overtopping of N. Frontage Road during heavy rain events. See Darien Meeting Minutes in Exhibit N.

14. Is the structure hydraulically connected to or within the floodway of an IDNR-OWR designated Public Body of Water? ☐ No ☒ Yes. OWR 3704 Rules apply.

15. Required IDNR - OWR Permit type:
☒ Individual 3700 ☐ SWP #2 ☐ SWP #12 ☐ Floodway 3708
☐ None ☐ Other

Proposed Structure Data

16. Project Scope (check all that apply):
a. ☐ Complete Replacement
b. ☐ Superstructure Replacement
c: ☐ Superstructure Widening; Length of Pier Extension in the water:
U/S D/S
d. ☐ Bridge ☐ Culvert ☐ Three-sided Bridge
e. ☐ New Alignment
f. Work Planned Below Q_{100} HWE? ☐ Yes ☐ No
g. ☐ Profile Raise

17. If a bridge is proposed, supply:
Flow line elevation (ft): Abutment type:
Preliminary low beam elevation (ft): Skew (degrees):
Width of deck (ft): Number of spans:
Total length from face to face of abutment (ft)

18. If a culvert is proposed, supply:
Type and size: Length (ft):
Upstream invert elevation (ft): Entrance type:
Downstream invert elevation (ft): Skew (degrees):
Note: Upstream and downstream elevations should reflect the elevations before the standard 3" drop (or other embedment) is applied

19. If a three-sided structure is proposed, supply:
U/S Flow line elevation (ft): Skew (degrees):
Span (ft): Length (ft):
Height (ft): Number of spans:

20. a. Is the IDOT Clearance Policy met? ☐ Yes ☐ No ☒ NA Value (ft):
b. Is the IDOT Freeboard Policy met? ☐ Yes ☒ No ☐ NA Value (ft): 0.33-feet

21. Type of streambed soil : ☐ Clay ☐ Silt ☐ Sand ☒ Loam ☐ 232A - Ashkum Silty Clay Loam (USDA Soil Survey)

22. Scour/ Migration Problems: ☐ None/Minimal ☒ Significant ☐ Severe
Comments: The embankment behind the northwest wingwall has eroded and is exposing the wall.

Ice Concerns: ☒ None/Minimal ☐ Significant ☐ Severe
Comments:

Debris Concerns: ☒ None/Minimal ☐ Significant ☐ Severe
Comments:

Proposed or Identified Countermeasures:

Existing Structure Data

		Structure U/S	Subject Structure	Structure D/S
23.	Distance from proposed (subject) structure: (ft.)	14-feet	N\A	1800-feet
24.	Type of structure:	Golf Course Berm	Box Culvert	Twin 36" Dia. RCP
25.	Low beam elevation:	N/A	700.12	684.40
26.	Flow line elevation:	695.66	694.12	681.40
27.	Maximum known high water elevation:	Unknown	698.23	Unknown
28.	Date of maximum high water:	Unknown	May 12, 1966	Unknown
29.	Cause (backwater, headwater, etc.):	Unknown	Headwater	Unknown
30.	Does structure carry entire design flood flow?	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☐ No
	If not, state area of additional waterway opening: (ft^2)	Overtop Weir	Overtop Roadway	Unknown
31.	Type and size of existing overflow structures:	Overtop Weir	Overtop Roadway	Overtop Roadway
32.	Has adverse scour occurred under or adjacent to the structure?	No	Yes	No
33.	Classify type of scour and/or aggradation / degradation:	None	Degradation	None

Required Additional Data

34. Deviations from the General Procedures presented in IDOT Drainage Manual CH. 2, CH.6, and CH.7:
The location of the fully effective cross section could not be placed due to the stream crossings located upstream of the subject culvert. The created head is established by comparing the maximum created head for each upstream section and selecting the cross section resulting in the greatest value.

35. Information regarding high water from other streams, reservoirs, flood control projects, proposed channel changes, or other controls affecting proposed waterway area:
Wards Creek is impounded upstream of I-55 by the construction of a berm used by the Carriage Green Golf Course.

36. Site Inspection made by: Dustin Book Date: January 16, 2013

Remarks:

37. Prepared by: Dustin Book | DJB Date February 25, 2016

Signed (QA/QC): Date 3/9/16

Hydraulic Report Checklist

The District or Consultant should complete the following checklist before submitting the Hydraulic Report for approval.

1. ☒ Title Page
2. ☒ Table of Contents
3. ☒ Narrative - (as outlined in Section 2-601.01 Item #3)
4. ☒ Waterway Information Table (WIT) - (as outlined in Section 2-601.01 Item #4)
5. ☒ Hydraulic Report Data Sheets
6. ☒ Location Map - should show the subject structure along with nearby location defining landmarks (cities, roads, highways, nearby structures over same stream, etc.)
7. ☒ USGS Hydrologic Atlas (historical data available on selected streams- District 1 only)
8. ☒ Photographs - (Minimum: U/S & D/S structure faces, U/S & D/S channel, U/S & D/S roadway across structure)
9. ☒ Hydrology (map, calculations and related exhibits)
10. ☒ Streambed Profile
11. ☒ Roadway Profile (existing and proposed)
12. ☒ Cross Section Plots - with plan layout preferably overlayed upon an aerial photo with the contours
13. ☒ Bridge Opening Plots
14. ☒ Natural Condition Analysis
15. ☒ Existing Condition Analysis
16. ☐ Proposed Condition Analysis

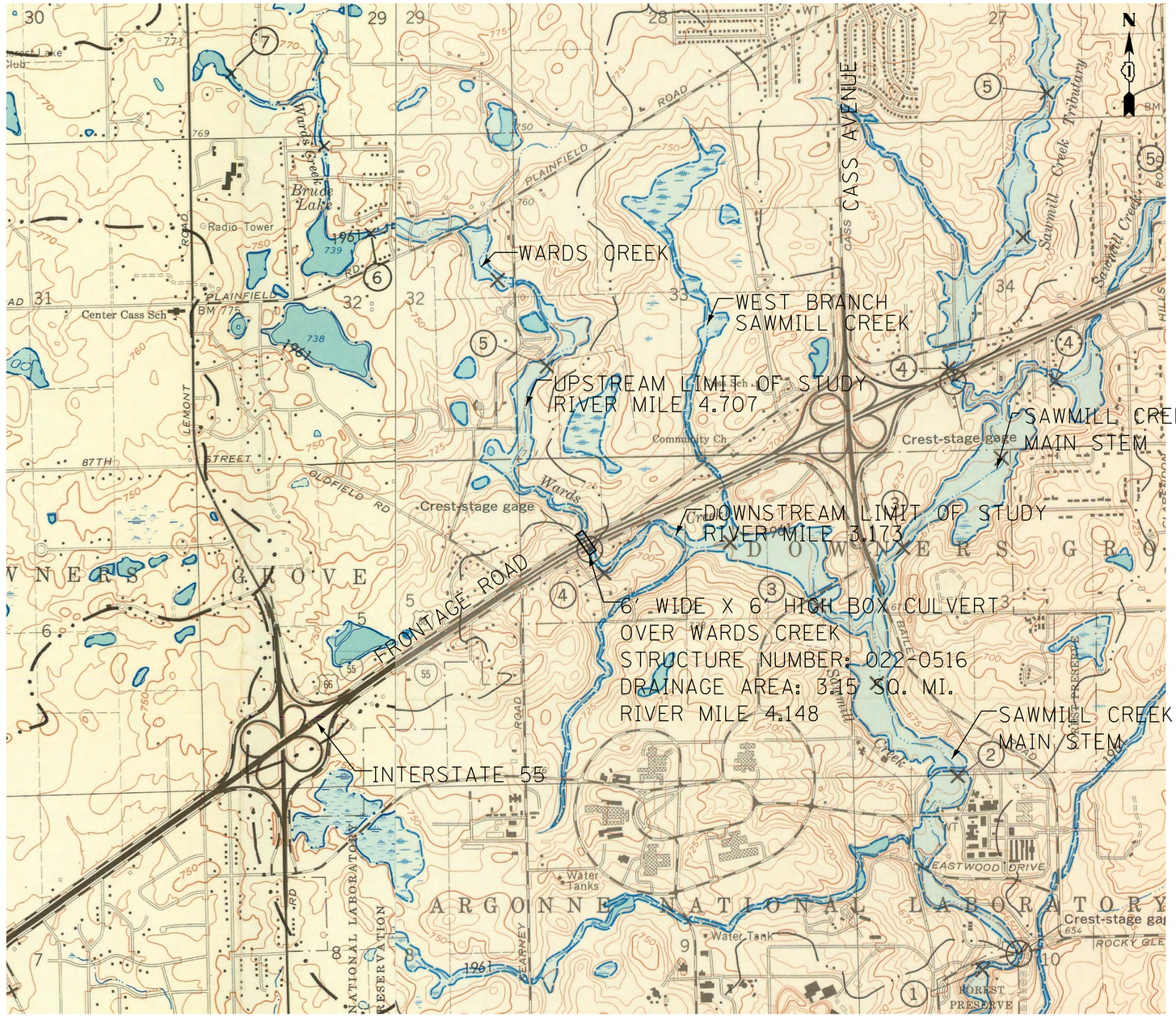
When HEC-RAS modeling is being used, ALL Plans (Natural, Existing, & Proposed) shall be included in ONE Project File.

17. ☒ Scour Analysis – Existing and Proposed Conditions
18. ☐ Compensatory Storage Calculations (if required- District 1 only. Include permit summary form and related attachments.)
19. ☒ Survey Notes (if available, CADD plot of survey points. No Electronic Point Files)
20. ☒ EWSE Data - (per Section 2-402.06)
21. ☒ Correspondence Notes
22. ☒ CD with Project Files (Include pdf copy of the Hydraulic Report and working files for the hydrology and hydraulic analyses.)

IV. EXHIBITS

EXHIBIT A

PROJECT LOCATION MAP ON USGS HYDROLOGIC ATLAS



PROFILE OF FLOODS:

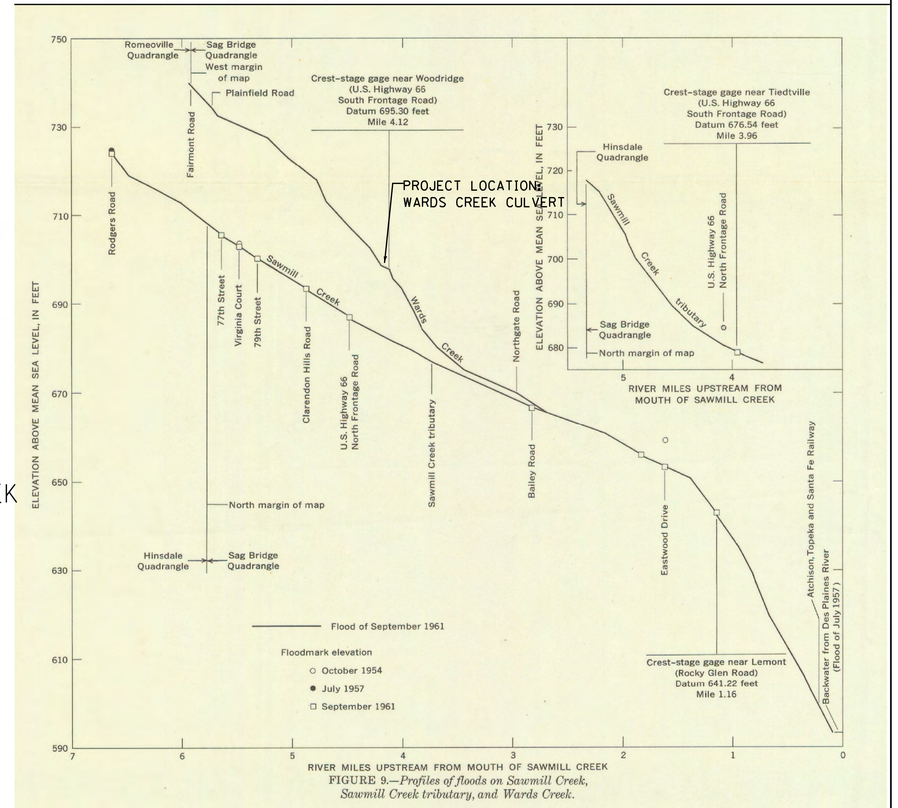


FIGURE 9.—*Profiles of floods on Sawmill Creek, Sawmill Creek tributary, and Wards Creek.*

LEGEND:

Area flooded 1954, 1957 and 1961	
Boundary of 1954 flood	1954
Boundary of 1957 flood	1957
Boundary of 1961 flood	1961
Drainage divide	
River mile measured along stream channel	13

SCALE:

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

GENERAL LOCATION DRAINAGE MAP:

ROUTE: INTERSTATE 55 (STEVENSON EXPRESSWAY)
LIMITS: I-355 TO I-90/94
BASE MAPS: HYDROLOGIC ATLAS HA-146 (ROMEOVILLE QUADRANGLE)
HYDROLOGIC ATLAS HA-149 (SAG BRIDGE QUADRANGLE)

FILE NAME = $FILEL$	USER NAME = $USER$	DESIGNED -	REVISED -
		DRAWN -	REVISED -
$MODELNAME$	PLOT SCALE = $SCALE$	CHECKED -	REVISED -
	PLOT DATE = $DATE$	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

I-55 OVER WARDS CREEK
EXHIBIT A – LOCATION MAP

SCALE: SHEET OF SHEETS STA. TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				EX. A
CONTRACT NO.				
ILLINOIS FED. AID PROJECT				

EXHIBIT B

PHOTOGRAPHS OF THE STRUCTURE AND SURROUNDING AREA

INTERSTATE 55 OVER WARDS CREEK
DUPAGE COUNTY

S.N. 022-0516 – Photographs taken December 14, 2012

Photo #1 – Downstream Face of Wards Creek Culvert (Looking North)

Photo #2 – Upstream Face of Wards Creek Culvert (Looking South)

Exhibit B

INTERSTATE 55 OVER WARDS CREEK
DUPAGE COUNTY

S.N. 022-0516 – Photographs taken December 14, 2012

Photo #3 – Downstream Face of 10” & 24” RCP Culvert through Golf Course Berm (Looking Northeast)

Photo #4 – Upstream End of 24” RCP Culvert through Golf Course Berm (Looking Southwest)

INTERSTATE 55 OVER WARDS CREEK
DUPAGE COUNTY

S.N. 022-0516 – Photographs taken December 14, 2012

Photo #5 – Upstream End of 24" RCP Culvert through Golf Course Berm (Looking West)

Photo #6 – Downstream Face of 30" CMP Culvert through Golf Course Berm (Looking East)

Photo #7 –Golf Course Berm (Looking West)

Photo #8 –Golf Course Berm (Looking East)

Photo #9 –Golf Course Berm Spillway (Looking North)

INTERSTATE 55 OVER WARDS CREEK
DUPAGE COUNTY

S.N. 022-0516 – Photographs taken December 14, 2012

Photo #10 – Golf Course Bridge #1 (Looking Northeast)

Photo #11 – Golf Course Bridge #1 – with Berm in the background (Looking South)

INTERSTATE 55 OVER WARDS CREEK
DUPAGE COUNTY

S.N. 022-0516 – Photographs taken December 14, 2012

Photo #12 – Golf Course Bridge #2 (Looking North)

Photo #13 – Golf Course Bridge #2 (Looking South)

Photo #14 – Downstream Face of Carlisle Court Culvert (Looking West)

Photo #15 – Upstream Face of Carlisle Court Culvert (Looking East)

Photo #16 – Wards Creek Downstream Carlisle Court (Looking East)

Photo #17 – Wards Creek Upstream Carlisle Court (Looking West)

Photo #18 – Carlisle Court (Looking North)

Photo #19 – Kentwood Court (Looking Northwest)

Photo #20 – Downstream Face of Kentwood Court Culvert (Looking West)

Photo #21 – Upstream Face of Kentwood Court Culvert (Looking East)

Photo #22 – Wards Creek Downstream Kentwood Court (Looking Northeast)

Photo #23 – Wards Creek Upstream Kentwood Court (Looking Southwest)

Photo #24 – Downstream Face of Kimberly Court Culvert (Looking West)

Photo #25 – Upstream Face of Kimberly Court Culvert (Looking East)

Photo #26 – Wards Creek Downstream of Kimberly Court (Looking Southeast)

Photo #27 – Wards Creek Upstream of Kimberly Court (Looking Northwest)

Photo #28 – Kimberly Court (Looking North)

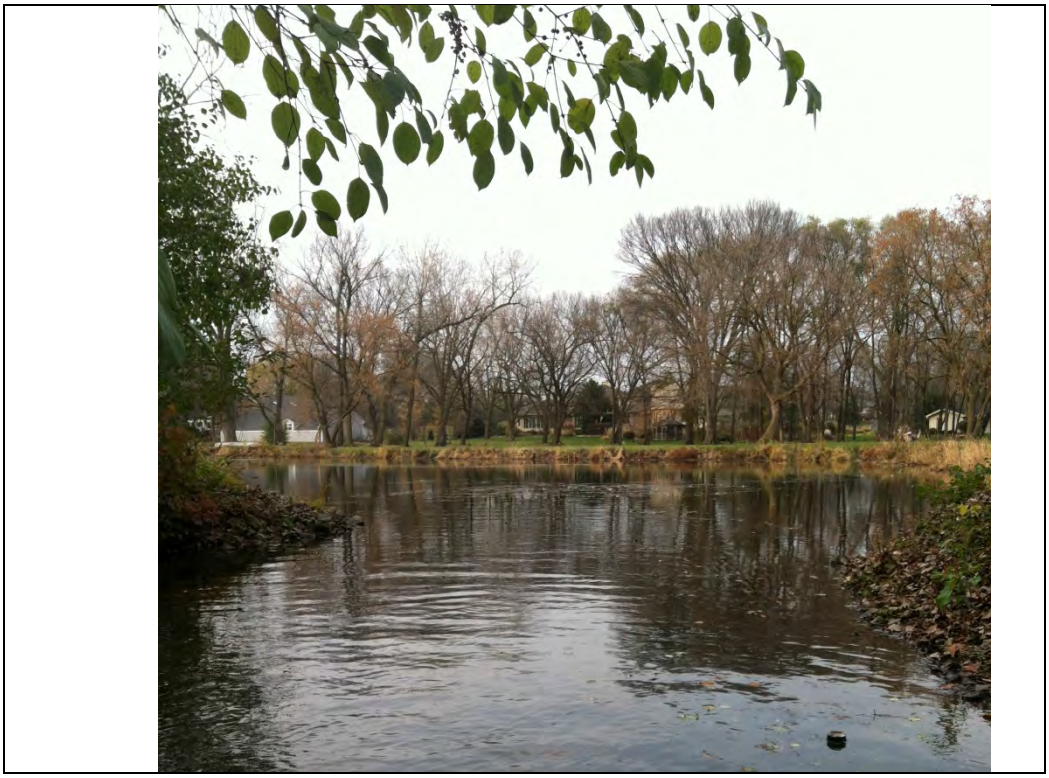


Photo #29 – Existing Pond Near the Upstream Limits of the Study (Looking West)

Photo #30 – Wards Creek Culvert – Erosion behind Northwest Wingwall (Looking North)

Photo #31 – – Wards Creek Northwest Wingwall – Erosion behind Northwest Wingwall (Looking West)

EXHIBIT C

FLOOD INSURANCE STUDY (FIS) INFORMATION

FLOOD INSURANCE STUDY

A Report of Flood Hazards in

DUPAGE COUNTY, ILLINOIS

AND INCORPORATED AREAS

DuPage County

Community Name	Community Number	River Basin
Addison, Village of	170198	
Aurora, City of	170320	
Bartlett, Village of	170059	
Bensenville, Village of	170200	
Bloomingdale, Village of	170201	
Carol Stream, Village of	170202	
Clarendon Hills, Village of	170203	
Darien, City of	170750	
Downers Grove, Village of	170204	
DuPage County (Unincorporated Areas)	170197	
Elmhurst, City of	170205	
Glen Ellyn, Village of	170207	
Glendale Heights, Village of	170206	
Hinsdale, Village of	170105	
Itasca, Village of	170210	

Community Name	Community Number	River Basin
Lemont, Village of	170117	
Lisle, Village of	170211	
Lombard, Village of	170212	
Naperville, City of	170213	
Oak Brook, Village of	170214	
Oakbrook Terrace, City of	170215	
Roselle, Village of	170216	
Villa Park, Village of	170217	
Warrenville, City of	170218	
Wayne, Village of	170865	
West Chicago, City of	170219	
Westmont, Village of	170220	
Wheaton, City of	170221	
Willowbrook, Village of	170222	
Winfield, Village of	170223	
Wood Dale, City of	170224	
Woodbridge, Village of	170737	

CTP Cooperating Technical Partners

Data for Disaster Resistance

Federal Emergency Management Agency
State of Illinois

Flood Insurance Study Number
17043CV000H

TABLE 3 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
WARDS CREEK					
At Interstate Highway 55	0.75	171	*	207	*
WAUBANSEE CREEK					
At Kane-Kendall County boundary	16.50	770	1,220	1,447	1,950
WEST BRANCH DUPAGE RIVER					
Approximately 475 feet upstream of confluence with Unnamed Creek (south of 87th Street)	124.5	3,545	4,970	5,655	7,575
At DuPage-Will County line	123.0	3,510	4,920	5,600	7,500
At Hillside Road	107.3	3,075	4,000	4,400	5,250
At Ogden Avenue	105.0	2,880	3,740	3,960	5,000
Upstream of Fawell Dam	100.0	2,900	4,100	4,600	5,850
At confluence with Kress Creek	80.3	2,460	3,460	3,850	4,900
Above mouth, Kress Creek	62.0	1,800	2,600	2,900	3,900
At Roosevelt Road (State Highway 38)	58.5	1,700	2,400	2,700	3,550
At North Avenue	28.5	970	1,360	1,540	1,980
Downstream limit of study (near Jefferson Street) in Village of Hanover Park	16.4	730	1,010	1,160	1,460
At Lake Street	10.1	600	830	930	1,170
At Irving Park Road	4.70	335	460	505	640
WEST BRANCH SAWMILL CREEK					
At Interstate Highway 55	0.75	178	290	345	495
Near Cass School	0.58	149	245	290	420
Near Bay View	0.42	146	238	285	402
WEST BRANCH TRIBUTARY NO. 1					
Just upstream of Forest Preserve Road	1.41	65	140	190	305

*Data not available

FLOODING SOURCE		RIVER CHANNEL				BASE FLOOD WATER SURFACE ELEVATIONS (FEET NGVD)
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	STREAM-BED ELEVATION (FT. NGVD)	
Wards Creek (SWSW)						
SWSW0011	15,518	*	*	*	665.8	670.4
SWSW0012	19,298	*	*	*	683.9	688.8

[1] In feet above confluence with Sawmill Creek

* Data not available

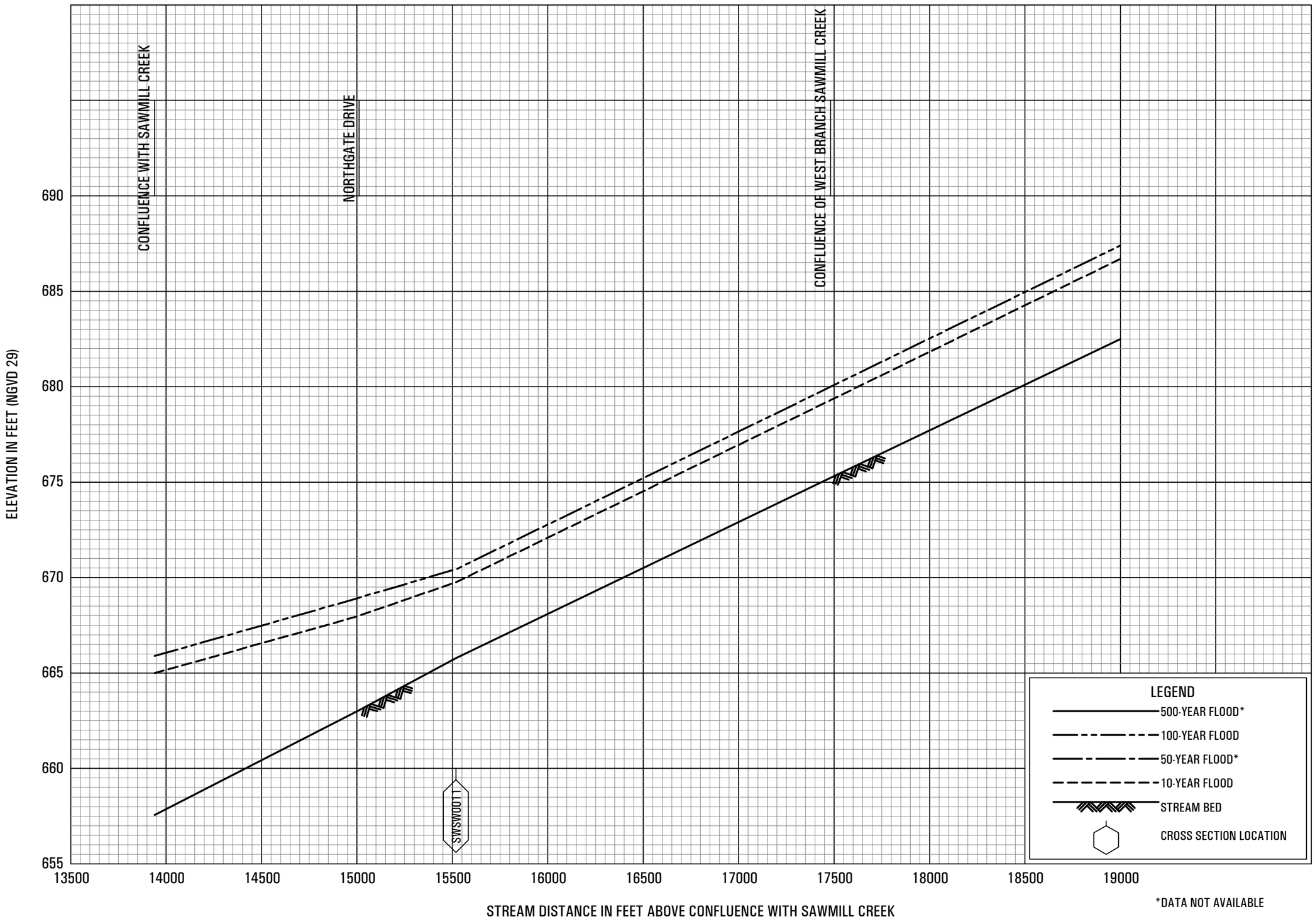
TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

DUPAGE COUNTY, IL
AND INCORPORATED AREAS

100-YEAR FLOOD DATA

WARDS CREEK (SWSW)



FLOOD PROFILES

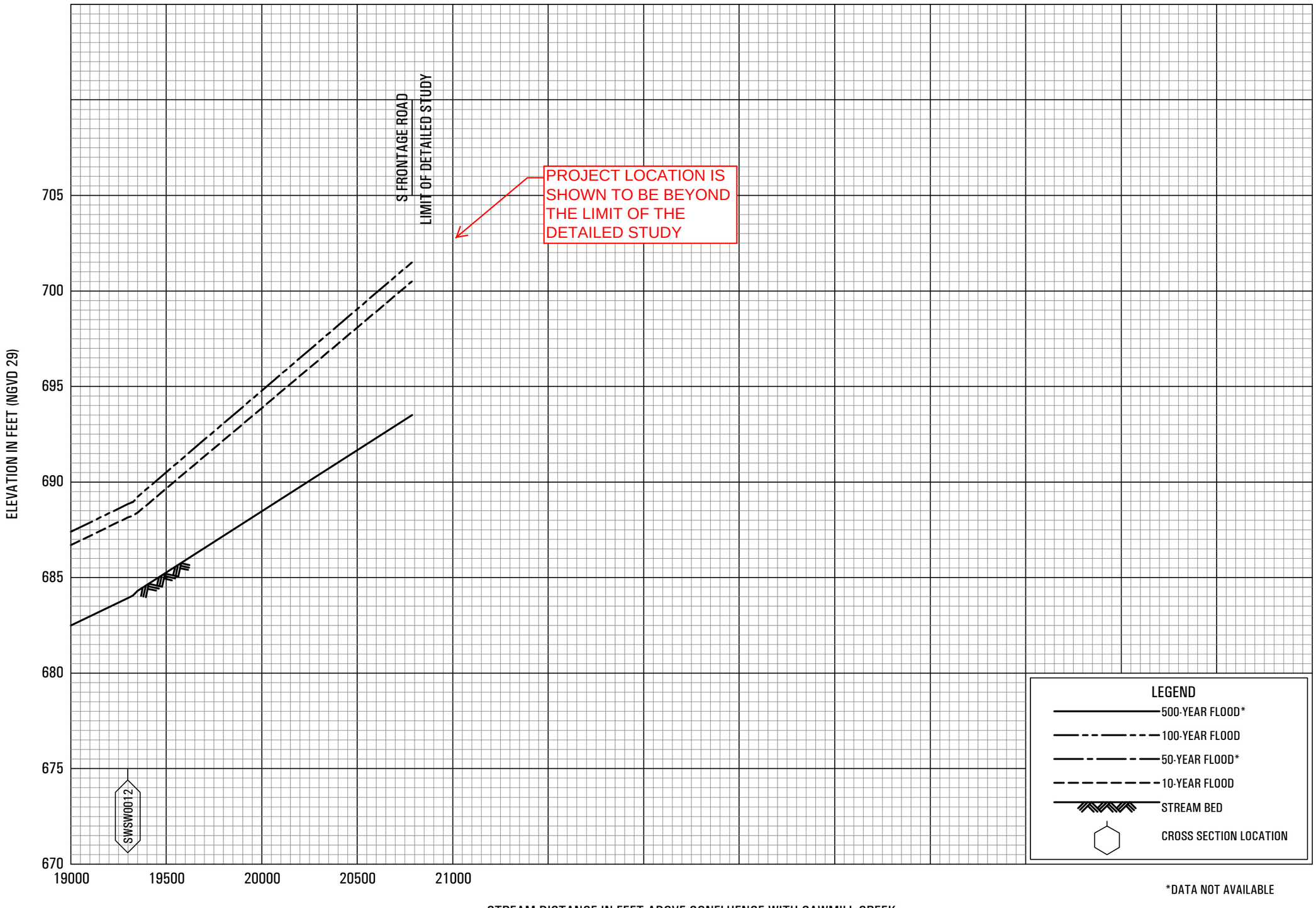
WARDS CREEK (SWSW)

FEDERAL EMERGENCY MANAGEMENT AGENCY

DUPAGE COUNTY, IL

AND INCORPORATED AREAS

146P



*DATA NOT AVAILABLE

FLOOD PROFILES

WARDS CREEK (SWSW)

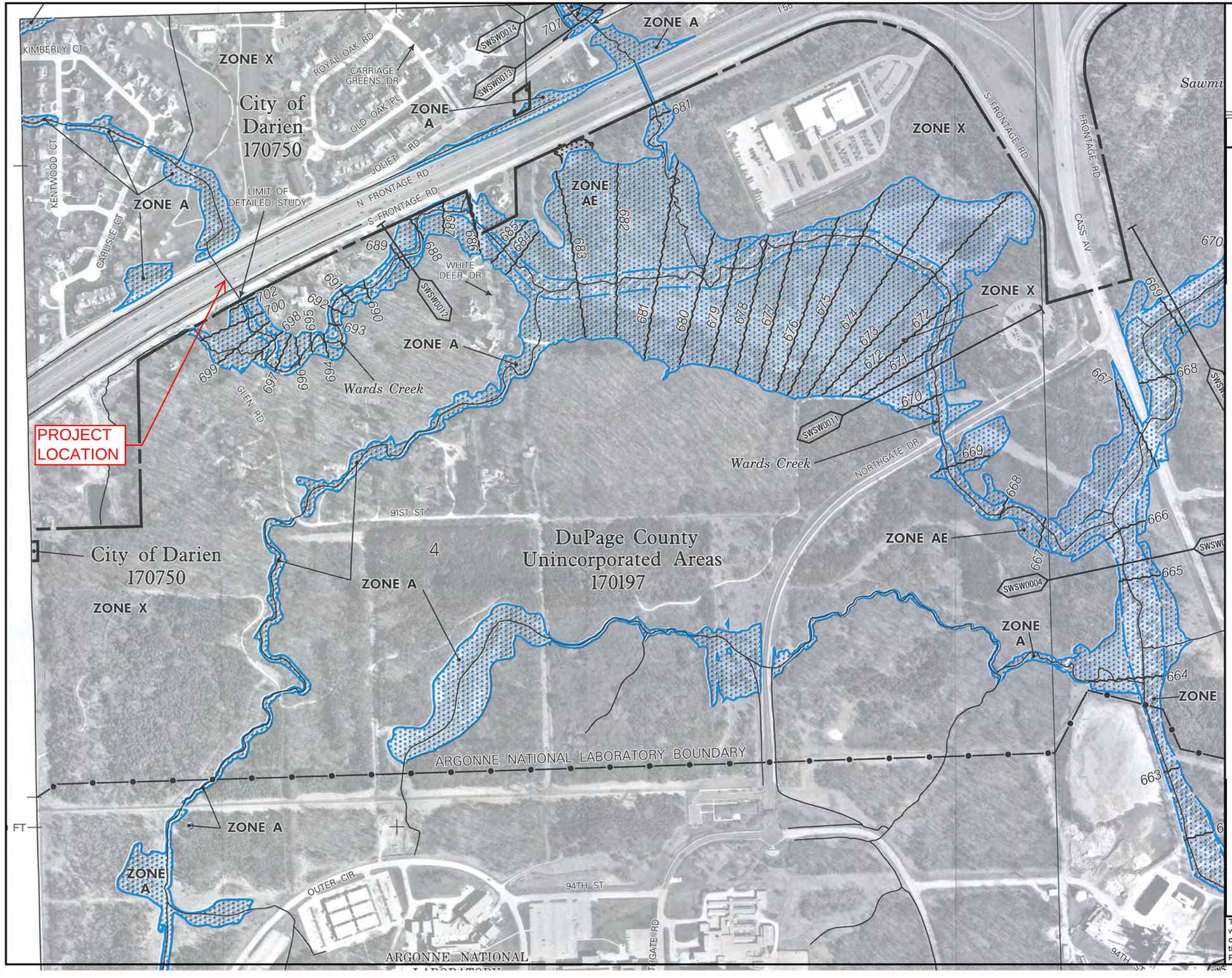
FEDERAL EMERGENCY MANAGEMENT AGENCY

DUPAGE COUNTY, IL

AND INCORPORATED AREAS

147P

SEE PANEL 1001 FOR CONTINUATION TO THE WEST AND NORTH



MAP SCALE 1" = 500'

250 0 500 1000 FEET

METE

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1002H

FIRM

FLOOD INSURANCE RATE MAP

DuPAGE COUNTY, ILLINOIS AND INCORPORATED AREAS

PANEL 1002 OF 1006

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DARIEN, CITY OF	170750	1002	H
DuPAGE COUNTY	170197	1002	H

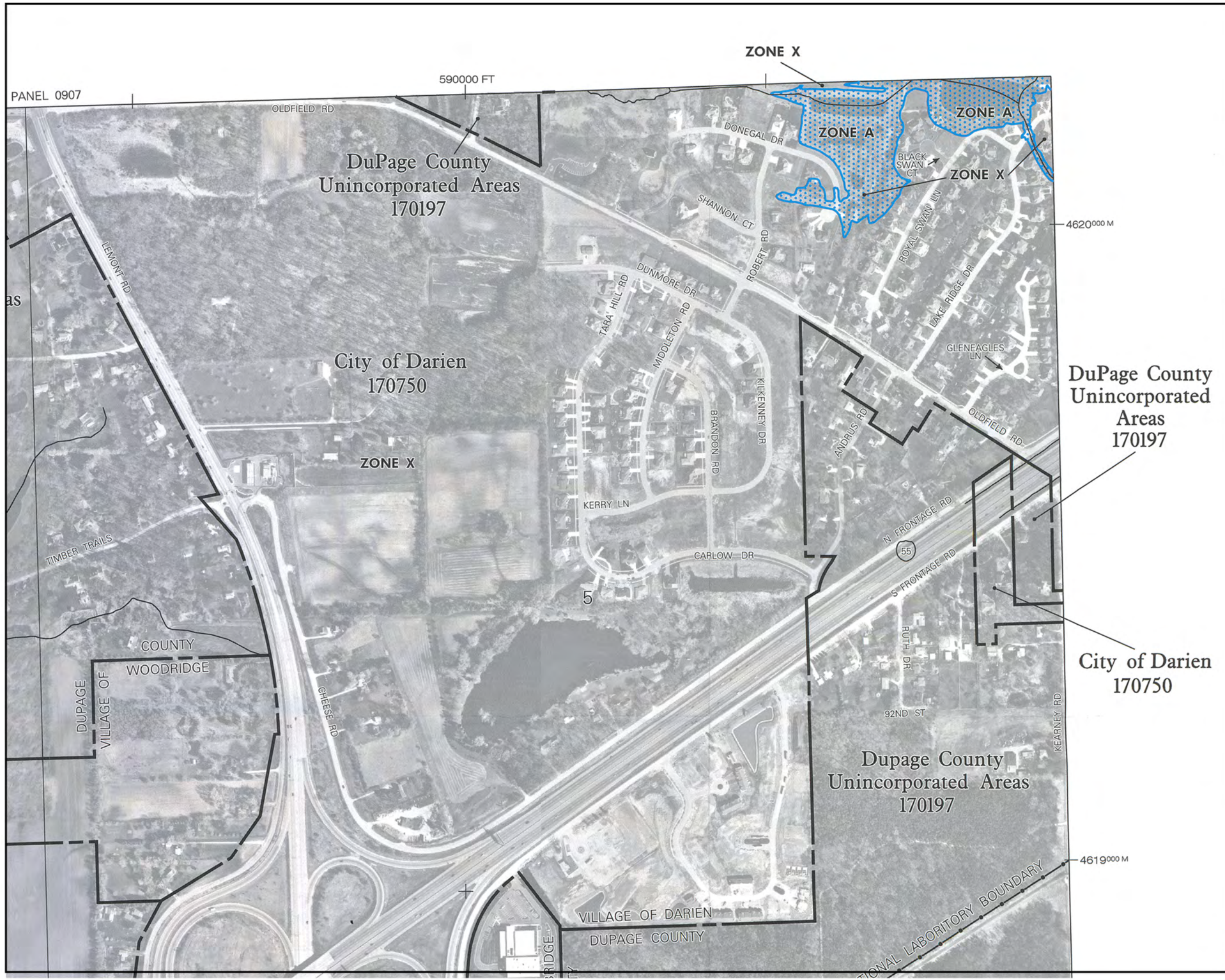
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 17043C1002H

EFFECTIVE DATE DECEMBER 16, 2004

Federal Emergency Management Agency

SEE PANEL 1002 FOR CONTINUATION TO THE EAST



MAP SCALE 1" = 500'

250 0 500 1000 FEET

MET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1001H

FIRM

FLOOD INSURANCE RATE MAP

DuPAGE COUNTY,
ILLINOIS
AND INCORPORATED AREAS

PANEL 1001 OF 1006

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DARIEN, CITY OF	170750	1001	H
DuPAGE COUNTY	170197	1001	H
WOODRIDGE, VILLAGE OF	170737	1001	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
17043C1001H

EFFECTIVE DATE
DECEMBER 16, 2004

Federal Emergency Management Agency

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the National Geodetic Vertical Datum of 1929

DPDP0001 — DPDP0001 — Cross section line

97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

4276000 M — 1000-meter Universal Transverse Mercator grid values, zone 16

600000 FT — 5000-foot grid values; Illinois State Plane Coordinate System, East Zone (FIPSZONE 1201), Transverse Mercator Projection.

DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)

● M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
December 16, 2004

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0908H

FIRM

FLOOD INSURANCE RATE MAP

DuPAGE COUNTY,
ILLINOIS
AND INCORPORATED AREAS

PANEL 0908 OF 1006

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BARTLETT, CITY OF	170696	0908	H
BOLINGBROOK, VILLAGE OF	170064	0908	H
DUPAGE COUNTY	430666	0908	H
WILLOWBROOK, VILLAGE OF	170222	0908	H

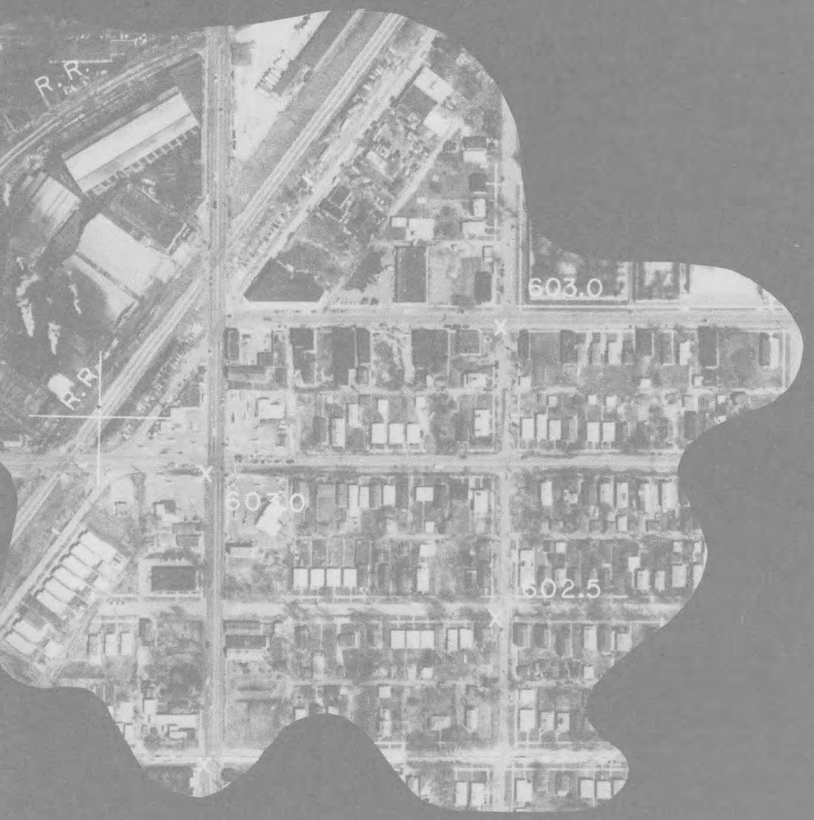
Refer to the **Map Number** shown above when ordering maps and the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
17043C0908H

EFFECTIVE DATE
DECEMBER 16, 2004

Federal Emergency Management Agency

Flood Plain Information Maps and Profiles



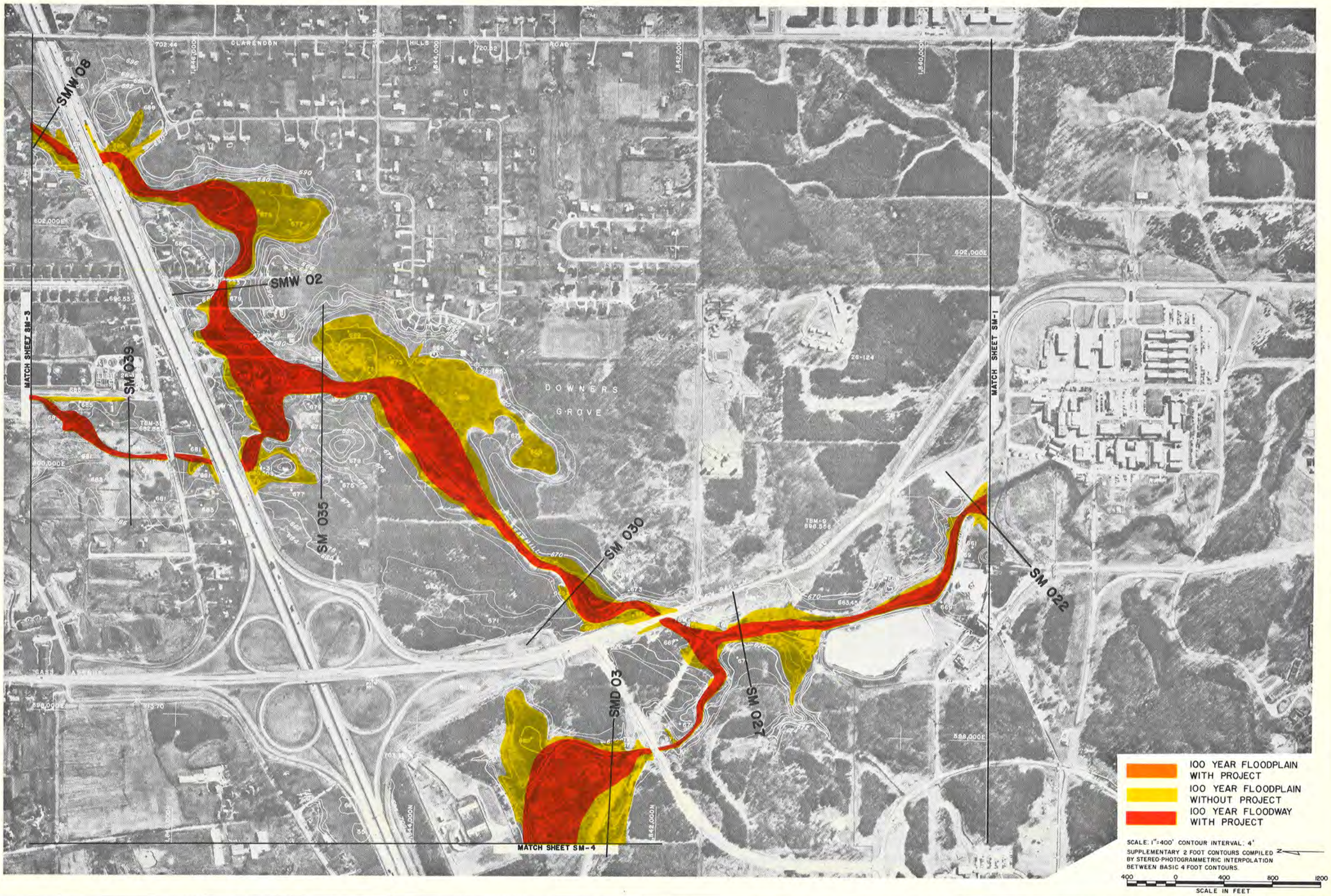
DES PLAINES RIVER

Cook and DuPage Counties, Illinois

DECEMBER 1975

Prepared by:
Des Plaines River Steering Committees

With assistance by:
U.S. Department of Agriculture
Soil Conservation Service and Forest Service
Metropolitan Sanitary District of Greater Chicago
Illinois Department of Conservation



PREPARED BY ALSTER & ASSOCIATES INC. MADISON, WISCONSIN	DATE OF PHOTOGRAPHY: MARCH 7, 1974 DATE OF MAPPING: SPRING, 1974	PREPARED FOR U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE IN COOPERATION WITH METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO	FLOODPLAIN TOPOGRAPHIC MAP DES PLAINES RIVER WATERSHED DU PAGE AND COOK COUNTIES ILLINOIS	SHEET SM-2

MATCH SHEET SM-2

SMD 10

SMD 18

SMD 13

13 SMD

SMD 26

WARDS CREEK
6'x6' REINFORCED
CONCRETE CULVERT

100 YEAR FLOODPLAIN WITH PROJECT

100 YEAR FLOODPLAIN WITHOUT PROJECT

100 YEAR FLOODWAY WITH PROJECT

SCALE: 1"=400' CONTOUR INTERVAL: 4'
SUPPLEMENTARY 2 FOOT CONTOURS COMPILED BY STEREO-PHOTOGRAMMETRIC INTERPOLATION BETWEEN BASIC 4 FOOT CONTOURS.

400 0 400 800 1200
SCALE IN FEET

PREPARED BY ALSTER & ASSOCIATES INC. MADISON, WISCONSIN	DATE OF PHOTOGRAPHY: MARCH 7, 1974 DATE OF MAPPING SPRING 1974	PREPARED FOR U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE IN COOPERATION WITH METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO	FLOODPLAIN TOPOGRAPHIC MAP DES PLAINES RIVER WATERSHED DU PAGE AND COOK COUNTIES ILLINOIS	SHEET SM-4

SAWMILL CREEK — LOWER TRIB 1 / EAST BRANCH + SAWMILL CREEK & LOWER WARDS CREEK

LISTING FROM SCS ← i.e. FPI 1975

INPUT ONLY

~~THIS FILE PROVIDED FOR INFORMATIONAL PURPOSE — NOT VERIFIED AS FINAL FIS MODEL~~

~~SAM~~ 12/~~FEB~~

THIS MODEL APPARENTLY USED FOR DUPAGE COUNTY UNINC. AREAS FIS 1982/1985 REACHES (LOWER XS OF THIS MODEL).

DARIEN / WILLOWBROOK / "DOWNERS GROVE" REACHES SUPERSEDED BY (1) LATER WSP-2 RUNS, SHOWN ON COMMUNITY ESDP MICROFICHES, AND (2) LOMRS AS NOTED.

-WS/ISWS 2/15/2012

```
WSP2        SAWMILL CREEK FLOODWAYS WITHOUT PROJECT HCI
    SM002   591.6       2658.3
    SM003   598.1       2649.6
    SM008   623.7       2623.2
    SM016   652.0       2588.0
    019SM   657.24      2395.26
    SM022   659.7       2395.3
    SM027   665.3       2256.3
    SM030   669.2       1299.0
    SM035   673.9       1190.6
    SM039   680.9       495.3
    SM046   693.6       378.5
    SM049   709.0       313.2
    SM052   720.4       226.1
    SMW02   679.2       733.0
    SMW08   689.6       617.4
    SMW11   694.6       566.0
    SMW17   700.4       480.6
    18SMW   702.40      410.69
    SMW19   705.3       410.7
    SMW22   710.6       339.5
    SMD03   670.3       923.1
    SMD10   688.8       661.3
    13SDM   704.16      599.10
    SMD13   704.2       599.1
    SMD18   715.3       477.3
    SMD26   731.0       353.3   (1)
TITLE       DES PLAINS RIVER - SAWMILL CREEK FUTURE W/O PROJECT
TITLE       PRESENT CONDITION WITHOUT PROJECT
TRIB        SM027       SM035
DISCHARGE   -1.0        1.0         2.0         3.0         2.0         5.0
DISCHARGE   -1.0        10.0        25.0        100.0
OUTPUT      RPS
REACH       SM002       13.70       850.0       750.0       750.0
FLOW-FREQ   SM002          2658.34     1819.11     1400.15     1042.71     633.81
FLOW-FREQ   SM002       42.0        28.0        14.0
REACH       SM003       13.65       820.0       770.0       770.0
FLOW-FREQ   SM003          2649.56     1813.11     1395.52     1039.25     631.69
FLOW-FREQ   SM003       42.0        28.0        14.0
REACH       SM008       13.50       2630.0      2580.0      2580.0
FLOW-FREQ   SM008          2623.20     1795.09     1381.62     1028.86     625.33
FLOW-FREQ   SM008       42.0        28.0        14.0
REACH       SM016       13.30       3900.0      3500.0      3500.0
FLOW-FREQ   SM016          2588.00     1771.04     1363.07     1015.00     616.85
FLOW-FREQ   SM016       39.0        26.0        13.0
ROAD        019SM       2.7         1800.0      1550.0                  12.55
REACH       SM022       12.21       1610.0      1600.0      1600.0
FLOW-FREQ   SM022          2395.26     1639.30     1261.47     939.08      570.41
FLOW-FREQ   SM022       36.0        24.0        12.0
REACH       SM027       11.43       2450.0      2450.0      2450.0
FLOW-FREQ   SM027          2256.34     1544.35     1188.25     884.39      536.97
FLOW-FREQ   SM027       33.0        22.0        11.0
REACH       SM030       6.21        1550.0      1500.0      1500.0
FLOW-FREQ   SM030          1298.98     889.72      683.75      507.90      307.22
FLOW-FREQ   SM030       18.0        12.0        6.0
REACH       SM035       5.64        2750.0      2750.0      2750.0
FLOW-FREQ   SM035          1190.58     815.57      626.64      465.33      281.31
FLOW-FREQ   SM035       18.0        12.0        6.0
REACH       SM039       2.14        2250.0      1950.0      1950.0
FLOW-FREQ   SM039          495.27      339.66      260.48      192.82      115.87
                           100          25          10           5           2
```

(1) MODEL SUBMITTED FOR LOMR 97-05-053P INCLUDES REVISED DATA

-WS/ISWS 2/15/2012

SM002 – SM039: LOMR 92-05-081P SUPERSEDES

SM046 – SM052: LOMRS 92-05-088P & 97-05-381P SUPERSEDE

-WS/ISWS 2/15/2012

HARZA ENGINEERING COMPANY

```
CULV 1     18SMW      2          11348
CULV 2     3.5                   30.0       696.8      696.4      0.025
SECTION    18SMW
           0.0        706.0      60.0       704.0      130.0      702.0
           250.0      701.5      300.0      702.0      400.0      706.0
ENDTABLE
SEGMENT    SMW19      1          D          -12.
NVALUE     0.090
SEGMENT    SMW19      2          C          12.
NVALUE     0.075
SEGMENT    SMW19      3          D          800.
NVALUE     0.090
SECTION    SMW19
              -170.0     710.0     -150.0     708.0      -90.0     706.0SMW19  1 6
               -30.0     704.0      -12.0     702.5       -4.0     700.5SMW19  2 6
                 0.0     700.5        4.0     700.5       12.0     702.5SMW19  3 6
                30.0     704.0      160.0     706.0      230.0     708.0SMW19  4 6
               370.0     708.0      420.0     706.0      700.0     706.0SMW19  5 6
               800.0     708.0                                          SMW19  6 6
ENDTABLE
SEGMENT    SMW22      1          D          -11.
NVALUE     0.088
SEGMENT    SMW22      2          C          11.
NVALUE     0.065
SEGMENT    SMW22      3          D          280.
NVALUE     .082
SECTION    SMW22
              -300.0     716.0     -260.0     714.0      -210.0    710.0SMW22  1 4
               -11.0     709.8       -4.0     707.8         0.0    707.8SMW22  2 4
                 4.0     707.8       11.0     709.3       160.0    710.0SMW22  3 4
               200.0     712.0      280.0     716.0                    SMW22  4 4
ENDTABLE
COMPUTE    SMW02      SMW22      SM035
TITLE      SAWMILL CREEK TRIB TO DOWNER GROVE (WARDS CREEK)
REACH      SMD03      5.12       1600.0     1600.0     1600.0
FLOW-FREQ  SMD03          923.06     625.30     478.84     352.88     212.89
FLOW-FREQ  SMD03      15.0       10.0       5.0
REACH      SMD10      3.52       3750.0     3600.0     3600.0
FLOW-FREQ  SMD10          661.33     449.52     344.05     253.71     152.73
FLOW-FREQ  SMD10      12.0       8.0        4.0
ROAD       13SMD      2.7        1250.0     1150.0                3.15
REACH      SMD13      3.15       108.0      350.0      350.0
FLOW-FREQ  SMD13          599.10     407.62     311.94     230.07     138.41
FLOW-FREQ  SMD13      9.0        6.0        3.0
REACH      SMD18      2.44       2700.0     2600.0     2600.0
FLOW-FREQ  SMD18          477.30     325.50     249.01     183.73     110.37
FLOW-FREQ  SMD18      6.0        4.0        2.0
REACH      SMD26      1.74       4150.0     3200.0     3200.0
FLOW-FREQ  SMD26          353.28     241.66     184.78     136.42      81.79
FLOW-FREQ  SMD26      6.0        4.0        2.0
SEGMENT    SMD03      1          D          262.0
NVALUE     0.080
SEGMENT    SMD03      2          C          290.0
NVALUE     0.055
SEGMENT    SMD03      3          D          1100.0
NVALUE     0.080
SECTION    SMD03
                 0.0     677.0      50.0     674.0      100.0     671.4SMD03  1 7
               150.0     669.4     200.0     669.2      262.0     668.7SMD03  2 7
               274.0     667.3     279.0     666.2      282.0     665.6SMD03  3 7
```

SUBMITTED MODEL FOR LOMR 97-05-053P CONTAINS MORE DATA

-WJ/SWS 2/15/2012

HARZA ENGINEERING COMPANY

```
                285.0     665.8     289.0     667.3     290.0     669.3SMD03  4 7
                400.0     668.5     500.0     668.9     600.0     670.1SMD03  5 7
                700.0     670.1     800.0     670.4     900.0     671.7SMD03  6 7
               1000.0     673.8    1100.0     678.1                   SMD03  7 7
ENDTABLE
SEGMENT   SMD10      1          D          42.0
NVALUE    0.080
SEGMENT   SMD10      2          C          100.0
NVALUE    0.065
SEGMENT   SMD10      3          D          290.0
NVALUE    0.080
SECTION   SMD10
                  0.0     699.8      17.0     699.1      25.0     694.5SMD10  1 5
                 39.0     687.7      42.0     687.3      60.0     685.9SMD10  2 5
                 86.0     685.8      87.0     684.1      90.0     683.9SMD10  3 5
                 92.0     683.9      97.0     684.8     100.0     687.0SMD10  4 5
                141.0     687.6     200.0     691.0     290.0     694.4SMD10  5 5
ENDTABLE
CULV1     13SMD      1          41111
CULV2     6.0        6.0        292.0      694.2      694.2      0.020
SECTION   13SMD
                  0.0     702.9     100.0     703.9     200.0     705.613SMD  1 7
                300.0     707.0     400.0     708.5     500.0     709.313SMD  2 7
                600.0     709.7     700.0     709.6     800.0     709.213SMD  3 7
                900.0     708.4    1000.0     708.1    1100.0     707.513SMD  4 7
               1200.0     706.2    1300.0     705.8    1400.0     706.113SMD  5 7
               1500.0     707.0    1600.0     708.3    1700.0     709.913SMD  6 7
               1800.0     712.6    1900.0     715.8                   13SMD  7 7
ENDTABLE
SEGMENT   SMD13      1          D          60.0
NVALUE    0.080
SEGMENT   SMD13      2          C          100.0
NVALUE    0.065
SEGMENT   SMD13      3          D          400.0
NVALUE    0.080
SECTION   SMD13
                  0.0     712.7      20.0     708.0      30.0     705.9SMD13  1 6
                 60.0     700.5      78.0     696.8      81.0     696.0SMD13  2 6
                 84.0     695.6      87.0     695.9      88.0     696.8SMD13  3 6
                 89.0     697.5     100.0     699.1     150.0     704.1SMD13  4 6
                200.0     708.9     250.0     711.4     300.0     711.9SMD13  5 6
                350.0     712.4     400.0     714.7                   SMD13  6 6
ENDTABLE
SEGMENT   SMD18      1          D          290.0
NVALUE    0.070
SEGMENT   SMD18      2          C          330.0
NVALUE    0.050
SEGMENT   SMD18      3          D          600.0
NVALUE    0.075
SECTION   SMD18
                  0.0     726.0      40.0     724.0     140.0     722.0SMD18  1 5
                200.0     720.0     290.0     718.0     300.0     714.0SMD18  2 5
                308.0     709.8     318.0     709.8     330.0     716.0SMD18  3 5
                450.0     718.0     470.0     720.0     510.0     722.0SMD18  4 5
                600.0     726.0                                     SMD18  5 5
ENDTABLE
SEGMENT   SMD26      1          D          268.0
NVALUE    0.075
SEGMENT   SMD26      2          C          283.
NVALUE    0.050
```

NOTE:
MODEL SUBMITTED FOR
LOMR 97-05-053P
CONTAINS MORE
EXTENSIVE DATA
ABOVE I-55.

-WS/ISWS
2/15/2012

HARZA
ENGINEERING COMPANY

```
SEGMENT    SMD26      3          D          750.0
NVALUE     0.070
SECTION    SMD26
                 0.0      738.8       40.0      736.8       80.0      733.4SMD26   1 7
               110.0      732.1      160.0      731.1      268.0      730.1SMD26   2 7
               274.0      728.3      275.0      727.6      277.0      727.6SMD26   3 7
               279.0      728.3      283.0      729.9      300.0      729.9SMD26   4 7
               350.0      730.3      400.0      730.3      450.0      730.0SMD26   5 7
               465.0      729.6      475.0      729.9      500.0      730.2SMD26   6 7
               600.0      732.9      700.0      738.5      750.0      740.5SMD26   7 7
ENDTABLE
COMPUTE    SMD03      SMD26      SM027
ENDJOB
ENDRUN
/* END OF FILE
```

NOTE:

MODEL SUBMITTED FOR

LOMR 97-05-053P

CONTAINS MORE

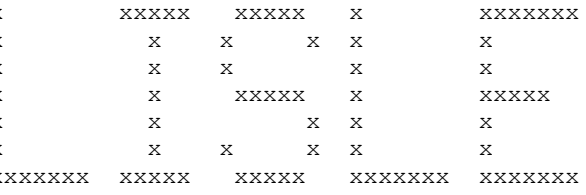
EXTENSIVE

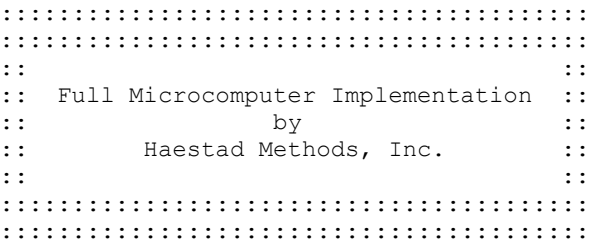
DATA.

-WS/RSWS 2/15/2012

HARZA
ENGINEERING COMPANY

```
*****************************************************************************
*                                   * (program) S/N:                        *
*                                   * HMVersion    :  2.20                  *
*               WSP-2               * Date         :  2/15/**               *
*                                   * Time         : 11:31:42               *
*      L I S L E   V E R S I O N    * Input file   : SM1975x.wsp            *
*    (Updated for FLOW-FREQ input)  * Output file  : SM1975w.txt            *
*                                   *                                        *
*                                   *                                        *
*****************************************************************************
```





37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

EXECUTION STARTED AT 11:31:42

----------80/80 LIST OF INPUT DATA----------

```
------------------------------80/80 LIST OF INPUT DATA--------------------------------
TITLE     SAWMILL CREEK TRIB TO DOWNERS GROVE (WARDS CREEK)
REACH     SMD03         5.12      1600      1600
FLOW-FREQ SMD03       923.06     625.3    478.84    352.88
REACH     SMD10         3.52      3750      3600      3600
FLOW-FREQ SMD10       661.33    449.52    344.05    253.71
*
*         *** [ SEE ALSO LINDLEY SC MODEL FOR LOMR 97-05-053P  ] ***
*         *** [ FOR MORE DETAILED DATA ABOVE HERE (APPX I-55)  ] ***
*
ROAD      13SMD          2.7      1250      1150               3.15
REACH     SMD13         3.15       108       350       350
FLOW-FREQ SMD13        599.1    407.62    311.94    230.07
REACH     SMD18         2.44      2700      2600      2600
FLOW-FREQ SMD18        477.3     325.5    249.01    183.73
REACH     SMD26         1.74      4150      3200      3200
FLOW-FREQ SMD26       353.28    241.66    184.78    136.42
SEGMENT   SMD03            1         D       262
NVALUE       0.08
SEGMENT   SMD03            2         C       290
NVALUE      0.055
SEGMENT   SMD03            3         D      1100
NVALUE       0.08
SECTION   SMD03
                0       677        50       674       100     671.4
              150     669.4       200     669.2       262     668.7
              274     667.3       279     666.2       282     665.6
              285     665.8       289     667.3       290     669.3
              400     668.5       500     668.9       600     670.1
              700     670.1       800     670.4       900     671.7
             1000     673.8      1100     678.1
ENDTABLE
SEGMENT   SMD10            1         D        42
NVALUE       0.08
SEGMENT   SMD10            2         C       100
NVALUE      0.065
SEGMENT   SMD10            3         D       290
NVALUE       0.08
SECTION   SMD10
                0     699.8        17     699.1        25     694.5
               39     687.7        42     687.3        60     685.9
               86     685.8        87     684.1        90     683.9
               92     683.9        97     684.8       100       687
              141     687.6       200       691       290     694.4
ENDTABLE
*
```

```
------------------------------80/80 LIST OF INPUT DATA--------------------------------
*         *** [ SEE ALSO LINDLEY SC MODEL FOR LOMR 97-05-053P  ] ***
*         *** [ FOR MORE DETAILED DATA ABOVE HERE (APPX I-55)  ] ***
*
CULV1     13SMD            1     41111
CULV2             6        6       292     694.2     694.2      0.02
SECTION   13SMD
                0     702.9       100     703.9       200     705.6
              300       707       400     708.5       500     709.3
              600     709.7       700     709.6       800     709.2
              900     708.4      1000     708.1      1100     707.5
             1200     706.2      1300     705.8      1400     706.1
             1500       707      1600     708.3      1700     709.9
             1800     712.6      1900     715.8
ENDTABLE
SEGMENT   SMD13            1         D         60
NVALUE        0.08
SEGMENT   SMD13            2         C        100
NVALUE       0.065
SEGMENT   SMD13            3         D        400
NVALUE        0.08
SECTION   SMD13
                0     712.7        20       708        30     705.9
               60     700.5        78     696.8        81       696
               84     695.6        87     695.9        88     696.8
               89     697.5       100     699.1       150     704.1
              200     708.9       250     711.4       300     711.9
              350     712.4       400     714.7
ENDTABLE
SEGMENT   SMD18            1         D        290
NVALUE        0.07
SEGMENT   SMD18            2         C        330
NVALUE        0.05
SEGMENT   SMD18            3         D        600
NVALUE       0.075
SECTION   SMD18
                0       726        40       724       140       722
              200       720       290       718       300       714
              308     709.8       318     709.8       330       716
              450       718       470       720       510       722
              600       726
ENDTABLE
SEGMENT   SMD26            1         D        268
NVALUE       0.075
SEGMENT   SMD26            2         C        283
NVALUE        0.05
```

```
------------------------------80/80 LIST OF INPUT DATA-------------------------------
SEGMENT   SMD26            3        D        750
NVALUE        0.07
SECTION   SMD26
                0     738.8        40     736.8        80     733.4
              110     732.1       160     731.1       268     730.1
              274     728.3       275     727.6       277     727.6
              279     728.3       283     729.9       300     729.9
              350     730.3       400     730.3       450       730
              465     729.6       475     729.9       500     730.2
              600     732.9       700     738.5       750     740.5
ENDTABLE
COMPUTE   SMD03     SMD26       SM027
------------------------------END OF 80/80 LIST-------------------------------
```

□

```
                  COMPUTE   SMD03     SMD26       SM027

-----------------------------STARTING DATA FROM PREVIOUS COMPUTATIONS-------------------------------
```

RATING TABLE FOR SECTION SMD03 Given DA= 5.1

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	FREQUENCY (YEARS)	CRIT ELEV	FRICTION SLOPE
0	665.6	0.0	0.0						
ZERO DAMG	668.5	41.1	267.9	.00	.00	.00			

*****WARNING-BANKFULL OR ZERO DAMAGE ELEV BELOW FIRST PROFILE. FLOW INTERPOLATED LINEARLY FROM CHANNEL BOTTOM*****

BANK FULL	668.7	63.5	286.4	.00	.00	.00			

*****WARNING-BANKFULL OR ZERO DAMAGE ELEV BELOW FIRST PROFILE. FLOW INTERPOLATED LINEARLY FROM CHANNEL BOTTOM*****

1	669.4	248.0	352.9	.00	.00	.00	5.00	668.8	.00498
2	669.8	382.4	478.8	.00	.00	.00	10.00	669.0	.00321
3	669.9	465.2	625.3	.00	.00	.00	25.00	669.2	.00370
4	670.3	682.8	923.1	.00	.00	.00	100.00	669.3	.00347

SEGMENT TABLE FOR SECTION SMD03

CSM		TOTAL	SEG NO 1	2	3
			D	C	D
1	DISCHARGE CFS	352.88	31.	191.	131.
69.	VELOCITY FPS	2.53	.79	2.95	.91
2	DISCHARGE CFS	478.84	58.	206.	214.
94.	VELOCITY FPS	1.98	.77	2.78	.92
3	DISCHARGE CFS	625.30	92.	242.	292.
122.	VELOCITY FPS	2.13	.96	3.07	1.00
4	DISCHARGE CFS	923.06	173.	298.	453.
180.	VELOCITY FPS	2.10	1.16	3.30	1.02
1	ELEV 669.4 KD	4773.	274.	2924.	1576.
2	ELEV 669.8 KD	8348.	970.	3687.	3691.
3	ELEV 669.9 KD	10222.	1407.	4073.	4742.
4	ELEV 670.3 KD	15621.	2862.	5102.	7657.

*****SECT.SMD10 KD VALUES REVERSED ON SEGMENT 2 AT ELEVATION 685.90 VALUE CHANGED TO EQUAL PREVIOUS VALUE*****

RATING TABLE FOR SECTION SMD10 Given DA= 3.5

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	FREQUENCY (YEARS)	CRIT ELEV	FRICTION SLOPE
0	683.9	0.0	0.0						
BANK FULL	687.0	73.2	209.1	.00	.00	.00			
*****WARNING-BANKFULL OR ZERO DAMAGE ELEV BELOW FIRST PROFILE. FLOW INTERPOLATED LINEARLY FROM CHANNEL BOTTOM*****									
ZERO DAMG	687.0	73.2	209.1	.00	.00	.00			
*****WARNING-BANKFULL OR ZERO DAMAGE ELEV BELOW FIRST PROFILE. FLOW INTERPOLATED LINEARLY FROM CHANNEL BOTTOM*****									
1	687.7	125.5	253.7	8.14	.00	.00	5.00	686.5	.00431
2	688.0	161.0	344.0	8.97	.00	.00	10.00	686.7	.00417
3	688.3	191.8	449.5	9.49	.00	.00	25.00	687.0	.00450
4	688.8	254.4	661.3	10.33	.00	.00	100.00	687.5	.00453

SEGMENT TABLE FOR SECTION SMD10

CSM		TOTAL	SEG NO 1	2	3
			D	C	D
1	DISCHARGE CFS	253.71	0.	241.	12.
72.	VELOCITY FPS	2.20	.78	2.21	.77
2	DISCHARGE CFS	344.05	1.	314.	28.
98.	VELOCITY FPS	2.37	.76	2.44	.93
3	DISCHARGE CFS	449.52	3.	396.	51.
128.	VELOCITY FPS	2.63	.96	2.74	1.15
4	DISCHARGE CFS	661.33	6.	548.	107.
188.	VELOCITY FPS	2.93	1.23	3.13	1.45
1	ELEV 687.7 KD	3823.	4.	3702.	116.
2	ELEV 688.0 KD	5281.	16.	4890.	376.
3	ELEV 688.3 KD	6673.	34.	5936.	704.
4	ELEV 688.8 KD	9807.	90.	8166.	1551.

*****SECT.SMD13 KD VALUES REVERSED ON SEGMENT 1 AT ELEVATION 701.20 VALUE CHANGED TO EQUAL PREVIOUS VALUE*****

ROAD SECTION 13SMD

NO.	HW	CFS	HL	TW	CSM
0	694.20	0.00	0.00	0.00	0.00
1	701.10	230.07	3.46	697.64	5.00
2	703.17	311.94	5.26	697.91	10.00
3	703.72	407.62	5.55	698.17	25.00
4	704.19	599.10	5.55	698.64	100.00

MIN ROAD ELEVATION 702.90

OPENING NO.	NO. CULVERTS	CULV. CODE	HEIGHT OR DIAM	WIDTH	LENGTH	U/S INVERT	D/S INVERT	(N) COEFF
1	1	41111.	6.00	6.00	292.00	694.20	694.20	.020

RATING TABLE FOR SECTION SMD13 Given DA= 3.1

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	FREQUENCY (YEARS)	CRIT ELEV	FRICTION SLOPE
0	695.6	0.0	0.0						
BANK FULL	699.1	54.7	143.9	.00	.00	.00			
*****WARNING-BANKFULL OR ZERO DAMAGE ELEV BELOW FIRST PROFILE. FLOW INTERPOLATED LINEARLY FROM CHANNEL BOTTOM*****									
ZERO DAMG	699.1	54.7	143.9	.00	.00	.00			
*****WARNING-BANKFULL OR ZERO DAMAGE ELEV BELOW FIRST PROFILE. FLOW INTERPOLATED LINEARLY FROM CHANNEL BOTTOM*****									
1	701.2	156.7	230.1	.52	.00	.00	5.00	698.4	.00105
2	703.2	318.9	311.9	.77	.00	.00	10.00	698.8	.00032
3	703.7	373.7	407.6	.84	.00	.00	25.00	699.1	.00037
4	704.2	427.5	599.1	.90	.00	.00	100.00	699.7	.00057

SEGMENT TABLE FOR SECTION SMD13

CSM		TOTAL	SEG NO 1	2	3
			D	C	D
1	DISCHARGE CFS	230.07	0.	217.	13.
73.	VELOCITY FPS	1.58	.34	1.62	.59
2	DISCHARGE CFS	311.94	8.	261.	43.
99.	VELOCITY FPS	1.14	.39	1.22	.51
3	DISCHARGE CFS	407.62	14.	329.	64.
129.	VELOCITY FPS	1.29	.47	1.40	.59
4	DISCHARGE CFS	599.10	25.	469.	105.
190.	VELOCITY FPS	1.67	.64	1.84	.79
1	ELEV 701.2 KD	7090.	14.	6678.	398.
2	ELEV 703.2 KD	17403.	423.	14608.	2372.
3	ELEV 703.7 KD	21233.	701.	17207.	3325.
4	ELEV 704.2 KD	24992.	1015.	19647.	4330.

RATING TABLE FOR SECTION SMD18 Given DA= 2.4

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	FREQUENCY (YEARS)	CRIT ELEV	FRICTION SLOPE
0	709.8	0.0	0.0						
1	713.0	52.7	183.7	.00	.00	.00	5.00	711.7	.00485
2	713.7	68.6	249.0	.00	.00	.00	10.00	712.1	.00431
3	714.4	87.2	325.5	.00	.00	.00	25.00	712.5	.00385
4	715.3	114.0	477.3	.00	.00	.00	100.00	713.1	.00405

SEGMENT TABLE FOR SECTION SMD18

CSM		TOTAL	SEG NO 1	SEG NO 2	SEG NO 3
			D	C	D
1	DISCHARGE CFS	183.73	0.	184.	0.
75.	VELOCITY FPS	3.49	.00	3.48	.00
2	DISCHARGE CFS	249.01	0.	249.	0.
102.	VELOCITY FPS	3.64	.00	3.63	.00
3	DISCHARGE CFS	325.50	0.	326.	0.
133.	VELOCITY FPS	3.74	.00	3.73	.00
4	DISCHARGE CFS	477.30	0.	477.	0.
196.	VELOCITY FPS	4.19	.00	4.19	.00
1	ELEV 713.0 KD	2639.	1.	2637.	1.
2	ELEV 713.7 KD	3792.	1.	3790.	1.
3	ELEV 714.4 KD	5244.	1.	5242.	1.
4	ELEV 715.3 KD	7501.	1.	7499.	1.

RATING TABLE FOR SECTION SMD26 Given DA= 1.7

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	FREQUENCY (YEARS)	CRIT ELEV	FRICTION SLOPE
0	727.6	0.0	0.0						
ZERO DAMG	729.6	13.9	95.8	.00	.00	.00			
*****WARNING-BANKFULL OR ZERO DAMAGE ELEV BELOW FIRST PROFILE. FLOW INTERPOLATED LINEARLY FROM CHANNEL BOTTOM*****									
BANK FULL	729.9	24.2	110.1	14.50	.00	.00			
*****WARNING-BANKFULL OR ZERO DAMAGE ELEV BELOW FIRST PROFILE. FLOW INTERPOLATED LINEARLY FROM CHANNEL BOTTOM*****									
1	730.4	121.7	136.4	17.96	.00	.00	5.00	730.0	.00398
2	730.6	150.9	184.8	21.76	.00	.00	10.00	730.1	.00395
3	730.8	211.3	241.7	23.77	.00	.00	25.00	730.2	.00328
4	731.0	289.2	353.3	26.02	.00	.00	100.00	730.3	.00300

SEGMENT TABLE FOR SECTION SMD26

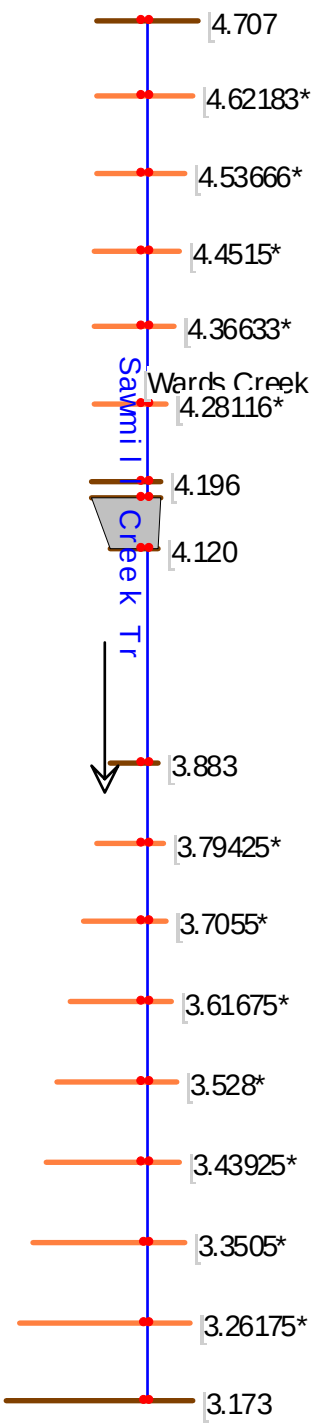
CSM		TOTAL	SEG NO 1	2	3
			D	C	D
1	DISCHARGE CFS	136.42	5.	61.	70.
78.	VELOCITY FPS	1.95	.50	2.35	.82
2	DISCHARGE CFS	184.78	7.	76.	101.
106.	VELOCITY FPS	1.90	.56	2.71	.92
3	DISCHARGE CFS	241.66	19.	73.	150.
139.	VELOCITY FPS	1.76	.67	2.37	.98
4	DISCHARGE CFS	353.28	35.	85.	233.
203.	VELOCITY FPS	1.71	.74	2.48	1.12
1	ELEV 730.4 KD	1854.	41.	1073.	741.
2	ELEV 730.6 KD	2891.	111.	1225.	1555.
3	ELEV 730.8 KD	4117.	228.	1421.	2468.
4	ELEV 731.0 KD	6291.	512.	1691.	4088.

----------80/80 LIST OF INPUT DATA----------

```
ENDJOB
```

**********NORMAL END OF JOB----------

Plan 01: FIS-Base Model



WardsCreekCulvert.rep

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X             X      X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: WardsCreekCulvert
Project File : WardsCreekCulvert.prj
Run Date and Time: 9/10/2014 4:58:55 PM

Project in English units

Project Description:
Hydraulic Analysis of Culvert Carrying Interstate 55 over Wards Creek

****

PLAN DATA

Plan Title: FIS-Base Model
Plan File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec_ras\WardsCreekCulvert.p01

Geometry Title: FIS_Base Model Geometry
Geometry File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec_ras\WardsCreekCulvert.g01

Flow Title   : FIS_Flow Data
Flow File   : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec_ras\WardsCreekCulvert.f01

Plan Description:
FEMA FIS Base Model converted from WSP2 data.

Geometry and flow data taken
from 1975 WSP2 model cited by ISWS as the regulatory model titled:
"SAWMILL
CREEK TRIB TO DOWNERS GROVE (WARDS CREEK)".

Manning's n value of channel and
overbanks adjusted to calibrate the resulting water surface elevation.

Plan Summary Information:
Number of: Cross Sections =   18   Multiple Openings =   0
            Culverts   =   1   Inline Structures =   0
            Bridges   =   0   Lateral Structures =   0

Computational Information
    Water surface calculation tolerance = 0.01
    Critical depth calculation tolerance = 0.05
    Maximum number of iterations   = 20
    Maximum difference tolerance   = 0.3
    Flow tolerance factor   = 0.001

Computation Options
    Critical depth computed at all cross sections
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method: Average Conveyance

WardsCreekCulvert.rep

Computational Flow Regime: Subcritical Flow

****

FLOW DATA

Flow Title: FIS_Flow Data
Flow File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec_ras\WardsCreekCulvert.f01

Flow Data (cfs)

River	Reach	RS	10-Year	50-Year	100-Year	500-Year
Sawmill Creek Tr	Wards Creek	4.707	249.01	400	477.3	690
Sawmill Creek Tr	Wards Creek	4.196	311.94	480	599.1	850
Sawmill Creek Tr	Wards Creek	3.883	344.05	550	661.33	905
Sawmill Creek Tr	Wards Creek	3.173	478.84	775	923.06	1290

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Sawmill Creek Tr	Wards Creek	10-Year		Known WS = 669.8
Sawmill Creek Tr	Wards Creek	50-Year		Known WS = 670.2
Sawmill Creek Tr	Wards Creek	100-Year		Known WS = 670.3
Sawmill Creek Tr	Wards Creek	500-Year		Known WS = 670.7

****

GEOMETRY DATA

Geometry Title: FIS_Base Model Geometry
Geometry File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec_ras\WardsCreekCulvert.g01

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.707

INPUT
Description: FIS Station SMD18
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	726	40	724	140	722	200	720	290	718
300	714	308	709.8	318	709.8	330	716	450	718
470	720	510	722	600	726				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	290	.055	330	.075

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
290	330	433.33	450	433.33	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.62183*

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	723.78	34.71	721.79	83.89	720.39	121.49	719.35	125.83	719.18
173.56	717.31	251.67	715.08	262.22	711.29	265.92	709.6	268.29	708.48
270.67	707.43	279	707.43	281.38	708.45	282.17	708.92	282.96	709.36

```
  291.67  713.18   337.5  714.64  383.33  716.07  413.89  716.76  429.17  718.15
  434.26  718.58     475  720.32  520.83  722.07  566.67  724.12

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*************************************************************
       0    .072  251.67    .057  291.67    .076  566.67    .076

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        251.67  291.67           433.33     450  433.33             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.53666*

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0  721.57   29.43  719.59   71.11  717.91  102.99  716.71  106.67  716.52
  147.13  714.62  213.33  712.17  224.44  708.59  228.33  707.04  230.83  705.99
  233.33  705.07     240  705.07   242.5  705.94  243.33   706.5  244.17  706.99
  253.33  710.37     300  712.53  346.67  714.63  377.78  715.52  393.33   716.8
  398.52  717.15     440  718.63  486.67  720.13  533.33  722.23

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*************************************************************
       0    .073  213.33    .058  253.33    .077  533.33    .077

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        213.33  253.33           433.33     450  433.33             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.4515*

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0  719.35   24.14  717.38   58.33  715.43   84.48  714.06    87.5  713.87
  120.69  711.93     175  709.25  186.67  705.88  190.75  704.48  193.38  703.49
     196   702.7     201   702.7  203.62  703.43   204.5  704.07  205.38  704.62
     215  707.55   262.5  710.42     310   713.2  341.67  714.28   357.5  715.45
  362.78  715.73     405  716.95   452.5   718.2     500  720.35

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*************************************************************
       0    .075     175     .06     215    .078     500    .078

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           175     215           433.33     450  433.33             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.36633*

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0  717.13   18.85  715.17   45.56  712.96   65.98  711.41   68.33  711.21
```

94.25	709.23	136.67	706.33	148.89	703.17	153.17	701.92	155.92	700.99
158.67	700.33	162	700.33	164.75	700.92	165.67	701.65	166.58	702.25
176.67	704.73	225	708.32	273.33	711.77	305.56	713.04	321.67	714.1
327.04	714.3	370	715.27	418.33	716.27	466.67	718.47		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.077	136.67	.062	176.67	.078	466.67	.078

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
136.67	176.67	433.33	450	433.33	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.28116*

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	714.92	13.56	712.96	32.78	710.48	47.47	708.76	49.17	708.56
67.82	706.54	98.33	703.42	111.11	700.47	115.58	699.36	118.46	698.5
121.33	697.97	123	697.97	125.88	698.41	126.83	699.22	127.79	699.87
138.33	701.92	187.5	706.21	236.67	710.33	269.44	711.81	285.83	712.75
291.3	712.88	335	713.58	384.17	714.33	433.33	716.58		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.078	98.33	.063	138.33	.079	433.33	.079

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
98.33	138.33	433.33	450	433.33	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.196

INPUT
Description: FIS Station SMD13
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	712.7	20	708	30	705.9	60	700.5	78	696.8
81	696	84	695.6	87	695.9	88	696.8	89	697.5
100	699.1	150	704.1	200	708.9	250	711.4	300	711.9
350	712.4	400	714.7						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	60	.065	100	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	100	350	108	350	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.175

INPUT
Description: FIS Station SMD13 (Copy) - Upstream Face
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	711.3	20	706.6	30	704.5	60	699.1	78	695.4
81	694.6	84	694.2	87	694.5	88	695.4	89	696.1
100	697.7	150	702.7	200	707.5	250	710	300	710.5
350	711	400	713.3						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	60	.065	100	.08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

60	100		293	293	293	.1	.3

CULVERT

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.148

INPUT
Description: FIS Station 13SMD (Interstate 55 Culvert)
Distance from Upstream XS = .5
Deck/Roadway Width = 292
Weir Coefficient = 2.7
Upstream Deck/Roadway Coordinates
num= 20

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	702.9	0	100	703.9	0	200	705.6	0
300	707	0	400	708.5	0	500	709.3	0
600	709.7	0	700	709.6	0	800	709.2	0
900	708.4	0	1000	708.1	0	1100	707.5	0
1200	706.2	0	1300	705.8	0	1400	706.1	0
1500	707	0	1600	708.3	0	1700	709.9	0
1800	712.6	0	1900	715.8	0			

Upstream Bridge Cross Section Data
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	711.3	20	706.6	30	704.5	60	699.1	78	695.4
81	694.6	84	694.2	87	694.5	88	695.4	89	696.1
100	697.7	150	702.7	200	707.5	250	710	300	710.5
350	711	400	713.3						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	60	.065	100	.08

Bank Sta: Left Right Coeff Contr. Expan.

60	100	.1	.3

Downstream Deck/Roadway Coordinates
num= 20

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	702.9	0	100	703.9	0	200	705.6	0
300	707	0	400	708.5	0	500	709.3	0
600	709.7	0	700	709.6	0	800	709.2	0
900	708.4	0	1000	708.1	0	1100	707.5	0
1200	706.2	0	1300	705.8	0	1400	706.1	0
1500	707	0	1600	708.3	0	1700	709.9	0
1800	712.6	0	1900	715.8	0			

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	710.1	17	709.4	25	704.8	39	698	42	697.6
60	696.2	86	696.1	87	694.4	90	694.2	92	694.2
97	695.1	100	697.3	141	697.9	200	701.3	290	704.7

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .08      42    .065     100     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
            42     100             .1       .3

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   702.9
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1           Box       6       6
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                 .5     292      .02      .02        0                   .4                1
Upstream   Elevation =  694.2
           Centerline Station =  84
Downstream Elevation =  694.2
           Centerline Station =  91

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.120

INPUT
Description: FIS Station SMD10 (Copy) - Downstream Face
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   710.1      17   709.4      25   704.8      39     698      42   697.6
      60   696.2      86   696.1      87   694.4      90   694.2      92   694.2
      97   695.1     100   697.3     141   697.9     200   701.3     290   704.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .08      42    .065     100     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            42     100          1149.99 1250.01 1149.99             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 3.883

INPUT
Description: FIS Station SMD10
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   699.8      17   699.1      25   694.5      39   687.7      42   687.3
      60   685.9      86   685.8      87   684.1      90   683.9      92   683.9
      97   684.8     100     687     141   687.6     200     691     290   694.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .08      42     .07     100     .08
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            42     100              450  468.75     450             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 3.79425*

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0  696.95   13.26  696.29   26.53  695.67   28.13  695.61   39.79  691.84
   41.37  691.36   53.05  688.34   64.54  685.34    69.5  684.97   86.19  683.64
    96.2  683.54  107.33  683.36  110.29  683.32  111.22  681.82     114  681.61
  115.75  681.61  118.75  682.11  120.75  682.52  122.75   683.9  123.75  684.79
  160.08  685.02  181.47  685.24   193.1  685.68  226.13  687.01  259.15  688.19
  264.54  688.39  292.18  689.07   325.2  690.01  358.23  691.05  391.25  692.36

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*************************************************************
       0     .08    69.5    .069  123.75     .08  391.25     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          69.5  123.75              450  468.75     450             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 3.7055*

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   694.1   18.51   693.1   37.02   692.2   39.26  692.11   55.53  688.64
   57.74  688.22   74.05   685.6   90.07  682.99      97  682.65  112.38  681.38
   121.6  681.22  131.85  680.91  134.58  680.83  135.44  679.54     138  679.33
   139.5  679.33   142.5  679.78   144.5  680.24   146.5  681.53   147.5  682.58
  194.35  682.66  221.95  682.89  236.94  683.28  279.54   684.6  322.13  685.61
  329.08  685.79  364.72  686.41  407.31   687.4  449.91  688.59   492.5  690.33

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*************************************************************
       0     .08      97    .069   147.5     .08   492.5     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            97   147.5              450  468.75     450             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 3.61675*

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0  691.25   23.76  689.92   47.52  688.74   50.39  688.62   71.28  685.43
   74.11  685.08   95.04  682.87  115.61  680.63   124.5  680.33  138.56  679.12
     147   678.9  156.38  678.46  158.88  678.35  159.66  677.26     162  677.04
  163.25  677.04  166.25  677.45  168.25  677.96  170.25  679.15  171.25  680.36
  228.63   680.3  262.42  680.53  280.79  680.88  332.95  682.18  385.11  683.02
  393.62  683.18  437.27  683.74  489.43  684.78  541.59  686.12  593.75  688.29
```

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	124.5	.068	171.25	.08	593.75	.08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Coeff Contr.	Expan.
124.5	171.25	450	468.75	450	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 3.528*

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	688.4	29.01	686.73	58.02	685.27	61.52	685.13	87.02	682.22
90.48	681.94	116.03	680.14	141.14	678.28	152	678	164.75	676.86
172.4	676.58	180.9	676.01	183.17	675.87	183.88	674.97	186	674.75
187	674.75	190	675.12	192	675.67	194	676.78	195	678.15
262.9	677.94	302.89	678.18	324.63	678.49	386.36	679.76	448.09	680.44
458.16	680.57	509.81	681.07	571.54	682.16	633.27	683.66	695	686.25

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	152	.067	195	.08	695	.08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Coeff Contr.	Expan.
152	195	450	468.75	450	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 3.43925*

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	685.55	34.26	683.55	68.51	681.8	72.65	681.64	102.77	679.02
106.85	678.8	137.02	677.4	166.68	675.92	179.5	675.67	190.94	674.6
197.8	674.26	205.43	673.55	207.46	673.38	208.09	672.69	210	672.46
210.75	672.46	213.75	672.79	215.75	673.39	217.75	674.41	218.75	675.94
297.18	675.58	343.37	675.82	368.47	676.09	439.77	677.35	511.06	677.85
522.7	677.97	582.36	678.4	653.66	679.55	724.95	681.19	796.25	684.21

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	179.5	.067	218.75	.08	796.25	.08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Coeff Contr.	Expan.
179.5	218.75	450	468.75	450	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 3.3505*

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	682.7	39.5	680.37	79.01	678.33	83.79	678.14	118.51	675.81
123.21	675.66	158.02	674.67	192.21	673.56	207	673.35	217.12	672.34

223.2	671.94	229.95	671.1	231.75	670.9	232.31	670.41	234	670.17
234.5	670.17	237.5	670.46	239.5	671.11	241.5	672.04	242.5	673.72
331.45	673.22	383.84	673.47	412.31	673.69	493.18	674.93	574.04	675.27
587.24	675.36	654.91	675.74	735.77	676.93	816.64	678.73	897.5	682.17

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	207	.066	242.5	.08	897.5	.08

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
207	242.5	450	468.75	450	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 3.26175*

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	679.85	44.75	677.18	89.5	674.87	94.92	674.65	134.26	672.61
139.58	672.52	179.01	671.93	217.75	671.21	234.5	671.03	243.31	670.08
248.6	669.62	254.48	668.65	256.04	668.42	256.53	668.13	258	667.89
258.25	667.89	261.25	668.13	263.25	668.83	265.25	669.67	266.25	671.51
365.73	670.86	424.32	671.11	456.16	671.3	546.59	672.52	637.02	672.68
651.78	672.76	727.45	673.07	817.89	674.32	908.32	676.26	998.75	680.14

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	234.5	.066	266.25	.08	998.75	.08

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
234.5	266.25	450	468.75	450	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 3.173

INPUT
Description: FIS Station SMD03
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	677	50	674	100	671.4	150	669.4	200	669.2
262	668.7	274	667.3	279	666.2	282	665.6	285	665.8
289	667.3	290	669.3	400	668.5	500	668.9	600	670.1
700	670.1	800	670.4	900	671.7	1000	673.8	1100	678.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	262	.065	290	.08

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
262	290	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Sawmill Creek Tr

Reach	River Sta.	n1	n2	n3	n4
Wards Creek	4.707	.07	.055	.075	
Wards Creek	4.62183*	.072	.057	.076	.076

WardsCreekCulvert.rep

*Wards Creek	*	4.53666*	*	.073*	.058*	.077*	.077*
*Wards Creek	*	4.4515*	*	.075*	.06*	.078*	.078*
*Wards Creek	*	4.36633*	*	.077*	.062*	.078*	.078*
*Wards Creek	*	4.28116*	*	.078*	.063*	.079*	.079*
*Wards Creek	*	4.196	*	.08*	.065*	.08*	*
*Wards Creek	*	4.175	*	.08*	.065*	.08*	*
*Wards Creek	*	4.148	*Culvert	*	*	*	*
*Wards Creek	*	4.120	*	.08*	.065*	.08*	*
*Wards Creek	*	3.883	*	.08*	.07*	.08*	*
*Wards Creek	*	3.79425*	*	.08*	.069*	.08*	.08*
*Wards Creek	*	3.7055*	*	.08*	.069*	.08*	.08*
*Wards Creek	*	3.61675*	*	.08*	.068*	.08*	.08*
*Wards Creek	*	3.528*	*	.08*	.067*	.08*	.08*
*Wards Creek	*	3.43925*	*	.08*	.067*	.08*	.08*
*Wards Creek	*	3.3505*	*	.08*	.066*	.08*	.08*
*Wards Creek	*	3.26175*	*	.08*	.066*	.08*	.08*
*Wards Creek	*	3.173	*	.08*	.065*	.08*	*

SUMMARY OF REACH LENGTHS

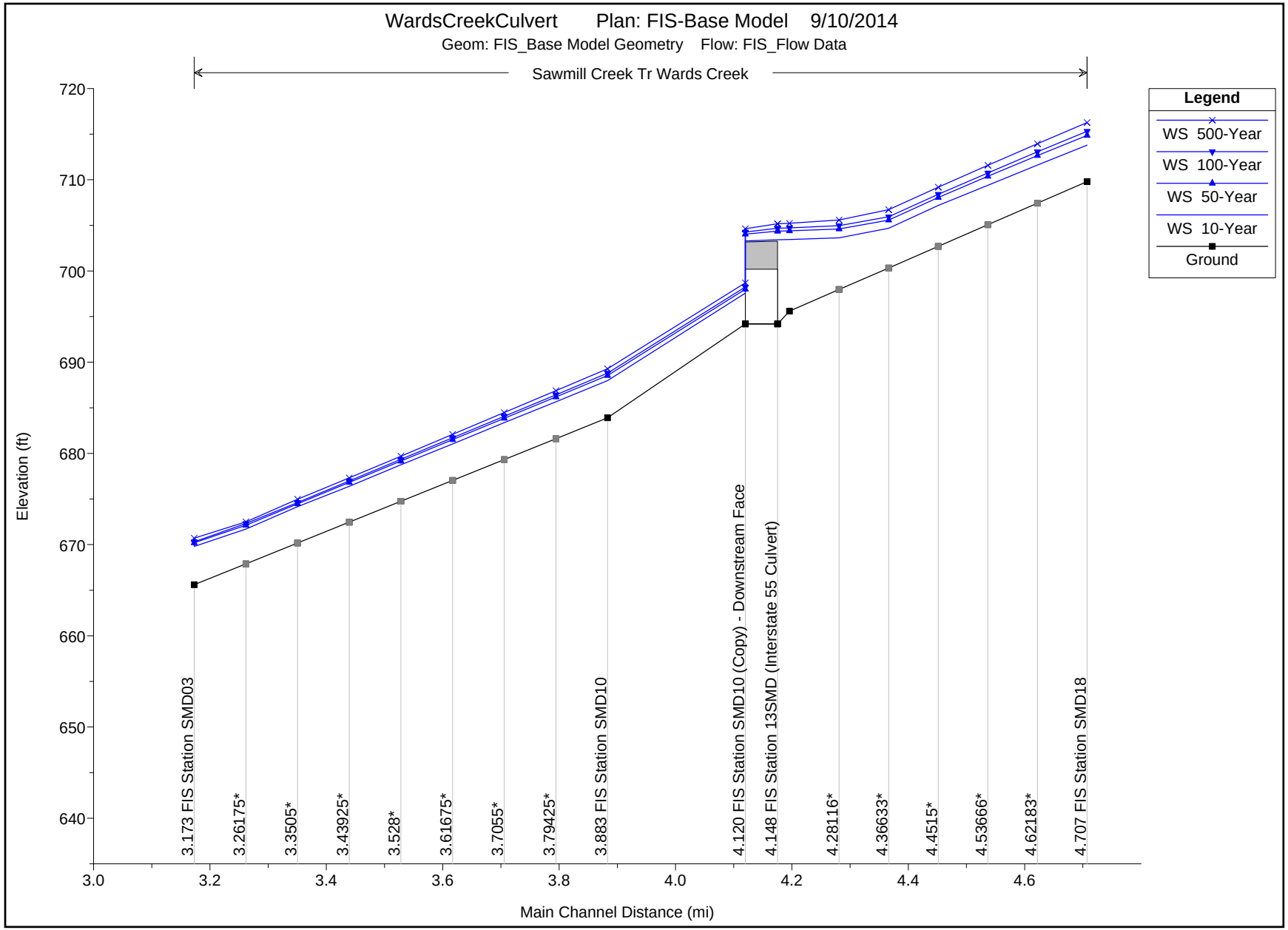
River: Sawmill Creek Tr

Reach	River Sta.	Left	Channel	Right
*Wards Creek	* 4.707	* 433.33*	450*	433.33*
*Wards Creek	* 4.62183*	* 433.33*	450*	433.33*
*Wards Creek	* 4.53666*	* 433.33*	450*	433.33*
*Wards Creek	* 4.4515*	* 433.33*	450*	433.33*
*Wards Creek	* 4.36633*	* 433.33*	450*	433.33*
*Wards Creek	* 4.28116*	* 433.33*	450*	433.33*
*Wards Creek	* 4.196	* 350*	108*	350*
*Wards Creek	* 4.175	* 293*	293*	293*
*Wards Creek	* 4.148	*Culvert *	*	*
*Wards Creek	* 4.120	* 1149.99*	1250.01*	1149.99*
*Wards Creek	* 3.883	* 450*	468.75*	450*
*Wards Creek	* 3.79425*	* 450*	468.75*	450*
*Wards Creek	* 3.7055*	* 450*	468.75*	450*
*Wards Creek	* 3.61675*	* 450*	468.75*	450*
*Wards Creek	* 3.528*	* 450*	468.75*	450*
*Wards Creek	* 3.43925*	* 450*	468.75*	450*
*Wards Creek	* 3.3505*	* 450*	468.75*	450*
*Wards Creek	* 3.26175*	* 450*	468.75*	450*
*Wards Creek	* 3.173	* 0*	0*	0*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Sawmill Creek Tr

Reach	River Sta.	Contr.	Expan.
*Wards Creek	* 4.707	* .1*	.3*
*Wards Creek	* 4.62183**	.1*	.3*
*Wards Creek	* 4.53666**	.1*	.3*
*Wards Creek	* 4.4515* *	.1*	.3*
*Wards Creek	* 4.36633**	.1*	.3*
*Wards Creek	* 4.28116**	.1*	.3*
*Wards Creek	* 4.196 *	.1*	.3*
*Wards Creek	* 4.175 *	.1*	.3*
*Wards Creek	* 4.148 *	Culvert *	*
*Wards Creek	* 4.120 *	.1*	.3*
*Wards Creek	* 3.883 *	.1*	.3*
*Wards Creek	* 3.79425**	.1*	.3*
*Wards Creek	* 3.7055* *	.1*	.3*
*Wards Creek	* 3.61675**	.1*	.3*
*Wards Creek	* 3.528* *	.1*	.3*
*Wards Creek	* 3.43925**	.1*	.3*
*Wards Creek	* 3.3505* *	.1*	.3*

```
                                                  WardsCreekCulvert.rep
*Wards Creek      *    3.26175**       .1*        .3*
*Wards Creek      *    3.173   *       .1*        .3*
**************************************************
```


WardsCreekCulvert Plan: FIS-Base Model 9/10/2014
Geom: FIS_Base Model Geometry Flow: FIS_Flow Data
Sawmill Creek Tr Wards Creek
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Elevation (ft)
720
710
700
690
680
670
660
650
640
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
Main Channel Distance (mi)
3.173 FIS Station SMD03
3.26175*
3.3505*
3.43925*
3.528*
3.61675*
3.7055*
3.79425*
3.883 FIS Station SMD10
4.120 FIS Station SMD10 (Copy) - Downstream Face
4.148 FIS Station 13SMD (Interstate 55 Culvert)
4.28116*
4.36633*
4.4515*
4.53666*
4.62183*
4.707 FIS Station SMD18

HEC-RAS Plan: 001 River: Sawmill Creek Tr Reach: Wards Creek

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)	
Wards Creek	4.707	10-Year	249.01	709.80	713.79	712.07	713.99	0.004815	3.53	70.52	25.33	0.37
Wards Creek	4.707	50-Year	400.00	709.80	714.87	712.83	715.11	0.004855	3.99	100.14	29.97	0.39
Wards Creek	4.707	100-Year	477.30	709.80	715.32	713.12	715.59	0.004887	4.18	114.07	31.96	0.39
Wards Creek	4.707	500-Year	690.00	709.80	716.28	713.86	716.62	0.005104	4.70	149.03	52.24	0.41
Wards Creek	4.196	10-Year	311.94	695.60	703.45	698.78	703.46	0.000262	1.14	342.01	99.82	0.09
Wards Creek	4.196	50-Year	480.00	695.60	704.40	699.36	704.42	0.000324	1.41	443.97	114.74	0.10
Wards Creek	4.196	100-Year	599.10	695.60	704.72	699.67	704.75	0.000412	1.64	481.94	119.91	0.11
Wards Creek	4.196	500-Year	850.00	695.60	705.24	700.31	705.29	0.000609	2.10	545.94	128.15	0.14
Wards Creek	4.175	10-Year	311.94	694.20	703.43	697.38	703.44	0.000105	0.84	494.77	121.60	0.06
Wards Creek	4.175	50-Year	480.00	694.20	704.37	697.95	704.38	0.000144	1.07	616.49	136.66	0.07
Wards Creek	4.175	100-Year	599.10	694.20	704.68	698.27	704.70	0.000189	1.26	660.25	141.54	0.08
Wards Creek	4.175	500-Year	850.00	694.20	705.18	698.91	705.21	0.000294	1.63	732.09	149.04	0.10
Wards Creek	4.148		Culvert									
Wards Creek	4.120	10-Year	311.94	694.20	697.57	696.94	697.77	0.014865	3.58	89.17	76.19	0.51
Wards Creek	4.120	50-Year	480.00	694.20	698.00	697.32	698.25	0.014297	4.14	128.29	103.66	0.53
Wards Creek	4.120	100-Year	599.10	694.20	698.25	697.60	698.53	0.013752	4.40	155.15	108.59	0.53
Wards Creek	4.120	500-Year	850.00	694.20	698.70	698.05	699.03	0.013063	4.87	206.42	117.40	0.53
Wards Creek	3.883	10-Year	344.05	683.90	687.98	686.72	688.06	0.004960	2.48	157.99	109.10	0.29
Wards Creek	3.883	50-Year	550.00	683.90	688.54	687.20	688.66	0.005077	2.92	222.56	120.04	0.31
Wards Creek	3.883	100-Year	661.33	683.90	688.80	687.42	688.93	0.005134	3.11	253.87	125.00	0.32
Wards Creek	3.883	500-Year	905.00	683.90	689.28	687.85	689.44	0.005241	3.47	317.05	134.45	0.33
Wards Creek	3.173	10-Year	478.84	665.60	669.80	669.25	669.84	0.003277	2.43	397.79	435.00	0.26
Wards Creek	3.173	50-Year	775.00	665.60	670.20	669.49	670.25	0.003750	2.85	591.72	603.34	0.29
Wards Creek	3.173	100-Year	923.06	665.60	670.30	669.61	670.36	0.004207	3.08	653.83	639.16	0.30
Wards Creek	3.173	500-Year	1290.00	665.60	670.70	669.76	670.75	0.003221	2.92	926.64	705.58	0.27

HEC-RAS Plan: 001 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.707	10-Year	713.99	713.79	0.19	2.19	0.00		249.01		25.33
Wards Creek	4.707	50-Year	715.11	714.87	0.25	2.22	0.00		400.00		29.97
Wards Creek	4.707	100-Year	715.59	715.32	0.27	2.25	0.00		477.30		31.96
Wards Creek	4.707	500-Year	716.62	716.28	0.34	2.33	0.01		689.14	0.86	52.24
Wards Creek	4.196	10-Year	703.46	703.45	0.02	0.03	0.00	9.28	255.21	47.46	99.82
Wards Creek	4.196	50-Year	704.42	704.40	0.03	0.04	0.00	21.76	368.88	89.35	114.74
Wards Creek	4.196	100-Year	704.75	704.72	0.03	0.05	0.00	30.36	450.83	117.91	119.91
Wards Creek	4.196	500-Year	705.29	705.24	0.05	0.07	0.01	50.21	618.64	181.14	128.15
Wards Creek	4.175	10-Year	703.44	703.43	0.01			16.35	233.13	62.46	121.60
Wards Creek	4.175	50-Year	704.38	704.37	0.01			32.42	337.65	109.92	136.66
Wards Creek	4.175	100-Year	704.70	704.68	0.02			43.50	413.06	142.54	141.54
Wards Creek	4.175	500-Year	705.21	705.18	0.03			68.38	568.04	213.59	149.04
Wards Creek	4.148		Culvert								
Wards Creek	4.120	10-Year	697.77	697.57	0.20	9.67	0.03		310.43	1.51	76.19
Wards Creek	4.120	50-Year	698.25	698.00	0.26	9.56	0.04	0.44	460.38	19.18	103.66
Wards Creek	4.120	100-Year	698.53	698.25	0.28	9.56	0.05	1.65	555.03	42.41	108.59
Wards Creek	4.120	500-Year	699.03	698.70	0.33	9.55	0.05	5.37	742.09	102.55	117.40
Wards Creek	3.883	10-Year	688.06	687.98	0.09	2.32	0.00	1.09	315.74	27.22	109.10
Wards Creek	3.883	50-Year	688.66	688.54	0.12	2.35	0.00	4.30	467.24	78.46	120.04
Wards Creek	3.883	100-Year	688.93	688.80	0.13	2.37	0.00	6.47	544.51	110.35	125.00
Wards Creek	3.883	500-Year	689.44	689.28	0.16	2.42	0.00	11.98	705.98	187.04	134.45
Wards Creek	3.173	10-Year	669.84	669.80	0.04			63.80	183.12	231.92	435.00
Wards Creek	3.173	50-Year	670.25	670.20	0.05			147.29	246.78	380.93	603.34
Wards Creek	3.173	100-Year	670.36	670.30	0.06			181.16	275.63	466.27	639.16
Wards Creek	3.173	500-Year	670.75	670.70	0.05			260.98	293.63	735.39	705.58

HEC-RAS Plan: 001 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.196	10-Year	703.46	703.45	0.02	0.03	0.00	9.28	255.21	47.46	99.82
Wards Creek	4.196	50-Year	704.42	704.40	0.03	0.04	0.00	21.76	368.88	89.35	114.74
Wards Creek	4.196	100-Year	704.75	704.72	0.03	0.05	0.00	30.36	450.83	117.91	119.91
Wards Creek	4.196	500-Year	705.29	705.24	0.05	0.07	0.01	50.21	618.64	181.14	128.15
Wards Creek	4.175	10-Year	703.44	703.43	0.01			16.35	233.13	62.46	121.60
Wards Creek	4.175	50-Year	704.38	704.37	0.01			32.42	337.65	109.92	136.66
Wards Creek	4.175	100-Year	704.70	704.68	0.02			43.50	413.06	142.54	141.54
Wards Creek	4.175	500-Year	705.21	705.18	0.03			68.38	568.04	213.59	149.04
Wards Creek	4.148		Culvert								
Wards Creek	4.120	10-Year	697.77	697.57	0.20	9.67	0.03		310.43	1.51	76.19
Wards Creek	4.120	50-Year	698.25	698.00	0.26	9.56	0.04	0.44	460.38	19.18	103.66
Wards Creek	4.120	100-Year	698.53	698.25	0.28	9.56	0.05	1.65	555.03	42.41	108.59
Wards Creek	4.120	500-Year	699.03	698.70	0.33	9.55	0.05	5.37	742.09	102.55	117.40
Wards Creek	3.883	10-Year	688.06	687.98	0.09	2.32	0.00	1.09	315.74	27.22	109.10
Wards Creek	3.883	50-Year	688.66	688.54	0.12	2.35	0.00	4.30	467.24	78.46	120.04
Wards Creek	3.883	100-Year	688.93	688.80	0.13	2.37	0.00	6.47	544.51	110.35	125.00
Wards Creek	3.883	500-Year	689.44	689.28	0.16	2.42	0.00	11.98	705.98	187.04	134.45

HEC-RAS Plan: 001 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
Wards Creek	4.148 Culvert #1	10-Year	703.44	703.43	701.37	703.44	703.28	310.81	1.13	5.85	8.63	11.86
Wards Creek	4.148 Culvert #1	50-Year	704.38	704.37	704.08	704.38	703.28	340.26	139.74	6.37	9.45	12.22
Wards Creek	4.148 Culvert #1	100-Year	704.70	704.68	704.46	704.70	703.28	349.37	249.73	6.43	9.70	12.33
Wards Creek	4.148 Culvert #1	500-Year	705.21	705.18	705.03	705.21	703.28	364.46	485.54	6.47	10.12	12.51

Errors Warnings and Notes for Plan : 001

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.62183* Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.53666* Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.4515* Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.36633* Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.28116* Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.196 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.148 Profile: 10-Year Culv: Culvert #1
Warning:	During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade
	answer may not be valid.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.120 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.79425* Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.7055* Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.61675* Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.528* Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.43925* Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.3505* Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.26175* Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.

Errors Warnings and Notes for Plan : 001

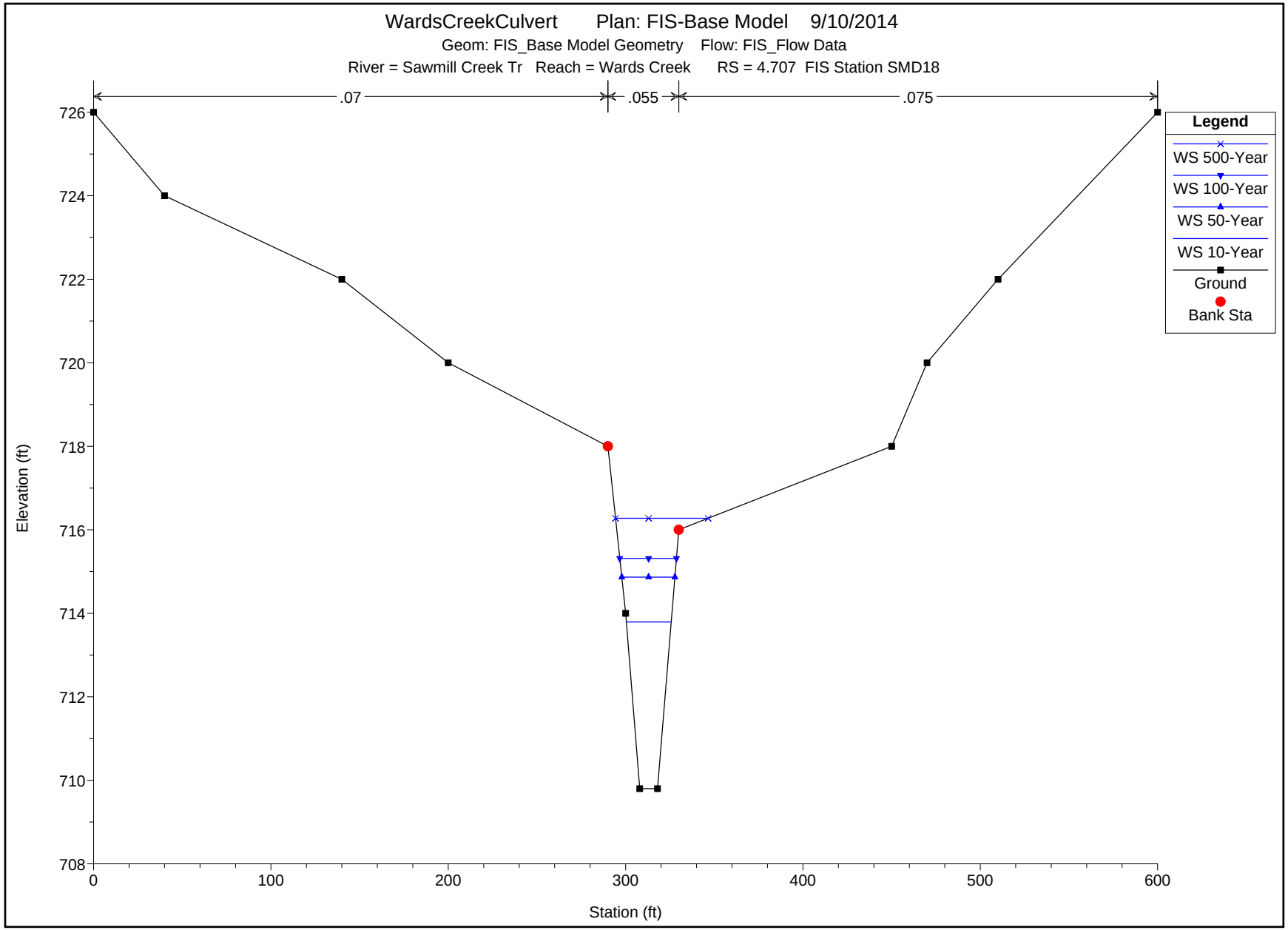
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.62183* Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.53666* Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.4515* Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.36633* Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.28116* Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.196 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.120 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.79425* Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.7055* Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.61675* Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.528* Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.43925* Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.3505* Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.26175* Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.

Errors Warnings and Notes for Plan : 001

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.62183* Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.53666* Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.4515* Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.36633* Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.28116* Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.196 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.120 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.79425* Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.7055* Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.61675* Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.528* Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.43925* Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.3505* Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.26175* Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.

Errors Warnings and Notes for Plan : 001

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.62183* Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.53666* Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.4515* Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.36633* Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.28116* Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.196 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.120 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.79425* Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.7055* Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.61675* Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.528* Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.43925* Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.3505* Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.26175* Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may
	indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for
	additional cross sections.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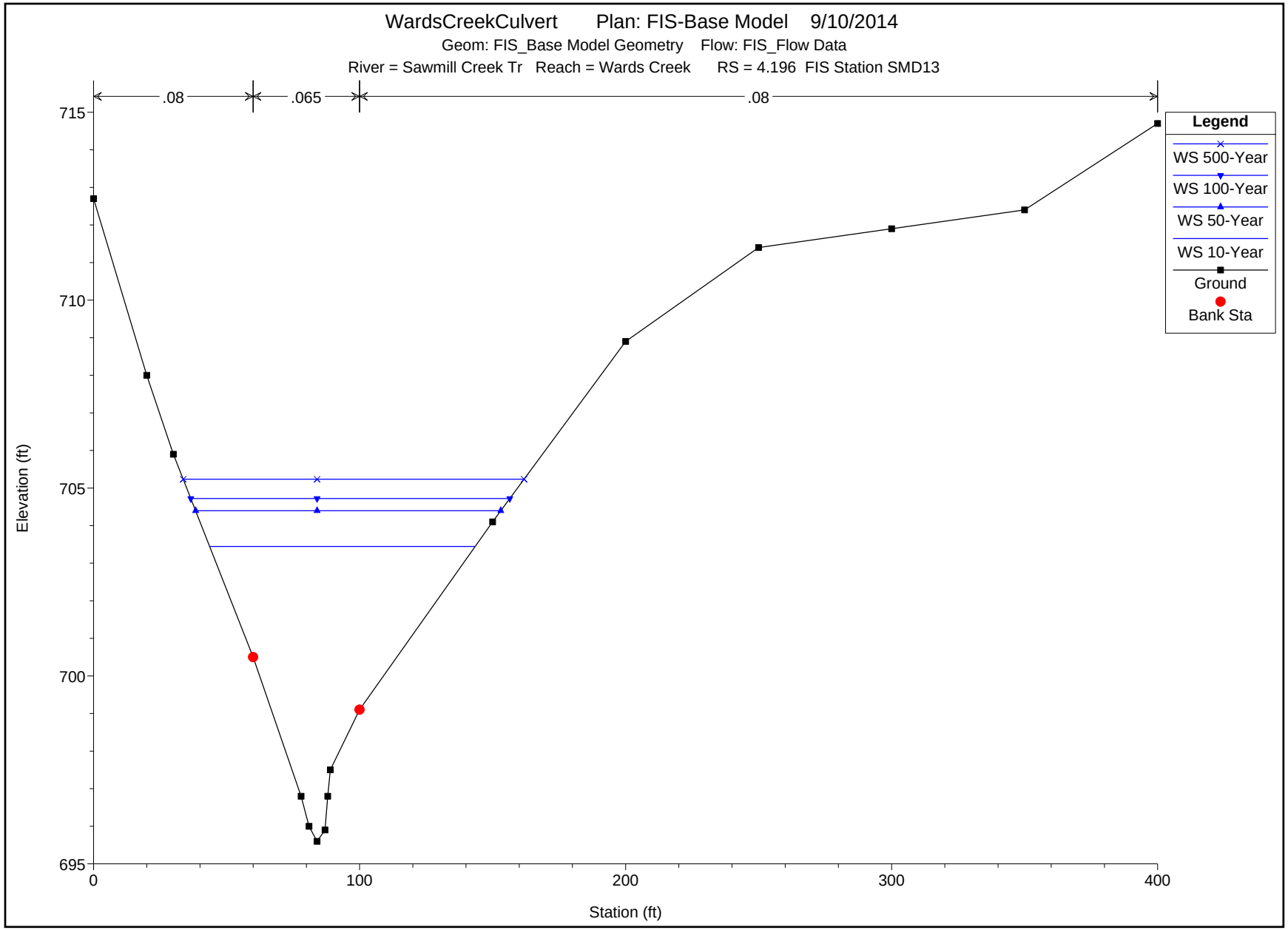
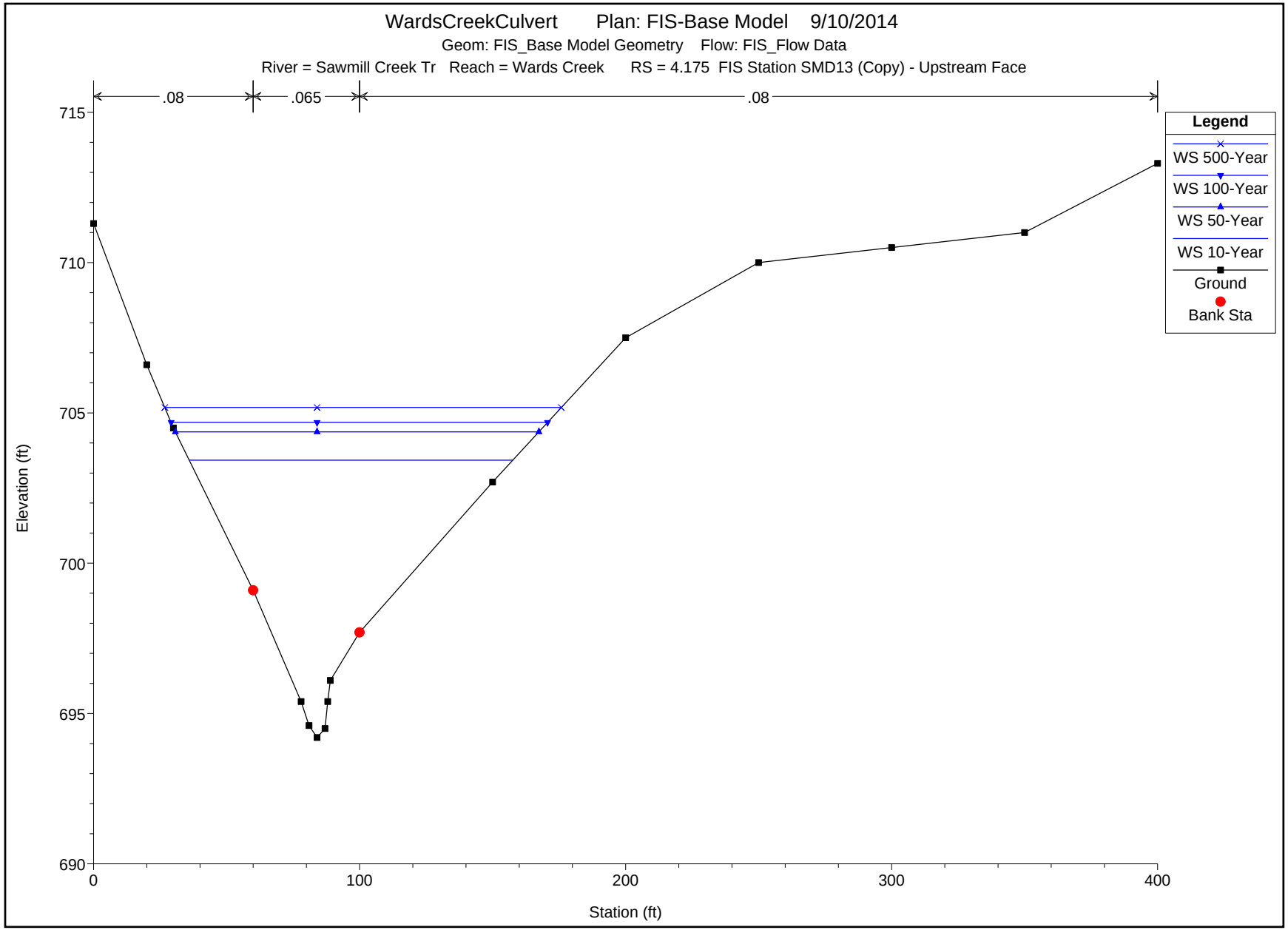
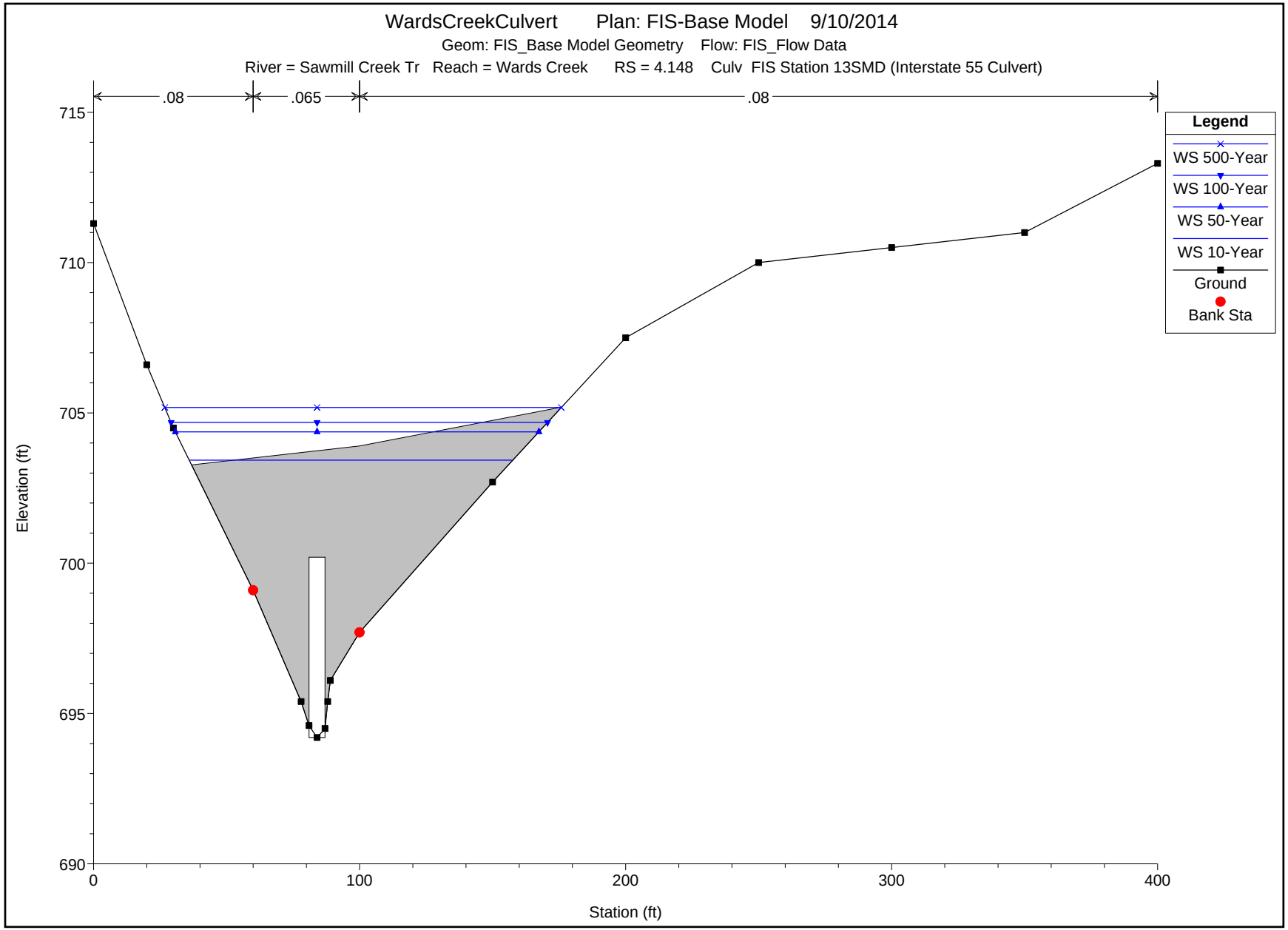
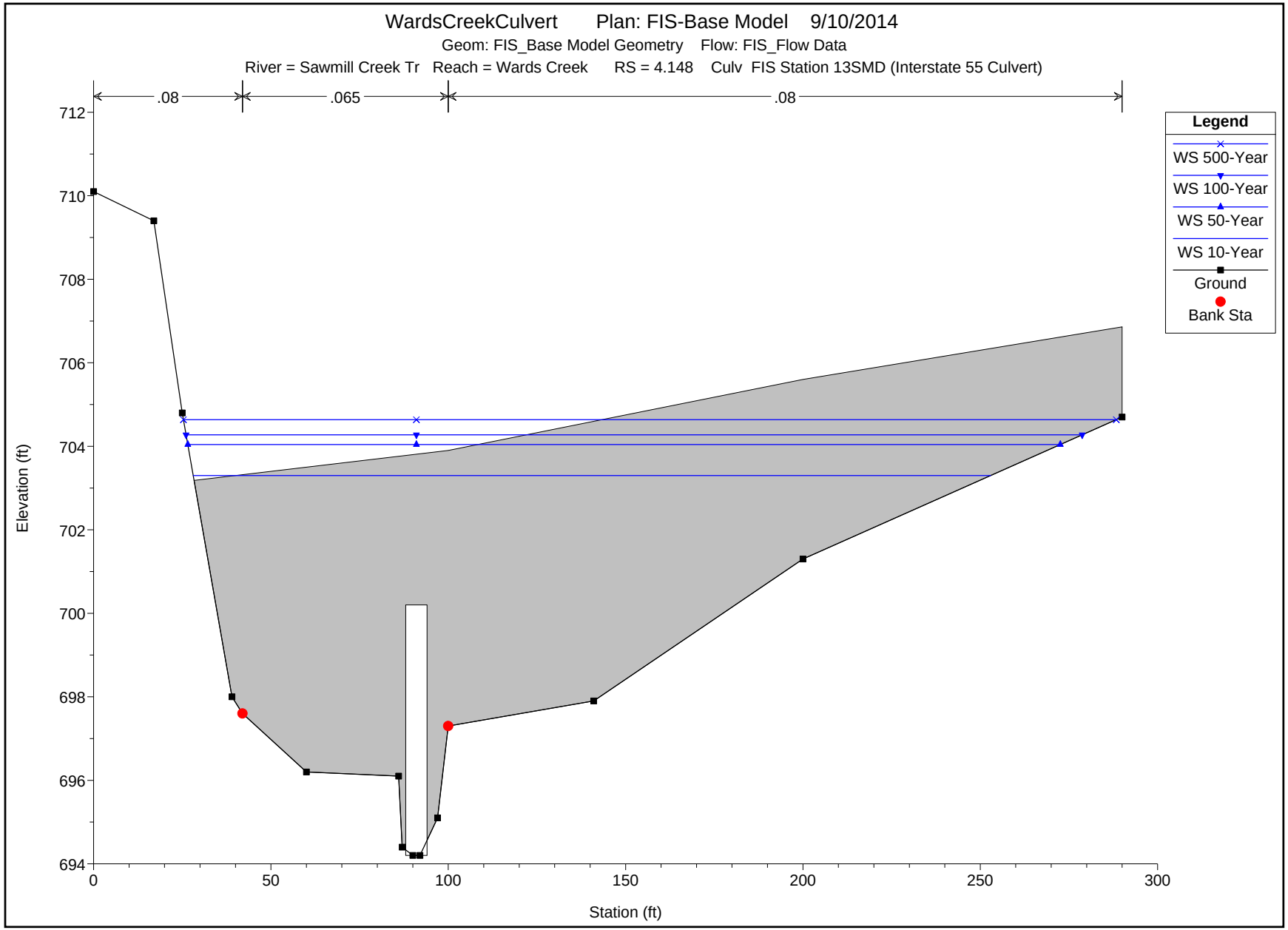
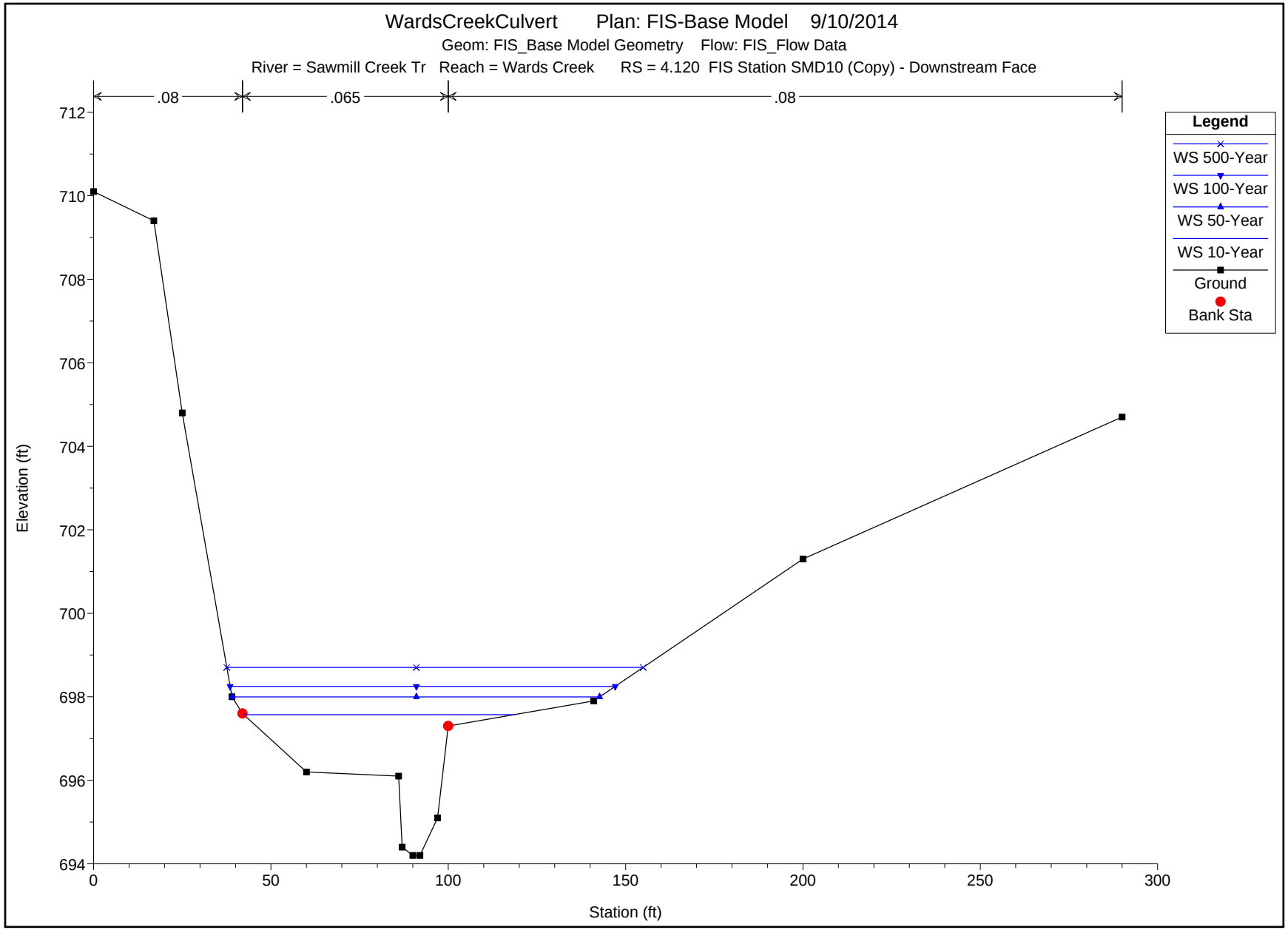
Geom: FIS_Base Model Geometry Flow: FIS_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.707 FIS Station SMD18
.07
.055
.075
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
726
724
722
720
718
716
714
712
710
708
0
100
200
300
400
500
600
Station (ft)

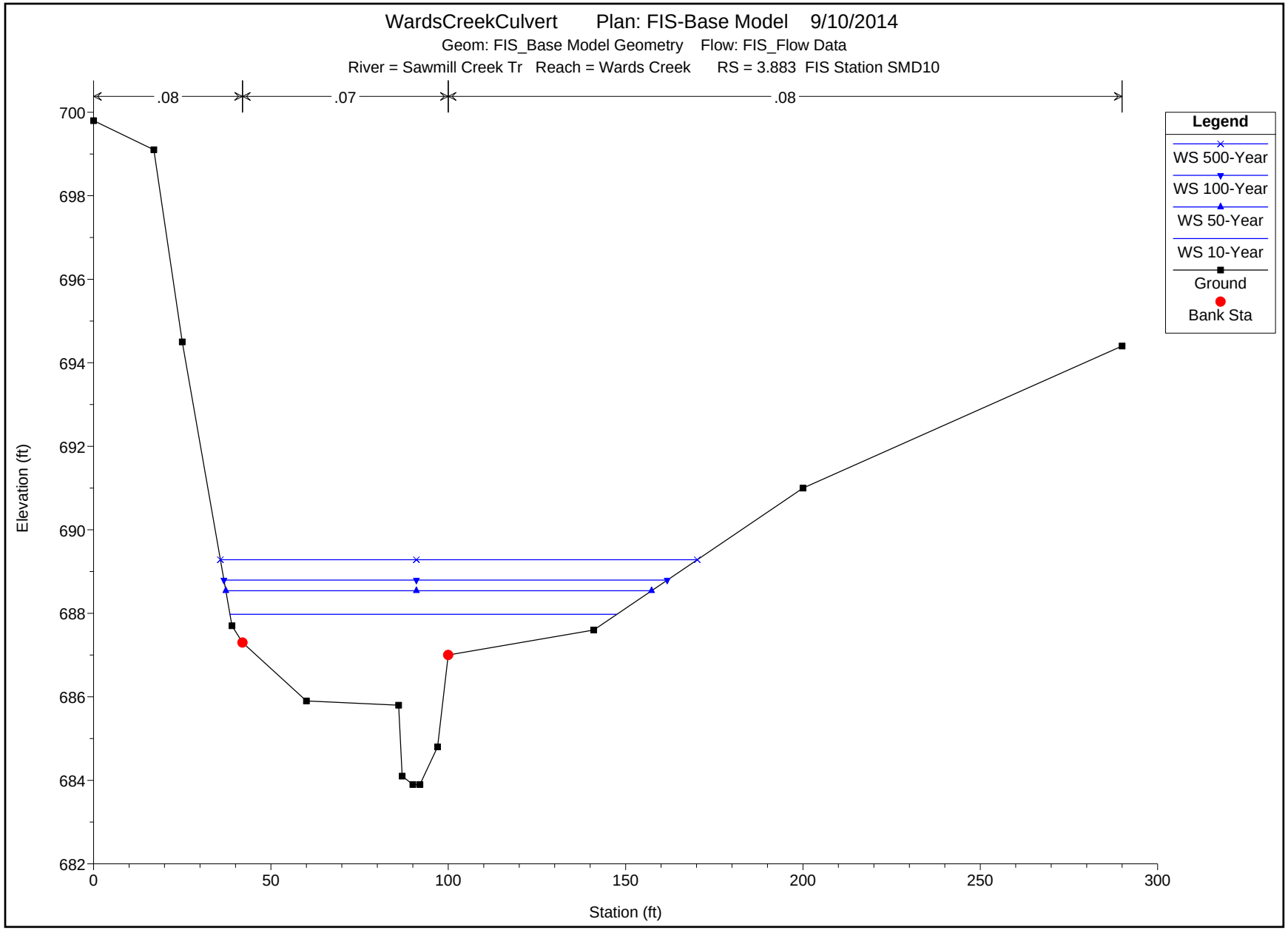

WardsCreekCulvert Plan: FIS-Base Model 9/10/2014
Geom: FIS_Base Model Geometry Flow: FIS_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.196 FIS Station SMD13
.08
.065
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
715
710
705
700
695
0
100
200
300
400
Station (ft)


WardsCreekCulvert Plan: FIS-Base Model 9/10/2014
Geom: FIS_Base Model Geometry Flow: FIS_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.175 FIS Station SMD13 (Copy) - Upstream Face
.08
.065
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
715
710
705
700
695
690
0
100
200
300
400
Station (ft)


WardsCreekCulvert Plan: FIS-Base Model 9/10/2014
Geom: FIS_Base Model Geometry Flow: FIS_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.148 Culv FIS Station 13SMD (Interstate 55 Culvert)
.08
.065
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
715
710
705
700
695
690
0
100
200
300
400
Station (ft)


WardsCreekCulvert Plan: FIS-Base Model 9/10/2014
Geom: FIS_Base Model Geometry Flow: FIS_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.148 Culv FIS Station 13SMD (Interstate 55 Culvert)
.08
.065
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
696
694
0
50
100
150
200
250
300
Station (ft)


WardsCreekCulvert Plan: FIS-Base Model 9/10/2014
Geom: FIS_Base Model Geometry Flow: FIS_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.120 FIS Station SMD10 (Copy) - Downstream Face
.08
.065
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
696
694
0
50
100
150
200
250
300
Station (ft)


WardsCreekCulvert Plan: FIS-Base Model 9/10/2014
Geom: FIS_Base Model Geometry Flow: FIS_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 3.883 FIS Station SMD10
.08
.07
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
700
698
696
694
692
690
688
686
684
682
0
50
100
150
200
250
300
Station (ft)

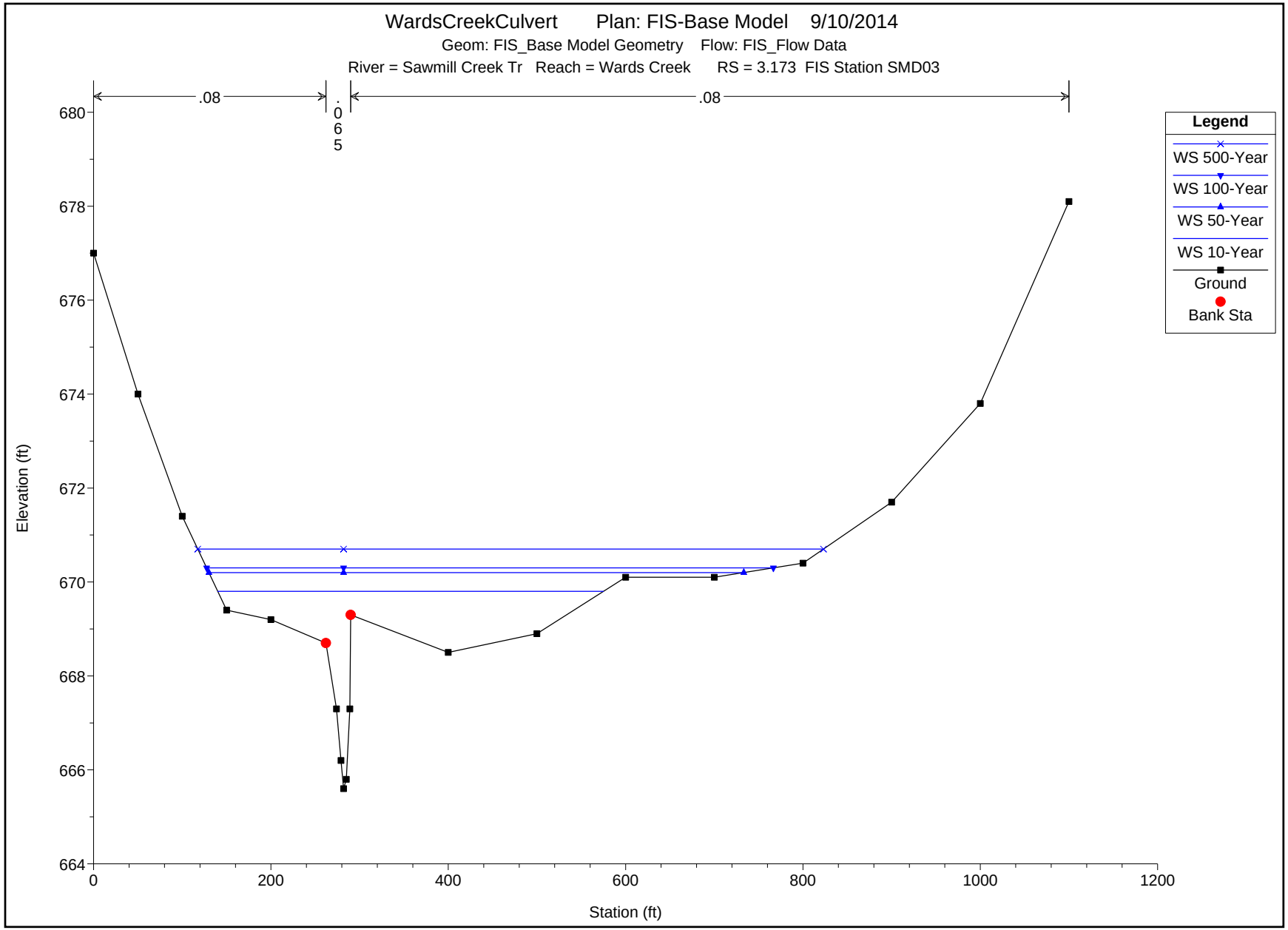
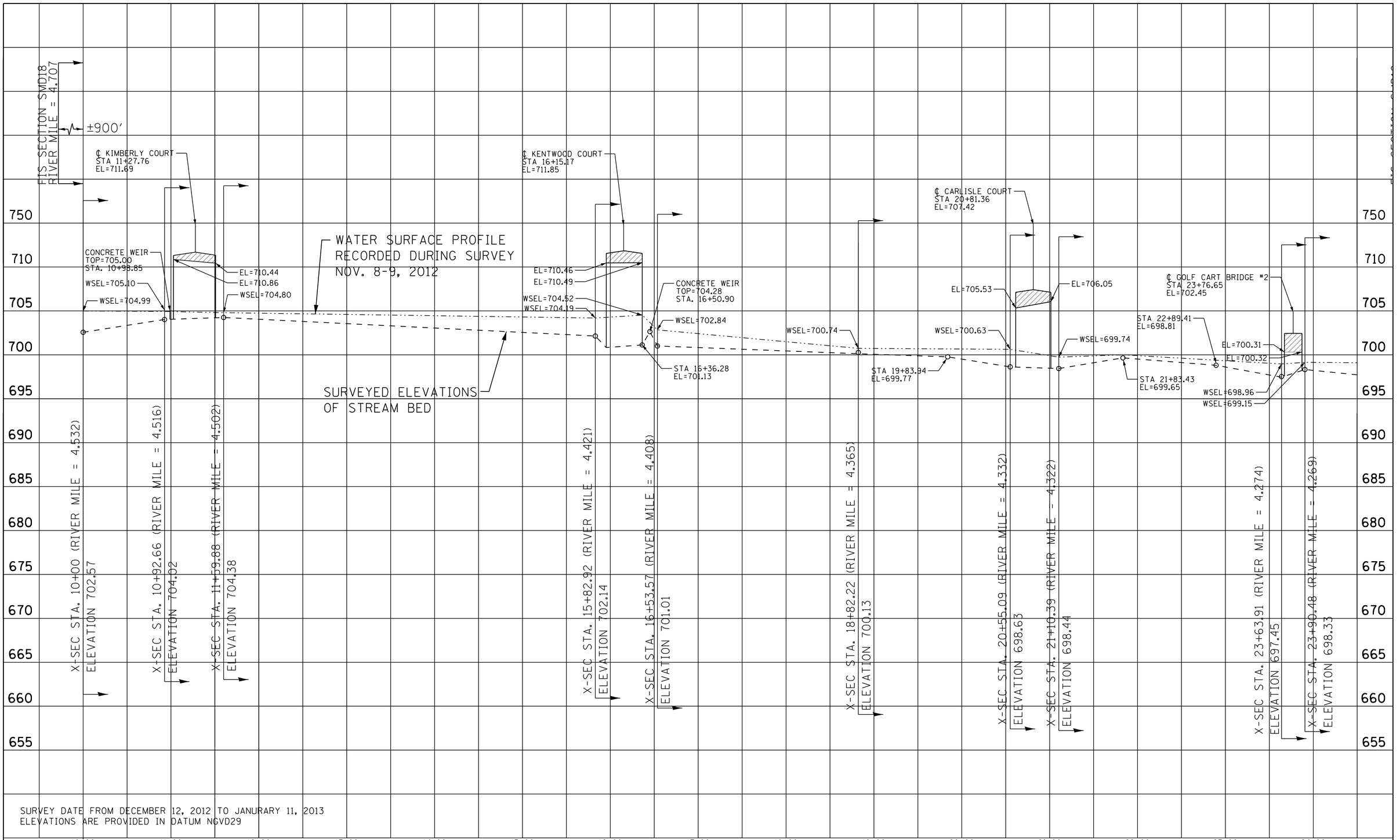

WardsCreekCulvert Plan: FIS-Base Model 9/10/2014
Geom: FIS_Base Model Geometry Flow: FIS_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 3.173 FIS Station SMD03
.08
.065
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
680
678
676
674
672
670
668
666
664
0
200
400
600
800
1000
1200
Station (ft)

EXHIBIT D

STREAMBED PROFILE



SURVEY DATE FROM DECEMBER 12, 2012 TO JANURARY 11, 2013
ELEVATIONS ARE PROVIDED IN DATUM NGVD29

VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 100' (0.0189 MILE)

PLAN: SURVEYED, PLOTTED, ADDRESS CHECKED, RT. OF WAY CHECKED, CADD FILE NAME, NOTE BOOK, NO.; BY, DATE

PROFILE: SURVEYED, PLOTTED, ADDRESS CHECKED, BKM. NOTED, STRUCTURE NOTATNS CHKD, NOTE BOOK, NO.; BY, DATE

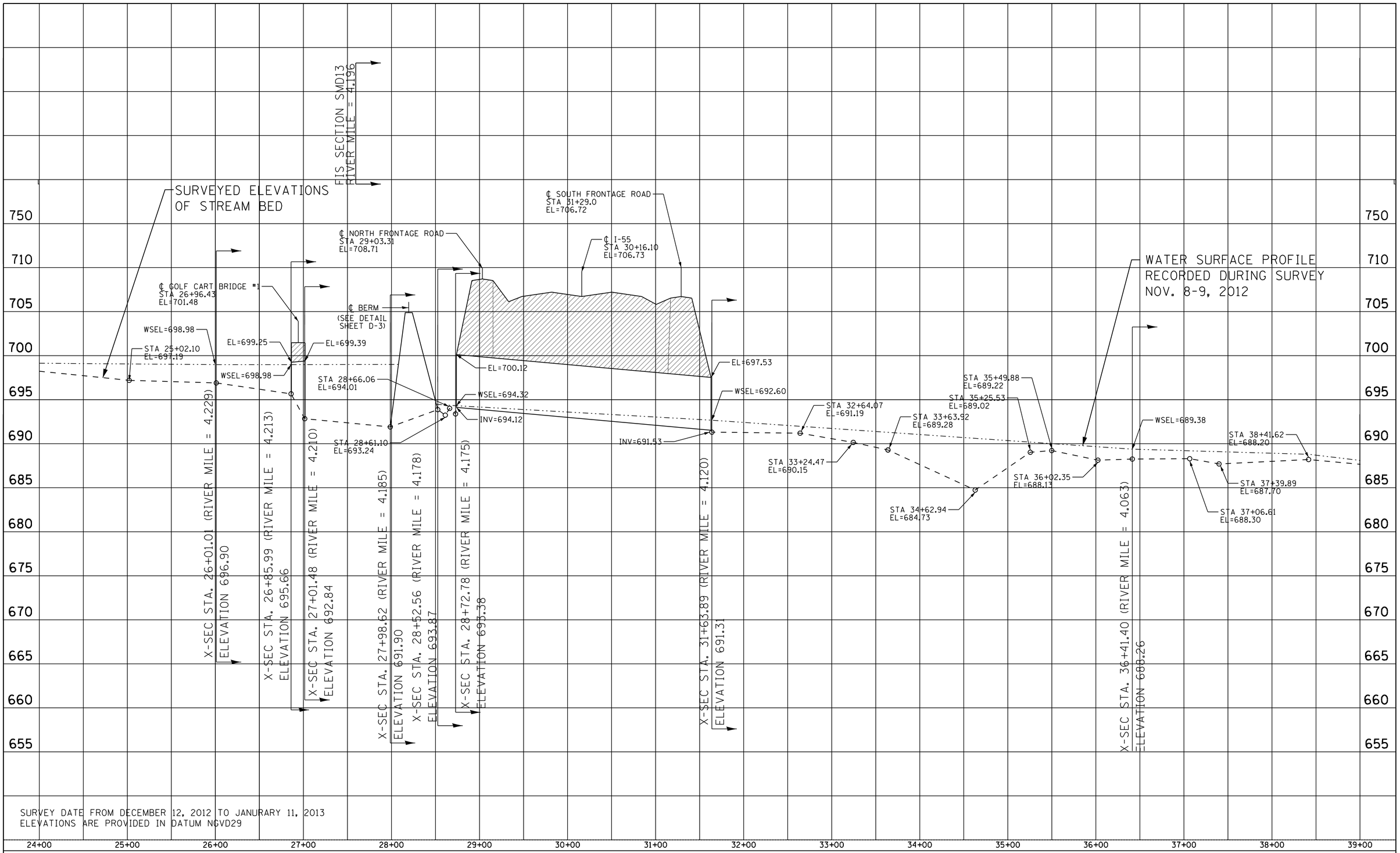
FILE NAME = V:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\DIP9176210-sht-prof.dgn	USER NAME = dbook	DESIGNED -	REVISED -
		DRAWN -	REVISED -
	PLOT SCALE = 50.0000 ' / in.	CHECKED -	REVISED -
Default	PLOT DATE = 10/28/2015	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT D – STREAMBED PROFILE

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
			3	D-1
CONTRACT NO.				
ILLINOIS FED. AID PROJECT				



SURVEY DATE FROM DECEMBER 12, 2012 TO JANURARY 11, 2013
ELEVATIONS ARE PROVIDED IN DATUM NGVD29

VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 100' (0.0189 MILE)

PLAN: SURVEYED, PLOTTED, ALIGNMENT CHECKED, RT. OF WAY CHECKED, CADD FILE NAME, NOTE BOOK, NO., BY, DATE

PROFILE: SURVEYED, PLOTTED, GRADES CHECKED, B.M. NOTED, STRUCTURE NOTATNS CHKD, NOTE BOOK, NO., BY, DATE

FILE NAME = V:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\DIP9176210-sht-prof.dgn Default	USER NAME = dbook	DESIGNED -	REVISED -
	PLOT SCALE = 50.0000 ' / in.	DRAWN -	REVISED -
	PLOT DATE = 10/28/2015	CHECKED -	REVISED -
		DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT D – STREAMBED PROFILE

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
			3	D-2
		CONTRACT NO.		
		ILLINOIS FED. AID PROJECT		

PLAN
SURVEYED
PLOTTED
PROFILES CHECKED
R/T. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
PROFILES CHECKED
B.M. NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE

750
710
705
700
695
690
685
680
675
670
665
660
655

SURVEYED ELEVATIONS
OF STREAM BED

WATER SURFACE PROFILE
RECORDED DURING SURVEY
NOV. 8-9, 2012

WSEL=687.57
STA 39+91.36
EL=687.00
WSEL=686.82
STA 40+09.69
EL=685.22

FIS SECTION SMD10
RIVER MILE = 3.883

FIS SECTION SMD03
RIVER MILE = 3.173

320.00'
3750'

X-SEC STA. 391+44.21 (RIVER MILE = 4.032)
ELEVATION 687.26

X-SEC STA. 41+04.74 (RIVER MILE = 3.972)
ELEVATION 686.46

X-SEC STA. 27+98.62
(RIVER MILE = 4.185)

X-SEC STA. 28+52.56
(RIVER MILE = 4.178)

DETAIL OF GOLF COURSE BERM

℄ BERM
ELEV=±704.95

BERM CULVERT #1
36" Ø CMP
U/S INV=699.64
D/S INV=699.86

T/WEIR
ELEV=699.98

BERM CULVERT #2
24" Ø RCP
U/S INV=698.58
D/S INV=695.46

BERM CULVERT #3
10" Ø RCP
U/S INV=694.59
D/S INV=693.84

SURVEY DATE FROM DECEMBER 12, 2012 TO JANURARY 11, 2013
ELEVATIONS ARE PROVIDED IN DATUM NGVD29

39+00 40+00 41+00

VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 100' (0.0189 MILE)

FILE NAME = V:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\DIP9176210-sht-prof.dgn	USER NAME = dbook	DESIGNED -	REVISED -
		DRAWN -	REVISED -
	PLOT SCALE = 50.0000 ' / in.	CHECKED -	REVISED -
Default	PLOT DATE = 10/28/2015	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT D – STREAMBED PROFILE

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
			3	D-3
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

EXHIBIT E

ROADWAY PROFILE AND HISTORIC PLANS

NOTE: THE I-55 PROFILE & SLOPES FROM WEST TO EAST.
THE I-55 FRONTAGE N PROFILE SLOPES FROM EAST TO WEST.

THE OVERTOPPING PROFILE IS THE GREATER OF THE I-55 AND FRONTAGE ROAD PROFILES PROVIDED AT EACH STATION.

DATUM: NGVD29

N

I-55 SB ℄ STA 4783+04.31
(I-55 ℄ STA. 333+07.31)
N FRONTAGE RD
LOW EOP ELEV = 705.67

24" RCP
10" RCP

WARDS CREEK

36" CMP

OVERTOPPING WEIR

BERM

EXISTING ROW

I-55 FRONTAGE N

I-55 SB ℄

℄ I-55

6'x6' BOX CULVERT
(SN 022-0516)

I-55 SB ℄ STA 4785+88.62
OVERTOPPING ELEV = 708.19

4790+00
340+00
2790+00
4795+00
345+00
2795+00
4785+00
335+00
2785+00

I-55 ℄ STA 337+24.18
STA 30+16.03 ℄ WARDS CREEK

I-55 FRONTAGE S

EXISTING ROW

PROFILE OF I-55 SB ℄
PROFILE OF I-55 FRONTAGE N ℄
LOW EOP ELEVATION = 705.67
OVERTOPPING ELEVATION = 708.19
RESULTING OVERTOPPING PROFILE
PROFILE OF I-55 FRONTAGE N ℄
100 YR HEADWATER ELEV = 708.34
PROFILE OF I-55 SB ℄
50 YR HEADWATER ELEV = 705.34
WARDS CREEK CULVERT
I-55 ℄ STA 337+24.18
U/S INV = 694.12
D/S INV = 691.53
℄ INV = ±692.82

715 710 705 700 695 690

I-55 FRONTAGE N ℄ ELEVATION	706.61	706.29	705.97	706.24	706.59	706.94	707.48	707.97	708.22	708.36	708.42	708.75	709.18	709.38	709.62	709.77	709.76	709.54	709.31	709.09	708.60	707.96
I-55 SB ℄ ELEV	710.83	710.31	709.80	709.52	709.23	708.94	708.65	708.38	708.13	707.81	707.43	706.21	707.01	706.83	706.64	706.40	706.11	705.84	705.58	705.29	705.04	704.84

4782+00 4783+00 4784+00 4785+00 4786+00 4787+00 4788+00 4789+00 4790+00 4791+00 4792+00 4793+00 4794+00 4795+00 4796+00

USER NAME = dbook	DESIGNED - CL	REVISED -	
	DRAWN - STANTEC	REVISED -	
PLOT SCALE = 50.0000 ' / in.	CHECKED - JVO	REVISED -	
PLOT DATE = 9/22/2014	DATE - 12/13/2013	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

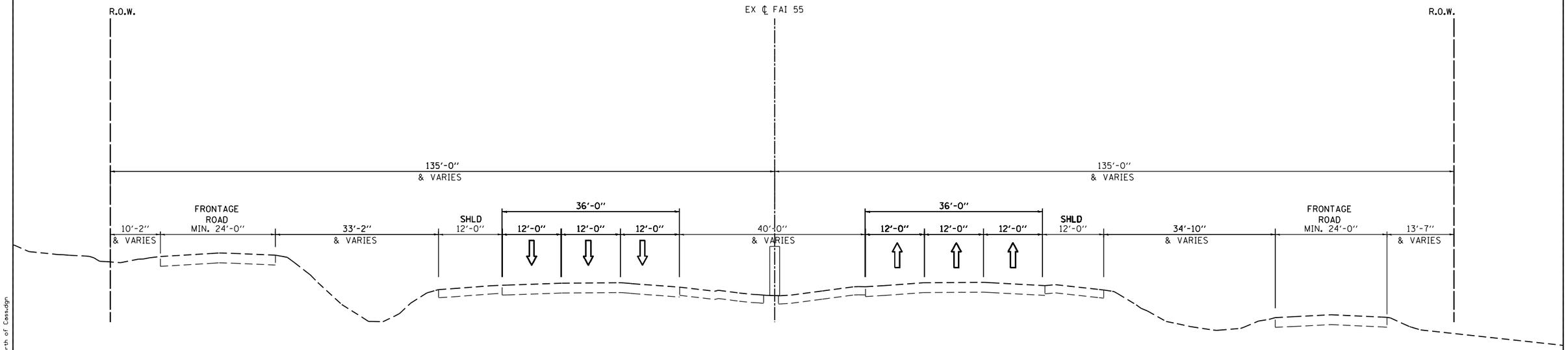
I-55 MANAGED LANE STUDY
WARDS CREEK – PLAN AND PROFILE

SCALE: 1": 50' | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
55		DUPAGE/COOK		
		CONTRACT NO. P9176210		
		ILLINOIS FED. AID PROJECT		

FILE NAME = N:\1786\active\17682037.IDOT.I-55\civil\drainage\wards creek h-\DUP9176210-100 Wards Creek Plan&Prof.dgn

Default



EXISTING I-55 TYPICAL SECTION
NORTH/SOUTH OF CASS AVENUE
STA 337+00 TO STA 430+00
(LOOKING NORTH)

FILE NAME = V:\1786\active\178680037.1DOT.I-55\civil\drawings\sht\Exhibits\DUP\178210 Typicals-sheets.North of Cass.dgn

I-55 MANAGED LANE PROJECT

USER NAME = mjverheyen	DESIGNED - MJV	REVISED -
	DRAWN - STANTEC	REVISED -
PLOT SCALE = 20.0000 ' / In.	CHECKED - CL	REVISED -
PLOT DATE = 8/28/2014	DATE - 8/28/2014	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

TYPICAL SECTIONS

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
55		DUPAGE/COOK		

CONTRACT NO.

ILLINOIS | FED. AID PROJECT

FEDERAL AID ROUTE NO.	SEC.	COUNTY	TOTAL SHEETS	SHEET NO.
FAI 03	22-2	DU PAGE	13	1
FED. ROAD DIST. NO. 7	ILLINOIS	PROJECT	I-03-6(7)	

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS AND BUILDINGS
DIVISION OF HIGHWAYS

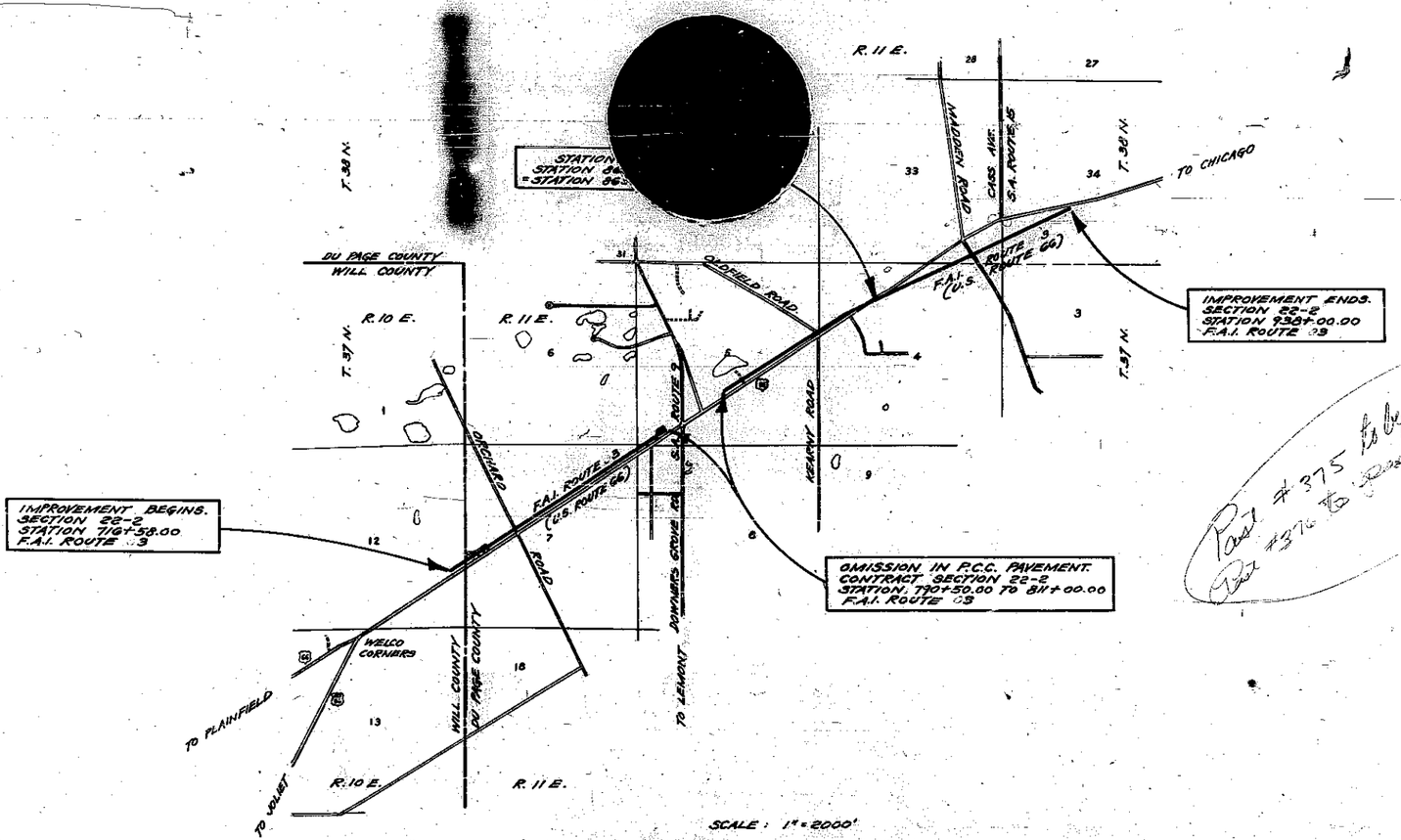
PLANS FOR PROPOSED FEDERAL AID HIGHWAY

SCALES

PLAN	1 INCH	100 FT.
PROFILE, HOR.	1 INCH	100 FT.
PROFILE, VERT.	1 INCH	10 FT.
CROSS-SECTIONS	1 INCH	5 FT. VERT.
	1 INCH	10 FT. HORZ.
	1 INCH	5 FT. HORZ.

F.A.I. ROUTE 3 SECTION 22-2
PROJECT I-03-6(7)
DU PAGE COUNTY

LOCATION OF SECTION INDICATED THUS:—



SCALE : 1" = 2000'

GROSS LENGTH 22,137.50 FEET = 4.193 MILES
PROJECT LENGTH — OMISSION 50 FEET = 3.905 MILES

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS AND BUILDINGS
DIVISION OF HIGHWAYS

SUBMITTED JUN 20 1957 D. S. Morrison DISTRICT ENGINEER
EXAMINED July 2 1957 Ralph T. Burns BUREAU OF ROAD PLANS AND CONTRACTS
PASSED July 2 1957 [illegible] ENGINEER OF ORDERS
APPROVED July 2 1957 P. M. Bateman CHIEF HIGHWAY ENGINEER
APPROVED July 2 1957 [illegible] DIRECTOR

Pass #375 to Def #376
Def #376 To Pass #377

DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
APPROVED [redacted]
DIVISION ENGINEER [redacted] DATE

		COUNTY	TOTAL	SHEET NO.
F.A.I. 03	22-2	DUPAGE	73	10
STA. 830+00		STA. 860+00		

HOMER ANDRUS

B.M. 43 ELEV. 759.17
D.H. NAIL IN ROOT OF 24" MAPLE
190' RT. OF STA. 830+05

HOMER ANDRUS

B.M. 45 ELEV. 718.50
D.H. NAIL IN ROOT OF 28" OAK
38' RT. OF STA. 846+20

JOS. H. LINDAUER

JOHN B. HEARTT

NOTE: ACCESS OF OLDFIELD ROAD TO F.A.I. ROUTE 03 TO BE CLOSED

SECTION CORNER

STA. 853+00 F.A.I. ROUTE 03 LT. & RT.
3-STD 1258-R. INLETS
P-2, 30"x54" (LT.)
P-2, 30"x170' S.E.R.C.C.P.
P-2, 30"x47' (RT.)
STD. 1976 D 30-2
(2 HDWLS.)

G.B.C. 37

CURVE DATA & F.A.I. ROUTE 03
P.I. STA. 853+16.30
Δ 9°-24'-00"
D 0°-30'-00"
R 11459.19'
L 1880.00'
T 942.06'
E 34.62'
S.E. 0.010%
S.E. ATTAINED FROM;
STA. 844+28.84 TO 844+28.84
STA. 863+04.84 TO 863+04.84

FRONTAGE ROADS DATA.
S.E. 0.025%
S.E. ATTAINED FROM;
STA. 844+24.84 TO 845+24.84
STA. 863+04.84 TO 864+04.84

STA. 838+62.62
SPECIAL CULVERT DESIGN
6'x6'x287'-3½"
STD. 2024

G.B.C. 136

FOR OLDFIELD ROAD CONNECTION, SEE DETAIL, SHEET No. 16

OLDFIELD ROAD

H. AHRBRECKER

HOMER ANDRUS

A.A. MISTERFELD

SIDE ROAD ENTRANCE STA. 842+90 P-1 18"x77'

433 LIN. FT. GUTTER REMOVAL: EXIST. GUTTER INLETS, OUTLETS & ENTRANCES SHALL BE REMOVED AS GUTTER REMOVAL AND NO EXTRA COMPENSATION WILL BE ALLOWED FOR THE REMOVAL OF ADDITIONAL CONCRETE.

STA. 835+00 LT. FR. RD. P-1 18"x 40' STD. 878 D 18-2 (2 HDWLS.)

P.E. STA. 835+65 P-1 15"x 40'

P.E. STA. 838+80 P-1 15"x 40'

F.E. STA. 830+40

INV. 727.30

INV. 727.15

1957 A.D.T. = 50

625 LIN. FT. STEEL PLATE BEAM GUARD RAIL

180°-45'

P.I. STA. 830+70.26

℄ F.A.I. ROUTE 03 (U.S. 66)

5°15'

844+02.67

625 LIN. FT. STEEL PLATE BEAM GUARD RAIL

LEFT FRONTAGE ROAD

P.E. STA. 853+00

INV. 699.40

INV. 697.40

INV. 698.70

EXIST. 6'x6' CULV.

P.E. STA. 856+00 P-1 15"x 40'

TEMPORARY DETOUR SPECIAL PROVISIONS

REMOVE EXISTING STRUCTURES AND STORM SEWER AS INCIDENTAL TO EARTH EXCAVATION.

REMOVE NORTH END OF CULVERT TO LEFT SHOULDER EDGE OF RIGHT FRONTAGE RD. AND FLOOR OF STRUCTURE, AND PLUG END. COST OF PLUGGING END TO BE INCIDENTAL TO EARTH EXCAVATION.
CONCRETE REMOVAL ..... 3.2 C.Y.

PLUG ENDS OF EXISTING PIPE. COST TO BE INCIDENTAL TO EARTH EXCAVATION

RIGHT FRONTAGE ROAD

PLUG END OF EXISTING STRUCTURE. COST TO BE INCIDENTAL TO EARTH EXCAVATION.

P.E. STA. 851+50 P-1 15"x 40'

FOR GLEN ROAD CONNECTION, SEE DETAIL, SHEET No. 16

30 LIN. FT. GUARD RAIL REMOVAL.

P.E. STA. 858+80 P-1 15"x 40'

GLEN ROAD

STA. 828+85 TO 832+50
365 LIN. FT. SPECIAL TYPE PAVED DITCH
(SEE DETAIL SHEET No. 17)

N&W. P. POLE ℄ F.A.I. ROUTE 03 P.O.T. IRON PIN
"X" CUT IN SIGNAL BASE
TIES TO P.O.T. STA. 844+00 F.A.I. ROUTE 03

10"OAK 20"OAK P.C. SPIKE 16"OAK
TIES TO P.C. STA. 844+74.84 F.A.I. ROUTE 03

N&W. 8"WALL "X" CUT IN CONCRETE P.I. IRON PIN TAN. LINE 2 F.A.I. ROUTE 03 N&W. 14" MAPLE
TIES TO P.I. STA. 854+16.00 F.A.I. ROUTE 03

B.M. 4 ELEV. 700.22
N&W. IN ROOT OF 20" OAK
16' RT. OF STA. 855+84

WUNDERLICH WOODS SUB.

NOTE: ACCESS OF KE... ROAD TO F.A.I. ROU... TO BE CLOSED.

...F BUILDING ...ION

STA. 844+51 TO STA. 847+61
TREE REMOVAL 2.13 ACRES

ROBERT BARTLETT'S GREENWOOD ACRES SUB.

B.M. 44 ELEV. 731.58
S.W. CORNER OF CULV. HDWL.
130' RT. OF STA. 839+73

KEARNEY ROAD

BEGIN ENTIRE PAVEMENT REMOVAL STA. 844+25

P.C. STA. 844+74.84

ROUTE 03 - RT.

1977.0

PROFILE OF EXISTING GROUND
PROFILE OF PROPOSED CROWN

730
720
710
700

-0.24 %
PROFILE OF EXISTING GROUND ON ℄ OF LEFT FRONTAGE ROAD.
-0.46 %
-0.20 %
F.L. 729.00
F.L. 728.40
SPECIAL LEFT DITCH GRADING
P.V.I. STA. 832+00
P.V.C. STA. 831+58
P.V.I. STA. 836+40.00 ELEV. 726.40 500' V.C. C = 0.17'
C 831+58 F 832+00
C&F 837+00
-1.73 %
INVERTS: ELEV. 722.25 LT. ELEV. 722.10 RT.
PROFILE OF PROPOSED CROWN F.A.I. ROUTE 03
P.V.C. STA. 840+00
P.V.I. STA. 840+00 ELEV. 730.42
P.V.I. STA. 843+50 ELEV. 730.42 500' V.C. C = 2.47'
-4.07 %
P.V.C. 845+00
LEFT FRONTAGE ROAD
P.V.I. STA. 849+00 ELEV. 709.67 800' V.C. C = 4.78'
PROFILE OF PROPOSED CROWN ON ℄ OF LEFT FRONTAGE RD.
P.V.T. 853+00
P.V.C. 857+00
+0.71 %
PROFILE OF EXISTING GROUND
1249 C.Y. EXCESS EXCAVATION OBTAINED FROM STA. 716+58 TO 731+00 TO BE PLACED IN EMBANKMENT STA. 950+90 TO 852+50.
C 851+00 E 850+00
PROFILE OF EXISTING GROUND ON ℄ OF F.A.I. RTE. 03
-0.50 %
P.V.C. STA. 849+00
P.V.T. STA. 853+00
INVERTS: ELEV. 699.60 LT. ELEV. 698.50 RT.
INVERTS: ELEV. 694.90 LT. ELEV. 692.40 RT.
PROFILE OF PROPOSED CROWN ON ℄ OF RIGHT FRONT. RD.
-1.99 %
P.V.I. STA. 852+00 ELEV. 706.05 800' V.C. C = +3.98'
PROFILE OF EXISTING GROUND ON ℄ OF RIGHT FRONT. RD.
+1.50 %
P.V.I. STA. 860+00 ELEV. 719.05 500' V.C. C = -2.62'
P.V.C. STA. 848+24.84
P.V.C. STA. 848+50
P.V.T. STA. 853+50
P.V.C. 857+00
RIGHT FRONTAGE ROAD

EARTH EXCAVATION 15,811 C.Y.
EMBANKMENT 1,223 C.Y.
P.E. STA. 835+65
EMBANKMENT 30 C.Y.
14,289 C.Y. EXCESS EXCAVATION TO BE PLACED IN EMBANKMENT STA. 863+64 TO 874+22
OVERHAUL 865,800

806 ℄ 2
UNSTABLE MATERIAL TO BE REMOVED AND REPLACED STA. 839+65 TO 841+35
EARTH EXCAVATION 3,272 C.Y.
GRANULAR EMBANKMENT 3,272 C.Y.

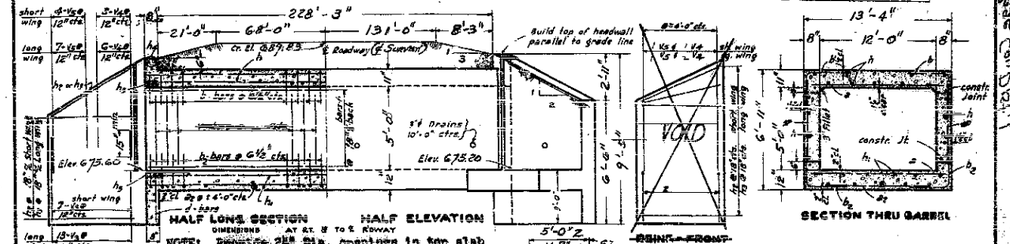
EARTH EXCAVATION 21,174 C.Y.
EMBANKMENT 20,661 C.Y.
P.E. STA. 838+80
EMBANKMENT 30 C.Y.
OLD FIELD RD. APPROACH
EMBANKMENT 122 C.Y.
3622 C.Y. BROKEN CONCRETE PAV'T. OBTAINED STA. 830+00 TO 838+28 TO BE PLACED IN EMBANKMENT STA. 947+00 TO 850+90.

EARTH EXCAVATION 25,024 C.Y.
EMBANKMENT 26,585 C.Y.
GLEN RD. STA. 853+00
EARTH EXCAVATION 93 C.Y.
EMBANKMENT 152 C.Y.
P.E. STA. 855+00
EMBANKMENT 30 C.Y.
P.E. STA. 858+00
EMBANKMENT 32 C.Y.

P.E. STA. 858+80
EMBANKMENT 35 C.Y.
P.E. STA. 861+60
EMBANKMENT 32 C.Y.

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF HIGHWAYS

FAI 103	22	JU	PAGE 73	SHEET NO. 19 SHEETS 73



BILL OF MATERIAL

BAR	NO.	SIZE	LENGTH
a	1122	#7	12'-6"
a_1	72	#4	8'-6"
b	1036	#5	5'-6"
b_1	1036	#5	8'-0"
d	24	#4	4'-6"
h	200	#4	29'-0"
h_1	210	#4	29'-0"
h_2	16	#4	5'-9"
h_3	16	#4	12'-0"
h_4	6	#6	14'-9"
h_5	16	#6	15'-9"
V			
V_1	40	#4	5'-0"
V_4	18	#4	4'-0"
V_5	22	#4	2'-6"
W	14	#5	16'-0"
W_1	12	#5	10'-6"
z	32	#5	7'-8"
Z_1	20	#5	7'-0"
Class "X" Concrete		Cu Yds	355.7
Reinforcement Bars		Lbs	53870

NOTE:- All bars shall be round ASTM A305-49. The size number is the number of ⅛ inches in the nominal diameter.

GENERAL NOTES

Class X concrete shall be used thru-out. Exposed edges shall be beveled ¾". For backfilling and embankment, see standard specifications.

Cut a & a bars to fit. This work shall be done in the field and considered incidental to the cost of reinforcing bars.

STANDARDS	COMPUTED	
	CHECKED	
	DRAWN	R. H. Wood
	CHECKED	
SPECIAL	ASSEMBLED	
	CHECKED	

Reading = Reinf. Revised-11-56-J.E.M.

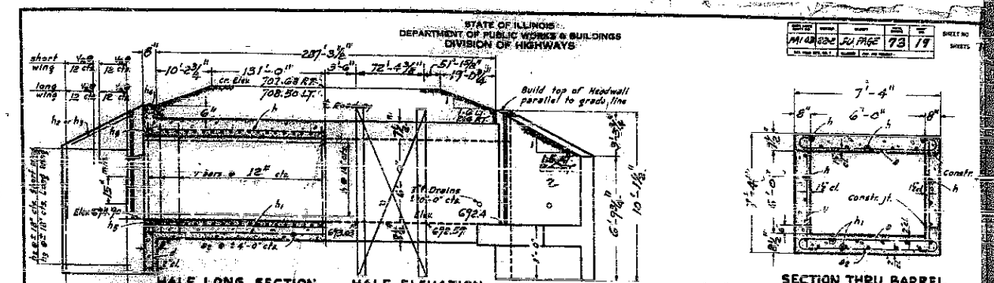
DESIGNED 7-2 57
V. M. Pagnucco
Chief Engineer
Director

f_s = 20000 #/in²
f_c = 1100 #/in²
n = 10
H-20 LOADING

SPECIAL CULVERT DESIGN
STA. 922+20

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF HIGHWAYS

FAI 103	22	JU	PAGE 73	SHEET NO. 19 SHEETS 73



BILL OF MATERIAL

BAR	NO.	SIZE	LENGTH
a	700	#6	8'-6"
a_2	54	#4	6'-3"
ℓ	15	#4	4'-6"
h	195	#4	65'-0"
h_1	99	#8	25'-6"
h_2	14	#4	8'-0"
h_3	14	#4	9'-0"
h_4	4	#6	6'-3"
h_5	12	#6	7'-0"
V	440	#4	7'-0"
V_2	16	#4	4'-0"
V_3	18	#4	5'-0"
V_4	46	#4	5'-0"
W	14	#9	11'-0"
W_1	14	#9	13'-2"
z	32	#5	7'-6"
Z_1	30	#5	7'-3"
Class "X" concrete	Cu Yds		158.0
Reinforcement Bars	Lbs		16,880

NOTE:- All bars shall be round ASTM A305-47. The size number is the number of ⅛ inches in the nominal diameter.

GENERAL NOTES

Class X concrete shall be used thru-out. Exposed edges shall be beveled ¾". For backfilling and embankment, see standard specifications. Tilt hook of "a" bars, if necessary, to obtain 1½" minimum clearance at top of hook.

STANDARDS	COMPUTED	
	CHECKED	
	DRAWN	R. H. WOOD
	CHECKED	
SPECIAL	ASSEMBLED	
	CHECKED	

Reading = Reinf. Revised-11-56-J.E.M.
Reading Revised 6-47

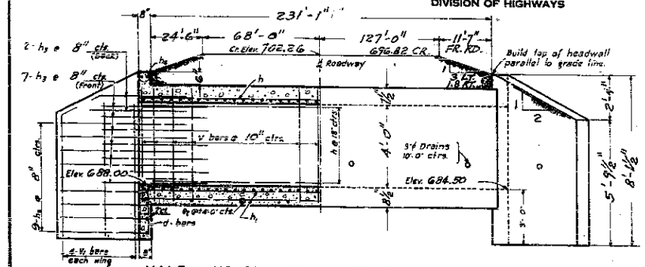
DESIGNED 7-2 57
V. M. Pagnucco
Chief Engineer
Director

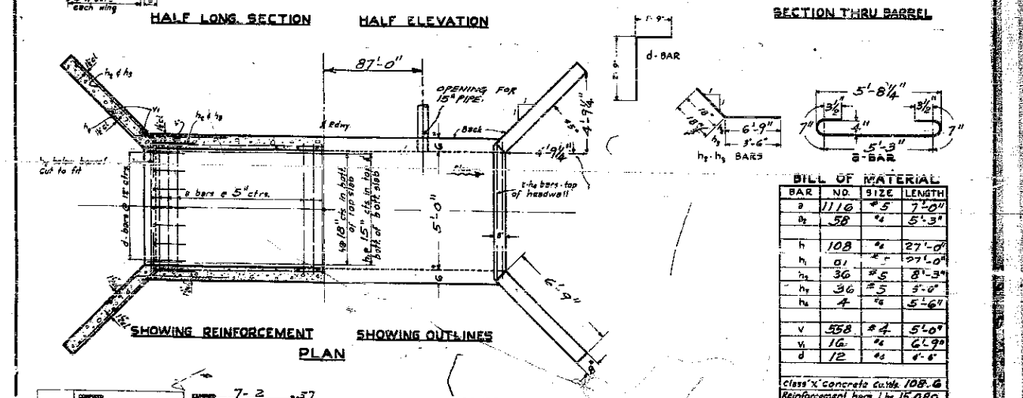
f_s = 20000 #/in²
f_c = 1100 #/in²
n = 10
H-20 LOADING.

SPECIAL CULVERT DESIGN
STA. 856+22.63

STANDARD 2024

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF HIGHWAYS





BILL OF MATERIAL

BAR	NO.	SIZE	LENGTH
a	1116	#5	7'-0"
a_1	58	#4	5'-3"
h	108	#4	27'-0"
h_1	01	#4	27'-0"
h_2	36	#5	8'-3"
h_3	36	#5	5'-0"
h_4	4	#6	5'-6"
V	558	#4	5'-0"
V_1	16	#4	6'-9"
d	12	#4	4'-6"
Class "X" concrete	Cu Yds		108.6
Reinforcement bars	Lbs		15,080

NOTE:- All bars shall be round ASTM A305-49. The size number is the number of ⅛ inches in the nominal diameter.

GENERAL NOTES

Class X concrete shall be used throughout. At least six feet of Barrel shall be poured monolithically with wing walls. Exposed edges shall be beveled ¾". For backfilling & embankments see Std. Spec's. Tilt hook of "a" bars if necessary, to obtain 1½" minimum clearance at top of hook.

STANDARD	COMPUTED	
	CHECKED	
	DRAWN	C.L. NAEGELY
	CHECKED	
SPECIAL	ASSEMBLED	
	CHECKED	

Reinf. Revised-11-56-J.E.M.

DESIGNED 7-2 57
V. M. Pagnucco
Chief Engineer
Director

f_s = 20000 #/in²
f_c = 1100 #/in²
n = 10
H-20 Loading

SPECIAL CULVERT DESIGN
STA. 880+36

STANDARD 2029

FAI 55

F.A.I. RTE. 55	Section		73	77

859 — 710 — 712.15 — 709.50 — 709.68 — F.L. 706.41 — 706.68 — 706.45 — F.L. 702.88 — 706.89 — F.L. 703.89 — 706.53 — 706.42 — 706.39 — 4:1 — F.L. 703.10 — 710.83 — 710.61 — 710.84 — F.L. 708.2 — 710 — 859

C=1260 F=0

858 — 710 — 710.09 — 709.86 — 709.59 — F.L. 706.55 — 707.12 — 706.96 — 706.89 — F.L. 703.38 — 707.13 — 706.95 — 706.89 — 4:1 — F.L. 703.30 — 710.21 — 709.64 — 709.67 — F.L. 705.2 — 710 — 858

C=294 F=195

857 — 709.60 — 709.75 — 709.20 — F.L. 703.88 — 707.63 — 707.42 — 707.39 — F.L. 703.89 — 707.63 — 707.45 — 707.37 — 4:1 — F.L. 703.64 — 708.42 — 708.35 — 708.28 — 700 — 857

C=0 F=1387

STA. 856+23
SPEC. CULV. DESIGN
6'-0" x 6'-0" 290'-4 1/8"
STD. 290 24

856 — 695 — 708.89 — 708.68 — 708.59 — F.L. 704.38 — 709.13 — 707.93 — 707.87 — F.L. 704.39 — 709.13 — 707.95 — 707.93 — 4:1 — F.L. 704.14 — 708.32 — 707.05 — 706.78 — 695 — 856

EXIST. 6'x6' CONC. CULV.

C=0 F=2161

STA. 855+37

855 — 705 — 708.18 — 707.93 — 707.68 — F.L. 706.8 — 708.63 — 708.40 — 708.33 — F.L. 703.8 — F.L. 704.87 — 702.60 — 702.46 — 702.89 — F.L. 703.13 — 4:1 — F.L. 704 — 705.90 — 705.69 — 705.36 — F.L. 702.8 — 705 — 855

C=892 F=236

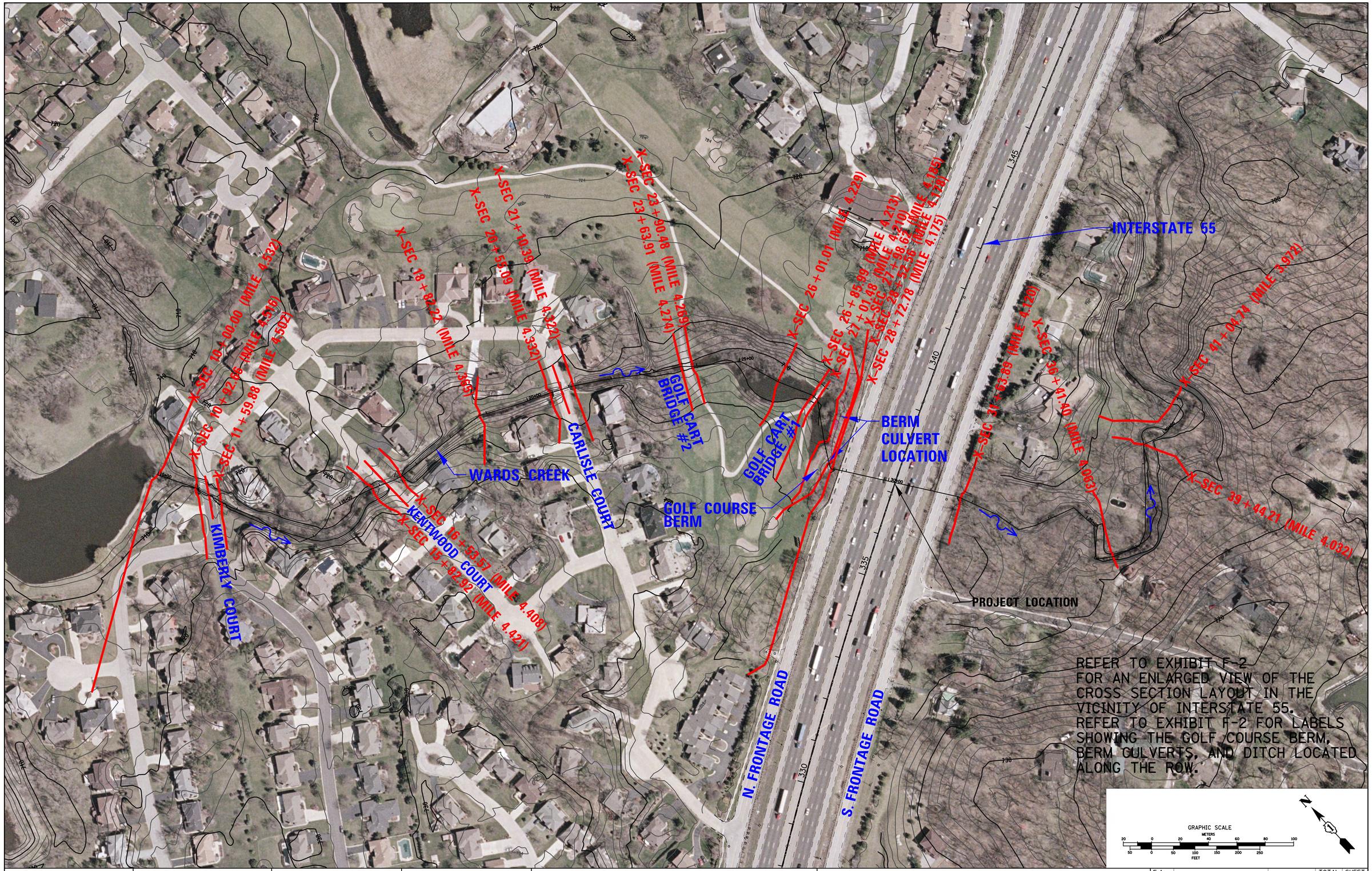
150 40 20 100 80 60 40 20 20 40 60 80 100 20 40 150

PLATE 3 CROSS SECTION B.P.R. STANDARD
DIVISION OF HIGHWAYS - NEW YORK

F.A.I. RTE. 03

EXHIBIT F

CROSS SECTIONS



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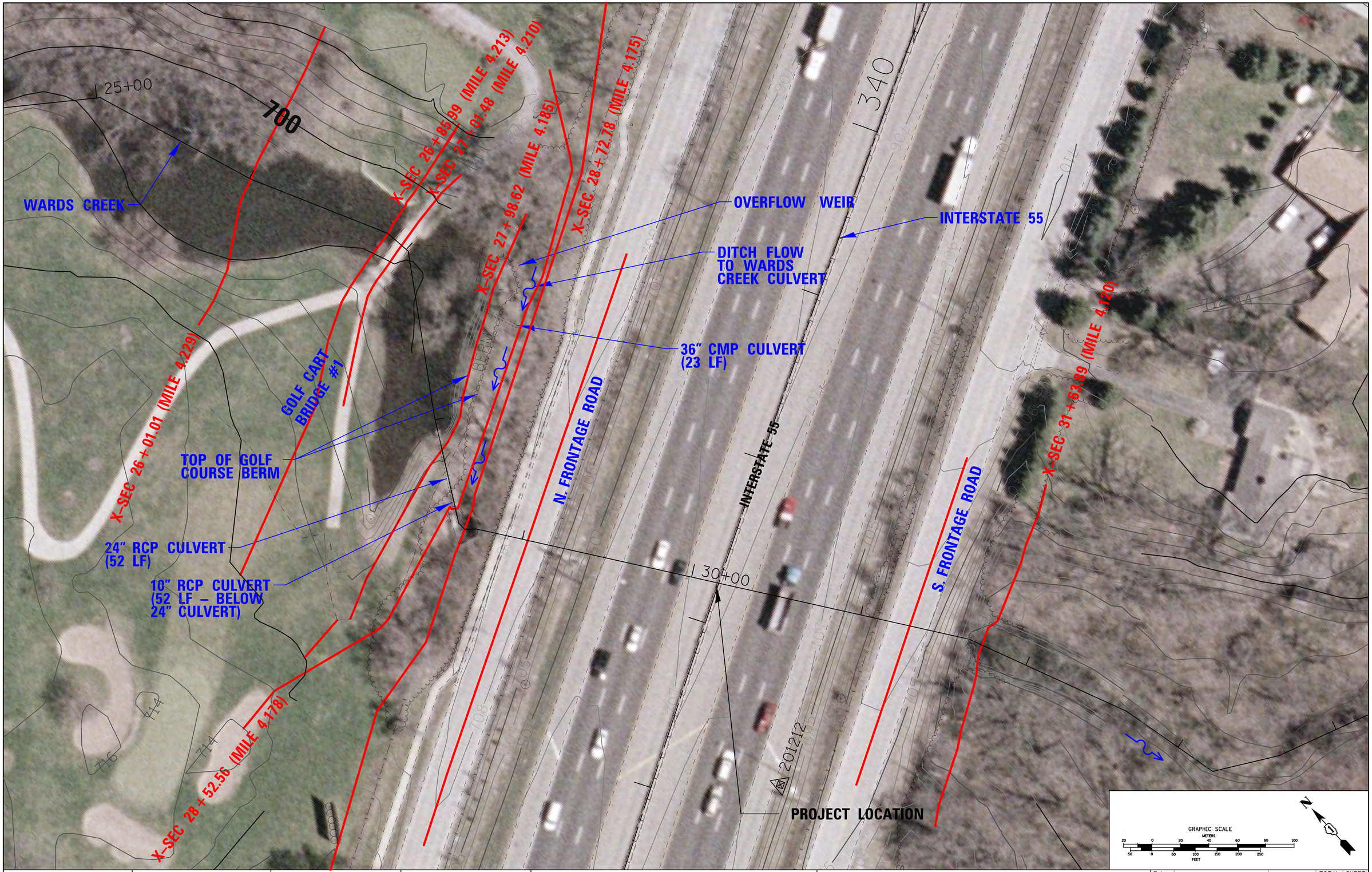
Default	PLOT DATE = 10/24/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CROSS SECTION LOCATION EXHIBIT

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				F-1
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		



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	PLOT DATE = 10/24/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

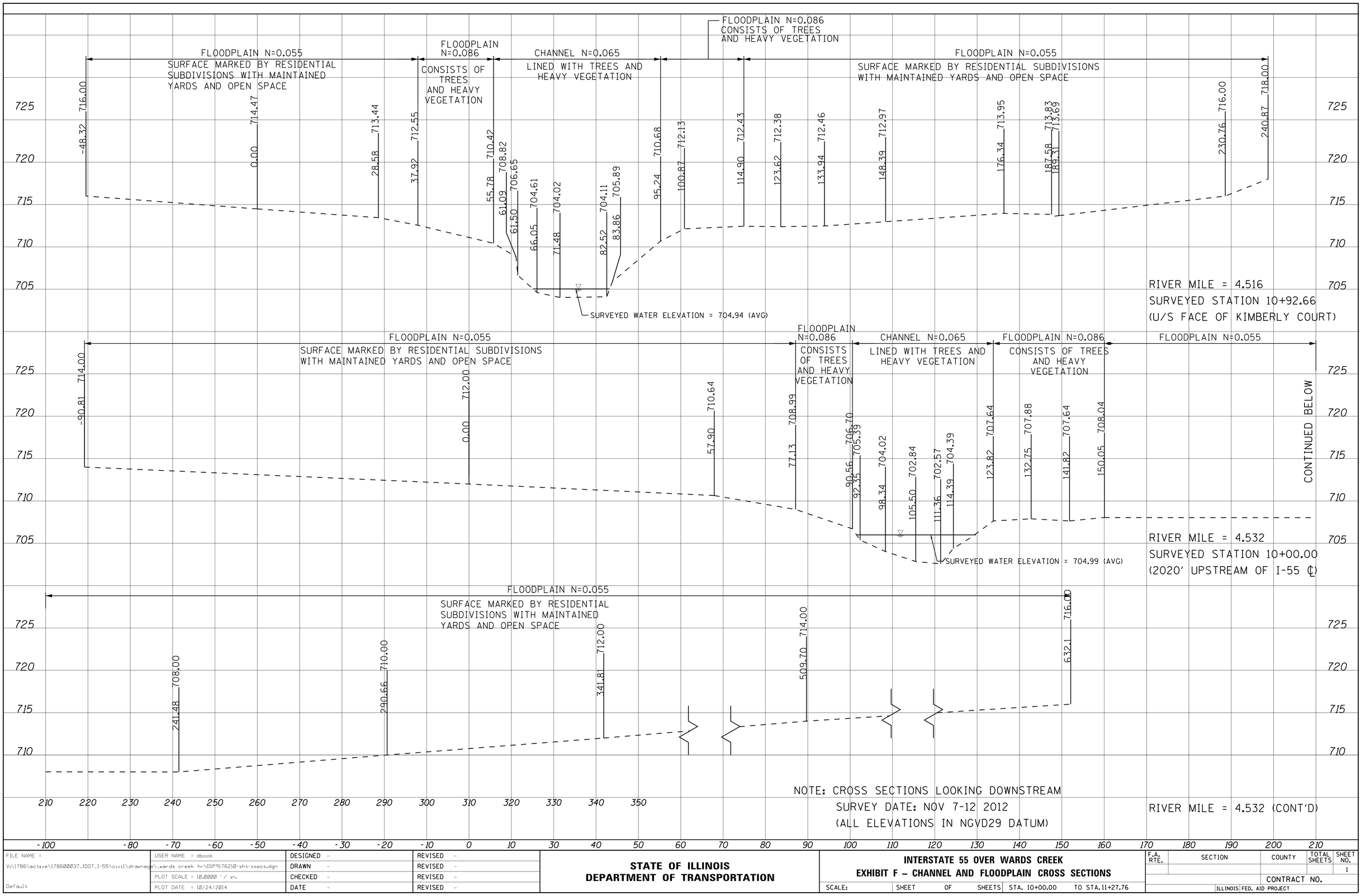
INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CROSS SECTION LOCATION EXHIBIT (DETAIL)

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				F-2

CONTRACT NO.

ILLINOIS | FED. AID PROJECT



FINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

ORIGINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

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Default	PLOT DATE = 10/24/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 10+00.00 | TO STA. 11+27.76

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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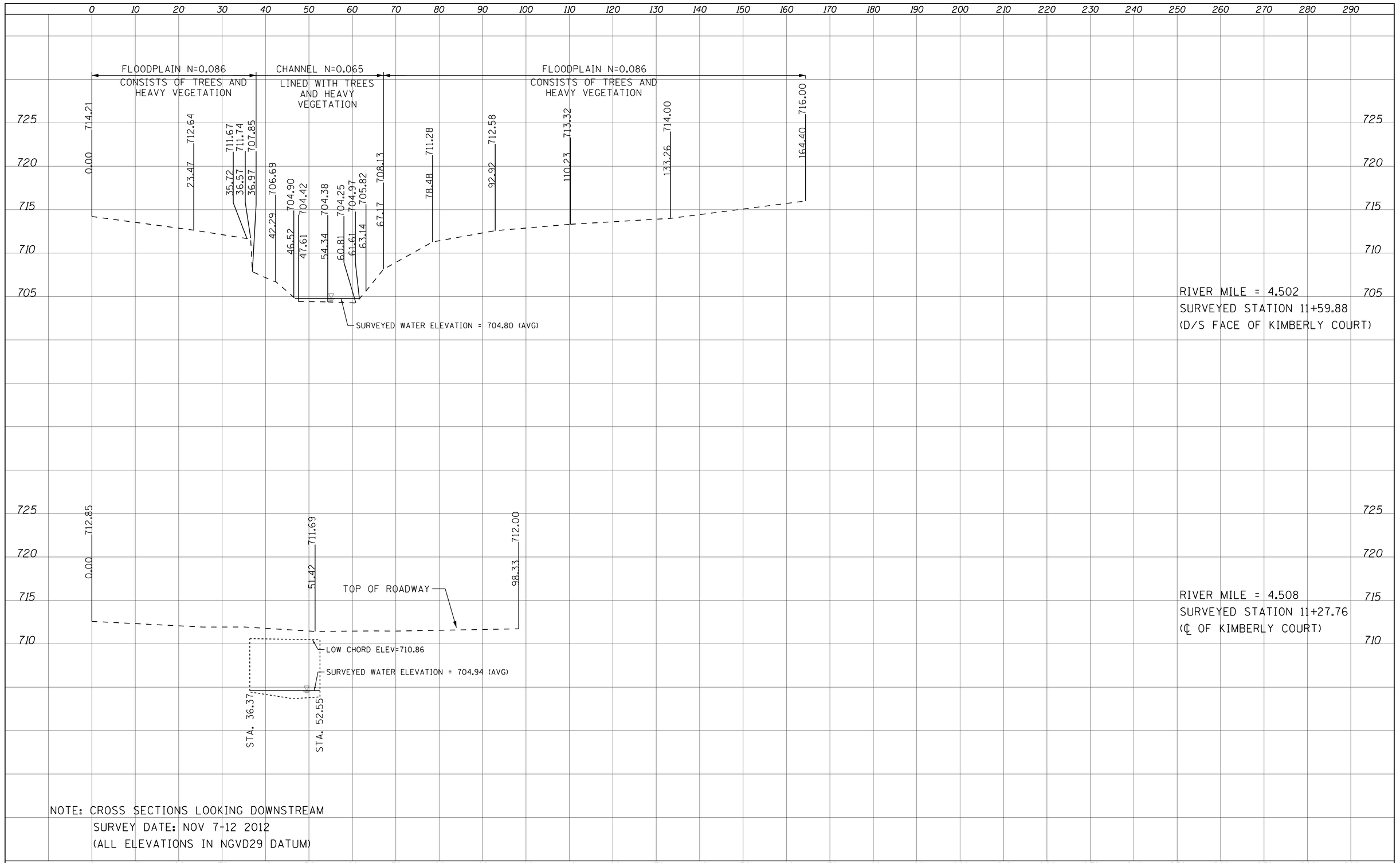
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			



NOTE: CROSS SECTIONS LOOKING DOWNSTREAM
SURVEY DATE: NOV 7-12 2012
(ALL ELEVATIONS IN NGVD29 DATUM)

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Default	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 11+59.88 | TO STA. 15+82.92

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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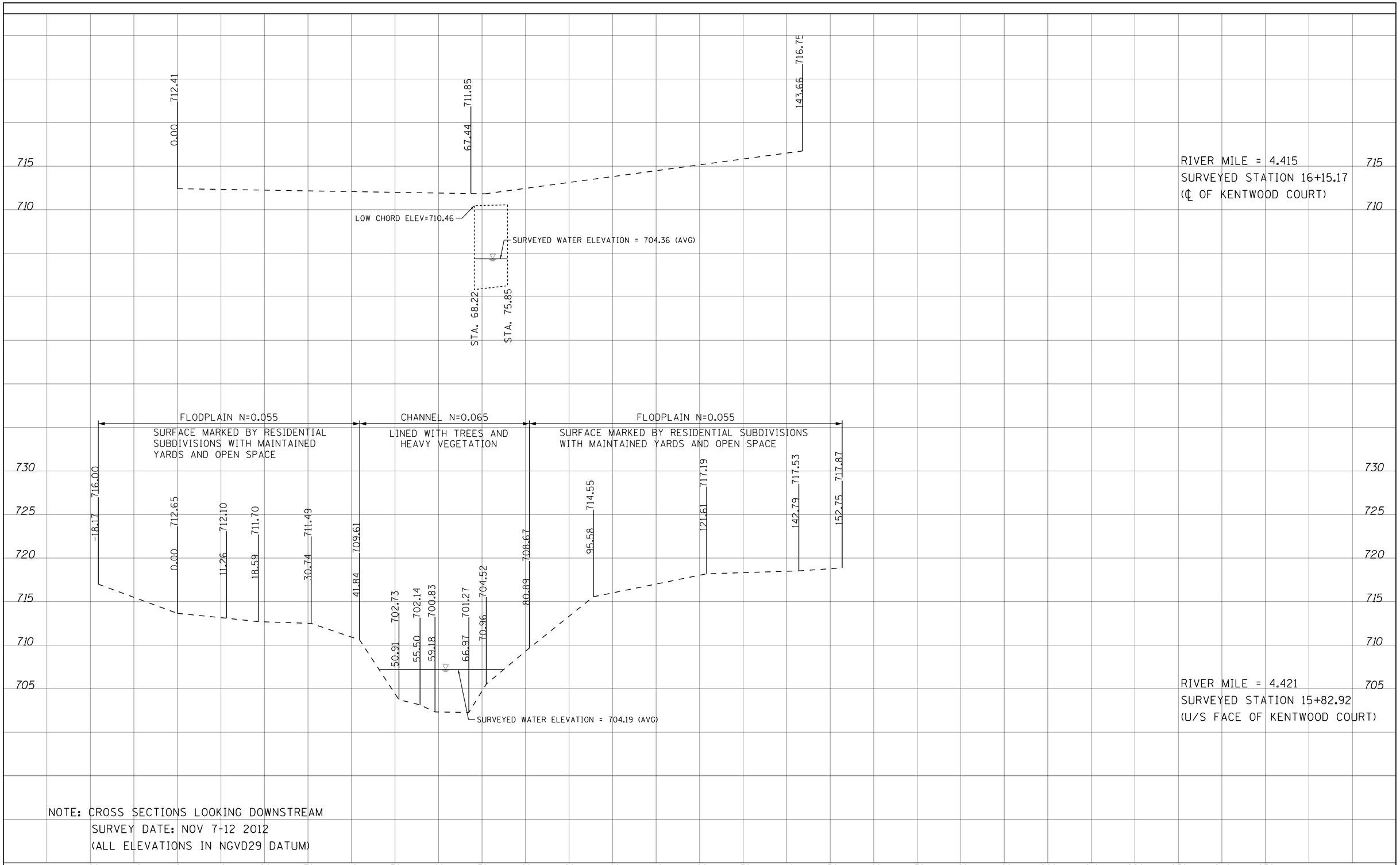
CONTRACT NO.

ILLINOIS FED. AID PROJECT



NOTE: CROSS SECTIONS LOOKING DOWNSTREAM
SURVEY DATE: NOV 7-12 2012
(ALL ELEVATIONS IN NGVD29 DATUM)

FINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

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		DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 16+15.17 | TO STA. 18+82.22

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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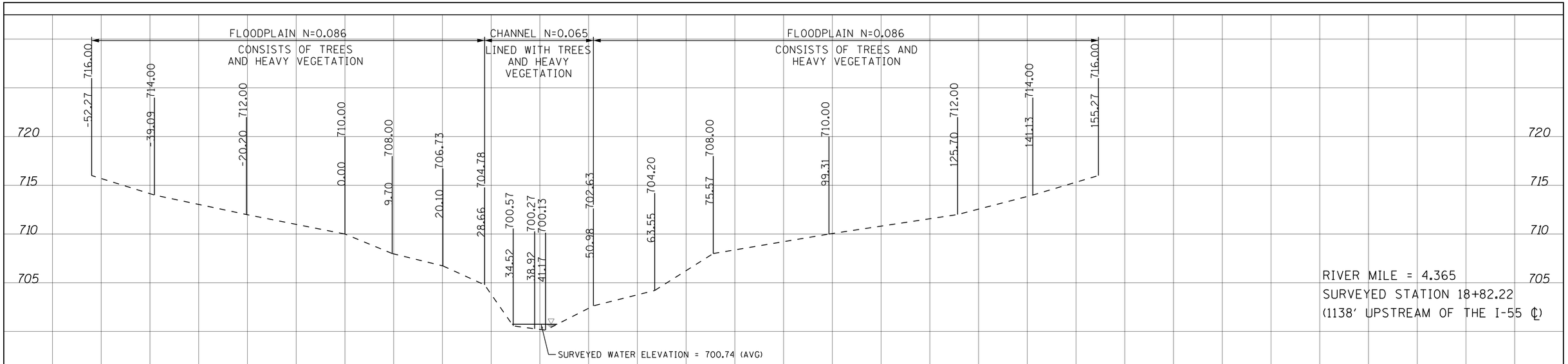
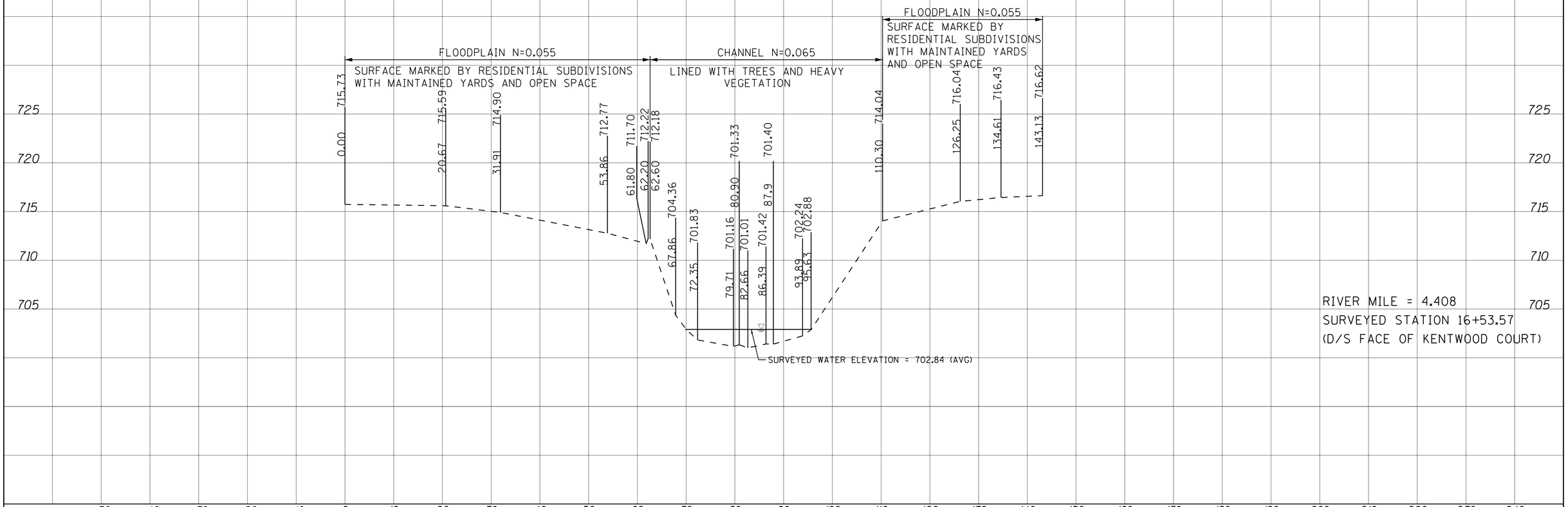
CONTRACT NO.

ILLINOIS FED. AID PROJECT





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Default	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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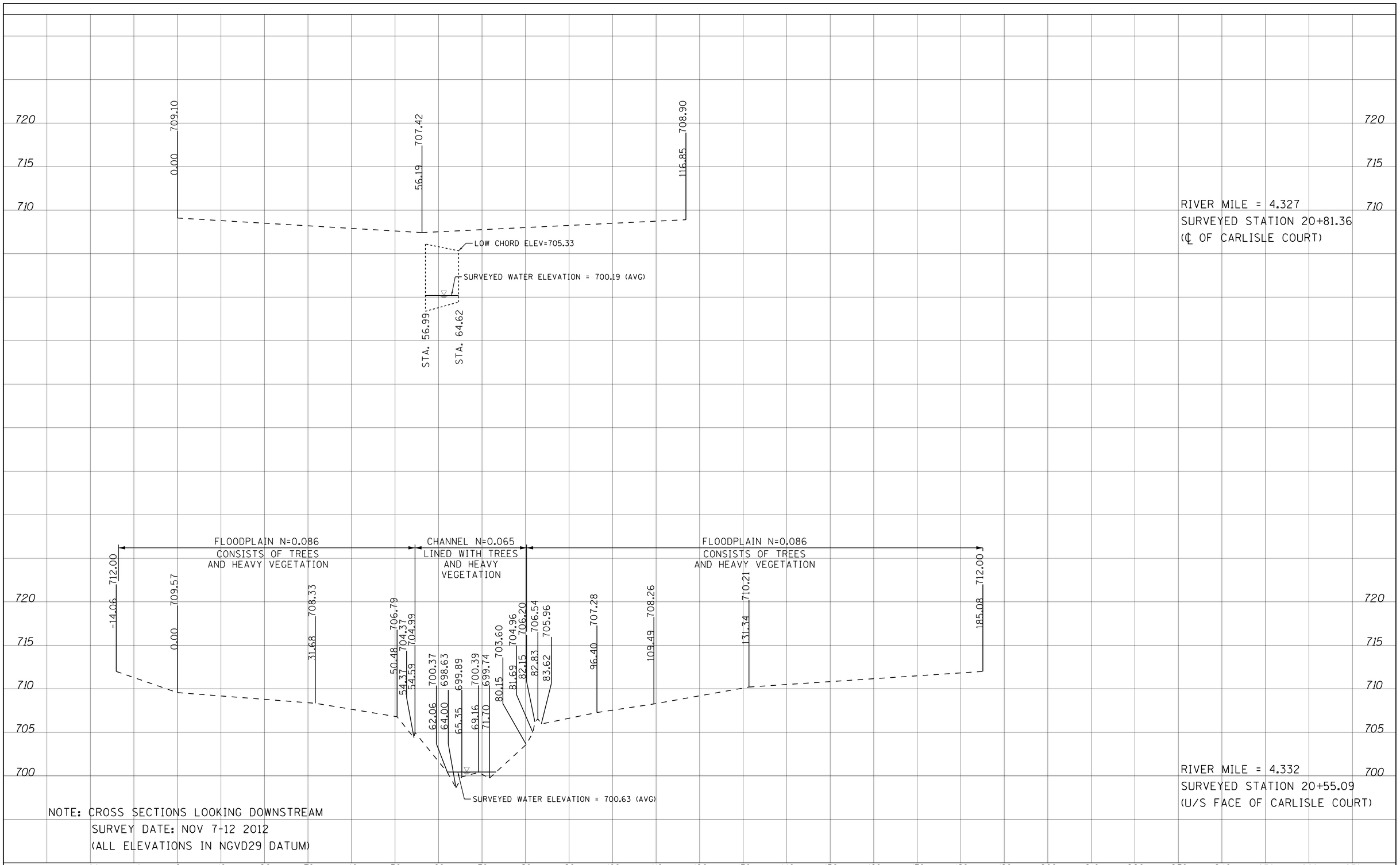
CONTRACT NO.

ILLINOIS | FED. AID PROJECT



FINAL SURVEY
NOTE BOOK
NO.
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
BY
DATE

ORIGINAL SURVEY
NOTE BOOK
NO.
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
BY
DATE

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Default	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 20+55.09 | TO STA.21+10.39

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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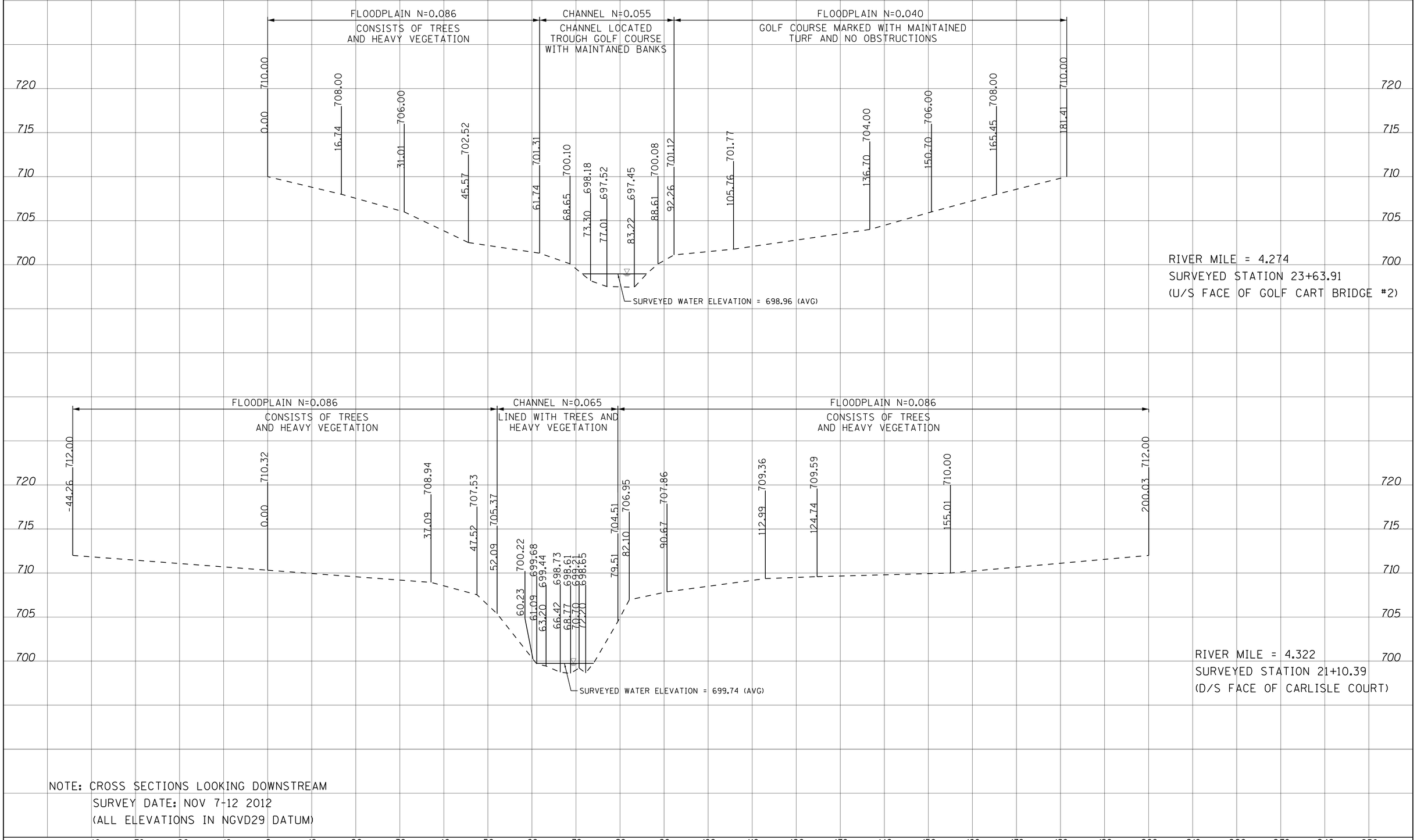
CONTRACT NO.

ILLINOIS FED. AID PROJECT



NOTE: CROSS SECTIONS LOOKING DOWNSTREAM
SURVEY DATE: NOV 7-12 2012
(ALL ELEVATIONS IN NGVD29 DATUM)

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Default	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 23+63.91 | TO STA. 23+90.48

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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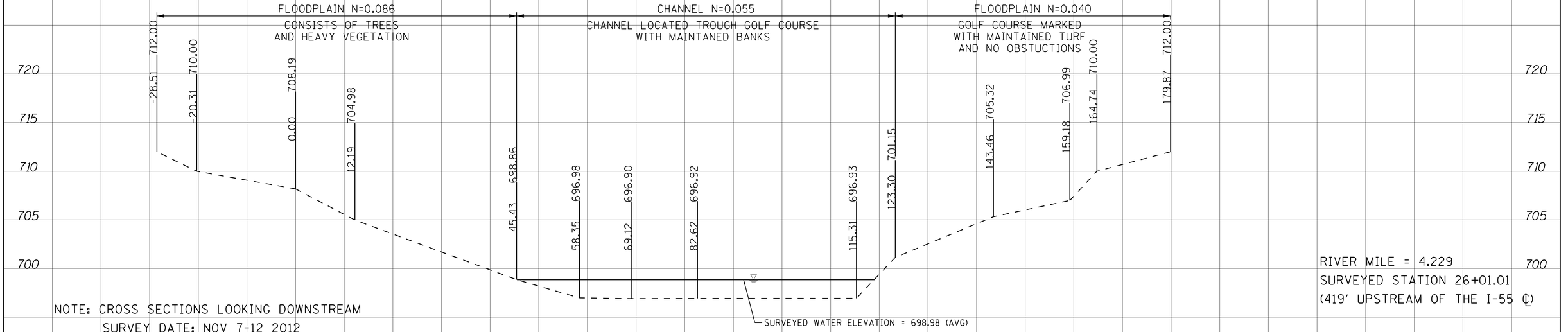
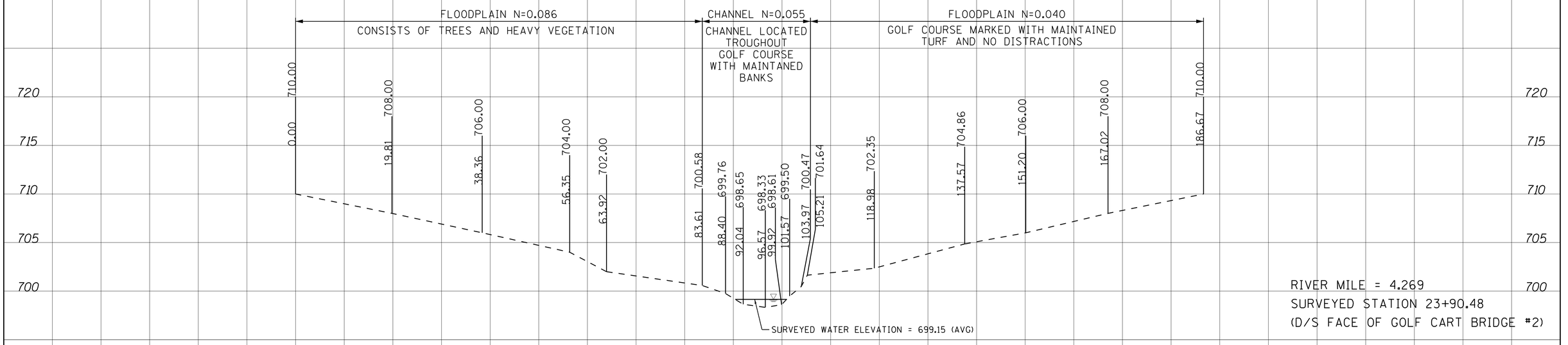
CONTRACT NO.

ILLINOIS FED. AID PROJECT



NOTE: CROSS SECTIONS LOOKING DOWNSTREAM
SURVEY DATE: NOV 7-12 2012
(ALL ELEVATIONS IN NGVD29 DATUM)

FINAL SURVEY
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
NOTE BOOK
NO.
BY
DATE



NOTE: CROSS SECTIONS LOOKING DOWNSTREAM
SURVEY DATE: NOV 7-12 2012
(ALL ELEVATIONS IN NGVD29 DATUM)

ORIGINAL SURVEY
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
NOTE BOOK
NO.
BY
DATE

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		DRAWN -	REVISED -
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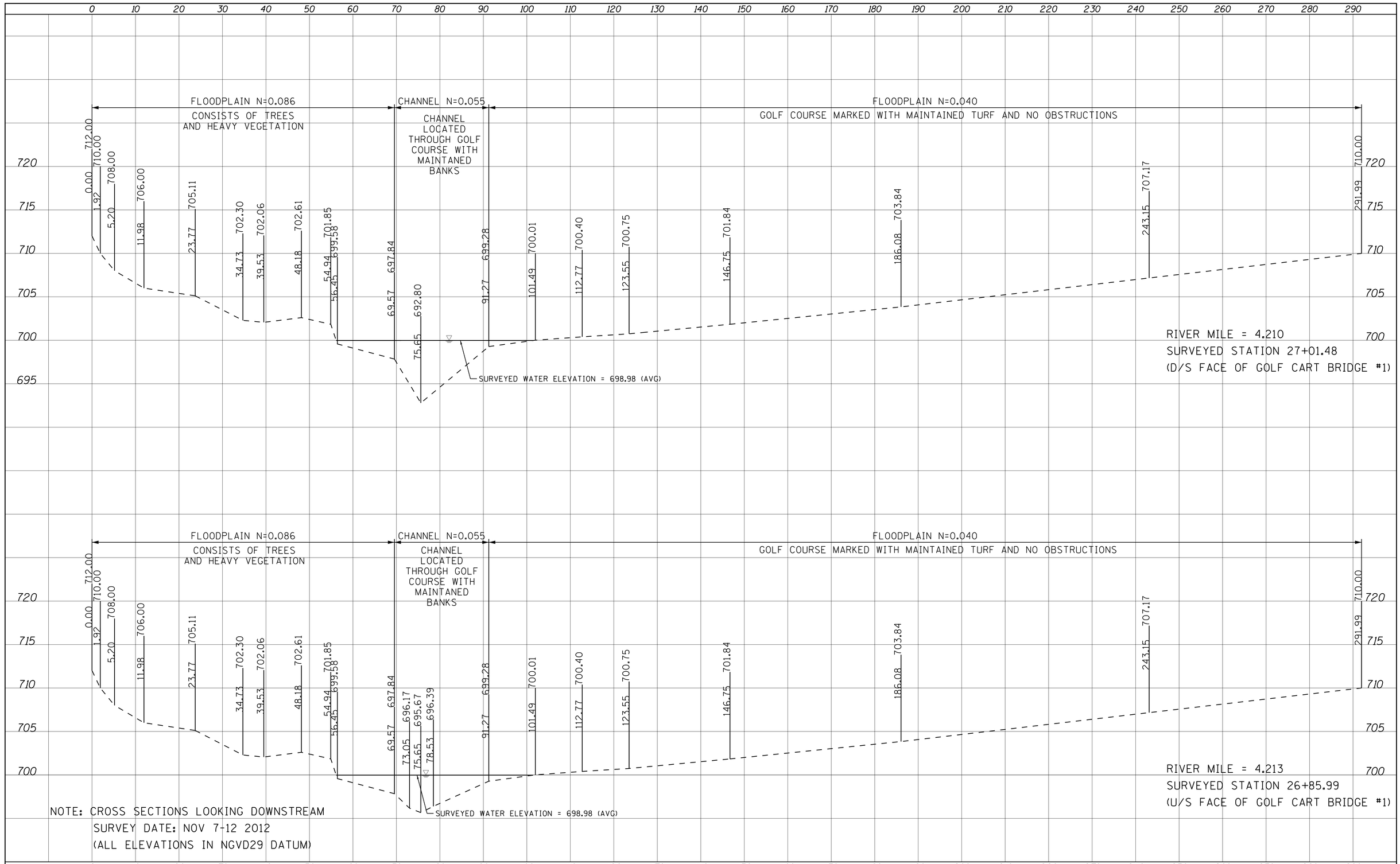
Default	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 26+01.01 | TO STA. 26+85.99

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				7
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			



FINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

ORIGINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

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		DRAWN -	REVISED -
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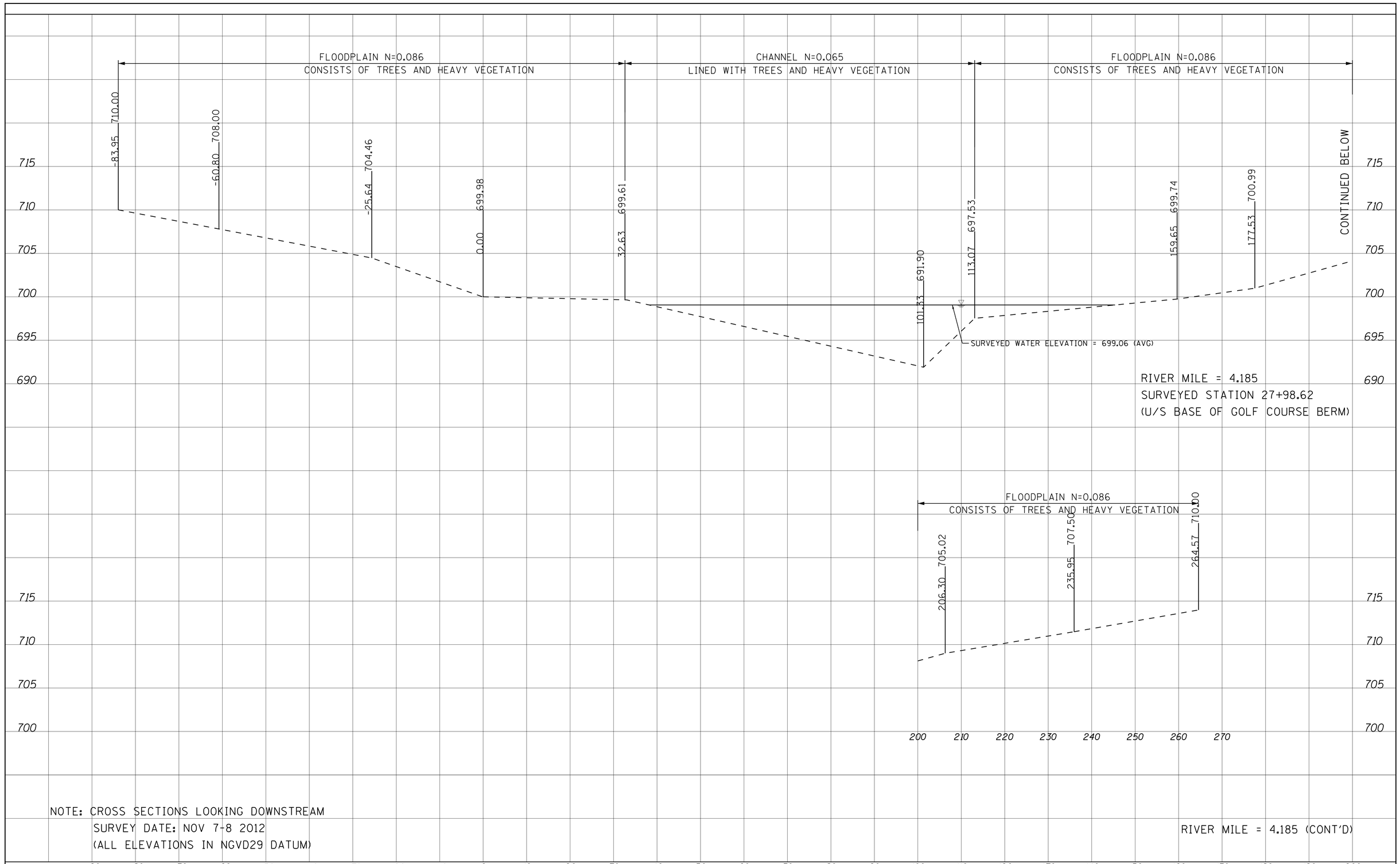
Default	PLOT DATE = 8/5/2016	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 26+01.01 | TO STA. 26+85.99

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				8
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			



NOTE: CROSS SECTIONS LOOKING DOWNSTREAM
SURVEY DATE: NOV 7-8 2012
(ALL ELEVATIONS IN NGVD29 DATUM)

RIVER MILE = 4.185 (CONT'D)

FINAL SURVEY — SURVEYED / PLOTTED / TEMPLATE / AREAS / AREAS CHECKED — BY — DATE — NOTE BOOK — NO.

ORIGINAL SURVEY — SURVEYED / PLOTTED / TEMPLATE / AREAS / AREAS CHECKED — BY — DATE — NOTE BOOK — NO.

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Default	PLOT SCALE = 10.0000 ' / in.	DRAWN -	REVISED -
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		DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

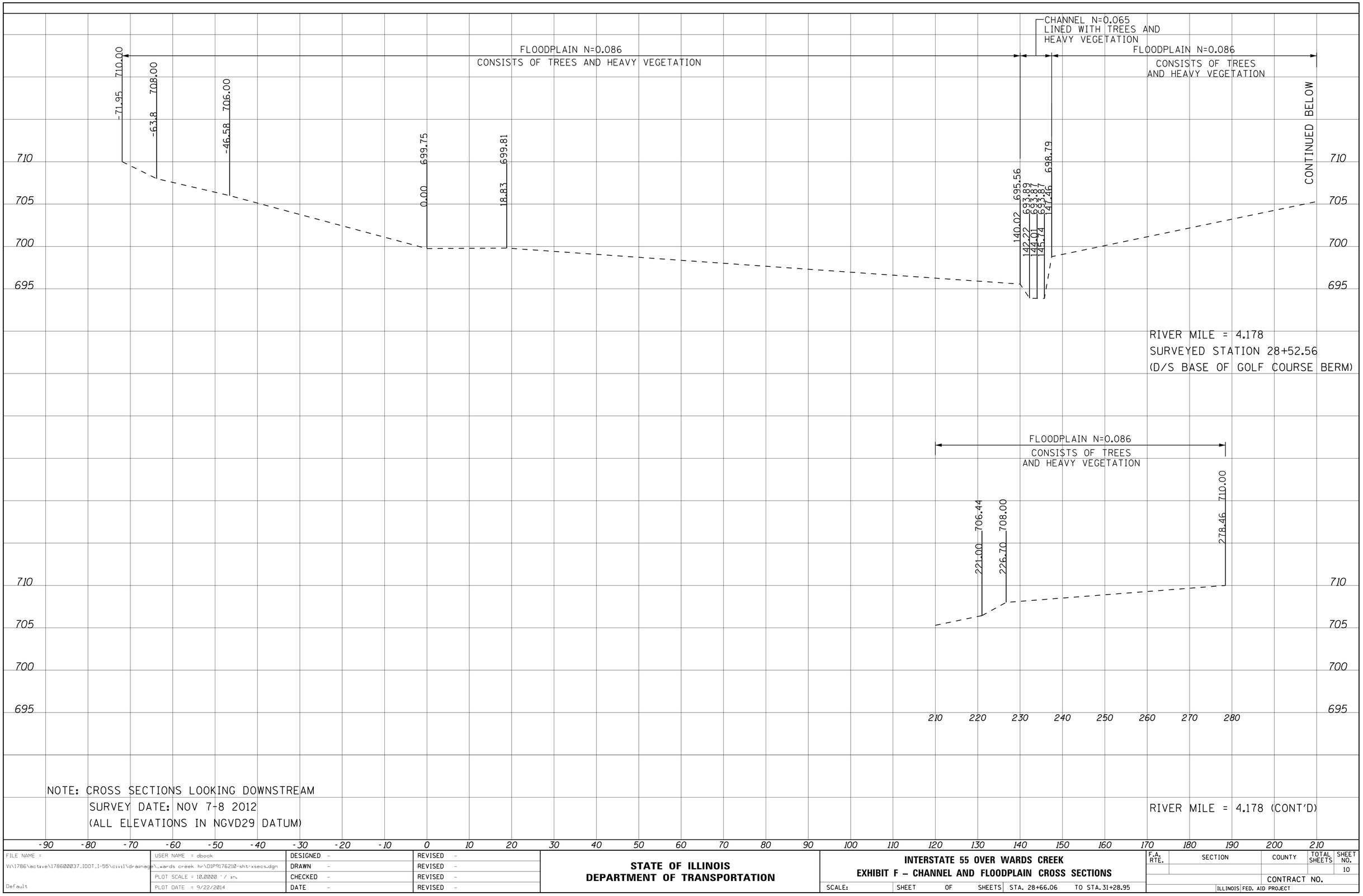
INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 28+66.06 | TO STA. 31+28.95

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				9
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

FINAL SURVEY

NOTE BOOK	BY	DATE
SURVEYED		
PLOTTED		
TEMPLATE		
AREAS		
AREAS CHECKED		
NO.		



ORIGINAL SURVEY

NOTE BOOK	BY	DATE
SURVEYED		
PLOTTED		
TEMPLATE		
AREAS		
AREAS CHECKED		
NO.		

NOTE: CROSS SECTIONS LOOKING DOWNSTREAM
SURVEY DATE: NOV 7-8 2012
(ALL ELEVATIONS IN NGVD29 DATUM)

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Default	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

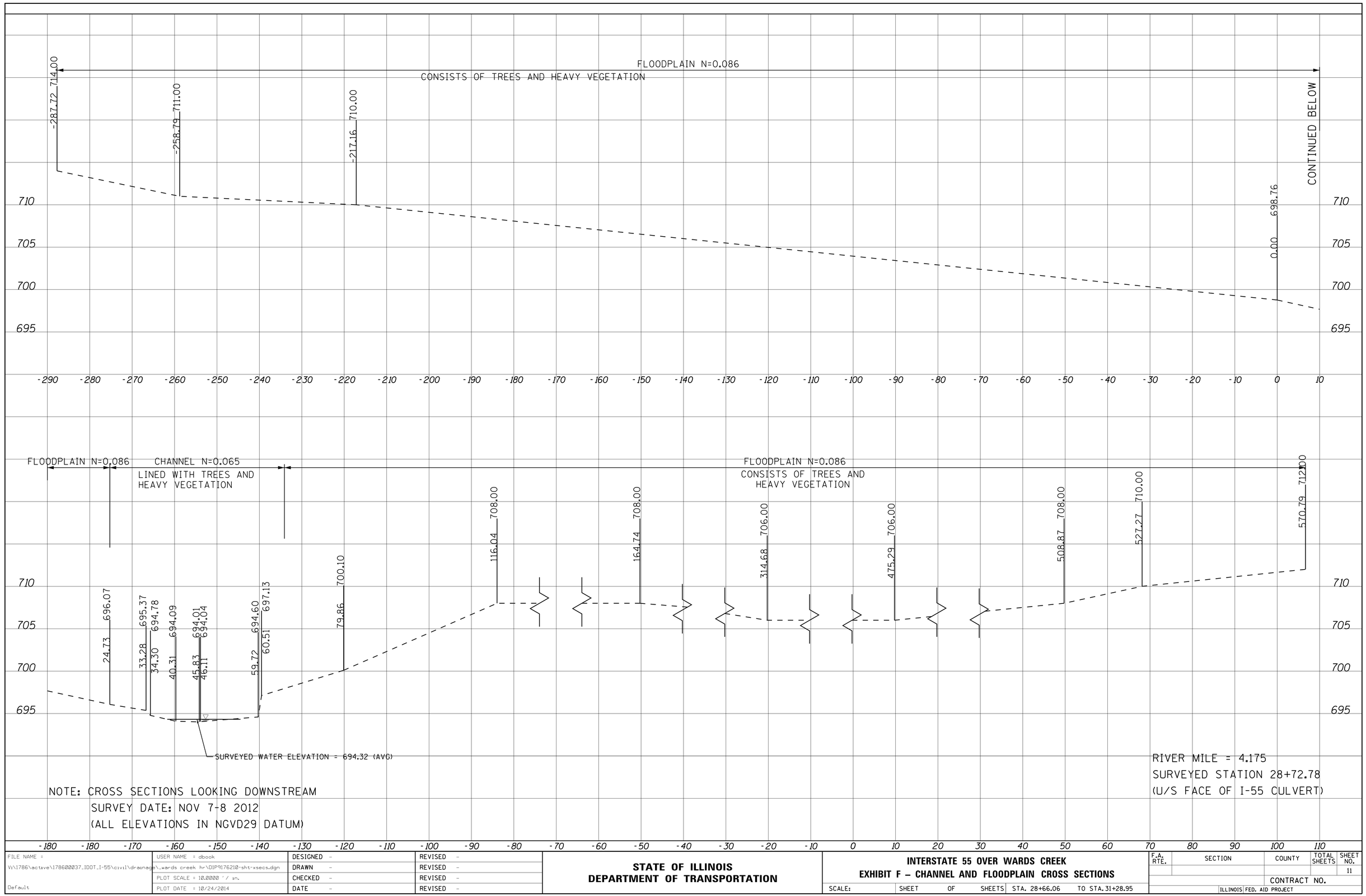
INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 28+66.06 | TO STA. 31+28.95

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				10

CONTRACT NO.

ILLINOIS | FED. AID PROJECT



NOTE: CROSS SECTIONS LOOKING DOWNSTREAM
SURVEY DATE: NOV 7-8 2012
(ALL ELEVATIONS IN NGVD29 DATUM)

RIVER MILE = 4.175
SURVEYED STATION 28+72.78
(U/S FACE OF I-55 CULVERT)

FINAL SURVEY / ORIGINAL SURVEY
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
NOTE BOOK
NO.
BY
DATE

FILE NAME = V:\1786\actuve\178600037_IDOT_I-55\civil\drainage_wards creek hr\DIP9176210-sht-xsecs.dgn	USER NAME = dbook	DESIGNED -	REVISED -
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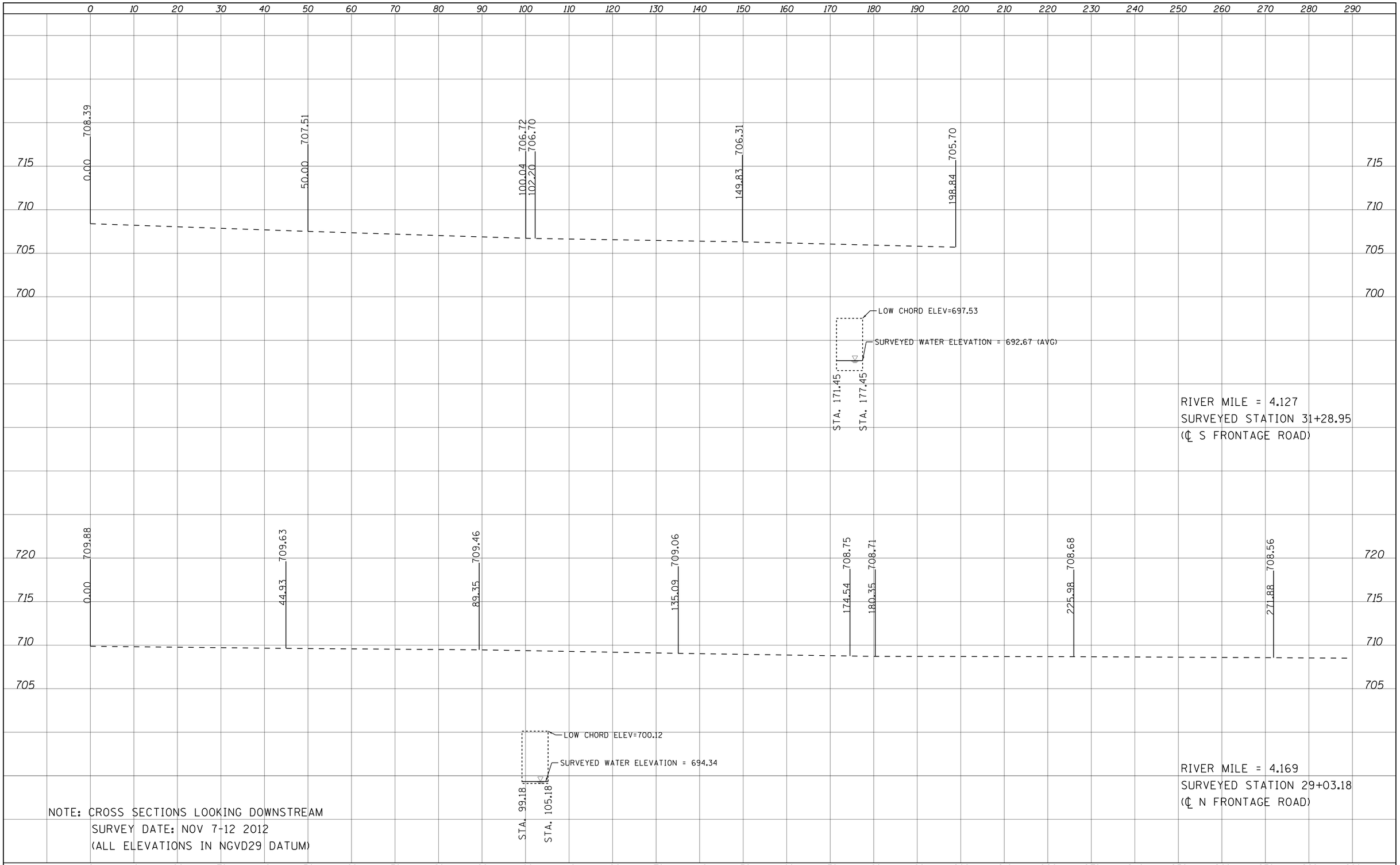
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 28+66.06 | TO STA. 31+28.95

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				11
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			



NOTE: CROSS SECTIONS LOOKING DOWNSTREAM
SURVEY DATE: NOV 7-12 2012
(ALL ELEVATIONS IN NGVD29 DATUM)

FINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

ORIGINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

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	PLOT DATE = 9/22/2014	CHECKED -	REVISED -
		DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

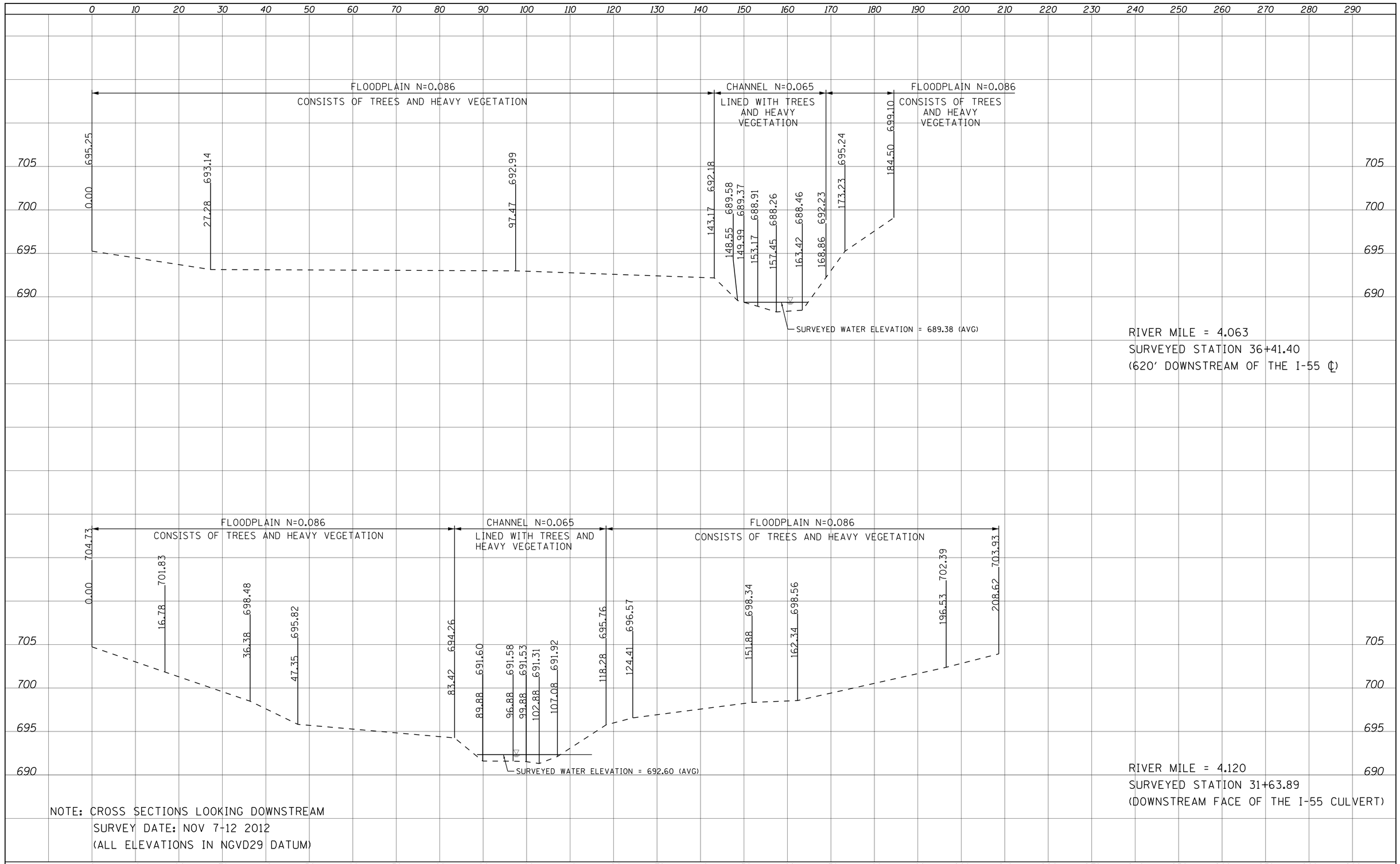
INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 31+75.49 | TO STA. 36+41.40

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				12

CONTRACT NO.

ILLINOIS FED. AID PROJECT



FINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

ORIGINAL SURVEY — NOTE BOOK — NO. — SURVEYED — PLOTTED — TEMPLATE — AREAS — AREAS CHECKED — BY — DATE

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Default	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

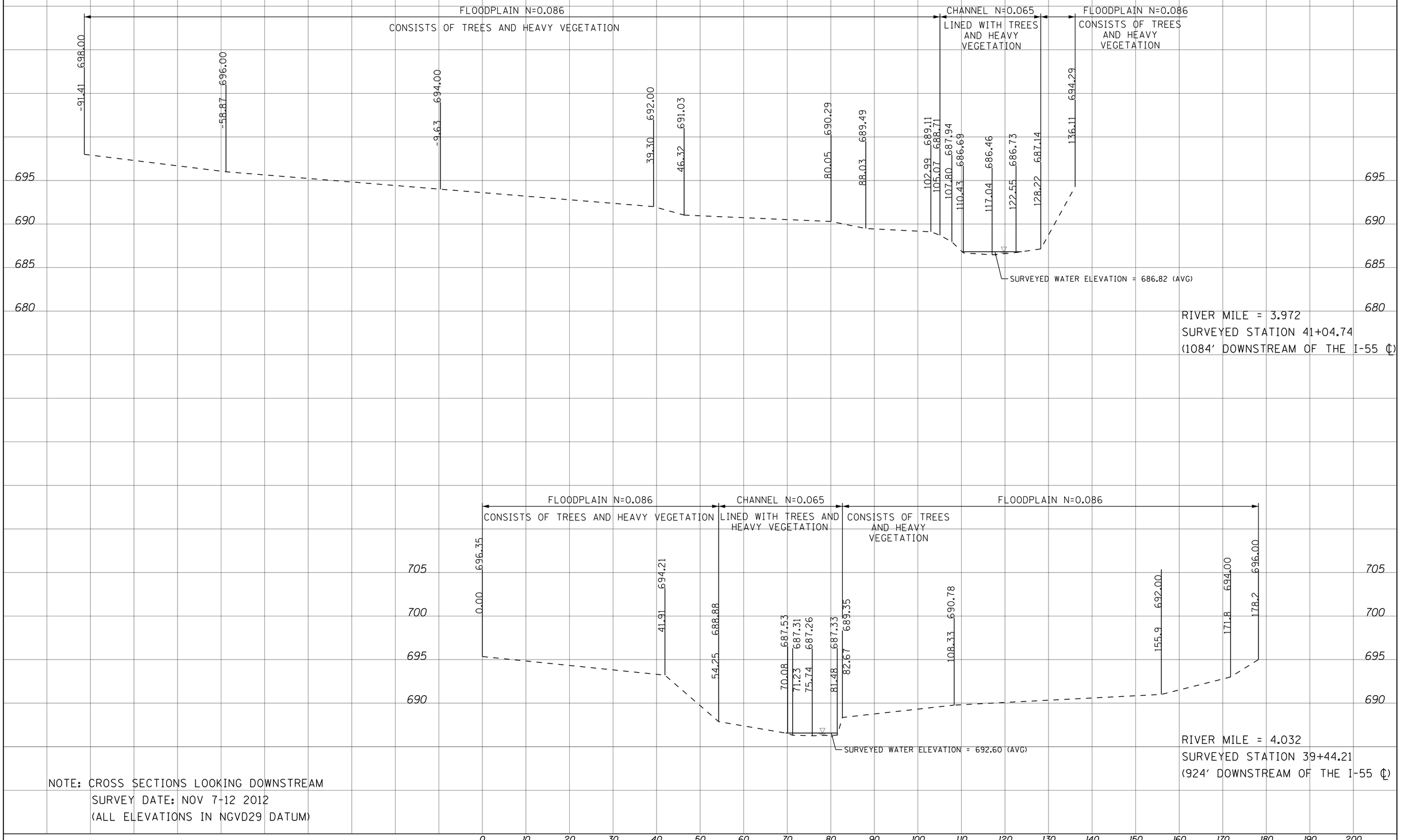
INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 39+44.21 | TO STA. 41+04.74

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				13

CONTRACT NO.

ILLINOIS FED. AID PROJECT



FINAL SURVEY
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
NOTE BOOK
NO.
BY
DATE

ORIGINAL SURVEY
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
NOTE BOOK
NO.
BY
DATE

NOTE: CROSS SECTIONS LOOKING DOWNSTREAM
SURVEY DATE: NOV 7-12 2012
(ALL ELEVATIONS IN NGVD29 DATUM)

FILE NAME = V:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\DIP9176210-sht-xsecs.dgn	USER NAME = dbook	DESIGNED -	REVISED -
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Default	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT F – CHANNEL AND FLOODPLAIN CROSS SECTIONS

SCALE: | SHEET OF SHEETS | STA. 39+44.21 | TO STA. 41+04.74

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				14

CONTRACT NO.

ILLINOIS FED. AID PROJECT

EXHIBIT G

ANALYSIS OF MANNING'S N ROUGHNESS COEFFICIENT

Interstate 55 (Stevenson Expressway) over Wards Creek

Analysis of Manning's N Roughness Coefficient Values

Procedure:

Roughness coefficients are computed in accordance with the procedure outlined in the IDOT Drainage Manual, Chapter 5 - Open Channel Flow

Reference photographs of Ward Creek and corresponding floodplain taken in December 2012 and January 2013.

There are five types of channel and floodplain conditions identified within the area of study. A description of each type is provided below:

Item 1.

The stream channel flowing through the study area extends from the upstream limit of the study to the Carriage Green Golf Course property and again extending downstream of the Interstate 55 culvert crossing. The channel is defined by a consistent cross section and is flowing free with heavy plant growth on the banks. Portions of the cross sectional area are blocked with obstructions consisting of trees and cobbles.

Item 2.

The stream channel flowing through the Carriage Green Golf Course. The channel is defined by a consistent cross sections and is flowing free with turf grass along the banks and channel bottom.

Item 3.

Floodplain area located near the upstream limits of the study is comprised mainly of residental properities and large open areas. The cross section is obstructed with scattered buildings and the surface is comprised of manicured lawns.

Item 4.

Floodplain area located throughout the golf course and upstream of the Interstate 55 culvert crossing defined by large open areas and turf grass.

Item 5.

Floodplain area found throughout the study limits and is prevelant downstream of the Interstate 55 culvert crossing. The floodplain is generally characterized by undeveloped land consisting of wooded tree cover and heavy plant vegetation found adjacent to the channel banks and Forest Preserve propery .

CHANNEL ROUGHNESS COEFFICIENT (ITEMS #1 and 2)

$$n = (n_b + n_1 + n_2 + n_3 + n_4)\, m$$

Where:

n_b = a base value of n for a straight uniform, smooth channel in natural materials
n_1 = a value added to correct for the effect of surface irregularities
n_2 = a value for variations in shape and size of the channel cross section
n_3 = a value for obstructions
n_4 = a value for vegetation and flow conditions
m = a correction factor for meandering of the channel

Item #1 Channel Description

The stream channel flowing through the study area extends from the upstream limit of the study to the Carriage Green Golf Course property and again extending downstream of the Interstate 55 culvert crossing. The channel is defined by a consistent cross section and is flowing free with heavy plant growth on the banks. Portions of the cross sectional area are blocked with obstructions consisting of trees and cobbles.

This n-value is applied to two reach locations of the overall study limits. The locations are defined as:
1.) from the upstream limit of the study and extending to the Carriage Green Golf Cart Path #2
2.) downstream of Interstate 55 to the downstream limit.

Factor		Value	Description
Base Value	n_b =	0.030	Base material of channel is comprised of firm soil with evidence of cobbles throughout the limits.
Irregularity	n_1 =	0.005	Minor - channel compares to carefully dredged channels, but with slightly eroded or scoured sideslopes.
Variation in Channel Cross Section	n_2 =	0.000	The size and shape of the channel cross slope sections change gradually.
Obstructions	n_3 =	0.005	Minor - obstructions occupy less than 15-percent of the cross sectional area.
Vegetation	n_4 =	0.025	Large - Channel banks are lined with 8 to 10-year old trees with weeds along the side slopes. No significant vegetation along the channel bottoms.
Meandering	m =	1.000	Minor - The ratio of the channel length to the valley length is 1.0 to 1.2
Item 1: Calculated Channel Roughness Coefficient, n =		0.065	
Approximates the Regulatory Model n- value of 0.065 for the channel			

Item #2 Channel Description

The stream channel flowing through the Carriage Green Golf Course. The channel is defined by a consistent cross sections and is flowing free with turf grass along the banks and channel bottom.

This n-value is applied to the portion of the channel located through the Carriage Green Golf Course.

Factor		Value	Description
Base Value	n_b =	0.028	Base material of the channel is comprised of firm soil.
Irregularity	n_1 =	0.005	Minor - channel compares to carefully dredged channels, but with slightly eroded or scoured sideslopes.
Variation in Channel Cross Section	n_2 =	0.005	Alternating occassionally - large and small cross sections alternate occasionally.
Obstructions	n_3 =	0.005	Minor - obstructions occupy less than 15-percent of the cross sectional area.
Vegetation	n_4 =	0.010	Small - dense growth of flexible turf grass growing along the channel banks and the depth of flow is at least three times the height of the vegetation.
Meandering	m =	1.000	Minor - The ratio of the channel length to the valley length is 1.0 to 1.2
Item 2: Calculated Channel Roughness Coefficient, n =		0.053	
Approximates the Regulatory Model n- value of 0.050 and 0.055 for the channel			

FLOODPLAIN ROUGHNESS COEFFICIENT (ITEMS #3, 4, and 5)

$$n = (n_b + n_1 + n_2 + n_3 + n_4)\, m$$

Where:

n_b = a base value of n for the floodplain's natural bare soil surface, with nothing on the surface
n_1 = a value to correct for the effect of surface irregularities on the floodplain
n_2 = a value for variations in shape and size of the floodplain cross-section (assumed to equal 0.0)
n_3 = a value for obstructions on the floodplain
n_4 = a value for vegetation on the floodplain
m = a correction factor for sinuosity of the floodplain, equal to 1.0

Item 3 Floodplain Description:

Floodplain area located near the upstream limits of the study is comprised mainly of residental properities and large open areas. The cross section is obstructed with scattered buildings and the surface is comprised of manicured lawns.

This n-value is applied to the portions of the floodplain located at the upstream limit of the study that are adjacent to the residential subdivision.

Factor		Value	Description
Base Value	n_b =	0.030	Base material of channel is comprised of firm soil
Surface Irregularity	n_1 =	0.003	Minor - a floodplain with minor irregularity is shape with a few rises and dips visible on the floodplain.
Variation in Channel Cross Section	n_2 =	0.000	Not Applicable
Obstructions	n_3 =	0.012	Minor - obstructions occupy less than 15 percent of the cross-sectional area.
Vegetation	n_4 =	0.010	Small - dense growths of flexible turf grass where the average depth of flow is at least two times the height of the vegetation.
Meandering	m =	1.000	Not Applicable
Item 3: Calculated Floodplain Roughness Coefficient, n =		0.055	

FLOODPLAIN ROUGHNESS COEFFICIENT (ITEMS #3, 4, and 5)

Item 4 Floodplain Description:

Floodplain area located throughout the golf course and upstream of the Interstate 55 culvert crossing defined by large open areas and turf grass.

This n-value is applied to the portions of the floodplain located adjacent to the Golf Course.

Factor		Value	Description
Base Value	n_b =	0.030	Base material of channel is comprised of firm soil
Surface Irregularity	n_1 =	0.000	Compares the flatest floodplain attainable. The floodplain consists of a very broad and flat section with little change in elevation.
Variation in Channel Cross Section	n_2 =	0.000	Not Applicable
Obstructions	n_3 =	0.005	Minor - Obstructions, such as trees, occupy less than 15 percent of the cross-sectional area.
Vegetation	n_4 =	0.005	Small - dense growths of flexible turf grass where the average depth of flow is at least two times the height of the vegetation.
Meandering	m =	1.000	Not Applicable
Item 4: Calculated Floodplain Roughness Coefficient, n =		0.040	

Item 5 Floodplain Description:

Floodplain area found throughout the study limits and is prevelant downstream of the Interstate 55 culvert crossing. The floodplain is generally characterized by undeveloped land consisting of wooded tree cover and heavy plant vegetation found

This n-value is applied to the portions of the floodplain located along the study limits and adjacent to the bank. This value is alo applied to the floodplain located downstream of the crossing.

Factor		Value	Description
Base Value	n_b =	0.028	Base material of channel is comprised of firm soil
Surface Irregularity	n_1 =	0.008	Moderate - floodplain has more rises and dips.
Variation in Channel Cross Section	n_2 =	0.000	Not Applicable
Obstructions	n_3 =	0.005	Minor - obstructions (debris, stumps, exposed roots, etc.) occupy less than 15 percent of the cross-sectional area.
Vegetation	n_4 =	0.045	Very Large - moderate dense brush with heavy stands of timber.
Meandering	m =	1.000	Not Applicable
Item 5: Calculated Floodplain Roughness Coefficient, n =		0.086	
Approximates the Regulatory Model n- values ranging between 0.070 and 0.080 for the floodplain.			

EXHIBIT H

CULVERT & BRIDGE OPENING PLOTS

36" CMP (23 LF)
OUTLET FROM BERM

DITCH FLOW TO CULVERT

EDGE OF WATER

N. FRONTAGE ROAD

℄ INTERSTATE 55
SB LANES

338+00

INTERSTATE 55

℄ INTERSTATE 55
NB LANES

S. FRONTAGE ROAD

STA. 337+24.18 ℄ I-55=
STA. 30+16.03 ℄ WARDS CREEK

6' x 6' REINFORCED
CONCRETE BOX CULVERT

CONCRETE WINGWALLS

10" RCP (52 LF) AND 24" RCP (52 LF)
OUTLET FROM BERM

LIMITS OF THE
TOP OF BERM

6.1°

30+00

6.0'

290.2'

6.0'

337+00

N

SCALE:
1" = 20' HORIZONTAL
1" = 2' VERTICAL

℄ WARDS CREEK

NGVD29 DATUM

PLAN
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
ENGINEER CHECKED
BM. NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE

708
706
704
702
700
698
696
694
692

STA. 0.50
EL. 708.78

STA. 45.38
EL. 708.43

STA. 90.64
EL. 708.39

TOP OF ROADWAY (OVERTOPPING PROFILE)

STA. 50.30
EL. 707.51

STA. 100.30
EL. 706.71

STA. 150.10
EL. 706.30

TOP OF ROADWAY (S. FRONTAGE ROAD)

706
704
702
700
698
696
694
692
690

STA. 40.32
EL. 700.12

STA. 46.32
EL. 700.12

6.0'
MEASURED
PERPENDICULAR
TO FLOW

STA. 40.32
EL. 694.12

WSEL=694.34

STA. 46.32
EL. 694.12

UPSTREAM FACE
(LOOKING DOWNSTREAM)

STA. 96.88
EL. 697.53

STA. 102.88
EL. 697.53

6.0'
MEASURED
PERPENDICULAR
TO FLOW

STA. 96.88
EL. 691.53

WSEL=692.67

STA. 102.88
EL. 691.53

DOWNSTREAM FACE
(LOOKING DOWNSTREAM)

0 20 60 80 100 40 80 120 140 180

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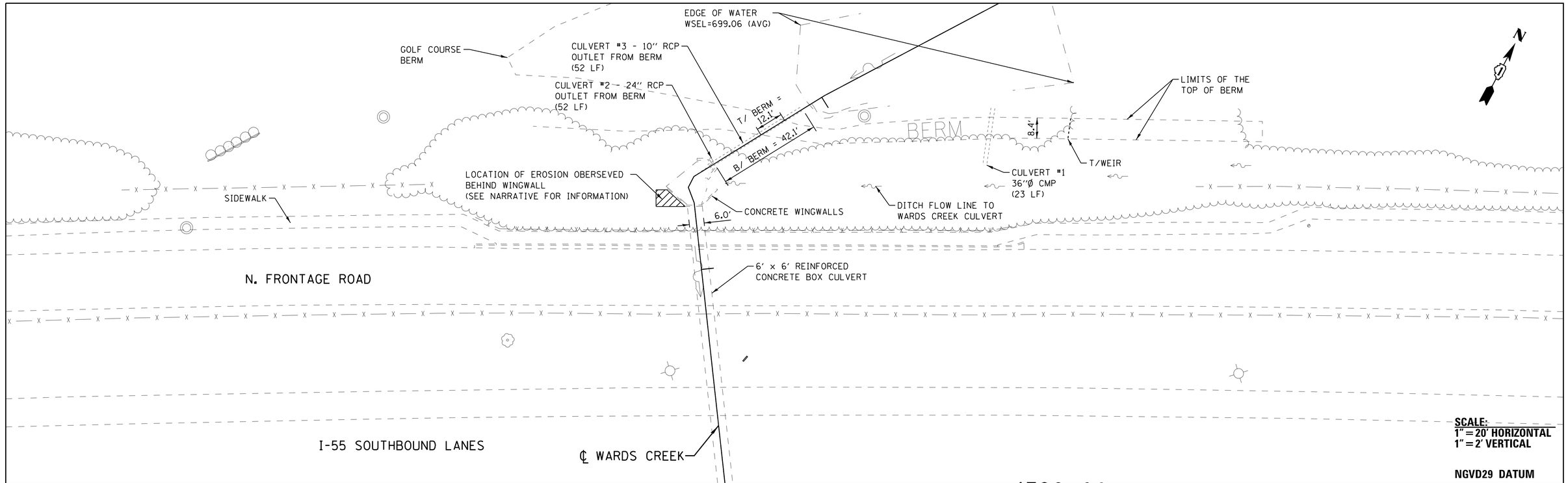
		DATE -	REVISED -

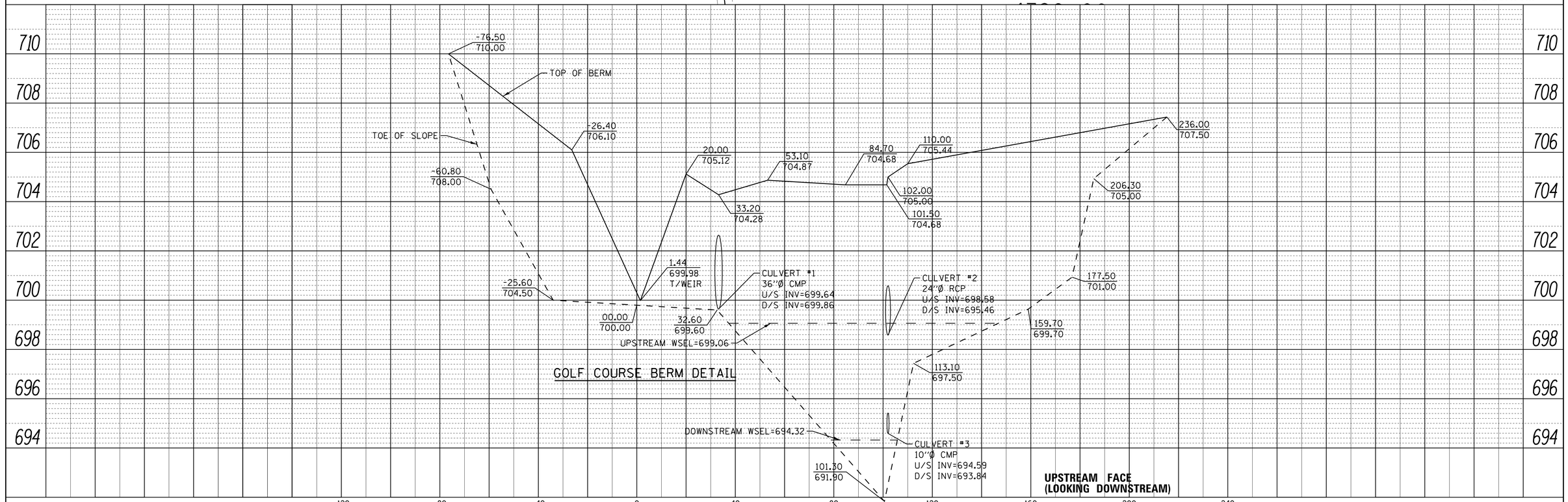
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT H – EXISTING CULVERT OPENING PLOT

SCALE: SHEET OF SHEETS STA. TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				H-1
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			





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PROFILE — SURVEYED / PLOTTED / GRADES CHECKED / B.M. NOTED / STRUCTURE NOTATNS CHKD / NOTE BOOK / NO. / BY / DATE

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Default		DRAWN -	REVISED -
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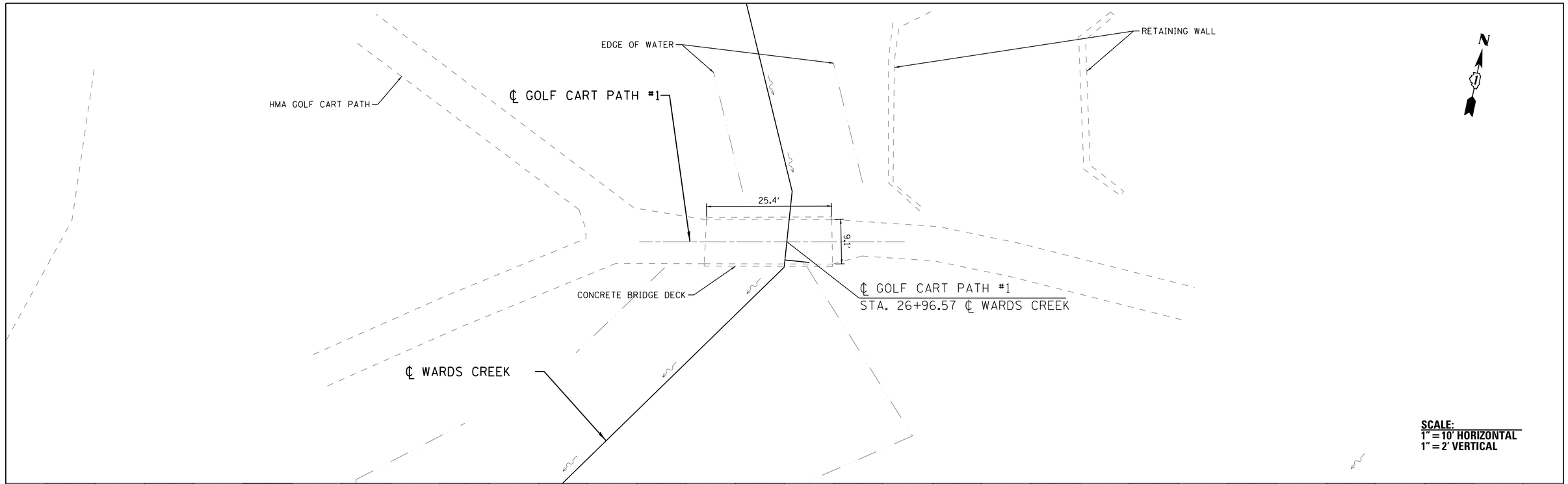
	PLOT DATE = 3/9/2016	DATE -	REVISED -

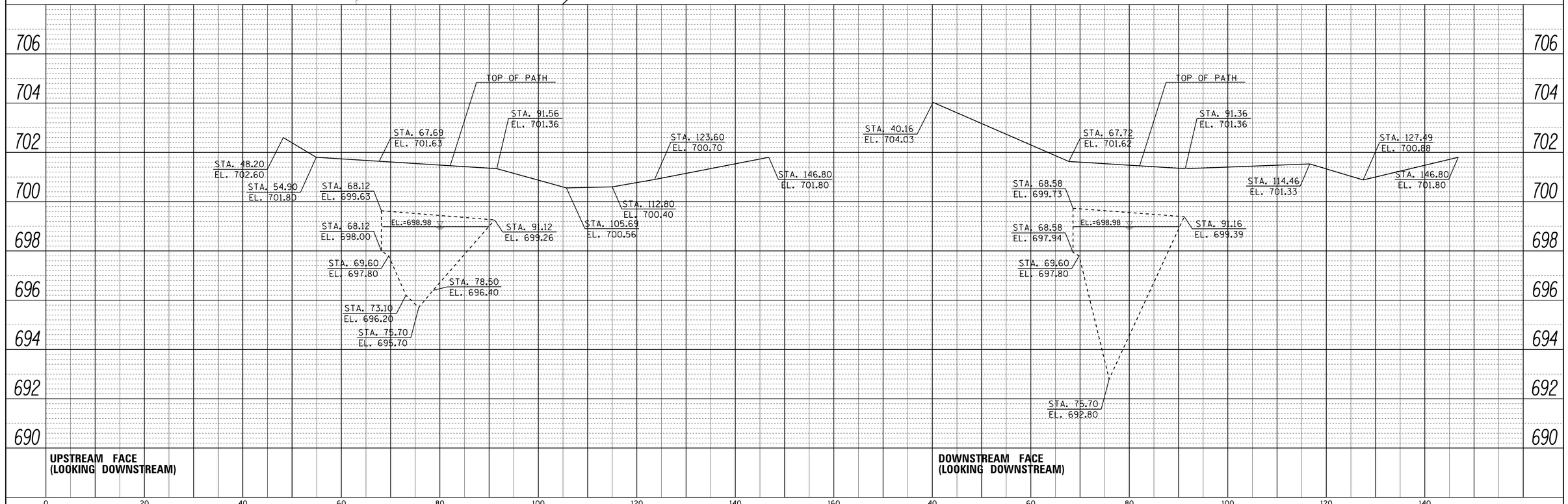
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT H – GOLF COURSE BERM PLOT

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				H-2
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			





PLAN
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
ELEVATIONS CHECKED
B.M. NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE

FILE NAME = V:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\DIP9176210-sht-brdg-gc	USER NAME = dbook	DESIGNED -	REVISED -
Default		DRAWN -	REVISED -
	PLOT SCALE = 10.0000 ' / in.	CHECKED -	REVISED -
	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT H – GOLF CART PATH #1 BRIDGE OPENING PLOT

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				H-3
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

PLAN
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
PROFILE CHECKED
B.M. NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE

EDGE OF WATER

℄ GOLF CART PATH #2

27.9'

17.9'

HMA GOLF CART PATH

CONCRETE BRIDGE DECK

℄ GOLF CART PATH #2
STA. 23+77.83 ℄ WARDS CREEK

℄ WARDS CREEK

N

SCALE:
1" = 10' HORIZONTAL
1" = 2' VERTICAL

NGVD29 DATUM

STA. 31.00
EL. 706.00

STA. 42.69
EL. 703.20

STA. 56.05
EL. 702.16

STA. 61.74
EL. 702.15

STA. 61.84
EL. 702.62

TOP OF PATH

STA. 90.11
EL. 702.18

STA. 90.21
EL. 702.00

STA. 65.91
EL. 700.67

STA. 65.91
EL. 700.58

STA. 68.70
EL. 700.10

STA. 82.11
EL. 700.31

STA. 88.51
EL. 700.06

EL.=698.96

STA. 73.30
EL. 698.20

STA. 77.00
EL. 697.50

STA. 83.20
EL. 697.40

STA. 108.62
EL. 702.00

STA. 136.70
EL. 704.00

UPSTREAM FACE
(LOOKING DOWNSTREAM)

STA. 56.40
EL. 704.00

STA. 61.69
EL. 702.59

STA. 65.40
EL. 702.26

STA. 74.10
EL. 702.20

TOP OF PATH

STA. 83.87
EL. 700.56

STA. 88.40
EL. 699.80

EL.=699.15

STA. 92.00
EL. 698.60

STA. 96.60
EL. 698.30

STA. 101.53
EL. 702.15

STA. 101.53
EL. 700.33

STA. 101.53
EL. 699.46

STA. 99.90
EL. 698.60

STA. 112.53
EL. 702.03

STA. 119.00
EL. 702.40

DOWNSTREAM FACE
(LOOKING DOWNSTREAM)

706 704 702 700 698 696 694 692 690

0 20 40 60 80 100 120 40 60 80 100 120 140

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Default		DRAWN -	REVISED -
	PLOT SCALE = 10.0000 ' / in.	CHECKED -	REVISED -
	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

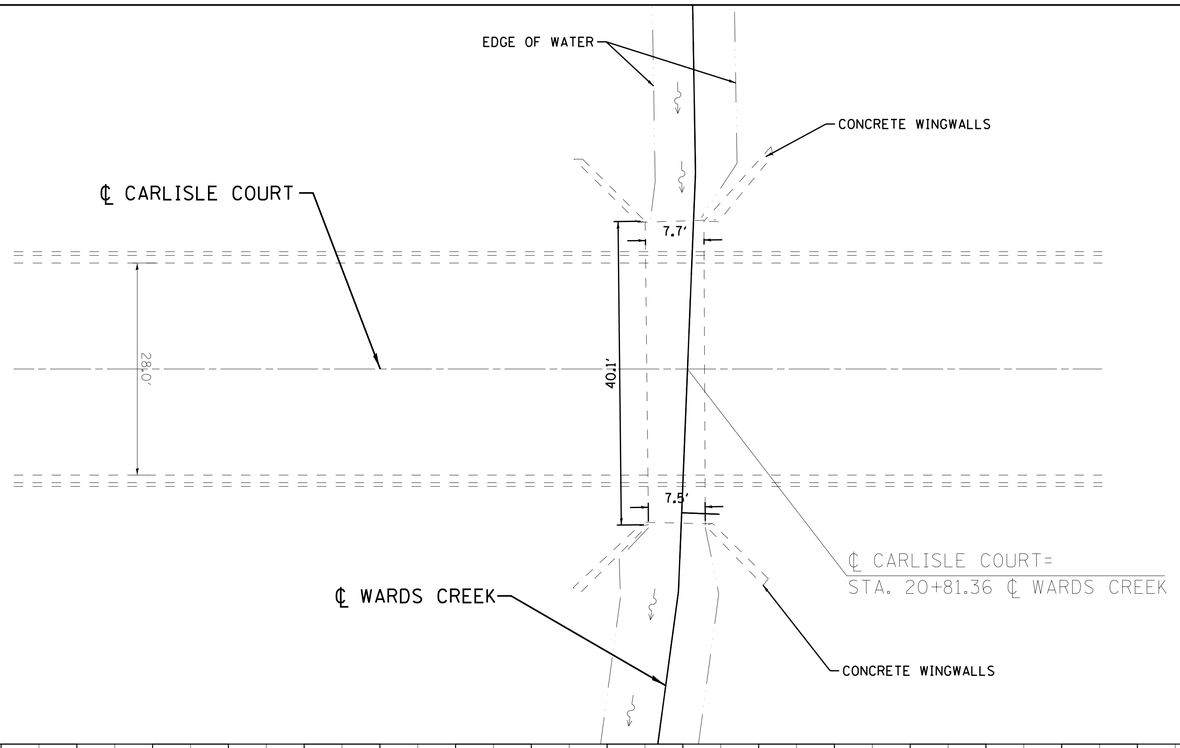
INTERSTATE 55 OVER WARDS CREEK
EXHIBIT H – GOLF CART BRIDGE #2 BRIDGE OPENING PLOT

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				H-4

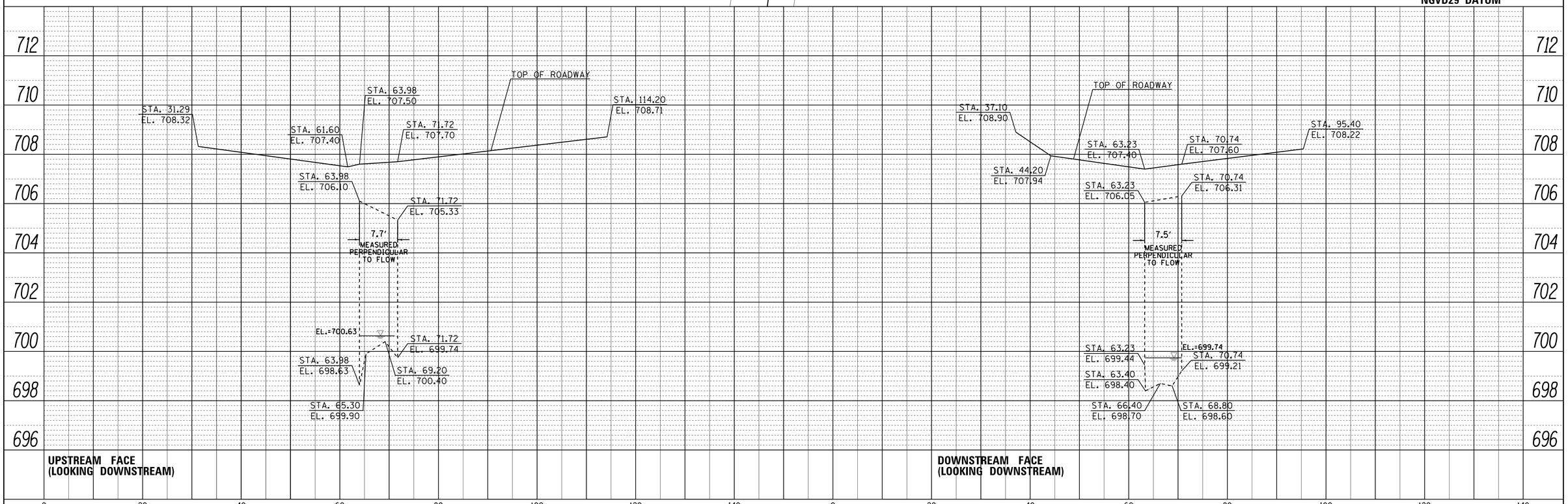
CONTRACT NO.

ILLINOIS | FED. AID PROJECT



SCALE:
1" = 10' HORIZONTAL
1" = 2' VERTICAL

NGVD29 DATUM



PLAN
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
PROFILE CHECKED
B.M., NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE

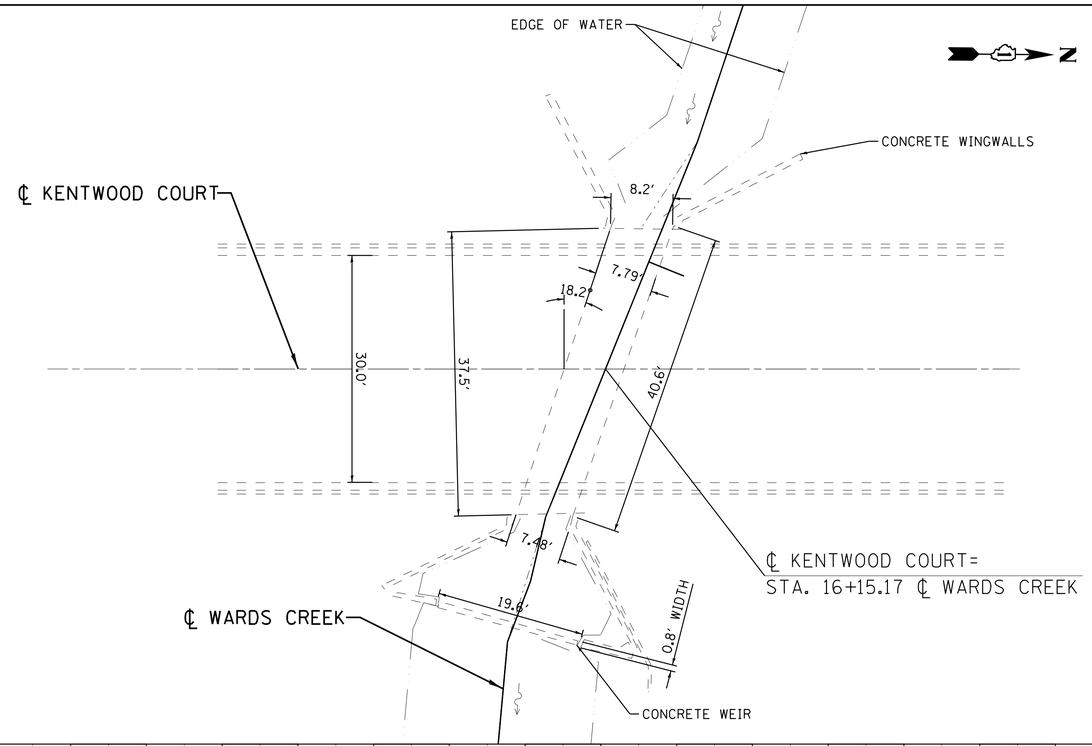
FILE NAME = V:\1786\active\1786000037_IDOT_I-55\civil\drainage_wards creek hr\DIP9176210-sht-brdg-ch Default	USER NAME = dbook	DESIGNED -	REVISED -
		DRAWN -	REVISED -
	PLOT SCALE = 10.0000 ' / in.	CHECKED -	REVISED -
	PLOT DATE = 9/22/2014	DATE -	REVISED -

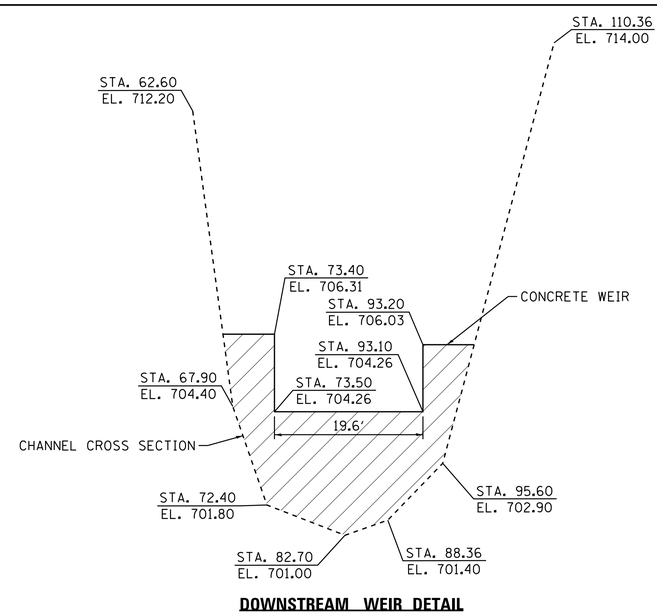
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT H – CARLISLE COURT BRIDGE OPENING PLOT

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				H-5
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

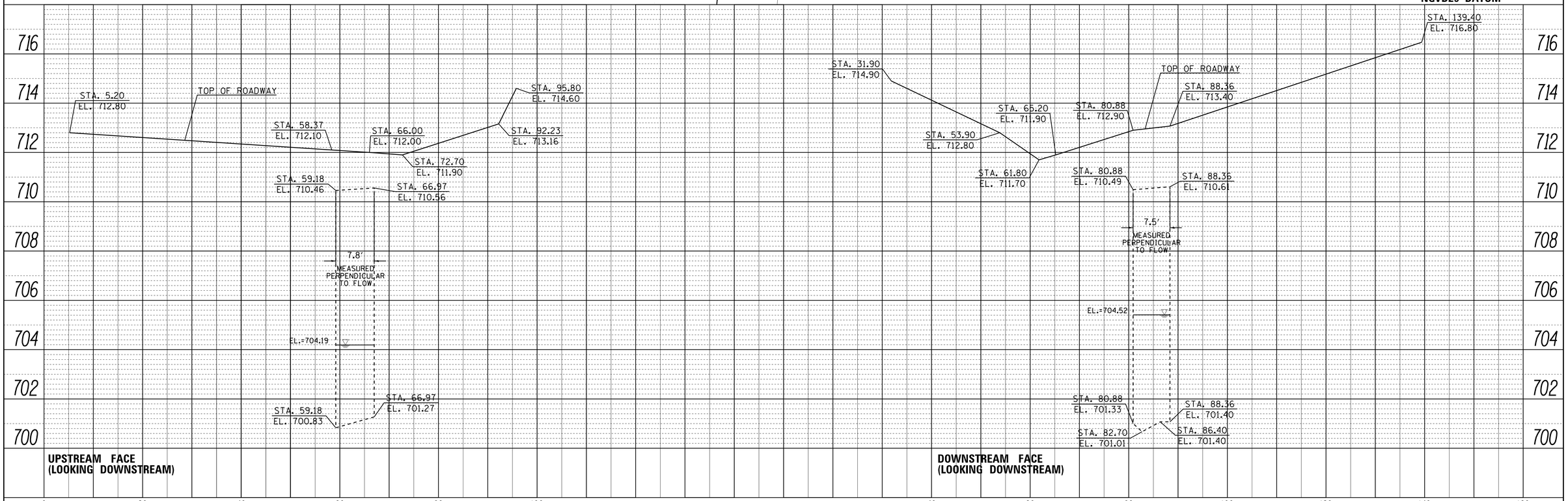




DOWNSTREAM WEIR DETAIL

SCALE:
1" = 10' HORIZONTAL
1" = 2' VERTICAL

NGVD29 DATUM



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PROFILE — SURVEYED, PLOTTED, DESIGN CHECKED, B.M. NOTED, STRUCTURE NOTATNS CHKD, NOTE BOOK, NO., BY, DATE

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	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

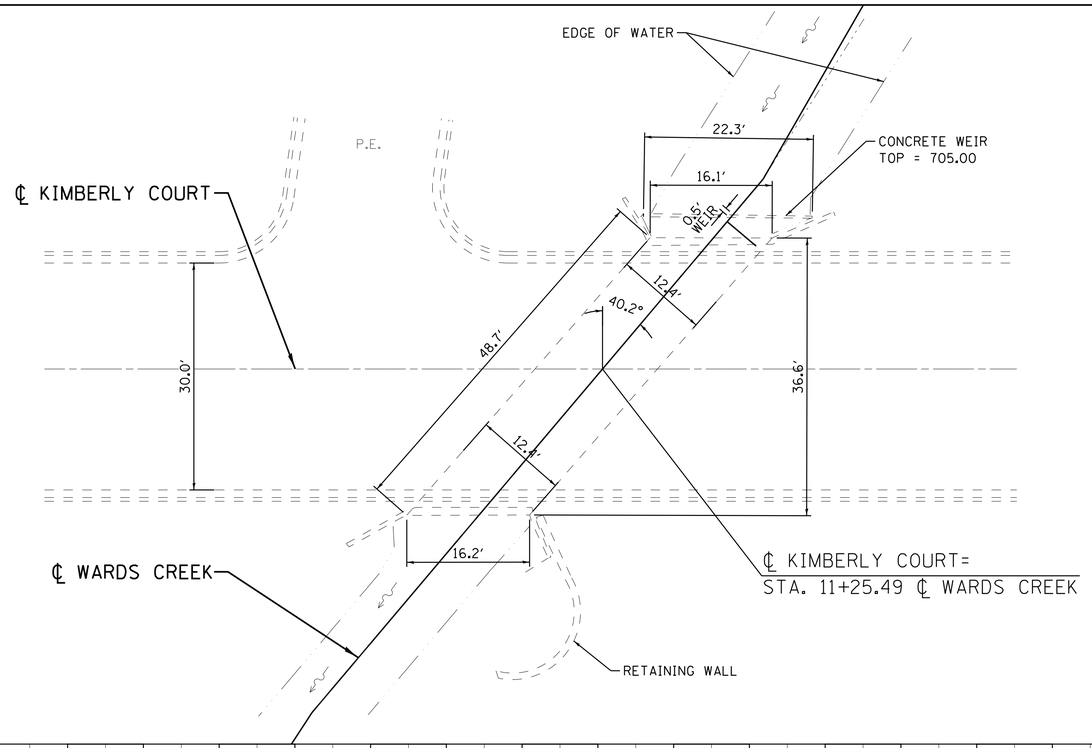
INTERSTATE 55 OVER WARDS CREEK
EXHIBIT H – KENTWOOD COURT BRIDGE OPENING PLOT

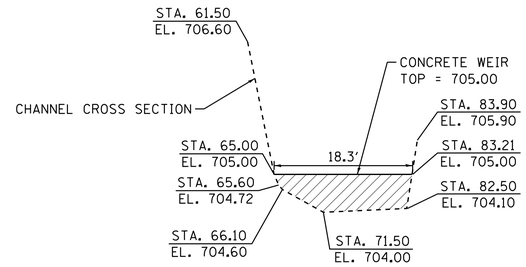
SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				H-6

CONTRACT NO.

ILLINOIS | FED. AID PROJECT

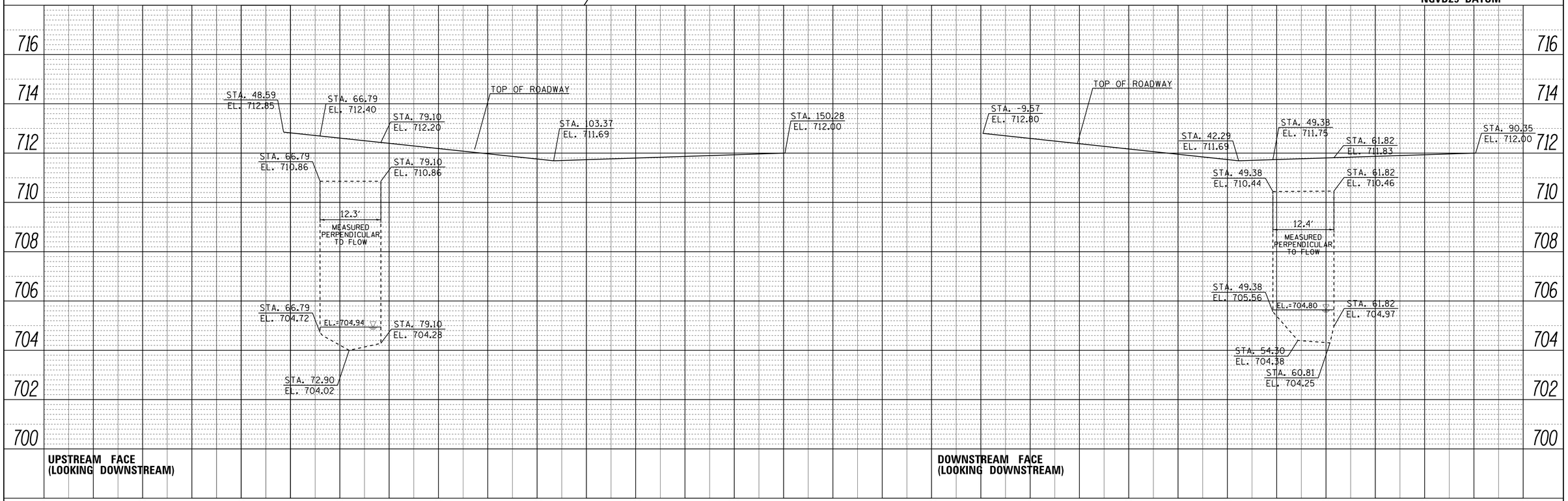




UPSTREAM WEIR DETAIL

SCALE:
1″ = 10′ HORIZONTAL
1″ = 2′ VERTICAL

NGVD29 DATUM



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SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
ELEVATIONS CHECKED
B.M. NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE

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		DRAWN -	REVISED -
	PLOT SCALE = 10.0000 ' / in.	CHECKED -	REVISED -
	PLOT DATE = 9/22/2014	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

INTERSTATE 55 OVER WARDS CREEK
EXHIBIT H – KIMBERLY COURT BRIDGE OPENING PLOT

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
				H-7

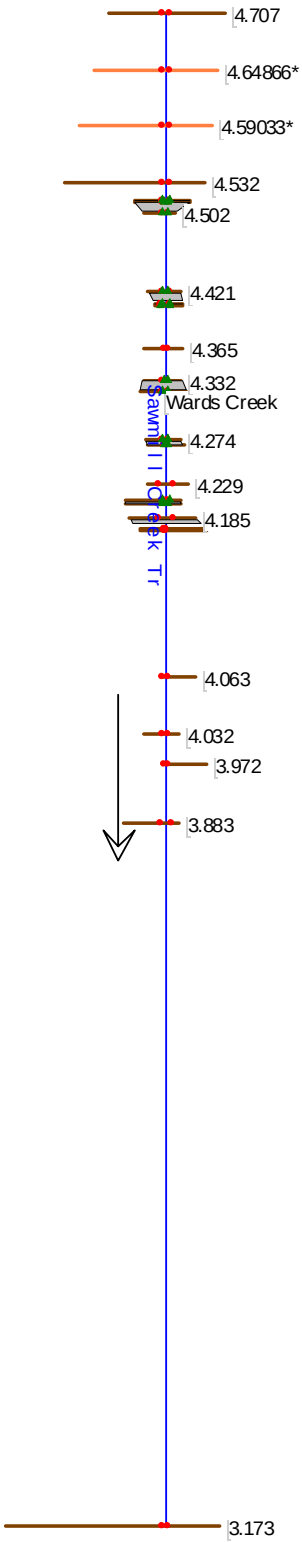
CONTRACT NO.

ILLINOIS FED. AID PROJECT

EXHIBIT I

NATURAL CONDITIONS HYDRAULIC MODEL AND RESULTS

Plan 03: IND-Natural Conditions



WardsCreekCulvert.rep

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
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****

PROJECT DATA
Project Title: WardsCreekCulvert
Project File : WardsCreekCulvert.prj
Run Date and Time: 3/9/2016 1:59:00 PM

Project in English units

Project Description:
Hydraulic Analysis of Culvert Carrying Interstate 55 over Wards Creek

****

PLAN DATA

Plan Title: IND-Natural Conditions
Plan File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec-ras\WardsCreekCulvert.p03

Geometry Title: IND_Natural Conditions Geometry
Geometry File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec-ras\WardsCreekCulvert.g03

Flow Title   : IND_Flow Data
Flow File   : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec-ras\WardsCreekCulvert.f02

Plan Description:
Independent Natural Conditions

Geometry includes field measured cross
sections and upstream structures.

Note the flow data file is modified to
state the discharges at FIS Station 4.196 to be provided upstream of the FIS
location at IND Station 4.210.

Plan Summary Information:
Number of: Cross Sections =   26   Multiple Openings =   0
Culverts   =   1   Inline Structures =   2
Bridges   =   5   Lateral Structures =   0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations   = 20
Maximum difference tolerance   = 0.3
Flow tolerance factor   = 0.001

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

WardsCreekCulvert.rep

****

FLOW DATA

Flow Title: IND_Flow Data
Flow File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec-ras\WardsCreekCulvert.f02

Flow Data (cfs)

River	Reach	RS	10-Year	50-Year	100-Year	500-Year
Sawmill Creek Tr	Wards Creek	4.707	249.01	400	477.3	690
Sawmill Creek Tr	Wards Creek	4.210	311.94	480	599.1	850
Sawmill Creek Tr	Wards Creek	3.883	344.05	550	661.33	905
Sawmill Creek Tr	Wards Creek	3.173	478.84	775	923.06	1290

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Sawmill Creek Tr	Wards Creek	10-Year		Known WS = 669.8
Sawmill Creek Tr	Wards Creek	50-Year		Known WS = 670.2
Sawmill Creek Tr	Wards Creek	100-Year		Known WS = 670.3
Sawmill Creek Tr	Wards Creek	500-Year		Known WS = 670.7

****

GEOMETRY DATA

Geometry Title: IND_Natural Conditions Geometry
Geometry File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec-ras\WardsCreekCulvert.g03

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.707

INPUT
Description: FIS Station SMD18
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	726	40	724	140	722	200	720	290	718
300	714	308	709.8	318	709.8	330	716	450	718
470	720	510	722	600	726				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	290	.059	330	.075

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
290	330	289	300	289	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.64866*

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-30.27	722	4.74	720.48	92.26	718.69	96.77	718.55	144.77	717.06
177.78	716.31	204.65	715.32	223.53	714.23	225.08	713.41	230.54	711.56
234.05	710.45	237.1	709.25	242.47	707.4	249.13	707.4	252.07	709
261.27	713.2	267.45	713.35	273.64	713.31	279.35	713.49	342.18	714.03

```
     376  714.99  411.13  715.95  416.57  716.03  442.45  717.51  494.22  719.15
  526.56  720.07   610.7  722.67

Manning's n Values        num=       6
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*****************************************************************************
  -30.27    .065  204.65    .069  223.53    .061  261.27    .079  279.35    .233
   610.7    .233

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        223.53  261.27              289     300     289             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.59033*

INPUT
Description:
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*****************************************************************************
  -60.53     718  -30.52  716.97   44.51  715.38   48.39  715.28   89.54  714.11
  117.84  713.45  140.87  712.16  157.07  710.47  158.69   709.4  164.42  707.78
   168.1   706.9   171.3  706.03  176.93     705  180.27     705  183.23   706.7
  192.53   710.4  200.13  710.63  207.72  710.45  214.72  710.74  291.84  711.01
  333.35  712.49  376.47  713.98  383.14  714.06  414.91  715.03  478.44  716.29
  518.13  717.04   621.4  719.33

Manning's n Values        num=       6
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*****************************************************************************
  -60.53     .06  140.87    .077  157.07    .063  192.53    .082  214.72    .392
   621.4    .392

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        157.07  192.53              289     300     289             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.532

INPUT
Description: Surveyed X-Sec 10+00.00 - 2020-feet upstream of I-55
             Centerline.

Upstream limit of survey
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*****************************************************************************
   -90.8     714       0     712    57.9   710.6    77.1     709    90.6   706.7
    92.3   705.4    98.3     704   105.5   702.8   111.4   702.6   114.4   704.4
   123.8   707.6   132.8   707.9   141.8   707.6   150.1     708   241.5     708
   290.7     710   341.8     712   509.7     714   632.1     716

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*****************************************************************************
   -90.8    .055    77.1    .086    90.6    .065   123.8    .086   150.1     .55

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          90.6   123.8                75      93     122             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.516

INPUT
```

WardsCreekCulvert.rep

Description: Surveyed X-Sec 10+92.66 - U/S cross section taken at inline weir
structure at Kimberly Court.

Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-48.3	716	0	714.5	28.6	713.4	37.9	712.6	55.8	710.4
61.1	708.8	61.5	706.6	65.6	704.72	66.1	704.6	71.5	704
82.5	704.1	83.9	705.9	95.2	710.7	100.9	712.4	114.9	712.4
123.6	712.4	132.5	712.5	148.4	713	176.3	714	187.6	713.8
189.31	713.7	228.6	716	238.7	718				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-48.3	.055	37.9	.086	55.8	.065	95.2	.086	114.9	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55.8	95.2	8	8	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-48.3	56.79	711.7	F
89.1	238.7	711.7	F

INLINE STRUCTURE

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.515

INPUT
Description: Weir Location U/S of Kimberly Court Bridge
Distance from Upstream XS = 6
Deck/Roadway Width = .5
Weir Coefficient = 2.6
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
65	705	83.21	705

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.514

INPUT
Description: Copied X-Sec 11+00 - U/S Face of Kimberly Court -
Copy of
Surveyed X-Sec 10+92.66 placed at the upstream face of the bridge
and downstream of the weir.

Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-48.3	716	0	714.5	28.6	713.4	37.9	712.6	55.8	710.4
61.1	708.8	61.5	706.6	65.6	704.72	66.1	704.6	71.5	704
82.5	704.1	83.9	705.9	95.2	710.7	100.9	712.4	114.9	712.4
123.6	712.4	132.5	712.5	148.4	713	176.3	714	187.6	713.8
189.31	713.7	228.6	716	238.7	718				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-48.3	.055	37.9	.086	55.8	.065	95.2	.086	114.9	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55.8	95.2	45	59	40	.3	.5

```
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -48.3   64.79   711.7       F
    81.1   238.7   711.7       F

BRIDGE


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.508

INPUT
Description: Kimberly Court Bridge
Distance from Upstream XS =       2
Deck/Roadway Width        =      49
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
**************************************************************************
       0   714.5           48.59  712.85           66.79   712.4  710.86
    79.1   712.2  710.86  103.37  711.69          150.28     712

Upstream Bridge Cross Section Data
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**************************************************************************
   -48.3     716       0   714.5    28.6   713.4    37.9   712.6    55.8   710.4
    61.1   708.8    61.5   706.6    65.6  704.72    66.1   704.6    71.5     704
    82.5   704.1    83.9   705.9    95.2   710.7   100.9   712.4   114.9   712.4
   123.6   712.4   132.5   712.5   148.4     713   176.3     714   187.6   713.8
  189.31   713.7   228.6     716   238.7     718

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
**************************************************************************
   -48.3    .055    37.9    .086    55.8    .065    95.2    .086   114.9    .055

Bank Sta: Left   Right    Coeff Contr.   Expan.
          55.8    95.2            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -48.3   64.79   711.7       F
    81.1   238.7   711.7       F

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
**************************************************************************
   -9.57   712.8           42.29  711.69           49.38  711.75  710.44
   61.82  711.83  710.46   90.35     712

Downstream Bridge Cross Section Data
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**************************************************************************
       0   714.2    23.5   712.6    35.7   711.7    36.6   711.7      37   707.9
    42.3   706.7    46.5   704.9    47.6   704.4    54.3   704.4    60.8   704.3
   61.61  704.97   63.14  705.82    67.2  708.13    78.5   711.3    92.9   712.6
   110.2   713.3   133.3     714   164.4     716

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .086      37    .065    67.2    .086

Bank Sta: Left   Right    Coeff Contr.   Expan.
            37    67.2            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   47.38     711       F
   63.82   164.4     711       F
```

WardsCreekCulvert.rep

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins = 711.75
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.502

INPUT
Description: Surveyed X-Sec 11+59.88 - D/S Face of Kimberly Court
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	714.2	23.5	712.6	35.7	711.7	36.6	711.7	37	707.9
42.3	706.7	46.5	704.9	47.6	704.4	54.3	704.4	60.8	704.3
61.61	704.97	63.14	705.82	67.2	708.13	78.5	711.3	92.9	712.6
110.2	713.3	133.3	714	164.4	716				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	37	.065	67.2	.086

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
37 67.2 406 423 421 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	47.38	711	F
63.82	164.4	711	F

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.421

INPUT
Description: Surveyed X-Sec 15+82.92 - U/S Face of Kentwood Court
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-18.2	716	0	712.6	11.3	712.1	18.6	711.7	30.7	711.5
41.8	709.6	50.9	702.7	55.5	702.1	59.18	700.83	67	701.27
71	704.5	80.9	708.7	95.6	714.6	121.6	717.2	142.8	717.5
152.8	717.9								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-18.2	.055	41.8	.065	80.9	.055

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          41.8    80.9               68      65      68             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -18.2   47.18   711.8       F
   78.97   152.8   711.8       F

BRIDGE


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.415

INPUT
Description: Kentwood Court Bridge
Distance from Upstream XS =      12
Deck/Roadway Width        =      38
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
**************************************************************************
       0   712.6             5.2   712.8           59.18   712.1  710.46
   66.97     712  710.56    72.7   711.9           148.9   716.8

Upstream Bridge Cross Section Data
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
   -18.2     716       0   712.6    11.3   712.1    18.6   711.7    30.7   711.5
    41.8   709.6    50.9   702.7    55.5   702.1   59.18  700.83      67  701.27
      71   704.5    80.9   708.7    95.6   714.6   121.6   717.2   142.8   717.5
   152.8   717.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
   -18.2    .055    41.8    .065    80.9    .055

Bank Sta: Left   Right    Coeff Contr.   Expan.
          41.8    80.9             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -18.2   47.18   711.8       F
   78.97   152.8   711.8       F

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
**************************************************************************
    -4.4   712.8             65.2   711.9            80.9   712.9  710.49
   88.36   713.4  710.61    139.4   716.8

Downstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   715.7    20.7   715.6    31.9   714.9    53.9   712.8    61.8   711.7
    62.2   712.2    62.6   712.2    67.9   704.4    72.4   701.8    79.7   701.2
    80.9  701.33    82.7     701    86.4   701.4    87.9   701.4    93.9   702.2
   95.63   702.9   110.3     714   126.2     716   134.6   716.4   143.1   716.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .055    62.6    .065   110.3    .055

Bank Sta: Left   Right    Coeff Contr.   Expan.
          62.6   110.3             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   77.15  711.25       F
   92.11   143.1  711.25       F
```

WardsCreekCulvert.rep

```
Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =     712
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.410

INPUT
Description: Copy of X-Sec for D/S Face of Kentwood Court

X-Sec Shifted
             5-feet upstream to allow for input of downstream weir structure.
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   715.7    20.7   715.6    31.9   714.9    53.9   712.8    61.8   711.7
    62.2   712.2    62.6   712.2    67.9   704.4    72.4   701.8    79.7   701.2
    80.9  701.33    82.7     701    86.4   701.4    87.9   701.4    93.9   702.2
   95.63   702.9   110.3     714   126.2     716   134.6   716.4   143.1   716.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .055    62.6    .065   110.3    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          62.6   110.3                 5       5       5             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   77.15  711.25       F
   92.11   143.1  711.25       F

INLINE STRUCTURE


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.409

INPUT
Description: Concrete Weir located D/S from Kentwood Court
Distance from Upstream XS =     2.5
Deck/Roadway Width        =      .8
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =        6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
    66.6  706.31    73.4  706.31    73.5  704.26    93.1  704.26    93.2  706.03
   109.3  706.03
```

WardsCreekCulvert.rep

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.408

INPUT
Description: Surveyed X-Sec 16+53.57 - D/S Face of Kentwood Court
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	715.7	20.7	715.6	31.9	714.9	53.9	712.8	61.8	711.7
62.2	712.2	62.6	712.2	67.9	704.4	72.4	701.8	79.7	701.2
80.9	701.33	82.7	701	86.4	701.4	87.9	701.4	93.9	702.2
95.63	702.9	110.3	714	126.2	716	134.6	716.4	143.1	716.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.055	62.6	.065	110.3	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
62.6	110.3	296	229	240	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	75.15	711.25	F
94.11	143.1	711.25	F

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.365

INPUT
Description: Surveyed X-Sec 18+82.22 - 1138' Upstream of the I-55 Centerline
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-52.3	716	-39.1	714	-20.2	712	0	710	9.7	708
20.1	706.7	28.7	704.8	34.5	700.6	38.9	700.3	41.2	700.1
51	702.6	63.6	704.2	75.6	708	99.3	710	125.7	712
141.1	714	154.6	716						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-52.3	.086	28.7	.065	51	.086

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
28.7	51	181	173	170	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.332

INPUT
Description: Surveyed X-Sec 20+55.09 - U/S Face of Carlisle Court Culvert
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-14.1	712	0	709.6	31.7	708.3	50.5	706.8	54.4	704.4
54.6	705	62.1	700.4	64	698.63	65.3	699.9	69.2	700.4
71.7	699.74	80.1	703.6	81.7	705	82.1	706.2	82.8	706.5

```
    83.6     706    96.4   707.3   109.5   708.3   131.3   710.2   185.1     712

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
   -14.1    .086    54.6    .065    82.1    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          54.6    82.1               57      55      57              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -14.1      58   707.3       F
    77.7   185.1   707.3       F

BRIDGE


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.327

INPUT
Description: Carlisle Court Bridge
Distance from Upstream XS =       6
Deck/Roadway Width        =      40
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
     5.4   709.1            61.6   707.4              64   707.5 706.102
    71.7   707.7 705.332   122.2   708.9

Upstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
   -14.1     712       0   709.6    31.7   708.3    50.5   706.8    54.4   704.4
    54.6     705    62.1   700.4      64  698.63    65.3   699.9    69.2   700.4
    71.7  699.74    80.1   703.6    81.7     705    82.1   706.2    82.8   706.5
    83.6     706    96.4   707.3   109.5   708.3   131.3   710.2   185.1     712

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*************************************************
   -14.1    .086    54.6    .065    82.1    .086

Bank Sta: Left   Right    Coeff Contr.   Expan.
          54.6    82.1             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -14.1      58   707.3       F
    77.7   185.1   707.3       F

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
       6   709.1            62.2   707.4            63.2   707.4  706.05
    70.7   707.6  706.31   122.8   708.9

Downstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
   -44.3     712       0   710.3    37.1   708.9    47.5   707.5    52.1   705.4
    60.2   700.2    61.1   699.7    63.2  699.44    63.4   698.4    66.4   698.7
    68.8   698.6    70.7  699.21    72.2   698.6    79.5   704.5    82.1     707
    90.7   707.9     113   709.4   124.7   709.6     155     710     200     712

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*************************************************
   -44.3    .086    52.1    .065    79.5    .086
```

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          52.1    79.5            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -44.3   60.95   706.5       F
   72.95     200   706.5       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =   707.4
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.322

INPUT
Description: Surveyed X-Sec 21+10.39 - D/S Face of Carlisle Court Culvert
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
   -44.3     712       0   710.3    37.1   708.9    47.5   707.5    52.1   705.4
    60.2   700.2    61.1   699.7    63.2  699.44    63.4   698.4    66.4   698.7
    68.8   698.6    70.7  699.21    72.2   698.6    79.5   704.5    82.1     707
    90.7   707.9     113   709.4   124.7   709.6     155     710     200     712

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
   -44.3    .086    52.1    .065    79.5    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          52.1    79.5              268     264     268             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -44.3   60.95   706.5       F
   72.95     200   706.5       F

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.274

INPUT
Description: Surveyed X-Sec 23+63.91 - U/S Face of Golf Cart Path Bridge #2
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     710    16.7     708      31     706    45.6   702.5    61.7   701.3
    68.7   700.1    73.3   698.2      77   697.5    83.2   697.4    88.6   700.1
```

```
    92.3   701.1   105.8   701.8   136.7     704   150.7     706   165.5     708
   181.4     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .086    61.7    .055    92.3     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          61.7    92.3                28      27      28              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   61.91   701.9       F
   92.51   181.4   701.5       F

BRIDGE


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.2715

INPUT
Description: Golf Cart Patch Bridge #2
Distance from Upstream XS =       4
Deck/Roadway Width        =      18
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      11
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
   25.99 704.484           51.16 702.545           56.05 702.159
   61.74  702.15           61.84 702.621           65.91  702.56 700.668
   88.51  702.21 700.314   90.11 702.183           90.21     702
  101.51 702.006             110     702

Upstream Bridge Cross Section Data
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     710    16.7     708      31     706    45.6   702.5    61.7   701.3
    68.7   700.1    73.3   698.2      77   697.5    83.2   697.4    88.6   700.1
    92.3   701.1   105.8   701.8   136.7     704   150.7     706   165.5     708
   181.4     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .086    61.7    .055    92.3     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          61.7    92.3             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   61.91   701.9       F
   92.51   181.4   701.5       F

Downstream  Deck/Roadway Coordinates
    num=      10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
   40.16 704.484             65.4 702.263             70.3 702.159
    74.1 702.199           77.96  702.19 700.632  101.53  702.15 700.325
  102.05  702.15          114.46 702.002          127.69 703.232
  151.12 705.942

Downstream Bridge Cross Section Data
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     710    19.8     708    38.4     706    56.4     704    63.9     702
    83.6   700.6    88.4   699.8      92   698.6    96.6   698.3    99.9   698.6
   101.6   699.5     104   700.5   105.2   701.6     119   702.4   137.6   704.9
   151.2     706     167     708   186.7     710
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    83.6    .055     104     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          83.6     104            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   82.62   701.2       F
  102.78   186.7   701.2       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =     702
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.269

INPUT
Description: Surveyed X-Sec 23+90.48 - D/S Face of Golf Cart Path Bridge #2
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     710    19.8     708    38.4     706    56.4     704    63.9     702
    83.6   700.6    88.4   699.8      92   698.6    96.6   698.3    99.9   698.6
   101.6   699.5     104   700.5   105.2   701.6     119   702.4   137.6   704.9
   151.2     706     167     708   186.7     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    83.6    .055     104     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          83.6     104              281     211     211             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   82.62   701.2       F
  102.78   186.7   701.2       F

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.229

INPUT
Description: Surveyed X-Sec 26+01.01
```

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-28.5	712	-20.3	710	0	708.2	12.2	705	45.4	698.9
58.4	697	69.1	696.9	82.6	696.9	115.3	696.9	123.3	701.1
143.5	705.3	159.2	707	164.7	710	179.9	712		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-28.5	.086	45.4	.055	123.3	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
45.4	123.3	88	85	88 .1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.213

INPUT
Description: Surveyed X-Sec 26+85.99 - U/S Face of Golf Cart Bridge #1
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	712	1.9	710	5.2	708	12	706	23.8	705.1
34.7	702.3	39.5	702.1	48.2	702.6	54.9	701.8	56.5	699.6
69.6	697.8	73.1	696.2	75.7	695.7	78.5	696.4	91.3	699.3
101.5	700	112.8	700.4	123.6	700.7	146.8	701.8	186.1	703.8
243.2	707.2	292	710						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	69.6	.055	91.3	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
69.6	91.3	15	15	15 .3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	64.12	701.2	F
95.12	292	701.2	F

BRIDGE

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.2115

INPUT
Description: Golf Cart Path Bridge #1
Distance from Upstream XS = 4
Deck/Roadway Width = 9
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
24.42	704.032		38.05	702.202		67.69	701.632	
68.12	701.63	699.631	91.56	701.36	699.251	93.21	701.337	
93.67	701.329		101.35	700.878		105.69	700.561	
112.8	700.4							

Upstream Bridge Cross Section Data
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	712	1.9	710	5.2	708	12	706	23.8	705.1
34.7	702.3	39.5	702.1	48.2	702.6	54.9	701.8	56.5	699.6
69.6	697.8	73.1	696.2	75.7	695.7	78.5	696.4	91.3	699.3
101.5	700	112.8	700.4	123.6	700.7	146.8	701.8	186.1	703.8
243.2	707.2	292	710						

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    69.6    .055    91.3     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          69.6    91.3             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   64.12   701.2       F
   95.12     292   701.2       F

Downstream  Deck/Roadway Coordinates
    num=       9
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
   40.16 704.032           60.15 702.202           67.72 701.622
   68.58  701.55 699.732   91.16  701.36 699.392   91.97 701.352
  114.46 701.329          127.69 700.878          151.12 700.561

Downstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     712     1.9     710     5.2     708      12     706    23.8   705.1
    34.7   702.3    39.5   702.1    48.2   702.6    54.9   701.8    56.5   699.6
    69.6   697.8    75.7   692.8    91.3   699.3   101.5     700   112.8   700.4
   123.6   700.7   146.8   701.8   186.1   703.8   243.2   707.2     292     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    69.6    .055    91.3     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          69.6    91.3             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   68.08   700.2       F
   91.56     292   700.2       F

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =   701.3
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.210

INPUT
```

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Description: Surveyed X-Sec 27+01.48 - D/S Face of Golf Cart Bridge #1

Copy
of X-Sec 26+85.99
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	712	1.9	710	5.2	708	12	706	23.8	705.1
34.7	702.3	39.5	702.1	48.2	702.6	54.9	701.8	56.5	699.6
69.6	697.8	75.7	692.8	91.3	699.3	101.5	700	112.8	700.4
123.6	700.7	146.8	701.8	186.1	703.8	243.2	707.2	292	710

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	69.6	.055	91.3	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
69.6	91.3	64	82	113	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	68.08	700.2	F
91.56	292	700.2	F

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.185

INPUT
Description: Surveyed X-Sec 27+98.62 - U/S Side of Berm
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-84	710	-60.8	708	-25.6	704.5	0	700	32.6	699.6
101.3	691.9	113.1	697.5	159.7	699.7	177.5	701	206.3	705
236	707.5	264.6	710						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-84	.086	32.6	.065	113.1	.086

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
32.6	113.1	61	53	50	.3	.5

CULVERT

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.183

INPUT
Description: Golf Course Berm
Distance from Upstream XS = 15
Deck/Roadway Width = 12
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 16

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
-76.5	710	-26.4	706.1	1.77	699.91
20	705.12	33.2	704.28	53.1	704.87
84.7	704.68	96.2	704.72	101.5	704.68
102	705	105	705.21	107	705.35
110	705.44	157.4	706.05	182.8	707.34
236	707.5				

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

```
     -84     710   -60.8     708   -25.6   704.5       0     700    32.6   699.6
   101.3   691.9   113.1   697.5   159.7   699.7   177.5     701   206.3     705
     236   707.5   264.6     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
     -84    .086    32.6    .065   113.1    .086

Bank Sta: Left   Right    Coeff Contr.   Expan.
          32.6   113.1             .3       .5

Downstream  Deck/Roadway Coordinates
    num=      15
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
   -63.8     708           -30.8   706.1            2.63  699.91
    15.6  705.12            28.9  704.28            48.6  704.87
    80.2  704.68            91.7  704.72            96.9  704.68
   107.7     705           115.8  705.21           124.1  705.35
   154.9  705.44           202.4  706.05           239.5  707.34

Downstream Bridge Cross Section Data
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
     -72     710   -63.8     708   -46.6     706       0   699.8    18.8   699.8
     140   695.6   142.2   693.9     144   693.9   145.7   693.9   147.5   698.8
     221   706.4   228.3     708   278.5     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
     -72    .086     140    .065   147.5    .086

Bank Sta: Left   Right    Coeff Contr.   Expan.
          140   147.5             .3       .5

Upstream Embankment side slope              =       3 horiz. to 1.0 vertical
Downstream Embankment side slope            =       5 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =   704.2
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  3

Culvert Name     Shape      Rise    Span
Culvert #1      Circular       3
FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 3 - Pipe projecting from fill
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  7      23     .024     .024        0                  .5               1
Upstream   Elevation =  699.64
           Centerline Station =  33.11
Downstream Elevation =  699.86
           Centerline Station =  29.3

Culvert Name     Shape      Rise    Span
Culvert #2      Circular       2
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 3 - Groove end entrance; pipe projecting from fill
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  1      52     .015     .015        0                  .5               1
Upstream   Elevation =  698.58
           Centerline Station =  101.3
Downstream Elevation =  695.46
           Centerline Station =  143.95

Culvert Name     Shape      Rise    Span
```

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```
Culvert #3      Circular     .83
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 3 - Groove end entrance; pipe projecting from fill
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  1      52     .015     .015        0                  .5               1
Upstream   Elevation =  694.59
           Centerline Station =  101.3
Downstream Elevation =  693.84
           Centerline Station =  143.95

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.178

INPUT
Description: Surveyed X-Sec 28+52.56 - D/S Side of Berm
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
     -72     710   -63.8     708   -46.6     706       0   699.8    18.8   699.8
     140   695.6   142.2   693.9     144   693.9   145.7   693.9   147.5   698.8
     221   706.4   228.3     708   278.5     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
     -72    .086     140    .065   147.5    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           140   147.5               10      14      20             .3       .5

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.175

INPUT
Description: HEC-RAS Interpolated Cross at the Upstream Face of I-55 Culvert
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
  -70.72  709.74  -62.57  707.77  -45.47  705.79  -30.54  703.81     .86  699.68
   19.55  699.68   72.79  697.86  140.06  695.54  140.97  694.86  141.21   694.7
  141.75  694.31  142.47   693.8  144.24   693.8  145.91   693.8  146.93   696.3
  147.88  698.68  183.42   702.4  220.23  706.23  227.42  707.81  276.83  709.81

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
  -70.72    .086  140.06    .065  147.88    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        140.06  147.88              593     775     746             .3       .5

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.063

INPUT
Description: Surveyed X-Sec 36+41.40 - Approximately 500- feet downstream of
             I-55
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   695.3    27.3   693.1    97.5     693   143.2   692.2   148.6   689.6
     150   689.4   153.2   688.9   157.5   688.3   163.4   688.5   168.9  692.26
   173.2   695.2   184.5   699.1
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086   143.2    .065   168.9    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         143.2   168.9              135     303     325             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.032

INPUT
Description: Surveyed X-Sec 39+44.21
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   696.4    41.9   694.2    54.3   688.9    70.1   687.5    71.2   687.3
    75.7   687.3    81.5   687.3    82.7   689.4   108.3   690.8   155.9     692
   171.8     694   178.2     696

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    54.3    .065    82.7    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          54.3    82.7               87     161     227             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 3.972

INPUT
Description: Surveyed X-Sec 41+04.74 - Approximately 1000-feet downstream of
             I-55
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
   -91.4     698   -58.9     696   -9.63     694    39.3     692    46.3     691
    80.1   690.3      88   689.5     103   689.1   105.1   688.7   107.8   687.9
   110.4   686.7     117   686.5   122.5   686.7   128.2   687.1   136.1   694.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
   -91.4    .086   105.1    .065   128.2    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         105.1   128.2              692     320     209             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 3.883

INPUT
Description: FIS Station SMD10
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   699.8      17   699.1      25   694.5      39   687.7      42   687.3
      60   685.9      86   685.8      87   684.1      90   683.9      92   683.9
      97   684.8     100     687     141   687.6     200     691     290   694.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
```

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```
*********************************************
       0     .08      42     .07     100     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            42     100              3600    3750    3600             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 3.173

INPUT
Description: FIS Station SMD03
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0     677      50     674     100   671.4     150   669.4     200   669.2
     262   668.7     274   667.3     279   666.2     282   665.6     285   665.8
     289   667.3     290   669.3     400   668.5     500   668.9     600   670.1
     700   670.1     800   670.4     900   671.7    1000   673.8    1100   678.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .08     262    .055     290     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            262     290                0       0       0             .1       .3

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

SUMMARY OF MANNING'S N VALUES

River:Sawmill Creek Tr
*************************************************************************************************
*     Reach      *   River Sta.   *   n1    *   n2    *   n3    *   n4    *   n5    *   n6    *
*************************************************************************************************
*Wards Creek     *    4.707       *      .07*     .059*     .075*          *          *          *
*Wards Creek     *    4.64866*    *     .065*     .069*     .061*     .079*     .233*     .233*
*Wards Creek     *    4.59033*    *      .06*     .077*     .063*     .082*     .392*     .392*
*Wards Creek     *    4.532       *     .055*     .086*     .065*     .086*      .55*          *
*Wards Creek     *    4.516       *     .055*     .086*     .065*     .086*     .055*          *
*Wards Creek     *    4.515       *Inl Struct*        *         *         *         *         *
*Wards Creek     *    4.514       *     .055*     .086*     .065*     .086*     .055*          *
*Wards Creek     *    4.508       *Bridge   *         *         *         *         *         *
*Wards Creek     *    4.502       *     .086*     .065*     .086*          *          *          *
*Wards Creek     *    4.421       *     .055*     .065*     .055*          *          *          *
*Wards Creek     *    4.415       *Bridge   *         *         *         *         *         *
*Wards Creek     *    4.410       *     .055*     .065*     .055*          *          *          *
*Wards Creek     *    4.409       *Inl Struct*        *         *         *         *         *
*Wards Creek     *    4.408       *     .055*     .065*     .055*          *          *          *
*Wards Creek     *    4.365       *     .086*     .065*     .086*          *          *          *
*Wards Creek     *    4.332       *     .086*     .065*     .086*          *          *          *
*Wards Creek     *    4.327       *Bridge   *         *         *         *         *         *
*Wards Creek     *    4.322       *     .086*     .065*     .086*          *          *          *
*Wards Creek     *    4.274       *     .086*     .055*      .04*          *          *          *
*Wards Creek     *    4.2715      *Bridge   *         *         *         *         *         *
*Wards Creek     *    4.269       *     .086*     .055*      .04*          *          *          *
*Wards Creek     *    4.229       *     .086*     .055*      .04*          *          *          *
*Wards Creek     *    4.213       *     .086*     .055*      .04*          *          *          *
*Wards Creek     *    4.2115      *Bridge   *         *         *         *         *         *
*Wards Creek     *    4.210       *     .086*     .055*      .04*          *          *          *
*Wards Creek     *    4.185       *     .086*     .065*     .086*          *          *          *
*Wards Creek     *    4.183       *Culvert  *         *         *         *         *         *
*Wards Creek     *    4.178       *     .086*     .065*     .086*          *          *          *
*Wards Creek     *    4.175       *     .086*     .065*     .086*          *          *          *
*Wards Creek     *    4.063       *     .086*     .065*     .086*          *          *          *
*Wards Creek     *    4.032       *     .086*     .065*     .086*          *          *          *
*Wards Creek     *    3.972       *     .086*     .065*     .086*          *          *          *
*Wards Creek     *    3.883       *      .08*      .07*      .08*          *          *          *
*Wards Creek     *    3.173       *      .08*     .055*      .08*          *          *          *
*************************************************************************************************
```

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SUMMARY OF REACH LENGTHS

River: Sawmill Creek Tr

Reach	River Sta.	Left	Channel	Right
Wards Creek	4.707	289	300	289
Wards Creek	4.64866*	289	300	289
Wards Creek	4.59033*	289	300	289
Wards Creek	4.532	75	93	122
Wards Creek	4.516	8	8	8
Wards Creek	4.515	Inl Struct		
Wards Creek	4.514	45	59	40
Wards Creek	4.508	Bridge		
Wards Creek	4.502	406	423	421
Wards Creek	4.421	68	65	68
Wards Creek	4.415	Bridge		
Wards Creek	4.410	5	5	5
Wards Creek	4.409	Inl Struct		
Wards Creek	4.408	296	229	240
Wards Creek	4.365	181	173	170
Wards Creek	4.332	57	55	57
Wards Creek	4.327	Bridge		
Wards Creek	4.322	268	264	268
Wards Creek	4.274	28	27	28
Wards Creek	4.2715	Bridge		
Wards Creek	4.269	281	211	211
Wards Creek	4.229	88	85	88
Wards Creek	4.213	15	15	15
Wards Creek	4.2115	Bridge		
Wards Creek	4.210	64	82	113
Wards Creek	4.185	61	53	50
Wards Creek	4.183	Culvert		
Wards Creek	4.178	10	14	20
Wards Creek	4.175	593	775	746
Wards Creek	4.063	135	303	325
Wards Creek	4.032	87	161	227
Wards Creek	3.972	692	320	209
Wards Creek	3.883	3600	3750	3600
Wards Creek	3.173	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Sawmill Creek Tr

Reach	River Sta.	Contr.	Expan.
Wards Creek	4.707	.1	.3
Wards Creek	4.64866**	.1	.3
Wards Creek	4.59033**	.1	.3
Wards Creek	4.532	.1	.3
Wards Creek	4.516	.3	.5
Wards Creek	4.515	Inl Struct	
Wards Creek	4.514	.3	.5
Wards Creek	4.508	Bridge	
Wards Creek	4.502	.3	.5
Wards Creek	4.421	.3	.5
Wards Creek	4.415	Bridge	
Wards Creek	4.410	.3	.5
Wards Creek	4.409	Inl Struct	
Wards Creek	4.408	.3	.5
Wards Creek	4.365	.1	.3
Wards Creek	4.332	.3	.5
Wards Creek	4.327	Bridge	
Wards Creek	4.322	.3	.5
Wards Creek	4.274	.3	.5
Wards Creek	4.2715	Bridge	

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*Wards Creek     *    4.269   *       .3*       .5*
*Wards Creek     *    4.229   *       .1*       .3*
*Wards Creek     *    4.213   *       .3*       .5*
*Wards Creek     *    4.2115  *Bridge   *         *
*Wards Creek     *    4.210   *       .3*       .5*
*Wards Creek     *    4.185   *       .3*       .5*
*Wards Creek     *    4.183   *Culvert  *         *
*Wards Creek     *    4.178   *       .3*       .5*
*Wards Creek     *    4.175   *       .3*       .5*
*Wards Creek     *    4.063   *       .1*       .3*
*Wards Creek     *    4.032   *       .1*       .3*
*Wards Creek     *    3.972   *       .1*       .3*
*Wards Creek     *    3.883   *       .1*       .3*
*Wards Creek     *    3.173   *       .1*       .3*
****************************************************
```

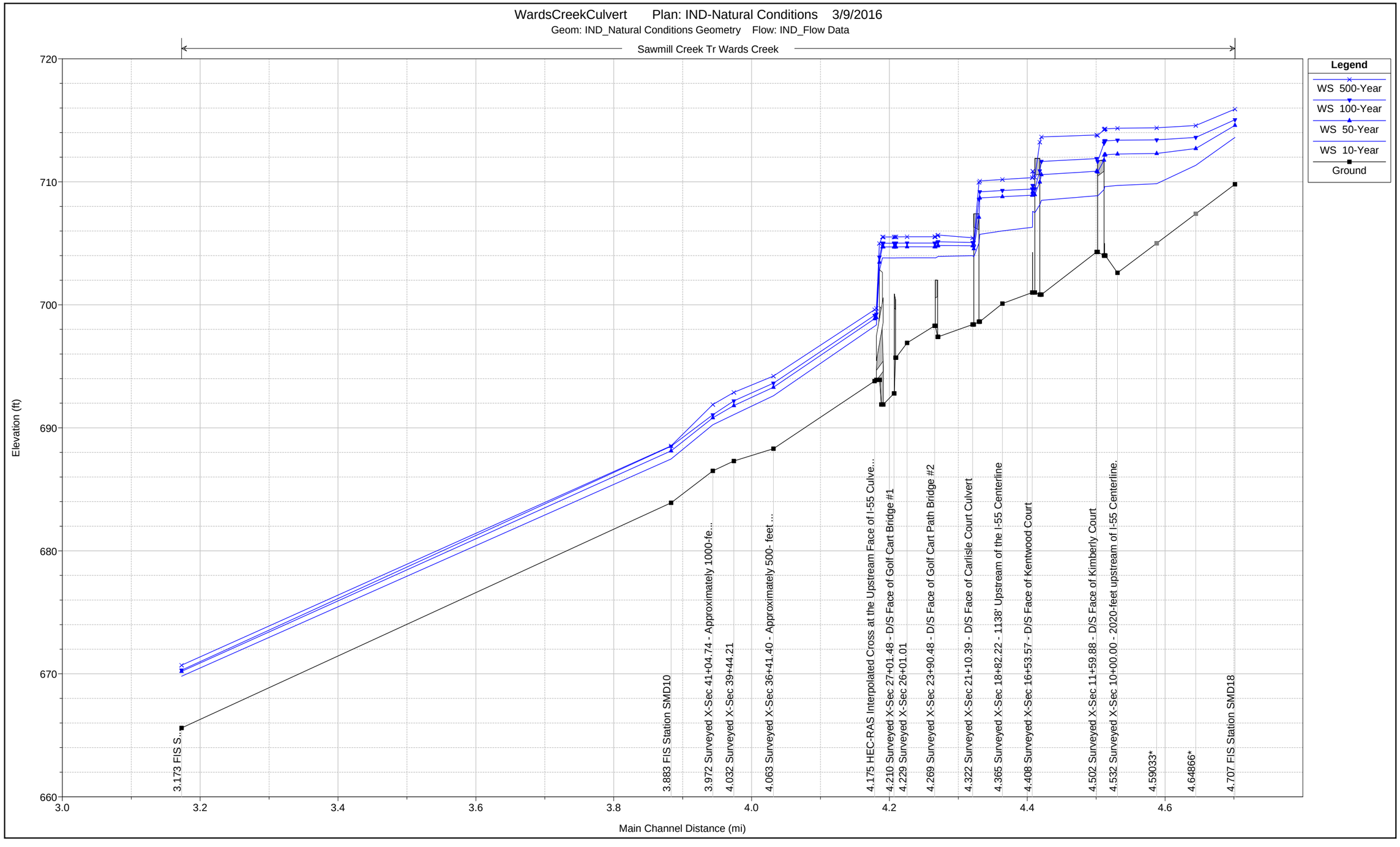
WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
Sawmill Creek Tr Wards Creek
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Elevation (ft)
720
710
700
690
680
670
660
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
Main Channel Distance (mi)
3.173 FIS S...
3.883 FIS Station SMD10
3.972 Surveyed X-Sec 41+04.74 - Approximately 1000-fe...
4.032 Surveyed X-Sec 39+44.21
4.063 Surveyed X-Sec 36+41.40 - Approximately 500- feet ...
4.175 HEC-RAS Interpolated Cross at the Upstream Face of I-55 Culve...
4.210 Surveyed X-Sec 27+01.48 - D/S Face of Golf Cart Bridge #1
4.229 Surveyed X-Sec 26+01.01
4.269 Surveyed X-Sec 23+90.48 - D/S Face of Golf Cart Path Bridge #2
4.322 Surveyed X-Sec 21+10.39 - D/S Face of Carlisle Court Culvert
4.365 Surveyed X-Sec 18+82.22 - 1138' Upstream of the I-55 Centerline
4.408 Surveyed X-Sec 16+53.57 - D/S Face of Kentwood Court
4.502 Surveyed X-Sec 11+59.88 - D/S Face of Kimberly Court
4.532 Surveyed X-Sec 10+00.00 - 2020-feet upstream of I-55 Centerline.
4.59033*
4.64866*
4.707 FIS Station SMD18

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek

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)	
Wards Creek	4.707	10-Year	249.01	709.80	713.61	712.09	713.83	0.006656	3.77	65.97	24.63	0.41
Wards Creek	4.707	50-Year	400.00	709.80	714.59	712.80	714.88	0.007008	4.35	91.97	28.73	0.43
Wards Creek	4.707	100-Year	477.30	709.80	715.05	713.11	715.37	0.006878	4.51	105.77	30.79	0.43
Wards Creek	4.707	500-Year	690.00	709.80	715.91	713.86	716.32	0.007679	5.16	133.84	34.60	0.46
Wards Creek	4.532	10-Year	249.01	702.60	709.70	705.13	709.72	0.000292	1.15	446.86	214.77	0.09
Wards Creek	4.532	50-Year	400.00	702.60	712.26	705.76	712.27	0.000113	0.93	1160.14	375.38	0.06
Wards Creek	4.532	100-Year	477.30	702.60	713.38	706.01	713.39	0.000077	0.84	1662.77	520.52	0.05
Wards Creek	4.532	500-Year	690.00	702.60	714.36	706.66	714.36	0.000084	0.94	2228.05	622.39	0.05
Wards Creek	4.516	10-Year	249.01	704.00	709.61	705.99	709.67	0.001182	1.91	130.39	34.22	0.16
Wards Creek	4.516	50-Year	400.00	704.00	712.20	706.66	712.24	0.000591	1.69	249.58	59.08	0.12
Wards Creek	4.516	100-Year	477.30	704.00	713.33	706.92	713.37	0.000410	1.58	363.42	128.37	0.11
Wards Creek	4.516	500-Year	690.00	704.00	714.30	707.60	714.35	0.000443	1.79	519.63	194.53	0.11
Wards Creek	4.515		Inl Struct									
Wards Creek	4.514	10-Year	249.01	704.00	709.50	706.12	709.63	0.001722	2.87	86.66	33.61	0.22
Wards Creek	4.514	50-Year	400.00	704.00	712.17	706.85	712.22	0.000601	1.70	247.91	58.75	0.12
Wards Creek	4.514	100-Year	477.30	704.00	713.31	707.18	713.34	0.000418	1.60	359.90	127.29	0.11
Wards Creek	4.514	500-Year	690.00	704.00	714.28	708.00	714.32	0.000450	1.81	515.41	193.59	0.11
Wards Creek	4.508		Bridge									
Wards Creek	4.502	10-Year	249.01	704.30	708.86	706.47	709.06	0.003524	3.51	70.89	32.92	0.30
Wards Creek	4.502	50-Year	400.00	704.30	710.85	707.19	711.09	0.002566	3.86	103.62	40.22	0.27
Wards Creek	4.502	100-Year	477.30	704.30	711.89	707.50	711.97	0.000985	2.38	220.38	51.81	0.17
Wards Creek	4.502	500-Year	690.00	704.30	713.80	708.35	713.89	0.000742	2.46	376.58	120.92	0.15
Wards Creek	4.421	10-Year	249.01	700.83	708.49	703.42	708.53	0.000504	1.47	169.22	37.16	0.11
Wards Creek	4.421	50-Year	400.00	700.83	710.58	704.09	710.63	0.000431	1.70	235.55	49.52	0.11
Wards Creek	4.421	100-Year	477.30	700.83	711.66	704.39	711.70	0.000391	1.77	269.70	66.95	0.11
Wards Creek	4.421	500-Year	690.00	700.83	713.64	705.15	713.68	0.000280	1.61	495.87	98.81	0.09
Wards Creek	4.415		Bridge									
Wards Creek	4.410	10-Year	249.01	701.00	707.60	703.42	707.71	0.001207	2.67	93.09	36.11	0.19
Wards Creek	4.410	50-Year	400.00	701.00	709.17	704.18	709.35	0.001473	3.43	116.56	39.25	0.22

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek (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)	
Wards Creek	4.410	100-Year	477.30	701.00	709.70	704.54	709.93	0.001682	3.83	124.53	40.32	0.23
Wards Creek	4.410	500-Year	690.00	701.00	710.86	705.42	711.23	0.002274	4.86	141.90	42.64	0.28
Wards Creek	4.409		Inl Struct									
Wards Creek	4.408	10-Year	249.01	701.00	706.30	703.22	706.42	0.001737	2.71	91.79	33.52	0.22
Wards Creek	4.408	50-Year	400.00	701.00	708.91	703.85	709.03	0.001068	2.83	141.16	38.73	0.18
Wards Creek	4.408	100-Year	477.30	701.00	709.41	704.17	709.57	0.001223	3.17	150.69	39.74	0.20
Wards Creek	4.408	500-Year	690.00	701.00	710.33	704.91	710.59	0.001772	4.10	168.18	41.59	0.24
Wards Creek	4.365	10-Year	249.01	700.10	706.01	702.78	706.07	0.001171	2.06	143.96	46.07	0.17
Wards Creek	4.365	50-Year	400.00	700.10	708.79	703.50	708.83	0.000470	1.79	311.45	79.14	0.12
Wards Creek	4.365	100-Year	477.30	700.10	709.29	703.81	709.34	0.000510	1.95	352.92	87.46	0.12
Wards Creek	4.365	500-Year	690.00	700.10	710.19	704.52	710.26	0.000662	2.39	438.83	103.82	0.14
Wards Creek	4.332	10-Year	249.01	698.63	705.73	702.27	705.83	0.001580	2.48	100.55	29.71	0.19
Wards Creek	4.332	50-Year	400.00	698.63	708.69	702.96	708.74	0.000587	1.84	275.27	91.87	0.12
Wards Creek	4.332	100-Year	477.30	698.63	709.18	703.27	709.24	0.000618	1.98	324.82	109.51	0.13
Wards Creek	4.332	500-Year	690.00	698.63	710.07	704.00	710.14	0.000743	2.33	433.47	132.52	0.14
Wards Creek	4.327		Bridge									
Wards Creek	4.322	10-Year	249.01	698.40	703.99	701.27	704.25	0.004153	4.07	61.22	24.58	0.32
Wards Creek	4.322	50-Year	400.00	698.40	704.80	702.15	705.30	0.006567	5.64	70.91	26.78	0.41
Wards Creek	4.322	100-Year	477.30	698.40	705.07	702.54	705.71	0.008074	6.44	74.10	27.47	0.46
Wards Creek	4.322	500-Year	690.00	698.40	705.45	703.58	706.64	0.013815	8.77	78.68	28.49	0.60
Wards Creek	4.274	10-Year	249.01	697.40	703.93	699.94	703.95	0.000270	1.23	249.94	96.10	0.10
Wards Creek	4.274	50-Year	400.00	697.40	704.82	700.72	704.84	0.000304	1.46	339.85	106.48	0.11
Wards Creek	4.274	100-Year	477.30	697.40	705.13	701.02	705.16	0.000333	1.59	373.67	109.97	0.11
Wards Creek	4.274	500-Year	690.00	697.40	705.68	701.75	705.72	0.000456	1.97	435.49	116.08	0.14
Wards Creek	4.2715		Bridge									
Wards Creek	4.269	10-Year	249.01	698.30	703.82	700.91	703.86	0.000613	1.81	185.42	72.48	0.15
Wards Creek	4.269	50-Year	400.00	698.30	704.72	701.59	704.77	0.000686	2.15	256.23	86.26	0.16
Wards Creek	4.269	100-Year	477.30	698.30	705.02	701.96	705.08	0.000757	2.34	283.55	91.92	0.17
Wards Creek	4.269	500-Year	690.00	698.30	705.54	702.63	705.63	0.001063	2.94	333.74	102.92	0.21

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek (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)	
Wards Creek	4.229	10-Year	249.01	696.90	703.82	697.73	703.83	0.000024	0.46	591.96	117.78	0.03
Wards Creek	4.229	50-Year	400.00	696.90	704.72	698.03	704.72	0.000039	0.64	701.41	126.95	0.04
Wards Creek	4.229	100-Year	477.30	696.90	705.02	698.17	705.03	0.000048	0.73	740.78	130.05	0.05
Wards Creek	4.229	500-Year	690.00	696.90	705.54	698.50	705.55	0.000079	0.97	808.70	135.51	0.06
Wards Creek	4.213	10-Year	249.01	695.70	703.82	698.78	703.82	0.000066	0.75	468.27	157.56	0.05
Wards Creek	4.213	50-Year	400.00	695.70	704.71	699.40	704.72	0.000080	0.90	617.28	176.04	0.06
Wards Creek	4.213	100-Year	477.30	695.70	705.01	699.69	705.02	0.000091	0.98	672.05	182.37	0.06
Wards Creek	4.213	500-Year	690.00	695.70	705.52	700.29	705.54	0.000133	1.24	768.43	196.81	0.08
Wards Creek	4.2115		Bridge									
Wards Creek	4.210	10-Year	311.94	692.80	703.81	697.31	703.82	0.000081	0.89	498.10	157.45	0.06
Wards Creek	4.210	50-Year	480.00	692.80	704.70	698.14	704.71	0.000097	1.04	646.95	175.92	0.06
Wards Creek	4.210	100-Year	599.10	692.80	705.01	698.64	705.02	0.000122	1.20	701.61	182.24	0.07
Wards Creek	4.210	500-Year	850.00	692.80	705.52	699.47	705.54	0.000177	1.49	797.47	196.56	0.08
Wards Creek	4.185	10-Year	311.94	691.90	703.81	694.78	703.81	0.000015	0.35	1166.28	219.42	0.02
Wards Creek	4.185	50-Year	480.00	691.90	704.70	695.32	704.71	0.000023	0.47	1367.39	231.82	0.03
Wards Creek	4.185	100-Year	599.10	691.90	705.01	695.64	705.01	0.000031	0.56	1438.93	237.13	0.03
Wards Creek	4.185	500-Year	850.00	691.90	705.52	696.20	705.52	0.000051	0.74	1561.93	248.24	0.04
Wards Creek	4.183		Culvert									
Wards Creek	4.178	10-Year	311.94	693.90	698.36	697.41	698.47	0.008012	3.73	137.01	86.95	0.34
Wards Creek	4.178	50-Year	480.00	693.90	698.97	697.82	699.08	0.007848	3.98	195.25	106.21	0.34
Wards Creek	4.178	100-Year	599.10	693.90	699.25	698.04	699.38	0.008374	4.30	226.88	117.12	0.36
Wards Creek	4.178	500-Year	850.00	693.90	699.72	698.43	699.89	0.009425	4.87	286.14	135.22	0.38
Wards Creek	4.175	10-Year	311.94	693.80	698.26	697.34	698.37	0.008166	3.80	135.26	86.60	0.35
Wards Creek	4.175	50-Year	480.00	693.80	698.87	697.75	698.99	0.007902	4.05	194.09	106.53	0.35
Wards Creek	4.175	100-Year	599.10	693.80	699.15	697.98	699.29	0.008507	4.38	224.91	117.23	0.37
Wards Creek	4.175	500-Year	850.00	693.80	699.60	698.36	699.78	0.009701	4.99	282.44	134.93	0.40
Wards Creek	4.063	10-Year	311.94	688.30	692.60	690.98	692.84	0.007256	3.93	83.61	49.29	0.39
Wards Creek	4.063	50-Year	480.00	688.30	693.30	691.67	693.59	0.007374	4.53	146.98	145.57	0.41
Wards Creek	4.063	100-Year	599.10	688.30	693.63	692.08	693.91	0.007026	4.68	196.11	150.18	0.41

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek (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)	
Wards Creek	4.063	500-Year	850.00	688.30	694.21	693.48	694.47	0.006411	4.88	285.04	158.18	0.40
Wards Creek	4.032	10-Year	311.94	687.30	691.07	689.40	691.21	0.004073	3.09	123.26	69.79	0.30
Wards Creek	4.032	50-Year	480.00	687.30	691.81	689.98	691.97	0.004067	3.54	186.01	100.70	0.31
Wards Creek	4.032	100-Year	599.10	687.30	692.19	690.33	692.37	0.004104	3.78	226.86	110.78	0.32
Wards Creek	4.032	500-Year	850.00	687.30	692.88	690.92	693.07	0.003973	4.11	306.04	117.90	0.32
Wards Creek	3.972	10-Year	311.94	686.50	690.25	688.71	690.44	0.005499	3.71	101.28	51.02	0.36
Wards Creek	3.972	50-Year	480.00	686.50	690.81	689.39	691.11	0.007042	4.67	136.87	76.84	0.42
Wards Creek	3.972	100-Year	599.10	686.50	691.06	689.84	691.43	0.008322	5.29	157.43	86.66	0.46
Wards Creek	3.972	500-Year	850.00	686.50	691.89	690.30	692.24	0.006777	5.40	232.49	93.41	0.43
Wards Creek	3.883	10-Year	344.05	683.90	687.46	686.71	687.65	0.013777	3.46	105.21	90.89	0.47
Wards Creek	3.883	50-Year	550.00	683.90	688.13	687.19	688.31	0.009755	3.63	174.49	112.00	0.42
Wards Creek	3.883	100-Year	661.33	683.90	688.50	687.42	688.67	0.007797	3.58	217.64	119.24	0.38
Wards Creek	3.883	500-Year	905.00	683.90	688.53	687.85	688.85	0.013878	4.81	221.77	119.91	0.51
Wards Creek	3.173	10-Year	478.84	665.60	669.80	669.28	669.85	0.002865	2.69	397.79	435.00	0.29
Wards Creek	3.173	50-Year	775.00	665.60	670.20	669.56	670.27	0.003351	3.19	591.72	603.34	0.32
Wards Creek	3.173	100-Year	923.06	665.60	670.30	669.61	670.37	0.003785	3.46	653.83	639.16	0.34
Wards Creek	3.173	500-Year	1290.00	665.60	670.70	669.81	670.76	0.002970	3.31	926.64	705.58	0.31

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.707	10-Year	713.83	713.61	0.22	2.25	0.00		249.01		24.63
Wards Creek	4.707	50-Year	714.88	714.59	0.29	1.93	0.02		400.00		28.73
Wards Creek	4.707	100-Year	715.37	715.05	0.32	1.53	0.04		477.30		30.79
Wards Creek	4.707	500-Year	716.32	715.91	0.41	1.48	0.06		690.00		34.60
Wards Creek	4.532	10-Year	709.72	709.70	0.02	0.05	0.00	11.72	202.67	34.62	214.77
Wards Creek	4.532	50-Year	712.27	712.26	0.01	0.02	0.00	62.40	242.63	94.97	375.38
Wards Creek	4.532	100-Year	713.39	713.38	0.01	0.01	0.00	112.35	249.97	114.98	520.52
Wards Creek	4.532	500-Year	714.36	714.36	0.01	0.02	0.00	215.39	310.15	164.46	622.39
Wards Creek	4.516	10-Year	709.67	709.61	0.06				249.01		34.22
Wards Creek	4.516	50-Year	712.24	712.20	0.04			5.14	393.59	1.27	59.08
Wards Creek	4.516	100-Year	713.37	713.33	0.04			18.01	439.51	19.78	128.37
Wards Creek	4.516	500-Year	714.35	714.30	0.04			46.23	566.24	77.53	194.53
Wards Creek	4.515		Inl Struct								
Wards Creek	4.514	10-Year	709.63	709.50	0.13	0.01	0.03		249.01		33.61
Wards Creek	4.514	50-Year	712.22	712.17	0.04	0.00	0.09	4.96	393.82	1.22	58.75
Wards Creek	4.514	100-Year	713.34	713.31	0.04	0.00	0.04	17.66	440.68	18.96	127.29
Wards Creek	4.514	500-Year	714.32	714.28	0.04	0.00	0.01	45.72	568.21	76.07	193.59
Wards Creek	4.508		Bridge								
Wards Creek	4.502	10-Year	709.06	708.86	0.19	0.45	0.08		249.01		32.92
Wards Creek	4.502	50-Year	711.09	710.85	0.23	0.37	0.09		400.00		40.22
Wards Creek	4.502	100-Year	711.97	711.89	0.08	0.25	0.02	0.21	458.75	18.35	51.81
Wards Creek	4.502	500-Year	713.89	713.80	0.08	0.18	0.02	16.00	616.74	57.26	120.92
Wards Creek	4.421	10-Year	708.53	708.49	0.03	0.02	0.08		249.01		37.16
Wards Creek	4.421	50-Year	710.63	710.58	0.04	0.02	0.13		400.00		49.52
Wards Creek	4.421	100-Year	711.70	711.66	0.05	0.01	0.17		477.30		66.95
Wards Creek	4.421	500-Year	713.68	713.64	0.04	0.01	0.10	61.48	604.55	23.97	98.81
Wards Creek	4.415		Bridge								

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.410	10-Year	707.71	707.60	0.11				249.01		36.11
Wards Creek	4.410	50-Year	709.35	709.17	0.18				400.00		39.25
Wards Creek	4.410	100-Year	709.93	709.70	0.23				477.30		40.32
Wards Creek	4.410	500-Year	711.23	710.86	0.37				690.00		42.64
Wards Creek	4.409		Inl Struct								
Wards Creek	4.408	10-Year	706.42	706.30	0.11	0.32	0.03		249.01		33.52
Wards Creek	4.408	50-Year	709.03	708.91	0.12	0.16	0.04		400.00		38.73
Wards Creek	4.408	100-Year	709.57	709.41	0.16	0.18	0.06		477.30		39.74
Wards Creek	4.408	500-Year	710.59	710.33	0.26	0.24	0.10		690.00		41.59
Wards Creek	4.365	10-Year	706.07	706.01	0.06	0.23	0.00	1.37	211.56	36.08	46.07
Wards Creek	4.365	50-Year	708.83	708.79	0.04	0.09	0.00	24.02	295.03	80.96	79.14
Wards Creek	4.365	100-Year	709.34	709.29	0.04	0.10	0.00	35.30	342.45	99.56	87.46
Wards Creek	4.365	500-Year	710.26	710.19	0.06	0.12	0.00	66.08	467.56	156.36	103.82
Wards Creek	4.332	10-Year	705.83	705.73	0.10	0.03	0.16		249.01		29.71
Wards Creek	4.332	50-Year	708.74	708.69	0.05	0.01	0.36	15.91	362.86	21.23	91.87
Wards Creek	4.332	100-Year	709.24	709.18	0.05	0.01	0.14	26.85	416.03	34.42	109.51
Wards Creek	4.332	500-Year	710.14	710.07	0.07	0.01	0.02	69.41	547.58	73.00	132.52
Wards Creek	4.327		Bridge								
Wards Creek	4.322	10-Year	704.25	703.99	0.26	0.18	0.12		249.01		24.58
Wards Creek	4.322	50-Year	705.30	704.80	0.49	0.22	0.23		400.00		26.78
Wards Creek	4.322	100-Year	705.71	705.07	0.64	0.24	0.31		477.30		27.47
Wards Creek	4.322	500-Year	706.64	705.45	1.19	0.35	0.57		690.00		28.49
Wards Creek	4.274	10-Year	703.95	703.93	0.02	0.00	0.01	14.71	181.93	52.37	96.10
Wards Creek	4.274	50-Year	704.84	704.82	0.03	0.00	0.01	29.88	255.48	114.64	106.48
Wards Creek	4.274	100-Year	705.16	705.13	0.03	0.00	0.01	37.76	292.38	147.16	109.97
Wards Creek	4.274	500-Year	705.72	705.68	0.05	0.00	0.01	59.25	395.41	235.34	116.08
Wards Creek	4.2715		Bridge								

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.269	10-Year	703.86	703.82	0.04	0.01	0.02	38.94	169.22	40.85	72.48
Wards Creek	4.269	50-Year	704.77	704.72	0.05	0.02	0.02	67.35	240.97	91.68	86.26
Wards Creek	4.269	100-Year	705.08	705.02	0.06	0.03	0.03	82.38	277.25	117.67	91.92
Wards Creek	4.269	500-Year	705.63	705.54	0.09	0.04	0.04	124.52	378.53	186.95	102.92
Wards Creek	4.229	10-Year	703.83	703.82	0.00	0.00	0.00	10.16	234.88	3.97	117.78
Wards Creek	4.229	50-Year	704.72	704.72	0.01	0.00	0.00	20.12	369.14	10.73	126.95
Wards Creek	4.229	100-Year	705.03	705.02	0.01	0.01	0.00	25.55	437.00	14.75	130.05
Wards Creek	4.229	500-Year	705.55	705.54	0.01	0.01	0.00	41.06	623.39	25.55	135.51
Wards Creek	4.213	10-Year	703.82	703.82	0.01	0.00	0.00	28.17	106.71	114.13	157.56
Wards Creek	4.213	50-Year	704.72	704.71	0.01	0.00	0.00	48.79	145.91	205.30	176.04
Wards Creek	4.213	100-Year	705.02	705.01	0.01	0.00	0.00	59.19	165.81	252.30	182.37
Wards Creek	4.213	500-Year	705.54	705.52	0.02	0.00	0.00	84.12	223.44	382.44	196.81
Wards Creek	4.2115		Bridge								
Wards Creek	4.210	10-Year	703.82	703.81	0.01	0.00	0.00	31.27	154.03	126.64	157.45
Wards Creek	4.210	50-Year	704.71	704.70	0.01	0.00	0.00	53.59	201.00	225.42	175.92
Wards Creek	4.210	100-Year	705.02	705.01	0.01	0.00	0.01	68.56	238.37	292.17	182.24
Wards Creek	4.210	500-Year	705.54	705.52	0.02	0.01	0.01	96.75	313.81	439.44	196.56
Wards Creek	4.185	10-Year	703.81	703.81	0.00			24.49	232.65	54.80	219.42
Wards Creek	4.185	50-Year	704.71	704.70	0.00			43.74	343.87	92.39	231.82
Wards Creek	4.185	100-Year	705.01	705.01	0.00			56.56	424.07	118.47	237.13
Wards Creek	4.185	500-Year	705.52	705.52	0.01			85.20	591.65	173.15	248.24
Wards Creek	4.183		Culvert								
Wards Creek	4.178	10-Year	698.47	698.36	0.11	0.09	0.00	210.37	101.57		86.95
Wards Creek	4.178	50-Year	699.08	698.97	0.12	0.09	0.00	353.69	126.27	0.04	106.21
Wards Creek	4.178	100-Year	699.38	699.25	0.13	0.09	0.00	453.22	145.32	0.57	117.12
Wards Creek	4.178	500-Year	699.89	699.72	0.17	0.10	0.00	664.10	181.84	4.06	135.22
Wards Creek	4.175	10-Year	698.37	698.26	0.11	5.49	0.04	205.21	106.73		86.60
Wards Creek	4.175	50-Year	698.99	698.87	0.12	5.35	0.05	347.17	132.77	0.06	106.53

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.175	100-Year	699.29	699.15	0.14	5.33	0.04	445.31	153.16	0.63	117.23
Wards Creek	4.175	500-Year	699.78	699.60	0.18	5.28	0.03	653.55	192.32	4.13	134.93
Wards Creek	4.063	10-Year	692.84	692.60	0.24	1.61	0.03	2.36	309.54	0.03	49.29
Wards Creek	4.063	50-Year	693.59	693.30	0.29	1.58	0.04	41.09	438.25	0.66	145.57
Wards Creek	4.063	100-Year	693.91	693.63	0.28	1.52	0.03	105.18	492.56	1.36	150.18
Wards Creek	4.063	500-Year	694.47	694.21	0.27	1.38	0.02	260.57	586.12	3.31	158.18
Wards Creek	4.032	10-Year	691.21	691.07	0.14	0.76	0.01	6.06	282.54	23.34	69.79
Wards Creek	4.032	50-Year	691.97	691.81	0.16	0.85	0.01	13.20	397.85	68.94	100.70
Wards Creek	4.032	100-Year	692.37	692.19	0.18	0.92	0.02	18.42	465.80	114.88	110.78
Wards Creek	4.032	500-Year	693.07	692.88	0.19	0.82	0.02	30.18	586.61	233.21	117.90
Wards Creek	3.972	10-Year	690.44	690.25	0.20	2.79	0.00	21.91	282.34	7.69	51.02
Wards Creek	3.972	50-Year	691.11	690.81	0.30	2.76	0.03	50.50	415.98	13.52	76.84
Wards Creek	3.972	100-Year	691.43	691.06	0.37	2.70	0.06	79.80	501.82	17.47	86.66
Wards Creek	3.972	500-Year	692.24	691.89	0.34	3.38	0.01	207.60	616.16	26.25	93.41
Wards Creek	3.883	10-Year	687.65	687.46	0.18	17.75	0.04	0.04	337.98	6.03	90.89
Wards Creek	3.883	50-Year	688.31	688.13	0.19	18.01	0.04	2.43	494.01	53.55	112.00
Wards Creek	3.883	100-Year	688.67	688.50	0.18	18.27	0.03	4.96	564.77	91.60	119.24
Wards Creek	3.883	500-Year	688.85	688.53	0.32	18.01	0.08	7.03	769.47	128.50	119.91
Wards Creek	3.173	10-Year	669.85	669.80	0.05			59.65	202.35	216.84	435.00
Wards Creek	3.173	50-Year	670.27	670.20	0.07			139.23	275.69	360.08	603.34
Wards Creek	3.173	100-Year	670.37	670.30	0.07			171.84	308.97	442.26	639.16
Wards Creek	3.173	500-Year	670.76	670.70	0.06			250.61	333.23	706.17	705.58

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.210	10-Year	703.82	703.81	0.01	0.00	0.00	31.27	154.03	126.64	157.45
Wards Creek	4.210	50-Year	704.71	704.70	0.01	0.00	0.00	53.59	201.00	225.42	175.92
Wards Creek	4.210	100-Year	705.02	705.01	0.01	0.00	0.01	68.56	238.37	292.17	182.24
Wards Creek	4.210	500-Year	705.54	705.52	0.02	0.01	0.01	96.75	313.81	439.44	196.56
Wards Creek	4.185	10-Year	703.81	703.81	0.00			24.49	232.65	54.80	219.42
Wards Creek	4.185	50-Year	704.71	704.70	0.00			43.74	343.87	92.39	231.82
Wards Creek	4.185	100-Year	705.01	705.01	0.00			56.56	424.07	118.47	237.13
Wards Creek	4.185	500-Year	705.52	705.52	0.01			85.20	591.65	173.15	248.24
Wards Creek	4.183		Culvert								
Wards Creek	4.178	10-Year	698.47	698.36	0.11	0.09	0.00	210.37	101.57		86.95
Wards Creek	4.178	50-Year	699.08	698.97	0.12	0.09	0.00	353.69	126.27	0.04	106.21
Wards Creek	4.178	100-Year	699.38	699.25	0.13	0.09	0.00	453.22	145.32	0.57	117.12
Wards Creek	4.178	500-Year	699.89	699.72	0.17	0.10	0.00	664.10	181.84	4.06	135.22
Wards Creek	4.175	10-Year	698.37	698.26	0.11	5.49	0.04	205.21	106.73		86.60
Wards Creek	4.175	50-Year	698.99	698.87	0.12	5.35	0.05	347.17	132.77	0.06	106.53
Wards Creek	4.175	100-Year	699.29	699.15	0.14	5.33	0.04	445.31	153.16	0.63	117.23
Wards Creek	4.175	500-Year	699.78	699.60	0.18	5.28	0.03	653.55	192.32	4.13	134.93

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
Wards Creek	4.183 Culvert #1	10-Year	703.81	703.81	703.63	703.81	704.20	45.91	224.10	5.45	6.50	8.24
Wards Creek	4.183 Culvert #2	10-Year	703.81	703.81	704.30	703.82	704.20	37.02	224.10	5.45	11.79	11.79
Wards Creek	4.183 Culvert #3	10-Year	703.81	703.81	697.76	703.81	704.20	4.90	224.10	5.45	9.06	9.06
Wards Creek	4.183 Culvert #1	50-Year	704.71	704.70	704.89	704.71	704.20	57.19	378.50	5.74	8.09	9.26
Wards Creek	4.183 Culvert #2	50-Year	704.71	704.70	704.86	704.69	704.20	39.28	378.50	5.74	12.50	12.50
Wards Creek	4.183 Culvert #3	50-Year	704.71	704.70	697.90	704.72	704.20	5.03	378.50	5.74	9.31	9.31
Wards Creek	4.183 Culvert #1	100-Year	705.01	705.01	705.36	705.02	704.20	60.76	493.92	5.76	8.60	9.60
Wards Creek	4.183 Culvert #2	100-Year	705.01	705.01	704.88	705.00	704.20	39.37	493.92	5.76	12.53	12.53
Wards Creek	4.183 Culvert #3	100-Year	705.01	705.01	697.90	705.01	704.20	5.04	493.92	5.76	9.31	9.31
Wards Creek	4.183 Culvert #1	500-Year	705.52	705.52	705.55	705.14	704.20	62.16	743.40	5.80	8.79	9.81
Wards Creek	4.183 Culvert #2	500-Year	705.52	705.52	704.89	705.48	704.20	39.40	743.40	5.80	12.54	12.54
Wards Creek	4.183 Culvert #3	500-Year	705.52	705.52	697.91	705.48	704.20	5.04	743.40	5.80	9.32	9.32

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Wards Creek	4.515		Inl Struct									
Wards Creek	4.514	10-Year	709.63	709.50	706.12	0.01	0.03	33.61		249.01		2.87
Wards Creek	4.514	50-Year	712.22	712.17	706.85	0.00	0.09	58.75	4.96	393.82	1.22	1.70
Wards Creek	4.514	100-Year	713.34	713.31	707.18	0.00	0.04	127.29	17.66	440.68	18.96	1.60
Wards Creek	4.514	500-Year	714.32	714.28	708.00	0.00	0.01	193.59	45.72	568.21	76.07	1.81
Wards Creek	4.508 BR U	10-Year	709.60	709.37	706.44	0.41	0.03	12.35		249.01		3.82
Wards Creek	4.508 BR U	50-Year	712.12	711.76	707.30	0.86	0.02			400.00		4.79
Wards Creek	4.508 BR U	100-Year	713.30	713.14	707.70	0.91	0.14	112.25	3.09	406.17	68.03	3.43
Wards Creek	4.508 BR U	500-Year	714.31	714.23	708.68	0.33	0.03	190.45	51.32	413.93	224.75	2.57
Wards Creek	4.508 BR D	10-Year	709.16	708.85	706.71	0.05	0.06	12.47		249.01		4.47
Wards Creek	4.508 BR D	50-Year	711.23	710.80	707.56	0.04	0.10			400.00		5.29
Wards Creek	4.508 BR D	100-Year	712.26	711.64	707.95	0.02	0.27			477.30		6.32
Wards Creek	4.508 BR D	500-Year	713.95	713.77	708.96	0.01	0.05	119.38	59.12	513.47	117.41	3.78
Wards Creek	4.502	10-Year	709.06	708.86	706.47	0.45	0.08	32.92		249.01		3.51
Wards Creek	4.502	50-Year	711.09	710.85	707.19	0.37	0.09	40.22		400.00		3.86
Wards Creek	4.502	100-Year	711.97	711.89	707.50	0.25	0.02	51.81	0.21	458.75	18.35	2.38
Wards Creek	4.502	500-Year	713.89	713.80	708.35	0.18	0.02	120.92	16.00	616.74	57.26	2.46
Wards Creek	4.421	10-Year	708.53	708.49	703.42	0.02	0.08	37.16		249.01		1.47
Wards Creek	4.421	50-Year	710.63	710.58	704.09	0.02	0.13	49.52		400.00		1.70
Wards Creek	4.421	100-Year	711.70	711.66	704.39	0.01	0.17	66.95		477.30		1.77
Wards Creek	4.421	500-Year	713.68	713.64	705.15	0.01	0.10	98.81	61.48	604.55	23.97	1.61
Wards Creek	4.415 BR U	10-Year	708.43	708.13	704.14	0.49	0.04	7.87		249.01		4.39
Wards Creek	4.415 BR U	50-Year	710.48	709.99	705.29	0.74	0.07	7.81		400.00		5.62
Wards Creek	4.415 BR U	100-Year	711.52	710.89	705.81	1.10	0.08			477.30		6.34
Wards Creek	4.415 BR U	500-Year	713.57	713.22	707.14	1.33	0.35	95.46	86.88	591.26	11.87	5.02
Wards Creek	4.415 BR D	10-Year	707.91	707.49	704.42	0.04	0.15	7.58		249.01		5.19
Wards Creek	4.415 BR D	50-Year	709.67	708.96	705.60	0.06	0.26	7.52		400.00		6.77
Wards Creek	4.415 BR D	100-Year	710.33	709.43	706.15	0.07	0.34	7.51		477.30		7.62
Wards Creek	4.415 BR D	500-Year	711.90	710.38	707.52	0.09	0.58	7.47		690.00		9.89
Wards Creek	4.410	10-Year	707.71	707.60	703.42			36.11		249.01		2.67
Wards Creek	4.410	50-Year	709.35	709.17	704.18			39.25		400.00		3.43
Wards Creek	4.410	100-Year	709.93	709.70	704.54			40.32		477.30		3.83
Wards Creek	4.410	500-Year	711.23	710.86	705.42			42.64		690.00		4.86

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Wards Creek	4.409		Inl Struct									
Wards Creek	4.365	10-Year	706.07	706.01	702.78	0.23	0.00	46.07	1.37	211.56	36.08	2.06
Wards Creek	4.365	50-Year	708.83	708.79	703.50	0.09	0.00	79.14	24.02	295.03	80.96	1.79
Wards Creek	4.365	100-Year	709.34	709.29	703.81	0.10	0.00	87.46	35.30	342.45	99.56	1.95
Wards Creek	4.365	500-Year	710.26	710.19	704.52	0.12	0.00	103.82	66.08	467.56	156.36	2.39
Wards Creek	4.332	10-Year	705.83	705.73	702.27	0.03	0.16	29.71		249.01		2.48
Wards Creek	4.332	50-Year	708.74	708.69	702.96	0.01	0.36	91.87	15.91	362.86	21.23	1.84
Wards Creek	4.332	100-Year	709.24	709.18	703.27	0.01	0.14	109.51	26.85	416.03	34.42	1.98
Wards Creek	4.332	500-Year	710.14	710.07	704.00	0.01	0.02	132.52	69.41	547.58	73.00	2.33
Wards Creek	4.327 BR U	10-Year	705.65	705.02	703.13	1.14	0.01	7.71		249.01		6.32
Wards Creek	4.327 BR U	50-Year	708.37	707.13	704.29	2.57	0.00			400.00		8.95
Wards Creek	4.327 BR U	100-Year	709.09	708.58	704.83	2.35	0.35	83.62	38.05	424.01	15.24	6.04
Wards Creek	4.327 BR U	500-Year	710.10	709.96	705.55	1.00	0.91	130.61	170.73	389.25	130.02	3.60
Wards Creek	4.327 BR D	10-Year	704.50	703.89	701.89	0.08	0.18	7.58		249.01		6.26
Wards Creek	4.327 BR D	50-Year	705.79	704.56	703.07	0.13	0.37	7.55		400.00		8.93
Wards Creek	4.327 BR D	100-Year	706.39	704.71	703.62	0.16	0.51	7.55		477.30		10.38
Wards Creek	4.327 BR D	500-Year	708.19	705.01	705.01	0.28	0.99	7.54		690.00		14.31
Wards Creek	4.322	10-Year	704.25	703.99	701.27	0.18	0.12	24.58		249.01		4.07
Wards Creek	4.322	50-Year	705.30	704.80	702.15	0.22	0.23	26.78		400.00		5.64
Wards Creek	4.322	100-Year	705.71	705.07	702.54	0.24	0.31	27.47		477.30		6.44
Wards Creek	4.322	500-Year	706.64	705.45	703.58	0.35	0.57	28.49		690.00		8.77
Wards Creek	4.274	10-Year	703.95	703.93	699.94	0.00	0.01	96.10	14.71	181.93	52.37	1.23
Wards Creek	4.274	50-Year	704.84	704.82	700.72	0.00	0.01	106.48	29.88	255.48	114.64	1.46
Wards Creek	4.274	100-Year	705.16	705.13	701.02	0.00	0.01	109.97	37.76	292.38	147.16	1.59
Wards Creek	4.274	500-Year	705.72	705.68	701.75	0.00	0.01	116.08	59.25	395.41	235.34	1.97
Wards Creek	4.2715 BR U	10-Year	703.94	703.90	699.94	0.05	0.01	95.63	23.28	117.97	107.76	1.29
Wards Creek	4.2715 BR U	50-Year	704.84	704.79	700.41	0.03	0.01	106.19	45.28	151.44	203.27	1.28
Wards Creek	4.2715 BR U	100-Year	705.15	705.10	700.48	0.03	0.01	109.66	56.17	170.31	250.81	1.33
Wards Creek	4.2715 BR U	500-Year	705.71	705.64	703.15	0.04	0.02	115.65	85.52	225.77	378.71	1.56
Wards Creek	4.2715 BR D	10-Year	703.88	703.81	702.64	0.01	0.02	72.35	53.28	102.39	93.34	1.79
Wards Creek	4.2715 BR D	50-Year	704.79	704.71	702.97	0.01	0.02	86.11	91.75	133.72	174.53	1.77

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Wards Creek	4.2715 BR D	100-Year	705.11	705.01	703.12	0.01	0.02	91.73	111.75	151.36	214.19	1.85
Wards Creek	4.2715 BR D	500-Year	705.66	705.53	703.52	0.01	0.02	102.76	167.59	202.79	319.62	2.20
Wards Creek	4.269	10-Year	703.86	703.82	700.91	0.01	0.02	72.48	38.94	169.22	40.85	1.81
Wards Creek	4.269	50-Year	704.77	704.72	701.59	0.02	0.02	86.26	67.35	240.97	91.68	2.15
Wards Creek	4.269	100-Year	705.08	705.02	701.96	0.03	0.03	91.92	82.38	277.25	117.67	2.34
Wards Creek	4.269	500-Year	705.63	705.54	702.63	0.04	0.04	102.92	124.52	378.53	186.95	2.94
Wards Creek	4.229	10-Year	703.83	703.82	697.73	0.00	0.00	117.78	10.16	234.88	3.97	0.46
Wards Creek	4.229	50-Year	704.72	704.72	698.03	0.00	0.00	126.95	20.12	369.14	10.73	0.64
Wards Creek	4.229	100-Year	705.03	705.02	698.17	0.01	0.00	130.05	25.55	437.00	14.75	0.73
Wards Creek	4.229	500-Year	705.55	705.54	698.50	0.01	0.00	135.51	41.06	623.39	25.55	0.97
Wards Creek	4.213	10-Year	703.82	703.82	698.78	0.00	0.00	157.56	28.17	106.71	114.13	0.75
Wards Creek	4.213	50-Year	704.72	704.71	699.40	0.00	0.00	176.04	48.79	145.91	205.30	0.90
Wards Creek	4.213	100-Year	705.02	705.01	699.69	0.00	0.00	182.37	59.19	165.81	252.30	0.98
Wards Creek	4.213	500-Year	705.54	705.52	700.29	0.00	0.00	196.81	84.12	223.44	382.44	1.24
Wards Creek	4.2115 BR U	10-Year	703.82	703.81	698.76	0.00	0.00	157.45	22.40	50.52	176.08	0.52
Wards Creek	4.2115 BR U	50-Year	704.72	704.70	699.33	0.00	0.00	175.92	43.58	65.97	290.44	0.56
Wards Creek	4.2115 BR U	100-Year	705.02	705.01	699.40	0.00	0.00	182.23	54.05	74.30	348.95	0.60
Wards Creek	4.2115 BR U	500-Year	705.54	705.51	701.85	0.00	0.00	196.54	79.03	99.05	511.93	0.74
Wards Creek	4.2115 BR D	10-Year	703.82	703.81	696.91	0.00	0.00	154.98	13.14	82.92	152.95	0.63
Wards Creek	4.2115 BR D	50-Year	704.71	704.70	697.78	0.00	0.00	175.89	30.91	101.32	267.76	0.67
Wards Creek	4.2115 BR D	100-Year	705.02	705.01	698.14	0.00	0.00	182.20	40.08	111.78	325.43	0.71
Wards Creek	4.2115 BR D	500-Year	705.53	705.51	698.94	0.00	0.00	196.47	62.02	144.29	483.69	0.86
Wards Creek	4.210	10-Year	703.82	703.81	697.31	0.00	0.00	157.45	31.27	154.03	126.64	0.89
Wards Creek	4.210	50-Year	704.71	704.70	698.14	0.00	0.00	175.92	53.59	201.00	225.42	1.04
Wards Creek	4.210	100-Year	705.02	705.01	698.64	0.00	0.01	182.24	68.56	238.37	292.17	1.20
Wards Creek	4.210	500-Year	705.54	705.52	699.47	0.01	0.01	196.56	96.75	313.81	439.44	1.49
Wards Creek	4.185	10-Year	703.81	703.81	694.78			219.42	24.49	232.65	54.80	0.35
Wards Creek	4.185	50-Year	704.71	704.70	695.32			231.82	43.74	343.87	92.39	0.47
Wards Creek	4.185	100-Year	705.01	705.01	695.64			237.13	56.56	424.07	118.47	0.56
Wards Creek	4.185	500-Year	705.52	705.52	696.20			248.24	85.20	591.65	173.15	0.74

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. US.	Min El Prs	BR Open Area	Prs O WS	Q Total	Min El Weir Flow	Q Weir	Delta EG
			(ft)	(ft)	(sq ft)	(ft)	(cfs)	(ft)	(cfs)	(ft)
Wards Creek	4.508	10-Year	709.63	710.86	75.58		249.01	711.80		0.58
Wards Creek	4.508	50-Year	712.22	710.86	75.58		400.00	711.80		1.13
Wards Creek	4.508	100-Year	713.34	710.86	75.58		477.30	711.80		1.37
Wards Creek	4.508	500-Year	714.32	710.86	75.58		690.00	711.80		0.44
Wards Creek	4.415	10-Year	708.53	710.56	71.04		249.01	712.00		0.82
Wards Creek	4.415	50-Year	710.63	710.56	71.04		400.00	712.00		1.28
Wards Creek	4.415	100-Year	711.70	710.56	71.04		477.30	712.00		1.78
Wards Creek	4.415	500-Year	713.68	710.56	71.04		690.00	712.00		2.45
Wards Creek	4.327	10-Year	705.83	706.10	44.71		249.01	707.41		1.58
Wards Creek	4.327	50-Year	708.74	706.10	44.71		400.00	707.41		3.45
Wards Creek	4.327	100-Year	709.24	706.10	44.71		477.30	707.41		3.53
Wards Creek	4.327	500-Year	710.14	706.10	44.71		690.00	707.41		3.49
Wards Creek	4.2715	10-Year	703.95	700.67	23.67		249.01	702.04		0.09
Wards Creek	4.2715	50-Year	704.84	700.67	23.67		400.00	702.04		0.08
Wards Creek	4.2715	100-Year	705.16	700.67	23.67		477.30	702.04		0.08
Wards Creek	4.2715	500-Year	705.72	700.67	23.67		690.00	702.04		0.09
Wards Creek	4.2115	10-Year	703.82	699.63	49.81		249.01	701.30		0.00
Wards Creek	4.2115	50-Year	704.72	699.63	49.81		400.00	701.30		0.00
Wards Creek	4.2115	100-Year	705.02	699.63	49.81		477.30	701.30		0.00
Wards Creek	4.2115	500-Year	705.54	699.63	49.81		690.00	701.30		0.00

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.532	10-Year	709.72	709.70	0.02	0.05	0.00	11.72	202.67	34.62	214.77
Wards Creek	4.532	50-Year	712.27	712.26	0.01	0.02	0.00	62.40	242.63	94.97	375.38
Wards Creek	4.532	100-Year	713.39	713.38	0.01	0.01	0.00	112.35	249.97	114.98	520.52
Wards Creek	4.532	500-Year	714.36	714.36	0.01	0.02	0.00	215.39	310.15	164.46	622.39
Wards Creek	4.516	10-Year	709.67	709.61	0.06				249.01		34.22
Wards Creek	4.516	50-Year	712.24	712.20	0.04			5.14	393.59	1.27	59.08
Wards Creek	4.516	100-Year	713.37	713.33	0.04			18.01	439.51	19.78	128.37
Wards Creek	4.516	500-Year	714.35	714.30	0.04			46.23	566.24	77.53	194.53
Wards Creek	4.515		Inl Struct								
Wards Creek	4.514	10-Year	709.63	709.50	0.13	0.01	0.03		249.01		33.61
Wards Creek	4.514	50-Year	712.22	712.17	0.04	0.00	0.09	4.96	393.82	1.22	58.75
Wards Creek	4.514	100-Year	713.34	713.31	0.04	0.00	0.04	17.66	440.68	18.96	127.29
Wards Creek	4.514	500-Year	714.32	714.28	0.04	0.00	0.01	45.72	568.21	76.07	193.59
Wards Creek	4.508		Bridge								
Wards Creek	4.415		Bridge								
Wards Creek	4.410	10-Year	707.71	707.60	0.11				249.01		36.11
Wards Creek	4.410	50-Year	709.35	709.17	0.18				400.00		39.25
Wards Creek	4.410	100-Year	709.93	709.70	0.23				477.30		40.32
Wards Creek	4.410	500-Year	711.23	710.86	0.37				690.00		42.64
Wards Creek	4.409		Inl Struct								
Wards Creek	4.408	10-Year	706.42	706.30	0.11	0.32	0.03		249.01		33.52
Wards Creek	4.408	50-Year	709.03	708.91	0.12	0.16	0.04		400.00		38.73
Wards Creek	4.408	100-Year	709.57	709.41	0.16	0.18	0.06		477.30		39.74
Wards Creek	4.408	500-Year	710.59	710.33	0.26	0.24	0.10		690.00		41.59
Wards Creek	4.365	10-Year	706.07	706.01	0.06	0.23	0.00	1.37	211.56	36.08	46.07
Wards Creek	4.365	50-Year	708.83	708.79	0.04	0.09	0.00	24.02	295.03	80.96	79.14

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.365	100-Year	709.34	709.29	0.04	0.10	0.00	35.30	342.45	99.56	87.46
Wards Creek	4.365	500-Year	710.26	710.19	0.06	0.12	0.00	66.08	467.56	156.36	103.82

HEC-RAS Plan: 03 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Q Total	Q Weir	Q Gates
			(ft)	(ft)	(cfs)	(cfs)	(cfs)
Wards Creek	4.515	10-Year	709.67	709.61	249.01	249.01	
Wards Creek	4.515	50-Year	712.24	712.20	400.00	400.00	
Wards Creek	4.515	100-Year	713.37	713.33	477.30	477.30	
Wards Creek	4.515	500-Year	714.35	714.30	690.00	690.00	
Wards Creek	4.409	10-Year	707.71	707.60	249.01	249.01	
Wards Creek	4.409	50-Year	709.35	709.17	400.00	400.00	
Wards Creek	4.409	100-Year	709.93	709.70	477.30	477.30	
Wards Creek	4.409	500-Year	711.23	710.86	690.00	690.00	

Errors Warnings and Notes for Plan : 03

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.64866* Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.59033* Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.532 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.516 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.515 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.514 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 10-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 10-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.502 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.421 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 10-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 10-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.410 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.409 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.408 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.332 Profile: 10-Year
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 10-Year Upstream

Errors Warnings and Notes for Plan : 03 (Continued)

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 10-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.322 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.274 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 10-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 10-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.269 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.229 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.213 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 10-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 10-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.210 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 10-Year Culv: Culvert #2
Note:	Culvert critical depth exceeds the height of the culvert.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations
	are not valid and the supercritical result has been discarded. The outlet answer will be used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 10-Year Culv: Culvert #3
Note:	The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height
	of the culvert.
Note:	Culvert critical depth exceeds the height of the culvert.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.175 Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.

Errors Warnings and Notes for Plan : 03 (Continued)

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.063 Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.972 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.

Errors Warnings and Notes for Plan : 03

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.64866* Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.59033* Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.532 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.516 Profile: 50-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.515 Profile: 50-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.514 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 50-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 50-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.502 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.421 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 50-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 50-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.410 Profile: 50-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.409 Profile: 50-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.408 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.332 Profile: 50-Year
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

Errors Warnings and Notes for Plan : 03 (Continued)

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 50-Year Upstream
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 50-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.322 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.274 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 50-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 50-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.269 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.229 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.213 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 50-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 50-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.210 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 50-Year Culv: Culvert #1
Note:	During supercritical analysis, the culvert direct step method went to critical depth. The program then assumed critical
	depth at the outlet.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations
	are not valid and the supercritical result has been discarded. The outlet answer will be used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 50-Year Culv: Culvert #2
Note:	Culvert critical depth exceeds the height of the culvert.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations
	are not valid and the supercritical result has been discarded. The outlet answer will be used.

Errors Warnings and Notes for Plan : 03 (Continued)

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 50-Year Culv: Culvert #3
Note:	The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height
	of the culvert.
Note:	Culvert critical depth exceeds the height of the culvert.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.175 Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.063 Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.972 Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.

Errors Warnings and Notes for Plan : 03

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.64866* Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.59033* Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.532 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.516 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.515 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.514 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 100-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 100-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.502 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.421 Profile: 100-Year
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 100-Year Upstream
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 100-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.410 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.409 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.408 Profile: 100-Year

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Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.332 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 100-Year
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer
	has been disregarded.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 100-Year Upstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 100-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.322 Profile: 100-Year
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.274 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 100-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 100-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.269 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.213 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 100-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 100-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.210 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 100-Year Culv: Culvert #1
Note:	During supercritical analysis, the culvert direct step method went to critical depth. The program then assumed critical

Errors Warnings and Notes for Plan : 03 (Continued)

	depth at the outlet.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations
	are not valid and the supercritical result has been discarded. The outlet answer will be used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 100-Year Culv: Culvert #2
Warning:	During the supercritical analysis, the program could not balance the energy equation during the forewater calculations
	inside of the culvert. The program assumed critical depth at the outlet and continued on.
Note:	Culvert critical depth exceeds the height of the culvert.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations
	are not valid and the supercritical result has been discarded. The outlet answer will be used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 100-Year Culv: Culvert #3
Note:	The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height
	of the culvert.
Note:	Culvert critical depth exceeds the height of the culvert.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.175 Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.063 Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.032 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.972 Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.

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Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.64866* Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.59033* Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.532 Profile: 500-Year
Warning:	The cross-section end points had to be extended vertically for the computed water surface.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.516 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.515 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.514 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 500-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 500-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.502 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.421 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 500-Year Upstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 500-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.410 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.409 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.408 Profile: 500-Year

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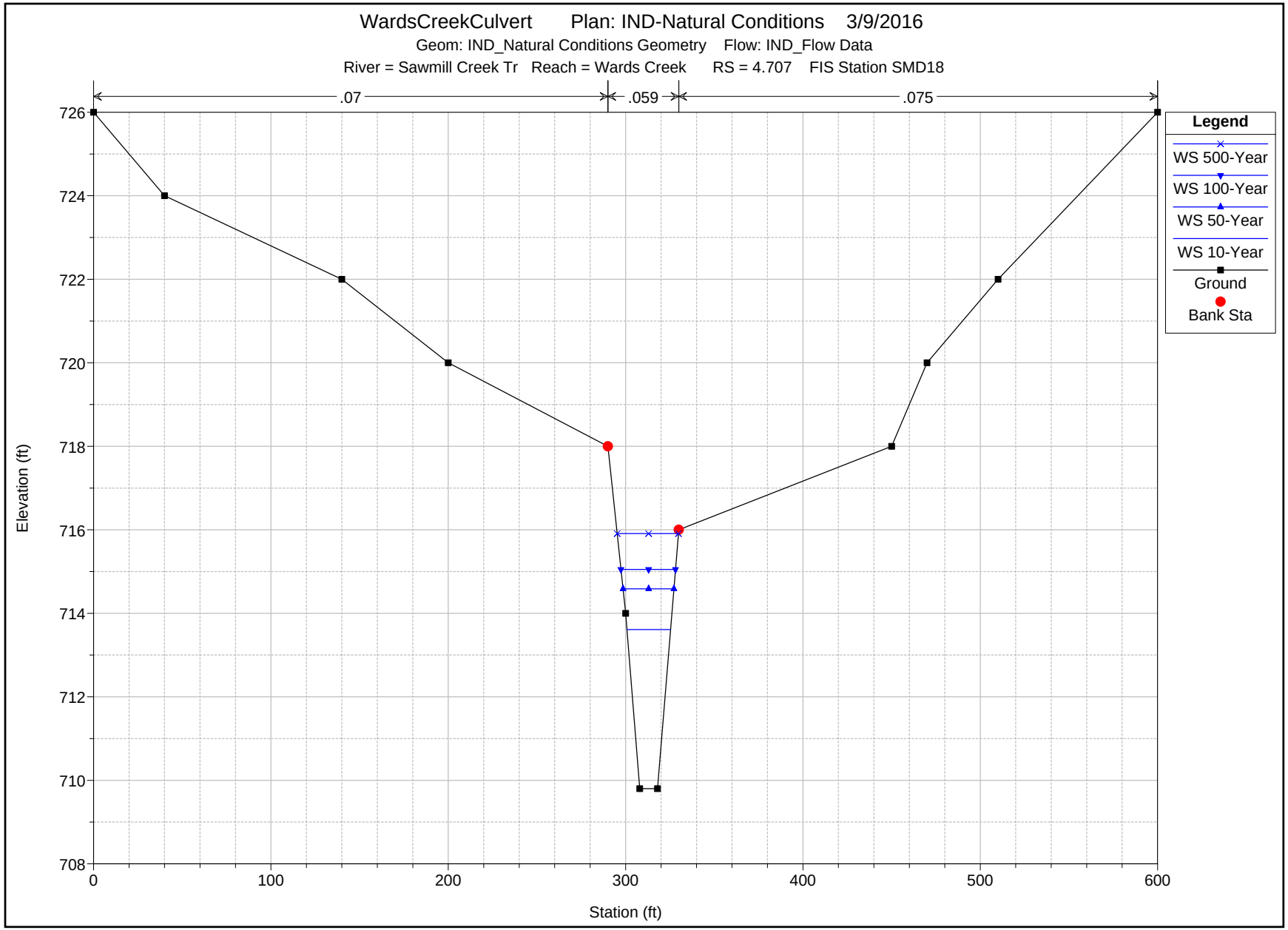
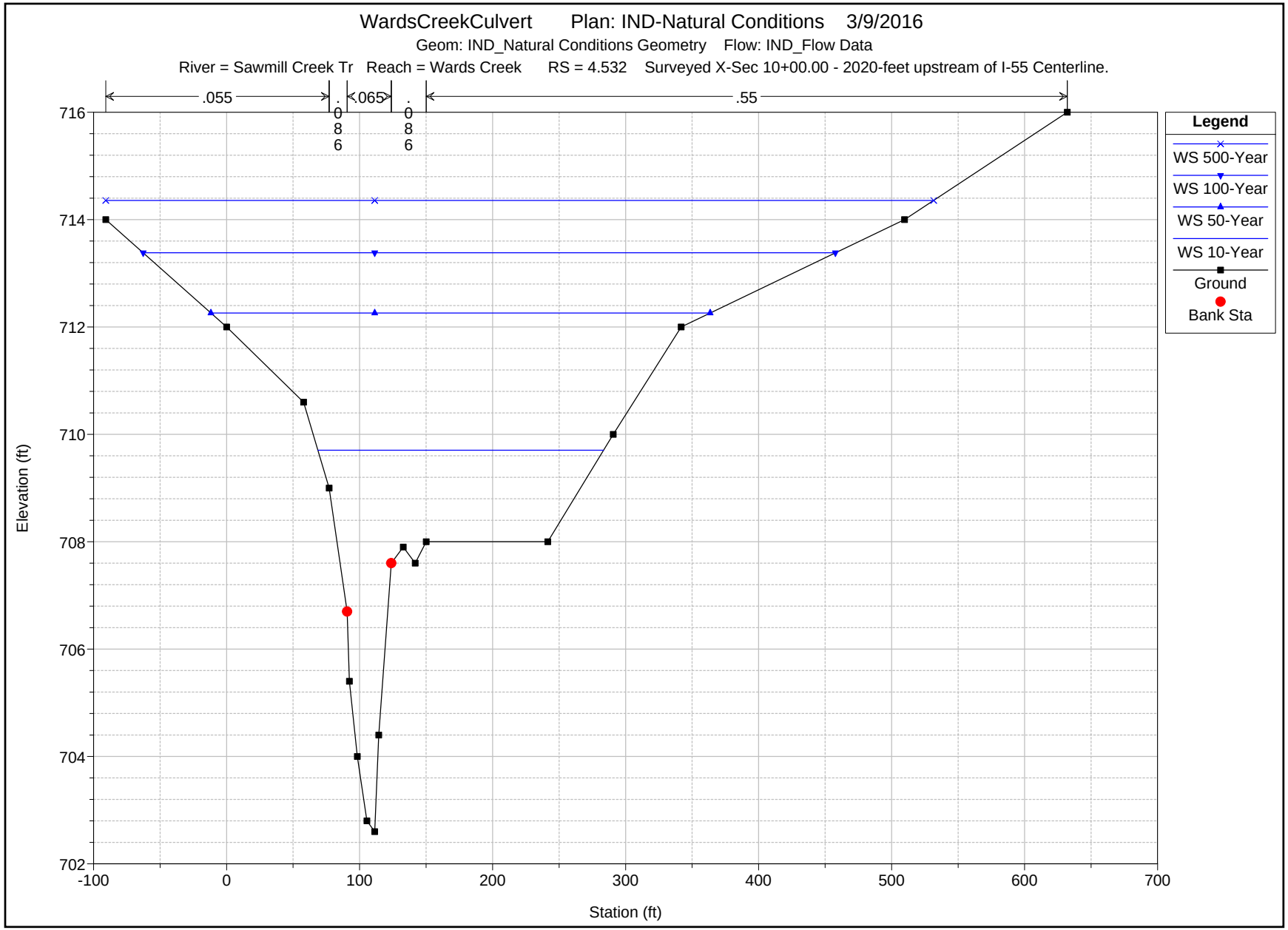
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.332 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 500-Year
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer
	has been disregarded.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 500-Year Upstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 500-Year Downstream
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used critical depth
	for the water surface and continued on with the calculations.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water
	surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
	defaulted to critical depth.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.322 Profile: 500-Year
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.274 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 500-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 500-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.269 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.213 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 500-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 500-Year Downstream

Errors Warnings and Notes for Plan : 03 (Continued)

Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.210 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 500-Year Culv: Culvert #1
Note:	The flow in the culvert is entirely supercritical.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 500-Year Culv: Culvert #2
Warning:	During the supercritical analysis, the program could not balance the energy equation during the forewater calculations
	inside of the culvert. The program assumed critical depth at the outlet and continued on.
Note:	Culvert critical depth exceeds the height of the culvert.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations
	are not valid and the supercritical result has been discarded. The outlet answer will be used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 500-Year Culv: Culvert #3
Note:	The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height
	of the culvert.
Note:	Culvert critical depth exceeds the height of the culvert.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.175 Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.063 Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.972 Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.707 FIS Station SMD18
.07
.059
.075
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
726
724
722
720
718
716
714
712
710
708
0
100
200
300
400
500
600
Station (ft)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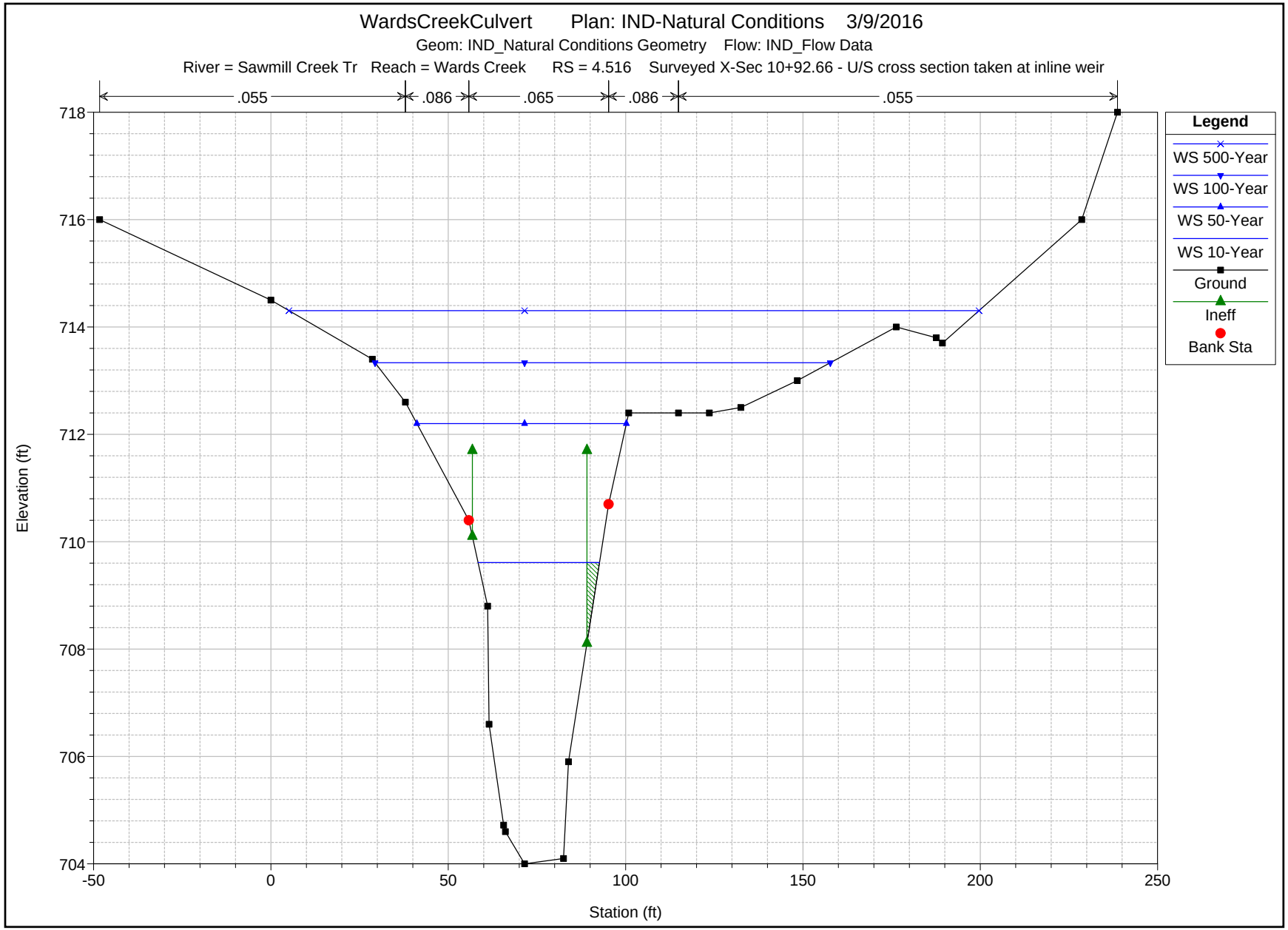
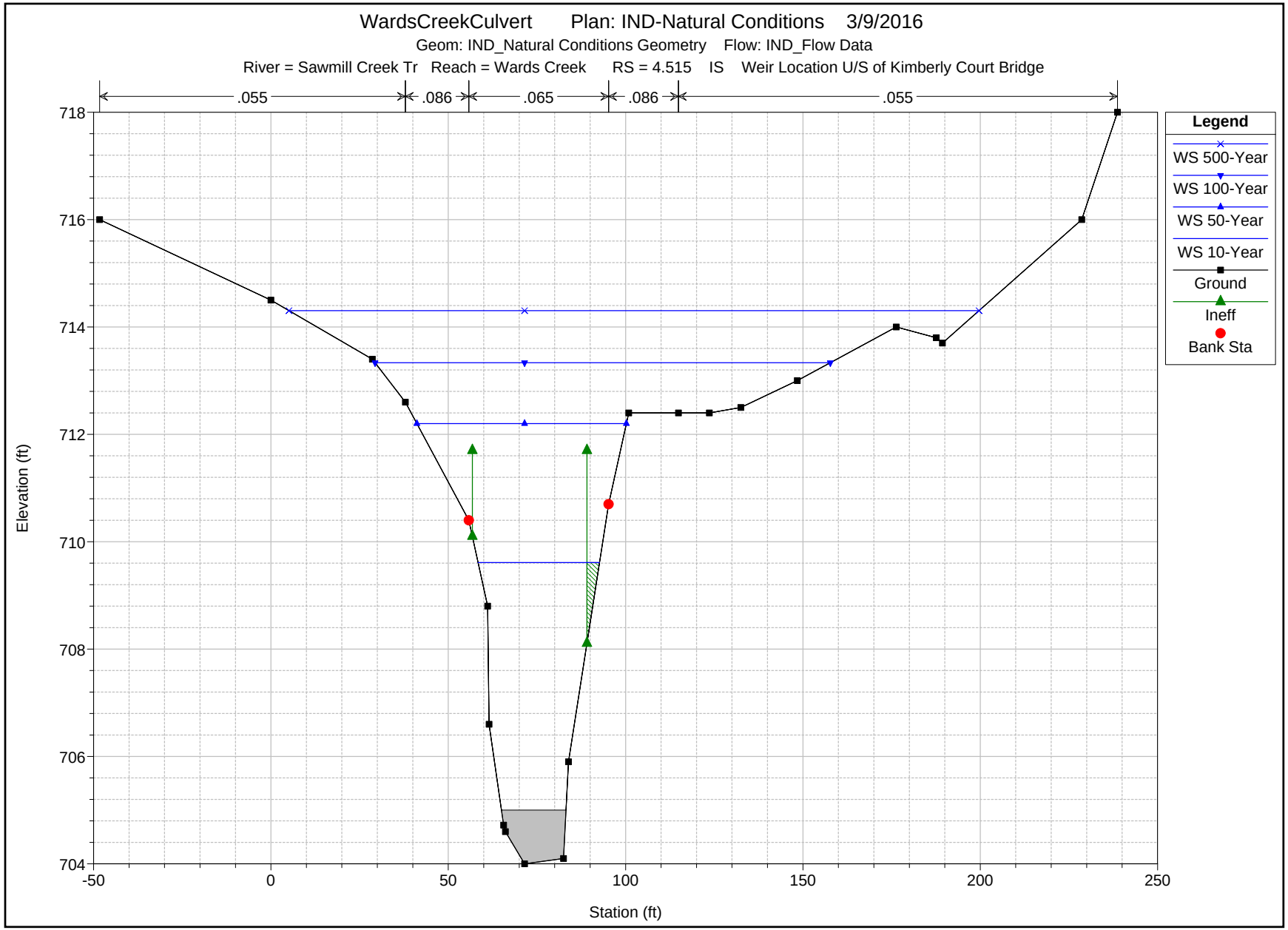
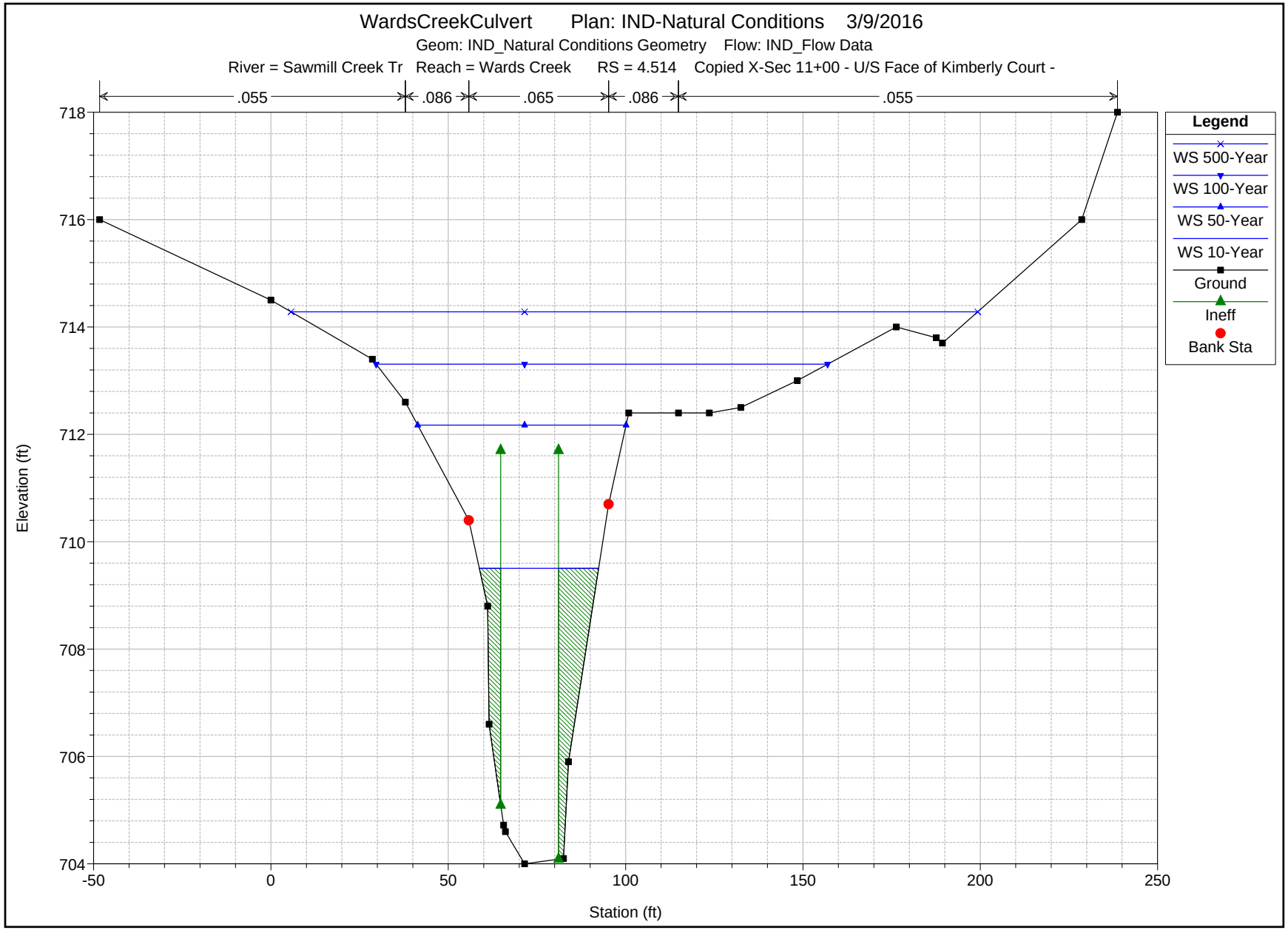
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.532 Surveyed X-Sec 10+00.00 - 2020-feet upstream of I-55 Centerline.
.055
.086
.065
.086
.55
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
716
714
712
710
708
706
704
702
-100
0
100
200
300
400
500
600
700
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.516 Surveyed X-Sec 10+92.66 - U/S cross section taken at inline weir
.055
.086
.065
.086
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
718
716
714
712
710
708
706
704
-50
0
50
100
150
200
250
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.515 IS Weir Location U/S of Kimberly Court Bridge
.055
.086
.065
.086
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
718
716
714
712
710
708
706
704
-50
0
50
100
150
200
250
Station (ft)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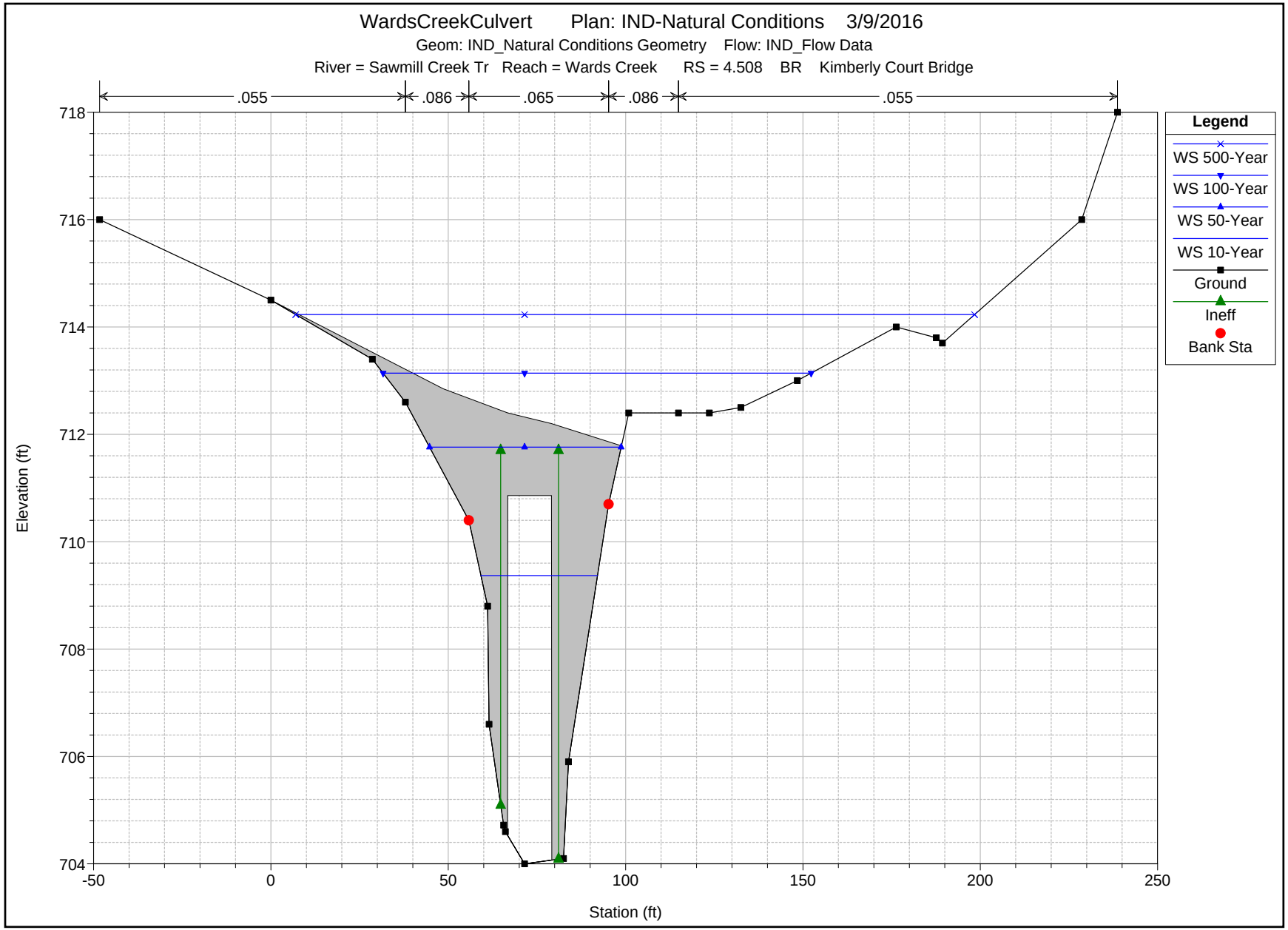
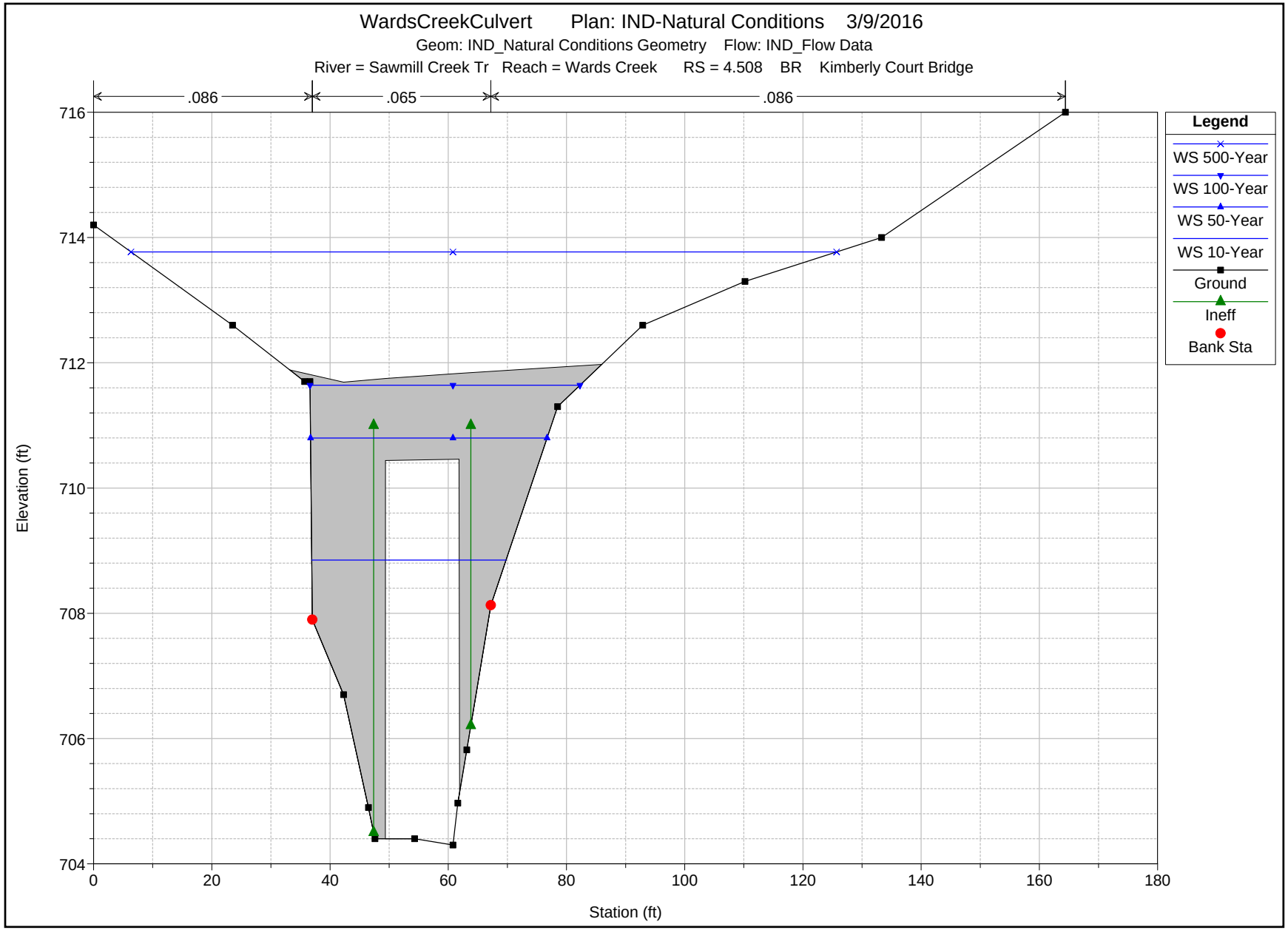
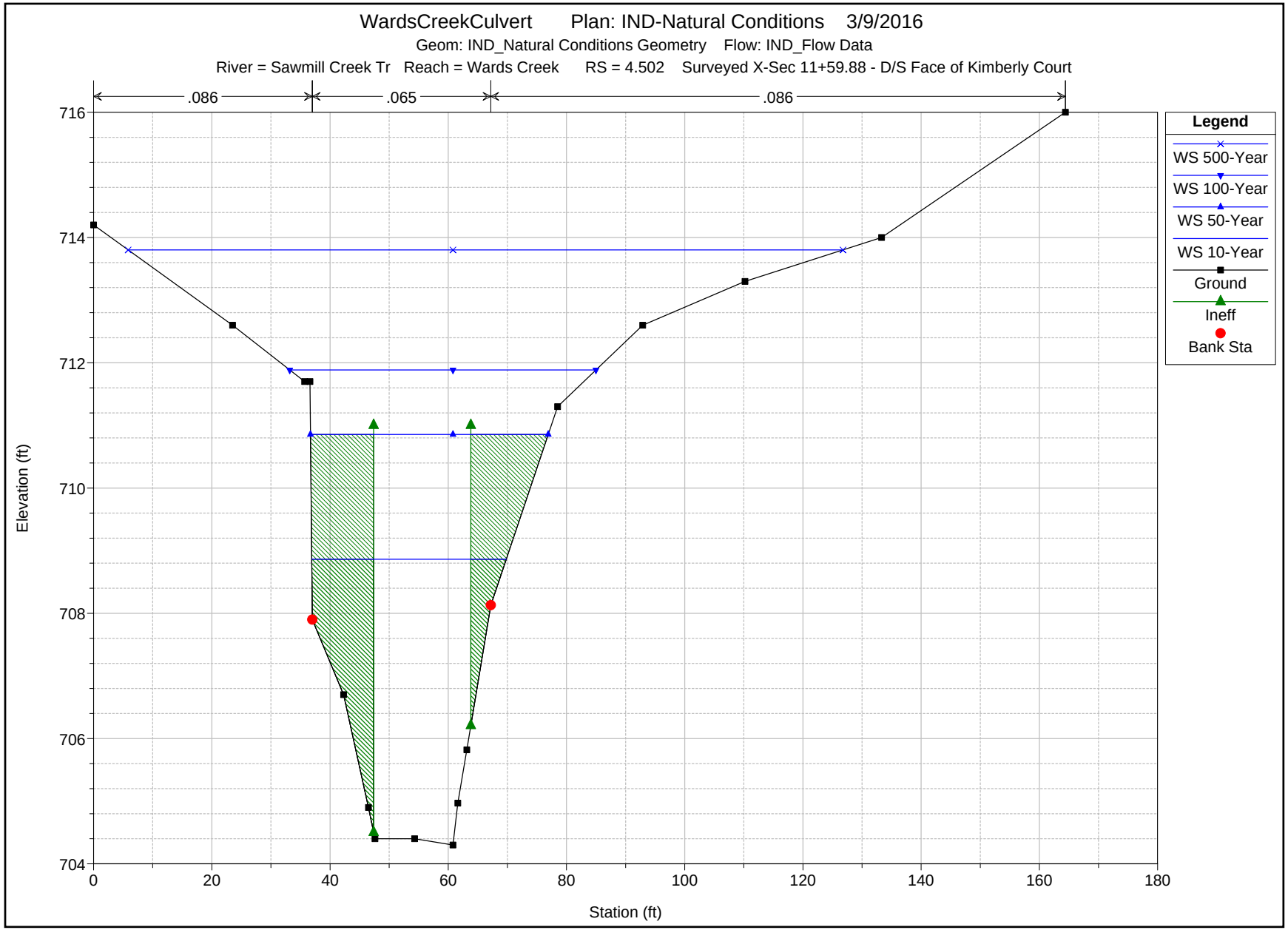
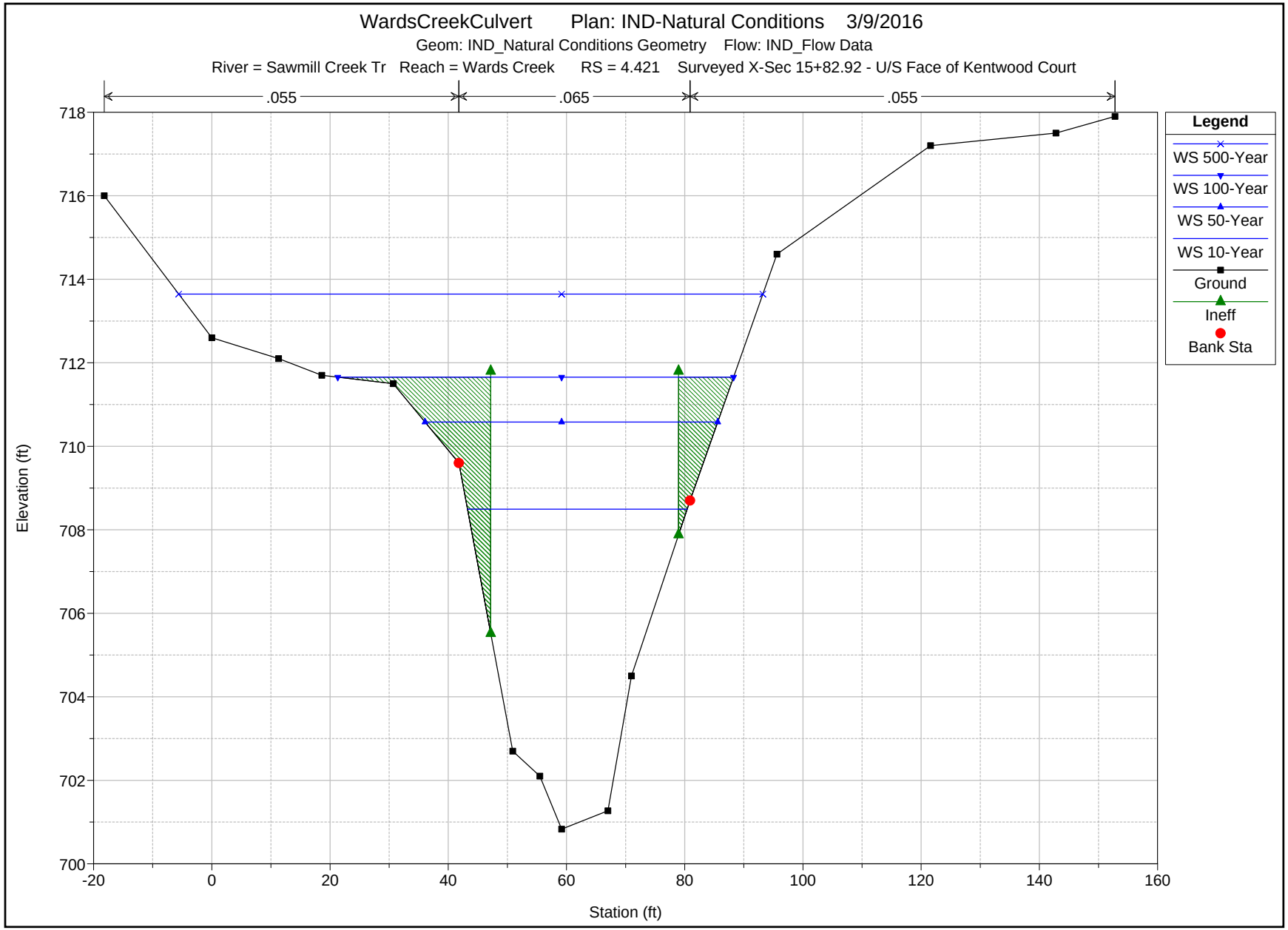
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.514 Copied X-Sec 11+00 - U/S Face of Kimberly Court -
.055
.086
.065
.086
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
718
716
714
712
710
708
706
704
-50
0
50
100
150
200
250
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.508 BR Kimberly Court Bridge
.055
.086
.065
.086
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
718
716
714
712
710
708
706
704
-50
0
50
100
150
200
250
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.508 BR Kimberly Court Bridge
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
716
714
712
710
708
706
704
0
20
40
60
80
100
120
140
160
180
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.502 Surveyed X-Sec 11+59.88 - D/S Face of Kimberly Court
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
716
714
712
710
708
706
704
0
20
40
60
80
100
120
140
160
180
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.421 Surveyed X-Sec 15+82.92 - U/S Face of Kentwood Court
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
718
716
714
712
710
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706
704
702
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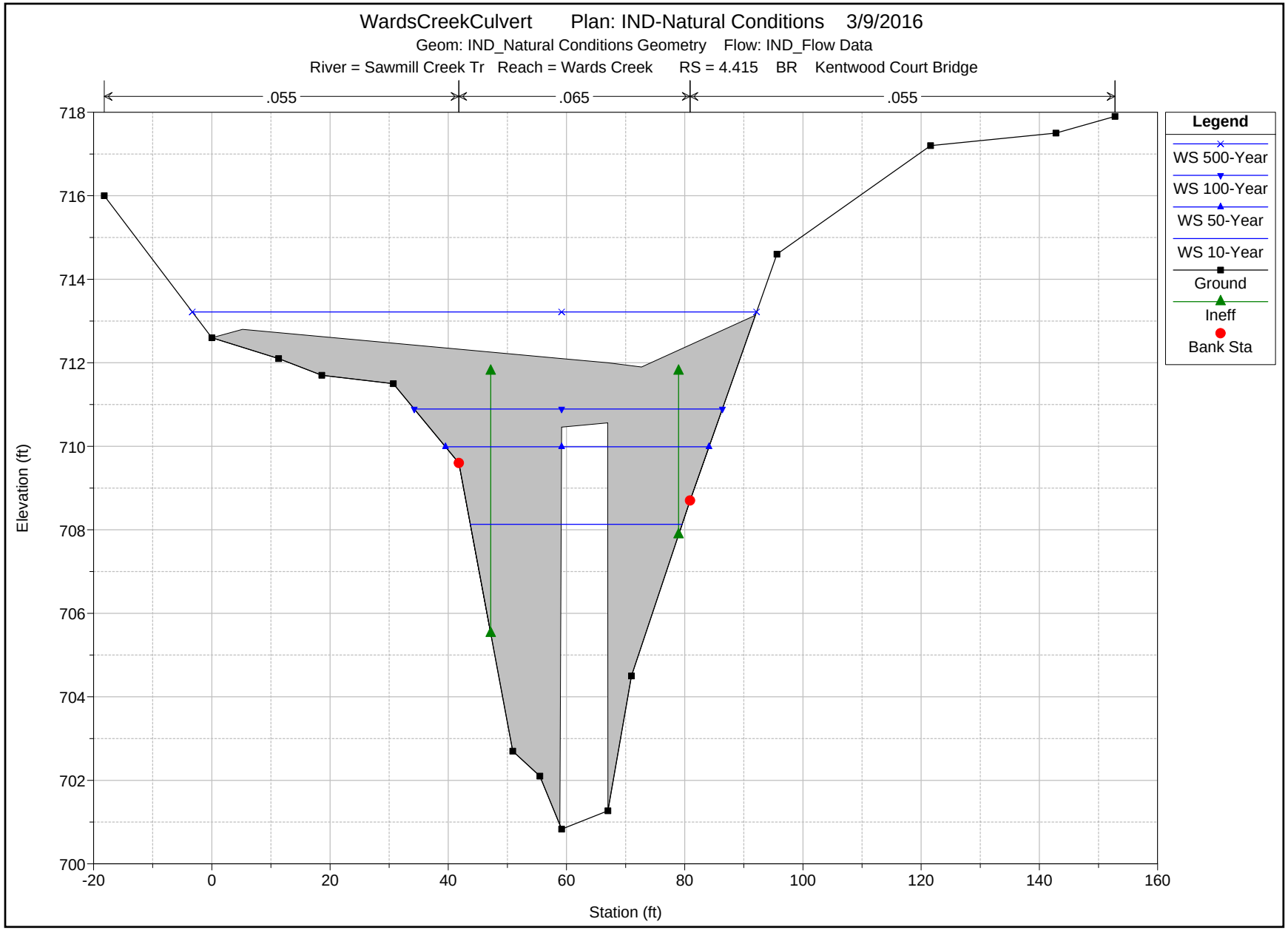
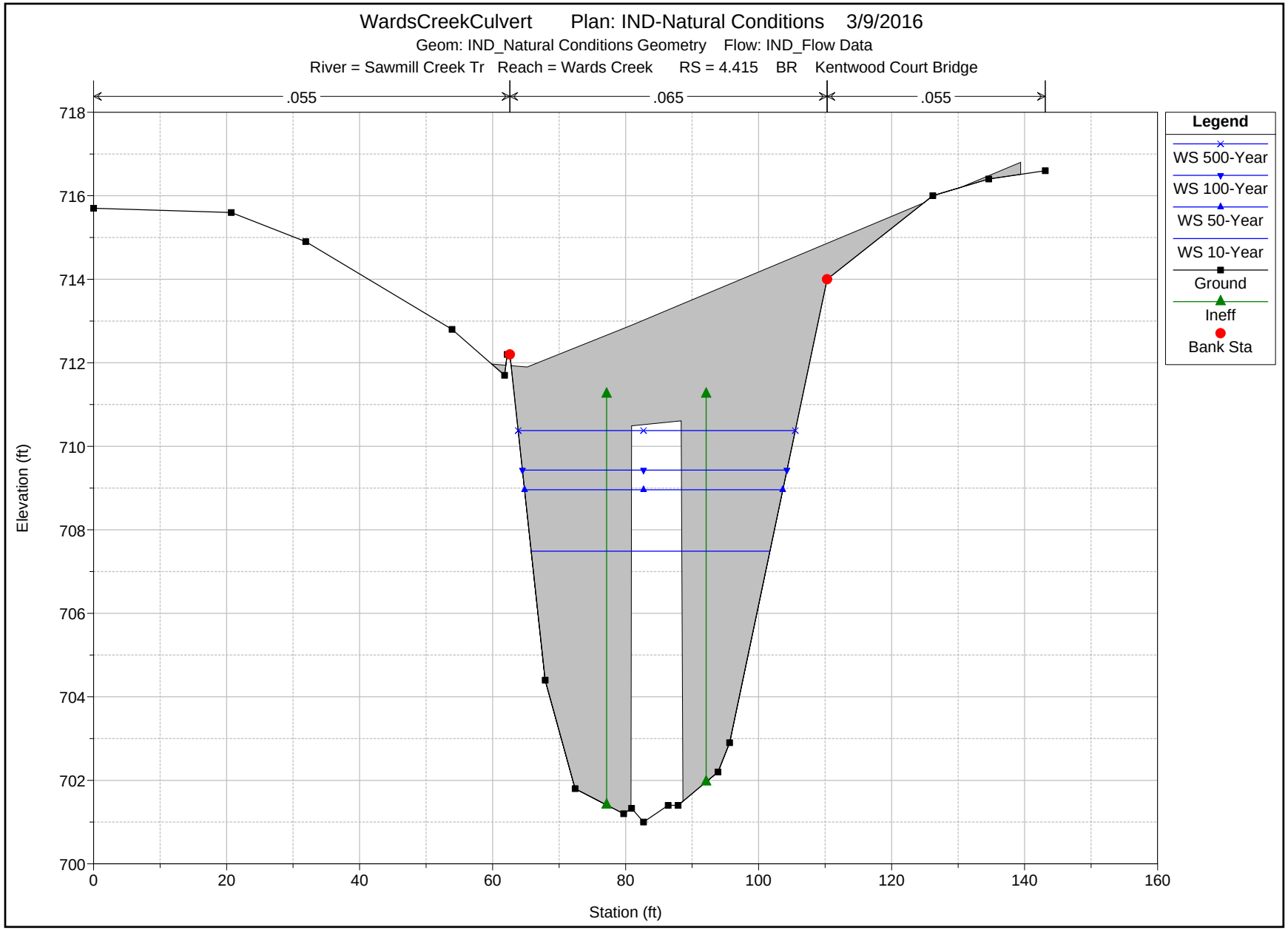
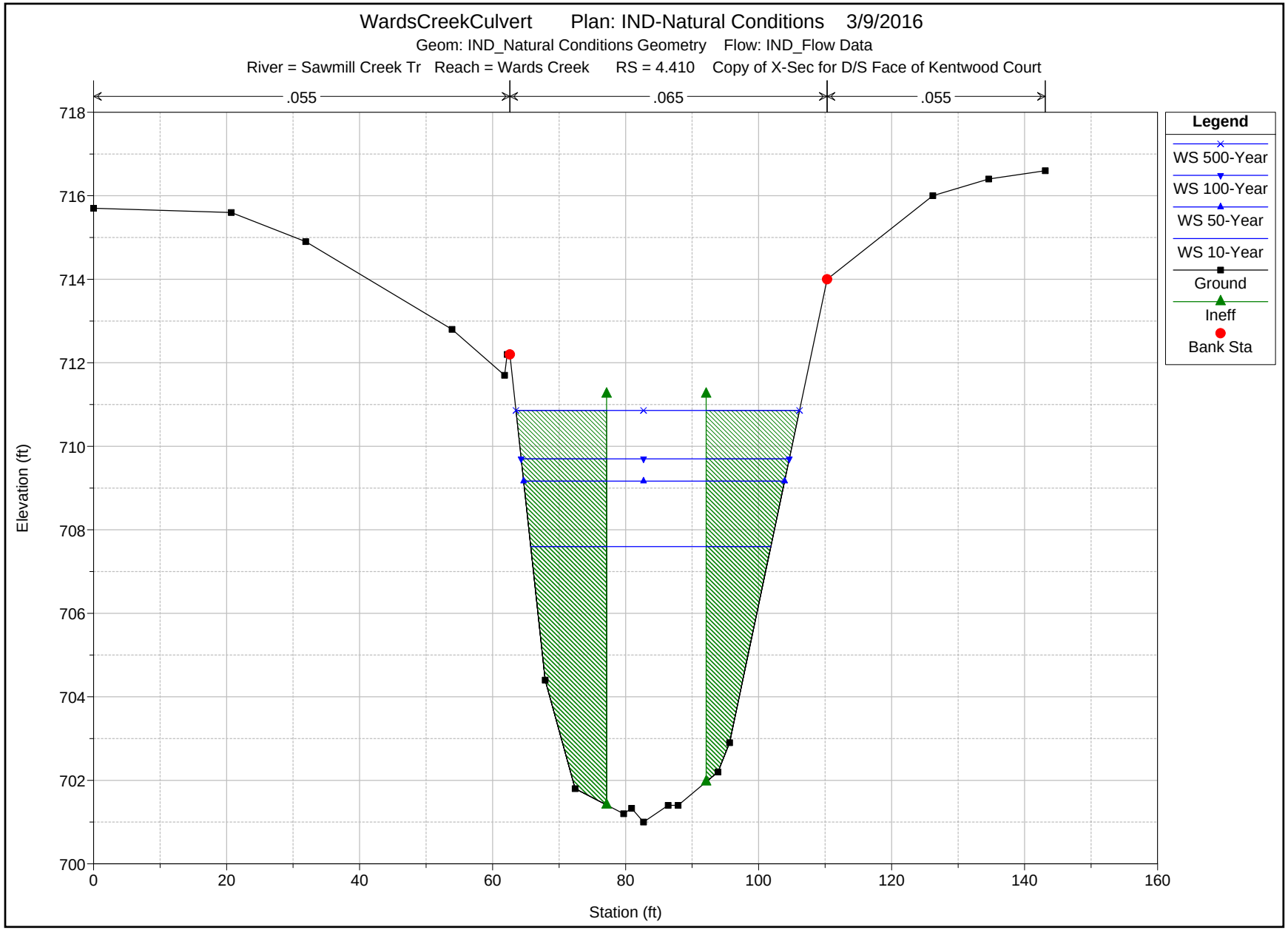
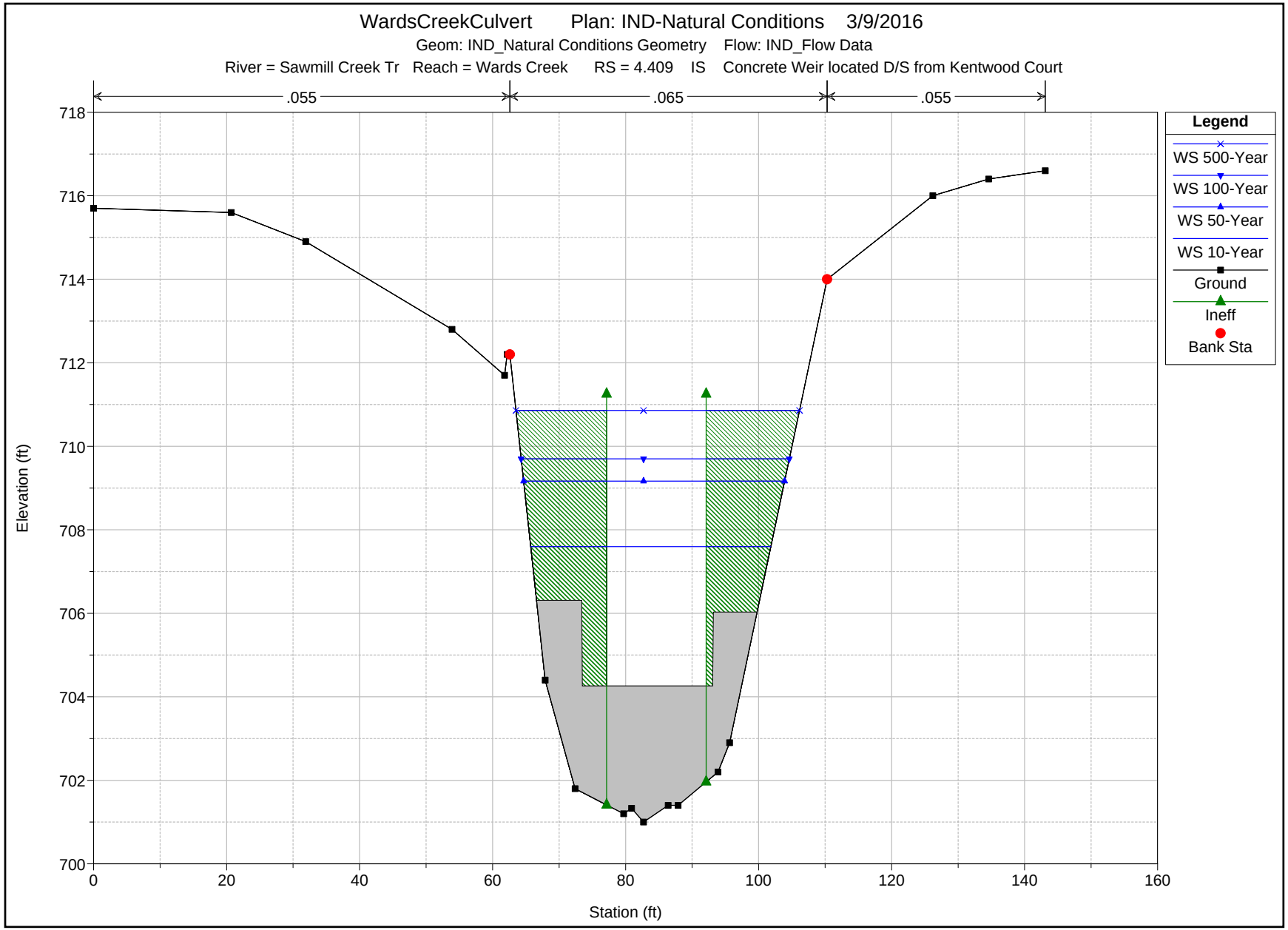
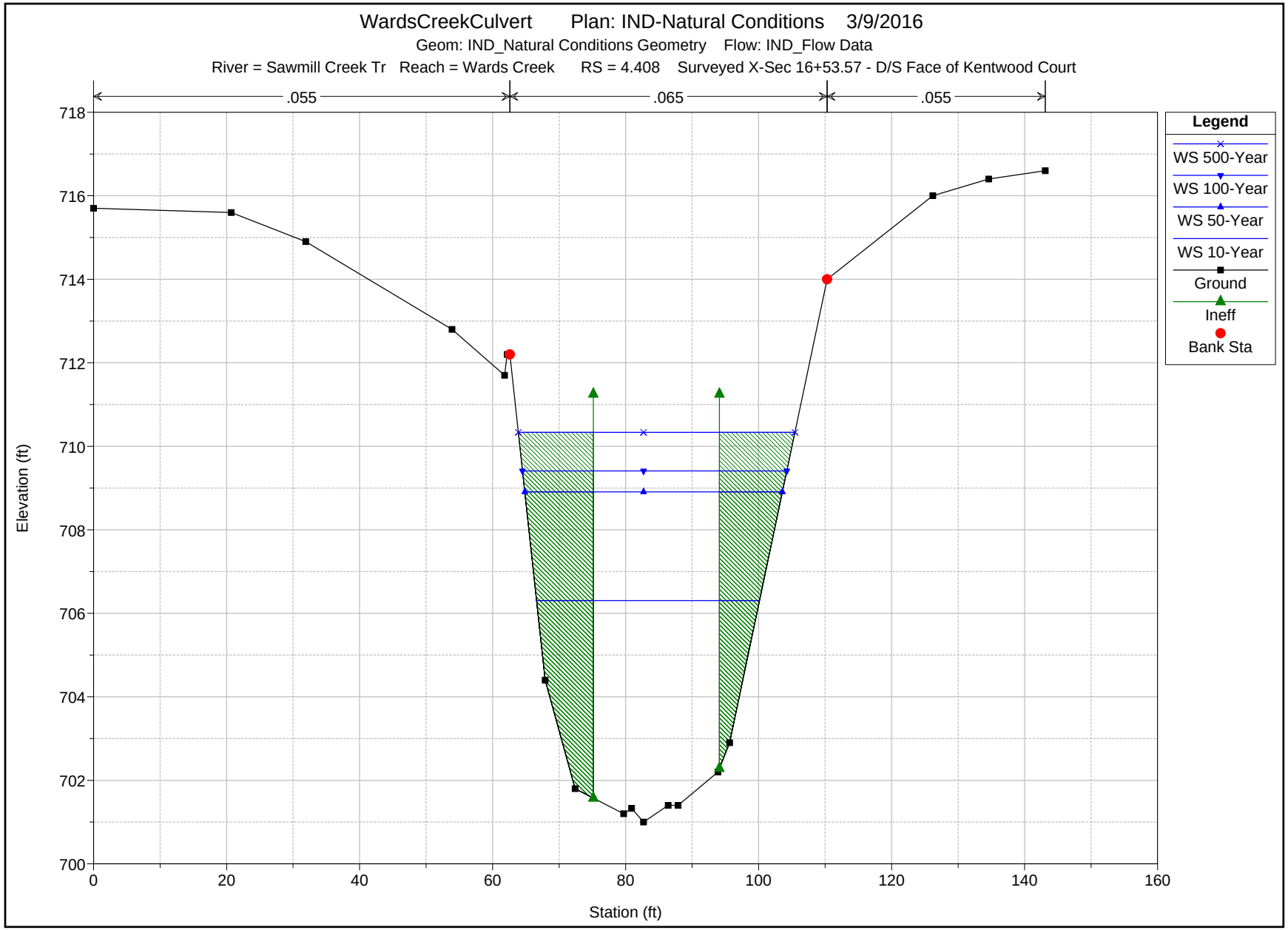
-20
0
20
40
60
80
100
120
140
160
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.415 BR Kentwood Court Bridge
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
702
700
-20
0
20
40
60
80
100
120
140
160


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.415 BR Kentwood Court Bridge
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
702
700
0
20
40
60
80
100
120
140
160


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.410 Copy of X-Sec for D/S Face of Kentwood Court
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
702
700
0
20
40
60
80
100
120
140
160


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.409 IS Concrete Weir located D/S from Kentwood Court
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
702
700
0
20
40
60
80
100
120
140
160


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.408 Surveyed X-Sec 16+53.57 - D/S Face of Kentwood Court
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
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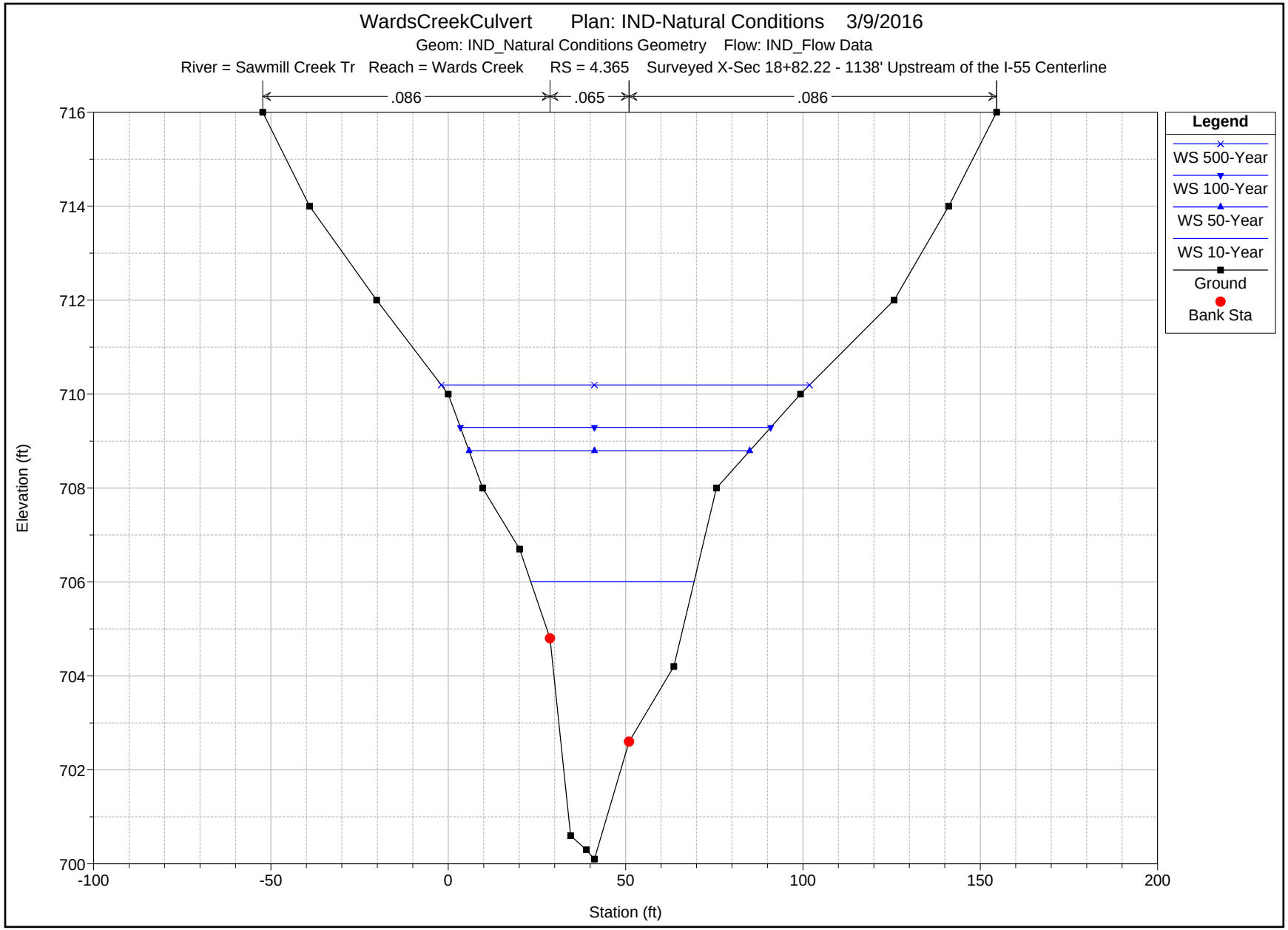
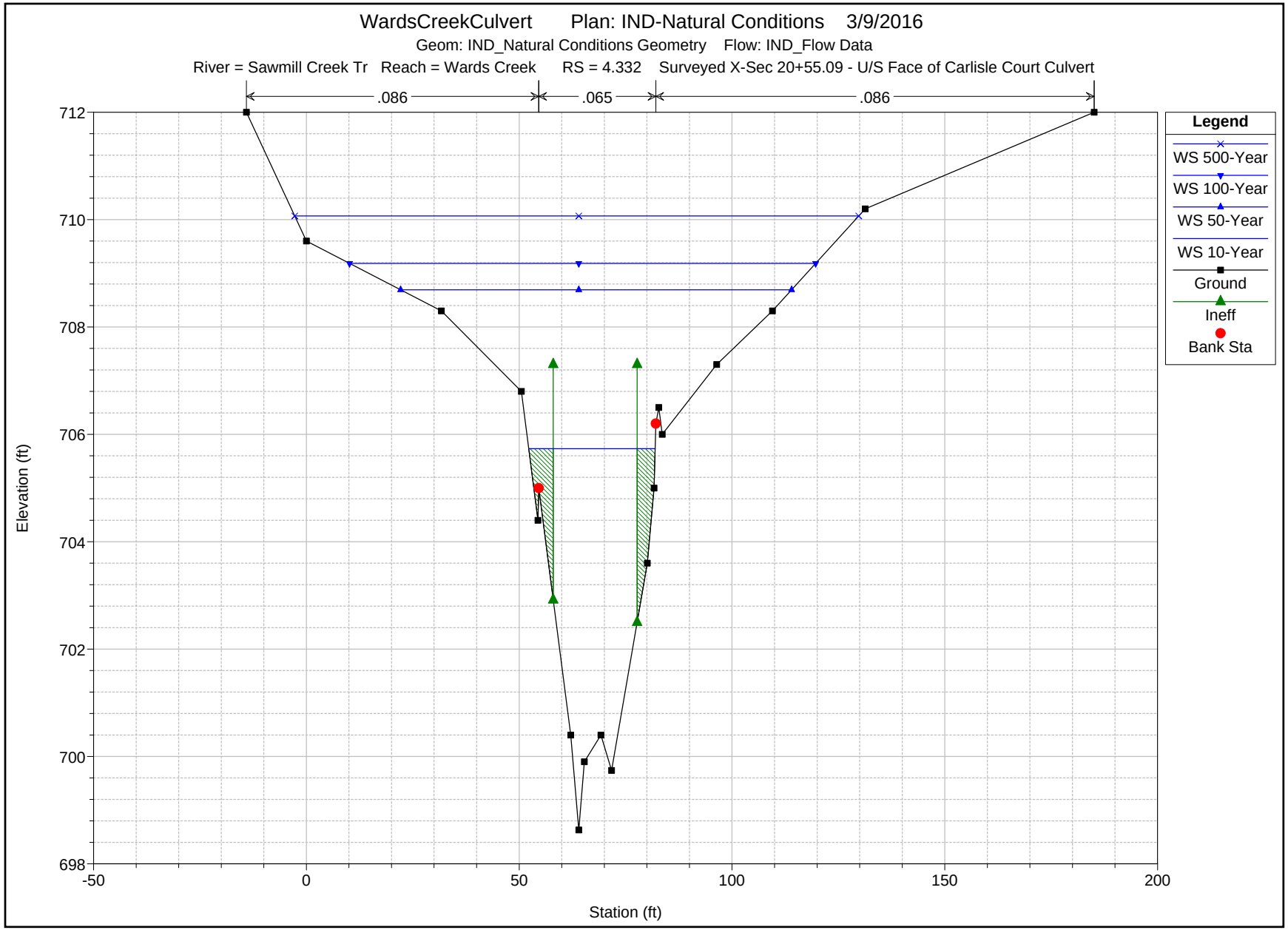
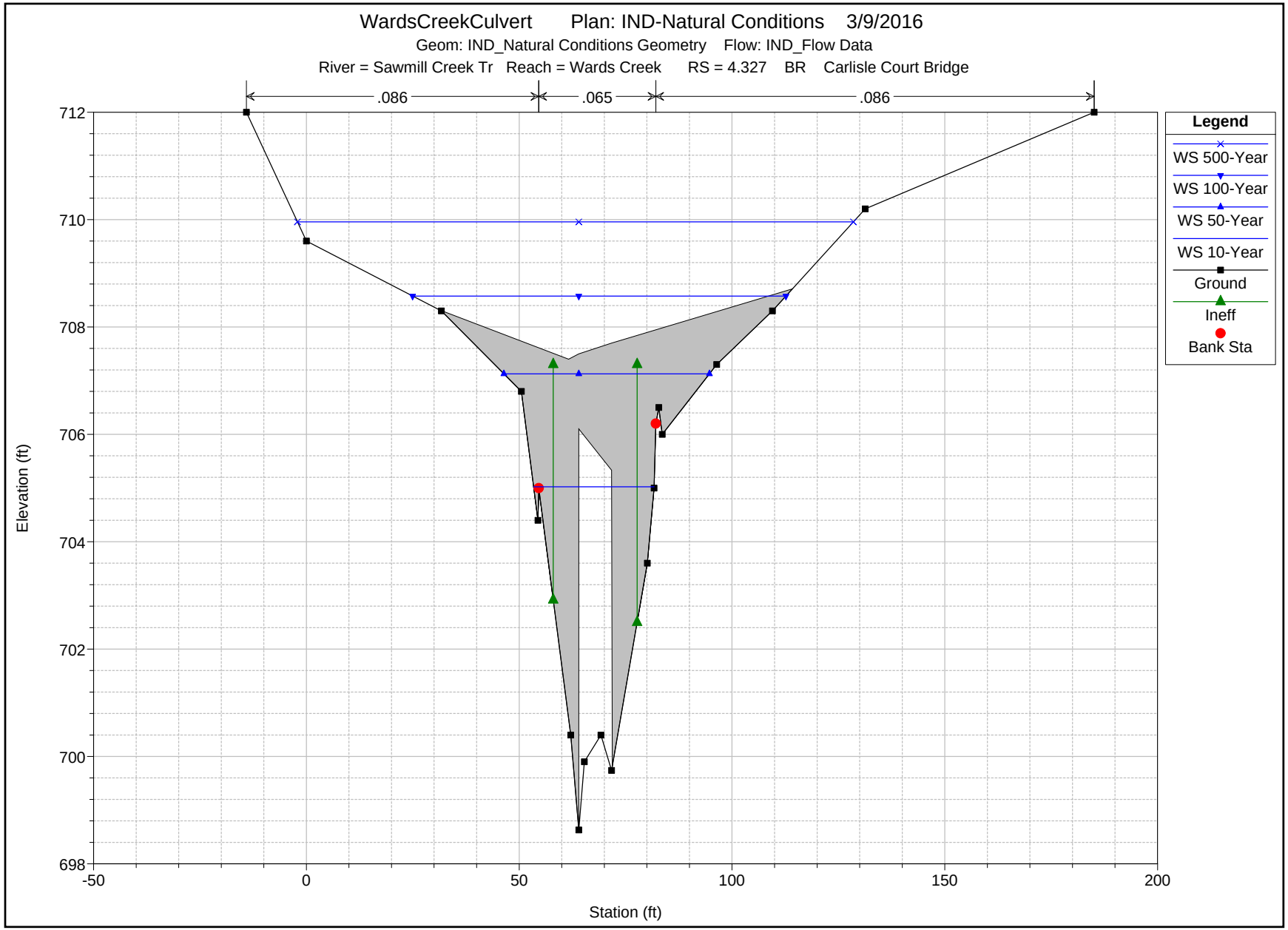
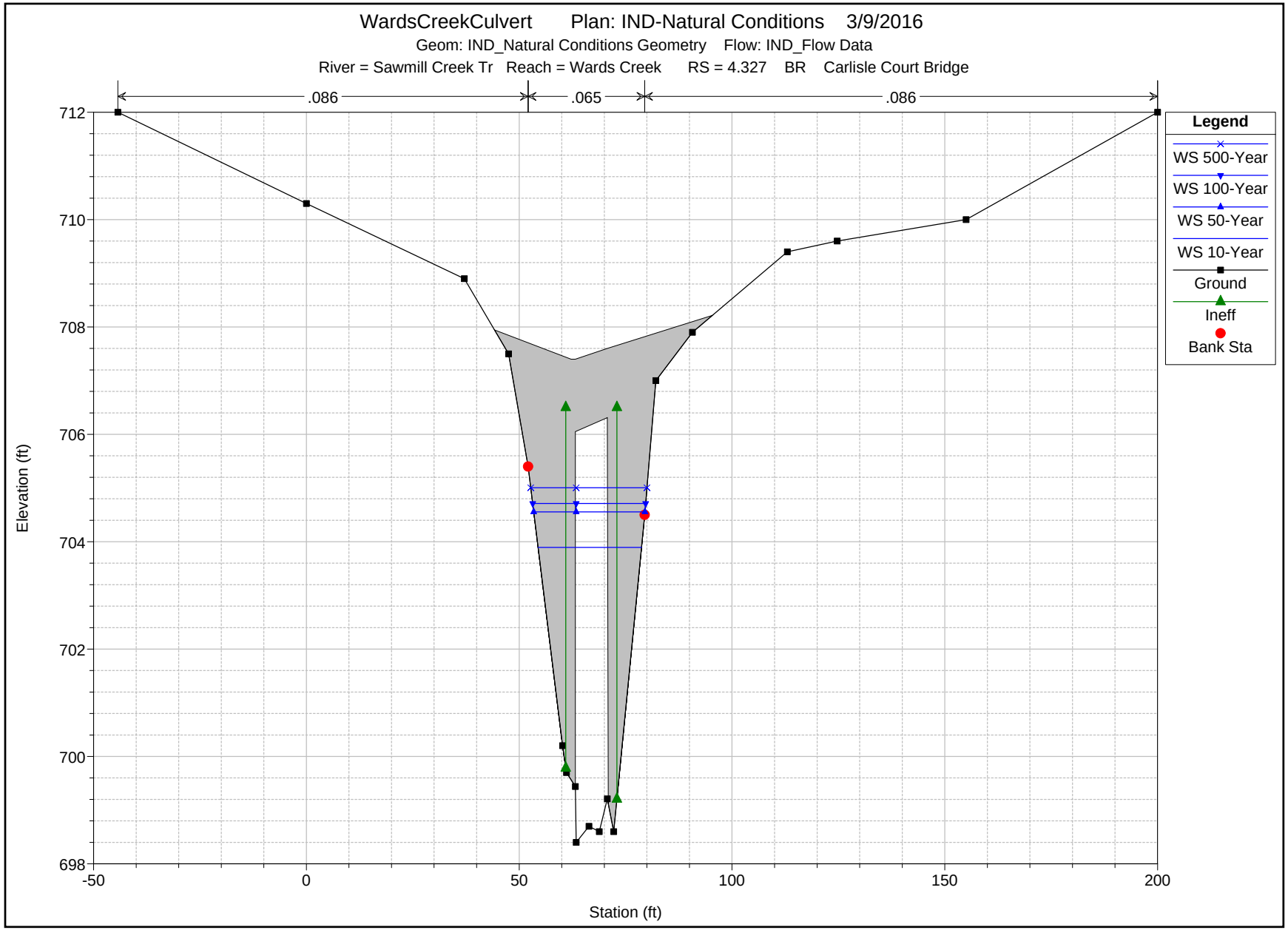
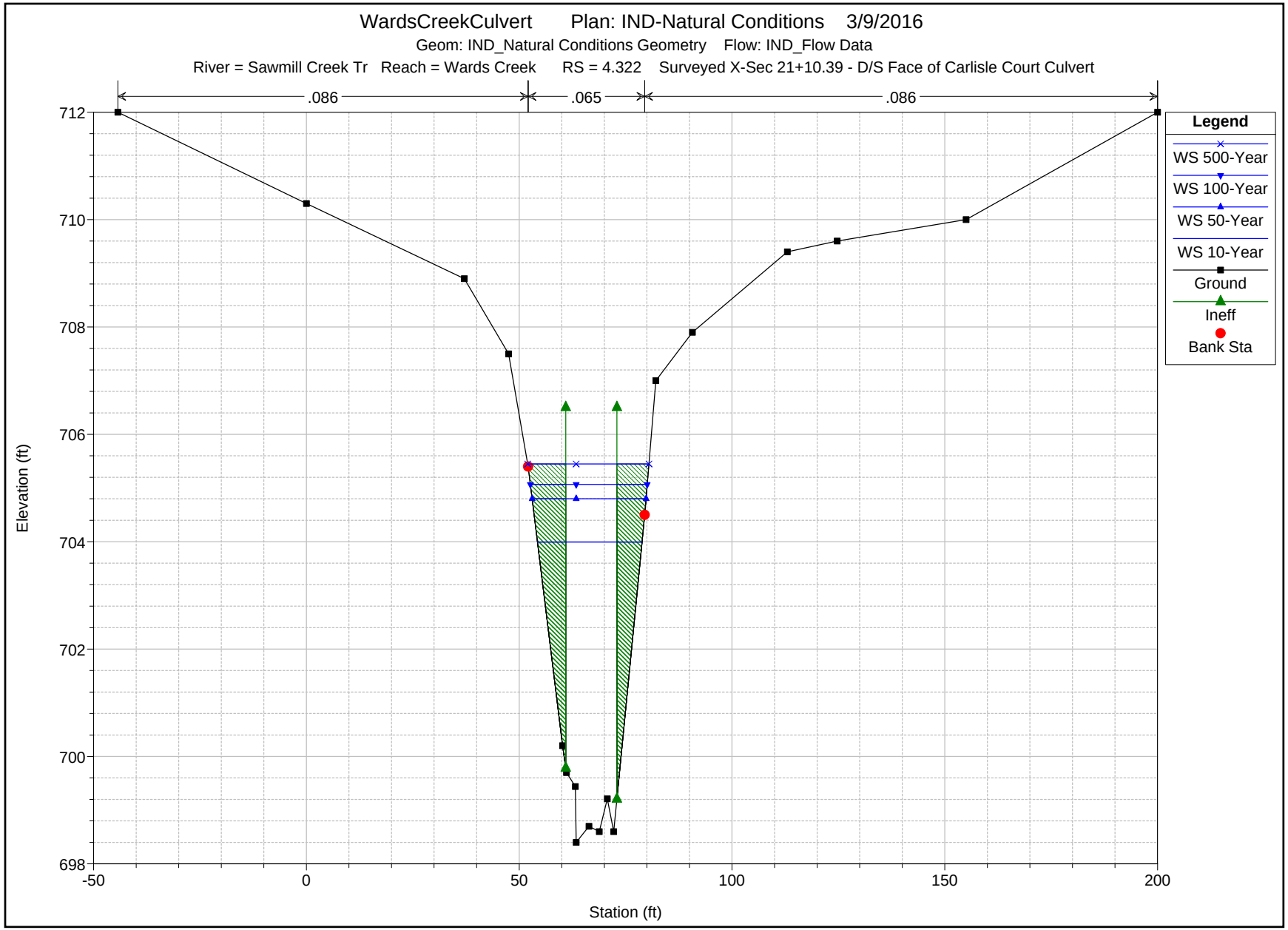
700
0
20
40
60
80
100
120
140
160

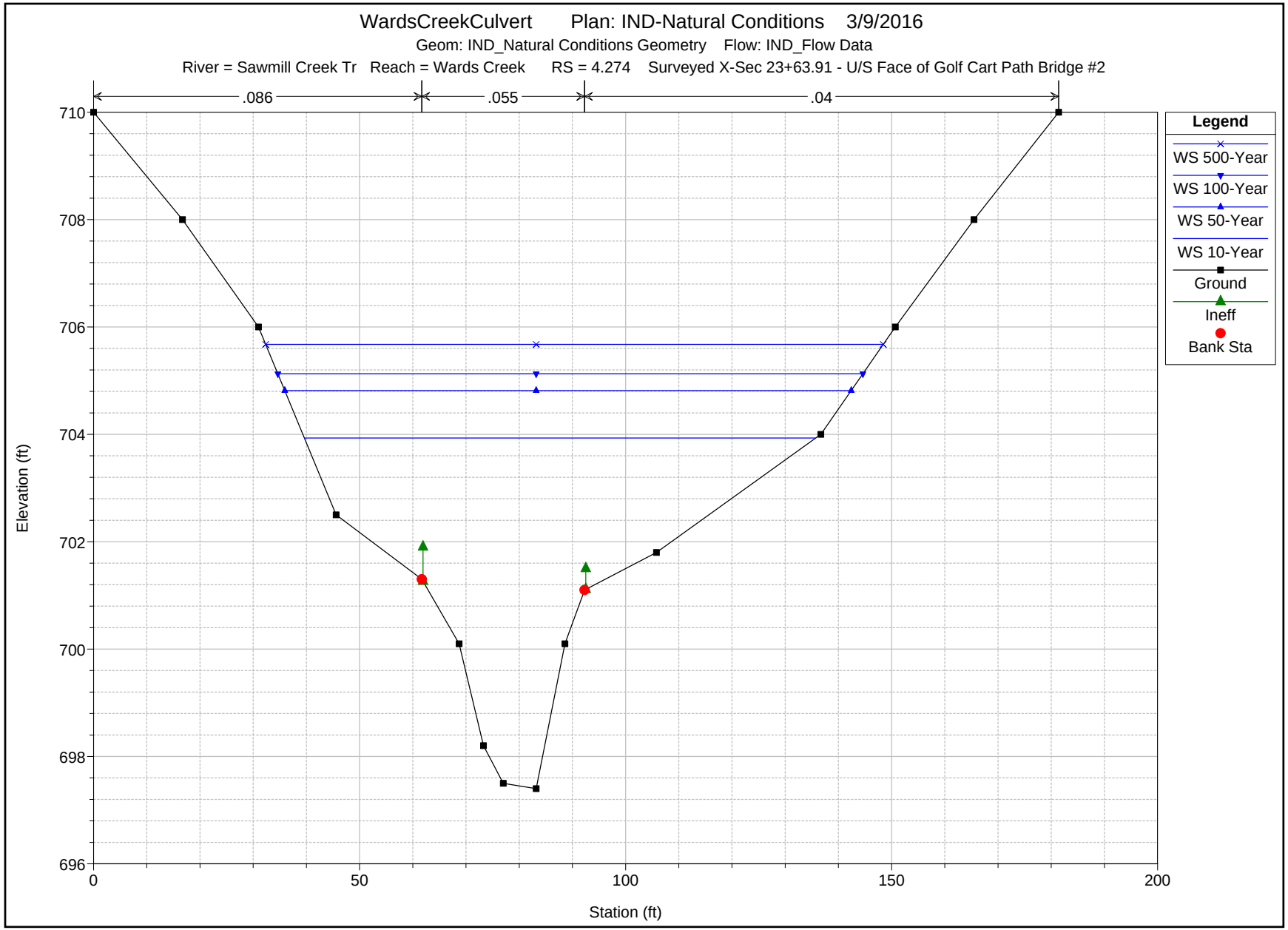

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.365 Surveyed X-Sec 18+82.22 - 1138' Upstream of the I-55 Centerline
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
716
714
712
710
708
706
704
702
700
-100
-50
0
50
100
150
200
Station (ft)

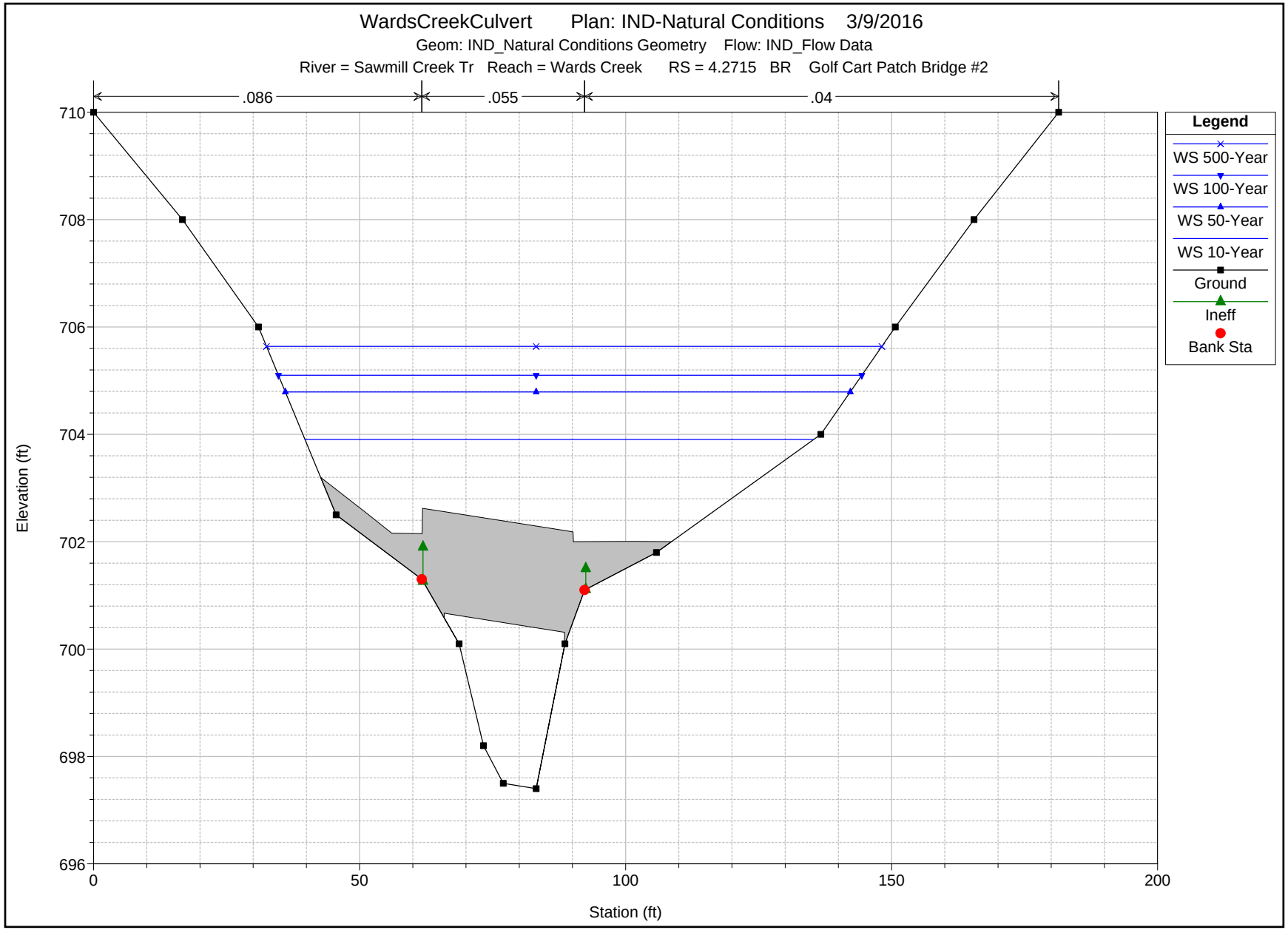

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.332 Surveyed X-Sec 20+55.09 - U/S Face of Carlisle Court Culvert
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
-50
0
50
100
150
200
Station (ft)

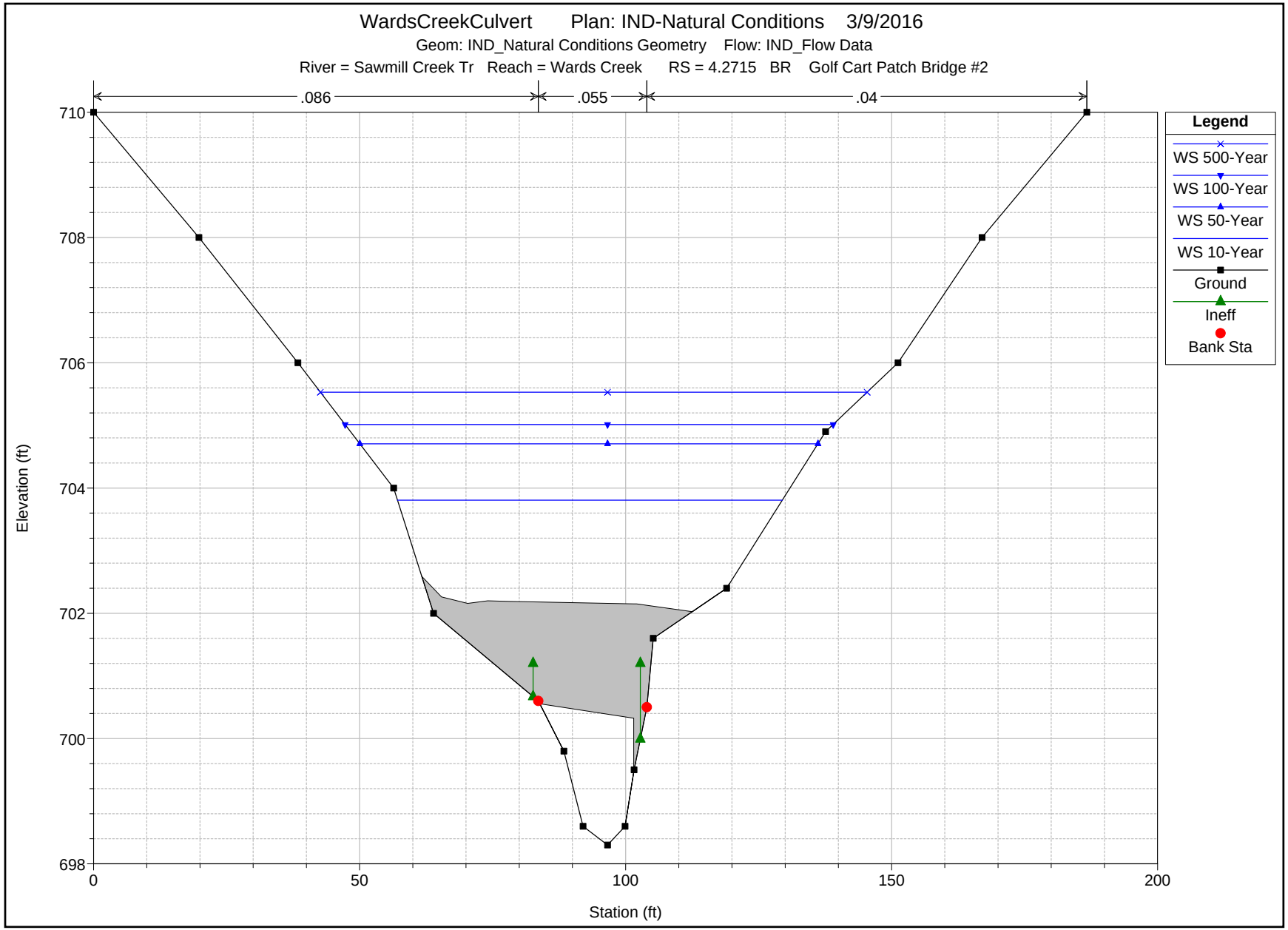

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.327 BR Carlisle Court Bridge
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
-50
0
50
100
150
200
Station (ft)

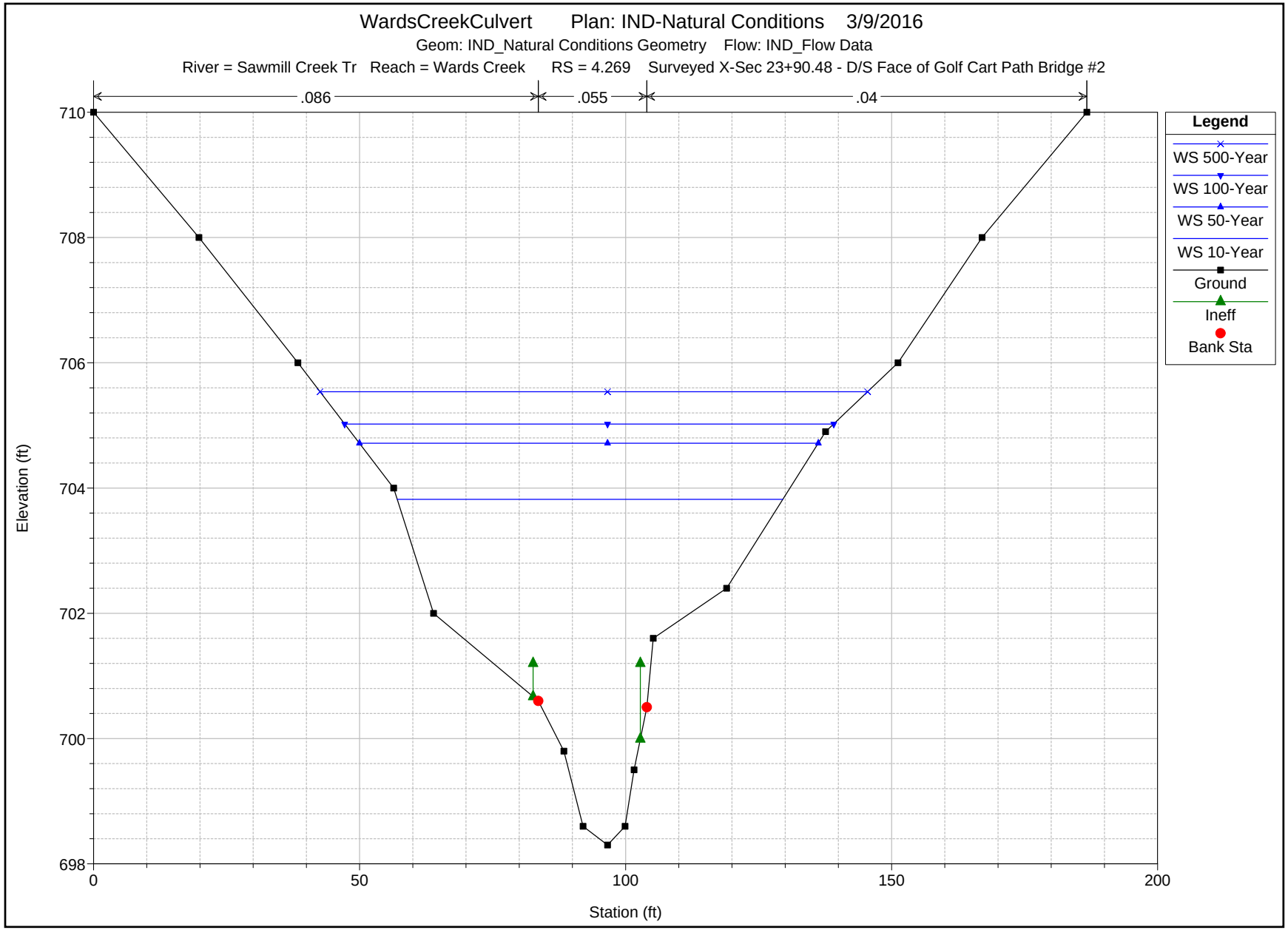

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.327 BR Carlisle Court Bridge
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
-50
0
50
100
150
200
Station (ft)

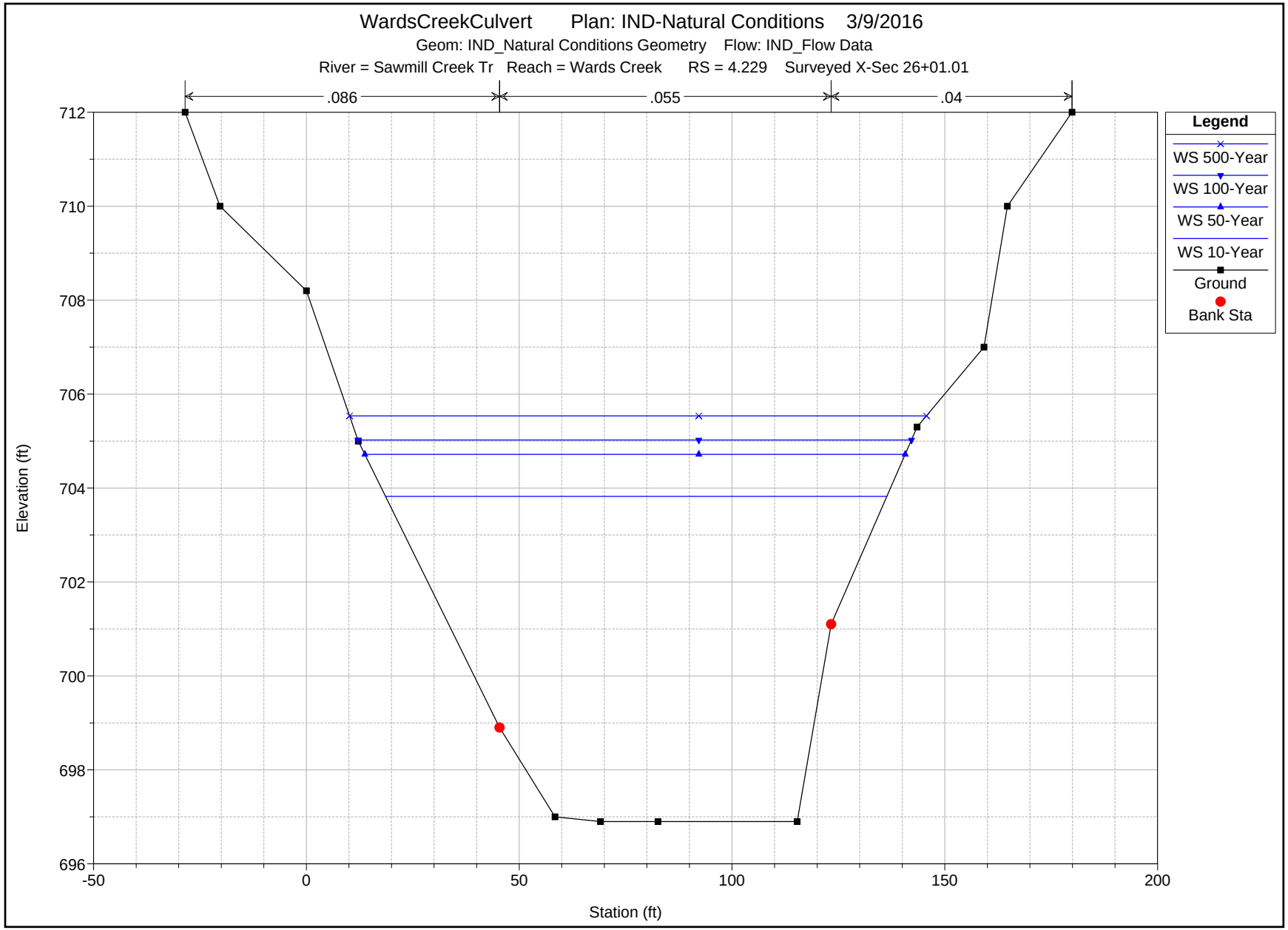

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.322 Surveyed X-Sec 21+10.39 - D/S Face of Carlisle Court Culvert
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
-50
0
50
100
150
200
Station (ft)

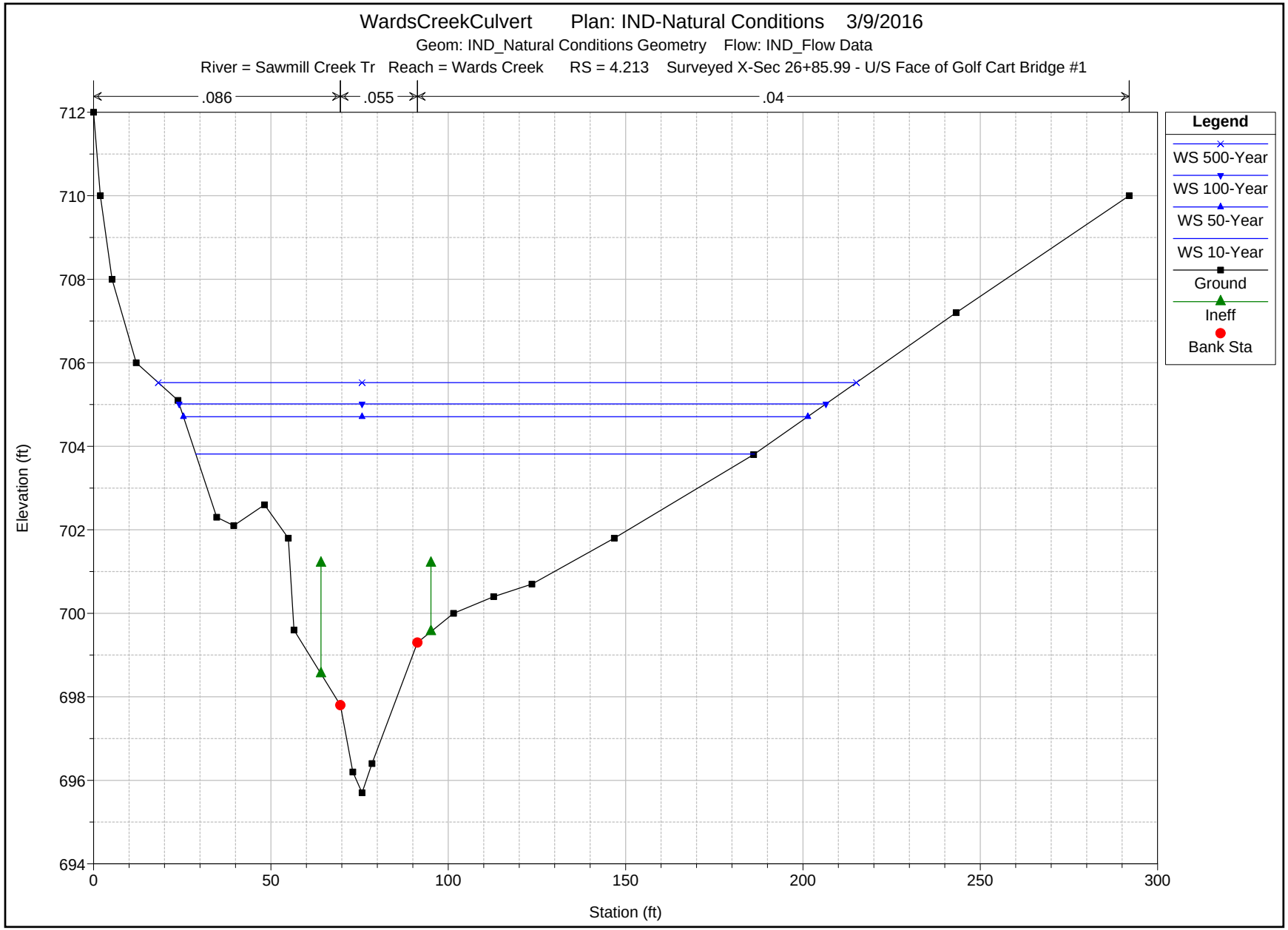

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.274 Surveyed X-Sec 23+63.91 - U/S Face of Golf Cart Path Bridge #2
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
696
0
50
100
150
200
Station (ft)

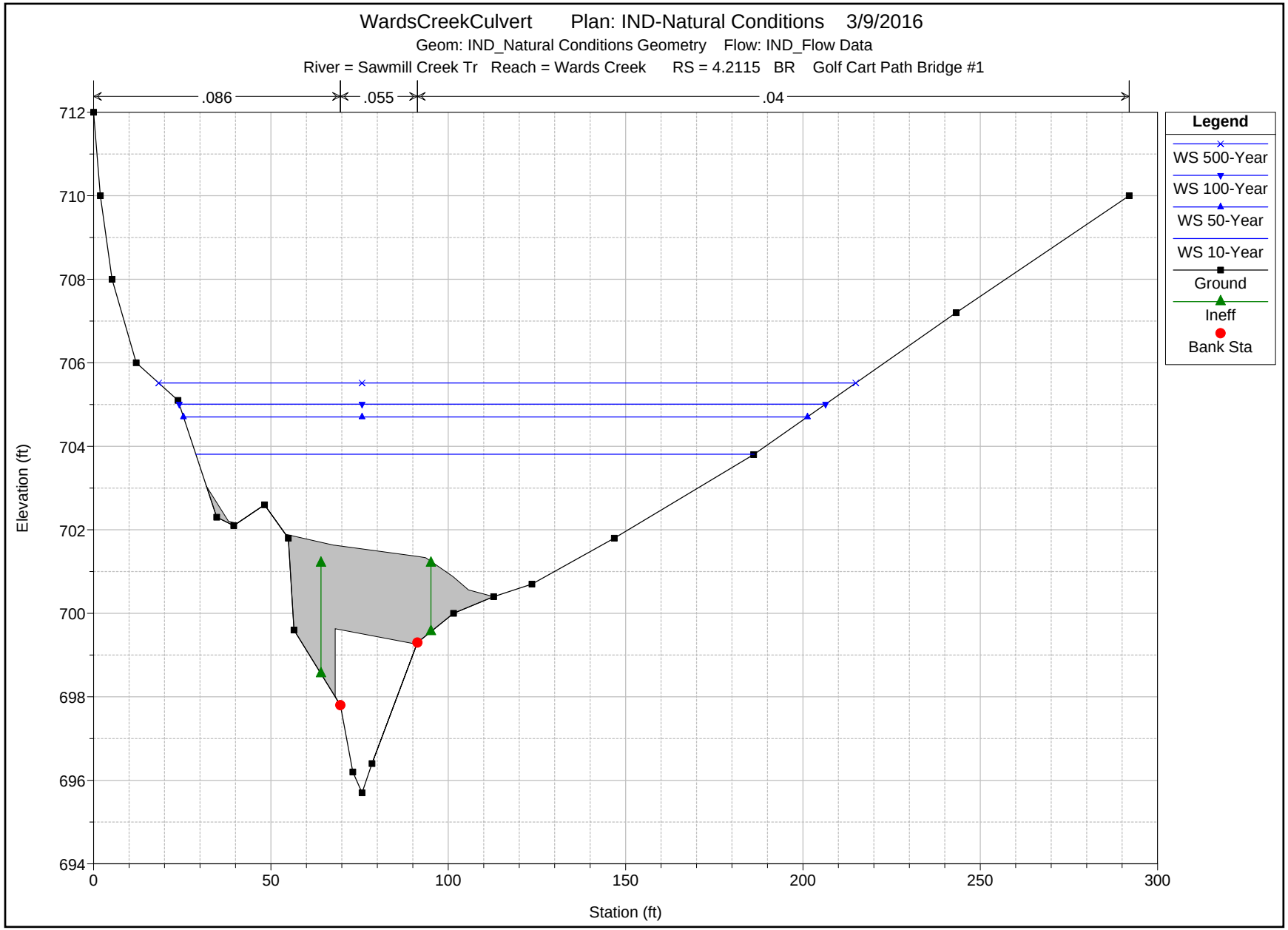

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.2715 BR Golf Cart Patch Bridge #2
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
696
0
50
100
150
200
Station (ft)

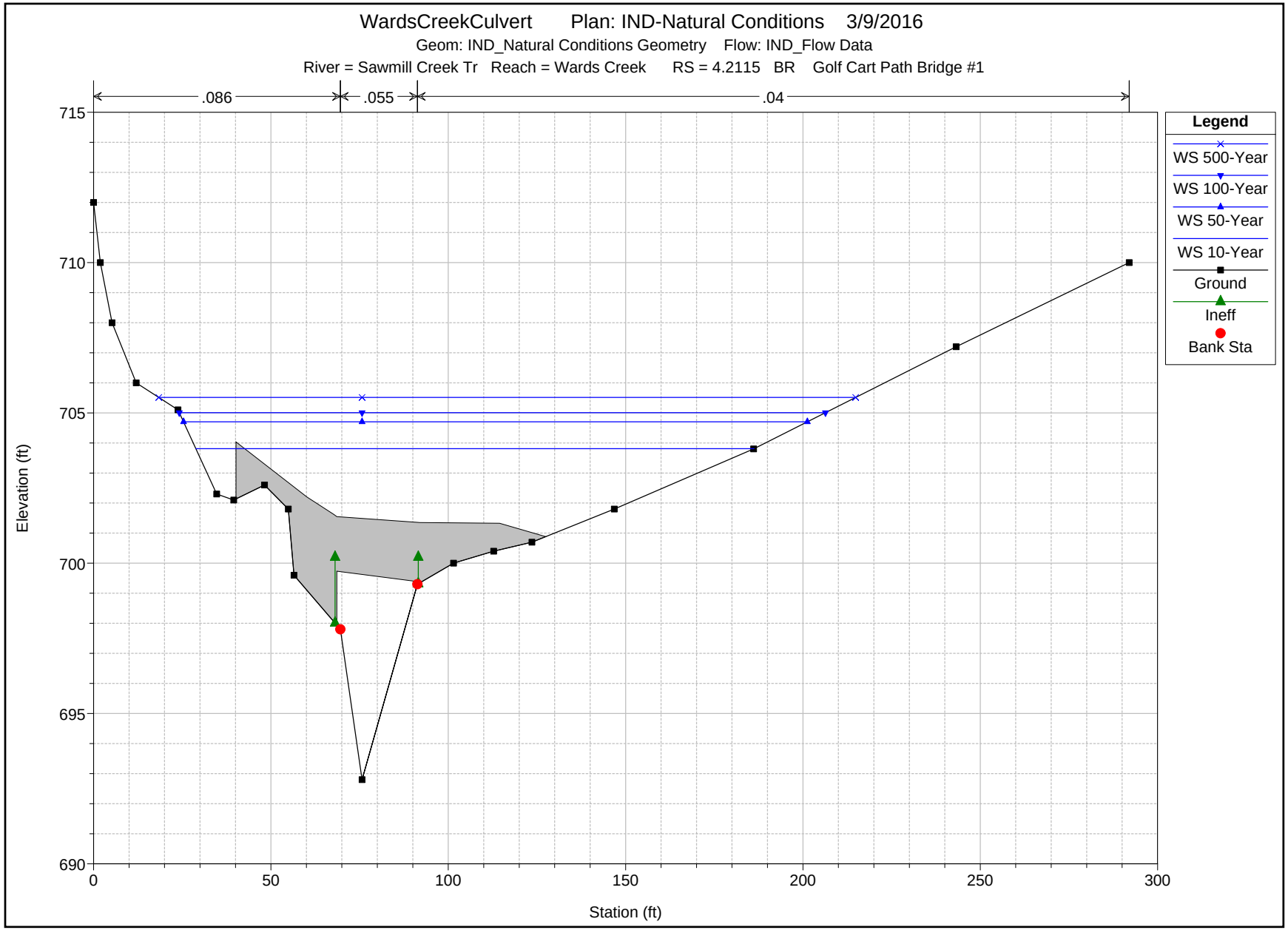

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.2715 BR Golf Cart Patch Bridge #2
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
0
50
100
150
200
Station (ft)

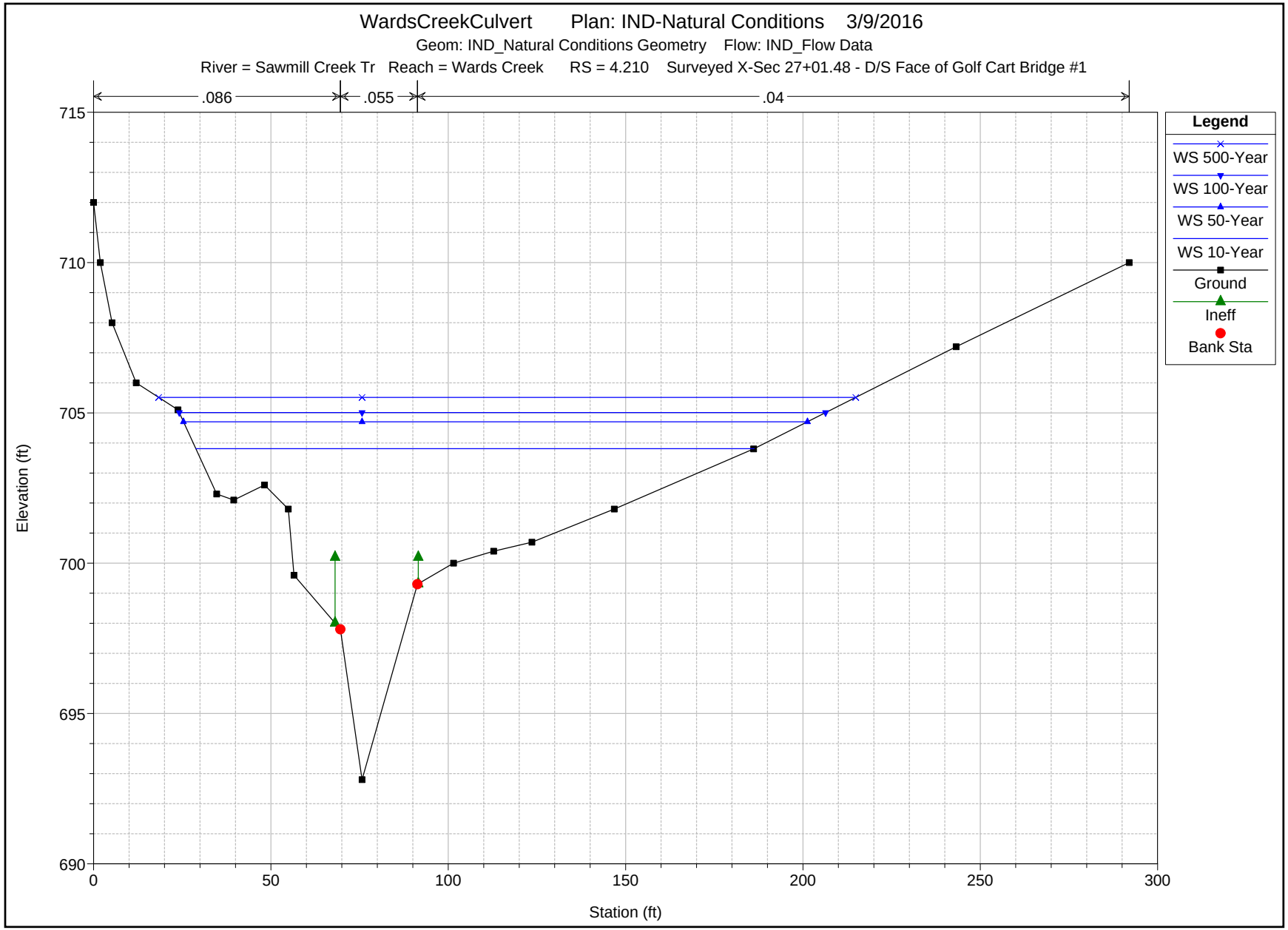

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.269 Surveyed X-Sec 23+90.48 - D/S Face of Golf Cart Path Bridge #2
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
0
50
100
150
200
Station (ft)

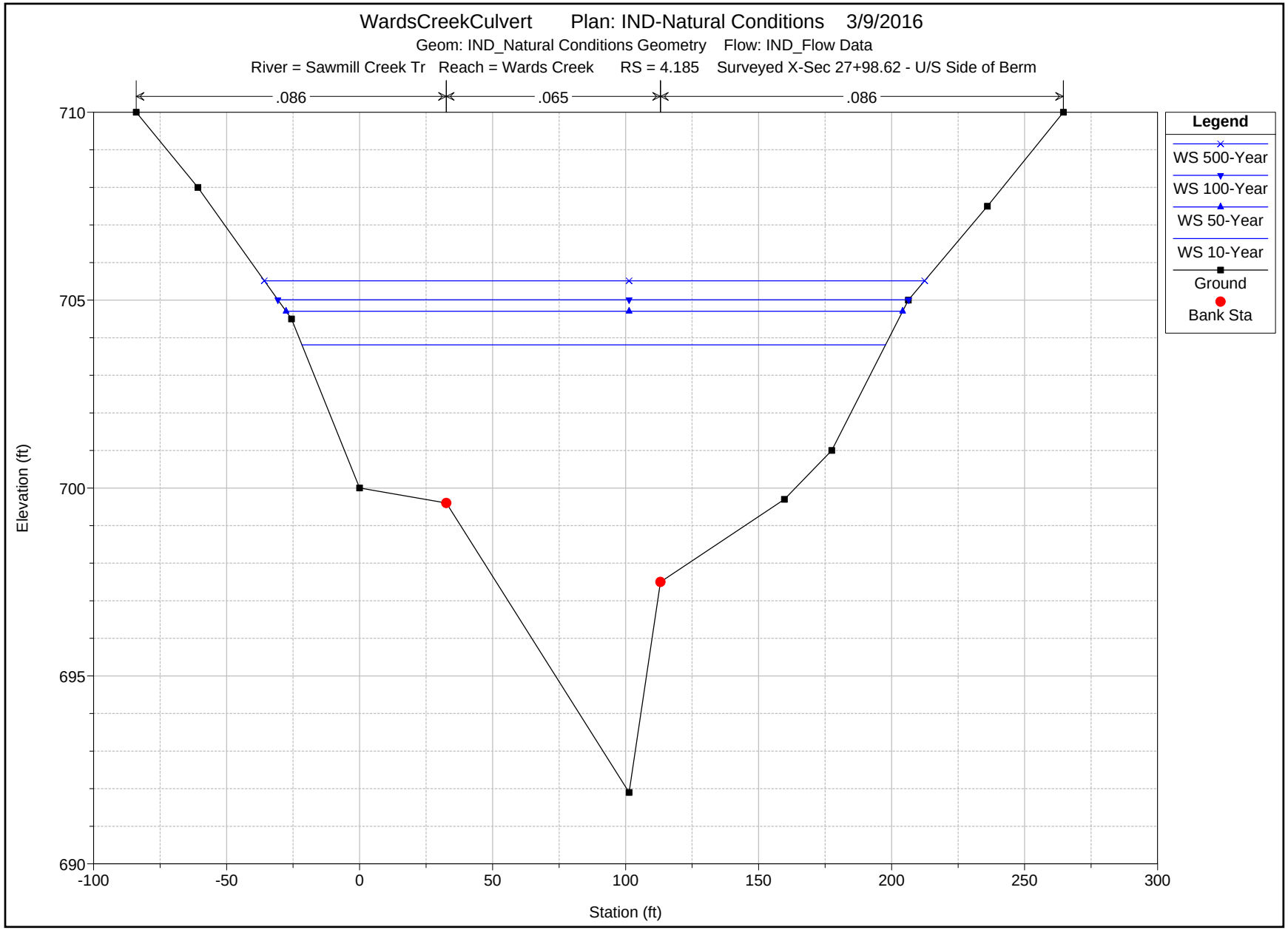

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.229 Surveyed X-Sec 26+01.01
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
696
-50
0
50
100
150
200
Station (ft)

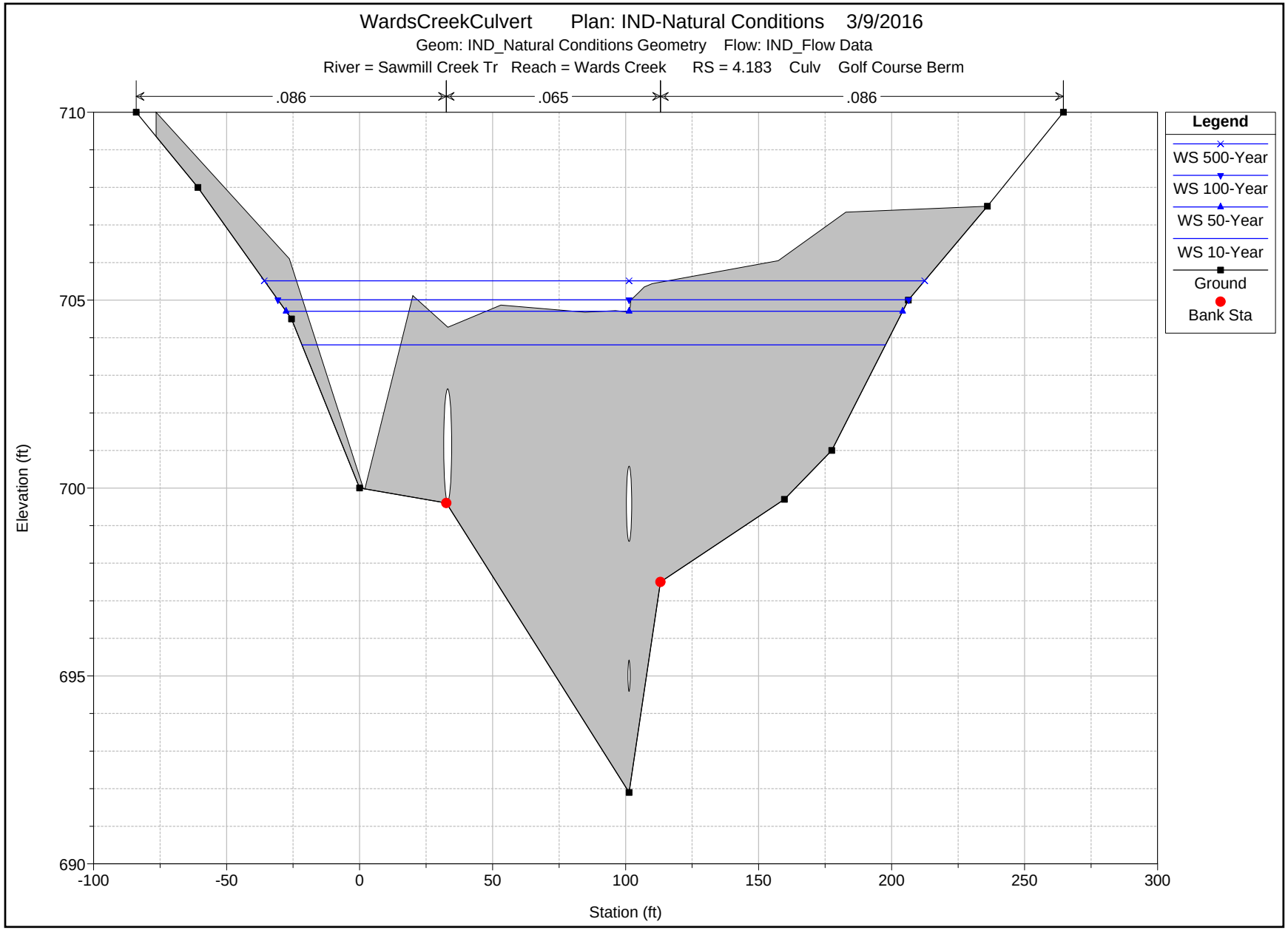

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.213 Surveyed X-Sec 26+85.99 - U/S Face of Golf Cart Bridge #1
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
696
694
0
50
100
150
200
250
300
Station (ft)

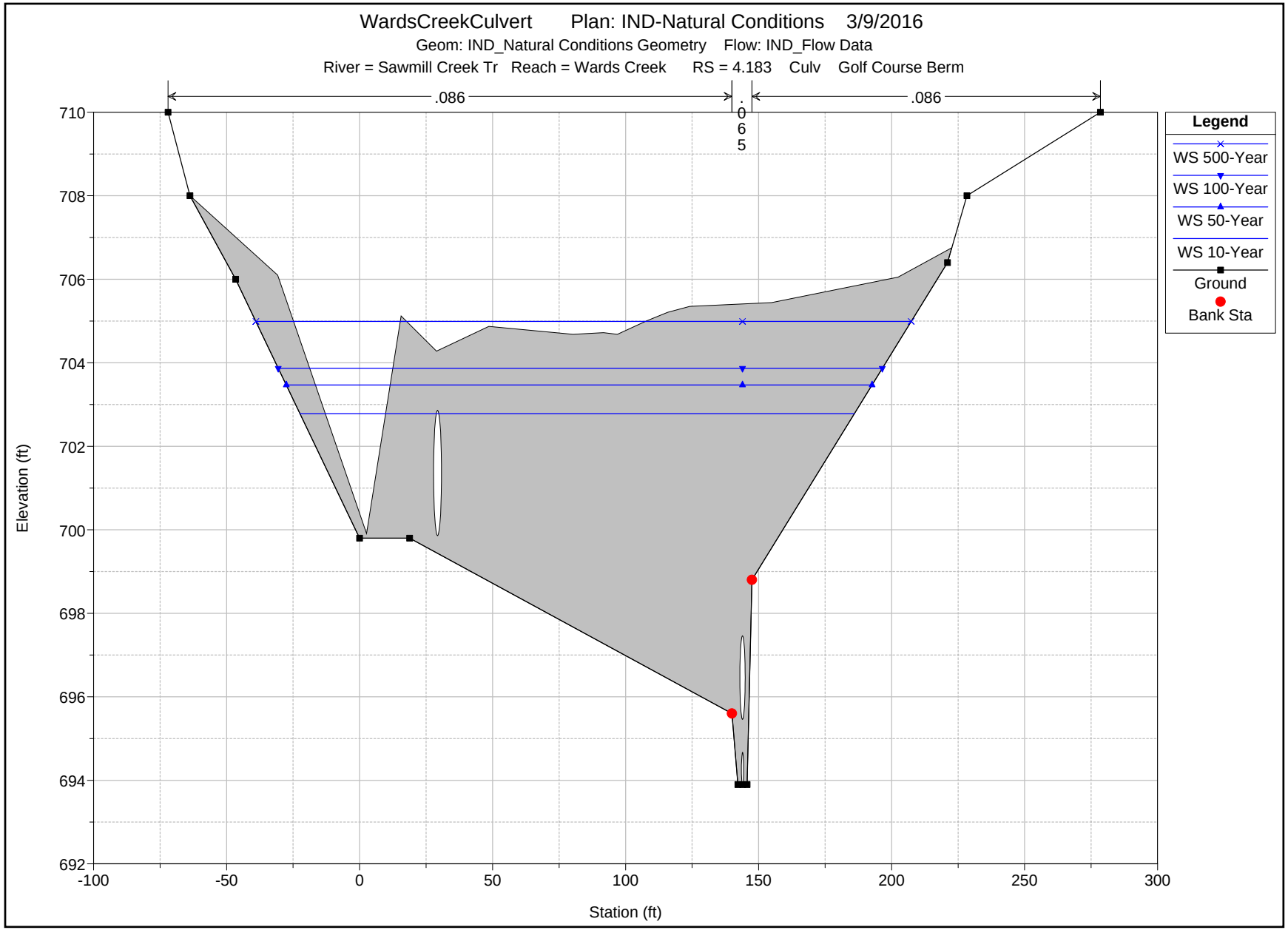

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.2115 BR Golf Cart Path Bridge #1
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
696
694
0
50
100
150
200
250
300
Station (ft)

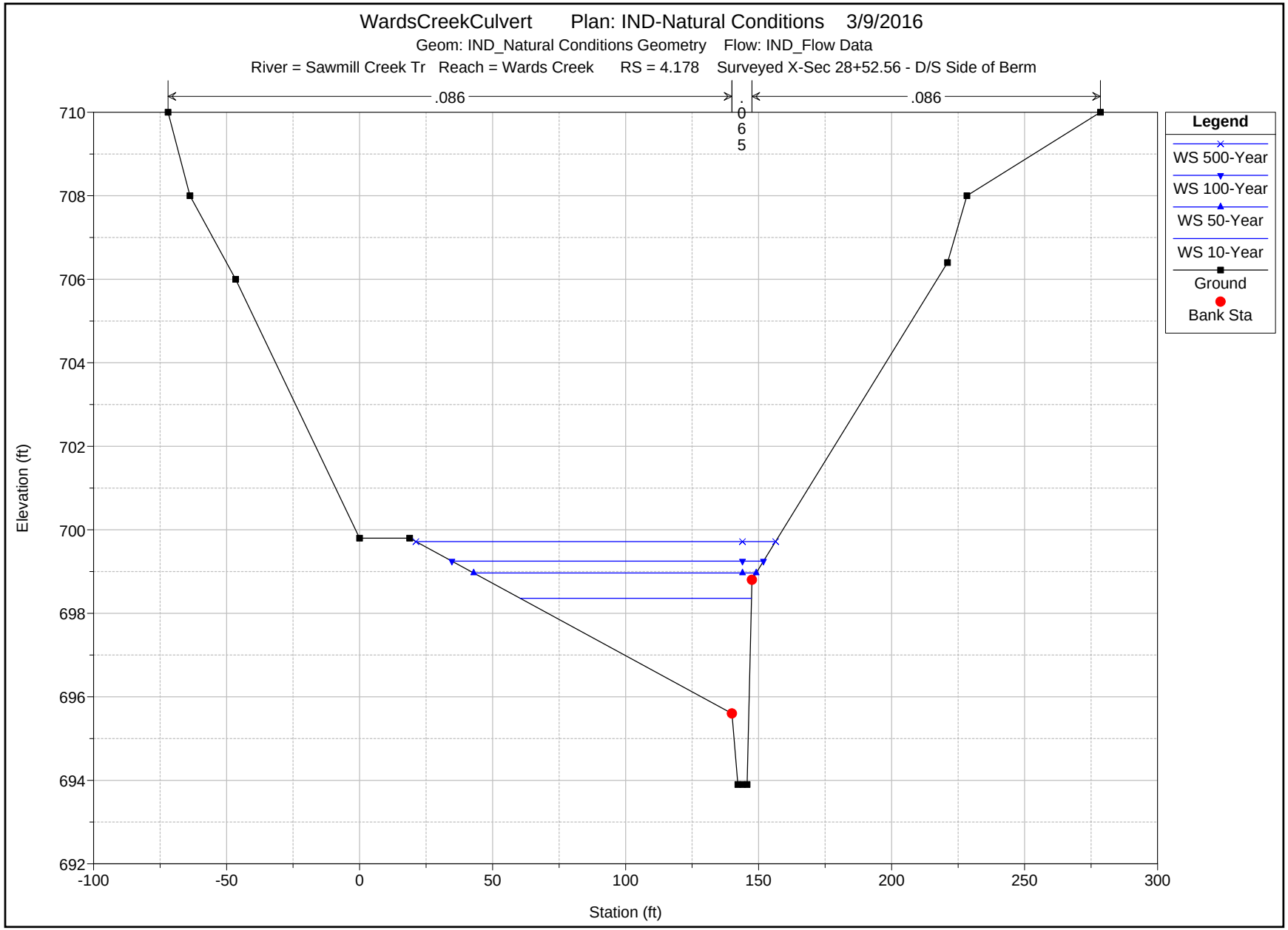

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.2115 BR Golf Cart Path Bridge #1
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
715
710
705
700
695
690
0
50
100
150
200
250
300
Station (ft)

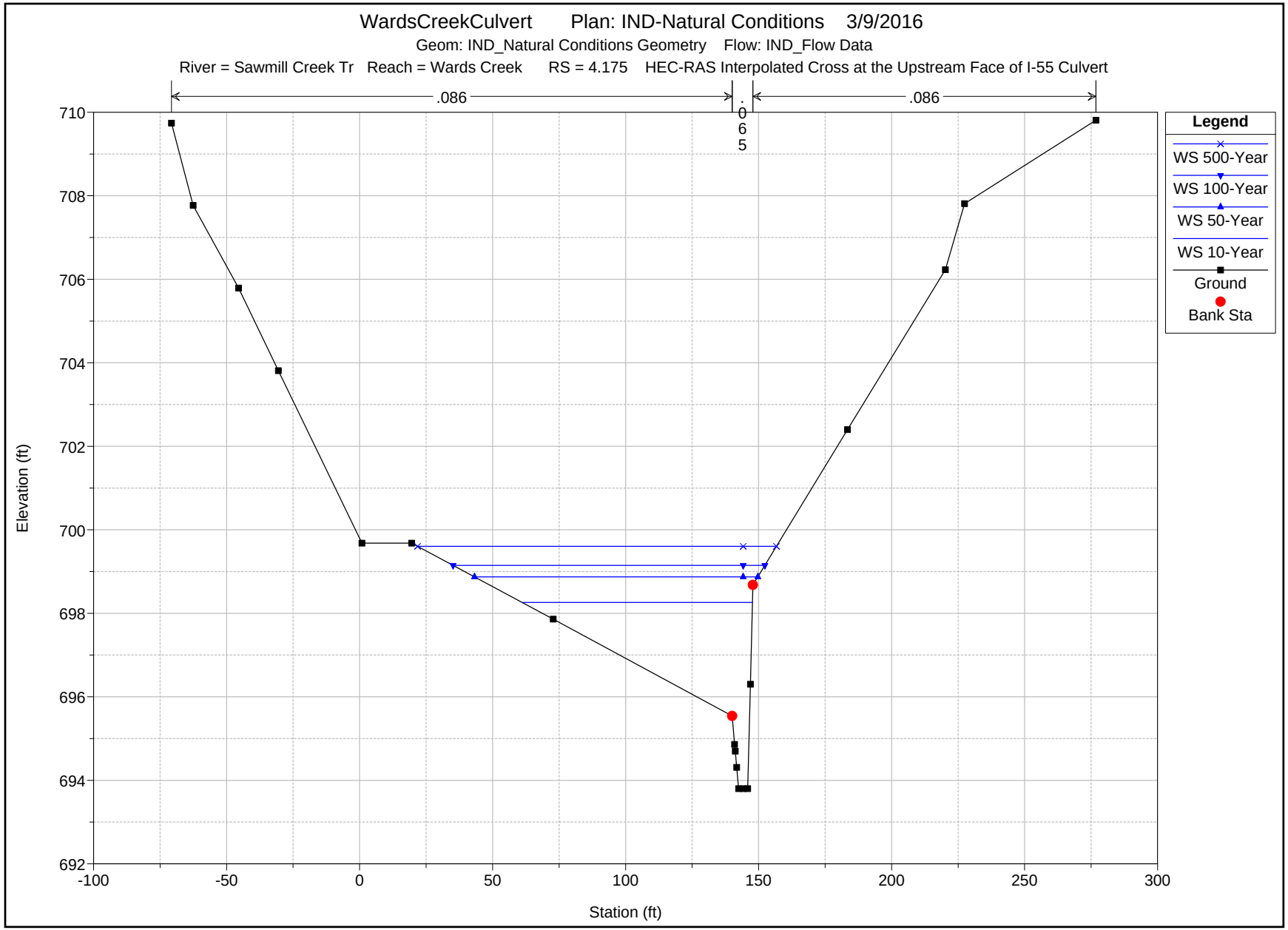

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.210 Surveyed X-Sec 27+01.48 - D/S Face of Golf Cart Bridge #1
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
715
710
705
700
695
690
0
50
100
150
200
250
300
Station (ft)

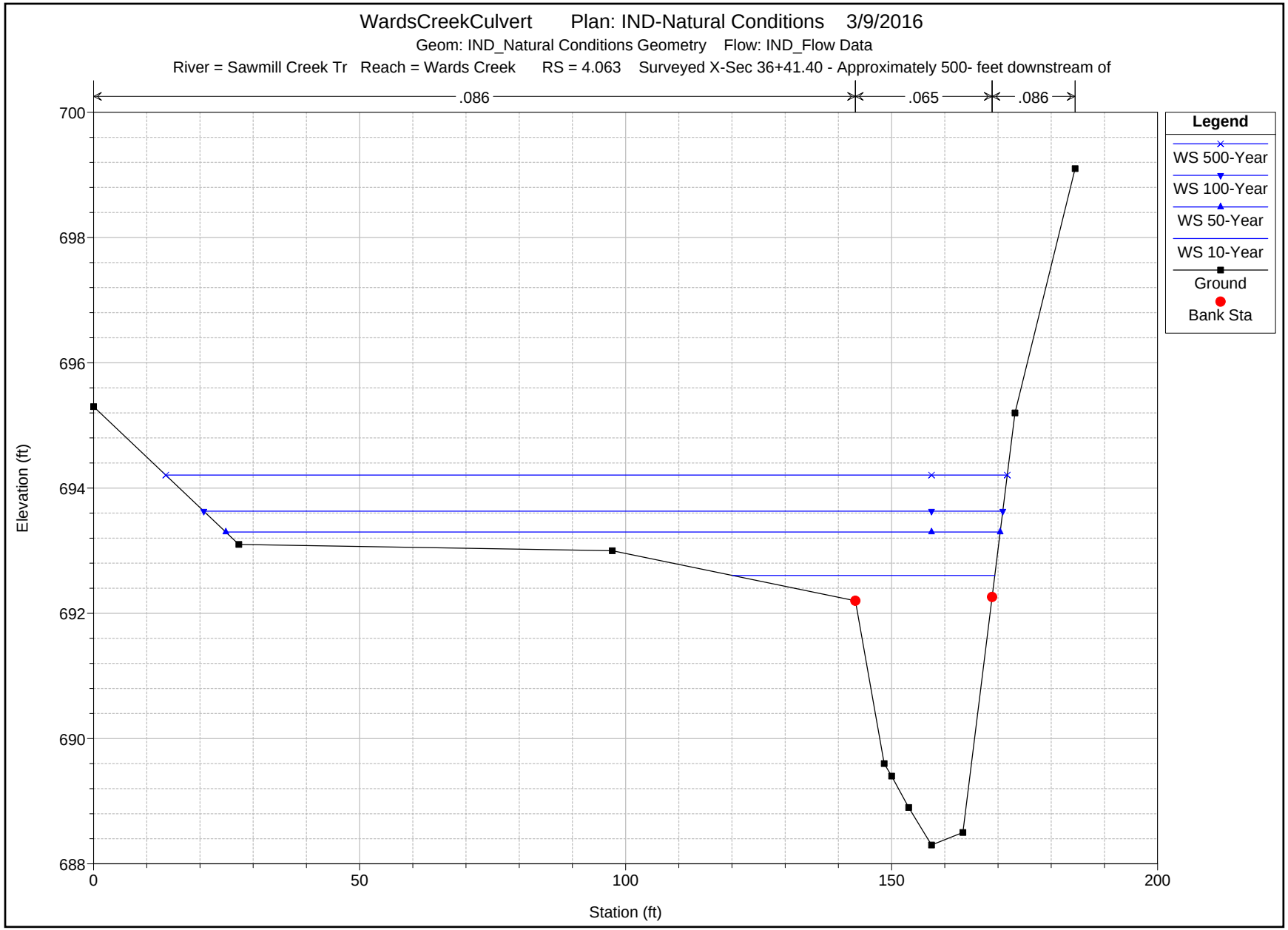

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.185 Surveyed X-Sec 27+98.62 - U/S Side of Berm
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
710
705
700
695
690
-100
-50
0
50
100
150
200
250
300
Station (ft)

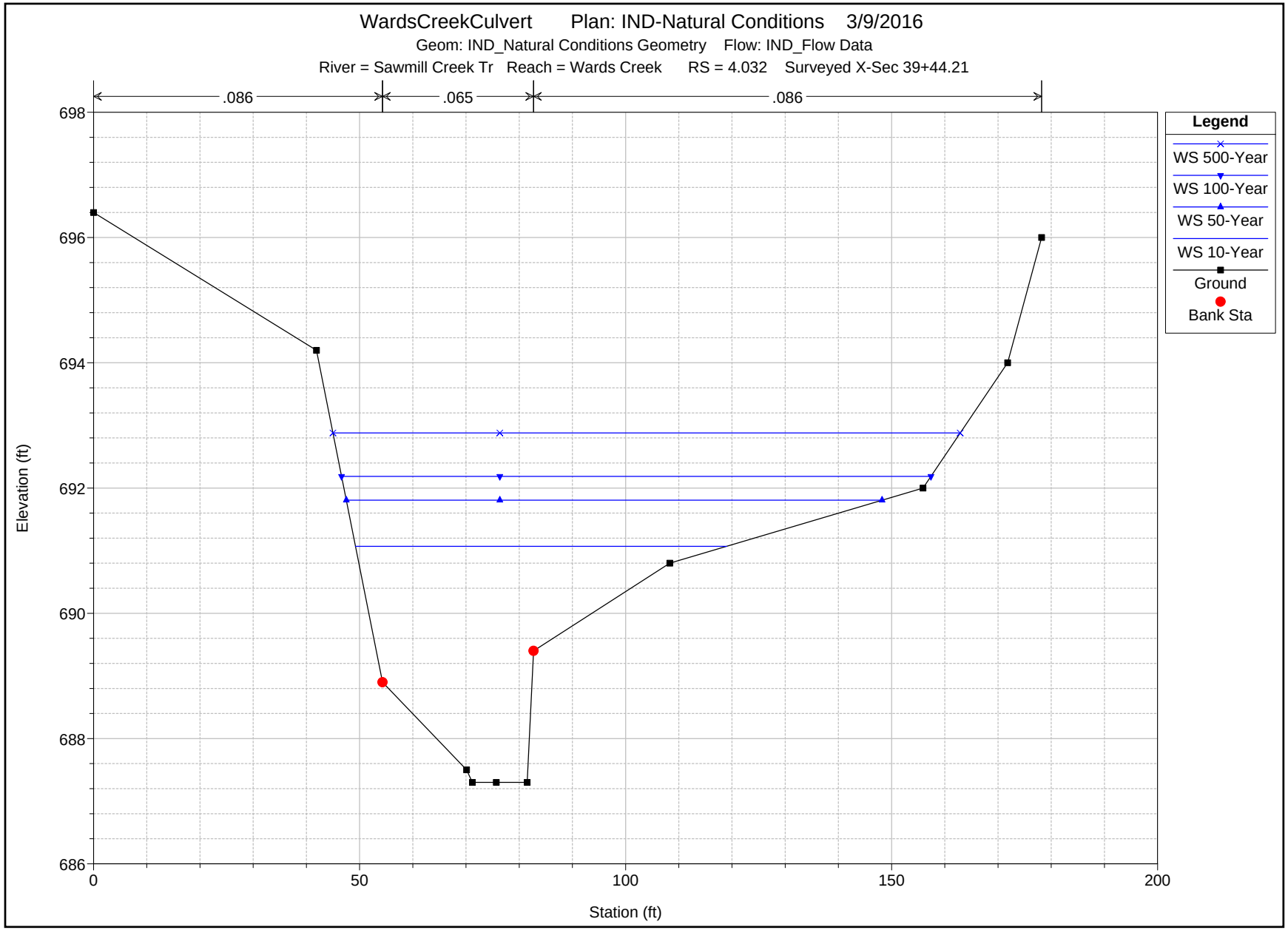

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.183 Culv Golf Course Berm
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
710
705
700
695
690
-100
-50
0
50
100
150
200
250
300
Station (ft)

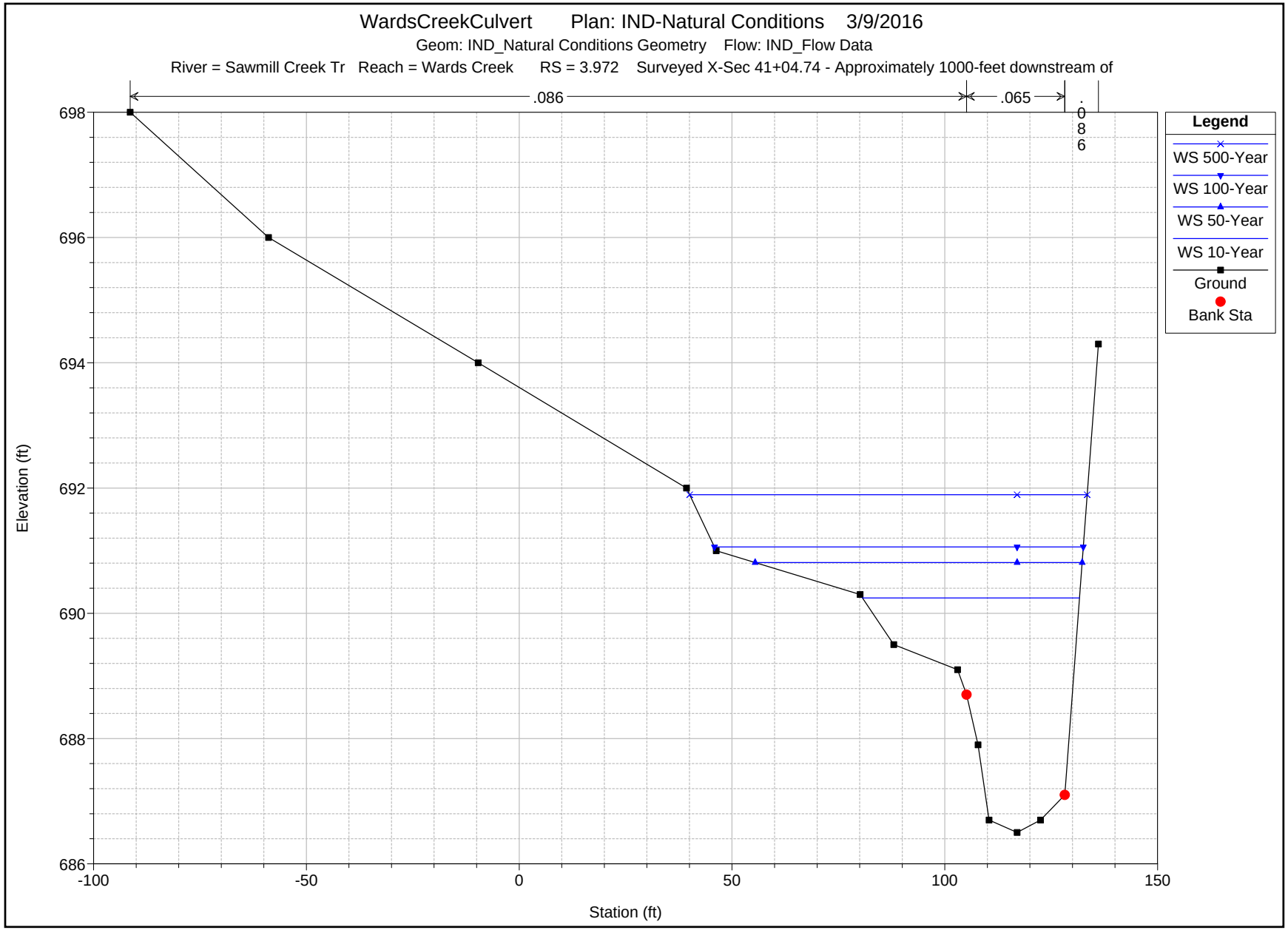

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.183 Culv Golf Course Berm
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
710
708
706
704
702
700
698
696
694
692
-100
-50
0
50
100
150
200
250
300

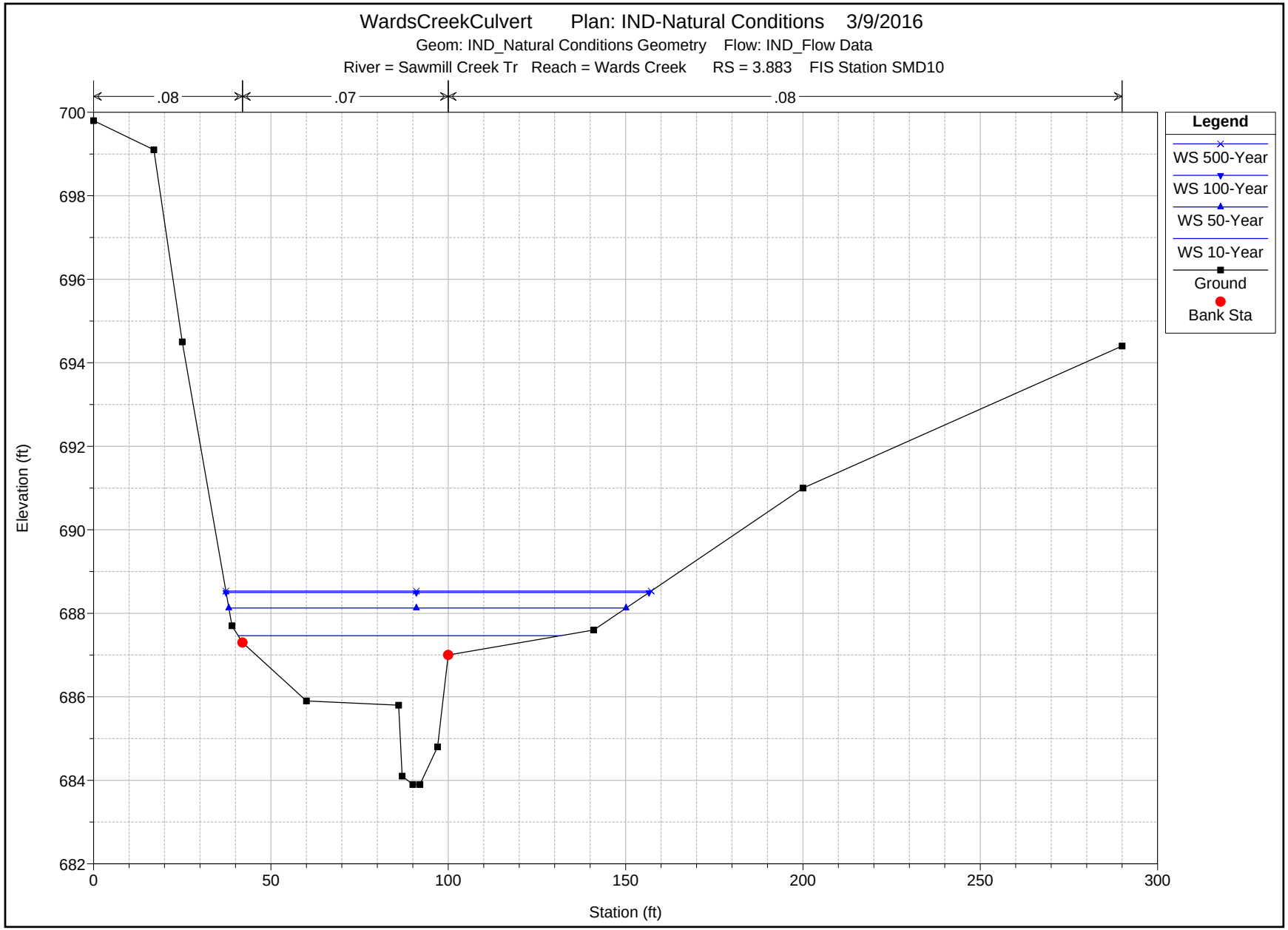

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.178 Surveyed X-Sec 28+52.56 - D/S Side of Berm
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
696
694
692
-100
-50
0
50
100
150
200
250
300
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.175 HEC-RAS Interpolated Cross at the Upstream Face of I-55 Culvert
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
696
694
692
-100
-50
0
50
100
150
200
250
300
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.063 Surveyed X-Sec 36+41.40 - Approximately 500- feet downstream of
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
700
698
696
694
692
690
688
0
50
100
150
200
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.032 Surveyed X-Sec 39+44.21
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
698
696
694
692
690
688
686
0
50
100
150
200
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 3.972 Surveyed X-Sec 41+04.74 - Approximately 1000-feet downstream of
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
698
696
694
692
690
688
686
-100
-50
0
50
100
150
Station (ft)


WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 3.883 FIS Station SMD10
.08
.07
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
700
698
696
694
692
690
688
686
684
682
0
50
100
150
200
250
300
Station (ft)

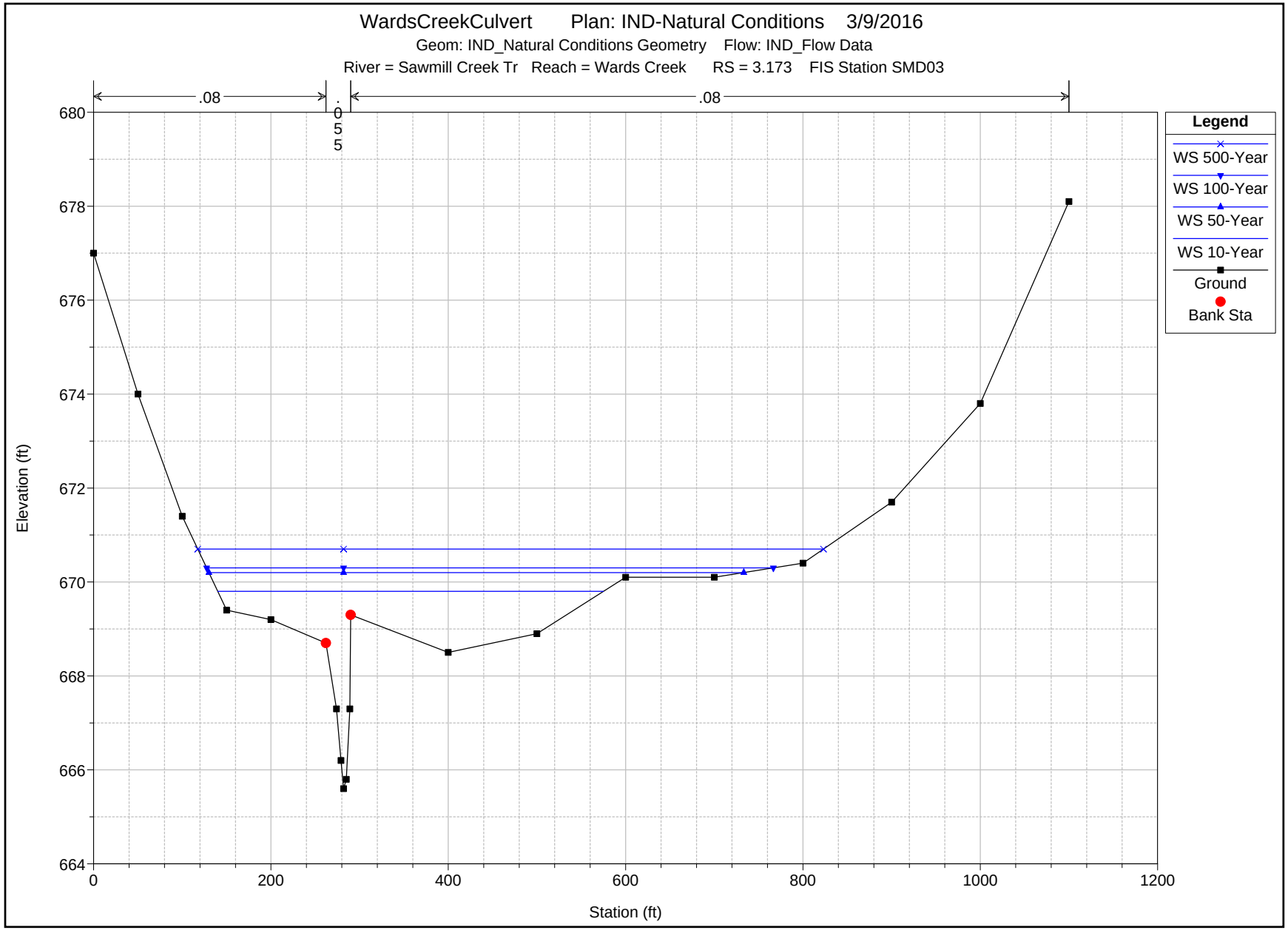
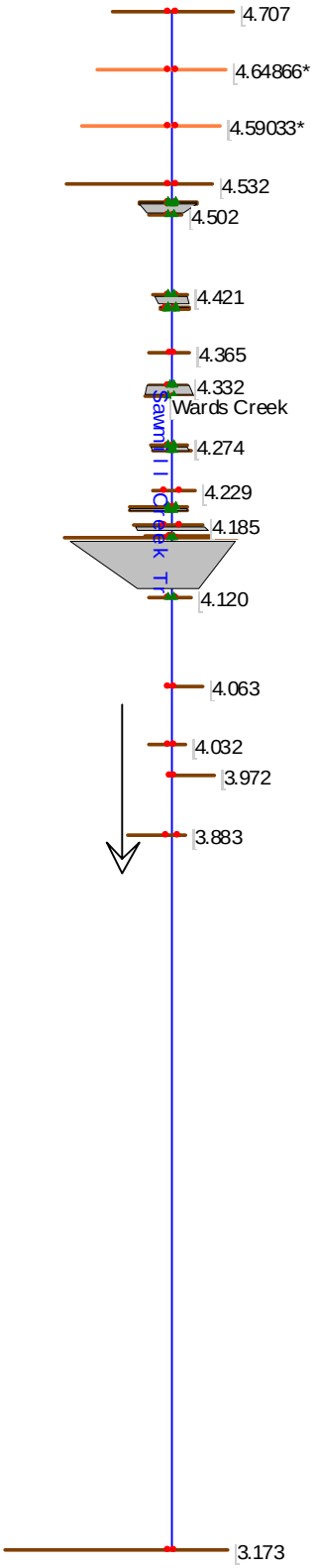

WardsCreekCulvert Plan: IND-Natural Conditions 3/9/2016
Geom: IND_Natural Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 3.173 FIS Station SMD03
.08
.055
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
680
678
676
674
672
670
668
666
664
0
200
400
600
800
1000
1200
Station (ft)

EXHIBIT J

EXISTING CONDITIONS HYDRAULIC MODEL AND RESULTS

Plan 02: IND-Existing Conditions



WardsCreekCulvert.rep

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: WardsCreekCulvert
Project File : WardsCreekCulvert.prj
Run Date and Time: 3/9/2016 2:21:04 PM

Project in English units

Project Description:
Hydraulic Analysis of Culvert Carrying Interstate 55 over Wards Creek

****

PLAN DATA

Plan Title: IND-Existing Conditions
Plan File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec-ras\WardsCreekCulvert.p02

Geometry Title: IND_Existing Conditions Geometry
Geometry File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec-ras\WardsCreekCulvert.g02

Flow Title   : IND_Flow Data
Flow File   : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec-ras\WardsCreekCulvert.f02

Plan Description:
Independent Existing Conditions

Geometry includes field measured cross
sections and upstream structures.

Note the flow data file is modified to
state the discharges at FIS Station 4.196 to be provided upstream of the FIS
location at IND Station 4.210.

Plan Summary Information:
Number of: Cross Sections =   27   Multiple Openings =   0
            Culverts   =   2   Inline Structures =   2
            Bridges   =   5   Lateral Structures =   0

Computational Information
    Water surface calculation tolerance = 0.01
    Critical depth calculation tolerance = 0.01
    Maximum number of iterations   = 20
    Maximum difference tolerance   = 0.3
    Flow tolerance factor   = 0.001

Computation Options
    Critical depth computed at all cross sections
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method: Average Conveyance
    Computational Flow Regime: Subcritical Flow

WardsCreekCulvert.rep

****

FLOW DATA

Flow Title: IND_Flow Data
Flow File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec-ras\WardsCreekCulvert.f02

Flow Data (cfs)

River	Reach	RS	10-Year	50-Year	100-Year	500-Year
Sawmill Creek Tr	Wards Creek	4.707	249.01	400	477.3	690
Sawmill Creek Tr	Wards Creek	4.210	311.94	480	599.1	850
Sawmill Creek Tr	Wards Creek	3.883	344.05	550	661.33	905
Sawmill Creek Tr	Wards Creek	3.173	478.84	775	923.06	1290

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Sawmill Creek Tr	Wards Creek	10-Year		Known WS = 669.8
Sawmill Creek Tr	Wards Creek	50-Year		Known WS = 670.2
Sawmill Creek Tr	Wards Creek	100-Year		Known WS = 670.3
Sawmill Creek Tr	Wards Creek	500-Year		Known WS = 670.7

****

GEOMETRY DATA

Geometry Title: IND_Existing Conditions Geometry
Geometry File : v:\1786\active\178600037_IDOT_I-55\civil\drainage_wards creek hr\hec-ras\WardsCreekCulvert.g02

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.707

INPUT
Description: FIS Station SMD18
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	726	40	724	140	722	200	720	290	718
300	714	308	709.8	318	709.8	330	716	450	718
470	720	510	722	600	726				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	290	.059	330	.075

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
290	330	289	300	289	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.64866*

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-30.27	722	4.74	720.48	92.26	718.69	96.77	718.55	144.77	717.06
177.78	716.31	204.65	715.32	223.53	714.23	225.08	713.41	230.54	711.56
234.05	710.45	237.1	709.25	242.47	707.4	249.13	707.4	252.07	709
261.27	713.2	267.45	713.35	273.64	713.31	279.35	713.49	342.18	714.03

```
     376  714.99  411.13  715.95  416.57  716.03  442.45  717.51  494.22  719.15
  526.56  720.07   610.7  722.67

Manning's n Values        num=       6
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************************************************
  -30.27    .065  204.65    .069  223.53    .061  261.27    .079  279.35    .233
   610.7    .233

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        223.53  261.27              289     300     289             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.59033*

INPUT
Description:
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
  -60.53     718  -30.52  716.97   44.51  715.38   48.39  715.28   89.54  714.11
  117.84  713.45  140.87  712.16  157.07  710.47  158.69   709.4  164.42  707.78
   168.1   706.9   171.3  706.03  176.93     705  180.27     705  183.23   706.7
  192.53   710.4  200.13  710.63  207.72  710.45  214.72  710.74  291.84  711.01
  333.35  712.49  376.47  713.98  383.14  714.06  414.91  715.03  478.44  716.29
  518.13  717.04   621.4  719.33

Manning's n Values        num=       6
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************************************************
  -60.53     .06  140.87    .077  157.07    .063  192.53    .082  214.72    .392
   621.4    .392

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        157.07  192.53              289     300     289             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.532

INPUT
Description: Surveyed X-Sec 10+00.00 - 2020-feet upstream of I-55
             Centerline.

Upstream limit of survey
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
   -90.8     714       0     712    57.9   710.6    77.1     709    90.6   706.7
    92.3   705.4    98.3     704   105.5   702.8   111.4   702.6   114.4   704.4
   123.8   707.6   132.8   707.9   141.8   707.6   150.1     708   241.5     708
   290.7     710   341.8     712   509.7     714   632.1     716

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************************************************
   -90.8    .055    77.1    .086    90.6    .065   123.8    .086   150.1     .55

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          90.6   123.8                75      93     122             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.516

INPUT
```

WardsCreekCulvert.rep

Description: Surveyed X-Sec 10+92.66 - U/S cross section taken at inline weir
structure at Kimberly Court.

Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-48.3	716	0	714.5	28.6	713.4	37.9	712.6	55.8	710.4
61.1	708.8	61.5	706.6	65.6	704.72	66.1	704.6	71.5	704
82.5	704.1	83.9	705.9	95.2	710.7	100.9	712.4	114.9	712.4
123.6	712.4	132.5	712.5	148.4	713	176.3	714	187.6	713.8
189.31	713.7	228.6	716	238.7	718				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-48.3	.055	37.9	.086	55.8	.065	95.2	.086	114.9	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55.8	95.2	8	8	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-48.3	56.79	711.7	F
89.1	238.7	711.7	F

INLINE STRUCTURE

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.515

INPUT
Description: Weir Location U/S of Kimberly Court Bridge
Distance from Upstream XS = 6
Deck/Roadway Width = .5
Weir Coefficient = 2.6
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
65	705	83.21	705

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.514

INPUT
Description: Copied X-Sec 11+00 - U/S Face of Kimberly Court -
Copy of
Surveyed X-Sec 10+92.66 placed at the upstream face of the bridge
and downstream of the weir.

Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-48.3	716	0	714.5	28.6	713.4	37.9	712.6	55.8	710.4
61.1	708.8	61.5	706.6	65.6	704.72	66.1	704.6	71.5	704
82.5	704.1	83.9	705.9	95.2	710.7	100.9	712.4	114.9	712.4
123.6	712.4	132.5	712.5	148.4	713	176.3	714	187.6	713.8
189.31	713.7	228.6	716	238.7	718				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-48.3	.055	37.9	.086	55.8	.065	95.2	.086	114.9	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55.8	95.2	45	59	40	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-48.3	64.79	711.7	F
81.1	238.7	711.7	F

BRIDGE

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.508

INPUT
Description: Kimberly Court Bridge
Distance from Upstream XS = 2
Deck/Roadway Width = 49
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	714.5	48.59	712.85	66.79	712.4
79.1	712.2	103.37	711.69	150.28	712

710.86 710.86

Upstream Bridge Cross Section Data
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-48.3	716	0	714.5	28.6	713.4	37.9	712.6	55.8	710.4
61.1	708.8	61.5	706.6	65.6	704.72	66.1	704.6	71.5	704
82.5	704.1	83.9	705.9	95.2	710.7	100.9	712.4	114.9	712.4
123.6	712.4	132.5	712.5	148.4	713	176.3	714	187.6	713.8
189.31	713.7	228.6	716	238.7	718				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-48.3	.055	37.9	.086	55.8	.065	95.2	.086	114.9	.055

Bank Sta: Left Right Coeff Contr. Expan.
55.8 95.2 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-48.3	64.79	711.7	F
81.1	238.7	711.7	F

Downstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
-9.57	712.8	42.29	711.69	49.38	711.75
61.82	711.83	90.35	712		

710.44 710.46

Downstream Bridge Cross Section Data
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	714.2	23.5	712.6	35.7	711.7	36.6	711.7	37	707.9
42.3	706.7	46.5	704.9	47.6	704.4	54.3	704.4	60.8	704.3
61.61	704.97	63.14	705.82	67.2	708.13	78.5	711.3	92.9	712.6
110.2	713.3	133.3	714	164.4	716				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	37	.065	67.2	.086

Bank Sta: Left Right Coeff Contr. Expan.
37 67.2 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	47.38	711	F
63.82	164.4	711	F

WardsCreekCulvert.rep

```
Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =  711.75
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.502

INPUT
Description: Surveyed X-Sec 11+59.88 - D/S Face of Kimberly Court
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   714.2    23.5   712.6    35.7   711.7    36.6   711.7      37   707.9
    42.3   706.7    46.5   704.9    47.6   704.4    54.3   704.4    60.8   704.3
   61.61  704.97   63.14  705.82    67.2  708.13    78.5   711.3    92.9   712.6
   110.2   713.3   133.3     714   164.4     716

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .086      37    .065    67.2    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            37    67.2             406     423     421             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   47.38     711       F
   63.82   164.4     711       F

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.421

INPUT
Description: Surveyed X-Sec 15+82.92 - U/S Face of Kentwood Court
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
   -18.2     716       0   712.6    11.3   712.1    18.6   711.7    30.7   711.5
    41.8   709.6    50.9   702.7    55.5   702.1   59.18  700.83      67  701.27
      71   704.5    80.9   708.7    95.6   714.6   121.6   717.2   142.8   717.5
   152.8   717.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
   -18.2    .055    41.8    .065    80.9    .055
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          41.8    80.9               68      65      68             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -18.2   47.18   711.8       F
   78.97   152.8   711.8       F

BRIDGE


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.415

INPUT
Description: Kentwood Court Bridge
Distance from Upstream XS =      12
Deck/Roadway Width        =      38
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
**************************************************************************
       0   712.6             5.2   712.8           59.18   712.1  710.46
   66.97     712  710.56    72.7   711.9           148.9   716.8

Upstream Bridge Cross Section Data
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**********************************************************************************
   -18.2     716       0   712.6    11.3   712.1    18.6   711.7    30.7   711.5
    41.8   709.6    50.9   702.7    55.5   702.1   59.18  700.83      67  701.27
      71   704.5    80.9   708.7    95.6   714.6   121.6   717.2   142.8   717.5
   152.8   717.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
   -18.2    .055    41.8    .065    80.9    .055

Bank Sta: Left   Right    Coeff Contr.   Expan.
          41.8    80.9             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -18.2   47.18   711.8       F
   78.97   152.8   711.8       F

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
**************************************************************************
    -4.4   712.8             65.2   711.9            80.9   712.9  710.49
   88.36   713.4  710.61    139.4   716.8

Downstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**********************************************************************************
       0   715.7    20.7   715.6    31.9   714.9    53.9   712.8    61.8   711.7
    62.2   712.2    62.6   712.2    67.9   704.4    72.4   701.8    79.7   701.2
    80.9  701.33    82.7     701    86.4   701.4    87.9   701.4    93.9   702.2
   95.63   702.9   110.3     714   126.2     716   134.6   716.4   143.1   716.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .055    62.6    .065   110.3    .055

Bank Sta: Left   Right    Coeff Contr.   Expan.
          62.6   110.3             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   77.15  711.25       F
   92.11   143.1  711.25       F
```

WardsCreekCulvert.rep

```
Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =     712
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.410

INPUT
Description: Copy of X-Sec for D/S Face of Kentwood Court

X-Sec Shifted
             5-feet upstream to allow for input of downstream weir structure.
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   715.7    20.7   715.6    31.9   714.9    53.9   712.8    61.8   711.7
    62.2   712.2    62.6   712.2    67.9   704.4    72.4   701.8    79.7   701.2
    80.9  701.33    82.7     701    86.4   701.4    87.9   701.4    93.9   702.2
   95.63   702.9   110.3     714   126.2     716   134.6   716.4   143.1   716.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .055    62.6    .065   110.3    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          62.6   110.3                 5       5       5             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   77.15  711.25       F
   92.11   143.1  711.25       F

INLINE STRUCTURE


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.409

INPUT
Description: Concrete Weir located D/S from Kentwood Court
Distance from Upstream XS =     2.5
Deck/Roadway Width        =      .8
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =        6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
    66.6  706.31    73.4  706.31    73.5  704.26    93.1  704.26    93.2  706.03
   109.3  706.03
```

WardsCreekCulvert.rep

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.408

INPUT
Description: Surveyed X-Sec 16+53.57 - D/S Face of Kentwood Court
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	715.7	20.7	715.6	31.9	714.9	53.9	712.8	61.8	711.7
62.2	712.2	62.6	712.2	67.9	704.4	72.4	701.8	79.7	701.2
80.9	701.33	82.7	701	86.4	701.4	87.9	701.4	93.9	702.2
95.63	702.9	110.3	714	126.2	716	134.6	716.4	143.1	716.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.055	62.6	.065	110.3	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
62.6	110.3	296	229	240	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	75.15	711.25	F
94.11	143.1	711.25	F

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.365

INPUT
Description: Surveyed X-Sec 18+82.22 - 1138' Upstream of the I-55 Centerline
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-52.3	716	-39.1	714	-20.2	712	0	710	9.7	708
20.1	706.7	28.7	704.8	34.5	700.6	38.9	700.3	41.2	700.1
51	702.6	63.6	704.2	75.6	708	99.3	710	125.7	712
141.1	714	154.6	716						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-52.3	.086	28.7	.065	51	.086

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
28.7	51	181	173	170	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.332

INPUT
Description: Surveyed X-Sec 20+55.09 - U/S Face of Carlisle Court Culvert
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-14.1	712	0	709.6	31.7	708.3	50.5	706.8	54.4	704.4
54.6	705	62.1	700.4	64	698.63	65.3	699.9	69.2	700.4
71.7	699.74	80.1	703.6	81.7	705	82.1	706.2	82.8	706.5

```
    83.6     706    96.4   707.3   109.5   708.3   131.3   710.2   185.1     712

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
   -14.1    .086    54.6    .065    82.1    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          54.6    82.1               57      55      57              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -14.1      58   707.3       F
    77.7   185.1   707.3       F

BRIDGE


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.327

INPUT
Description: Carlisle Court Bridge
Distance from Upstream XS =       6
Deck/Roadway Width        =      40
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
     5.4   709.1            61.6   707.4              64   707.5 706.102
    71.7   707.7 705.332   122.2   708.9

Upstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
   -14.1     712       0   709.6    31.7   708.3    50.5   706.8    54.4   704.4
    54.6     705    62.1   700.4      64  698.63    65.3   699.9    69.2   700.4
    71.7  699.74    80.1   703.6    81.7     705    82.1   706.2    82.8   706.5
    83.6     706    96.4   707.3   109.5   708.3   131.3   710.2   185.1     712

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
   -14.1    .086    54.6    .065    82.1    .086

Bank Sta: Left   Right    Coeff Contr.   Expan.
          54.6    82.1             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -14.1      58   707.3       F
    77.7   185.1   707.3       F

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
       6   709.1            62.2   707.4            63.2   707.4  706.05
    70.7   707.6  706.31   122.8   708.9

Downstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
   -44.3     712       0   710.3    37.1   708.9    47.5   707.5    52.1   705.4
    60.2   700.2    61.1   699.7    63.2  699.44    63.4   698.4    66.4   698.7
    68.8   698.6    70.7  699.21    72.2   698.6    79.5   704.5    82.1     707
    90.7   707.9     113   709.4   124.7   709.6     155     710     200     712

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
   -44.3    .086    52.1    .065    79.5    .086
```

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          52.1    79.5            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -44.3   60.95   706.5       F
   72.95     200   706.5       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =   707.4
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.322

INPUT
Description: Surveyed X-Sec 21+10.39 - D/S Face of Carlisle Court Culvert
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
   -44.3     712       0   710.3    37.1   708.9    47.5   707.5    52.1   705.4
    60.2   700.2    61.1   699.7    63.2  699.44    63.4   698.4    66.4   698.7
    68.8   698.6    70.7  699.21    72.2   698.6    79.5   704.5    82.1     707
    90.7   707.9     113   709.4   124.7   709.6     155     710     200     712

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
   -44.3    .086    52.1    .065    79.5    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          52.1    79.5              268     264     268             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -44.3   60.95   706.5       F
   72.95     200   706.5       F

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.274

INPUT
Description: Surveyed X-Sec 23+63.91 - U/S Face of Golf Cart Path Bridge #2
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     710    16.7     708      31     706    45.6   702.5    61.7   701.3
    68.7   700.1    73.3   698.2      77   697.5    83.2   697.4    88.6   700.1
```

```
    92.3   701.1   105.8   701.8   136.7     704   150.7     706   165.5     708
   181.4     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    61.7    .055    92.3     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          61.7    92.3                28      27      28              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   61.91   701.9       F
   92.51   181.4   701.5       F

BRIDGE


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.2715

INPUT
Description: Golf Cart Patch Bridge #2
Distance from Upstream XS =       4
Deck/Roadway Width        =      18
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      11
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*****************************************************************************
   25.99 704.484           51.16 702.545           56.05 702.159
   61.74  702.15           61.84 702.621           65.91  702.56 700.668
   88.51  702.21 700.314   90.11 702.183           90.21     702
  101.51 702.006             110     702

Upstream Bridge Cross Section Data
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     710    16.7     708      31     706    45.6   702.5    61.7   701.3
    68.7   700.1    73.3   698.2      77   697.5    83.2   697.4    88.6   700.1
    92.3   701.1   105.8   701.8   136.7     704   150.7     706   165.5     708
   181.4     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    61.7    .055    92.3     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          61.7    92.3             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   61.91   701.9       F
   92.51   181.4   701.5       F

Downstream  Deck/Roadway Coordinates
    num=      10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*****************************************************************************
   40.16 704.484             65.4 702.263             70.3 702.159
    74.1 702.199           77.96  702.19 700.632  101.53  702.15 700.325
  102.05  702.15          114.46 702.002          127.69 703.232
  151.12 705.942

Downstream Bridge Cross Section Data
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     710    19.8     708    38.4     706    56.4     704    63.9     702
    83.6   700.6    88.4   699.8      92   698.6    96.6   698.3    99.9   698.6
   101.6   699.5     104   700.5   105.2   701.6     119   702.4   137.6   704.9
   151.2     706     167     708   186.7     710
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    83.6    .055     104     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          83.6     104             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   82.62   701.2       F
  102.78   186.7   701.2       F

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =     702
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.269

INPUT
Description: Surveyed X-Sec 23+90.48 - D/S Face of Golf Cart Path Bridge #2
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     710    19.8     708    38.4     706    56.4     704    63.9     702
    83.6   700.6    88.4   699.8      92   698.6    96.6   698.3    99.9   698.6
   101.6   699.5     104   700.5   105.2   701.6     119   702.4   137.6   704.9
   151.2     706     167     708   186.7     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    83.6    .055     104     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          83.6     104             281     211     211             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   82.62   701.2       F
  102.78   186.7   701.2       F

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.229

INPUT
Description: Surveyed X-Sec 26+01.01
```

WardsCreekCulvert.rep

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-28.5	712	-20.3	710	0	708.2	12.2	705	45.4	698.9
58.4	697	69.1	696.9	82.6	696.9	115.3	696.9	123.3	701.1
143.5	705.3	159.2	707	164.7	710	179.9	712		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-28.5	.086	45.4	.055	123.3	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
45.4	123.3	88	85	88	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.213

INPUT
Description: Surveyed X-Sec 26+85.99 - U/S Face of Golf Cart Bridge #1
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	712	1.9	710	5.2	708	12	706	23.8	705.1
34.7	702.3	39.5	702.1	48.2	702.6	54.9	701.8	56.5	699.6
69.6	697.8	73.1	696.2	75.7	695.7	78.5	696.4	91.3	699.3
101.5	700	112.8	700.4	123.6	700.7	146.8	701.8	186.1	703.8
243.2	707.2	292	710						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	69.6	.055	91.3	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
69.6	91.3	15	15	15	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	64.12	701.2	F
95.12	292	701.2	F

BRIDGE

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.2115

INPUT
Description: Golf Cart Path Bridge #1
Distance from Upstream XS = 4
Deck/Roadway Width = 9
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
24.42	704.032		38.05	702.202		67.69	701.632	
68.12	701.63	699.631	91.56	701.36	699.251	93.21	701.337	
93.67	701.329		101.35	700.878		105.69	700.561	
112.8	700.4							

Upstream Bridge Cross Section Data
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	712	1.9	710	5.2	708	12	706	23.8	705.1
34.7	702.3	39.5	702.1	48.2	702.6	54.9	701.8	56.5	699.6
69.6	697.8	73.1	696.2	75.7	695.7	78.5	696.4	91.3	699.3
101.5	700	112.8	700.4	123.6	700.7	146.8	701.8	186.1	703.8
243.2	707.2	292	710						

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    69.6    .055    91.3     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          69.6    91.3             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   64.12   701.2       F
   95.12     292   701.2       F

Downstream  Deck/Roadway Coordinates
    num=       9
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
   40.16 704.032           60.15 702.202           67.72 701.622
   68.58  701.55 699.732   91.16  701.36 699.392   91.97 701.352
  114.46 701.329          127.69 700.878          151.12 700.561

Downstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     712     1.9     710     5.2     708      12     706    23.8   705.1
    34.7   702.3    39.5   702.1    48.2   702.6    54.9   701.8    56.5   699.6
    69.6   697.8    75.7   692.8    91.3   699.3   101.5     700   112.8   700.4
   123.6   700.7   146.8   701.8   186.1   703.8   243.2   707.2     292     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0    .086    69.6    .055    91.3     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          69.6    91.3             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   68.08   700.2       F
   91.56     292   700.2       F

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =   701.3
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.210

INPUT
```

WardsCreekCulvert.rep
Description: Surveyed X-Sec 27+01.48 - D/S Face of Golf Cart Bridge #1

Copy
of X-Sec 26+85.99
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	712	1.9	710	5.2	708	12	706	23.8	705.1
34.7	702.3	39.5	702.1	48.2	702.6	54.9	701.8	56.5	699.6
69.6	697.8	75.7	692.8	91.3	699.3	101.5	700	112.8	700.4
123.6	700.7	146.8	701.8	186.1	703.8	243.2	707.2	292	710

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	69.6	.055	91.3	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
69.6	91.3	64	82	113	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	68.08	700.2	F
91.56	292	700.2	F

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.185

INPUT
Description: Surveyed X-Sec 27+98.62 - U/S Side of Berm
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-84	710	-60.8	708	-25.6	704.5	0	700	32.6	699.6
101.3	691.9	113.1	697.5	159.7	699.7	177.5	701	206.3	705
236	707.5	264.6	710						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-84	.086	32.6	.065	113.1	.086

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
32.6	113.1	61	53	50	.3	.5

CULVERT

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 4.183

INPUT
Description: Golf Course Berm
Distance from Upstream XS = 15
Deck/Roadway Width = 12
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 16

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
-76.5	710	-26.4	706.1	1.77	699.91
20	705.12	33.2	704.28	53.1	704.87
84.7	704.68	96.2	704.72	101.5	704.68
102	705	105	705.21	107	705.35
110	705.44	157.4	706.05	182.8	707.34
236	707.5				

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

```
     -84     710   -60.8     708   -25.6   704.5       0     700    32.6   699.6
   101.3   691.9   113.1   697.5   159.7   699.7   177.5     701   206.3     705
     236   707.5   264.6     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
     -84    .086    32.6    .065   113.1    .086

Bank Sta: Left   Right    Coeff Contr.   Expan.
          32.6   113.1             .3       .5

Downstream  Deck/Roadway Coordinates
    num=      15
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
   -63.8     708           -30.8   706.1            2.63  699.91
    15.6  705.12            28.9  704.28            48.6  704.87
    80.2  704.68            91.7  704.72            96.9  704.68
   107.7     705           115.8  705.21           124.1  705.35
   154.9  705.44           202.4  706.05           239.5  707.34

Downstream Bridge Cross Section Data
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
     -72     710   -63.8     708   -46.6     706       0   699.8    18.8   699.8
     140   695.6   142.2   693.9     144   693.9   145.7   693.9   147.5   698.8
     221   706.4   228.3     708   278.5     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
     -72    .086     140    .065   147.5    .086

Bank Sta: Left   Right    Coeff Contr.   Expan.
          140   147.5             .3       .5

Upstream Embankment side slope              =       3 horiz. to 1.0 vertical
Downstream Embankment side slope            =       5 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =   704.2
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  3

Culvert Name     Shape      Rise    Span
Culvert #1      Circular       3
FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 3 - Pipe projecting from fill
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  7      23     .024     .024        0                  .5               1
Upstream   Elevation =  699.64
           Centerline Station =  33.11
Downstream Elevation =  699.86
           Centerline Station =  29.3

Culvert Name     Shape      Rise    Span
Culvert #2      Circular       2
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 3 - Groove end entrance; pipe projecting from fill
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  1      52     .015     .015        0                  .5               1
Upstream   Elevation =  698.58
           Centerline Station =  101.3
Downstream Elevation =  695.46
           Centerline Station =  143.95

Culvert Name     Shape      Rise    Span
```

WardsCreekCulvert.rep

```
Culvert #3      Circular     .83
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 3 - Groove end entrance; pipe projecting from fill
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  1      52     .015     .015        0                  .5               1
Upstream   Elevation =  694.59
           Centerline Station =  101.3
Downstream Elevation =  693.84
           Centerline Station =  143.95

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.178

INPUT
Description: Surveyed X-Sec 28+52.56 - D/S Side of Berm
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
     -72     710   -63.8     708   -46.6     706       0   699.8    18.8   699.8
     140   695.6   142.2   693.9     144   693.9   145.7   693.9   147.5   698.8
     221   706.4   228.3     708   278.5     710

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
     -72    .086     140    .065   147.5    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           140   147.5               10      14      20             .3       .5

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.175

INPUT
Description: Surveyed X-Sec 28+72.78 - Upstream Face of Culvert
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
  -287.7     714  -258.8     711  -217.2     710       0   698.8    24.7   696.1
    33.3   695.4    34.3   694.8    40.3   694.1    45.8     694    46.1     694
    59.7   694.6    60.5   697.1    79.9   700.1     116     708   164.7     708
   314.7     706   475.3     706   508.9     708   527.3     710   570.8     712

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
  -287.7    .086    24.7    .065    60.5    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          24.7    60.5               319     309     319             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
  -287.7   32.32   707.9       F
   54.32   570.8   707.9       F

CULVERT


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.148

INPUT
Description: Wards Creek Culvert crossing Interstate 55
Distance from Upstream XS =      18
Deck/Roadway Width        =     245
Weir Coefficient          =     2.7
```

WardsCreekCulvert.rep

Upstream Deck/Roadway Coordinates
num= 19

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-492.77	708		-414.43	709		-225.05	709.85	
-133.53	709.593		-88.96	709.348		-44.9	709.183	
.48	708.775		45.38	708.426		90.64	708.39	
136.17	708.279		165.97	708.19		204.59	708.382	
254.59	708.652		304.59	708.94		354.59	709.23	
404.59	709.52		454.59	709.8		504.59	710.31	
554.59	710.83							

Upstream Bridge Cross Section Data
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-287.7	714	-258.8	711	-217.2	710	0	698.8	24.7	696.1
33.3	695.4	34.3	694.8	40.3	694.1	45.8	694	46.1	694
59.7	694.6	60.5	697.1	79.9	700.1	116	708	164.7	708
314.7	706	475.3	706	508.9	708	527.3	710	570.8	712

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-287.7	.086	24.7	.065	60.5	.086

Bank Sta: Left Right Coeff Contr. Expan.
24.7 60.5 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-287.7	32.32	707.9	F
54.32	570.8	707.9	F

Downstream Deck/Roadway Coordinates
num= 18

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-326.48	709		-137.1	709.85		-45.58	709.593	
-1.01	709.348		43.05	709.183		88.43	708.775	
133.33	708.426		178.59	708.39		224.12	708.279	
253.92	708.19		292.54	708.382		342.54	708.652	
392.54	708.942		442.54	709.232		492.54	709.522	
542.54	709.802		592.54	710.312		642.54	710.832	

Downstream Bridge Cross Section Data
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	704.7	16.8	701.8	36.4	698.5	47.4	695.8	83.4	694.3
89.9	691.6	96.9	691.6	99.9	691.5	102.9	691.3	107.1	692.2
118.3	695.8	124.4	696.6	151.9	698.3	162.3	698.6	196.5	702.4
208.6	703.9								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	83.4	.065	118.3	.086

Bank Sta: Left Right Coeff Contr. Expan.
83.4 118.3 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92.38	702.75	F
107.38	208.6	702.75	F

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins = 708
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

```
Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1           Box       6       6
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  8     290     .013     .013        0                  .4                1
Upstream   Elevation =  694.12
           Centerline Station =  43.32
Downstream Elevation =  691.53
           Centerline Station =  99.88

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.120

INPUT
Description: Surveyed X-Sec 31+63.89 - Downstream Face
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   704.7    16.8   701.8    36.4   698.5    47.4   695.8    83.4   694.3
    89.9   691.6    96.9   691.6    99.9   691.5   102.9   691.3   107.1   692.2
   118.3   695.8   124.4   696.6   151.9   698.3   162.3   698.6   196.5   702.4
   208.6   703.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .086    83.4    .065   118.3    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          83.4   118.3              274     466     427             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   92.38  702.75       F
  107.38   208.6  702.75       F

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.063

INPUT
Description: Surveyed X-Sec 36+41.40 - Approximately 500- feet downstream of
             I-55
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0   695.3    27.3   693.1    97.5     693   143.2   692.2   148.6   689.6
     150   689.4   153.2   688.9   157.5   688.3   163.4   688.5   168.9  692.26
   173.2   695.2   184.5   699.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .086   143.2    .065   168.9    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         143.2   168.9              135     303     325             .1       .3

CROSS SECTION


RIVER: Sawmill Creek Tr
REACH: Wards Creek        RS: 4.032

INPUT
```

WardsCreekCulvert.rep

Description: Surveyed X-Sec 39+44.21
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	696.4	41.9	694.2	54.3	688.9	70.1	687.5	71.2	687.3
75.7	687.3	81.5	687.3	82.7	689.4	108.3	690.8	155.9	692
171.8	694	178.2	696						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	54.3	.065	82.7	.086

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
54.3	82.7	87	161	227	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 3.972

INPUT
Description: Surveyed X-Sec 41+04.74 - Approximately 1000-feet downstream of I-55
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-91.4	698	-58.9	696	-9.63	694	39.3	692	46.3	691
80.1	690.3	88	689.5	103	689.1	105.1	688.7	107.8	687.9
110.4	686.7	117	686.5	122.5	686.7	128.2	687.1	136.1	694.3

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-91.4	.086	105.1	.065	128.2	.086

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
105.1	128.2	692	320	209	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 3.883

INPUT
Description: FIS Station SMD10
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	699.8	17	699.1	25	694.5	39	687.7	42	687.3
60	685.9	86	685.8	87	684.1	90	683.9	92	683.9
97	684.8	100	687	141	687.6	200	691	290	694.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	42	.07	100	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
42	100	3600	3750	3600	.1	.3

CROSS SECTION

RIVER: Sawmill Creek Tr
REACH: Wards Creek RS: 3.173

INPUT
Description: FIS Station SMD03
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

WardsCreekCulvert.rep

0	677	50	674	100	671.4	150	669.4	200	669.2
262	668.7	274	667.3	279	666.2	282	665.6	285	665.8
289	667.3	290	669.3	400	668.5	500	668.9	600	670.1
700	670.1	800	670.4	900	671.7	1000	673.8	1100	678.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	262	.055	290	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
262	290	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Sawmill Creek Tr

Reach	River Sta.	n1	n2	n3	n4	n5	n6
Wards Creek	4.707	.07	.059	.075			
Wards Creek	4.64866*	.065*	.069*	.061*	.079*	.233*	.233*
Wards Creek	4.59033*	.06*	.077*	.063*	.082*	.392*	.392*
Wards Creek	4.532	.055*	.086*	.065*	.086*	.55*	
Wards Creek	4.516	.055*	.086*	.065*	.086*	.055*	
Wards Creek	4.515	Inl Struct					
Wards Creek	4.514	.055*	.086*	.065*	.086*	.055*	
Wards Creek	4.508	Bridge					
Wards Creek	4.502	.086*	.065*	.086*			
Wards Creek	4.421	.055*	.065*	.055*			
Wards Creek	4.415	Bridge					
Wards Creek	4.410	.055*	.065*	.055*			
Wards Creek	4.409	Inl Struct					
Wards Creek	4.408	.055*	.065*	.055*			
Wards Creek	4.365	.086*	.065*	.086*			
Wards Creek	4.332	.086*	.065*	.086*			
Wards Creek	4.327	Bridge					
Wards Creek	4.322	.086*	.065*	.086*			
Wards Creek	4.274	.086*	.055*	.04*			
Wards Creek	4.2715	Bridge					
Wards Creek	4.269	.086*	.055*	.04*			
Wards Creek	4.229	.086*	.055*	.04*			
Wards Creek	4.213	.086*	.055*	.04*			
Wards Creek	4.2115	Bridge					
Wards Creek	4.210	.086*	.055*	.04*			
Wards Creek	4.185	.086*	.065*	.086*			
Wards Creek	4.183	Culvert					
Wards Creek	4.178	.086*	.065*	.086*			
Wards Creek	4.175	.086*	.065*	.086*			
Wards Creek	4.148	Culvert					
Wards Creek	4.120	.086*	.065*	.086*			
Wards Creek	4.063	.086*	.065*	.086*			
Wards Creek	4.032	.086*	.065*	.086*			
Wards Creek	3.972	.086*	.065*	.086*			
Wards Creek	3.883	.08*	.07*	.08*			
Wards Creek	3.173	.08*	.055*	.08*			

SUMMARY OF REACH LENGTHS

River: Sawmill Creek Tr

Reach	River Sta.	Left	Channel	Right
Wards Creek	4.707	289*	300*	289*
Wards Creek	4.64866*	289*	300*	289*
Wards Creek	4.59033*	289*	300*	289*
Wards Creek	4.532	75*	93*	122*
Wards Creek	4.516	8*	8*	8*

WardsCreekCulvert.rep

*Wards Creek	*	4.515	*Inl Struct*	*	*	
*Wards Creek	*	4.514	*	45*	59*	40*
*Wards Creek	*	4.508	*Bridge	*	*	*
*Wards Creek	*	4.502	*	406*	423*	421*
*Wards Creek	*	4.421	*	68*	65*	68*
*Wards Creek	*	4.415	*Bridge	*	*	*
*Wards Creek	*	4.410	*	5*	5*	5*
*Wards Creek	*	4.409	*Inl Struct*	*	*	
*Wards Creek	*	4.408	*	296*	229*	240*
*Wards Creek	*	4.365	*	181*	173*	170*
*Wards Creek	*	4.332	*	57*	55*	57*
*Wards Creek	*	4.327	*Bridge	*	*	*
*Wards Creek	*	4.322	*	268*	264*	268*
*Wards Creek	*	4.274	*	28*	27*	28*
*Wards Creek	*	4.2715	*Bridge	*	*	*
*Wards Creek	*	4.269	*	281*	211*	211*
*Wards Creek	*	4.229	*	88*	85*	88*
*Wards Creek	*	4.213	*	15*	15*	15*
*Wards Creek	*	4.2115	*Bridge	*	*	*
*Wards Creek	*	4.210	*	64*	82*	113*
*Wards Creek	*	4.185	*	61*	53*	50*
*Wards Creek	*	4.183	*Culvert	*	*	*
*Wards Creek	*	4.178	*	10*	14*	20*
*Wards Creek	*	4.175	*	319*	309*	319*
*Wards Creek	*	4.148	*Culvert	*	*	*
*Wards Creek	*	4.120	*	274*	466*	427*
*Wards Creek	*	4.063	*	135*	303*	325*
*Wards Creek	*	4.032	*	87*	161*	227*
*Wards Creek	*	3.972	*	692*	320*	209*
*Wards Creek	*	3.883	*	3600*	3750*	3600*
*Wards Creek	*	3.173	*	0*	0*	0*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Sawmill Creek Tr

Reach	River Sta.	Contr.	Expan.
*Wards Creek	* 4.707	* .1*	.3*
*Wards Creek	* 4.64866**	.1*	.3*
*Wards Creek	* 4.59033**	.1*	.3*
*Wards Creek	* 4.532	* .1*	.3*
*Wards Creek	* 4.516	* .3*	.5*
*Wards Creek	* 4.515	*Inl Struct*	*
*Wards Creek	* 4.514	* .3*	.5*
*Wards Creek	* 4.508	*Bridge *	*
*Wards Creek	* 4.502	* .3*	.5*
*Wards Creek	* 4.421	* .3*	.5*
*Wards Creek	* 4.415	*Bridge *	*
*Wards Creek	* 4.410	* .3*	.5*
*Wards Creek	* 4.409	*Inl Struct*	*
*Wards Creek	* 4.408	* .3*	.5*
*Wards Creek	* 4.365	* .1*	.3*
*Wards Creek	* 4.332	* .3*	.5*
*Wards Creek	* 4.327	*Bridge *	*
*Wards Creek	* 4.322	* .3*	.5*
*Wards Creek	* 4.274	* .3*	.5*
*Wards Creek	* 4.2715	*Bridge *	*
*Wards Creek	* 4.269	* .3*	.5*
*Wards Creek	* 4.229	* .1*	.3*
*Wards Creek	* 4.213	* .3*	.5*
*Wards Creek	* 4.2115	*Bridge *	*
*Wards Creek	* 4.210	* .3*	.5*
*Wards Creek	* 4.185	* .3*	.5*
*Wards Creek	* 4.183	*Culvert *	*
*Wards Creek	* 4.178	* .3*	.5*
*Wards Creek	* 4.175	* .3*	.5*
*Wards Creek	* 4.148	*Culvert *	*
*Wards Creek	* 4.120	* .3*	.5*
*Wards Creek	* 4.063	* .1*	.3*

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                                                  WardsCreekCulvert.rep
*Wards Creek     *    4.032   *       .1*       .3*
*Wards Creek     *    3.972   *       .1*       .3*
*Wards Creek     *    3.883   *       .1*       .3*
*Wards Creek     *    3.173   *       .1*       .3*
*************************************************
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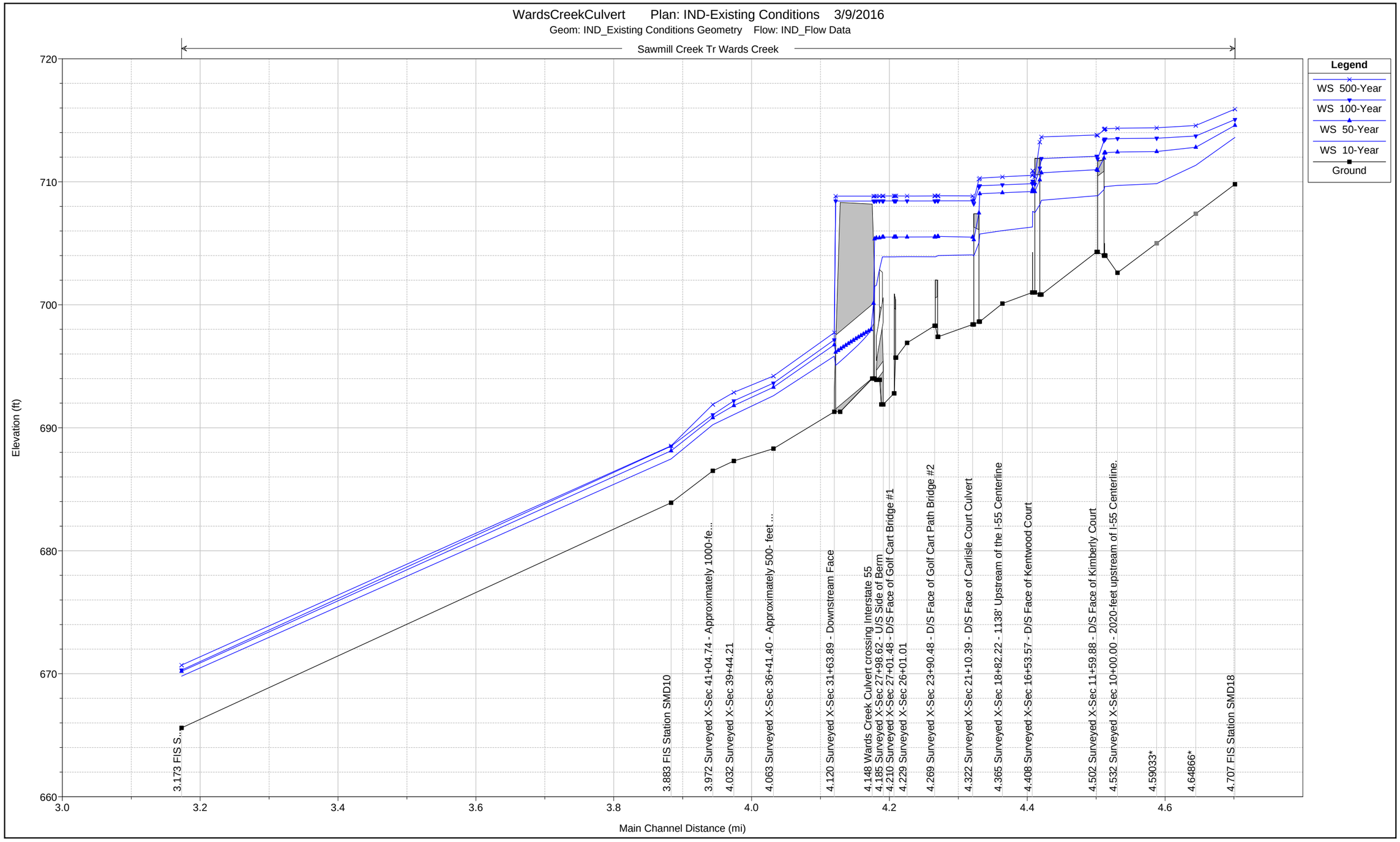

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
Sawmill Creek Tr Wards Creek
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Elevation (ft)
720
710
700
690
680
670
660
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
Main Channel Distance (mi)
3.173 FIS S...
3.883 FIS Station SMD10
3.972 Surveyed X-Sec 41+04.74 - Approximately 1000-fe...
4.032 Surveyed X-Sec 39+44.21
4.063 Surveyed X-Sec 36+41.40 - Approximately 500- feet ...
4.120 Surveyed X-Sec 31+63.89 - Downstream Face
4.148 Wards Creek Culvert crossing Interstate 55
4.185 Surveyed X-Sec 27+98.62 - U/S Side of Berm
4.210 Surveyed X-Sec 27+01.48 - D/S Face of Golf Cart Bridge #1
4.229 Surveyed X-Sec 26+01.01
4.269 Surveyed X-Sec 23+90.48 - D/S Face of Golf Cart Path Bridge #2
4.322 Surveyed X-Sec 21+10.39 - D/S Face of Carlisle Court Culvert
4.365 Surveyed X-Sec 18+82.22 - 1138' Upstream of the I-55 Centerline
4.408 Surveyed X-Sec 16+53.57 - D/S Face of Kentwood Court
4.502 Surveyed X-Sec 11+59.88 - D/S Face of Kimberly Court
4.532 Surveyed X-Sec 10+00.00 - 2020-feet upstream of I-55 Centerline.
4.59033*
4.64866*
4.707 FIS Station SMD18

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek

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)	
Wards Creek	4.707	10-Year	249.01	709.80	713.61	712.09	713.83	0.006656	3.77	65.97	24.63	0.41
Wards Creek	4.707	50-Year	400.00	709.80	714.59	712.80	714.88	0.006983	4.34	92.10	28.75	0.43
Wards Creek	4.707	100-Year	477.30	709.80	715.06	713.11	715.38	0.006807	4.50	106.17	30.85	0.43
Wards Creek	4.707	500-Year	690.00	709.80	715.91	713.86	716.32	0.007678	5.16	133.84	34.60	0.46
Wards Creek	4.532	10-Year	249.01	702.60	709.70	705.13	709.72	0.000292	1.15	446.81	214.77	0.09
Wards Creek	4.532	50-Year	400.00	702.60	712.42	705.76	712.43	0.000101	0.89	1222.77	396.37	0.06
Wards Creek	4.532	100-Year	477.30	702.60	713.52	706.01	713.52	0.000070	0.81	1734.95	538.15	0.05
Wards Creek	4.532	500-Year	690.00	702.60	714.36	706.66	714.37	0.000084	0.94	2229.00	622.48	0.05
Wards Creek	4.516	10-Year	249.01	704.00	709.61	705.99	709.67	0.001182	1.91	130.39	34.22	0.16
Wards Creek	4.516	50-Year	400.00	704.00	712.37	706.66	712.41	0.000535	1.64	259.58	60.99	0.12
Wards Creek	4.516	100-Year	477.30	704.00	713.47	706.92	713.51	0.000374	1.53	381.83	134.98	0.10
Wards Creek	4.516	500-Year	690.00	704.00	714.31	707.60	714.35	0.000442	1.79	519.92	194.59	0.11
Wards Creek	4.515		Inl Struct									
Wards Creek	4.514	10-Year	249.01	704.00	709.50	706.12	709.63	0.001723	2.87	86.65	33.61	0.22
Wards Creek	4.514	50-Year	400.00	704.00	712.34	706.85	712.38	0.000544	1.65	257.91	60.67	0.12
Wards Creek	4.514	100-Year	477.30	704.00	713.47	707.18	713.50	0.000376	1.54	380.64	134.51	0.10
Wards Creek	4.514	500-Year	690.00	704.00	714.28	708.00	714.33	0.000450	1.81	515.69	193.65	0.11
Wards Creek	4.508		Bridge									
Wards Creek	4.502	10-Year	249.01	704.30	708.86	706.47	709.06	0.003526	3.51	70.89	32.92	0.30
Wards Creek	4.502	50-Year	400.00	704.30	710.98	707.19	711.21	0.002399	3.78	105.74	40.70	0.26
Wards Creek	4.502	100-Year	477.30	704.30	712.08	707.50	712.16	0.000885	2.30	230.74	56.52	0.16
Wards Creek	4.502	500-Year	690.00	704.30	713.81	708.35	713.89	0.000741	2.46	376.94	121.06	0.15
Wards Creek	4.421	10-Year	249.01	700.83	708.49	703.42	708.53	0.000504	1.47	169.21	37.15	0.11
Wards Creek	4.421	50-Year	400.00	700.83	710.73	704.09	710.77	0.000404	1.66	240.29	50.76	0.11
Wards Creek	4.421	100-Year	477.30	700.83	711.89	704.39	711.92	0.000321	1.50	338.66	73.68	0.09
Wards Creek	4.421	500-Year	690.00	700.83	713.65	705.15	713.68	0.000280	1.61	496.19	98.84	0.09
Wards Creek	4.415		Bridge									
Wards Creek	4.410	10-Year	249.01	701.00	707.60	703.42	707.71	0.001208	2.68	93.08	36.11	0.19
Wards Creek	4.410	50-Year	400.00	701.00	709.40	704.18	709.57	0.001335	3.33	120.05	39.72	0.21

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek (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)	
Wards Creek	4.410	100-Year	477.30	701.00	710.05	704.54	710.26	0.001467	3.68	129.74	41.01	0.22
Wards Creek	4.410	500-Year	690.00	701.00	710.89	705.42	711.25	0.002252	4.85	142.33	42.70	0.28
Wards Creek	4.409		Inl Struct									
Wards Creek	4.408	10-Year	249.01	701.00	706.32	703.22	706.43	0.001718	2.70	92.09	33.55	0.22
Wards Creek	4.408	50-Year	400.00	701.00	709.20	703.85	709.32	0.000938	2.73	146.76	39.32	0.17
Wards Creek	4.408	100-Year	477.30	701.00	709.84	704.17	709.98	0.001024	3.00	158.90	40.61	0.18
Wards Creek	4.408	500-Year	690.00	701.00	710.53	704.91	710.78	0.001649	4.02	171.84	41.97	0.24
Wards Creek	4.365	10-Year	249.01	700.10	706.03	702.78	706.09	0.001151	2.05	144.88	46.23	0.17
Wards Creek	4.365	50-Year	400.00	700.10	709.11	703.50	709.14	0.000395	1.69	337.31	84.42	0.11
Wards Creek	4.365	100-Year	477.30	700.10	709.75	703.81	709.79	0.000397	1.79	395.28	95.20	0.11
Wards Creek	4.365	500-Year	690.00	700.10	710.40	704.52	710.46	0.000596	2.30	461.24	108.73	0.14
Wards Creek	4.332	10-Year	249.01	698.63	705.76	702.27	705.85	0.001555	2.46	101.02	29.76	0.19
Wards Creek	4.332	50-Year	400.00	698.63	709.03	702.96	709.07	0.000478	1.72	308.00	103.86	0.11
Wards Creek	4.332	100-Year	477.30	698.63	709.68	703.27	709.72	0.000456	1.77	382.97	125.74	0.11
Wards Creek	4.332	500-Year	690.00	698.63	710.29	704.00	710.36	0.000649	2.22	464.16	138.22	0.13
Wards Creek	4.327		Bridge									
Wards Creek	4.322	10-Year	249.01	698.40	704.06	701.27	704.31	0.003984	4.02	61.98	24.76	0.31
Wards Creek	4.322	50-Year	400.00	698.40	705.50	702.15	705.89	0.004533	5.05	79.24	28.65	0.35
Wards Creek	4.322	100-Year	477.30	698.40	708.45	702.54	708.52	0.000766	2.21	240.40	58.42	0.14
Wards Creek	4.322	500-Year	690.00	698.40	708.85	703.58	708.99	0.001312	2.99	265.84	67.43	0.19
Wards Creek	4.274	10-Year	249.01	697.40	704.00	699.94	704.02	0.000252	1.20	256.97	97.40	0.10
Wards Creek	4.274	50-Year	400.00	697.40	705.56	700.72	705.58	0.000167	1.18	422.15	114.79	0.08
Wards Creek	4.274	100-Year	477.30	697.40	708.45	701.02	708.46	0.000041	0.74	811.44	156.20	0.04
Wards Creek	4.274	500-Year	690.00	697.40	708.87	701.75	708.88	0.000070	1.00	877.04	162.90	0.06
Wards Creek	4.2715		Bridge									
Wards Creek	4.269	10-Year	249.01	698.30	703.90	700.91	703.94	0.000562	1.75	191.62	73.43	0.14
Wards Creek	4.269	50-Year	400.00	698.30	705.51	701.59	705.55	0.000364	1.72	331.27	102.41	0.12
Wards Creek	4.269	100-Year	477.30	698.30	708.45	701.96	708.46	0.000073	0.99	711.24	156.01	0.06
Wards Creek	4.269	500-Year	690.00	698.30	708.85	702.63	708.87	0.000122	1.32	776.22	164.03	0.08

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek (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)	
Wards Creek	4.229	10-Year	249.01	696.90	703.91	697.73	703.91	0.000023	0.46	601.96	118.65	0.03
Wards Creek	4.229	50-Year	400.00	696.90	705.51	698.03	705.52	0.000027	0.57	805.68	135.22	0.03
Wards Creek	4.229	100-Year	477.30	696.90	708.44	698.17	708.45	0.000012	0.45	1250.66	164.61	0.02
Wards Creek	4.229	500-Year	690.00	696.90	708.85	698.50	708.85	0.000021	0.63	1318.33	169.91	0.03
Wards Creek	4.213	10-Year	249.01	695.70	703.90	698.78	703.91	0.000061	0.73	481.73	159.32	0.05
Wards Creek	4.213	50-Year	400.00	695.70	705.51	699.40	705.51	0.000045	0.72	765.53	196.37	0.04
Wards Creek	4.213	100-Year	477.30	695.70	708.44	699.69	708.45	0.000012	0.45	1441.95	260.41	0.02
Wards Creek	4.213	500-Year	690.00	695.70	708.85	700.29	708.85	0.000020	0.60	1548.82	268.13	0.03
Wards Creek	4.2115		Bridge									
Wards Creek	4.210	10-Year	311.94	692.80	703.90	697.31	703.90	0.000076	0.87	511.63	159.22	0.05
Wards Creek	4.210	50-Year	480.00	692.80	705.51	698.14	705.51	0.000057	0.85	795.64	196.28	0.05
Wards Creek	4.210	100-Year	599.10	692.80	708.44	698.64	708.45	0.000017	0.55	1472.47	260.40	0.03
Wards Creek	4.210	500-Year	850.00	692.80	708.85	699.47	708.85	0.000029	0.73	1579.24	268.11	0.04
Wards Creek	4.185	10-Year	311.94	691.90	703.90	694.78	703.90	0.000014	0.35	1185.05	220.52	0.02
Wards Creek	4.185	50-Year	480.00	691.90	705.51	695.32	705.51	0.000016	0.42	1559.58	248.04	0.02
Wards Creek	4.185	100-Year	599.10	691.90	708.44	695.64	708.44	0.000009	0.36	2382.56	312.73	0.02
Wards Creek	4.185	500-Year	850.00	691.90	708.85	696.20	708.85	0.000015	0.49	2510.72	322.03	0.02
Wards Creek	4.183		Culvert									
Wards Creek	4.178	10-Year	311.94	693.90	701.58	697.42	701.58	0.000170	0.81	604.13	187.75	0.05
Wards Creek	4.178	50-Year	480.00	693.90	705.44	697.82	705.44	0.000033	0.48	1456.81	254.08	0.03
Wards Creek	4.178	100-Year	599.10	693.90	708.44	698.04	708.44	0.000015	0.38	2289.79	304.84	0.02
Wards Creek	4.178	500-Year	850.00	693.90	708.84	698.43	708.84	0.000025	0.51	2414.78	316.58	0.02
Wards Creek	4.175	10-Year	311.94	694.00	701.50	696.16	701.56	0.000544	1.97	158.09	138.73	0.13
Wards Creek	4.175	50-Year	480.00	694.00	705.36	696.77	705.42	0.000308	1.98	242.97	231.19	0.10
Wards Creek	4.175	100-Year	599.10	694.00	708.44	697.15	708.44	0.000015	0.49	2689.42	699.76	0.02
Wards Creek	4.175	500-Year	850.00	694.00	708.84	697.91	708.84	0.000024	0.63	2973.02	711.25	0.03
Wards Creek	4.148		Culvert									
Wards Creek	4.120	10-Year	311.94	691.30	695.82	693.98	696.20	0.006912	4.93	63.23	71.13	0.42

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek (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)	
Wards Creek	4.120	50-Year	480.00	691.30	696.75	694.77	697.35	0.008427	6.22	77.16	83.26	0.48
Wards Creek	4.120	100-Year	599.10	691.30	697.15	695.27	697.95	0.010246	7.21	83.12	91.30	0.54
Wards Creek	4.120	500-Year	850.00	691.30	697.74	696.25	699.06	0.014704	9.24	92.00	103.29	0.66
Wards Creek	4.063	10-Year	311.94	688.30	692.60	690.98	692.84	0.007256	3.93	83.61	49.29	0.39
Wards Creek	4.063	50-Year	480.00	688.30	693.30	691.67	693.59	0.007374	4.53	146.98	145.57	0.41
Wards Creek	4.063	100-Year	599.10	688.30	693.63	692.08	693.91	0.007026	4.68	196.11	150.18	0.41
Wards Creek	4.063	500-Year	850.00	688.30	694.21	693.48	694.47	0.006411	4.88	285.04	158.18	0.40
Wards Creek	4.032	10-Year	311.94	687.30	691.07	689.40	691.21	0.004073	3.09	123.26	69.79	0.30
Wards Creek	4.032	50-Year	480.00	687.30	691.81	689.98	691.97	0.004067	3.54	186.01	100.70	0.31
Wards Creek	4.032	100-Year	599.10	687.30	692.19	690.33	692.37	0.004104	3.78	226.86	110.78	0.32
Wards Creek	4.032	500-Year	850.00	687.30	692.88	690.92	693.07	0.003973	4.11	306.04	117.90	0.32
Wards Creek	3.972	10-Year	311.94	686.50	690.25	688.71	690.44	0.005499	3.71	101.28	51.02	0.36
Wards Creek	3.972	50-Year	480.00	686.50	690.81	689.39	691.11	0.007042	4.67	136.87	76.84	0.42
Wards Creek	3.972	100-Year	599.10	686.50	691.06	689.84	691.43	0.008322	5.29	157.43	86.66	0.46
Wards Creek	3.972	500-Year	850.00	686.50	691.89	690.30	692.24	0.006776	5.40	232.52	93.41	0.43
Wards Creek	3.883	10-Year	344.05	683.90	687.46	686.71	687.65	0.013777	3.46	105.21	90.89	0.47
Wards Creek	3.883	50-Year	550.00	683.90	688.13	687.19	688.31	0.009755	3.63	174.49	112.00	0.42
Wards Creek	3.883	100-Year	661.33	683.90	688.50	687.42	688.67	0.007797	3.58	217.64	119.24	0.38
Wards Creek	3.883	500-Year	905.00	683.90	688.53	687.85	688.85	0.013886	4.82	221.72	119.90	0.51
Wards Creek	3.173	10-Year	478.84	665.60	669.80	669.28	669.85	0.002865	2.69	397.79	435.00	0.29
Wards Creek	3.173	50-Year	775.00	665.60	670.20	669.56	670.27	0.003351	3.19	591.72	603.34	0.32
Wards Creek	3.173	100-Year	923.06	665.60	670.30	669.61	670.37	0.003785	3.46	653.83	639.16	0.34
Wards Creek	3.173	500-Year	1290.00	665.60	670.70	669.81	670.76	0.002970	3.31	926.64	705.58	0.31

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.707	10-Year	713.83	713.61	0.22	2.25	0.00		249.01		24.63
Wards Creek	4.707	50-Year	714.88	714.59	0.29	1.84	0.02		400.00		28.75
Wards Creek	4.707	100-Year	715.38	715.06	0.31	1.43	0.04		477.30		30.85
Wards Creek	4.707	500-Year	716.32	715.91	0.41	1.48	0.06		690.00		34.60
Wards Creek	4.532	10-Year	709.72	709.70	0.02	0.05	0.00	11.72	202.67	34.61	214.77
Wards Creek	4.532	50-Year	712.43	712.42	0.01	0.02	0.00	66.76	237.96	95.28	396.37
Wards Creek	4.532	100-Year	713.52	713.52	0.01	0.01	0.00	117.07	245.21	115.02	538.15
Wards Creek	4.532	500-Year	714.37	714.36	0.01	0.02	0.00	215.48	310.07	164.46	622.48
Wards Creek	4.516	10-Year	709.67	709.61	0.06				249.01		34.22
Wards Creek	4.516	50-Year	712.41	712.37	0.04			6.19	392.21	1.60	60.99
Wards Creek	4.516	100-Year	713.51	713.47	0.03			19.75	433.43	24.12	134.98
Wards Creek	4.516	500-Year	714.35	714.31	0.04			46.26	566.11	77.63	194.59
Wards Creek	4.515		Inl Struct								
Wards Creek	4.514	10-Year	709.63	709.50	0.13	0.01	0.03		249.01		33.61
Wards Creek	4.514	50-Year	712.38	712.34	0.04	0.00	0.09	6.01	392.45	1.54	60.67
Wards Creek	4.514	100-Year	713.50	713.47	0.03	0.00	0.03	19.64	433.82	23.84	134.51
Wards Creek	4.514	500-Year	714.33	714.28	0.04	0.00	0.01	45.75	568.08	76.17	193.65
Wards Creek	4.508		Bridge								
Wards Creek	4.502	10-Year	709.06	708.86	0.19	0.45	0.08		249.01		32.92
Wards Creek	4.502	50-Year	711.21	710.98	0.22	0.34	0.09		400.00		40.70
Wards Creek	4.502	100-Year	712.16	712.08	0.08	0.21	0.02	0.42	456.88	20.00	56.52
Wards Creek	4.502	500-Year	713.89	713.81	0.08	0.18	0.02	16.05	616.61	57.34	121.06
Wards Creek	4.421	10-Year	708.53	708.49	0.03	0.02	0.08		249.01		37.15
Wards Creek	4.421	50-Year	710.77	710.73	0.04	0.01	0.13		400.00		50.76
Wards Creek	4.421	100-Year	711.92	711.89	0.03	0.01	0.18	7.10	462.24	7.96	73.68
Wards Creek	4.421	500-Year	713.68	713.65	0.04	0.01	0.09	61.59	604.42	23.99	98.84
Wards Creek	4.415		Bridge								

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.410	10-Year	707.71	707.60	0.11				249.01		36.11
Wards Creek	4.410	50-Year	709.57	709.40	0.17				400.00		39.72
Wards Creek	4.410	100-Year	710.26	710.05	0.21				477.30		41.01
Wards Creek	4.410	500-Year	711.25	710.89	0.36				690.00		42.70
Wards Creek	4.409		Inl Struct								
Wards Creek	4.408	10-Year	706.43	706.32	0.11	0.32	0.03		249.01		33.55
Wards Creek	4.408	50-Year	709.32	709.20	0.12	0.14	0.04		400.00		39.32
Wards Creek	4.408	100-Year	709.98	709.84	0.14	0.14	0.05		477.30		40.61
Wards Creek	4.408	500-Year	710.78	710.53	0.25	0.22	0.10		690.00		41.97
Wards Creek	4.365	10-Year	706.09	706.03	0.06	0.23	0.00	1.42	211.32	36.27	46.23
Wards Creek	4.365	50-Year	709.14	709.11	0.03	0.08	0.00	27.58	290.07	82.36	84.42
Wards Creek	4.365	100-Year	709.79	709.75	0.04	0.07	0.00	41.20	332.47	103.62	95.20
Wards Creek	4.365	500-Year	710.46	710.40	0.06	0.11	0.00	68.63	461.62	159.75	108.73
Wards Creek	4.332	10-Year	705.85	705.76	0.09	0.02	0.16		249.01		29.76
Wards Creek	4.332	50-Year	709.07	709.03	0.04	0.01	0.36	20.18	353.45	26.37	103.86
Wards Creek	4.332	100-Year	709.72	709.68	0.04	0.01	0.02	37.25	396.49	43.57	125.74
Wards Creek	4.332	500-Year	710.36	710.29	0.06	0.01	0.01	78.25	534.51	77.25	138.22
Wards Creek	4.327		Bridge								
Wards Creek	4.322	10-Year	704.31	704.06	0.25	0.17	0.12		249.01		24.76
Wards Creek	4.322	50-Year	705.89	705.50	0.40	0.12	0.19		400.00		28.65
Wards Creek	4.322	100-Year	708.52	708.45	0.07	0.03	0.03	6.12	463.37	7.80	58.42
Wards Creek	4.322	500-Year	708.99	708.85	0.13	0.05	0.06	12.45	660.53	17.02	67.43
Wards Creek	4.274	10-Year	704.02	704.00	0.02	0.00	0.00	15.11	180.01	53.89	97.40
Wards Creek	4.274	50-Year	705.58	705.56	0.02	0.00	0.00	33.81	232.33	133.86	114.79
Wards Creek	4.274	100-Year	708.46	708.45	0.01	0.00	0.00	50.83	212.99	213.49	156.20
Wards Creek	4.274	500-Year	708.88	708.87	0.01	0.00	0.00	75.51	298.78	315.71	162.90
Wards Creek	4.2715		Bridge								

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.269	10-Year	703.94	703.90	0.04	0.01	0.02	39.51	167.02	42.49	73.43
Wards Creek	4.269	50-Year	705.55	705.51	0.03	0.01	0.01	72.05	220.04	107.91	102.41
Wards Creek	4.269	100-Year	708.46	708.45	0.01	0.01	0.00	100.12	186.56	190.63	156.01
Wards Creek	4.269	500-Year	708.87	708.85	0.02	0.01	0.01	147.29	259.36	283.35	164.03
Wards Creek	4.229	10-Year	703.91	703.91	0.00	0.00	0.00	10.39	234.42	4.20	118.65
Wards Creek	4.229	50-Year	705.52	705.51	0.00	0.00	0.00	23.70	361.58	14.72	135.22
Wards Creek	4.229	100-Year	708.45	708.44	0.00	0.00	0.00	40.16	394.08	43.06	164.61
Wards Creek	4.229	500-Year	708.85	708.85	0.01	0.00	0.00	58.46	563.51	68.02	169.91
Wards Creek	4.213	10-Year	703.91	703.90	0.01	0.00	0.00	28.44	104.94	115.63	159.32
Wards Creek	4.213	50-Year	705.51	705.51	0.01	0.00	0.00	48.79	129.78	221.43	196.37
Wards Creek	4.213	100-Year	708.45	708.44	0.00	0.00	0.00	65.09	109.19	303.02	260.41
Wards Creek	4.213	500-Year	708.85	708.85	0.00	0.00	0.00	95.20	151.73	443.07	268.13
Wards Creek	4.2115		Bridge								
Wards Creek	4.210	10-Year	703.90	703.90	0.01	0.00	0.00	31.69	151.45	128.80	159.22
Wards Creek	4.210	50-Year	705.51	705.51	0.01	0.00	0.00	54.64	177.45	247.91	196.28
Wards Creek	4.210	100-Year	708.45	708.44	0.00	0.00	0.00	79.10	151.73	368.27	260.40
Wards Creek	4.210	500-Year	708.85	708.85	0.01	0.00	0.00	113.87	206.17	529.96	268.11
Wards Creek	4.185	10-Year	703.90	703.90	0.00			24.91	231.69	55.33	220.52
Wards Creek	4.185	50-Year	705.51	705.51	0.00			48.06	334.21	97.73	248.04
Wards Creek	4.185	100-Year	708.44	708.44	0.00			79.63	377.09	142.38	312.73
Wards Creek	4.185	500-Year	708.85	708.85	0.00			116.40	527.74	205.86	322.03
Wards Creek	4.183		Culvert								
Wards Creek	4.178	10-Year	701.58	701.58	0.00	0.00	0.02	260.10	41.41	10.43	187.75
Wards Creek	4.178	50-Year	705.44	705.44	0.00	0.00	0.02	394.95	38.34	46.71	254.08
Wards Creek	4.178	100-Year	708.44	708.44	0.00	0.00	0.00	478.29	38.57	82.24	304.84
Wards Creek	4.178	500-Year	708.84	708.84	0.00	0.00	0.00	679.61	53.52	116.86	316.58
Wards Creek	4.175	10-Year	701.56	701.50	0.06				311.94		138.73
Wards Creek	4.175	50-Year	705.42	705.36	0.06				480.00		231.19

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.175	100-Year	708.44	708.44	0.00			243.04	238.78	117.28	699.76
Wards Creek	4.175	500-Year	708.84	708.84	0.00			338.47	317.37	194.15	711.25
Wards Creek	4.148		Culvert								
Wards Creek	4.120	10-Year	696.20	695.82	0.38	3.29	0.07		311.94		71.13
Wards Creek	4.120	50-Year	697.35	696.75	0.60	3.60	0.15		480.00		83.26
Wards Creek	4.120	100-Year	697.95	697.15	0.81	3.78	0.26		599.10		91.30
Wards Creek	4.120	500-Year	699.06	697.74	1.33	4.06	0.53		850.00		103.29
Wards Creek	4.063	10-Year	692.84	692.60	0.24	1.61	0.03	2.36	309.54	0.03	49.29
Wards Creek	4.063	50-Year	693.59	693.30	0.29	1.58	0.04	41.09	438.25	0.66	145.57
Wards Creek	4.063	100-Year	693.91	693.63	0.28	1.52	0.03	105.18	492.56	1.36	150.18
Wards Creek	4.063	500-Year	694.47	694.21	0.27	1.38	0.02	260.57	586.12	3.31	158.18
Wards Creek	4.032	10-Year	691.21	691.07	0.14	0.76	0.01	6.06	282.54	23.34	69.79
Wards Creek	4.032	50-Year	691.97	691.81	0.16	0.85	0.01	13.20	397.85	68.94	100.70
Wards Creek	4.032	100-Year	692.37	692.19	0.18	0.92	0.02	18.42	465.80	114.88	110.78
Wards Creek	4.032	500-Year	693.07	692.88	0.19	0.82	0.02	30.18	586.61	233.22	117.90
Wards Creek	3.972	10-Year	690.44	690.25	0.20	2.79	0.00	21.91	282.34	7.69	51.02
Wards Creek	3.972	50-Year	691.11	690.81	0.30	2.76	0.03	50.50	415.98	13.52	76.84
Wards Creek	3.972	100-Year	691.43	691.06	0.37	2.70	0.06	79.80	501.82	17.47	86.66
Wards Creek	3.972	500-Year	692.24	691.89	0.34	3.38	0.01	207.62	616.14	26.25	93.41
Wards Creek	3.883	10-Year	687.65	687.46	0.18	17.75	0.04	0.04	337.98	6.03	90.89
Wards Creek	3.883	50-Year	688.31	688.13	0.19	18.01	0.04	2.43	494.01	53.55	112.00
Wards Creek	3.883	100-Year	688.67	688.50	0.18	18.27	0.03	4.96	564.77	91.60	119.24
Wards Creek	3.883	500-Year	688.85	688.53	0.32	18.02	0.08	7.03	769.50	128.47	119.90
Wards Creek	3.173	10-Year	669.85	669.80	0.05			59.65	202.35	216.84	435.00
Wards Creek	3.173	50-Year	670.27	670.20	0.07			139.23	275.69	360.08	603.34
Wards Creek	3.173	100-Year	670.37	670.30	0.07			171.84	308.97	442.26	639.16
Wards Creek	3.173	500-Year	670.76	670.70	0.06			250.61	333.23	706.17	705.58

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.210	10-Year	703.90	703.90	0.01	0.00	0.00	31.69	151.45	128.80	159.22
Wards Creek	4.210	50-Year	705.51	705.51	0.01	0.00	0.00	54.64	177.45	247.91	196.28
Wards Creek	4.210	100-Year	708.45	708.44	0.00	0.00	0.00	79.10	151.73	368.27	260.40
Wards Creek	4.210	500-Year	708.85	708.85	0.01	0.00	0.00	113.87	206.17	529.96	268.11
Wards Creek	4.185	10-Year	703.90	703.90	0.00			24.91	231.69	55.33	220.52
Wards Creek	4.185	50-Year	705.51	705.51	0.00			48.06	334.21	97.73	248.04
Wards Creek	4.185	100-Year	708.44	708.44	0.00			79.63	377.09	142.38	312.73
Wards Creek	4.185	500-Year	708.85	708.85	0.00			116.40	527.74	205.86	322.03
Wards Creek	4.183		Culvert								
Wards Creek	4.178	10-Year	701.58	701.58	0.00	0.00	0.02	260.10	41.41	10.43	187.75
Wards Creek	4.178	50-Year	705.44	705.44	0.00	0.00	0.02	394.95	38.34	46.71	254.08
Wards Creek	4.178	100-Year	708.44	708.44	0.00	0.00	0.00	478.29	38.57	82.24	304.84
Wards Creek	4.178	500-Year	708.84	708.84	0.00	0.00	0.00	679.61	53.52	116.86	316.58
Wards Creek	4.175	10-Year	701.56	701.50	0.06				311.94		138.73
Wards Creek	4.175	50-Year	705.42	705.36	0.06				480.00		231.19
Wards Creek	4.175	100-Year	708.44	708.44	0.00			243.04	238.78	117.28	699.76
Wards Creek	4.175	500-Year	708.84	708.84	0.00			338.47	317.37	194.15	711.25
Wards Creek	4.148		Culvert								
Wards Creek	4.120	10-Year	696.20	695.82	0.38	3.29	0.07		311.94		71.13
Wards Creek	4.120	50-Year	697.35	696.75	0.60	3.60	0.15		480.00		83.26
Wards Creek	4.120	100-Year	697.95	697.15	0.81	3.78	0.26		599.10		91.30
Wards Creek	4.120	500-Year	699.06	697.74	1.33	4.06	0.53		850.00		103.29
Wards Creek	4.063	10-Year	692.84	692.60	0.24	1.61	0.03	2.36	309.54	0.03	49.29
Wards Creek	4.063	50-Year	693.59	693.30	0.29	1.58	0.04	41.09	438.25	0.66	145.57
Wards Creek	4.063	100-Year	693.91	693.63	0.28	1.52	0.03	105.18	492.56	1.36	150.18
Wards Creek	4.063	500-Year	694.47	694.21	0.27	1.38	0.02	260.57	586.12	3.31	158.18

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
Wards Creek	4.183 Culvert #1	10-Year	703.90	703.90	703.74	703.90	704.20	47.15	236.59	2.32	6.67	8.34
Wards Creek	4.183 Culvert #2	10-Year	703.90	703.90	701.91	703.90	704.20	25.02	236.59	2.32	7.96	7.96
Wards Creek	4.183 Culvert #3	10-Year	703.90	703.90	696.25	703.88	704.20	3.18	236.59	2.32	5.88	5.88
Wards Creek	4.183 Culvert #1	50-Year	705.51	705.51	701.14	705.51	704.20	10.52	464.70	0.07	1.49	1.49
Wards Creek	4.183 Culvert #2	50-Year	705.51	705.51	699.52	705.51	704.20	4.24	464.70	0.07	1.35	1.35
Wards Creek	4.183 Culvert #3	50-Year	705.51	705.51	695.03	705.51	704.20	0.54	464.70	0.07	1.00	1.00
Wards Creek	4.183 Culvert #1	100-Year	708.44	708.44	700.34	708.44	704.20	2.60	594.48	0.01	0.37	0.37
Wards Creek	4.183 Culvert #2	100-Year	708.44	708.44	699.12	708.45	704.20	1.66	594.48	0.01	0.53	0.53
Wards Creek	4.183 Culvert #3	100-Year	708.44	708.44	694.94	708.47	704.20	0.36	594.48	0.01	0.66	0.66
Wards Creek	4.183 Culvert #1	500-Year	708.85	708.85	700.45	708.85	704.20	3.45	844.20	0.01	0.49	0.49
Wards Creek	4.183 Culvert #2	500-Year	708.85	708.85	699.21	708.86	704.20	2.13	844.20	0.01	0.68	0.68
Wards Creek	4.183 Culvert #3	500-Year	708.85	708.85	694.86	708.85	704.20	0.23	844.20	0.01	0.42	0.42
Wards Creek	4.148 Culvert #1	10-Year	701.56	701.50	701.26	701.56	708.33	311.94		5.68	11.87	14.68
Wards Creek	4.148 Culvert #1	50-Year	705.42	705.36	705.42	704.04	708.33	480.00		8.61	13.33	17.35
Wards Creek	4.148 Culvert #1	100-Year	708.44	708.44	708.44	706.71	708.33	585.66	18.22	11.29	16.27	19.27
Wards Creek	4.148 Culvert #1	500-Year	708.84	708.84	708.93	708.84	708.33	644.27	205.73	11.10	17.90	17.90

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Wards Creek	4.515		Inl Struct									
Wards Creek	4.514	10-Year	709.63	709.50	706.12	0.01	0.03	33.61		249.01		2.87
Wards Creek	4.514	50-Year	712.38	712.34	706.85	0.00	0.09	60.67	6.01	392.45	1.54	1.65
Wards Creek	4.514	100-Year	713.50	713.47	707.18	0.00	0.03	134.51	19.64	433.82	23.84	1.54
Wards Creek	4.514	500-Year	714.33	714.28	708.00	0.00	0.01	193.65	45.75	568.08	76.17	1.81
Wards Creek	4.508 BR U	10-Year	709.60	709.37	706.44	0.41	0.03	12.35		249.01		3.82
Wards Creek	4.508 BR U	50-Year	712.28	711.93	707.30	0.91	0.02	7.29		399.80	0.20	4.78
Wards Creek	4.508 BR U	100-Year	713.47	713.35	707.70	0.90	0.14	124.21	7.19	381.11	89.00	3.01
Wards Creek	4.508 BR U	500-Year	714.31	714.23	708.68	0.33	0.03	190.52	51.40	413.68	224.93	2.56
Wards Creek	4.508 BR D	10-Year	709.16	708.85	706.71	0.05	0.06	12.47		249.01		4.48
Wards Creek	4.508 BR D	50-Year	711.35	710.92	707.56	0.04	0.11			400.00		5.29
Wards Creek	4.508 BR D	100-Year	712.43	711.85	707.95	0.02	0.25	29.52	0.01	477.29		6.14
Wards Creek	4.508 BR D	500-Year	713.95	713.77	708.96	0.01	0.05	119.53	59.25	513.12	117.63	3.78
Wards Creek	4.502	10-Year	709.06	708.86	706.47	0.45	0.08	32.92		249.01		3.51
Wards Creek	4.502	50-Year	711.21	710.98	707.19	0.34	0.09	40.70		400.00		3.78
Wards Creek	4.502	100-Year	712.16	712.08	707.50	0.21	0.02	56.52	0.42	456.88	20.00	2.30
Wards Creek	4.502	500-Year	713.89	713.81	708.35	0.18	0.02	121.06	16.05	616.61	57.34	2.46
Wards Creek	4.421	10-Year	708.53	708.49	703.42	0.02	0.08	37.15		249.01		1.47
Wards Creek	4.421	50-Year	710.77	710.73	704.09	0.01	0.13	50.76		400.00		1.66
Wards Creek	4.421	100-Year	711.92	711.89	704.39	0.01	0.18	73.68	7.10	462.24	7.96	1.50
Wards Creek	4.421	500-Year	713.68	713.65	705.15	0.01	0.09	98.84	61.59	604.42	23.99	1.61
Wards Creek	4.415 BR U	10-Year	708.43	708.13	704.14	0.49	0.04	7.87		249.01		4.39
Wards Creek	4.415 BR U	50-Year	710.63	710.16	705.29	0.70	0.06	7.80		400.00		5.51
Wards Creek	4.415 BR U	100-Year	711.73	711.11	705.81	1.05	0.06			477.30		6.34
Wards Creek	4.415 BR U	500-Year	713.58	713.23	707.14	1.31	0.35	95.53	88.21	589.62	12.16	4.99
Wards Creek	4.415 BR D	10-Year	707.91	707.49	704.42	0.04	0.15	7.58		249.01		5.19
Wards Creek	4.415 BR D	50-Year	709.87	709.20	705.60	0.05	0.25	7.51		400.00		6.56
Wards Creek	4.415 BR D	100-Year	710.62	709.80	706.15	0.06	0.31	7.49		477.30		7.30
Wards Creek	4.415 BR D	500-Year	711.92	710.41	707.52	0.09	0.57	7.47		690.00		9.86
Wards Creek	4.410	10-Year	707.71	707.60	703.42			36.11		249.01		2.68
Wards Creek	4.410	50-Year	709.57	709.40	704.18			39.72		400.00		3.33
Wards Creek	4.410	100-Year	710.26	710.05	704.54			41.01		477.30		3.68
Wards Creek	4.410	500-Year	711.25	710.89	705.42			42.70		690.00		4.85

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Wards Creek	4.409		Inl Struct									
Wards Creek	4.365	10-Year	706.09	706.03	702.78	0.23	0.00	46.23	1.42	211.32	36.27	2.05
Wards Creek	4.365	50-Year	709.14	709.11	703.50	0.08	0.00	84.42	27.58	290.07	82.36	1.69
Wards Creek	4.365	100-Year	709.79	709.75	703.81	0.07	0.00	95.20	41.20	332.47	103.62	1.79
Wards Creek	4.365	500-Year	710.46	710.40	704.52	0.11	0.00	108.73	68.63	461.62	159.75	2.30
Wards Creek	4.332	10-Year	705.85	705.76	702.27	0.02	0.16	29.76		249.01		2.46
Wards Creek	4.332	50-Year	709.07	709.03	702.96	0.01	0.36	103.86	20.18	353.45	26.37	1.72
Wards Creek	4.332	100-Year	709.72	709.68	703.27	0.01	0.02	125.74	37.25	396.49	43.57	1.77
Wards Creek	4.332	500-Year	710.36	710.29	704.00	0.01	0.01	138.22	78.25	534.51	77.25	2.22
Wards Creek	4.327 BR U	10-Year	705.67	705.06	703.13	1.11	0.01	7.71		249.01		6.28
Wards Creek	4.327 BR U	50-Year	708.70	707.46	704.29	2.29	0.13	3.54		400.00		8.92
Wards Creek	4.327 BR U	100-Year	709.69	709.58	704.83	0.73	0.15	123.53	96.67	305.23	75.39	3.12
Wards Creek	4.327 BR U	500-Year	710.33	710.22	705.55	0.67	0.24	135.70	187.86	360.88	141.25	3.12
Wards Creek	4.327 BR D	10-Year	704.55	703.96	701.89	0.07	0.17	7.57		249.01		6.18
Wards Creek	4.327 BR D	50-Year	706.27	705.29	703.07	0.09	0.29	7.53		400.00		7.94
Wards Creek	4.327 BR D	100-Year	708.81	708.21	703.62	0.02	0.27	52.81	6.31	466.93	4.06	6.30
Wards Creek	4.327 BR D	500-Year	709.42	708.50	705.01	0.04	0.39	59.52	20.05	648.59	21.36	7.90
Wards Creek	4.322	10-Year	704.31	704.06	701.27	0.17	0.12	24.76		249.01		4.02
Wards Creek	4.322	50-Year	705.89	705.50	702.15	0.12	0.19	28.65		400.00		5.05
Wards Creek	4.322	100-Year	708.52	708.45	702.54	0.03	0.03	58.42	6.12	463.37	7.80	2.21
Wards Creek	4.322	500-Year	708.99	708.85	703.58	0.05	0.06	67.43	12.45	660.53	17.02	2.99
Wards Creek	4.274	10-Year	704.02	704.00	699.94	0.00	0.00	97.40	15.11	180.01	53.89	1.20
Wards Creek	4.274	50-Year	705.58	705.56	700.72	0.00	0.00	114.79	33.81	232.33	133.86	1.18
Wards Creek	4.274	100-Year	708.46	708.45	701.02	0.00	0.00	156.20	50.83	212.99	213.49	0.74
Wards Creek	4.274	500-Year	708.88	708.87	701.75	0.00	0.00	162.90	75.51	298.78	315.71	1.00
Wards Creek	4.2715 BR U	10-Year	704.02	703.98	699.94	0.04	0.01	96.99	23.92	115.59	109.50	1.23
Wards Creek	4.2715 BR U	50-Year	705.57	705.55	700.41	0.01	0.01	114.64	49.20	132.66	218.15	0.94
Wards Creek	4.2715 BR U	100-Year	708.46	708.45	700.48	0.00	0.00	156.16	66.86	117.30	293.14	0.51
Wards Creek	4.2715 BR U	500-Year	708.88	708.86	703.15	0.00	0.00	162.82	98.37	164.39	427.24	0.68
Wards Creek	4.2715 BR D	10-Year	703.96	703.89	702.64	0.01	0.02	73.31	54.12	99.84	95.05	1.69
Wards Creek	4.2715 BR D	50-Year	705.55	705.51	702.97	0.00	0.01	102.36	97.05	117.89	185.06	1.28

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Wards Creek	4.2715 BR D	100-Year	708.46	708.45	703.12	0.00	0.00	156.01	123.86	93.37	260.07	0.61
Wards Creek	4.2715 BR D	500-Year	708.87	708.85	703.52	0.00	0.00	164.03	180.72	129.44	379.84	0.81
Wards Creek	4.269	10-Year	703.94	703.90	700.91	0.01	0.02	73.43	39.51	167.02	42.49	1.75
Wards Creek	4.269	50-Year	705.55	705.51	701.59	0.01	0.01	102.41	72.05	220.04	107.91	1.72
Wards Creek	4.269	100-Year	708.46	708.45	701.96	0.01	0.00	156.01	100.12	186.56	190.63	0.99
Wards Creek	4.269	500-Year	708.87	708.85	702.63	0.01	0.01	164.03	147.29	259.36	283.35	1.32
Wards Creek	4.229	10-Year	703.91	703.91	697.73	0.00	0.00	118.65	10.39	234.42	4.20	0.46
Wards Creek	4.229	50-Year	705.52	705.51	698.03	0.00	0.00	135.22	23.70	361.58	14.72	0.57
Wards Creek	4.229	100-Year	708.45	708.44	698.17	0.00	0.00	164.61	40.16	394.08	43.06	0.45
Wards Creek	4.229	500-Year	708.85	708.85	698.50	0.00	0.00	169.91	58.46	563.51	68.02	0.63
Wards Creek	4.213	10-Year	703.91	703.90	698.78	0.00	0.00	159.32	28.44	104.94	115.63	0.73
Wards Creek	4.213	50-Year	705.51	705.51	699.40	0.00	0.00	196.37	48.79	129.78	221.43	0.72
Wards Creek	4.213	100-Year	708.45	708.44	699.69	0.00	0.00	260.41	65.09	109.19	303.02	0.45
Wards Creek	4.213	500-Year	708.85	708.85	700.29	0.00	0.00	268.13	95.20	151.73	443.07	0.60
Wards Creek	4.2115 BR U	10-Year	703.90	703.90	698.76	0.00	0.00	159.22	22.99	49.38	176.64	0.50
Wards Creek	4.2115 BR U	50-Year	705.51	705.51	699.33	0.00	0.00	196.28	45.81	57.49	296.70	0.43
Wards Creek	4.2115 BR U	100-Year	708.45	708.44	699.40	0.00	0.00	260.40	65.71	47.68	363.91	0.24
Wards Creek	4.2115 BR U	500-Year	708.85	708.85	701.85	0.00	0.00	268.11	96.38	66.31	527.31	0.32
Wards Creek	4.2115 BR D	10-Year	703.90	703.89	696.91	0.00	0.00	157.68	13.68	80.55	154.79	0.60
Wards Creek	4.2115 BR D	50-Year	705.51	705.51	697.78	0.00	0.00	196.25	35.92	83.78	280.30	0.50
Wards Creek	4.2115 BR D	100-Year	708.45	708.44	698.14	0.00	0.00	260.40	59.25	61.62	356.43	0.27
Wards Creek	4.2115 BR D	500-Year	708.85	708.85	698.94	0.00	0.00	268.10	87.58	84.75	517.67	0.35
Wards Creek	4.210	10-Year	703.90	703.90	697.31	0.00	0.00	159.22	31.69	151.45	128.80	0.87
Wards Creek	4.210	50-Year	705.51	705.51	698.14	0.00	0.00	196.28	54.64	177.45	247.91	0.85
Wards Creek	4.210	100-Year	708.45	708.44	698.64	0.00	0.00	260.40	79.10	151.73	368.27	0.55
Wards Creek	4.210	500-Year	708.85	708.85	699.47	0.00	0.00	268.11	113.87	206.17	529.96	0.73
Wards Creek	4.185	10-Year	703.90	703.90	694.78			220.52	24.91	231.69	55.33	0.35
Wards Creek	4.185	50-Year	705.51	705.51	695.32			248.04	48.06	334.21	97.73	0.42
Wards Creek	4.185	100-Year	708.44	708.44	695.64			312.73	79.63	377.09	142.38	0.36
Wards Creek	4.185	500-Year	708.85	708.85	696.20			322.03	116.40	527.74	205.86	0.49

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. US.	Min El Prs	BR Open Area	Prs O WS	Q Total	Min El Weir Flow	Q Weir	Delta EG
			(ft)	(ft)	(sq ft)	(ft)	(cfs)	(ft)	(cfs)	(ft)
Wards Creek	4.508	10-Year	709.63	710.86	75.58		249.01	711.80		0.58
Wards Creek	4.508	50-Year	712.38	710.86	75.58		400.00	711.80		1.17
Wards Creek	4.508	100-Year	713.50	710.86	75.58		477.30	711.80		1.34
Wards Creek	4.508	500-Year	714.33	710.86	75.58		690.00	711.80		0.44
Wards Creek	4.415	10-Year	708.53	710.56	71.04		249.01	712.00		0.82
Wards Creek	4.415	50-Year	710.77	710.56	71.04		400.00	712.00		1.20
Wards Creek	4.415	100-Year	711.92	710.56	71.04		477.30	712.00		1.67
Wards Creek	4.415	500-Year	713.68	710.56	71.04		690.00	712.00		2.43
Wards Creek	4.327	10-Year	705.85	706.10	44.71		249.01	707.41		1.54
Wards Creek	4.327	50-Year	709.07	706.10	44.71		400.00	707.41		3.18
Wards Creek	4.327	100-Year	709.72	706.10	44.71		477.30	707.41		1.19
Wards Creek	4.327	500-Year	710.36	706.10	44.71		690.00	707.41		1.37
Wards Creek	4.2715	10-Year	704.02	700.67	23.67		249.01	702.04		0.08
Wards Creek	4.2715	50-Year	705.58	700.67	23.67		400.00	702.04		0.03
Wards Creek	4.2715	100-Year	708.46	700.67	23.67		477.30	702.04		0.00
Wards Creek	4.2715	500-Year	708.88	700.67	23.67		690.00	702.04		0.01
Wards Creek	4.2115	10-Year	703.91	699.63	49.81		249.01	701.30		0.00
Wards Creek	4.2115	50-Year	705.51	699.63	49.81		400.00	701.30		0.00
Wards Creek	4.2115	100-Year	708.45	699.63	49.81		477.30	701.30		0.00
Wards Creek	4.2115	500-Year	708.85	699.63	49.81		690.00	701.30		0.00

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.532	10-Year	709.72	709.70	0.02	0.05	0.00	11.72	202.67	34.61	214.77
Wards Creek	4.532	50-Year	712.43	712.42	0.01	0.02	0.00	66.76	237.96	95.28	396.37
Wards Creek	4.532	100-Year	713.52	713.52	0.01	0.01	0.00	117.07	245.21	115.02	538.15
Wards Creek	4.532	500-Year	714.37	714.36	0.01	0.02	0.00	215.48	310.07	164.46	622.48
Wards Creek	4.516	10-Year	709.67	709.61	0.06				249.01		34.22
Wards Creek	4.516	50-Year	712.41	712.37	0.04			6.19	392.21	1.60	60.99
Wards Creek	4.516	100-Year	713.51	713.47	0.03			19.75	433.43	24.12	134.98
Wards Creek	4.516	500-Year	714.35	714.31	0.04			46.26	566.11	77.63	194.59
Wards Creek	4.515		Inl Struct								
Wards Creek	4.514	10-Year	709.63	709.50	0.13	0.01	0.03		249.01		33.61
Wards Creek	4.514	50-Year	712.38	712.34	0.04	0.00	0.09	6.01	392.45	1.54	60.67
Wards Creek	4.514	100-Year	713.50	713.47	0.03	0.00	0.03	19.64	433.82	23.84	134.51
Wards Creek	4.514	500-Year	714.33	714.28	0.04	0.00	0.01	45.75	568.08	76.17	193.65
Wards Creek	4.508		Bridge								
Wards Creek	4.415		Bridge								
Wards Creek	4.410	10-Year	707.71	707.60	0.11				249.01		36.11
Wards Creek	4.410	50-Year	709.57	709.40	0.17				400.00		39.72
Wards Creek	4.410	100-Year	710.26	710.05	0.21				477.30		41.01
Wards Creek	4.410	500-Year	711.25	710.89	0.36				690.00		42.70
Wards Creek	4.409		Inl Struct								
Wards Creek	4.408	10-Year	706.43	706.32	0.11	0.32	0.03		249.01		33.55
Wards Creek	4.408	50-Year	709.32	709.20	0.12	0.14	0.04		400.00		39.32
Wards Creek	4.408	100-Year	709.98	709.84	0.14	0.14	0.05		477.30		40.61
Wards Creek	4.408	500-Year	710.78	710.53	0.25	0.22	0.10		690.00		41.97
Wards Creek	4.365	10-Year	706.09	706.03	0.06	0.23	0.00	1.42	211.32	36.27	46.23
Wards Creek	4.365	50-Year	709.14	709.11	0.03	0.08	0.00	27.58	290.07	82.36	84.42

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Wards Creek	4.365	100-Year	709.79	709.75	0.04	0.07	0.00	41.20	332.47	103.62	95.20
Wards Creek	4.365	500-Year	710.46	710.40	0.06	0.11	0.00	68.63	461.62	159.75	108.73

HEC-RAS Plan: 02 River: Sawmill Creek Tr Reach: Wards Creek

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Q Total	Q Weir	Q Gates
			(ft)	(ft)	(cfs)	(cfs)	(cfs)
Wards Creek	4.515	10-Year	709.67	709.61	249.01	249.01	
Wards Creek	4.515	50-Year	712.41	712.37	400.00	400.00	
Wards Creek	4.515	100-Year	713.51	713.47	477.30	477.30	
Wards Creek	4.515	500-Year	714.35	714.31	690.00	690.00	
Wards Creek	4.409	10-Year	707.71	707.60	249.01	249.01	
Wards Creek	4.409	50-Year	709.57	709.40	400.00	400.00	
Wards Creek	4.409	100-Year	710.26	710.05	477.30	477.30	
Wards Creek	4.409	500-Year	711.25	710.89	690.00	690.00	

Errors Warnings and Notes for Plan : 02

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.64866* Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.59033* Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.532 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.516 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.515 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.514 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 10-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 10-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.502 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.421 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 10-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 10-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.410 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.409 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.408 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.332 Profile: 10-Year
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 10-Year Upstream

Errors Warnings and Notes for Plan : 02 (Continued)

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 10-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.322 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.274 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 10-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 10-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.269 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.229 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.213 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 10-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 10-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.210 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.178 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.175 Profile: 10-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.148 Profile: 10-Year Culv: Culvert #1
Note:	The flow in the culvert is entirely supercritical.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.120 Profile: 10-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.063 Profile: 10-Year

Errors Warnings and Notes for Plan : 02 (Continued)

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.972 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 10-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.

Errors Warnings and Notes for Plan : 02

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.64866* Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.59033* Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.532 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.516 Profile: 50-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.515 Profile: 50-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.514 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 50-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 50-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.502 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.421 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 50-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 50-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.410 Profile: 50-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.409 Profile: 50-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.408 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.332 Profile: 50-Year
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 50-Year Upstream

Errors Warnings and Notes for Plan : 02 (Continued)

Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 50-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.322 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.274 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 50-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 50-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.269 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.213 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 50-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 50-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.210 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.178 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.175 Profile: 50-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.148 Profile: 50-Year Culv: Culvert #1
Warning:	Since the culvert has supercritical flow, the program should be run in mixed flow in order to check if the cross section
	downstream of the culvert has supercritical flow.
Note:	The flow in the culvert is entirely supercritical.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.120 Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

Errors Warnings and Notes for Plan : 02 (Continued)

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.063 Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.972 Profile: 50-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 50-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.

Errors Warnings and Notes for Plan : 02

Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.64866* Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.59033* Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.532 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.516 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.515 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.514 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 100-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 100-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.502 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.421 Profile: 100-Year
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 100-Year Upstream
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 100-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.410 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.409 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.408 Profile: 100-Year

Errors Warnings and Notes for Plan : 02 (Continued)

Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.332 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 100-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 100-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.322 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.274 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 100-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 100-Year Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.269 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.213 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 100-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 100-Year Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.210 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 100-Year
Warning:	The weir over culvert is submerged.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.175 Profile: 100-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.148 Profile: 100-Year Culv: Culvert #1
Warning:	During the supercritical analysis, the program could not converge on a supercritical answer in the downstream cross
	section. The program used the solution with the least error.
Warning:	During the culvert outlet control computations, the program could not balance the culvert/weir flow. The reported outlet
	energy grade answer may not be valid.
Note:	Culvert critical depth exceeds the height of the culvert.
Note:	The flow in the culvert is entirely supercritical.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.120 Profile: 100-Year
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.063 Profile: 100-Year

Errors Warnings and Notes for Plan : 02 (Continued)

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.032 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.972 Profile: 100-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 100-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.

Errors Warnings and Notes for Plan : 02

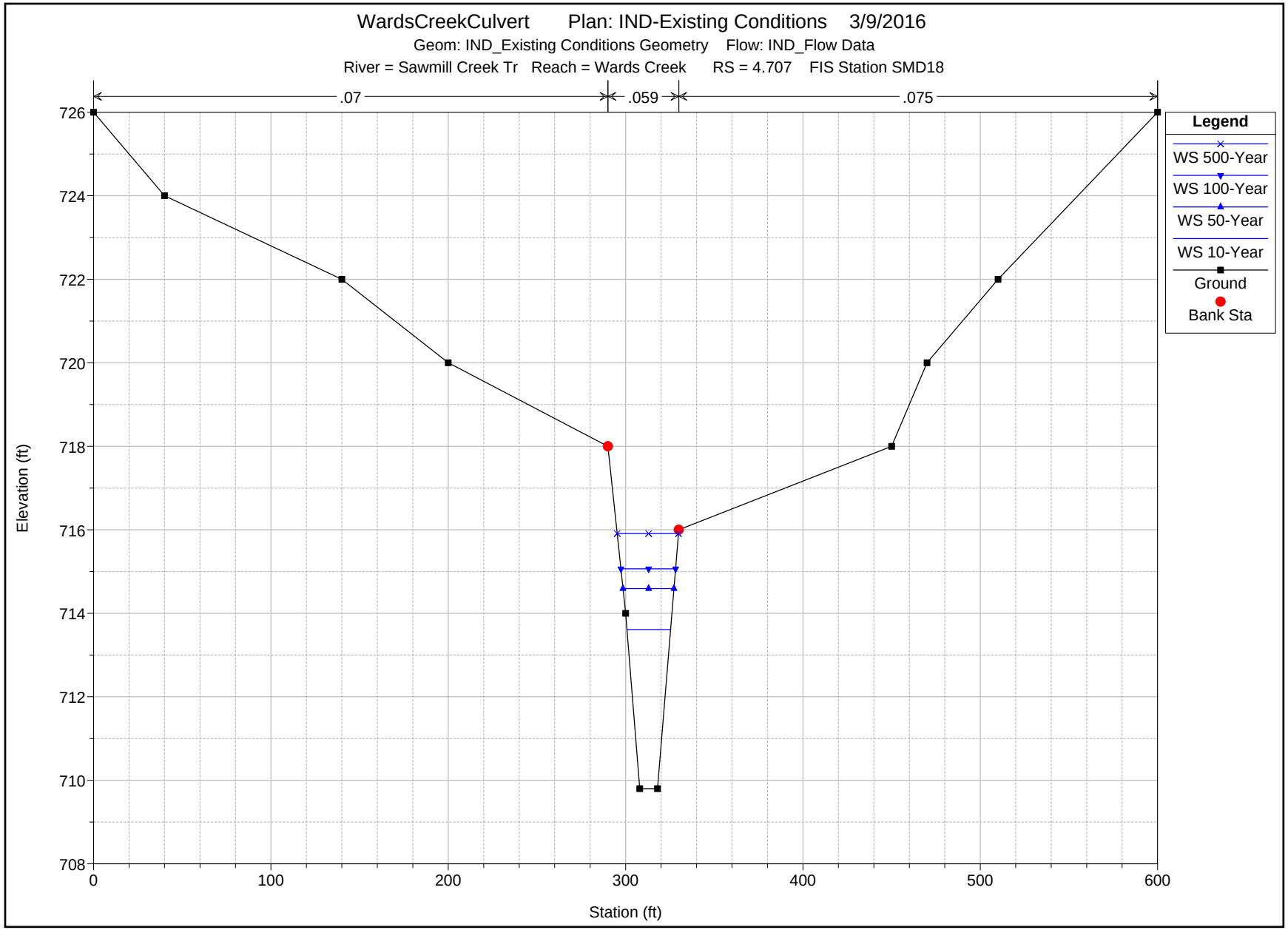
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.707 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.64866* Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.59033* Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.532 Profile: 500-Year
Warning:	The cross-section end points had to be extended vertically for the computed water surface.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.516 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.515 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.514 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 500-Year Upstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.508 Profile: 500-Year Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.502 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.421 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 500-Year Upstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.415 Profile: 500-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.410 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.409 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.408 Profile: 500-Year

Errors Warnings and Notes for Plan : 02 (Continued)

Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.332 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 500-Year Upstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.327 Profile: 500-Year Downstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.322 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.274 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 500-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2715 Profile: 500-Year Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.269 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.213 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 500-Year Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.2115 Profile: 500-Year Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.210 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.183 Profile: 500-Year
Warning:	The weir over culvert is submerged.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.175 Profile: 500-Year
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.148 Profile: 500-Year Culv: Culvert #1
Note:	The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height
	of the culvert.
Note:	Culvert critical depth exceeds the height of the culvert.
Note:	During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note:	The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations
	are not valid and the supercritical result has been discarded. The outlet answer will be used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.120 Profile: 500-Year
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

Errors Warnings and Notes for Plan : 02 (Continued)

	need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 4.063 Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.972 Profile: 500-Year
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.
Location:	River: Sawmill Creek Tr Reach: Wards Creek RS: 3.883 Profile: 500-Year
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
	This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
	need for additional cross sections.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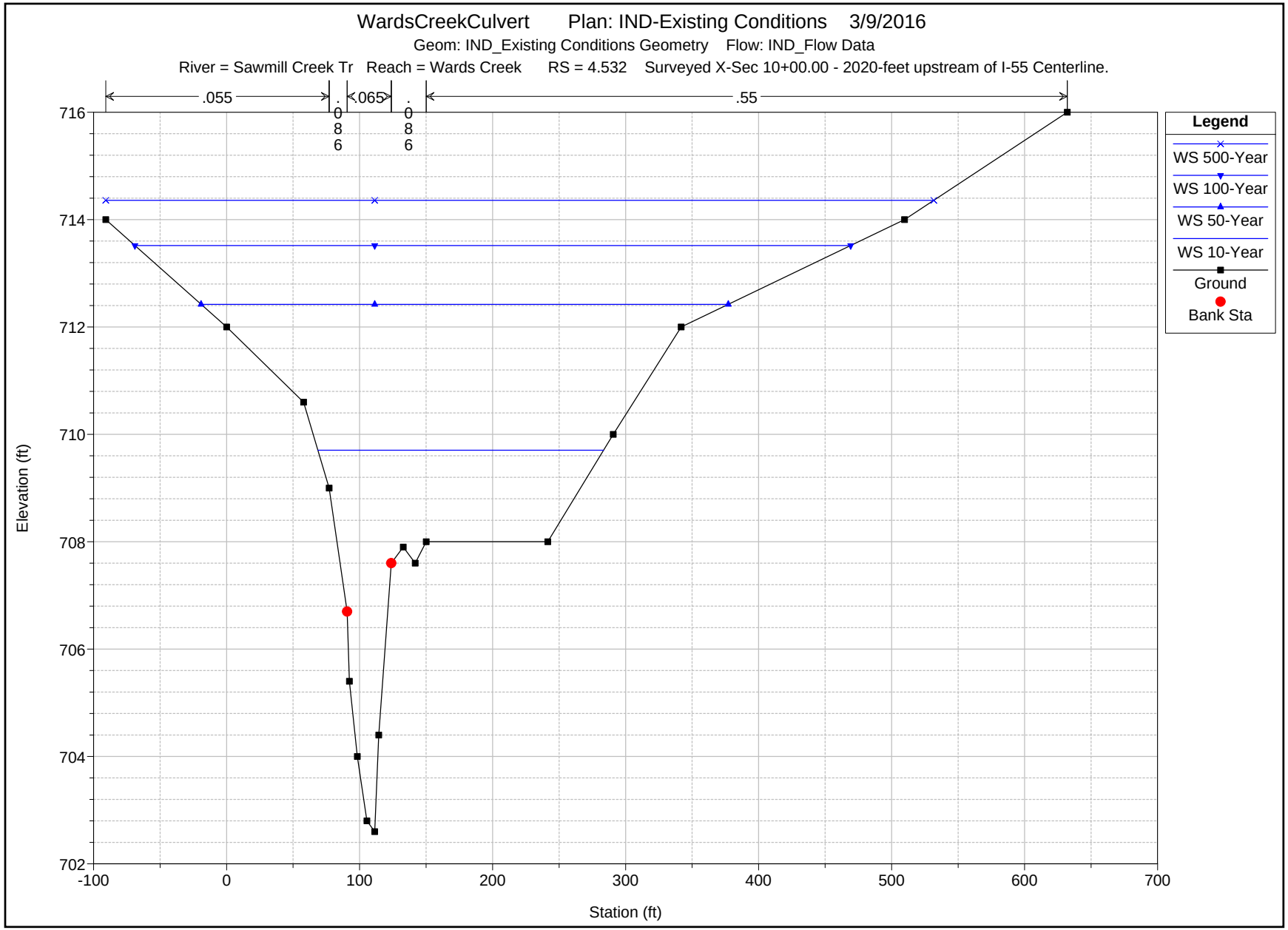
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.707 FIS Station SMD18
.07
.059
.075
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
726
724
722
720
718
716
714
712
710
708
0
100
200
300
400
500
600
Station (ft)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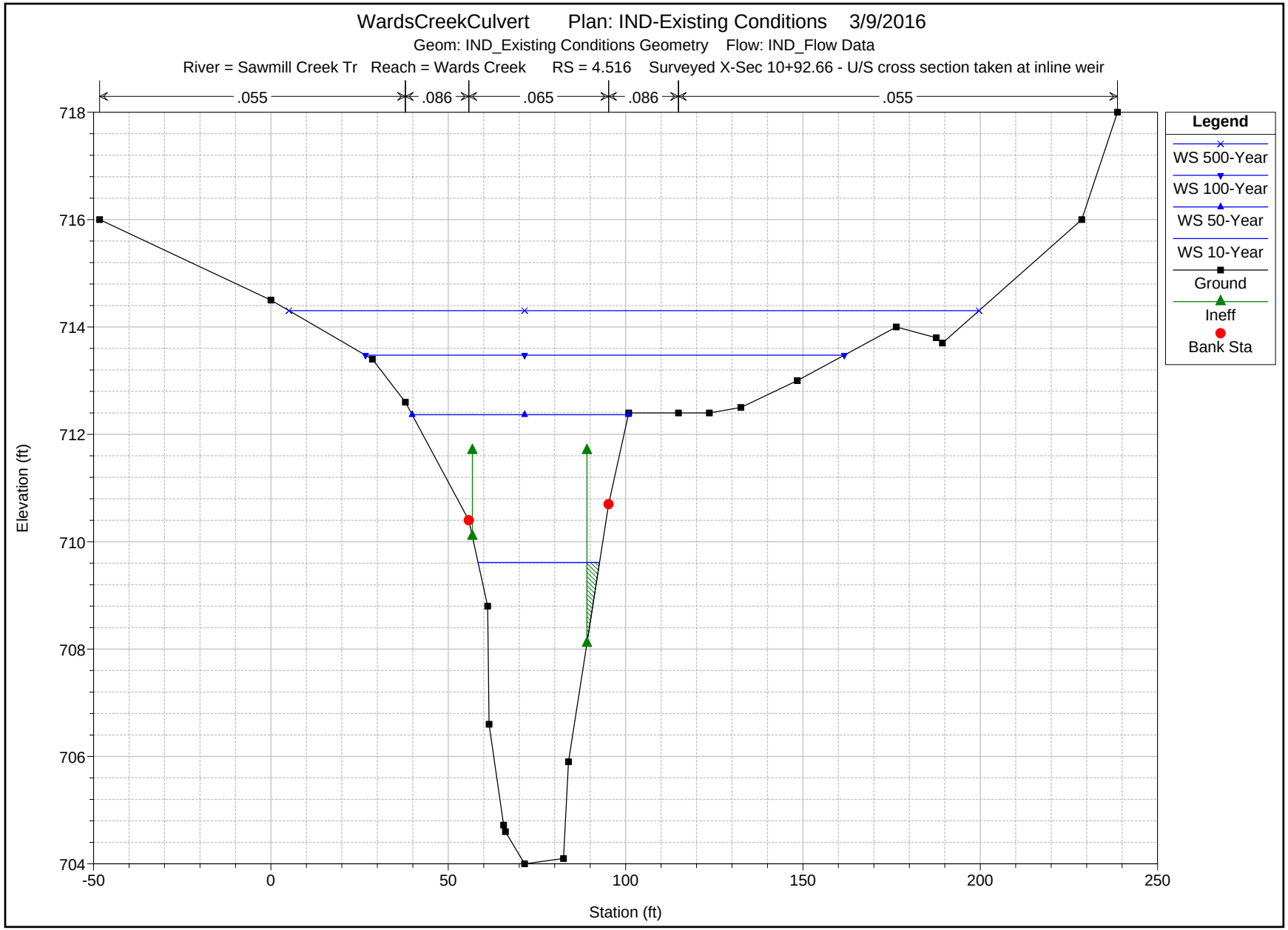
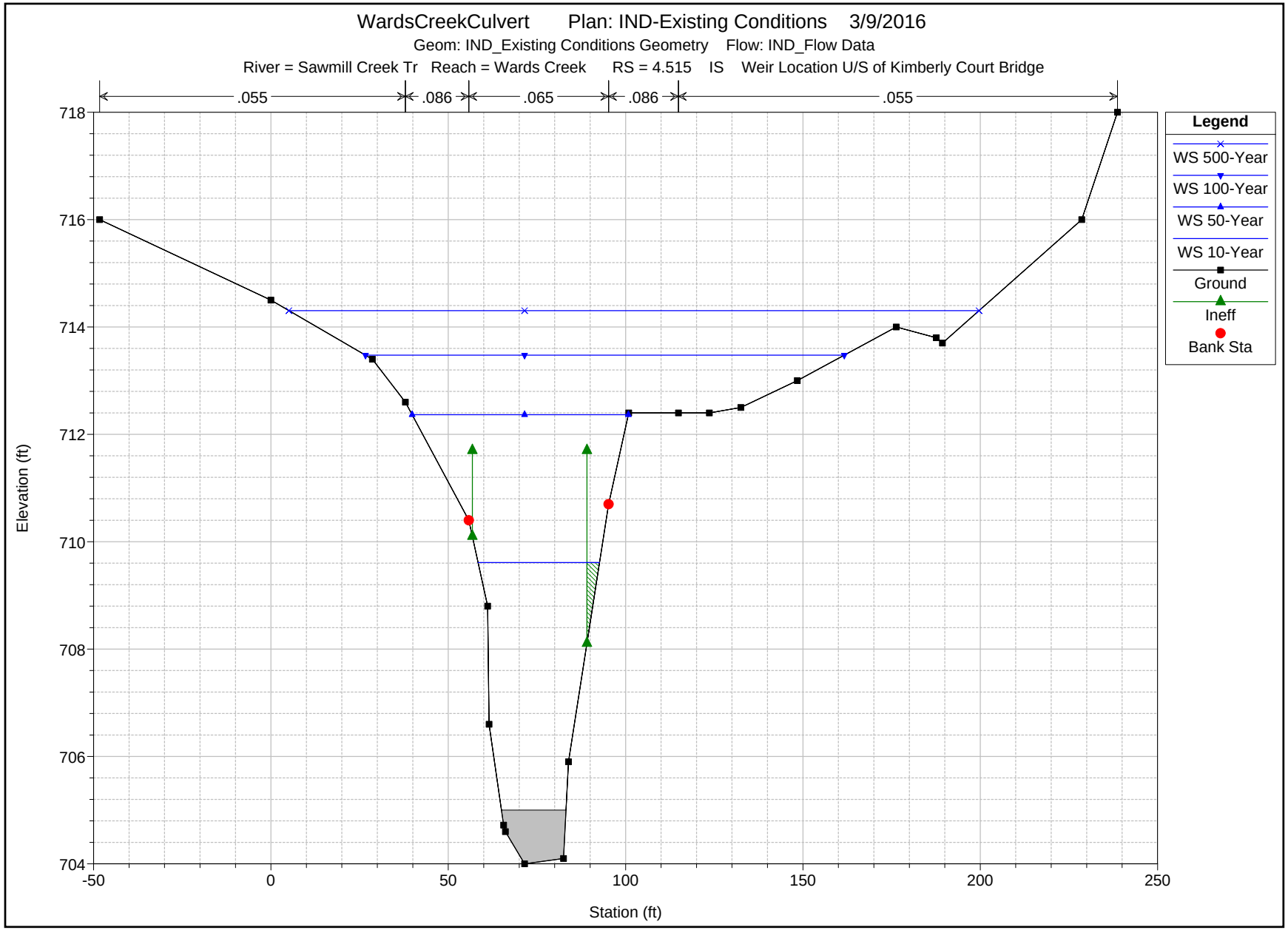
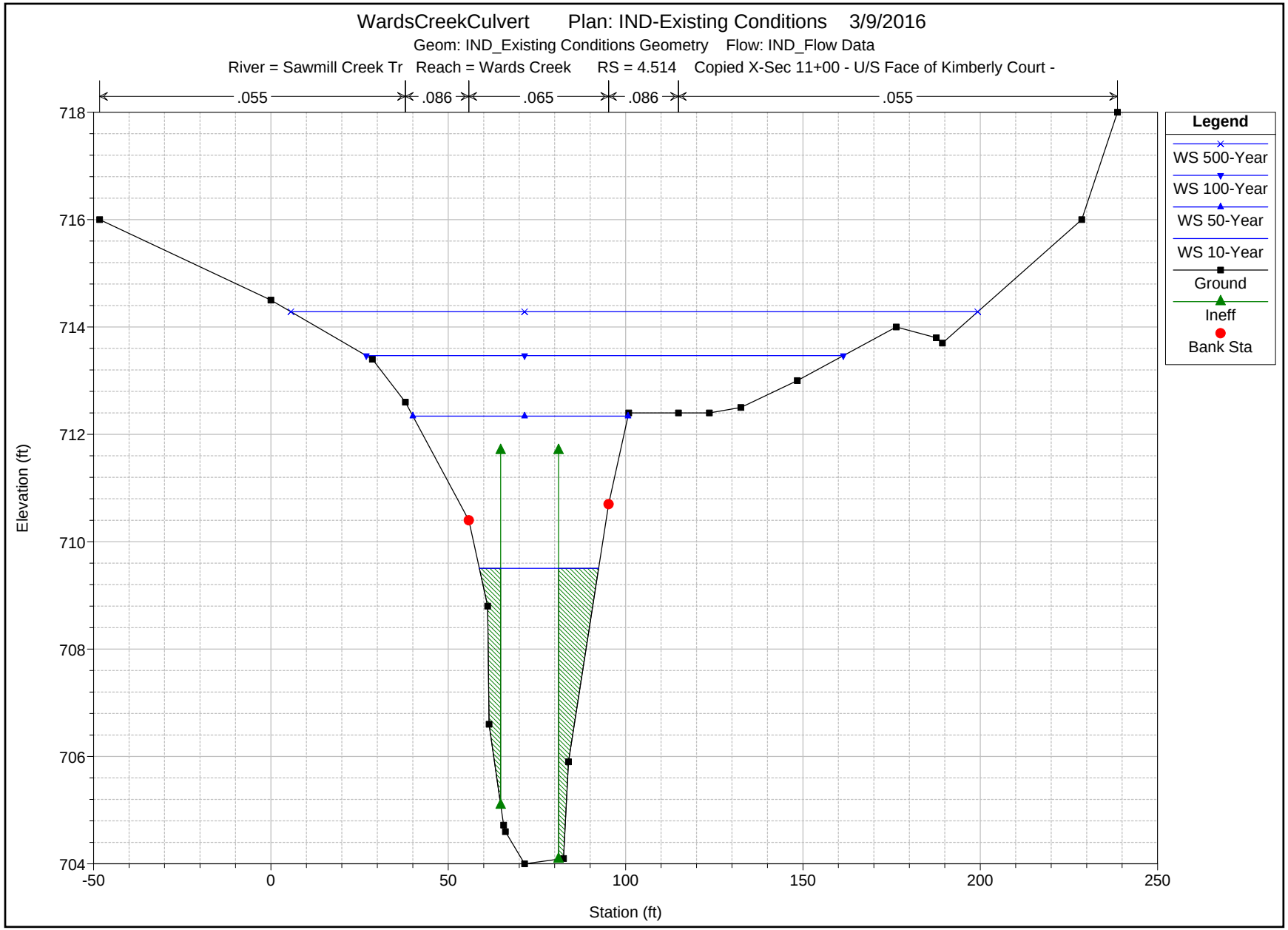
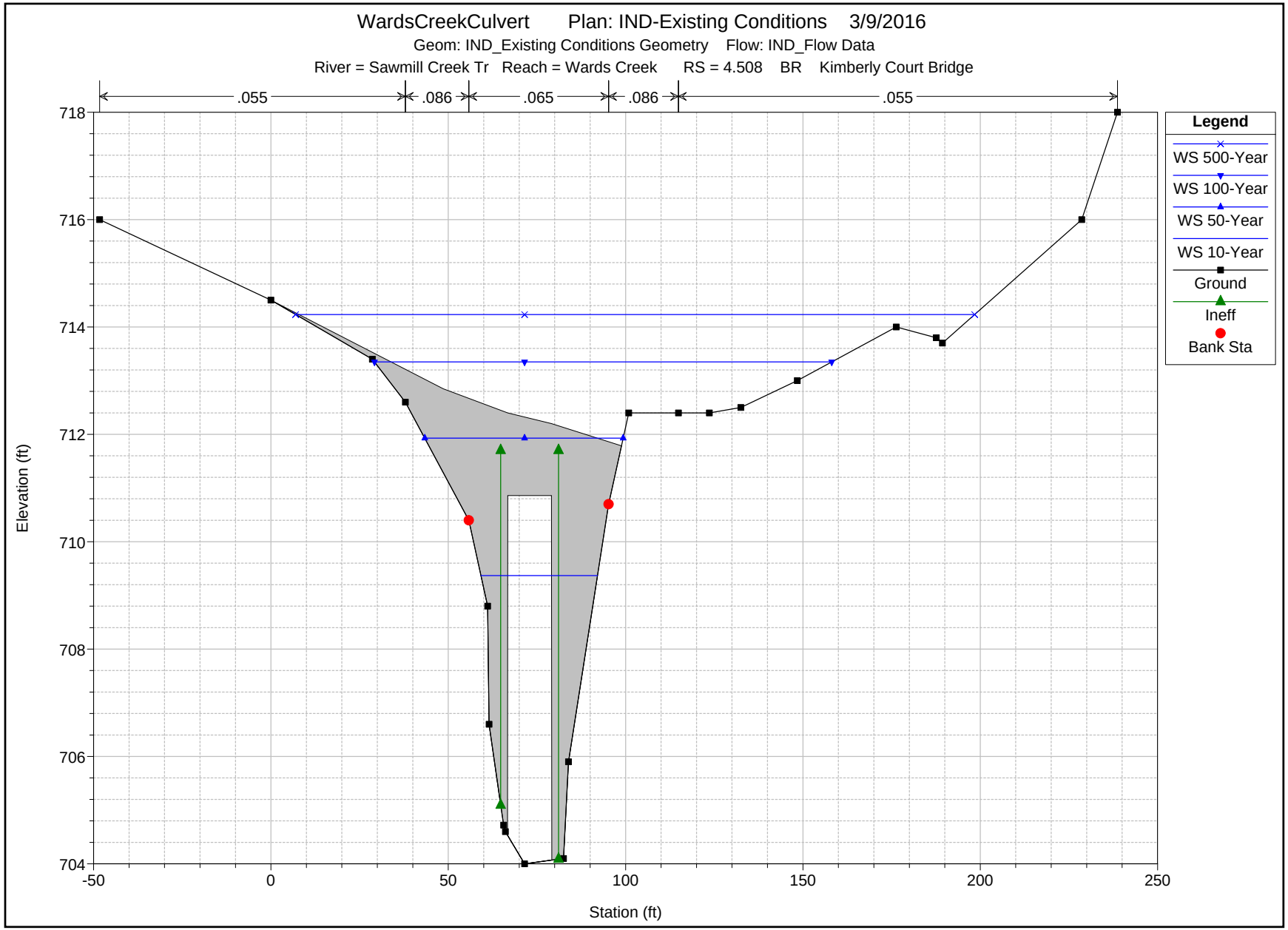
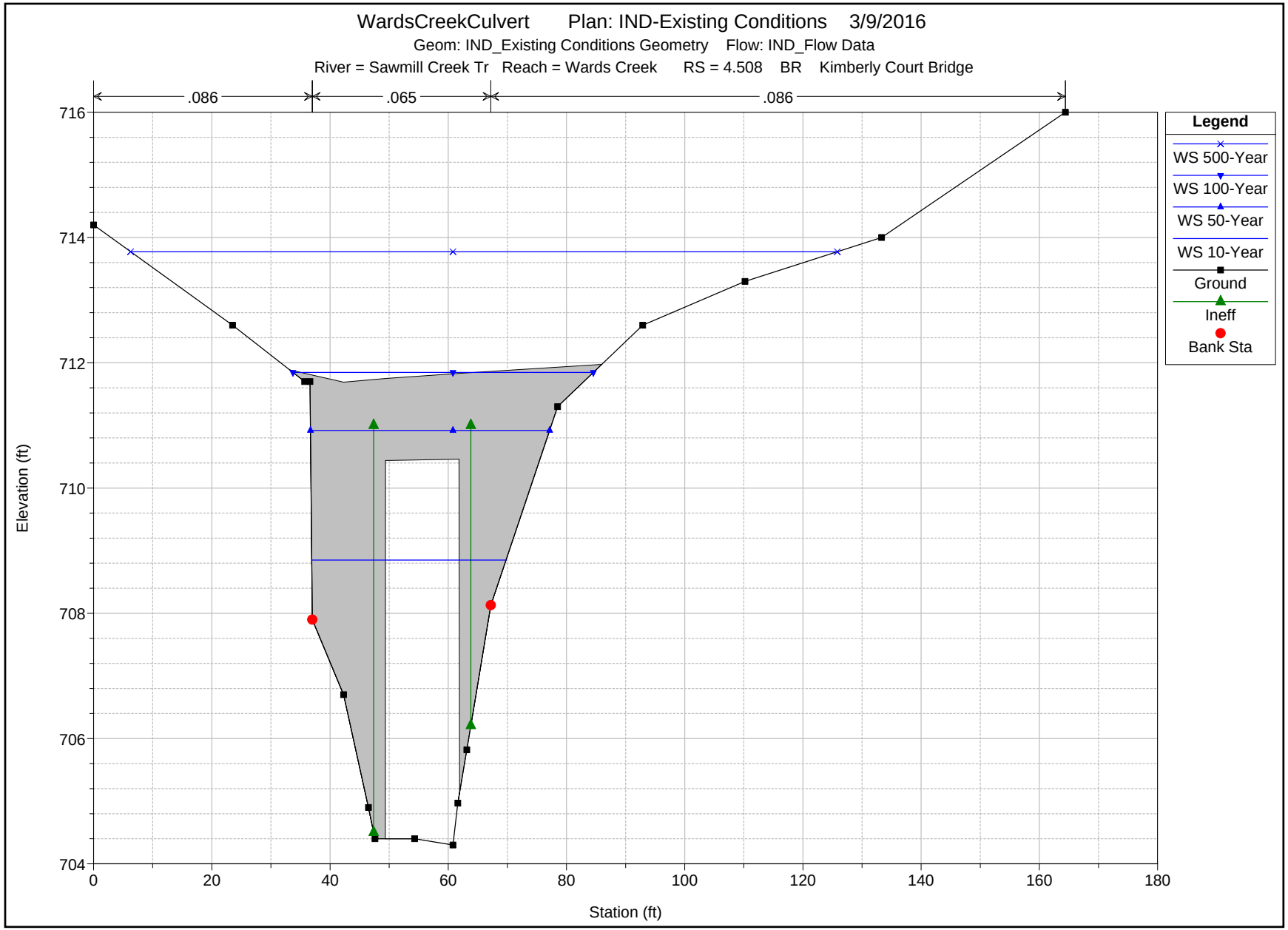
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.532 Surveyed X-Sec 10+00.00 - 2020-feet upstream of I-55 Centerline.
.055
.086
.065
.086
.55
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
716
714
712
710
708
706
704
702
-100
0
100
200
300
400
500
600
700
Station (ft)

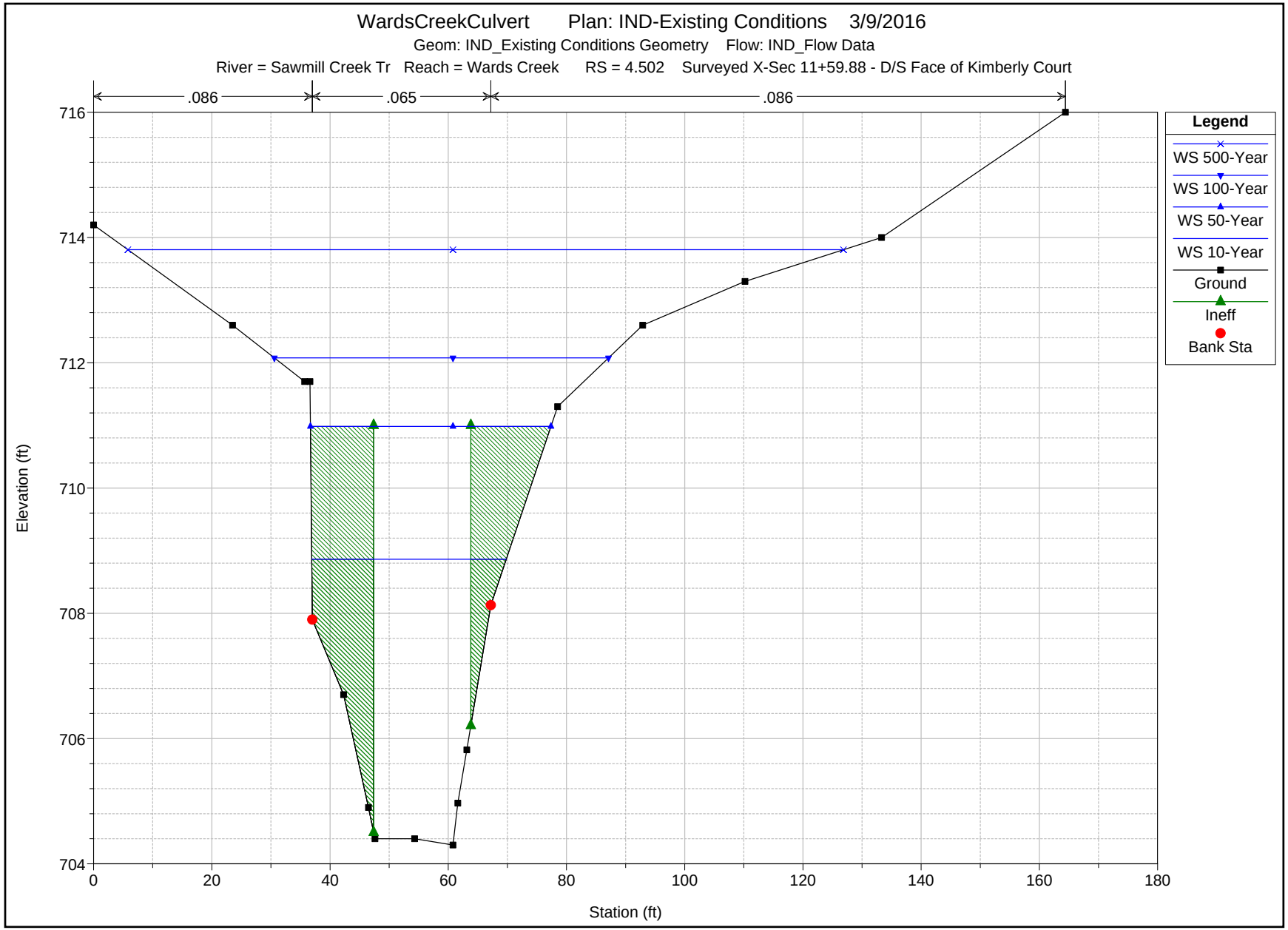

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.516 Surveyed X-Sec 10+92.66 - U/S cross section taken at inline weir
.055
.086
.065
.086
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
718
716
714
712
710
708
706
704
-50
0
50
100
150
200
250
Station (ft)

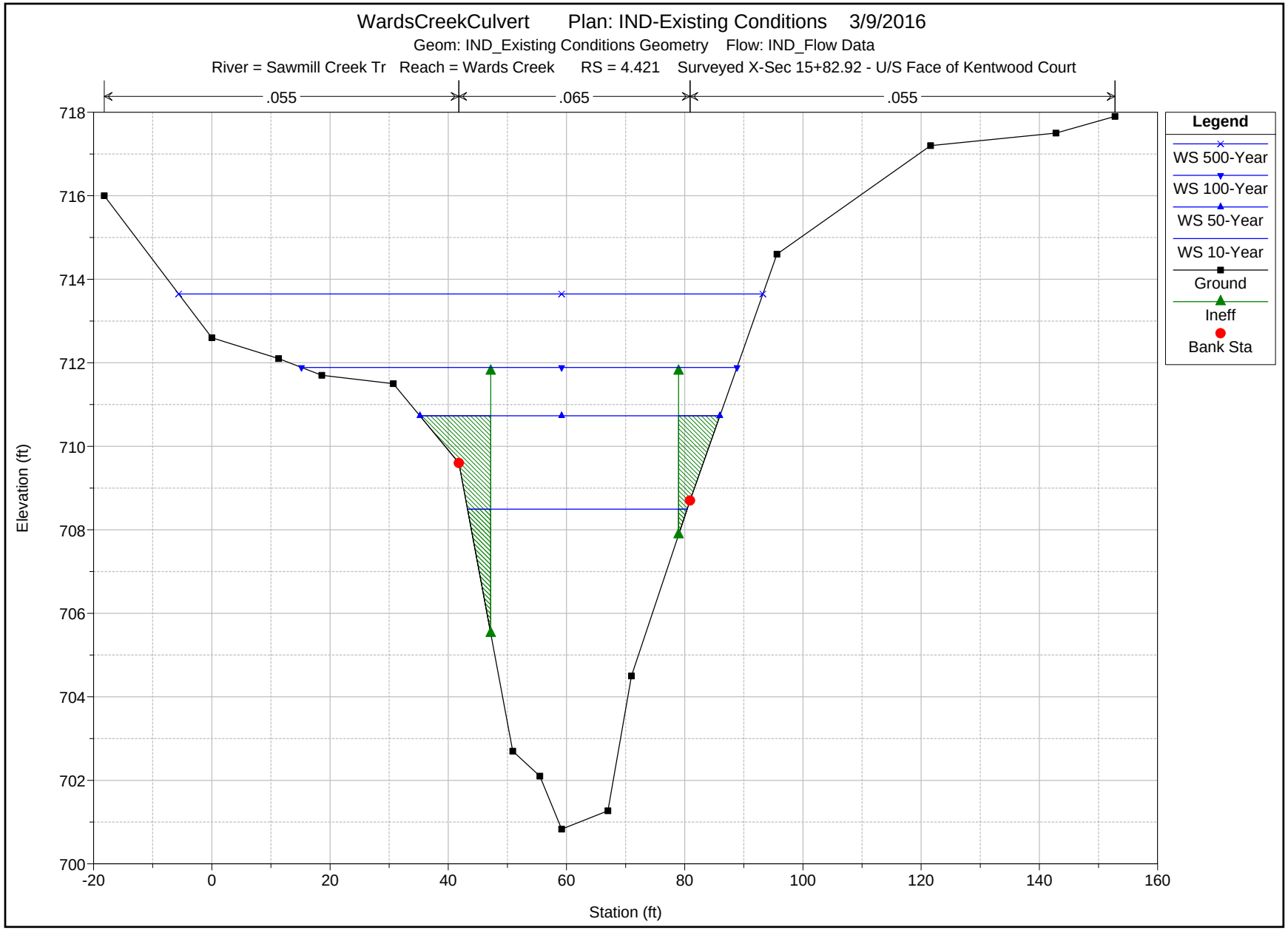

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.515 IS Weir Location U/S of Kimberly Court Bridge
.055
.086
.065
.086
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
718
716
714
712
710
708
706
704
-50
0
50
100
150
200
250
Station (ft)

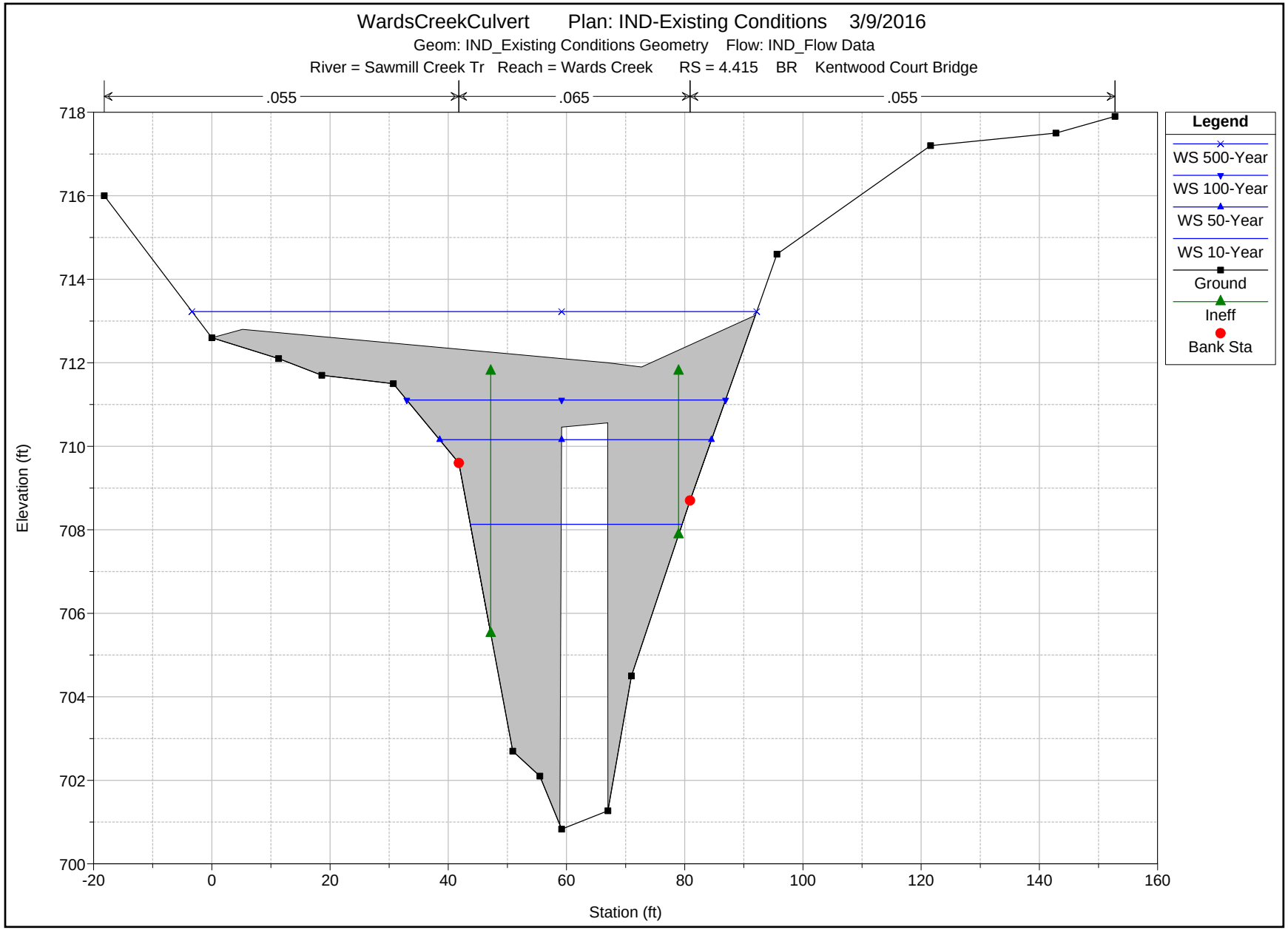

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.514 Copied X-Sec 11+00 - U/S Face of Kimberly Court -
.055
.086
.065
.086
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
718
716
714
712
710
708
706
704
-50
0
50
100
150
200
250
Station (ft)


WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.508 BR Kimberly Court Bridge
.055
.086
.065
.086
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
718
716
714
712
710
708
706
704
-50
0
50
100
150
200
250
Station (ft)


WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.508 BR Kimberly Court Bridge
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
716
714
712
710
708
706
704
0
20
40
60
80
100
120
140
160
180
Station (ft)


WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.502 Surveyed X-Sec 11+59.88 - D/S Face of Kimberly Court
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
716
714
712
710
708
706
704
0
20
40
60
80
100
120
140
160
180
Station (ft)


WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.421 Surveyed X-Sec 15+82.92 - U/S Face of Kentwood Court
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
702
700
-20
0
20
40
60
80
100
120
140
160


WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.415 BR Kentwood Court Bridge
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
702
700
-20
0
20
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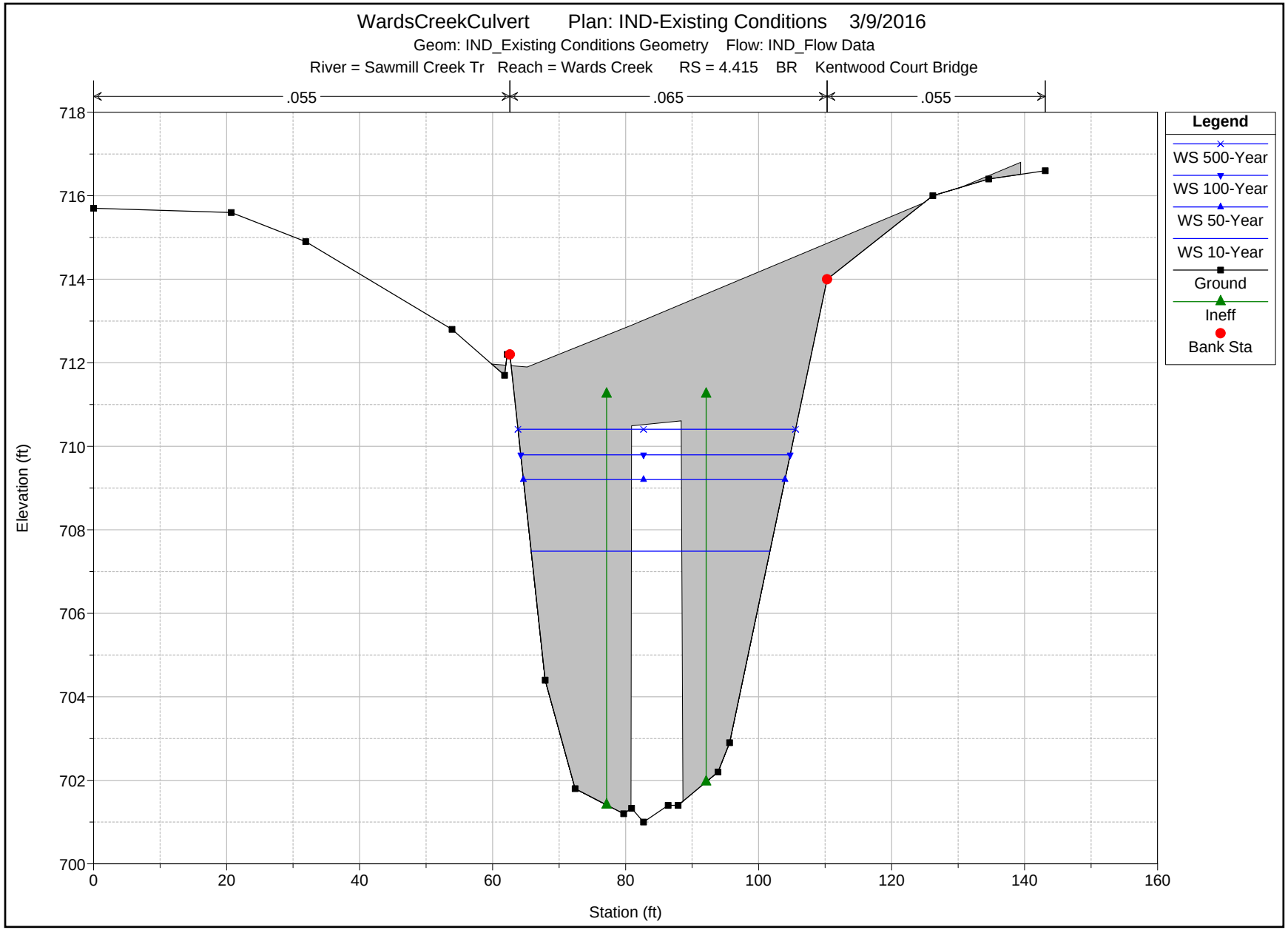
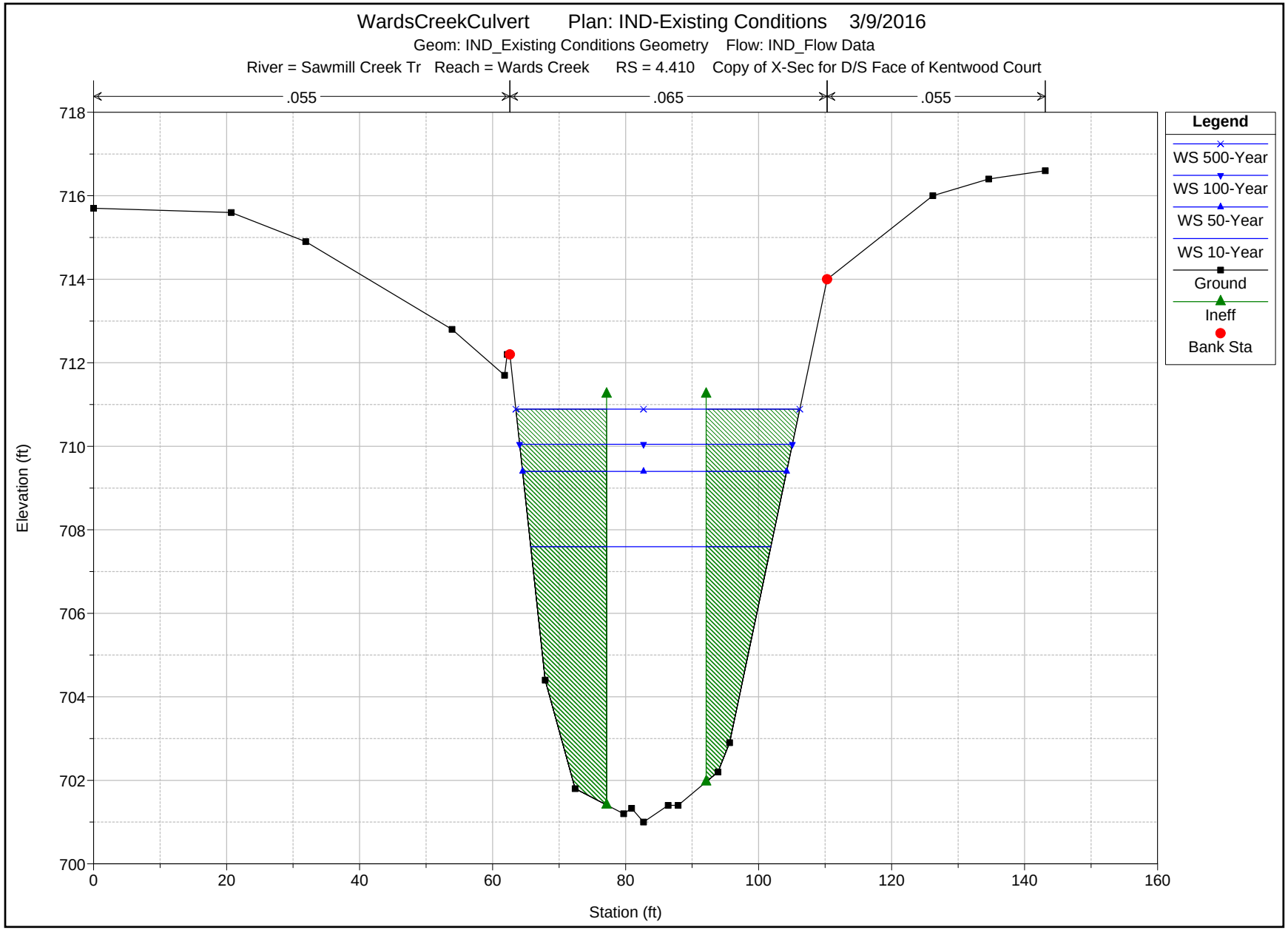
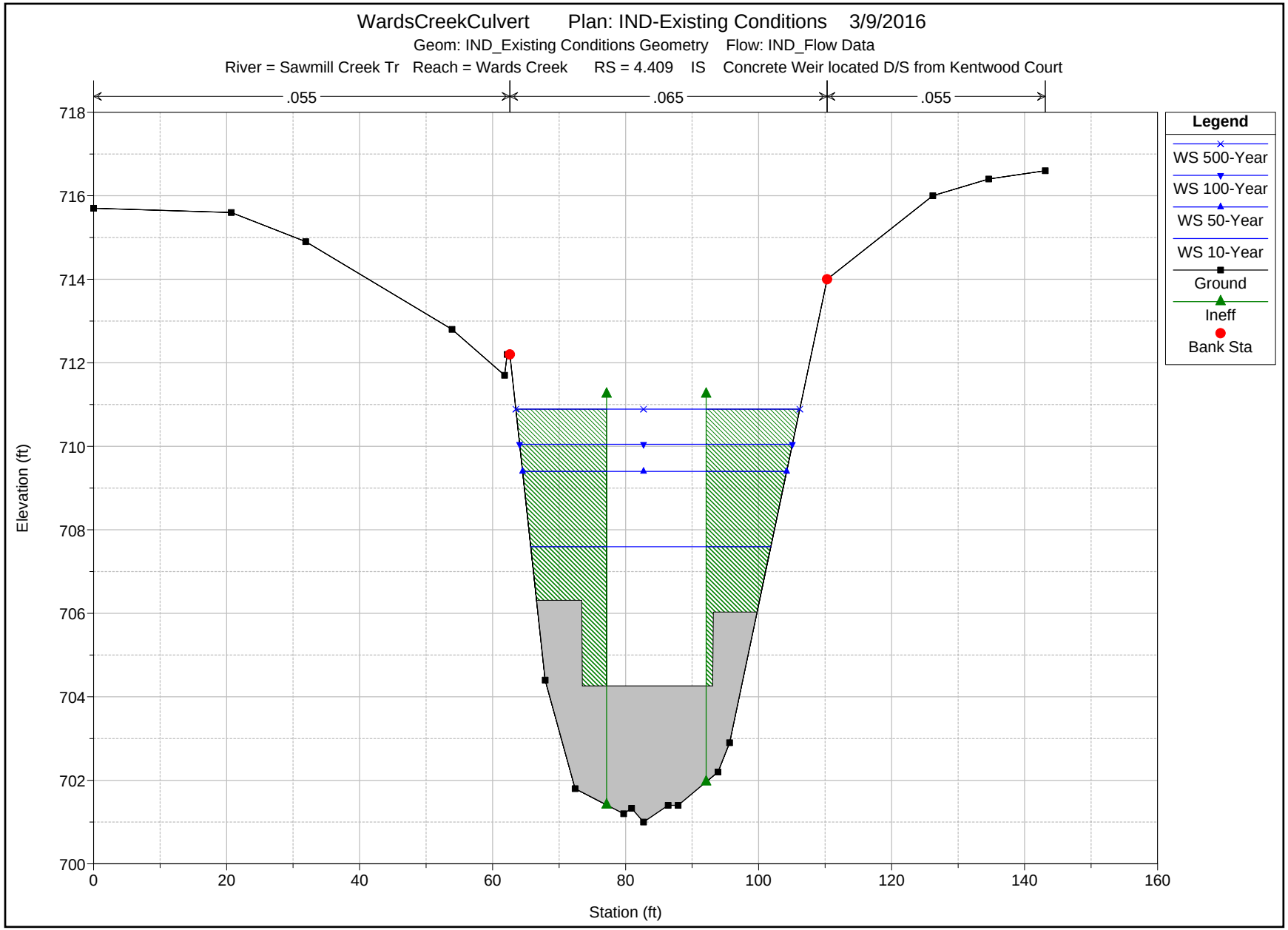
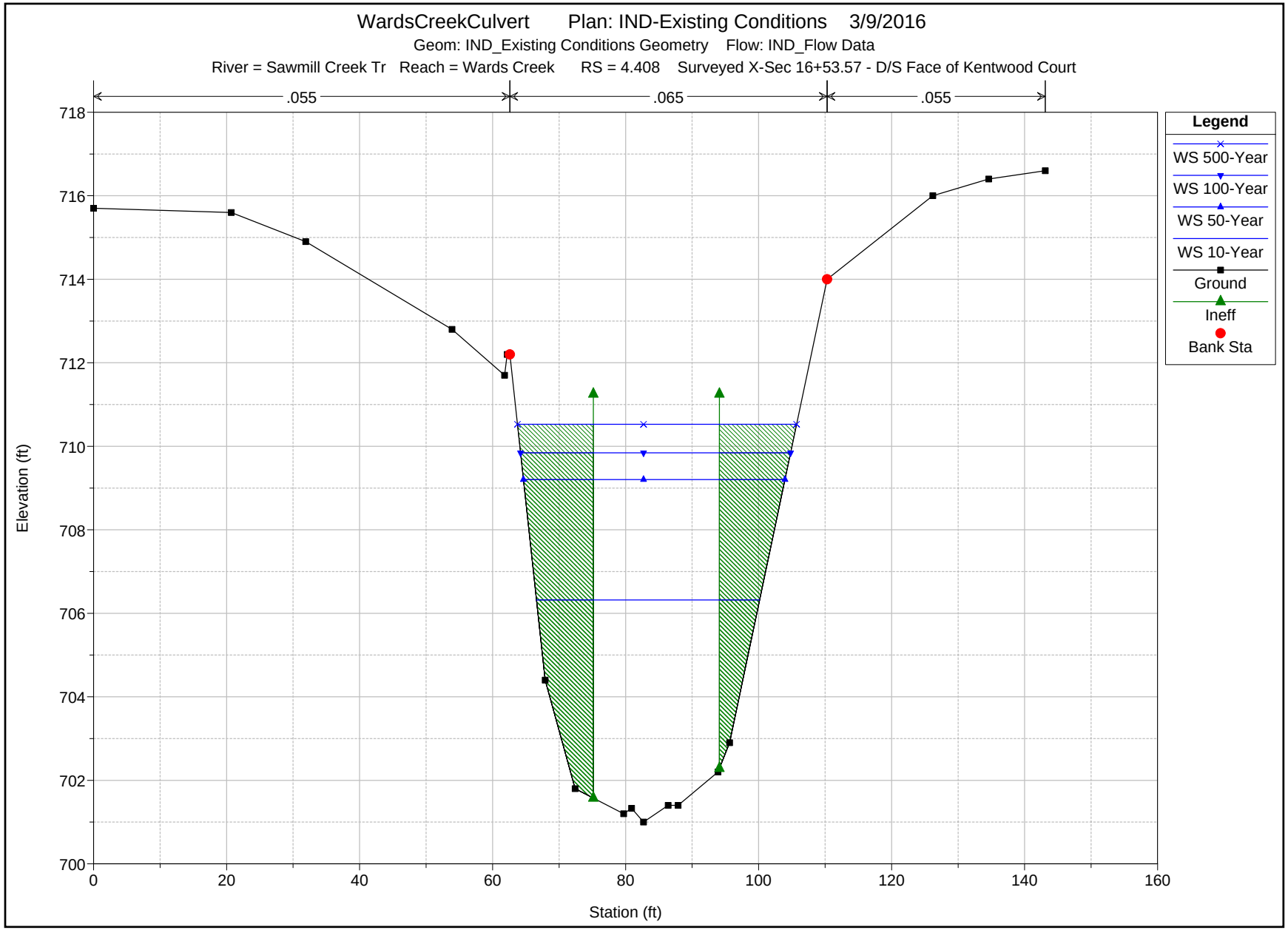
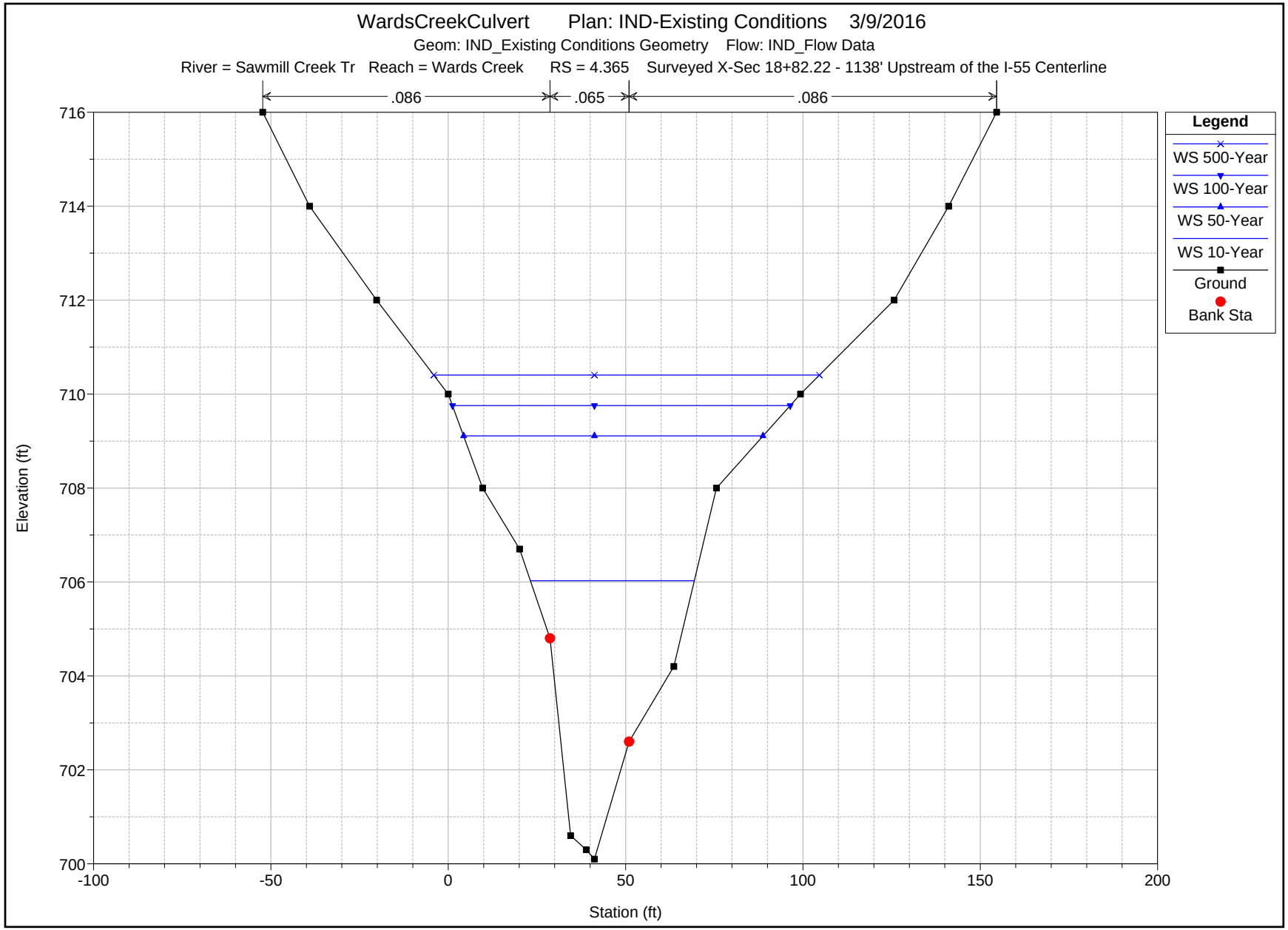
60
80
100
120
140
160

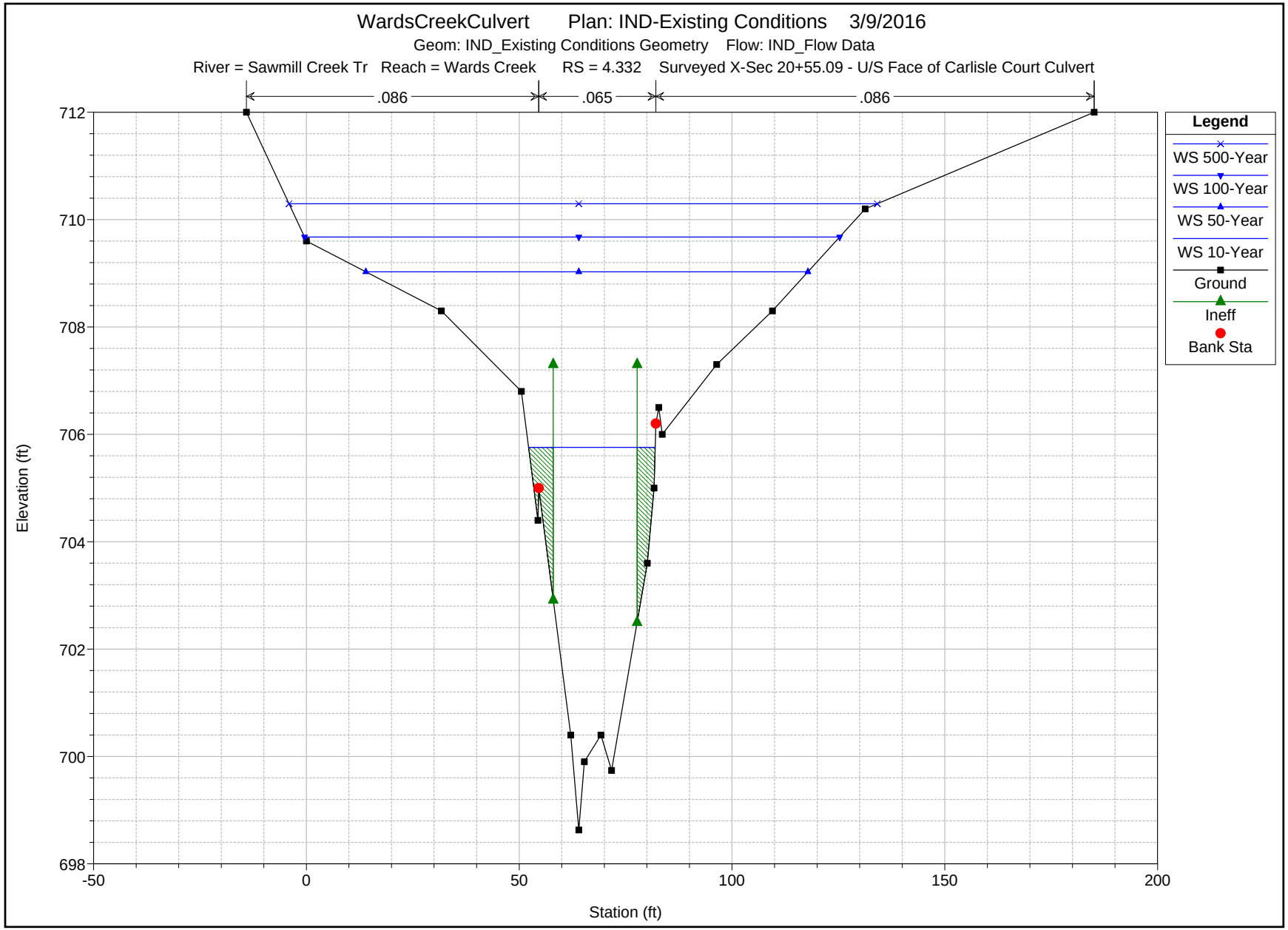

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.415 BR Kentwood Court Bridge
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
702
700
0
20
40
60
80
100
120
140
160

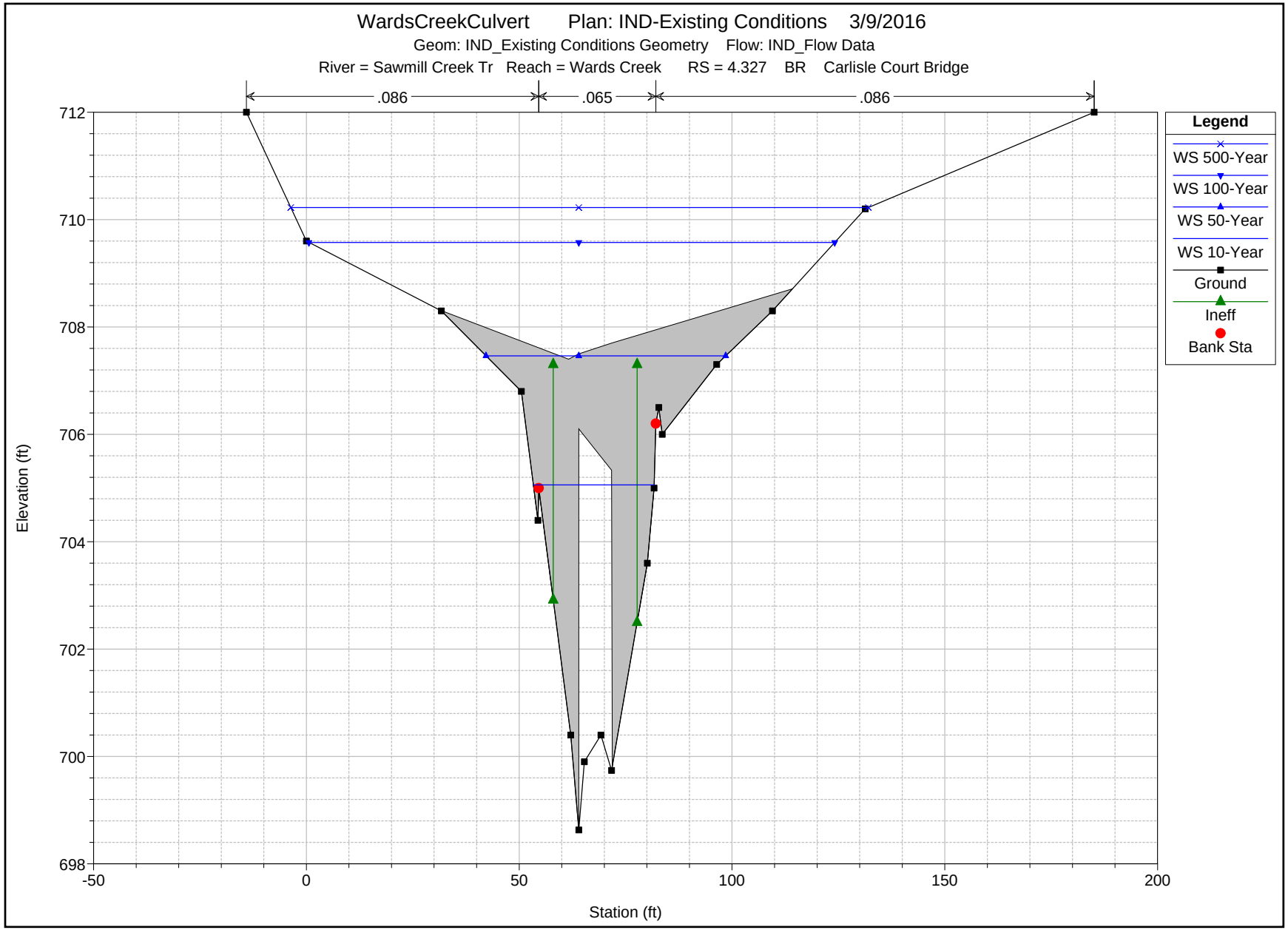

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.410 Copy of X-Sec for D/S Face of Kentwood Court
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
702
700
0
20
40
60
80
100
120
140
160

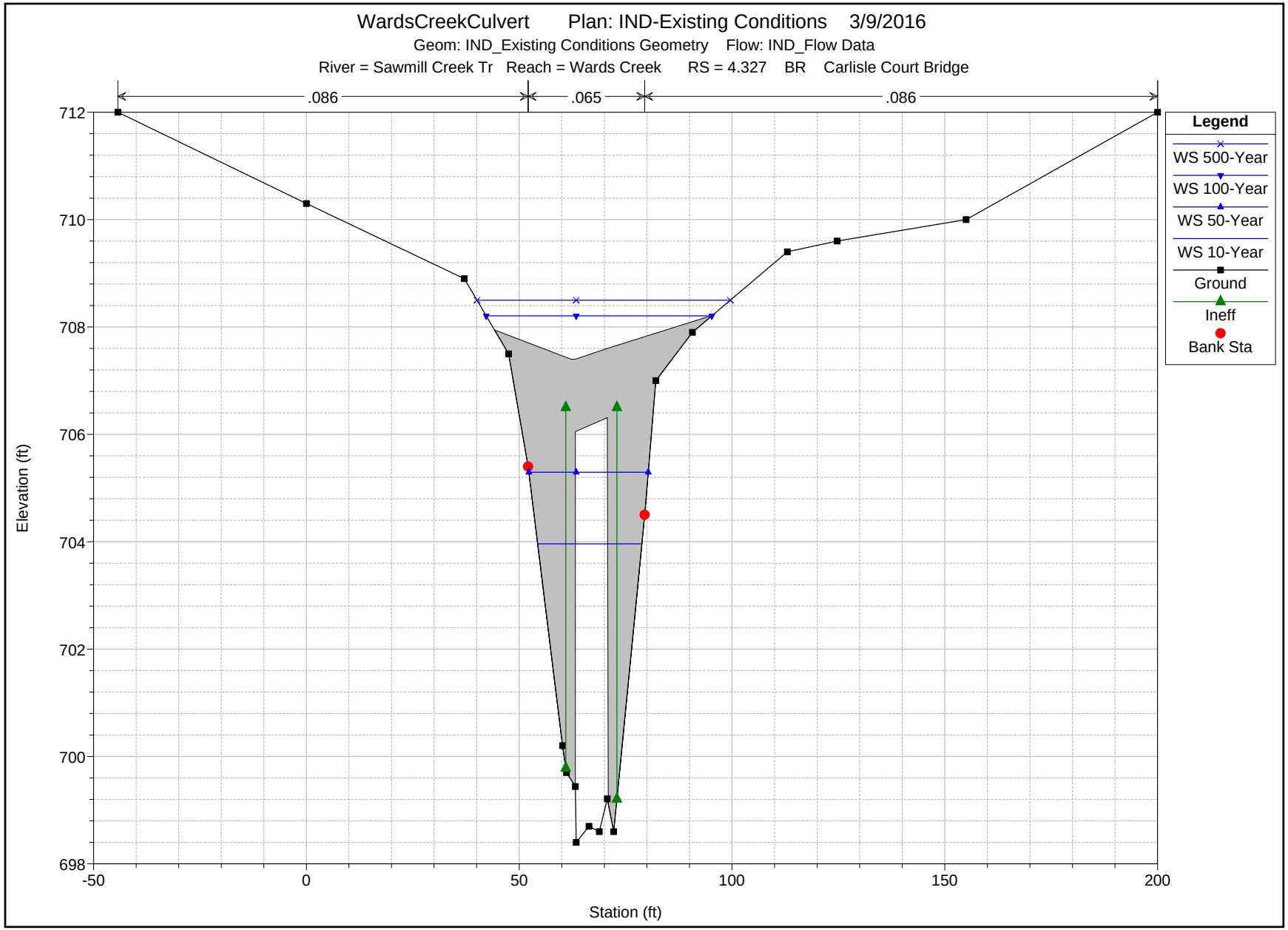

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.409 IS Concrete Weir located D/S from Kentwood Court
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
702
700
0
20
40
60
80
100
120
140
160

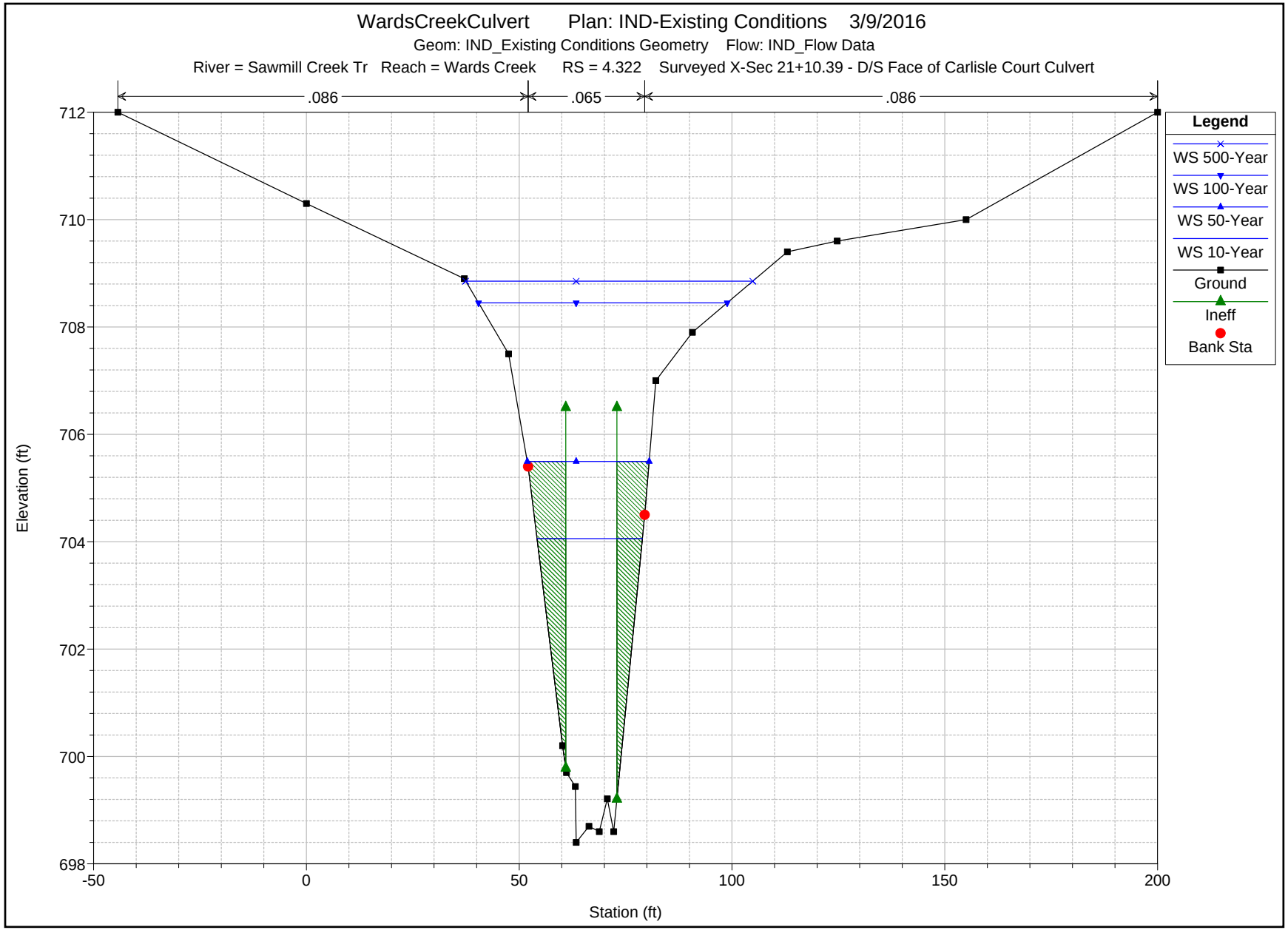

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.408 Surveyed X-Sec 16+53.57 - D/S Face of Kentwood Court
.055
.065
.055
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
718
716
714
712
710
708
706
704
702
700
0
20
40
60
80
100
120
140
160

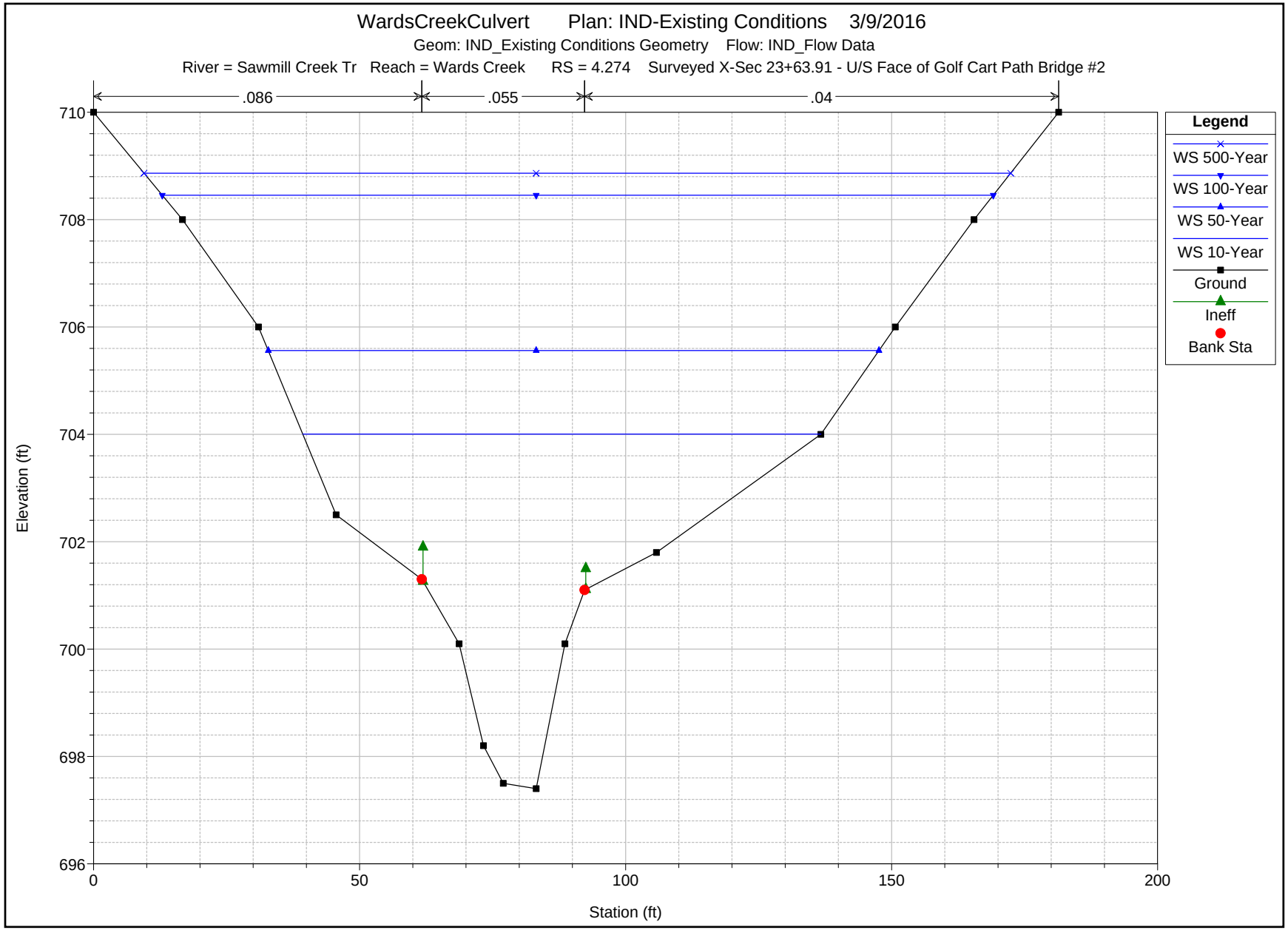

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.365 Surveyed X-Sec 18+82.22 - 1138' Upstream of the I-55 Centerline
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
716
714
712
710
708
706
704
702
700
-100
-50
0
50
100
150
200
Station (ft)

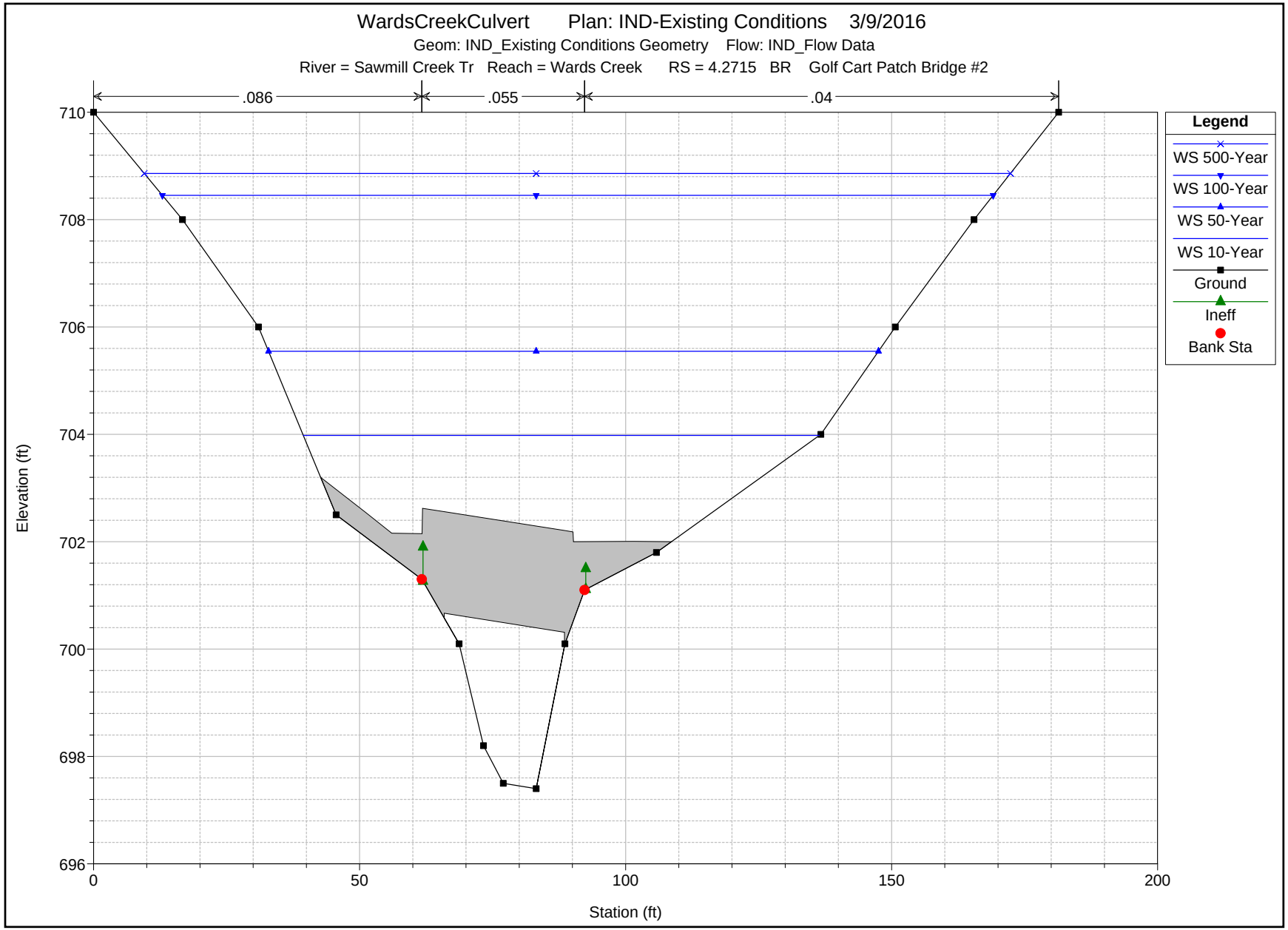

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.332 Surveyed X-Sec 20+55.09 - U/S Face of Carlisle Court Culvert
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
-50
0
50
100
150
200
Station (ft)

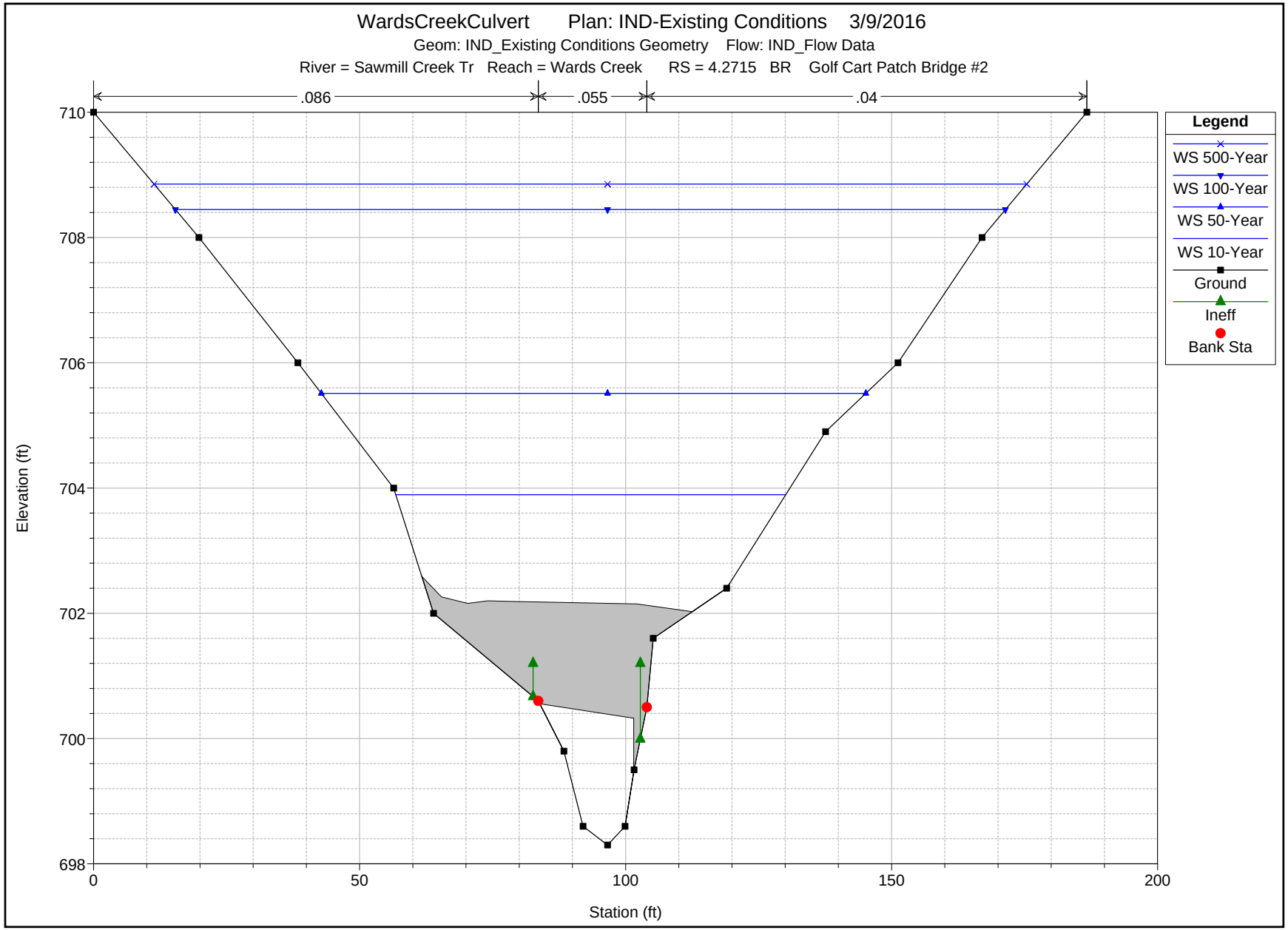

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.327 BR Carlisle Court Bridge
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
-50
0
50
100
150
200
Station (ft)

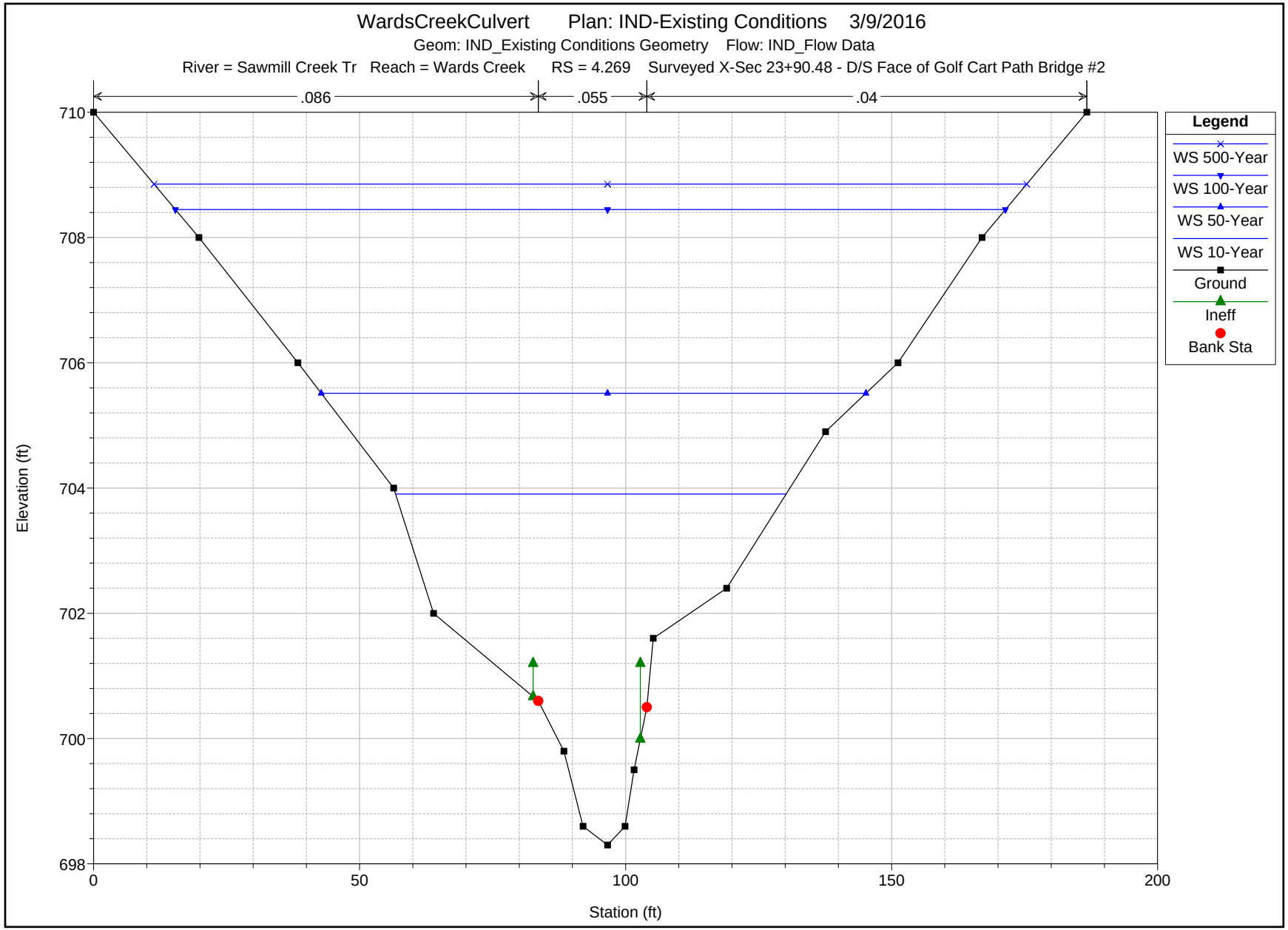

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.327 BR Carlisle Court Bridge
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
-50
0
50
100
150
200
Station (ft)

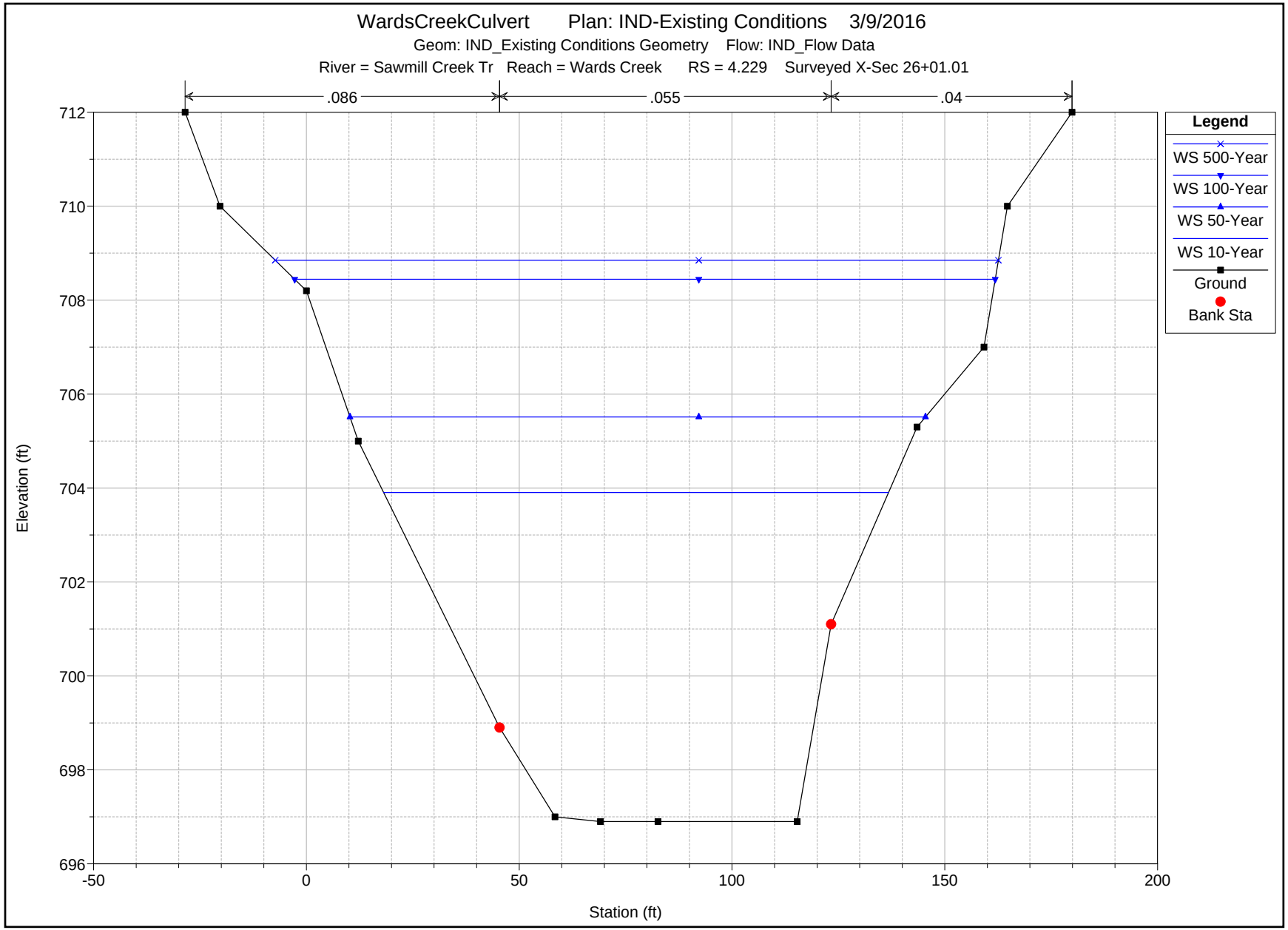

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.322 Surveyed X-Sec 21+10.39 - D/S Face of Carlisle Court Culvert
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
-50
0
50
100
150
200
Station (ft)

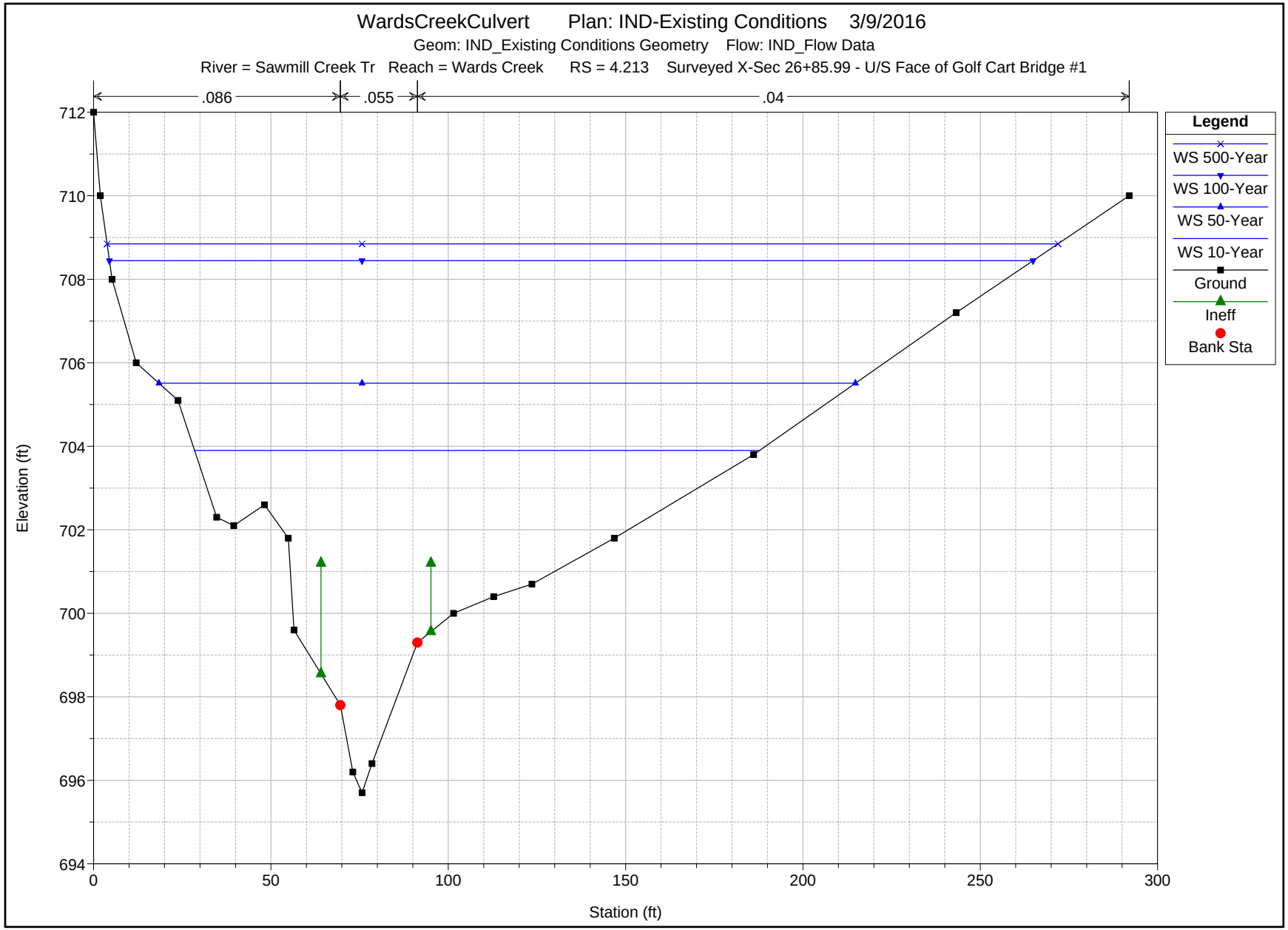

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.274 Surveyed X-Sec 23+63.91 - U/S Face of Golf Cart Path Bridge #2
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
696
0
50
100
150
200
Station (ft)

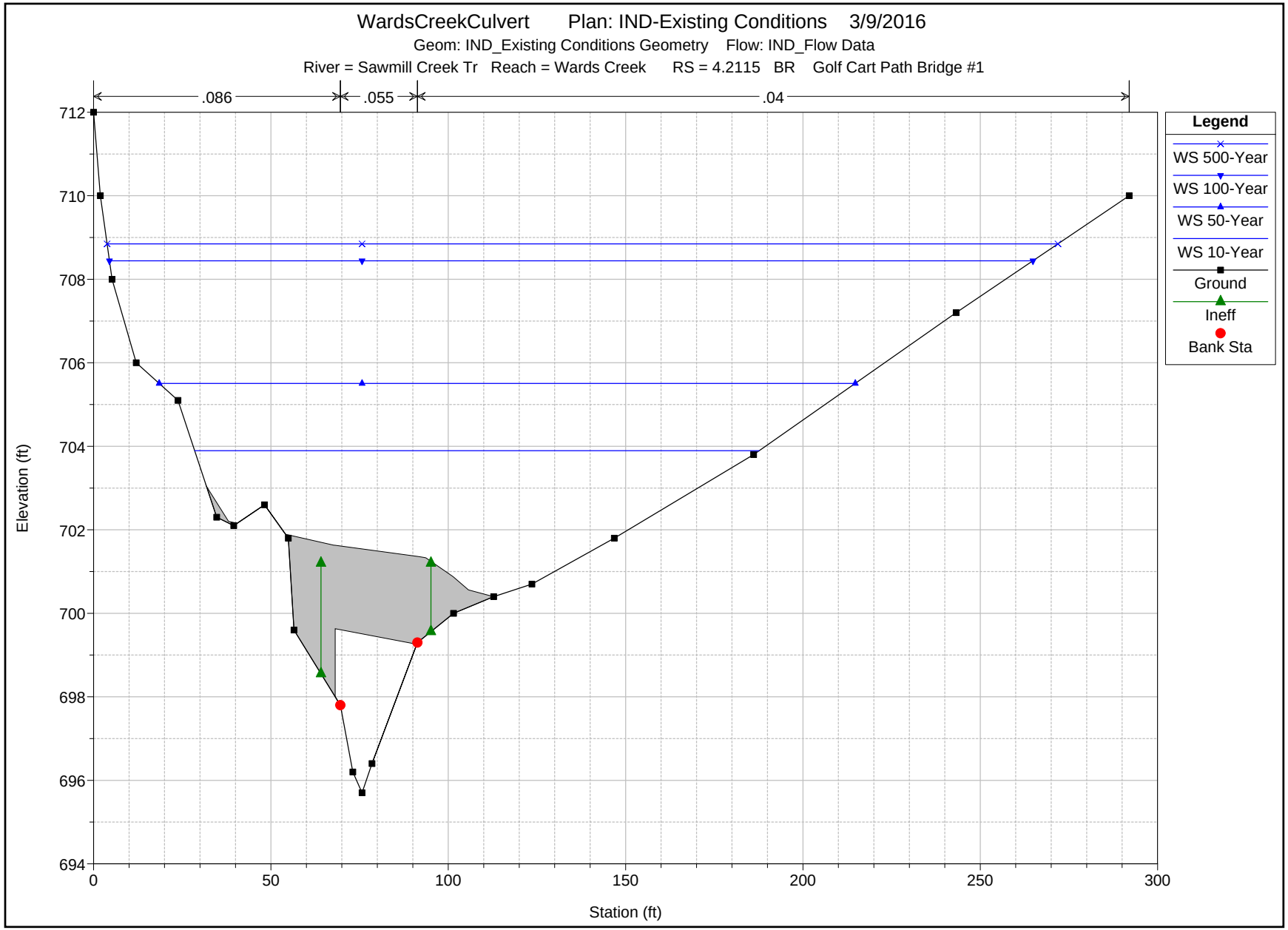

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.2715 BR Golf Cart Patch Bridge #2
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
696
0
50
100
150
200
Station (ft)

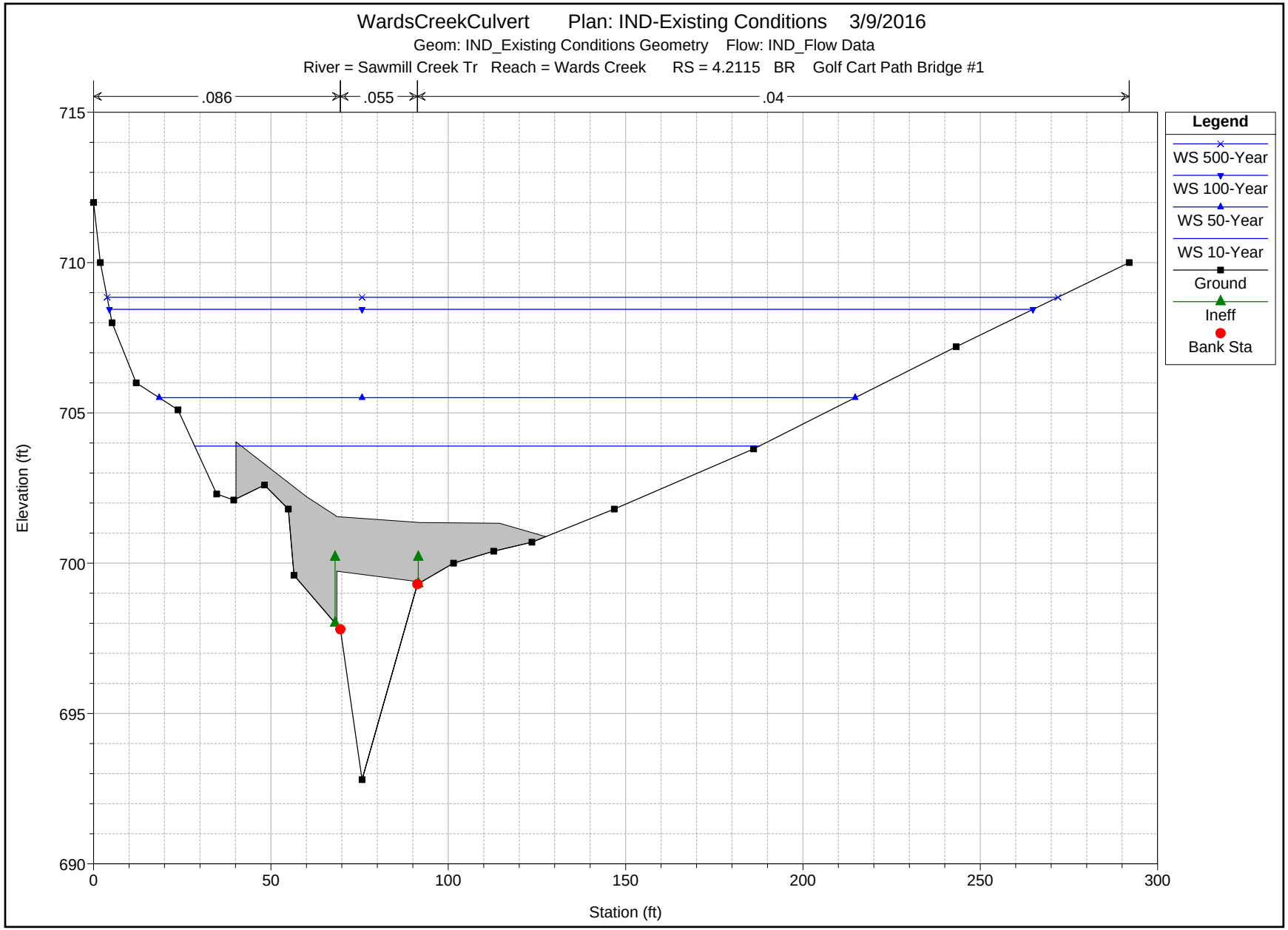

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.2715 BR Golf Cart Patch Bridge #2
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
0
50
100
150
200
Station (ft)

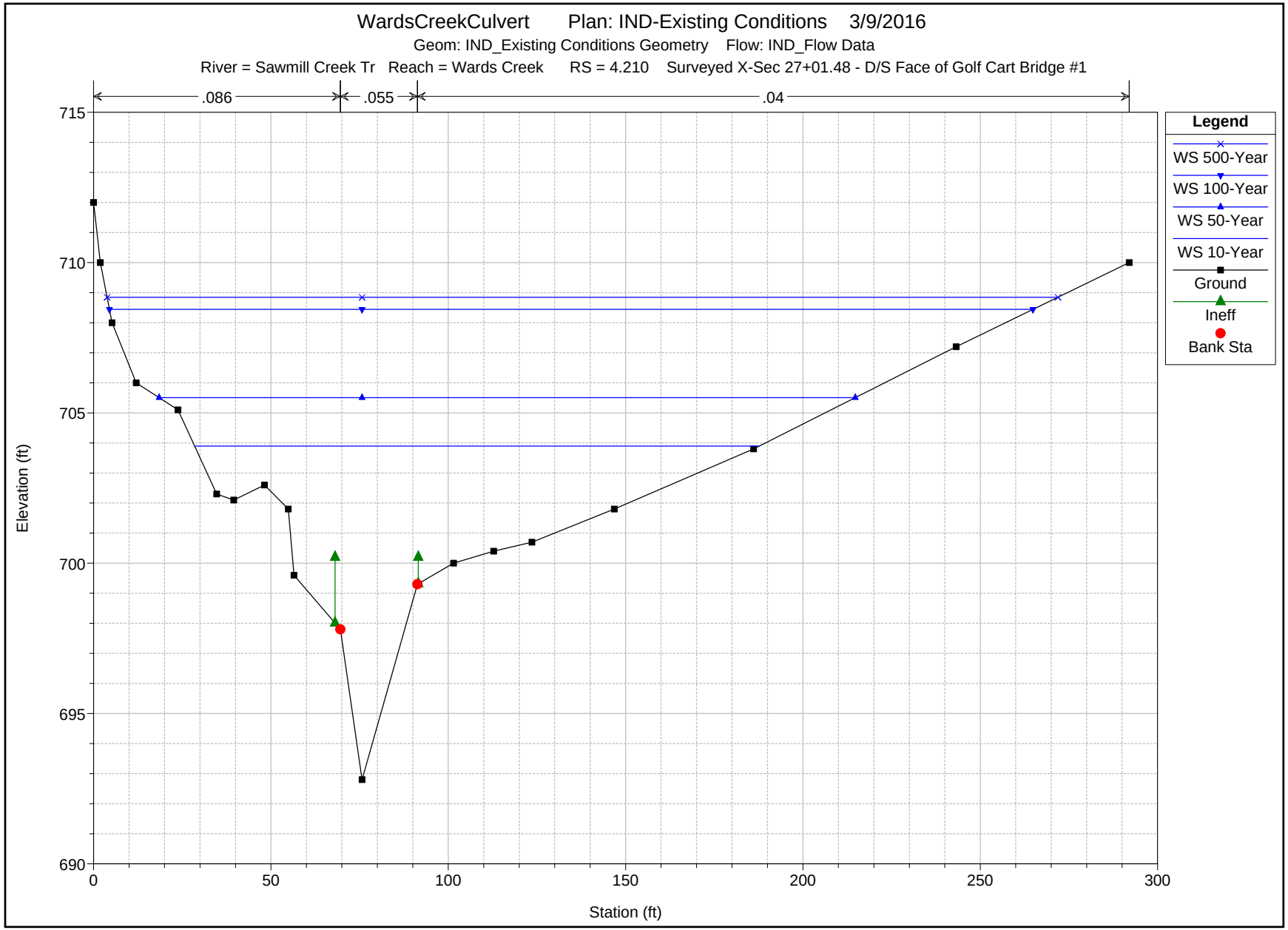

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.269 Surveyed X-Sec 23+90.48 - D/S Face of Golf Cart Path Bridge #2
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
0
50
100
150
200
Station (ft)

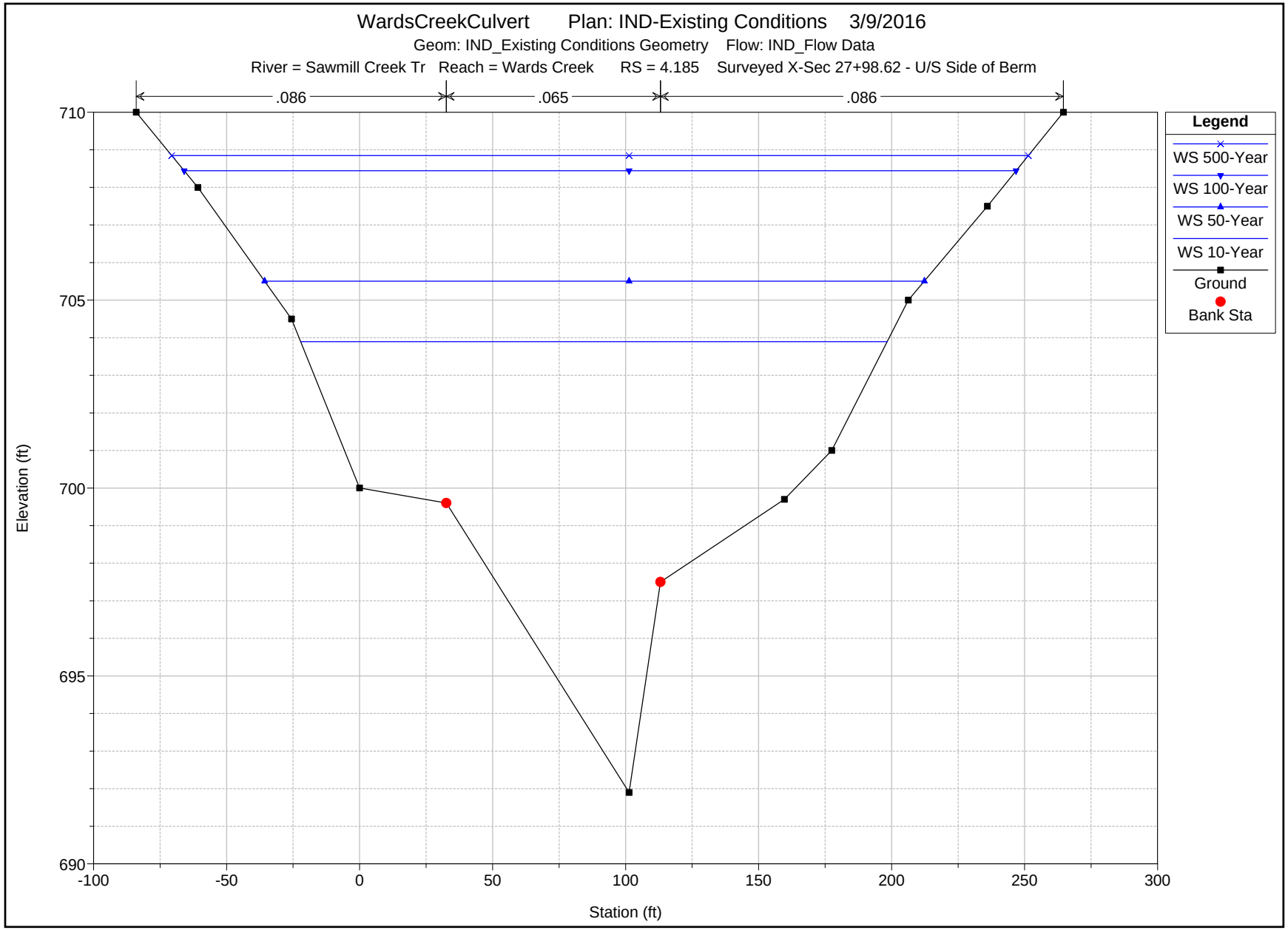

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.229 Surveyed X-Sec 26+01.01
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
696
-50
0
50
100
150
200
Station (ft)

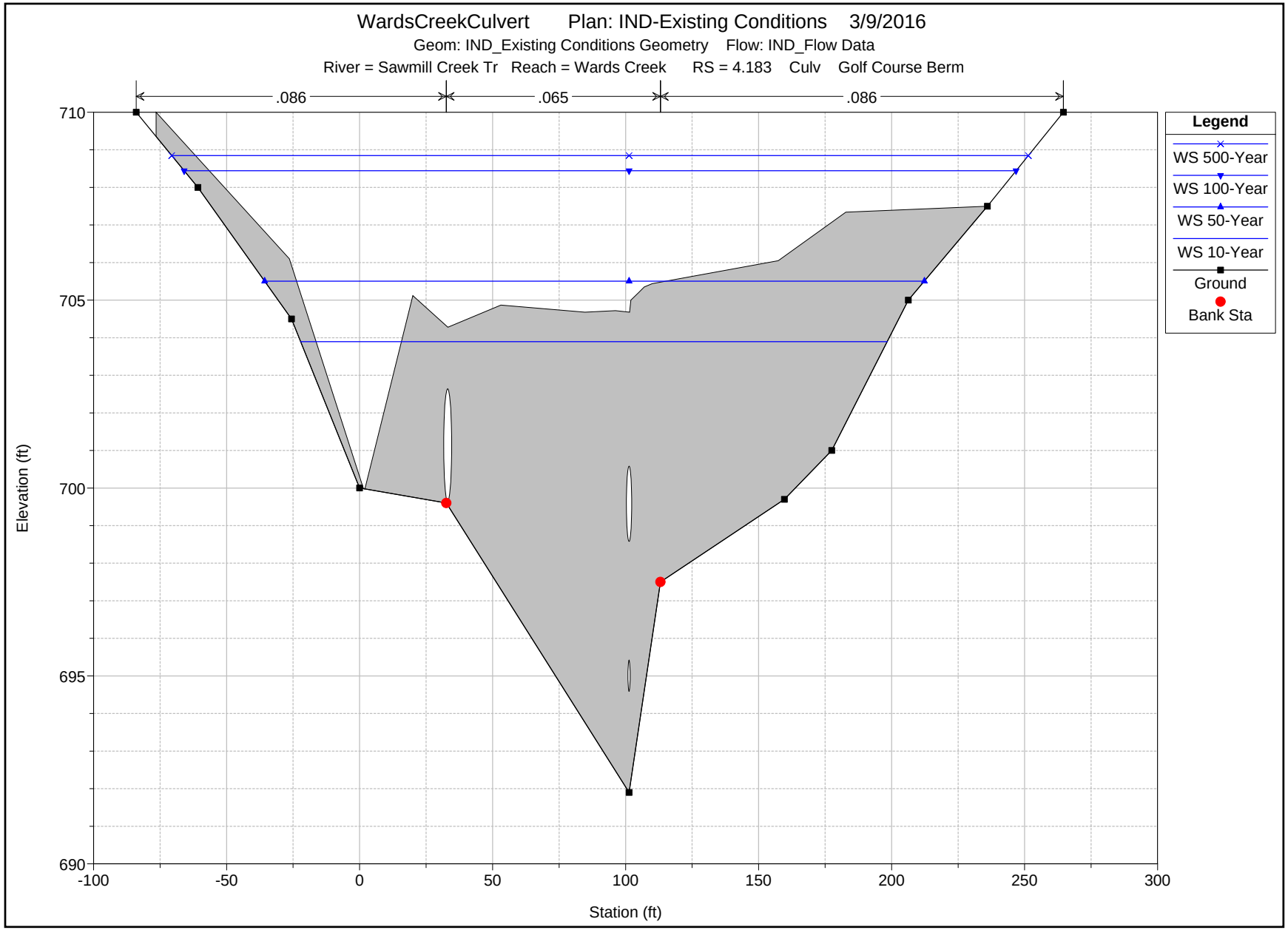

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.213 Surveyed X-Sec 26+85.99 - U/S Face of Golf Cart Bridge #1
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
696
694
0
50
100
150
200
250
300
Station (ft)

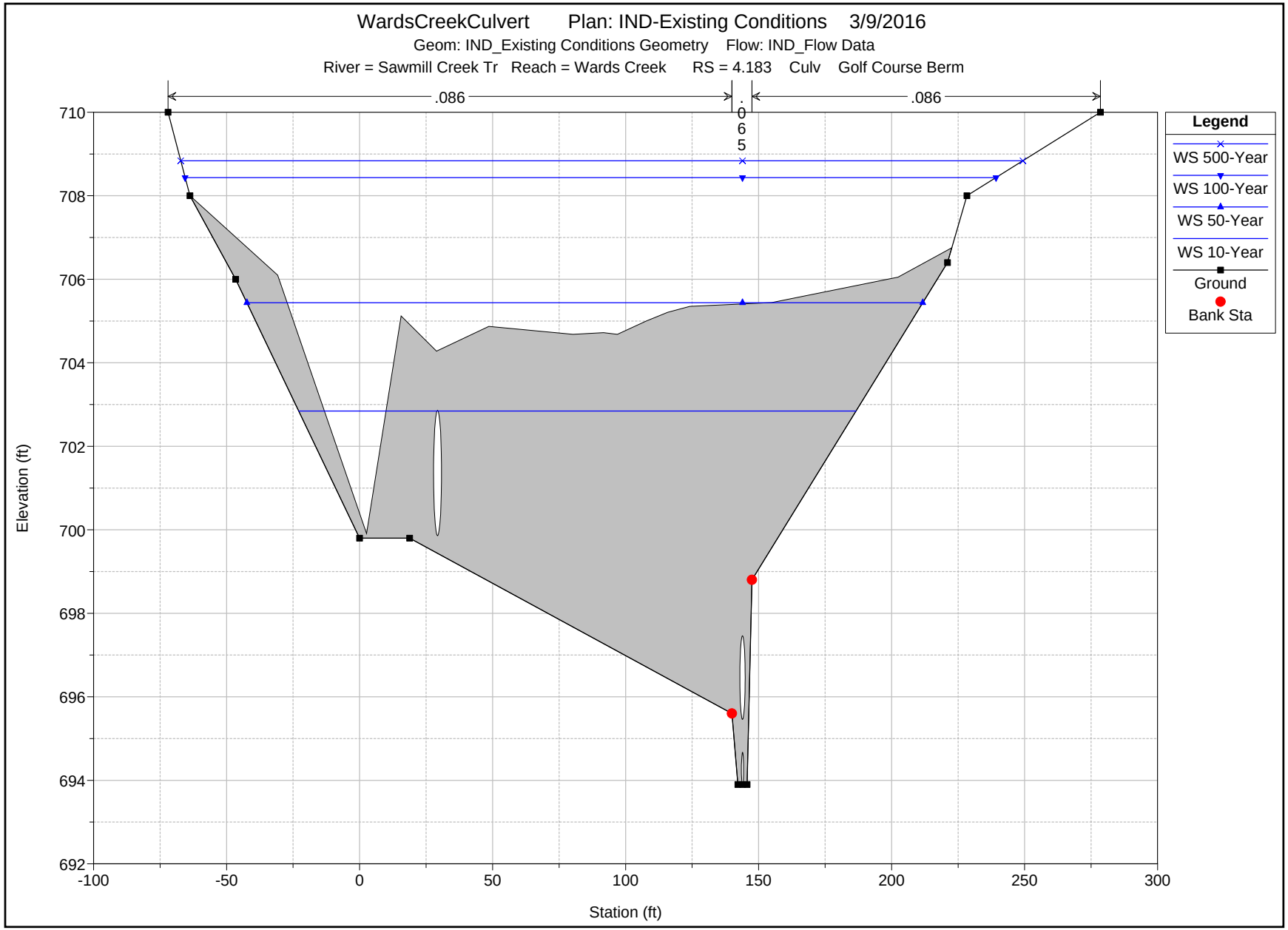

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.2115 BR Golf Cart Path Bridge #1
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
712
710
708
706
704
702
700
698
696
694
0
50
100
150
200
250
300
Station (ft)

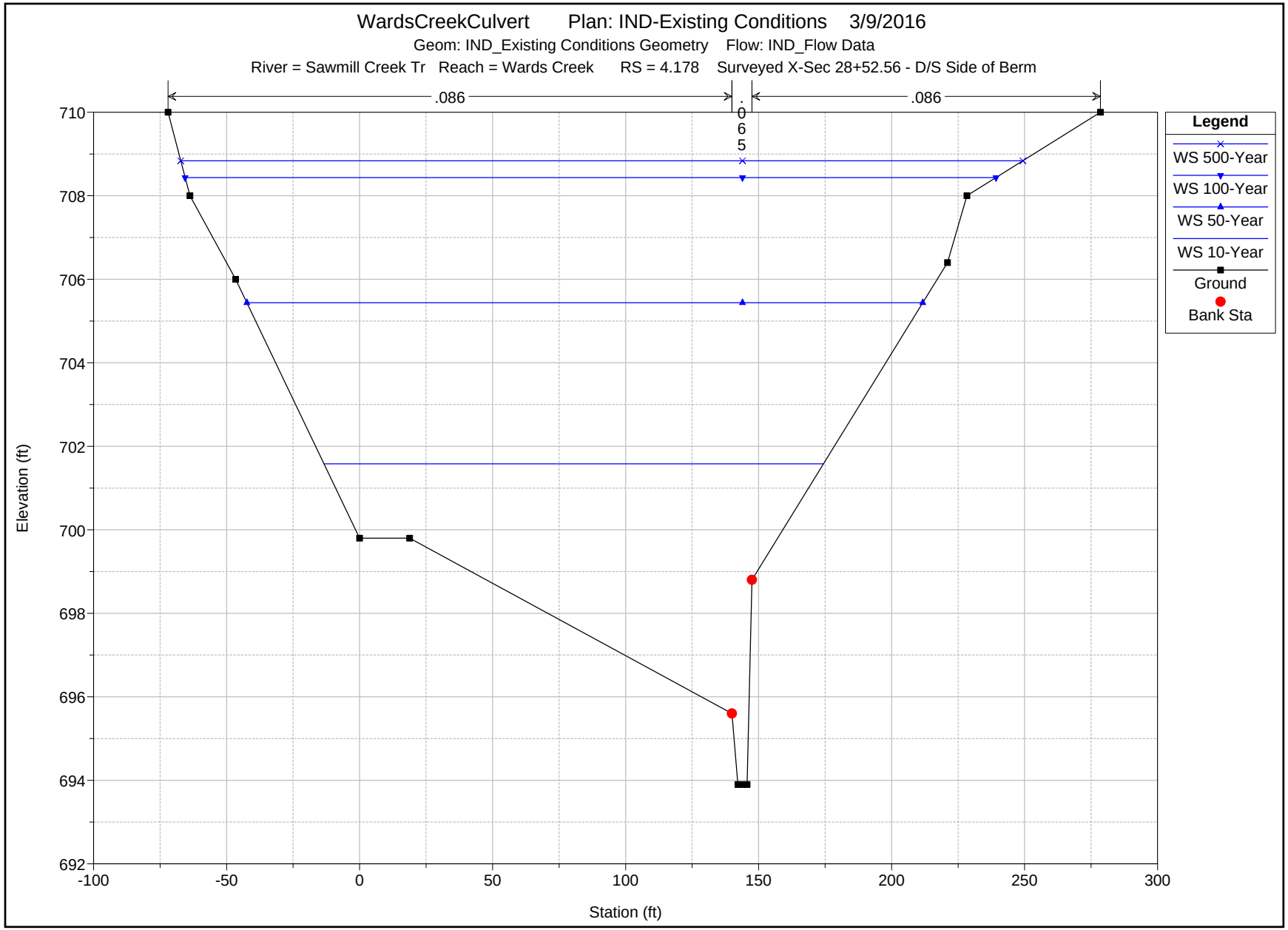

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.2115 BR Golf Cart Path Bridge #1
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
715
710
705
700
695
690
0
50
100
150
200
250
300
Station (ft)

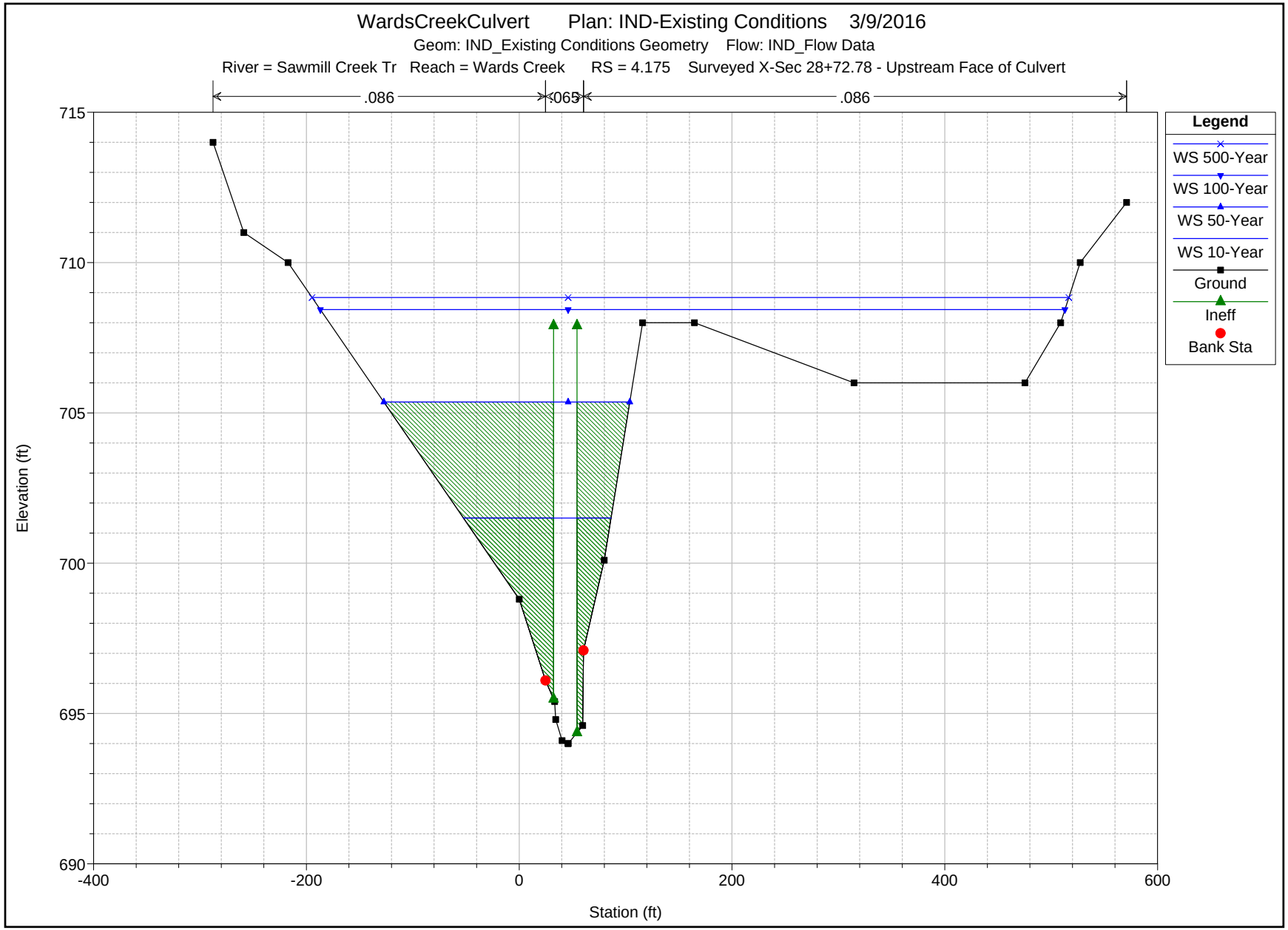

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.210 Surveyed X-Sec 27+01.48 - D/S Face of Golf Cart Bridge #1
.086
.055
.04
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
715
710
705
700
695
690
0
50
100
150
200
250
300
Station (ft)

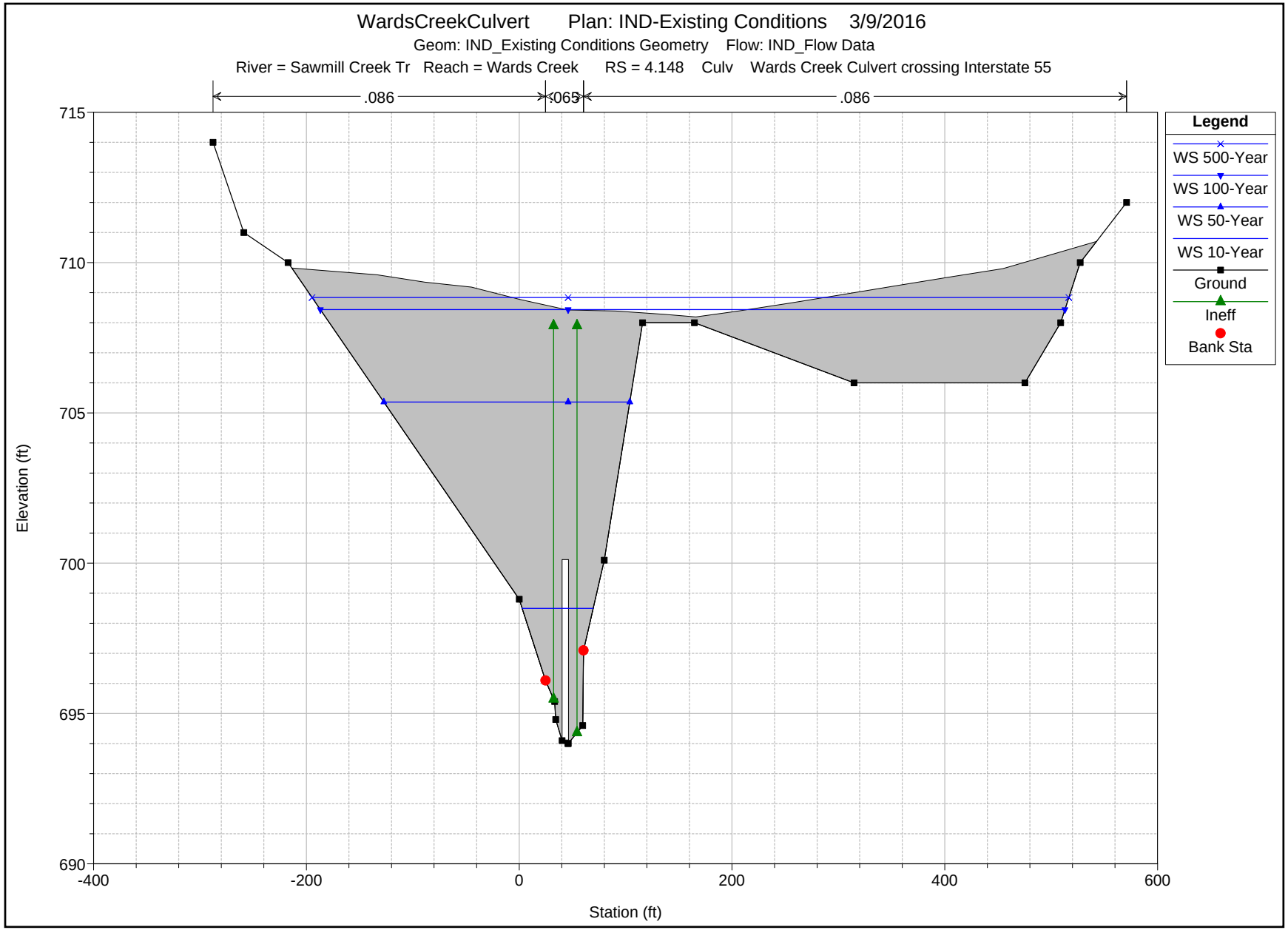

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.185 Surveyed X-Sec 27+98.62 - U/S Side of Berm
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
710
705
700
695
690
-100
-50
0
50
100
150
200
250
300
Station (ft)

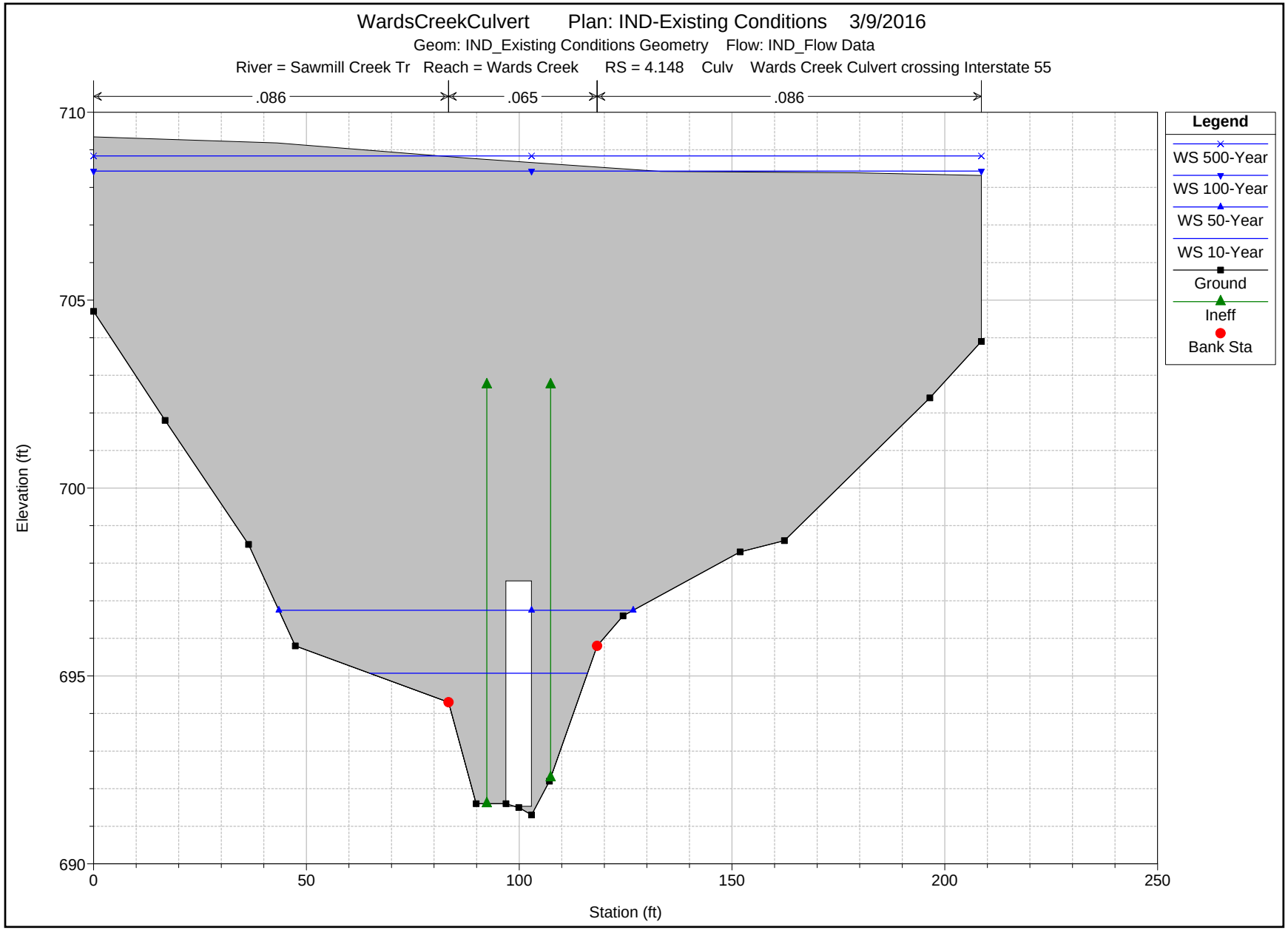

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.183 Culv Golf Course Berm
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
710
705
700
695
690
-100
-50
0
50
100
150
200
250
300
Station (ft)

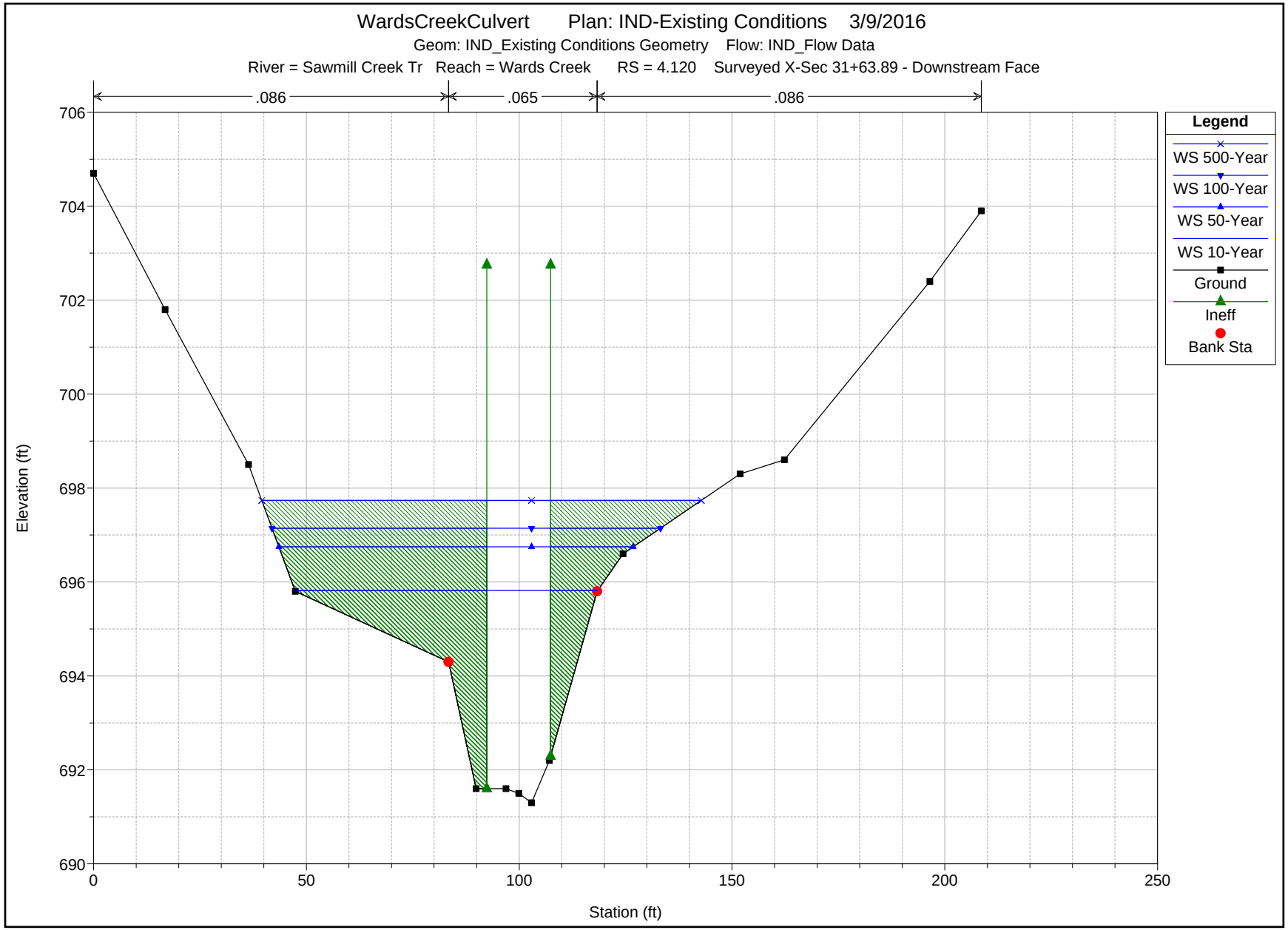

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.183 Culv Golf Course Berm
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
696
694
692
-100
-50
0
50
100
150
200
250
300
Station (ft)

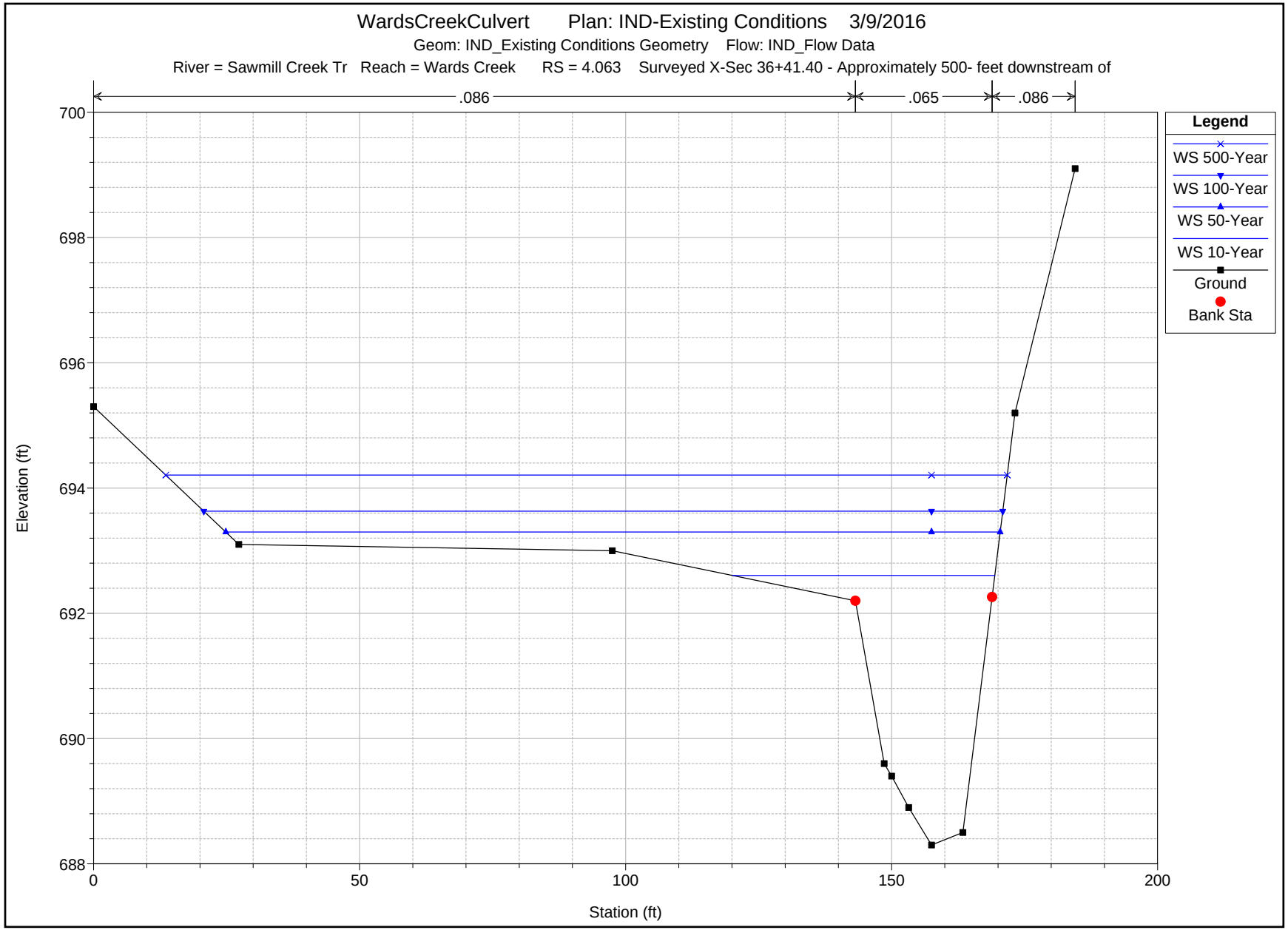

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.178 Surveyed X-Sec 28+52.56 - D/S Side of Berm
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
710
708
706
704
702
700
698
696
694
692
-100
-50
0
50
100
150
200
250
300
Station (ft)

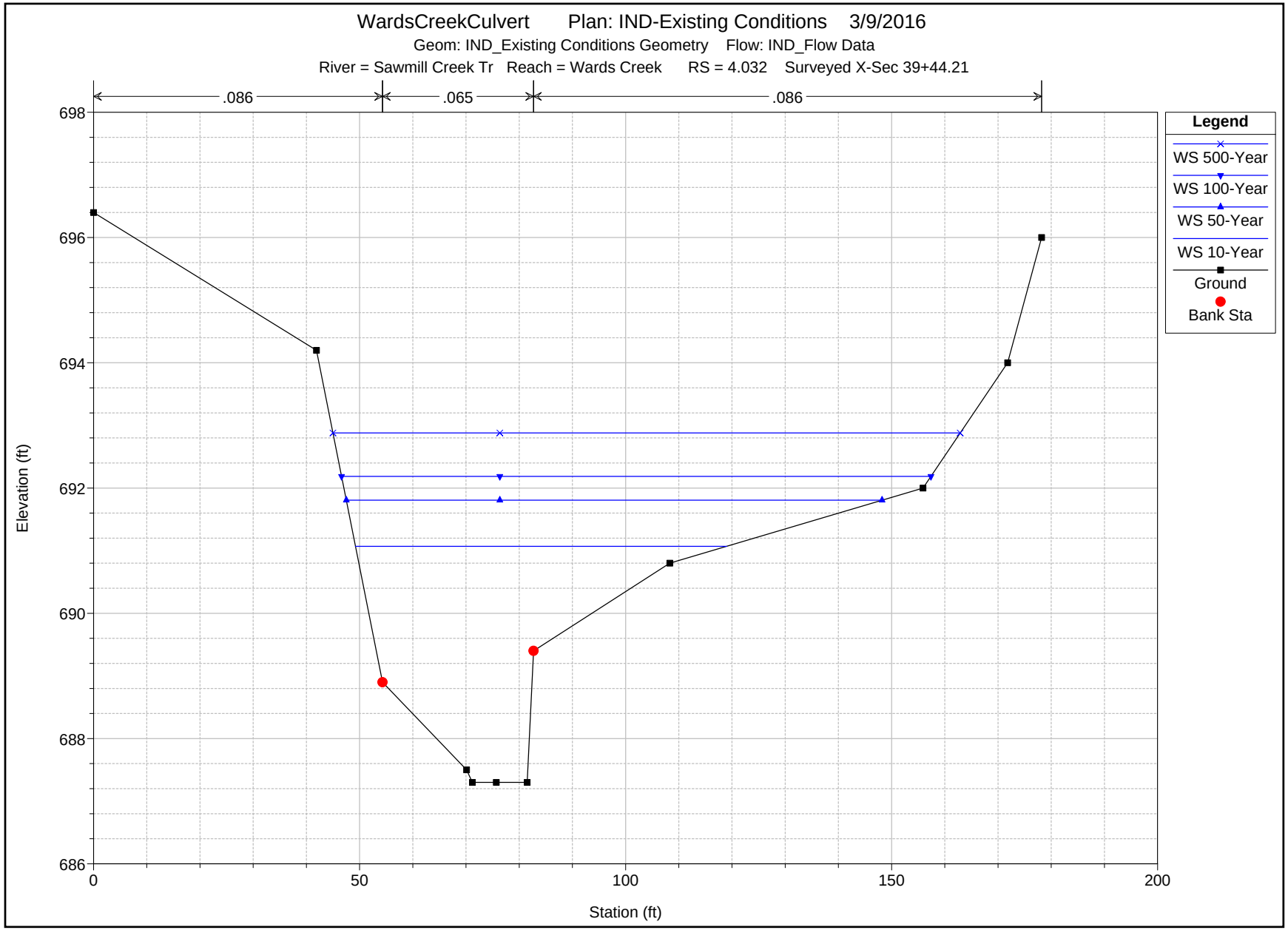

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.175 Surveyed X-Sec 28+72.78 - Upstream Face of Culvert
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
715
710
705
700
695
690
-400
-200
0
200
400
600
Station (ft)

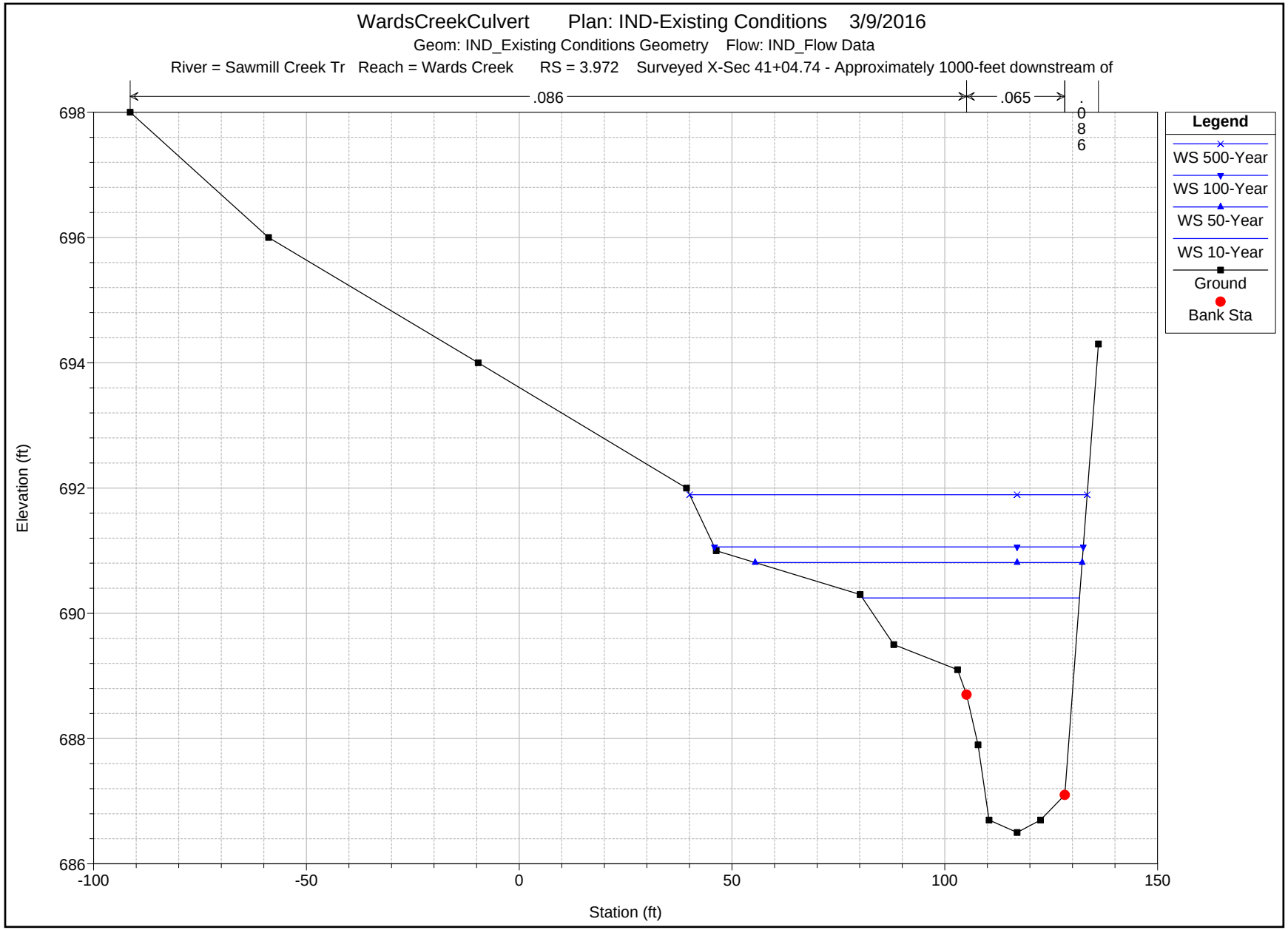

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.148 Culv Wards Creek Culvert crossing Interstate 55
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
715
710
705
700
695
690
-400
-200
0
200
400
600
Station (ft)

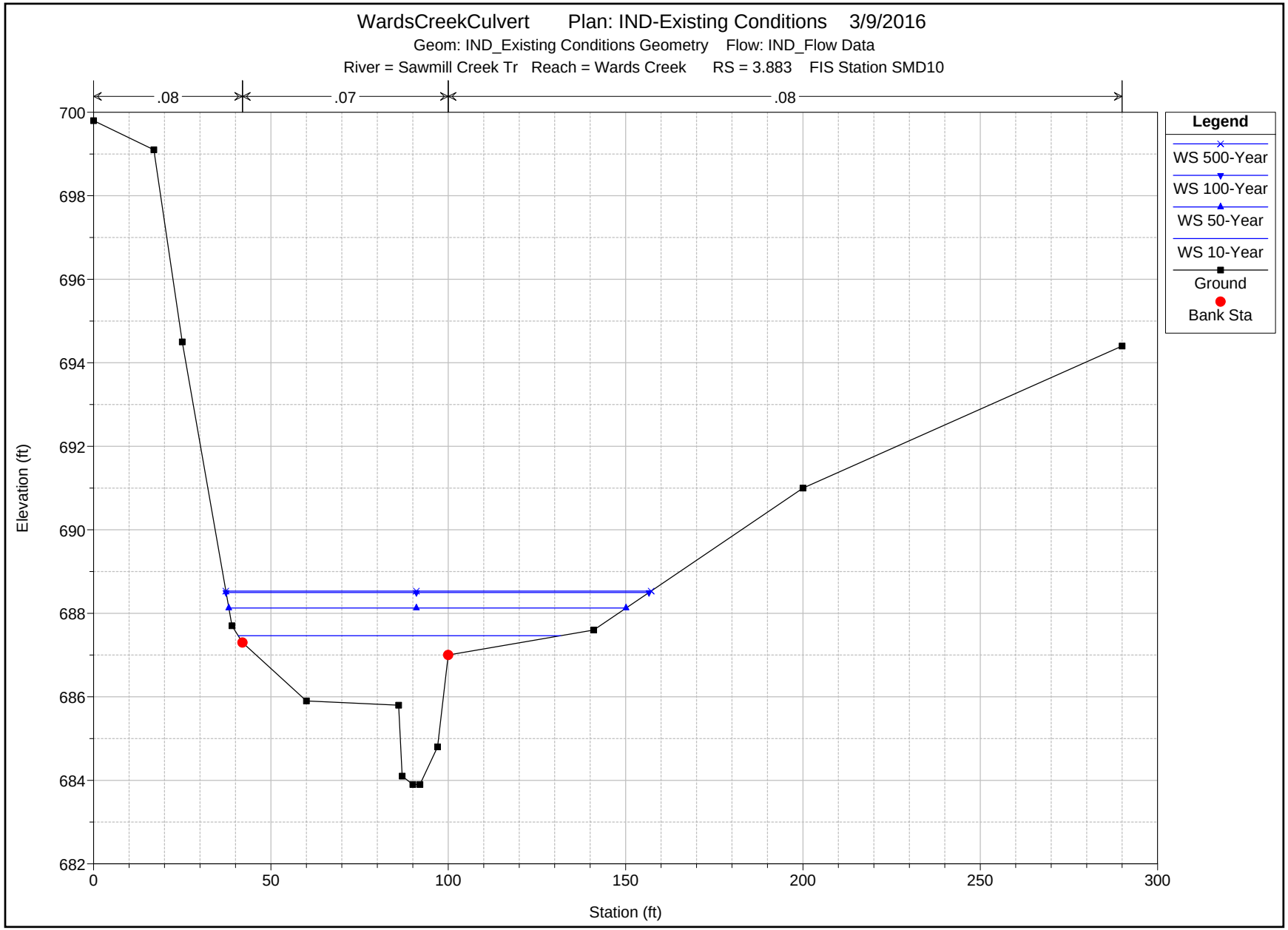

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.148 Culv Wards Creek Culvert crossing Interstate 55
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
710
705
700
695
690
0
50
100
150
200
250
Station (ft)


WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.120 Surveyed X-Sec 31+63.89 - Downstream Face
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
706
704
702
700
698
696
694
692
690
0
50
100
150
200
250
Station (ft)


WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.063 Surveyed X-Sec 36+41.40 - Approximately 500- feet downstream of
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
700
698
696
694
692
690
688
0
50
100
150
200
Station (ft)


WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 4.032 Surveyed X-Sec 39+44.21
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
698
696
694
692
690
688
686
0
50
100
150
200
Station (ft)


WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 3.972 Surveyed X-Sec 41+04.74 - Approximately 1000-feet downstream of
.086
.065
.086
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
698
696
694
692
690
688
686
-100
-50
0
50
100
150
Station (ft)


WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 3.883 FIS Station SMD10
.08
.07
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
700
698
696
694
692
690
688
686
684
682
0
50
100
150
200
250
300
Station (ft)

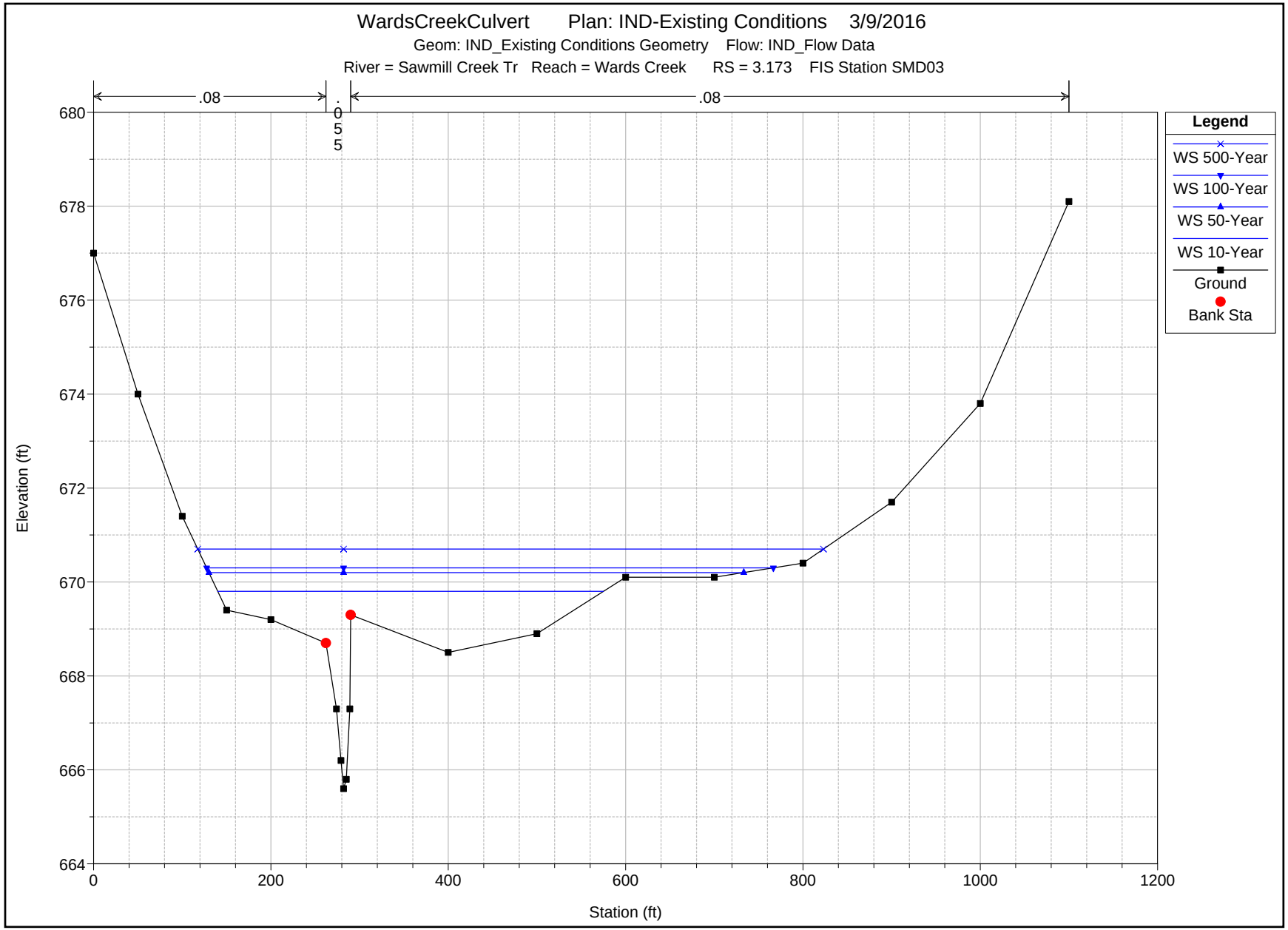

WardsCreekCulvert Plan: IND-Existing Conditions 3/9/2016
Geom: IND_Existing Conditions Geometry Flow: IND_Flow Data
River = Sawmill Creek Tr Reach = Wards Creek RS = 3.173 FIS Station SMD03
.08
.055
.08
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
680
678
676
674
672
670
668
666
664
0
200
400
600
800
1000
1200
Station (ft)

EXHIBIT K

PROPOSED CONDITIONS HYDRAULIC MODEL AND RESULTS

EXHIBIT L

PERMIT SUMMARY

EXHIBIT M

COMPENSATORY STORAGE

EXHIBIT N

CORRESPONDENCE

MEETING MINUTES

City of Darien

Date:	**January 16, 20132**		
Time:	**10:00 am to 10:45 am**		
Location:	**Field Observation**		
	North Frontage Road – between Lemont and Cass Avenues		
	Darien, IL 60561		
Attendees	**Name**	**Organization**	**Email**
	Dan Salvato	**City of Darien Superintendent of Public Works**	dsalvato@darienil.gov
	Dustin Book	**Stantec**	dustin.book@stantec.com

1. The meeting began at 10:00 am.
2. The meeting opened with introductions and a brief discussion of the managed lanes project. The purpose of the study is to evaluate the design and construction of a managed lane within the existing I-55 facility. The project is limited to a rehabilitation of the existing inside shoulders and is not anticipated to include reconstruction and/or widening along the corridor.
3. Stantec is preparing a Location Drainage Study in support of the Managed Lanes Project to identify existing drainage problems, design deficiencies, and provide recommendations.
4. Mr. Salvato identified the location of five (5) existing drainage problems along the North Frontage Road and vicinity of the project area. A summary of the problems and locations are outlined below.
    a. The intersection of Bailey Road and North Frontage Road: An existing clay drainage tile (approximate 18-inch diameter) was crushed and blocked during the installation of a power pole at the southwest corner of the intersection. At the location of the pole, the upstream end of the pipe is exposed and the existing subgrade is washing resulting in a large hole at the base of the pole. Mr. Salvato indicated that the upstream portion of the pipe that crossed beneath Frontage Road had been repaired earlier by IDOT (John Cleary – Foreman). In addition, the detention basin for the Carriage Greens Estate Subdivision found north of the tile, along Bailey Road overtops during large rainfall events. It was unclear if the detention basin outlets to the broken drain tile.
    b. The West Branch of Sawmill Creek crossing at North Frontage Road: The City of Darien has observed historical flooding and overtopping of the Frontage Road at this crossing. The channel was observed to fill up the ditch located upstream of the culvert and resulted in the Creek overtopping the roadway. No dates were provided for the event.

       Stantec is preparing a Major Culvert Crossing Analysis at this location as part of the Location Drainage Study for I-55.
    c. The Wards Creek crossing at North Frontage Road: The City of Darien has identified repeat flooding at this location. It was observed that the Carriage Green Golf course constructed a berm just north of the right-of-way to impound Wards Creek and establish a water feature as part of the

course. Two existing pipe culverts maintain flow through the berm to the existing culvert crossing beneath I-55. During large rain events, the water feature will flood the golf course and overtop the berm.

During the field observation, it was noted that the embankment behind the upstream wingwall at the west side was severely eroded away and the wingwall was exposed.

Stantec is preparing a Hydraulic Analysis at this location as part of the Location Drainage Study for I-55.

d. 8200 block of Cass Avenue (approximately 900-feet north of the intersection with North Frontage Road): A sag location along Cass Avenue repeatedly floods with several inches of standing water during rain events. The flooding has resulted in road closures in the past. Mr. Salvato indicated that the flooding was a result of capacity and is not the result of any sort of blockage.

   Mr. Book indicated that the location of the flooding and corresponding storm sewer is likely outside of the limits of the study. A cursory review of the IDOT storm system at Cass Avenue will verify if the storm sewer is tributary to the IDOT system or if the receiving sewer is undersized.

e. Cass Avenue and North Frontage Road: The existing curb provided along the raised median located on Frontage Road (east of Cass Avenue) is deteriorating and should be replaced. A large portion of curb along the south side of the median, near the east end is missing.

   Mr. Book indicated that the problem is noted however it is not drainage related and will not be identified as part of the Location Drainage Study.

5. The meeting concluded at 10:45 am.

Copies to:	Agar Shirani - IDOT, File
Minutes Issued by:	Dustin Book
Date Issued:	January 16, 2013

These minutes reflect our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact us. We will consider the minutes to be accurate unless written notice is received within 10 working days of the date minutes are issued.

Book, Dustin

From: Winograd, Esther B
Sent: Wednesday, July 18, 2012 2:44 PM
To: Kendall, David A.
Cc: Phan, Michael T; Shirani, Agar B; Masouridis, Eleftherios P
Subject: I-55, I-355 to I-94, vaious streams.
Attachments: SawmillCk-andtribs_ModelsEtcFromISWS-FPI.zip; SKMBT_42112071814410.pdf

Hi Dave,

Attached is a zipped file containing hydraulic modeling for the various streams that may need hydraulic report as part of the subject project. The attached information was received from ISWS. In addition, attached some correspondence with ISWS explaining various issues related to the zipped file. One of the issues to be aware of is the changing names of the Sawmill tributaries between the various FEMA studies.

It is also suggested that you contact FEMA and DuPage County for available models to complement the information from ISWS.

Please let me know if you have any question regarding the above.
Thanks

Esther Winograd
Hydraulic Section
Bureau of programming
IDOT-DOH
201 West Center Court,
Schaumburg, IL 60196-1096
tel; 847/705-4475

Winograd, Esther B

From: Winograd, Esther B
Sent: Thursday, January 26, 2012 10:12 AM
To: 'Saylor, William F'
Cc: Masouridis, Eleftherios P
Subject: RE: I-55 in Dupage Counties

Thank you much.

I can add one error I believe I found: Drainage area for Wards Creek is noted in the published FIS study as less than 1 sq. mile, but when you check with the USGS it is about 3 sq. miles.

Esther Winograd
847/705-4475

From: Saylor, William F [mailto:wsaylor@illinois.edu]
Sent: Thursday, January 26, 2012 9:58 AM
To: Winograd, Esther B
Subject: RE: I-55 in Dupage Counties

Esther,

It will take me some time to get some scans to you, as I am very behind on pending requests. I don't have all of the data. Here is the context of the FEMA-effective mapping in the Sawmill Creek watershed across I-55 that you should know:

- The FEMA-effective flood hazard mapping in the watershed is from a combination of the DuPage County Unincorporated Areas 1982 FIRM/FIS, the City of Darien 1979 FIRM/FIS, and 1990s LOMRs on each stream in Darien. Separate models or model runs were used for each of these products; it will be important to refer to the corporate limits shown on the pre-countywide 1979 & 1982 FIRMs. Later I will send you scans of my annotated pre-countywide maps for reference.

- I-55 was shown mostly on the DuPage County Unincorporated Areas FIRMs through here. I do not have the FEMA archive models for the DuPage County Unincorporated Areas FIRMs/FIS. I have print copies (only) of the models from the Darien 1979 FIS, but some of the Darien FIS models started above I-55.

- While the LOMRs are all upstream, the case files for them may include electronic versions of the before and after models. I only have data from one of the LOMRs. Details later.

- The 2004 DuPage County FIS does not completely or accurately incorporate all of the sources. The flood profiles and floodway data table have errors. I will provide my notes on that as well.

- The tributaries have been labeled with different names among the various FIRMs, and even on the current FIRM. You would probably need to include all the possible names in an order to the FEMA Engineering Library, or a request to DuPage County, say. (At one time, DuPage County was trying to collect all the FEMA models; I don't know if they were successful.)

So, that's some indication of the extra searching that you may need to do to obtain and sort the subject data. I will send some scans with further explanation when I can, possibly separately by stream.

- Bill

Winograd, Esther B

From: Saylor, William F [wsaylor@illinois.edu]
Sent: Wednesday, February 15, 2012 5:04 PM
To: Winograd, Esther B
Subject: RE: I-55 in Dupage Counties

Esther:

I have bundled the data that I have regarding Sawmill Creek and tributaries crossing I-55, in the following zip file that you can download from the link shown:

/wsaylor/Sawmill Creek/SawmillCk-andtribs_ModelsEtcFromISWS-FPI.zip
https://netfiles.uiuc.edu/xythoswfs/webui/_xy-41853047_2-t_BLhlyVzc

The files in it are named by stream as follows:

SawmillCk (main stem)
SawmillCkEBr aka Trib 1
SawmillCkWBr
Wards Creek aka Trib B of Sawmill Creek West Branch

and within these the filenames sort alphabetically upstream to downstream, more or less.

Each, here, except Sawmill Creek East Branch, have LOMRs in the upper reaches (above I-55) as previously noted.

It turns out that I have the model data for the lower reaches, the source being a printout of Fldwy WSP2 input data, only. For reasons I can't fully account for, I wrote this data off when I originally looked at it ten years ago, but upon closer review, I find it represents the flood profiles originally in the DuPage County Unincorporated Areas 1982/1985 FIS below and across I-55. It is apparently the SCS 1975 Flood Plain Information study model data. In this process I converted the still-effective portion of this data to electronic format (in SawmillCk_Uninc_FPI-WSP2-1975copy.zip within the bundle) and also included the image scan of its source.

Misc notes to be aware of:

- In that lower model data file, the highest Q is the Q100. Thus, the 100-year flood elevation are the last line in each section output and not the second to last line per usual.

- I-55 is not necessarily modeled in the data.

- Shortly above I-55, the later versions or LOMRs apply.

- The treatment of the reaches of Wards Creek vs Sawmill Creek West Branch below I-55 isn't all that clear to me.

- The electronic data for Wards Creek (the other embedded zip file) is associated with an upstream LOMR case, but the data starts at I-55.

I do not have applicable data for Black Partridge Creek after all, FYI.

Good luck.
- Bill

Winograd, Esther B

From: Masouridis, Eleftherios P
Sent: Monday, August 11, 2014 12:14 PM
To: Winograd, Esther B
Subject: FW: I-55 over Wards Creek, 6'x6' box culvert

We should plan on basing the project on the Part 3700 rules.

Perry

E. Perry Masouridis, P.E.
Drainage Studies Manager
Illinois Department of Transportation, Region 1
Bureau of Programming, Hydraulics Section
201 West Center Court
Schaumburg, IL. 60196-1096

Phone: (847) 705-4474 Fax: (847) 221-3052
Email: eleftherios.masouridis@illinois.gov

From: Jereb, Gary
Sent: Monday, August 11, 2014 11:39 AM
To: Masouridis, Eleftherios P
Subject: RE: I-55 over Wards Creek, 6'x6' box culvert

Hi Perry-

Your approach is reasonable. Alternatively you could create your own geometry file for the project reach and use the downstream FIS data (Qs, WSEs) as your downstream boundary condition.

Gary

From: Masouridis, Eleftherios P
Sent: Monday, August 11, 2014 9:46 AM
To: Jereb, Gary
Subject: FW: I-55 over Wards Creek, 6'x6' box culvert

Hi Gary,

We are working on the culvert crossing shown on the attachment and the mapped floodway stops just downstream of I-55 so we were planning on applying the Part 3700 rules.

Since the regulatory WSP-2 model extends upstream of the mapped floodway we converted the WSP-2 model to HEC-RAS. I think the results are slightly higher the FIS so we are using that as the base to evaluate the project.

Do you have any concerns or is this a reasonable approach?

Thanks

Perry

E. Perry Masouridis, P.E.
Drainage Studies Manager
Illinois Department of Transportation, Region 1
Bureau of Programming, Hydraulics Section
201 West Center Court
Schaumburg, IL. 60196-1096

Phone: (847) 705-4474 Fax: (847) 221-3052
Email: eleftherios.masouridis@illinois.gov

From: Winograd, Esther B
Sent: Saturday, August 09, 2014 2:36 PM
To: Masouridis, Eleftherios P
Subject: I-55 over Wards Creek, 6'x6' box culvert

Perry-

Attached is the FIS map showing the subject project location, and an older IDNR regulatory study map.
As can be seen, the floodway for Wards Creek stops at the downstream face of the subject culvert.
The IDNR old regulatory study extends further north, and is the base for the FIS study. The available model is the WSP2 which extends as shown on the old regulatory study.

Should this project be permitted based on IDNR rules of 3700 or 3708?
Thanks

Esther Winograd
Hydraulic Section
Bureau of programming
IDOT-DOH
201 West Center Court,
Schaumburg, IL 60196-1096
tel; 847/705-4475

Station list Available data

ILLINOIS RIVER BASIN

05533300 WARDS CREEK NEAR WOODRIDGE, IL

LATITUDE 414332 LONGITUDE 0875919 NAD27 DRAINAGE AREA 3.21 CONTRIBUTING DRAINAGE AREA DATUM 695.30 NGVD29

WATER YEAR	DATE	TIME	PEAK DISCHARGE (CFS)	DISCHARGE CODES	GAGE HEIGHT (FT)	GAGE HEIGHT CODES	HIGHEST SINCE	MAX GAGE HEIGHT (FT)	DATE	TIME	GAGE HEIGHT CODES	NUMBER PARTIAL PEAKS
1962	03/12/1962		60.0		1.04							0
1963	04/30/1963		20.0	2								0
1964	04/06/1964		35.0		0.36							0
1965	09/22/1965		55.0		0.91							0
1966	05/12/1966		151		2.93							0
1967	06/10/1967		109		2.12							0
1968	08/17/1968		48.0		0.73							0
1969	04/04/1969		73.0		1.35							0
1970	06/21/1970		95.0		1.83							0
1971	02/04/1971		70.0		1.28							0
1972	08/26/1972		87.0		1.66							0
1973	04/22/1973		94.0		1.81							0
1974	05/16/1974		102		1.98							0
1975	04/18/1975		146		2.84							0
1976	07/21/1976		101		1.97							0

Table of Contents Introduction Station Descriptions Surface-Water Data Ground-Water Data Meteorological Data Biological Data

Station list Available data

ILLINOIS RIVER BASIN

05533300 WARDS CREEK NEAR WOODRIDGE, IL

LOCATION.-- Lat 41°43'32", long 87°59'19" (NAD of 1927), in SW1/4NW1/4 sec. 4, T. 37 N., R. 11 E., Du Page County, Hydrologic Unit 07120004, at culvert on U.S. Highway 66, 3 mi southwest of Woodridge, 3.5 mi north of Lemont.

DRAINAGE AREA.-- 3.21 mi^2.

PERIOD OF RECORD.--
SURFACE-WATER DISCHARGE AND STAGE
PARTIAL RECORD: Annual maximum, water years 1962 to 1976.

GAGE.-- Crest-stage gage. Datum is 695.30 ft above NGVD of 1929 (695.02 ft NAVD 1988).

EXTREMES FOR PERIOD OF RECORD.--
SURFACE-WATER DISCHARGE AND STAGE: Maximum discharge, 151 ft^3/sec, May 12, 1966, gage height, 2.93 ft.

Table of Contents | Introduction | Station Descriptions | Surface-Water Data | Ground-Water Data | Meteorological Data | Biological Data

Illinois Department of Transportation

File 120

022-0516

Printed

NBI Field Inspection Report

SN: District: 1 Spans: 1 Appr. Spans: 0 Skew: 0 ADT: Truck Pct: ADT Un: 0

Facility Carried: I-55, N and S Frontage Rd Name:

Feature Crossed: Creek Location: 0.9 mi SW of Cass St

Inspection Date: 02/01/2012

Inspector 1: Michael D. Muller

Inspector 2:

Inspection Notes: I-55: Sta 197+00 Wooden guardrail @ N. frontage rd Pix @ S: Struct \ S. Sect. Culv \ I-55 Stevenson \ File 120 856+23

Temp: 45°

Resources

Time to Insp:	Trffc Ctrl:	Boat:	Waders:	Snooper:
1:00			W	
	Ladder:	Manlift:	Other:	
			Flashlight	

Inspector's Appraisals

	Prev	New		Prev	New		Prev	New
58-Deck Condition:		N	62-Culvert Condition:		5	72-Approach Rdwy Align:		8
59-Superstructure Cond:		N	61-Channel Condition:		4	111-Pier Navig Protection:		N
60-Substructure Cond:		N	71-Waterway Adequacy:		8			

Additional Inspection Data

	Prev	New
36A-Bridge Railing Adequacy:		2

Approach Guardrail Adequacy: 36B-Transitions:	Prev	New	36C-Guardrail:	Prev	New	36D-Ends:	Prev	New
		2			2			2

108A-Wearing Surface Type:	Prev	New	108B-Type of Membrane:	Prev	New	108C-Deck Protection:	Prev	New
		N			N			N

108D-Total Deck Thickness (In.):	Prev	New

59A-Paint Date (Mo/Yr):	Prev	New	59B-Paint Systems:	Prev	New
	/				

59C-Utilities Attached:	Prev	New
		NNN

70D2-Posting OTAT:	Prev	New	70A2-Single:	Prev	New	70B2-Comb 3S1:	Prev	New	70C2-Comb 3S2:	Prev	New

Remarks:
- Heavy erosion behind WW's. Worse @ NW WW → hole threatening N. Frontage
- Large HP's, efflo, random map cracking @ walls & top slab. WORSE @ ORIG CULV.
- 1 to 2 ft zone @ const jts where delam, spall w/exp reb, vert cracks, leaching, seepage and rust develop.
- Chloride contamd Scattered HL cracking. N wall @ Mid section: Horiz crk.

Inspected By: MDM

4/13/12

Illinois Department of Transportation

File (120) 022-0516 **Culvert Inspection Report**

Culvert Number: _____ *(to be filled in by Office)*

*** Location & Inventory Information ***				
Facility Carried:	I. 55, N and S frontage Rd	Feature Crossed:	Creek	Team Section 137
Location:	0.9 mi SW of Cass St	Municipality:	Darien	DuPage County
Total # Cells:	1	Material:	1-Concrete	Culvert.
Cell Height:	6	Skew:	6° 16' 00"	
Cell Width:	6	Culvert Opening:	36	
Amount of Fill:	8	Deck Thickness:	N/A	
# of Lanes:	10			

90 – Inspection Date:	02/01/2012	90C – Temperature (°F):	45
90A – Inspection Leader:	Michael D. Muller		

Inspector's Appraisal

61 – Channel and Channel Protection Condition Condition: _

Description of any deterioration:

- Heavy erosion behind WW's in general - Erosion @ downstream banks.
- NW WW: Very large hole developing threatening the N. frontage road.
- Made worse by scour created by flow from culvert under Golf course

62 – Culvert Condition: _

Description of any deterioration:

Worse zone = original culvert @ S to Mid section: large HP's, efflorescence, random & map cracking @ walls & top slab. 1 to 2 ft zone @ const. jts where delam, spalls w/exp reb, vert cracks, leaching, seepage and rust develop - Chloride contamination. scattered HL cracking. Mid section @ N wall: horiz crack.

90B – Inspection Access Remarks:

Wooden guardrail @ N frontage road, by golf course.

I-55: sta 197+00.

Slight break in flow inside culvert: misalignment? or settlement?

	Signature	Date	Inspection Entry
Inspector:	M.D.M	02/01/2012	

Culvert Inspection Report

Culvert Number: _____

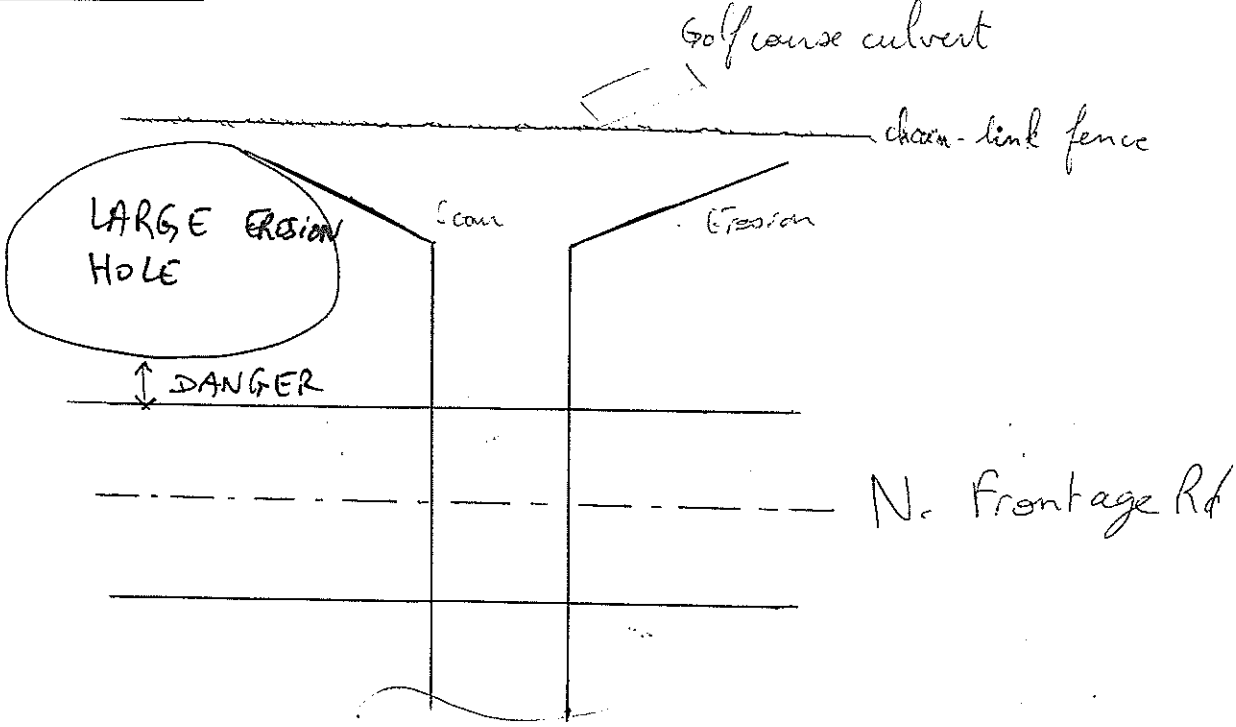
Repairs Needed:

Massive erosion @ N end undermining pavement of N. Frontage Rd. Made worse by flow from culvert under golf course (scour)

Additional Comments:

Pix @ S:\Structures\South Section Culverts\I-35 Stevenson\File 120 856+23.

Sketch of Culvert Layout and Dimensions:



Illinois Department of Transportation

Bridge Repairs Report

Structure Number: 0220516

Location & Inventory Information

Facility Carried: I- 55 & FRONT RDS
Feature Crossed: CREEK
Location: .9M SW OF CASS
Team Section: 135
Mat/Type/#Spans: Concrete/Culvert/0

*** PROPOSED MAINTENANCE REPAIRS ***							
(Only Active IWC's are Shown)							
Repair Code	**Repair Description**	**IWC Date**	**Completed By**	**Prty. Code**	**Qty.**	**Unit**	**Inspector**
Status	**Comments**						
752	SLOPEWALL REPAIR	04/06/2012	DL	M	30	SQ. YD.	MULLERMD
AP	(NOT EXACTLY SLOPEWALL REPAIR) Sheet piling recommended to stop erosion on behind NW WW of this culvert, threatening N Frontage Rd.						

4/13/2012 10:13:41 AM Page 1 of 1 **Priority Codes:** H-High, M-Medium, L-Low

SN 0220516 BBS-BRR (Rev. 01/2002)

SCM

File (120)

Illinois Department of Transportation
Structures Information Management System
Inspector's Inventory Report (S-114)

Date: 02/01/2012

Mickael D. Muller

Structure Number: 022-0516

District: 1
Municipality: Darien
Facility Carried: I-55 N and S frontage Rd
Feature Crossed: Creek
(21) Maintenance Resp: IDOT
(22A) Reporting Agency: IDOT Maintenance

Maintenance County: DuPage
Maint Township:
Bridge Name:
Location: 0.9 mi SW of Cass St

(41) Bridge Status:
(41A) Status Date:
(41B) Status Remarks:

SCREEN 1

Item No. / Name	Existing Values	Revisions
(101) Parallel Designation:		
(35) Structure Flared:		
(31) Design Load:		
(31A) Struct Steel Weight (Lbs.):		
(60A/B) Substr Matrl:		
(8A1) Bridge Remarks (Existing):		
Bridge Remarks (Revised):		

Item No. / Name	Existing Values	Revisions
(49) Structure Length (Ft.):		7.3
(112) AASHTO Bridge Length (Ft.):		6.0
(51) Bridge Roadway Width (Ft.):		~~192.0~~ 0
(32) Approach Roadway Width (Ft.):		192.0
(52) Deck Width (Ft.):		
(48) Length of Longest Span (Ft.):		
(107/A) Deck Type/Thickness (In.):		N / 0.0
(45/6) Nbr Spans Main/Approach:		1 / 0
(43A/B) Main Span Material/Type:		1 / 19
(44AN/BN) Near Appr Span Matrl/Type #1:		/
(44AN/BN) Near Appr Span Matrl/Type #2:		/
(44AF/BF) Far Appr Span Matrl/Type #1:		/
(44AF/BF) Far Appr Span Matrl/Type #2:		/

SCREEN 2

Item No. / Name	Existing Values	Revisions
(34A) Skew Dir/Angle (Deg-Min-Sec):	/	R / 6 16 00
(33) Bridge Median Type:		4
(33A) Bridge Median Width (Ft):		1
(38) Navigation Control:		
(39) Navigation Vert Clear (Ft):		
(40) Navigation Horiz Clea (Ft):		
(50A) Sidewalk Width On - Right (Ft):		
(50B) Sidewalk Width On - Left (Ft):		
(50C) Sidewalks Under Structure:		

Item No. / Name	Existing Values	Revisions
(36E) Guardrails On - Right:		
(36F) Guardrails On - Left:		
(55B1) RR Lateral Underclearance (Ft.):		
(54B3) RR Vert Underclearance (Ft. - In.):		
(62A) Culvert Cells (Count):		1
(62B) Culvert Cell Width (Ft.):		6.0
(62C) Culvert Cell Height (Ft.):		6.0
(62D) Culvert Cell Opening Area (Sq. Ft.):		36.0
(62E) Culvert Fill Depth (Ft.):		8.0

SCREEN 9

Key Route On

Item No. / Name	Existing Values	Revisions
(28) Number Of Lanes:		
(102) One Or Two Way Traffic:		

	South Or East		North Or West	
	Value	Revisions	Value	Revisions
(47) Max Rdwy Width (Ft.):		72.0		
(47A/B) Horizontal (Ft.):		287.0		

SCREEN 10

Key Route Under

Item No. / Name	Existing Values	Revisions
(28) Number Of Lanes:		
(102) One Or Two Way Traffic:		

	South Or East		North Or West	
	Value	Revisions	Value	Revisions
(47) Max Rdwy Width (Ft.):				
(47A/B) Horizontal (Ft.):				
(55B/56) Min Lateral:				

File (120) 856+23 I-55, N, S Frontage / Creek 0.9 mi SW of Cass Ave 02/01/2012


01 - Location


02 - S Frontage Rd approach lkg E


03 - S Frontage Rd cross view


04 - Downstream S Channel Note moderate erosion

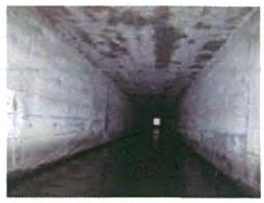

05 - Location on I-55 SB view from N Frontage Rd


06 - I55 SB cross view lkg S


07 - I55 NB cross view lkg S


08 - Efflo and erosion behind WW typ


09 - Old conduit attached to SE WW and in channel by...


10 - S section general condition lkg N


11 - Scattered lower half vert cracking in walls worse at...


12 - Vert cracking w mineral deposit in walls typ S sec...


13 - HL cracking at walls and top slab Mineral deposit r...


14 - Water seeping at construction joint Stalagti...


15 - Water seeping stalagtites and rust at cons...


16 - 1 to 2 ft of delam rust seepage vert cracks and s...


17 - Spalls and rust spots at const joints at S to mid sec...


18 - 1 to 2 ft of delam rust seepage vert cracks and s...


19 - 1 to 2 ft of delam rust seepage vert cracks and s...


20 - General condition at N section


21 - Bottom wall vert cracking and mineral depo...


22 - W wall N section horiz crack w chloride vert crac...


23 - Vert cracking w mineral deposit in walls typ S sec...


24 - Spall by construction joint at N section


25 - Random cracking


26 - Low concrete and vibration quality


27 - Possible scour and water seepage along interf...


28 - flow break possible minor settlement or chang...


29 - HL cracking at walls and top slab Mineral deposit r...


30 - Vert cracking rust seepage and delam by co...


31 - HL vert cracking at N end


32 - N channel


33 - Important erosion behind NW WW THREA...


34 - Location N Frontage and pavement condition

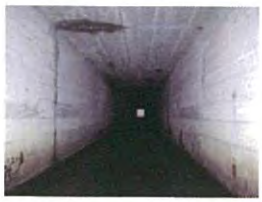

35 - NW WW Elevation shot impossible

File 120

36 - N Elevation

37 - N Elevation

38 - General condition N end



39 - General condition N section

40 - General condition N section

41 - General condition N section

42 - General condition mid section

43 - General condition mid section

44 - General condition mid to S section lkg S

45 - General condition mid to S section lkg S

46 - General condition S section

47 - S end and channel
Note electric cable

48 - S elevation

EXHIBIT O

SURVEY NOTES

pg 138 12/05/12 OW/JH SUNNY 50

110203

FILE 20121205.DW

Pts 2000 — 2196

Tc 1435 BS 1436 CHECK 2083

1844353.8035 1844580.1804

1080031.0499 1080012.4682

708.0' 712.0

710.2239 709.1387

HI 5.11 HR 6.00

Tc cp 1435

Known e cp 1436

1844580.1804

1080012.4682

709.1387

BS e cp 1436

CHECK SHOT 2083

1844580.2345

1080012.4677

709.0876

BS CHECK SHOT 2145

1844580.2022

1080012.4805

709.0653

HI 5.06 HR 6.00

Tc cp 1436

Known e cp 1435

1844353.8035

1080031.0499

710.2239

BS e cp 1435

CHECK SHOT 2146

1844353.7885

1080031.0431

710.2852

BS CHECK SHOT 2196

1844353.7856

1080031.0306

710.2945

FB 162 Pg 146

11/06/12
TW/JH

Control Stadium

Cloudy/Rain 55

110203.001

I 55 Tollway

Pts 0023, 24 — 0026 - 0032

HI 1.314

TP @ 201215
1844559.196
1083004.674
692.144

Check @ CP 201231
1845224.184
1083444.575
691.071

CHeck @ cp 201231
1855453.469
1101219.778
668.946

CHeck @ cp 201233
1855678.295
1104266.904
643.962

CHeck @ cp 201211
1842381.058
1077585.312
715.871

8 8/8 CHeck # 0026
1845224.152
1083444.537
691.058

5 3/8 Rod 2.0
CHeck 0027
1855453.440
1101219.707
668.891

F7/7 Rod 2.80
CHeck 0028
1855678.224
1104266.904
643.962

2 7/8 Rod 2.46 0033
CHeck ~~0032~~
1842381.006
1077585.327
715.911

FB 162 Pg 147

11/07/12
TW/JH

110203 I 55 Stadium #1

Cloudy 50

File 201211 08 TW

HI

BASE @ CP 201216
1845224.184
1083444.575
691.071

CHeck @ 201217

#0043 (950) HI 21.03 NOT 6.567 25.40
#0045 (950) HI 21.09 NOT 25.10
Pts 0034 - 0073

CHeck 0034
1845886.396
1084869.029
690.960

11/08/12
TW
Sunny 45
File 201211 08 TW
Pts 74-99
600-

HI 1.420

BASE @ CP 201216
1845224.184
1083444.575
691.071

CHeck @ cp 201217
1845886.434
1084869.042
691.068

694 DFG+1

CHeck 0074
1845886.405
1084869.962
690.953

FB162 Pg 148 — 11/08/12 TW

110203 I 55 Stream B1 — Chevy 450

File 2012 1108 TW

5.057 / 4.0

T	0079 BS	cp [illegible]	CAbut 81
	1842678.8482	1842677.0559	1842677.0780
	1078845.0842	1078799.4303	1078799.454
4.562	695.4285	696.5958	696.6297
3.82			CHeck 0095
10.382			1842677.0566
			1078799.4286
			696.6298

File 2012 1109 TW — Pts 593 - 853 — 11/09/12 TW

HI = Base @ 201216

1845224.184
1083444.575
691.07

CHeck @ cp 201217
1845886.424
1084869.042
691.068

9 7/9 Gpop 3.2
CHeck 0593
1845886.445
1084869.000
690.961

Hr 9.0d ~~13.17~~ NOT 13.11 # 665
Hr 9.24 NOT 13.11 # 666
#680 Hr 5.94 NOT 9.0 of TBW
708 Hr 21.13 NOT 35.10
Pts 853

FB162 Pg 149 — 11/27/12 TW DA Sunny

110203 I 55 Stream #1

HI 5.33
Hr 6.0

T @ cp 722 BS	cp 721	CHeck 855
1843775.2688	1843654.4881	1843654.5406
1077482.0939	1077456.0265	1077456.0279
712.1504	714.8194	914.8045
		CHeck 0785
		1843654.5663
		1077456.0596
		714.8162

File 2012 11 12 TW — Pts 480 - 499, 786 - 1008, 1026 - 1074 — INST GPS

Hr 1.226 BASE @ 201216

1845224.184
1083444.575
691.07

CHeck @ cp 201217
1845886.424
1084869.042
691.068

9 8/8 Gpop 2.80 CHeck 1006
1845886.453
1084868.971
690.959

500' 682 BFE
1000' 684 BFE

EXHIBIT P

COMPUTER DISC OF HYDRAULIC MODELS